



**2nd International Conference on
Research Trends in Engineering and
Management**

ICRTEM 2022

25th-26th August, 2022

Virtual Conference

Organized by

R R Institute of Technology, Bangalore, India

In Association with

Institute For Engineering Research and Publication (IFERP)

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IFERP-Explore

We cordially invite you to attend the **2nd International Conference on Research Trends in Engineering and Management (ICRTEM-22)** which will be held on **25th-26th August, 2022**. The main objective of this **2nd ICRTEM-22** is to provide a platform for researchers, students, academicians as well as industrial professionals from all over the world to present their research results and development activities in relevant fields of Engineering and Technology. This conference will provide opportunities for the delegates to exchange new ideas and experience face to face, to establish business or research relationship and to find global partners for future collaboration.

These proceedings collect the up-to-date, comprehensive and worldwide state-of-art knowledge on cutting edge development of academia as well as industries. All accepted papers were subjected to strict peer-reviewing by a panel of expert referees. The papers have been selected for these proceedings because of their quality and the relevance to the conference. We hope these proceedings will not only provide the readers a broad overview of the latest research results but also will provide the readers a valuable summary and reference in these fields.

The conference is supported by many universities, research institutes and colleges. Many professors played an important role in the successful holding of the conference, so we would like to take this opportunity to express our sincere gratitude and highest respects to them. They have worked very hard in reviewing papers and making valuable suggestions for the authors to improve their work. We also would like to express our gratitude to the external reviewers, for providing extra help in the review process, and to the authors for contributing their research result to the conference.

Since May 2022, the Organizing Committees have received more than 250 manuscript papers, and the papers cover all the aspects in Engineering and Technology. Finally, after review, about 121 papers were included to the proceedings of **ICRTEM-22**.

We would like to extend our appreciation to all participants in the conference for their great contribution to the success of **ICRTEM-22**. We would like to thank the keynote and individual speakers and all participating authors for their hard work and time. We also sincerely appreciate the work by the technical program committee and all reviewers, whose contributions made this conference possible. We would like to extend our thanks to all the referees for their constructive comments on all papers; especially, we would like to thank to organizing committee for their hard work.

Acknowledgement



Er. R. B. Satpathy

Chief Executive Officer (CEO)

Institute for Engineering Research and Publication (IFERP)

IFERP is hosting the 2nd International Conference on Research Trends in Engineering and Management (ICRTEM-22) this year in month of July. The main objective of ICRTEM-22 is to grant the amazing opportunity to learn about groundbreaking developments in modern industry, talk through difficult workplace scenarios with peers who experience the same pain points, and experience enormous growth and development as a professional. There will be no shortage of continuous networking opportunities and informational sessions. The sessions serve as an excellent opportunity to soak up information from widely respected experts. Connecting with fellow professionals and sharing the success stories of your firm is an excellent way to build relations and become known as a thought leader.

I express my hearty gratitude to all my Colleagues, Staffs, Professors, Reviewers and Members of Organizing Committee for their hearty and dedicated support to make this conference successful. I am also thankful to all our delegates for their pain staking effort to make this conference successful.

Chief Patron message



Shri Y RajaReddy

Chairman
PKMET, Bangalore

I am extremely pleased to know that the Department of Electronics and Communication Engineering of RRIT is organizing an 2nd International Conference on Research Trends in Engineering & Management (ICRTEM-2022) on 25th & 26th of August 2022. I understand, a substantial number of researchers have submitted their papers for presentation in the conference and also for publication. The response to this conference from all over India and Foreign countries is most encouraging. I am sure all the participants will be benefitted by their interaction with their fellow scientists and engineers which will help for their research work and subsequently to the society at large.

I wish the conference meets its objective and confident that it will be a grand success.

Patron Message

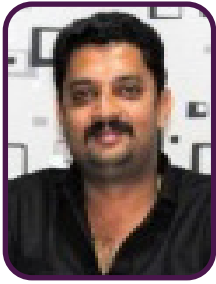


Sri Kiran H R

Secretary
PKMET, Bangalore

I am pleased to state that the Department of Electronics and Communication Engineering of RRIT is organizing a prestigious 2nd International Conference on Research Trends in Engineering & Management (ICRTEM-2022) on 25th and 26th of August 2022. Concept to commissioning is a long route. The conference may strengthen theme of “Innovative India” and may translate the innovations into a workable product. The conference forum will set a path for the academicians, researchers who play a major role in bringing out new products through innovations. Also I am delighted to know that the conference has received innovative ideas for presentation. I wish the participants of the conference to get additional insight into their subjects of interest. I wish the organizers of the conference a great success.

Patron Message



Sri Arun H R

Director
PKMET, Bangalore

I am delighted to wish Department of Electronics and Communication Engineering for organizing 2nd International Conference on Research Trends in Engineering & Management (ICRTEM-2022) on 25th and 26th of August 2022. I have a strong desire that the conference to unfold new domains of research among the Electronics and Communication Engineering fraternity and will boost the knowledge level of many participating budding research scholars by opening a plethora of future developments in the field of Electronics and Communication Engineering and other areas of Engineering.

I appreciate the faculties and department Head of Electronics and Communication Engineering for continuous untiring contribution in making the conference a reality.

I wish the conference a great grand success and motivate other departments to follow the trend, to make RRIT reach higher levels of learning in the next few years.

Message by the Principal



Dr. Mahendra K V

Principal, RRIT, Bangalore

The 2nd International Conference on Research Trends in Engineering & Management (ICRTEM-2022) Organized by the department of Electronics & Communication Engineering, R. R. Institute of Technology, Bangalore, India on 25th and 26th of August 2022 in association with IFERP is a great pride and honor for the College. The College has made tremendous progress in all areas of academic, non-academics, capacity building relevant to staff and students. The College has achieved another milestone in getting NAAC accreditation. Conferences are an important way researchers stay connected to others in their field and learn about cutting-edge technologies. It provides a platform for scholars, researchers from industry and academia to demonstrate their findings and studies. The conference brings together the members of research communities to enrich their knowledge in various emerging areas of research. One of the primary aims of all engineers who take part in international conferences is to acquire information and expertise on the latest and most recent advancements that have taken place in their field. Engineering conferences are the right place to learn about new tools that are being used in the field by engineers who are involved in similar streams of research such as yourself. Enrolling yourself into an engineering conference and taking an active part in the event can mean making a considerable and sizable investment of your time, money and resources. My heartfelt encouragement to all staff members and Students for their participation in the Conference and my best wishes for their fruitful effort. I thank all the organizers for their efforts in making the event successful .

Convener Message



Dr. Sunitha HD

Professor & HOD
Department of Electronics & Communication Engineering
R R Institute of Technology, Bangalore

It gives me immense pleasure to present the proceedings of 2nd International Conference on Research Trends in Engineering & Management (ICRTEM-2022), organized by the department of Electronics and Communication Engineering, R R Institute of Technology, Bangalore in association with IFERP. The main objective of organizing this conference is to share and enhance the knowledge of researchers in engineering & Management domain. This conference aims to bridge the researchers working in academia or industry and other professionals through presentations and keynote sessions on current technology and trends. My heartfelt thanks to our Management, Principal, IFERP, Keynote speakers, reviewers and organizing committee for their support in organizing this conference and making it a success.

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KEYNOTE SPEAKERS



Keynote Biography



Dr. Abhay Kumar

Vice Chancellor
Pratap University
Jaipur

Prof. (Dr.) Abhay Kumar, Vice- Chancellor, Pratap University, has more than 39 years of experience in the field of education. He has been an entrepreneur for 3 years and worked in the industry for over 16 years as Senior Manager- Personnel.

He acquired his PhD from the Department of Business Management, HNB Garhwal University, Srinagar Garhwal and completed his MBA from Motilal Nehru Institute of Research and Business Administration, the University of Allahabad.

Prof Kumar has a keen interest in the field of Marketing Management; Strategy being his forte and he has more than 20 years of experience in teaching and research. He is the author of several research papers and has also been the Keynote speaker/Chief Guest at a number of Conferences and Seminars.

Prof Kumar is a member of numerous bodies related to higher education and is on the Boards of Management and Advisory Boards of many institutes and universities.



Keynote Biography



Dr. Sailesh Iyer

Professor and Dean, CSE/IT Department, Rai School of Engineering,
Head, Collaborations and Tie-ups, Rai University, Ahmedabad.
President, RU IIC and RU Nodal Officer-GSIRF.

Dr. Sailesh Iyer has a Ph.D. (Computer Science) and currently serving as a Professor with Rai University, Ahmedabad. He has more than 22 years of experience in Academics, Industry and Corporate Training out of which 18 years are in core Academics. In addition to Patents, he is involved as an Editor for 6 book projects with River Publishers (Denmark), IGI Global(USA), Taylor and Francis(UK) and Bentham Science (UAE). A hardcore Academician and Administrator, he has excelled in Corporate Training, Delivered Expert Talk in various AICTE sponsored STTP's, ATAL FDP's, Reputed Universities, Government organized Workshops, Orientation and Refresher Courses organized by HRDC, Gujarat University. Research Contribution include reputed Publications, Track Chair and TPC Member for various reputed International and National Conferences, Reviewer of International Journals like Multimedia Tools and Applications (Springer), Journal of Computer Science (Scopus Indexed), International Journal of Big Data Analytics in Healthcare (IGI Global), Journal of Renewable Energy and Environment and Editor in various Journals. Expert Talk on Research based topics in various Universities and Conferences in addition to guiding Research Scholars as Supervisor. He has also been invited as a Judge for various events, Examiner for Reputed Universities, is a Computer Society of India Lifetime Member and was serving as Managing Committee (MC) Member, CSI Ahmedabad Chapter from 2018-2020. Research interest areas include Computer Vision and Image Processing, Cyber Security, Data Mining and Analytics, Artificial Intelligence, Machine Learning, Blockchain.



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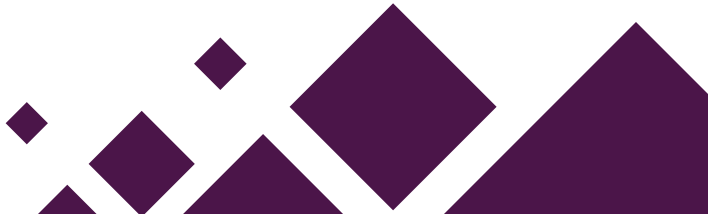
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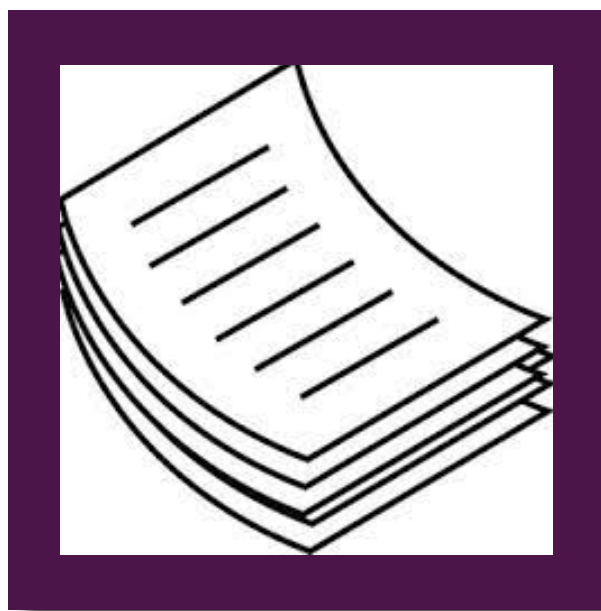
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ABSTRACTS



A Comprehensive Survey on Medical Image Segmentation Methods

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Abstract---

A method or technique for identifying the inner or outer structure of the human body is called medical imaging. The approach examines medical diagnoses, studies ailments, and provides image data sets that are both normal and abnormal. There are two types of medical imaging: hidden imaging for medical purposes and recognizable imaging for medical purposes. A civilian can understand the second form of medical imaging, in contrast to the first aspect that requires a physician's interpretation. All of this necessitates segmentation. The initial stage in image processing has traditionally been called segmentation. Segmentation outcomes significantly impact all subsequent image analysis processes including representation of an object and illustration, feature dimension, and even top intensity tasks like object categorization. Image decomposition is thus considered as an important and critical technique for assisting in the presentation, representation, and image processing of the region of interest in any medical image. A good segmentation result would make additional image processing analysis much easier. This paper provides a quick overview of the different techniques and types of segmentation methods used in preprocessing of medical images.

Keywords---

Medical Image Segmentation, Imaging Modalities, Region-Based, Edge-Based

INTRODUCTION

The increased usage of imaging modalities for medical purposes (such as CT and MR images) requires the employment of powerful computers to aid radiologists in testing and planning treatments for patients. Furthermore, physical segmentation is an error-prone as well as time-taking operation due to which numerous imaging scans are required for each patient. As a result, to define the region of interest, dependable automated techniques should be used [1].

Image segmentation is a method for correctly classifying the elements of an image in a decision- making

application by separating it into different segments. As a result, image segmentation's goal is to reduce or change the appearance of an image or transfer an image's information into a more meaningful form, making it easier to analyze. It separates an image into several distinct regions, with high similarity between the pixels in each zone and high contrast between the regions. It is a useful tool in a variety of sectors and applications, including health care, traffic picture analysis, medical image analysis, pattern identification, and so on. Image segmentation can be done in a variety of ways, including Neural network-based, threshold-based, morphological-based, edged-based, graph-based, clustering-based, and so on. All of these approaches have strong and weak points, thus one must select an algorithm depending on their specific requirements. Furthermore, the majority of medical image analysis tasks like enrollment, labeling, and motion detection necessitate segmentation. Partitioning of the heart, particularly the LV (Left Ventricle), using cardiac imaging is a good example. For calculating sensor readings such as ventricular mass ratio, pulse rate, and wall motion tracking, which provides information on wall thickness and other issues. LV segmentation is required. The development and execution of related segmentation approaches necessitate a thorough grasp of the underlying issues and the data's nature and philosophical or medicinal significance.

The remaining part of this paper consists of a literature review in the II section, the III section is about the segmentation approaches, the IV section is about the comparison of medical image segmentation methods, followed by a conclusion and references.

LITERATURE REVIEW

Table I highlights the various methodologies, together with their benefits and drawbacks, for some important forms of study that have been conducted in recent years.

Table I: Literature Review

Sl. No	Methods Used	Benefits	Drawbacks
1	The segmentation procedure is carried out in this work utilizing the CNN algorithm, and the segmentation is divided into three methods: 1) Neural Network with Full Convolution. 2) U- Net. 3) A Generative Adversarial Network [2].	CNN works well with all the 3 methods.	<ul style="list-style-type: none"> Medical images are different from natural images. There are weaknesses in the deep learning model. It is primarily concerned with three aspects: network topology, 3D data separation modeling approach, and loss functions.

2	This survey paper compares hybrid segmentation methods (Edge detection segmentation, Clustering techniques, Region-based segmentation techniques, Thresholding, Partial differential equations, Watershed segmentation, Partial differential equations, ANN) to new segmentation methods (Marker Controlled Watershed Segmentation, Otsu thresholding, FCM with advanced optimization techniques) [3].	The accuracy of a hybrid combination is higher than a single approach	Existing techniques outperform the old approaches of segmentation.
3	The present picture segmentation quality assessment approaches are summarized in this study, with an emphasis on unsupervised segmentation methods (Remote Sensing Image, Natural Image) and supervised segmentation methods (Natural Image, Remote Sensing Image) (Medical Image, Remote Sensing Image, Natural image)[4].	The supervised, and unsupervised techniques have different image modalities.	The number of parameters used in this technique can be changed in the future to enhance segmentation.
4	The segmentation in this paper is done by using CNN. The different segmentation methods used are Fully convolutional networks, Seg-Net, Dilated Convolutions, and U-Net [5].	Using a simple two-way architecture (that can express both global and regional information) and two CNNs to express regional label dependencies that achieved great performance.	Further CNN design enhancements and alterations, as well as the incorporation of complementing data from additional imaging modalities, may improve the current method.
5	This paper gives a systematic review segmentation of the medical image. The segmentation methods used in this review are divided into 3 different categories. Obsolete Technique (Deformable models, Multiresolution models, Coupled Surface, Geodesic Minimal Paths), Ancient Technique (Thresholding, Region-Based, Edge Detection, Graph Cut, Appearance model, Class-Based, Target Tracking, Atlas Based) Recent Technique (Active Shape Model, ANN, Segmentation using AI, Clustering)[6].	<ul style="list-style-type: none"> The clustering-based technique is considered the best approach. To reduce a situation, different segmentation approaches are applied. 	The brain tumor identification and segmentation system's additional scope is that if there is a 3D image of the brain tumor, the tumor size, tumor kind, and tumor stage may be determined.
6	Various picture segmentation approaches are discussed and evaluated in this work. For tumor segmentation from brain MRI scans, the integration of FCNN with CRF and DeepMedic with CRF or the success of an ensemble is higher [7].	When it comes to brain tumor segmentation, a combination of FCNN with CRF and DeepMedic with CRF or Synthesis is more efficient.	A closed contoured algorithm can be enhanced simply by raising the regional area and lowering the thickness of the region bordering lines.
7	The segmentation methods are divided into different parts, Edge Based Segmentation (First order Derivative: i) Prewitt operator ii) Sobel operator iii) Canny operator iv) Test operator, Second Order Derivative: i) Laplacian operator ii) Zerotcrossings), Thresholding (Local: i) Histogram, Global (Adaptive): i) Otsu's Thresholding), Region-based segmentation (Region Growing, Region Splitting And Merging, Watershed segmentation, Level Set method), based on similarities or discontinuities [8].	<ul style="list-style-type: none"> Detection of their edge and their orientation. Finding the correct place and finding a wider area. 	<ul style="list-style-type: none"> Incorrect noise sensitivity Misbehaving at edges, curves, and where the gray-level intensity varies

8	This research examines the segmentation of tumor-containing CT and MR images. SVN and ANN-based Brain Tumor MR Images Segmentation, Levenberg-Marquardt Tumor Diagnosis in MRI Brain Images, Wavelet and Zernike oriented CT and MR Image Segmentation and Reassembling, Local Independent Transformation-based CT and MR Image Segmentation, Segmentation and Analysis of CT and MR Images using Geometric Transform Invariant, and ANN are among the segmentation methods/techniques considered in this review[9]	The method of local independent-based segmentation is extremely dependable.	The segmentation techniques are very slow.
9	This paper provides a quick overview of how the convolution neural network is utilized in medical image segmentation to attain improved accuracy [10].	CNN technique gives higher accuracy	The whole training is required to be repeated for various types of images and formats.
10	Region-Based Segmentation (Threshold, Regional growth), Edge Detection Segmentation (Sobel Operator, Laplacian Operator), and Segmentation Based On Clustering (K-mean Clustering algorithm), Segmentation Based On Weakly- Supervised Learning in CNN, etc.[11].	To discover the region of interest, a CNN model is applied, which enhances segmentation.	Image segmentation analysis isn't exact, still there are numerous practical challenges are present in applied research.

SEGMENTATION METHODS

Many researchers have identified many separation approaches, but not a single solution found that can be used for all types of applications has been provided. Based on properties, segmentation divides an image into different areas like illumination, colour, texture, and sensitivity of each zone are all the same. Particularly segmentation highlights the area of expertise in mechanization. The following tree depicts several techniques for picture segmentation found in the review of the literature. The authors emphasize the introductory details concerning these strategies with this review in mind. Complete details on these strategies, however, can be discovered in the cited literature.

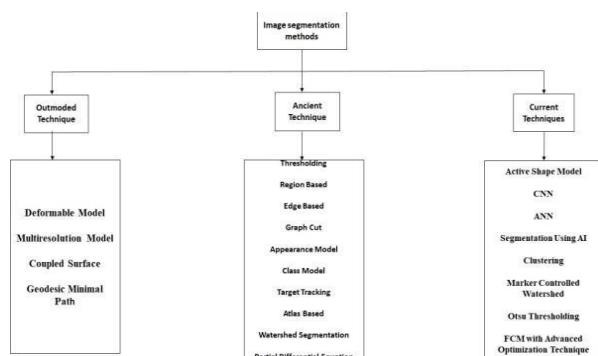


Fig 1. Medical Image Segmentation Methods

Outmoded Technique

Outmoded segmentation techniques that were developed in the late 1990s are no longer widely used. Deformable models, multi-resolution methods, linked/coupled surfaces, and geodesic minimum math are examples of

segmentation techniques that fit within this category. These strategies are briefly discussed in this section.

Deformable Model

Deformable models use deformation shapes or exteriors to define boundaries [6]. This has been widely utilized in medical imageries to separate images, particularly for the segmentation of anatomical features. It is accomplished by incorporating previous item image data and requiring the resulting boundaries to be unrelenting and smooth. During deformation, forces that are present internally originating from the curves aid in flattening the arch. To adjust the curves or surface to the object boundaries, external solutions are determined based on imageries data.

Multi-resolution Model

A multi-resolution approach is a global high-quality resolution that is adaptable to a wide range of flaws and data kinds. The continued serving component extension must always be permitted to conform to the attention when each imagery examines difficult, deals with the building of a certain size of the area. This is accomplished by combining a general segmentation approach depending on the definitions of uniformity with global and regional modification. It also discusses an estimate of the multi-resolution least mean square error method for robust edge orientation estimation. The technique effectively makes use of the spatial consistency of contour operations for small kernels of different levels to produce many consistent edge locations and orientations. This approach has the benefits of extracting orientations on the outskirts from information with a poor signal-to-noise ratio [6].

Coupled Surface (CS)

Many medical imaging researchers are confronted with the challenge of segmenting a volumetric layer with a narrow width. The grey level standards in between the face, as well as the surrounding face, are referred to as a layer. A final representation of the boundary faces and unintentional layer separation is achieved by rapidly forming two entrenched faces, each prompted by circumstance-specific while keeping the connection of image-derived knowledge. A local controller depending on grayscale readings is believed to apprehend, the data to achieve a surface decision, use of such grey level based information instead of a second variance improves the ability to comprehend uniformity and, as a result, improves the enhancement [6].

Geodesic Minimal Path

The geodesic voting approach is another image segmentation technique. This approach calculates geodesics from a set of reasons that are scattered in appearances and an expected basis reason. The amount of geodesics that ignore this pixel determines the geodesic density at each pixel of the presentation. The target organization accepts a high geodesic density of appearance points. Overall, the client provides image starts and endpoints and receives the shortest path as an outcome. Basic geodesics relate to these minimum pathways. It locates a series of arcs that minimize the energy of geodesic active outlines on a global scale. Different criteria can also be used to automatically generate a set of endpoints from a single beginning point.

Ancient Technique

Outdated techniques are particularly ancient and are no longer in use. Although techniques from the past are outdated, they're still employed in a variety of ways. Edge detection, thresholding, graph cut, region-based segmentation, automated and semi-automatic segmentation, Markov random field approach, appearance models, class-based segmentation, automated and semi-automatic segmentation, atlas-based segmentation, and target tracking are some of the approaches available.

Thresholding

The simplest fundamental way of image partitioning is threshold partitioning, which has been among the most often used similar segmentation techniques. It is a typical image grayscale data processing algorithm that splits the image grayscale data processing directly based on the grey value of distinct targets. The two major types of thresholding methods are the regional threshold approach and the global limit approach. The global limit technique splits the input into two areas: forefront and backdrop, using single threshold. For the local threshold approach, which divides the image into several target regions and backdrops using multiple thresholds, different segmentation thresholds must be determined. [8].

The threshold approach has the advantage of being easier to calculate and implement. When the goal and backdrop have a strong contrast it is possible to generate a

separation effect. The drawback is good answers for image partitioning issues involving there is no significant grayscale variation or it's difficult to find an image with a wide overlapping of gray levels.

Region-Based Segmentation

These methods divide the input image into sub-regions depending on the set of rules, such as ensuring that all pixels in a certain region have a similar grey level [11]. In intensity ethics, region-based algorithms are impacted by inside a cluster of nearby pixels on similar designs. A cluster can be defined as a region, and the segmentation method assumes that anatomical parts are clustered according to regions.

Edge-Based Segmentation

The border segmentation method detects discontinuity. Edge detection can be done by recognizing the boundary between two regions or by identifying variations in image intensity. The borders of images can be used to determine characteristics such as corners, lines, and curves. In image analysis, edge detection is crucial. Edge-based approaches include the Sobel operator and the Laplacian operator.

Graph Cut

For image segmentation, graph cut provides clean, smooth devising. It includes a language for converting uncreative constrained segmentation signals, as well as a series of powerful computational tools for extracting fragmentation of the world from all of these straightforward single elements. Because it uses both border and regional information, the suggested Network cut-based sorting. It can also produce a globally optimal outcome for the energy function at the same time [6].

Appearance Model

A neutral function is utilized in collaborative image segmentation techniques, which includes appearance representations as an unknown adaptable. The objective is to be fair in terms of unidentifiable segmentation and advanced directional elitism. This preparation reveals an energizing bias of perfect to optimum segmentation. It also enables the development of a novel two-fold decomposition optimization approach that provides a low value. Graph cuts were used to further hybridize the results, and the resulting crossing is used to segment pharmaceutical images.

Target Tracking

In the research, a detection method in video images depending on pattern recognition as well as image splitting has been suggested. Authors can recognize all items in an image using image segmentation. The pictures could be moving or static. As a result, the target detection technique is used on a variety of traveling and stationary objects. A movable camera is used to capture these still or moving. It is fed into a greater tracker to appropriately associate time that is limited.

Atlas Based Segmentation (ABS)

Images can be segmented using atlas-based segmentation even if there is no clear relationship between areas and pixel intensity. When the items of a comparable

construction must be segmented, this method is commonly utilized. It means that the items must have the same texture, and that information about changes between them is encoded in their spatial relationship, with other objects, or in their morphological metric feature.

Current Technique

In the field of medical imaging, these segmentation approaches are relatively recent. There are various uncertainties in medical pictures. To deal with these problems, researchers started applying intelligent techniques in medical imaging, such as intuitionistic fuzzy sets, artificial intelligence, neural networks, fuzzy sets, and so on. The authors examine segmentation approaches that fall into this category in this section, including active, ANN partitioning, shape models, and artificial bits of intelligence separation, as well as clustering.

Artificial Neural Network

Different approaches were appropriate for different types of images, and quantifying the yield of a certain procedure was difficult because there may be a lot of accurate segmentation focused on a single image. Image segmentation is a process that divides non-overlapping sections from an original data image, with each area being homogenous and the combination of any two types being heterogenous. The highest field identity abstract of an input image is calculated as a segmented image. Although extensive research has gone into developing several distinct methods and methodologies for image segmentation, That's still hard to say whether one method provides more accurate segmentation results than the other, for a single view or a series of images, or, more typically, for an entire class containing images.

Clustering

FCM method combines the principles of fuzzy numbers and k-means clustering. This enables the distribution of a data fact among different clusters. With the use of expectation maximization, data points are assigned to different clusters (EM). It aims to arrive at maximum probability estimates of statistical representation restrictions in an iterative manner. The EM approach has successfully used GMM, in which a combination of workings of the Gaussian type is merged to make some mixed flow. The Gaussian methods' resource and correlation are calculated, modified in the EM iteration, and many Gaussian results are merged to produce a general prototype. Later, an FCM technique was found to solve this restriction. The inclusion of non-membership

and hesitancy has made a significant contribution to this clustering. Medical photos were successfully used to demonstrate the notion. It was useful for grouping distinct sections of medical images and detecting anomalies in photos. Following that, a fresh approach called possibilistic fuzzy c-means is presented.

Marker Controlled Watershed (MCW)

MCW segmentation is indeed a variation of the watersheds approach. To address the issue of decomposition in watershed transforms, Watershed Partitioning Using Markers has been developed, in which specific elements in a digital image are preset. Separating surrounding tissues and organs from the area of interest is one of the most significant jobs to be completed during medical image segmentation, as surrounding organs & tissues often have comparable intensity and fuzzy borders as the ROI. In these situations, the watershed transform approach is commonly employed for segmenting the contacting parts from the organ of fascination. However, there are a few downsides to this technique, including over-segmentation, noise sensitivity, and the inability to recognize areas with low-resolution borders. The marker-controlled watershed transform, on the other hand, overcomes this problem by utilizing a marker function to predetermine the value and probable localization of the desired region. As a result, using marker-controlled watershed transformation over the watershed transform technique is more efficient since it eliminates the downsides of watershed transformation.

Otsu Thresholding

Otsu thresholding is a variation of the threshold separation method. OT divides the picture or an image into 2 types: forefront and background. On both sides of the image, the image's different intensity value elements are iterated till the inter-class variation is as tiny as possible. [8].

Advanced Optimization Technique in FCM

FCM is highly vulnerable to noise because it is dependent solely on the luminance of pixels. Many writers have advocated that spatial relations amongst pixels be added to FCM to improve its performance to solve this problem. In terms of segmentation outcomes, this updated form of FCM has proven to be more effective.

COMPARISION OF MEDICAL IMAGE SEGMENTATION METHODS

The following Table II has the different segmentation methods with their advantages and disadvantages. Which will help to select the best method based on the situation.

Table II: Comparison of Segmentation Methods

Sl. No	Methods	Advantages	Disadvantages	Applications
1	Thresholding	These approaches are the quickest, simplest, and most straightforward to apply.	It frequently exceeds the detection limit required for precise classification.	They are primarily used in projects with a varied intensity allocation.
2	Edge-Based segmentation	Only when the edge is strong, it work wonderfully.	A discontinuity or a similar criterion is used to segment one or even more areas or items.	Applied to all medical image segmentation types

3	Region-Based segmentation	Excellent for blurry images with difficult-to-find edges.	Speed should be specified	Applied in color channels
4	Graph Cut	quick and precise works on images with big unknown regions and produces good segmentation results	Shrinking bias	Applied to computer vision problems
5	Atlas Model	Automated, resistant to variations in shape and intensity, and integrates previous shape and density data	Creating an atlas is time-consuming and error-prone in registration.	Mainly applied to MR images.
6	Watershed segmentation	Produces complete division of the image	Over segmentation	Applied on grayscale images
7	Compression based methods	Less storage consumption.	The approach is relatively slow	These methods are primarily used with MRI and CT images.
8	ANN	Training data is used to solve complex problems	The training process requires overtraining	Can be applied to market segmentation
9	Clustering	Easy to implement	Cluster value should be defined	Applied on MR images but not on CT images
10	Deformable Methods	They are capable of handling inversions and ensuring piecewise consistency. These approaches are noise-resistant and provide sub-pixel precision.	Speed of the system gets affected	Work well with the image's statistical regional information.

CONCLUSION

This paper gives a high-level review of some of the approaches and techniques used in medical image segmentation. The medical sector is made up of a variety of medical modalities, each of which encompasses a variety of ailments and difficulties. So the goal of this study is to look at the strategies offered and applied in all of these modalities to assist the medical industry in assessing or solving a specific problem. Each strategy has its own set of advantages and disadvantages. Each method's application is determined by the type of application and the resources available. Even though considerable research has been done in this area, we can still conclude that there is a lot of potential for a more promising alternative.

REFERENCES

- [1] M. S. Fasihi and W. B. Mikhael, "Overview of Current Biomedical Image Segmentation Methods," 2016 International Conference on Computational Science and Computational Intelligence (CSCI), 2016, pp. 803-808, doi: 10.1109/CSCI.2016.0156
- [2] Liu, Xiangbin, Liping Song, Shuai Liu, and Yudong Zhang. 2021. "A Review of Deep-Learning- Based Medical Image Segmentation Methods" *Sustainability* 13, no. 3: 1224. <https://doi.org/10.3390/su13031224>.
- [3] Rituparna Sarma and Yogesh Kumar Gupta 2021 "A Comparative Study of New and Existing Segmentation Techniques", IOP Conf. Ser.: Mater. Sci. Eng. 1022 012027.
- [4] Wang, Z., Wang, E. & Zhu, Y. Image segmentation evaluation: a survey of methods. *Artif Intell Rev* **53**, 5637–5674(2020). <https://doi.org/10.1007/s10462-020-09830-9>.
- [5] [5] F. Cao and Q. Bao, "A Survey On Image Semantic Segmentation Methods With Convolutional Neural Network," 2020 International Conference on Communications, Information System and Computer Engineering (CISCE), 2020, pp. 458-462, DOI: 10.1109/CISCE50729.2020.00103.
- [6] Chiranji Lal Chowdhary, D.P. Acharjya, Segmentation and Feature Extraction in Medical Imaging: A Systematic Review, *Procedia Computer Science*, Volume 167, 2020, Pages 26-36, ISSN 1877-0509, <https://doi.org/10.1016/j.procs.2020.03.179>.
- [7] Wadhwa A, Bhardwaj A, Singh Verma V. A review on brain tumor segmentation of MRI images. *Magn Reson Imaging*. 2019 Sep;61:247-259. doi: 10.1016/j.mri.2019.05.043. Epub 2019 Jun 11. PMID: 31200024.
- [8] Kulkarni, Sunita & Sundari, G.. (2018). A Review on Image Segmentation for Brain Tumor Detection. 552-555. 10.1109/ICECA.2018.8474893.
- [9] K. K. Gupta, N. Dhanda and U. Kumar, "A Comparative Study of Medical Image Segmentation Techniques for Brain Tumor Detection," 2018 4th International Conference on Computing Communication and Automation (ICCCA), 2018, pp. 1-4, doi: 10.1109/CCAA.2018.8777561.
- [10] R. Merjulah and J. Chandra, "Segmentation technique for medical image processing: A survey,"

- 2017 International Conference on Inventive Computing and Informatics (ICICI), 2017, pp. 1055-1061, doi: 10.1109/ICICI.2017.8365301.
- [11] Y. Song and H. Yan, "Image Segmentation Techniques Overview," 2017 Asia Modelling Symposium (AMS), 2017, pp. 103-107, doi: 10.1109/AMS.2017.24.
- [12] Jalab, Hamid & Majeed, Ali. (2019). Magnetic Resonance Imaging Segmentation Techniques of Brain Tumors: A Review. Archives of Neuroscience. In Press. 10.5812/ans.84920.
- [13] M. Sumithra , S. Malathi , , 2018, A Survey on Medical Image Segmentation Methods with Different Modalities, INTERNATIONAL JOURNAL OF ENGINEERING RESEARCH & TECHNOLOGY (IJERT) PECTEAM – 2018 (Volume 6 – Issue 02), <http://dx.doi.org/10.17577/IJERTCON030>
- [14] Chatterjee, Priyadarshini & Rani, Dutta. (2021). A Survey on Techniques used in Medical Imaging Processing. Journal of Physics: Conference Series. 2089. 012013. 10.1088/1742-6596/2089/1/012013.
- [15] X. Chen and L. Pan, "A Survey of Graph Cuts/Graph Search Based Medical Image Segmentation," in IEEE Reviews in Biomedical Engineering, vol. 11, pp. 112-124, 2018, doi: 10.1109/RBME.2018.2798701.
- [16] Nameirakpam, Dhanachandra & Chanu, Yambem. (2017). A Survey on Image Segmentation Methods using Clustering Techniques. European Journal of Engineering Research and Science. 2. 15. 10.24018/ejers.2017.2.1.237.
- [17] Shafi, Aarish & Padha, Devanand. (2019). Medical Image Segmentation A Review of Recent Techniques, Advancements and a Comprehensive Comparison. International Journal of Computer Sciences and Engineering. 7.114-124. 10.26438/ijcse/v7i7.114124.
- [18] Masood, Saleha & Sharif, Muhammad & Masood, Afifa & Mussarat, Yasmin & Raza, Mudassar. (2015). A Survey on Medical Image Segmentation. Current Medical Imaging Reviews. 11. 3-14. 10.2174/157340561101150423103441.
- [19] N. Siddique, S. Paheding, C. P. Elkin and V. Devabhaktuni, "U-Net and Its Variants for Medical Image Segmentation: A Review of Theory and Applications," in IEEE Access, vol. 9, pp. 82031-82057, 2021, doi:10.1109/ACCESS.2021.3086020.
- [20] Sharma N, Aggarwal LM. Automated medical image segmentation techniques. *J Med Phys*. 2010;35(1):3-14. doi:10.4103/0971-6203.58777
- [21] N. Kumari and S. Saxena, "Review of Brain Tumor Segmentation and Classification," 2018 International Conference on Current Trends towards Converging Technologies (ICCTCT), 2018, pp. 1-6, doi: 10.1109/ICCTCT.2018.8551004.

Node MCU Based Home Automation with IoT

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Abstract:

Internet Of Things (IOT) connects and monitors various devices and sensors and provides a platform that control remotely across a network. Home automation and monitoring improves the comfort and security of human lives. The system is designed with the aim of reducing costs and making the system user friendly and it is built on IoT to get more accurate and error-free control over the flow. Home automation is being used by installing appropriate sensors in houses and control switches remotely. Switching capabilities are included in the system for controlling all the connected appliances in the home. The Blynk server is used to track all of these activities. To sense various characteristics within the house, the Node MCU (ESP8266) microcontroller is employed. It permits data gathering in real time and transmission. To make our everyday life smarter, secure, and less time-consuming, the complete architecture of a sensing based smart home automation system is best recommended.

Keywords:

Blynk App, ESP8266, Home Automation, Internet Of Things, Node MCU, Sensors

INTRODUCTION

The fantasy of having the whole process accomplished instantly for all of us has come true. A few of the mechanism that works perform admirably in this situation is a home robotization system. Home automation, often known as smart homes, is a type of technology used in the home atmosphere to supply luxury, privacy, flexibility, and decrease in power consumption to the owners or consumers. Home robotization is a abstraction

that entails the tracking and supervision of different equipment's in real time. IOT possess the ability to join a network without the need for human communication. An IoT system is made up of a collection of hardware devices such as microcircuit, detectors, and other components that communicate data to and from a server and microcontroller.

Robotization systems can assist in saving time, strengthening quality of life in homes, and conserving power by automatically executing multiple orders. The IoT is fully reliant on Internet for automation technologies. IoT devices are also more secure, which can help with home security systems. IoT can also send us notifications about threads and user safety. A fair bit of time can be gained by using IoT automation.

The expansion of IoT's fashion capability has gone widely to make home operations and daily duties. The goal of using this technique in the home is to monitor and save energy while reaching and maintaining some certain comfort level. As indicated in Fig. 1, home robotization systems implementing IoT have three key corridors. The observing and data collection component is the most important part. This is often accomplished by the use of different sensors, in various locations throughout the house to live and collect requested data like as temperature, wetness, or light. Alternating current is also involved in this model.

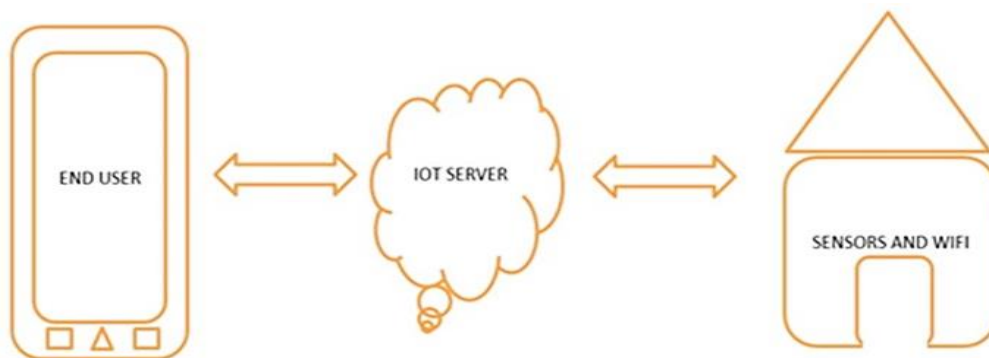


Fig 1: System for Home Monitoring

The provided model allows users to regulate household appliances according to their preferences. The graph for the house temperature can also be viewed using the graphs in the Blynk app. The temperature can be shown in three different types of graphs: line graphs, area graphs, and bar charts. The user can also manually change the data interval to live, fifteen minute, thirty minute, one hour, two hour, six hour, twelve hour, one day, two day, one week, two week and two month. Three-month, six-month, and one-year intervals are also available. Data can also be exported in.csv file for further analysis.

This research describes and examines the architecture of an IoT connected intelligent home system of electricity, which can be implemented in one or more styles. Section 1 presented a brief review of the research on Iot applications used for household computerization. Section 2 details the planning technique. Section 3 shows the simulation outcomes. At last, Section 4 finishes the study with a comments on the trends in coming years.

LITERATURE REVIEW

According to our research, nowadays one can find a lot of systems in the field of home automation which can provide distinguished operational features such as controlling lights, fans, kitchen appliances, security systems and so on. But some of the systems lack the mechanism of the coordination of all the above mentioned fields. Our system is aimed to provide a balanced coordination between all the components in the home to provide better control over the activities.

Harsh Kumar Singh et al.2019 have explained that if a person wishes to set up an already constructed transfer-based computerization device, all of the gadgets must be connected to the device; as a result, only the system will have control over those devices. They've built their system in such a way that the user first logs in with correct credentials, then chooses a room based on their preferences, and then follows the model's instructions. In this model, the user can also customize the layout to meet their needs. The Node MCU is used to control relays, which are in charge of controlling the system's AC supply. [1]

Majid Al-Kuwari et al.2018 have explained that the interplay among the person and the machine may be accomplished in numerous ways. Even if you only have a rudimentary understanding of programming, there's a whole variety of straightforward ways to display data in a portable or browser based app. Another manipulate alternative is thru cell GSM wherein the person can ship instructions in codes with the aid of using Short Message Service to the ESP8266. This manipulation technique necessitates the use of a one-of-a-kind GSM module in the circuit. This approach also can be implemented through the use of emails. They have used the Blynk application which provides easy access to the interface and one don't need to manage the servers for data retrieval and sending. Hence one can concentrate more on the hardware optimization of the system. [2]

The important requirement of Home computerization system is to display and manage the states of the electric home equipment, the usage of any cell, PC, tablet, laptop, and so forth which can be linked with the net via the server. The electric home equipment and the sun panel managed via the host. The sensor's output could be delivered via cell software called Blynk to make the technology more effective. During this time, the host receives anomalous output from the detectors, the Blynk software program is meant to provide notification. [3]

Surasura Lokesh et al.2020 have explained that the proposed system also incorporates home automation concepts such as energy conservation by automating light devices to turn on/off only when necessary, such as when the user is away from home and electrical devices in the home are wasting energy unnecessarily, the user can simply look into the Mobile app and turn them off.[4]

K. Lova Raju et al.2019 in their model the ultra low-cost digital thermal reading sensor, they explained, is a digital steaminess and thermal reading sensor that is inexpensive. A humidity sensor and a thermistor are the main components. A humidity sensor is used to sense and monitor both air and water temperature, whereas a thermistor is a type of resistor that changes with thermal reading and generates a virtual output at digital pins. It's is

intuitive to use, but this requires precise count in order to obtain the required data. The Blynk App allows users to develop their own app that is linked to the Blynk Host, which allows the model signal to be transmitted and received between the user and the server. This Blynk programme can be obtained by downloading it from a registered app store. To use this software to track the condition of all household appliances and operate them, the user should first enroll with its database. This is identical to a platform that allows the users to track and control device status. [5]

Shopan Dey et al. 2016 have explained that the IoT devices are used in a variety of structures to manage and monitor digital, electrical, and industrial systems. A single administrator oversees the connected device to the cloud server, which encompasses a wide range of users as well as sensor and nodes. Each user can only control the units to which they are tied, but the supervisor has access to and control over all units associated with each user. [6]

METHODOLOGY

Espressif developed the ESP8266, a wifi module is linked with this microcontroller. With the help of the ESP8266, IoT systems can be created.



Fig 2: Node MCU

The transfer of alternating current from the source to the actual device is controlled by relays. The relay already has alternating current from the source, so when it receives the command from the microcontroller, it permits the currents to flow

through the actual devices. It regulates the opening and shutting of an electrical circuit's current connections.



Fig 3: Four Channel Relay Module

Blynk is a framework for creating smartphone apps that can operate with a variety of microcontrollers. Blynk does not require any mobile programming. Blynk focuses on the functionality of microcontrollers and is completely free to use. Blynk Server is in charge of all data transfers between the smartphone and the hardware. You can use Blynk Cloud or set up your own Blynk server on your own computer.



Fig 4: Blynk Host

In the model, the Node MCU is first connected to a Light Dependent Resistor (LDR), which is then connected to the actual device (Tube light), so that when the light in the room exceeds the acceptable value, the tube light in the room comes on automatically and the Blynk app is updated. The

Node MCU is now connected to a DHT-11 sensor, which would then be connected to the Physical Device (Fan), so that when the room temperature rises over a particular threshold, the fan automatically turns on, and the Blynk app is updated accordingly.

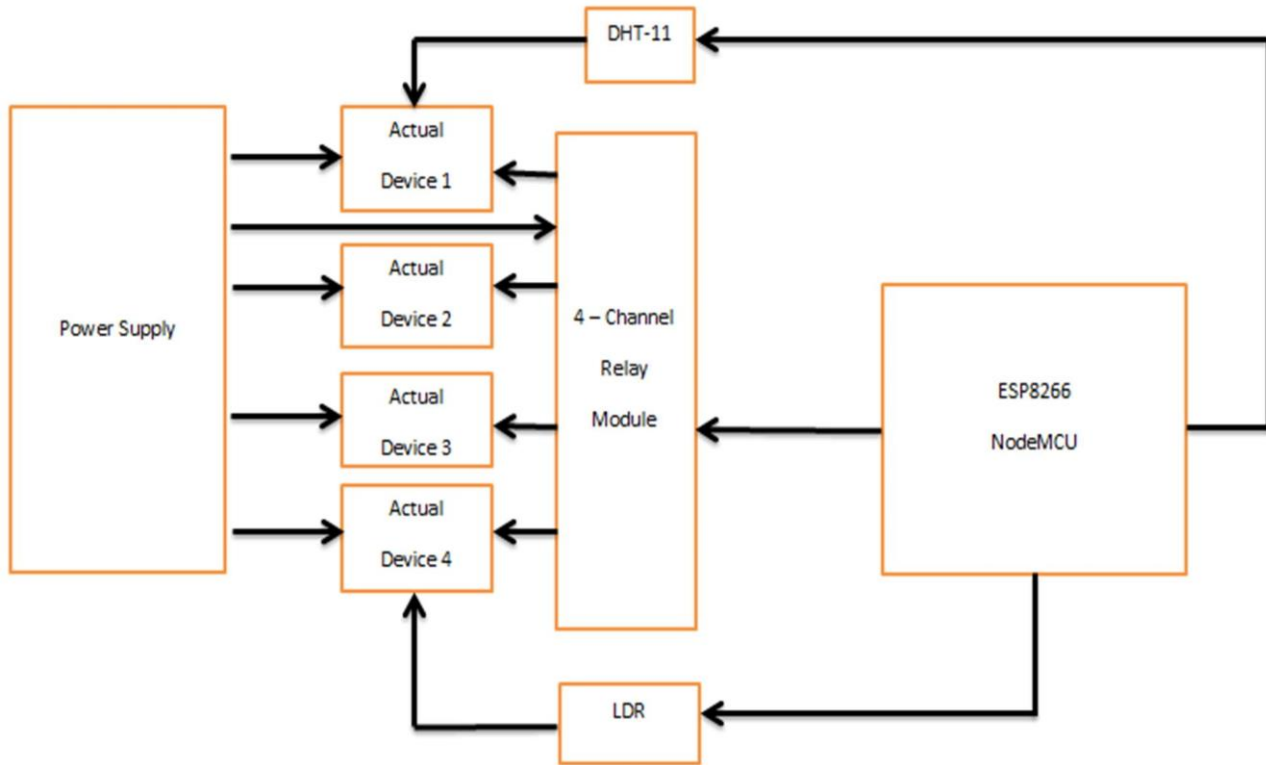


Fig 5: Block Diagram

Also one can control more devices in the room like AC, Heater, Lamp, etc. with the Blynk App as well as manually. So when one turns ON/OFF any device the Blynk App will give real time update about the condition of device.

RESULTS AND DISCUSSIONS

In below figure actual connections of the presented home automation model is shown, where node MCU is connected with the 4 channel relay module, DHT-11 sensor, LDR and power source. Actual device is connected with the Relay module and power supply.

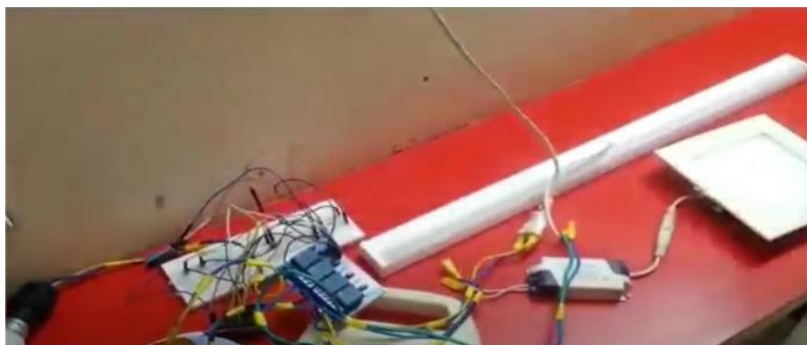


Fig 6: Home Automation Setup

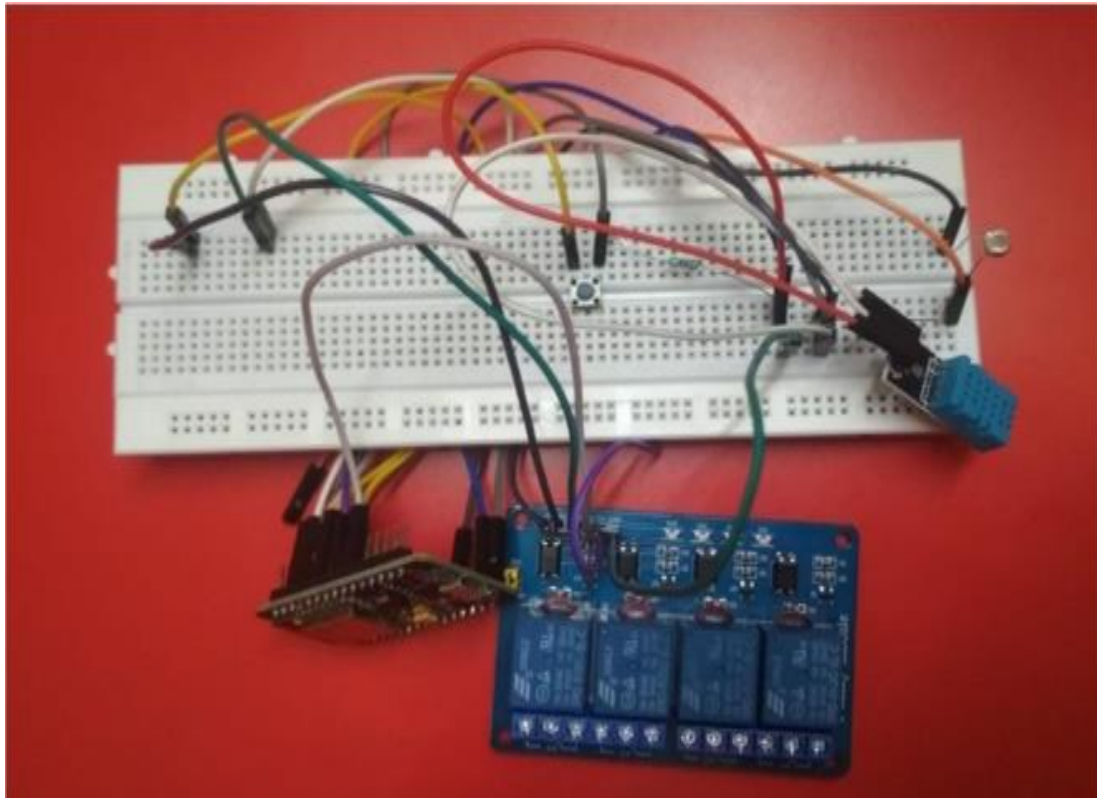


Fig 7: Circuit For Home Automation

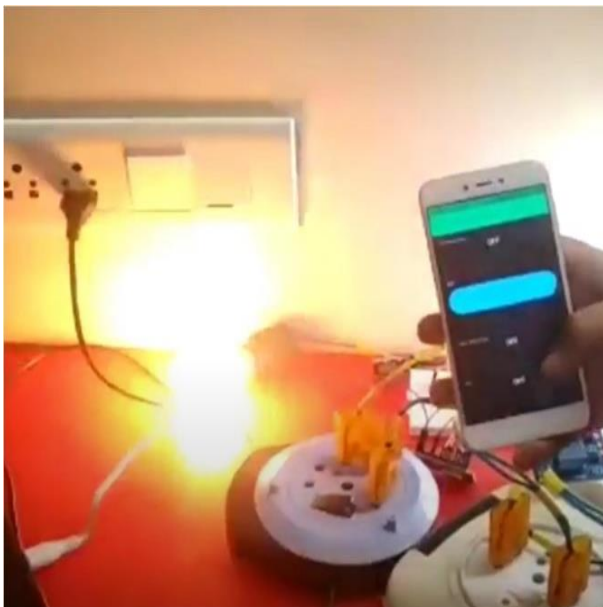


Fig 8: Setup for Bulb

When the light in the room is turned ON with the help of LDR sensing then the status of light is updated in real time in Blynk app. Also when the other devices are turned ON/OFF their status is also updated in Blynk in app in real time. One can also

use Blynk cloud in Laptop for getting the status of the device in the home.

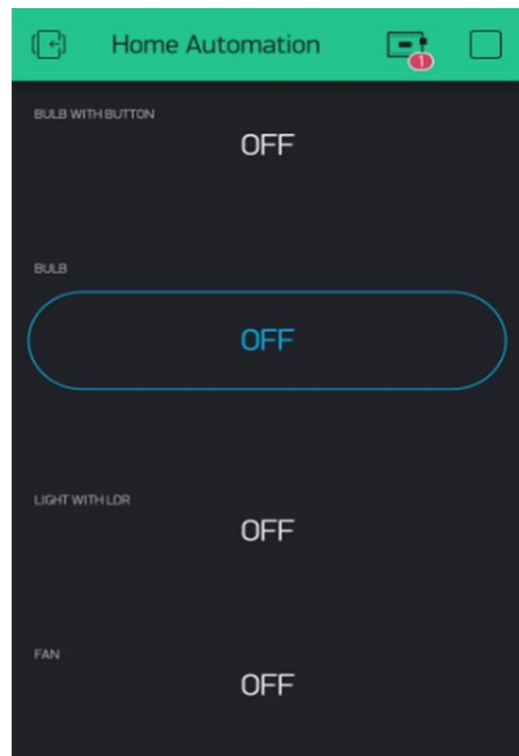


Fig 9: Blynk App Interface



Fig 10: Complete Setup

It's also possible to get a plot of the temperature inside the house. The graph's interval can be manually selected, for example, live, half-hour, twenty-four-hour, and so on. Also three types of chart can be obtained as shown in below figures.



Fig 11: Line Graph in Fifteen Minute Interval

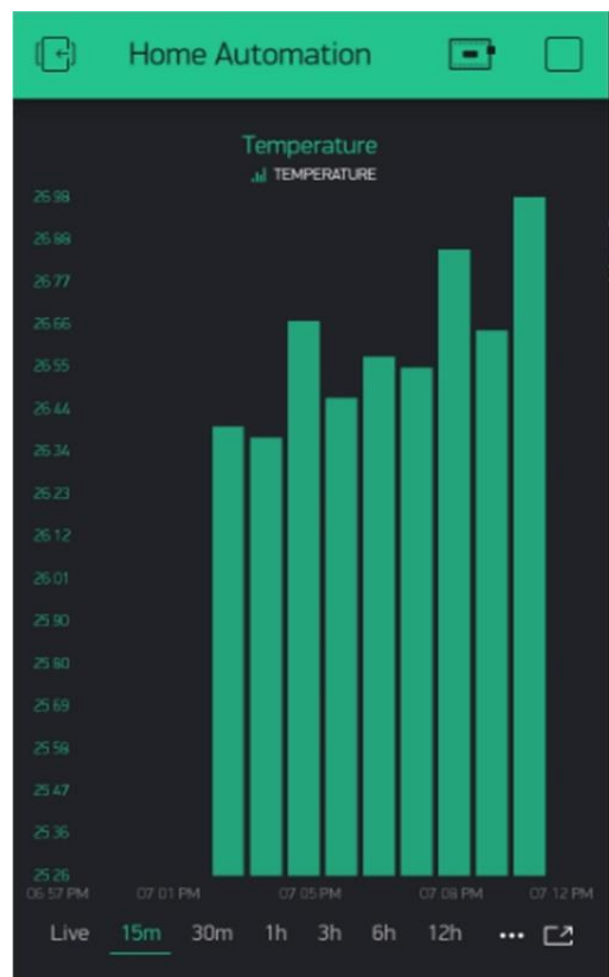


Fig 12: Bar Graph in Fifteen Minute Interval

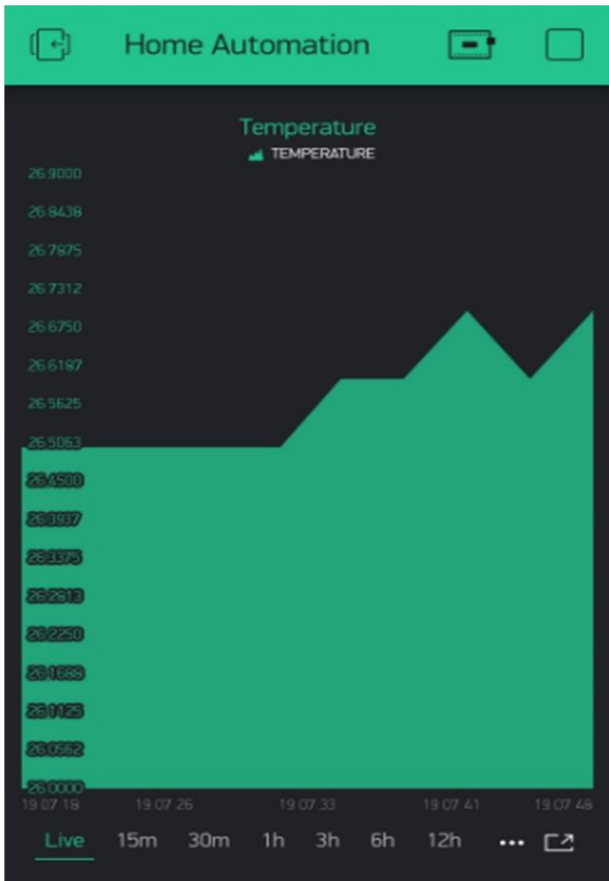


Fig 13: Area Graph in Live Mode

CONCLUSION

A actual home automation method was successfully implemented in this work, and it's also performing admirably. Its major goal is using a smartphone or tablet to control home appliances in a convenient manner while also providing powerful home protection and stability features. The Node MCU microcontroller serves as a user-to- hardware interface. It is configured and connected to a variety of devices, including lights, air conditioning (AC), fans, and other devices. This method can also be used to control devices by physically disabled people. It might be used for industrial uses by developing a domain-based website that allows the entire industrial structure to be monitored from a remote location. All of this adds up to a smart home computerized system that is completely functional and versatile, due to IoT technology. More capability and classiness could be applied to the existing system using advanced artificial intelligence, allowing the home automation system to develop, adjust, and expand on its own. A phone

call system that is automated can also be incorporated. In the event of a gas leak or a fire alarm, the appropriate authority would be notified immediately, making the system more effective when clients are out of home.

REFERENCES

- [1] Harsh Kumar Singh , Saurabh Verma , Shashank Pal , Kavita Pandey, "A Step Towards Home Automation Using IoT", 2019 IEEE.
- [2] Majid Al-Kuwari, Abdulrhman Ramadan, Yousef Ismael, Laith Al-Sughair, Adel Gastli, Mohieddile Delammar, "Smart Home Automation Using IoT Based Sensing And Monitering Platform", 2018.
- [3] Yasir Arafat, Md. Mohaiminul Islam, Md. Nahiyen Farook, S. M. G. Mostafa, "Design and Implementation of an IoT Based Home Automation", 2019, IEEE
- [4] Surasura Lokesh, Shashidhar B.Patil, Aishwarya Gugawad, "Home Security And Automation Using NodeMCU-ESP8266", 2020
- [5] K. Lova Raju, Member, IEEE, V. Chandrani , SK. Shahina Begum , M. Pravallika Devi, "Home Automation and Security System with Node MCU using Internet of Things", 2019
- [6] Shopan Dey, Ayon Roy, Sandip Das, "Home Automation Using Internet of Thing", 2016
- [7] K. Lova Raju^{1*}, Member, IEEE, V. Chandrani¹, SK. Shahina Begum¹, M. Pravallika Devi¹, Home Automation and Security System with Node MCU using Internet of Things 2019
- [8] Vikram.N, Harish.k, Nihaal.M, Raksha umesh, Shetty Aashik Ashok kumar, "A Low Cost Home Automation System Using Wi-Fi Based Wireless Sensor Network Incorporating Internet of Things (IoT)", IEEE 7th International Advance Computing Conference, pp. 174-178, 2017.
- [9] Himanshu Singh, Vishal Pallagani[†], Vedant Khandelwal, Venkanna U. "IoT based Smart Home Automation System using Sensor Node", 2018.

- [10] Ravi Kishore Kodali, Vishal Jain, Suvadeep Bose and Lakshmi Boppana. "IoT Based Smart Security and Home Automation System", pp. 1286-1289, 2016.
- [11] Homera Durani, Mitul Sheth, Madhuri Vaghasia, Shyam Kotech, " Smart Automated Home Application using IoT with Blynk App", 2nd International Conference on Inventive Communication and Computational Technologies (ICICCT 2018), pp. 393-397, September 2018.
- [12] Yong Tae Park, Pranesh Sthapit, Jae-Young Pyun, "Smart Digital Door Lock for the Home Automation", IEEE, pp. 1-6, TENCON 2009.
- [13] F. M. G. K. D. Sukmana, Husni Teja, "Wireless and mobile (apwimob),IEEE asia pacific conference on," pp. 183 – 187, 2015.
- [14] [14]G.Mahalakshmi, M.Vigneshwaran, "IOT Based Home Automation Using Arduino", International Journal of Engineering and Advanced Research Technology (IJEART), pp. 7-11, 2017.

Content-based Image Retrieval for Multidimensional Objects using Euclidean Distance and an Artificial Neural Network

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Abstract:

With advancements in computer vision and visualization leading to the growth of bulk digital data in today's world, the complication of searching for a specific image and retrieving the related data has become difficult. Image retrieval is performed on FIDS30 and fruti360 dataset images using feature fusion and compared with different similarity measures such as Euclidean distance and Artificial Neural Network. Initially, the image is converted to greyscale and binarized using Otsu thresholding, followed by segmentation using K means clustering and the contour method to select the region of interest (ROI), and finally, the color histogram, gray level co-occurrence, and histogram gradient feature vector are extracted. Images in the database are trained for 10 epochs and tested to retrieve images from the database using similarity measures such as Euclidean distance and artificial neural networks. The experimental results for various image classes are recorded using Euclidean distance and ANN. For 2D data, the confusion matrix is obtained for color, shape, texture, and fusion features. Although Euclidean distance performs better, when considering 3D data images with different views, ANN outperforms the traditional Euclidean distance measure.

Keywords:

ANN, Euclidean distance(ED), 2D, 3D, Confusion matrix

INTRODUCTION

Because of the introduction of storage devices and the internet, database images are rapidly growing. Retrieving an image from a collection of database is a challenging task. One solution is to manually annotate the images. However, this task takes time and is not suitable for all applications. Because the annotating process is dependent on the semantic accuracy with which the image is described, content-based image retrieval systems are developed that are based on extracting local and global features from image content[1]. Recall images are built based on principles of feature extraction, matching, and indexing. Following are the fundamental steps of an image retrieval system: First, features from database-stored images are retrieved; next, features from query photos are extracted; finally, these features are compared with image features from database images; and ultimately, a match is obtained.

LITERATURE REVIEW AND RELATED WORK

Since 1990, CBIR has come a long way, and there are many CBIR algorithms that process images into various tasks. Feature extraction techniques such as Gabor,

Wavelet, and Histogram over color and texture features are discussed in paper [6]. Wavelet transform retrieves images at a much faster rate than other techniques[8]. Ponomarev, A., Nalamwar, A. [18] author proposes a CBIR system which employs "DCT and DWT and the Hierarchical k-means algorithm. The results in the paper demonstrate the efficacy of the given method. In terms of precision. Satish Tunga, D. Jayadevappa, and C. Gururaj [12] compared various approaches to object retrieval based on content and reviewed available algorithms, discussing techniques, advantages, disadvantages, limitations, and the semantic gap between low and high level features. Shrivastava, Nishant Vipin Tyagi [13] suggested a method for filtering out irrelevant data based on different attributes in order to get color images which eliminates the need for segmentation and normalization techniques. "D.T. Ingole, M.D. Ingole, Yogita Mistry [6]" proposed method that uses cross spatial and frequency features such as moments using SWT, features using Gabor wavelet transform "binarized statistical image features, color and edge directivity descriptor" features. The CBIR system. Jun Yue, Zhenbo Li, Lu Liub, and Zetian Fub [14] proposed a color and texture fusion method that used color histogram and cooccurrence matrices. The fusion method provides greater accuracy. Ahmed J. Afifi and Wesam M. Ashour [15] proposed "ranklet transform for pre-processing and image enhancement operations, images are clustered with k means clustering and without clustering" and discovered that the system performed better without clustering. D. Latha & A. Geetha [16] in this paper author proposed hybrid image features and multilevel approach. Experimentally compared with databases such as Corel-1k and DB VEG. "Guangyi Xie, Baolong Guo, Zhe Huang, Yan Zheng, And Yunyi Yan" [17] proposed method that employs the texon template to detect and extract color descriptor on consistent zone and Hu moments on dataset Corel-1k, Corel-5k, and Corel-10k, and experimental results show that it outperforms current image retrieval methods based on content.

METHODOLOGY

Content-based search examines the image contents rather than the accompanying metadata, such as tags, keywords, or descriptions. Information extracted from the image itself, including colors, shape, textures, and other details are referred to as content. The given block diagram and

functionality of the system are based on the work. Figure 1 and algorithm proposed.

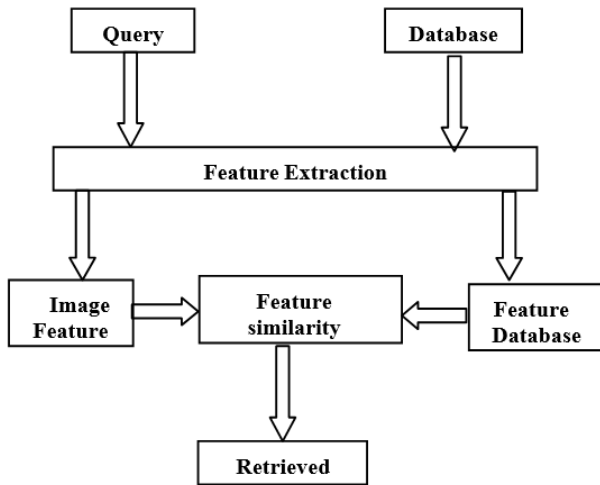


Figure 1. CBIR system block diagram

A. Proposed algorithm

1. Read the image input (x)
2. Resize the image
3. Converting the image to grayscale
4. Image preprocessing is performed (x)
 - a) Image color conversion (x)
 - b) Using the Median Filter on an image (x)
5. Segmentation is applied to image(x) by a) using K-Means Clustering and b) converting to binary image by thresholding using Otsu's method.
6. Use Morphological operations on image (x) to remove background dilation using a kernel matrix of [3, 3].
7. Using the Contour method to Select Bounding ROI
8. ROI Feature Extraction
9. Data Processing read each image from the dataset, apply steps 2 through 8, and save it
10. Finding Euclidian Distance between input image feature and Dataset image features matrix
11. Sorting Euclidian Distance in ascending order
12. Determining the Euclidian Distance between an input image feature and the image feature matrix in a dataset 11. Ascending Euclidean Distance Sorting
13. The first ten images with the lowest Euclidian Distance index value will be returned.
14. Showing 10 Images
15. Train ANN using the features of the Processed Dataset 15. Feed the input image feature metric to the trained ANN and test it for 10 epochs.
16. Retrieving the index value of all images that are similar to the input image
17. Display the first ten images that are similar to the input image.

B. COLOR FEATURE

The color histogram is a feature representation in image retrieval that is sensitive to noise. This work extract the color moments, cumulative histograms, color correlograms, and color histograms. In order to create a

perceptually consistent space, they first convert the R, G, and B color system to HSV and then quantized the transformed color space into m bins because color set feature vectors are binary, allowing for a fast search Color is extremely important in the human visual perception mechanism. Figure 2a and Figure 2b depicts a representation for 2D and 3D images A popular graphing tool is the histogram. It is employed..

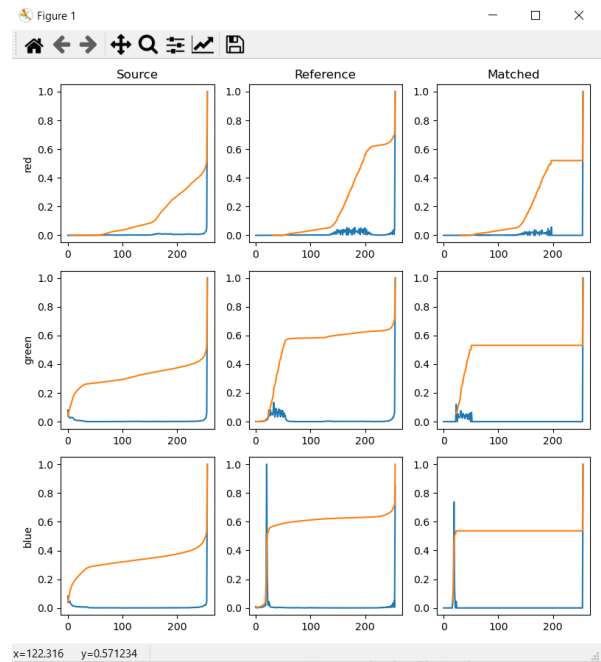


Fig 2a Output of applying histogram matching of source image, reference image, and histogram matched image for 2D image

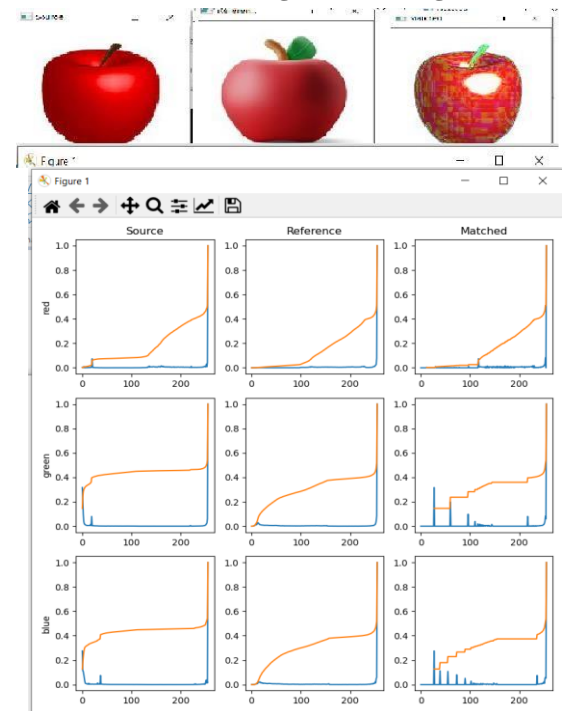


Fig 2b Output of applying histogram matching of source image, reference image, and histogram matched image for 3D image

C. TEXTURE

Texture informs us about the structural arrangement of surfaces and objects in an image. It is a spectral approach that is based on the intensity distribution across the image. Texture has the properties of periodicity and scalability. In this paper, we looked at nine properties: homogeneity, ASM, energy, correlation, dissimilarity, contrast, mean, standard deviation, entropy, and maximum. Texture analysis is important in image comparison because it supplements the color feature. GLCM feature for 2D and 3D images as shown in Figure 3a and b.

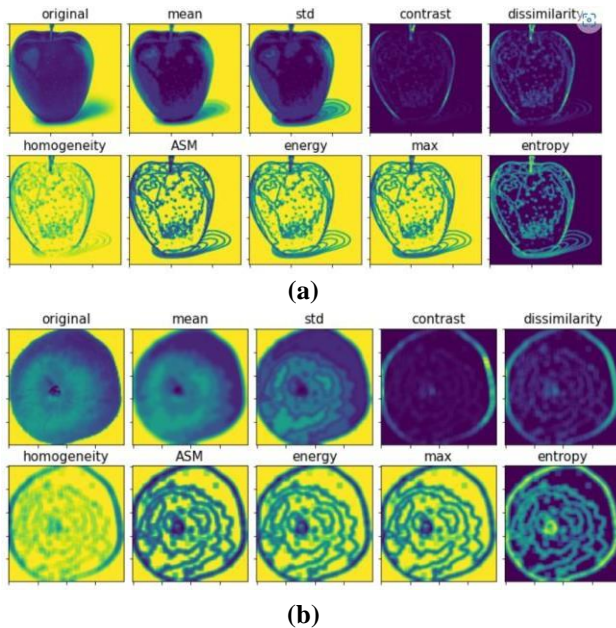


Figure 3 a & 3b: GLCM (a)mean (b)standard deviation (c)contrast (d)dissimilarity (e)homogeneity (f)ASM (g)energy (h)max (i)entropy for 2D and 3D images resply

1.5 Shape features

The histogram of gradient feature descriptor is used as a shape feature in this work, and the distribution of histograms and gradient directions are used as features. Gradient x and y derivatives of an image are useful because gradient magnitude is high around edges and corners. Figure 4 depicts a Histogram of Oriented Gradients (HOG).

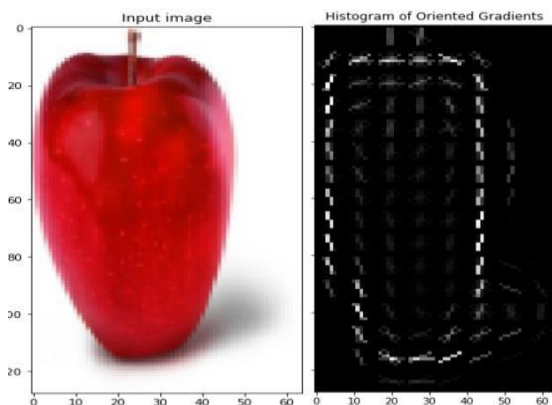


Figure 4: Gradient Histogram Visualization

1.6 Multilayer Perceptron

A multilayer perceptron (MLP) is made up of perceptron with each perceptron acting as an input layer, sending outputs to all perceptrons in the hidden layer, and all perceptrons in the hidden layer sending outputs to the output layer. utilizing various weights as illustrated in Figure 5. MLP employs a decision function with a step function, and the output is binary, based on probability-based predictions or the classification of items into multiple labels. An input query is connected to the desired results through a neural network, which is a network of neurons. By repeatedly changing the associations' strengths, the network is trained to map to the right answers [12]. A function called $f(\cdot)$ (RmRo can be studied using a multi-layer perceptron (MLP), where m stands for the magnitude of the input and o for the magnitude of the output. An MLP implementation called Classifier trains using back propagation[19]. A classifier is employed when data is made available gradually and the model's desired data changes often. Nonlinear systems don't have to worry about interpretability.

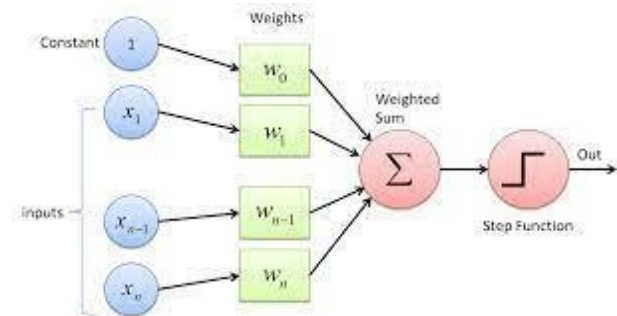
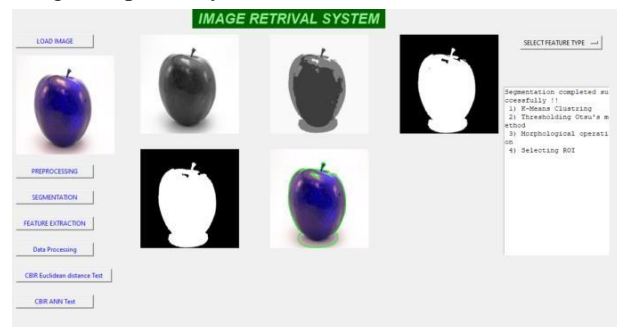


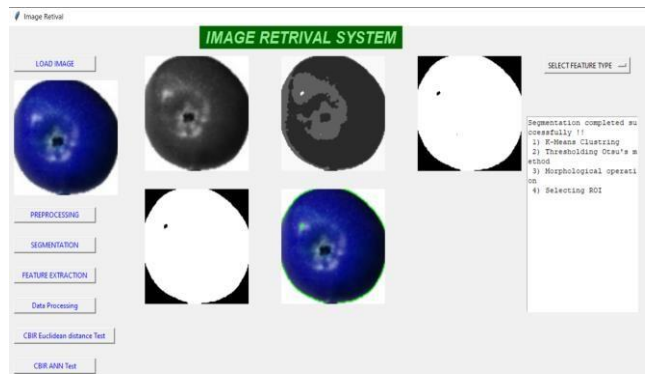
Figure 5: MLP Perceptron Structure

1.8 Result and Discussion

Consider an image, resize it, convert it to greyscale, the resulting image is preprocessed using a median filter, and then the image is segmented using K means clustering, converted to binary, and then the region of interest is selected using dilation. Data processing is used to train the data with features and then test the data. Use Euclidean distance and an artificial neural network to compute similarity measures. Figures 6a and 6b depict the results of preprocessing, segmentation, morphological analysis, and retrieval for 2D and 3D images respectively.



(a)



(b)

Figure 6a & b Preprocessing image output
(a) resize, (b)Greyscae, (c) The median filter (d) K means clustering (e) Otsu Thresholding(f) Morphological operation (f) ROI for 2D and 3D images resply

Experiment results are shown for retrieval of 2D and 3D objects for fusion of features using ED and ANN measures respectively in figure 7a,7b,8a,8b and also performance evaluation using confusion matrix for ANN and ED methods. Bar graph for accuracy of sytem using ED and ANN method

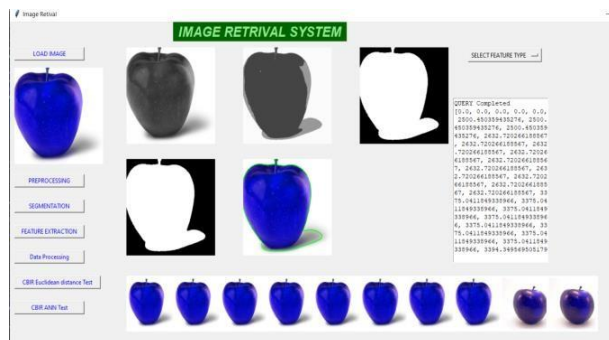


Figure 7a : Euclidean Distance retrieval results for fusion of features for 2D images

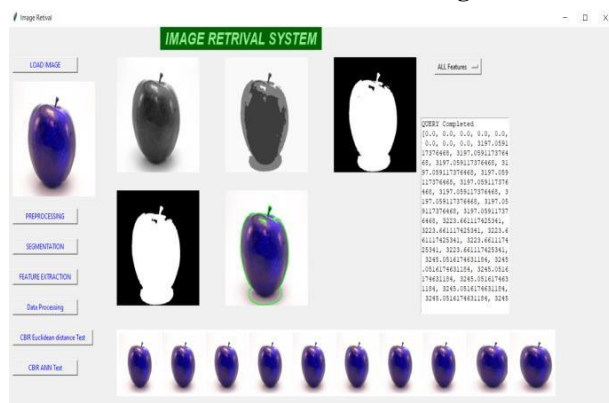


Figure 7b: ANN retrieval results for fusion of features for 2D images

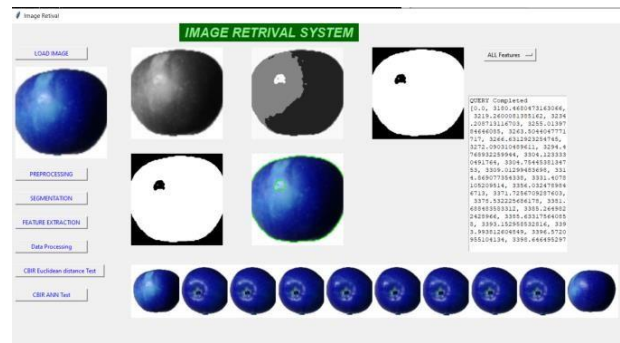


Figure8a: Euclidian Distance retrieval results for fusion of features for 3D images

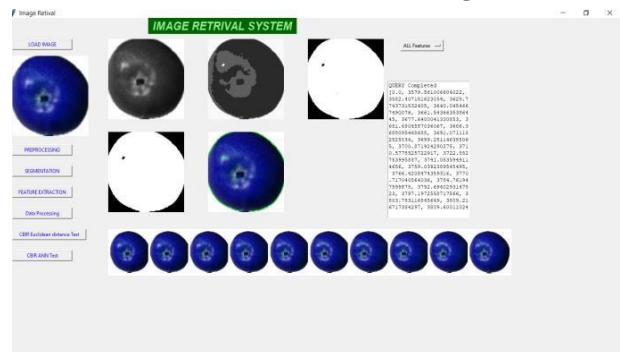


Figure 8b: ANN retrieval results for fusion of features for 3D images

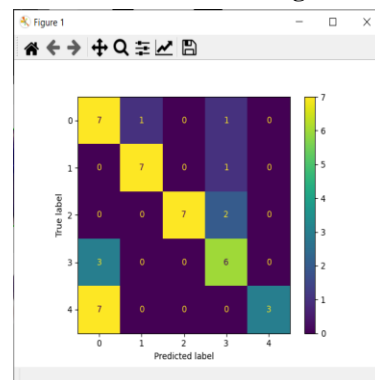


Figure 9a depicts the performance evaluation of the ED method using the confusion matrix

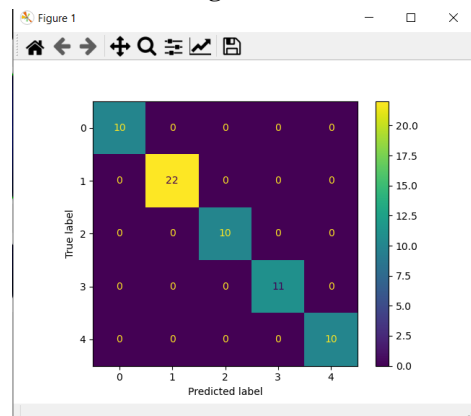


Figure 9b depicts the performance evaluation of the ANN method using the confusion matrix

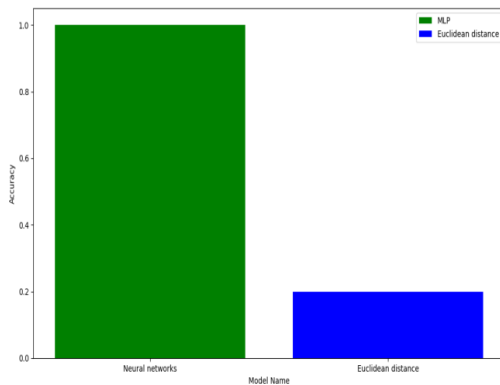


Figure 10: ANN Accuracy vs. Euclidean Distance

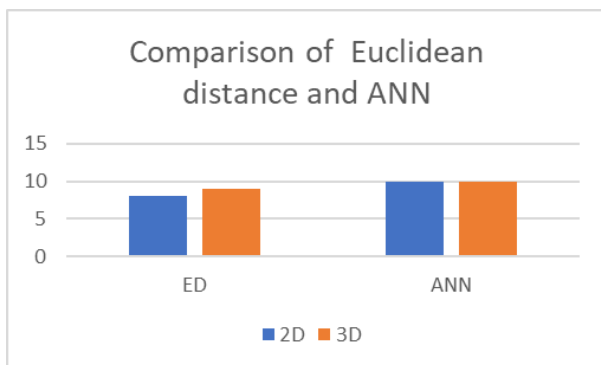


Figure 11 depicts the comparison of the accuracy of the ANN and the Euclidean distance. For 2D and 3D data

We can conclude from experiment and observation that the ANN method outperforms the Euclidean distance. In the table 1.8 below, the proposed approach is compared to the other methods.

Sl no	Author/year	Features	Feature extraction method used	Images	Similarity measure	Accuracy
1	(Pavithra & Sharmila, 2019)	Color, Texture, Shape	Color Moment LBP, Canny Edge Detector (CLC)	WANG Corel 5k, Corel 10k	Euclidean distance	83%, 69%, 60%
2	(Rana et al., 2019)	Color, Texture, Shape	Color Moment Ranklet, Transformation Invariant Moment(CR)	Caltech101	Euclidean distance	65%
3	(Thusnavis Bella & Vasuki, 2019)	Color, Texture, Shape	Color Moment GLCM, Geometric Shape Feature(CGS)	Corel 10k	Euclidean distance	56%
4	Proposed Method	Color, Texture, Shape	Color histogram, moment, auto correlogram GLCM, HOG	FIDS30, Fruit 360	Euclidean distance, ANN	80% /75 %, 90% /82%

Table1.8 Comparison with the other methods

1.8 CONCLUSION:

This work focuses on the core components of a content-based image retrieval system for 2D and 3D images, such as image feature representation, indexing, query processing, query-image matching, and user interaction., while outlining significant problems. In this paper, image data is preprocessed before being trained and tested with two similarity measures to produce retrieval results using Euclidean distance and ANN. The formation of content-based representation retrieval systems has been found to

have better promise, due to the semantic gap between image similarity outcomes and user perception. From experiment it is observed that for 2D images Euclidean distance gives good result but when you use ANN based similarity measures for 2D images and 3D images for both we yield good results for fusion of features. The application of machine learning and deep learning concepts to image retrieval yields promising results. In this paper, we used Euclidean distance and ANN for matching and classification, with ANN outperforming Euclidean distance. thus reducing semantic gap.

REFERENCES

- [1] V. Castelli, and L. Bergman, Image Databases: Search and Retrieval of Digital Imagery, Wiley-Interscience, USA, 2002.
- [2] Manpreetkaur, Neelofarsohi "A Novel Technique For Content Based Image Retrieval Using Color, Texture and Edge Features", international conference on Communication and electronics system (ICCES), IEEE, 2017
- [3] K.B.A.B. Chathurika, P.K.S.C. Jayasinghe, "A Revised Averaging Algorithm For An Effective Feature Extraction In Component-Based Image Retrieval System", International Advance Computing Conference (IACC). IEEE, 2015
- [4] AnushaYalavarthi, K. veeraswamy, K. AnithaSheela, "Content Based Image Retrieval Using Enhanced Babor Wavelet Transform", International Conference On Computer, Communications And Elelctronics. IEEE, 2017
- [5] Ms. Sandhya R. Shinde, Ms. SonaliSabale, Mr. Siddhant Kulkarni, Ms. Deepti Bhatia, "Experiments On Content Based Image Classification Using Color Feature Extraction", International Conference On Communication, Information And Computing Technology (ICCICT), Jan. 16-17, IEEE, 2015.
- [6] Marouane Ben Haj Ayeche, Hamid Amiri, "Content Based Image Retrieval In The Topic Space Using SOM And LDA", 3rd, International Conference On Content Engineering And Information Technology (CEIT), 2015
- [7] Yogita Mistry , D.T. Ingole, M.D. Ingole Content based image retrieval using hybrid features and various distance metric Journal of Electrical Systems and Information Technology Volume 5 (2018) 874–888 Electronics Research Institute (ERI). Production and hosting by Elsevier
- [8] G. Papakostas, D. Koulouriotis, and V. Tourassis, "Feature extraction based on wavelet moments and moment invariants in machine vision systems," in Human-Centric Machine Vision, InTech, London, UK, 2012
- [9] Ruigang Fu, Biao Li, Yinghui Gao, Ping Wang ATR Key Lab ,Content-Based Image Retrieval Based on CNN and SVM 2016 2nd IEEE International Conference on Computer and Communications pg 638-642

- [10] Mayank Jain and Divakar Singh Research Scholar India. A Survey on CBIR on the Basis of Different Feature Descriptor British Journal of Mathematics & Computer Science 14(6): 1-13, 2016, Article no.bjmcs.24000 issn: 2231-0851 science domain international www.sciencedomain.org
- [11] Content Based Image Retrieval using Color, Shape and Texture Ramesh K Lingadalli ,N.Ramesh Student, Information Science and Engineering (S.E), M. S. Ramaiah Institute of Technology, Bangalore, India Associate Professor, Information Science and Engineering International Advanced Research Journal in Science, Engineering and Technology Vol. 2, Issue 6, June 2015 Copyright to IARJSET DOI 10.17148/IARJSET.2015.2610
- [12] Satish Tunga, D.Jayadevappa & C.Gururaj A Comparative Study of Content Based Image Retrieval Trends and Approaches International Journal of Image Processing (IJIP), Volume (9) : Issue (3) : 2015
- [13] Nishant Shrivastava, Vipin Tyagi An efficient technique for retrieval of color images in large databases,Computers and Electrical Engineering Volume 46 (2015) pg no 314–327 Elsevier
- [14] Jun Yue , Zhenbo Li ,1 , Lu Liub , Zetian Fub, Content-based image retrieval using color and texture fused features Mathematical and Computer Modelling 54(2011)1121-1127 Elsevier
- [15] Ahmed J. Afifi and Wesam M. Ashour Image Retrieval Based on Content Using Color Feature International Scholarly Research Network ISRN Computer Graphics Volume 2012, Article ID 248285, 11 pages doi:10.5402/2012/248285
- [16] D. Latha & A. Geetha Effective CBIR based on hybrid image features and multilevel approach Multimedia Tools and Applications <https://doi.org/10.1007/s11042-022-12588-7>
- [17] Guangyi Xie , Baolong Guo, (Senior Member, Ieee), Zhe Huang, Yan Zheng, And Yunyi Yan, Combination of Dominant Color Descriptor and Hu Moments in Consistent Zone for Content Based Image Retrieval VOLUME 8, 2020 Digital Object Identifier 10.1109/ACCESS.2020.3015285
- [18] Ponomarev, A., Nalamwar, H. S., Babakov, I., Parkhi, C. S., & Buddhawar, G. (2016, February). Content-based image retrieval using color, texture and shape features. Key Engineering Materials, 685, 872–876. <https://doi.org/10.4028/www.scientific.net/KEM.685.872>

A Study on Application of Total Quality Management Practices in Indian Automobile Industry

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Abstract:

The industrial world is becoming more competitive day by day. Therefore, industries should be best in class by performing excellence in manufacturing goods and providing excellence in services. In these highly competitive markets, the products and services produced are not simply sold. There is a need of good managerial and marketing philosophies to make the goods and services competitive in the market. The important philosophy is TQM and its tools and techniques. Total quality management is one of the most vital management philosophies, which helps the organization to satisfy their customer in a best possible manner. However, there exist extensive numbers of examples of failed or badly performed implementation process of TQM. This is a problematic phenomenon, which negatively affects organizations in their development towards business excellence and ultimately survival in a competitive environment. The present study is an attempt to assess the different total quality management tools and techniques of selected Indian automotive industry. The study also tries to explore the similarity and differences in total quality management practices in the selected automotive firms. An attempt has been made to know the barriers in total quality management implementation. The research is a multiple case study to investigate TQM implementation in selected automotive firms in India and the following firms chose for this research: TVS Motor Company Limited, Toyota Kirloskar Motor Limited, J.K. Tyres Limited and Automotive Axles Limited. Firstly, a within-case analysis is performed which means each case is a unit of analysis. Then a cross-case analysis is performed. The comparison between the cases shows both similarities and differences in approach to TQM. The case study analysis within the Indian automobile industry has been performed with the help of data collected from documentation, archival records and previous research work. The study is descriptive in nature and the secondary data collected from the various resources has been analysed to achieve the objective of the research. The result of the analysis shows some similarities and differences in prevailing quality management practices in selected automotive firms. The research shows some quality programs such as Statistical Process Control, Quality Audit, Total Productive Maintenance and Failure Mode and Effect Analysis are the most relevant quality programs undertaken by all companies during the implementation of TQM. The other objective of research is to identify the barrier factors during the implementation of TQM. The practical implication of research finding refers to the fact that managers might gain a lot by placing their emphasis on total quality management approach and implement the most effective tools and techniques of TQM in their organization.

Keywords:

TQM, Practices, Automobile, Techniques

INTRODUCTION

The industrial world is becoming competitive and competitive in multiple times. Therefore industries should become world class by performing excellence in manufacturing goods and should provide excellence in services. In these highly competitive markets the products and services produced are not simply sold. The industries should have the managerial and marketing philosophies to sell the goods and services. The important philosophy is TQM and its principles such as quality, quality of products, quality of services, quality of processes, quality of suppliers, quality of maintenance, quality of employees and their involvement etc., The overall management of quality in the industries starting from suppliers to customers or end users is known as Total Quality Management (TQM). Total quality management is also defined as a management philosophy, aims to maintain the standard qualities in procuring raw materials, able to manage the standard qualities in manufacturing processes, able to produce the standard quality of goods, able to finally able to satisfy the distributors and end customers with their excellent quality of products and services. Quality management deals with the processes, products, services and initiates the innovations in the company to satisfy the customers. Quality management is concern for producing the excellent products having high quality and durability. TQM is applicable to beyond the boundaries of the company. It includes suppliers, supplier's suppliers, logistics providers, distributors, dealers, customers manage the quality in logistics and distribution processes, and end users. TQM tries to enhance the quality of each and every process of quality chain. TQM involves each and every person in the manufacturing and quality chain to take part in solving the problems and improving the quality of products and services continuously (Venkateshwarlu et al., 2011).

1.1 Background of the study

Before the era of economic liberalization in India, i.e., till the late 1980s, the automobile-manufacturing sector in India had been stagnant, there were few indigenous auto manufacturers. The start of a new era for Indian automobile manufacturing – was when, in 1983, Maruti, the Government of India and Suzuki started manufacturing small cars. The policy of economic liberalization initiated by the Government of India in 1991 gave a further impetus to the growth of this sector. Major manufacturers such as General Motors, Hyundai, Fiat, Honda, etc., set up manufacturing bases in India.

With liberalization came increased competition and manufacturers came under pressure to improve quality – this was necessary for growth in this competitive market, and, indeed, for survival, automakers began to implement formal quality improvement programs, such as TQM. India has emerged as an Automotive manufacturing hub in the past decade. Competition in Automotive Sector requires the manufacturers and their suppliers to innovate, improve, and increase their efficiency to meet the challenges of globalization. This forces the manufacturers to maintain high quality standards in their manufacturing process under strong competitive pressure (Phusavat, 2008). Low Labor cost, availability of raw materials, and the emerging automobile market leads the foreign manufacturer to outsource the manufacturing of the automobile component to gain competitive advantage. The relatively stable economic growth and developed infrastructure, low cost manpower, low cost manufacturing and increasing demand for vehicle provides the Indian automotive companies with opportunities to grow at a fast pace. Customer focus and continuous improvement enhances the quality innovation process in an organization. Total Quality Management implementation focuses on continuous improvement and customer focus which leads to the innovation processes in the organization. TQM and innovation together integrates organization objectives and functions which ultimately results in Customer Satisfaction. Emergence of Indian automotive industry as a global player seeks for understanding the complexity of quality practices required for running the business successfully in the international competitive environment.

1.2 Purpose of the Study

The present study is an attempt to assess the different total quality management tools and techniques of selected Indian automotive industry. The study also tries to explore the similarity and differences in total quality management practices in the selected automotive firms. An attempt has been made to know the barriers in total quality management implementation. This research is a multiple case study to investigate TQM practices in selected automobile manufacturing firm. Each case is a unit of analysis. The case analysis is performed based on data collected through documents, archival records and previous research work.

1.3 About the selected company

The present research focused on assessing TQM initiatives in selected Indian automotive industries to explain and identify similarities and differences in the total quality management practices and barrier factors of TQM implementation. The research is a multiple case study to investigate TQM implementation in selected automotive industries in India and the following firms chose for this research.

❖ *TVS motor company limited*

TVS Motor Company Limited, (hereafter referred to as TVS) the flagship company of the USD 2.2 billion TVS

Group, is the third largest two-wheeler manufacturer in India and among the top ten in the world, with an annual turnover of over USD 650 million. TVS is the first two-wheeler manufacturer in the world to be honored with the hallmark of Japanese Quality - The Deming Prize for TQM. This company is following such quality programs as Quality Control Circle, Just-in-time, Statistical Process Control, Quality Audit, Total Productivity Maintenance (TPM), FMEA (failure mode effect analysis), the PDCA (Plan, Do, Check, Act) cycle, 5 'S' (sort, straighten, shine, standardize, sustain), Kaizen and QFD (quality function deployment). The quality tools include 7 QC tools such as process flow chart, cause & effect diagram, check list, scatter diagram, pareto chart, histogram, control chart and 7 new management tools such as Affinity Diagram, Relationship Diagrams, Tree Diagram, Matrix Diagram, Prioritization Matrix, Activity Network Diagram, Process Decision Program Chart. Decrease in defects and improvement in productivity are also noteworthy achievements. The company successfully implemented TPM (Total Productive Maintenance) for decreasing defects and improving productivity and received TPM excellence award. Other important achievements include decrease in work accidents, decrease in work-in-progress, increase in work satisfaction and improvement in morale.

❖ *Toyota Kirloskar Motor Ltd.*

As a joint venture between Kirloskar Group and Toyota Motor Corporation, Toyota Kirloskar Motor Private Limited (TKM) aims to play a major role in the development of the automotive industry and the creation of employment opportunities, not only through its dealer network, but also through ancillary industries. TKM's growth since inception can be attributed to one simple, yet important aspect of its business philosophy - "Putting Customer First". While managing growth, TKM has maintained its commitment to provide quality products at a reasonable price and has made every effort to meet changes in customer needs. The Toyota Production System is now widely accepted as a proven approach to more resource-effective, environmentally responsible production. By empowering employees to expose problems as they arise - by stopping the production line in case of a problem, for instance - the system clearly shows that lasting gains in productivity and quality are possible. This company is following such quality programmes as Quality Control Circle, Just-in-time, Statistical Process Control, Quality Audit, Total Productivity Maintenance (TPM), FMEA, Toyota in-built quality system, the PDCA (Plan, Do, Check, Act) cycle, kanban and Kaizen. The quality tools include check list, flow chart, 7 QC tools and 7 new management tools. Apart from the above, achieving positive change, use of quality tools, close cooperation among functions, quick decision making process and role of the quality department are also considered as important for the successful implementation of TQM.

❖ *J.K Tyres Limited*

The flagship company of JK Organization, JK Tyre & Industries Ltd is one of India's foremost tyre manufacturers and is also amongst the top 25 manufacturers in the world. For the past four decades, JK Tyre has been at the forefront in driving innovation and excellence in the tyre industry through introduction of ground-breaking technologies and products that cater to diverse business segments in the automobile industry. Pioneers of radial technology, the Company produced the first radial tyre in 1977 and is currently the market leader in Truck Bus Radial segment. In 2019, the Company achieved a remarkable feat by entering the coveted Limca Book of Records with the country's largest off-the-road tyre. The Company provides end-to-end solutions across segments of passenger vehicles, commercial vehicles, farming, Off-the-Road and two & three-wheelers. This company is following such quality programs as Quality Control Circle, Statistical Process Control, Quality Audit, Total Productivity Maintenance (TPM), FMEA, Advance Product Quality Planning (APQP), Design of Experiment (DoE), Benchmarking and Business Process Reengineering (BPR). The quality tools include check list, flow chart and seven QC tools.

❖ *Automotive Axles Limited*

Automotive Axles Limited (AAL), established in 1981, is a joint venture of Arvin Meritor Inc., USA (formerly the automotive division of Rockwell International Corporation), and the Kalyani Group. With manufacturing facilities located at Mysore, the company is currently the largest independent manufacturer of Rear Drive Axle Assemblies in the country. Over the years, AAL has developed an impressive domestic OEM clientele that includes Ashok Leyland, Telco, Vehicle Factory, Jabalpur, Mahindra & Mahindra, Volvo and Bharat Earth Movers. AAL exports axle parts to USA, and Italy. The infrastructure at AAL spans highly specialized manufacturing processes involving Friction Welding, Flash Butt Welding, CO2 Welding, CNC Machining, Flexible Machine Centres and a range of specially built machines for production of Axles and Brakes. TQM in this company was introduced by the top management and the company is following the Japanese model. This company is following such quality programs as Statistical Process Control, Quality Audit, Total Productivity Maintenance (TPM), Failure Mode and Effect Analysis (FMEA) and Kaizen. The quality tools include check list, flowchart and seven QC tools.

LITERATURE REVIEW

Numerous literatures have been reviewed to assess the role of Total Quality Management in the automobile manufacturing organizations. A number of research paper have been studied for the purpose of thorough understanding of elements and principles of total quality management and its implementation in selected Indian automobile industry. Total Quality Management, as name indicates, it involves in improving quality and performance of product and service of a company. Here,

customer satisfaction is the main motive which creates customer attraction and fulfills customer expectation. So, it can be said that focusing on customer satisfaction, total quality management manages peoples and business processes. In simple term Total Quality Management includes performance, appearance, easy accessibility, delivery and maintenance or after sales service, cost efficiency and value. Total Quality Management takes into account all quality measures taken at all levels and involving all company workforce. The present research is a multiple case study to investigate TQM Practices prevalent in some automotive and automotive components manufacturing firms.

2.1 Conceptual Discussion

The Total Quality Management were developed at the time of First World War which has evolved from the quality ascertain methods. The war effort led to large scale manufacturing efforts that often produced poor quality. To help correct this, quality inspectors were introduced on the production line to ensure that the level of failures due to quality was minimized (Patel, 2011) After the First World War, quality assessment became more commonplace in manufacturing environments and this led to the introduction of Statistical Quality Control This quality technique provided a statistical method of quality based on sampling. On the other hand, Dow *et al.* (2007) opined that it was not possible to inspect every item; a sample was tested for quality. According to Aravindan *et al.* (2008), the theory of Statistical Quality Control was based on the concept that dissimilarity in the production process leads to variation in the end product. If the variation in the process could be removed this would lead to a higher level of quality in the end product. After Second World War, the industrial manufacturers in Japan produced poor quality items. In the years of 1950 quality control was an integral part of Japanese manufacturing and was adopted by all levels of workers within an organization. It was seen as companywide quality control which involves all human resources from administration to the workforce in quality control.

2.2 Principles of Total Quality Management

The Total Quality Management is a business approach to improving the efficiency, competitiveness and elasticity of an organization which is beneficial for all stakeholders of an organization (Baldwin, 2020). Following are the principle of total quality management Executive Management: top management of the organization should need to take initiative for the implementation of total quality management Training: Success can be achieved through training and motivation of the people associated with the value chain. The employees should get training about the concept and way to maintain the quality or quality control. Customer focus: It indicates how the product and services of a company can satisfy the need & wants of customer. For this, the company has to improve the quality of the product or service so that people willing to pay for it and want to purchase more and more. If the customers get satisfied it will lead the company to create more profit as well as the market

share. Methodology and tools: There have to be use appropriate methodology and tools to find out the problems which are responsible for low quality. Once the problems are short out, the company has to try to solve the entire problem by using appropriate methods and tools. It will reduce time to solve the problems.

Decision making: Decision making is vital for every company. It is not only helping the company to maintain the quality but also the overall performance depend upon it. A good decision can lead the company to higher position whereas a bad decision can make the company worst. There have to be made quality decisions based on measurement, in terms of total quality management. Continuous improvement: the continuous and gradual improvement system is the key for TQM implementation. The long run success of the organization depends upon the philosophy of their quality management system and ability to improve continuously. Company culture: the shared culture of organization should be capable of bringing involvement of all stakeholder to develop the quality conscious work culture. Company culture is crucial for sustainable production of the high quality products and services. Employee involvement: Employee should be encouraged to be pro-active in recognize and addressing quality related difficulty. Without employee involvement the total quality management will not be successful for what it stands for. Ultimately, the affects will reflect on the performance of the company.

2.3 Evaluation tools of Total Quality Management

The concept of quality has existed for many years, but the meaning has changed with the change of time. Total quality management attempts to maintain the quality in every aspect of the company. On the other hand TQM is concerned with technical aspects of quality as well as the participation of people in quality, such as customers, companies' human resources, and suppliers. Here we look at the specific concepts that make up the view point of total quality management.

S.No	Concept	Main idea
1.	Customer focus	To identify and satisfy the need and wants of the customer.
2.	Continuous improvement	An idea of never ending step up
3.	Employee empowerment	Employees are likely to seek out, identify and correct quality problems
4.	Use of quality tools	Correct employee training in the use of quality tools.
5.	Product design	Products and services need to be designed to fulfill customer expectation.
6.	Process management	Quality should be built into the process; sources of quality problems should be recognized and corrected.

7.	Managing supplying quality	Quality concepts must extend to a company's suppliers.
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Table-1: Concept and main idea of TQM

2.4 Issues/Barriers in TQM implementation

Successful implementation of TQM depends not only on the presence of facilitating factors, but also on doing away with the impediments. The following factors have been identified to be barriers for the implementation of TQM.

- Fear and resistance to change
- Costly and long term study
- Lack of consistent top management commitment
- Lack of competent management
- Lack of qualified quality consultants
- Inadequate knowledge about TQM
- Inadequate planning
- Difficulty in developing company specific model
- Resources limitation
- Lack of training
- Lack of skilled worker
- Reluctance of workers to involve in decision making
- Employee apathy
- Lack of coordination between departments
- Ineffective maintenance programs
- Poor condition of machines

RESEARCH METHODOLOGY

The choice of research approach is not only dependent on the researcher's epistemological position, but should also be based on the type of research questions we set out to illuminate (Holm & Solvang, 1991; Yin, 1994; Merriam, 1998). The objective to generate knowledge regarding TQM implementation, by studying, analyzing and describing such implementation process, contains research questions of a descriptive nature. Therefore, the research design chosen is based on social, non-experimental, empirical and qualitative science. A case study is a research strategy used when attempting to understand complex organization problems; in essence allowing one to focus on something which is sufficiently manageable and can be understood in all its complexity (Moor, 1987). Many examples exist which have employed this method when conducting TQM research (Kanj, 1996; MacDuffie, 1997; Sohal and Lu, 1998; Choi et al, 1997; Longenecker and Scazzero, 1993; Thiagarajan, 1995; Meegan, 1997 and Ridgeway, 1997) After reviewing the literature on total quality management practices, the Quality tools and Techniques used in Indian Automotive Sector were identified with the help of content analysis of quality policies of selected

Indian automotive firms by visiting websites of these companies. Apart from the concerned website of company, a number of research paper related to the TQM practices of selected firm was reviewed for thorough understanding of tools and techniques of TQM in these automotive firms. The study is descriptive in nature. The Companies are shortlisted from the database of Society of Indian Automobile manufacturer (SIAM) based on convenience sampling.

3.1 Objective of the study

The main objective of this research are following:

- To identify the prevalent tools and techniques of total quality management in selected automotive firm.
- To identify the similarities and differences in TQM practices in selected automotive firm.
- To identify barrier factors in TQM implementation in selected firm.

3.2 Scope of the study

The research is a multiple case study to investigate TQM practices in selected automotive and automotive component industries in India. The following firms have been selected for study:

- ❖ TVS Motor Company – Mysore
- ❖ Toyota Kirloskar Ltd. – Bangalore
- ❖ J.K. Industries Ltd. - Mysore
- ❖ Automotive Axles Ltd. - Mysore

The present research focused on assessing TQM practices in the above automotive industries to explain and identify similarities and differences in the prevalent practices and difficulties experienced in TQM implementation.

REVIEW OF TQM PRACTICES, ANALYSIS AND FINDINGS

This study is mainly focused on reviewing the prevalent total quality management practices in the selected automotive firms. The other purpose of the study was to identify the similarities and differences in total quality management practices and barrier factors during the implementation of these quality tools and techniques.

Company name \ Quality program	A	B	C	D
QCC	Y	Y		
JIT	Y			Y
SPC	Y	Y	Y	Y
QA	Y	Y	Y	Y
TPM	Y	Y	Y	Y
FMEA	Y	Y	Y	Y
QFD	Y		Y	

Table-2: The various quality programs/techniques prevalent in selected firms

Where,

A = TVS Motor Company B = Toyota Kirloskar Ltd C = J.K. Industries Ltd; D = Automotive Axles Ltd

FINDING

- The table shows some quality programs such as Statistical Process Control (SPC), Quality Audit (QA), Total Productive Maintenance (TPM) and Failure Mode and Effect Analysis (FMEA) are the most quality programs undertaken by all companies for TQM.
- Automotive axles ltd. follows SPC, QA, TPM and FMEA, while it does not follow QCC and JIT.
- J.K tyres ltd. follows all quality programs except for QCC and QFD.

From the table, it can be observed that TVS motor company and Toyota kirloskar motor have all quality programs in practice such as SPC, QA, TPM, FMEA, QFD, JIT, QCC except for QFD which Toyota kirloskar motor is not following

Major barrier factors for TQM implementation

Fear and resistance to change has been an important barrier factor in the implementation of TQM for all the companies. Inadequate knowledge about TQM has also been an important barrier for all the companies. Most of the difficulties had stemmed from inadequate knowledge and understanding about TQM, resistance and disregard on the part of employees and lack of consistent top management support.

CONCLUSION

This study started with an extensive review of literature about quality and its concepts, TQM tools and techniques, prevalent total quality management practices and implementation of TQM in selected Indian automotive firms. The major objectives of this study were:

- To identify the prevalent tools and techniques of total quality management in selected automotive firms.
- To identify the similarities and differences in TQM practices in selected automotive firms.
- To identify barrier factors in TQM implementation in selected firms.

In order to fulfill the research objectives, the following methods for collecting data were adopted: documentation (public information documents of company), visiting the concerned website of the company, previous research papers reviews and information available on society of indian automobile manufacturers (SIAM). Each of the companies is treated as unit of analysis. One of the objective of research was to identify the various prevailing tools and techniques of the selected automotive firms. The various prevailing techniques of the firms are Quality Control Circle, Just-in-time, Statistical Process Control, Quality Audit, Total Productivity Maintenance (TPM), FMEA(failure mode effect analysis), and QFD(quality function deployment). The quality tools include 7 QC tools such as process flow chart, cause & effect diagram, check list, scatter diagram,

pareto chart, histogram, control chart and 7 new management tools such as Affinity Diagram, Relationship Diagrams, Tree Diagram, Matrix Diagram, Prioritization Matrix, Activity Network Diagram, Process Decision Program Chart. The result of the analysis shows some similarities and differences in prevailing quality management practices in selected automotive firms. The research shows some quality programs such as Statistical Process Control (SPC), Quality Audit (QA), Total Productive Maintenance (TPM) and Failure Mode and Effect Analysis (FMEA) are the most quality programs undertaken by all companies during the implementation of TQM. J.K tyres ltd. follows all quality programs except for QCC and QFD. The TVS motor company and Toyota kirloskar motor have all quality programs in practice except for QFD which Toyota kirloskar motor is not following. The other objective of research was identifying the barrier factors during the implementation of TQM. The major barrier factors which are common for the all case companies are: Fear and resistance to change, inadequate knowledge about TQM and costly and long-term study. Other barrier factors are inadequate planning, Difficulty in developing company specific models, Lack of competent management, Lack of training, Lack of consistent top management commitment, Lack of skill of workers.

REFERENCES

- [1] Aautomotive axles limited. (2015). *quality*. Retrieved june 12, 2020, from autoaxle.com: <https://www.autoaxle.com/Quality.aspx>.
- [2] Automotive axles limited. (2015). *overview*. Retrieved june 11, 2020, from Automotive :
- [3] J.K tyres company ltd. (1977). *About JK tyre*. Retrieved may 29, 2020, from jktyre.com: jktyre.com/overview
- [4] Society of indian automobile manufacturers. (n.d.). *About us*. Retrieved june 1, 2020,from SIAM: <http://www.siam.in/about-us.aspx>
- [5] Toyota kirloskar motor. (2012, june). *Toyota kirloskar company ltd*. Retrieved may 30,2020, from [www.toyatabharat.com: toyotabharat.com/q-service](http://www.toyatabharat.com/q-service)
- [6] TVS motor company. (n.d.). *About us*. Retrieved from TVSmotor corporate web site: www.tvsmotor.com
- [7] Kaynak, H. (2003). The relationship between total quality management practices and their effects on firm.
- [8] Performance, Journal of Operations Management, 21(4), 405-435.
- [9] David, J. what is the total quality control? The japaneese way. (New Jersey: prenticehall, 1985)
- [10] Powell, T. C. (1995), Total quality management as competitive advantage, a review and empirical study, Strategic Management Journal, Vol. 13, No. 2, pp. 119-134.
- [11] J.K tyres company ltd. (1977). *About JK tyre*. Retrieved may 29, 2020, from [jktyre.com: jktyre.com/overview](http://jktyre.com/overview)
- [12] Society of Indian Automobile Manufacturers. (n.d.). *Members*. Retrieved from Societyof Indian Automobile Manufacturers: WWW.SIAM.IN
- [13] Society of indian automobile manufacturers. (n.d.). *About us*. Retrieved june 1, 2020,from SIAM: <http://www.siam.in/about-us.aspx>
- [14] Toyota kirloskar motor. (2012, june). *Toyota kirloskar company ltd*. Retrieved may 30,2020, from [www.toyatabharat.com: toyotabharat.com](http://www.toyatabharat.com)
- [15] Sreehari K P (2003), "TQM in Construction", *International Journal of Quality*.
- [16] turers and service providers. *Industrial Management & Data Systems*, 1080, 191–207.
- [17] Venkateshwarlu, N., Agarwal, A., & Kulshreshtha, M. (2011). *Implementation of TQM: A Case Study in an Auto Company*. VII(2), 74–82.

Purchase Decision Styles of Women Consumers in Chennai City- A Study

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Abstract:

This study examines the purchase decision styles of women consumers. Specifically, Sproles and Kendall's Consumer Style Inventory (CSI) was used to determine the various decision-making styles. Eight styles were taken for the study. The questionnaire was prepared in a statement format using the Likert scale. The questionnaires were tested among 750 women consumers, to assess the reliability and validity of the measurement. The validation is done through Confirmatory Factor Analysis (CFA). The factors like quality consciousness, brand consciousness, novelty /fashion consciousness, recreational /shopping, price consciousness, impulsiveness/ careless, confused by over choice, and habitual/ brand loyal which were found to be unique to the women consumers.

Keywords:

Consumer decision making, CSI, Decision styles, Purchase decision styles, women decision styles

INTRODUCTION

For over the decennary, it is universally accepted and welcomed truth is women are great decision-makers and influencers in the family purchase decision making. There is a common phrase in the marketing concept "the customer is the king". In the same way, the women customers are the king when it comes to purchasing consumer durables for their families. Women are considered multi-taskers because they are in and around the house and society does all the work. The preferences and desires of each member of the family differ. Women who are the primal member of the family try to recognize the desires of the members and makes the decision.

Tremendous growth has taken place concerning the role of women in family decision-making. The women consumer decision-making process involves a chain of related and subsequent stages of activities. The process begins with problem recognition followed by information search, evaluation of alternatives, purchase decision, and post-purchase behavior. A consumer may or may not follow all five stages when triggered by an intense or immediate need and may skip some. All over the world, it is primarily women who are engaged in and manage household activities. Most marketers know that women are unique, but women think differently from men because there is a behavioral variation between the brains of men and women.

REVIEW OF LITERATURE

Sproles and Kendall (1986). The researchers reported that many styles were identified by the consumers in the study. They are recreational consciousness,

perfectionism consciousness, confused by over choice, habitable and brand loyalty, price and value consciousness, Brand Consciousness, fashion consciousness, quality Consciousness, novelty consciousness, Variety seeking behavior, and Impulsive impulsive/ carelessness.

Mukhtar E, Mukhtar H (1991) studied the influence of women in the purchase of consumer durables. The study identified various cultural and economic factors that affect women's decision-making power urban women, women in nuclear families, educated women, and working women have higher decision-making power than rural women, women in extended families, illiterate women, and unemployed women. It was identified that men make more decisions on the purchase of all consumer goods than women.

Hafstrom et al (1992) confirmed that seven of eight factors represented dimensions of consumer decision making. The only factor that was not confirmed was novelty and fashion consciousness. The investigators appreciated this finding as a potential connection between brand and fashion consciousness among Korean consumers.

Canabal (2002) explained the decision-making styles of South Indian Consumers and identified five decision-making styles, brand-conscious style, high quality conscious / perfectionist style, confused by over choice style, impulsive / brand in different style, and recreational shopper style.

Kwan et al (2004) explored the relationship between consumers' decision-making styles and clothing choice criteria of young Chinese consumers towards buying casual wear. A questionnaire was adopted as the tool to collect primary data and the research instrument was administered to 161 University students in Shanghai, Beijing, and Guangzhou on the Mainland. The result inferred that six decision-making styles, recreational and hedonistic consciousness, perfectionism consciousness, confused by over choice, habitual and brand loyalty, price and value consciousness, and brand and fashion consciousness were found on the mainland.

Patel, Vipul (2008) in his research paper titled "Consumer Decision Making Styles in Shopping Malls: An Empirical Study" surveyed 128 mall shoppers and found six decision-making styles: price consciousness, quality consciousness, recreational, confused by over choice, novelty conscious and variety seeking.

Sungwon, John (2009) examined specific shopping styles involving athletic apparel and specific shopping pattern differences between male and female college

consumers in the United States. ANOVA and F-test were used to analyze the data. The result displayed that the male and female college-aged consumers had different decision-making styles, related to fashion, impulse, and brand consciousness and there was no significant difference between college classifications or interactions between gender and college classifications.

Subrahmanian (2011) examined the women's buying behavior concerning the age, marital status, occupation, professional status, etc., and identified the decision-maker and influencer for the purchase made by the women. The researcher concluded that the women in India have a greater discretionary income and utilize it to satisfy wants and her criteria for family purchases have been modified by her increased exposure to various new ideas and information and also act as a facilitator.

Lysonski, and Durvasula (2013) the researchers in their study investigated the change in the decision-making styles of Indian young adults from 1994 to 2009. The decision-making styles had a great impact on young adults of India. They encountered that the fluctuation in the economy changed the decision making by an increase in brand consciousness, novelty/fashion consciousness, impulsive/careless shopping decision making, and a decrease in perfectionist quality consciousness over time.

OBJECTIVES

To study the decision-making styles of women consumers.

To validate the factors of decision-making styles of women consumers.

HYPOTHESIS

1. There is no relationship between quality consciousness and purchase decision of women consumers
2. There is no relationship between brand consciousness and purchase decision of women consumers
3. There is no relationship between novelty/fashion consciousness and the purchase decision of women consumers
4. There is no relationship between recreational/shopping and purchase decisions of women consumers
5. There is no relationship between price consciousness and purchase decision of women consumers
6. There is no relationship between impulsiveness/careless and purchase decisions of women consumers
7. There is no relationship between confused by over choice and the purchase decision of women consumers
8. There is no relationship between habitual/brand loyal and purchase decisions of women consumers.

RESEARCH METHODOLOGY

The researcher adopted the convenience sampling method to collect the responses from the women consumers of Chennai city. The researcher visited all the 15 zones of Chennai city and circulated the questionnaires in each zone. The questionnaire was developed using the original items from the Sproles and Kendall Consumer Styles Inventory (1986). This questionnaire was tested among 750 to assess the reliability and validity of the measurement scales. Out of the 750 questionnaires administered, only 622 were usable for further analysis due to missing values or patterned marking of answers. Thus, the data obtained was first subjected to reliability analysis to ascertain the degree to which the measures were free from error and yielded consistent results. To measure the purchase decision styles of women consumers, the psychological response are obtained by a Likert five-point scale which is designed as 1. Strongly disagree 2. Disagree, 3. Neutral, 4. Agree, 5. Strongly Agree.

ANALYSIS AND DISCUSSION

In this section the researcher designed to find the reliability and validity of purchase decision factors namely quality consciousness, brand consciousness, novelty /fashion consciousness, recreational /shopping, price consciousness, impulsiveness/ careless, confused by over choice, and habitual/ brand loyal. The following table indicates the reliability of all the 8 factors at present:

Table 1- Reliability of the Factors

S.No	Factors	No of Statement	Cronbach Alpha
1	Quality Consciousness	9	0.797
2	Brand Consciousness	9	0.835
3	Novelty /Fashion Consciousness	9	0.910
4	Recreational /Shopping	9	0.769
5	Price Consciousness	9	0.802
6	Impulsiveness/ Careless	9	0.821
7	Confused By Over Choice	9	0.828
8	Habitual/ Brand Loyal	9	0.763

The above table exhibits that all the Cronbach Alpha values are > 0.75 and it is the above benchmark value generally stated in the commerce research as well as a large sample size. It shows that all the 8 factors are highly reliable and the researcher can go ahead for validation.

The validation is done by Confirmatory Factor Analysis (CFA). In this analysis, the researcher calculated the mean average scores of all the 8 factors namely quality consciousness, brand consciousness, novelty/fashion consciousness, recreational/shopping, price

consciousness, impulsiveness/ careless, confused by over choice, and habitual/ brand loyal.

From this analysis, these 8 factors are called observed factors, and the purchase decision of women consumers are considered unobserved factors. From the Confirmatory Factor Analysis (CFA) the researcher wants to validate that the above-mentioned 8 factors are the components of the purchase decision of women consumers. The confirmation can be done through the following fit indices:

Table 2- Estimates of fit indices

S. No	Fit Indices	Values	Benchmark Values
1	Chi-square value	5.079	--
2	T-value	.424	>.05
3	Comparative fit index	.979	>.9
4	The goodness of fit index	.970	>.9
5	Normal fit index	.972	>.9
6	Root mean square error of approximation	.079	Less than or equal to .08

From the above table it can be reported that the Chi-square value and probability values are exactly satisfied the required benchmark values of > .05 it is further verified and confirmed through the comparative fit index, the goodness of fit index, and normal fit index. These values are greater than the benchmark value of > .9. In the third stage, it is further confirmed through the root mean square error of approximation. The expected value is less than or equal to .08. Hence, all the fit indices simultaneously satisfy the required benchmark value of validity.

FINDINGS AND CONCLUSION

The study concludes that the purchase decision of women consumers is not a unique phenomenon but it is the combination of quality consciousness of women consumers as well as their brand consciousness and attachment towards specific brands attractive to them. The liberalization and globalization of the Indian economy motivated the women consumers to have novelty in their psychology and attractiveness towards fashion for the present trend. It is also assumed that women consumers are not able to draw the line of distinction between the recreational approach and the shopping behavior. They strongly agree that shopping and recreation are always together to influence their purchase decision. The majority of the women consumers are more price-conscious and also look for least price products with high quality. It is also found that they disagreed with its approach in their purchase decision that strongly agreed for the availability of many choices of products which confused them severely. There is moderate availability for brand loyalty but there are not habitually purchasing the products with a particular brand.

REFERENCES

- [1] Sproles, G.B., and Kendall, E.L. (1987). "A Short Test of Consumer Decision Making Styles." *The Journal of Consumer Affairs*, (5) 7-14.
- [2] Mujahid- Mukhtar E, Mukhtar H (1991) "Female participation in household decision-making: an analysis of consumer durables' acquisition in Pakistan", NCBI , 953-62
- [3] Hafstrom, J. L., Chae, J. S., & Chung, Y S. (1992), "Consumer decision making styles: comparison between the United States and Korean young consumers". *The Journal of 'Consumer Affairs*, 26(1), 146-158.
- [4] Canabal, Maria.E. (2002), "Decision Making Styles of Young South Indian Consumers: An Exploratory Study", *College Student Journal*, Vol.36 (1), 8-12.
- [5] Kwan C.Y., Yeung K.W., Au K.F. (2004), "Decision-Making Behaviour Towards Casual Wear Buying: A Study of Young Consumers in Mainland China", *Journal of Management & World Business Research*, Vol 1, (1) 1-10.
- [6] Patel, Vipul (2008), "Consumer Decision Making Styles in Shopping Malls: An Empirical Study", in *New Age Marketing: Emerging Realities*, Dhar, U., Nath, V.V., Nair, S.K., & Yadav, P.K. (Eds), Excell Books, New Delhi. 627-637.
- [7] Bae Sungwon, Miller John (2009) "consumer decision-making styles for sports apparel: gender comparisons between college consumers", *The ICHPER-SD journal of health research, physical education, recreation, sport & dance*, Volume: 4, Issue: (1) 40-45.
- [8] Subrahmanian M.U.(2011), "Buying Behavior of the New Aged Indian Women", *Indian Journal of Commerce & Management Studies*, Volume-II , (1)143-148.
- [9] Lysonski, S., Durvasula, S., & Zotos, Y. (2013). *Consumer Decision-Making Styles: A Multi-Country Investigation*. *European Journal of Marketing*, 30(12), 10–21.
- [10] Monica. K, B. Vijayakumar (2018), *Purchase decision styles of adolescent consumers in Chennai city*, *JETIR*, Vol 5 (9) 41-45

Battery Technology for Green Transportation

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Abstract:

Alkaline Al-air batteries have been constructed using Commercial Al-IND22 as the anode electrode. Functional batteries with satisfactory operation records have been constructed by using air-breathing (Platinum free) cathode electrodes simply made by depositing graphite black. The devices worked in the absence of oxygen, either through water reduction or by using hydrogen peroxide as an oxidant, allowing for a wide range of operation conditions. In the alkaline electrolyte, Al-oxidize quickly, creating hydrogen at rates that approached the theoretical maximum. The prevalence of grain imperfections in the alloy and the presence of broad grain boundaries were linked to fast corrosion. In this regard, pure aluminium corroded more slowly under the same conditions, resulting in a decreased rate of hydrogen production. An Al-air battery is the alternative source of power have crucial demand for the Energy system. Aluminium air (Al-air) batteries are regarded as a potential technology for supplying electricity to electric cars and portable electronics.

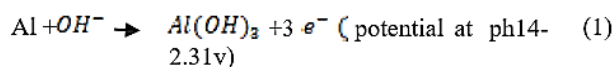
Keywords:

Aluminium air Battery, Grain boundary, Alkaline electrolyte, Al-IND22

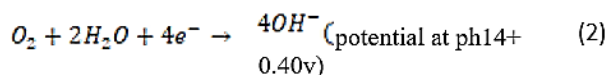
INTRODUCTION

Globally, an Al-air battery is the alternative source of power have crucial demand for the Energy system. Aluminium air (Al-air) batteries are regarded as a potential technology for supplying electricity to electric cars and portable electronics. The following reactions, which apply to an alkaline electrolyte, can be used to describe how they work [1]:

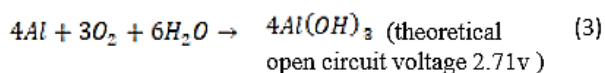
Anodic half-reaction



Cathodic half-reaction

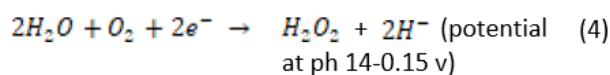


Overall reaction



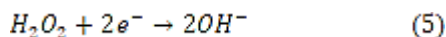
As a result, this procedure is projected to produce a large open-circuit voltage, open-circuit even though lower potentials may be obtained in practice. AL-air batteries are a remarkable energy density (18.1 kWh/Kg), lightweight (2.71g / cm³) which is ten times higher than that of his battery. [2-4]. Additionally. They are made of diminishing which is abundant in the Earth's crust (3rd most abundant element after O and Si), still

attract research. Interest related to improving construction design and ass assuring their stability. An aluminum metal anode and an air-exposed cathode. Al-air battery has been studied to give for many years 2,497. Researchers are interested in applications in portable electronics that -may require flexible geometry. Therefore choosing the right material for making electrodes is paramount [3]. The oxygen reduction of the cathodic hay - reaction predicts employment in the electrochemical field. However, employing Platinum (Pt) nanomaterial is a good option. Let's for ways to make noble-metal-free electrolytes [3,8-10]. These examples demonstrate that numerous aspects of the construction and Al-air batteries could function in Al-air to improve efficiency and develop smarter structures. At present, the practical point of view in the studies of Al-air batteries is directly related to low manufacturing and operating costs. Commercial aluminum is abundantly available in the world and is used for everyday applications, so it can be practically low cost and successfully employed to Manufacture Al-air batteries. Commercial aluminum of percentage of other metals. In an alkaline climate, such alloys degrade. Faster than pure aluminum [1]. This is also supported by the current data, some aluminize alloys are more corrosion resistant than others [2,14,15] but common commercial alloys are not [1]. However, there may be a trade-off between durability and construction and operation costs if they are used. As a result, in this study, we examine the applicability of a technical grade aluminum, Al-6061 application. Al-6061 is, the most famous in second popularity only to AL-6063[16], and it is most of the common aluminum alloy for common purpose use. A nickel (Ni) mesh (or foam) coated with a carbonaceous electrocatalyst is a Common Cathode electrode Al-air batteries for first aid, adding Platinum (Pt) is necessary or for oxygen reduction A/C to reflection (2). The presence of Platinum (Pt) makes a 4-electron reduction method possible. The current research, On the other hand, looks for scenarios in which Pt is eliminated. As a result, we used carbon fabric air-breathing electrodes that were loaded with Carbon black as an electro- catalyst with such electrodes, there is a slim chance of achieving 4- election oxygen. Reduction. However, it has been previously shown [17,18] that such electrodes are capable of 2- electron oxygen reduction, which results in the formation of hydrogen peroxide formation.

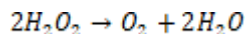


The lower open-circuit voltage ($\Delta v=42.31-0.15v$) reaction

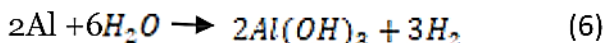
(3) However, it is still usable. In an alkaline atmosphere, hydrogen peroxide has a hard time surviving. However, undergoing a second reduction stage, may contribute to cell functionality.



By supplying oxygen through its degradation.



In another word, Although reaction (2) is difficult to do directly with a simple Carbonaceous electro-catalyst, it may be possible to achieve the same result through a slower method. With this in mind, in the current study, we have tested the operation of Al-air batteries using cathode electrodes formed solely of carbonaceous materials, i.e carbon cloth loaded with carbon black (commercial carbon nanoparticles) CB/CC will be used from now on. A serious issue faced by Al-air batteries is the corrosion of Aluminum and the passivation of its surface, by the formation of a protective oxide layer. Corrosion is accompanied by hydrogen evolution.



As previously stated, there has been a concerted attempt to reduce this reaction by developing certain aluminum alloys. A comprehensive review on this matter [2]. In the present work, we propose to use hydrogen creation as a parallel energy source by creating aluminum corrosion as an inevitable parallel effect, the circumstances for its synthesis, collection, and storage are now being investigated. Finally, Some Al-air battery applications may need their function without air and hence in the absence of ambient oxygen. In that circumstance, as previously stated supply can be assured in the presence of hydrogen peroxide can operate as an oxidant. In the current work, the effects of adding an oxidant on functioning in the absence of oxygen have also been investigated.

1.1 Electrical characteristics of the Al-air battery

The polarization curve of a device with an Al-6061 anode, a CB/CC cathode, and a KOH electrolyte is shown in fig. 3A. The active surface of both electrodes was 1 cm x 1cm. This device generated a 1.4-volt Open circuit and a short circuit current density (JSC) of 145mA cm⁻².

The maximum power is attained at 0.61 V and 75mA cm⁻² according to the relevant power density curve. The presently V_{oc} value is lower than the theoretical value of 2.71V, but this is to be expected due to losses resulting from the materials used to make the device and the reactor design, as well as other undisclosed factors. V_{oc} values are similar to or bigger than the currently reported ones that have been reported in the literature [9,12,20,21] and it appears difficult to approach the theoretical value.

CONSTRUCTION

1.1 Preparation of the anode electrode

The anode electrode was a 2mm thick aluminium plate with active dimensions. 2cm x 1.5 cm. It was mechanically polished before paper use to achieve a mirror-like finish, using SIC water-proof metallography Polishing paper and graphite black with carbon paste.

1.2 Preparation of CB/CC cathode electrode

Graphite black with was cut into 2cm x 1.5cm bits with active dimensions equal to Al plates. It was coated (only one side) with carbon paste. In repeated cases, the second layer of graphite black was deposited using a carbon paste enriched with Pt, by adding a few drops of diamminedinitrito - platinum for comparison purposes [11].

1.3 Description of devices

Plexiglas was used to create the gadget, which was built specifically for typical Al- air battery usage. The anode and cathode electrodes were placed on appropriate windows at a distance of 1cm from each other. Both electrodes were exposed to the electrolyte for 2 cm x 1.5 cm. The uncoated side of the graphite black was exposed to the ambient air, while the coated side was in contact with the electrolyte. This was a gas diffusion electrode at the time, which allowed continuous air and O₂ penetration and consequently oxygen supply. The hydrophobic (graphite black) coating prevented water from escaping through the electrode pores. The electrolyte filling the cell was aqueous KOH and left exposed to the environment. Another reactor was utilized to deoxygenate the electrolyte and measure Hydrogen production. It was made of pyrex glass and had a fitting that allowed inert gas (Ar) to be introduced, hydrogen to be collected, and electric connections to be formed. This time, the anode and cathode electrolyte (aqueous KOH). As a result, the active surface exposed to the electrolyte was roughly 2 x 2 cm x 2 cm (two sides exposed). The distance between the two electrodes, which were facing each other, was around 1cm. The electrolyte inside the reactor was 100 ml. A schematic design of this reactor is present in fig. 1A. water displacement was used to capture and store hydrogen, as shown in the insert of fig.1A. In addition, another reactor was used to separate hydrogen production by aluminium corrosion from electrochemical Hydrogen production by water reduction as shown in fig.1B. This H-shaped reactor included two connected compartments, each containing 100ml of the same alkaline electrolyte as before (aqueous KOH). One compartment housed the aluminium anode, while the other housed the graphite black cathode. The cathode chamber was sealed with a fitting that allowed for Ar flow, hydrogen Collection, and electric connections. The amount of hydrogen was substantially smaller this time, and the amount of hydrogen was determined using a model. As guide hydrogen created concurrently by Al corrosion may be released or collected at all the use of proper fittings.

1.4 Materials Used

Table 1 Material for Cathode & Anode

S.No	Plate	Dimension
1.	carbon black (cathode)	L = 2.1cm; B = 0.7cm; H =0.45cm ;weight =0.03g
2.	Al plate (Anode)	L= 2cm ; B = 1.5 cm; H = 0.2 cm ; weight = 0.02g

Table 2 Hollow pipe Material

S.No	Material	Nos	Dimension
1.	Copper coil	2	20 gauge; 1.5 m; turn 57
2.	Al hollow pipe	1	Dia = 1 cm ; height =23.5 cm
3.	Rubber	1	
4.	paper	1	
5.	Nacl		5 gm
6.	KoH		-
7.	Sand		-
8.	Gum	1	
9.	Distilled water		20 ml
10.	Black Carbon	2	
11.	Glass pipe	3	
12.	Beaker	3	

RESULT & DISCUSSION

The value of voltage and current is extremely good it can be used in green transportation, as we know that in the coming generation the fossil fuel will be depleted so that we have the alternative used of fuel we can use in the electrical vehicle. As aluminium-air battery grail in the EV market, it is long-range, cost-efficient, and recyclable. If we compare it with the lithium-ion battery it is having so much mechanical stress and there is battery degradation. The experiment of an aluminum air battery, gives a better result on the current, charge density, voltage, etc.

Table 3 Al air battery with KoH solution

S.No	KoH (gm)	Distilled water (ml)	Voltage (v)	Charging	Discharging
1.	30	100	0.389	1.08	0.400
2.	35	100	0.395	1.18	0.405
3.	40	100	0.445	1.28	0.428
4.	50	100	0.750	1.76	0.445

Table 4 Charging Voltage at different time

S.No	Charging Time (sec)	Voltage (v)	Resistance (charging) (k Ω)	Current (Milli amp)
1.	15	1.321	1.28	1.032
2.	30	1.900	1.687	1.126
3.	45	1.984	2.017	0.983
4.	60	1.978	3.207	0.616
5.	75	1.999	3.527	0.566
6.	90	2.04	3.777	0.540

Table 5 Hollow pipe with different Soln

S.No	Material (hollow pipe)	Solution	Cu coil	Voltage
1.	Al hollow pipe	Nacl (5gm)+ water(10ml)	1.5 m	0.486
2.	Al hollow pipe	Distilled water(20ml) with KoH(10gm)	1.5 m	1.273

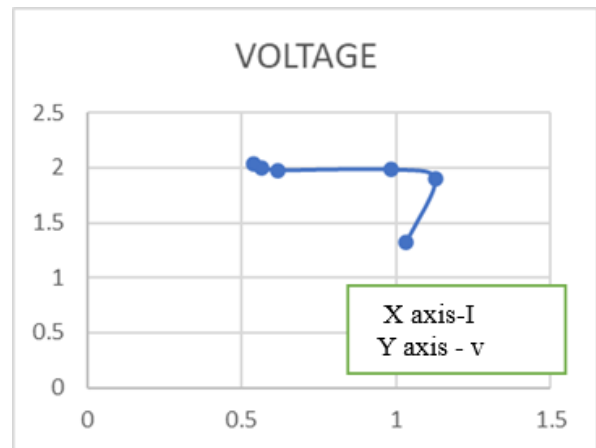


Fig 1 Graph of VI (charging)

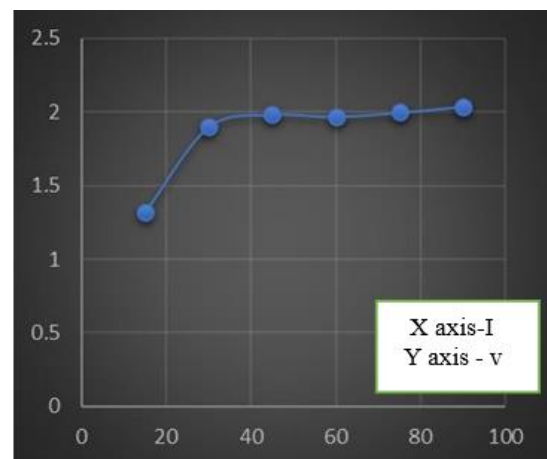


Fig 2 Graph of Voltage vs Time (charging)

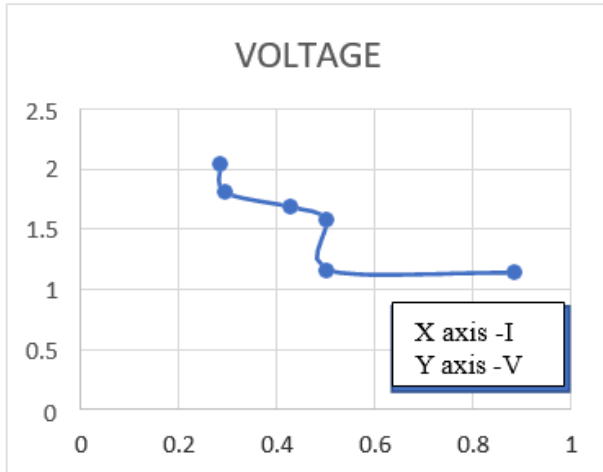


Fig 2 Graph of Voltage vs Time (charging)

Table 6 discharging voltage with different time

S.No	T_d (sec)	Voltage(v)	R_d (k Ω)	Current (Milli amp)
1.	15	2.040	7.183	0.284
2.	30	1.811	6.138	0.295
3.	45	1.690	3.948	0.428
4.	60	1.580	3.153	0.501
5.	75	1.160	2.310	0.502
6.	90	1.140	1.289	0.884

Where,

T_d = Discharging time

R_d = Discharging resistance

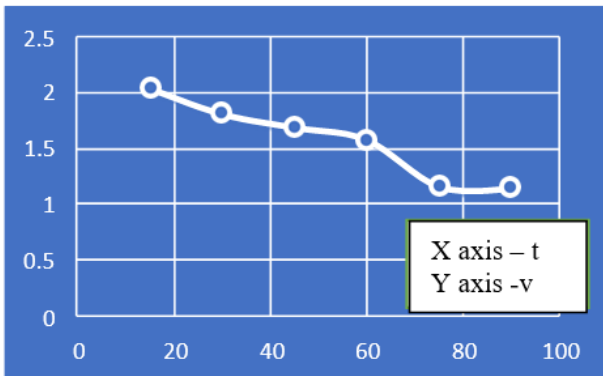


Fig 4 Graph of Voltage vs Time (discharging)



Fig 5 Carbon plate



Fig 6 Graphite

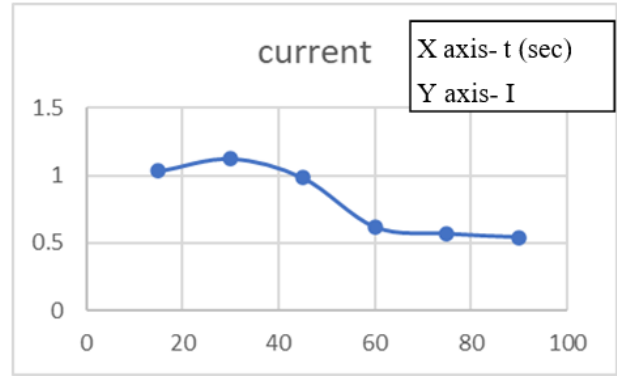


Fig 7 Graph of Current vs time (charging)

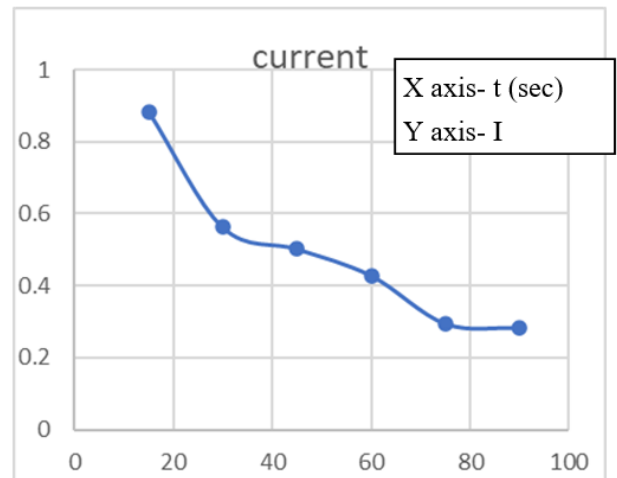


Fig 8 Graph of Current vs time (discharging)



Fig 9
After exp Al
sample(3x*4x)



Fig 10
After exp Al
sample(4x*4x)

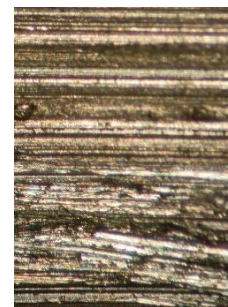


Fig 11 Before Al sample

CONCLUSION

The alkaline Al battery has been constructed which can be used for green transportation, in the coming generation it will be impacted by the economic market. The voltage and current profile are so good that is having so much carrying capacity.

REFERENCES

- [1] D. Raptis, A.K. Seferlis, V. Mylona, C. Politis, P. Lianos, Electrochemical hydrogen and electricity production by using anodes made of commercial aluminum, *Int. J. Hydrogen Energ.* 44 (2019) 1359–1365.
- [2] Y. Liu, Q. Sun, W. Li, K.R. Adair, J. Li, X. Sun, A comprehensive review on recent progress in aluminum-air batteries, *Green Energy Environ.* 2 (2017) 246–277.
- [3] C. Zhu, Y. Ma, W. Zang, C. Guan, X. Liu, S.J. Pennycook, J. Wang, W. Huang, Conformal dispersed cobalt nanoparticles in hollow carbon nanotube arrays for flexible Zn-air and Al-air batteries, *Chem. Eng. J.* 369 (2019) 988–995.
- [4] M. Mokhtar, M.Z.M. Talib, E.H. Majlan, S.M. Tasirin, W.M.F.W. Ramli, W.R.W. Daud, J. Sahari, Recent developments in materials for aluminum–air batteries: a review, *J. Ind. Eng. Chem.* 32 (2015) 1–20.
- [5] MdA. Rahman, X. Wang, C. Wen, High energy density metal-air batteries: a review, *J. Electrochem. Soc.* 160 (2013) 1759–1771.
- [6] A. Eftekhari, P. Corrochanoc, Electrochemical energy storage by aluminum as a lightweight and cheap anode/charge carrier, *Sustain. Energy Fuels* 1 (2017) 1246.
- [7] Y. Wang, W. Pan, H. Kwok, X. Lu, D.Y.C. Leung, Low-Cost Al-air batteries with paper-based solid electrolyte, *Energy Procedia* 158 (2019) 522–527.
- [8] B. Xu, H. Lu, W. Cai, Y. Cao, Y. Deng, W. Yang, Synergistically enhanced oxygen reduction reaction composites of specific surface area and manganese valence controlled a-MnO₂ nanotube decorated by silver nanoparticles in Al-air batteries, *Electrochim. Acta* 305 (2019) 360–369.
- [9] Q. Hong, H. Lu, Y. Cao, Improved oxygen reduction activity and stability on N, S-enriched hierarchical carbon architectures with decorating core-shell iron group metal sulphides nanoparticles for Al-air batteries, *Carbon* 145 (2019) 53–60.
- [10] J. Lia, J. Chena, H. Wana, J. Xiaob, Y. Tanga, M. Liuc, H. Wang, Boosting oxygen reduction activity of Fe-N-C by partial copper substitution to iron in Al-air batteries, *Appl. Catal. B Environ.* 242 (2019) 209–217.
- [11] R. Koç, S. Ozkeçeci, The fabrication of exfoliated graphite sheet-based air cathodes and gel electrolyte for metal-air batteries, *Energy Sources Part A* (2019) 1780–1790.
- [12] M.J. Tan, B. Li, P. Chee, X. Ge, Z. Liu, Y. Zong, X.J. Loh, Acrylamide-derived freestanding polymer gel electrolyte for flexible metal-air batteries, *J. Power Sources* 400 (2018) 566–571.
- [13] F. Migliardini, T.M. Di Palma, M.F. Gaele, P. Corbo, Solid and acid electrolytes for Al-air batteries based on xanthan-HCl hydrogels, *J. Solid State Electrochem.* 22 (2018) 2901–2916.
- [14] X. Liu, P. Zhang, J. Xue, The role of micro-nanoscale AlSb precipitates in improving the discharge performance of Al-Sb alloy anodes for Al-air batteries, *J. Power Sources* 425 (2019) 186–194.
- [15] T. Xu, Z. Hu, C. Yao, The effects of Ca addition on corrosion and discharge performance of commercial pure aluminum alloy 1070 as anode for Aluminum-air battery, *Int. J. Electrochem. Sci.* 14 (2019) 2606–2620.
- [16] Aluminum Alloys, Materials Management Inc, 23 December 2015.
- [17] X. Shi, Y. Zhang, S. Siahrostami, X. Zheng, Light-driven BiVO₄-C fuel cell with simultaneous production of H₂O₂, *Adv. Energy Mater.* 8 (2018) 1801158, 9 pp.
- [18] L. Fan, H. Lu, J. Leng, Z. Sun, C. Chen, The study of industrial aluminum alloy as anodes for aluminum-air batteries in alkaline electrolytes, *J. Electrochem. Soc.* 163 (2016) A8–A12.
- [19] L. Fan, H. Lu, J. Leng, Z. Sun, C. Chen, The study of industrial aluminum alloy as anodes for aluminum-air batteries in alkaline electrolytes, *J. Electrochem. Soc.* 163 (2016) A8–A12. I. Papagiannis, E. Doukas, A. Kalarakis, G. Avgouropoulos, P. Lianos, Photoelectrocatalytic H₂ and H₂O₂ production using visible-light-absorbing photoanodes, *Catalysts* 9 (2019) 243, 14 pp.
- [20] N. Bogolowski, J.-F. Drillet, Activity of different AlCl₃-based electrolytes for the electrically rechargeable aluminium-air battery, *Electrochim. Acta* 274 (2018) 353–358.
- [21] S. Sun, Y. Xue, Q. Wang, H. Huang, H. Miao, Z. Liu, Cerium ion intercalated MnO₂ nanospheres with high catalytic activity toward oxygen reduction reaction for aluminum-air batteries, *Electrochim. Acta* 263 (2018) 544–554.
- [22] D.J. Brodrecht, J.J. Rusek, Aluminum–hydrogen peroxide fuel-cell studies, *Appl. Energy* 74 (2003) 113–124.
- [23] H. Zhang, Y. Yang, T. Liu, H. Chang, Boosting the power-generation performance of micro-sized Al-H₂O₂ fuel cells by using silver nanowires as the cathode, *Energies* 11 (2018) 2316, 10pp.
- [24] F. Zhang, K. Edalati, M. Arita, Z. Horita, Fast hydrolysis and hydrogen generation on Al-Bi alloys and Al-Bi-C composites synthesized by high pressure torsion, *Int. J. Hydrogen Energy* 42 (2017) 29121–29130.

Crypto Exchange Wallet: Software Development Lifecycle

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Abstract:

The Global Crypto Payment Gateway Market is expected to grow at a CAGR of 22.8 % over the forecast period, according to Brand Essence Market Research. Some of the major factors driving the growth of the Global Crypto Payment Gateway Market are increased adoption of cryptocurrencies overall and more investment in this field. Our application is intended primarily for Ether operations, but it can also be used with the Hardhat package.

Keywords:

ethereum, smart contract, blockchain, web development, metamask, hardhat

INTRODUCTION

Covid-19 has dramatically accelerated the surge of online fraud over the last year. Most businesses now execute Crypto Payment, at least in part, online, presenting a perfect setting for attackers seeking to steal and exploit confidential material. Identity fraud has had the greatest impact on financial services, followed by professionals, which is unsurprising. It's logical that as the amount of people sharing sensitive information online has grown, so has the number of people seeking to stop it. Many crypto payment gateway providers in the industry have responded by offering a range of services to clients that have received a favorable reception in the Covid-19 era.

The Cryptocurrency Payment Gateway is a dynamic payment processing infrastructure that enables merchants and services to accept payments in several cryptocurrencies while maintaining security. Users can send money directly from one wallet to another using this service. These payment gateways are responsible for securely distributing the payment's sensitive wallet-related data to the merchant's software in addition to their primary functions. Businesses of various sizes use our payment network to find the most profitable, safe, and fast payment methods. The crypto payment gateway, which provides record-breaking and transaction transparency, is also emphasized by the blockchain ecosystem.

Moreover, blockchain's decentralized system eliminates intermediaries like banks from the payment process, speeds up transfers, and slows it down payment processing.

We will learn how to connect the ReactJS application and combine this with an Ethereum wallet using Metamask in this paper. Also, using the Solidity programming language, how to build decentralized applications on the Ethereum network. It is essentially a full-fledged Web 3.0 application.

Blockchain technology promises to provide rapid, secure, low-cost international payment processing services by utilizing encrypted distributed ledgers that provide trusted real-time verification of transactions without the need for middlemen such as correspondent banks and clearing houses (and other transactions). Blockchain technology was initially developed to support the digital currency Bitcoin, but it is now being investigated for a wide range of non-Bitcoin uses.

Bitcoin is the foundation of several existing blockchain-based payment processing systems. Some are intended for the relatively tiny subset of enterprises who trade directly in Bitcoin. Other payment processing options, on the other hand, reach a considerably bigger audience by transferring payments in conventional currencies via the Bitcoin distributed ledger. This allows them to avoid conventional banking infrastructure, allowing for faster payment and lower costs. The service transforms the payer's local currency into Bitcoin, which is subsequently converted into the receiver's local currency, typically delivering international payments within one to three days. 4 According to a Citi report, BitPesa is employing this technology in Kenya to enable enterprises to make faster, cheaper transfers between African countries without relying on slow and expensive local banking infrastructure Research report.

LITERATURE REVIEW

The proposed algorithm gives us a significant speed while transferring huge data and while keeping the privacy and security of the user. The algorithm tries to compute encrypted data and MAC calculations in parallel, it constitutes two parallel processors. The communication between two processors was achieved by MPI, the algorithm proves to be 85% more efficient as compared to the traditional algorithm [1].

As cryptocurrencies are getting more popular and are being adopted in the financial sector as well as being bought in the market to be used by common people. The paper address some of the important yet unsolved issues like cloud forensic problem, operational risk, and how the infrastructure can be made more efficient and vulnerabilities can be encountered.

Problems regarding the operational risk of software, open-source governance, and code maintenance can be solved. The analysis provides a more comparative detailed view of problems that are yet to be addressed and what were the previously proposed ideas.[2]

Crypto has provided the market with a decentralized version of the financial sector, payments. Ethereum and Tezos have also now provided the implementation and design based on the decentralization of the financial

sector. Uniswap and its similar class of AMMs have a fairly different range of applicabilities being provided. The paper focused on Uniswap based on constant product and mean AMM, and also on bonding curves, theoretical properties for the future.[3]

The paper states the comparative analysis of crypto vs traditional wallets used by the majority population worldwide. Security analysis and social acceptability are the major factors being studied. Crypto wallets seem to have advantages like low cost of the transfer, fast transaction, and security details of the user are being the major factors. There is no third party involved in the transaction or central authority while executing the transaction [4]

METHODOLOGY

In this project we have connected a single page react JS web application to the blockchain network web 3.0 and paired it to the ethereum wallet using Metamask and the transactions will take place with the help of ethereum networks using the solidity programming language. This web application will allow users to send transactions to the blockchain. After that each transaction will be paired with a GIF and a message that will be forever stored on the blockchain network

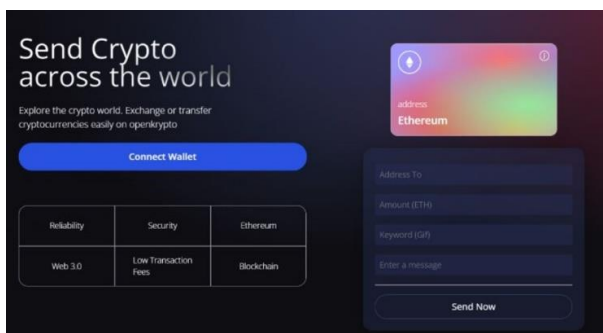


Fig. dashboard interface

The new user has to first click on the connect wallet button to access the web application for that he must have his metamask wallet extension paired with the browser he is currently using. After he has clicked on the button the metamask connection pop up will get triggered and it will ask the user to the account that he wants to use

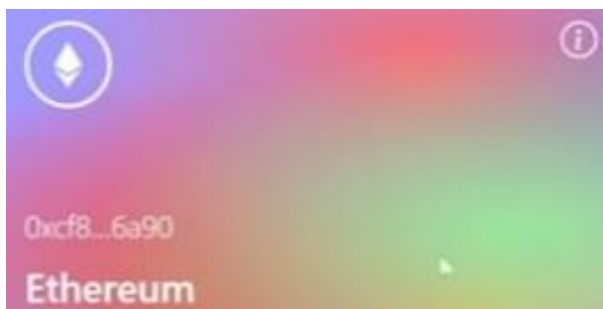


Fig. Ethereum Card interface

After successfully authentication with the account the respective wallet address will get displayed on the user interface section which is in the form of a wallet card as shown in the above figure

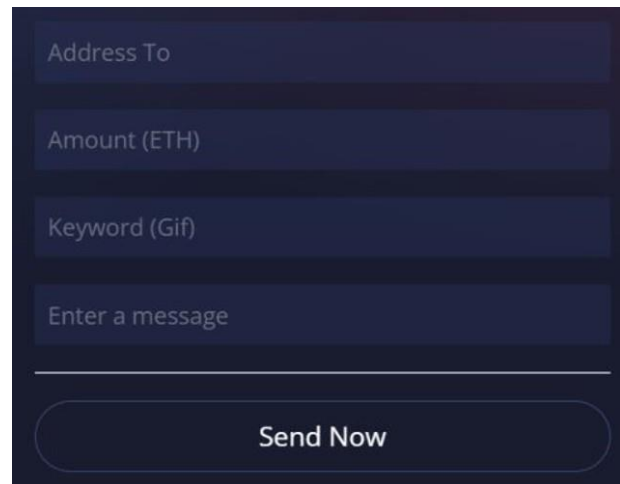


Fig. Form interface

Next up is the account form section on the user interface with the help of which the user can send the necessary amount of ethereum to the recipient. For that he has to fill up the address to section which will be the address of the recipient, amount to be specified in ETH, some GIF emoticon which is animated that will be directly be fetched from the giphy website api and lastly a message which the recipient can see, all this information will be permanently stored on the blockchain network. After typing in all the inputs the user now has to click on send now button which will then initiate the transaction process on the metamask wallet

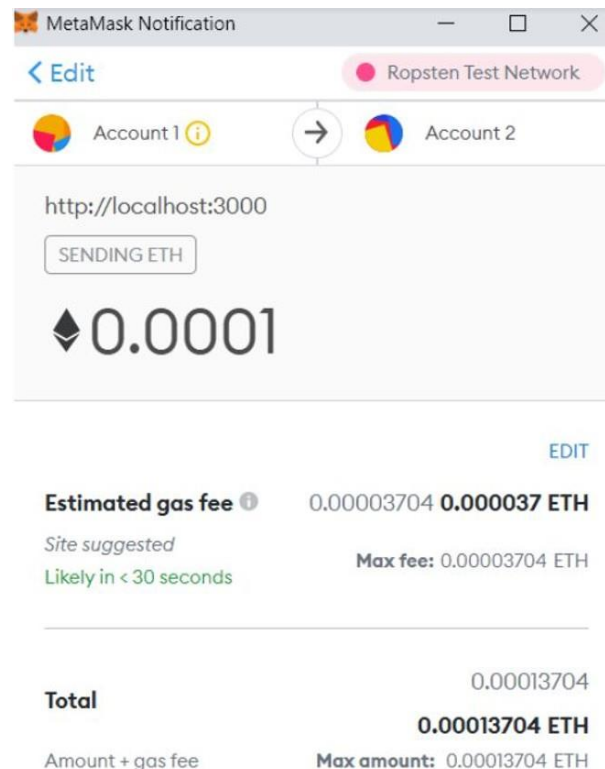
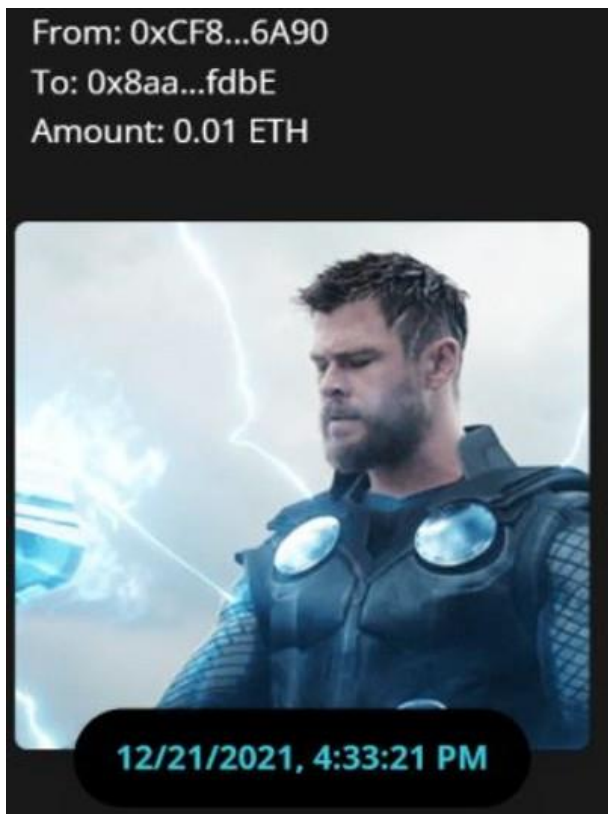


Fig. Metamask Wallet interface

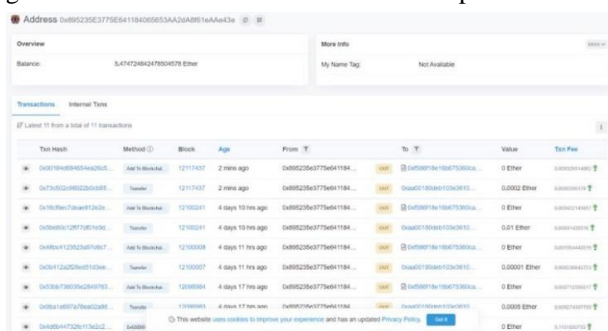
The ethereum network will calculate some gas fees which are the additional fees the sender has to pay in order to complete the transaction, the gas fees can be changed in the backend code part.

The metamask wallet will double confirm the transaction on the metamask wallet and after the user has clicked on send button approximately in 30 seconds the transaction will get completed and the amount of ETH will be transferred to the recipient's address.

For his guarantee, the user can see the list of transaction on the bottom section of the web application where he can confirm all the successful transactions sent along the date and timestamp



In this picture the address to, address from amount, the gif can be seen with the date and timestamp.



If the user clicks on the address then he will be directed to the etherscan website where in which he can see all the transactions being carried out in real time.

We have taken the help of ropsten testnet faucet to create some eth token for the only purpose for deployment and not for real usage to make this project possible.

Taking the business logic into consideration, we can make money from this web application by firstly taking some gas fees as commission which will be based on the

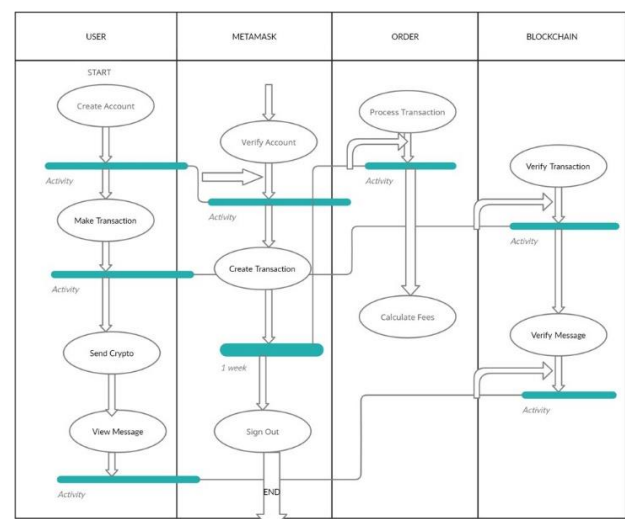
transaction amount given by the user in gwei rather than ethereum.

After the app scales to a big level, we can run local or regional ads on the left or right sections to generate revenue

The interfaces used were of hardhat and chai Hardhat is a development environment that allows developers to test, build, deploy, and debug Ethereum-based dApps. As a result, it assists programmers and developers in managing many of the responsibilities associated with constructing dApps and smart contracts. Hardhat not only gives developers with the tools they need to manage this process, but it also helps automate some of these tasks and offers developers with additional, useful features.

Chai is a node and browser-based BDD / TDD assertion library that works well with any javascript testing framework.

ARCHITECTURE



ACTIVITY DIAGRAM

An activity diagram is a diagram which shows, which represents a system's behavior. An activity diagram depicts the control flow from a starting point to a finishing point, highlighting the many decision routes that exist while the activity is being performed. An activity diagram can illustrate both sequential and concurrent processing of activities. They are commonly used in business and process modeling to illustrate the dynamic features of a system. A flowchart is quite similar to an activity diagram.

USE CASE DIAGRAM

The use case diagram's objective is to capture the dynamic aspect of a system. However, this description is too broad to characterize the purpose, given the purpose of the other four diagrams (activity, sequence, collaboration, and Statechart) is the same. We will investigate some special objective that will set it apart from the other four diagrams.

Use case diagrams are used to collect system requirements, including internal and external effects. The majority of these needs are design requirements. As a result, when analyzing a system to gather its functionality, use cases are produced and actors are identified.

When the initial task is finished, use case diagrams are created to show the outside view.

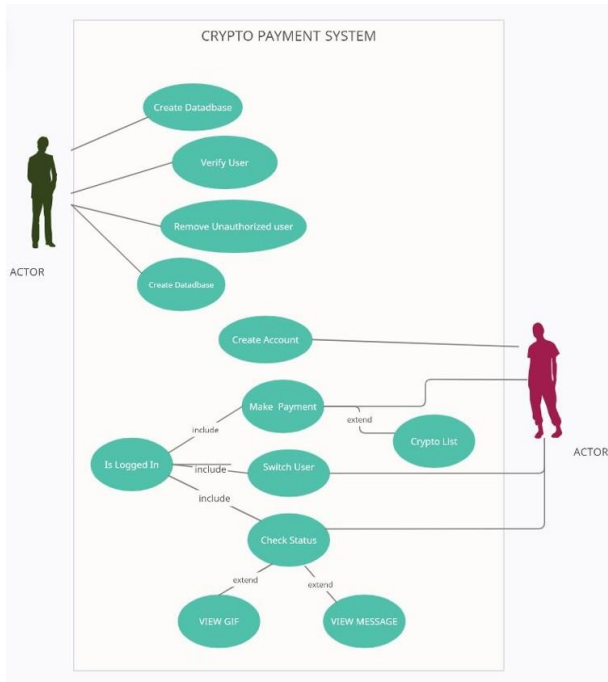


Fig. Use Case Diagram

CLASS DIAGRAM

A static diagram is a class diagram. It depicts an application's static view. A class diagram is being used not only to depict, characterize, and document various system components, but also to create program file for a software system.

A class diagram illustrates a class's properties and actions, as well as the limitations imposed on the system. Because they are the only UML diagrams that can be translated directly to object-oriented languages, class diagrams are frequently used in the modeling of object-oriented systems.

A class diagram depicts a set of classes, interfaces, connections, collaborations, and restrictions.

Class Diagrams' Function

The goal of a class diagram is to represent the static perspective of an application. Class diagrams are the only diagrams that can be directly transferred to object-oriented languages and are thus commonly utilized throughout creation.

Class diagrams vary from UML diagrams in that they can just represent the application's sequence flow, whereas activity and sequence diagrams may display the whole application. It is the most widely used UML diagram in the coding world.

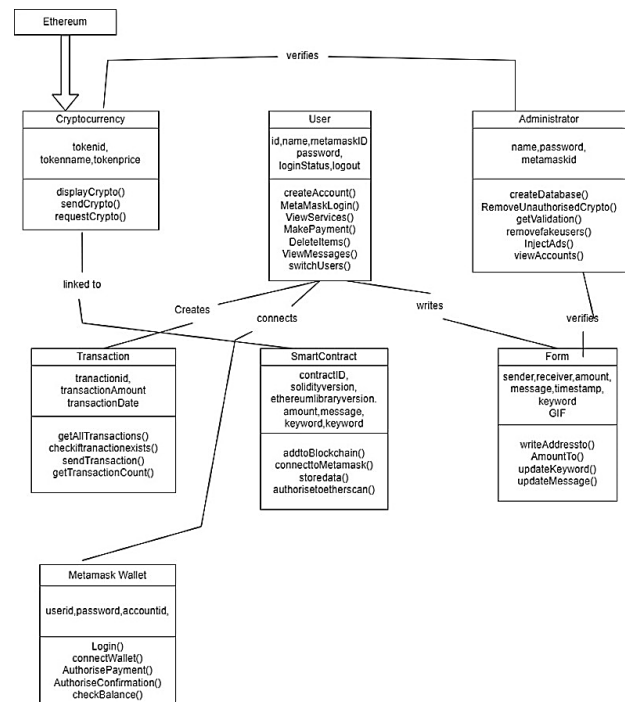


Fig. Class Diagram

PRODUCT BACKLOG

Product Backlog items that the Scrum Team can complete in one Sprint are considered ready for selection in a Sprint Planning event. This level of openness is often obtained following refining efforts. The act of cutting down and further defining Product Backlog items into smaller, more exact things is known as refining. This is a continuous process of adding details such as a description, order, and size. Attributes frequently differ depending on the field of work.

The Developers who will be executing the task are in charge of sizing. The Product Owner can have an impact on the Developers by assisting them in understanding and selecting trade-offs. Multiple Scrum Teams frequently collaborate on the same product.

Product Backlog					
Task ID	Story Name	Story Description	Estimate	Priority	Status
Iteration 1					
1	Design	Outlining and sketching the look of the pages	1	1	Done
2	Layout	Deciding on a common theme and Write a temporary working code.	1	2	Done
3	Registration	As an unauthorised user, I want to create a new account in metamask	1	3	Done
4	Login Page	As an unauthorised user, I want to login through metamask	1	4	Done
5	Logout Page	As an authorised user, I want to logout.	2	5	Done
6	Database	Create database on mongodb.com	1	6	Done
7	Database	Create a database table with the fields we need. (Name, Amount, Time, Address, GIF, Message)	1	7	Done
8	View Services	As an authorised user I want to see the list services available on the app	2	8	Done
Iteration 2					
Sprint 2					
9	Remove other unapproved coins	As an administrator, remove meme coins and other unauthorised crypto from the app	2	9	Done
10	decentralized crypto	As an administrator, only those blockchain should be visible on app that are approved by Indian Government	3	10	Done
11	Payment	As an authorised user I want to exchange cryptocurrencies and make payments online using metamask	4	11	Done
12	Payment Options	As an administrator I should get the validation message of my cryptocurrency transfer	3	12	Done
13	Change booked items	As an authorised user, I want to delete the selected item	2	13	Done
Iteration 3					
Sprint 3					

14	Edit Users	As an authorised user, I would like to select or switch between multiple users	4	14	Done
15	List of Accounts	As an administrator, I want to see the list of accounts on login	3	15	Done
16	Display Message	As an user, I want to see the suitable message which I type on the transaction made	2	16	Done
17	Display GIFs	As an user, I want to see the suitable GIF which I type on the transaction made	2	17	Done
18	View Transactions	As an administrator, I want to see the transactions made by the users through the app on the database	4	18	Done
Iteration 4					
Sprint 4					
19	Transaction History	As a user I should be able to see the history of my metamask exchange	4	19	Pending
20	Remove Unauthorised User	The rights to remove any unauthorised user should be given to admin	4	20	Pending
21	Ads	Inject simulated ads from the test server	2	21	Pending
22	Ads and monetization	Plug in real ads and to monetize the app	2	22	Pending
23	GPS	Change current city automatically according to the GPS location	2	23	Pending

Fig. Product Backlog

PLANNING POKER

The estimating process, in which project managers, product managers, and software developers must forecast the degree of effort required to complete a development assignment, is a typical bottleneck that they all encounter. Estimation is a two-edged sword: it's extremely useful for breaking down long-term projects into manageable and short-term tasks, but a mistake move might disrupt long-term project planning.

Management frequently puts pressure on product development teams to enhance the accuracy of their projections, but this is easier said than done. These teams must not only choose how to estimate, but they must also choose the best time to do it. Planning poker is an approach that can help to simplify estimating in agile. Let's go through this strategy in detail.

The intermediary will disappear. The participants place their trust fully in the technology instead of in people and institutions. There is no central issuing institution. Cryptocurrency involves serious risks, some of which have not been identified, such as in the areas of security and legislation.

Smart contracts, for example, are another interesting trend. This is a lengthy procedure. If these operations are embedded in a block chain, they can be run considerably quicker, more efficiently, and intelligently. The tests are then completed entirely automatically.

Planning Poker Activity				
Saurabh J	Aryan	Saurabh K	Shruti	
Sprint 1				
1	1	1	1	
1	2	2	1	
1	3	3	1	
1	4	4	4	
5	4	5	5	
6	2	6	1	
7	7	7	6	
8	2	7	8	
Sprint 1				
9	8	9	6	
6	10	5	10	
11	11	11	4	
4	12	3	12	
13	11	13	4	
Sprint 1				

Fig. Planning Poker

BURNDOWN CHART

A burndown chart displays the amount of work performed in an epic or sprint as well as the overall amount of work remaining. Burndown charts are used to forecast your team's chances of finishing their job in the time allotted. They're also helpful in keeping the team updated on potential scope creep.

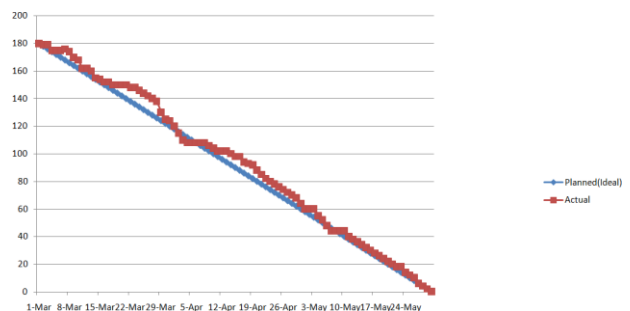


Fig. Burndown Chart

The adoption of technology is determined by the needs of the company. The adoption of technology determines the profit margin. Most banks across the world have

adopted blockchain because they regard their customers' privacy first and foremost. There are always advantages and disadvantages to any technology, and blockchain is no exception. The only issue with technology is its high cost.

The cost drives the day-to-day operations of businesses, thus banks must consider this thoroughly before adopting this technology. When a blockchain-based financial system is supported by blockchain, it becomes more temper proof.

The Metamask wallet ungoes two step process to authorize the transaction , the first step shows the amount to be transferred in ethereum and the second step calculates the gas fees required. After some 30 seconds the transaction is permanently stored on the blockchain network. We can check the transaction srealttime in etherscan.

ACKNOWLEDGMENT

We would like to thank Prof Swati Jafhav for her constant support for the completion of this project and this research paper.

REFERENCES

- [1] Eyal, I. (2017). Blockchain Technology: TransformingLibertarian Cryptocurrency Dreams to Finance and Banking Realities Computer MDPI AG
- [2] Popova, N.A., Butakova, N.G. (2019). Research of a possibility of using blockchain technology without tokens to protect banking transactions Proceedings of the 2019 IEEE Institute of Electrical and Electronics Engineers Inc.
- [3] Wu,T.,Liang,X.(2017).Exploration and practice of interbank application based on blockchain ICCSE 2017 - 12thInternational Conference on Computer Science and Education Institute of Electrical and Electronics Engineers Inc.,
- [4] Sun, H., Mao, H., Bai, X., (...), Hu, K., Yu, W. (2018).
- [5] Multi-blockchain model for central bank digital currency Parallel and Distributed Computing, Applications and Technologies IEEE Computer Society
- [6] Cocco, L., Pinna, A., Marchesi, M. (2017). Banking onblockchain: Costs savings thanks to the blockchain technology Future Internet MDPI AG
- [7] Wang, X., Xu, X., Feagan, L., (...), Jiao, L., Zhao, W. (2018). Inter-Bank Payment System on Enterprise Blockchain Platform IEEE International Conference on Cloud Computing, CLOUD IEEE Computer Society
- [8] Harris,W.L.,Wonglimpiyarat,J.(2019).Blockchai n platform and future bank competition Foresight EmeraldGroup Publishing Ltd
- [9] (PDF) *Crypto Wallet: A Perfect Combination with Blockchain and Security Solution for Banking*. Available from:

https://www.researchgate.net/publication/342801641_Crypto_Wallet_A_Perfect_Combination_with_Blockchain_and_Security_Solution_for_Banking [accessed Jun 01 2022].

Implementation of 32-Bit Vedic Multiplier using Verilog

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Abstract:

This paper is based on the design and implementation of 32-bit Vedic multiplier. The proposed Vedic multiplier architecture is designed to take two 32-bit inputs and arrange each 32-bit input into two 16-bit blocks, apply 'Urdhava Triyagbhyam' method that is the vertical and crosswise method on these blocks and arrange the partial products in a manner that they can be added using basic adders. This architecture is designed and implemented using the Verilog code and then simulated using the Cadence tool. The results of implementation are then compared to the results of implementation of another non-Vedic multiplier in order to show that the proposed design is more efficient with respect to their power analytics.

Keywords:

Vedic, Urdhava Triyagbhyam, IXI, Carry Lookahead adder, Multiplier

INTRODUCTION

A binary multiplier is an electronic circuit used in digital electronics in order to multiply two given binary numbers. Multiplication is a very crucial arithmetic operation and is substantially used in microprocessors, microcontrollers and digital signal processors. It is a time consuming operation as it utilizes more time and clock cycles when compared to other simple arithmetic operations. There are various multiplication algorithms and architectures proposed in literature for the improvement of efficiency of multiplication using Array, Booth and Vedic algorithms. Multipliers are used in the MAC unit of digital signal processors to perform various algorithms. They are also commercially used in computers, mobiles, high speed calculators, etc.

DESIGN APPROACH

1. Carry Look Ahead Adder

The carry lookahead adder also known as the fast adder is a type of adder in digital logic which is used to improve the speed by decreasing the amount of time required to obtain carry bits. This basically calculates more than one carry bits prior to the sum thereby reducing the wait time required to calculate the result of the given large valued bits of the adder.

The advantages of the carry lookahead adder are that it has reduced propagation delay and it also provides with fast addition logic, whereas the disadvantages of the carry lookahead adder are that it is economically costlier due to the presence of a large number of hardware in the circuit, and as also the number of variables in the carry lookahead adder increases, the complexity of the circuit also increases.

The below figure shows the block diagram of a simple 4-bit carry lookahead adder.

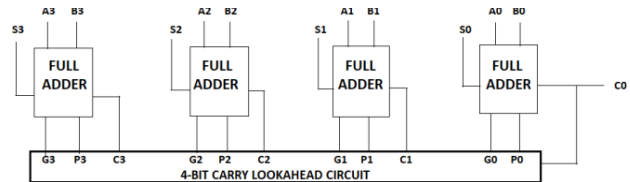


Figure 0-1 . 4-bit Carry Lookahead adder.

A. Logic Of Carry Lookahead Adder^[8]

Given the two Boolean functions for the sum and carry as follows:

$$\text{SUM} = A_i \oplus B_i \oplus C_i$$

$\text{Cout} = C_{i+1} = A_i \cdot B_i + (A_i \oplus B_i) \cdot C_i$ Let Carry Generate function, $G_i = A_i \cdot B_i$ Carry Propagate function, $P_i = (A_i \oplus B_i)$

Therefore, Carry function, $C_{i+1} = G_i + P_i \cdot C_i$

Thus, for 4-bit adder, we can extend the carry, as shown in the following equations.

$$C_1 = G_0 + P_0 \cdot C_0$$

$$C_2 = G_1 + P_1 \cdot C_1 = G_1 + P_1 \cdot G_0 + P_1 \cdot P_0 \cdot C_0$$

$$C_3 = G_2 + P_2 \cdot G_1 + P_2 \cdot P_1 \cdot G_0 + P_2 \cdot P_1 \cdot P_0 \cdot C_0$$

$$C_4 = G_3 + P_3 \cdot G_2 + P_3 \cdot P_2 \cdot G_1 + P_3 \cdot P_2 \cdot P_1 \cdot G_0 + P_3 \cdot P_2 \cdot P_1 \cdot P_0 \cdot C_0$$

B. Algorithm Of Multiplier Using CLA^[8]

Begin Program Multiplier = 32 bits Multiplicand = 32 bits Output = 64 bits

Put the multiplier in the least significant half, and clear the most significant half

For i = 1 to 32 Begin Loop

If the least significant bit of the 64-bit register contains binary '1'

Begin If

Add the Multiplicand to the Most Significant Half using the CLAA

Begin Adder C[0] = '0'

For j = 0 to 31 Begin Loop

Calculate Propagate $P[j] = \text{Multiplicand}[j] \oplus \text{Most Significant Half}[j]$

Calculate Generate $G[j] = \text{Multiplicand}[j] \cdot \text{Most Significant Half}[j]$

Calculate Carries $C[i+1] = G[i] + P[i] \cdot C[i]$ Calculate Sum $S[i] = P[i] \oplus C[i]$

End Loop End Adder

Shift the 64-bit Register one bit to the right throwing away the least significant bit

Else

Only Shift the 64-bit Register one bit to the right throwing away the least significant bit

End If End Loop

Register = Sum of Partial Products End Program

2. Vedic Multiplier

The word "Vedic" is derived from the word "Vedas", an ancient repository of all knowledge. Vedic mathematics provides a solution to the problem of long computation times by reducing the time required to perform calculations. It comes from the fourth Vedas of "Atharvaveda". Atharva Veda mainly handles fields like engineering, mathematics, sculpture, medicine and all other sciences. Vedic mathematics covers all areas of mathematics, both pure mathematics and applied mathematics. It was rediscovered by Sri Barati Krishnatil Saji through the Vedas from 1911 to 1918. Vedic mathematics is summarized in sixteen sutras and thirteen sub-sutras. These scripts greatly reduce all basic calculations. All the advantages come from the fact that the Vedic approaches to mathematics are completely different and are considered to be very close to how human intelligence functions. Vedic mathematics can be practiced in all areas of mathematics, including arithmetic, algebra, and geometry.

A. Methodology

From figure 2, it is seen that initially the rightmost digit of the multiplier and the rightmost digit of the multiplicand are multiplied giving the least significant bit of the product term as shown in step 1. Now in step 2, the leftmost digit of the multiplier and the rightmost digit of the multiplicand, and the rightmost digit of the multiplier and the leftmost digit of the multiplicand are multiplied and then added to result in the middle part of the product term. Finally in step 3, the leftmost digit of the multiplier and the leftmost digit of the multiplicand are multiplied to result in the most significant bit of the product term. This is the process in which multiplication is carried out.

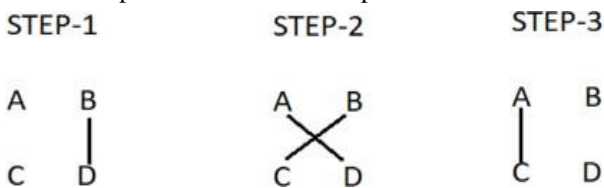


Figure 0-2 . IXI Methodology of multiplication.

EXAMPLE: Multiplication of two numbers: 524*878

The numbers on each side of the line are multiplied and added to the forward step from the previous step. This will produce one of the result bits and a carry value. This carry value will be added to the next step, so the process will continue. If there are multiple rows in a step, then all results will be added to the previous carry.

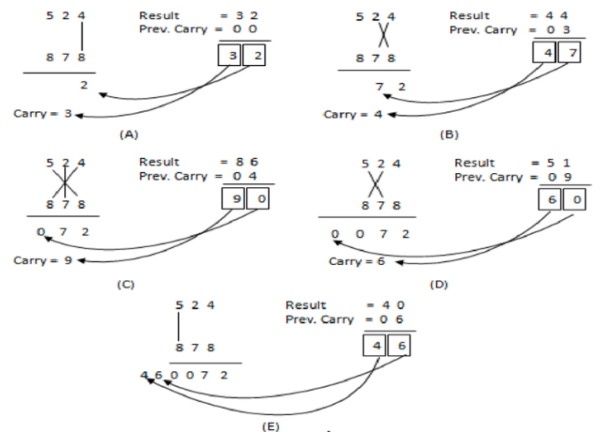


Figure 0-3. Example for Vedic multiplication.

VEDIC MULTIPLIER ARCHITECTURE:

A. 2x2 Vedic Multiplier Architecture

The 2x2 multiplier module is implemented using four AND gates and two half adder modules. The total delay of the 2x2 multiplier is equal to two half adder delays.

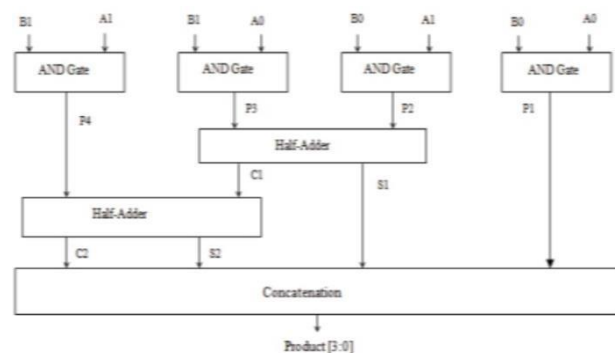


Figure 0-1 . 2x2 multiplier module architecture.

It consists of four AND gates used for single-bit AND operations and two half-adders which add up the numbers obtained in the previous section to provide sums and carry. At the end of the concatenation, all results are performed to obtain the final 4-bit product. This architecture is essentially an implementation of the IXI method. First, multiply most of the numbers on the right to produce the final LSB product. Then multiply the LSB of the first digit by the MSB of the second digit, multiply the MSB of the first digit by the LSB of the second digit, and add half of the adder block.

The total obtained by this adder is the second digit of the product. In the next step, the two numeric MSBs are joined together and the result is added to the half adder performed earlier. Therefore, the total obtained constitutes the third digit of the final product and the orientation is the MSB of the product.

IMPLEMENTATION OF 32-BIT VEDIC MULTIPLIER

The proposed 32-bit Vedic multiplier architecture utilizes three adder modules resulting in the reduction of combinational path delay. The obtained partial products are appropriately arranged to be added using the basic adder modules. Initially, a 2x2 multiplier is designed

conventionally due to minimal delay at this level of architecture. Using this 2x2 multiplier, 4x4 multiplier is designed using four blocks of 2-bit multiplier modules, a single 4-bit adder and two 6-bit adders.

Further, 8x8 multiplier architecture is designed using four blocks of 4-bit multiplier modules, a single 8-bit adder and two 12-bit adders. Similarly, using four 8-bit multiplier modules, a single 16-bit adder and two 24-bit adders, the 16-bit multiplier architecture is designed.

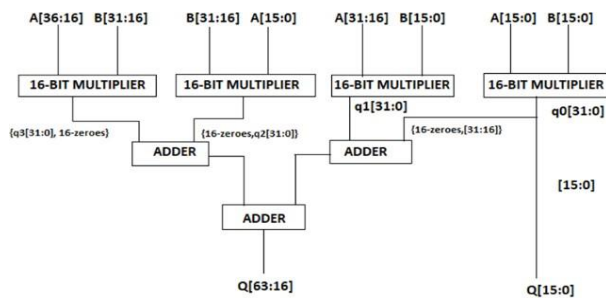


Figure 0-1. 32-bit Vedic multiplier architecture.

Finally, for the design of 32-bit multiplier architecture, the design of 16-bit multiplier can be used where four blocks of 16-bit multiplier modules, a single 32-bit adder and two 48-bit adders are used to result in a 64-bit product as shown in figure 5.

TEST RESULT ANALYSIS

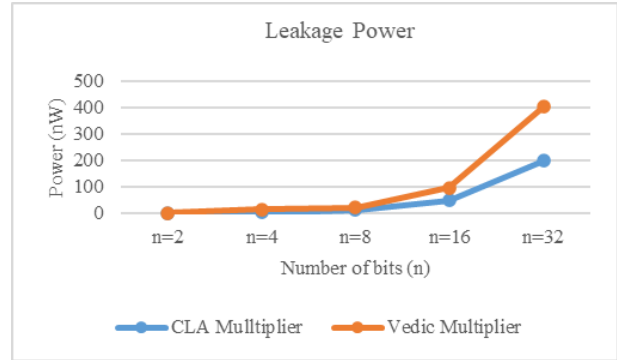
Proposed 32-bit Vedic multiplier design is implemented using Verilog and Cadence. The following tabular columns and graphical representations show the comparative results using the proposed designs for various operands.

TABLE 1: Power and Area analysis of Multiplier using CLA.

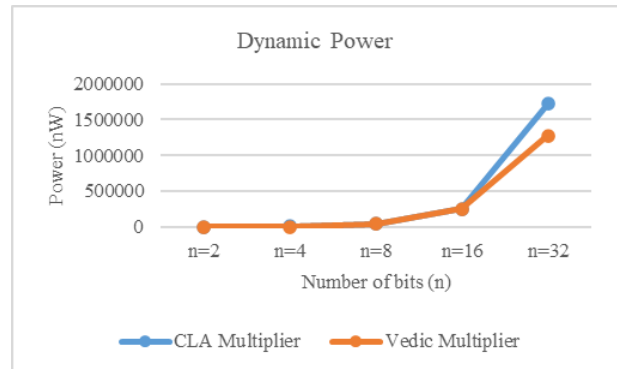
n-Bit multiplier	Leakage Power (nW)	Dynamic Power (nW)	Total Power (nW)	Total Area
n=2	0.540	1176.688	1177.229	25.463
n=4	13.750	4004.520	4018.270	314.042
n=8	21.770	46179.248	46201.018	934.930
n=16	96.125	250551.201	250647.325	4122.276
n=32	402.714	1277242.064	1277644.778	17267.452

TABLE 2 : Power and Area analysis of Vedic Multiplier

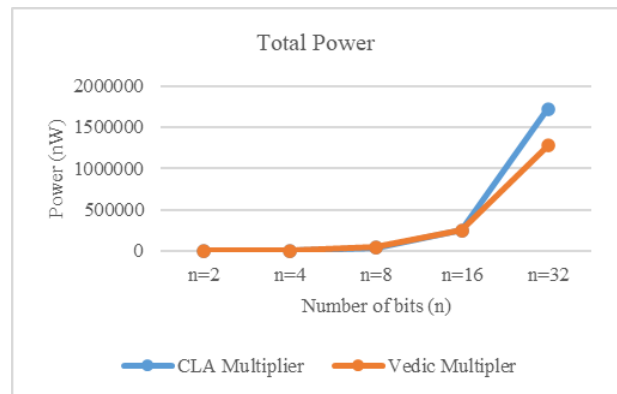
n-Bit multiplier	Leakage Power (nW)	Dynamic Power (nW)	Total Power (nW)	Total Area
n=2	0.540	1177.876	1178.417	25.463
n=4	2.872	7178.332	7181.204	139.947
n=8	12.909	41062.976	41075.886	635.979
n=16	48.122	254882.605	254930.727	2564.113
n=32	198.176	1721362.326	1721560.502	10497.819



Graph 1: Leakage Power Comparison



Graph 2: Dynamic Power Comparison



Graph 3: Total Power Comparison

CONCLUSION

It can be observed from the tabular results of power analysis comparisons between the proposed 32-bit Vedic multiplier architecture using basic adders and the 32-bit multiplier architecture using CLA that the suggested architecture consumes significantly less power than the multiplier developed using CLA. When compared to the suggested multiplier design, the CLA is more complicated in terms of circuit architecture, using more power and being less efficient.

REFERENCES

- [1] T.Sravanthi Devi, A.Madhu Sudhan, M.Tech VLSI Design, ECE, Anurag Group of Institutions, TS, India, "Original research paper on FPGA implementation of 32-bit Vedic multiplier and square architectures".

- [2] Jyoti Sharma, Sachin Kumar, Department of Electronics and Communication Engineering, Meri college of Engineering & Technology, Sampla, Bhadurgarh, Haryana, India, "Research paper on digital multipliers" (June 2014).
- [3] Akanksha Kant and Shobha Sharma, VSLI Design Indira Gandhi Delhi Technical University For Women New-Delhi, India Shobha Sharma, "Research papers on application of Vedic multiplier" (2015).
- [4] . Savita Nair, R.H.Khade , Ajit Saraf PG Student, Dept. of Electronics, PIIT, Panvel, Maharashtra, India, "Design and Analysis of Various 32bit Multipliers in an Approach towards a Fast Multiplier"(July 2015).
- [5] Syed Shahzad Hussain Shah, Muhammad Naseem Majoka, and Gulistan Raja, University of Engineering and technology, Department of Electrical Engineering, Taxila, Pakistan, "Design and implementation of 32-bit Vedic multiplier on FPGA" (February 2014).
- [6] Vikas Kaushik¹ and Himanshi Saini² ^{1, 2} ECE Department, Deenbandhu Chhotu Ram Univ. of Science & Technology, Sonipat, India, "A Review on Comparative Performance Analysis of Different Digital Multipliers" (2017).
- [7] Sarat Kumar Sahoo (Prof.), S. Prabhakar Karthikeyan (Prof), R. Anitha¹ (Prof.), Neha Deshmukh (student), Prashant Agarwal³ (student), School of Electrical Engineering VIT University , Vellore, India, "A 32 BIT MAC Unit Design Using Vedic Multiplier and Reversible Logic Gate" (2015).
- [8] Hasan Krad and Aws Yousif Al-Taie, Department of Computer Science and Engineering, College of Engineering, Qatar University, Qatar , "Performance Analysis of a 32-Bit Multiplier with a Carry- Look-Ahead Adder and a 32-bit Multiplier with a Ripple Adder using VHDL" (2008).

ABC_DE_WOA A New Hybrid Algorithm for Optimization Problems

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Abstract:

One of the most effective swarm intelligence-based algorithms for solving diverse global optimization issues is the artificial bee colony (ABC) method. Despite the fact that there are multiple ABC variations, the algorithm frequently shows a low convergence rate. Therefore, it is still important to maintain a balance between an algorithm's intensity and diversification. In this situation, the traditional ABC algorithm has been combined with the WOA and DE to create a novel hybrid ABC algorithm (ABC DE WOA). For simple benchmark problems with up to 100 dimensions, 50 dimensions, 30 dimensions, and 10 dimensions, the proposed hybrid method is principally compared with modern ABC variations like ABC WOA, ABC DE, and original ABC. Results show that the suggested method performs significantly better than its competitors in terms of the least error value reached and convergence speed.

Keywords:

Whale optimization algorithm (WOA), artificial bee colony algorithm (ABCA), benchmark functions (nature-inspired algorithms), intensification and diversification (ID), differential evolution (DE), convergence speed (CSP), and continuous optimization (CO)

INTRODUCTION

In recent years, a wide range of numerical optimization problems have been effectively optimized using nature-inspired techniques. One of the swarm intelligence-based algorithms that mimics honey bees' foraging behavior is the Artificial Bee Colony (ABC) algorithm, created by Karaboga and Basturk in 2008. The effective algorithm ABC was inspired by nature. Agarwal and Mehta provide an example of empirical examination of five nature-inspired algorithms on CEC 2014 benchmark functions (2017). It has been found that ABC provides a better result than other algorithms. Due to ABC's superior performance and straightforward implementation, scientists and researchers were drawn to it. ABC has a few flaws despite its good efficiency and straightforward implementation. It takes a while to achieve the best results because the ABC algorithm is metaheuristic and stochastic in nature. As a result, ABC's convergence speed needs to be increased. It should be made impossible for the algorithm to become stuck in regionally optimal answers. Exploration and exploitation are balanced by a good optimization technique. The researchers were inspired by this to create updated versions of the ABC algorithm. The modified versions were created by tweaking or incorporating additional parameters into the old ABC algorithm or by fusing it with alternative concepts or algorithms in various phases. All algorithms have the same goal, which is to either

increase solution quality or speed up execution, or both.. In this study, a new hybrid ABC technique is developed with the goal of improving stability, solution quality, and convergence speed. By adding DE in the spectator bee phase and WOA in the scout bee phase, the hybrid algorithm changes the conventional ABC algorithm. Simple benchmark functions are used to test the algorithm.

RELATED WORK

Title 1: Empirical analysis of five nature-inspired algorithms for real-world parameter optimization issues is the subject of title one.

Authors: Shikha Mehta and Parul Agarwal

1 Year: -2017

In brief: Nature-inspired algorithms have gained attention in recent years as potential methods for tackling computationally challenging issues. The researchers have created new algorithms as a result of the enormous success of existing algorithms in offering close to optimum answers. To find the optimum algorithms for various issue classes, however, very little work has been performed. This study aims to evaluate the performance of five modern algorithms that draw inspiration from nature: the bat algorithm (BA), artificial bee colony algorithm (ABC), cuckoo search algorithm (CS), firefly algorithm (FA), and flower pollination algorithm (FPA). The performance of these algorithms is assessed using the CEC2014 30 benchmark functions, which encompass unimodal, multimodal, hybrid, and composite issues with dimensions of 10, 30, 50, and 100.

Title 2: - ABC_DE_FP: A Novel Hybrid Algorithm for Complex Continuous Optimization Problems

Author: Parul Agarwal¹ · Shikha Mehta¹

Year: -2018

Abstract: - In this context, a novel hybrid ABC algorithm (ABC_DE_FP) has been developed by integrating FPA and DE in original ABC algorithm. To assess the efficacy of proposed hybrid algorithm, it is primarily compared with contemporary ABC variants such as GABC, IABC and AABC over simple benchmark problems. Thereafter, it is evaluated with respect to original ABC, FPA, hybrid ABC_FP, ABC_DE and ABC_SN over CEC2014 optimization problems for up to 100 dimensions.

Title 3: -An Improved Hybrid Whale Optimization Algorithm Based on Differential Evolution, Title 3.

YungYang Zhang, Yu Zhang, Gong Wang, and Bingshan Liu are the authors.

Year: -2020

In brief: A new hybrid algorithm is proposed in order to further enhance the efficiency of whale optimization algorithm and enhance the local search capability of the algorithm. The conventional whale optimization technique is simple to fall into local optimum. The common whale optimization algorithm is paired with differential evolution. Its superiority in accuracy and speed has been enhanced by the use of several test routines.

REVIEW OF ALGORITHMS

ARTIFICIAL BEE COLONY ALGORITHM

The ABC algorithm is effective in maximizing a number of objective functions. Three types of bees are used in the algorithm: working bees, observers, and scout bees. Bees in employment are connected to a specific food source (FS) and choose a new FS in close proximity to an existing FS. Equation (1) ($POS_{ij} = X_{ij} + ij(X_{ij} - X_{kj})$) is used to calculate the new solution. FS is the number of FSs (population size), D is the dimension of each FS, and ij is a uniformly distributed real random number in the range $[-1, 1]$, where j is a random integer in the range $[1, D]$ and k belongs to $(1, 2, \dots, FS)$ is a randomly chosen index that has to be different from i . If fitness of computed solution improves (i.e., nectar amount is high) then associated FS is replaced by new one otherwise old one remains in population. and a counter for entering into scout bee increases by 1. Bees in the background analyze the fitness of examined FSs and remember the FS with the highest nectar content. The employed bee transforms into a scout bee if nectar amount does not increase over the course of the life cycle and the counter reaches the "limit" value ($X_{ij} = lb_j + rand(0, 1)(ub_j - lb_j)$), where $i = 1, \dots, FS$ and $j = 1, \dots, D$, where FS is the number of FSs and D is the dimension parameter of the optimization problem). Upper and lower bounds (ub and lb) are previously established for a particular problem.

DIFFERENTIAL EVOLUTION ALGORITHM

The powerful EA DE was created by Storn and Price. Although there are many developed schemes for algorithm execution, DE/rand/1 is the most extensively used scheme and is utilized in this project. Three stages of the DE algorithm are used in succession: mutation, crossover, and selection. In the mutation phase, each target vector x_i (candidate solution) is used to calculate the mutant vector v_i , where a , b , and c are randomly selected (integer) indices of individuals in the population that are distinct from one another and $v_i = x_a + F.(x_b - x_c)$ is the candidate solution. Scaling factor F is defined as $[0, 2]$. *Crossover*: If $rand[0,1] \leq Cr$ or $j = j_{rand}$, a new vector ' u ' designated trial vector is produced from the mutant vector and the target vector ($U_{ij} = v_{ij}$); otherwise, X_{ij} is produced. Where $j = 1, 2, \dots, D$ is an index chosen at random from 1 to D, j_{rand} is Cr is crossover probability to regulate the parameter of mutant vector in trial vector. Target vector for the following generation is chosen for an optimization issue by performing greedy selection

between the trial vector and the target vector based on the fitness value of the objective function..

WHALE OPTIMISATION ALGORITHM

One of the world's largest mammals is the humpback whale. Additionally, it has a unique hunting system known as the bubble-net feeding technique. By creating unique bubbles that take the shape of a spiral or route, this foraging activity is made possible. The leader whale locates the target and dives down for around 12 metres, enveloping the prey in a spiral-shaped bubble, and then swims up to the surface while trailing the bubbles. a knowledgeable whale that synchronizes with the leader via calling. Behind the leader, the others line up and assume the same stance for each lunge.

PSEUDOCODE

//Employed Bee Phase – using the ABC Algorithm

For 1 to Population Size -Generating a new solution using GenNewSol() function using eq(1) $POS_{ij} = X_{ij} + \Phi_{ij}(X_{ij} - X_{kj})$. Bounding the violating variables to the upper bound and lower bound ($POS_{ij} = \min(POS_{ij}, ub)$, $POS_{ij} = \max(POS_{ij}, lb)$). Determining fitness of solution using CalFit() function: if $f \geq 0$, $fit = 1/(1+f)$ else $fit = 1+abs(f)$ where f is objective function value. If fitness of new solution > previous solution: set trial = 0 else trial = trial + 1

//Onlooker Bee Phase – using Differential Evolution

Set lower bound of scaling factor to β_{min} , Set upper bound of scaling factor to β_{max} and cross over probability p_{CR} . Let there be 3 randomly chosen individuals from the population (a, b, c). Mutation using eq(2) $v_i = x_a + F.(x_b - x_c)$ where $i = 1$ to FS, F is the scaling factor. if $rand[0,1] \leq Cr$ or $j = j_{rand}$, $U_{ij} = v_{ij}$, $U_{ij} = X_{ij}$ otherwise Where $j = 1, 2, \dots, D$, j_{rand} is index selected randomly from 1 to D. After generating new solution using DE algorithm. Calculating fitness of new solution using CalFit()

//Scout Bee Phase – using WOA (Whale optimization algorithm)

If trial counter exceeds limit (trial > limit). Enter scout bee phase. Positions of food sources determined using WOA algorithm

RESULTS

On comparing the results for our algorithm-ABC_WOA_DE with ABC_DE, ABC_WOA, ABC for 100 dimensions, 50 dimensions, 30 dimensions, 10 dimensions for each of the benchmark functions: Rastrigin, Schaffer, SphereNew, Griewank, Ackley, Dixon Price, Rosenbrock, SumSquares, Levy, rotated hyper ellipsoid function after tabulating the results and using Wilcoxon sum rank analysis.

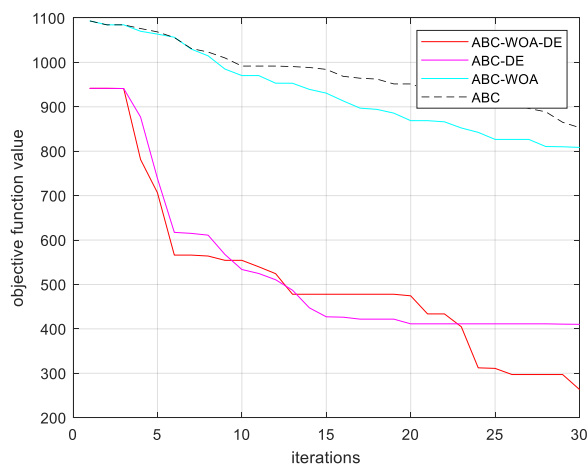
Wilcoxon sum rank test analysis for a) ABC_DE_WOA

		10D	30D	50D	100D
ABC	Better(+)	0	0	0	0
	Worse(+)	10	10	10	10
	No sig diff	0	0	0	0
ABC_WOA	Better(+)	0	0	0	0
	Worse(+)	10	10	10	10
	No sig diff	0	0	0	0
ABC_DE	Better(+)	2	3	2	3
	Worse(+)	8	8	8	7
	No sig diff	0	0	0	0

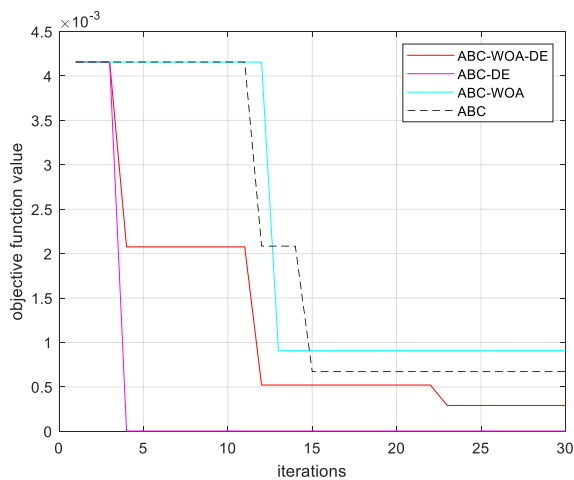
It is hence proved that ABC_DE_WOA algorithm performs better than the other algorithms.

For dim=100D

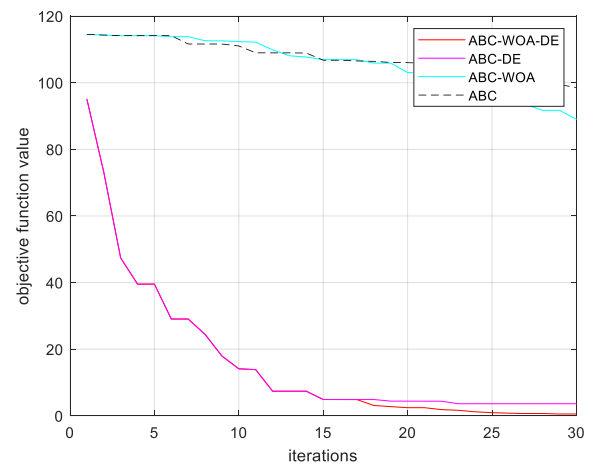
RLD for function 1



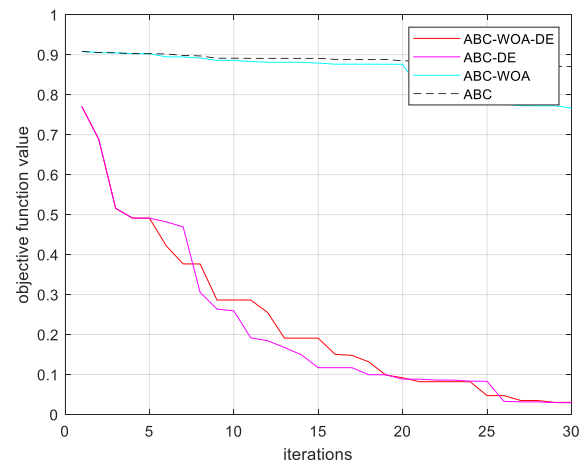
RLD for function 2



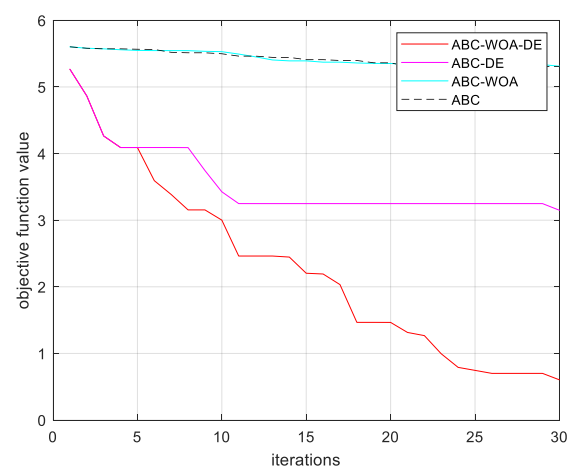
RLD for function 3



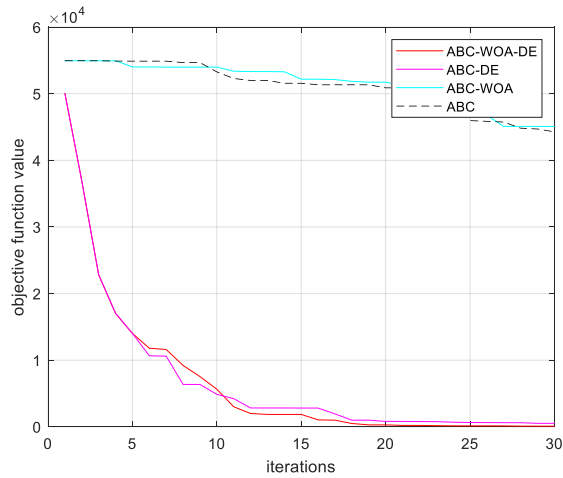
RLD for function 4



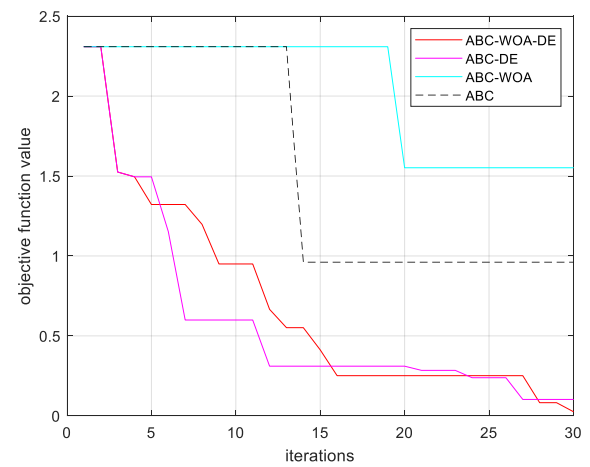
RLD for function 5



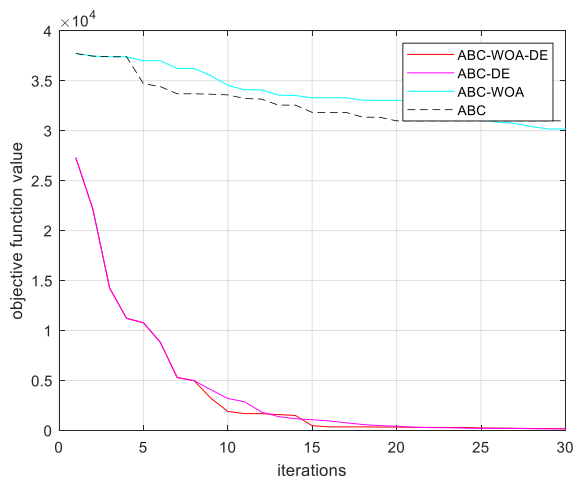
RLD for function 6



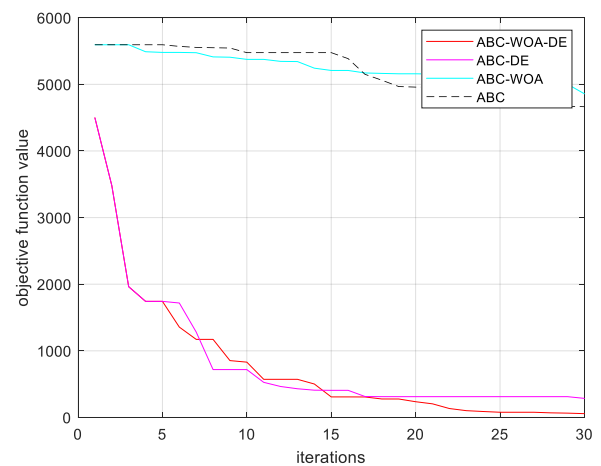
RLD for function 9



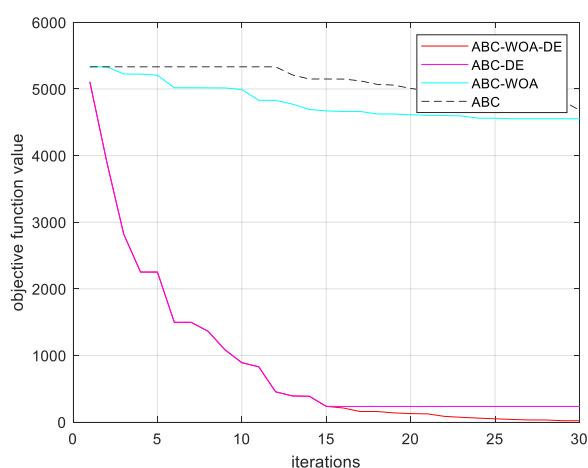
RLD for function 7



RLD for function 10



RLD for function 8



REFERENCES

- [1] ABC_DE_FP: A Novel Hybrid Algorithm for Complex Continuous Optimization Problems by Parul Agarwal; Shikha Mehta, International Journal of Bio-Inspired Computation (IJBC), Vol. 14, No. 1, 2019.
- [2] On the performance of artificial bee colony (ABC) algorithm, D Karaboga, B Basturk
- [3] A Hybrid ABC-DE Algorithm and Its Application for Time-Modulated Arrays Pattern Synthesis, Jing Yang, Wen Tao Li, Xiao-Wei Shi, Li Xin, Jian Feng Yu
- [4] A Hybrid Artificial Bee Colony with Whale Optimization algorithm for improved breast cancer diagnosis, S.Punithaa, Thompson Stephanb*, Ramani Kannan c, Ajith Abraham d

The Roadway to Green Firms: Top Management Role and Management Practices Leading To Sustainable Innovation

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Abstract:

Research problem- *The purpose underlying the paper is to offer some reflections on the role of the top management initiatives and strategic decisions and characteristics of top management towards implementing sustainable practices in firms and which leads to organizations imbibing sustainable innovative strategies which is the need of the 21st century environment. The role of top management commitment and initiative in green practices relationship remains mostly unexplored. It also demonstrates the critical role of top management in fostering green culture. The paper also outlines the sustainability aspect like green characteristics and management practices and strategies in marketing. Furthermore, it underscores the benefits of fostering top management initiatives and commitment to initiate environmental efforts and, ultimately, provides researchers with a deeper understanding of how a most overlooked factor of top manager may greatly influence Green innovation adoption. This paper reviews some of management practices, pertaining to technology, human resources and external relationship practices that are significantly influential in the adoption of green practices by firms. The insights forwarded by this paper could provide some basis for future studies in this domain, particularly regarding the role of top management; as well as the guidelines for industries to realize environmental transformation in their organization.*

Methodology- *The paper is a descriptive study and uses secondary sources of research papers from journals and also information from websites.*

The key findings- *The paper describes the role of top management in fostering green culture and hence adoption of green innovation for sustainable practices and also the sustainability dimensions in the industry.*

The managerial implications- *The paper outlines descriptive research implications: theoretical, strategic for the industry, and also for scholars.*

Keywords:

Sustainable, green innovation practices, sustainable development, green culture, top management commitment

INTRODUCTION

In recent times the business environment cannot sustain independently from the ecological balance. All economic activities require sustainable development. Hence going green has been a business trend. Green or sustainability business practices refers to the management and coordination of environmental, social and financial demands and concerns to ensure responsible, ethical and ongoing success of businesses. A green workplace also refers how sustainable it is ; it emphasises and constantly build up an environment of consciously choosing greener power sources like solar and wind energy, focuses on lowering its emissions, reducing waste and managing

waste in eco-friendly manners, pays attention to build sustainable green culture by also putting up sustainability team, sustainable rewards system etc. Also , the green design of the infrastructure also has evidence of increasing positive work environment and is associated with better mental health and hence productivity. The World Bank defines green growth as “economic growth that is environmentally sustainable.” Many studies have also stated the association of productive and satisfied employees who work in green /sustainable workplaces. It is not just the role of governments, climate activists but also organizations and every citizen to take up immediate and strong actions and incorporate best practices which supports environmental concerns. Green is a difficult word and the definition of greenness of product is indistinct ,generally acknowledged definition is missing and the concept boundaries are ill-defined (Fabien Durif Caroline Boivin Charles Julien et al., 2010). The terms such as ecological, natural, organic are complicating and ambiguous terms of greenness which confuses consumers.

Green marketing comprises of all activities premeditated to satisfy human needs while making sure environmental concerns are shielded(Kinoti, 2011). Three stages in the green marketing are (Eneizan et al., 2019): stage1: Associated with environmental glitches and their remedies. Stage2: Eco-friendly promotion which puts emphasis on clean technology(in the 80's). Stage3: Sustainable eco-promotion (late 90's and initial part of 2000's).Sustainable and green are frequently interchangeably termed; nonetheless "sustainable" has a comprehensive scope as it entails environmental, social and financial responsibility. Sustainable marketing framework entails three dimensions (R. Gordon et al., 2011) which are complementary and are co-dependent:(1)green marketing can cause damage like 'Green-Wash'(Yu Shan Chen et al., 2020); (2)social marketing is ineffective when implemented alone; (3)critical marketing cannot alone lead to transformation of customer perception. Sustainability efforts will harness the potential of marketing.

The adopters of sustainable practices are encouraged when their top management is environmentally oriented and they support and invest on their operations and recognise the importance of environmental issues facing their firms (Banerjee et al., 2003a).The awareness and prioritisation will eventually promote practices that can focus on environmental issues. Top management are instrumental in fostering organizational culture and influences the stakeholders and hence developing a green

culture is the long term best practices which helps organizations and environment co-exist in the most positive and growth-driven conducts.

OBJECTIVES

The objectives of the paper are to discuss the sustainability dimensions in the industry and role of top management in fostering green culture and hence adoption of green innovation for sustainable practices .

METHODOLOGY/APPROACH

The paper is a descriptive study and uses secondary sources of research papers from journals and also information from websites.

GREEN MARKETING STRATEGIES

Green marketing is also known as environmental marketing, nature-friendly marketing and ecological marketing. Many marketers supposed Green marketing to be a means of promotion or advertisement used in the marketing of products made in an environmentally sensitive manner. It is much broader concept beyond the practice of recyclable, ozone layer friendly and environmentally friendly. Green marketing includes products, production process, packaging, pricing, supply, logistics and promotional activities.

More organizations are making an effort to implement sustainable business practices as they recognize that they can offer attractive products to consumers and also expenses can also be decreased.

Eco-Labeling Product:

The factors that suggested the product is environmentally friendly are to be termed as the eco-label. Eco-label products are the symbol that boosts the consumer to buy eco-label products(Rex & Baumann, 2007). Study by (D'Souza et al., 2006) stated that eco-label are also termed as biodegradable, sustainable, environmental friendly, recyclable. There is a need to fill the gap between the consumer and the seller about the eco-label products that can urge them to use these products. It is suggested by the researcher that eco labels are the tool that can increase the awareness and lead to purchasing decision of eco-label products.

Green Packaging and Eco-Brand:

The brand associated which will nurture the environment is known as the eco-brand. Researcher did not attempt sufficiently towards the green branding and this was identified as a research gap(First & Khatriwal, 2010). Brands are the basis that can transform the behaviour of green consumption (Pickett-Baker & Ozaki, 2008). Brand characteristics are to be communicated(Maio, 2003).Study has revealed that consumer has positive response towards eco-label(Rahbar & Wahid, 2011). However, some consumers have adverse perception and undervalue performance(Fuller, 1999).Consumer willingness to purchase is more imperative than eco-packaging and eco-branding (Orsato, 2009).

Green Advertisements:

Marketers are not making sufficient communication with the consumers about the green products. It has been suggested that environmental friendly products should be advertised more prominently that consumer should be able to differentiate(D'Souza & Taghian, 2005). The common advertisement terms such as: ozone safe, recyclable, eco-friendly are the important feature. Apt marketing communication can enhance the response of the consumers (Ahmad et al., 2010). Many organizations are unable to entice substantial customers but they are able to develop the awareness (W. Gordon, 2002). Firms providing training for their employees about green issues will help understand and cater the appropriate green advertisements.

Green Premium Price:

It has been found that significant number of consumers are eager to pay premium (Berger, 2019). Price should be sustainable in the market(Meise et al., 2014). Green products have signalling benefit and justifies premiums; marketers should come out with high-priced green products; long-term strategy for premium products should be charged reasonably (Berger, 2019).

Eco-Image:

Eco-image is an effective marketing strategy (Devi Juwaheer et al. ,2012) . Consumer considers products which are environment friendly. Marketing efforts are made to develop the concern towards the environmentally friendly products and foster their consumption habits. The consumption pattern suggests the trust of the consumers and eco-friendly image can be achieved (Devi Juwaheer et al., 2012). Green image and eco-friendly perspective are included in the advertisement communications.

SUSTAINABLE INNOVATION

The rational of sustainability is an interdisciplinary concept and has been used in various disciplines such as politics, economy, science and arts. Innovation entails the idea of novelty and originality. Innovation refers to a new idea, method or device or the development of something novel (Rennings, 2000). It comprises of any practice that is new to organizations, including equipments. products, services, processes, policies, and projects. Sustainable innovation aims to benefit from all aspects of economic ,social and environmental .Sustainable Innovations are all innovations that have a positive environmental impact irrespective of whether this was the innovation's main goal (OECD, 2008). Innovation is not just in terms of products and processes but also in terms of management which entails the concept of total quality management(Eurostat, 1997). The term sustainable innovation also has been used interchangeably with Eco innovation, environmentally driven innovation and green innovation (Hordern et al., 2008). Organizations that take up strategic decisions to implement any business operations in a sustainable mode are also to benefit both in economic and environmental aspects (Y. S. Chen, 2000 ;Theyel, 2000) .Sustainable innovation should be

promoted in business organizations and has become the need of any organizations in modern times.

SUSTAINABLE MANAGEMENT PRACTICES

The management practices for Sustainable innovation according to many research studies can be classified into the classification of technology, human resources and environmental.

Technological :

The green practices adoption behaviour can be regarded as a technical innovation process as it entails putting in place new or improved processes, procedures, and systems to reduce energy consumption and minimise pollution (Lin & Ho, 2011). In the literature on technical innovation, technological aspects are frequently considered, however, their effects on the adoption of green practises have received diminutive attention. Numerous factors have been deliberated on their influences on technical. Innovation which comprises variables like relative advantage, compatibility, complexity, observability, ease of use, perceived usefulness, information intensity, and uncertainty (Rogers, 2003 ;Tornatzky & Fleischer, 1990;Frambach & Schillewaert, 2002 ;Jeyaraj et al., 2006).

Organizational :

The organizational context are the characteristics of the firm which are internal to an organization which has significant role to an innovation adoption and operation (L. G. Tornatzky & Fleischer, 1990). Variables relating to organisational characteristics have been discussed on their influences on technical innovation diffusion such as quality of human resources, top management's leadership skills, organizational support, organizational culture, and organizational size on their influences on technical innovation (L. G. Tornatzky & Fleischer, 1990 ;Kimberly & Evanisko, 1981).

Environmental :

The organizations are influenced by external environment in which they are operating. There are many environmental variables such as environmental uncertainty, stakeholder pressure, environmental munificence, governmental support, competitive pressure and network relations (Frambach & Schillewaert, 2002 ;Jeyaraj, Rottman, & Lacity, 2006b). Environmental uncertainty/predictability is widely studied as the most pertinent environmental characteristic that affects a strategic decision making of organizations (Li & Atuahene-Gima, 2002).

ROLE OF TOP MANAGEMENT AS MANAGEMENT PRACTICES FOR SUSTAINABLE INNOVATION

It is the top managers who make the strategic decisions of organizations, since they serve as the firm's primary human interface with the environment even if there are many internal and external factors influencing any changes on firms (Liang et al., 2007). The top management role as organization's primary interface to

external pressures and internal resources which influences organizational decision outcomes is supported by the upper echelons theory (Mason, 1984).It is imperative to promote a positive organizational culture which positions on establishing green culture "where the entire organization must reorient its attitudes and behaviours to be committed to achieving new goals" (Geneviève M. Perron et al., 2006).Top management is a critical motivator for organisations to implement green efforts and enhance performance of environmental initiatives (Dai, J., Montaabon, F., Cantor, 2014).

GREEN CULTURE:

Organizational culture is the formation of collective values and views that assist individuals in understanding how organisations work and functions which contributes in the foundation for organisational behaviour norms (Kumar et al., 2016).Green culture is an environmental community behaviour in which the social group functions and believes in working in environmental friendly ways and to solve environmental and climate issues (Ogiemwonyi et al., 2020).An organizational culture where employees at the operational level take further steps is necessary for successful environmental initiatives because employees are originators and receivers of the activities (Handfield et al., 2005 ;Testa et al., 2018).Developing a green culture entails promoting behaviour that people already wish to embrace, but in order to transform organizations to a green culture, the necessary tools and training are still required (Olson, 2008).

TOP MANAGEMENT AND GREEN CULTURE

Top management communicates clearly , listing it as part of organizational goals to employees that sustainability is the need of modern management and align environmental programs into the firm's daily operations. Top management can take up initiatives like employee involvement and empowerment (Daily & Bishop, 2003) and can be through reward and incentive (Pun et al., 2001)for motivating and directing employees towards a green behaviour. Top management promotes encouraging environment to policy implementation and along with incentives for employees which results in a favourable environmental performance (Branzei et al., 2004) (Banerjee et al., 2003b) .The various individual and organizational barriers in implementing sustainability will be overcome by incorporating sustainability concerns into the daily routine of the organization (Hoffman, 1993) . Employees will be motivated to participate in green practice with the support of green company culture (G.M. Perron et al., 2006) .

LIMITATIONS

The paper summarises descriptive aspects of sustainability and lacks empirical study with respect to the industry.

CONCLUSION AND FUTURE SCOPE

The adoption of sustainable green practices in organizations is of profound importance for sustainability. The paper describes the sustainability dimensions in the industry and the profound role of top management in the contribution of green culture and the adoption of sustainable practices. Managerial attitude, behaviour or any other significant changes with empirical support can be studied.

REFERENCES

- [1] Ahmad, H., Shah, I. A., & Ahmad, K. (2010). Factors in environmental advertising influencing consumer's purchase intention. *European Journal of Scientific Research*, 48(2), 217–226.
- [2] Banerjee, S. B., Iyer, E. S., & Kashyap, R. K. (2003a). Corporate environmentalism: Antecedents and influence of industry type. *Journal of Marketing*, 67(2), 106–122.
- [3] Banerjee, S. B., Iyer, E. S., & Kashyap, R. K. (2003b). Corporate environmentalism: Antecedents and influence of industry type. *Journal of Marketing*, 67(2), 106–122.
- [4] Berger, J. (2019). Signaling can increase consumers' willingness to pay for green products. Theoretical model and experimental evidence. *Journal of Consumer Behaviour*, 18(3), 233–246. <https://doi.org/10.1002/cb.1760>
- [5] Branzei, O., Ursacki-Bryant, T.J. Vertinsky, L., & Zhang, W. J. (2004). The formation of green strategies in Chinese firms: matching corporate environmental responses and individual principles. *Strategic Management Journal*, 25(11), 1075–1095.
- [6] Chen, Y. S. (2007). The Driver of Green Innovation and Green Image Green Core Competence. *Journal of Business Ethics*, 81, 531–543.
- [7] Chen, Yu Shan, Huang, A. F., Wang, T. Y., & Chen, Y. R. (2020). Greenwash and green purchase behaviour: the mediation of green brand image and green brand loyalty. *Total Quality Management and Business Excellence*, 31(1–2), 194–209. <https://doi.org/10.1080/14783363.2018.1426450>
- [8] D'Souza, C., & Taghian, M. (2005). Green advertising effects on attitude and choice of advertising themes. *Asia Pacific Journal of Marketing and Logistics*, 17(3), 51–66. <https://doi.org/10.1108/13555850510672386>
- [9] D'Souza, C., Taghian, M., & Lamb, P. (2006). An empirical study on the influence of environmental labels on consumers. *Corporate Communications*, 11(2), 162–173. <https://doi.org/10.1108/13563280610661697>
- [10] Dai, J., Montaabon, F., Cantor, D. (2014). Linking rival and stakeholder pressure to green supply management: mediating role of top management support. *Transportation Research Part E*, 71(11), 173–187.
- [11] Daily, B. F., & Bishop, J. W. (2003). TQM workforce factors and employee involvement: the pivotal role of teamwork. *Journal of Managerial Issues*, 15(4), 393–417.
- [12] Devi Juwaheer, T., Pudaruth, S., & Monique Emmanuelle Noyaux, M. (2012). Analysing the impact of green marketing strategies on consumer purchasing patterns in Mauritius. *World Journal of Entrepreneurship, Management and Sustainable Development*, 8(1), 36–59. <https://doi.org/10.1108/20425961211221615>
- [13] Eneizan, B., Mohamad Alhamad, A., Bin.Mat Junoh, M. Z., & Binti Tunku Ahmad, T. S. (2019). Green Marketing Strategies: Theoretical Approach. *American Journal of Economics and Business Management*, 2(2), 77–94. <https://doi.org/10.31150/ajeblm.vol2.iss2.69>
- [14] Eurostat, O. E. C. D. (1997). *Proposed guidelines for collecting and interpreting technological innovation data: Oslo manual, the measurement of scientific and technological series*.
- [15] Fabien Durif Caroline Boivin Charles Julien, A., Durif, F., Boivin, C., & Julien, C. (2010). In Search of a Green Product Definition. *Innovative Marketing*, 6(1).
- [16] First, I., & Khetriwal, D. S. (2010). Exploring the relationship between environmental orientation and brand value: Is there fire or only smoke? *Business Strategy and the Environment*, 19(2), 90–103. <https://doi.org/10.1002/bse.619>
- [17] Fuller, D. A. (1999). *Sustainable Marketing: Managerial - Ecological Issues*. SAGE Publications. https://books.google.co.in/books?hl=en&lr=&id=hsdyAwAAQBAJ&oi=fnd&pg=PP1&dq=Sustainable+Marketing:+Managerial+-+Ecological+Issues.+In+Sage+Publications.+Fuller&ots=qDEU0lyJfb&sig=Q9NuUCfjpEr4q2xwPEPfpXNzSvs&redir_esc=y#v=onepage&q=Sustainable Marketing%3A
- [18] Gordon, R., Carrigan, M., & Hastings, G. (2011). A framework for sustainable marketing. *Marketing Theory*, 11(2), 143–163. <https://doi.org/10.1177/1470593111403218>
- [19] Gordon, W. (2002). Brand Green : Mainstream or Forever Niche? *Brand Green: Mainstream or Forever Niche?*, 1(1). <https://doi.org/papers://248E978A-D3F2-453E-A670-D29D7166B452/Paper/p2878>
- [20] Handfield, R., Sroufe, R., & Walton, S. (2005). Integrating environmental management and supply chain strategies. *Business Strategy and the Environment*, 14(1), 1–19.
- [21] Hoffman, A. J. (1993). The importance of fit between individual values and organizational culture in the greening of industry. *Business Strategy and the Environment*, 20(4), 1015–1052.

- [22] Hordern, T., Borjesson, S., & Elmquist, M. (2008). *Managing green innovation present findings. Center for Business Innovation Working Paper Series*.
- [23] Kinoti, M. W. (2011). Green marketing intervention strategy and sustainable development. *International Journal of Business and Social Sciences*, 2(23), 263–273.
- [24] Kumar, G., Banerjee, R. N., Meena, P. L., & Ganguly, K. (2016). Collaborative culture and relationship strength roles in collaborative relationships: A supply chain perspective. *Journal of Business & Industrial Marketing*, 31(5), 587–599.
- [25] Liang, H., Saraf, N., Hu, Q., & Xue., Y. (2007). Assimilation of enterprise systems: the effect of institutional pressures and the mediating role of top management. *MIS Quarterly*, 31(1), 59–87.
- [26] Maio, E. (2003). Managing Brand in the New Stakeholder Environment. *Journal of Business Ethics*, 44(2–3), 235–246. <https://doi.org/10.1023/A:1023364119516>
- [27] Mason, P. A. H. D. C. (1984). Upper echelons: the organization as a reflection of its top managers. *Academy of Management Review*, 9(2), 193–206.
- [28] Meise, J. N., Rudolph, T., Kenning, P., & Phillips, D. M. (2014). Feed them facts: Value perceptions and consumer use of sustainability-related product information. *Journal of Retailing and Consumer Services*, 21(4), 510–519. <https://doi.org/10.1016/j.jretconser.2014.03.013>
- [29] OECD. (2008). *Environmental innovation and global markets*.
- [30] Ogiemwonyi, O., Harun, A., Alam, M., & Othman, B. (2020). Do We Care about Going Green? Measuring the Effect of Green Environmental Awareness, Green Product Value and Environmental Attitude on Green Culture An Insight from Nigeria. *Environmental and Climate Technologies*, 24(1), 254–274.
- [31] Olson, E. G. (2008). Creating an enterprise-level “green” strategy. *Journal of Business Strategy*, 29(2), 22–30. <https://doi.org/10.1108/02756660810858125>
- [32] Orsato, R. J. (2009). Eco-Branding. In *Sustainability Strategies* (pp. 96–120). Palgrave Macmillan UK. https://doi.org/10.1057/9780230236851_5
- [33] Perron, G.M., Cote, R. P., & Duffy, J. F. (2006). Improving environmental awareness training in business. *Journal of Cleaner Production*, 14(6–7), 551–562.
- [34] Perron, Geneviève M., Côté, R. P., & Duffy, J. F. (2006). Improving environmental awareness training in business. *Journal of Cleaner Production*, 14(6–7), 551–562. <https://doi.org/10.1016/j.jclepro.2005.07.006>
- [35] Pickett-Baker, J., & Ozaki, R. (2008). Pro-environmental products: Marketing influence on consumer purchase decision. *Journal of Consumer Marketing*, 25(5), 281–293. <https://doi.org/10.1108/07363760810890516>
- [36] Pujari, D., Peattie, K., & Wright, G. (2004). Organizational antecedents of environmental responsiveness in industrial new product development. *Industrial Marketing Management*, 33, 381–391.
- [37] Pun, K. F., Chin, K. S., & Gill, R. (2001). Determinants of employee involvement practices in manufacturing enterprises. *Total Quality Management*, 12(1), 95–109.
- [38] Rahbar, E., & Wahid, N. A. (2011). Investigation of green marketing tools’ effect on consumers’ purchase behavior. *Business Strategy Series*, 12(2), 73–83. <https://doi.org/10.1108/17515631111114877>
- [39] Rennings, K. (2000). Redening innovation: Eco-innovation research and the contribution from ecological economic. *Ecological Economics*, 32, 319–332.
- [40] Rex, E., & Baumann, H. (2007). Beyond ecolabels: what green marketing can learn from conventional marketing. *Journal of Cleaner Production*, 15(6), 567–576. <https://doi.org/10.1016/j.jclepro.2006.05.013>
- [41] Saa-Perez, P. D., & Garcia-Falcon, J. M. (2002). A resource-based view of human resource management and organizational capabilities development. *International Journal of Human Resource Management*, 13, 123–140.
- [42] Testa, F., Boiral, O., & Iraldo, F. (2018). Internalization of environmental practices and institutional complexity: can stakeholders pressures encourage greenwashing. *Journal of Business Ethics*, 147, 287–307.
- [43] Theyel, G. (2000). Management practices for environmental innovation and performance. *International Journal of Operations & Production Management*, 20(2), 249–266.

Scenario of Reactive Power Management Using FACTS Devices and HVDC in Indian Renewable Energy

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Abstract:

The main purpose and intent of this paper is to demonstrate the rudimentary and haphazard concept of reactive power in power system. The country's transmission system has grown rapidly in response to rising demand, connecting generating stations and allowing for the integration of Renewable Energy (RE) sources from RE-rich areas. Integrating variable producing sources into the grid can produce issues such as voltage fluctuations and outages, which can damage utility equipment as well as end users performance. Reactive power has never done any work but without it, very little work can be done. We have a control mechanism in reactive power compensation that allows us to better deal with a variety of occurrences. We can get a densely loaded network to cope with load changes and other events without deteriorating the grid's operation by adding and removing reactive power. The goal of the STATCOM is to regulate and support ac voltage while minimizing over- and under voltages that may arise in the network due to various faults and events, such as massive HVDC commutation failure.

Keywords:

FACTS, Hybrid STATCOM, MMC, MSR, HVDC, Renewable Energy, VSC HVDC, UHVDC, REMCs

INTRODUCTION

The country's transmission system has grown rapidly in response to rising demand, connecting generating stations and allowing for the integration of Renewable Energy (RE) sources from RE-rich areas. The country's goal of generating 175 GW of renewable electricity capacity by 2022 and 445 GW by 2030 opens up huge growth prospects for transmission capacity expansion at both the interstate and intrastate levels. The Indian government has set a goal of adding 175 GW of renewable energy capacity to the grid by 2022[11]. Solar and wind power, which account for the majority of renewable energy capacity, are, however, both intermittent and variable. Integrating such a large amount of renewable energy capacity into the current system poses a number of issues in terms of preserving the grid's voltage and frequency specifications. Grid stability can be jeopardized by managing the inherent volatility of distributed energy sources and renewable energy output. Reactive power is used to address grid voltage instability, also known as voltage instability, by temporarily delivering electricity and maintaining the grid voltage, thereby avoiding undue volatility. Power system factors such as active power utilization, voltage stability, power factor, system efficiency, energy cost, and power quality can all be managed by managing reactive power. As a

result, managing reactive power has various benefits, including voltage stability, power factor adjustment, system efficiency, cost control, improved power quality, and component longevity, as components are less susceptible to wear and tear due to repetitive voltage changes [10].

1.1 The way forward

Steps must be made by developers, transmission planners, and utilities to address power quality difficulties that arise as a result of the integration of renewables. In order to combat renewable volatility, the federal government's Green Energy

Corridors initiative focuses on the integration of large-scale renewable power into the national grid as well as the expansion of the balancing area. The project comprises building transmission infrastructure in renewable-rich areas as well as implementing control infrastructure solutions such as dynamic compensation devices (SVC and STATCOM), renewable energy management centers (REMCs), and energy storage. The Power Grid Corporation of India Limited is developing dynamic MVAR compensation technologies, such as STATCOM, and installing phasor measurement devices at important grid points. To improve grid reliability and voltage stability limits, a number of STATCOMs have been placed in the 400 kV grid [13]. In the western region, STATCOMs have been installed in Solapur, Aurangabad, Satna, and Gwalior; in the northern region, Lucknow and Nalagarh; in the eastern region, Ranchi, Rourkela, Jeypore, and Kishanganj; and in the southern region, Udumalpet, Trichy, Hyderabad, and NP Kunta (Ananthapuram). These devices will provide grid dynamic stability under varying situations, as well as a quick and reliable system reaction to severe grid disturbances requiring voltage recovery [5][6].

1.2 Reactive Power Compensation

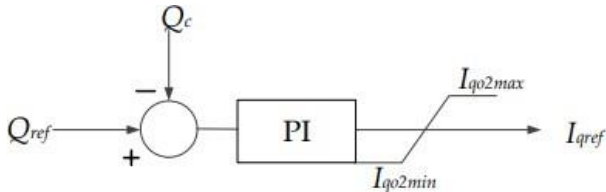
Increased long-distance transmission, grid-connected variable renewable energy generation, and synchronization of an all-India network all offer extra voltage and stability issues. As a result, transmission system operators are increasingly concerned about the requirement to transmit power efficiently. To do this, it is critical to stabilize voltage fluctuations in order to assure reliable operations. While the transmission system's goal is to give actual (or active) power to the network, the transmission network's energy transfer is only achievable with reactive (or virtual) power. Reactive

power is generated in alternating current (AC) circuits and is required for the proper operation of different electrical systems, including transmission lines, motors, and transformers. It simply promotes the flow of energy in an electric system, and it is created or absorbed by a wide range of equipment connected to the power grid. Because it impacts and regulates the voltage across the system, reactive power is critical to the security of power systems. Reactive power prevents damage to an electric system (such as generator and motor overheating), reduces transmission losses, and preserves the system's ability to withstand and prevent voltage collapse by supporting voltage management. When there is an excess of reactive power, the system power factor drops dramatically, lowering operational efficiency. When there is insufficient reactive power, the voltage sags, making it impossible to supply the required power to the load via transmission lines. To avoid this, the quantity of power generated and consumed should be as close as feasible; otherwise, the voltage profile would be unbalanced. For the optimization of reactive power and grid stability, a variety of static and dynamic devices and management choices are used to overcome these limits. These technologies enable transmission operators to maintain power quality and power transfer capability through active network management in light of the increased influx of renewables and increasing power variations [2][3][9][12].

1.3 Analysis of the Effects of VSC Reactive Power Control Mode on AC System Stability

1) Reactive Power Control Mode for VSC-HVDC

Direct current control, often known as vector control, is currently in widespread usage in Voltage Source Converter-HVDC (VSC-HVDC). A double closed-loop control structure is typically used in vector control. In the inner current control loop, which can monitor the reference current quickly, a decoupled control structure consisting of current feedback and voltage feed-forward is used. The power regulators in the outer loop combine the inverse steady-state model with a proportional-integral regulator to control active and reactive power independently [13].



2) The Effect of the VSC Reactive Power Control Mode on the System's Dynamic Power Angle Stability

$$V_s = \frac{x_t}{x_t + x_g} E \angle \delta + \frac{x_g}{x_t + x_g} V \angle 0$$

Let

$$E_1 = \frac{x_t}{x_t + x_g} E \quad \text{and} \quad E_2 = \frac{x_g}{x_t + x_g} V$$

According to the law of cosines, the amplitude of V_s can be calculated by

$$|V_s| = E_1^2 + E_2^2 + 2E_1 E_2 \cos \delta$$

When the AC voltage of the access point falls below its steady-state value, VSC-HVDC injects capacitive reactive power into the system to achieve constant voltage. Instead, in the event of a higher voltage, it will absorb capacitive reactive power [7][8].

1.4 HVDC Projects Across the Globe

HVDC technology is becoming increasingly important in long-distance power transmission. Several high-voltage direct current (HVDC) projects have already been completed or are in the planning stages around the world. By 2022, overall HVDC transmission operational capacity is expected to exceed 400 GW [29]. About 52 percent of this capacity is located in Asia, which is primarily driven by the major market participants, China and India. Several high-voltage direct current (HVDC) projects are being built in these locations to carry bulk power across great distances. Europe accounts for roughly 22% of all global HVDC developments [4].

Region	No. of Projects	HVDC Cable Length (km)	Total Capacity (MW)
North America	29	66,942	75,150
China and India	33	60,561	266,700
Europe	23	5772	20,220
Others	12	25,120	37,110

LITERATURE REVIEW

Tariq Maria, *et.al.*[1] STATCOM converter acts as an active power filter, adjusting voltage, reactive power, and power quality, when connected to a grid wind farm or solar farm Using the HBCC (hysteresis band current controller) technology, STATCOM generates reactive current in the opposite direction as the interrupting signal throughout the grid's current. Because STATCOM acts as an active filter, total harmonic distortion (THD) is decreased. Furthermore, STATCOM has the capacity to adjust voltage at the load bus, providing a more reliable solution for these systems.

AminMohammad Saberian, *et.al.*[2] states that regulating voltage, controlling power flow, dampening power oscillations, transient stability, and other issues have plagued modern power systems. FACTS devices are strategically placed; STATCOM and SVC play a crucial role in improving voltage stability and lowering system losses. The efficiency of reactive power, as well as the arrangement of an optimal control of voltage set point at the point of generator connection and at VAR setting in reactive power dispatch, can all be improved by choosing the best location during the planning phase.

Honey Baby, *et.al.*[3] explained SVC and STATCOM are examples of reactive power compensation (RPC) devices that have been modelled and incorporated into

RES. The location and sizing of RPC devices are critical for the stable and secure operation of the electric grid. Existing options for reactive power management include the use of capacitors, with power electronics-based FACTS (Flexible AC Transmission System) devices providing the greatest solution for reactive power control. Countless techniques used by various researchers are analysed to guide voltage/reactive power management. STATCOM, SVC, FACTS devices, UPFC, or a mix of devices are among the strategies employed by researchers. The existing power system network necessitates a proper reactive power management system, as well as coordination among numerous algorithms, objective functions, and control strategies on these RPC devices.

Marcus Haeusler, *et.al.*[4] explains that most converter designs, VSC HVDC does not necessitate additional reactive power adjustment or harmonic filters. There are HVDC solutions that allow for the seamless integration of renewable energy into the transmission grid. Back-to-back HVDC transmission systems and long-distance transmission networks based on VSC technology ensure long-term access to vast renewable energy resources including wind, solar, and hydro. In general, the end user demands AC power for a variety of purposes, however transferring AC over long distances results in transmission losses of roughly 10-15%. A HVDC transmission grid can be used to replace this high voltage long span AC transmission, reducing effective line losses to roughly 2%.

CASE STUDIES

3.1 Case Study 1:- Hybrid STATCOM in Rourkela, India

Power grid of India is constructing four STATCOMs for dynamic reactive power compensation in order to improve the voltage profile and dynamic stability of the transmission system in the Eastern Region of India. Each installation has a symmetrical high dynamic reactive power range output and an extra unsymmetrical range based on mechanically switched capacitors and reactors. The first installation was completed in March 2018 at the Rourkela substation [5].

System Structure and Operating Parameters :-

Using MMC technology, the compensating system was developed to offer a dynamic reactive power output of 300 Mvar. In order to obtain a total output of 510 Mvar on the HV side, an improved inductive power output based on manually switched branches was also necessary.

The arrangement used two STATCOM branches, each with a dynamic range of 150 Mvar, as a result of design optimization. In addition, two Mechanical Switched Reactor (MSR) branches were installed in the substation, each with a 105 Mvar output. Power Grid Corporation of India owns the compensation system in this project, while Siemens is the producer of the STATCOM. The compensation system's site installation and tests were

completed, and the STATCOM was officially launched in March 2018. A Modular Multilevel Converter (MMC) is used by the STATCOM [13]. The voltage sourced converter is made up of three identical phase legs that are coupled in a delta configuration. STATCOM phase legs are made up of 36 submodules that are connected in series. Four IGBTs, four diodes, and one dc capacitor are the major components of each submodule. To fit inside the limited available site area, a compact layout of the compensating system was devised, which takes up less than 81m× 88m. A structure was used to house the two STATCOM branches. The facility also houses the necessary valve cooling equipment as well as control and protection cubicles. All other equipment, such as circuit breakers and reactors, was installed outside. Figure 58 depicts an overview of the installation. The two breaker switched reactors are in the front; the two sets of STATCOM reactors are near the building in the top right corner; and the circuit breakers and isolators are to the right of the photo [5][6].



Fig. 1 - Rourkela Sub-station Power grid Ref [5]

The STATCOM in **Rourkela substation** equipment's main technical parameters are as following in below table-

Table 1 – Main technical parameters Ref [5][6]

	Parameter	Value
Main ratings	1. Voltage (KV)	36
	2. Connection Type	Delta
	3. Capacity (Mvar)	$2 \times \pm 150$
STATCOM transformer	1. Ratio (KV)	400/36
	2. Connection Type	YNd5
	3. Capacity (MVA)	511
Semiconductor devices	1. Voltage/current (V/A)	4500/1400
	2. Type	IGBT
Overload capability (current/time)		1600/2 s
Full load STATCOM valve losses (%)		<1%
Redundancy (%)		5
Estimated service life (year)		40
Cooling method		Water-cooled

3.2 Case Study 2:-Raigarh - Pugalur UHVDC Link

From Raigarh (Chhattisgarh) to Pugalur (Tamil Nadu), a 1,830 km long 6GW ultra-high voltage direct current

(UHVDC) transmission link is being built. The 800 kilovolt (kV) transmission link can supply electricity to over 80 million people. It runs from Raigarh in Central India to Pugalur in Tamil Nadu's southern state. Depending on demand, reliable electricity can now be transported in either direction with extremely low power losses and a small environmental footprint.



Fig. 2 - Converter valves of link Ref [5] Power grid

The converter valves and heart of the Raigarh-Pugalur UHVDC transmission link ± 800 kV, 6,000 MW, enable the conversion of AC power to DC power for efficient long-distance power transmission and then back to AC power for reliable AC-grid integration.

The link can transport 6000 megawatts of electricity, the equivalent of six big power plants, which is a 50% increase in transmission capacity over the existing 800 kV UHVDC cables. This also helps to increase the transmission distance from 800 km to over 1830 km, which is important for integrating remote renewables on a big scale, sending power over longer distances, and facilitating a more integrated grid. Initially number of poles used in this link is 2 and main reason for choosing HVDC is for long distance and bulk power transfer and its application is to connect remote generation.

The link helps the government's mission as well as the UN Sustainable Development Goal of ensuring that everyone has access to affordable, dependable, sustainable, and contemporary energy. By integrating traditional and renewable power generation, the link enhances grid resilience and stabilises the power infrastructure. It supports the government's aim of 450 gigawatts (GW) of renewable energy by 2030 by allowing for further development and integration of sustainable energy. When compared to a standard AC link, HVDC saves the environment by occupying just around one-third of the area.

Following the multi-terminal Northeast Agra link, Raigarh-Pugalur is the company's sixth HVDC project in India and the second UHVDC installation [5][6].

The 1,500 MW pole-I is the first leg of the 6,000 MW Raigarh – Pugalur HVDC Project, which will transport bulk power generated by Independent Power Producers (IPPs) in the state of Chhattisgarh utilising state-of-the-art HVDC technology between the Western and Southern regions. The majority of this project's implementation is well underway, and it will be phased in over the course of FY 2020-21 [5].

Using its professional skills and project management capabilities, Power grid finished this massive system despite many hurdles and lockdown constraints – encountered during the COVID19 epidemic.

Table 2 - Active/Reactive Power Balance Ref [6] [9]

Tie-Line Flow	Q	-1704.2	-1336
	P	-7842.6	-7143.2
Losses	Q	23841.7	23486.2
	P	2096	2024.6
Line Absorption (Inductive)	Q	13565.6	0
Line Charging Capacitive)	Q	45029	53378.8
Shunt capacitor (-cap/+ind.)	Q	1390	-10048.7
Load	Q	16269.6	18152.2
	P	52702.6	58398.5
Generation	Q	8333.8	-1978.5
	P	46958.2	53280
Year		2016-17	2017-18

CONCLUSION

In India, the country's principal transmission utility, Power Grid Corporation of India Limited, has commissioned SVCs at three locations in the northern region and STATCOMs at one location in the southern region (Power grid). STATCOMs are planned in 13 places in the northern, eastern, western, and southern regions. The entire investment in compensation devices throughout the Thirteenth Plan period is anticipated to be about Rs 28 billion, according to the Central Electricity Authority [5][6].

Net reactive power compensation is crucial for transmission network strengthening and is the most cost-effective way to increase power transfer capabilities while staying within power quality limits. Reactive power compensating devices, such as FACTs, will continue to play a significant role in stabilizing voltage, boosting power flow capacity, minimising blackouts, and decreasing losses as the country moves toward the integration of enormous amounts of renewable energy over long distances [1][3].

Hybrid STATCOM solutions with mechanically switched capacitors and reactors controlled by the STATCOM controller have been studied for optimising dynamic compensation. Under steady state, the STATCOM would largely be used for dynamic compensation, while the mechanically switched reactors / capacitors would be used for reactive compensation. As a result, instead of the previously allowed + 400 MVAR dynamic compensation in the form of SVC, a variable component of +200 MVAR to

+300 MVAR has been explored, with reactive compensation provided by Mechanically Switched Reactors & Capacitors.

Table 3 - At the following substations, STATCOMs have been proposed to meet the dynamic reactive compensation requirements Ref [5] Power grid

Sl. No.	Location	Dynamic Compensation (STATCOM)	Mechanically Switched Compensation (MVAR)	
			Capacitor	Reactor
Eastern Region				
1.	Jeypore	± 200 MVAR	2×125	2×125
2.	Kishanganj	± 200 MVAR	-	2×125
3.	Rourkela	± 300 MVAR	-	2×125
4.	Ranchi (New)	± 300 MVAR	-	2×125
Western Region				
1.	Aurangabad	± 300 MVAR	1×125	2×125
2.	Gwalior	± 200 MVAR	1×125	2×125
3.	Solapur	± 300 MVAR	1×125	2×125
4.	Satna	± 300 MVAR	1×125	2×125
Northern Region				
1.	New Lucknow	± 300 MVAR	1×125	2×125
2.	Nalagarh	± 200 MVAR	2×125	2×125
Southern Region				
1.	Trichy	± 200 MVAR	1×125	2×125
2.	Hyderabad	± 200 MVAR	1×125	2×125
3.	Udumalpet	± 200 MVAR	1×125	2×125

REFERENCES

- [1] Tariq, Maria, Hina Zaheer, and Tahir Mahmood. "Modeling and Analysis of STATCOM for Renewable Energy Farm to Improve Power Quality and Reactive Power Compensation." *Engineering Proceedings* 12, no. 1 (2021): 44.
- [2] Saberian, A., Farzan, P., Nejad, M. F., Hizam, H., Gomes, C., Radzi, M. A. M., & Ab Kadir, M. Z. A. (2013, June). Role of FACTS devices in improving penetration of renewable energy. In *2013 IEEE 7th International Power Engineering and Optimization Conference (PEOCO)* (pp. 432-437). IEEE.
- [3] Baby, H., & Jayakumar, J. (2019). A probe into reactive power management in renewable energy system using FACTS devices. *Int. J. Innov. Technol. Explor. Eng.*, 8, 619-626.
- [4] Haeusler, M., & Biswas, S. (2017). HVDC Solutions for Integration of the Renewable Energy Resources. *Siemens*.
- [5] <https://www.powergrid.in/>
- [6] <https://cea.nic.in/>
- [7] Wang, Y., Zhou, Y., Li, D., Shao, D., Cao, K., Zhou, K., & Cai, D. (2020). The Influence of VSC-HVDC Reactive Power Control Mode on AC Power System Stability. *Energies*, 13(7), 1677.
- [8] Ludin, G. A., Nakadomari, A., Yona, A., Mikkili, S., Rangarajan, S. S., Collins, E. R., & Senjyu, T. (2022). Technical and Economic Analysis of an HVDC Transmission System for Renewable Energy Connection in Afghanistan. *Sustainability*, 14(3), 1468.
- [9] Singh, M., Vardhan, T. V., Pradhan, J., & Meera, K. S. (2017, December). Reactive power management in transmission networks. In *2017 7th International Conference on Power Systems (ICPS)* (pp. 568-572). IEEE
- [10] Adetokun, B. B., & Muriithi, C. M. (2021). Application and control of flexible alternating current transmission system devices for voltage stability enhancement of renewable-integrated power grid: A comprehensive review. *Heliyon*, 7(3), e06461.
- [11] <https://www.irena.org/>
- [12] Sadiq, R., Wang, Z., Chung, C. Y., Zhou, C., & Wang, C. (2021). A review of STATCOM control for stability enhancement of power systems with wind/PV penetration: Existing research and future scope. *International Transactions on Electrical Energy Systems*, 31(11), e13079.
- [13] Arunprasanth, S., Annakkage, U. D., Karawita, C., & Kuffel, R. (2017). Impact of VSC HVDC on AC system generation.

An Efficient Security Framework Using ABC in Cloud Computing

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Abstract:

Security is the top subject for the people of IT in the past. In the previous couple of years, cloud computing is a model which is enabled for on-call for and suitable systems to get the right of entry to the computing sources. In the Field of Cloud Computing, one of the possible approaches to perform safety is to utilize intrusion recognition frameworks, which might be programming devices used to distinguish unusual sports in the organization. Intrusion Detection System (IDS) has turned out to be a critical part of private computer systems and data safety gadgets. IDS normally control numerous statistics traffic and this record may also include repetitive as well as insignificant highlights. This article proposes a novel approach towards Intrusion Detection System and creates the latest fitness function for Artificial Bee Colony Algorithms. The proposed approach has been trained with KDD Cup 99 dataset.

Keywords:

Intrusion Detection System (IDS), Quality of Service (QoS), Service Level Agreement (SLA), Support Vector Machine (SVM), Artificial Bee Colony Algorithm (ABC), Ant Colony Optimization (ACO), Software as a Service (SaaS), Platform as a Service (PaaS) and Infrastructure as a Service (IaaS)

INTRODUCTION

Cloud computing is a technology this is based totally on virtualization. Virtualization way to create a non-real version of the resource, consisting of the garage, network, server, or a working machine where the useful resource is divided into one or extra execution environments. Cloud gives offerings to the user using pay as you pass model thru the internet. There are three provider models of cloud- Infrastructure as a Service (IAAS), Platform as a Service (PAAS), Software program as a provider (SAAS) and 4 deployment fashions- personal cloud, public cloud, network cloud, hybrid cloud. [1][2]

Cloud Computing assumes a prime function in the world of internet that reduces the entire user's load in terms of storage and renovation of the records. User stores and retrieves their facts from cloud in view of access consent. A large number of customers store their records in the cloud with by confiding in the framework. Cloud vendors inclusive of Google Cloud, Amazon offer safety regarding user's records to an extremely good quantity. However, there may be an absence in considering with the aid of the user due to the facts loss and information robbery frequently happens in the cloud. Decryption and Encryption of information perform a primary part within the protection of information. [6]

Cloud computing exceptionally normal innovation today and the requests of cloud computing administrations are expanding day by day and in this way datacenter the executives. This development innovation greatly affects climate. Cloud computing is a cutting edge innovation for managing the enormous scope information. Cloud computing is a modern-day generation for dealing with massive-scale facts. In terms of information, infrastructure, and virtualization, security is one of the essential worries in the Clouds models. The Artificial Bee Colony (ABC) is an individual from the group of multitude of Swarm Intelligence based Algorithm. It rebuilds the honey bee course to the last course and has been shown to be compelling for streamlining.[3]

RELATED WORK

Maryam Saman Azariet et al [4] proposed a new technique for service composition with the help of Cuckoo Optimization and Artificial Bee Colony Algorithm. The proposed approach tried to locate an optimal provider Composition that has desirable good fitness and has low reaction time. The simulation outcomes of the proposed technique are showed the effective combination with excessive performance and dynamic cloud surroundings and appropriate objective function are a major attention.

Gagandeep K. & Manoj A. [5] presented artificial bee colony based workflow scheduling approach. In this approach, Live migration is likewise achieved to balance the load between to be had digital machines. Extensive experiments have been completed through considering the proposed techniques. Experimental results screen that proposed method outperforms others in phrases of makespan, execution cost, performance, utilization, electricity intake, and speedup.

Dinesh P. & Sumit M. [2] introduced a review of some existing Cloud Security Models. This article additionally presented the accuracy of SVM and Naïve Bayes utilizing the KDD Cup 99 dataset. This paper discussed the parameters like Privacy, Integrity and Confidentiality. After the trivial work it is proved that Naïve Bayes performed better than SVM.

Samriya, J. K., & Kumar, N. [7] proposed an algorithm in which the mainly conspicuous, work planning is to guarantee Quality of service (QoS) to the client. In the limit of the outsider the planning happens consequently it is a huge state for guaranteeing its safety. Cloud computing (CC) framework offers inescapable computational idea models with enormous versatile and

flexible services. Processing assets in the cloud climate should be planned to work with the suppliers to use the assets besides the clients could get minimal expense application. The primary goal of this proposed work is to provide QoS for example price, makespan, limited relocation of assignment with security implementation additionally the recommended algorithm ensures that the approved demands are implemented without abusing Service Level Agreement (SLA). These goals are achieved using Fuzzy Ant Bee Colony Algorithm. The investigational result affirms that got work booking purpose with guaranteed QoS is achieved by the planned algorithm. In this proposed algorithm given the intension of QoS mindful planning with safety efforts in the cloud space.

Liang Xu et al [8] proposed scheduling model for the mixture stream shop issue having discrete matching machines. Three streamlining targets as well as the makespan, absolute weighted earliness/lateness time and complete holding up period were assessed in this model. A multi-objective ABC algorithm in view of Pareto improvement was planned. To adjust to answer for the discrete booking issue of half breed stream shop, the wellness an incentive for arrangements by non-dominated arranging is applied in the better algorithm. The variety of the populace examine is expanded by adding variables of versatile inquiry to work on the way of area search in ABC algorithm. Meanwhile, in the pursuit interaction of the whole populace, the local indexed lists are saved into outside documents and rebuilt with the first populace for refreshing, to ensure that more magnificent people are saved. At long last, Run information exhibit that the proposed algorithm in this approach can rapidly discover the most ideal arrangements, is successful in accomplishing multi-objective improvement.

Singh A. et al. [9] planned an enhancement algorithm alluded as ABC is utilized to pick the utilized to choice the upgraded esteem from extricated set of highlights. It is likewise used to catch the ideal arrangements of elements from non-spam and spam information. Toward the completion, execution measure basis and contrasting the current and recommended work to investigate the advancement of the recommended work. In this article, spam recognition framework is taking higher exactness, accuracy, review, and F-measure as thinks about to classifiers utilized already, for example, Naïve Bayes and SVM. In this examination, we measure upper exactness with the advantage of recommended algorithm to figure out non-spam and spam information. The issue of Spam Finding is addressed by utilizing classifiers since and accomplished outcomes is improved however consistently, Spammer will think of fresh strategies of transferring Spam messages.

Luocheng Shen et al [10] proposed an approach, the enhancement issue of ABC in light of load balance algorithm to develop the overall load balance execution and make better flexible. The smooth network cloud basis attributes to group virtual machine (VM) is utilized

and the ABC algorithm is enhanced. Reproduction examination approves the adequacy of the proposed technique. In this approach, ABC advancement load balancing algorithm in light of assets request grouping is introduced. Pretending investigations of the algorithm have been directed. The outcomes show that, the algorithm is appropriate for smooth network Cloud registering climate to diminish makespan, reaction time and assets profitability.

Ragmani, Awatif et al [11], proposed an energy proficiency answer for Cloud registering by relating a quick and brilliant algorithm. First and foremost, this article gives an assessment of the energy proficiency inside the Cloud climate over the Taguchi experience proposal. Besides, the approach presents a honey bee state booking algorithm which means to streamline the energy effectiveness whereas ensuring an ideal reaction time. The approval outcomes obtained from the Green Cloud test system underscore the adequacy of the proposed booking algorithm strategy. In synopsis, this training empowered the author to assess the development of energy effectiveness inside the cloud climate and the meaning of a virtual machine planning algorithm to give a superior nature of administration on account of a superior handling time. Also, a few perception and ends are as yet not took advantage of.

Marwah Hashim Eawna et al, [12] proposed a unique assets provisioning algorithm by utilizing ABC and ACO and center around time advancement in multi-level clouds. Likewise, the got effects display that the ACO quicker than other meta-heuristic calculation like ABC, Particle Swarm Optimization (PSO), Simulated Annealing (SA) and hybrid Particle Swarm Optimization-Simulated Annealing (PSO-SA). In this article author introduced an insightful methodology. Author proposed a unique assets provisioning algorithm by utilizing ABC and ACO in multi-level clouds. Author carried out the algorithms on recreated conditions on CloudSim and verified implemented time as for request (expanding number of undertakings), the acquired outcomes display that ACO meets rapidly to ideal provisioning and thus gives assets a less number of cycles than ABC. Author have likewise shown that ACO beats other advancement algorithms, especially Particle Swarm Optimization, Simulated Annealing and the crossover PSO-SA.

Amel Bousrih & Zaki Brahmi [13] proposed a unique methodology towards limiting expense reaction time and energy utilization for composite information concentrated administrations. It involves the ABC to choose and observe the ideal expense and reaction season of an information concentrated assistance. The recently formed information escalated administration will be an extraordinary commitment to multiple information serious administrations research. Author proposed a productive information concentrated web service composition methodology in light of ABC algorithm. Author's answer depends on two primary stages: i) the pre-composition stage which includes two stages: the

initial step is about an informational indexes' development methodology to diminish the informational collections exchange recurrence; and the subsequent advance will be a cloud examples' arrangement of each web administrations in light of their feedback and results. ii) the other stage is the arrangement and choice stage utilizing the counterfeit artificial bee colony. This methodology is portrayed by precision and responds to dynamicity of web administration and its information reproductions. This methodology is versatile while keeping the imperative of minimization the QoS.

Elaheh Hallaj & Seyyed Reza Kamel Tabbakh [14], examined some planning algorithms in light of ABC. These algorithms exploit the cleverness of honey bees' conduct to arrive at an ideal task of assignments to assets. A logical examination has likewise been done to momentarily display the attributes and uses of bee colony strategy for planning in circulated figuring region. This approach explored some of honey bee settlement based planning investigates in the field of circulated task planning for terms of assessment technique, significant goal, issue size and algorithms' system. The insightful outcomes display that the assessment strategy is reproduction in 90% of the talked about mechanisms; significant goal is the make span in 45% of the mechanisms; issue size is below 100 VMs in 33% and below 500 assignments in 41% of the mechanisms and the algorithms' procedure is the essential ABC method or its adjusted forms for certain progressions in unique strides, in 70% of the mechanisms.

Rimpy S. & Shivani S. [15] proposed a two new methodologies for example artificial bee colony is a multitude based advancement procedure for energy productive steering calculation and the compressive detecting is additionally used to expand the energy rate or execution. The proposed procedure has presented very huge improvement over accessible ones. This methodology has been proposed for upgrading the execution of the WSNs by using the get-together based data complete and with progress systems. This approach proposed two fresh methods for example fabricated bumble bee settlement appearance based smoothing out system for imperativeness viable guiding estimation and the usage of the compressive identifying moreover increase the execution. The planned methodology is formed and implemented in the MATLAB 2013a by using far off correspondence and data assessment instrument stash. Various appraisal of boundaries has been considered for preliminary purposes for example no of gatherings molded, organize life time and estimation time.

PROPOSED METHOD

In this part, we have implemented an IDS that utilizes streamlining algorithm, i.e., Artificial Bee Colony Algorithm. The proposed estimation exhibits remarkable efficiency in work enlargement and development plan issues. Later investigation exhibits that Artificial Bee Colony Algorithm -based improvement strategies are

very convincing and useful interestingly, with the innate computation and large number techniques like PSO. Most importantly, we have chosen includes arbitrarily and handled them. After that we have utilized advancement process by utilizing ABC Algorithm.

In this proposed IDS, we have designated 3 Features set from the KDD 99 Dataset, the Feature no. 35 (dst_host_diff_srv_rate), 36 (dst_host_same_src_port_rate) and 37 (dst_host_srv_diff_host_rate). In the ABC Algorithm we have planned our new fitness function for optimal value. In Figure 1, we have accomplished optimization using ABC.

We have utilized new fitness function. The full stages for optimization discussed below in figure 1.

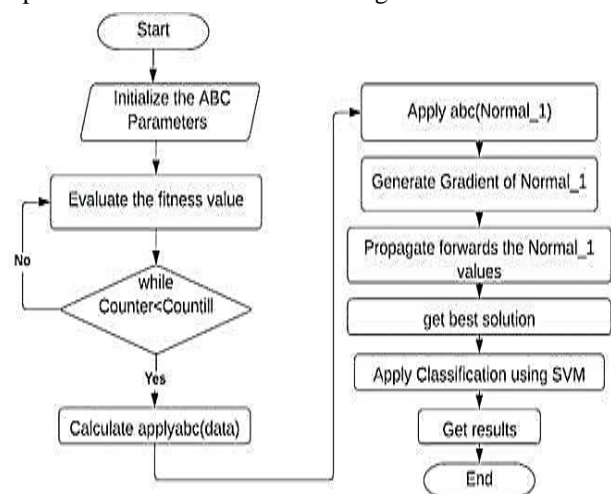


Fig. 1. Optimization Using ABC Algorithm

RESULTS AND DISCUSSIONS

In the planned approach, we have used SVM for classification resolution and a detailed examination for the same is prepared as first of all we split the dataset in to two forms training and test dataset. After that we train the planned approach by consuming the training dataset and later the planning, calculate the reactions or the test dataset. Discover the accuracy, precision and recall parameters of the planned approach and designed the support vectors.

As we take 12 records from 0 to 11 rows and design a graph (Figure 2) later training the values as X- axis (Total Record Count) and Y- axis (Dst Host Error). The red line displays the DOS based values and green line displays the DOS based values in figure 2.

In the wake of Training and testing the qualities we have determined the exactness of our proposed IDS by utilizing three boundaries: Accuracy, Precision and Recall as in Table 1.

We have prepared 36 preliminaries in our proposed IDS. From these preliminaries, we have noticed upsides of Accuracy (87.5 %), Precision (1.0), and Recall (0.5), these are awesome or rehashed upsides of our observational work.

From the fundamentals drove for the proposed IDS close by SVM and Naïve Bayes, it is seen that the proposed IDS (ABC) performed better as differentiation with the SVM and Naïve Bayes IDS concerning Accuracy, Precision and Recall regard as shown in Table 2.

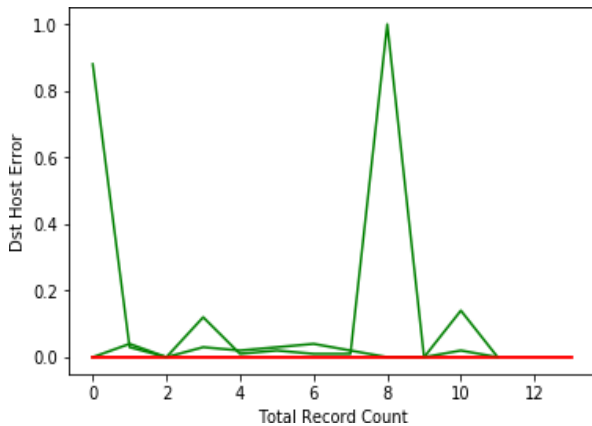


Table 1. Accuracy, Precision and Recall

Fig. 2 – Total Record Count (x-axis) and Dst Host Error (y-axis)

	Proposed IDS (ABC)		
	Accuracy	Precision	Recall
Run 1	75.0	0.5	0.5
Run 2	87.5	1.0	0.5
Run 3	87.5	0.66	1.0
Run 4	62.5	0.3	0.5
Run 5	87.0	1.0	0.5
Run 6	75.0	0.5	0.5
Run 7	75.0	0.5	0.5
Run 8	87.5	1.0	0.5
Run 9	75.0	0.5	0.5
Run 10	50.0	0.2	0.5
Run 11	87.5	1.0	0.5
Run 12	62.0	0.4	1.0
Run 13	50.0	0.2	0.5
Run 14	87.0	0.6	1.0
Run 15	75.0	0.5	0.5
Run 16	75.0	0.5	0.5
Run 17	87.0	0.6	1.0
Run 18	75.0	0.5	0.5
Run 19	62.0	0.3	0.5
Run 20	50.0	0.3	1.0
Run 21	87.5	1.0	0.5
Run 22	62.4	0.4	1.0
Run 23	75.0	0.5	1.0
Run 24	87.5	0.6	1.0
Run 25	75.0	0.5	0.5
Run 26	87.5	1.0	0.5
Run 27	50.0	0.2	0.5
Run 28	87.5	0.5	1.0
Run 29	87.5	1.0	0.5

Run 30	87.5	1.0	0.5
Run 31	75.0	0.5	1.0
Run 32	75.0	0.5	0.5
Run 33	87.5	1.0	0.5
Run 34	87.5	0.6	1.0
Run 35	62.5	0.4	1.0
Run 36	75.0	0.5	0.5

Table 2. Comparison of SVM, Naïve & Proposed Ids

	SVM			Naïve Bayes			Proposed IDS		
	Accuracy	Precision	Recall	Accuracy	Precision	Recall	Accuracy	Precision	Recall
Run 1	62.40	0.4	0.7	64.30	0.5	1	87.4	1.0	0.5
Run 2	61.91	0.3	0.5	63.19	0.4	0.4	87.0	0.6	1.0
Run 3	60.11	0.4	0.4	60.23	0.4	0.5	75.0	0.5	0.5
Run 4	57.80	0.5	0.6	62.06	0.3	0.6	62.4	0.4	1.0
Run 5	54.20	0.3	0.6	56.09	0.6	0.4	50.0	0.2	0.5
Run 6	55.12	0.4	0.5	58.39	0.5	0.4	75.0	0.5	0.5
Run 7	57.38	0.5	0.4	56.18	0.4	0.7	62.0	0.3	0.5

The appearance of the proposed IDS interestingly, with SVM and Naïve Bayes IDS is shown in Figure 3. It is seen that proposed IDS has Accuracy regarded as 87.5%, Precision regard anyway 1.0 and Recall regard 1.0 which is by all accounts better interestingly, with both the models.

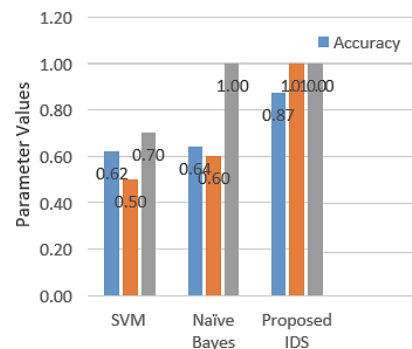


Figure 3. Comparison of SVM, Naïve Bayes and Proposed IDS for 3 Parameters

CONCLUSION AND FUTURE SCOPE

In this empirical work, we have arranged a protected framework for the cloud computing environment. We have similarly achieved an upgrade using ABC Algorithm. The limits like accuracy, precision & recall have been involved in the idea for the ABC improvement strategy. From the groundwork drove for the proposed IDS nearby SVM and Naïve Bayes, it is seen that the proposed IDS performed better alternately, with the SVM and Naïve Bayes IDS concerning Accuracy, Precision, and Recall limits. We have driven around 7 primers for ABC. By seeing these primers, to the extent that Accuracy, Precision, and Recall we have achieved 87.5% (max.) - Accuracy, 1.0 (max.) - Precision, and 1.0 (max.) -

Recall limits. Our next aim is to research on storage optimization in cloud computing.

REFERENCES

- [1] Garg, Saurabh Kumar, and RajkumarBuyya. "Green cloud computing and environmental sustainability." *Harnessing Green IT: Principles and Practices* (2012): 315-340.
- [2] Parkash, D. and Mittal, S., 2020. Comparative Study and Performance Analysis Of Various Data Security And Cloud Storage Models. *Solid State Technology*, pp.6318-6331.
- [3] Kimpan, Warangkhan; Kruekaew, Boonhatai (2016).Joint 8th International Conference on Soft Computing and Intelligent Systems (SCIS) and 17th International Symposium on Advanced Intelligent Systems (ISIS) –“Heuristic Task Scheduling with Artificial Bee Colony Algorithm for Virtual Machines.”, 281–286.
- [4] Azari, Maryam Saman; Bouyer, AsgarAli; Zadeh, NaserFaraj (2015). [IEEE 2015 2nd International Conference on Knowledge-Based Engineering and Innovation (KBEI) - Tehran, Iran] 2nd International Conference on Knowledge-Based Engineering and Innovation (KBEI) –“Service composition with knowledge of quality in the cloud environment using the cuckoo optimization and artificial bee colony algorithms.”, 539–545.
- [5] Kaur, Gagandeep; Agnihotri, Manoj (2017). [IEEE 2017 International Conference on Intelligent Sustainable Systems (ICISS) - Palladam, India] International Conference on Intelligent Sustainable Systems (ICISS) – “Artificial bee colony based live migration technique for cloud data centers.”, 560–567.
- [6] Shree, S. Raja; ChilambuChelvan, A.; Rajesh, M. (2020). [IEEE 2020 International Conference on Computer Communication and Informatics (ICCCI) - Coimbatore, India (2020.1.22-2020.1.24)] 2020 International Conference on Computer Communication and Informatics (ICCCI) - Optimization of Secret Key using cuckoo Search Algorithm for ensuring data integrity in TPA. , (), 1–5.
- [7] Samriya, J. K., & Kumar, N. (2020). Fuzzy Ant Bee Colony For Security And Resource Optimization In Cloud Computing. 2020 5th International Conference on Computing, Communication and Security (ICCCS).
- [8] Liang Xu, ; Ji Yeming, ; Huang Ming, (2016). [IEEE 2016 2nd International Conference on Cloud Computing and Internet of Things (CCIoT) - Dalian, China (2016.10.22-2016.10.23)] 2016 2nd International Conference on Cloud Computing and Internet of Things (CCIoT) - Solving hybrid flow-shop scheduling based on improved multi-objective artificial bee colony algorithm. , (), 43–47.
- [9] Singh, A., Chahal, N., Singh, S., & Gupta, S. K. (2021). Spam Detection using ANN and ABC Algorithm. 2021 11th International Conference on Cloud Computing, Data Science & Engineering (Confluence).
- [10] Shen, Luocheng; Li, Jiazhou; Wu, Yan; Tang, Zhenyu; Wang, Yi (2019). [IEEE 2019 IEEE Innovative Smart Grid Technologies - Asia (ISGT Asia) - Chengdu, China (2019.5.21-2019.5.24)] 2019 IEEE Innovative Smart Grid Technologies - Asia (ISGT Asia) - Optimization of Artificial Bee Colony Algorithm Based Load Balancing in Smart Grid Cloud. , (), 1131–1134.
- [11] Ragmani, Awatif; Omri, Amina El; Abghour, Noredine; Moussaid, Khalid; Rida, Mohammed (2017). [IEEE 2017 3rd International Conference of Cloud Computing Technologies and Applications (CloudTech) - Rabat, Morocco (2017.10.24-2017.10.26)] 2017 3rd International Conference of Cloud Computing Technologies and Applications (CloudTech) - An intelligent scheduling algorithm for energy efficiency in cloud environment based on artificial bee colony., (), 1–8.
- [12] Eawna, MarwahHashim; Hamdy, Salma; El-Horbaty, El-Sayed M. (2015). [IEEE 2015 IEEE Seventh International Conference on Intelligent Computing and Information Systems (ICICIS) - Cairo, Abbassia, Egypt (2015.12.12-2015.12.14)] 2015 IEEE Seventh International Conference on Intelligent Computing and Information Systems (ICICIS) - New trends of resource provisioning in multi-tier Cloud computing. , (), 224–230.
- [13] Bousrih, Amel; Brahmi, Zaki (2015). [IEEE 2015 5th International Conference on Information & Communication Technology and Accessibility (ICTA) - Marrakech (2015.12.21-2015.12.23)] 2015 5th International Conference on Information & Communication Technology and Accessibility (ICTA) - Optimizing cost and response time for data intensive services' composition based on ABC algorithm. , (), 1–6.
- [14] Hallaj, Elaheh; Tabbakh, Seyyed Reza Kamel (2015). [IEEE 2015 International Congress on Technology, Communication and Knowledge (ICTCK) - Mashhad, Iran (2015.11.11-2015.11.12)] 2015 International Congress on Technology, Communication and Knowledge (ICTCK) - Study and analysis of task scheduling algorithms in clouds based on artificial bee colony. , (), 38–45.
- [15] Sharma, Rimpay; Sharma, Shivani (2017). [IEEE 2017 7th International Conference on Cloud Computing, Data Science & Engineering - Confluence (Confluence) - Noida, India (2017.1.12- 2017.1.13)] 2017 7th International Conference on Cloud Computing, Data Science & Engineering - Confluence - Evaluating the performance of density grid-based clustering using ABC technique for efficient routing in WSNs. , (), 450–455.

Development of Virtual Reality Based Experimentation of Digital Electronics Laboratory

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Abstract:

The interest to develop and implement a virtual reality-based laboratory setup arose during the Covid pandemic period when there was difficulty in conveying laboratory education to students. There is also a major transition from traditional learning to online/remote or web-based virtual labs for in-depth learning of the concepts. Students thrive for a more interactive learning and have begun accessing online laboratory platforms.

In this context, a novel methodology using Virtual Reality is deployed for the conduction of Digital Electronics laboratory experiments virtually for experiments like OR Gate, Ex-OR Gate, Ex-NOR Gate, and Half-Adder. Students can implement the theoretical knowledge via experimentation in detail and hold on to the basics with the Virtual reality advancements. The report has detailed the implementation methodology of Virtual reality labs using the Unity3D software for the Engineering Undergraduate program, on a platform developed to carry out experiments in the Digital Electronics laboratory.

This project work has come up with a prototype hardware setup of a 3D VR lab environment interfaced with unity 3D software using a wifi module called Node MCU, where the experiments conducted virtually on desktop or mobile phones gave respective outputs in VR and hardware setup developed. This 3D VR lab setup can be used effectively by wearing 3D VR headsets which are affordable and the experiments can be controlled by a controller and mouse for mobile access. For VR Lab access on a desktop, a keyboard and a mouse are used.

Keywords:

Blynk IoT, Digital Electronics laboratory, Node MCU, Unity3D

INTRODUCTION

The importance of outcome-based learning is most focused in the coming days of education system where hands-on learning to be given more priority. This has led to the implementation of online laboratories via remote access which provides students an opportunity to explore their college laboratories at their comfort and convenience. The Online education advancement for the outcome-based learning has been the need of the hour with the ongoing pandemic situation. The necessity in imparting the theoretical knowledge to the students by making them Visualize with real time experiments was an important part for a student to master a concept. But the Covid pandemic had created kiosk and students were facing difficulties in gaining knowledge on the subjects thoroughly. The colleges have always strived hard to have the infrastructure well set and maintained for the

student learning and provide access the experimental setups. The Real time experimentation has made the budding engineers more explorative with the knowledge and skill sets they are exposed to with the laboratory facilities at the colleges for all levels of educational and professional learning courses.

This pandemic has created a hindrance for the student's education system especially for the higher end educational and professional courses, which can be resolved when it is concerned to laboratory experimentation by means of remote laboratory setup. The Remote laboratory setup allows the user or student to utilize the concerned laboratories remotely from their location of comfort and time space. This Remote access to laboratories provides opportunity to students in large number to access the experiments at a time without the problems of availability.

The availability of hands-on lab in engineering and science education requires costly equipment and instrumentation that is restricted for little and limited periods of time for a huge number of students. Virtual reality labs are anytime anywhere accessible labs. These labs can be accessed through internet on any PC/Laptop and Smartphone/ Tablet. Virtual labs are developed in self learning mode. Learners can practice in own pace.

Physical laboratories have certain limitations with respect to the equipment availability and so the installation and operational costs are high. This can be resolved with Virtual Reality Laboratory that can limit to one instrument at a time that can be accessed by any number of students in virtual.

The Virtual reality Lab setup for Digital Electronics lab experiments integrate very simple and less- expensive technical aspects with a powerful interface based on firmware and IoT. The Digital electronics circuit laboratory implements experiments like OR gate, Ex-OR gate, Ex-NOR gate and Half-adder. The motivation for the proposed work envisaged is to provide practical activity for the technical education at university level, which overcomes the limitations of traditional labs. The 'VR based Digital electronics' lab setup is developed by knowing the importance of laboratory course and impact on student learning outcomes. In the next section, literature reviews carried out in respect of the domain of research are discussed. By considering important and relevant scientific works reported by the earlier investigators, the advantages and disadvantages of various Remote and virtual laboratories and the methods

of implementation in the different fields of engineering are elaborated.

Some of the related works considered for the development of VR based Digital electronics laboratory is a paper based on importance, comparison, advantages of VR, AR and hands-on Lab. The author also gave a case study about the usage of VR, AR and hands-on lab with each of its merits and demerits. Virtual Reality Labs provide a more effective way of learning as it provides better interaction [1].

Numerous tests on scale elevator for PLC simulation implemented had helped students in gaining programming skill sets of PLC where they designed automation lines using different methods such as Karnaugh maps and graph sets. They have interfaced elevator, PLC with remote user internet and connected HMI(LABVIEW) to a high end PC connected to PLC. PLC is in turn connected to vision system. High end PC had access to web server, data base server and access server [2].

Virtual reality Biology labs for microscopic experiments made a statistical analysis on student's feedback on learning outcomes in order to meet the 6 levels of Bloom's Taxonomy and its advances in future education and scope [3].

A web based measurement laboratory for remote instrumentation management and distance training in electric measurement course using FER web based management. This FER web based laboratory used a central (master)server (MS) and several decentralized experiment control servers(ECS) to coordinate different users on network and connect them to the appropriate measurement hardware [4].

A Remote analog electronic lab uses solution to control the hardware of remote laboratory based on three level architecture. In the first level servers were placed with labview. In the second level provided communication interface which uses LX1 to link with equipment and experiment server. The third level contains the components or prebuilt circuit to carry out experiments [5].

PIC laboratory is used on a smart phone with android access by a mobile graphical interface to learn STL and ladder programming language via wifi, GSM and GPRS. For future remote education they have used computer graphical interface which uses java language on computer and a Labview interface that is designed and applies commands from middle computer to PLC and results are obtained[6].

An enhanced remote control of real models using PLC foxtrot that is a hardware model replacing software controller; PLC Tecomart Foxtrot is a PLC equipment that has 6 multipurpose inputs, 2 analog outputs and outputs of 6 relays. This PLC is programmed using software mosaic which is used to select type of controller, set the values and do tasks to design PID controller [7].

A project for UG students called LILA (Library of labs) which provides access to experiments. The integration of

virtual labs and remote experiments were the highlights of the work [8].

The 3D modelled lab environment setup for Digital circuit and a learning management system used unity 3D software and rhino platform for development of lab [9].

These works were considered for developing a Virtual Reality based Digital electronic lab setup in a more simplified manner than the above highlighted work, with the usage of a wifi module Node MCU a Dev Kit/board consisting of ESP8266 wifi enabled chip. The Node MCU ESP8266 Integrates a Wi-Fi transceiver. It can connect to a WiFi network and interact with the Internet and set up a network of its own in order to allow other devices to connect directly to it. Blynk IoT is used in the developed project to connect electronic devices to the Internet and remotely monitor and control devices such as Node MCU.

The prototype model developed has one another advancement that is the 3D effect and virtual view with virtual devices. The use of Unity 3D software has the features to develop a 3D Virtual environment similar to developing a gaming setup which is an added advantage and this VR lab setup developed provides user an opportunity to conduct experiments by moving in a VR space, conduct experiments and verify results which also reflects in the hardware module developed.

METHODOLOGY

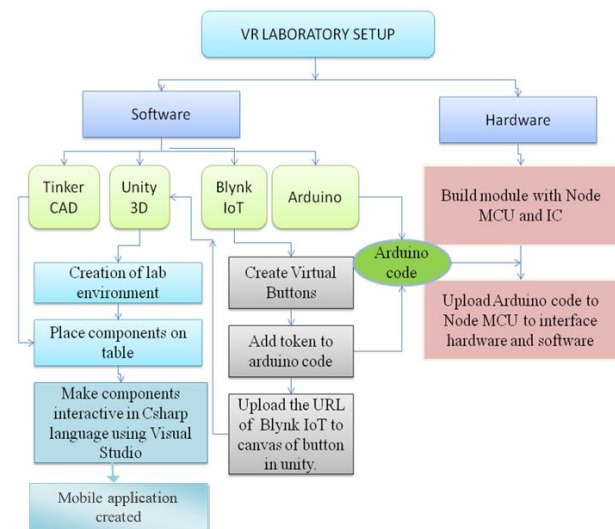


Fig 2.1: Stages of creating the VR digital electronics lab training module

In this project Unity 3D is used to create lab environment and the 3D components obtained from Tinker CAD was placed on the experiment table. These components were made interactive by programming with CSharp using the Visual Studio software for button control and LED glow. Blynk IoT was used to create virtual button and authentication token for wifi module. This wifi module (Node MCU) works on a particular wifi network which is connected with Blynk application. The URL obtained on creation of device on Blynk application was added to

canvas of button in Unity 3D. The authentication token from Blynk is added in the Csharp script written for hardware interface and finally the code in the Arduino IDE is uploaded to the Node MCU to interface hardware and software. The hardware setup is built for OR, Ex-OR, Ex-NOR and Half Adder ICs with the wifi module.

Fig 2.2 is the Experimental lab setup designed in Unity 3D. This experimental lab has access to 4 Digital electronics lab experiments such as OR gate, XOR gate, Ex-NOR gate and Half-adder. Each experiment is placed in one room. The digital circuit, procedure and conduction steps are displayed on the screen.

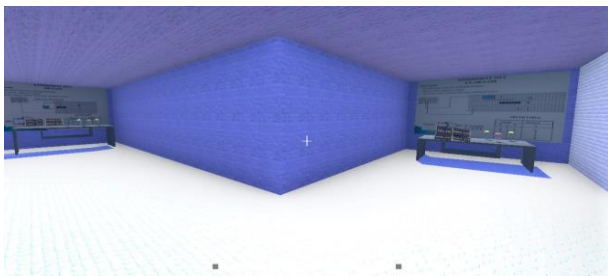


Fig 2.2: Experimental lab environment

The interactive buttons and LEDs which triggers binary inputs and their outputs respectively are placed on the table as shown in Fig 2.3. These components are obtained from Tinker CAD.

The interactive buttons and LEDs are programmed in Csharp using Visual studio software of Unity 3D. Canvas is uploaded with this programmed script that glows LEDs for the corresponding button pressed. Their corresponding output is reflected in the hardware setup with the inclusion of a URL obtained from an application called Blynk IoT that is used to interface the software with the hardware module.

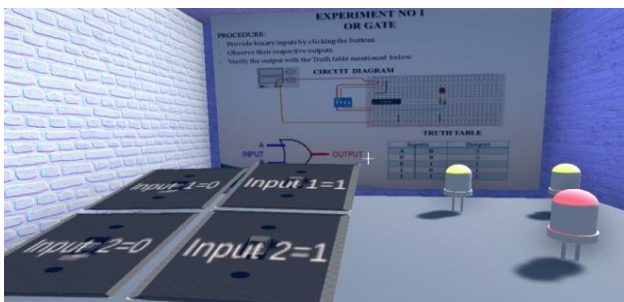


Fig 2.3: 3D Digital Electronics lab experimental setup

The mobile application for VR Digital Electronics lab is developed and debugged into the mobile phone which opens as an APK file.

The authentication token using which the Node MCU gets connected to network is "TMPL04y7DpSt" with the device name "o".

From fig 2.4 shows the platform used to build virtual buttons. These virtual buttons which gets triggered in Blynk IoT platform when input buttons are pressed either by touch on mobile phone, mouse click on laptop and

using controllers and mouse in mobile phone. fig 2.4 is the Blynk IoT dashboard that shows whether the device is online and connected and all the data related to the button inputs can be checked and analyzed. This platform can be accessed on mobile and check device information and status.

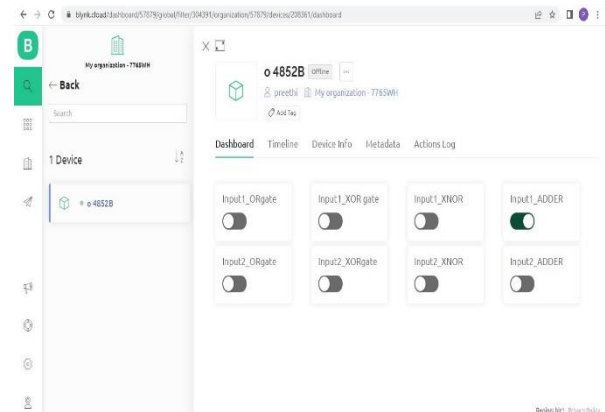


Fig 2.4 Blynk IoT Dashboard

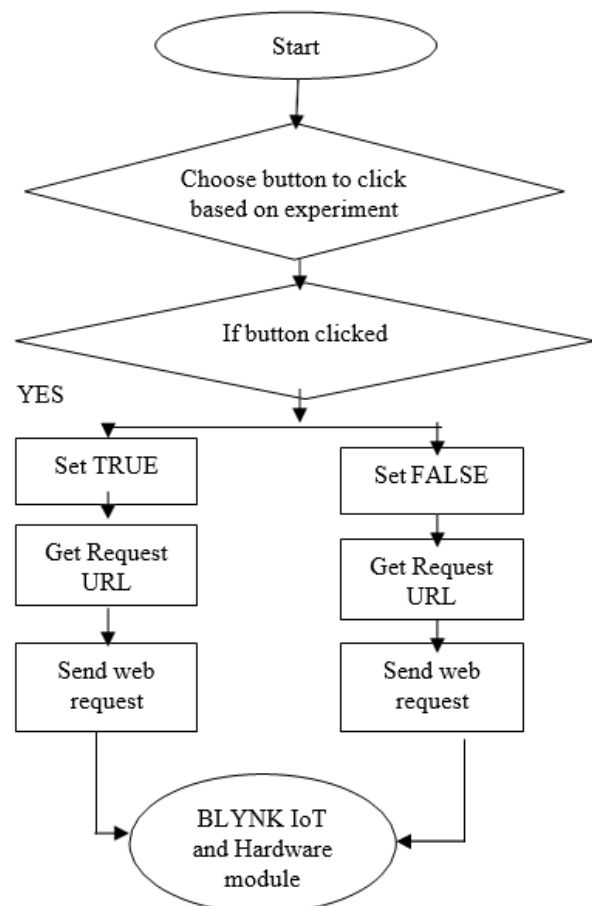


Fig 2.5: Flow Chart of Button Control in Unity

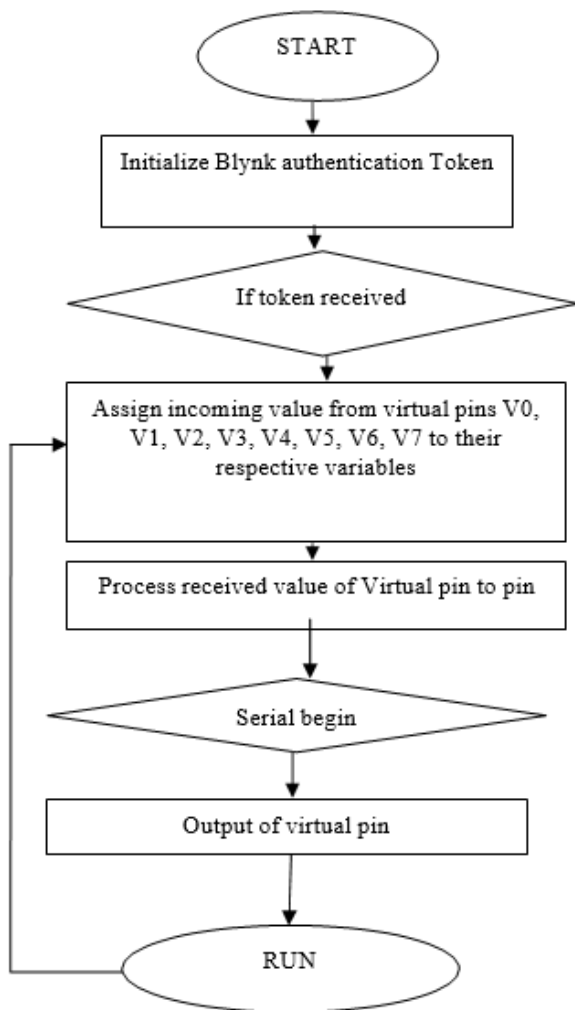


Fig 2. 6 Flow Chart of Hardware Interface

HARDWARE PROTOTYPE MODEL

In this project, VR laboratory can be experienced in two different modes.

- To access VR based Digital Electronics laboratory via mobile phone.

1. VR MODE:

The mobile is mounted in the case provided in IRUSU mini VR headset. The mobile USB port is connected with an OTG to connect a mouse by using which the user rotates the view within the VR Lab environment. The mobile is connected to a Bluetooth enabled controller which is used for controlling the movement in the VR Lab environment and triggering the input buttons of the experiments. The controller has a 360 degree rocker which is highlighted in fig 3.1 is used to move forward and backward. The button 'B' on controller which is seen in fig 3.1 when clicked, the VR scene will pause and enable the mouse mode to click the VR input buttons in the lab. When the button 'B' is clicked the cursor is visible, which is used to click the relevant VR buttons of the experiment in the VR scene and so the interaction takes place and the outputs are showcased with the LED glow.

2. TOUCH ACCESS:

The Digital Electronics VR Lab application in phone is accessed by connecting a controller for movement, touch gesture is used to trigger the virtual input buttons and rotation of user in the VR Lab.



Fig 2.4.1 IRUSU MINI VR Headset

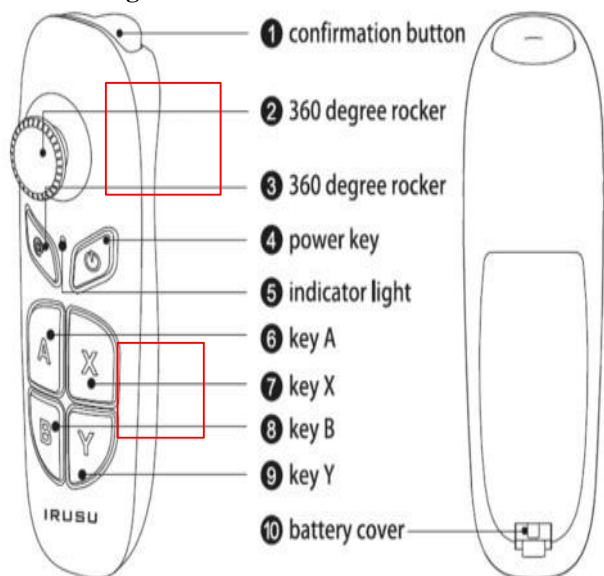


Fig 3.1 IRUSU Controller button functions

- To access VR based Digital Electronics laboratory via laptop, a mouse and keyboard is used for user's rotation and movement in VR space as in fig 3.2. ASWD Keys or the arrow keys are used for movement within the VR environment. Mouse is used to look around the laboratory as the user camera turns around when mouse is rotated. In order to trigger the VR buttons ESC key is first clicked which enables the mouse. The cursor is placed on surface that is to be triggered and clicked. Their respective outputs are showcased in the LEDS

placed on experimental table, based on the experiment being conducted.

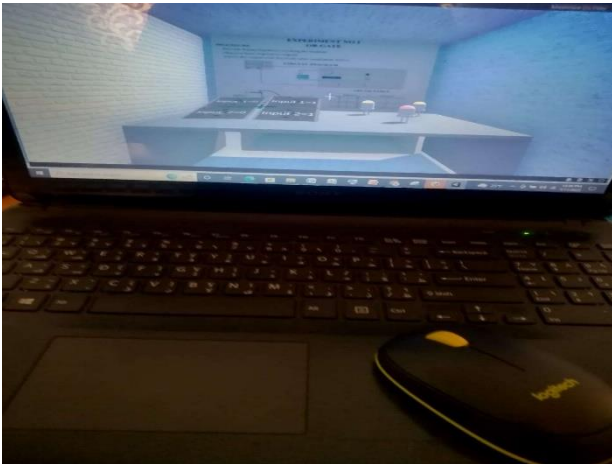


Fig 3.2 VR based Digital Electronics laboratory via laptop

This project model has been incorporated with Node MCU that has 8 input pins of which 2 pins each are connected to respective experiment based ICs as shown in the fig 3.3. The supply voltage to the Node MCU is given from a laptop. The wifi connection is provided from one particular device's hotspot.



Fig 3.3: Hardware prototype model

From fig 3.4 shows the connection diagram of Node MCU with the respective experiment ICs.

- D0 and D1 pin of Node MCU is connected to pin numbers 1 and 2 of IC 7486 and 7408 respectively for Adder experiment.
- D2 and D5 pin of Node MCU is connected to pin numbers

1 and 2 of IC 7486 respectively for EX-OR gate experiment.

- D4 and D8 pin of Node MCU is connected to pin numbers

1 and 2 of IC 74266 respectively for EX-NOR gate experiment.

- D6 and D7 pin of Node MCU is connected to pin numbers 1 and 2 of IC 7432 respectively for OR gate experiment.
- VCC and GND of Node MCU is given as common supply and ground on breadboard.
- 14th [pin of IC is connected to VCC and 7th Pin to the ground.
- Outputs are the Yellow colored LEDs connected to the output pins of respective IC (Third pin of every IC).

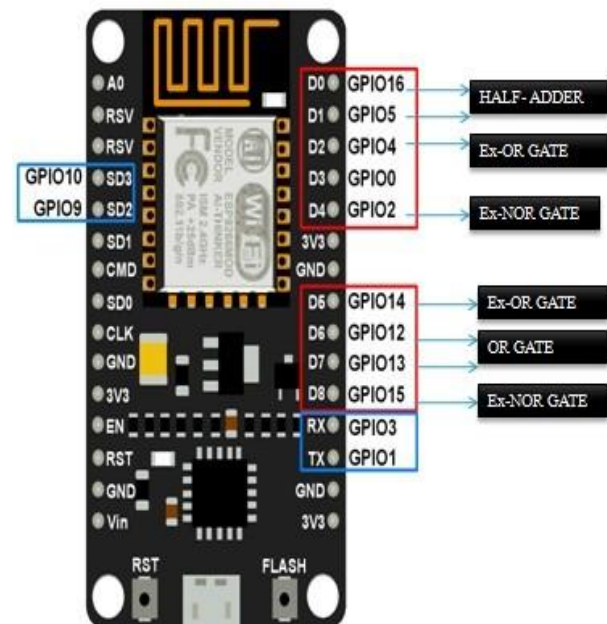


Fig 3.4 Input pins of Node MCU connected to respective experiments

RESULTS AND DISCUSSIONS

The virtual reality digital electronics lab is designed and interfaced with the hardware model by using a wifi module called Node MCU. The hardware model operates when a user gives input in the application via mobile phone or a PC through VR devices, controller and a mouse. The user provides input using the buttons, which results in corresponding output that is displayed in VR environment and hardware model.

The Basic gates such as OR Gate, Ex-OR Gate, Ex-NOR gate and Half-Adder are implemented in virtual reality and the hardware model showcases the results. The user walks within the laboratory environment and conducts the experiment and verifies the outputs.

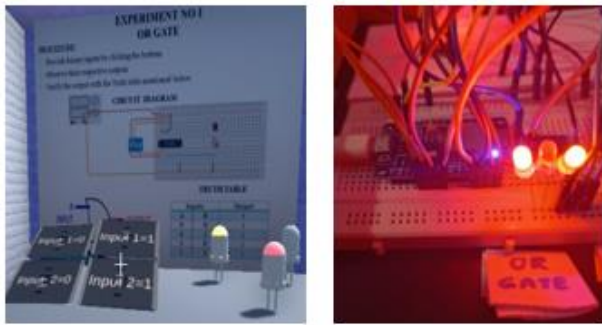


Fig 4.1: Experiment No 1 – OR Gate implementation

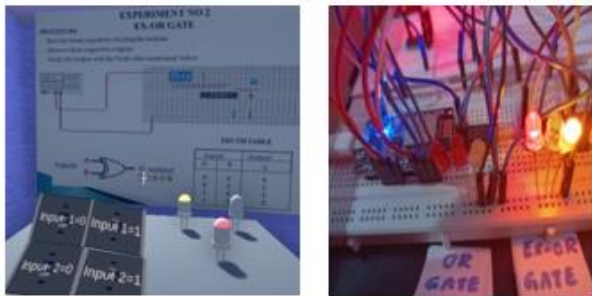


Fig 4.2: Experiment No 2 – Ex-OR Gate implementation

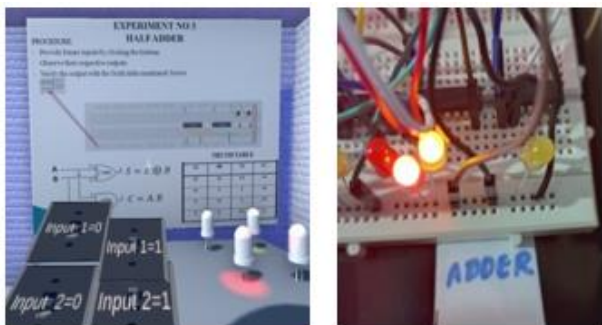


Fig 4.3: Experiment No 3 – Adder implementation

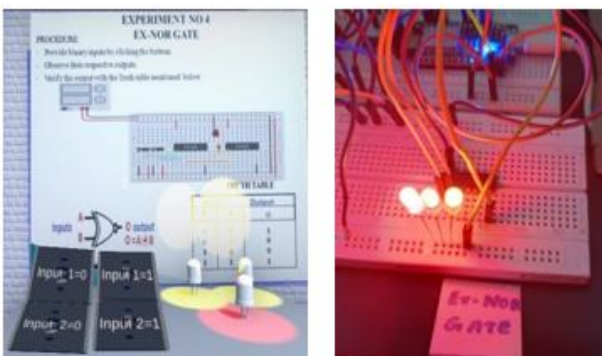


Fig 4.4: Experiment No 4 – Ex-NOR implementation

Fig 4.1, Fig 4.2, Fig 4.3, Fig 4.4 are the output results of virtual reality of Digital Electronics based laboratory access via Laptop/PC using a mouse and controller.

Virtual Reality Lab needs a laboratory environment which is modeled using Unity 3D software. The experimental setup is modeled in Tinker CAD with the essential components based on experiments to be conducted. The components are integrated by C sharp

programs according to chosen experiment and interfaced. A mobile application is created and interfaced with the virtual setup which works with the use of controllers and by wearing VR headsets for mobile access as in fig 4.5 and also by laptop access. The list of experiments included in this prototype model of virtual reality Digital Electronics laboratory setup includes Basic gates such as OR, XOR, Ex-NOR and Half Adder Various other experiments such as Decoder, Priority Encoder, Binary to Gray conversion and Ring & Johnson counter and many more to be included in the future works as per the design of prototype model.



ig 4.5 Digital Electronics VR lab accesses via mobile phone by touch control and controller / using controller and mouse with VR headset.

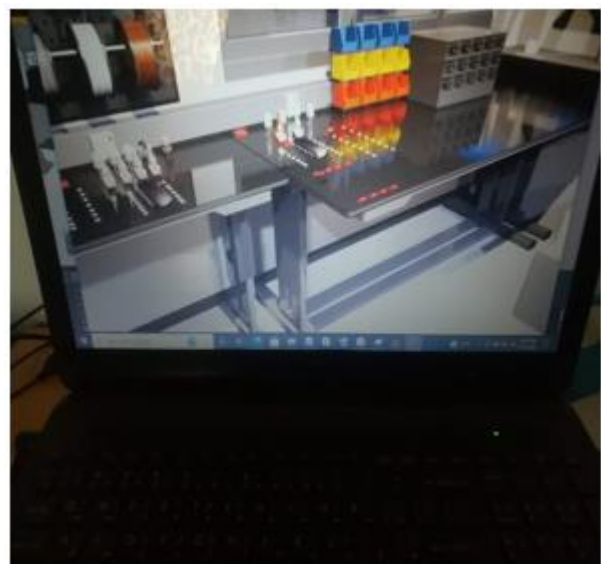


Fig 4.6 VR based Digital Electronics lab using SIMLAB

In the present work a prototype model is developed to prove virtual reality labs can be implemented with more precise and effective methods. The architecture used for the setup is simple which is of low budget with the use of a Node MCU. The same methodology can be used to implement various other experiments included in the curriculum of digital electronic laboratory. In further

advancements the Digital electronics trainer kit can be interfaced with the VR setup just like the prototype model currently developed which has provided access to 4 experiments. One another advancement that was carried out partially in the present work was to rig 3D circuits using 3D wires manually in VR environment, using SIMLAB software which is shown in fig 4.6. But then did not progress as the SIMLAB platform which was used to rig and verify results could not be interfaced with hardware. SIMLAB had ready templates whereas Unity 3D software made 3D component interaction by scripts.

CONCLUSION

The idea of virtual reality digital electronics lab is implemented and the VR lab components have been given an option to be triggered and verify the output in VR environment. This digital electronics VR lab is designed and developed to access in virtually has used Unity 3D along with Blynk IoT. The hardware setup is interfaced with the VR application developed that can be accessed by students via mobile or laptop/PC or by the use of VR glasses to have an effective experience of laboratory and to feel the reality of physical labs for a better learning by the use of controller and mouse connected to mobile/ PC. In the upcoming work, implementation to rig 3D circuits using 3D wires to be carried out with pick and place options by using controllers or VR gloves.

REFERENCES

- [1] Shatha Abu Shanab¹, Salaheddin Odeh², Rami Hodrob³, Mahasen Anabtawi⁴, “Augmented Reality Internet Labs Versus Hands-On and Virtual Labs: A Comparative Study,” in International Conference on Interactive Mobile and Computer Aided Learning (IMCL), 2012.
- [2] Jorge Alvarez, Gabino Díaz, Manuel Macías, “Programming logical controllers using remote labs and virtual reality”, Tecnológico de Monterrey Tampico, México, 2019.
- [3] Evgenia Paxinou, Martha Georgiou, Vasilis Kakkos, Dimitrios Kalles & Lia Galani, “Achieving educational goals in microscopy education by adopting virtual reality labs on top of face-to-face tutorials”, RESEARCH IN SCIENCE & TECHNOLOGICAL EDUCATION, 2020.
- [4] Roman Malaric¹, Marko Jurčević², Hrvoje Hegedus³, Drago Cmurk and Petar Mostarac “Electrical measurements student laboratory – replacing hands-on with remote and virtual experiments”, Electrical Engineering and Computing, University of Zagreb, Zagreb, Croatia, 2015.
- [5] U. Hernandez-Jayo¹, J. García-Zubíá¹, “Low Cost Remote and Reconfigurable Analog Electronics Laboratory”, University of Deusto, Bilbao, Spain, 2014.
- [6] Ali Safavi, Ali Akbar Safavi, Pedram Veisi, “A Remote and Virtual PLC Laboratory Via Smartphones”, School of Electrical and Computer Engineering Shiraz University Shiraz, Iran, 2013.
- [7] P. Trnka, Š. Gojda, D. Bauerová and M. Hofreiter, “Virtual Control Laboratory – Enhanced Remote Control of Real Models Using PLC FoxTrot”, Czech Technical University in Prague, Prague, Czech Republic, 2013.
- [8] Yvonne Tetour, David Boehringer, Thomas Richter, “Integration of Virtual and Remote Experiments into Undergraduate Engineering Courses”, Computing Center, University of Stuttgart, 2011.
- [9] Yaxin Liang, “Digital Circuit Learning System Based on Unity3D”, School of Information Engineering, Wuhan University of Technology, Wuhan, China, 2018.

Sign-Language Recognition and Translation into Speech

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Abstract:

Speech impairment is a very common disability faced by many people. There are approximately around 300 million people who are affected by this disability, which is just more than 5% of the current world's population. These facts have made researchers make vital progress in the field of Sign language detection and recognition.

Recognition of important differentiable hand signs/gestures was the focus of early work in Sign language recognition, hence just a few signs from the WASL dataset were chosen for recognizing sign language expressions. Using deep learning methods of convolutional neural networks (CNN), this paper intends to give a better and more robust representation of static indications. The proposed system's efficiency is calculated and evaluated on numerous CNN models and has achieved a training accuracy of 97.09% on colored images. The framework additionally shows its adequacy and convenience over the prior techniques utilized in the area of Sign language detection and recognition.

Keywords:

Sign-Language Recognition, Translation, Speech

INTRODUCTION

Sign language is a way of listening through the eyes. It is a standardized mode of communication with the use of hand movements as gestures and facial expressions. Sign language is the only mode through which deaf and mute individuals and individuals who have autism spectrum disorder can express their feelings seamlessly.

The prime objective of this paper is to provide a platform-independent mobile application that acts as a one-stop solution to the communication needs of deaf and mute individuals. Be it seeking help, asking for directions, or even having a casual conversation, all of it is supported in the application.

The proposed system utilizes machine learning techniques to achieve its translational goals. Specifically using advanced models like Shift Invariant Neural Networks also known as CNN, Natural Language Processing (NLP) and other image processing techniques which enable translation from sign language to speech.

RELATED WORKS

A comprehensive study of the available literature presents a catalog of previous studies to address this issue. In [1] the author proposes a vision-based hand gesture recognition by making use of max-pooling CNN. Color segmentation is used to obtain hand contours, and morphological image processing is used to reduce noisy edges in this approach. Only 6000 sign photos from six gesture classes were used in the studies, which yielded a 96% accuracy rate.

Feature extraction plays a major role while understanding the concept of Sign language recognition. Rioux-Maldague L, Giguere P, *et al* [2] reported a technique based on extraction of features for hand posture detection using depth and intensity pictures collected with Kinect. For segmentation, they made use of a threshold on the highest image depth, resized the image, and centralized the image for pre-processing. Using a deep belief network, the results were evaluated on known and found to be 99 percent recall and some precision were attained while for the unknown users, it was found to be a recall of 77 percent and attained a precision of 79 percent.

In [3], J Huang, W Zhou *et al* present a 3 dimensional convolutional network-based recognition system which was built using Kinect devices. Three-dimensional CNNs were utilized to find out real features from raw data, allowing them to adapt to huge variances in hand movement. The model was tested on an actual dataset of 35 signs with a 94.2% recognizing rate. Similar to the study on the Kinect-based hand gesture identification system proposed in [3], Pigou L *et al* in [4] worked on the Kinect devices from microsoft and the CNN-based identification system. Threshold technique, segregating the background from the foreground, and separating out the median were employed for pre-processing in this system. They used Nesterov's optimizer which was based on the Gradient descent acceleration and were able to distinguish Italian hand signals with a validation accuracy of 91.8%. Tang A *et al* suggested a hand position detection system for hand signals utilizing the Kinect sensors in a similar work [6]. Using a LeNet-5 CNN-based model, the suggested system was tried on 35 various hand signals and found to have an overall accuracy of 98.12 %.

For the recognition of continuous signs, paper [7] provides a hybrid strategy that combines the strong and unique properties of CNN with the modeling property based on succession of the Hidden Markov Model (HMM). A dynamic programming-based approach was used to pre-process the collected information. The hybrid CNN-HMM approach has been found to outperform other cutting-edge approaches.

Several strategies are available which can be applied on CNN for sign language recognition. In their study [9], Kshitij Bantupalli *et al* used deep CNN to create a self-imaging based system to recognize sign language expressions. The dataset included 200 signs shot from various angles and against diverse backdrops. On CNN, they used both mean and max pooling, also using stochastic pooling algorithms, with the stochastic pooling

strategy outperforming the others with a recognition rate of 92.88 %.

Kumar EK *et al* presented a two-stream CNN building design in [10], which uses two color-coded images as input: the joint distance topographic descriptor (JDTC) and the joint angle topographic descriptor (JATD). The generated raw data included sign videos of more than 40,000 numbers of the Indian based hand gestures, with a 92.14% accuracy rate.

PROPOSED METHODOLOGY

In this study, we utilize machine learning concepts to achieve the translation goals. Specifically using advanced models like Convolutional Neural Networks (CNN), Natural Language Processing (NLP), and other image processing techniques enable us to translate from sign language to speech.

As shown in the system architecture in Fig. 1, the sign language expression is recorded by the camera, and the image from the camera is pre-processed as per the CNN's input requirements. The image is then passed on to the CNN wherein it is classified as a known sign language expression which is passed on to the Speech Engine. The speech engine then converts the natural language input into audio format.

Dataset

WLASL – World Level American Sign Language is a popular dataset used for building sign language recognition models. It is the largest video dataset that features around 2,000 common different words in ASL.

Input and pre-processing

The real-time input is retrieved from the camera feed of the computer, this input is then resized to the dimensions of 28 x 28 pixels and is fed to the neural network.

Convolutional Neural Network (CNN)

As the CNN building design in Fig. 2 demonstrates, we create a sequential neural network with an Input Layer, 3 Convolutional layers, and an output layer. The input layer consists of the image of shape 28 x 28 x 1 which is passed to the convolutional layers.

There are 3 convolutional layers with a kernel size of 3 x 3 and each with 64 filters. We make use of the *ReLU* activation function and we have chosen Max pooling with a 2 x 2 pool size.

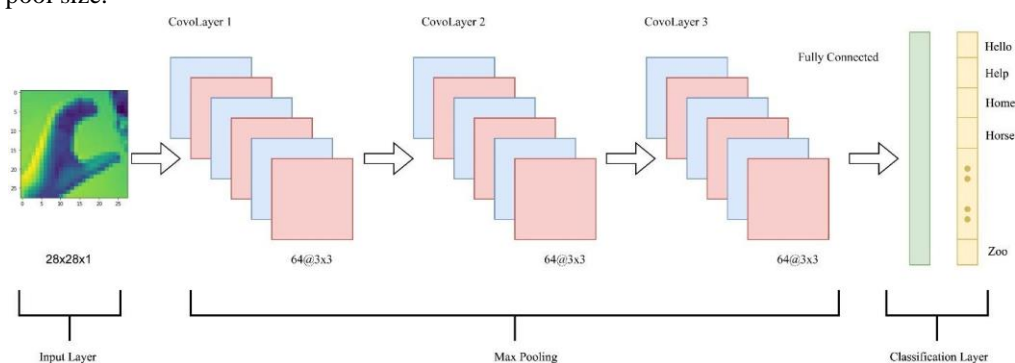


Fig. 2

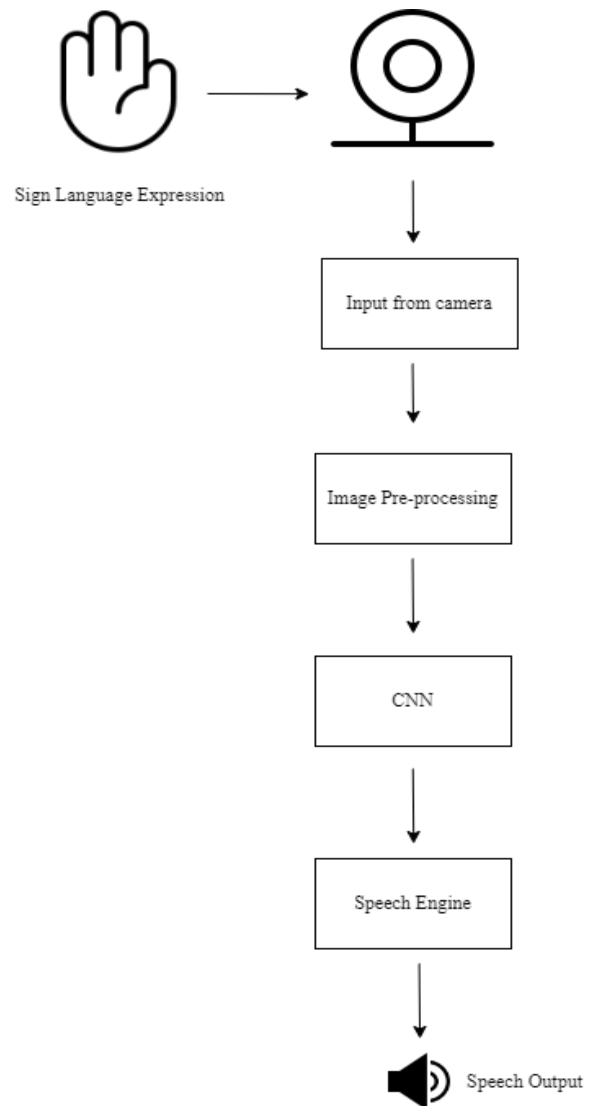


Fig. 1

At the output layer, we flatten the output to narrow down the classification of the given input. The output is received in the form of labels associated with each sign language expression which are then associated with a word in Natural language.

Speech Engine

The word in Natural Language is then converted into speech with the help of the *pyttsx3* [16] speech engine.

RESULTS

Using the WLASL dataset on 26 different sign language expressions, the performance of the proposed method was estimated where each expression had an average of 2,200 training examples and 800 samples. The model provided an average accuracy of 97% with 50 epochs. A graph of the accuracy of training data against the test data is shown in Fig.3.

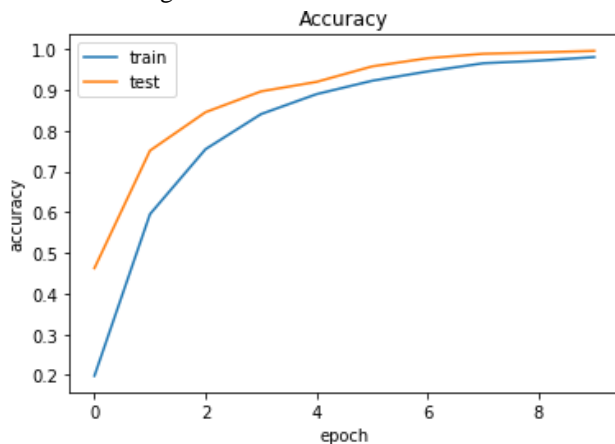


Fig. 3

CONCLUSION AND FUTURE SCOPE

This study presents an efficient method to recognize sign language expressions and convert them into speech. The CNN architecture propounded by this paper consists of three convolutional layers, *ReLU* activation function, and Max- pooling technique. The system showed an average accuracy of 97% at its peak.

The biggest challenges that were faced in the process were gathering ample amounts of data and also the existence of similar expressions for distinct words.

For future work, ample amounts of structured data need to be gathered and the system needs to be improved to recognize dynamic gestures.

REFERENCES

- [1] Nagi J, Ducatelle F, Di Caro GA, Cireşan D, Meier U, Giusti A, Gambardella LM, "Max-pooling convolutional neural networks for vision-based hand gesture recognition," IEEE international conference on signal and image processing applications (ICSIPA), 2011, PP. 342-347.
- [2] Rioux-Maldague L, Giguere P "Sign language fingerspelling classification from depth and color images using a deep belief network," IEEE Canadian conference on computer and robot vision (CRV), 2014, PP. 92-97.
- [3] Huang J, Zhou W, Li H, Li W "Sign language recognition using 3D convolutional neural networks," IEEE international conference on multimedia and expo (ICME), 2015, PP. 1-6.
- [4] Pigou L, Dieleman S, Kindermans PJ, Schrauwen B, "Sign language recognition using convolutional neural networks," Workshop at the European conference on computer vision. Springer, Cham, 2014, PP. 572-578.
- [5] Molchanov P, Gupta S, Kim K, Pulli K, "Multi-sensor system for driver's hand-gesture recognition," 11th IEEE international conference and workshops on automatic face and gesture recognition (FG), 2015, pp 1-8.
- [6] Tang A, Lu K, Wang Y, Huang J, Li H, "A real-time hand posture recognition system using deep neural networks," ACM Trans Intell Syst Technol (TIST), 2015, PP. 6(2):21
- [7] Koller O, Zargaran S, Ney H, Bowden R, "Deep sign: enabling robust statistical continuous sign language recognition via hybrid CNN-HMMs," Int J Computer Vis, 2018, PP. 126(12):1311-1325.
- [8] Kshitij Bantupalli, Ying Xie "American Sign Language Recognition using Deep Learning and Computer Vision," 2018, PP. 1-4.
- [9] Rao GA, Syamala K, Kishore PVV, Sastry ASCS, "Deep convolutional neural networks for sign language recognition," IEEE conference on signal processing and communication engineering systems (SPACES), 2018, PP. 194-197.
- [10] Kumar EK, Kishore PVV, Kiran Kumar MT. "3D sign language recognition with joint distance and angular coded color topographical descriptor on a 2-stream CNN," Neurocomputer, 2019, PP. 372:40-54
- [11] Dongxu Li, Cristian Rodriguez Opazo, Xin Yu, Hongdong Li "Word Level Deep Sign Language Recognition from Video," A New Large-Scale Dataset and methods comparison, 2019, PP. 1-11
- [12] Ka Leong Cheng, Zhaoyang Yang, Qifeng Chen, and Yu-Wing Tai "Fully Convolutional Networks for Continuous Sign Language Recognition," Supplementary Material, 2019, PP 1-3
- [13] Jie Huang, Wengang Zhou, Qilin Zhang, Houqiang Li, Weiping Li "Video-Based Sign Language Recognition without Temporal Segmentation," arXiv, 2018, PP. 1-8
- [14] Ankita Wadhawan, Parteek Kumar "Deep learning-based sign language recognition system for static signs," Springer, 2019, PP. 1-12
- [15] Dongxu Li, Xin Yu, Chenchen Xu, Lars Petersson, Hongdong Li "Transferring Cross-domain Knowledge for Video Sign Language Recognition," IEEE Xplore, 2020, pp 1-10
- [16] <https://pyttsx3.readthedocs.io/>

Evaluation of Hydrodynamic Pressure in Reservoir Adjacent to Concrete Gravity Dam using Finite Element Technique

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Abstract:

Gravity dam is an important structure for conservation of water for civilization. Effect of hydrodynamic pressure exerted on the upstream face of the dam due to the earthquake is an important factor for the design of Gravity dam. Thus, hydrodynamic analysis of adjacent reservoir is necessary to design of earthquake resistant dam. The sedimentary material in the reservoir bottom absorbs or radiates energy which affects the hydrodynamic pressure. Analytical solution does not deal with arbitrary geometry of dam or reservoir. So in this situation, finite element technique is useful which can tackle this problem. Unbounded reservoir is truncated at a suitable distance from dam to reduce computational domain and truncation boundary condition is applied. In the present work, dynamic response of adjacent reservoir has been studied in time domain considering upstream face of dam as vertical. The dam is considered as rigid and the effect of surface wave is neglected. The reservoir fluid is considered as compressible. Viscosity of the fluid is neglected. Sediment absorption effect has been considered into account. An efficient non-reflecting boundary condition has been used at the truncation surface. Finite element technique has been used for analysis purpose. Eight node isoparametric elements have been used for discretization of reservoir domain. Fluid pressure is considered as unknown nodal variable. Analysis has been done for different value of absorption coefficient of reservoir bottom. Hydrodynamic pressure is determined using Newmark's time integration method. Results have been compared for reservoir bed being horizontal and inclined.

Keywords:

Hydrodynamic pressure, Finite element, Seismic excitation, Unbounded reservoir

INTRODUCTION

Gravity dam is a very much important structure from several aspects, either be it engineering use or social use or industrial use. For stability and design of gravity dam thorough study is required on the hydrodynamic pressure developed by the adjacent reservoir. Different authors have proposed different methods for calculation of hydrodynamic pressure of unbounded reservoir adjacent to gravity dam subjected to earthquake excitation. Guan et al. (1994) studied the response of reservoir-dam-soil system due to earthquake. G. Sanberg (1995) proposed a new method for solving fluid structure interaction problem. K. Hatami (1997) studied the reservoir bottom effect on dam structure subjected to earthquake. Maity and Bhattacharya (1999) performed the analysis of infinite reservoir using finite element in time domain. Bouaanani et al. (2003) proposed a formulation for hydrodynamic pressure adjacent to gravity dam subjected

to earthquake. Gogoi and Maity (2006) proposed a non-reflecting boundary condition for analysis of infinite reservoir. Samii and Lotfi (2007) performed coupled and decoupled modal approach for seismic analysis of gravity dam. Attarnejada and Bagheri (2011) studied the hydrodynamic pressure including the dam-reservoir interaction. Hojati and Lotfi (2011) did the dynamic analysis of concrete gravity dam assuming two dimensional modeling. Samii and V. Lotfi, (2013) proposed high-order based boundary condition for dynamic analysis of infinite reservoirs.

In the present work, response of adjacent reservoir has been studied considering upstream face of dam as vertical. The dam is assumed as rigid and the effect of surface wave is neglected. The reservoir fluid is taken as compressible. Sediment absorption effect has been taken. An effective non-reflecting boundary condition has been used at the truncation surface. Finite element technique has been used for analysis purpose. Fluid pressure is considered as unknown nodal variable. Hydrodynamic pressure at the face of dam is determined using Newmark's time integration method.

THEORITICAL FORMULATION

The analysis is carried out considering two-dimensional problem. Viscosity of the fluid is neglected in the present work. Fluid is assumed to be compressible. The hydrodynamic pressure distribution in the reservoir system is governed by the pressure wave equation:

$$\nabla^2 p(x, y, z) = \frac{1}{c^2} \ddot{p}(x, y, t) \quad (1)$$

Where $p(x, y, t)$ is the hydrodynamic pressure, c is the wave velocity in water, t is the time variable and x, y are the space variables. The hydrodynamic pressure distributions may be calculated by solving Equation (1) with the following boundary conditions.

The boundary condition of the free surface (surface 1) is taken as follows. If the effect of surface waves of water is considered, then we get.

$$\frac{1}{g} \ddot{p} + \frac{\partial p}{\partial y} = 0 \quad (2a)$$

When the effect of surface waves of water is neglected, the boundary condition of the free surface may be expressed as

$$p(x, H_f) = 0 \quad (2b)$$

Here, H_f is the depth of the reservoir.

At dam-reservoir interface (surface 2), the pressure may be get by considering the following equation:

$$\frac{\partial p}{\partial n} (0, y, t) = -\rho_f a e^{i\omega t} \quad (3)$$

Where $a e^{i\omega t}$ is the horizontal component of the ground acceleration in which, ω is the circular frequency of vibration and $i = \sqrt{-1}$, n is the outwardly directed normal to the elemental surface along the interface, ρ_f is the density of the fluid.

When the absorption of pressure waves is considered at the bottom of the reservoir (surface 3) the pressure has to satisfy the following equation:

$$\frac{\partial p}{\partial n} (x, 0, t) = -i\omega q p (x, 0, t) \quad (4)$$

Here the coefficient q is as follows.

$$q = \frac{1}{c} \left(\frac{1-\alpha}{1+\alpha} \right) \quad (5)$$

The boundary condition at truncation surface (surface 4) may be written as follows.

$$\frac{\partial p}{\partial n} = \left(\xi_m - \frac{1}{c} \right) \dot{p} \quad (6)$$

According to Gogoi and Maity (2006), ξ_m is obtained as follows.

$$\xi_m = - \frac{i \sum_{m=1}^{\infty} \frac{\lambda_m^2 I_m}{\beta_m} e^{-k_m x} (\Psi_m)}{\Omega c \sum_{m=1}^{\infty} \frac{\lambda_m^2 I_m}{\beta_m k_m} e^{-k_m x} (\Psi_m)} \quad (7)$$

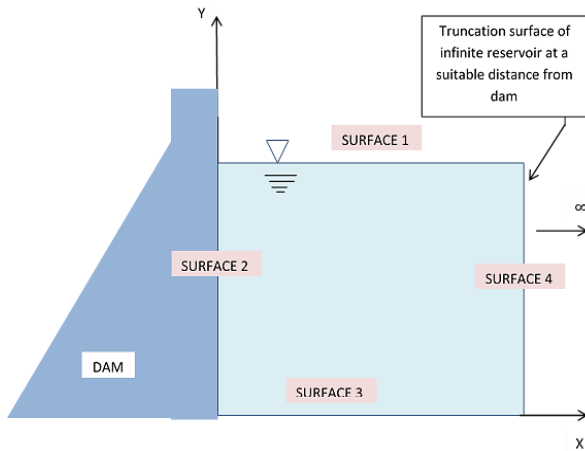


Fig. 1: Dam reservoir system

Applying all the boundary conditions and after finite element discretization equation (1) transformed into

$$[E] \{\ddot{p}\} + [A] \{\dot{p}\} + [G] \{p\} = \{F_r\} \quad (8)$$

To obtain the hydrodynamic pressure the equation (8) is solved using Newmark's integration method. In the present study, the values of δ and β used are taken as 0.5 and 0.25, respectively.

RESULTS AND DISCUSSION

For study of hydrodynamic pressure under dynamic load the inclined reservoir length is truncated and a suitable nonreflecting boundary condition is applied. The unbounded reservoir domain is discretised using finite element and equilibrium equation (8) is solved using Newmark's time integration method. The variation of

pressure is determined for harmonic and earthquake excitation. A MATLAB code has been developed for the analysis purpose.

For analysis of infinite reservoir with inclined base an effective boundary condition is applied at the truncated surface of the reservoir. Adjacent dam is assumed as rigid and vertical and the bottom of reservoir is assumed as absorptive. The effect of surface wave is neglected. the height (H_f) of the reservoir is taken as 75 m and the truncated reservoir length (L) is taken as 37.5 m ($L/H_f = 0.5$). The unit weight of water is taken as 10 kN/m³ and wave velocity in water is assumed as 1440 m/s. The reservoir domain is discretised by standard eight node finite element. Hydrodynamic pressure is determined for absorption coefficient (α) of reservoir bottom assuming 0.5 and 0.9. In both cases the reservoir bottom slope (θ) is considered as 0°, 3° and 6°. The results are determined for harmonic excitation and for earthquake excitation (Koyna earthquake, 1967). The Horizontal accelerogram of Koyna earthquake is shown in Fig. 2. By solving equation (8) hydrodynamic pressure is determined for different angle of bottom slope of reservoir.

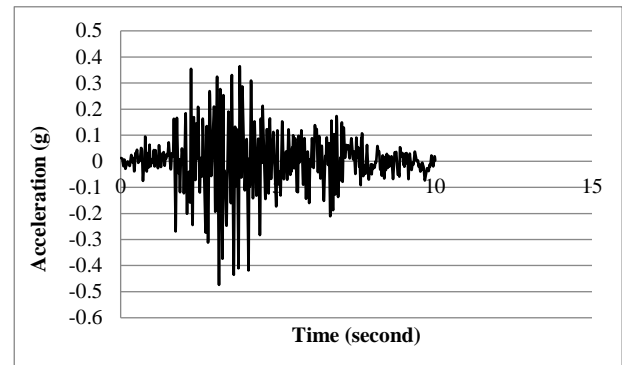


Fig. 2: Horizontal accelerogram of Koyna earthquake (1967)

First analysis is carried out for bottom absorption coefficient as 0.5. The reservoir bottom slope angle (θ) varies as 0°, 3° and 6° with the upstream face of dam as vertical. Variation of hydrodynamic pressure is determined for harmonic excitation. Distribution of hydrodynamic pressure coefficient C_p ($C_p = p/\rho_f a H_f$) at the face of dam-reservoir interface for $\alpha = 0.5$ is presented in Fig 3.

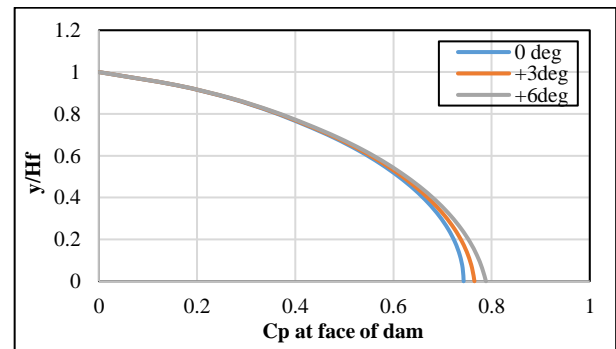


Fig. 3: Hydrodynamic pressure distribution along dam-reservoir interface for absorption coefficient (α) = 0.5

Next analysis is carried out for bottom absorption coefficient as 0.9. The reservoir bottom slope angle (θ) varies as 0° , 3° and 6° as before considering the upstream face of dam as vertical. Variation of hydrodynamic pressure is determined for harmonic excitation. Distribution of hydrodynamic pressure coefficient C_p ($C_p = p/\rho_f a H_f$) at the face of dam-reservoir interface for $\alpha = 0.9$ is presented in Fig.4.

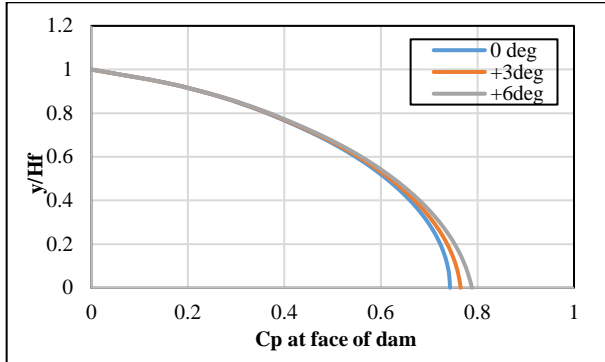


Fig. 4: Hydrodynamic pressure distribution along dam-reservoir interface for absorption coefficient (α) = 0.9

Next analysis is carried out for bottom absorption coefficient as 0.9 for an earthquake excitation (Koyna earthquake, 1967). The reservoir bottom slope angle (θ) varies as 0° , 3° and 6° as before considering the upstream face of dam as vertical. Time history plot of hydrodynamic pressure coefficient (C_p) at bottom of dam-reservoir interface at 3.17 second is shown in Fig. 5. Distribution of hydrodynamic pressure coefficient C_p ($C_p = p/\rho_f a H_f$) at the face of dam-reservoir interface for $\alpha = 0.9$ is presented in Fig.5.

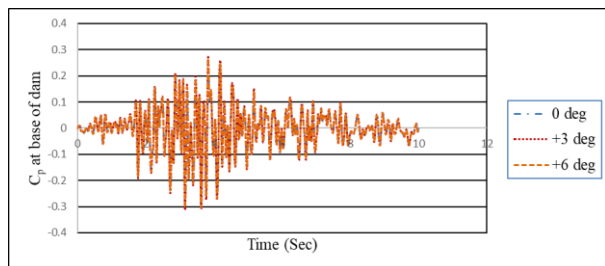


Fig. 5: Time history plot of hydrodynamic pressure coefficient (C_p) at bottom of dam-reservoir interface at 3.17 sec. for absorption coefficient (α) = 0.9.

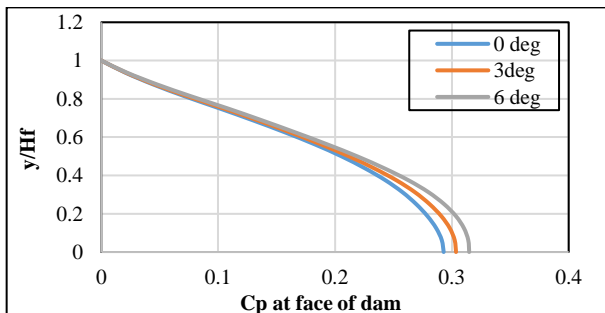


Fig. 6: Hydrodynamic pressure distribution along dam-reservoir interface due to seismic excitation at $t = 3.17$ sec. for absorption coefficient (α) = 0.9.

CONCLUSIONS

Behavior of reservoir adjacent to the concrete gravity dam under earthquake excitation is very important for stability of the dam structure. Study on hydrodynamic pressure developed by the adjacent reservoir is essential. In the present study, analysis of infinite reservoir is carried out for different slope of reservoir bottom. The reservoir bottom is assumed as absorptive. The dam is considered as rigid and an effective non-reflecting boundary condition is applied at the truncation surface.

From the present study it has been seen that hydrodynamic pressure at bottom of dam-reservoir interface is maximum due to dynamic excitation. Variation of hydrodynamic pressure distribution at the upstream face of dam is parabolic. Applied truncation boundary condition is effective for assumed truncated length of the reservoir. Slope of bottom of reservoir influenced the generation of hydrodynamic pressure in the reservoir. Increase in bottom slope angle results increase in hydrodynamic pressure. Reservoir bottom absorption is an important factor.

REFERENCES

- [1] A. Samii and V. Lotfi, "Comparison of coupled and decoupled modal approaches in seismic analysis of concrete gravity dams in time domain", *Finite Elements in Analysis and Design*, vol. 43, pp. 1003 – 1012, 2007.
- [2] A. Samii and V. Lotfi, "A high-order based boundary condition for dynamic analysis of infinite reservoirs", *Computers and Structures*, vol. 120, pp. 65–76, 2013.
- [3] D. Maity and S. K. Bhattacharya, "Time-domain analysis of infinite reservoir by finite element method using a novel far-boundary condition", *Finite Elements in Analysis and Design*, vol 32, pp 85-96, 1999.
- [4] F. Guan, I. D. Moore and G. Lin, "Transient response of reservoir-dam-soil systems to earthquakes", *International journal for numerical and analytical methods in geo-mechanics*, vol. 18, pp. 863-880, 1994.
- [5] G. Sanberg, "A new strategy for solving fluid-structure problems", *International journal for numerical methods in engineering*, vol. 38, pp. 357-370, 1995.
- [6] I. Gogoi and D. Maity, "A non-reflecting boundary condition for the finite element modelling of infinite reservoir with layered sediment", *Advances in Water Resources*, Vol. 29, pp. 1515–1527, 2006.
- [7] K. Hatami, "Effect of reservoir bottom on earthquake response of concrete dams", *Soil dynamics and earthquake engineering*, vol. 16, pp. 407-415, 1997.
- [8] M. Hojati and V. Lotfi, "Dynamic analysis of concrete gravity dams utilizing two-Dimensional modified efficient fluid hyper-element", *Advances in Structural Engineering*, Vol. 14, pp 1093-1106, 2011.

- [9] N. Bouaanani, P. Paultre and J. Proulx, "A closed-form formulation for earthquake-induced hydrodynamic pressure on gravity dams", *Journal of Sound and Vibration*, vol. 261, pp. 573–582, 2003.
- [10] R. Attarnejada and A. Bagheri, "Dam-Reservoir Interaction including the effect of vertical component of earthquake acceleration on hydrodynamic pressure", *Advanced Materials Research*, Vols. 255-260, pg. 3493-3499, 2011.

Delphi Migration with TLS Encryption

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Abstract:

Digital revolution of the internet has led to one of the most connected and flourishing worlds, ever seen in the history of the planet. The connectivity of the world has led to increase in the web technology and also increased threat to the data. Security is the most crucial issue to manage when there is information to be communicated via any electronic means. Transport layer should be secured so to provide a method for encrypting this data transferred SSL/TLS is a protocol utilized to ensure a secure means of communication is taking place. The communication is liable to be snooped upon due to the vulnerabilities present in the security of the system. The most extensively used protocol for securing the communications is SSL/TLS which provides a homogeneity in the data and transparency is provided among different servers. The main purpose has been to analyze the diverse methods present and acknowledge which is the most effective method to be used.

Keywords:

Delphi, Unicode, ANSI-Code, SSL, TLS

INTRODUCTION

The internet has helped in breaking down the barriers caused by geography which enabled world-wide connectivity. This is the reason that applications cannot be purely built on ANSI based environment. Unicode has been accepted as the standard means of transferring text and data. As it has provided support for virtually any writing system in the world, Unicode text is now used everywhere.

Delphi is a software which uses Pascal. Delphi 2007 has been used to develop many applications which are now being deprecated and the recent Delphi versions have embraced the Unicode Standard. Windows is using Unicode string, so the change of Delphi had to be done. Delphi developers will now be able to service the global market with their products. Delphi programs must be able to adapt and function on PCs running any of the many various translated versions of Windows, including the Japanese, Chinese, Greek, and Russian versions. Users of the software may be entering non-ANSI text or utilizing path names that are not based on ANSI. In certain situations, ANSI-based apps may not always perform as expected. Windows programs created with a fully Unicode-enabled Delphi will be able to deal with and function in those scenarios.

LITERATURE SURVEY

Networks are a common sort of data for expressing interactions between persons, corporations, tele communications hubs, and other entities, according to author [1]. For immediate perception, network or graph representation offers an intuitive approach to examine the node-link structure of data transmitted. Nevertheless,

even with fairly substantial data of few more nodes, naïve node-link layouts often struggle to connect facts on network topologies.

The author [2] describes how mapper algorithm is a prominent technique from practical data processing for deriving topological representations of large information. Mapper Interactive, a digital platform for collaborative presentation and analysis of large coordinates, is presented in this study. It supports real data analysis by implementing the mapper method in a dynamic, accessible, and sufficient detail to enable approach.

In [3], the author introduces a novel approach for comparative methods, standardization, and representation of large data sets, as well as comparative methods of algorithms on these data sets. The authors have formulated a mechanism for retrieving unambiguous interpretations from data sets. The method is to categorize the data together which is enhanced by a series of procedures which are established upon the data. Approach to put together this data can be any of them as the Mapper process doesn't rely on the method used for clustering.

Topological data analysis (TDA) is a discipline of discussion and reflection on comprehending the strength and texture of complicated data, according to the author [4]. A better technique to uncover hidden links among complex and responsible for considerable is to compute topological characteristics of data, such as coupled components, loops, and voids.

[5] outlines the structure and functional sequence of the procedures to be implemented, as well as a description of wide assortment of challenges and their resolutions. Due to inadequacies in SSL/TLS, that is used to encrypt communication between source and the destination, among the major threats to transport level security exists.

The author in [6], describes how SSL/TLS is the most frequently used network protocol standardized for way to access, authenticity, and confidentiality. OpenSSL is largely a library that allows programmers to integrate strong encryption support in their code, but it is also a command-line utility that offers access to most of its features.

Comprehensive privacy demonstrations for a 5KLOC application are proposed in the publication [7], which are based on exact encryption assumptions on basic components. The majority of them use autonomous primary justification. Some algorithms and encryption combinations are still not supported, and the code has to be tuned for reliability.

The author shows in [8] that the amount of encrypted support in Computer networks using the SSL/TLS

protocol is very variable, with a considerable fraction of the servers supporting poor, defective, or outmoded encryption. The statistics should be relevant for SSL/TLS protocol assessment as well. Any endeavor to enhance the encryption features of SSL/TLS performance have to be done.

[9] presents measures of TLS screening intensity and reflects on a series of surveys on TLS monitoring. Evaluating the incidence and type of TLS gateways requires more effective measurement techniques. SSL/TLS is the popular protocol used for providing a standard for security, authenticity, stability, and confidentiality. Command line is used for accessing a vast chunk of capabilities of the OpenSSL which is a library utilized by many programmers for encryptions.

The author acknowledges in [10] that OpenSSL is essentially a framework that programmers use to integrate robust encryption features in their applications, even though it is a platform that offers command-line accessibility to almost all of its functions. Authorization type and CA validation are now accessible to the entire certification content validation in TLS 1.2. With the exception of parsing certification categories for client certificate decision.

[11] presents the authors massive feat of ensuring the security of a core interface which is TLS. This was executed in a precise manner and it also encompasses the numerous TLS forms. The authors also address the several shortcomings encountered in the protocol and ways for it to be avoided and secured. In this paper, a way to derive the encapsulation from the protocol of TLS which is handshake and if we combine this with a secure technique for encryption a secure protocol can be established.

The authors in [12] have established a new architecture with the help of applications which are cutting-edge channels of the various TLS forms, which is referred as TLS switching. An application which is reliable along with a proxy are used for developing two channels which are secure for toggling between the client and the application.

UNICODE

Unicode has been a standard measurement for defining all recorded languages' letters of the alphabet for preservation, access, and representation by modern systems. Unicode provides each character a different identifier, equivalent to the ANSI coding style sequence of characters, which includes both command elements and legible symbols from the Latin alphabet.

Unicode, like the ANSI coding standard, can represent a wide range of symbols, including monetary symbols, scientific and mathematical notation, and other esoteric characters. To represent such a significant sequence of numbers, Unicode characters often need up to four bytes of information. The ANSI code specification, uses eight bits decoding to confine the multitude of distinct characters at a time.

Unicode assigns a number value called a code point to each control character, character, or symbol. Once issued by the Unicode Technical Committee, a character's code point is unchangeable. Every data item could be expressed in any number of bytes, with the bulk of common data items using less than two bytes.

The use of Unicode throughout Delphi 2009 is one of the numerous new features present in the software. In Delphi, the default string is now a Unicode-based string. The IDE, compiler, RTL, and VCL are all fully Unicode-enabled because Delphi is mostly created using Delphi.

In Delphi, the transition to Unicode is a natural one. Because Windows is completely Unicode-aware, it's only natural that programs created for it utilize a Unicode string as the default. The advantages for Delphi developers go beyond simply being able to utilize the same string type as Windows.

Delphi developers now have a fantastic opportunity with the addition of Unicode support. Unicode data may now be read, written, accepted, produced, displayed, and dealt with by Delphi developers, and it's all built right in. The apps may be ready for whatever type of data that the customers or users can throw at them with simply a few, or in some cases no, code modifications. Applications that previously only supported ANSI-encoded data may now be simply changed to support practically every character set on the planet.

MIGRATION TO ANSI-CODE

Delphi 2009 did not introduce Unicode support; rather, it became more widespread with this edition. In Delphi 2007, several drivers that were used with previous version servers have to be upgraded. Delphi can also save and compile source files in UTF-8 format since Delphi 2005.

The WideString type, which has been available since Delphi 3, is a two-byte string type. Things have altered drastically for Delphi 2009. Module identifiers, procedure designations, data types, standard labels, character constants, and other contexts can all utilize Unicode strings. The string and character data types, however, are the most significant change for most developers.

The Unicode string, now specifies the String type. Similarly, the Char type has been updated to WideChar, which is a two-byte character type, and PChar has been updated to PWideChar, which is a reference to a two-byte Char. The far more remarkable property of these core data types' enhancements here is that every symbol is expressed along with at minimum one script. The number of characters in a string is not equal to the size of the string in bytes.

Delphi's improved Unicode technology has definitely worked out better in this case. Furthermore, a Char element has now become two bytes rather than a single byte. The native string category, AnsiString, nonetheless persists. AnsiString items are benchmark numbered and have version interpretations, same like previously. They

contain eight-byte ANSI variable for every letter, are comparison numbered, and have version linguistic features. If requirement for an eight-bit specific character or a pointer.

Even the classic Pascal String is still in use. These strings can have a maximum length of 255 bytes and are not reference counted.

CONCLUSION

Secure communication occurs using SSL/TLS protocol and it also provides a crucial method and technique for ensuring the data present in the application to be secured. SSL provides a reliable security for the network. A number of shortcomings have been encountered which have a led to the introduction of a number of vulnerabilities which can be attacked. Since SSL/TLS has been established on a number of cryptographic methods fewer flaws are encountered. Many counter measures have been proposed to solve the attack problems. Newer optimization methods should be developed every time to solve the ever-growing attack process.

Delphi has been used by various systems for the process of development and this Delphi has helped in creation of many applications. Hence it was necessary for it to be migrated from Unicode to ANSI Code but also to be able to provide the current encryptions of the TLS.

REFERENCES

- [1] Mustafa Hajij, Paul Rosen, Bei Wang, "Mapper on Graphs for Network Visualization", Social and Information Networks Journal, Cornell University, April 3, 2018.
- [2] Zhou, Youjia, Nithin Chalapathi, Archit Rathore, Yaodong Zhao, and Bei Wang. "Mapper Interactive: A scalable, extendable, and interactive toolbox for the visual exploration of high-dimensional data." In 2021 IEEE 14th Pacific Visualization Symposium (PacificVis), pp. 101-110. IEEE, 2021.
- [3] Gurjeet Kaur Chatar Singh, Facundo Mémoli and Gunnar Carlsson, "Topological Methods for the Analysis of High Dimensional Data Sets and 3D Object Recognition", Wright State University, 2017.
- [4] Hendrik Jacob van Veen, Nathaniel Saul, David Eargle, and Sam W. Mangham, "A flexible Python implementation of the Mapper algorithm", The Journal of Open Source Software, 17 October, 2019.
- [5] Peter Bye, ClearPath Forward Systems an Introduction, Unisys Corporation, January 13, 2018. Accessed on: January 18, 2022.
- [6] Ashutosh Satapathy, Jenila Livingston L.M, "A Comprehensive Survey on SSL/ TLS and their Vulnerabilities", International Journal of Computer Applications, Volume 153, November 2016.
- [7] Maria Navin J R, Suresh P, Pradeep K R "Implementation of OpenSSL API's for TLS 1.2 Operation," International Journal of Advanced Computer Research ISSN, Volume-3, Number 3, Issue 12, September 2013.
- [8] Homin K Lee, Tal Malkin and Erich Nahum, "Cryptographic Strength of SSL/TLS Servers", Proceedings of 7th ACM SIGCOMM conference on Internet Measurement, California, October 2017.
- [9] Karthikeyan Bhargavan, Cedric Fournet, Markulf Kohlweiss, Alfredo Pironti, Pierre Yves Strub, "Implementing TLS with Verified Cryptographic Security", IEEE Symposium on Security and Privacy, 2013, pp. 445-462.
- [10] Mark O'Neill, Scott Ruoti, Kent Seamons, Daniel Zappala, "TLS Inspection: How Often and Who Cares?", IEEE Internet Computing, 2017.
- [11] Hugo Krawczyk, Kenneth G. Peterson, and Hoeteck Wee, "On the Security of TLS Protocol: A Systematic Analysis", Springer, Advances in Cryptology 2013, Volume 8042.
- [12] Migdal Denis, Christian Johansen, and Audun Josang, "Offline Trusted Device and Proxy Architecture Based on a new TLS Switching Technique", International Workshop on Secure Internet of Things (SIoT) 2017, Page 10.
- [13] Ahmed Alqattaa, Andreas Abmuth, "Analysis of Internet Security Protocol TLS Version 1.3", Obstbayerische Technische Hochschule Amberg-Weiden, 2019.
- [14] Preeti Sirohi, Amit Agarwal, and Sapna Tyagi, "A Comprehensive study on security attacks on SSI/TLS protocol", 2nd Interbational Conference on Next Generation Computing Technologies, 2016.
- [15] Shaji, Elwin, and Narayanan Subramanian. "Assessing Non-Intrusive Vulnerability Scanning Methodologies for Detecting Web Application Vulnerabilities on Large Scale." 2021 International Conference on System, Computation, Automation and Networking (ICSCAN). IEEE, 2021.
- [16] Govender, Castello, and Brett van Niekerk. "Secure key exchange by NFC for instant messaging." 2021 Conference on Information Communications Technology and Society (ICTAS). IEEE, 2021.
- [17] Liu, Niansheng, Guohao Yang, Yu Wang, and Donghui Guo. "Security analysis and configuration of SSL protocol", In 2008 2nd International Conference on Anti-Counterfeiting, Security and Identification, pp. 216-219. IEEE, 2008.
- [18] Li, Wei, Shuyue Xiang, and Shuangbao Chen. "Improvement method of SSL protocol identity authentication based on the attribute certificate." In 2012 International Conference on Computer Science and Service System, pp. 1154-1157. IEEE, 2012.
- [19] Dastres, Roza, and Mohsen Soori. "Secure socket layer (ssl) in the network and web security." International Journal of Computer and Information Engineering 14, no. 10 (2020): 330-333.

- [20] Wagner, David, and Bruce Schneier. "Analysis of the SSL 3.0 protocol." In *The Second USENIX Workshop on Electronic Commerce Proceedings*, vol. 1, no. 1, pp. 29-40. 1996.
- [21] Jurcut, Anca, Tom Coffey, Reiner Dojen, and Robert Gyorodi. "Security Protocol Design: A Case Study Using Key Distribution Protocols." *Journal of Computer Science & Control Systems* 2, no. 2 (2009).
- [22] Altaf, Ayesha, M. Younus Javed, and Attiq Ahmed. "Security enhancements for privacy and key management protocol in IEEE 802.16 e-2005." *2008 Ninth ACIS International Conference on Software Engineering, Artificial Intelligence, Networking, and Parallel/Distributed Computing*. IEEE, 2008.
- [23] Harold A. Linstone, Murray Turoff, Olaf Helmer, "The Delphi Method Technique and Applications", New Jersey Institute of Technology 2002.
- [24] Alexander Jonsson, "Assesing Delphi as a Programming Language for Beginners", KTH Royal Institute of Technology, 2021.
- [25] Nick Hodges, Stefan Glienke, "Dependency Injection in Delphi", Lean Publishing, 2017.
- [26] Li, Jian-Qiang, F. Richard Yu, Genqiang Deng, Chengwen Luo, Zhong Ming, and Qiao Yan. "Industrial internet: A survey on the enabling technologies, applications, and challenges." *IEEE Communications Surveys & Tutorials* 19, no. 3 (2017): 1504-1526.

The Survey: Anomaly Detection in Cellular Networks

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Abstract:

We know that a tremendous amount of data is produced about and by people, electronic devices, and interactions between them. Billions of electronic devices like mobile phones have led to significant growth of worldwide mobile data in the past decade. If there is a high surge in traffic in a particular area, this may lead to a service outage in the same area and these types of unexpected behaviors are called as outliers/anomalies. This is why detecting anomalies is highly valuable for users as well as for network operators. Detecting anomalies in the network requires the employment of efficient methods which in turn requires strong literature. This paper gives brief information about anomalies in cellular networks, anomaly detection frameworks, call data records, techniques, and methodology, and classifies different approaches into four categories: statistical anomaly detection, classifier-based anomaly detection, anomaly detection using machine learning, and artificial intelligence. The paper also discusses research challenges with the datasets used for network anomaly detection.

Keywords:

component, formatting, style, styling, insert

INTRODUCTION

Rapid enhancement in the mobile technology has attracted people into smart phones, wearable devices, tablets and hence increases the mobile phone subscriber. According to a report by Ericson in 2011, the mobile phones have surpassed the entire world population [6]. Due to this massive growth in mobile phone subscribers the congestion in the mobile network became common. Hence providing subscribers a good quality of service becomes challenging. With this massive growth of the mobile data the storage and processing this data has become a big challenge. There are pros and cons of the data, the pros are where we can understand specific user activity and the mobile traffic demand. And now coming to cons of this data, it is manageability and a significant rise in traffic may lead to service outage. For example, if there is a high surge in traffic in a particular area, this may lead to a service outage in the same area. This may lead to a service outage in the area and these types of unexpected behaviors are called as outliers/anomalies. This is why detecting anomalies is highly valuable for users as well as for network operators. If we take a look in the last 10 years, there have been notable system failures. On July month of 2012, the official French network operator naming 'Orange Telecom' had suffered a severe outage and which has caused more than 26 million were affected and they were not able to send or receive messages, making calls, and were not able to use internet data services for roughly nine hours. This happened due to lack of management tool which would have detected anomaly, due to this the operator was

unable avoid outage in their network. As a result, operator had to allocate resource which added extra money and also added the customer dissatisfaction on the top. Upon investigation, it was found that not upgrading the software caused the outage.

To be precise, anomaly is something which deviates from normal, expected and standard, detecting anomalies will allow network operators to gather more information of the particular region in the network and this can be very useful for network operator to balance traffic and allocate resource in the particular region. This can lead to better user experience. The mobile data contains the spatio-temporal information which helps network operator to monitor network state and detecting anomalous behavior. According to [8], United States spends about \$15 Billion on managing cell outages annually. For detecting anomaly in the network, the use of machine learning, artificial intelligence are being used recently. According to [5], for anomaly detection in the cellular networks with the use of machine learning, there are three methods categorized into clustering based, statistical based, and classification based methods, here the clustering takes the lead because clustering is an unsupervised machine-learning algorithm which does not require labeled data from cellular network. In [4] the use of aggregation which include special aggregation and threshold where special aggregation use the unsupervised machine learning which is applied in big data analysis for clustering similar network behavior. In [20], the use of new adaptive approach for detecting anomalies, here it has two parts where in first the overloaded base station are detected using machine learning algorithm and drone deployment in the affected area for support or we can say resource allocation. In [3], the use of edge server to monitor cells where CDR data is fed to convolution neural network model and the resultant output will give the anomalous cells. In [2], the call data records are referred as big data because of its volume, variety and veracity. For detecting anomalies in the network k-means clustering is used which is a unsupervised clustering techniques and the detected anomalies are compared with the ground truth information for verifying the accuracy and from the comparative at any time and location will be referred as anomaly. The above mentioned are some of the techniques used for anomaly detection and more detailed review is being mentioned in the further section of this paper.

RELATED WORK

This section briefs about anomaly detection in cellular networks,

Anomaly detection is a technique of searching elements in data which does not match the expected pattern or behavior [5]. There are various surveys on anomalies detection techniques emerged in domains of statistics and machine learning. The anomaly detection techniques can be classified in 3 categories: statistical – based clustering based and classification based.

In statistic based anomaly detection technique, where the statistical models are applied for anomaly detection, it includes threshold based methods. PCA approach which is principle-component-analysis. In threshold based methods, the features are selected and then features are estimated with suitable statistical-model. And finally a threshold is marked/set to differentiate normal traffic from abnormal one. Here the main drawback is that threshold based techniques need prior knowledge about anomalous behavior for setting threshold. On the other hand PCA does not require any prior knowledge about anomalous behavior. In PCA the traffic data mapped to principle component in higher dimension are anomalous and remaining are normal traffic behavior of the network but PCA is sensitive to degree of unity of the data.

In classification based category, there are several methods like decision tree, rule based method, support vector machine, Bayesian network and neural network. Classification based methods makes use of labeled data for making classifier learn and then apply the learned classifier for classifying an instance or test instance as anomalous or normal. Classification based detection methods are considered flexible but they require labeled data which requires significant human efforts to get one.

In clustering technique, it doesn't require pre-labeled data, which is why it is widely used for anomaly detection. Here hierarchical clustering is used for identifying abnormal traffic by comparing it with normal. K-means clustering is used because of its ability to solve clustering problem of large datasets [5]. going into anomaly detection first let us know the basics of our network architecture. The network architecture diagram and its explanation is mentioned in the next section.

NETWORK ARCHITECTURE

The below diagram shown is the current LTE network architecture.

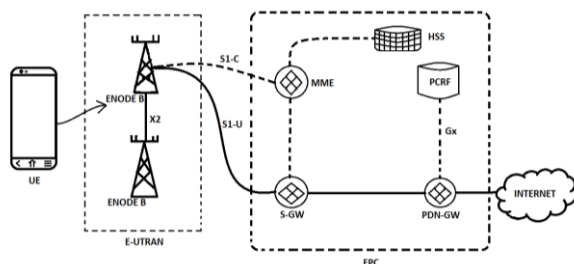


Figure1. Network Architecture

----- Control plane
 ————— User plane

This is the current LTE network architecture which contains UE (User equipment), E-UTRAN (Evolved UMTS Terrestrial Radio Access Network), and EPC (Evolved packet core) or also called as core network. UE is the user equipment which sends communication request and receive request from the network. The user equipment connects to the eNodeB whereas eNodeB is used for resource management; it forwards the request from UE to MME (mobility management entity) and to S-GW (serving-gateway). ENodeB can transfer the UE request to different eNodeB via X2 interface as shown in diagram if it is overwhelmed by the requests with the help of mobility management entity. The MME authenticates user, carry out paging and can handover request to different eNodeB. Since there are lots of serving gateway, the MME selects the suitable serving gateway for the user and connects to it. This can happen when the UE is not in stationary condition which moving from one place to another or we can say in motion. And then the serving gateway (S-GW) forwards the user data packet to PDN-GW. The S-GW has privilege to take decision on where to forward the user data packet. When the user request reaches PDN-GW, the PDN-GW adds an IP address to the user request and request is sent to the other network like we can say internet (websites, 3G network, etc...). The PCRF (Policy and charging rule function) generates bill by looking into user data usage, calculate call time, messages sent and etc and generates bill for the user. The HSS (Home subscriber server) contains the subscribers data, it contains user database, service subscription, user identification and addressing. As shown in the diagram the EPC (Evolved packet core) is also called as core network and this where the call data record (CDR) is generated and is further used for processing user information and finding anomaly in the network also.

DATASET

Huge amount of data is generated from the cellular network because of millions of mobile phones and other electronic devices. And they are making data storage, acquisition, management, analysis and representation challenging day by day because of addition of new smart phone and other communication devices. These increases the research challenge and below are some unique research challenges which are arising from the data generated from the network.

- Data encryption:* Network operators often collect CDR, measurement report, and traffic counters and termed them as key indicators of the performance. For monitoring the performance of the network and detecting anomaly in the network which may have impacted the user experience. The data sets are usually collected by DPI (Deep packet inspection) which inspects the packet header and the data part. Let us take an instance; we know that IP (Internet protocol) contains source port, destination port, source address and destination address. Because of increasing encryption of the packet has led DPI (Deep packet inspection) incapable of classifying traffic

types and collecting KPI (key performance indicators). So, therefore the data mining and ML (Machine learning) techniques are needed for monitoring performance of the network in the absence of KPI.

- b) *Data heterogeneity*: The data sources in the network are heterogeneous. The data set are usually semi-structured or unstructured which are not possible to manage by RDBMS (relational database management system). So the NoSQL databases like Casandra and MongoDB have been deployed. Compared to RDBMS the NoSQL databases are more scalable and much more efficient for processing and storing rapid changing and heterogeneous data set. NoSQL DB (Database) are suitable for real time data analysis.
- c) *Data distribution*: Since we know that cellular network is a distributed infrastructure. If we take 4G cellular network, it consists of evolved nodeB, serving gateway, mobile management entity, packet data network gateway, home subscriber server and etc. Large variety of probes and sensor are laid down across entire network. Monitoring of data is generating distributively. Nowadays SQM (service quality management) architecture aggregates all data to single point and process all together. These type of approach can become difficult to realize in the future because of exponential growth in network size and scale. The big challenge here is carrying out the anomaly detection in distributed way for monitoring information exchange across different network elements
- d) *Energy management*: The management, storage and processing of profusion network data cause high energy consumption. This energy management problem will increase as the network data increases.

TABLE1. Data set used across researchers

Author	Data
Xiaowei Qin, Shuang Tang, Xiaohui Chen*, Dandan Miao, Guo Wei.	Real data of China Mobile Networks, and the data is collected from IuPS and IuCS, duration of one month and total cell is 243.
Dujia Yang, Dandan Miao, Xiaowei Qin, Guo Wei.	3G data taken from Baiyin, china, dataset collected from RNC of one month. (80 BS, 340 cells, 582 attributes)
Zhongshan Zhang, Hazrat Ali.	CDR dataset is obtained from Nodobo, which is a suite of software developed at the University of Strathclyde, which included grid id, received sent messages and calls.
Qiqi Zhu and Li Sun	The dataset is from telecom italia of the city Milan which is divided into 100x100 square grids which contains, received sent messages and calls.

Yutao Lu, Juan Wang, Miao Liu, Guan Gui, Tomoaki Ohtsuki.	Real 4G data from a certain network operator is used, The data contains KQI's (key quality indicators and has threshold for each of them.
Hussain, Bilal, Qinghe Du, Ali Imran.	The CDR is taken from the telecom Italia from LTE-A generated, divided network into subgrids.
Bilal Hussain, Qinghe Du, Pinyi Ren.	Data gathered from telecom italia , The spatiotemporal data contained over 10 million user activity logs for 10,000 cells spread across Milan, Italy.

ANOMALY DETECTION TECHNIQUE

1) Learning based methods

In this field learning means training the historical samples for obtaining prediction model, this process of learning model is called learning method. The learning method for detection of anomaly is of great approach for solving problems faced during anomaly detection by improving detection accuracy, false alarm rate, reducing false alarm and providing better security guarantee for the cellular network.

- a) *Rule based method*: The rule based technique is been used for anomaly detection in cellular networks. The idea behind this method is learning the historic data which is characterized into 'if' condition and 'then' condition. The 'if' condition part is called premise of the rule and 'then' condition part is called conclusion of the rule. In a given anomaly if the anomaly satisfies the premises condition, then we can say that premise of the rule is satisfied and if the anomaly satisfies the 'then' condition it is specified in the conclusion. The advantages of the rule based approach for anomaly detection is robust, dynamic and flexible. The detection rate of rule based technique is high compared to clustering based or statistical based.

In [21], the rule based anomaly detection is used for (CADM) CDR base anomaly detection method which is based on the analysis of the users call activities and it detects unusual user activity in cellular network. By analyzing CITYID and CELLID which are user location information in the city and users cellular network information respectively. This approach (CADM) detects the unusual activity of the user's location that changes quickly over a while. And the CADM also detects the location where the anomaly was detected.

- b) *Neural Network*: Neural network which is also referred as 'NN', NN is a inspired by biology which is a programming paradigm which enables a system or computer to learn unknown non linear map from observation. This is a well known machine learning approaches where it can be used for regression or classifier and it has been widely used in image recognition and speech recognition. For

implementing anomaly detection, the training data consists of cellular network measurement as NN input and anomaly will be labeled as NN output. The neural network is trained with learning algorithm and once the training completes, then the neural network can be used for detecting anomaly in input network measurement.

In [22] the semi-supervised neural network method is used for analyzing user activity here the data is extracted from CDR which is generated by cellular network for detecting abnormal behavior of the users. Semi-supervised learning is the combination of unsupervised learning and semi-supervised learning which uses large amount of marked data and marked data for pattern recognition. The semi-supervised learning brings out great efficiency that is why more attention is being given to the semi-supervised learning in this field.

c) *Ensemble method*: Since it is a supervised learning algorithm the ensemble method will work effectively if no single tradition anomaly detection method provided desired performance. The ensemble method is trained and then it is used for making decision. In this method it builds a set of models in a certain way, those decision are combined by un-weighted or weighted voting, and the ensemble methods gives better results when there is significant difference between models[23].

2) Statistical Anomaly detection methods

a) *Statistical based*: In statistic based anomaly detection technique, where the statistical models are applied for anomaly detection, it includes threshold based methods. PCA approach which is principle-component-analysis. In threshold based methods, the features are selected and then features are estimated with suitable statistical-model. And finally a threshold is marked/set to differentiate normal traffic from abnormal one. Here the main drawback is that threshold based techniques need prior knowledge about anomalous behavior for setting threshold. On the other hand PCA does not require any prior knowledge about anomalous behavior. In PCA the traffic data mapped to principle component in higher dimension are anomalous and remaining are normal traffic behavior of the network but PCA is sensitive to degree of unity of the data.

b) *Classification based*: In classification based category, there are several methods like decision tree, rule based method, support vector machine, Bayesian network and neural network. Classification based methods makes use of labeled data for making classifier learn and then apply the learned classifier for classifying an instance or test instance as anomalous or normal. Classification based detection methods are considered flexible but they require labeled data which requires significant human efforts to get one.

c) *Clustering based*: In clustering technique, it doesn't require pre-labeled data, which is why it is widely

used for anomaly detection. Here hierarchical clustering is used for identifying abnormal traffic by comparing it with normal. K-means clustering is used because of its ability to solve clustering problem of large datasets [5]. Before going into anomaly detection first let us know the basics of our network architecture. The network architecture diagram and its explanation is mentioned in the next section.

In [2][6], the clustering is used for anomaly detection where the hierarchical and k-means clustering is used. In [2], the anomalous behavior in LTE network with CDR is analyzed by using elbow method. After performing clustering on CDR data, the clusters with lowest objects are considered as anomaly. After the simulation results it is found that k-means clustering has lower complexity than hierarchical clustering.

Similarly in [6], the k-means clustering is used for detecting anomaly in cellular network with CDR, there the CDR data is cleaned on the bases of detection results to obtain anomaly free data and the anomaly free data is used for NN training and it used for traffic prediction of the users through ARIMA model for improving service quality.

3) Artificial intelligence based anomaly detection.

In [3] the artificial intelligence based anomaly detection framework is introduced where the cellular network is divided into 2 sub-grids and each has four BS (base station) and an edge server collocated with one of the base station, when LTE –A network generates the CDR from each cell from core network shared among its edge server and edge server processes them for detecting anomaly. After detecting anomalous cells, the edge server reports the anomalous cell ID to CN (core network) for curative actions.

CONCLUSION

Networks are becoming more complex by everyday because of never ending development of mobile technology and at the same time the security of the network also has to be taken into consideration. The security of the network needs more and more attention in order to maintain good quality of service. This paper gives a n overview of LTE network architecture, dataset, anomaly detection techniques in cellular network. And we believe that still more in depth knowledge is required in this area of field until it achieves solid maturity.

REFERENCES

- [1] Sun, Weijian, Xiaowei Qin, Shuang Tang, and Guo Wei. "A QoE anomaly detection and diagnosis framework for cellular network operators." In *2015 IEEE Conference on Computer Communications Workshops (INFOCOM WKSHPS)*, pp. 450-455. IEEE, 2015.
- [2] Parwez, Md Salik, Danda B. Rawat, and Moses Garuba. "Big data analytics for user-activity analysis and user-anomaly detection in mobile wireless network." *IEEE Transactions on Industrial Informatics* 13, no. 4 (2017): 2058-2065.

- [3] Hussain, Bilal, Qinghe Du, Ali Imran, and Muhammad Ali Imran. "Artificial intelligence-powered mobile edge computing-based anomaly detection in cellular networks." *IEEE Transactions on Industrial Informatics* 16, no. 8 (2019): 4986-4996.
- [4] Yang, Dujia, Dandan Miao, Xiaowei Qin, and Guo Wei. "A novel anomaly detection with temporal and spatial aggregation in mobile networks." In *2016 8th International Conference on Wireless Communications & Signal Processing (WCSP)*, pp. 1-5. IEEE, 2016.
- [5] Zhu, Qiqi, and Li Sun. "Big data driven anomaly detection for cellular networks." *Ieee Access* 8 (2020): 31398-31408.
- [6] Sultan, Kashif, Hazrat Ali, and Zhongshan Zhang. "Call detail records driven anomaly detection and traffic prediction in mobile cellular networks." *IEEE Access* 6 (2018): 41728-41737.
- [7] Ciocarlie, Gabriela, Ulf Lindqvist, Kenneth Nitz, Szabolcs Nováczki, and Henning Sanneck. "Dcad: Dynamic cell anomaly detection for operational cellular networks." In *2014 IEEE Network Operations and Management Symposium (NOMS)*, pp. 1-2. IEEE, 2014.
- [8] Hussain, Bilal, Qinghe Du, and Pinyi Ren. "Deep learning-based big data-assisted anomaly detection in cellular networks." In *2018 IEEE Global Communications Conference (GLOBECOM)*, pp. 1-6. IEEE, 2018.
- [9] Tanhatalab, Mohammad Rasoul, Hossein Yousefi, Hesam Mohammad Hosseini, Mostafa Mofarah Bonab, Vahid Fakharian, and Hadis Abarghouei. "Deep RAN: A Scalable Data-driven platform to Detect Anomalies in Live Cellular Network Using Recurrent Convolutional Neural Network." In *2020 IEEE 18th World Symposium on Applied Machine Intelligence and Informatics (SAMI)*, pp. 269-274. IEEE, 2020.
- [10] Casas, Pedro, Alessandro D'Alconzo, Pierdomenico Fiadino, and Christian Callegari. "Detecting and diagnosing anomalies in cellular networks using Random Neural Networks." In *2016 International Wireless Communications and Mobile Computing Conference (IWCMC)*, pp. 351-356. IEEE, 2016.
- [11] Ciocarlie, Gabriela F., Ulf Lindqvist, Szabolcs Nováczki, and Henning Sanneck. "Detecting anomalies in cellular networks using an ensemble method." In *Proceedings of the 9th international conference on network and service management (CNSM 2013)*, pp. 171-174. IEEE, 2013.
- [12] Yang, Kai, Ruilin Liu, Yanjia Sun, Jin Yang, and Xin Chen. "Deep network analyzer (DNA): A big data analytics platform for cellular networks." *IEEE Internet of Things Journal* 4, no. 6 (2016): 2019-2027.
- [13] Sun, Bo, Fei Yu, Kui Wu, Yang Xiao, and Victor CM Leung. "Enhancing security using mobility-based anomaly detection in cellular mobile networks." *IEEE Transactions on Vehicular Technology* 55, no. 4 (2006): 1385-1396.
- [14] Sukkhwatthani, Pichanun, and Wipawee Usaha. "Performance evaluation of anomaly detection in cellular core networks using self-organizing map." In *2008 5th International Conference on Electrical Engineering/Electronics, Computer, Telecommunications and Information Technology*, vol. 1, pp. 361-364. IEEE, 2008.
- [15] Hussain, Bilal, Qinghe Du, Sihai Zhang, Ali Imran, and Muhammad Ali Imran. "Mobile edge computing-based data-driven deep learning framework for anomaly detection." *IEEE Access* 7 (2019): 137656-137667.
- [16] Qin, Xiaowei, Shuang Tang, Xiaohui Chen, Dandan Miao, and Guo Wei. "SQoE KQIs anomaly detection in cellular networks: Fast online detection framework with Hourglass clustering." *China Communications* 15, no. 10 (2018): 25-37.
- [17] Lu, Yutao, Juan Wang, Miao Liu, Kaixuan Zhang, Guan Gui, Tomoaki Ohtsuki, and Fumiyuki Adachi. "Semi-supervised machine learning aided anomaly detection method in cellular networks." *IEEE Transactions on Vehicular Technology* 69, no. 8 (2020): 8459-8467.
- [18] Dridi, Aicha, Chérifa Boucetta, Seif Eddine Hammami, Hossam Afifi, and Hassine Mounsla. "STAD: Spatio-Temporal Anomaly Detection Mechanism for Mobile Network Management." *IEEE Transactions on Network and Service Management* 18, no. 1 (2020): 894-906.
- [19] Casas, Pedro, and Juan Vanerio. "Super learning for anomaly detection in cellular networks." In *2017 IEEE 13th International Conference on Wireless and Mobile Computing, Networking and Communications (WiMob)*, pp. 1-8. IEEE, 2017.
- [20] Boucetta, Cherifa, Boubakr Nour, Seif Eddine Hammami, Hassine Mounsla, and Hossam Afifi. "Adaptive range-based anomaly detection in drone-assisted cellular networks." In *2019 15th International Wireless Communications & Mobile Computing Conference (IWCMC)*, pp. 1239-1244. IEEE, 2019.
- [21] Karatepe, Ilyas Alper, and Engin Zeydan. "Anomaly detection in cellular network data using big data analytics." In *European Wireless 2014; 20th European Wireless Conference*, pp. 1-5. VDE, 2014.
- [22] Hussain, Bilal, Qinghe Du, and Pinyi Ren. "Semi-supervised learning based big data-driven anomaly detection in mobile wireless networks." *China Communications* 15, no. 4 (2018): 41-57.
- [23] Ciocarlie, Gabriela F., Ulf Lindqvist, Szabolcs Nováczki, and Henning Sanneck. "Detecting anomalies in cellular networks using an ensemble method." In *Proceedings of the 9th international conference on network and service management (CNSM 2013)*, pp. 171-174. IEEE, 2013.

Grama Vikas (Village Interaction System)

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Abstract:

The Grama Vikas Leads up to an idea of solving a set of problems which are related to day-to-day life of villagers as well as farmers. It includes the problems related to crops for farmers and various government schemes, apart from that a local villager can also use this system to get informational values related to the plants as well as medicinal values using OCR system and voice recognition system.

Plant diseases result in significant productivity and economic losses, as well as a decline in agricultural product quality and quantity large-scale crop monitoring, plant disease diagnosis is getting greater attention these days. Switching from one disease control approach to another is extremely challenging for farmers. Expert observation with the naked eye is the traditional method for detecting and identifying plant diseases in practice. Picture acquisition, some of the techniques include Pre-processing of images, feature extraction, and neural network-based categorizations are all included. A unique characteristic is the capacity to extract knowledge only by listening to noises. Because persons who are blind or visually handicapped can respond to noises, speech signals are a more effective way of communication than text. The aim of this study is to create a low-cost, user-friendly speech synthesis system based on optical character recognition (OCR). The Laboratory virtual instruments engineering workbench was used to create an OCR-based speech synthesis system.

Keywords:

Grama Vikas, Village Interaction System

INTRODUCTION

We are looking forward to make a system which consist of a simple interface as well easiest way for anyone who are illiterate to interact with the machine via voice, text or images to identify the problems and provide its solution in simple local language voice/text as per the user convenient. Thus, even provide others details such as governments funding as well as others schemes.

The other advantage includes to find infected crops condition by scanning them providing a desired solution. This feature can also be useful for farmers for medical treatment.

Leaf Disease Detection

India is predominantly an agricultural country, with agriculture employing the vast majority of its citizens. Agriculture research attempts to improve food quality and productivity, while cutting costs and improving profitability. A complex interaction of soil, seed, and agrochemicals results in the agricultural production system.

The most important agricultural products are vegetables and fruits. Product quality control is essential in order to obtain more valuable things. Plant diseases have been

shown in numerous studies to impair the quality of agricultural goods. Natural changes in a plant's health that impair or stop critical functions like photosynthesis are known as diseases, transpiration, pollination, fertilization, and germination are only a few examples.

These illnesses are brought on by pathogens like fungus, Bacteria and viruses, as well as unfavorable environmental circumstances, are all factors to consider. As a result, detecting plant disease at an early stage is crucial [1]. Farmers require continual specialized monitoring, which can be exorbitantly costly and time-consuming. As a result, it's vital to establish a rapid [2], low-cost, and accurate technique to identify infections from symptoms on plant leaves. Machine vision can be used for image-based automatic inspection, Robot guidance and process control The goal of this research is to see if plant leaf sickness can be diagnosed by looking at the texture of the leaf. The leaf has a number of advantages in all seasons over flowers and fruits [3], [4].

The portions of this paper are listed below. The Leaf disease identification is critical, as is plant leaf analysis, and the many types and symptoms of leaf illness are all covered in Section 1.

Section 2 delves into the specifics of contemporary research in this field. Section 3 contains a quick examination of various image processing approaches as well as fundamental methodology for leaf disease identification. Finally, part 4 brings this work to a close by outlining probable future directions.

1.1. An examination of plant diseases and their signs and symptoms

Agricultural science makes heavy use of RGB picture feature pixel counting algorithms. Image Analyses can be used for a variety of objectives, including:

1. To identify plant illnesses on the leaves, stems, and fruits.
2. To determine the extent to which a disease has affected an area.
3. To determine the impacted area's borders.
4. To find out what color the damaged area is
5. Fruit size and form are determined.

Herespond to some of the most common indications plant leaf diseases caused by fungi, bacteria, and viruses.

1.1.1. Symptoms of bacterial infection

The condition is distinguished by little specks of pale green that quickly appear wet. As seen in figure 1(a), the lesions expand and eventually seem as barren, lifeless areas; for example, leaf spot caused by bacteria generates water-soaked patches on the foliage that are brown or

black, frequently surrounded by a bright halo, that are all nearly the same size. When the spots have dried, they appear speckled.

1.1.2. Symptoms of viral illness

Viruses create the most challenging plant leaf diseases to treat, identify of all plant leaf diseases. Viruses have no obvious symptoms and are often confused with food shortages and chemical poisoning. Figure 1 shows how to look for stripes that are yellow or green in color or patches on leaves. This sickness is spread by Cucumber aphids, leafhoppers, whiteflies, and aphids beetle insects, e.g., Mosaic Virus (b). Leaves may be wrinkled, curled, or stunted in growth.



(a) Bacterial leaf spot



(b) mosaic virus

figure1. On the leaves, there are bacterial and viral diseases.

1.1.3. Symptoms of fungal infection

Some of the fungus-caused plant leaf diseases are addressed below and illustrated in Figure 2, for example, the fungus *phytophthora infester's* causes late blight, as shown in Figure 2. (a). It first On lower, older leaves, it appears as water-soaked gray-green blotches. These patches darken as the fungal condition progresses, On the undersides, white fungal growth emerges. The fungus *Alter aria solani* (seen in figure 2) causes early blight (b). Concentric rings of little brown dots produce elder leaves, on their upper surfaces; downy mildew causes yellow to white blotches. Develop initially on the lower, older leaves. On the undersides, these sections are coated with a white to greyish coating, Figure 2 illustrates this (c).

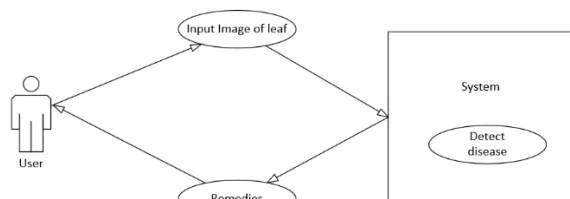
bull's eye pattern. When disease matures, it spreads outward on the leaf surface causing it to turn yellow. In



(a)Blight in its last stages. (b) Blight in its early stages. (c) mildew(downy)

Figure 2. Fungal disease on leaves

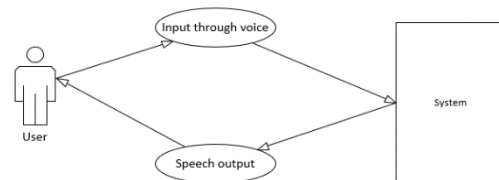
Use case Diagram: Leaf Disease Detection



OCR/ Voice

The duplication of human functions, such as reading, by machines is an old goal. Machine reading, on the other hand, has progressed from a pipe dream to a reality during the previous few decades. Text is ubiquitous in our daily lives, whether it's in the form of a document or not (newspapers, books, mail, magazines, etc.) or natural settings (signs, screens, schedules) that may be read by the average person. Unfortunately, due to their vision impairments, People who are blind or visually challenged are refused access to such material. Prevent them from accessing textual information, limiting their movement in open spaces. The OCR based voice synthesis technology will considerably increase the visually impairer's ability to engage with their surroundings in the same way that sighted people do.

Use Case Diagram: Voice to Voice

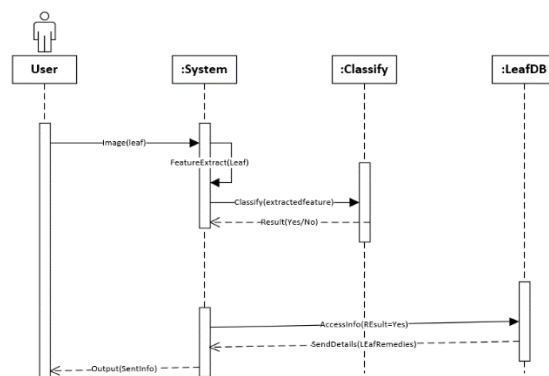


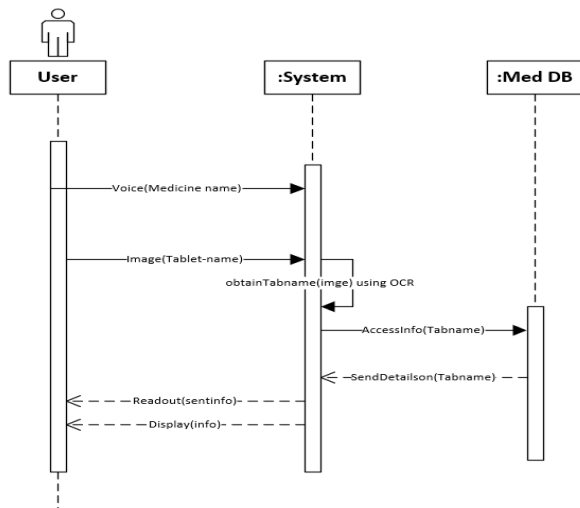
METHODOLOGY

As illustrated in fig.3, there are five primary steps for identifying infections on plant leaves. The processing system includes picture capture using a digital camera or the internet, picture enhancement and image segmentation are examples of pre-processing (Where the regions that are damaged and those that are usable are separated). extraction and classification of features. Last but not least, the presence of disease on the plant's leaf will be determined. Collect RGB photographs of leaf samples was the initial stage. A step-by-step procedure is provided below:

- 1) RGB image acquisition;
- 2) color space conversion of the input image;
- 3) Component segmentation;
- 4) Extraction of important segments;
- 5) Texture feature computation;
- 6) Neural network configuration for recognition

Sequential Diagram: Leaf Database and Medicine Values

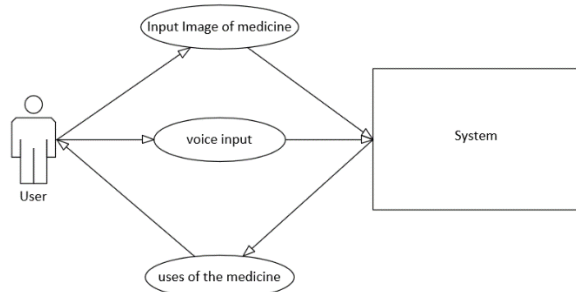




The translation of a document into a mechanical or electronic form, photographs of handwritten or convert printed text into editable text Optical character recognition (OCR) is the term used to describe the process of (OCR) [12]. The process phases for the OCR-based system are as follows:

- Photo capture
- Photo preprocessing (Finalization)
- Photo segmentation
- Recognition & matching

Use Case Diagram: Prescription Reading



LITERATURE SURVEY

1. Convolutional Neural Networks are used by an A self-driving robot will detect damaged leaves in plants..

Author: Prasad S.A Kesava; K P Peeyush

Published in: The 3rd International Conference on Electronics and Informatics was held on 2019 (ICOEI)

Abstract: The major goal of this suggested project is to create a robot that can distinguish damaged leaves from healthy leaves. A robot is equipped with a smartphone camera that sends live footage to a laptop for image analysis. The suggested system employs an Arduino Uno for robot navigation. The robot will be equipped with a four-wheel drive system. The diseased leaves are detected using the help of a Convolutional Neural Network (CNN) from a set of normal and diseased leaves.

Algorithm -: Convolutional Neural Network (CNN)

2. Voice-activated personal assistant on a laptop (Neobot)

Author: Jitendra Kumar; Piyush Vashistha; Juginder Pal Singh; Pranav Jain

Publisher: On 2019 was held the 3rd International Conference on Electronics, Communication, and Aerospace Technology (ICECA).

Abstract: This project's objective is to create a personal assistant using a laptop as a processor chip and underlying architecture. It stresses the use of ambient technologies, robotics, and IoT to replace screen-based interaction, implying that the user interface is merged with the physical device. It includes components such as IR sensors, a Pi camera [6], a microphone, and a motor driver. It's a voice-controlled personal assistant that can read material from photographs and then communicate it to the customer using the built-in speaker. **Connectionist Temporal Classification (CTC).**

Algorithm -: Connectionist Temporal Classification (CTC).

3. Design and Implementation of Text to Speech Conversation

Name of Author: - Itunuoluwa Isewon

Year of Publication: -2019

Summary of the Paper: - This paper only focuses on Blind person. It only works for Stored Samples.

Similarities /Differences: - NLP based implementations high in accuracy

Algorithm: - A Text to speech synthesizer

4. Deep learning is being used to detect disease in plant leaves.

Author: HalilDurmuş.

Published in: The 6th International Conference on Agro-Geoinformatics was held on 2018.

Abstract: This project's objective is to identify illnesses that affect tomato plants in fields or greenhouses. On the one hand, deep learning was utilized to detect numerous diseases on the other hand. tomato plant leaves for this purpose. The goal of the project was to have the On the robot, a deep learning system is running in real time. As a result, the robot will be able to detect a variety of objects plant illnesses while travelling on the field or in the greenhouse, either manually or automatically. Similarly, illnesses can be diagnosed using close-up pictures of plants. Physical alterations within the tomato plant's leaves are caused by the diseases studied in this study. RGB cameras can detect these changes in the leaves.

Algorithm: - Deep learning algorithm.

5. Using a Multi-Support Vector Machine, we can classify leaf diseases.

Author: R. Ramalakshmi; V. Ramachandran; A. Jenifa

Published in: 2019 IEEE International Conference.

Abstract: This study proposes cotton The Multi-Support Vector Machine (MSVM) was used to classify leaf diseases. The suggested system takes automatic snapshots of the crops at every stage and processes them at an early stage to identify defects, preventing the farmer from losing both money and products. The above-mentioned multi-SVM approach is used to create models that are either human or robot supervised.

Image processing has been applied in order to catch leaves at critical stages.

Algorithm: - Multi-SVM algorithm.

6. Village People's Robotic Personal Assistant with Voice Control

Author: U.K. Jishnu; Indu V.; K.J. Ananthakrishnan; KoradaAmith; P Sidharth Reddy; Pramod S. Jishnu

Publication: In the year 2020, the 5th International Conference on Communication and Electronics Systems (ICCES) was taken place (ICCES)

Abstract: The robot personal assistant aids people in their day-to-day duties by reducing their manual efforts. This study outlines the creation of a personal assistant robot that can pick up long and short distance things using voice commands. The android smartphone is sandwiched between the robot and the robot, Bluetooth is utilized to communicate. A camera and a robotic arm are likely to be included on the four-wheeled robot. The camera is put to use to detect objects, estimate distances, and pick and arrange items using a robotic arm. It can be used in a variety of ways, including chemical industries and healthcare for the crippled and aged.

Algorithm: - Voice detection algorithm

7. A Review of the Most Up-to-Date IoT Sensors for Non-Food Crops in Agriculture

Author: H. R. Vinutha Priya, N. Sneha.

Published: 2019-04-01

Abstract: Precision Agriculture's purpose is to build a method of farm management that takes advantage of the digital age to produce crops, as well as how IoT sensors are being used to improve agriculture and generate profit. It employs GPS, GNS, and remote sensors, drones, and other technologies. Non-food crops must be domesticated. What are In this research, are IoT sensors used in non-food crops? What are the primary factors that influence crop development, particularly non-food vegetation, which is a source of income? How kilometers are used in farms, as well as their restrictions and demands. Additionally, Sensors for key non-food crop features, a specialized device requirement, and wireless communications technologies linked to IoT in agriculture have all been identified.

Algorithm: - Hybrid Algorithm.

8. A Chiral Pesticide Sensor Made on Acetyl cholinesterase-Modified Graphene

Author: Yunpeng Zhang, Xiaotoung Lui, Shi Qiu, Qiuqi Zhang, Wei Tang, Hongtao Lui, Yunlong Guo*, Yongqiang Ma*, Xiaojun Guo*, Yunqi Liu* Yunpeng

Zhang, Xiaotoung Lui, Shi Qiu, Qiuqi Zhang, Wei Tang, Hongtao Lui, Yun

Published in: J. Am. Chem. Soc. 2019, August 26, 2019 <https://pubs.acs.org/doi/abs/10.1021/jacs.9b05724>

Abstract: Graphene-based sensors due to their excellent sensitivity, biocompatibility, and low cost, are attractive technologies for chemical and biological detection.. However, graphene sensors are still unable to distinguish between enantiomers when it comes to chiral identification, which is critical in biological systems. By modifying graphene with acetyl cholinesterase and utilising As one example, chiral pesticide compounds, we were able to create a very sensitive graphene chiral sensor (Ache). According to quantum chemical simulations, the enantiomer's inhibitory action On the other hand, Ache was transferred to graphene., enabling in order to find chiral chemicals using electricity. The device's sensitivity for (+)/ (-)-methamidophos was 0.34 g/l and 0.32 g/l, respectively, at a 1 V working voltage, which is significantly greater than 6.90 mg/l circular dichroic and 5.16 mg/l circular dichroic, respectively. In addition, real-time, quick detection is available.

Algorithm: - Hybrid Algorithm.

9. In Egypt's calcareous soils, the Green Seeker active optical sensor was used to optimise maize nitrogen fertiliser.

Author: Ali Mohamed Ali, Ibrahim Abou-Amer & Sheriff Mahmoud Ibrahim.

Published in: Accepted author version online: November 28, 2018, Published online: December 2, 2018.

Abstract: Sensor-based nitrogen (N) management systems offer the potential to increase N fertiliser efficiency while lowering the amount of lost N entering the environment. Egypt produces maize on calcareous soil west of the Nile Delta; An active optical sensor was used to evaluate a need-based N management strategy. During 2015 and 2016, field tests were done in two locations to design and validate an algorithm for optimising N fertiliser application. In an experiment done in 2015 at two distinct locations, to create plots with different yield potentials, an increasing rate of N fertiliser was applied. The experiment was conducted, which took place in 2016, was designed to validate the existing sensor algorithms. The best growth stage was found to be V9 (9th leaf collar fully unfurled).

Algorithm -: CNN & Chemical Detection Algorithm

10. Detection of Fungal Diseases in Plants Using photo Processing

Author - Jagadeesh D.Pujari

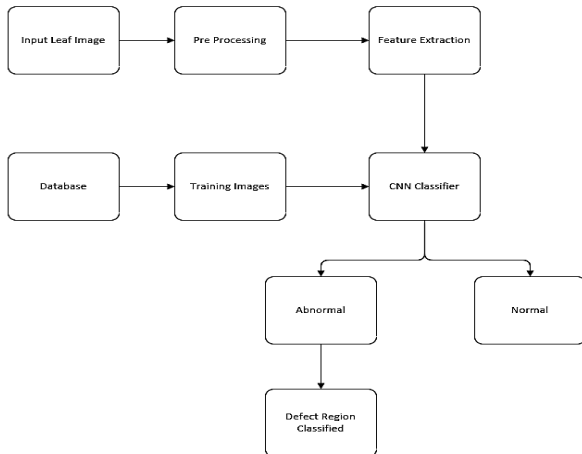
Publish – 2019 (ELSEVIER)

Abstract - The paper describes a research of pixels processing algorithms for identifying and classifying fungal disease symptoms in various agriculture/horticulture crops. Computers have been utilised in agricultural production and protection studies

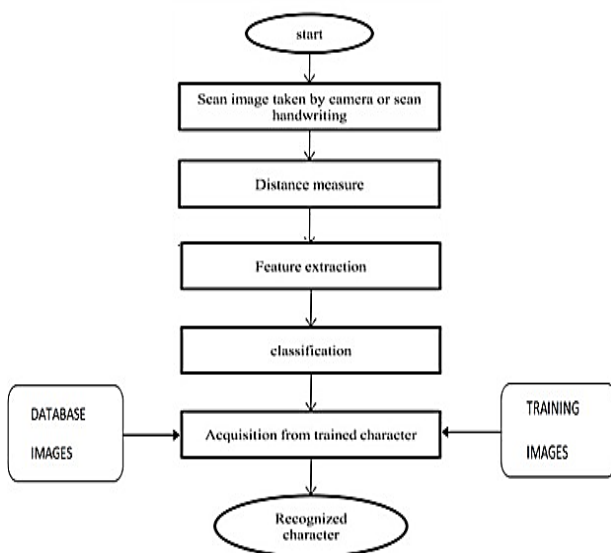
for mechanization, automation, and the development of decision support systems.

Algorithm - Color Enhancement Algorithm

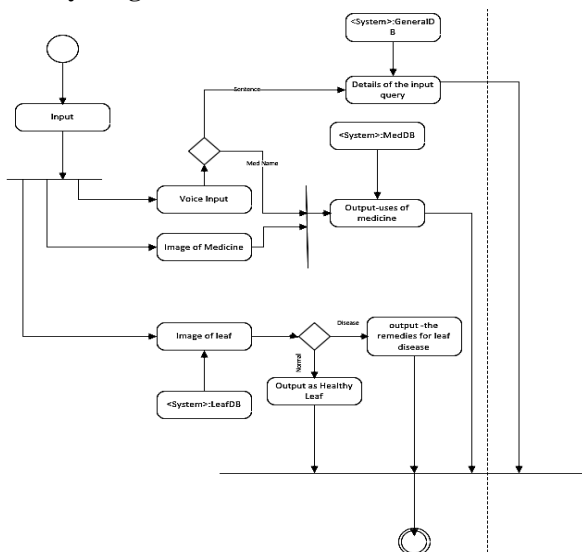
Data Flow Diagram: Leaf Disease Detection



Data Flow Diagram: Image Detection



Activity Diagram:



CONCLUSION

This study looked into a voice synthesis system based on OCR (which can be used as an effective means of communication between people). OCR and speech synthesis are part of the developed system. IMAQ Vision for Lab VIEW was used to scan Obtain an image in OCR from printed or written character documents. Algorithms for segmentation and correlation were created in Lab VIEW were used to recognize the various characters. The second component uses Microsoft Speech Object Library to turn recognized text into speech (V 5.1). The created OCR based voice artificial system is simple to use, lower priced, and provides real-time results. Furthermore, the application provides the necessary flexibility to be readily updated if necessary.

It also includes a summary of image processing techniques for

Combining all these conclusions we are getting a system for village thus named as GRAMA VIKAS (VILLAGE INTERACTION SYSTEM).

REFERENCES

- [1] Anand H. Kulkarni, Ashwin Patil R. K., applying image processing technique to detect plant diseases, International Journal of Modern Engineering Research, vol.2, Issue.5, pp: 3661-3664, 2012.
- [2] F. Argenti, L. Alparone, G. Benelli, "Fast algorithms for texture analysis using co-occurrence matrices" Radar and Signal Processing, IEE Proceedings, vol. 137, Issue 6, pp:443-448, No. 6, December 1990.
- [3] P. Revathi, M. Hemalatha, Classification of Cotton Leaf Spot Diseases Using Image Processing Edge Detection Techniques, IEEE International Conference on Emerging Trends in Science, Engineering and Technology, pp:169-173, Tiruchirappalli, Tamilnadu, India, 2012.
- [4] Tushar H. Jaware, Ravindra D. Badgujar and Prashant G. Patil, Crop disease detection using image segmentation, National Conference on Advances in Communication and Computing, World Journal of Science and Technology, pp:190-194, Dhule, Maharashtra, India, 2012.
- [5] Prof. Sanjay B. Dhaygude, Mr. Nitin P. Kumbhar, Agricultural plant Leaf Disease Detection Using Image Processing, International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, S & S Publication vol. 2, Issue 1, pp: 599-602, 2013.
- [6] Mokhled S. Al-Tarawneh an Empirical Investigation of Olive Leaf Spot Disease Using Auto-Cropping Segmentation and Fuzzy C-Means Classification, World Applied Sciences Journal, vol.23, no.9, pp:1207-1211, 2013.
- [7] Yan-Cheng Zhang, Han-Ping Mao, Bo Hu, Ming - Xi Li, Feature Selection of Cotton Disease leaves Image Based on Fuzzy feature Selection Techniques, Proceedings of the 2007 International Conference on Wavelet Analysis and Pattern

- Recognition, pp:124-129, Beijing, China, Nov. 2007.
- [8] Haiguang Wang, Guanlin Li, Zhanhong Ma, Xiaolongbao Li, Image Recognition of Plant Diseases Based on Back propagation Networks, 5th International Congress on Image and Signal Processing, pp-894-900, Chongqing, China, 2012
- [9] [9] Simona E. Grigorescu, Nicolai Petkov, and Peter Kruizinga, Comparison of Texture Features Based on Gabor Filters, IEEE ransaction on Image Processing, vol. 11, No. 10, pp-1160-1167, oct 2002.
- [10] S. Arivazhagan, R. Newlin Shebiah, S. Ananthi, S. Vishnu Varthini, Detection of unhealthy region of plant leaves and classification of plant leaf diseases using texture features, Commission Internationale du Genie Rural (CIGR) journal, vol. 15, no.1, pp:211-217, March 2013.
- [11] Dheeb Al Bashish, M. Braik, and S. Bani-Ahmad, A Framework for Detection and Classification of Plant Leaf and Stem Diseases, 2010 International Conference on Signal and Image Processing, pp: 113-118, Chennai, India, 2010.
- [12] Song Kai, liu zhikun, Su hang, Guo crunching, A Research of maize disease image recognition of Corn Based on BP Networks, Third International Conference on Measuring Technology and Mechatronics Automation, pp:246-249, Shenyang, China, 2011.
- [13] H. Al-Hiary, S. Bani-Ahmad, M. Reyalat, M. Braik and Z. ALRahamneh, Fast and Accurate Detection and Classification of Plant Diseases, International Journal of Computer Applications, Wageningen Academic publishers, vol. 17, no.1, pp: 31-38, March 2011.
- [14] A.Menukaewjinda, P.Kumsawat, K.Attakitmongcol, A.Srikaew, Grape leaf disease detection from color imagery using hybrid intelligent system, Proceedings of electrical Engineering/electronics, Computer, Telecommunications and Information technology (ECTI-CON), vol 1. pp: 513-516, Krabi, Thailand, 2008.
- [15] Haiguang Wang, Guanlin Li, Zhanhong Ma, Xiaolong Li, Image Recognition of Plant Diseases Based on Principal Component Analysis and Neural Networks, 8th International Conference on Natural Computation, pp-246-251, Chongqing, China, 2012.
- [16] S.M.A. Haque, et al. Automatic detection and translation of bengali text on road sign for visually impaired Daffodil Int. Univ. J. of Sc. and Tech, 2 (2007) Google Scholar
- [17] N. Ezaki, et al. Text detection from natural scene images: Towards a system for visually impaired persons In Proceedings of the International Conference on Pattern Recognition (2004), pp. 683-686 View Record in ScopusGoogle Scholar
- [18] T. Yamaguchi, et al. Digit classification on signboards for telephone number recognition In Proceedings of 7th International Conference on Document Analysis and Recognition (2003), pp. 359-363 View Record in ScopusGoogle Scholar
- [19] K. Matsuo, et al. Extraction of character string from scene image by binarizing local target area Trans. of The Ins. of Elec. Eng. of Japan, 122-C (2) (2002), pp. 232-241 CrossRefGoogle Scholar
- [20] T. Yamaguchi, M. Maruyama Character Extraction from Natural Scene Images by Hierarchical Classifiers In Proceedings of the International Conference on Pattern Recognition (2004), pp. 687-690 View Record in ScopusGoogle Scholar
- [21] J. Yang, et al. An automatic sign recognition and translation system Proceedings of the Workshop on Perceptive User Interfaces (2001), pp. 1-8 ArticleDownload PDFGoogle Scholar
- [22] H. Li, et al. Automatic Text Detection and Tracking in Digital Video IEEE Trans. on Im. Proc, 9 (1) (2000), pp. 147-156 View Record in ScopusGoogle Scholar
- [23] B.B. Chaudhuri, U. Pal A complete printed bangla OCR system Pat. Rec, 31 (1997), pp. 531-549 Google Scholar
- [24] A.O.M. Asaduzzaman, et al. Printed bangla text recognition using artificial neural network with heuristic method Proceedings of International Conference on Computer and Information Technology (2002), pp. 27-28 View Record in ScopusGoogle Scholar
- [25] T. Sato, T. Kanade Video OCR: Indexing digital news libraries by recognition of superimposed caption ICCV Workshop on Image and Video retrieval (1998), pp. 1-10 Google Scholar
- [26] T. Dutoit High quality text-to-speech synthesis: a comparison of four candidate algorithms IEEE International Conference on Acoustics, Speech, and Signal Processing (1994), pp. 19-22 Google Scholar
- [27] B.M. Sagar, et al. OCR for printed Kannada text to machine editable format using database approach WSEAS Trans. on Computers, 7 (2008), pp. 766-769 View Record in ScopusGoogle Scholar

A Study on Enriching the Work-Life Balance in the Light of the Bhagavad Gita

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Abstract:

Introduction: The new normal world order, where the private and professional spheres of individuals are blurred and affected, warrants a revisit on individuals' work-life balance situation.

Objective: The paper deliberates on enriching the psycho-physical dimension of individuals' work-life balance in the light of the Bhagavad Gita's spiritual perspectives.

Methodology and Discussion: The methodology and discussion of the concept-based paper involves deducing and presenting: (a) the four factors that are vital/central to the work-life balance, namely, efficiency and satisfaction, priorities and time management, conflict and bonding, and control of multiple roles. (b) the appropriate spiritual perspectives of the Bhagavad Gita, and (c) the take-away for enriching the work-life balance.

Conclusion: The spiritual perspectives of the Bhagavad Gita, that enriches all dimensions of work-life balance, has the potency to visualize a paradigm shift from work-life balance to a comprehensive work-life synthesis.

Keywords:

Psycho-physical Environment, Spiritual Perspectives, The Bhagavad Gita, Work-life Balance, Work-life Synthesis

INTRODUCTION

The new normal world order, primarily influenced by the pandemic and its resultant uncertainty, impacts the private and professional domains of individuals. The physical, psychological and social aspects of individuals as well as business interests in the form of investment, production, distribution and consumption of goods and services, experience the challenges posed by the new normal. This situation, where the private and professional spheres of individuals are blurred and affected, warrants a revisit on individuals' work-life balance situation.

Work-Life Balance

Work-life balance may be understood as a conscious effort by individuals to effectively balance their 'work' (career/professional and its associated satisfaction) on the one hand, and 'life' (family/personal and its associated satisfaction) on the other. This 'balance' may be perceived as (a) balancing of multiple roles, (b) balance of equity among multiple roles, (c) balance of satisfaction among multiple roles, (d) balance of fulfillment of role salience among multiple roles, (e) balance of relationship between conflict and facilitation, and (f) balance of control among multiple roles. Let us briefly see the definitions under each perception.

(a) Work-life balance as a balance of multiple roles

The work-life balance may be perceived as individuals act of balancing multiple roles. According to Greenhuns, Collins and Shaw (2003, 511) 'Work-family balance reflects an individual's orientation across different life roles, an inter-role phenomenon'.

(b) Work-life balance as equity among multiple roles

The work-life balance may be perceived as equality among individuals' multiple life roles. In fact, Greenhuns, Collins and Shaw (2003, 513) have also underlined this conception when they define work-life balance as 'the extent to which an individual is engaged in-and equally satisfied with-his or her work role and family role We propose three components of work family-balance; time balance, involvement balance, and satisfaction balance'.

(c) Work-life balance as satisfaction among multiple roles

The work-life balance may be perceived as individuals' satisfaction with multiple roles. Kirchmeyer (2000, 80) defines work-life balance as 'achieving satisfying experiences in all life domains and to do so requires personal resources such as energy, time, and commitment to be well distributed across domains'.

(d) Work-life balance as fulfillment of role salience between multiple roles

The work-life balance may be perceived not only as individuals' satisfaction with multiple roles, but also the fulfillment of the varying importance (Salience) of multiple roles to them. Greenhaus and Allen (2006) are of the opinion that work-life balance may be seen as the extent to which an individual's effectiveness and satisfaction in work and family roles are compatible with the individuals' life role priorities at a given point in time.

(e) Work-life balance as relationship between conflict and facilitation

The work-life balance may be perceived as a relationship between absence of conflict and presence of facilitation. Work-life conflict emerges due to the non-compatibility of demands that work and life place on individuals. In other words, the demand on work makes it difficult to fulfill the demands on life and vice versa. In the words of Frone (2003, 145) 'low levels of inter-role conflict and high levels of inter-role facilitation represents work-family balance'.

(f) Work-life balance as a control among multiple roles

The work-life balance may be understood as the degree of control/autonomy that individuals perceive themselves to possess over their multiple role demands. According to Fleetwood (2007, 351) ‘Work-life balance is about people having a measure of control over when, where and how they work’.

Factors influencing work-life balance

From the foregone elucidation of the definitions, we may deduce the following important factors that are vital/central to the work-life balance. They are: (1) Efficiency and Satisfaction (2) Priorities and Time Management (3) Conflict and Bonding, and (4) Control of multiple roles. The above factors may be enriched for effective work-life balance.

OBJECTIVE OF THE PAPER

The paper deliberates on enriching the psycho-physical dimension of individuals work-life balance in the light of the Bhagavad Gita’s spiritual perspectives. The Bhagavad Gita is a comprehensive spiritual manual that expounds the intra-personal dimensions of individuals.

METHOD OF THE PAPER

The method of the concept-based paper involves deducing and presenting: (a) the four factors that are vital/central to the work-life balance, (b) the appropriate spiritual perspectives of the Bhagavad Gita, and (c) the take-away for enriching the work-life balance.

DISCUSSION

Let now proceed to discuss each of the four vital factors that enriches the work-life balance through empowering the individual.

(1) Efficiency and Satisfaction

Efficiency of individuals in work roles leads to enhanced productivity. Efficiency of individuals in non-work/private roles fulfills the expectations. It is common knowledge that individuals aspire satisfaction in whatever roles they perform, be it work or private/personal. Thus, efficiency and satisfaction happens to play a vital part in the work-life balance of individuals.

The Bhagavad Gita’s Spiritual Perspectives on Efficiency and Satisfaction

The Bhagavad Gita points out that in order to maintain a healthy physical body, individuals must consciously avoid extremes (complete indulgence or complete abstinence) regarding food and sleep (*Chapter VI, Verse 16, Volume. 2, p. 135*), body postures (*Chapter VI, Verse 13, Volume. 2, p. 132*) as well as recreation and work (*Chapter VI, Verse 17, Volume. 2, 136*).

According to the Bhagavad Gita, work/action must be performed as *Karmayoga*. The term ‘*Karma*’ refers to ‘duty/intention’ and ‘*Yoga*’ refers to ‘dexterity in action’. The Bhagavad Gita proclaims that any action/work must be performed as one’s own duty or on one’s own

intention and not based on the results of that action/work performed. (*Chapter II, Verses 47-49, Volume. 1, pp. 177-192*).

Takeaways for Enriching Work-life Balance

Physical efficiency requires a healthy physical body. The Bhagavad Gita’s prescription for a healthy physical body, when inculcated, would enable individuals to choose a ‘middle path’ approach towards life in terms of factors such as work, food, sleep and leisure. This would ensure physical efficiency in individuals, thereby enhancing work-life balance. It may be pointed out here that the middle-path approach is not only effective for managing individuals, but also organizations and society.

The Bhagavad Gita’s advocacy of *karmayoga* enables the following learning for individuals: Firstly, the term ‘*yoga*’ itself denotes performing any action in an efficient manner. This perception empowers individuals to perform any action, be it work roles or non-work/personal roles, with at most efficiency. Secondly, the term ‘*karma*’ denotes duty/intention in the performance of any action. This perception ensures that the satisfaction of individuals lies in performing any action based on duty/intention. Here, we may observe that satisfaction is not linked with the result of the action. It is common knowledge that satisfaction based on result brings in expectations, uncertainty, stress and so on. Therefore, when actions are performed based on duty/intention, there emerges a positive sense of responsibility, interest, efficiency and satisfaction, in individuals.

Thus, we are able to observe that the Bhagavad Gita’s spiritual perception of *karmayoga* empowers individuals with enhancing the vital factors of efficiency and satisfaction that would enrich the work-life balance.

(2) Priorities and Time Management

In the present fast-paced life style, where performance of work and non-work roles is a race against time, the notion of priorities takes centre-stage. Priority-setting is a skill that involves taking into consideration a number of factors and parameters. Similar is the case with time management. No doubt, priorities and time management plays a vital part in the work-life balance of individuals.

The Bhagavad Gita’s Spiritual Perspectives on Priorities and Time Management

While discussing the nature of mind, the Bhagavad Gita proclaims two techniques for individuals, namely, (a) a spirit of discrimination by renouncing (*vairagya*) the unwanted and holding-on to the important factors, and (b) the constant practice (*abhyasa*) of the same (*Chapter VI, Verse 35, Volume. 2, p. 159*).

Takeaways for Enriching Work-life Balance

The Bhagavad Gita’s spiritual perspective of discriminating renunciation, when inculcated, would enable individuals to prioritize based on roles that are more important/urgent for them to achieve their life’s objectives (short and long run). This parameter may also

be used to delegate and eliminate tasks. When roles are prioritized, the given time is optimally utilized.

It is a common adage that practice makes a man perfect. The Bhagavad Gita's emphasize on the constant practice of the above technique would enable individuals to be more consistent in prioritizing their role schedules in order to achieve their objectives of life. It would assist them with more focus and stability.

Thus, we are able to observe that the Bhagavad Gita's spiritual perception of discriminating renunciation and practice empowers individuals with enhancing the vital factors of priority and time management that would enrich the work-life balance.

(3) Conflict and Bonding

In the present scenario, characterized by work-from-home situation, individuals are increasingly called upon to address the challenges posed by their multiple role engagement. This situation often leads to the emergence of work-life conflict. Work-life conflict occurs: (a) when family and personal responsibilities infringe upon work demands and (b) when work responsibilities infringe upon family/private demands/needs. Work-life conflict breaks the sense of bonding affecting both work as well as life domains of individuals. Thus, conflict and bonding are in inverse relationship and both the factors happens to play a vital part in the work-life balance of individuals.

The Bhagavad Gita's Spiritual Perspectives on Conflict and Bonding

The Bhagavad Gita states that individuals may attain a state of emotional stability - *sthitaprajna* (Chapter II, Verse 72, Volume 1, p. 247) characterized by a strong mind, not shaken by adversity & duality, free from fear (Chapter II, Verse 56, Volume 1, p. 221), has complete control over attachment or detachment (Chapter II, Verse 57, Volume 1, p. 225), experiences peace (Chapter II, Verse 71, Volume 1, p. 246) and tranquility (Chapter II, Verse 52, Volume 1, p. 209).

Further, the Bhagavad Gita proclaims that individuals may get established in a state of same sightedness (*samadarsana*) i.e., seeing the Self (*atman*) as residing in all beings and all beings as residing in the Self (Chapter V, Verse 18, Volume 2, p. 67).

Takeaways for Enriching Work-life Balance

The Bhagavad Gita's spiritual perspective of emotional stability, when inculcated, would enable individuals to have a great degree of control over their emotions, in all situations. A little reflection on the work-life conflict would show that conflicts at work or life roles are external to the individuals and therefore, they have limited influence over it. What is under the control of individuals is their internal emotional stability and its reflected attitude towards work-life conflicts. Therefore, individuals with emotional stability would adequately respond and mitigate the challenges of the external work-life conflict. This would also result in improving the social bonding among individuals

The Bhagavad Gita's perception of same sightedness would enable individuals to inculcate a strong sense of empathy towards others during the course of their work and non-work/personal roles. This virtue would not only mitigate work-life conflict, but also positively enhance social bonding among individuals.

Thus, we are able to observe that the Bhagavad Gita's spiritual perception of emotional stability and same sightedness empowers individuals with enhancing the vital factors of conflict mitigation and bonding that would enrich the work-life balance.

(4) Control of Multiple Roles

In the present-day world, a sense of control over multiple roles is an important skill to acquire and cherish for individuals. This is so because roles (both work and non-work/personal) have become more complex, dynamic and unexpected, demanding the complete attention and focus of individuals. In such a scenario, individuals possessing a sense of control over multiple roles is a highly positive feature that plays a vital part in the work-life balance of individuals.

The Bhagavad Gita's Spiritual Perspectives on the Control of Multiple Roles

The Bhagavad Gita points out the positives of controlling important intra-personal factors in individuals such as the senses (Chapter II, Verse 58, Volume 1, p. 225), desires (Chapter II, Verse 55, Volume 1, p. 214), anger (Chapter II, Verse 56, Volume 1, p. 221) and the mind (Chapter II, Verse 57, Volume 1, p. 225).

Takeaways for Enriching Work-life Balance

The Bhagavad Gita's spiritual perspective of intra-personal factor-control, when inculcated, would enable individuals to possess a greater degree of control over their mind-set and emotions. A little reflection on the control of multiple roles would show that these roles (at work or life) are external to the individuals and therefore, they have limited influence over it. What is under the control of individuals is their internal mind-set and emotions and its reflected attitude towards multiple roles. Therefore, individuals with intra-personal factor-control would adequately respond and mitigate the challenges of the external multiple roles.

Thus, we are able to observe that the Bhagavad Gita's spiritual perception of controlling the intra-personal factors such as the senses, desire, anger and the mind empowers individuals to appropriately address issues emerging out of multiple roles. This would adequately enrich the work-life balance.

CONCLUSION

From the deliberations on the definitions of work-life balance, we are able to deduce the four factors that are central to the work-life balance, namely, efficiency and satisfaction, priorities and time management, conflict and bonding, and control of multiple roles.

We may state that a discussion on the concept of work-life balance, in the light of the spiritual perspectives of

the Bhagavad Gita, brings out a number of vital intra-personal guidelines such as the middle-path approach and duty/intention based action, renunciation and its practice, emotional stability and same sightedness, control of the senses, desire, anger and the mind, for empowering individuals to comprehensively address the various issues involved in work-life balance.

We may observe that the spiritual perspectives of the Bhagavad Gita has the potency to not only enrich the individual's psycho-physical environment, but also the work/professional environment and the family/private life environment, of work-life balance.

Let us conclude by stating that the inputs from the spiritual perspectives of the Bhagavad Gita propels to visualize a journey/movement from the paradigm of work-life balance to a paradigm of a comprehensive and harmonious work-life synthesis.

REFERENCES

- [1] Fleetwood S (2007) Why work-life balance now?, *The International Journal of Human Resource Management*, 18, pp. 387-400.
- [2] Frone M R (2003) Work-Family balance, in Quick J C & Tetrick L E (Eds), *Handbook of Occupational Health Psychology*, Washington DC: American Psychological Association.
- [3] Greenhuns J H & Allen T D (2006) *Work-family balance: Exploration of a concept*, paper presented at the Families and Work Conference, Provo, UT.
- [4] Greenhuns J H, Collins K M and Shaw J D (2003) The relation between work-family balance and quality of life, *Journal of Vocational Behavior*, 63, pp. 510-531.
- [5] Kirchmeyer C (2000) Work-life initiatives: Greed or benevolence regarding worker's time, in C L Cooper and D M Rousseau (Eds), *Trends in Organisational Behaviour*, Chichester: John Wiley & Sons.
- [6] Swami Ranganathananda (2010), *Universal Message of the Bhagavad Gita*, Volume. 1-3, First Edition, Sixth Impression, Kolkata

Detection of COTS-Starfish in Underwater Image using Convolution Neural Networks: A Survey

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Abstract:

With the rapid escalation of digital cameras and technology, community people can acquire a huge number of images for quantitative analysis. Manual analysis is time consuming and prone to error. Coral reef estimation domain is focused mainly on detection and annotations of coral eating starfish. This is difficult since the image data reveals the insignificant variation depending on light scattering, image clarity and outlook. Analysis has been done by many authors to understand the computational model and strategies used to implement detections and annotations. The authors analyzed computational model and strategies with respect to accuracy and efficiency which gave better understanding of the existing models and helps to design the model with better accuracy and efficiency. This paper summarizes computational model and strategies proposed by the various authors for detections and annotations of coral eating starfish.

Keywords:

Convolutional Neural networks, Thematic Mapping, Coral Eating Starfish

INTRODUCTION

The world's biggest coral reef, Australia's Great Barrier Reef, is home to 1,500 species of fish and 400 types of corals. Unfortunately, the reef is in jeopardy due to an overabundance of one specific starfish, the coral-eating crown-of-thorns starfish. Existing procedures have flaws in terms of operational scalability, data resolution, dependability, and traceability, to name a few. This study will assist researchers in identifying organisms that are endangering Australia's Great Barrier Reef and taking educated action to save the reef for future generations. The Great Barrier Reef of Australia is the world's biggest coral reef, covering an area of roughly 344,400 square kilometres and consisting of over 2900 reefs and over 900 islands with a total length of around 2300 kilometres. It's off the coast of Queensland, Australia, in the Coral Sea. The Great Barrier Reef Marine Park protects the coral reef by prohibiting human usage such as fishing and tourism. But still the Great Barrier Reef is facing so many issues like

- Climate change
- Pollution
- Coral bleaching
- Overfishing

Overfishing is a huge issue since its disrupting the food chains vital to reef life. Excess population of crown-of-thorns starfish, which are a significant source of coral

loss on the Great Barrier Reef during coral bleaching, is one of the primary outbreaks of overfishing, and it is critical to manage the population of crown-of-thorns starfish.

The coral polyps are eaten by the crown-of-thorns starfish. When a place becomes overpopulated, it poses a threat to the reefs. According to research undertaken by the Reef Research Centre (RRC), an epidemic of this species occurred in 2000, resulting in the death of around 66% of living coral on the studied reef. These outbreaks can be triggered by poor water quality or overfishing of starfish predators, and they happen in cycles. The starfish prefers hard corals over soft corals when it comes to feeding. They prefer branching corals and table-like corals to rounded corals because they have less exposed surface area. The presence of bivalve mollusks and worms on the surface of rounded corals may cause them to avoid feeding on them. The starfish may be observed feeding on soft corals in reef locations with low densities of hard coral, reflecting the nature of the reef community or owing to feeding by high density crown-of-thorns. Only two situations cause them to modify their behaviour: during mating season and when they are in great numbers. When there is a large density of them fighting for living corals, they move at all hours of the day and night. There are hundreds of distinct coral species across the world, which are divided into hard and soft corals. Hard corals form colonies to form massive reef blocks. Corals need calcium to develop their skeletons, which they get from seawater. Soft corals do not have rocky skeletons and build plants or trees. Due to the latest technology in picture collecting employing various autonomous underwater vehicles, the quantity of photos and databases continues to quickly expand at numerous environmental research institutes and aquatic-based authorities.

DETECTION OF COTS-STARFISH USING NEURAL NETWORKS

Daniel Smith et al., [6] proposed a novel shape recognition algorithm to autonomously classify the Northern Pacific Sea Star (*Asterias amurens*) from benthic images that were collected by the Starbug AUV during 6 km of transects in the Derwent estuary. The algorithm's effectiveness was partly owed to its ability to recognize regionally deformed sea star structures made during the segmentation of distorted pictures. This algorithm was created to categorize the Northern Pacific

Sea Star based on photos obtained by the Starbug AUV in the Derwent estuary. The poor signal-to-noise ratio in underwater vision, along with soft focus and motion blur in pictures captured by AUVs, resulted in a deformed image space that made categorization challenging. Despite the damaged picture space, the recognition system obtained a 77.5% joint classification rate and a 13.5% misclassification rate. The salient region detection and Area Integral Invariant Matching components of the method contributed the most to recognition performance (AIIM). The detection of salient patches lowered the area of interest for sea star identification, and therefore the risk of misclassification. The AIIM allowed sea stars to be recognized despite differences in form class.

Feras Dayoub et al., [7] demonstrated a unique vision-based underwater robotic system for identifying and controlling Crown-of-Thorns starfish (COTS) in coral reef habitats. One of the most serious dangers to Australia's Great Barrier Reef has been identified as COTS. These starfish actually devour coral, causing widespread damage to reefs and the marine ecosystems that rely on them. Evidence suggests that nutrient runoff from land has intensified recent outbreaks of COTS, necessitating the substantial employment of divers to manually inject biological agents into the starfish in an attempt to limit population numbers. Facilitating this control program using robotics is the goal of proposed method. The proposed work provides a vision-based COTS identification and tracking system based on a Random Forest Classifier (RFC) trained on underwater photos. To track COTS with a moving camera, the proposed integrate the RFC in a particle filter detector and tracker, where the RFC's projected class probability is utilized as an observation probability to weight the particles and sparse optical flow estimation is employed for the filter's prediction step. The technology is tested in a realistic laboratory setting using a robotic arm that swings a camera at various speeds and heights through a range of real- size photos of COTS in a reef habitat. COTS starfish are wreaking havoc on Australia's Great Barrier Reef and the marine ecology it sustains. The findings indicate the algorithms' resilience in visual detection of COTS.

Hailing Zhou et al., [8] proposed a hybrid detection method which uses Gaussian Mixture Model (GMM) for background modelling and object recognition using blob features. This method was developed to overcome problem faced by both traditional methods and advanced detection and recognition approach using image processing and deep learning to study diversity and abundance of marine animals. Traditional methods, like as towed nets and human observation, posed a harm to the animal's environment, while improved techniques posed their own challenges. Because they train with a huge number of object examples, statistical learning requires a significant quantity of data to categorize. Because of the fluctuation in lighting in the picture data set, the learning-based model suffers from overfitting. The proposed hybrid model uses statistic learning on the

background to segment images and then extracts features for foreground picture recognition. In the typical GMM, a single GMM is formed and used to detect objects in multiple photos, but in the proposed approach, a distinct GMM is built for each image for background modelling. The Bouman method is then used to generate the clusters. The photos are then classified as foreground or background using the Otsu method, and the blob analysis is performed on the foreground images. Blob analysis is performed by extracting characteristics from each blob, such as bounding box, convex hull, compactness, and so on. Various blob characteristics are utilized to detect various items based on the properties of the object. Even with variable light and reflection, the findings generated using this model functioned well. The model had an accuracy of roughly 90%, with some minor mistakes when it recognized other items as the desired object.

Dale Stokes et al. [9] devised a photographic quadrant survey approach for automating the categorization of coral reef benthic invertebrates. The picture data that has been gathered and organized into blocks is compared to a library of manually classified recognized species blocks. The texture and colour space are used to determine the likelihood of recognition. In the paper, authors discussed attempts have been already made to automate the Pacific starfish utilizing intensity variation and binary form recognition. However, there were shortcomings, such as the model's ability to identify only generic groupings and the difference in amount of absorption between different sources of water, such as clear and turbid. The work first attempted to automate the categorization using Mahalanobis distance classification, however it was unable to differentiate the reef benthos. The fundamental reason for the failure was that no organism resembled the typical organism, as demonstrated by the classification error matrix. The picture data was obtained using a typical digital camera with flash units on either side coupled to a stiff frame. Before manual processing, a histogram of colour intensity was employed to correct the lighting of picture data. A random group of images were processed manually to compare with the automated processing approach. Software were used to identify and calculate the surface area coverage of reef framework corals. The library of photos of a group of species was then created by picking spots of known categorization on quadrant photographs and appending descriptive metrics. This descriptive Metrix featured both texture and block colour; the metrics for each block were generated and utilized as a point in hypervolume throughout the automated processing. The categorization technique computed the probability density between each sample block and the species library. This provides spatial maps of identifying kinds which helps decrease spatial noise in classification. Finally, the selection is based on the similarities found between the sample block and that within species library. Then formed into binary and filtered to remove misidentified blocks. Further development is carried to bring changes in texture

discrimination metrics and segmentation of image data into different regions before performing the library classification.

Ellen M. Ditra et al., [10] proposed a model of object detection using Mask R-CNN, it works by classifying and localizing region of interest. The model was developed using ResNet50 configuration and was trained on ImageNet 1K dataset on Azure VM which was equipped with NVIDIA V100 GPU. The annotation part for the training data set was carried out on software developed by Griffith university. The mean average precision value mAP50 was used in this study, it determines the ability to mask around the region of interest. The F1 was also taken into consideration which calculates the maximum number of goal object in the frame. This F1 determined the success of the model since the model was built to answer the abundance of object in the specific region. The training data was divided by 80/20 i.e., 20% was used to form validation dataset. The overfitting of the model was minimized by using early stopping technique and by assessing on a set of 2500 iteration of validation set the performance was continuously monitored to determine where the model drops in performance. Three various models were used and performance curve for each was generated and made sure that all three had consistence performance. The performance of the model was high both unseen and test datasets. Since the conclusion was based on F1 score, it turned out to be high $F1 > 92\%$. This model was mainly proposed because the manual processing of image data to collect information on abundance, distribution of animals was very difficult and only 5% of the collected data was analyzed. Since the rate at which the data set generated is high, the processing of all the information to get desired output need to be increased and deep learning can be very handy since the processing of still image data sets or the video data sets can be done using deep learning. The automatic processing can be done at the faster rate. The result of the model shows the robustness of mode even under variation in illumination and clarity of water and also the rate at which the model processes when compared to manual processing. The future work would be to test on different novel locations and compare different sites that varies in environmental condition.

Mohamed Elsayed Elawady et al. [11] presented a CNN architecture to solve the problem of classifying coral into various categories. The input layer, hidden layers, and output layer are the primary components of this design. The input layer consists of three basic colour channels plus additional channels for texture and shape descriptors, which include components such as zero component analysis whitening, phase congruency, and Weber local descriptor, as well as preprocessing steps such as colour correction/enhancement and smoothing filter. Hidden layers are made up of one or more layers, each of which comprises of a convolution layer followed by a down-sampling layer, allowing the network to discover appropriate convolutional kernel weights and additive biases. As a classification layer, the output layer

is used. Convolution layers employ the logistic (sigmoid) function, which is the most frequent activation function. Moorea Labelled Corals and Atlantic Deep-Sea databases were used. There are 5 coral and 4 non-coral classifications in both datasets. Each picture is 181×181 , with nine output classes, 300 samples per class, three input channels, one learning rate, ten network epochs, six to twelve hidden output maps, and a training/test set ratio of two. Due to similarities in their form qualities or development environment, the proposed framework delivers a greater classification rate for some corals (Pavon) and misclassification for others (Monti). The framework's limitations include a lack of performance on large-scale input data and a difficulty in determining the appropriate settings for a deep convolutional neural network.

Oscar Beijbom et al., [12] presented a technique for calculating the proportion of the reef area that is covered by corals, sand, rock, and algae. It comprises coral categorization based on each class's physical and chemical features. Texture, shape, colour, and size are all factors. Color extension was used to encode the colour information of the coral picture. Moorea Labelled Corals provided the dataset. Preprocessing, Texture and Color Descriptors, and Machine Learning are the four essential processes in the proposed technique. To save time and resources, image scaling was done during the preprocessing stage. The ColorChannelStretch technique is used to enhance the intensity across each of the RGB channels. The proposed method uses the Maximum Response filter in the Texture and Color stage. The Support Vector Machine (SVM) and the Radial Basis Kernel were introduced in the Machine Learning stage. The training process was completed with 4-fold cross validation, and the parameters were optimized using the Grid Search hyperparameter tuning approach. To manage the variation dataset, a multiple scaling strategy is used. The findings revealed that the suggested method accurately estimates coral coverage across numerous reef sites and years, indicating that it has great promise for large-scale coral reef study.

Shihavuddin et al., [13] established a reef dataset categorization framework that can be applied to several single and composite datasets. For improved picture improvement, this system employs numerous feature descriptors. Algorithms such as Neural Networks, KNNs, and SVMs are used in classification. To continue training and classifying the dataset, the proposed system contains numerous phases. For higher accuracy, it truly depends on the dataset's distribution. The improvement of underwater photos, which strives to improve classification accuracy, is a significant step. By including medium effects like as blurring and light uniform distribution, it improves the image visibility. In the case of SVM, the kernel is a crucial parameter for scaling the project's features. For improved border generation, many kernels are offered. Optional Dimensional Reduction (ODR) is used to improve the representation of lower-dimensional picture data. The estimation of the

predictions of the picture data that will eventually represent the output classes is one of the prior settings. Classification entails selecting the best algorithms from the available options in order to get better outcomes. The next phase is thematic mapping, which is used to show picture data at a wider scale. On numerous datasets, the chosen framework attained an overall accuracy of 93 percent, according to the results. Despite the model's low runtime execution, it was able to outperform all previously used and verified models in terms of classification accuracy.

CONCLUSIONS

The identification and annotation of coral reef images has been a significant computer vision area that focuses on organisms that are harming Australia's Great Barrier Reef so that appropriate steps may be taken to conserve the reef for future generations. Various methodologies for recognizing and annotating photos presented by various authors are covered in this study. The underlined photos are handled by a variety of computational models that take into account a variety of factors such as image size, number of channels, normalization technique, number of network epochs, learning rate, and the number of hidden output maps..

REFERENCES

- [1] https://www.earthwatch.org.au/save-the-reef-and-oceans?gclid=CjwKCAjw46CVBhB1EiwAgy6M4ozi3wdbzfg5zRzRDTX0zvcQxoqMkkHWunmb5SI7OYMi6cokxYZvIhoCQj0QAvD_BwE.
- [2] <https://reefresilience.org/stressors/predator-outbreaks/crown-of-thorns-starfish/>
- [3] Morais, Renato A., David R. Bellwood, "Principles for Estimating Fish Productivity on Coral Reefs," *Coral Reefs* 39, no. 5, Springer, pp. 1221- 1231, June 2020, DOI: doi.org/10.1007/s00338-020-01969-9).
- [4] Lisa Boström-Einarsson, Mary C. Bonin, Philip L. Munday, Geoffrey P. Jones, "Loss of live coral compromises predator-avoidance behaviour in coral reef damselfish", *Sci Rep.* 2018; 8: 7795. May 2018, DOI: 10.1038/s41598-018-26090-4.
- [5] Ghallab, Ahmed, Aldoushy Mahdy, Hashem Madkour, Alaa Osman, "Distribution and Diversity of Living Natural Resources from the Most Northern Red Sea Islands, Egypt: I-Hard and Soft Corals." *Egyptian Journal of Aquatic Biology and Fisheries* 24, no. 5, pp.125-145, August 2020, DOI: 10.21608/ejabf.2020.103627.
- [6] Daniel Smith, Matthew Dunbabin, "Automated Counting of the Northern Pacific Sea Star in the Derwent using Shape Recognition", *IEEE 9th Biennial Conference of the Australian Pattern Recognition Society on Digital Image Computing Techniques and Applications*, Australia, December 2007, DOI: 10.1109/DICTA.2007.4426838.
- [7] Dayoub, Feras, Matthew Dunbabin, Peter Corke, "Robotic Detection and Tracking of Crown-of-Thorns Starfish." *IEEE/RSJ International Conference on Intelligent Robots and Systems*, Germany, December 2015, DOI: 10.1109/IROS.2015.7353629.
- [8] Zhou, Hailing, Lyndon Llewellyn, Lei Wei, Doug Creighton, Saeid Nahavandi, "Marine Object Detection using Background Modelling and Blob Analysis", *IEEE International Conference on Systems, Man, and Cybernetics*, pp. 430-435, January 2016, China, DOI: 10.1109/SMC.2015.86.
- [9] Stokes, M. Dale, Grant B. Deane, "Automated Processing of Coral Reef Benthic Images" *Limnology and Oceanography: Methods* 7 by the American Society of Limnology and Oceanography, Inc., pp. 157-168, 2009, DOI: doi.org/10.4319/lom.2009.7.157.
- [10] Ditria, Ellen M., Sebastian Lopez-Marcano, Michael Sievers, Eric L. Jinks, Christopher J. Brown, Rod M. Connolly, "Automating the Analysis of Fish Abundance using Object Detection: Optimizing Animal Ecology with Deep Learning", *Frontiers in Marine Science*, June 2020, DOI: doi.org/10.3389/fmars.2020.00429
- [11] Mohamed Elsayed Elawady, Dr. Neil Robertson, Prof. David Lane, "Sparse Coral Classification using Deep CNN", *Centre Universitaire Condorcet, University of Burgundy*, 2015.
- [12] Beijbom, Oscar, Peter J. Edmunds, David I. Kline, B. Greg Mitchell, David Kriegman, "Automated Annotation of Coral Reef Survey Images", *IEEE Conference on Computer Vision and Pattern Recognition, USA*, pp. 1170-1177, 2012, DOI: 10.1109/ CVPR.2012.6247798 .
- [13] Shihavuddin, A. S. M., Nuno Gracias, Rafael Garcia, Arthur CR Gleason, Brooke Gintert, "Image- Based Coral Reef Classification and Thematic Mapping", *Remote Sensing* 5(4) 2013, pp. 1809- 1841, DOI: doi.org/10.3390/rs5041809.

Study of Typology and Vitality of Parks for Sustainable Development of Cities

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Abstract:

As cities expand, public spaces and land are at risk of being occupied, reassigned, and seized. Many Indian cities are seeing a disturbing reality in which public places are dwindling or disappearing entirely. Public open spaces emphatically affect urban areas and their occupants. Typical examples of public space include roads, public parks, libraries, and so forth. The word 'public space' is frequently misinterpreted to indicate other things, such as 'plazas, market places, streets' which are a subset of the larger idea of social space but parks are often ignored to be considered as public spaces. Parks have become an asset that people need for rest and relaxation but more importantly, these are places for social interaction. They improve community cohesion by offering a gathering space for residents. In Indian cities, the most acute need is for locations to which everyone has access. The quality of life in cities is determined by the availability and accessibility of urban parks. This paper aims to study the variety of parks on the basis of their use, carrying capacity, and type of activities that are happening in these areas. The study examines the main components of vitality, as well as its criteria, determinants, and the most efficient park vitality indicators in Indian cities. The study is limited to the functional and physical characteristics of the parks, and parameters pertaining to the activities and behavior of park users.

Keywords:

Park typology, park vitality, public space, Urban area

INTRODUCTION

Open Public Spaces (OPS) play an important role in city and town planning and development. It plays a significant role in defining the built form and urban structure of the city. The life, form, and experience of towns and cities are significantly influenced by open spaces on a global scale. The need for urban open spaces offers social, health, environmental, and economic benefits. "Open public spaces" are defined as "all spaces that are publicly owned or intended for public use, free to access, and enjoyable for everyone without regard to profit" in the Charter of Public Space.

A sense of community that we somehow lost when we stopped practicing social habits and stopped frequently going to the common gathering places in our neighborhoods is something that has been discussed more and more in recent years. Neighborhood parks are important "Spaces," or public areas with scenic relief that promote cross-cultural exchange and environmental sustainability. Parks can be thought of as "the lungs of the city," as they are used by urban residents for outdoor

leisure and recreation activities, contributing significantly to residents' health and well-being [1]. In many contexts, vitality, the concept that distinguishes successful urban areas from others, is lacking.

Urban public spaces that are vibrant are safer, more appealing, and have more options for social activities, as well as being a place for cross-cultural interactions. The process of making places for people has produced this kind of space as a successful end product. [2].

HISTORY OF PARKS

In the 16th century, parks were purposefully fashioned to mimic nature, with the built environment serving as the park's main attraction in most instances [3]. The more formal royal and titled gardens in Europe were given the name park by English travelers during this time [4]. As early as the 17th century, the public had access to the royal parks in London, including Hyde Park [5]. In Europe, especially in France, the English natural-style garden gained enormous popularity. The wealthy in England traveled to the continent in style, and private parks with classical features were designed by architects like Kent, Brown, and Repton. The royals of Germany were constructing "people's parks" like the one that opened in Munich in 1789 during this interim period, altering public gardens on the remnants of old German defenses [6]. Parks started to become more closely associated with cities at the end of the 18th century throughout all Europe. The process of urbanizing American and European cities has included the creation of urban parks. In industrial cities across Britain, urban parks were established. There were not many London's Royal Parks and some historic meeting greens prior to the 1850s. The enormously well-liked parks in other industrial cities were leisure parks that the city acquired or contributed to, rather than being created as urban parks for the general public. The park historian divides the development of urban parks in America into 4 distinct eras [7]:

1. The Pleasure Ground (1850–1900),
2. Reform Park (1900–1930)
3. The Recreation Center, (1930–19653).
4. The Open-Space System, starting in 1965

PUBLIC PARKS

Lynch provides the most basic definition of a park, describing parks as green-colored plots of land on

planners' maps [8]. This brief but accurate description serves as an excellent starting point for defining parks because it demonstrates that parks, like maps, have different typologies.

A. Typology of Parks

A public park is a public area that the government manages. The size of the park and, consequently, its classification are related to the level of government involvement. A park's size can range from a national park to something smaller. There is a government agency with jurisdiction over each type of park. National, regional, local, City, Community, and Neighborhood parks are the six main categories of parks.

B. National Parks

Undoubtedly, a national park serves as a conservation area. A reserve of undeveloped, partially undeveloped, or natural land is frequently declared by or owned by a political entity. The preservation of untamed nature for prosperity and as a source of national pride is a common goal, regardless of how each country designates its own national parks [9].

C. Regional Parks

Parks at the regional level occupy a middle ground between those at the municipal and federal levels. The size of a park is not determined by the level of government in charge; several provinces have established enormous provincial parks that, in terms of scope, resources, and management, resemble some country's national parks. A regional park may in some cases cover more land than a national park.

D. Local Parks

A local park is a piece of land that has been preserved for its scenic beauty, historical significance, recreational value, or other reason, and is managed by a local government. A local park can be a region that spans multiple jurisdictional boundaries or it can be a special park area that is part of a single jurisdiction, such as a town, district, or region.

E. City Parks

City parks include areas with unique natural features, historic significance, or centralized cultural facilities and serve the entire city. The facilities are typically designed with families and adults in mind.

F. Community Parks

The general consensus is that the region from which a city draws visitors to community parks is within a radius of the park of about 2.4 kilometers. Compared to neighborhood parks, community parks offer more amenities and serve a much wider area. They act as a hub for neighborhood activities, and as such, it is suggested that they provide either the facilities or the level of activity that is appropriate in the public where sonic boom, lighting, and motor traffic are acceptable. Various zones are designed to offer a variety of structured or unstructured outdoor recreation activities. These parks should be accessible and function by major or collector streets [10].

G. Neighborhood Parks

In residential areas, small parks offer unstructured recreation.

Neighborhood parks typically provide a local park service within a 500–800 meter radius and at the neighborhood level. At this level, parks can offer amenities for both active and passive leisure. The current benchmark for neighborhood parks is 0.6 hectares per 1,000 residents. A typical neighbourhood park features a variety of activities including a playground area for kids, recurring feature, open grass for passive use, and features multipurpose fields for sports.

VITALITY: A NEW APPROACH TO ASSESSING THE "INTANGIBLE" BENEFITS OF PARK USAGE

This paper describes vitality as a substitute for measuring the benefits because the accessible interaction between residents and urban parks primarily co-produces the intangible benefits. Urban public space activity levels and the concept of vitality are closely related [11]. According to Jacob, people's actions and the variety of their lives allegedly created urban vitality, which is typically described as a place's capacity to inspire active social and economic activities as well as cultural exchanges (1961) [11]. According to the definition, park vitality is the drive that encourages city residents to sustainably use recreational facilities. This is due to the richness, accessibility, and diversity of the landscape. A park's vitality is also greatly influenced by how frequently visitors interact with them, how frequently they engage in various forms of recreation, and how satisfied they are with their free time, according to the "recreational service produce-utilization-human well-being" cascade view. Due to the recreational benefit resulting from the users' on-site recreational experience, the level of recreation use, measured as visitors flow, is one of the potential proxies of the benefit provided by the recreational services [12]. The subjective enjoyment of leisure activities, on the other hand, significantly benefits people's psychological well-being. The design of both natural and artificial elements, as well as amenities that accommodate visitors' preferences and needs, are all important factors in creating enjoyable recreational experiences, according to research on recreation.

VITALITY IN PARKS

Lynch (1981) defines vitality, one of the performance dimensions of urban design, as the extent to which the form of places supports human functions, biological needs, and capabilities.

The degree of a city's vitality is related to how successful it is on the social front. According to Montgomery's definition from 1998, it describes the number of people using the park at various times of the day and night, the use of amenities, the frequency of cultural events and holidays throughout the year, the presence of bustling street life, and generally how much a location feels alive or lively [13]. Urban vitality is a crucial characteristic

because it lowers crime, improves user perception, increases both active and passive enjoyment of the streetscape – people watching – fosters social interaction, and offers opportunities for cross-cultural exchange. As a result, the vitality of parks is thought to be a key indicator in creating sustainable cities. According to recent studies, both the visual appeal of the environment and the variety of the supported activities contribute to vitality. It should be noted that recreational space with a better design will meet more people's needs. So, one of the main goals of a good park is to meet people's needs and adapt to their activities. The widely accepted Maslow hierarchy of needs describes the different levels of needs, from the most basic physical needs up to more complex social needs, which include needs for belonging, safety, and so forth. According to these, the following could be acknowledged as the three most significant social components of the public sphere: accessibility, equity, and safety. Accessibility is the most important factor at the most macro level. Accessibility can be divided into two categories: (a) visual accessibility, which allows people to see it and understand what is happening there; and (b) physical accessibility, which allows people to enter that space and make use of its amenities. A public area in a city should be welcoming to visitors who want to use its amenities. This point introduces us to equity, a crucial social need. Environments that can be equally shared by all social groups are said to be equitable. They offer all the characteristics that a wide range of users need.

Without compromising the welfare of other groups, they cater to their needs. The environments that are unequal or exclusive exhibit characteristics that make them less accessible to women, ethnic minorities, elders, disabled, poor people, and children, among other groups in society. As much as it is concerned with creating physical form, the urban design also focuses on creating fair urban public spaces. They could also be described as those that give people more options; as a result, they are more responsive. A more democratic, socially balanced environment that is accessible to everyone is ensured by the consideration of equity in public realm design. Equity creates a secure, important public space where members of various social classes can interact peacefully.

According to Maslow's hierarchy of needs, safety and security come second to basic physiological needs. These could be broadly divided into two categories: (i) Protection from physical harm (from illness, disease, human elements, artificial elements like cars, etc.); and (ii) Protection from mental harm (having control over the environment, maintaining the privacy, and avoiding being socially or physically lost)[14].

CONCLUSION

From the above literature study, it can be easily quoted that there are four characteristics of vitality. Levels of activity, use, participation, interaction, communication, exchange, and representation refer to how activity, use,

and interaction. Vitality plays a key role to strengthen the parks which helps in creating sustainable cities.

REFERENCES

- [1] J. Hayward, "Managing Parks as Human Ecosystem", Public and Spaces New York and London. Plenum Press. Chapter 8, pp. 26, 1989.
- [2] P.F. Wilkinson, "Types of Urban Open Space", Urban Open Space Planning, Faculty of Environmental Studies, York University, pp. 58-61, July 1983.
- [3] L. Baljon, "Designing Parks, An Examination of Contemporary Approaches to Design in Landscape Architecture", Amsterdam, Architecture and Natura Press, pp. 236, 1992.
- [4] N.T. Newton, "Design on the Land Cambridge", Harvard University Press, pp.271. 1971.
- [5] R. Rosenzweig and E. Blackmar, "The Park and the People, A History of Central Park, Ithaca and London", Cornell University Press, pp. 623, 1992.
- [6] B. Whitaker and K. Browne, "Parks for people", Schocken Books, the University of Michigan, pp. 144, 1973.
- [7] G. Cranz, "Urban Parks of the Past and Future. From Parks as Community Places", Available at: http://www.pps.org/urban_parks, 1997.
- [8] K. Lynch, "The Openness of Open Space. 1965. City sense and City Design Writings and projects of Kevin Lynch", Cambridge, Massachusetts, MIT Press, pp. 389- 412, 1964.
- [9] M. Chubb and H.R. Chubb, "Provincial Parks and Forests, One third of our time", Toronto, Ontario, John Wiley and Sons, ISBN-13: 978-0471156376, pp. 768, August 1981.
- [10] Medina community Report. "Park and trail master plan". Available at: <http://medinamn.us/wp-content/uploads/2014/03/Park-Master-Plan-Adopted-March-18-2014.pdf>, pp. 47, 2014
- [11] Jacobs, J. The Death and Life of Great American Cities. (Vintage); Random House: New York, NY, USA, 1961.
- [12] S. Jalaladdini, D. Oktay, "Urban Public Spaces and Vitality: A Socio-Spatial Analysis in the Streets of Cypriot Towns," Procedia - Social and Behavioral Sciences, vol. 35, pp. 664-674, 2012.
- [13] J. Montgomery, "Making a city: urbanity, vitality, and urban design," Journal of Urban Design, vol. 3, pp. 93-116, 1998.
- [14] P. Cozens, "Urban planning and environmental criminology: Towards a new perspective for safer cities," Planning practice and research, vol. 26, pp. 481-508, 2011.

Arduino Based Driver Drowsiness Detection and Alerting System

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Abstract:

Nowadays, more and more professions require long-term concentration. Drivers must keep a close eye on the road, so they can react to sudden events immediately. Driver fatigue often becomes a direct cause of many traffic accidents. Therefore there is a need to develop the systems that will detect and notify a driver of him/her bad psychophysical condition, which could significantly reduce the number of fatigue-related car accidents.

Drowsy driving is a major cause of traffic accidents. Eye blinking is considered as important evidence of driver drowsiness. In this report, a portable and low cost device for monitoring a driver's drowsiness is proposed. The proposed system consist of two main parts that detect eye blinking based on IR sensors mounted on eyewear. Depending on the reflected and absorbed IR radiation, this system detects and classifies the eye blinking into normal blinking.

Keywords:

Arduino Nano, Eye blink sensor

INTRODUCTION

Drowsy driving is a major problem. No one knows the exact moment when sleeps comes over their body. This makes the driver less able to pay attention while driving. Each year, drowsy driving accounts for about 100,000 crashes, 71,000 injuries, and 1,550 fatalities according to the National Highway Safety Administration. It contributes to an estimated 9.5% of all crashes, and 10.8% of those that involved airbag deployment (AAA).

About 27% of drivers report driving while being so tired drivers have difficulty keeping their eyes open (AAA). Most drowsy driving crashes occur between midnight and 6 pm or later on in the afternoon when the body regulates sleep (NHTSA).

Accidents due to driver drowsiness can be prevented using eye blink sensors. The driver is supposed to wear the eye blink sensor frame, the eye blink sensor works by illuminating the eye and eyelid area with infrared light. The sensor is connected with Arduino nano.

MATERIALS REQUIREMENTS

Hardware

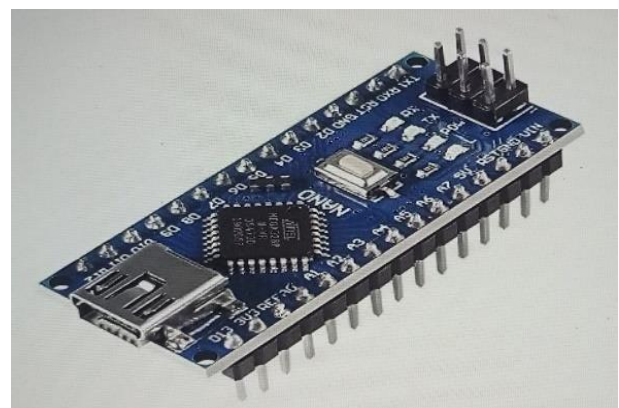
- Arduino Nano
- Eye blink sensor
- 9v battery
- SPST switch
- Spectacles

- Vibrator motor
- RF Transceiver module

Software

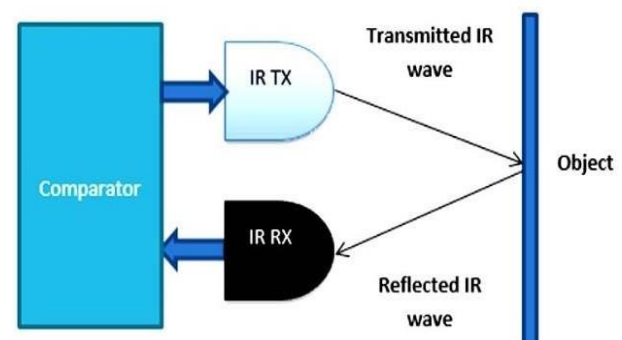
- Arduino IDE
- Language- C and C++

Arduino Nano



This arduino compatible nano V3.0 micro- controller is a small, complete, micro- controller board based on the ATmega328 MCU.

Eye blink sensor



The eye blink sensor is used to detect the eye blinks and using which we can also detect the activities like the drowsiness of the driver while driving. It works based on the infrared LED. It contains an infrared transmitter and receiver LED which is used to detect the eye blink. The infrared source include an IR LED and infrared detectors include photodiodes. The energy emitted by the infrared source is reflected by an object and falls back on the receiver, the resistance of the photodiode falls down significantly. This photoreceiver is connected with a potentiometer to form a voltage divider circuit, which gives a variable analog output when blinking activity is detected.

433 MHz Transceiver module

The RF stands for Radio Frequency. The corresponding frequency range varies between 30 KHz to 300GHz. Here we are using a 433 MHz RF Transceiver module which comprises a 433 MHz RF Transmitter and RF Receiver. The Transmitter/receiver pair operates at a frequency of 433 MHz. An RF transmitter receives serial data and transmits it wirelessly through RF through its antenna. The transmitted data is received by an RF receiver operating at the same frequency as that of the transmitter.

METHODOLOGY

This project involves controlling accident and saving driver's life as well as owner's problem of compensating every time even it's the fault of the driver. In this project we design spectacles which is worn by the driver. The setup consist of many more things such as Arduino nano, IR sensors, buzzer, one battery, one on/off switch buttons, one motor. Now what happens here is battery is connected with microcontroller and the other one is connected with RF transceiver module. This entire setup works in this way, as soon as the driver wears the spectacles. IR sensor checks weather the eyes are closed or not, if the eyes are not closed then it again checks for it, this loop continues until the eyes are found closed. As soon as the eyes are found closed, it again goes for a second check and again if the eyes are found closed then the buzzer is blown and red LED is on and it continues blowing for 1 minute and then buzzer and LED will be off, after 1 minute. The same process keeps repeating.

In short we can say that whenever the driver feels drowsy his eyes starts to blink for more than one second, this status is detected by the IR sensor and the buzzer is blown to make the driver conscious.

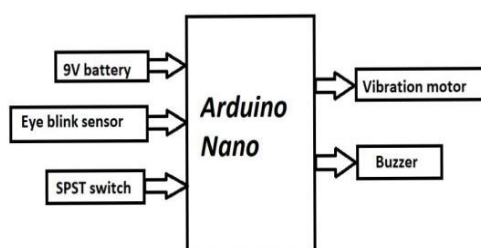


FIG: BLOCK DIAGRAM

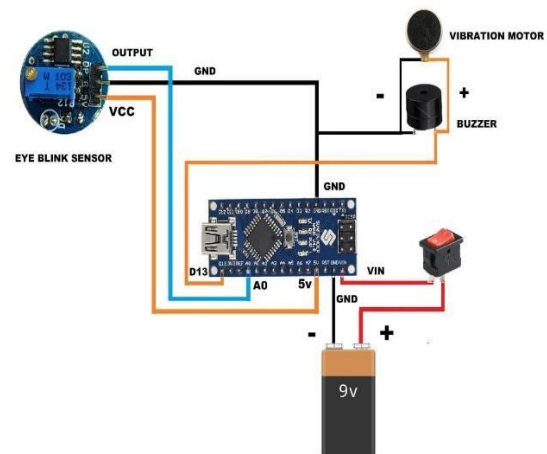


FIG: CIRCUIT DIAGRAM

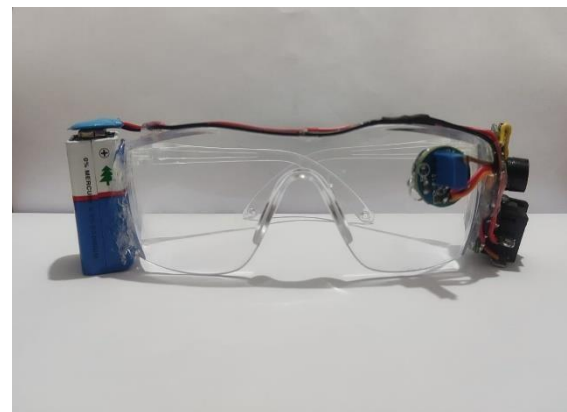


FIG: PROTOTYPE OF THE PROJECT

CONCLUSION

Purpose of our project is to help solving real life problem in very cost effect way. It alerts the driver. Whenever the driver feels drowsy and closes his eyes for more than one second, the buzzer will blown and motor starts to vibrate. As a result it alerts the driver. This will help in avoiding many road accident in night time.

REFERENCES

- [1] <https://circuitdiggest.com/microcontroller-projects/arduino-based-driver-drowsiness-detection-and-alert-system>
- [2] ISSN:2321-9653; IC value: 45.98; SJ Impact Factor: 6.887 Volume 6 Issue IV, April 2018- Drowsiness Detection and Alert System
- [3] Archana Jenis M.R M.E. 2020, 8:4 ISSN(Online):2348-4098 ISSN(Print):2395-4752- Driver Drowsiness and Alcohol Detection System Using Arduino
- [4] <https://www.arduino.cc/>
- [5] www.fierceelectronics.com/sensors/what-ir-sensor
- [6] https://en.m.wikipedia.org/wiki/Arduino_IDE

Natural Disaster Detection System with Personalized Notification System

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Abstract:

In this context, Internet-of- Things (IoT)-based disaster detection and response systems have been proposed to cope with disasters and emergencies by improving the disaster detection. Here we design a general system with a number of sensors detect abnormal situations. Disasters such as landslide, flood & earthquake. This system uses three sensors, namely the vibration sensor, to detect the soil movement, the soil moisture sensor to detect soil moisture levels, and piezoelectric sensor. Sensor data is processed using Arduino Uno. The soil movement and soil moisture data are sent to the receiving node using the LoRa communication system so that residents around locations with the potential for disasters can access data from the sensor nodes for free. Based on the design and testing results, the LoRa system can work well at 250 meters in the channel with many buildings and trees.

Keywords:

Natural disaster detection, LORA, MQTT, Arduino IDE, sensors.

INTRODUCTION

Every year, natural and human-induced disasters result in infrastructural damages, monetary costs, distresses, injuries and deaths. Unfortunately, climate change is strengthening the destructive power of natural disasters. In this context, Internet-of Things (IoT)- based disaster detection and response systems have been proposed to cope with disasters and emergencies by improving the disaster detection. Accordingly, IoT devices are used to collect data and help to identify different types of natural and manmade disasters. Here we design a general system with a number of sensors detect abnormal situations. Disasters such as landslide, fire accidents and explosions and earthquake. Major difference between this system and existing systems is the decentralized and personalized alerting system. Here we get the location of disaster detected area and using this location identifies all the people in that area based on their phone location and sends them alert regarding the disaster before the situation gets dire.

This can be used as an early warning system in the most unexpected situations. Natural disasters are unexpected events that concern world-wide nations. Every year, extreme weather conditions, hurricanes, earthquake, droughts, floods, and heatwave cause considerable damages, monetary costs, mass evacuations, distresses, injuries and deaths. For instance, the tsunami that in March 2011, destroyed more than 120,000 buildings, occasioned an estimated financial

damage of about \$199 billion dollars, and caused 15,894 deaths. In Canada, the Fort McMurray wildfire forced over 88,000 people to leave their town, caused an estimated C\$3.6 billion of insurance costs, destroyed about 10% of all structures in the town, and provoked chaos with people leaving their home with whatever they could take.

Natural disaster like earthquake, landslide, and flood detection is included in this system. This system is used to predict the occurrence of the disaster ensuring safety of the people. In recent technology advance communication media make a new technology in the disaster monitoring system. In this system different sensors are used and are embedded. Software like Arduino ide is used for programming and for notification part android phone is used for monitoring.

RELATED WORK

[1]. Arjun D. S (2016), presents an enhanced architecture for Cloud Sourcing using the Weather Disaster Monitoring using the Wireless sensor network. The weather forecasting department predict about weather atmosphere. Weather department to prediction about rain, tsunami, Earthquake, wind etc. Weather department prediction about the disaster is not correct. Its only safety for the human to display message through wireless sensors.

[2]. Ashish Rauniyar (2017), Nowadays, all countries and humans are prone to natural and artificial disasters. Early disaster detection about Earthquake, Fire, Storms, and Floods detect prediction for many people safety is easily safe. All the cloud sourced data are providing information of certain geographics region are analyzed in cloud platform. Cloud of source data make its way to analysis and more than thousand people life are lost. The fog computing is new and efficient way to cloud sourcing using IOT. In this paper public safety are most important concept of cloud sourcing-based disaster management to avoid the any disaster. Cloud- sourced data can be used to detect and alert about the disaster.

[3]. Rajesh Singh (2018), In this system it is all about working on machine automatically. IOT technology's important approach to speed up of the information about the power system and efficient management of power system infrastructure. Disaster prediction and reduction of power transmission line is important application of Internet of Things. Disaster management information transmission are easy on Embedded software.

Transmission is very reliable. Internet Of Things technology improves the reliability of transmission and reduce the power loss.

[4]. The paper introduces the application of IOT in online monitoring system of Power transmission line. In this author Yiyang Zhang (2018), Aims to create awareness about the uses of IOT in disaster management system in the world and to cover all geographical area. It handles the all the issues and challenges of IOT application of disaster management.

[5]. Garcia A. (2019) Ground-based techniques are mostly used in landslide monitoring system. The landslide disasters are occurred using ground-based techniques using measure the whole slope of landslide easily. All the surface and subsurface surveying real time data availability. Commonly the adopted sensors include inclinometers, accelerometers, strain gauges, wire extensometers, pressure transducer, GPS. This impotent concept they are important to battery, data storage and transmission technology. This system is based on cable connection between sensors, data loggers and GPRS modems. This system are installation and operation are running to take more time. The transmission of data is transmitted without pre-processing. Ground-based techniques are handling all working about the land like as vibration of land, slope of land, moisture level of land, distance is measure are easily. This ground-based techniques are more used to weather department.

SYSTEM REQUIREMENTS

Hardware

The hardware components used in our project is listed below.

- Arduino uno
- NodeMCU
- Lora transceiver
- Vibration sensor
- Moisture sensor
- Piezoelectric

Software

- Arduino IDE tool
- MyMQTT app

METHODOLOGY

The proposed network architecture is composed of four entities; Sensor data, Lora Node, Lora Gateway and Cloud server.

Sensor Data:

Monitoring system these include multiple sensors and this system three disaster are included earthquake, landslide, fire. First of all, moisture sensor measures the water level and vibration sensor measure the Richter scale earthquake and fire sensor measure the temperature. All the systems are running in geographic area the disaster is occurred. Sensor data are high upon

fixed threshold value or cross the threshold value Alert to the authorized person through the text message.

Lora Node:

As the name implies, long range transmission capability with less power consumption makes LoRa a significant player in IoT networks. In LoRa technology, a message transmitted by any device can be received by single or multiple gateways. The received messages will be forwarded to the central network for processing. Smart server architecture will handle these messages to each related application.

LoRa alliance is an open, non-profit organization of members that standardize, develop, monitor and improve LoRa standards. Internet of Things is one of the major drivers behind this highly efficient LP- WAN technology.

Lora Gateway:

LoRa gateway is a sophisticated software architecture designed to carry out communication in LoRa network terminology. It acts as a smart hub between end devices and application network servers. In future, it will be preinstalled on all IoT enabled hardware to support a wide range of applications.

Cloud server:

The places where the disaster is detected the people around that area or the person authorized to that area will get a notification of disaster. The whole notification process is carried by the cloud server. When the cloud server receives the notification from NodeMCU, the message is sent to the user by cloud server.

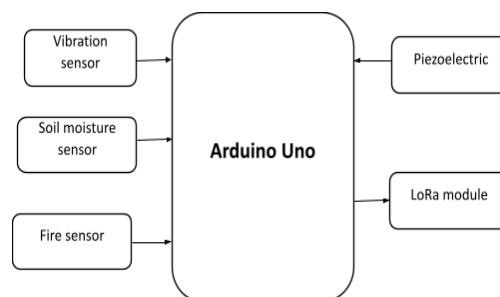


Fig 1: Transmitter block diagram

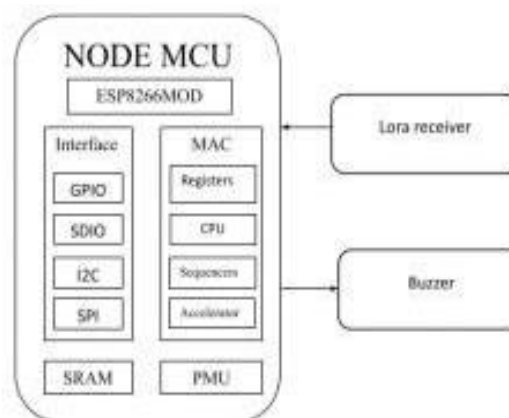


Fig 2: Receiver block diagram

Description of block diagram:

- Divided into two sections transmitter and receiver.
- Transmitter is used for detection and has all the sensors connected to it.
- Transmitter uses Arduino uno and Lora is used for communication.
- Lora is connected using serial UART interface.
- Depending on sensor type they use ADC or GPIO interface.
- At receiver buzzer is used for local alert.

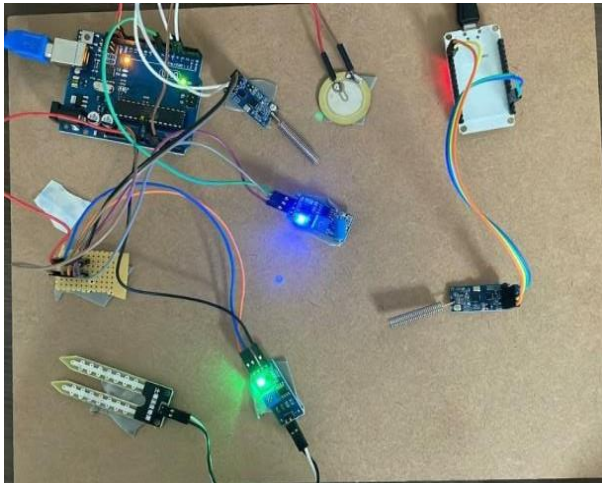


Fig 3: Prototype of the Project.

CONCLUSION

In this proposed system three commercial sensors are used like moisture sensor, vibration sensor, piezoelectric sensor. All sensors monitor environment and generate Alert signal to water, vibration and pressure when sensor crosses the threshold value. The system can also send the status of all sensor values to an Android phone using Wi-Fi. This system helps out people to reach to the nearest safe place prior to disaster. We have a future plan to make this application to provide safety to people and them to need not any risk to anything when disasters are occurred. Data packets sent by sensor nodes can be completely received at a distance of 250 meters with many obstructive objects such as buildings and trees. This range can be increased by adjusting the LoRa physical layer, such as coding rate, spreading factor and bandwidth. An Android-based application has also been running well to get sensor data from the MQTT server.

In order to benefit from previous projects and experiences, we plan soon to design a novel architecture based on wireless mesh sensor networks that responds to emergency requirements such as the mobility of first responders. Since the project is based on LORA, they inherit all the advantages and the limits of such communication, so, designers must take this point into consideration.

REFERENCES

- [1] World Health Organization, "Disasters & emergencies definitions training package," Geneva, Switzerland, 2002.
- [2] United Nations Department of Economic and Social Affairs, "Population aging 2006," Available: <http://www.un.org/esa/population/publications/ageing/ageing2006.htm>. Accessed on: Feb. 1, 2018.
- [3] J. W. Brown and M. Lisa, "Older adults and disasters: How to be prepared and assist others." Washington, DC, USA, American Psychological Association, 2018.
- [4] P. Pandey and R. Litoriya, "An activity vigilance system for elderly based on fuzzy probability transformations," *J. Intell. Fuzzy Syst.*, vol. 36, no. 3, pp. 2481–2494, 2019.
- [5] P. Pandey and R. Litoriya, "Legal/regulatory issues for MMBD in IoT BT," *Multimedia Big Data Computing for IoT applications: Concepts, Paradigms and Solutions*, S. Tanwar, S. Tyagi, and N. Kumar, Eds., Singapore: Springer, 2020, pp. 367–388.
- [6] B. Wisner, J. Gaillard, and I. Kelman, "Framing disaster," in *Handbook of Hazards and Disaster Risk Reduction*. Evanston, IL, USA: Routledge, 2011.

Solar Based Energy Efficient Street Lights

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Abstract:

This paper depicts the solar based energy efficient street lights. Street lighting accounts for a large percentage of total energy consumption worldwide. Wastage of electricity is a common problem in India and despite being an electricity-deficient Country, you can see street lights working even during the day. Electricity theft is another huge issue and it is not easy to track the amount of electricity consumed by each street light, making it challenging to determine if there is a leak somewhere in the line. This paper will make a good impact on the street light that glows only during the night time, on detection of the vehicle movement. In this paper, the main focus is to find the vehicle presence in the highway and if present, turning on the street lights in that area. We also detect whether it's light or dark and make the lights run based on the detection. In addition to this, we also use solar panels and manage the power.

Keywords:

darkness-LDR, vehicle movement-IR Transceiver, energy usage-solar.

I. INTRODUCTION

Automation plays an increasingly very important role in the world economy and in daily life. Automatic systems are being preferred over any kind of manual system. Intelligent light sensing refers to public street lighting that adapts to movement by vehicles. The research work shows automatic control of streetlights as a result of which **power is saved** to some extent. Basically, street lighting is one of the important parts. Therefore, the street lamps are relatively simple but with the development of urbanization, the number of streets increases rapidly with high traffic density. There are several factors need to be considered in order to design a good street lighting system such as night-time safety for community members and road users, **provide public lighting at cost effective**.

At the beginning, street lamps were controlled by manual control where a control switch is set in each of the street lamps which is called the first generation of the original street light. After that, another method that has been used was optical control method done using high pressure sodium lamp in their system. Nowadays, it is seen that the method is widely used in the country. The method operates by set up an optical control circuit, change the resistance by using of light sensitive device to control street lamps light up automatically at dusk and turn off automatically after dawn in the morning.

Due to the technological development nowadays, road lighting can be categorized according to the installation area and performance, for an example, lighting for traffic

routes, lighting for subsidiary roads and lighting for urban center and public amenity areas.

The LED is considered a promising solution to modern street lighting system due to its behavior and advantages. Apart from that, the advantages of LED are likely to replace the traditional street lamps. Therefore, the research work highlights the energy efficient system of the street lights system using LED lamps with IR sensor interface for controlling and managing.

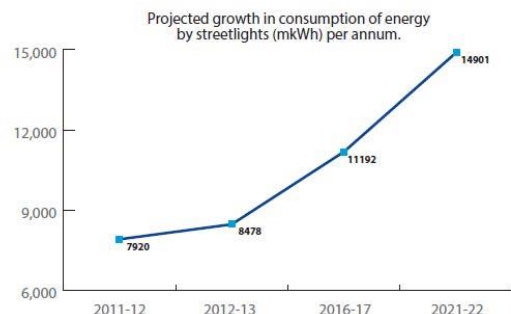


Figure 1: Power Wastage Statistics

II LITERATURE SURVEY

Wellsprings of measurements for the writing overview had been many, anyway the significant assets are reports, diaries, net, magazines and records. As the set of experiences for executing the mission required a skill of installed gadget, it likewise includes the investigate Arduino IDE for programming the product program to unique sensors utilized and Arduino UNO board.

C.Bhuvaneshwari et al [2] have analyzed the street light with auto tracking system by which one can increase the conversion efficiency of the solar power generation. Here, the sun tracking sensor is the sensing device which senses the position of the sun time to time and gives the output to the amplifier based on light density of the sun.

S.Suganya et al [3] and W. Yue [4] have proposed about Street Light Glow on detecting vehicle movement using sensor is a system that utilizes the latest technology for sources of light as LED lamps. It is also used to control the switching of street light automatically according to the light intensity.

M.Abhishek et al [5] have implemented design of traffic flow based street light control system with effective utilization of solar energy in the year 2015. They used the renewable source of energy i.e. the solar power for street lighting.

K.Santha et al [6] have surveyed on Street Lighting System Based on Vehicle Movements. The system

operates in the automatic mode which regulates the streetlight according to brightness and dimness.

From this literature survey, the methods each one has implemented and used is simple and easy to understand.

These papers are focused to further implement a much efficient system and make things automated.

III SYSTEM REQUIREMENTS

Hardware Required

1. Arduino UNO R3
2. IR Transceivers (which supports Arduino)
3. Light Dependent Resistor
4. Light Emitting Diodes
5. Power supply
6. Solar Panel
7. Rechargeable Batteries
8. TP 4056
9. LM2596

Software Required

1. Arduino IDE
2. Embedded C

IV METHODOLOGY

The fundamental point of view of this paper is to detect the movement of vehicle and based on the detection turning on the street lights.

The block diagram is as shown in the below fig.2

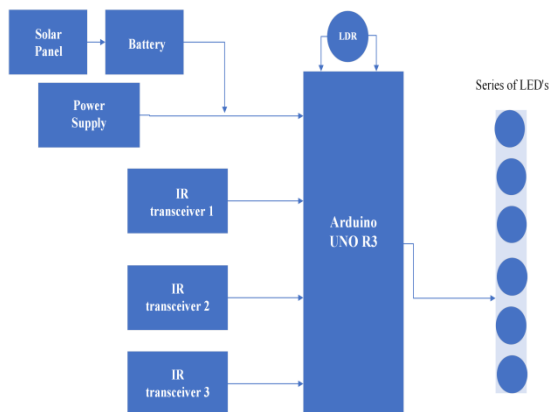


Figure 2: Solar Based Energy Efficient Street Light Block Diagram.

The fundamental part of this solar based energy efficient street lights is Arduino UNO, which is associated with the function of all the blocks.

An LDR is a component that has a (variable) resistance that changes with the light intensity that falls upon it. The LDR is connected to Arduino UNO which is used to detect the presence of light or darkness.

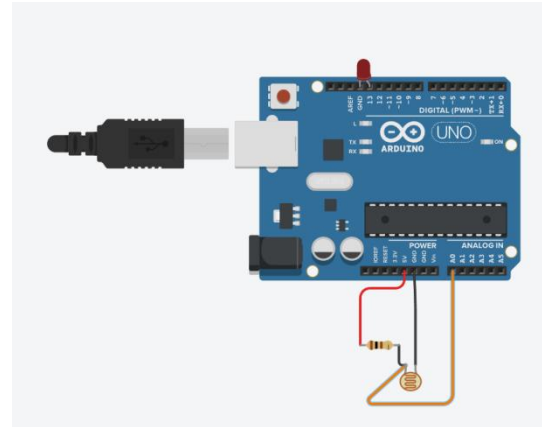


Figure 3: LDR Circuit Diagram

This LDR circuit diagram shows how you can make a light detector. An LDR or “Light Dependent Resistor” is a resistor where the resistance decreases with the strength of the light.

When it’s dark, the LDR has high resistance and when it’s light, the LDR has low resistance. It flows from the positive battery terminal, through the resistor, and based on that, the LED glows.

An infrared (IR) transceiver is a device which is capable of both sending and receiving infrared data.

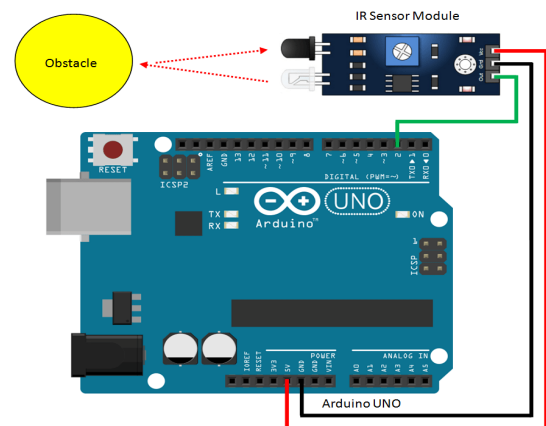


Figure 4: IR Transceiver Circuit Diagram

An electronic device called an infrared (IR) transceiver is able to communicate data using infrared light. IR transceiver units can both transmit and receive information. IR transceivers operate by sending rapid pulses of light on the infrared spectrum. This means that the pulses are not visible to the human eye, but can be detected by other transceivers.

If the LDR detects that it is darkness outside, then the IR transceivers search for the vehicle blockage in the IR transceiver’s path and turns on the light which are associated with that IR transceiver’s surrounding. When the vehicle moves forward, this is detected by the next IR transceiver and turns on light which are associated with this IR transceiver and the previous light get turn off. The whole process is repeatedly done and power is conserved.

Solar panels (also known as "PV panels") are used to convert light from the sun, which is composed of particles of energy called "photons", into electricity that can be used to power electrical loads.

We all know that energy from the sun comes on the earth in the form of little packets called photons. When the sunlight strikes these photovoltaic cells in the solar panel already forming an electric field, the photons of sunlight startle the electrons inside these cells activating them to start flowing.

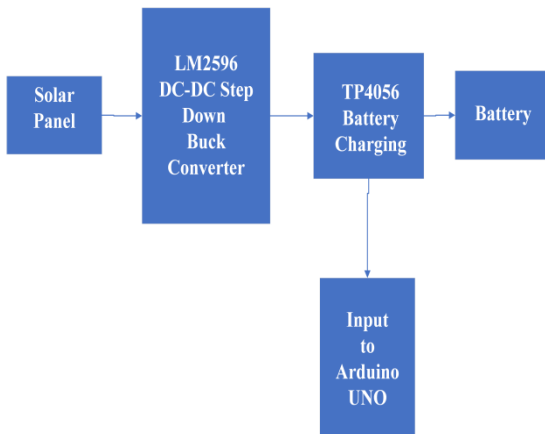
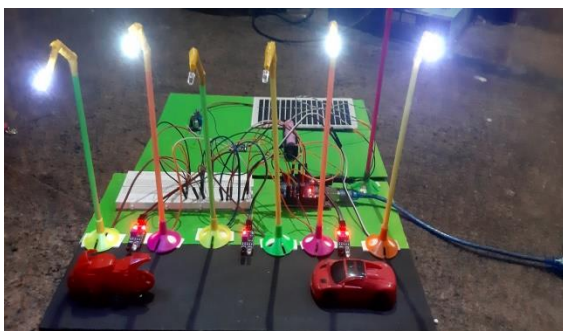
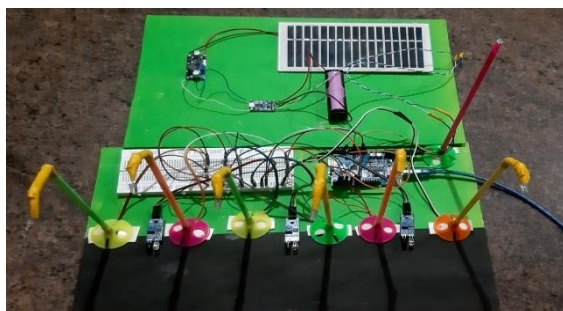


Figure 5: Solar Panel Power Switch Schematic

There are installed solar panels on the street lights which are absorbing the solar energy and converting into electrical energy. This can be stored in battery and used to supply power to the LED or it can also be sent to the power stations for the daily usage by the public.

V RESULTS

The solar energy is converted into electrical energy during the day time and that electrical energy is stored in the batteries. During the Night time, the IR transceivers detect the vehicle movement and turns on the light based on the detection.



VI CONCLUSION

Through this paper we can conserve a lot of electricity which is wasting in the form of street lights. We can also use the solar energy for the for the operation or we can feed it to the power stations so that it can be used for the domestic purpose.

REFERENCES

- [1] <http://opensourceecology.org/wiki/Automation>.
- [2] C.Bhuvaneshwari, R.Rajeswari, C.Kalaiahasan, Analysis of Solar energy based street light with auto tracking system, International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, Vol 2, Issue 7, July 2013.
- [3] S. Suganya, R. Sinduja, T. Sowmiya & S. Senthilkumar, Street light glow on detecting vehicle movement using sensor.
- [4] W. Yue; S. Changhong; Z. Xianghong; Y. Wei; "Design of new intelligent street light control system," 8th IEEE international Conferences on Control and Automation (ICCA), (2010), Page(s): 1423 – 1427
- [5] M.Abhishek, Syedajram shah, K.Chetan, K. Arun Kumar, Design and implementation of traffic flow based street light control system with effective utilization of solar energy, International journal of Science Engineering and Advance Technology, IJSEAT, Vol 3, Issue 9, September -2015
- [6] Padmadevi, S., and K. SanthaSheela. "Survey on street lighting system based on vehicle movements." Int. J. Innov. Res. Sci., Eng., Tech 3, no. 2 (2012).
- [7] www.electronicshub.org

Electric Grass Cutter with IoT Based Battery Monitoring System

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Abstract:

The “Electric grass cutter with IoT based battery monitoring system” is battery operated device aimed to perform efficiently and also to reduce the negative impact on environment due to conventional method. Providing affordable production model to farmers a highly powerful grass cutters capable of providing enough torque and speed meeting present industry standards. Also including battery monitoring system to monitor battery statistics like Battery percentage, Battery voltage, Battery temperature etc.,. As it is equipped with NODE MCU Wi-Fi module which frequently updates battery data to server through api of Thingspeak. This system doesn't require human intervention for the updation by this method one can even access the data from anywhere in the world.

Keywords:

Electric grass cutter, IoT based Battery Monitoring System (BMS), Node MCU, Thingspeak.

INTRODUCTION

A Battery operated Grass cutter is a simple mini project with a purpose of providing a reliable alternative for the traditional petrol based grass cutters and also to provide an affordable device for farmers.

The purpose of including battery monitoring system is to help them to get aware of their battery status before using the device, this ensures that battery is capable of running for desired durations before getting emptied.

The prototype of BMS can also be used in other applications such as in electric vehicles etc.,.

EXISTING SYSTEM

Almost all existing grass cutters are powered by petrol engines. They use polluting fuels such as petroleum, which are harmful to the environment. The initial cost is also huge. Even the operating cost is comparatively high. It also requires professionals to use it effectively due to its complexity and bulkier form. It is also dangerous to handle as the fuel used is flammable. Even it has so many moving parts resulting in noise and vibrations. Frequent servicing of the petrol engine is an additional cost which again increases the maintenance cost.

PROPOSED SYSTEM

Thereby to overcome the problems faced in the existing system a new system is proposed here. Grass cutter earlier used to work through air pressurized by petrol engine is now replaced by a powerful DC motor directly attached to the cutter head. The customized blade is used

to cut the hard thick shrubs and a nylon strip is used to cut thin grasses of thickness 1 inch approximately. Addition to that we also have a battery monitoring system to monitor our power source for prolonged and assistive interface between user and the device.

The device is also light weight and can be operated by any age groups. We also strive to replace every device including vehicles in agricultural domain to new electric technology with the help of batteries and this IoT based BMS serves a greater purpose and reach.

SYSTEM REQUIREMENTS

Hardware

1. DC775 Motor
2. PWM speed controller
3. Battery 24V 7.2Ah
4. Charger 24V, 1A
5. PVC fittings
 - a. 1 1/4" - 4ft length tube
 - b. Tee – 2 nos
 - c. 120 degree elbow – 1 nos
 - d. 90 degree elbow – 1nos
 - e. Cap – 1nos
 - f. End cap – 1 nos
 - g. Pvc glue – 1 nos
6. Connecting wires 1.5sq mm
7. Node-MCU 12E module
8. TP4056 Charging module
9. Resistors 100 kΩ - 2 nos

Software

1. Arduino IDE
2. Thingspeak

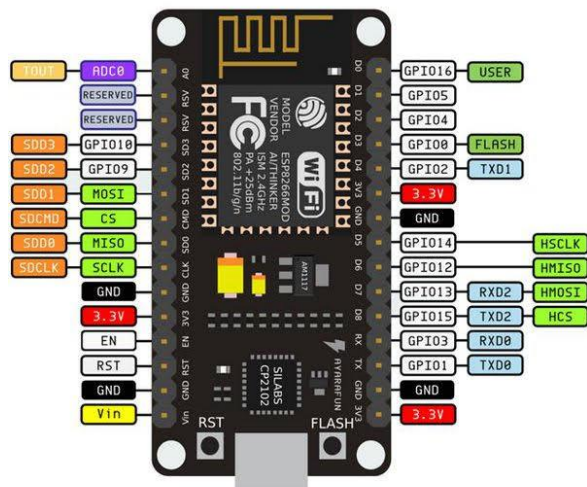
METHODOLOGY

1. **PVC materials** are used for external housing of electric grass cutter.

2. **DC 775 Bearing motor** is chosen as it has high torque and speed and also efficient and reliable.

- a. High Power 775 Bearing motor
- b. Overall Length: 98mm
- c. Shaft Type - D shaft
- d. Diameter: 44 mm

- e. Speed: 12V ~ 4000 rpm,
 - f. 24V ~ 14000 rpm
 - g. Current(no-load): 12V - 400ma, 24V - 600ma
 - h. Current(Full-load): 12V - 5a, 24V - 10a
 - i. Shaft Diameter: 5 MM
 - j. Shaft Length - 15 mm
3. *Pwm Voltage Controller*
- a. Max 400 watts PWM Speed Controller.
 - b. With reverse polarity protection, high current protection.
 - c. Working Voltage: DC 12V - DC 40V.
 - d. Static Current:0.02 A
 - e. PWM Duty Cycle:10% -100%
 - f. PWM Frequency:13 KHz.
 - g. Size:6cm x 7.5cm x 2.8cm
4. *Battery*
- a. 24V,7.2Ah
 - b. 4 hours of stand by time
5. *Node-Mcu 12e Module*
- a. Operating voltage: 3.3V
 - b. Input Voltage: 7-12V
 - c. Digital I/O pins DIO: 16
 - d. USB- TTL based on CP2102 is included onboard, enabling plug n play
 - e. Microcontroller: Tensilica 32-bits RISC CPU Xtensa LX106
6. *TP4056 Charging module*
- a. Dimension: 25 x 19 x 10 (LxWxH)mm.
 - b. Input interface: micro USB.
 - c. Current Protection: Yes.
 - d. Charging mode: Linear charging.
 - e. Current: 1A adjustable.
 - f. Charge precision: 1.5%.
 - g. Input voltage: 4.5V-5.5V.
 - h. Full charge voltage: 4.2V



PICTORIAL CIRCUIT DIAGRAM

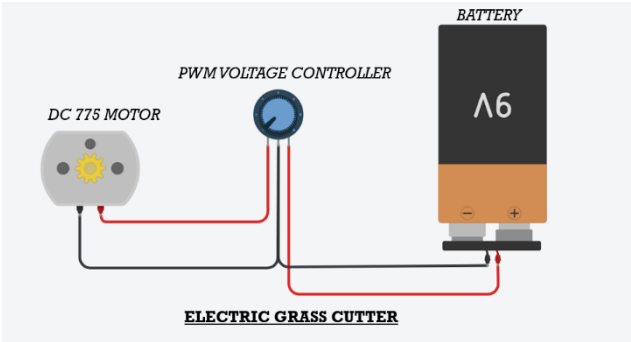


Fig. Electric Grass Cutter

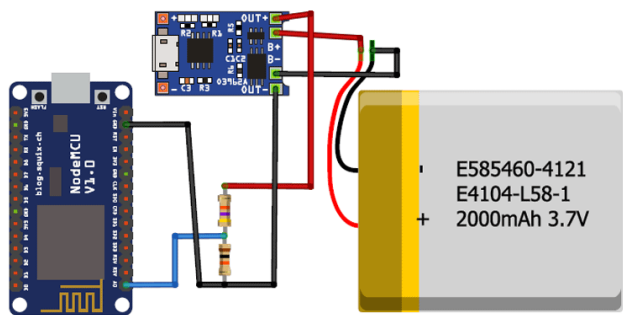


Fig. Battery Monitoring System

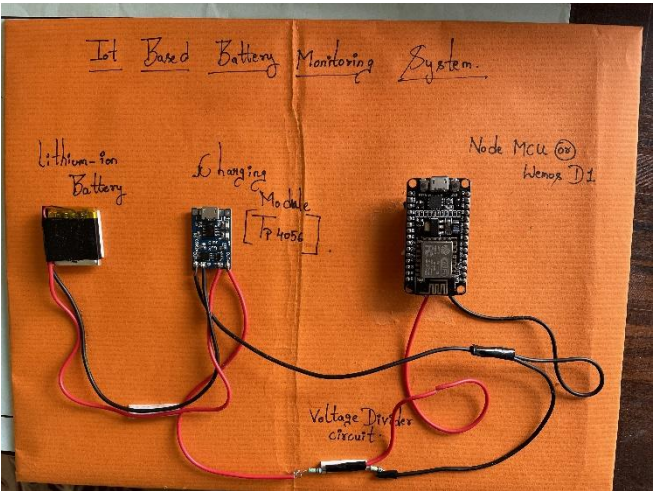


Fig. IoT based Battery Monitoring System

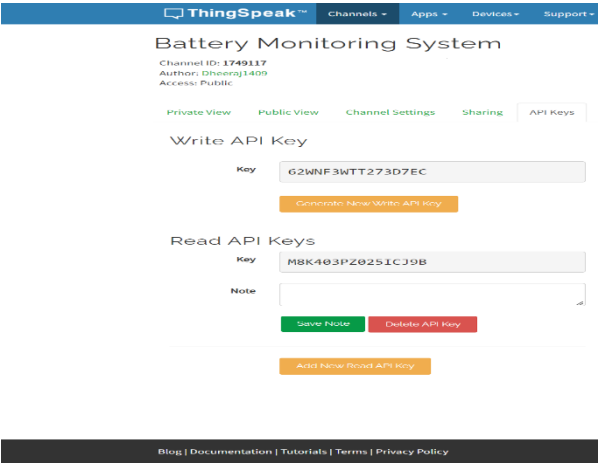


Fig Thingspeak API keys

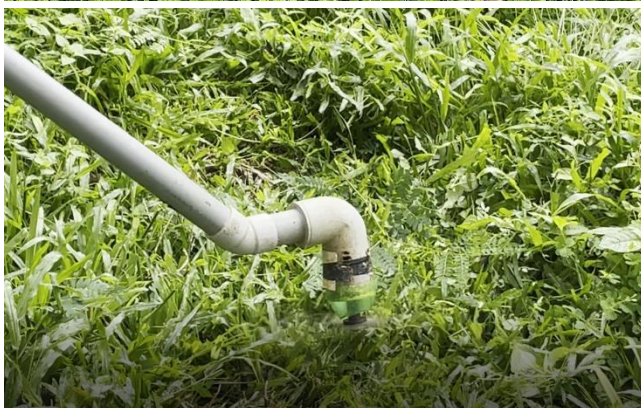
REAL
LIFE APPLICATION



Fig Graphical representation
PROTOTYPE MODELS



Fig. Electric Grass Cutter



CONCLUSION

Thus to overcome the problems faced in the existing system a new system is proposed here.

Grass cutter earlier used to work through air pressurized by petrol engine is now replaced by a powerful DC motor directly attached to the cutter head. The customized blade is used to cut the hard thick shrubs and a nylon strip is used to cut thin grasses of thickness 1 inch approximately.

In addition to that, we also have a battery monitoring system to monitor our power source for prolonged and assistive interface between user and the device.

The device is also light weight and can be operated by any age groups.

We also strive to replace every device including vehicles in agricultural domain to new electric technology with the help of batteries and this IoT based BMS serves a greater purpose and reach.

We would like to thank our sponsorer

Mr. Naveen Moras

Kopatti village, Bhagamandala, Madikeri, Kodagu

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who supported us through out the completion of our grass cutter with constant moral and financial support.

REFERENCES

- [1] T. Koppel, P. Tint, G. Karajeva, K. Reinhold, and S. Kalle, "Vibration and noise caused by lawn maintenance machines in association with risk to health," *Agronomy Research*, vol. 10, pp. 251-260, 01/01 2012.
- [2] R. C. Willson and A. V. Mordvinov, "Secular total solar irradiance trend during solar cycles 21–23," *Geophysical Research Letters*, vol. 30, no. 5, 2003, doi: 10.1029/2002gl016038.
- [3] R. V. Sanjana Arunesh, Shreyas Arunesh, Nivetha N., "Design and Implementation of Automatic Lawn Cutter," *IJSTE - International Journal of Science Technology & Engineering*, vol. 2, no. 11, 2016, doi: <http://www.ijste.org/articles/IJSTE2111065.pdf>.
- [4] N. K. Santosh S. Gudi, P. B. Bhagawati, "Smart Solar Grass Cutter For Lawn Coverage," *International Journal of Innovative Science and Research Technology*, vol. 2, no. 5, 2017, doi: <https://www.scribd.com/document/347922063/Smart-Solar-Grass-Cutter-for-Lawn-Coverage>.
- [5] B. P. Prof. S. M. Patil, Kumbhar Snehal, Patil Dhanashri, "Smart Solar Grass Cutter With Lawn Coverage," *International Research Journal of Engineering and Technology (IRJET)*, vol. 5, no. 3, 2018, doi: <https://www.irjet.net/volume5-issue3>.
- [6] B. P. Dilip, N. B. P., V. S. U., S. W., and P. S. M., "Design and Implementation of Automatic Solar Grass Cutter," *International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering*, vol. 6, no. 4, 2017, doi: <http://www.ijareeie.com/volume6-issue-4>.

- [7] M. J. S. Asha N, Saraswathi R, Rahul R, Ravikiran, "Smart Grass Cutter," Perspectives in Communication, Embedded-Systems and Signal-Processing (PiCES), vol. 1, no. 6, 2017, doi: <http://www.picesjournal.com/ojs/index.php/pices/article/view/31/22>.
- [8] F. D. W. Praful P. Ulhe, Manish D. Inwate, Krushnkumar S. Dhakte, "Modification of Solar Grass Cutting Machine," IJIRST –International Journal for Innovative Research in Science & Technology, vol. 2, no. 11, 2016, doi: <http://www.ijirst.org/articles/IJIRSTV2I11261.pdf>.
- [9] S. B. Amrutesh P., Venu B., "Solar Grass Cutter With Linear Blades By Using Scotch Yoke Mechanism," Int. Journal of Engineering Research and Applications, vol. 4, no. 9 (Version 3), 2014, doi: [https://www.ijera.com/papers/Vol4_issue9/Version%203/C49031021.p df](https://www.ijera.com/papers/Vol4_issue9/Version%203/C49031021.pdf).
- [10] H. A. B. Y.M.Gaikwd, Pooja.S.Ighe, Vishakha.S.Birari, "Solar based Automatic Grass Cutter," IJSTE - International Journal of Science Technology & Engineering, vol. 3, no. 7, 2017, doi: <http://www.ijste.org/articles/IJSTEV3I7045.pdf>.
- [11] O. A. Tanimola, Diabana, P. D, Bankole, Y. O., "Design and Development of a Solar Powered Lawn Mower," International Journal of Scientific & Engineering Research, vol. 5, no. 6, 2014, doi: <https://www.ijser.org/researchpaper/DESIGN-ANDDEVELOPMENT-OF-A-SOLAR-POWERED-LAWN-MOWER.pdf>.
- [13] H. B. Vuthaluru, V. K. Pareek, and R. Vuthaluru, "Multiphase flow simulation of a simplified coal pulveriser," Fuel Processing Technology, vol. 86, no. 11, pp. 1195-1205, 2005/07/25/ 2005, doi: <https://doi.org/10.1016/j.fuproc.2004.12.003>

Smart Gardening and Hydropower Generation

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Abstract:

Intelligent smart systems have become a trend in most of the business domains wherein it reduces the human work with smart features. Proposed system helps in monitoring the plants and in their progress. It saves cost, ensures safety and helps the farmer in cultivating the crops in a better way. When the farmers or normal people want to plant or to prepare their own garden, major concern is periodical maintenance. This prototype helps in automated monitoring of the plants based on the parameters and their progress. Plants will be watered in the regular intervals based the moisture content of the soil. Humidity of the garden will be displayed on the LCD screen with the help of humidity sensor which helps the farmer to see whether his crops can be grown at that particular humidity level. In addition to that, prototype consists of a gutter assembly where the funneled water from the roof turns on the turbine. As the turbines are rotated, electricity is generated which will be an added advantage. It also helps in detecting the animal motion with the help of PIR sensor which helps in stopping the animals entering the garden.

Keywords:

Humidity sensor, LCD screen, PIR sensor, Turbine.

INTRODUCTION

It is actually a precision automatic watering system for the plant which automatically waters the plant without your engagement with the system. This is made up of Arduino which can easily make by nontechnical persons also so it is the **Arduino watering system** this system is used in gardens and farms widely. Project for the smart watering system is not using only the garden and farms it is implemented into the crops and smart greenhouse also. Automation the process of monitoring the garden can transform garden irrigation process from being manual and static to smart and dynamic one. This leads to higher comfortability, water using efficiency and less human supervision effort. Measuring the soil moisture of the plant gives information if the plant is ideally watered, over watered or under watered. Humidity monitoring device is called a hygrometer. Hygrometer may be designed for indoor or outdoor humidity monitoring use or both. Hydropower or hydroelectricity is the conversion of mechanical energy from flowing water into electrical energy. The fall and movement of water is part is a continuous natural cycle of water called water cycle. Hydropower is considered renewable energy source because the water cycle is constantly renewed by the sun. We will not run out of hydropower as long as the water cycle continues. This is where we can make use of the rain water. Using this we can generate electricity and make use of this water to the plants and in gardens. This is a project where we can make use of over flow the overhead tank along with the rain water. Using

this water, we can produce the power and we can prevent soil erosion too. In addition to this, it reduces the storm water runoff, flooding and pollution of surface water with the fertilizers, pesticides, metals, and sediments. We are making use of sprinkler to spray the pesticides.

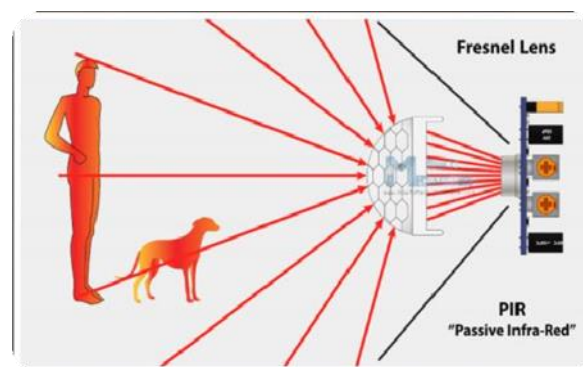


Fig: Detection of PIR sensor

LITERATURE SURVEY

[1]. "Automatic Plant Watering And Monitoring". A research paper. Automatic plant watering and monitoring. The

reason for this is quite obvious since plants have innumerable uses. A source of survival (oxygen), purifying the air, vital food resources, builds the soil and soil moisture and humidity sensing using sensor and implemented in plant growth paves the path for the control of water and fertilizers in efficient way. These save at least 20-30% water consumption than conventional methods. The wireless sensor networks are used to collate data and process it from a central node to irrigate and grow plants in gardens. The newest generation technology is Internet of Things Blinkit which is, in fact, the most widely used ideas for gardens or nursery monitoring by sending data with different wireless communication [1]

[2]. "IoT Based Garden Monitoring System". A research paper proposed a system based on IoT which is used for smart monitor and control over homegrown plants. Arduino UNO acts as the heart of the overall system and microcontroller is used for data transfer which is obtained by the sensors. A mobile application is also made available where the end user can add any plant growth conditions. Major advantage of this system is to smart monitor and to implement control watering. [2]

[3]. "Hydropower generation based on the concept of cross flow generation". A research paper proposed the idea of rainwater harvesting from multi-story building

rooftops and converting the rainwater potential to electricity based on precipitation and building height. The use of a cross-flow turbine to harness the energy from rainwater has been identified by Zhejiang Huang, as well as the trend of rainwater power generation technology. Saleh and Daud used the Simulink models in the MatLab Simulink Package to simulate a rainwater harvesting system (RWH). [3]

SYSTEM REQUIREMENTS SOFTWARE REQUIREMENTS

- Arduino IDE
- Blink Kit Application

HARDWARE REQUIREMENTS:

- Arduino UNO
- Soil moisture sensor
- Servo motor
- DC mini water pump
- Jumper wire
- Breadboard
- Single channel relay module
- 12-volt DC adaptor
- Turbine
- Containers
- Dynamo
- LED bulb
- PIR sensor
- DHT 11 temperature and humidity sensor
- Node MCU board

METHODOLOGY



Fig: Block diagram of automated garden and monitoring

The fundamental point of view of this paper is to give a automatic watering of plants by detecting humidity and generate light for indoor gardening makes easy by self watering and gives right amount of light for right time.

In the monitoring of garden, three sensors namely Humidity Sensor, Soil Moisture Sensor and PIR sensor are used. Their features and their role in the monitoring and controlling plant growth in garden are discussed.

1.Humidity sensor- Humidity is an important factor that needs to be measured in greenhouse and nursery gardening since humidity level in the air influences a variety of physical, chemical, and biological processes. A moisture-holding substrate serves as a dielectric between the two electrodes of the humidity sensing capacitor. The capacitance value changes as the humidity level changes. This measures, processes and converts the resistance values into digital form. This sensor measures temperature with a negative temperature coefficient thermistor, which causes its resistance value to decrease as the temperature rises. This sensor is usually made of semiconductor ceramics or polymers to achieve higher resistance values even with slight temperature changes.

2.Soil Moisture sensor- The volumetric value of water in the soil is measured by a soil moisture sensor. Permittivity is mainly used to assess the water content of the soil (dielectric permittivity). The moisture content of the soil can be determined by putting this sensor into the ground.

3.PIR sensor – PIR sensor can detect animal/human movement in a requirement range. PIR is made of a pyroelectric a sensor, which is able to detect different levels of infrared radiation. The detector itself does not emit any energy but passively receives it.

AUTOMATED GARDEN MONITORING AND CONTROL SYSTEM

The proposed work consists of two sections namely the monitoring and the controlling. Arduino UNO R3 acts as a controller for monitoring and controlling the system with environment conditions obtained using the sensors namely DHT11 temperature and humidity sensor and soil moisture sensor. The controlling section consists of Motor pump, Lights and Cooling fans. To display the status of the sensors an app is used. The block diagram of automated gardening control and monitoring using Arduino.

4.Arduino- The e ATmega328P-based UNO is a microcontrollerboard is an open-source platform in which the hardware and software are freely available and can be modified to meet the needs of the user. The software used here is an Integrated Development Environment (IDE), which requires only a basic understanding of programming. This IDE can be used to code content conductivity and, as a result, the lower the sensitivity.

5.Relay Module Electric current flowing through the relay's coil produces a magnetic field, which draws a lever and changes the switch contacts. Since the coil current can be turned on or off, relays have two switch locations and double-

throw (changeover) switches. The relay in this work acts as a switch to the electric bulb. The bulb is used to control the humidity acting as a heat source. When the sensed humidity is greater than the threshold value then the microcontroller will give signal to the relay and it switches on/off the bulb accordingly¹.

.6.Servo motor A servo motor is a rotary actuator that allows for precise control of angular position. It consists of a motor coupled to a sensor for position feedback. It also requires a servo drive to complete the system. The drive uses the feedback sensor to precisely control the rotary position of the motor.

Software Requirements: The Arduino IDE and blinkit application play a major role here for smart controlling the growth of plants. The Arduino Integrated Development Environment (IDE), also known as the Arduino program, includes a text editor for writing code, a message field, a text console, a toolbar with buttons for common functions, and a series of menus. It communicates with and uploads programmes to the Arduino and hardware. Here in the working system the IDE is used to program the Arduino micro-controller. We can mention all the threshold values such as temperature, moisture, humidity and compile the program. Once it is compiled the content is copied and the hex file is pasted in the appropriate place and the arduino will act accordingly to control the operation of the pump. Here the entire coding of this work did using blinkit application. Here in the system, temperature and humidity are inversely proportional to each other. When temperature increases humidity decreases and vice versa.

RESULTS

Our proposed system and specifications. Based on the results collected by all the sensors, the environmental factors are controlled. First the Humidity sensors measure the humidity around it and transmit it to the Node MCU. If the humidity is greater than the threshold value, then electric bulb will automatically turn on and controls the humidity. The Soil Moisture Sensor will detect the moisture content of the soil and when the soil is too dry it will send signal to the controller and then the water pump is turned on automatically. We can monitor all the values of humidity and soil moisture using android application. In this way the system is monitored and controlled with the environmental factors which affect the

plant growth in our garden. PIR sensor will detect the moving and non moving objects and then it will send signal to the controller and then the buzzer is turned on automatically. By using turbine from a overhead tank the electricity is generated for the use of garden.

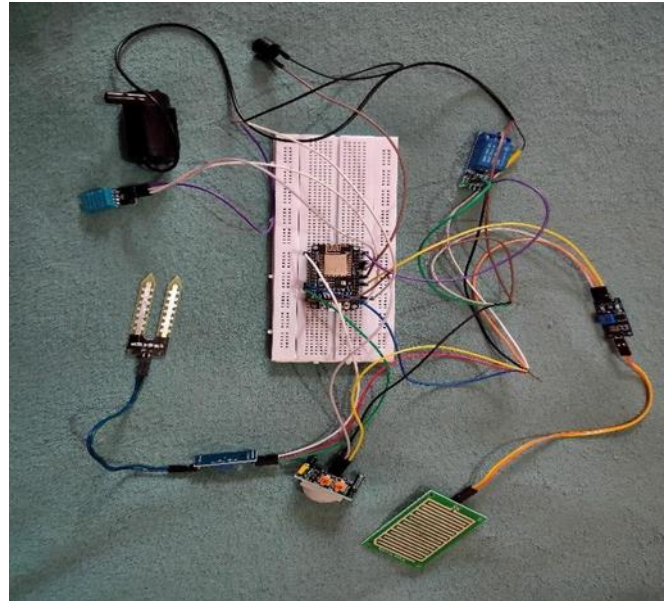


Fig: Circuit diagram

CONCLUSION

The smart automated garden monitoring and control using Arduino with sensor technology is proposed, simulated and tested. Agriculturists or gardeners can utilize and implement this system, to control and monitor all parameters such as temperature, humidity, soil moisture, and light intensity. This system is designed not only to monitor the plants but also for the healthier growth of plants without wastage of water and is successfully controlled remotely through mobile application in our personal device. The optimal environment provided by these sensors result better growth and productivity. In future the work can be improved with image processing technology to monitor the plant diseases with the variation occur with the leaves and stems.

REFERENCES

- [1] Sambath, M., Prasant, M., Bhargav Raghava, N., & Jagadeesh, S. (2019). IoT Based Garden Monitoring System. Journal Of Physics: Conference Series, 1362, 012069. Doi:10.1088/1742- 6596/1362/1/012069
- [2] Mohamad Syafiq Mohd Rafi , Nur Irwany Ahmad , Diyya Hidayah Abd Rahman , Nazrul Azril, 2019, Monitoring And Controlling Water Pumping System Using IoT For Agriculture Purpose, Journal Of Advanced Research In Applied Mechanics, Issue 1 (2019) 1-15.
- [3] Ardiansah, Irfan & Bafdal, Nurpilihan & Suryadi, Edy & Bono, Awang. (2020). Greenhouse Monitoring And Automation Using Arduino: A Review On Precision Farming And Internet Of Things (IoT). International Journal On Advanced Science, Engineering And Information

Technology. 10. 703.
10.18517/IJASEIT.10.2.10249.

- [4] N. Hassan, S. I. Abdullah, A. S. Noor And M. Alam, "An Automatic Monitoring And Control System Inside Greenhouse," 2015 3rd International Conference On Green Energy And Technology (ICGET), Dhaka, Bangladesh, 2015, Pp. 1-5Doi: 10.1109/Icget.2015.7315084

IOT Based Controlling of Power Grid

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Abstract:

An electric network, electric grid, or electricity network is an integrated electricity supply network for producers to consumers. it consists of electricity producing stations. the main objective of this study is to monitor the electricity grid system process, disclose this system at a dangerous level, monitor the current line, and reduce convention system expenses. from anywhere on the internet, we can monitor. We can do it also if a system is enabled or disabled .it uses an electrical microcontroller to monitor a single- phase electric device using Arduino to read sensor voltage and current and then communicate measured data via a new Android application for wireless monitoring .it enables the monitoring of several basic power quality parameter of basic voltage. the technology also determines the line frequency and power factor

Keywords:

Arduino Uno, power grid, android App, Sensor, Voltage and Current, Internet of Things

INTRODUCTION

Computerization shows a main part in the industrial processes and IT application. Energies manufactures provides all he houses with energy through intermediary power-controlled hubs knows as Electrical Grip. Sometimes the failure of the electrical grip causes difficult that the lead to blackout of the whole region supplied by this specific grid. The project seeks to solve the problem though the use of IoT for communication and to address a number of additional challenges that an intelligent system can tackle to minimize excessive energy losses IoT's intelligent energy grid is built the at mega series controller that manage the different system operations. IoT gradually becomes an essential element of our lives that can felt within us. With wi-fi technology the system communicates via internet. The reconnecting operational grip fails and a different energy grip occurs, the system shift transmission lines to the grid, making it easier for particular location whose grid id OFF to supply electricity. And the information, form update via IoT which the grid is actively updated via IoT smartphone application, may be used the authorities and updates. In addition, atomic and nanostructures take use of speeds that were previously unimaginable for storing, detecting, and computing. For this reason, many researchers and currently trying to develop the new types of materials for connecting them it. Comprehensive research investigations in scholarly arts and print and online repots illustrating the inherent efficacy and application of IoT changes has been carried out and accessible. In the shape of print resources. In addition to grip monitoring, this project also includes the advanced energy consumption tracking capabilities and even electricity stealing. The manor goal of the work of this

work is 'IoT' power grid control for the basic is develop an intelligent system to take advantage of the project. The major goal is to shut down the Remote-Control System, to monitor the power line current, to minimize the cost of the traditional system at unsafe levels. We did frequency and voltage monitoring in this project. Beside measuring the data current. Form all across the internet we can check. This could also be doe by enabling or disabling the system.

Fresh information transmission by internet of things (IoT) and storage revolution. Goals that are identifiable and intelligent by the making judgments in connection with events or allowing them to be contextualized. You can pass information on yourself. They can have access or be components of the other services to information utilized by the others. Internet of Things (IoT) is an interconnected system for the transmission of data across a network and the transfer of information through a network, without human or human interaction. It includes interconnected computer devices, mechanical or alphanumeric apparatuses, matters, natures, and persons with unique identifiers. due to the confluence of many technologies, real -time analysis, machine education, commodity and embedded system, the inter of things concept has changed. In future development of electricity grid sensor, actuators and transducers, real-time energy tracking and monitored services are anticipated to play significant role. IoT has become a technology via internet and mobile application throughout the grid system, which enables enhanced grid management. We suggested an IoT aided power monitoring and control system because of the above-mentioned advancement in IoT and the use of of in power networks. It gives customers and utilise the benefit of analysing and managing their resources. This article presents IoT-based power monitoring with blynk software. A literature analysis highlights existing SG, IoT and IoT research. SG supports. Our additional to article include: the integration of the open-source IoT platform that delivers information analyses is supplied for the deployment of the IoT aided power monitoring system. The hardware architecture enables electrical load characteristics like current, frequency, and connected load voltage to be accessed.

MATERIAL REQUIREMENT

Hardware

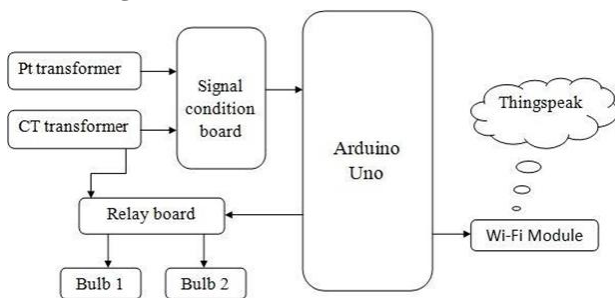
- Arduino uno
- Nodemcu ESP82266
- Signal Condition board
- Current transformer

- Power Transformer
- LCD 16x2
- Load

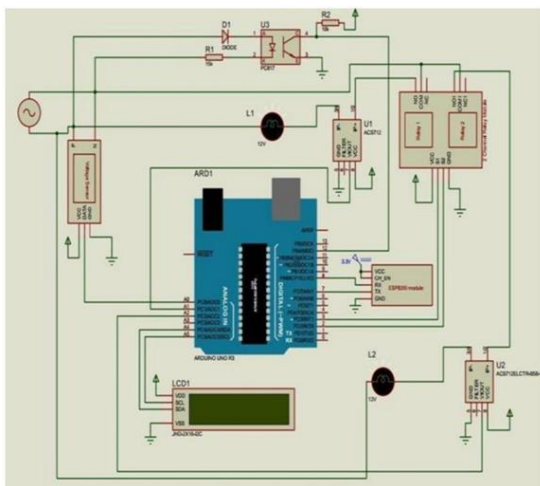
Software

- Arduino IDE
- OrCAD design
- Android App

Block Diagram



User interface of Proteus



Project Picture



CONCLUSION

The Smart Power Grid is undergoing a transformation in the energy arena. Both owner and user-friendly technology are Smart Power Grid. Application form

anywhere on the internet may verify the current system. Authority is able to govern Internet Power line system. One of the most Promising and Prominent Internet applications in business in the intelligent power grid. Efficient power transmission. After energy disruptions, electricity. Reduced service operation and administration expenses and eventually cheaper energy bills for customers. Technology to save time. The requirement for the current grid systems is critical for intelligent operations in power system infrastructure is a new and enhanced grid that resolve several difficulties in the old grid with efficiency and dependability. This study presents the creation of the IoT based prototype for power monitoring and control. Blynk applications are utilized as a software solution for remote access to consumer charge data. The wide scale installation of the architectures described needs the development of cost effectively integrated power sensing and monitoring equipment. Authors will create a cloud- based intelligent metering system for use in clear cities in future.

REFERENCE

- [1] - Wikipedia
- [2] - Enj Article

Smart Water Management System

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Abstract:

Water is essential to human life and the health of the environment. To fulfill the good quality of water required by the people we developed IoT based water quality monitoring automation system for home, offices, etc. To design a system we measured water pH, water level, flow, temperature etc. water parameters using different sensors. In this paper we proposed a smart sensor interface device that integrates water tank level monitoring, water pollution monitoring and water pipeline leakage monitoring. We used ultrasonic sensor to check the water tank level, flow sensor to detect water leakage in pipelines, pH sensor to check the water quality and temperature sensor to check the temperature of the water. The system automation is represented by using Labview software. This automation system is control by using laptop/mobile phones. By placing this system in a smart building, we will be able to collect and analyze the water usage patterns of the residents and save a lot of water from wastage.

Keywords:

Microcontroller, pH Sensors, Flow Sensor, Temperature Sensor, Ultrasonic Sensor.

INTRODUCTION

Water is an essential need for human survival but due to rapid pace of industrialization and greater emphasis on agricultural growth combined with latest advancements, agricultural fertilizers and nonenforcement of laws have led to water pollution to a large extent. The availability of good quality water is paramount in preventing outbreaks of water-borne diseases as well as improving the quality of life. In order to ensure the safe supply of the drinking water the quality needs to be monitor in real time. The internet of Things (IoT) is a revolutionary concept that has the potential to turn virtually anything to smart. IoT provide interface to monitor and operate remotely from anywhere and anytime. Water quality refers to the chemical, physical, biological, and radiological characteristics of water. In this work Water quality is calculated by considering waters physical (temperature) and chemical (pH) indicators. Water pollution monitoring system can help to detect the water pollution that means the quantity of pH and the temperature of the water. The pipe leakage detection is also the important thing to avoid the wastage of water. So, to ensure safe supply of drinking water and to avoid wastage of water we are proposing a Smart Water monitoring automation System using the techniques of different sensors (Internet of Things) and Analytics. The existing liquid level control systems are widely used for monitoring of liquid levels, reservoirs, silos, and dams etc. The proposed system is used for home / office.

LITERATURE SURVEY

To Designed a good quality model we studied out different existing system developed by researchers. Different authors have proposed distinguished models to check water quality, water leakage by analyzing the parameters such as temperature, pH and electrical conductivity, pressure and so on. By considering all these points we designed a smart water monitoring system which can perform all these monitoring functions. Bhad Vidya et al. [1] has proposed a system which monitors the water level periodically. They designed a zigbee network which has lower energy and real time behavior. It helps to wireless sensor network to send the notification message to the mobile application user and digital notification board. A microcontroller, water level sensor and a pair of Raspberry pi and DAS have been used to design the system. The Sensor used to detect the water level, then the data will go to transmit and receive through the Raspberry pi and the whole procedure is then control by this unit. Mithila Barabde et al. [2] develop a system for continuous monitoring of water quality at remote places using wireless sensor networks with low power consumption, low cost and high detection accuracy. The system architecture consists of data monitoring nodes, a base station and a remote station. All these stations are connected using wireless communication link. For developing this system they have considered the parameters such as pH, conductivity, turbidity level, etc that are analyzed to improve the water quality. These parameter readings were sent to the remote monitoring station to display in visual format on a server PC with the help of MATLAB and is also compared with standard values. If the obtained value is above the threshold value automated warning SMS alert will be sent to the agent. Jayti bhatt et al. [3] were proposed IOT based water quality monitoring system to ensure the safe supply of drinking water in real time. Water parameter such as pH, turbidity, conductivity, dissolved oxygen, temperature is considered to check the water quality. The measured values from the sensors are processed by microcontroller and these processed values are transmitted remotely to the core controller that is raspberry pi using Zigbee protocol. Zigbee module is connected to controller which manages data coming from different devices. To transmit the data to IOT, a gateway is created on the raspberry pi using FTP. Separate IP address is provided which make possible to monitor data from anywhere in the world using the internet. Cho Zin Myint et al. [4] presented a reconfigurable smart sensor interface device for water quality monitoring system in an IoT environment. The smart water Quality monitoring system consists of Field

Programmable Gate Array design board, sensors, Zigbee based wireless communication module and personal computer (PC). System collects the five parameters of water data such as water pH, water level, turbidity, carbon dioxide (CO₂) on the surface of water and water temperature in parallel and in real time basis with high speed from multiple different sensor nodes. Author provided smart water quality monitoring system of single chip solution to interface transducers to sensor network using Field Programmable Gate Array development tool presented with wireless method by using a wireless XBee module. Anthony Faustine et al. [5] implemented a model by evaluating prevailing environment including availability of cellular network coverage at the site of operation. The system consists of an Arduino microcontroller, water quality sensors, and a wireless network connection module. It detects water temperature, dissolved oxygen, pH, and electrical conductivity in real-time and disseminates the information in graphical and tabular formats to relevant stakeholders through a web-based portal and mobile phone platforms. Ali M. Sadeghioon et al. [6] designed a smart wireless sensor network for leak detection in water pipelines, based on the measurement of relative indirect pressure changes in plastic pipes. The sensor nodes were deployed in the field trials and they collected temperature and relative pressure data. Leak tests and daily pressure variations were clearly registered by the nodes showing a response in both the relative pressure sensor (FSR) as well as the temperature sensors. It is postulated that the temperature sensors have the potential to be combined with the FSR data to identify leaks as opposed to „normal“ pressure drops. A. Ejah Umraeni Salam et al. [7] proposed a model to detect the leakage of pipeline by computerized on-line system using pressure analysis, as a determinant of the leakage in a pipe. Pressure at each node is taken as input data. The pressure data is obtained from the simulation results using the EPANET 2.0 software. To train the data a detection system of magnitude and location of leakage with pressure analysis obtained from the EPANET using the method of Radial Basis Function Neural Network produces the accuracy of the 98% of the entire existing pipeline on the water distribution network J. Navarajan et al. [8] introduces wireless sensor networking using several sensors to measure water quality, microcontroller and Zigbee module. This system based on wireless sensor network that consists of Wireless Water Quality Monitoring Network and Remote Data Center. S. Geetha et al. [9] provided a power efficient, simpler solution for in-pipe water quality monitoring based on Internet of Things technology is presented. The model developed is used for testing water samples and the data uploaded over the Internet are analyzed. The system also provides an alert to a remote user, when there is a deviation of water quality parameters from the pre-defined set of standard values.

Components of System

In the proposed smart water quality monitoring automation system, water quality monitoring, pipe leakage detection and water level monitoring is designed. The hardware of wireless smart water quality monitoring automation system comprises the following components:

Ultrasonic Sensor

Ultrasonic sensors emit short, high-frequency sound pulses at regular intervals. These propagate in the air at the velocity of sound. If they strike an object, then they are reflected back as echo signals to the sensor, which itself computes the distance to the target based on the time-span between emitting the signal and receiving the echo. The ultrasonic sensor is used to measure the level of our water tank to avoid the overflow of water.

Temperature Sensor

The temperature sensor is used to measure the temperature of water. In our system to check the quality of water, temperature is also considered as one parameter.

pH Sensor

The pH sensor is used to measure the quantity of hydrogen in water. pH is only one of a variety of factors affecting corrosion (3–8). The pH of a solution is the negative common logarithm of the hydrogen ion activity: The pH of water is a measure of the acid–base equilibrium and, in most natural waters, is controlled by the carbon dioxide bicarbonate, carbonate equilibrium system. An increased carbon dioxide concentration will therefore lower pH, whereas a decrease will cause it to rise.

Flow Sensor

Flow sensor is used for flow measurements to find the leakage in a pipe. Accurate flow measurement is an essential step both in the terms of qualitative and economic points of view. This sensor sits in line with the water line and contains a pinwheel sensor to measure how much water has moved through it. There is an integrated magnetic Hall-Effect sensor that outputs an electrical pulse with every revolution.

GSM

A GSM modem could also be a standard GSM mobile phone with the appropriate cable and software driver to connect to a serial port or USB port on computer. Any phone that supports the “extended AT command set” for sending/receiving SMS messages is used.



Fig1. (a) Ultrasonic Sensor (b) pH sensor (c) Temperature sensor (d) Flow Sensor

METHODOLOGY

In our proposed system we carried out experiments for identifying water tank level, to check water quality and to detect water leakage in a pipe.

Water tank level monitoring

In water tank level monitoring system for monitoring the level of tank we use the ultrasonic sensor. An ultrasonic sensor is a device that can measure the distance by using sound waves. In water level monitoring the transmitter send the sound waves and receiver receive the signal. By using following formula we calculate the distance.

$$\text{Distance} = (\text{speed of sound} \times \text{time taken}) / 2$$

In our system we consider that the height of our tank is 30cm. To avoid the wastage of water we use the automation for the motor. If the water level is less than 20 % then microcontroller send the +ve signal to the relay and relay automatically gets ON and motor will be get started. If the level of water tank is greater than or equal to 80% then microcontroller send the -ve signal to the relay and relay will be automatically gets OFF then motor also gets OFF. In this both the situations the GSM send the message to the user. If the level is less than 20% then it will send the message Alert: level is 20. If the level is greater than or equal to 80% then it will send the message like Alert: level is 80.

Water quality monitoring

Water quality monitoring system is very important for measure the quality of the water. To measure the quality of water we use the pH and the temperature sensor. The pH stands for “Potential of Hydrogen,” referring to the amount of hydrogen found in water. pH is measured on a scale that runs from 0 to

14. 7 is neutral, meaning there is a balance between acid and alkalinity. A measurement below 7 means acid is present and a measurement above 7 is basic (or alkaline). The second parameter is a temperature. Temperature will also affect the equilibrium and the pH. In pure water, a decrease in pH of about 0.45 occurs as the temperature is raised by 25 °C. We kept the pH probes and temperature sensor in the water for two minute and recorded the pH value and temperature value that was displayed on the meter screen on Labview.

In this water quality monitoring system if the value of pH sensor is greater than 7 then it will be send the message to the user and if the temperature is greater than 50 then also the GSM send the message to the user.

Water pipe leakage detection

In the water pipe leakage detection system for detecting the leakage we use the flow sensor to measure the flow of the water. In our system we use the two flow sensors for measure the flow of water. If the flow measured from first flow sensor and flow measured from second flow sensor is not equal that means the leakage is present in our system.

If the leakage is occurred in our system then the GSM send the message to the user that is Alert: Leakage is detected. The block diagram of our system is shown in Fig 2.

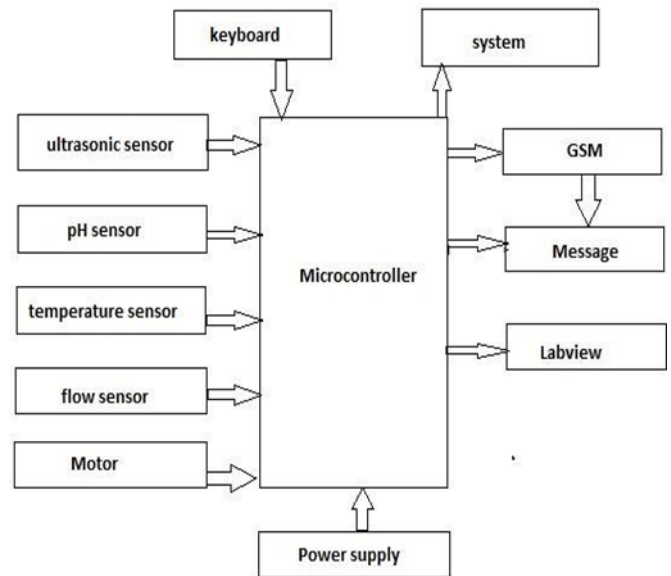


Fig 2: Block diagram of system

In our system the microcontroller is the core component which controls all the devices those are connected to the microcontroller. Ultrasonic, pH, temperature, flow sensor, motor, 22 GSM is connected to the microcontroller. Microcontroller sends the data to the computer through the USB connector. Motor is used to fill the empty tank. If the tank level is below 10% then motor automatically gets ON and if tank level is greater than 80% then it will be gets OFF. The relay is used to control the functioning of motor. Relays are switches that open and close circuits electromechanically. Relay controls one electrical circuit by opening and closing contacts in another circuit.

In our model the coding of required component is written in Arduino IDE. In this we can show the output on serial monitor. We connected microcontroller to the computer through USB cable and then measured the data measured by sensor.

Following figure 3 displays the results of experimental work done. The first graph represents the pH value of the water which is the 5 and second graph represent the value of the temperature which is 25 degree Celsius. Leakage is represented by third graph. And last graph represent the water tank level. Dashboard is created by using Labview.

System runs on battery power and comprises of four sub circuits working synchronously; sensor circuit, controller circuit, SMS circuit and relay driver circuit. Sensor senses the level of the water in tank which is continuously fed to controller system. As the system encounters the empty level condition, status of load shedding is checked. Relay coil is energized and the pump operates when there is no load shedding.

SOFTWARE REQUIREMENTS

1. IDE Arduino.
2. EMBEDDED C

HARDWARE REQUIRMENTS

1. ARDUNIO NANO (ATMEGA328P)
2. Ultrasonic Sensor
3. Temperature Sensor
4. PH Sensor
5. FLOW SENSOR
6. GSM

CONCLUSION

The system can monitor water quality automatically, and it is low in cost and does not require people on duty. This system is used to avoid the huge amount of water is being wasted by uncontrolled use of home/offices etc. So the water quality testing is likely to be more economical, convenient and fast. This designed smart water system can be easily applied to home, offices, and schools and at any places where water tanks are used. By placing this system in a smart building, we will be able to collect and analyze the water usage patterns of the residents and save a lot of water from wastage. This is the small contribution from our side to save and supply good quality of water.

REFERENCES

- [1]. Bhad Vidya, Kale Poonam, Gavhale Priyanka, Darekar Gaurav, Prof A.S Chandgude, "Water Level Monitoring System In Real Time Mode Using WSN", International Journal of Emerging Technology and Advanced Engineering (ISSN 2250-2459, ISO 9001:2008 Certified Journal, Volume 6, Issue 9, September 2016.
- [2]. Mithila Barabde, Shruti Danve, "Real Time Water Quality Monitoring System", International Journal of Innovative Research in Computer and Communication Engineering Vol. 3, Issue 6, June 2015.
- [3]. jayti bhatt, jignesh patoliya, "IoT based water quality monitoring system", International Journal Of Industrial Electronics And Electrical Engineering Volume-4, Issue-4, Apr.-2016.
- [4]. Cho Zin Myint*, Lenin Gopal*, and Yan Lin Aung, "Reconfigurable Smart Water Quality Monitoring System in IoT Environmet", ACIS 16th International Conference on Computer and Information Science (ICIS), IEEE xplore, ISBN: 978-1-5090-5507-4.
- [5]. Anthony Faustine , Aloys N. Mvuma, Hector J. Mongi, Maria C. Gabriel, Albino J. Tenge, Samuel B. Kucel, "Wireless Sensor Networks for Water Quality Monitoring and Control within Lake Victoria Basin: Prototype Development", Wireless Sensor Network, 2014, 6, 281-290.
- [6]. Ali M. Sadeghioon, Nicole Metje , David N. Chapman and Carl J. Anthony, "SmartPipes: Smart Wireless Sensor Networks for Leak Detection in Water Pipelines", Journal of Sensor and Actuator Networks ISSN 2224-2708.
- [7]. A Ejah Umraeni Salam, Muh.Tola1, Mary Selintung and Farouk Maricar, "On-Line Monitoring System Of Water Leakage Detection In Pipe Networks With Artificial Intelligence", ARPN Journal of Engineering and Applied Sciences VOL. 9, NO. 10, OCTOBER 2014.
- [8]. J.Navarajan, B. Aswin kumar, S. venkatesh , T. jayachandran, "Detection of Water Pollution and Water Management Using Smart Sensors with IOT", International Research Journal of Engineering and Technology (IRJET) Volume: 04 Issue: 04 | Apr - 2017.
- [9]. S. Geetha and S. Gouthami, "Internet of things enabled real time water quality monitoring system", Department of Electrical and Electronics Engineering", (2016) 2: 1. <https://doi.org/10.1186/s40713-017-0005-y>.

Smart Reminder

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Abstract:

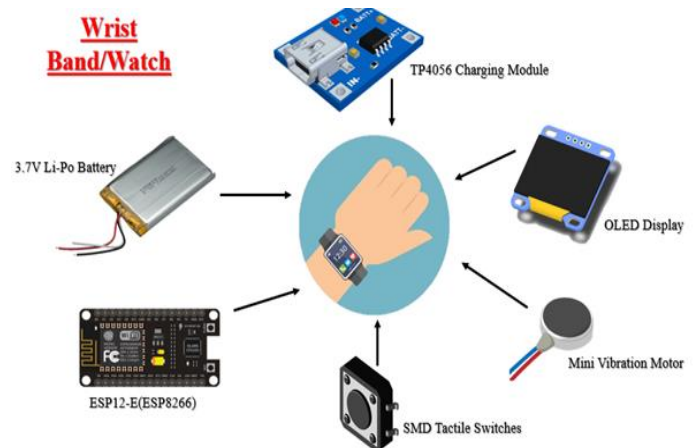
Forgetting things and other daily activities have become a problem for everyone, especially senior citizens. They usually forget about their health related things like medicines. To solve this problem upto an extent we can remind them about the medicines. What if we are out of station or we are in a situation where we can't call our elder once, to solve this we are going to develop a "SMART REMINDER SYSTEM" which includes a microcontroller and a wrist band/watch which can be connected to our smart phone using IoT technology.

INTRODUCTION

Smart watch is basically a wearable mini computer/mini smart phone in the form of wrist watch with light weight and immediate access to messages, notifications, calls and other digital datas in our daily life.

Smart watch provides a touch screen interface, many potential capabilities like notifications, GPS Navigation, calendar synchronization and fitness tracking. However, so far these are the main applications updated in a smart watch, till now there is no technology implemented regarding health problems(Eg: medicine related) for elder once, to resolve this problem we are going to implement our idea to remind them about their medications.

In this project we are using a microcontroller(Arduino UNO), ESP 8266 WiFi Module, a wrist band/ watch which includes a mini LED display, vibration motor, battery and switches. We will be using IoT technology, WiFi technology to implement this reminder system.



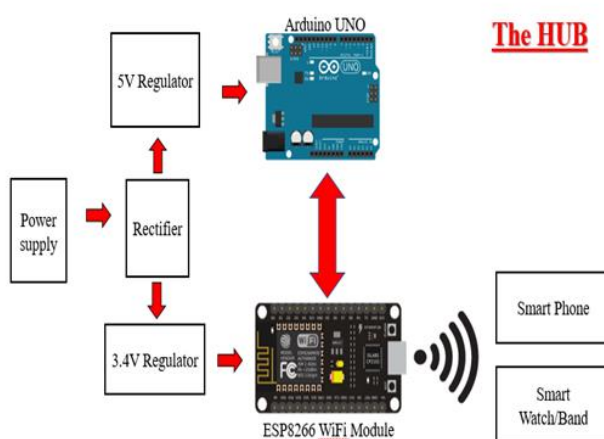
WORKING PRINCIPLE

Arduino UNO which has integrated ATmega328P microcontroller, several I/O pins and several features which can be programmed with the help of Arduino IDE tools. In this project the Arduino UNO will be acting as a hub for the communication between our smart phone and the wrist band/watch. The microcontroller will be programmed to receive messages from our smart phone through the ESP8266 WiFi Module and the same WiFi Module will also connects with the wrist band when in range. We will be using a single mobile application which can take certain message input, time input and a reminder switch. The microcontroller also be programmed for giving reminder message signals to the wrist band at fixed time for the medicines by itself, this will be useful when our smart phone is out of range or switched off.

When a message signal is send from the smart phone, it reaches the microcontroller(hub) and then it is transferred to the wrist band. The wrist band is equipped with an ESP8266 WiFi Module, vibration motor, LED display, switches and a battery. When the message signal is received from the microcontroller the wrist band display will show the message content(the name/color of the pills to be taken) and the vibration motor will start to vibrates in a strong intensity which in turns reminds the elder person to take that pill at that time. The vibration motor can be stopped by pressing a switch provided in the wrist band.

By the pressing of that switch in the wrist band generates an opposite message signal and send to the microcontroller which we can consider as that our elder one had taken the medicine and this data can be accessed from our smart phone.

BLOCK DIAGRAM



Software Requirements

Android Software Development Kit (Android SDK).
 Android Studio.
 Arduino IDE Tool

Hardware Requirements

Arduino UNO
 ESP8266 WiFi Module
 Power supply & voltage regulators
 LED Display
 Vibration Motor
 Resistors
 Capacitors
 SMD Switches and ON/OFF Buttons
 Li-Po Battery
 Plastic Casing & Wrist Strap
 Smart Phone
 TP4056 Charging Module

Automated Medication Dispensing System	Mrs. Bhagya Shree S R	2014	Uses the LCD display and audio buzzer signals.
Medication Adherence Monitoring Using Modern Technology.	Murtadha Aldeer	2017	The system uses RFID tag to keep the record of pills taken.
Automatic Pill Reminder For Easy Supervision	Animesh Kumar Sahu	2017	It uses the LCD display and GSM module to send the notifications

Table 1: Literature Survey

Title of Paper	Author	Year	Summary of Paper
Intelligent Pillbox: Automatic and Programmable Assistive Technology Device	Juan Marcelo Parra	2017	A circular medicine box which will rotate itself at each dosage time.
Smart Medicine Dispenser (SMD).	Wissam Antoun	2018	An android Application sends notifications to the entities involved accordingly.
MEDIBOX IoT Enabled Patient Assisting Device.	Achsah Mary Marks	2016	The LCD displays the details of the medicine and buzzer for alarm notification.

CONCLUSION

The autonomous pill box designed aims at assisting a patient completely with a user friendly manner and reduces human efforts. The circular shape of the box will help in rotating the box and the dispenses the only pill required; the alarm and notification features will help in keeping the record of the medication and will greatly increase the medicine effectiveness.

REFERENCES

- [1] Juan Marcelo Parra, Wilsom Valdez, Andreea Guevara, Priscila Cedillo, Jose Ortiz-Segarra, "Intelligent Pillbox: Automatic and Programmable Assistive Technology Device", Proceedings of the IASTED International Conference Biomedical Engineering (BioMed 2017), February 20-21, 2017 Innsbruck, Austria.
- [2] Wissam Antoun, Ali Abdo and Suleiman Al-Yaman Abdallah Kassem, Mustapha Hamad and Chady ElMoucarry, "Smart Medicine Dispenser (SMD)", 2018 IEEE 4th Middle East Conference on Biomedical Engineering (MECBME).
- [3] H.-W. Kuo, "Research and Implementation of Intelligent MedicalBox," M.S.thesis, Department of Electrical Engineering, I-Shou University, Kaohsiung, TW, 2009.
- [4] S.-C. Huang, H.-Y. Chang, Y.-C. Jhu and G.-Y. Chen, "The Intelligent Pill Box-Design and Implementation", in Proceedings of the IEEE International Conference on Consumer Electronics, May 26-28, Taiwan.

- [5] E. E. Abdallah and E. Fayyumi, "Assistive Technology for Deaf People Based on Android Platform," *Procedia - Procedia Comput. Sci.*, vol. 94, no. Fnc, pp. 295-301, 2016.
- [6] Murtadha Aldeer, Richard P.Martin WINLAB, Rutgers, "Medication Adherence Monitoring Using Modern Technology", The State University of New Jersey, North Brunswick, NJ 08902, US
- [7] Baviskar Pallavi V., Sanjay S. Gharde, K. P. Adhiya, "Identification of Handwritten Simple Mathematical Equation Based on SVM and Projection Histogram",

4-Channel Touchless Switchboard for the Post Covid World

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Abstract:

Due to the outbreak of Covid-19 pandemic, a new technology called touchless sense switch (TSS) has been introduced, which helps read human inputs without touching any equipment or switch panel. Each button/switch that needs human input through physical touch can be replaced with a sensing area activated by TSS whose broad designing process is described here

Keywords:

4-Channel Touchless Switchboard.

INTRODUCTION

As Covid-19 is still rampant we need to be cautious. Wearing mask, social distancing, and washing or sanitising our hands properly from time to time is absolutely necessary to avoid it. As a precaution, we should also avoid touching any item including the electrical switches as far as possible. In public places, schools, and offices the electrical switchboards are touched by one and all, and so can pass on the virus from one person to many.

Here is a solution in the form of a 4-channel touchless switchboard. Arduino Uno as the heart of the project, surrounded by four ultrasonic sound sensors, offers a simple, low-cost, and novel solution. The switches can be turned on and off alternately by just placing a hand next to the ultrasonic sound sensors on the device, without touching.

SYSTEM REQUIREMENTS

Hardware

The hardware components used in our project is listed below.

1. Arduino UNO
2. HC-SR04 Sensor
3. 4-Channel Relay Module
4. Jumper Wires

Software

1. Arduino IDE tool

METHODOLOGY

Touchless sense switch is designed to read human inputs without requiring a person to touch any equipment or switch panel. The systems process and interpret these signals according to preset algorithms and take the desired action for the user.

Vcc supplies power to the HC-SR04 ultrasonic sensor. You can connect it to the 5V output from your Arduino.

Trig (Trigger) pin is used to trigger ultrasonic sound pulses. By setting this pin to HIGH for 10μs, the sensor initiates an ultrasonic burst.

Echo pin goes high when the ultrasonic burst is transmitted and remains high until the sensor receives an echo, after which it goes low. By measuring the time the Echo pin stays high, the distance can be calculated.

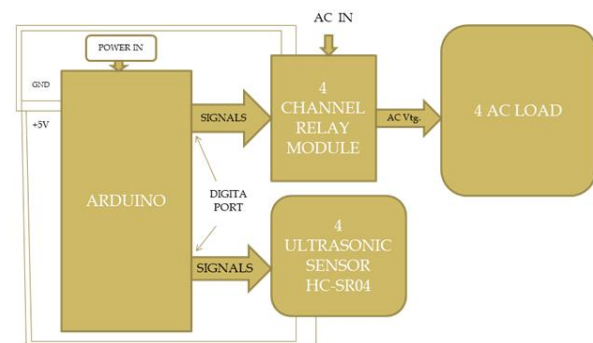


Fig a: Block diagram of TSS



Fig b : PIN DETAILS OF HC-SR04 SENSOR

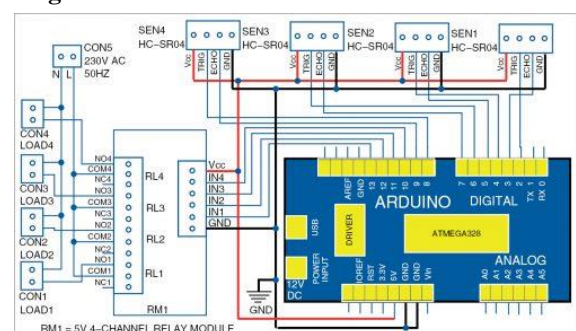


Fig 2: Circuit Diagram

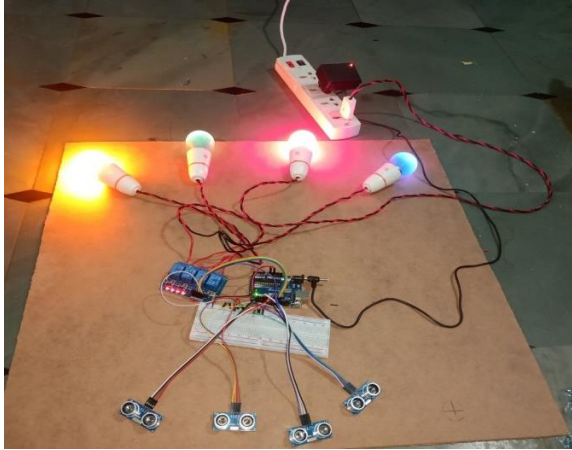


Fig 3: Prototype of the Project.

CONCLUSION

This technology is a solution to address one of the problems caused due to the current pandemic. The existing physical human-machine interactions via touch panels and switches pose life threat during pandemic situations as viruses can spread through physical contacts by infected/uninfected individuals.

In addition, the performance is maximised and wear-tear cost is reduced with the use of this technology. The design of this also gives the flexibility of configuring the behaviour of switching.

REFERENCES

- [1] <https://www.electronicsforu.com/electronics-projects/4-channel-touchless-switchboard-post-covid-world>
- [2] https://en.wikipedia.org/wiki/Arduino_Uno
- [3] <https://www.maxbotix.com/articles/how-ultrasonic-sensors-work.htm>

Factors Influencing Organizational Structure for Highway Construction Project Performance Improvement

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Abstract:

Organizational factors influencing project effectiveness can be identified. These elements can be suggested for enhancement in highway construction projects. To achieve the study's objectives, data from highway construction organisations is gathered via a questionnaire survey. Initially, the main factors influencing organisational effectiveness are identified. Size, Duration, Resource, Technology, Complexity, Internal Interdependency, External Interdependency, Customer Base, Uncertainty, and Importance are the factors. Then its sub factors under these main factors are determined. All ten factors are responsible for the organization's effectiveness, and some are critical to the organization's operation. As a result, this project may be useful in improving the characteristics of organisations that can be implemented in the future for large construction projects.

INTRODUCTION

The relationship between economic growth and infrastructure investment is very evident. The faster the economy grows more the need for faster and reliable mode for transport for movement of goods and people. High growth of Indian economy is driving the demand for transportation industry. The transportation industry is classified into majorly three segments i.e. aviation, roads and railways. India has a road network of 5.23 million kilometers. Present government's high focus on infrastructure investment and friendly approach towards Private-Public Partnership (PPP) model gives room for private players in the industry. India has witnessed 112 completed road projects via Public –Private Partnership Model and 150 projects are being completed.

It is clear that infrastructure investment and economic growth are related. The need for quicker and more dependable modes of transportation for the movement of people and products increases as the economy expands more quickly. The need for the transportation sector is being driven by India's rapid economic growth. The aircraft, road, and rail sectors make up the bulk of the transportation industry. India has a 5.23 million km long road network. Private firms can now enter the market because to the current administration's strong emphasis on infrastructure investment and favorable attitude toward the Private-Public Partnership (PPP) model. With the help of a public-private partnership model, India has

seen 112 road projects completed, and 150 more are in the process of being finished.

Transportation industry contributed roughly 6.3% of GDP and is majorly dominated by road sector. More than 50% of freight and 90% of passenger traffic are handled by road. Government as well private investments, rising exports, increasing interstate movement of goods and passengers, growing FMCG sector and rising disposable income are the major drivers of transpiration industry in India. In order to boost the connectivity across country, 100% FDI has been allowed in roads and Highway sector via automatic route. In case of aviation sector, government has increased the FDI limit from 79% to 100% of which up to 49% is available under automatic route.

The success of a project is greatly influenced by the organizational environment surrounding it. Many practitioners believe that organization of a major Construction project will have a significant impact on the successful completion of the project. The Project managers can enhance their overall chance of success by understanding how organizations affect projects. Organizational structure refers to the organizational and administrative patterns, such as the arrangement of departments and the division of labor, and distribution of authority. Thus organization structures have a great influence on the timeliness (schedule) & cost of project.

Organization can be defined as group of people who must coordinate their activities in order to meet organizational objective. The organization for construction project is temporary; Organizing for project management requires flexibility because of the uniqueness of each project. Some Important considerations for selection of organization are project scope and complexity, time schedule, geographic location, contract terms, financial arrangements, and so forth. The organizational structure must facilitate the integration of company efforts to achieve project goals and objectives. This integration and coordination is especially important in the engineering and construction phases of large industrial type projects.

PROBLEM STATEMENT

The aim of research work to find effective solution for original work of highway for kept the cost minimum as per project planning and scheduling.

OBJECTIVE

1. To study the concept of various types of organizations and their characteristics.
2. Discuss organization structures for highway projects and to identify the factors affecting on it.
3. Evaluation the above factors and finding results.
4. Discussion and suggestions given for effective organization for highway project

SCOPE:

This research will concentrate on studying the organizational structure of the different construction projects. The report from the investigations of case studies of highway construction projects aims further to improve the characteristics of organizations, which can be implement in the future major construction. In addition, comparison can be done between organizations of highway construction projects.

REVIEW OF WORK

This works reviews the relevant literature on organizational structures related to construction projects, the concept of organization structures, and further discusses the problems associated with them. The Reviews of other authors help me to understand the topic easily.

Xueying Wu et. al. (2019): The author said that the implementation of green projects continues to encounter several challenges with regards to the project management techniques applied in different construction projects. He want to find out the relationship between green construction management and the quality of highway engineering projects, and to try to help innovators identify the best place to focus. Adopted mixed research method where both quantitative and qualitative research approaches were used, analysis techniques adopted included Pearson's correlation, regression analysis. The effect of financial issues and design codes, standards, and various risks will be the most effective green performance constructing strategies. Its research result will help stakeholders in improving the quality standards for highway engineering projects and help practitioners and help them improve green construction management in an effort to promote sustainable development of project management.¹

According to **D. V. Parikh et. al. (2019)**, from early 21st century, he have been observing an interesting trend among global organizations, especially in the technology and consulting space, to make their performance management approach more development-focused and less dependent on relative ranking and normalization. While performance management is an area of immense personal interest, it has recently gained prominence as a topic of discussion, with many Indian companies initiating big as well as small changes to the way they approach the measurement and management of

performance. This has also encouraged their Indian counterparts to critically evaluate their current performance processes and make modifications. So in today's world projects should be organized to accomplish complex tasks that cannot be handled by lone individuals but by multidisciplinary teams in the construction industry. The success of a project depends upon how well the personnel can work effectively to accomplish the objectives within scope, cost and quality constraints. Performance management is about directing and supporting employees to work as effectively and efficiently as possible in line with the needs of the organization.²

E Oktavianti et. al. (2019): In this paper the author can tell about the SMART techniques and the system of SMART technique use. The system that can automatically calculate the results of promotions and provide recommendations for the candidates who are eligible to be promoted is needed. SMART method is chose as decision support system. The criteria's set by HRD consist of experience and potential result and performance value. The superior assessment of the normalization value of each criteria's is 0.2 for experience, 0.4 for potential result, 0.3 of performance value and 0.1 of supervisor's assessment.³

NakHyeok Choi et. al. (2017): In this paper the author said that the relation between efficiency and effectiveness of highway management at the state level in United States. It was systemically designed to test the relationship by controlling the state's political factors, fiscal capacity, median voter, and economic conditions. This study contributes to the discussion on sustainability management by focusing on highways as the target of empirical analyses. The study deals with efficiency and effectiveness that were discussed as performance proxies in prior literature and examines the empirical investigation between them. The relationship between them has not been adequately discussed, though efficiency and effectiveness are the most important values in the public sector. He studies aims to build up the concept of efficiency and effectiveness for infrastructure spending, to suggest measurement strategies, and to find empirical evidence on their relationship. The results of the fixed effects model and the spatial autoregressive panel model show that statistically strong relationship between efficiency and effectiveness which are respectively measured by two analysis approaches.⁴

Meera Ramesh kumar Patel et. al. (2017):- In this paper author shows that the different type of MCDM (Multi- Criteria Decision Making) techniques and the information about SMART method. In this paper has application of SMART method and process of the SMART method. The author takes the case study and uses the SMART method to calculation of the weightage and scores.⁵

David Arditi et. al. (2017): The Author investigates that explore the relationship between a construction company's organizational culture and delay. The

questionnaire survey was administered to construction companies located in the U.S. and India in order to collect data on their organizational culture experienced in their projects. The percentage of delay relative to the project duration is lower in the U.S. as compared to India. Despite the fact that delays are caused by a multitude of reasons often mentioned in the literature and statistical analysis indicates that there is also a significant relationship between organizational culture and the magnitude of delays. This relationship is useful for a construction company in cultivating an organizational culture that is expected to reduce project delay.⁶

Vrushali Chaudhari et. al. (2015): This Paper is intended to describe the various types of factors affecting the effectiveness of the organizational structures used in the different types of construction project. Thus the factors of organization affecting the effective working of project can be determined. These factors can be proposed for improvement for both private as well as for public project. The ten main factors & their sub factor are determined through literature review. Thought all ten factors are responsible for the effectiveness of organization; some factors are critically responsible for working of organization. These factors will go to determine through this paper. Thus this paper can be helpful to improve the characteristics of organizations, which can be implemented in future, for major construction projects.⁷

Riza Yosia Sunindij (2015): The author said that the construction industry has always been considered as one of the most dangerous industrial sectors. Focusing on safety among small organizations is important to keep improving safety performance in the construction industry because the majority of organizations in the industry are small organizations. It is important to focus improvement efforts on safety performance of small organizations, so that the overall industry performance may be improved. Using a questionnaire survey, this research collected data from construction organizations based in New South Wales, Australia. Data analysis results have identified key barriers faced by small organizations when implementing safety and linking safety performance with insurance premium and licensing system, and subsidizing safety training for small organizations.⁸

Mulla Aneesah et. al. (2015): The author is said that the Supply Chain Management is recognized as a leading process improvement, cost saving and revenue enhancing business strategy. Supply chain management is a great opportunity for the construction industry primarily to reduce cost and time, and thus improve profitability. It applies to all businesses involved in the delivery of construction projects. The supply chains in construction can be divided into two major groups as the construction chain and materials chain, which help to separate the procurement and management operations.⁹

Ehab E., et. al. (2013): In this paper the author has to identify the different factors, those are affecting

organization selection. In this paper there is ten main factor and each factor has some sub factor which is the total factors is Forty three were prepared to be surveyed in the questionnaire. To evaluate various organizational structures and their co-ordination efficiencies, this study utilizes the analytical process to quantify the success of organizational structures and does to identify the optimal structure of organization. And give the weight and score to the factors.¹⁰

Lokesh Kumar Meena et. al. (2013):- The present study is conducted to overcome the defects and to take advantage of the merits of both line organization and functional organization, line and staff organization has been evolved. Line and staff organization is a combination of line organization and functional organization. It is a type of organization in which there are two sets of officers for administration. The paper is mainly concern with line and staff organization in organization development. The conceptual paper has covered that what is need for line and staff organization, what is meaning, features, their management styles, line and staff positions, line and staff and functional authority for any organization development of organization behavior.¹¹

Solomon Kwarteng Forkuoh et. al. (2012): In this paper the author is trying to show that the relationship and correlation among the family set up, line of authority and chain of command in traditional family set up. He finally compares with that of non- family business and suggests the best for smooth running and managing of family businesses. A study on the chain of command in families, family business and non- family business as well as the organizational charts of business, were made and final recommended to made the authorities concern. The most family businesses surveying that the same organizational structure as that of their families, the head of family as chief executive officer and grandsons at the bottom of the organizational charts which shows the chain of command.¹²

Dusan Bobera (2008): The author said that, according to recent and scientific publicity accepted attitudes, three basic organizational forms for project management, with their description, characteristics, advantages and disadvantages, as well as to try to identify the cases in which some of them could be applied. In analyze the functional organizational type, where the project is a part of functional enterprise organization, clear project organization and combined or matrix system. According to the fact that each one of the models mentioned above has its own advantages and disadvantages, in this paper the author is to present the procedure to choose the model will be the most appropriate for implementation in particular cases. It is necessary to consider the nature of the potential project, characteristics of different projects, advantages and disadvantages of every organizational form, different preferences in the culture of the home organization.¹³

Min-Yuan Cheng et. al. (2003):- This author's study relies on Trend Model to investigate various modes of

coordination among the team members of construction projects. Trend Model establishes an Activity Relationship Matrix (ARM) to identify the activity relationships within the construction process. The author is tell about the project organization, organizational structure, optimal organization, Trend model, trend analysis, analytic hierarchy process, organization communication, communication resistance and some other information about the organization.¹⁴

NOTEWORTHY CONTRIBUTIONS

Previous research work is studies shows noteworthy contribution, study was review from recent past in Xueying Wu et. al. 2019 adopted mixed research method where both quantitative and qualitative research approaches. D. V. Parikh et. al. 2019 focuses on Improvement the performance management skills of an individual and teams. 2019 E Oktavianti et. al. using SMART technique to improve the process and quality of the decision-making results. NakHyeok Choi et. al. 2017 to build up the concept of efficiency and effectiveness for infrastructure spending, to suggest measurement strategies, and to find empirical evidence on their relationship. Meera Ramesh kumar Patel et. al. 2017 takes the case study and uses the SMART method to calculate the weightage and scores. David Arditi et. al. 2017 Author investigates that explore the relationship between a construction company's organizational culture and delay. Vrushali Chaudhari et. al. 2015 considers the ten factors which are responsible for the effectiveness of organization. Riza Yosia Sunindij 2015 is mainly focus on improvement efforts on safety performance of small organizations. Mulla Aneesa.I et. al. 2015 focusing on the cost saves and revenue enhancing business strategy of Supply Chain Management. Ehab E. et. al. 2013 author identify the different factors those are affecting organization selection. Lokesh Kumar Meena et. al. 2013 the work is mainly concern with line and staff organization in organization development. Solomon Kwarteng Forkuoh et. al. 2012 the author is trying to show that the relationship and correlation among the family set up, line of authority and chain of command in traditional family set up.

GAP IDENTIFICATION The concept of organizational structure is a system that outlines how certain activities are directed in order to achieve the goals of an organization and the activities can include rules, roles, and responsibilities. It also determines how the information flows between levels within the company.

The authors of Literature reviewers are focused on the building construction organization, public and private organization, family set up organization, organizational structure of Egyptian construction market, etc.

This research focuses on the highway construction organization because highway construction work is so vast; therefore, the proper organization is necessary. In infrastructure development the highway construction work plays the very important role. If the proper

communication in organizational structure then the speed of work gets fast and coordination also maintain in organization.

In highway construction company has any sections and departments under the organizations, therefore to maintain the proper coordination, first we have to make the planning of organization and maintain the chain of command.

PROPOSED METHEDOLOGY

1. Literature survey is to be conduct from previous research studies from various national and international journal research papers. This will help in understanding of basic terminologies and further research work
2. To carry out the proposed study of various types of organizational structures used for highway construction projects.
3. Conducting case study on ongoing six to eight highway construction projects in Maharashtra.
4. Formation of the questionnaire on the above study by identifying the factors of organizations affecting the success of project.
5. Collect the data by conducting the personal interview of the employees and fill the questionnaire.
6. To Analyze the above data by SMART (Simple Multi Attribute Rating Technique) or RI method. This method is used to rank each key factor then the ranking is converted into score and from these score the weightage of each factor is found out.
7. Graphical representation will carried out by considering main factor affecting the each organization
8. Based on the above work findings will be drawn and necessary recommendations will be given on organizational structures.

EXPECTED OUTCOME

1. The study indicates the critical factors involved in the optimization of the organization structure which contributes in the field of highway Construction Company and will help to improve the performance of the construction organization in highway construction companies.
2. The result of the study indicates that there are different critical factors for different organization for highway construction companies that likely to improve the effective organization and can lead up to the project success.
3. The factors states in the study can be used as a check list to form an organization structure for the highway organization. The critical factors states in the study for specific organization can be used as a most important factors by the manager level person who going to set up an organization structure for the project.

4. As an active resource the project manager need to be an effective and clear leadership power. The successful project manager has self-motivation and goal orientation. This is most important in Highway Construction Organization.
5. Organizations linker shelter there is highly maintained discipline, regarding incoming and outgoing timings of employees. This leads to daily reporting of work to the project manager, which is helpful to maintain the schedule of project. Thus it minimizes the duration of project.
6. Technology has enormous effects on the development and construction organizations in past decades. The effects have get to experience in various disciplines, such as organizational efficiency, communication approach and employee behavior.
7. Obviously technology helps to minimize the effort and increase the speed of the work, that's why the members of the organization structure must be technocracy which leads to powerful and successful organization. Thus it is important in highway construction organization.

REFERENCES

- [1] Xueying Wu, Wenyi Zhao and Tianshan Ma, "Improving the Impact of Green Construction Management on the Quality of Highway Engineering Projects," *Sustainability* 2019, 11, 1895; doi: 10.3390/su11071895, journal MDPI, Published: 29 March 2019
- [2] Dhaval Virendra Parikh, Prof. Sumit Phugat, "Performance Management in Road Construction Project," *International Research Journal of Engineering and Technology*, Volume 06, Issue 04, Apr 2019 (1561-1566).
- [3] E Oktavianti, N Komala, and F Nugrahani, "Simple multi attribute rating technique (SMART) method on employee promotions," *International Conference of Computer and Informatics Engineering*, IOP Publishing Ltd, Journal of Physics: Conf. Series 1193, 19 April 2019.
- [4] NakHyeok Choi and Kyujin Jung, "Measuring Efficiency and Effectiveness of Highway Management in Sustainability," *Sustainability* 2017, 9, 1347; doi:10.3390/su9081347.
- [5] Meera Rameshkumar Patel, Manisha Pranav Vashi, Bhasker Vijay Kumar Bhatt, "SMART- Multi-criteria decision-making technique for use in planning activities", *Research Gate*, publication No- 315825133, March 2017.
- [6] David Arditi, Shruti Nayak, Atilla Damci "Effect of organizational culture on delay in construction", *International Journal of Project Management* 35 (2017) 136 – 147.
- [7] Vrushali Chaudhari, Prof. P. B. Bhangale, "Effective Organizational Structure for Construction Industry: Case Study," Volume IV, Issue VII, July 2015.
- [8] Riza Yosia Sunindij, "Improving safety among small organizations in the construction industry: key barriers and improvement strategies," *Proceeding Engineering* 125 (2015) 109 – 116.
- [9] Mulla Aneesa.I, Dr. A.K.Gupta, Prof. D.B.Desai, "Supply Chain Management: Effective Tool in Construction Industry," *International Journal of Novel Research in Engineering and Science*, Vol. 2, Issue 1, pp.: (35-40), Month: March 2015.
- [10] Ehab E., Hossam H., Waleed M., "Optimum Organization Structure for construction projects (Management tool of selecting Organization in Egyptian Construction Market)", *International journal of Engineering Science and Innovative Technology (IJESIT)* Vol.2, Issue 3, May 2013, pp.411-431.
- [11] Lokesh Kumar Meena S. L. Bairwa K. Lakra, Maina Kumari and R.S.Meena, "A Study of Line and Staff Organization in Organization Behavior, research gate, publication No- 303251506, July 2013.
- [12] Solomon Kwarteng Forkuoh, Abraham Osei, "Adopting best organizational structure for effective Management and control of family businesses in Ghana," *International Journal of Advanced Research in Management and Social Sciences*, ISSN: 2278-6236 Vol. 1 | No. 3 | September 2012.
- [13] Dušan Bobera, "Project Management Organization," *Management Information Systems*, Vol. 3 (2008), No. 1, pp. 003-009.
- [14] Min-Yuan Cheng, Cheng-Wei Su and Horng-Yuh You, "Optimal Project Organizational Structure for Construction Management," *research gate, Journal of Construction Engineering and Management*, February 2003.

Geohazard in India and the Role of Geotechnical Engineering in Georisk Reduction

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Abstract:

Geohazard is any situation that poses a threat to human life, property, or the environment by causing damage or failure of geotechnical structures such as foundation, slope, tunnel etc. The likelihood of such a situation can be considered as a georisk. The major geohazards that have been documented in India in past century are foundation failure, soil liquefaction, slope instability, ground subsidence, retaining wall failure, tunnel squeezing and rockfall. Georisk in India has amplified in this century due to increase in civil engineering construction and increase in number of user of the civil engineering facilities. This paper reviews past recorded and existing geohazards in India and discusses the possible causes of increase in georisk in India with mitigation measures and scope of geotechnical engineering in reducing the georisk in India.

Keywords:

geohazard, georisk mitigation, geotechnical structures, smart geostructures.

INTRODUCTION

Geohazard is any situation that poses a threat to human life, property, or the environment by causing damage or failure of geotechnical structures such as foundation, slope, tunnel etc. by natural agents viz. gravity, earthquake, water (rainfall, flood, tsunami), geological thrusts from faults & folds etc. and artificial factors viz. impact load, blast load etc. The likelihood of such a situation can be considered as a georisk. This paper reviews past recorded and existing geohazards and georisk analysis in India and mitigation measures.

MAJOR GEOHAZARDS IN INDIA

The major geohazards that have been documented in India in past century are discussed in the consequent sub-sections.

2.1 Foundation failure



Fig. 1: Collapse of Jahu Bridge [4]

A foundation transfers the load of the superstructure of a construction to the supporting soil. Foundation may fail if it exceeds its design capacity or if the supporting soil

fails. An incident of foundation failure at the St. Thomas Church, New Delhi was reported by [1]. Tel bridge pier failure in Orissa (September 1979), Kandla port and Customs Tower failure by Bhuj earthquake in 2001 [2], IIT Guwahati Dibrang Hostel raft foundation tilting due to differential settlement [3] are some recent examples of foundation failures in India. Jahu Bridge (Fig. 1) in Himachal Pradesh was collapsed in 2014 due to pier foundation failure caused by river scouring.

2.2 Soil liquefaction



(a) Indo-Nepal Earthquake, 1934 [5]



(b) Assam, 1950 (Source: archives.assam.gov.in)



(c) Coastal Gujarat, 2001 [6]

Fig. 2: Soil liquefaction in India due to earthquake

Soil liquefaction is the phenomenon where soil loses its strength or stiffness causing damage or failure of the existing structure resting on it [7]. This can occur either due to static loading (termed as static or flow liquefaction) or dynamic loading such as earthquake which is more prevalent in India. Bihar 1934 [Fig. 1(a)], Assam 1950 [Fig. 1(b)], Coastal Gujarat 2001 [Fig. 1(c)] are some of the major liquefaction incidents in India occurred due to earthquake. As there was no major civil engineering construction in most of these sites, therefore no damage was observed in past. However, it will be hazardous in future if the liquefaction occurs in a site having a civil engineering structure. The 1988 Assam Earthquake caused widespread liquefaction and damage of railway tracks, embankments and a hotel building [8].

2.3 Slope instability

Hill slope, bridge abutments, river banks are the examples of natural slope; and embankments, earth-fill dams, mine tailings are the examples of man-made slopes. Slope instability triggered by rainfall/melting snow infiltration and earthquake is the major reason of landslide and embankment failure in India. Landslides in hilly areas of different states (Himachal Pradesh, Jammu and Kashmir, Assam, Meghalaya, Karnataka, Kerala, Tamil Nadu to name a few) are triggered by rainfall and earthquake damaging human lives, property and infrastructure (Fig.3). This is also the cause of frequent traffic disruption in these regions. Major floods in Assam, Bihar, Kerala and West Bengal caused embankment failure resulting in inundation of nearby areas (Fig.4).



Fig. 3: Landslide damaging a house in Kerala [9]



Fig. 4: Embankment failure causing inundation in Sunderban, West Bengal (source: Times of India)

2.4 Ground subsidence and sinkholes



Fig. 5: Sinkhole due to tunnel excavation in Chennai (source: The new Indian Express)

The formation of cavity below the sub-surface can be due to various reason such as sub-surface erosion, mining and excavation etc. can cause occurrence of ground subsidence (Raniganj coalfield subsidence, 1991) and sinkholes (Annasalai sinkhole in Chennai, 2017).

2.5 Retaining wall failure

Retaining walls are earth retaining structures to retain the backfill and add stability to a cut or slope. Retaining walls in Sangli city in Maharashtra, 2005 and 2006; Dwarkanagar, Visakhapatnam, 2012 and Shimla, 2019 failed causing instability to the backfill.



Fig. 6: Retaining wall failure in Sangli [10]

2.6 Dam failure

Dams are earth filled barriers to make a reservoir. Dam failure may occur due to piping, toppling of dam foundation, dam wall burst, landslide, geological forces such as faults etc. Failure of such a huge water filled structure can cause flooding in the downstream area (Fig. 7). Planchet Dam (1961), Machhu Dam (1979), Kaddam (1957), Panshet (1961), Khadakwasla (1961), Chikkhole (1962) and Nanak Sagar (1967) are major dam failures in India [11].



Fig. 7: Floods of water, mud and debris flowing to downstream due to Uttarakhand dam failure, 2021 (Source: <https://news.sky.com/story/uttarakhand-dam-disaster-what-caused-indias-deadly-flood-12214731>)

2.7 Tunnel squeezing



Fig. 8: Squeezing in Nathpa Jhakri tunnel [12]

Squeezing occurred inside Nathpa Jhakri tunnel resulting in narrowing of the tunnel diameter which was caused by the change in stress state of the rock mass after excavation.

2.8 Rockfall

Rockfalls are characterized by fast movement (falling, rolling, bouncing and sliding) of dislocated rocks along a hill slope. Huge rockfall boulders can cause fatality, property destruction and traffic disruption in hilly road e.g. NH-44A, Mizoram (Fig. 9) and Mumbai Pune expressway.



Fig. 9: Rockfall along NH-44A, Mizoram [13]

CAUSE OF INCREASE IN GEORISK IN INDIA

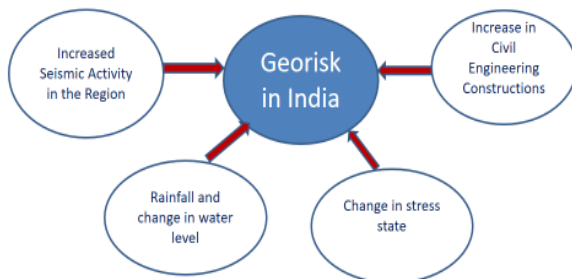


Fig. 10: Causes of increase in georisk in India

The hazards motioned in previous section resulted in serious consequences such as fatality, loss of property etc. thus making these hazards a risk to the region. Besides these hazards, there may have been many geohazards occurred in India which remained without proper documentation. Soil liquefaction and slope failures are caused by natural agent mainly earthquake and rainfall whereas the remaining hazards are caused by combination of natural agents and human induced processes such as change in stress state due to excavation or construction of facilities, ground water condition change etc.

As India is a developing country, more civil engineering constructions are built in the recent past to facilitate development and more individuals are able to get access to the facilities. Hence, more individuals will be affected on the occurrence of a geohazard. Hence the seriousness or vulnerability of hazards are increasing. Moreover, as major part of India lies in a seismically active zone, this has increased the probability of occurrence of geohazards. All of these reasons have combined to amplification of the georisk scenario in India.

MITIGATION MEASURES CURRENTLY IN PRACTICE TO REDUCE THE GEORISK IN INDIA

Geotechnical engineering is contributing to a great extent to reduce the georisk in India.

Liquefaction potential mapping and ground improvement methods (e.g.: stone columns, grouting, deep mixing method) are adopted at various sites to mitigate the soil liquefaction.

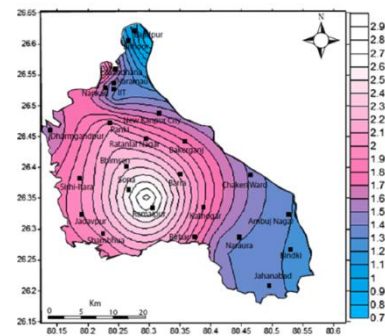


Fig. 11: Liquefaction Potential map of Kanpur city [14]

Instances of developing landslide susceptibility map, application of soil nailing/ rock bolts, wire meshing, shotcreting and geosynthetics (Geotube, Geobags, Geocells etc.) are observed for slope stabilization (Fig. 12) and to prevent damage from rockfall (Fig. 13).



Fig. 12: Embankments with Geotube and Geobags in Assam (source: SNDRP)



Fig. 13: Rockfall mitigation using the combination of rock bolt and wire meshing in Mumbai-Pune expressway (source: Maccaferri)

Measures such as preloading and vertical drains, pile foundations, shoring and underpinning, vibro compaction, deep compaction, micro-piles etc. are suggested by practicing engineers to avoid foundation failure [1], [3] and [15].

Re-grading of backfill material to facilitate drainage, use of shear key and tie backs, geosynthetically reinforced

retaining wall (geogrids) are applied to prevent retaining wall failure [16]. Steel support with yielding beam element and pressure relief holes were used to prevent tunnel squeezing [17].

CONCLUSION AND FUTURE SCOPE

Geohazards caused by natural agents (earthquake and water) cannot be prevented. However, adequate measures in the form of ground improvement, proper design of geostructures and increasing the strength of soil can be adopted to minimize the georisk due to hazards triggered by natural causes and human activity.

During the early stage of last century, record of geodisasters was found to be limited. The documentation of geohazards is increasing at present time and the geotechnical engineers are carrying out detailed geotechnical analysis of the incident to interpret the cause of failure. Post failure case studies, stability analysis of geostructures and probabilistic risk assessment of the geohazards are available in literature. However, there is need for proper assessment of the type and level of geohazards in any given space and time, based on past records and experiences as well as scientific inputs [18]. Based on this, appropriate prevention measures can be decided economically to avoid a future disaster.

There is huge scope for geotechnical engineering to additionally reduce the georisk in India. A single mapping of entire region for a particular geodisaster can help in design of smart geostructures. Structural health monitoring of geostructures and Digital Transformation (DX) can be used as tools for preparation of such maps. As India is still following specification based design of geostructures, a shift to performance based design will provide more freedom to geotechnical engineers to design a structure aptly. More research in the form of numerical modelling and physical model tests can be conducted to comprehend and predict behavior of geostructures during hazardous condition, which will give more insight into the cause of failure of different geostructures. The modern geo techniques such as ground freezing, vacuum preloading etc. also can be used effectively to strengthen the ground.

ACKNOWLEDGEMENT

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REFERENCES

- [1] Sharma, D., "Foundation failure of the St. Thomas Church, New Delhi," 2nd International Conference on Case Histories in Geotechnical Engineering, pp.1365-1369, June 1988.
- [2] Dash, S. R., Govindaraju, L. and Bhattacharya, S., "A case study of damages of the Kandla Port and Customs Office tower supported on a mat-pile foundation in liquefied soils under the 2001 Bhuj earthquake," Soil dynamics and Earthquake Engineering, 29(2), pp. 333-346, 2009.
- [3] Dey, A. and Reddy, M. A., "Compensated raft foundation on a preloaded soil improved by vertical drains," Ground Improvement and Geosynthesis GSP 238, ASCE, pp. 515-525, 2014.
- [4] Rajendran, R., "Bridge failures case studies in India (2016-2019)," Masters Thesis, Politecnico Milano, 2019.
- [5] Acharya, P., Sharma, K. and Acharya, I. P., "Seismic liquefaction risk assessment of critical facilities in Kathmandu Valley, Nepal," GeoHazards, vol. 2, pp. 153-171, 2021. <https://doi.org/10.3390/geohazards2030009>
- [6] Narula P. L. and Choubey, S. K., "Macro seismic surveys for the Bhuj (India) earthquake of 26 January," 2001, https://www.iitk.ac.in/nicee/EQ_Reports/Bhu/j/narula1.htm
- [7] Jefferies, M. and Been, K., "Soil liquefaction: a critical state approach," CRC press, Taylor and Francis book series, Sep. 2015.
- [8] Gupta, M. K., "Liquefaction during 1988 earthquakes and a case study," 7th International Conference on Case Histories in Geotechnical Engineering, pp. 1757-1761, June 1993.
- [9] Andrewwinner, R. and Chandrasekaran, S. S., "Finite element and vulnerability analyses of a building failure due to landslide in Kaithakunda, Kerala, India", Advances in Civil Engineering, 5297864, 2022. <https://doi.org/10.1155/2022/5297864>
- [10] Padhye, R. D. and Ullagaddi, P. B., "Case study of failure of a R.C.C. counterfort retaining wall," 16th International Conference on Case Histories in Geotechnical Engineering, paper no. 2.05, 2008.
- [11] Latha, A. "What are the odds of a dam burst?" India Water Portal, Jul 2015.
- [12] Hoek, E., "Big tunnels in bad rock," Journal of Geotechnical and Geoenvironmental Engineering, ASCE, 127(9), pp. 726-740, 2001.
- [13] Verma, A. K., Sinha, R. K., Sardana, S., Jaswal, M. and Singh T. N., "Investigation into the rockfall hazard along Lengpui-Aizawl highway, NH-44A, Mizoram, India," Indian Geotechnical Journal, 51, pp. 732-745, 2021.
- [14] Naik, S. P. and Patra, R. N., "Generation of liquefaction potential map for Kanpur city and Allahabad city of northern India: An Attempt for Liquefaction Hazard Assessment," Geotechnical and Geological Engineering, 36, pp. 293-305, 2018.
- [15] Sridharan, A. and Srinivasa Murthy, B. R., "Remedial measures to a building settlement problem," 7th International Conference on Case Histories in Geotechnical Engineering, pp. 221-224, June 1993.
- [16] Souza, I., Naik, A. and Savoikar, P., "Forensic case study of retaining wall failure in Goa," Indian

Geotechnical conference GeoNEst, IIT Guwahati, December 2017.

- [17] Sharma, H. R. and Tiwari, A. N., “Tunnelling in the Himalayan region: geological problems and solutions,” International Water Power and Dam Construction, 64, pp. 14-19, 2012.
- [18] Gupta, S. P., “Geohazards risk management in India,” 8th Asian Rock Mechanics Symposium, Sapporo, Japan, October 2014.

IOT Based Smart Industrial Panel Using Python for Speed Control and Monitoring of DC Motor

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Abstract:

Internet Of Thing (IOT) makes the monitoring and controlling process become accessible everywhere and every time. In this project, the IOT is used to monitor and control the speed of a DC Motor remotely through smart industrial panel web applications which can be accessed through mobile phone, laptops, system and smart gadgets. DC motor play's vital role in different industries. We have used Microcontroller, ESP 8266 wi-fi module and web server also with the help of some transducers we can easily achieve our goal to protect and control the motor as well as to monitor various parameters. We have provided several controls through internet to avoid faults in DC motor. The Industrial person can monitor the parameters using IOT smart industrial panel provided with unique login credentials which comes under the proposed system. When a person login to the IOT platform using the credentials, he/she can choose the appropriate motor to turn on, off or to vary the speed from the remote location and, can monitor the real time voltage current flowing through it. The control signal with the information containing speed, read API id, DC motor id will be sent to the microcontroller through an http request. Micro controller will verify for the API and sends initial control signal to the controller. This makes the DC motor to run at particular speed. The status of the motor will be displayed in the localized display block and web application in real time.

Keywords:

Raspberry Pi Pico, WIFI, Anti Clockwise, sensor.

INTRODUCTION

DC motors are very useful for various applications because of their wide range of speed control and relatively small size. In previous time for controlling or operating two or more motors the workers need to go to respective location where the motor is placed but with the help of this technology the operator can easily control all motors of the plant from a single control room. Also, for checking various parameters of motor like current and voltage we have to use measuring instrument but with the help of this project we can continuously monitor the parameters on a single computer screen. Various faults like short circuit fault are very common in DC motors to avoid these faults our system provide protection to DC motor. Speed control means intentional change of drive speed to a value required for performing the specific work process. This concept of speed control or adjustment should not be taken to include the natural change in speed which occurs due to change in the load on the shaft. Any given piece of industrial equipment may have its speed change or adjusted mechanically by means of stepped pulleys, sets of change gears, variable speed friction clutch

mechanism and other mechanical devices. Historically it is proved to be the first step in transition from nonadjustable speed to adjustable speed drive. The electrical speed control has many economical as well as engineering advantages over mechanical speed control the nature of the speed control requirement for an industrial drive depends upon its type. Some drives may require continues variation of speed for the whole of the range from zero to full speed or over a portion of this range, while the others may require two or more fixed speeds.

SYSTEM REQUIREMENTS

Hardware

1. Microcontroller RP2040
2. DC Motor.
3. Step-Down Transformer.
4. Speed Sensor
5. Voltage and Current Sensor
6. 16x2 LCD Display.
7. WIFI Module ESP8266.
8. MOSFET.
9. Diode.
10. Opto isolator

Software

1. VS CODE Editor.
2. THONNY IDE.
3. PYTHON IDE.
4. DJANGO

METHODOLOGY

The entire project is depending on IOT based embedded system so interfacing of all hardware with wi-fi and internet is very important part in its functioning. The whole programming is done in Python IDE and then it is load in the Node MCU and with the help of wi-fi and various sensors we have achieved the required goals like protection to motor from over voltage or faulty conditions. Also study and observing of various parameters of motor like current and voltage. Controlling of motor is another very important feature in this project.

1. Development of controller circuit for the speed control of DC motor using PWM method.
2. Design of python based smart Industrial IOT panel.

3. Development of read API to transfer data from web application (IOT platform) to microcontroller.
4. Development of write API to transfer data from microcontroller to web application server.
5. Displaying the real time data in web application and localized display.

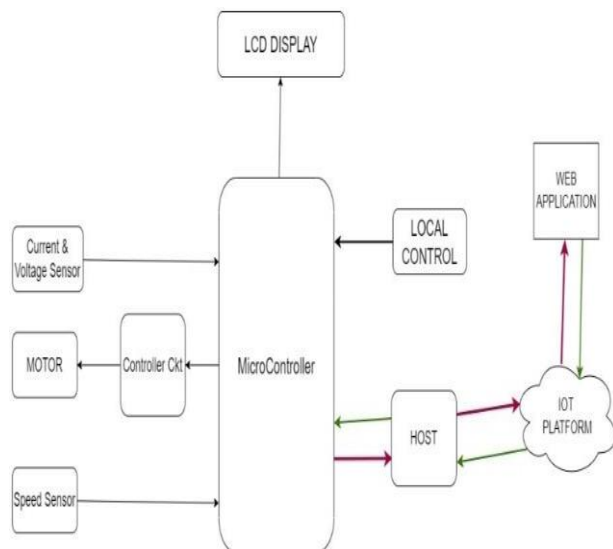


Fig.1 Block Diagram

In the proposed system the speed and operation of the DC motor is monitored and controlled through IOT from a WEB application. The industrial person will be provided with a unique login credential, using the same one can login to web application and control the required DC motor from the list. The speed and the voltage value are sent to the server through host from microcontroller.

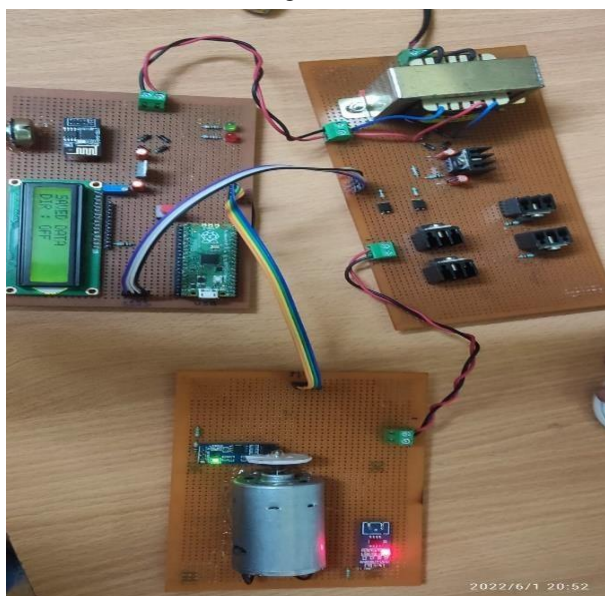


Fig.2 Prototype of the project

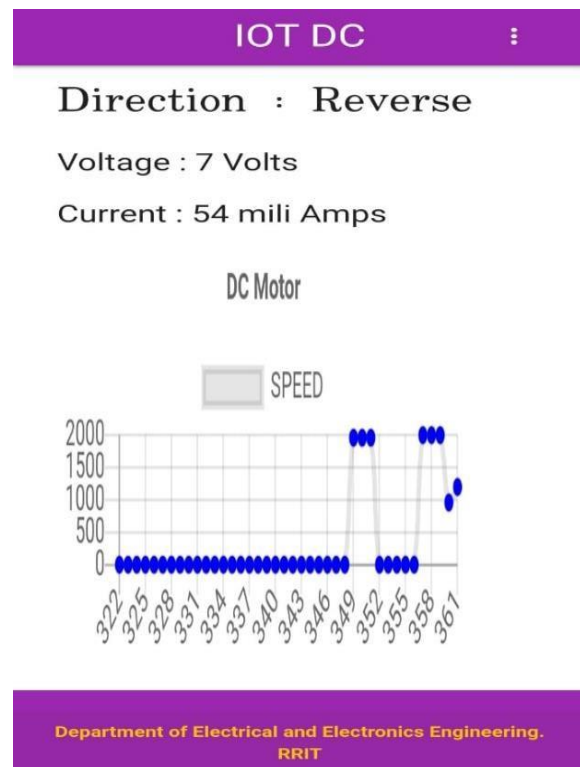


Fig. 3 Graphical Representant

CONCLUSION

The proposed project technique will make hardware model where the IOT Technique is used for control dc motor. Therefore, the speed and the direction of dc Motor can be controlled by use of phone using IOT. In this paper, proposed the new architecture to control the DC motor, which uses a flexible industrial based Android smartphone at a reasonable price and implemented by Ethernet shield and Raspberry pi Pico as well as using web domain for system control configuration. The proposed architecture is used in a web service for communication between the remote user and the industrial device. All Android based smartphone, the Ethernet shield connection is the support built, and the industry access device to control can use the phone, 3G or 4G to access the Web page on hosting server using Android App or web domain.

This paper represents the IoT is well known and rapidly growing technology nowadays. Now IoT becomes a vital part of human life. In the future millions of things should be interconnected with the cloud. Recently IoT comes all over the field such as industry, home automation, electric vehicle, traction, agriculture, medical field, etc. with the help of sensors this paper represents IoT-based condition monitoring parameters and controlling the speed of the motor with the help of PWM techniques. Analysis and visualize voltage, current, speed on LCD display. By analyzing the motor parameters make the motor to be operated in safe and protective in nature, it also helps in calculating new data to interact with social media and other devices. From thing speak visualization the waveform of voltage,

current, temperature, and speed on the mobile application by connecting to hotspot module. Through Python anywhere continuously monitored the motor parameter and if any fault takes place, it will get an alert message on the mobile application. In industries required continuous monitoring data value for power consumption and maintenance application.

REFERENCES

- [1] IOT based control of DC traction motor Akanksha¹, Shubham Kathuria² ^{1,2} School of Electrical Engineering, VIT University, Chennai Tamil Nādu 600127, India.
- [2] Speed Control of DC Motor by using IoT Pratima A. Uparwat¹, Lalit S. Khiradkar², Arati S.Sindhimeshram³, Chaitrali P. Dhenge⁴, Kunal K. Kamble⁵, Pratiksha Panchabhai⁶ ^{1,2,3,4,5}UG Students, Dept. of Electrical Engineering, JDCEM, Maharashtra, India ⁶ Professor Dept. of Electrical Engineering, JDCEM, Maharashtra, India.
- [3] SPEED MONITORING AND CONTROLLING OF MOTOR USING INTERNET OF THINGS (IOT) ENHANCED WITH WI-FI 1Mr.P. Balaji, Ganadipathy Tuli's Jain Engineering College, Vellore, India, Assistance professor, Dept. of EEE, Ganadipathy Tulis's Jain Engineering Collage, Vellore India, 4 Associate Professor, Dept. of EEE, Ganadipathy Tulis's Jain Engineering Collage, Vellore India.
- [4] DBWS++Controlling+DC+Motors+with+the+LM 98N+D ual+H-Bridge+and+an+ArdinoWebsite;- <https://s3.amazonaws.com/download.dronebotworkshop.com/DBWS++Controlling+DC+Motors+with+the+L298N+Du al+H-Bridge+and+an+Ardi no.pdf>
- [5] V.J. Sivanagappa and K. Haribalan, "Speed Control of DC Motor via Internet for reaction Applications".
- [6] Andrea Azzarra and Luca Mottola, "Virtual Resources for the Internet of Things". Swedish
- [7] Innovation Agency VINNOVA and "Smart Living Technologies" (SHELL) of the Italian Ministry for university and research. 7. Online: <https://praxis.ac.in/the-smartphone-and-the-internet-of-things/>
- [8] Krishna Dharavath¹, F. A. Talukdar², R. H. Laskar³, Study on Biometric Authentication Systems, Challenges and Future Trends: A Review, IEEE International Conference on Computational Intelligence and Computing Research, 2019.
- [9] PWM Based Automatic Closed Loop Speed Control Of DC Motor" by Atul Kumar Dewangan, Nibbedita Chakraborty, Sashi Shukla, Vinod Yadu, IJETT – 2020
- [10] "Remote Controlling and monitoring of Induction motors using internet", Abdulkadir, Cakır, Hakan Cali's, Gokhan Turan Suleiman Demirel University, Faculty of Technology, Department of Electrical and Electronic Engineering, Isparta Turkey.
- [11] Speed Monitoring & Controlling of motor using IOT Enhanced With WI-FI", by P. Balaji, R. Murali, M.

A Critical Analysis of Pre-Packaged Insolvency Framework for Restructuring

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Abstract:

In a post-pandemic world, where insolvency laws for some have been suspended, creditors of Indian corporates are left with little leverage and even lesser hope for recoveries. Many believe that times like these call for new mechanisms in the Indian restructuring space. Prepacks, or pre-packaged restructuring agreements, are currently being widely suggested as the next best option for creditors and Indian distressed companies. Given the inevitable rising financial stress in India's financial sector heightened by payment moratoriums on term loan facilities and protections for certain potential defaults, creditors have been left searching for alternate, viable restructuring mechanisms.

The primary element of prepacks, which differentiates it from standard Indian in-court restructurings, is the involvement of company promoters and shareholders in the process. The IBC is founded on a creditor-in-control model, where creditors decide the fate of a distressed company. In comparison, prepacks by nature typically have some shareholder cooperation and court approval a combination that the insolvency law explicitly sidesteps. Therefore, without a dilution of the existing Section 29A provision, the introduction of prepacks could end up contradicting existing insolvency "policy", which was put in place for a targeted purpose. On the flip side, diluting Section 29A could help insofar as facilitating more "resolutions" across the board, since finding third-party bidders could be a challenge.

INTRODUCTION

Prior to the IBC's introduction, Indian insolvency laws were scattered across statutes and courts/tribunals. Therefore, the IBC was introduced as a comprehensive law dealing with all forms of insolvencies, restructurings, and bankruptcies in the country. In line with this objective, one could argue that introducing prepacks within the IBC framework itself (i.e. a feature of the overall insolvency law) would make sense. However, because of their unique nature, incorporating prepacks into the IBC would demand certain tweaks to the law and its underlying processes. The IBC and supporting rules and regulations in their present form are prescriptive in nature when defining the restructuring process. Some processes include the invitation and evaluation of bids, followed by obtaining approvals of a shortlisted bid by an insolvent company's creditor committee. The final stage then includes obtaining judicial approval (or rejection) of the creditor committee-selected bid by an insolvency tribunal. Introducing prepack would mean skipping all the prior

processes, and directly seeking the insolvency tribunal's approval for a pre-decided and pre-creditor-approved arrangement between the company and its financial lenders. Though roping in these changes has been suggested publicly, prepacks are not technically tools of insolvency (insolvencies are established through court proceedings). Prepacks by nature are generally more of pre-insolvency tools that could potentially be introduced in India through alternative means, such as schemes of arrangement under the Companies Act.

The primary element of prepacks, which differentiates this particular tool from standard Indian in-court restructurings, is the involvement of company promoters and shareholders in the process. The IBC is founded on a creditor-in-control model, where creditors decide the fate of a distressed company. As of today, the law largely keeps the existing management outside the in-court restructuring process. The four-year-old law, tailored to the country's unique circumstances and characteristics, goes a step further to prevent promoters and founders from buying back their insolvent companies at a discount under Section 29A of the IBC. Section 29A, or the eligibility provision, bars defaulting promoters from buying back their companies and lists out a set of eligibility rules for who effectively cannot (and consequently, can) make an insolvency acquisition. The underlying objective behind this provision was to prevent an insolvent company to be placed back in the hands of (what are presumed to be) "errant" promoters, whose alleged incapability in managing the company was reflected in the firm's defaults.

In comparison, prepacks by nature typically have some shareholder cooperation and court approval — a combination that the insolvency law explicitly sidesteps. Therefore, without a dilution of the existing Section 29A provision, the introduction of prepacks could end up contradicting existing insolvency "policy", which was put in place for a targeted purpose. On the flip side, diluting Section 29A could help insofar as facilitating more "resolutions" across the board, since finding third-party bidders could be a challenge.

Giving company founders the ability to stay involved with the potentially imminent overhanging threat of insolvency may also be a fringe benefit of placing prepacks under the IBC: with Section 29A, many believe that locking out founders from bidding results in distressed companies with shallower bids (less competition, less incentive for a bidder/founder to spend more, and ultimately, less recoveries for creditors). A prepack mechanism that also hints at the potential for

insolvency might keep promoters in check and leave room for the IBC to be a revival process as well as a distressed sale process.

Another issue that arises when assessing prepacks as an Indian restructuring tool is in dealing with avoidance transactions. These are transactions which a company pre-emptively executes while anticipating potential insolvency proceedings or an out-of-court restructuring. Avoidance transactions tend to either place one or more creditor(s) in a relatively beneficial position compared to other creditors, or to protect its assets from being included in the asset pool available during a restructuring process. Insolvency laws across jurisdictions generally do provide for the reversal of these transactions. However, in an envisaged prepack scenario, these transactions are unlikely to see reversal. If creditors are aware of these transactions, they could adjust a restructuring deal price accordingly.

PREPACKS UNDER SECTION 12A OF IBC?

One provision of the IBC that could facilitate the introduction of prepacks is Section 12A. Section 12A effectively allows for the “withdrawal” of insolvency proceedings, typically following a settlement with the defaulting company. The withdrawal requires approval by 90% of the financial creditor votes, an application by the party that initiated the insolvency process to begin with, and ultimate approval from the insolvency tribunal.

Fitting a prepack mechanism in this scenario makes some sense: the company and creditors may agree to the terms of restructuring beforehand. The company could file itself into insolvency and negotiate terms for a prepack, which could then be submitted to the company’s committee of financial creditors.

Once a prepack agreement is finalized, this settlement could subsequently be placed before the insolvency tribunal for approval under a potentially expanded Section 12A. Settlements and withdrawals made under Section 12A are also not bound by Section 29A, which would better fit a promoter-driven pre-packaged solution. However, a change in the threshold required for creditor approval of a prepack deal may be required, just in case 90% is deemed by stakeholders as too high.

One aspect, albeit obvious, that could leave Section 12A as the less ideal approach to use across the board is that in this provision for a prepack-like mechanism, the company in question must already be in insolvency (i.e. a creditor or the company itself would have needed to successfully obtain a court order to trigger the in-court restructuring). This option could be better presented for companies in insolvency already — particularly those in early stages — where a “prepack” settlement plan that creditors trust and approve could receive judicial assent. This would, broadly speaking, mirror the prepack process but might be better applicable for companies whose creditor(s) chose already to initiate insolvency. Since many financially stressed Indian companies have yet to be formally admitted into insolvency, Section 12A would not be an option to begin with and a separate

option may be better suited for these non-insolvent firms.

It is also pertinent to note here that, currently, there is nothing that prevents the insolvency tribunal from “modifying” the terms of the settlement agreement under Section 12A. In a prepack scenario, the parties involved may not be keen on such judicial involvement in their individual commercial arrangement (as the market has seen in multiple previous insolvency cases). Ideally, legislators writing India’s prepack rules could consider building in some protections against courts getting involved in a previously decided commercial deal. Further, the possibility of litigation by operational creditors potentially claiming unfair treatment under a prepack deal must also be anticipated. It could, then, make sense for a prepack under Section 12A to reiterate the commercial wisdom of contracting creditors (as is the case under the IBC).

PREPACKS UNDER A FRESH SECTION OF IBC

For companies that aren’t already in insolvency and/or cannot use Section 12A as a prepack mechanism, prepacks may be better served through the introduction of a new, separate chapter in the IBC.

This chapter, which could be introduced through an amendment to the existing law, might provide specific principle-based provisions for the process of entering into a prepack, approving the prepack and any timelines for such approvals, if necessary. Introducing prepacks into the IBC in this format could limit or override other provisions of the law (such as Section 29A). Considering the amount of litigation that has already plagued the existing IBC process to achieve the ideal objective of “protecting the interests of all stakeholders,” a prepack chapter would likely need to provide suitable measures to ensure or address the protection of stakeholders (i.e. non-participating or dissenting creditors).

There is also need for appropriate provisions to ensure some type of a binding nature on all creditors of the financially stressed company and its other stakeholders, which could be included once a prepack is approved by the insolvency tribunal. This theoretically would not be dissimilar from a successful in-court restructuring under the IBC, but the binding-on everyone nature of this deal could open the floodgates to excessive litigation.

As a result, while rules and regulations that complement the law may be introduced, it would be ideal if the mechanism — especially if introduced as a fresh component into the IBC — abstain from prescribing strict terms for a prepack. Maintaining some degree of flexibility in the prepack provisions could encourage innovation, limit arguably unreasonable litigation, and cater to the unique characteristics of each company from a sectoral standpoint. Policy makers, the legislature and the regulator must also be cognizant that resolution professionals (akin to trustees, administrators, etc.) and judges would require some training in dealing with what would be a new animal in the Indian restructuring space. Building a solid foundation of understanding, while

leaving enough flexibility for the inherent principles of a debtor-favored system to seep into India's creditor-in-control law, would likely be pivotal to the success of prepacks.

The key, ultimately, might lie in finding a balance as to where and how the IBC could be used either in lieu of prepacks or as the right platform to introduce prepacks. While Section 12A may be better afforded as a back-up option for companies already put into insolvency, introducing a fresh and flexible "pre-insolvency" chapter might be a more organized approach.

CRITICAL ANALYSIS OF PREPACKS INCLUSION IN IBC

Pros:

1. In line with IBC objectives, would result in a comprehensive law for different types of restructuring in India.
2. Clean method of obtaining judicial approval, since a successful restructuring under the IBC depends on court approval: keeping judges aware of different "chapters" in the law (i.e. prepacks, insolvency resolution process, liquidation process, etc.) could help streamline process better.
3. Could be extended to companies in insolvency, through the use of existing Section 12A provision.
4. Principle-based (and not restrictive, tight rules) provisions in an existing law could reduce scope for litigation.
5. Could limit litigation from existing founders, keeping them as potential acquirers or partners in a prepack (unlike an insolvency) may raise the "value" of a financial bid.
6. Allows creditors more autonomy in drafting a plan, could open room for instruments and concepts like interim financing, bringing the focus more on "revival".
7. May be in line with IBC's objective of speedy resolution, since prepacks provide a faster restructuring mechanism (e.g. can be completed in as less as 30 days in the U.S.).
8. Speedier process could lead to preserving value by limiting financial loss by keeping company operational.
9. Company can continue to function as a going concern under the existing management; would save time that a resolution professional would spend in acquainting herself with the business, ultimately leading to less disruption of business during the restructuring process.

Cons:

1. Prepack is, in essence, a pre-insolvency mechanism; could be 'technically inaccurate' to insert as part of the insolvency law.
2. Introducing prepacks as a separate chapter will likely include some overriding of other provisions, such as Section 29A; Section 12A may also require some amendments.
3. A prepack deal under the IBC would leave it open to litigation, which could end up spurring years of delays on a deal (similar to insolvency in India).
4. Prepacks may not always protect interests of each and every stakeholder (or even all creditors for that matter); could contradict an objective of the IBC and result in extended litigation.
5. Arriving at a decision between creditors and creditor types (which the law technically demands) could result in delay of forming a plan and in combination with other restructuring rules, a company that would fare better in insolvency might never be put into insolvency.
6. Tribunals and courts in the country have been known to analyze existing bids, make changes to commercial terms; such scrutiny in prepacks could add to execution delays.
7. Judges, insolvency professionals will require training for their limited roles in the prepack mechanism compared to existing IBC processes; such training may delay the introduction of prepacks but absence of the training may not be conducive to smooth implementation.
8. Voting thresholds, approval timelines might mirror IBC too much and one or the other (either prepacks or insolvency) could be forgotten/undermined/abused.

PRE-PACKS AND SCHEMES OF ARRANGEMENT

Schemes of Arrangement under the Indian Companies Act 2013 offer an alternative, existing mechanism for debt restructuring in India. While this mode has rarely been employed for debt restructuring, the limited suspension of insolvency proceedings under the IBC has brought some focus back on schemes as a potential mechanism for restructuring. Under the Companies Act, any scheme of arrangement needs to be approved by 75% (in value) of each class of creditors and shareholders. A debt restructuring scheme, specifically, requires the consent of 75% of the secured creditors in value.

While the law does not stipulate what constitutes a 'class', groups with a 'common interest' have usually

been classified as a separate class of creditors by courts. Therefore, creditors whose interests are so dissimilar that a consultation between them is not possible would necessarily form two different classes (i.e. secured and unsecured creditors are likely to be classified as different classes). Moreover, a copy of the scheme must also be sent to relevant sector and government authorities (i.e. income tax authorities, the central bank, the Securities and Exchange Board of India (SEBI), stock exchanges and the Competition Commission of India) who can also put forward any objections they may have. Once approved by the relevant majority of creditors and shareholders, the scheme is submitted to the National Company Law Tribunal (NCLT) for its approval. Only shareholders or creditors holding at least 10% shareholding or 5% of the outstanding debt, respectively, may file objections to the scheme at this stage. Once the NCLT approves the scheme, it becomes binding on the company, its creditors and its shareholders.

A scheme of arrangement and a prepack share various similarities: Both are binding on a stakeholder once the restructuring arrangement/scheme receives court approval and are based on a debtor-in-possession model (i.e., promoters of the company retain control over the management and company) Both offer the advantage of continuing business as usual while the re-structuring process is ongoing (as opposed to the creditor-in-control model where the management of the company is handed over to a 'third party' administrator / resolution professional).

Arguably, most of the benefits of prepacks are already available under the scheme route which begs the questions: What advantages do prepacks have over schemes? Does India really need a separate framework of prepacks when most of its benefits are available under a pre-existing mechanism? To answer these questions, it is important to understand the reasons for schemes having rarely been used for debt restructuring. For one, procedural hurdles and delays have often been cited as the biggest roadblock to successfully utilizing schemes under the Companies Act. Another important point to note is, unlike insolvency proceedings, schemes do not enjoy the benefit of a moratorium. Therefore, there is an invariable risk of dissenting creditors initiating separate enforcement and recovery proceedings while the scheme is in the pipeline or awaiting NCLT approval.

The specific requirement of obtaining 75% consent from each class of creditors is also unique to schemes. Arguably, secured and unsecured creditors (such as operational creditors) would be considered as different "classes" of creditors. This effectively means that unsecured creditors could block the entire scheme process if they are unhappy with the recoveries being offered. Therefore, unlike an insolvency process which allows for cross-class cramming down (with certain protections), a scheme only allows cramming down of a minority within a specific class. The consent requirement from each class of creditors means that the process is prolonged, especially for larger companies with multiple

classes of creditors and/or shareholders. Moreover, obtaining shareholders' consent may prove to be cumbersome, especially in cases involving severely financially distressed companies.

Prepack proponents might argue that the disadvantages of a scheme can be overcome under a prepack framework. Interestingly, the Interim Report of the Bankruptcy Law Reform Committee released in February 2015 specifically considered whether schemes of arrangement can be used to facilitate hybrid-rescue mechanisms like 'pre-packaged rescues. In fact, introducing pre-packs through certain amendments to the already existing provisions for schemes of arrangements under the Companies Act 2013 might prove to be one relatively seamless way of bringing prepacks into India. Needless to say, the provisions of schemes would need to be amended to provide the following:

1. Strict timelines for the entire process (especially for the time within which NCLT must grant its approval to the scheme)
2. Amendment of the voting thresholds such that certain creditor groups are unable to hamstring the process (possibly mirroring the IBC by permitting voting to be based on the entire pool of financial creditors and not specific classes of creditors)
3. Relaxation of the requirement to obtain shareholder approval for debt restructuring schemes
4. Introducing a moratorium at an appropriate stage of the process

Ultimately, a prepack introduced through a scheme of arrangement could be tested by the NCLT against limited grounds (so as to avoid courts adjudicating on commercials) such as:

- Whether the proposal resulted in value maximization of the business operations
- Whether it accounts for the interests of all stakeholders

However, even if prepacks are introduced in this manner, it is likely that risks of delays due to litigation by disgruntled creditors and increased costs due to prolonged court processes will continue to affect their feasibility as means of restructuring.

PRE-PACKS UNDER 7TH JUNE CIRCULAR

On 7 June 2019, the RBI released a circular that provided a framework for the "resolution" of companies with stressed loans, outlining India's out-of-court restructuring guidelines. From the creditors' perspective, the circular only applies to RBI-regulated entities such as banks and non-banking financial companies (NBFCs). Lenders covered by the circular are required to devise a restructuring strategy for the stressed company (which may also include initiating insolvency proceedings against the company).

The creditors then enter into an inter-creditor agreement (ICA) to set out the framework for restructuring and resolution, if they decide on an out-of-court restructuring. The ICA also mandates signatories to abide by certain rules, such as being bound by certain voting thresholds and being prohibited from taking extraneous legal action against the company till the restructuring process is ongoing. One year has passed since the release of this circular; it would not be incorrect to say that restructurings under it have not been very successful, except for a handful of companies. One of the primary reasons for this failure has been the lack of participation of non-bank lenders (such as insurance companies, mutual funds and debenture holders) and offshore creditors (such as foreign bondholders and lenders) in the restructuring process.

Technically, nothing stops non-bank or offshore lenders from signing an ICA and participating in the out-of-court restructuring process. However, as was seen in the case of housing finance giant, Dewan Housing Finance Corporation Limited, reasons such as: regulatory restrictions on mutual funds (regulated by India's securities market watchdog, SEBI), a fear of binding yourself to a (most likely) public-sector bank-led process, or even difficulties in coordinating with voluminous number of debenture holders/bondholders usually lead to such creditors staying out of the ICA process. Creditors that do not enter into the ICA (which mandates a standstill obligation on signatories to not start insolvency or recovery proceedings) – often end up initiating recovery proceedings against the stressed company. This, in turn, could potentially derail the entire out-of-court restructuring process.

A similarity between out-of-court restructuring under the 7 June circular and prepacks is their dependence on the 'debtor-in control' model (as opposed to the IBC process which follows the 'creditor-in-control' model). On the other hand, the most critical difference in the two processes is the court sanction of a prepack. Arguably, a court-sanctioned prepack arrangement is more likely to be enforced and may lead to a higher certainty of outcomes, as opposed to a restructuring under the 7 June circular which is primarily contract-driven and lacks a final approval from a judicial entity. That said, if prepacks were to be introduced into the IBC itself, then it would also have a statutory basis, which may encourage increased participation by non-bank lenders.

OVERVIEW OF ALL INTEGRATION OPTIONS OF PREPACKS IN INDIAN FRAMEWORK

A. Existing In Court Process

In-court proceedings under IBC:

- Amendment to the law to make prepacks a part of Section 12A
- Amendment to regulations of the corporate insolvency resolution process
- Dilution of Section 29A

- Provisions for protecting non-participating creditors
- Strict and short timelines
- Need for training of resolution professionals and judges to sensitize and equip them to deal with prepacks

Schemes of Arrangement:

- Amendment of the law to allow cross-class cram down of creditors
- Amendment of the law to provide for a moratorium
- Include a strict timeline for approval of a scheme

B. Existing out-of-court process

The restructuring strategy and arrangement agreed under the 7 June framework. It would be possible to add an extra layer of requirements; plan, could be placed for approval before the NCLT; may be subject to litigation delays.

C. Fresh Mechanism

- Introduction of a fresh chapter in the IBC
- Limiting applicability of other provisions of the IBC to the chapter
- Issuance of rules/regulations supporting the new chapter
- Need for principle-based requirements regarding the prepack agreement without prescriptive details on the terms of the agreement
- Need for provisions ensuring binding nature of prepack once approved by the insolvency tribunal
- Need for training of resolution professionals and judges to sensitize and equip them to deal with the new mechanism

OVERVIEW OF GLOBAL PREPACKS FRAMEWORK: USA & UK

USA

Prepacks in the U.S. (debtor-in-possession) find their origin in equity receiverships prevalent in the 19th century. Presently, a typical prepack in the U.S. involves a stressed company:

- entering into an agreement with its key creditors soliciting approval of the agreement by specific classes of creditors
- making disclosures to all creditors prior to filing for bankruptcy before bankruptcy courts

The prepack agreement is then placed for approval in such bankruptcy proceedings. The stressed firm can only file for bankruptcy proceedings to obtain judicial approval of the pre-packaged agreement when reorganization/restructuring under the agreement receives favourable votes. This process involves pre-petition solicitation of votes and provides a sense of certainty to the outcome of the restructuring in question. It causes minimal disruption to the business of the stressed firm, since the company continues operating while the prepack remains under negotiation.

UK

Pre-packaged sales are currently not regulated under the United Kingdom's Insolvency Act, 1986 (the primary law governing insolvency and bankruptcy in U.K.) but are instead provided for through the regulation of administrators Statements of Insolvency Practice' (SIPs) are issued by the Insolvency Practitioners Association and contain certain guiding principles that are to be followed by insolvency practitioners in the U.K.

Under the SIPs, specifically under the Statement of Practice 16 (SIP16), a set of guidelines for administrators have been prescribed to ensure transparency and objectivity while entering into a pre-packaged sale. As per SIP16, the administrator is required to provide a detailed disclosure statement to the creditors explaining why a pre-packaged sale has been undertaken and demonstrating how the administrator has acted with due regard to their interests. This disclosure statement requires the administrator to provide details of:

1. the purchaser and whether any related or connected party of the seller was involved in the transaction
2. the assets sold
3. the sale consideration received
4. how the valuation of the business assets was decided

If a pre-packaged sale involves a related or connected party, it must be endorsed by an independent body of experts (the 'pre-pack pool') that evaluates whether the sale is fair or not.

ASSESSING READINESS OF INDIAN FRAMEWORK FOR PREPACKS

The success of any prepack greatly depends on the promoters of a company. The question of whether a prepack dependent in part on a promoter-driven environment — would survive in India remains to be answered. In the absence of a looming insolvency/liquidation threat, promoters may lack the incentive to work towards a solution that equitably balances the interest of its creditors. With the promoter

at the helm of the stressed company, creditors may also face issues around information flow, since obtaining accurate information about the company will depend on the intent and active cooperation of the existing management. This concern has already cropped up in out-of-court restructurings taking place in India at the moment, as reported. However, it is possible that the severe stress in the current economic slowdown may provide enough incentive for promoters to efficiently restructure their companies' liabilities, particularly if they believe that maintaining control was possible.

Neither in-court nor out-of-court proceedings have escaped the plague of litigation surrounding the restructuring of stressed companies. In order to evaluate the feasibility of prepacks as means of restructuring in India, it is important to consider whether this mechanism would provide any advantage over existing restructuring mechanisms. Insolvency proceedings under the IBC, out-of-court restructuring under 7 June circular as well as schemes of arrangements under the Companies Act 2013 have all been victims of delays. Be it on account of litigation by dissenting and unsecured creditors or the notoriously slow court processes, India is yet to see a sophisticated and quick means of restructuring and resolution (even though the IBC, with its genuine efforts to enforce strict timelines to some degree, has certainly made some headway). History has made inconceivable that prepacks will not face the same problems. Creditors have often failed to get past the initial stage of agreeing to an ICA in out-of-court restructurings under the 7 June circular. The efficacy of a prepack will also depend on a consensus amongst creditors, as well as the company. In the absence of a threat of insolvency proceedings, reaching a consensus with the existing management of the company may become even more difficult.

It is also likely that prepacks, when introduced, would allow the dilution or relaxation of restrictions under existing restructuring mechanisms (e.g. the relaxation of restrictions under Section 29A of IBC or other quality control measures such as credit rating requirements under the 7 June circular). While the rationale for these relaxations would lie in making prepacks an attractive avenue for restructuring, history shows us that the Indian market is litigious. The following have already been challenged in court: constitutional objections to the IBC, RBI's earlier out-of-court restructuring framework that was released on 12 February 2018, and even the recent RBI moratorium rules introduced as reliefs from the adverse impact of the COVID- 19 pandemic on the credit market.

Therefore, there may be an inherent risk of a challenge to a prepack framework as well, especially on the grounds of dilution of accepted principles of restructuring in the Indian context (such as the restrictions under section 29A of the IBC).

Prepacks have proven to be an effective tool of restructuring in the U.K. and the U.S. But that said, these jurisdictions are inherently more developed and sophisticated as far as their insolvency and restructuring

environments are concerned. The UK does not even directly regulate prepacks. Allowing such flexibility in the Indian market might be dangerous and is likely to result in challenges and litigation by unsecured and non-participating creditors who will be left out of the loop in an unregulated framework, or even promoters taking undue advantage of this flexibility.

The Indian market and restructuring infrastructure, as it stands right now, needs judicial monitoring to ensure fair treatment of all creditors. At the same time, this monitoring leads to delays and needs to walk the thin line between minimal interventions while ensuring protection of interests of all stakeholders.

Instead of introducing an entirely new framework which is bound to face teething problems (and likely most other problems of existing restructuring mechanisms), it might make more sense to amend existing frameworks for restructuring such as Section 12A of the IBC, schemes under the Companies Act or out-of-court restructuring under 7 June circular to bring in a hybrid version of prepacks.

Given the rising financial stress and an inability to initiate IBC proceedings for specific types of defaults in the wake of the pandemic, an alternate and effective restructuring mechanism is the need of the hour. Even if prepacks comprise the chosen, needed mechanism, it might be prudent not to introduce this option in haste. For instance, a regulatory sandbox test of prepacks to see the kind of companies, which may be susceptible to their use could be conducted before introducing this mechanism in India. Needless to say, the introduction of any new framework is likely to face initial hiccups. Moreover, India's existing infrastructure (be it courts, banks or corporates) is likely not going to begin functioning at full capacity anytime soon. In such circumstances, one can only wait and watch to see how a prepack works in the Indian context.

OVERVIEW OF PROPOSED PRE-PACKAGED RESTRUCTURING FRAMEWORK

The Indian government formed the Sub-Committee of the Insolvency Law Committee on Pre-packaged Insolvency Resolution Process (PPIRP) on 24 June 2020. The sub-committee was tasked with the responsibility of suggesting the design and framework for introduction of pre-packs in India. The Pre-pack report of the sub-committee was published on 8 January and the government has sought comments and suggestions on the proposed framework by 22 January.

Following are the key features of the framework proposed in the Pre-pack report:

- 1) **Phased introduction of PPIRP:** The sub-committee suggested that pre-packs be introduced in India in a phased manner. They have recommended that the pre-pack regime be introduced for the following categories of default: first, for COVID-19 defaults (i.e., defaults between 25 March 2020 until 25 March

2021, on the basis of which CIRP cannot be initiated under the IBC) and defaults between INR 0.1m (USD 1,365) to INR 10m (USD 0.14m); then for defaults of more than INR 10m (USD 0.14m); then for defaults up to INR 0.1m (USD 1,365); and then for pre-default stress. In case of pre-default stress a higher threshold (75%) of creditor consensus may be required for initiation of PPIRP.

- 2) **Initiation of PPIRP:** PPIRP can be initiated by the corporate debtor (CD), with approval of a simple majority of its shareholders and unrelated financial creditors (FCs) i.e., creditors such as banks, to whom debt is owed against the consideration of the time value of money. Post these approvals, the CD can approach the National Company Law Tribunal (NCLT) to commence PPIRP against the CD.
- 3) **Constitution of creditors' committee:** Upon initiation of PPIRP by the NCLT, a resolution professional (RP) is appointed. The CD will provide a list of creditors and their outstanding claims to the RP. This list is to be verified by the RP and a committee of creditors (CoC) comprising of unrelated FCs. In case there are no un-related FCs of the CD, the CoC will be made up of un-related operational creditors (OCs) of the CD. Operational creditors are creditors to whom monies are owed in relation to provision of goods and services.
- 4) **Management of CD:** The existing management of the CD will continue to be in control of the company. Creditors will retain control over key decisions (such as raising interim finance, change in management of the CD, entering into related party transactions) and such decisions will require 66% approval of the CoC, on a present and voting basis. Unlike CIRPs, where the RP takes over management of the CD, in PPIRPs, the RP will assume a supervisory role and is required to ensure that the PPIRP is conducted in a fair and transparent manner. The RP is also tasked with making a determination whether the CD has entered into any avoidance transactions. Avoidance transactions include preferential, undervalued, extortionate credit or fraudulent transactions, or are basically arrangements entered into by the CD prior to initiation of PPIRP that were preferential to one creditor over another, or not conducted at fair value.
- 5) **Submission of resolution plan:** The sub-committee has suggested that the PPIRP start with a 'base resolution plan' for the CD. The base resolution plan is to be provided by the promoter of the CD, unless the promoter is not eligible under Section 29A of the IBC. Section 29A of the IBC, lays down eligibility requirements for bidders submitting a resolution

plan in IBC processes. For example, Section 29A bars wilful defaulters, convicted offenders, entities holding a non-performing asset etc. from submitting resolution plans. If the promoter is 29A non-compliant, then the Committee of Creditors may arrange for submission of a resolution plan by a third party.

The proposed framework then provides two options:

- i. If the base resolution plan provides for payment of OC dues in entirety, then it can be put up before the Committee of Creditor for its vote; or
- ii. If the OC dues are not proposed to be paid in entirety, a swiss challenge process will be conducted.

Moreover, in scenario (ii), the resolution plan will need to give OCs and dissenting FCs, the minimum recovery guaranteed to them under the IBC - i.e., they should at least receive liquidation value of their debt. Approval of the resolution plan will require 66% votes of the CoC, on a present and voting basis.

- 6) **Timeline:** The proposed timeline for PPIRP is 90 days for filing the resolution plan with the NCLT and 30 days thereafter for the NCLT to approve or reject it. The sub-committee has also proposed a cooling off period of three years between two PPIRPs, to prevent misuse of the pre-packs by promoters. At any point during PPIRP, the Committee of Creditors may decide to terminate the process with a 66% majority, on a present and voting basis, if the CD engages in any activity which could potentially deplete the value of its assets.

KEY INSIGHTS

The Pre-Packs framework has been integrated into the framework of Indian Corporate Restructuring scenario sufficiently in the past year and even more rigorously in the COVID period to enable economic rescue of enterprises.

The legal mechanism however has not been formalized into any structured framework, as all the circulars and notifications only have an enabling effect on the existing framework to introduce pre-packaged deals under the RBI Prudential Framework for Resolution of Distressed Assets or under Section 12A of Insolvency and Bankruptcy Code 2016 or under the Schemes of Arrangement under the Companies Act 2013. Given the absence of a unified formally structured mechanism for the Pre-Packs framework, it is not in most shareholders' interests to opt and vote for such buy-ins and rescues, especially in view of the cross-class cram downs which become necessary for effective pre-packaged deals in enterprises entering early distress phases.

The limited applicability of the RBI Framework also calls for unified regulators action as the Takeover Code, Insolvency and Bankruptcy Code, RBI Framework, Companies Act and Inter-Creditor agreements would have to give sufficient flexibility in a unified sense for

the pre-packaged deals to enable early rescue of distressed enterprises. In the proposed framework, no concrete parameters are set out for NCLT to determine whether a debtor triggered PPIRP process can be exempt of the moratorium period. No conditions are specified for promoters not qualifying within 29A to become compliant and initiate the PIRP process. This fundamentally limits the scope for a distressed enterprise to undergo a Pre-Packaged resolution. The Pre-Packs framework would enable saving value in the market as a company undergoing Corporate Insolvency Resolution tends to lose a lot of value and business in the process, while pre-packaged deals are usually driven by strategic considerations, not purely financial ones which ensure optimum business and financial outcomes.

REFERENCES

- [1] Thomas H. Jackson, Robert E. Scott, On the nature of bankruptcy: An essay on bankruptcy sharing and the creditors' bargain, 75(155), Virginia LR., 168, (1989).
- [2] Anthony Miles, Risk Factors and Business Models: Understanding the Five Forces of Entrepreneurial Risk and the Causes of Business Failure, Dissertation.com: Boca Raton FLO, 1, (2011).
- [3] Donald R. Korobkin, Contractarianism and the Normative Foundations of Bankruptcy Law, 71 Tex. L. Rev, 554, (1993).
- [4] Abhishek Saxena & Akshay Sachthey. The Insolvency and Bankruptcy Code, 2016 - A Fresh Start for India's Insolvency Regime.
- [5] Shreya Prakash, Pulkit Gupta and Rob Downey, 'Insolvency and Bankruptcy Code: The Journey So Far and the Road Ahead', (2018) Vidhi Centre for Legal Policy and Ernst & Young accessed 19 February 2020; Dipak Mondal, 'IBC Delivering Results; a Reform Modi, Jaitley Should be Proud of' Business Today (10 April 2019) accessed 19 March 2021
- [6] Jose M. Garrido, Out-of-Court Debt Restructuring (World Bank Study 2012) paras 97-99 accessed 19 March 2021
- [7] Bo Xie, Comparative Insolvency Law: The Pre-pack Approach in Corporate Rescue (Edward Elgar Publishing 2016) 22-25; Pratik Datta, 'Value Destruction and Wealth Transfer under the Insolvency and Bankruptcy Code, 2016', (2018) NIPFP Working Paper No. 247
- [8] Lemma W. Senbet and Tracy Yue Wang, 'Corporate Financial Distress and Bankruptcy: A Survey' (2010) 5(4) Foundations and Trends in Finance 243, para 3.1.3
- [9] Stuart Gilson, Kose John and Larry H.P. Lang, 'Troubled Debt Restructurings: An Empirical Study of Private Reorganization of Firms in Default', (1990) 27 Journal of Financial Economics 315-353, para 2.2.1
- [10] Jan Adriaanse, Restructuring in the Shadow of the Law: Informal Re-organisation in the Netherlands, (2005), para 2.5.1

- [11] Insolvency and Bankruptcy Board of India, *Insolvency and Bankruptcy News* (The Quarterly Newsletter of the Insolvency and Bankruptcy Board of India, Vol. 13, 2019)
- [12] Claessens, Stijn, *Policy Approaches to Corporate Restructuring Around the World: What Worked, What Failed?* (2005) in Michael Pomerleano and William Shaw (eds.) *Corporate Restructuring: International Best Practices* (1st edn., The World Bank, 2005), accessed 19 February 2020
- [13] *Introduction: Toward Better Practices in Systemic Corporate Restructuring* in Michael Pomerleano and William Shaw (eds) *Corporate Restructuring: International Best Practices* (1st edn., The World Bank, 2005), accessed 19 February 2020.
- [14] Menaka Doshi, 'Who Among The 353 Resolution Professionals Can Manage 12 Large Insolvencies?' (2017) *Bloomberg Quint*, at <https://www.bloombergquint.com/law-and-policy/2017/06/19/challenges-facing-insolvency-professionals-large-corporate-insolvencies-bankruptcies-nclt-ibbi-ms-sahoo-comments>, accessed 24 February 2019.
- [15] KR Srivats, 'Time ripe to consider 'pre-packs' under insolvency: NCLT President' (2018) *The Hindu Business Line*, at <https://www.thehindubusinessline.com/economy/time-ripe-to-consider-pre-packs-underinsolvency-nclt-president/article23650251.ece>, accessed 24 February 2019.
- [16] Bo Xie, *Comparative Insolvency Law: The Pre-pack Approach in Corporate Rescue* Edward Elgar Publishing Cheltenham (2016).
- [17] Association of Business Recovery Professionals, 'Pre-packaged Sales', *Rescue Recovery Renewal*, at https://www.r3.org.uk/media/documents/publications/press/Pre-packs_briefing.pdf, accessed 24 February 2019

Survey on Various Biometric Techniques

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Abstract:

Biometrics is a rapidly developing technology that is being used to numerous industries such as forensics, protected areas, and security systems. This system serves as the foundation for pattern recognition systems that recognize and authenticate people using various biometric traits such as fingerprints, iris scans, retinal scans, hand geometry, and facial recognition. This is a list of the most important biometric systems. A wide range of applications, including Automated Teller Machine and mobile phones as well as protected building access, rely on these devices to function. When it levels of security and vulnerability, biometrics are intended to improve both. A variety of biometrics methods, including fingerprinting, iris scanning, face recognition, deoxyribonucleic acid recognition, hand and finger geometry, voice recognition, signature recognition, are discussed in this article for use in the implementation of a biometric system.

Index Terms:

Recognition, Biometric, Fingerprint, Face Recognition, Iris, DNA, Hand, and Finger.

INTRODUCTION

The scientific field of biometrics focuses on the systematic collection, analysis, and interpretation of biological data with the intention of verifying or identifying an individual or an item. As the term implies, biometrics is any physical or behavioural feature that may be linked to a specific individual. Biometric technology, in fact, dates back to ancient Egyptian times. As defined by the International Biometrics Association, biometrics is "the science of measuring and evaluating the unique physical or behavioural qualities that distinguish one individual from another for the goal of identifying them." The term "biometric" originates from the Ancient Greek word called "bios," which means life, and the word "metric," which means to measure; hence, the phrase "bio-metric" may alternatively be interpreted in English as "life of measurement." "Physical characteristics such as a person's fingerprints, DNA, face, retina, ear, and iris, as well as the hand and finger geometry, are all associated with both the shape of human body and dimensions of the human body, and they are all dependent on genetic information. Examples of behavioural features that are associated with an individual's behaviour or dynamic measurements include a person's signature, voice, and stride, amongst other things. [38][10][11]. Several kinds of biometrics are shown in figure1.

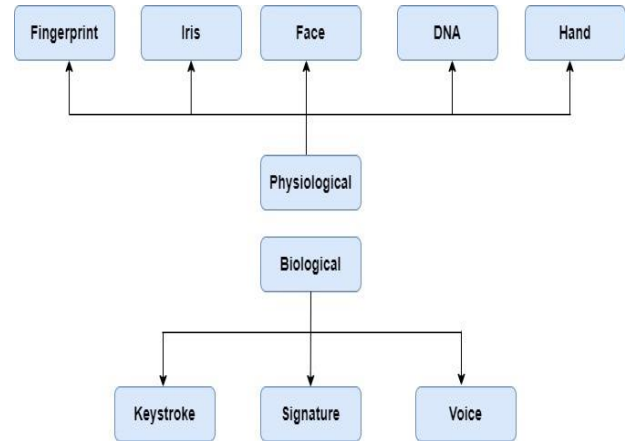


Fig 1A: Classification of Biometrics

The physical traits of individuals are used by developing technology applications to identify and recognize them. Nowadays, the diversity of applications is dependent on the identification or verification purpose in order to confirm the individual's identity, which is used to prove the individual's identity. For years, passwords, Personal Identification Number (PIN), and Identification cards are used for personal identification [10][11] in order to safeguard systems by limiting access, yet they have all been compromised at some point in time. If the system is infiltrated, it is impossible to remember passwords, and personal information might be stolen. On the other side, one's biometric information is susceptible to being misappropriated, forgotten, borrowed, or fabricated. [12] In addition, there is the possibility of using biometric traits as an additional layer of security. The authentication method relies on three components: prior knowledge, current possession, and current ownership of goods. Its purpose is to protect a system from being used by a third party that is not authorized to do so.

A. Scope of Biometric System

When compared to conventional techniques to human identification, biometrics provide more security and suitability. Biometrics may enhance or completely replace present technologies in a few specific areas. The purpose of this work is to provide a significant contribution by providing a complete assessment and comparison of current biometrics methods and novel biometric techniques, as well as their differences.

B. Traits of Biometric System

It is not easy to make a direct comparison between two different items. This might be fairly challenging. Because of this, the Researchers identified a number of critical aspects [12][14][15], and designated these factors as the required feature criteria of each biometric trait given in the table. These factors are taken into account.

These factors include the uniqueness, performance, collectability, circumvention, acceptability, universality, and permanence of the biometric trait. These features are referred to as the "seven pillars of biometrics" [10] in certain circles. The properties of several biometric approaches are summarized in Table I, which can be found here.

TABLE I. Biometric Features

Features	Description
Uniqueness	Each individual should have the trait yet be unique.
Performance	Precision, Security, speed, and sturdiness.
Collectability	The ease with which data may be captured, measured, and processed.
Circumvention	The ease with which a replacement may be used, i.e., the act of cheating.
Acceptability	The user population has no objections.
Universality	Each person should have the biometric trait.
Permanence	The biometric feature should be stable throughout time.

C. Services of Biometric System

A huge variety of government applications, as well as on our own laptops for login, have made extensive use of finger biometrics; in fact, they have been utilized at international border crossings. Biometric fingerprint identification is utilized in automobiles rather than keys. The ICAO has authorized the usage of electronic passports as a result of rising security risks.

TABLE II. Benefits of biometric technology

Benefits	Description
High Throughput	Throughput will be high even during fraud or fraudulent identity.
Emergency Identification	Biometric qualities registered in the biometric system allow for precise and speedy identification.
Unlosable	Neither lost or stolen.
No Corporation	Recognizes without user cooperation.
Unforgettable	Unforgettable due of its physical or character.
Cost Reduction	Proper implementation reduces costs.
No Identity Theft	Biometric verification decreases identity theft.

Compliance	Improved access control via authentication, which is based on the physical and behavioural features of the person.
Guarantees Physical Location	Ensures that the individual is physically present at the moment of authentication.

SURVEY ON BIOMETRIC SYSTEM

There are a number of different biometric systems available, and each one may be used for a specific purpose. Every person, during the course of their lifetime, acquires a one-of-a-kind collection of physiological features that serve to distinguish them from other people. Given that the "perfection" of a biometric technique is highly dependent on the specific application in question, there is no one strategy that can be singled out as the "best" option. This page provides a high-level review of the many different types of biometric technology that are now in widespread usage all around the world.

A. Fingerprint Recognition

It is the most well-known and oldest biometric identification method, and it is also the most ancient. When it comes to identification, it is a digitalized and computerized version of the archaic ink-and-paper approach that law enforcement agencies have employed for years. Through the analysis of a person's fingerprint, it is possible to identify that individual. For every person, fingerprints are distinct, immutable, and their fundamental characteristics do not change over time. In fact, identical twins' fingerprints are not similar at all. Additionally, the fingerprints on the same individual's two fingers are distinct. In order to create a fingerprint, furrows and ridges must be created. An individual fingerprint may be distinguished by the patterns of ridges and furrows as well as the tiny points on its surface. Three basic types of ridge patterns [16][17][18] may be distinguished: whorls, loops, and arches (Figure 2).

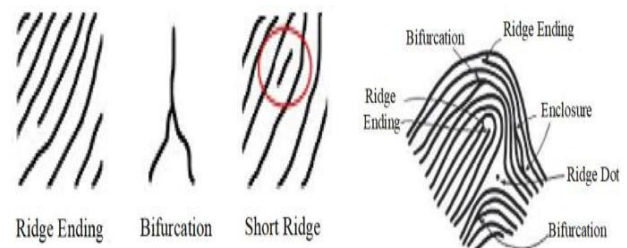


Fig. 1. Fingerprint Ridge, Enclosure and Bifurcation [40]

Immutability, which refers to the fact that ridge patterns never change throughout a person's life, and uniqueness, which refers to the fact that different fingers of the same individual have distinct ridge patterns, are the two essential concepts that are used to identify person's fingerprint. The fingerprint biometrics system has its own set of advantages and disadvantages, which are detailed in Table III.

TABLE III. Categories of Minutiae

Types of Minutiae	Description
crossover or bridge	A ridge that connects two parallel ridges.
Spur	Long ridge from short ridge with bifurcation.
Bifurcation	Point at which two or more ridges meets.
Island, short ridge, or independent ridge	A ridge starts and ends after just a short distance has been travelled.
lake or enclosure	After splitting and re-joining, a single ridge persists as a single ridge for the rest of its length.
ridge ending	The point at which ridge ends.
Dot	An isolated ridge with the same length and breadth as another ridge.

There are three kinds of fingerprint matching methods.

- **Image based matching or Pattern based matching:** It analyses the fundamental patterns of fingerprint between a claimant and a set of previously recorded templates of fingerprint to determine eligibility.
- **Correlation based approach:** The creation of it requires a significant amount of information based on greyscale. It is able to function even when given data of poor quality.
- **Approach based on Minutiae:** It is the recognition of minutiae points on the finger, as well as their relative location on the finger.

B. Iris Recognition

The iris is a circular connective tissue found in the eye that is flexible, thin, and coloured. It also has a round shape, which controls the amount of light that can enter the eye as well as the height and breadth of the pupil. Everyone has a unique iris, and even people who are genetically identical to one another have diverse patterns in their irises [19]. In addition, it is generally accepted that the right iris and left iris of the same individual are unique from one another rather than being identical to one another. The iris is shielded from harm by the cornea, although it may still be seen from the outside. The pigmentation of the iris, which may vary in colour from blue to brown to green, is what is meant when people talk about the "colour of the eye." It's possible that the colour is a mix of pale green, brown, and gold in some situations. This is a distinct possibility. Freckles, crypts, filaments and furrows are only few of the distinctive characteristics along with corona, striations pits, rings that may be seen on the iris [20]. Freckles are little bumps or crypts that may be seen in the iris. The illustration of an example eye may be seen in the following image, and the iris can be shown in figure 3.

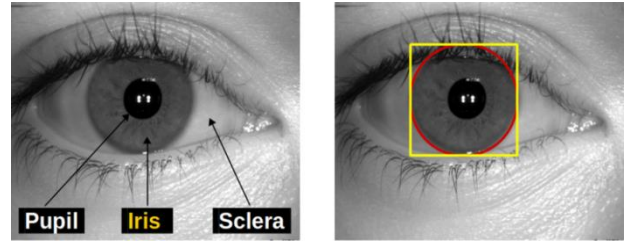


Fig. 2. IRIS Biometrics [41]

In order to determine whether or not the iris is present in the image, the appropriate method is used. In the event that it is established that the iris is present, a network of curves that includes the iris will be generated, and an iris-code will also be formed depending on the point of darkness. It is affected by two different factors: first, the blackness of the picture as a whole, and second, the changes in iris size produced by its normal process of expanding and contracting. Both of these factors have a bearing on it. The comparison of two iris codes may be quickly calculated using hamming distance, which is determined by the disparity in the amount of bits between the two codes. In addition, there is a method known as template matching, which may be employed. This method employs statistical computation in order to compare the template of an iris that has been saved with a template that has been retrieved [21][22].

C. Face Recognition

Face recognition is based on the measurements, ratio, and other physiological characteristics of a person's face. Faces may be identified and distinguished by humans based on the size, positioning, and shape of face traits including the chin, lips, nose, eyes, and jaw, in addition to the spatial relationships between these features (figure 4). When it comes to face recognition, researchers look at both particular and generic characteristics. Facial recognition may be accomplished in a number of different methods [23][24].

- **Eigen faces:** Utilizing a collection of weights that describe the canonical faces as the basis for the analysis of the whole face image is how this task is accomplished.
- **Skin texture analysis:** This is a new approach for face identification that incorporates other visual features of the skin as well. Identifying the locations of the individual's distinctive lines, spots, and patterns on their skin.
- **Facial metric:** For example, the distance between the nose and the lip or the distance between the pupil and the chin.

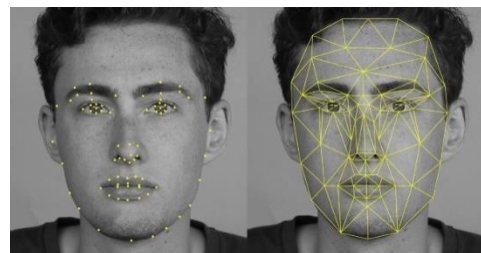


Fig. 3. Attributes and Features of the Face Image [39]

Face recognition system takes an image or video stream as an input, it produces an output as identification of the individual who appeared in the picture or video. This output may take any of these two forms. Detection of face and extraction of features are carried out concurrently in parallel with one another while simultaneously working on the same image. The full setup of the face recognition programme is shown in Figure 5, which may be seen here.

The first step, which involves making use of face recognition technologies, is to go through an image in search of a face and pinpoint its exact location. The next thing that has to be done is to extract the features of the face, which is also known as the feature vector. The feature extraction step is critical in the recognition of facial expressions because it verifies the unique qualities of the face and distinguishes between two individuals' differences in their facial features. In the third and final step, which is known as face recognition, the tasks of authentication, verification, and identification are the two activities that need to be finished. In order to authenticate or verify the face image template, it is important to compare the face picture with the face image template and to establish if the identity being used is accurate or wrong. The process of matching an image of a person's face to a number of other photos of people's faces that have been saved in a database is what is meant to be referred to as "identifying." In order to establish the identity of the face, various additional photographs of faces from the database are compared to it. Figure 6 illustrates the workflow for these operations by beginning with an input image as the point of departure.

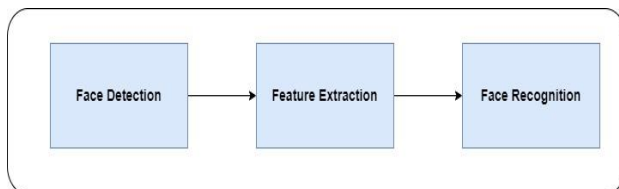


Fig. 4. General Configuration of Face Recognition Process

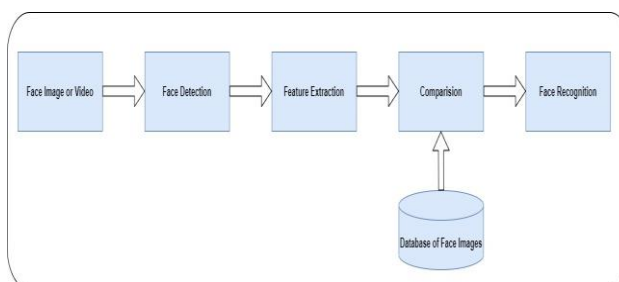


Fig. 5. The Sequence of Steps in the Face Recognition Process

Face recognition may be broken down into three fundamental ways [25]. When using the Feature-based Approach, it is important to consider the local aspects of a person's face such as his or her eyes, mouth, nose, and so on. These features are utilized to segment the face and to provide input data for face detection. Holistic Approaches to face detection and identification take into

account the full face when determining whether or not to utilize a particular face as an input. The Hybrid Approach is a blend of feature based and holistic techniques that is used to solve problems. In addition, there is a well-known method that is referred to as the "Template-based approach," and it is used to recognize and detect faces. This method works by computing the significant relation of an input picture to a standard face pattern by making use of all of the facial characteristics that are present in an image.

D. DNA Recognition

It is a kind of genetic material that can be found in every living thing and can be found in the nucleus of every cell. Hereditary characteristics are included inside the DNA of every single unique human being. It is inherently digital and do not change during the course of a person's lifespan or after that individual has passed away. DNA is the genetic code for an individual; this code is one-of-a-kind for each person, and only identical twins share the same DNA.

The human body has something in the neighbourhood of sixty trillion different cells. DNA serves as the template for the creation of the human body. It is a polymer made up of nucleotide units, and each nucleotide unit is composed of three different components: a sugar, a base, and a phosphate. Thymine (T), Cytosine (C), Guanine (G) and Adenine (A) are the 4 elements that combine to create base pairs and, as seen in figure 7, are responsible for determining an individual's morphology and physiology. In the molecule of DNA, the sections of sugar and phosphate that combine to produce nucleotide are responsible for the formation of the molecule's backbone structure. The DNA in a cell takes the shape of a double-stranded molecule, which is a double helix generated when two complementary strands spiral around each other. This results in chromosomes, which are lengthy structures consisting of double helices.

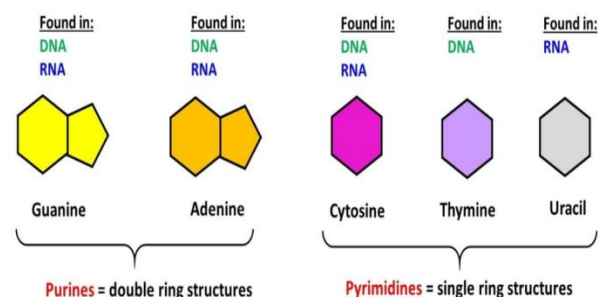


Fig. 6. DNA Biometrics [42]

The human genome consists of 23 pairs of chromosomes, making the total number of chromosomes in a human being's DNA and genes 46. Chromosomes are created from DNA in human cells so that the genetic material may be shared. The kids inherit almost all of the parent's DNA, which accounts for 99.7 percent. The remaining 0.3 percent is what makes each person's DNA unique. It is varied and includes repeating coding, which is the foundation of DNA biometrics.

Rather than being utilised for verification most of the time, DNA recognition is employed for identification [26]. DNA sequencing, sometimes referred to as genetic profiling, is the process that is used to create a DNA profile. The similarities between these DNA profiles are compared with DNA samples that have previously been collected, catalogued, and kept in a database. The CODIS System, which is utilised by the Federal Bureau of Investigation, is the most prevalent DNA database that is currently available. Because DNA biometrics are still in the process of being developed, they are not generally utilised [27], [28]. The following are the primary stages involved in DNA profiling:

- The extraction of DNA samples from saliva, blood, hair, sperm, or tissue and isolating or separating them.
- The division of the DNA sample into a greater number of smaller subunits or pieces.
- Classification of DNA's individual segments and pieces according to their size.

E. Hand and Finger Recognition

Researchers who were working in the field of biometrics made the discovery that the human hand, and more especially the palm, had a variety of traits that might potentially be used for the purpose of individual verification. These characteristics include the thickness of the palm, the breadth of the fingers, and the length of the fingers, among other measures, none of which are exclusive. In later life, the form of the hand tends to settle into a more consistent pattern. The characteristics of the hand on their own are insufficient for verification. However, when the measures of the fingers and hand are paired with a variety of other individual traits, they are accurate for the purposes of identification. The structure of the hand is susceptible to the passage of time and may shift as a result of factors such as disease, ageing, or weight change. The form of an individual's hand is something that is unique to them as an individual and is unlikely to alter much in the near future.

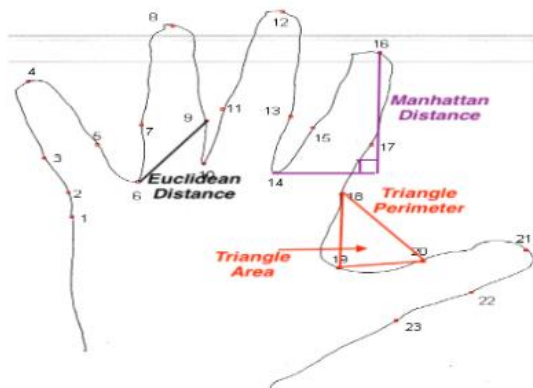


Fig. 7. Hand Geometry [43]

Hand Geometry may be broken down into two distinct categories: contact based and contact less. When using the Contact Based method, the claimant's hand is guided onto the surface of a scanner by five pins, which ensures that the claimant's hand is in the correct position relative

to the camera. Direct acquisition of the hand picture is possible in the Contact Less mode. Scanners may be divided into two categories: optical and infrared. Bit map images of the hand's shape are created using a black and white camera and light in this first category. In the second category, the hand's three-dimensional qualities are used to measure the shape of its form in both a horizontal and vertical plane. Some scanners just provide a visual stream that represents the shape of the hand. It is necessary to process the image signals analogously first, and then digitally, before getting the desired picture of the hand [29] [30].

F. Keystroke Recognition

The varied patterns of rhythm that people employ while typing on a keyboard are distinct enough to provide the basis for keystroke dynamics, a kind of biometric technology that may be used to identify individuals. Using a keystroke as a biometric approach, it is possible to get adequate discriminating information about a person by having them type on a keyboard in a certain manner. With the help of this biometric, it is possible to determine a person's keyboarding pattern as well as his or her typing rhythm and speed.

Because most researchers are focused on identification, it's possible that they don't have much of an interest in type dynamics. However, research has shown that two factors, known as dwell time and flight time, can provide an accuracy of 99 percent when identifying the person who is typing [31]. The amount of time that elapses between pressing a key and pressing the next key is referred to as the flight time. Dwell time refers to the amount of time that a key is held down for, while flight time refers to the amount of time that elapses between pressing a key and releasing it. The amount of time that passes between each character on a keyboard is referred to as inter-character timing.

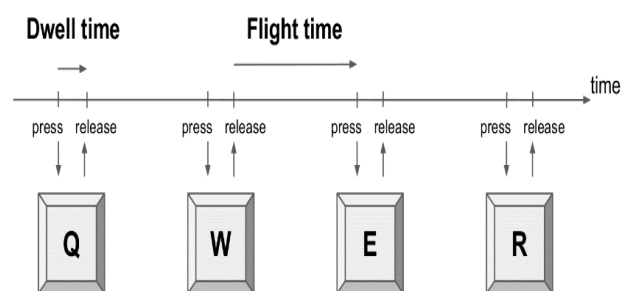


Fig. 8. Keystroke [44]

Fig. 9. Each individual's typing style is influenced by factors such as the time it takes to locate a key, the length of the journey, and the length of time spent at their home. In addition, there is a variance in the pace and rhythm with which the typing is performed. There are two types of keystroke recognition: static keystroke recognition and continuous keystroke recognition. Static keystroke recognition is the more common kind. Recognition that happens just once at the beginning of an engagement is referred to as a static keystroke, but recognition that persists during an active involvement is referred to as a continuous keystroke.

G. Signature Recognition

The behavioral pattern of how the signature is signed is given more importance than the look of the signature itself. Dynamic signature recognition is one of two modes of operation available. In the fixed approach or off line approach, the signature is on paper and scanned using a camera or optical scanner. System can recognize signature using speed, velocity, and pressure. In the online technique or dynamic technique, the signature is captured using a computerized tablet in real time, collecting behavioural aspects including speed, pressure, stroke direction, signature size, and time length [12].

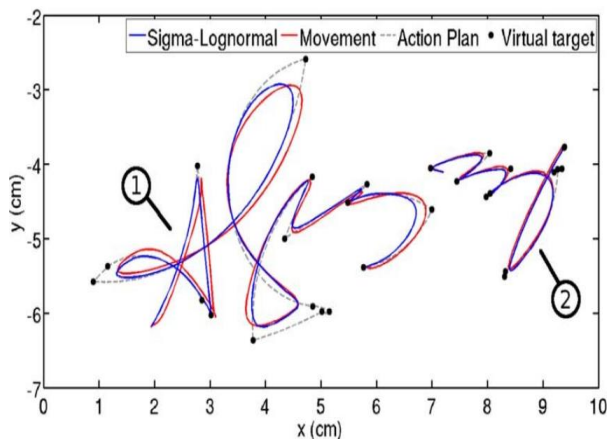


Fig. 9. Signature Informatics [45]

The angle of the pen, pauses, time length, pace, pressure, and direction of strokes when signing are all examples of behavioural patterns that may be used for signature verification. Unlike the graphical look of the signature, which can be readily replicated, replicating the signature while maintaining the same behavioural characteristics of the individual signing is quite challenging [32].

H. Voice Recognition

The human voice can be perfectly replicated, despite the fact that almost all of its qualities are exclusive to the individual speaker as well as to the pair of identical twins who share it. Variables in an individual's voice, both physical and behavioural, combine to produce a unique pattern of vocalization in that person's speaking voice. The physical characteristics of the vocal tract include the lips, the nasal cavity, as well as the form and size of the mouth. On the other hand, the behavioural characteristics of the vocal tract include the speed of speech, the emphasis on words, and accents.

As a result, voice recognition is based on how a person talks, with the emphasis placed on how that speech is formed by vocal characteristics rather than on how it is spoken or sounds. Voice recognition systems differentiate between individuals by analyzing the acoustic pattern features of their speech. These patterns include both behavioural aspects and anatomical aspects. Behavioural aspect contains speaking style as well as voice pitch. An anatomical aspect contains size as well as shape of neck and mouth [33][34]. Because the vocal tract is immune to the effects of cold, there will be no significant impact that the temperature has on the results of the test.

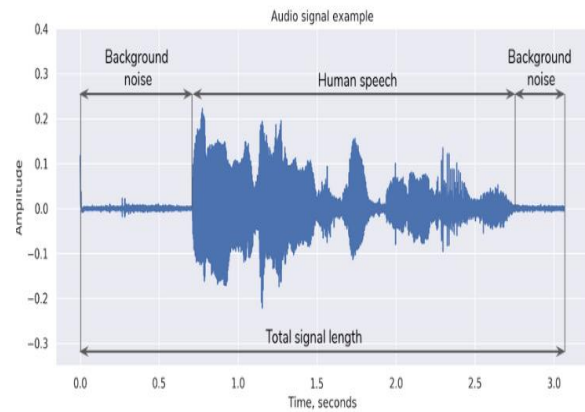


Fig. 10. Voice Biometrics [46]

Performance of speech recognition systems is evaluated in the context of environmental noise, speaker fluctuation (both in terms of pitch and tone), sensitivity of phonetic input systems, distance, and regular variations. Among other uses, speech recognition systems are used in hospital settings as well as government offices and financial institutions. It is possible to use speech recognition to determine an individual's identity. The objective of speech recognition is to determine who is speaking by analyzing their pronunciation as well as the tone and pitch of their voice. The purpose of Speech Recognition is to understand WHAT is being said and to be utilized in menu or map navigation, as well as in hand free computing. The goal of speech recognition is to comprehend WHAT is being said and to use this comprehension for use in hand-free computing, navigating menus or maps, and other similar tasks.

PERFORMANCE AND EVALUTION

An integral component of biometrics technology is the process of evaluating the performance of different biometric devices. The efficacy of any biometric authentication method can be evaluated using a variety of measures, such as the False Accept Rate (FAR), the False Reject Rate (FRR), the Crossover Rate (CER), and the Equal Error Rate (EER) [35][36][37]. False rejection refers to the process of incorrectly rejecting a claim of authentic identification. In a similar vein, the act of wrongfully accepting a fake identification claim is referred to as false acceptance. FAR and FRR are used in order to provide restricted access only to authorized users.

TABLE IV. Comparison of Various Biometric Techniques

Criteria	Finger	Iris	Face	DNA	Hand	Keystroke	Signature	Voice
Introduced	1981	1995	2000	1965	1986	2005	1970	1998
Error Factors	Dirt, Age, Dryness	Poor Light, Glasses	Glasses, Age, Light, Hair, Twins	Equipment's	Age, Injury, Dryness	Weather, Device	Changing Signature	Cold, Noise
Performance	H	H	M	H	L	L	L	L
Uniqueness	H	H	M	H	M	L	L	L
Universality	M	H	H	H	H	L	L	M
Collectability	M	H	H	L	H	M	H	M
Permanence	H	H	M	H	L	L	L	L
Acceptability	M	M	H	L	M	M	H	H
Circumvention	M	L	H	L	M	M	H	H
Cost	L	H	M	H	H	M	M	L

False Rejection Rate, often known as FRR, is a measure that estimates the chance of incorrectly identifying a legitimate user as an invalid user. It may be determined by using the procedure that is detailed below.

$$FRR = \frac{\text{Number of False Rejections}}{\text{Number of Identification Attempts}}$$

A statistic that assesses the chance of incorrectly accepting an unauthorized user as a real user is called the False Acceptance Rate (often abbreviated as FAR). This rate is also known as the FAR. The following is how one might calculate this probability: A biometric system has an extremely high degree of security if its false acceptance rate (FAR) is low. An example of FAR and FRR may be seen in figures 12 and 13, respectively.

$$FAR = \frac{\text{Number of False Acceptance}}{\text{Number of Identification Attempts}}$$

COMPARISON OF BIOMETRIC SYSTEM

Each biometric type has its own set of properties, which are listed below. These may be graded on a scale from Low, to Medium, to High, with L, M, and H standing for Low, Medium, and High, respectively. Table IV presents a comparison of biometric characteristics based on a variety of criteria.

The two types of recognition error rates are called "failure to enroll" (FTE) and "failure to capture," or "FTC." The FTE measures the proportion of input that is incorrect and hence cannot be enrolled in the recognition system. The false capture rate (FTC) is the proportion of times that a biometric feature is not captured by the system even though it is properly presented.

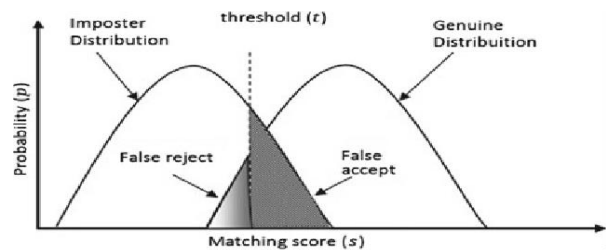


Fig. 11. Biometric System Error Rates [47]

When the similarity score, S , is higher than the acceptance threshold, then both of the samples being compared are from the same person.

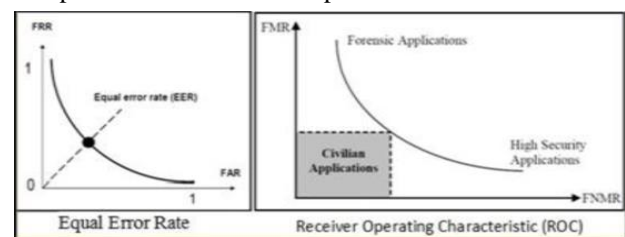


Fig. 12. EER and ROC [48]

If, on the other hand, S is lower than T , this indicates that the samples were taken from a unique individual. The distribution of samples that were created by two different individuals is referred to as the "Imposter distribution", while the distribution of samples that were generated by the same person is referred to as the "Genuine distribution".

EER or Crossover Rate refers to the point at which the FAR is equal to the FRR. This point is also known as the point at which the false CER. This suggests that the percentage of erroneous acceptances and the proportion of false rejections are about similar to one another. Figure 12 shows this argument. Figure 13, commonly known as the ROC, is a performance measure of a biometric system and contains a graphical depiction of the link that exists between FAR and FRR.

When compared to its CER ratio, the EER ratio of a biometric system that has high accuracy is one that has a low ratio. In the event that the threshold that is established is raised, the FAR will decrease, but the FRR will increase. Keeping a consistently low FAR while

keeping a consistently high FRR is the only method to ensure that access will never be provided to an unauthorized user [35] [36] [37] [3]. The performance of a variety of biometric methods are compared and contrasted in Tables IV and Table V.

TABLE V. Performance Evaluation

Identifier/ Criteria	Fingerprint	Iris	Face	DNA	Hand Geometry	Keystroke	Signature	Voice
CER	2%	0.01%	1%	-	1%	1.80%	-	6%
FTE	1%	0.50%	-	-	-	-	-	-
FAR	2%	0.94%	1%	-	2%	7%	-	2%
FRR	2%	0.99%	10%	-	2%	0.10%	-	10%

TABLE VI. List of Features, Advantages and Disadvantages of Biometric Characteristics

Biometric Characteristics	Description	Benefits	Drawbacks
Fingerprint [4]	Pore Structure, Fingerprint Line	<ol style="list-style-type: none"> 1. Affordable. 2. It is current most advanced approach. 3. Smaller template size for faster matcher. 4. Identical twins have distinct patterns. 	<ol style="list-style-type: none"> 1. Systems may be manipulated by using a fake finger, such as one made of wax, to fool them. 2. Cuts and scars might make it difficult to recognize someone.
Iris [9][4]	Iris Pattern	<ol style="list-style-type: none"> 1. Highly scalable, provided the iris structure stays constant. 2. High accuracy. 1 in 1078 iris patterns match. 3. Fast matching with small template. 	<ol style="list-style-type: none"> 1. Uses iris scanners to restrict data center access. 2. IRIS scanners are costly. 3. User participation is required. 4. High quality images may deceive scanners.
Facial Geometry [9]	face characteristics (eyes, nose, mouth)	<ol style="list-style-type: none"> 1. Non-intrusive. 2. Easy template storage. 3. Sociable. 	<ol style="list-style-type: none"> 1. Aesthetic changes in the face. 2. In the event of twins, uniqueness is lost. 3. Different facial expressions
DNA[27]	DNA code as human hereditary carrier	<ol style="list-style-type: none"> 1. High Performance. 2. Highly unique feature. 3. It is extremely ubiquitous. 	<ol style="list-style-type: none"> 1. More space needed. 2. Non-autonomous. 3. More informed on privacy.
Hand Geometry [4]	Finger, vein, and palm measurements	<ol style="list-style-type: none"> 1. High reliability and precision. 2. Solid, user-friendly. 3. Dry skin will not be a concern. 	<ol style="list-style-type: none"> 1. Hand shape is unreliable. 2. Unsuitable for young children. 3. Jewellery and dexterity imposes limitation.
Keystroke [9]	Keyboard strokes tempo (PC or other keyboard)	<ol style="list-style-type: none"> 1. Keyboard accept no extra hardware. 2. Easy to use. 3. No end-user training necessary. 	<ol style="list-style-type: none"> 1. Changes in the timing pattern that are dynamic. 2. Modifications to the keyboard hardware.
Signature [4][1]	Pressure and speed differential writing	<ol style="list-style-type: none"> 1. Widely admired. 2. Low cost of hardware. 3. Low overall error 4. Low storage need. 	<ol style="list-style-type: none"> 1. Expert forgers can copy signatures. 2. A person's distinctive style may change. 3. Emotional and physiological changes in a person's health.
Voice [4]	Timbre or Tone	<ol style="list-style-type: none"> 1. Reliable. 2. Less expensive. 3. Easy to use 	<ol style="list-style-type: none"> 1. Big database. 2. Affected by noise. 3. Changes if individual has cold.

CONCLUSION

Fingerprints, faces, voices, hand shape, iris and retina are some of the physical traits that the Biometric Recognition system can recognize. It has been discovered that biometric recognition systems outperform existing security systems in some applications such as ATMs, passports, credit cards, access control, and other similar applications. Furthermore, biometric recognition systems are found to be more accurate and effective than existing security systems in some applications. These systems can only function in the presence of a human being. As a result, these biometric systems have been shown to be very secure technologies.

REFERENCES

- [1] Ross, Arun & Prabhakar, Salil. (2004). An Introduction to Biometric Recognition. Circuits and Systems for Video Technology, IEEE Transactions on. 14. 4 - 20. 10.1109/TCSVT.2003.818349.
- [2] Yampolskiy, Roman & Govindaraju, Venu. (2008). Behavioural biometrics: A survey and classification. International Journal of Biometrics. 1. 10.1504/IJBM.2008.018665.
- [3] Chahal, Ramandeep, and Banur GVIET. "A comparative study of various biometric approaches." International Journal of Engineering Applied Sciences and Technology (2017).
- [4] Tripathi, K. P. "A comparative study of biometric technologies with reference to human interface." International Journal of Computer Applications 14, no. 5 (2011): 10-15.
- [5] Delac, Kresimir, and Mislav Grgic. "A survey of biometric recognition methods." In Proceedings. Elmar-2004. 46th International Symposium on Electronics in Marine, pp. 184-193. IEEE, 2004.
- [6] Lavanya, B., and H. Hannah Inbarani. "A Survey of Biometric Techniques." International Journal 5, no. 7 (2015).
- [7] Jaiswal, Sushma, et al. "BIOMETRIC: CASE STUDY | Open Access Journals." BIOMETRIC: CASE STUDY | Open Access Journals, www.rroij.com, <https://www.rroij.com/open-access/biometric-case-study-19-49.php?aid=37655>. Accessed 22 May 2022.
- [8] Ephim, M., Shreya Mohan, and N. A. Vasanthi. "Survey on multimodal biometric using palm print and fingerprint." In Amrita International Conference of Women in Computing, pp. 36-41. 2013.
- [9] Ross, Arun, and Anil K. Jain. "Human recognition using biometrics: an overview." In Annales Des Télécommunications, vol. 62, no. 1, pp. 11-35. Springer-Verlag, 2007.
- [10] Jain, Anil K., Arun Ross, and Salil Prabhakar. "An introduction to biometric recognition." IEEE Transactions on circuits and systems for video technology 14, no. 1 (2004): 4-20.
- [11] Jain, Anil K., Arun Ross, and Sharath Pankanti. "Biometrics: a tool for information security." IEEE transactions on information forensics and security 1, no. 2 (2006): 125-143.
- [12] Prabhakar, Salil, Sharath Pankanti, and Anil K. Jain. "Biometric recognition: Security and privacy concerns." IEEE security & privacy 1, no. 2 (2003): 33-42.
- [13] Wayman, James L. "Fundamentals of biometric authentication technologies." International Journal of Image and Graphics 1, no. 01 (2001): 93-113.
- [14] Weaver, Alfred C. "Biometric Authentication | Computer." Computer, dl.acm.org, 1 Feb. 2006, <https://dl.acm.org/doi/10.1109/MC.2006.47>.
- [15] Delac, Kresimir, and Mislav Grgic. "A survey of biometric recognition methods." In Proceedings. Elmar-2004. 46th International Symposium on Electronics in Marine, pp. 184-193. IEEE, 2004.
- [16] Maltoni, Davide, Dario Maio, Anil K. Jain, and Salil Prabhakar. Handbook of fingerprint recognition. Springer Science & Business Media, 2009.
- [17] Cappelli, Raffaele, Dario Maio, Davide Maltoni, James L. Wayman, and Anil K. Jain. "Performance evaluation of fingerprint verification systems." IEEE transactions on pattern analysis and machine intelligence 28, no. 1 (2005): 3-18.
- [18] Jain, Anil, Lin Hong, and Ruud Bolle. "On-line fingerprint verification." IEEE transactions on pattern analysis and machine intelligence 19, no. 4 (1997): 302-314.
- [19] Daugman, John. "How iris recognition works." In The essential guide to image processing, pp. 715-739. Academic Press, 2009.
- [20] Srivastava, Himanshu. "Personal identification using iris recognition system, a review." International Journal of Engineering Research and Applications (IJERA) 3, no. 3 (2013): 449-453.
- [21] Ganorkar, S. R., & Ghatol, A. A. (2007, February 1). Iris recognition | Proceedings of the 6th WSEAS International Conference on Signal Processing, Robotics and Automation. Guide Proceedings; dl.acm.org. <https://dl.acm.org/doi/10.5555/1353685.1353701>.
- [22] Bowyer, Kevin W., Karen Hollingsworth, and Patrick J. Flynn. "Image understanding for iris biometrics: A survey." Computer vision and image understanding 110, no. 2 (2008): 281-307.
- [23] Versha, Ms & Sarao, Dr. (2015). Comparative Analysis of Various Biometric Techniques. 3. 1-8.

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- [24] Jain, Anil K., and Stan Z. Li. Handbook of face recognition. Vol. 1. New York: Springer, 2011.
- [25] Chellappa, Rama, Charles L. Wilson, and Saad Sirohey. "Human and machine recognition of faces: A survey." *Proceedings of the IEEE* 83, no. 5 (1995): 705-741.
- [26] J. Dong, X. Meng, M. Chen and Z. Wang, "Template protection based on DNA coding for multimodal biometric recognition," 2017 4th International Conference on Systems and Informatics (ICSAI), 2017, pp. 1738-1742, doi: 10.1109/ICSAI.2017.8248565.
- [27] What is DNA?: MedlinePlus Genetics. (2021, January 19). What Is DNA?: MedlinePlus Genetics; medlineplus.gov. <https://medlineplus.gov/genetics/understanding/basics/dna/>
- [28] Inderscience Publishers. "Handheld DNA Detector." *ScienceDaily*. www.sciencedaily.com/releases/2008/03/080310173246.htm (accessed May 20, 2022).
- [29] Sanchez-Reillo, Raul, Carmen Sanchez-Avila, and Ana Gonzalez-Marcos. "Biometric identification through hand geometry measurements." *IEEE Transactions on pattern analysis and machine intelligence* 22, no. 10 (2000): 1168-1171.
- [30] Kukula, Eric, and Stephen Elliott. "Implementation of hand geometry at purdue university's recreational center: an analysis of user perspectives and system performance." In *Proceedings 39th Annual 2005 International Carnahan Conference on Security Technology*, pp. 83-88. IEEE, 2005.
- [31] Monroe, Fabian, and Aviel Rubin. "Authentication via keystroke dynamics." In *Proceedings of the 4th ACM Conference on Computer and Communications Security*, pp. 48-56. 1997.
- [32] A. B. M. A. Rahman, G. Mostaeen and M. H. Kabir, "A statistical approach for offline signature verification using local gradient features," 2016 2nd International Conference on Electrical, Computer & Telecommunication Engineering (ICECTE), 2016, pp. 1-4, doi: 10.1109/ICECTE.2016.7879570.
- [33] Eriksson, Anders, and Pär Wretling. "How flexible is the human voice?-a case study of mimicry." In *Fifth European Conference on Speech Communication and Technology*. 1997.
- [34] Furui, Sadaoki. "Recent advances in speaker recognition." *Pattern recognition letters* 18, no. 9 (1997): 859-872.
- [35] Tripathi, K. P. "A comparative study of biometric technologies with reference to human interface." *International Journal of Computer Applications* 14, no. 5 (2011): 10-15.
- [36] Liu, Simon, and Mark Silverman. "A practical guide to biometric security technology." *IT Professional* 3, no. 1 (2001): 27-32.
- [37] Harakannanavar, Sunil Swamilingappa, Prashanth Chikkanayakanahalli Renukamurthy, and Kori Basava Raja. "Comprehensive study of biometric authentication systems, challenges and future trends." *International Journal of Advanced Networking and Applications* 10, no. 4 (2019): 3958-3968.
- [38] Jain, Anil K., Karthik Nandakumar, and Arun Ross. "50 years of biometric research: Accomplishments, challenges, and opportunities." *Pattern recognition letters* 79 (2016): 80-105.
- [39] Murray, Cole. "Building a Facial Recognition Pipeline with Deep Learning in Tensorflow | by Cole Murray | HackerNoon.Com | Medium." *Medium*. [medium.com](https://medium.com/hackernoon/building-a-facial-recognition-pipeline-with-deep-learning-in-tensorflow-66e7645015b8), May 22, 2019. <https://medium.com/hackernoon/building-a-facial-recognition-pipeline-with-deep-learning-in-tensorflow-66e7645015b8>.
- [40] Patil, V., Ingle, D.R. An association between fingerprint patterns with blood group and lifestyle based diseases: a review. *Artif Intell Rev* 54, 1803–1839 (2021). <https://doi.org/10.1007/s10462-020-09891-w>
- [41] Severo, Evair & Laroca, Rayson & Bezerra, Cides & Zanlorensi, Luiz & Weingaertner, Daniel & Moreira, Gladston & Menotti, David. (2018). A Benchmark for Iris Location and a Deep Learning Detector Evaluation. 10.1109/IJCNN.2018.8489638.
- [42] Loreto Sixth Form College A level Biology. "DNA Structure." loretocollegebiology.weebly.com. Accessed May 31, 2022. <http://loretocollegebiology.weebly.com/dna-structure.html>.
- [43] Yu, Annie & Yick, Kit-Lun & Ng, Zerance & Yip, Joanne. (2012). 2D and 3D anatomical analyses of hand dimensions for custom-made gloves. *Applied ergonomics*. 44. 10.1016/j.apergo.2012.10.001.
- [44] Dziubiński, Maciek. "Building Supervised Models for User Verification—Part 1 of the Tutorial." *Medium*. [blog.daftcode.pl](https://blog.daftcode.pl/building-supervised-models-for-user-verification-part-1-of-the-tutorial-7496d5d394b9), March 2, 2018. <https://blog.daftcode.pl/building-supervised-models-for-user-verification-part-1-of-the-tutorial-7496d5d394b9>.
- [45] Diaz, Moises & Fischer, Andreas & Ferrer, Miguel & Plamondon, Réjean. (2016). Dynamic Signature Verification System Based on One Real Signature. *IEEE Transactions on Cybernetics*. PP. 10.1109/TCYB.2016.2630419.
- [46] IDVoice SDK Reference. "IDVoice SDK Reference." docs.idrnd.net. Accessed May 31, 2022. <https://docs.idrnd.net/voice/3.1.0/#overview>.
-

- [47] Elhoseny, Mohamed & Elkhateeb, Ahmed & Talaat, Ahmed & Hassanien, Aboul Ella. (2018). Multimodal Biometric Personal Identification and Verification. 10.1007/978-3-319-63754-9_12.
- [48] Miyazawa, Kazuyuki & Ito, Koichi & Aoki, Takafumi & Kobayashi, Koji & Nakajima, Hiroshi. (2006). A Phase-Based Iris Recognition Algorithm. 356-365. 10.1007/11608288_48.

Third Eye: TTS and Deep Learning-based Assistive Technology for Blind

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Abstract:

According to the World Health Organization (WHO), more than 2.2 billion people throughout the globe are affected by some kind of visual impairment, either in their near or distant vision. Over 12 million people in India are affected by blindness, making it the country with the largest blind population in the world. Traditional techniques, on the other hand, are more difficult and costly to change, and most of the time, blind people end up needing to move about by gripping a wooden stick. People who are blind have very restricted access, or none at all, to any of the many intelligent devices that are presently on the market across the world. The project's objective is to find solutions to the issues so that a blind person using an android application called Smart Third Eye would be able to go to a variety of sites independently. This project assists blind people in recognizing the items that are in their immediate environment and enables them to determine the kind of object with the use of a Deep Neural Network and YOLO. The other objective of the research is to help blind person to use voice instructions to travel to various locations. They also have the option of using voice assistants to make phone calls, and their caretakers are able to monitor their whereabouts using GPS technology and different sensors.

Keywords:

Deep Learning, Visual Impairment, YOLO, Android Application, GPS, Sensors.

INTRODUCTION

According to research that was carried out by the World Health Organization (WHO), there are approximately 2.2 billion people in the world who are blind or have significantly decreased eyesight. Out of these individuals, 62 million of them reside in India, of which 8 million have total vision impairment, according to the research. The visually impaired have a far greater number of challenges in their day-to-day life than a person with normal vision does, the most significant of which is the inability to move freely around the environment. Visually impaired persons have a difficult time investigating their environment, and mobility is the most major obstacle they face as a result of their lack of a thorough understanding and knowledge about their physical world. They also make use of canes to identify distinct objects and to avoid clashing with such objects. Canes, on the other hand, are not able to provide their users with any assistance in identifying the item, nor are they able to locate an item that is out of their immediate grasp. They rely almost entirely on the experiences they've had in the past in addition to their other senses in order to navigate through their environment. However, because of this reliance, they run the risk of experiencing accidents or injuries if they come across an unknown

item in a setting that is unfamiliar to them, which can be hazardous. In recent years, technical breakthroughs have led to the creation of assistive devices that may be used by those who are blind or visually impaired.

When we talk about Assistive Technology (AT), we're referring to any piece of hardware or piece of software that makes it simpler for people who are blind or visually impaired to perceive their surroundings. This, in turn, helps these individuals become more capable, independent, and self-sufficient. These technologies help people who are blind or visually impaired become more aware of their environment, which lessens the likelihood that they may hurt themselves or others, as well as the likelihood that others will hurt them. Assistive technology helps people react more effectively to a situation by giving them with information that helps them better understand the circumstance. In contrast to the development of wearable and portable device aids for the visually impaired, recent research indicates that there has been an uptick in the production of mobile application assistance for those who are blind or visually impaired. It is more desirable to have a single device that can accomplish many functions than to have numerous devices, and it should be more cost-effective to have the one device. The growing computational power of smartphones, in addition to the growing availability of smartphones, is creating incentives for the development of many applications with enhanced performance that are geared toward assisting visually impaired individuals in their day-to-day lives. The purpose of the investigation being carried out is to discover a wide variety of helpful technologies that have been developed on a platform based on mobile phones with the intention of assisting visually impaired people in their day-to-day life.

Real-time object identification is provided via the YOLO method, which is based on the utilization of neural networks. The efficiency and precision of this algorithm have contributed to its widespread use. It has found usage in a variety of applications, including those that detect animals, humans, and parking meters in addition to traffic signals. When using the Feature-based Approach, it is important to consider the local aspects of a person's face such as his or her eyes, mouth, nose, and so on. These features are utilized to segment the face and to provide input data for face detection. Holistic Approaches to face detection and identification take into account the full face when determining whether or not to utilize a particular face as an input. The Android application developed will help the blind person to enter

into the world of technology and it can be the beginning of a new era for them.

RELATED WORK

According to Mahdi S, A., et al. (2012), A way to implement mobility assistance for the blind person, there are several approaches to assess the distance between the barrier and the person. One of these is by the use of ultrasonic technology. Footwear which included a configuration of ultrasonic sensors all the way around the bottom was utilized to assist the visually impaired individual. The sensors are supported by a customized circuit that is housed inside the user's shoe. [23].

In the year 2012, Nassih, Mehdi., et al stated, the smart cane makes use of the RFID technique. It is used to detect obstacles and objects in front of the user, as well as to detect the RFID tag, if there is any, that has been placed in different areas in order to navigate the users. There is nothing particularly innovative about this design, it is basically a cane with a bag that the user wears on their back. To power the system, a bag is used, and speakers integrated into the bag's inside convey the output to the user. Although, since it is restricted to the places where the RFID tags have been set, this technology is only useful in a narrow area. In any other case, it will operate as a conventional stick in the areas where there are no tags [6].

The blind Cane, according to this article, is one of the aiding instruments for the blind, and it is quite significant, claimed Alshbatat and Abdel Ilah Nour in 2013. When used properly, the Guide Cane may aid visually challenged individuals in maintaining their safety on the road. Guide Canes are similar to white canes in that they are held in front of one's body when walking. This is due to the white cane's lighter weight and the guide cane's larger weight [24].

The author said in 2006 that the "Smart Cane" is an invention that was first developed as a traditional blind cane, However, from the moment it was designed, it was equipped with a sensor network. In contrast to the Guide Cane, this new invention is equipped with a variety of HC-SR04 sensors and servo motors, which makes it similar to the Guide Cane idea. The majority of the time, this gadget is made to help blind person to navigate their environment. As a result of this, the user is able to dodge obstacles and stuff ahead of them, hence the HC-SR04 sensor must be used [24].

In 2015, Author Sonal S., et al stated, With this development, the technology of HC-SR04 sensor and sound vibrations came into reality. There are a few things that aren't ideal about it, including the fact that it can't be folded and the fact that it's hard to keep in place. This idea does not have any sensors for detecting water regions, which is another disadvantage [8].

The researchers quoted Muhsin Asaad H., et al. (2013), who said that a white cane is assigned to detect impediments up to knee level within a range of 2 to 3 feet in height (0.91 m). In the case that the cane detects

an impediment, it will either vibrate or speak out loud. Because of this, the sensor, as well as the controller, are both housed inside the cane as a consequence of this, which has a battery life of 10 hours on a single charge in all conditions. By calculating the amount of time, it takes for the waves to go to the impediment and the amount of time it takes for the waves to travel back, we can determine the delay time. A buzzer is used to provide the user with distance information [9].

According to Manisha Bansode et al. [10], in 2015, they developed a speech-based system for the blind utilising a voice recognition module and GPS module installed on an Arduino board. The speech recognition module will get the name of the destination from a blind person, who will be the input to the system. A GPS receiver continually gets the current position, as well as its longitude and latitude, and compares it to the latitude and longitude of the destination, explains the manufacturer [23].

Harsur A, et al. [11] created a voice-based system for visually impaired people employing ultrasonic sensors, which allows blind people to roam independently inside the outside world. This project is composed mostly of six modules, which are as follows: Interface, Initialization, Address query translation, Route Query, Transversal of the route, as well as identification of obstacles. Because it is the first module in the system library, it is in the responsibility of ensuring that the initialization of the system library is carried out correctly. Additionally, it is responsible for ensuring that the system library is ready for use. In the next section of the module, i.e. Using a microphone, the user interface gathers the address of the destination from the user at this stage. The speech interface that was developed in this module makes use of services such as Text-to-Speech for the voice outputs and the Google Voice Recognizer API for the recognition of voice inputs and outputs. In the last section of the module, i.e., As we go on to the last part of the module "Address query translator converts geographic coordinates to coordinates that contain latitude and longitude." [23].

In this paper [25]: An ultrasonic sensor, a Raspberry Pi, and a camera were used to create navigation assistance for visually impaired people. In MATLAB, optical flow is used to analyze and estimate the movement of moving objects. The MATLAB code is translated into the language of the Raspberry Pi hardware. For optical flow estimate, the Horn-Schunk technique was used. For the purpose of picture segmentation, the thresholding approach was used. The object's boundaries were defined using the blob detection technique. Utilizing the camera as a source of data, the video gets transformed into grayscale frames, which are then relayed by the modules responsible for optical flow as well as image segmentation, which are responsible for the final output. The next phase involves the use of morphological approaches in order to obtain features, which are then sent along to the Blob algorithm for further processing.

Aside from that, noise filtering is employed to remove additive features from the data stream.

In this paper [26], RFID is a technological advancement that may assist in enhancing the organization and direction of people when participating in daytime activities. The device may be able to deliver a few bits of information to someone who is vision impaired, about the distinguishable and expedite the search; in addition to differentiating between medications, The user may get an audible indication from the device, which will assist them in locating the ideal item in the shortest amount of time feasible. A few chunks of information are made available to those who are visually challenged regarding the distinguishable of a designated item, namely the manner in which it is near or far away.

SYSTEM DESIGN AND IMPLEMENTATION

The creation of a system plan is one of the critical steps that must be taken in order to successfully deploy the necessary system. Because developing the architecture is part of the system plan, which is done first so that implementation may be done according to the architecture. Following that, data flow diagrams may be created on the basis of the architecture. Because of this, we will get an understanding of how the data flow should take place as well as the modules that are necessary to construct the necessary system. Therefore, the architecture and DFD make up the bulk of the system plan.

Modules and their descriptions

The following is a list of the six primary components that make up the system:

1. Messages:

The user may see the messages in two different formats: their inbox and the messages they have sent.

2. Calls:

The user is able to make calls from inside this app, which has a bespoke dialer and call records.

3. Battery:

The user may manually check the battery level, and the system will also provide a notification to the user when the battery is running low.

4. Notes:

The user is able to not only add new notes but also change it whenever it is necessary.

5. Text to Speech:

The programme takes care of everything, from performing the activities to even providing spoken reminders.

6. Read Messages/Notes:

Additionally, the technology assists the user in reading the contents of the message and the notes.

7. Navigation:

The System will take into account both the device's present position and its final destination location before

determining the best route for navigation based on the information provided by Google Services.

8. Face Recognition:

The technology is able to recognize who is in the immediate vicinity of you and will announce their name to you as they come into view.

9. Object Recognition:

The system takes use of YOLO to detect the things that are located in the immediate vicinity of the user, after which it will play back an audio representation of the kind of object that was discovered.

10. Object Detection:

The system is able to identify whether there are any items coming in front of him, and it will also produce a loud sound utilizing a buzzer when it does so. The distance between the ultrasonic sensor and the box would be:

$$D = 0.5 \times 0.025 \times 343 \text{ or about } 4.2875$$

11. Fall Detection:

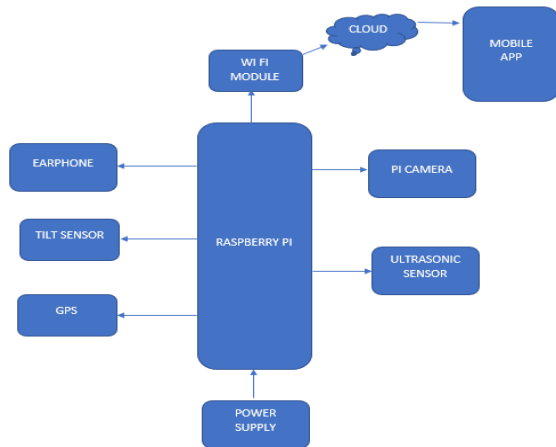
The technology is able to determine whether or not the blind person has collapsed, and the individual's loved ones will be able to keep an eye on them by utilizing an application on their Android mobile.

12. GPS Location:

In addition, the caregivers are able to get longitude and latitude readings, which will be of great assistance to them in locating the spot where the blind person was injured.

System Design

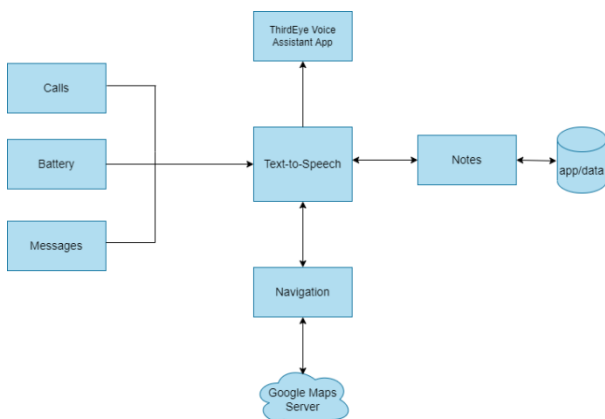
A Raspberry Pi camera is linked to the CPU in certain way. Python is the programming language used for the processor. The picture is captured in real time by the Pi camera and then sent to the Raspberry Pi-3 CPU so that it may be processed and also used for face recognition. The COCO model is used by the Python code in order to recognize and categorize the items. It will create border boxes around the objects that have been discovered, and it will also display the category index associated with the item. A Raspberry Pi camera is fastened to the frame of the wearer's smart glasses so that it may record the user's surroundings in real time. After some time has passed, the photographs are fed into the trained deep learning model, which then identifies any people who are in the images. As a consequence of this, the user's earphone is responsible for producing the voice output. Because of the tilt sensor that is linked to the system, it will become active if the individual is in danger of falling. an ultrasonic sensor is used in order to determine the distance at which the obstruction or item is located. And using the GPS, we will be able to simply determine the position of the blind person in the event that the fall detection feature is activated.



Project Hardware Architecture

In order to avoid the intelligent assistive system from making a mistake in its evaluation, we have merge the two fall recognition systems. When a fall signal is triggered by the proposed intelligent smart glasses as well as a fall signal is also obtained from the proposed wearable smart glasses, then it is largely decided to also be a legit fall event, and the current geolocation data is directly transmitted to the proposed cloud-based data management platform by a Wi-Fi module. Therefore, the location and time of the event are transferred to the proposed cloud-based information management platform for safekeeping, and a message is sent to the Android application in order to warn the family members or caretakers of the visually impaired user of the situation. On the other hand, if the proposed smart glasses do not detect a fall event but received a fall signal from the proposed wearable smart glasses, then this fall event will be rejected as the proposed smart glasses made an erroneous judgement.

The android application consists of mainly 5 modules, and these are Message, Calls, Notes, Battery and Google Map Navigation. All the modules works based on Text-to-Speech. The blind person gets all the information from an android mobile in voice output. The application is smart enough to identify the English as well as the Kannada language so that the blind person can able to understand both the text messages from the receivers



Project Android Application Architecture

The application also enables the blind person to make a call to any person by dialing his/her number. The dial-pad is designed in such a way that, A blind person can easily identify the digits placed on screen. In order to navigate across the different places, the user has to shake his mobile phone, then android application will prompt the user to enter the destination address as voice input.

The application also warns the user in case of low battery, despite the fact that application is closed or running. Whereas the blind can also read the notes which are stored. The notes can be read, by just tapping on the notes and the text will be converted into voice.

Sample code for Navigation in Android

The system will fetch the Android device current location and prompt the user to enter the destination. When user provides the destination address in terms of Voice. It will be converted into text. Hence navigation is calculated for a user between two locations and the time required to reach the destination is displayed considering the user is going to walk instead of riding a bike or driving license.

```

private void getData(String FromLoc, String ToLoc) {
    String url =
    "https://maps.googleapis.com/maps/api/directions/json?origin=" + FromLoc + "&destination=" + ToLoc +
    "&departure_time=1614237247149&traffic_model=best_guess&key=AIzaSyBs6ifdtEVD4B2hn0yNtezAvIr0GQJsxRI&mode=walking";
    StringRequest
    stringRequest
    = new StringRequest(
    Request.Method.GET,
    url,
    response -> {
        try
        {
            parseJson(response.toString());
        } catch (JSONException e) {
            e.printStackTrace();
        } catch (IOException e) {
            e.printStackTrace();
        }
    },
    error -> Log.d("LOG", error.toString()));
    queue.add(stringRequest);
}
  
```

Sample code for adding notes using SQL DB

```

public void add(String name,String mesg)
{
    SimpleDateFormat sdfd=new
    SimpleDateFormat("yyyy/MM/dd");
    SimpleDateFormat sdft=new
    SimpleDateFormat("HH:mm");
    ContentValues cv=new ContentValues();
    cv.put(NID,getid());
    cv.put(NNAME,name);
    cv.put(NNOTES,mesg);
    cv.put(NDATE,sdfd.format(new Date().getTime()));
}
  
```

```
cv.put(NTIME,sdf.format(new Date().getTime()));
sqldb.insert(TBNAME,null,cv);}
```

RESULTS AND DISCUSSIONS

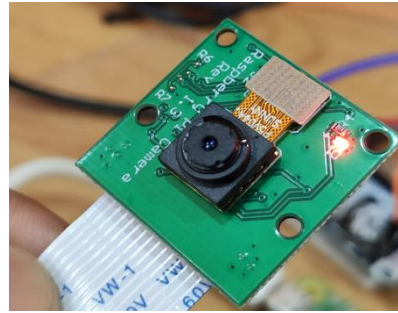
Hardware Implementation

Raspberry Pi (also known as RPi) is a credit card-sized computer that can be purchased for a minimal cost. It can be connected to a TV or computer display and utilises conventional peripherals such as a keyboard and mouse. Individuals of any age are able to experiment with computers and learn how to write code in a variety of languages using this capable and tiny piece of hardware, such as C/C++ and Python. The device is called a Raspberry Pi. It is capable of doing all of the tasks that one would expect a desktop computer to perform, including things like playing high-definition video, accessing the internet, creating spreadsheets, and word processing documents, as well as playing games. The Raspberry Pi operates in an open-source environment. It uses Linux (a varied distribution), and Raspbian, the main operating system that is supported runs open-source software and is capable of running a variety of open-source programmes. While concurrently releasing a major percentage of its own code as open source, the Raspberry Pi Foundation makes contributions to the Linux component as well as a range of other open-source extensions.



Raspberry Pi 3 Model B+

Raspberry Pi Camera has a flex cable in its package. The connector that is situated between the Ethernet port and the HDMI port is where the flex cable is placed, and the silver connection should be oriented so that it faces the HDMI port. To open the flex cable connection, pull the tabs on the top of the connector upwards and then toward the Ethernet port. This will open the connector. After that, the flex cable is carefully pushed all the way into the connection. After that, the upper portion of the connection is pulled toward the HDMI connector and then down, all while the flex cable is retained in its current position. The Raspberry Pi camera is being used in this instance for both the process of face detection as well as face recognition.



Raspberry Pi Camera

Ultrasonic Sensor is a piece of electronic equipment that emits ultrasonic sound waves, then transforms the sound that is reflected back from the target item into an electrical signal in order to calculate its distance from the object. The pace at which audible sound travels is much slower than that of ultrasonic waves. A source called an ultrasonic sensor is currently being used in order to detect the obstruction that is situated in front of the user. Serially connected to the Raspberry Pi's central processing unit.



HC-SR04 Ultrasonic Sensor

Raspbian, also known as Raspberry Pi OS (previously Raspbian), is an operating system for Raspberry Pi that is based on Debian. The Raspberry Pi operating system has been fine-tuned to perform very well on the ARM-based single-board computers manufactured by Raspberry Pi. It is compatible with all Raspberry Pi models with the exception of the Pico microcontroller.



Smart Glasses for Blind with HCSR04 & Pi Cam Mounting

The Smart Glasses consists of HC-SR04 Ultrasonic sensor mounted in front of the Smart glasses in order to detect the objects coming in front of the blind and the Pi Cam will help the blind to identify the type of object

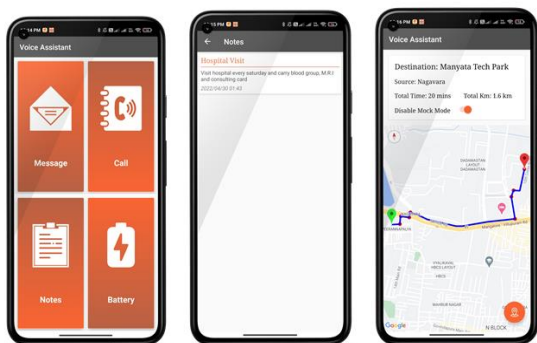
detected by HC-SR04. The Pi camera captures the object picture or human face and announce the name of the detected object.

Mobile Application Development

TTS is compatible with an extremely large number of personal digital devices, including desktop computers, mobile phones, and tablet PCs. It is possible to do text-to-speech conversion on files of any kind, including those written in Microsoft Word and Apple Pages, as well as any other kind of text file. Even the written material on websites accessible through the internet may be read aloud. Text is read out loud by the text-to-speech system (also known as TTS) in a computer-generated voice, and the tempo at which the text is read may generally be changed. The voices are of varying quality, but some of them have a human tone to them.

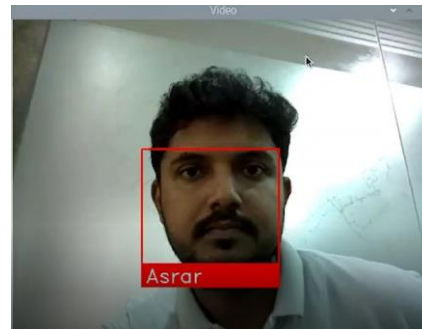
In many text-to-speech (TTS) programmes, individual words are highlighted as they are read aloud. Because of this, a person who is blind or has low vision may be able to understand the text via the use of simultaneous auditory processing. The phrase "optical character recognition" refers to a function that is sometimes included in certain TTS programmes (OCR). The optical character recognition (OCR) technique enables text-to-speech (TTS) programmes to read text aloud from images. Take for example a person who is blind or visually handicapped; they may take a photo of any newspaper, and the information in the newspaper will then be turned into audio. Immediately after the selection of the language, you will be able to utilise the speak method of the class in order to hear the text read aloud. An example of its syntax may be seen below:

```
ttobj.speak(toSpeak, TextToSpeech.QUEUE_FLUSH, null)
```



Voice Assistant Android App for Blind

Voice Assistant is an Android application that is based on TTS that is used to assist blind people with several choices like as TTS for Messages, TTS for Calls, and TTS for Notes and Battery. Whereas a blind person may also navigate to any location in the globe with his voice commands, the use of which android application will route him to the destination would guide him there. Caregivers are also able to see the status of the blind person in the event that the blind person has an accident. The falls detection sensor is now being used, and it will communicate this information to the caregiver.



```
START CAMERA
(process:1025): Gtk-WARNING **: 13:55:40.783: Locale not supported by C library.
Using the fallback 'C' locale.
Asrar face
Asrar face Detected
```

Face Recognition with Voice Playback.

After the face or object has been identified with the support of the Pi camera that is being used with Raspberry Pi, the system will announce the type of the object that has been identified or the name of the person whose face has been recognised. The system will make the announcement, and a blind person may use headphones to listen to the audio playback of the announcement. When opposed to object recognition, face recognition has a higher level of accuracy due to the fact that the system uses CNN to analyse several criteria before making a guess about the person's name.



```
pi@raspberrypi:~/Desktop/yolo-object-detection $ ./init.sh
[INFO] loading YOLO from disk...
[INFO] YOLO took 34.188268 seconds
bottle
Object present is bottle
Playing WAVE 'stdin' : Signed 16 bit Little Endian, Rate 22050 Hz, Mono
Playing WAVE 'stdin' : Signed 16 bit Little Endian, Rate 22050 Hz, Mono
```

Object Detection with Voice Playback

CONCLUSION

The study suggests a smart glasses system that is both low-cost and simple to implement, with the goal of assisting those who are blind in leading more independent lives. With the assistance of this programme, the visually impaired person will have no trouble getting about to various locations, and he will also be able to utilize his android phone with the assistance of text-to-speech. The module's mass manufacturing would result in a further reduction in its cost, as well as GPS-based navigation and the sharing of positions with the caretakers, all of which would ensure that the caretakers' loved ones are kept safe and are doing well. Therefore, enabling persons who are blind or

visually impaired to "see without the eye" Pre-process Image.

REFERENCES

- [1] Krishnan, R. Santhana, K. Lakshmi Narayanan, S. Mathumitha Murali, A. Sangeetha, C. Ramasamy Sankar Ram, and Y. Harold Robinson. "IoT based Blind People Monitoring System for Visually Impaired Care Homes." In *2021 5th International Conference on Trends in Electronics and Informatics (ICOEI)*, pp. 505-509. IEEE, 2021
- [2] Park, Jae Sung, Cheon Lee, Daesung Lim, Seongwoon Jung, Jiman Kim, Junghwa Choi, and YoungSu Moon. "Inclusive Convolutional Neural Network Design Enabling Partially Sighted People to Expand Viewing-Experience on Smart Screens." In *2022 IEEE International Conference on Consumer Electronics (ICCE)*, pp. 01-04. IEEE, 2022.
- [3] Masud, Usman, Tareq Saeed, Hunida M. Malaikah, F. U. Islam, and Ghulam Abbas. "Smart Assistive System for Visually Impaired People Obstruction Avoidance through Object Detection and Classification." *IEEE Access* 10 (2022): 13428-13441.
- [4] Bhoge, Vidya, and S. Y. Chinchulikar. "INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY REVIEW ON GPS NAVIGATION SYSTEM FOR BLIND PEOPLE."
- [5] Lay-Ekuakille, Aimé, and Subhas Chandra Mukhopadhyay. *Wearable and autonomous biomedical devices and systems for smart environment*. Heidelberg, Germany:: Springer, 2010.
- [6] Nassih, Mehdi, Ilham Cherradi, Youssef Maghous, Badr Ouriaghli, and Y. Salih-Alj. "Obstacles recognition system for the blind people using RFID." In *2012 Sixth International Conference on Next Generation Mobile Applications, Services and Technologies*, pp. 60-63. IEEE, 2012.
- [7] Alshbatat, Abdel Ilah Nour. "Automated mobility and orientation system for blind or partially sighted people." *International journal on smart sensing and intelligent systems* 6, no. 2 (2013).
- [8] Alam, Syed Tehzeeb, and Sonal Shrivastava. "Smart Device for Blind People." *Journal: International Journal of Engineering Research & Technology (IJERT)*, ISSN (2015): 2278-0181.
- [9] Mahdi Safaa, A., H. Muhsin Asaad, and I. Al-Mosawi Ali. "Using ultrasonic sensor for blind and deaf persons combines voice alert and vibration properties." *Research Journal of Recent Sciences ISSN 2277* (2012): 2502.
- [10] Bansode, Manisha, Shivani Jadhav, and Anjali Kashyap. "Voice recognition and voice navigation for blind using GPS." *International Journal of Innovative Research in Electrical, Electronics, Instrumentation and Control Engineering* 3, no. 4 (2015): 91-94.
- [11] Harsur, Anushree, and M. Chitra. "Voice based navigation system for blind people using ultrasonic sensor." *IJRITCC* 3 (2017): 4117-4122.
- [12] Lakde, Chaitali K., and Prakash S. Prasad. "Review paper on navigation system for visually impaired people." *International Journal of Advanced Research in Computer and Communication Engineering* 4, no. 1 (2015): 166-168.
- [13] Baldwin, Douglas. "Wayfinding technology: A road map to the future." *Journal of Visual Impairment & Blindness* 97, no. 10 (2003): 612-620.
- [14] Tapu, Ruxandra, Bogdan Mocanu, and Ermina Tapu. "A survey on wearable devices used to assist the visual impaired user navigation in outdoor environments." In *2014 11th international symposium on electronics and telecommunications (ISETC)*, pp. 1-4. IEEE, 2014.
- [15] Bagwan, Shagufta Md Rafique, and L. J. Sankpal. "VisualPal: A mobile app for object recognition for the visually impaired." In *2015 International Conference on Computer, Communication and Control (IC4)*, pp. 1-6. IEEE, 2015.
- [16] Chaudhari, Sunil B., and Shailaja A. Patil. "Notice of Removal: Real time video processing and object detection on android smartphone." In *2015 International Conference on Electrical, Electronics, Signals, Communication and Optimization (EESCO)*, pp. 1-5. IEEE, 2015.
- [17] Balani, Yogita, Deepa Narayanan, Shashank Parande, Aakash Birari, and Anjali Yeole. "Drishti-Eyes for the blind." In *2019 IEEE 5th International Conference for Convergence in Technology (I2CT)*, pp. 1-6. IEEE, 2019.
- [18] Saeed, Nada N., Mohammed A-M. Salem, and Alaa Khamis. "Android-based object recognition for the visually impaired." In *2013 IEEE 20th International Conference on Electronics, Circuits, and Systems (ICECS)*, pp. 645-648. IEEE, 2013.
- [19] Awad, Milios, Jad El Haddad, Edgar Khneisser, Tarek Mahmoud, Elias Yaacoub, and Mohammad Malli. "Intelligent eye: A mobile application for assisting blind people." In *2018 IEEE Middle East and North Africa Communications Conference (MENACOMM)*, pp. 1-6. IEEE, 2018.
- [20] Parikh, Neel, Ishita Shah, and Safvan Vahora. "Android smartphone based visual object recognition for visually impaired using deep learning." In *2018 International Conference on Communication and Signal Processing (ICCS)*, pp. 0420-0425. IEEE, 2018.
- [21] Shishir, Md Amanat Khan, Shahariar Rashid Fahim, Fairuz Maesha Habib, and Tanjila Farah. "Eye Assistant: Using mobile application to help the visually impaired." In *2019 1st International Conference on Advances in Science, Engineering and Robotics Technology (ICASERT)*, pp. 1-4. IEEE, 2019.

- [22] Valipoor, Mohammad Moeen, and Angélica de Antonio. "Recent trends in computer vision-driven scene understanding for VI/blind users: a systematic mapping." *Universal Access in the Information Society* (2022): 1-23.
- [23] Mahdi Safaa, A., H. Muhsin Asaad, and I. Al-Mosawi Ali. "Using ultrasonic sensor for blind and deaf persons combines voice alert and vibration properties." *Research Journal of Recent Sciences ISSN 2277* (2012): 2502
- [24] Shinohara, Kristen. "Designing assistive technology for blind users." In *Proceedings of the 8th International ACM SIGACCESS Conference on Computers and Accessibility*, pp. 293-294. 2006.
- [25] Maheshwari, Khushi, Sampada Lamba, Rishabh Sharma, and Parul Yadav. "A Survey on Mobile Applications for the Assistance of the Visually Impaired." (1997).
- [26] Dionisi, Alessandro, Emilio Sardini, and Mauro Serpelloni. "Wearable object detection system for the blind." In *2012 IEEE International Instrumentation and Measurement Technology Conference Proceedings*, pp. 1255-1258. IEEE, 2012.

A Review on Hardware Cryptocurrency Wallet

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Abstract:

In this paper, a review of the cryptocurrency wallet is presented in brief. Cryptocurrency is a sort of digital currency that ensures secure online transactions using encryption and a decentralized structure. Because these are digital funds, hackers may attempt to steal them, thus users must safeguard their private keys to keep their assets safe. This can be achieved by a crypto wallet, unlike a normal wallet that holds cash whereas the crypto wallet is a place where you store your public and private key for the transactions. They also offer the functionality of encrypting and signing algorithms. We have different types of crypto wallets like paper wallets, online wallets, hardware wallets, etc. The research presents hardware wallet stores the private key offline in hardware. So, the private key by no means comes out of the hardware so the bad actors cannot access it. For signing the transaction, the EDSA can be used and for encryption, AES can be used. This allows the user to protect their cryptocurrency from the bad actors.

Index Terms:

Advanced Encryption Standard(AES), cryptocurrency, Elliptic Curve Digital Signature algorithm(ECDSA), hardware-wallet, private/public key, signing, transaction.

INTRODUCTION

In this section, a brief introduction to the cryptocurrency wallet is presented. A cryptocurrency wallet is a software application, online platform, or hardware device that allows cryptocurrency users to store, send, and receive Bitcoins and other cryptocurrencies. Essentially, crypto wallets that hold users' Bitcoin balances don't store Bitcoins. The associated private and public keys with a particular wallet are stored. Cryptocurrency wallets have some similarities with regular wallets as it helps you to store cryptocurrencies. In addition to this basic key storage function, cryptocurrency wallets typically provide functionality for confidentiality and authentication by encrypting and signing information and allowing users to send and receive digital currency.

There are types of wallets are first is the hot wallet where the private keys are stored in the online environment using the internet like exodus mycelium, etc. whereas the second one is the cold wallet in which the private key is stored the offline environment like trezor, ledger, etc. In the hot and cold wallets, we have different types of wallets like online wallets, mobile wallets, the desktop wallet that comes under hot wallet and hardware wallet, and paper wallets are cold wallets. Among these the most secure approach to storing a private key of the cryptocurrency is in a hardware wallet which can't be accessed by hackers or bad actors because it is not accessed by the internet.

LITERATURE SURVEY

In this section, a brief introduction of the work that has been done in this field is discussed. Comparison between the traditional currencies, as well as cryptocurrencies based on the existing mechanism and the Current status of digital wallets in the market, options for better solutions to buy and use digital wallets, security of digital wallets, and future development trends, are considered in [1]. Various types of wallets based on some unique functions are compared and, in most cases, all wallets are built for existing blockchains and use the SHA256, ECDSA key generation algorithm like Guarda and Jaxx support web, mobile, and desktop platforms, for protection choose a hardware wallet. For convenience, choose the internet or mobile wallet [2].

A new digital encryption scheme based on Elliptic Curve-Diffie Hellman key sharing is fast, secure, and can be used with all existing wallets, including cryptocurrency hardware wallets with limited resources. which human visual side-channel verification of trusted screens on hardware wallets for secure backup and restore [3]. Electronic wallets (Blue Wallet) are a viable alternative to card-based payment methods and cash since users can pay with Bitcoin simply by checking the transaction information on the Blue Wallet screen and entering the PIN code [4]. The storage of digital assets such as QR codes for mutual verification between cold wallet (offline) and hot wallet(online) provides an additional layer of security for Bitcoin transactions. All crypto traders need to understand cold and hot wallets to ensure secure remittances [5].

The safety of a crypto-device primarily based totally on elliptic curves derives its safety from the computational infeasibility of the Elliptic Curve Discrete Logarithm Problem and the review of the arithmetic at the back of the Digital Signature Algorithm (DSA) and its elliptic curve analogue (ECDSA) [9]. ECDSA efficiency and speed can be improved without compromising security by eliminating the inversion operation in the signature generation and signature verification phase modulation [10]. Compared to other cryptographic algorithms, AES and ECC were the lightest cryptographic algorithms for memory [12]. ECDSA had advantages over other digital signature algorithms, in terms of execution time and amount of storage being used [13].

METHODOLOGY

This section provides a secure approach for the hardware wallet, since it is a simple device, it can only sign transactions, it needs to use the most sophisticated computer as a host for all other functions such as

preparing the transaction and broadcasting it to the network. A hardware wallet allows only specific types of data to pass through it such as cryptocurrency transactions, i.e. unsigned transactions, which are prepared by gathering the information from the network. Once it receives a transaction from the host it has to confirm the transaction details like the receiver's address, bitcoin, etc which is displayed by pressing the OK button, then the encryption and signing are performed and the signed transaction is sent back to the host and is sent to the network. The setup of the method can be seen as shown in fig.1 and their description is as follows

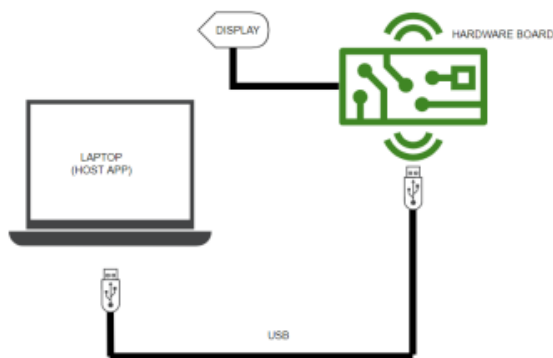


Fig.1: Set-Up of Proposed Methodology

The block diagram of the method that can be implemented is shown below in fig.2. First, create a wallet that stores the public and private keys and generate the keys. Secondly create the transaction details like the receiver's address, how many coins you want to send etc., and this information is sent to the hardware that contains the private and public key of the sender and verifies the details and the authenticity of the transaction is achieved using ECDSA and confidentiality using AES. After encryption, the transaction is sent back to the network.

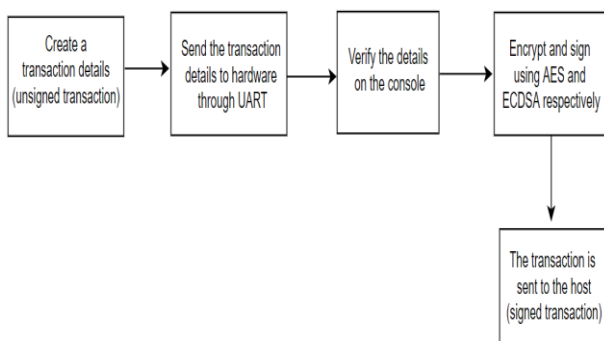


Fig. 2: Block diagram of the proposed method

Only signed and unsigned transactions can be transferred between your computer and hardware wallet. So, the private key cannot be accessed since it never leaves the hardware. A hardware wallet can be used with any computer without being featured/hacked even a public library computer or your laptop or infected. To ensure that your bitcoins are safe, you must ensure that the

transaction you approve on the hardware wallet screen matches the transaction your bridge program is displaying on your personal computer

A. Advanced Encrypted Standard(AES)

Data Encryption Standard (DES) was at risk from brute-force attacks, therefore the National Institute of Standards and Technology (NIST) began developing AES, also known by its original name "Rijndael", in 1997.

AES is a type of symmetric cryptography, in which a single key is used to encrypt and decode messages. AES is a symmetric block cypher that the US government employs to secure sensitive data. Hardware and software are both used to implement AES to encrypt the sensitive data.

AES treats plain text as a block made up of other blocks that are processed one at a time over a number of rounds. The key length determines the number of rounds, as described in table 1

Table 1:Round combination based on Key-Block

	Key Length	Block Length	Number of rounds
AES-128	4	4	10
AES-192	6	4	12
AES-256	8	4	14

For example, if the input is 128 bits and the output is also 128 bits of encrypted cipher text. AES relies on the substitution-permutation network principle which means it is performed using a series of linked operations that involves replacing and shuffling the input data.

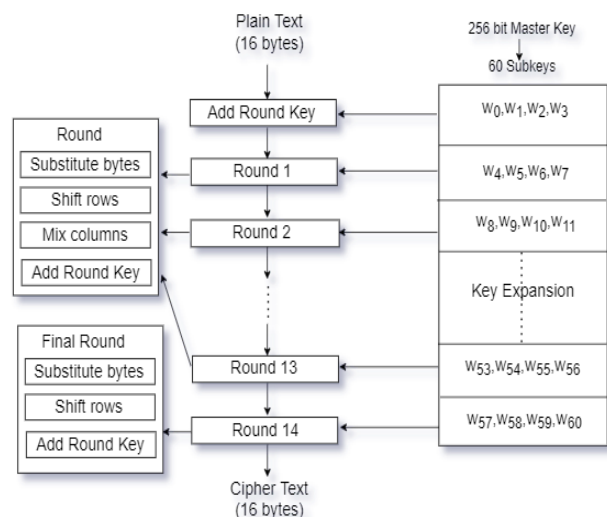


Fig.3: AES 256 Encryption Process

AES performs operations on bytes of data rather than in bits. Since the block size is 128 bits, the cipher processes 128 bits (or 16 bytes) of the input data at a time. Since the key length is 256 bits the number of rounds is 14. In each round we have 4 steps Sub Bytes, Shift Rows, Mix Column and Add Round Key except for the last round

where the mix column step is skipped. The encryption process of AES is shown in fig.3.

The steps involved in the AES-128 encryption process are as follows,

1. **Key Expansion** – round keys are derived from the master key using the [AES key schedule](#). AES requires a separate 128-bit round key block for each round plus one more.
 - From this 128-bit master key, we generate 10 subkeys each of 128 bits that are required for round operation
 - Each subkey has 4 words, each word is 32-bit or 4 bytes

Initial round key addition:

- **Add Round Key** – each byte of the state is combined with a byte of the round key using [bitwise XOR](#).

2. **From 1 to 13 rounds:**

- **Sub Bytes** – a [non-linear](#) substitution step where each byte is replaced with another according to an [S-Box](#). For example, if $s_{1,1} = \{53\}$, then the substitution value would be determined by the intersection of the row with index '5' and the column with index '3' in S-Box [2]. This would result in $s_{1,1}$ 'having a value of {ed}'.
- **Shift Rows** – In this step, the rows of the state are shifted cyclically based on the row number.
 - Row 0 = Circular left shift by 0 bits
 - Row 1 = Circular left shift by 1 bit
 - Row 2 = Circular left shift by 2 bits
 - Row 3 = Circular left shift by 3 bits
- **Mix Columns** – a linear mixing operation that operates on the columns of the state, in which the four bytes in each column are multiplied with the predefined matrix.
- **Add Round Key**

3. **Final round (making 14 rounds in total):**

- Sub Bytes
- Shift Rows
- Add Round Key

4. The result from step 4 i.e., the output of Add Round Key is cipher text

B. Elliptic Curve Digital Signature Algorithm (ECDSA)

The Elliptic Curve Digital Signature Algorithm (ECDSA) is a Digital Signature Algorithm (DSA) that uses keys derived from elliptic curve cryptography (ECC). It is a particularly efficient equation based on public-key cryptography (PKC). ECDSA is used across many security systems, is popular in secure messaging apps, and is the basis of Bitcoin security (with Bitcoin "addresses" serving as public keys). The domain parameter for an elliptic curve which was described

$$D = \{q, FR, a, b, G, n, h\},$$

Where q was the size of the field, R as an indication of the representation used for the element of Fq , a , and b were elements from Fq which was used as the definition of the elliptic curve equation E , G as a point generator, n was the order of G , and h as a cofactor.

The ECDSA algorithm consisted of three algorithms as shown in figure 4, namely

1. **Key Generation:** The random number d is chosen between the interval $[1, n - 1]$ which will be considered as a private key, this number is multiplied with the generator point G to get the public key
2. **Signature Generation:** The signature for the message m is (r, s) where
 $r = x_1 \bmod n$ and $s = k^{-1}(e + dr) \bmod n$
3. **Signature Verification:** The signature is verified if the below condition is satisfied
 $x_1 \bmod n = r$ where $(x_1, y_1) = u_1G + u_2Q$

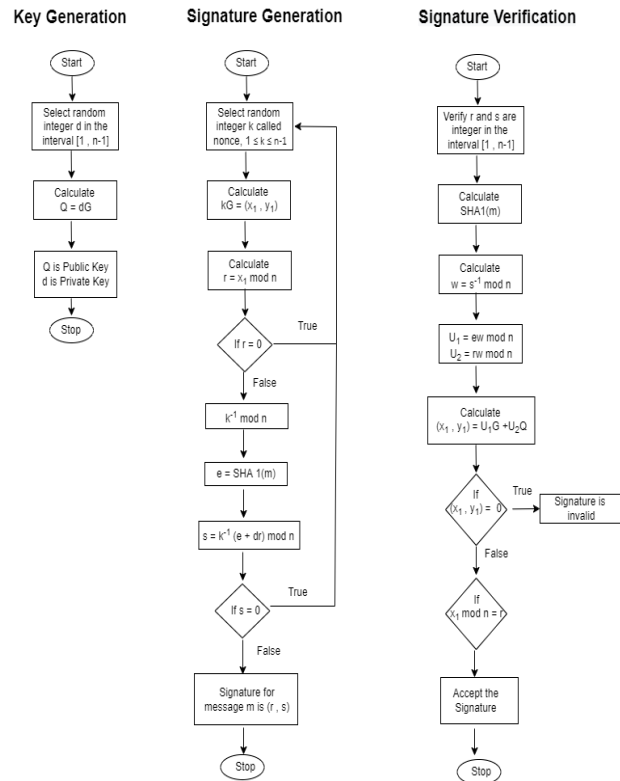


Fig.4:Flow diagram of the three algorithms

PROPOSED DESIGN

The proposed design has two component Hardware and Software. The hardware component can be FPGA in which the private key is already stored and the public key is calculated ,based on the input message the encryption and signing is done. The software component can be SDK which uses eclipse software where the transaction details can be created and sent to the Hardware for signing. The proposed design flow is shown in the fig.5. The function of the proposed design is as follows.

- Software: Prepare an unsigned transaction (input and output) by gathering the information from the network
- Hardware: Confirms the transaction by pressing the OK button once the data is received and the receiving address of the transaction can be displayed.
- Hardware: Return the result to the host app after signing the transaction.
- Software: The signed transaction is published to the network.

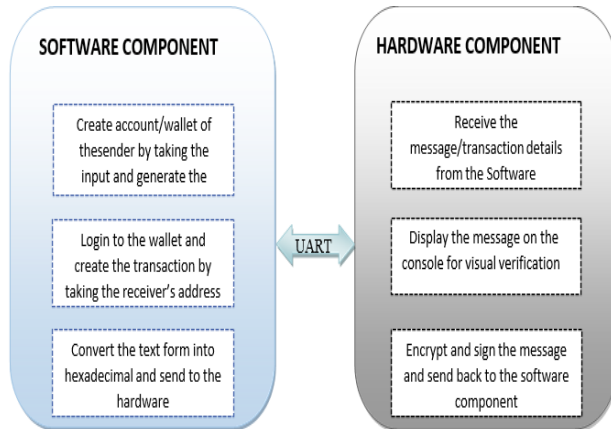


Fig.5 : Proposed Design

To implement the proposed design custom IP is generated using the AXI4 peripheral Interface which achieves the interaction between hardware and software components.

CONCLUSION

A brief review of the work related to the cryptocurrency wallet is presented in this paper. Among the different types of wallets, for protection choose a hardware wallet and for convenience, choose an internet or mobile wallet. Since protection is an important feature the hardware wallet is most secure in which the private key is stored in the hardware in offline mode. To develop a secure hardware wallet a design is presented that contains both hardware and software components. The confidentiality and authentication can be achieved by AES and ECDSA respectively. The methodology that is presented in this paper can achieve a secure hardware wallet for the cryptocurrency wallet.

REFERENCES

- [1]. Stevo Jokić, Aleksandar Sandro Cvetković, Saša Adamović, Nenad Ristić, Petar Spalević, "Comparative Analysis of Cryptocurrency Wallets Vs Traditional Wallets", EKOHOMIKA Vol. 65, July-September 2019.
- [2]. Saurabh Suratkar, Mahesh Shirole, Sunil Bhirud, "Cryptocurrency Wallet: A Review", 2020 4th International Conference on Computer, Communication and Signal Processing (ICCCSP) 2020 IEEE.
- [3]. H. Rezaeighaleh and C. Zou, "New Secure Approach to Backup Cryptocurrency Wallets", in The IEEE 2019 Global Communications Conference (GLOBECOM-2019), Hawaii, US, 2019.
- [4]. T. Bamert, C. Decker, R. Wattenhofer, and S. Welten, "Blue Wallet: The secure Bitcoin wallet", in Proceedings of the 10th International Workshop on Security and Trust Management, pp. 65- 80, Springer, 2014
- [5]. G. Khan, A. H. Zahid, M. Hussain, and U. Riaz, "Security of Cryptocurrency Using Hardware Wallet and QR Code", 2019 International Conference on Innovative Computing (ICIC), 2019, pp. 1-10.
- [6]. Lo-Yao Yeh*, Wan-Hsin Hsu†, Jiun-Long Huang‡, Chih-Ya Shen§ and Chi Wu-Lee, "Integrating Cellphone-based Hardware Wallet with Visual Certificate Verification System", GLOBECOM 2020 - 2020 IEEE Global Communications Conference 2020 IEEE.
- [7]. Hossein Rezaeighaleh, Cliff C. Zou, "Efficient Off-Chain Transaction to Avoid Inaccessible Coins in Cryptocurrencies", 2020 IEEE 19th International Conference on Trust, Security and Privacy in Computing and Communications (TrustCom)
- [8]. Srinivas Vedula, Abdul Sameer, Vaishali K, Varun VP, Radha Prajapath, Ms. Shaleen Bhatnagar, "Highly Secure Cryptocurrency Hardware Wallet", 2021 JETIR May 2021, Volume 8, Issue 5
- [9]. Benjamin K. Kikwai, "Elliptic Curve Digital Signatures and Their Application in the Bitcoin Cryptocurrency Transactions", International Journal of Scientific and Research Publications, Volume 7, Issue 11, November 2017 135 ISSN 2250-3153.
- [10]. Yasin Genç, Erkan Afacan, "Design and Implementation of an Efficient Elliptic Curve Digital Signature Algorithm (ECDSA)", 021 IEEE International IOT, Electronics and Mechatronics Conference (IEMTRONICS) 2021 IEEE.
- [11]. F. Information, "Advanced Encryption Standard (AES)", 2001.
- [12]. S. Singh, D. Brahmjit, and S. Poonam, "Lightweight Cryptography: A Solution to Secure IoT", Springer US, 2020.
- [13]. S. Levy, "Performance and Security of ECDSA", pp. 1-4, 2015.
- [14]. D. Johnson, A. Menezes, and S. Vanstone, "The Elliptic Curve Digital Signature Algorithm (ECDSA)", pp. 36-63, 2001.
- [15]. D. Manel, O. Raouf, H. Ramzi, and A. Mtibaa, "Hash Function and Digital Signature based on Elliptic Curve", 2013.

- [16]. Muhammad Nursalman, Rizky Rachman Judie P, Ammar Ashshiddiqi, "Implementation of AES and ECDSA for Encrypted Message in Instant Messaging Application", 2020 6th International Conference on Science in Information Technology (ICSITech),2020.

An Enhanced CNN for Handwritten Tamil Character Recognition Using Adam Optimizer

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Abstract:

In the data processing industry, data entry is regarded as a great bottleneck. An eminent Character Recognition (OCR) system acts as a key solution for this concern. The OCR is being familiarized in universal level for different languages. Till now, only a limited explores were made for the Tamil Handwritten character recognition (HCR). Existing research works provides best performances for many languages, but for the work towards Tamil language is not satisfactory in the recognition area. To resolve this demerit, this paper proposed an enhanced CNN for Tamil HCR utilizing Adam optimizer. Initially, encode the target variable using “one-hot-encode” method. Then, the encoded image is preprocessed using RGB to grey conversion, image resizing, slant removal and array conversion. Subsequently, word and characters are segmented as of the preprocessed image. Next, the segmented images are provided as input to the CNN classifier. The CNN is enhanced by utilizing Adam optimizer algorithm (AOA) which optimizes the weight value for minimizing its loss function. Finally, the experiential outcomes of the proposed CNN are contrasted to the prevailing SVM and some other machine learning algorithms. The proposed recognition system shows preminent performance when comparing with the prevailing methods.

Index Terms:

Adam Optimizer Algorithm, Deep learning, Enhanced CNN, Support Vector Machine, and Tamil Character Recognition.

INTRODUCTION

Spontaneous character recognition is a process that transforms scanned document imageries into electronically understandable setup. Handwriting recognition is a conspicuous area under the character recognition uses. Due to various writing samples, handwriting recognition did not reach the depth. HCR on hand-written documents remains as a big demand, though adequate studies have made in foreign scripts say Chinese, Arabic[16] and Japanese[20] characters by researchers. The HCR is an intricate task for certain Indian languages script. The HCR has ‘2’ types, i) Online character recognition[6], and ii) offline character recognition[17] are the two types. Since past years, offline hand-writing recognition has been a dynamic research domain in pattern recognition and even in image processing. In Off-line character recognition, the hand-written characters are transmuted into a string of 0's & 1's bit pattern or also termed digitization by the optically digitizing devices say optical scanner, camera,

etc. Comparing with online recognition, researches on offline recognition are more complicated.

Especially structures of Indian languages are highly hard to recognize. Considering recognition of offline Tamil handwriting, this is a tedious task due to its differences in forms, curvatures and overlapping characters. Tamil is one of the traditional South side Indian languages which have more character sets (247 characters) with 18 consonants, 12 vowels, 216 combinational characters, and 1 special character. Only a few exertions were made for addressing the identification of hand-written or printed Tamil Characters. For this reason, a special care and importance was given to the recognition of offline Tamil handwritten documents. To solve the issues in the state of recognition, countless of approaches such as machine learning[2] and deep learning are used. Habitually the recognition problem includes of various approaches, which often take account of preprocessing, feature extraction, classification and post processing[11]. Before training the hybrid model with dataset, we have applied few image processing methods like noise removal, slat correction, slope correction etc., However whichever recognition systems advised two most important steps, they are feature extraction and classification. So we should more concentration on those parts of the algorithm. During preprocessing, the input image to be recognized is cropped or warped. The classification stage recognizes the character. The unnecessary parts in the image are eradicated.

RELATED WORK

Seeing classification problems a lot of researchers have focused on many domains like handwriting recognition, pattern recognition and visual object recognition[4]. CNN and SVM are the strongest algorithms in the deep learning and machine learning regions. So these algorithms are effectively applied to a lot of handwritten character recognition problem too.

Abirami and others propounded statistic feature centered character recognition for offline Tamil hand-written document images utilizing HMM (Hidden Markov Model). In this framework, primarily the images (input) underwent pre-processing utilizing binarisation and normalization[1]. The features that were extorted after pre-processing encompasses slope centered directional features, curliness, curvature, aspect ratio, and linearity. Subsequently, the extorted features were provided as input to the symbol modeling classification

methodology. The accurateness was less so enhancement was requisite for this framework. N. Shanthi and K. Duraiswamy expounded a recognition system for offline hand-written Tamil characters centered on SVM (Support Vector Machine).[19] Primarily, preprocessing was executed utilizing thresholding, line segmentation, skeletonization, character segmentation, and normalization for making a standard image. Next, the features were extorted for the existent test and also training set. SVM was trained utilizing a training set but the recognition accurateness was tested with a test set. The optimal zone size was chosen grounded on the recognition accuracy created for a test set.

M. Antony Robert Raj and others proffered structural representation-centric offline Tamil HCR.[5] Initially, strip tree-centric shape discovering features had been implemented by rectangle formation and the same was represented in tree. Additionally, the character locations were extorted by 2 ways like: PM-Quad tree and Z-ordering techniques where PM-Quad tree locates the locations of shapes which were signified in tree. SVM was utilized in a hierarchical manner with a "divide-and-conquer" strategy to categorize the correct character attained from those 3-ways of features. Binu P. Chacko paved attention on Malayalam HCR utilizing Wavelet Energy (WE) Feature and ELM (Extreme Learning Machine).[7] The WE was a robust parameter which was derived utilizing wavelet transform. Moreover, WE diminished the influences of disparate categories of noises at diverse levels. Subsequently, the extorted features were provided as input to the intensively fastest leaning algorithm termed ELM for SLFN (Single Hidden Layer Feed-Forwarding Networks).

Ashlin Deepa Roselent Nelson and Ramisetty RajeswaraRao propounded a classifier for Tamil HCR utilizing modified GA and skeletonisation for ameliorating the outcomes of offline Tamil HCRs.6 The experiential outcomes on offline Tamil dataset elucidated that the propounded classifier could automatically diminish the rate of misclassification and also proffer excellent performance when contrasted to GA with the fixed chromosomal length. A. G. Ramakrishnan and others examined the efficacy of utilizing global features (DFT (Discrete-Fourier Transforms), DCT (Discrete-Cosine Transforms) and local features (processed co-ordinates (x, y)) and the combinations of both features.[18] This prototype utilized the SVM with RBF (i.e. Radial Basis Function) kernel for classification purpose which was trained and also tested in the 2006 IWFHR Tamil HCR competition data set.

MATERIAL AND METHODS

Recognition of Tamil character has been broadly studied in the former years by the academic laboratories and research companies. Presently, the researchers paved attention on disparate recognition methodologies for Tamil HCR on account of its open challenges. The aim of this proposed methodology is to increase accuracy in

recognizing the Tamil handwritten characters. This proposed system comprises 4 phases. Initially, the input data is taken as of the HP LAB data set.

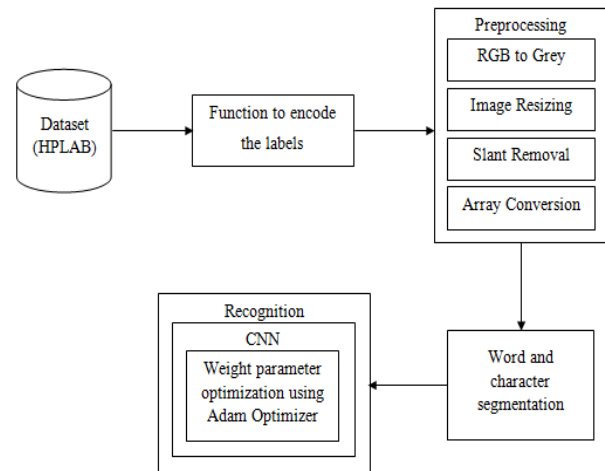


Fig. 1 Block Diagram for the proposed methodology

This dataset includes 157 classes, which representing the vowel, consonant, compound, special and Grantham handwritten characters. Then the data set is partitioned as i) training phase and ii) testing phase.[8-9] The later phase contains two parts one is image part and another one is that the images are represented as a digit. The input image is encoded using the "one-hot-encode" method. Next, the encoded image is preprocessed using RGB to grey conversion, image resizing, slant removal and array conversion. Next, the word and characters are segmented as of the pre-processed image. At last, the segmented images are provided as input to the CNN classifier. For diminishing the loss functions, the AOA is utilized. Block diagram for the proposed Tamil HCR is evinced in below Fig. 1,

A. Encode the labels

To begin with, the digit values of the image (input) are encoded play on with "one-hot-encode" method. In this planned method, the integer encoding cannot be utilized since there is no ordinal in the categorical variables. Hence, the integer encoding will result in unexpected results and poor performance. For which, the one-hot-encoding approach is utilized. In this approach, the binary value is added to all unique integer values. This indicates that a column will be generated for each output category and then a binary variable is provided as input for every category. For example, the primary image (ௐ) is represented by the fifth label in the dataset, which means that the sixth number in the array will have 1 and the rest will be occupied with 0 to create the array model.

B. Preprocessing

It encompasses a series of operations executed to make it appropriate for classification. In this proposed methodology, the preprocessing step involves the conversion of RGB into grey, image resizing (28×28), array conversion and slant removal. First, the RGB input

image is turned to grey scale image which is done by taking the average of the three pixel values proffered as,

$$H_g = \frac{R_i + G_i + B_i}{3} \quad (1)$$

Where, H_g symbolizes the grey scale handwritten image, R_i , G_i , and B_i signifies the three pixel values.

The input images have different dimension size (small or large) and these varied dimensions may influence the output. Hence, it is necessary to resize the images to a specific dimension. The resizing is done to augment the speed of processing. Here, all the images are resized at a dimension 28×28 which is expressed as,

$$R_i = \sum_{i=1}^N R(H_g)_i \quad (2)$$

Where, R_i denotes the resizing image. Next, in handwritten text, no one can judge a person's handwriting as it varies with a person's mindset. So the slant of the provided input image is eradicated. Slant indicates an angle that the baseline of a sentence or word makes with the horizontal direction. The removal of slant is evaluated as,

$$S_r = \sum_{i=1}^N R_i \quad (3)$$

Where, S_r indicates the slant removed image. Subsequently performing all the pre-mentioned steps, the gained image is kept in an array form A . The array conversion of the S_r is signified as,

$$A = \text{array}(S_r) \quad (4)$$

C. Segmentation

Segmentation of languages is remaining tricky task even however appreciated upgrading in the field of character recognition.[12] Particularly for handwritten character, segmentation is tricky dueto overlapping characters, so which needs even more attention. In this work, this section is focused on off-line recognition of handwritten characters of Tamil. The supreme elementary phase in

character recognition is to segment the input data into separable glyphs. This phase splits out sentences from the input document and subsequently words and letters from lines too. The projection based technique is used for segmentation of Tamil handwritten document, which contains three phases. The first one phase is answerable for detecting and separating lines from the text using horizontal projection. Later the segmented lines are delivered through the next phase which is planned to get words from the separated lines by vertical projection.[14] To end with, the third phase is takings those words and creates the character representation of each word. Horizontal Projection feature consists of three different features: they are Number of ink pixels in each row, Position of first ink pixel from left in each row and Position of first ink pixel from right in each row. The word segmentation utilizes the Vertical Projection (VP) similar to Horizontal Projection feature, this compute Vertical Projection feature for every column of normalized image[21-22]. The vertical projection defined as Number of ink pixels in each column, Position of first ink pixel from up to down, and Position of first ink pixel from down to up. The separation between two characters is considered as constant amplitude in the profile.

D. Classification utilizing CNN

Here, the resulting characters after segmentation are provided as input to the CNN. CNN signifies a robust design that can identify the highly variable patterns like varied shapes of handwritten characters.[15] CNNs comprise '2' concepts termed a) parameter sharing along with b) local connectivity.[13] Parameter sharing indicates the sharing of weights by every neuron on a specific FM. Local connectivity signifies the notion of neural connections only to a sub-set of the input image[23-25]. It assists to lessen the number of parameters in the complete system and makes the computation more effectual. The visual patterns are easily identified by spotting CNN's shared weight property. In shared weight, the CNN utilizes replicated filters with local connectivity and similar weight vectors. Taking the eminent LeNet-5, it comprises '3' categories of layers, say fully-connected, pooling and convolutional layers.[3] The convolutional layer targets to learn feature representations of the inputs.[10] CNN architectural diagram is evinced in Fig. 2,

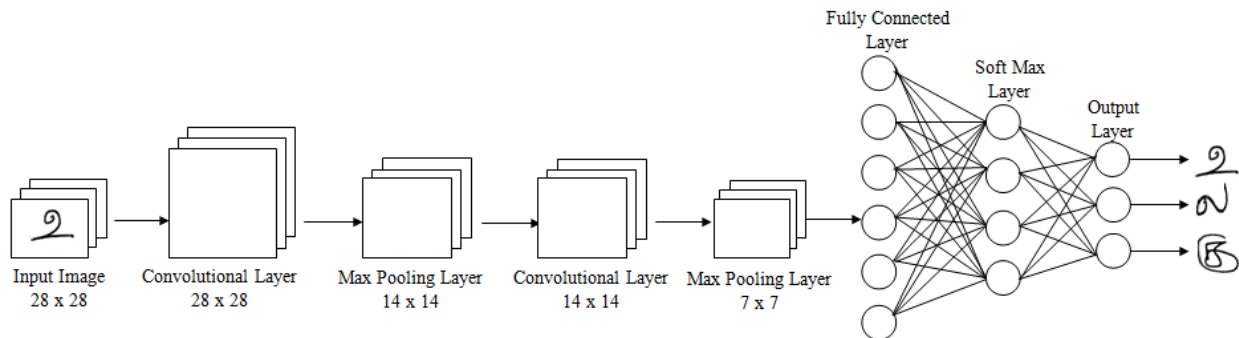


Fig. 2 Architecture diagram of CNN

Specifically, each neuron on a feature map (FM) is linked to an area of adjacent neurons in a former layer. Such a neighborhood is termed as the neuron's receptive field on a former layer. Subsequently, acquire a new FM by convolving an input using a learned kernel and also by deploying the element-wise non-linear AF (activation functions) in those convolved outcomes. To create every single FM, the spatial locations of an input share the kernel. The whole FMs are acquired by utilizing many different kernels. Mathematically, the feature values at (u, v) location in the k^{th} FM of l^{th} layer, $q_{u,v,k}^l$, is evaluated by:

$$q_{u,v,k}^l = w_k^l x_{u,v}^l + b_k^l \quad (5)$$

Where b_k^l and w_k^l indicates the bias term and weight factor of the k^{th} filter in l^{th} layer respectively, and $x_{u,v}^l$ signifies the input patch-centric location (u, v) of the l^{th} layer. The kernel w_k^l which creates the FM of $q_{u,v,k}^l$ is shared. This weight sharing process has multiple advantages like it can diminish the design complexity and train the network effortlessly. The AF introduces nonlinearities to CNN, which are necessary for multi-layer networks to spot nonlinear features. Let $n_a(\cdot)$ signify non-linear AF. The activation value $(n_a)^l_{u,v,k}$ of convolutional feature $q_{u,v,k}^l$ is evaluated as:

$$(n_a)^l_{u,v,k} = n_a(q_{u,v,k}^l) \quad (6)$$

Typical AFs are sigmoid, tan and ReLU. This proposed method used the ReLU (Rectified Linear AF). The ReLU has maximum advantages than the other AF like computational simplicity, and it is competent to output a true zero value (representational sparsity). The pooling layer targets to acquire shift-invariance by diminishing the resolution of the FMs. It is normally placed betwixt '2' convolutional layers. Each FM of a pooling layer is linked to its corresponding FM of the preceding convolutional layer. The pooling function $p(\cdot)$, for each FM $(n_a)^l_{u,v,k}$ is proffered as:

$$y_{u,v,k}^l = p((n_a)^l_{m,n,k}), \forall (m, n) \in R_{uv} \quad (7)$$

Where, R_{uv} indicates a local neighbor around location (u, v) . The '2' pooling operations are max pooling operation and average pooling operation.

After many pooling and convolutional layers, there might be at least one fully-connected layer that targets to execute high-level reasoning. They consider all

neurons of the former layer and link them to each neuron of the present layer to create global semantic data. Such fully-connected layers are not always needed since in its place a 1×1 convolution layer could be utilized. CNN's final layer is pondered as an output layer. The classification tasks generally utilize a softmax operator. For a specified task, parameters could be attained by diminishing the appropriate loss function in that task. This proposed method comprises N desired input-output relations $\{(x^{(n)}, y^{(n)})\}, n \in [1, \dots, N]\}$, where $x^{(n)}$ indicates n^{th} input data, $y^{(n)}$ signifies its corresponding target label and $o^{(n)}$ specifies the output of CNN. The CNN's loss function could be evaluated as:

$$L_f = \frac{1}{N} \sum_{n=1}^N l(\theta, y^{(n)}, o^{(n)}) \quad (8)$$

Where, L_f denotes the loss function. Training CNN is a problem of global optimization. Check whether L_f is minimal or maximal. If it is minimal, then train this model. The number of epochs signifies the total times that the model would cycle through the data. If the epochs running in this model are more, then the model would be improved more, up to a specific point. If that point is reached, the model stops from improving further amid each epoch. For this model, the number of epochs set to 30. For maximum L_f , update weight parameter by utilizing AOA and again evaluate L_f . The AOA is expounded as,

The Adam is evaluated as of the adaptive moment estimations.

$$r_t = \nabla_{L_f} f_t((L_f)_{t-1}) \quad (9)$$

Where $f_t((L_f)_{t-1})$ denotes the evaluation of the fixed loss function on the particular data occurring at time-step $t-1$, r_t indicates the gradient vector. Initially, c_t and v_t values are allotted as 0. Then the uncentered moments are evaluated for the each weight value.

$$c_t = \beta_1 \cdot c_{t-1} + (1 - \beta_1) \cdot r_t \quad (10)$$

$$v_t = \beta_2 \cdot v_{t-1} + (1 - \beta_2) \cdot (r_t)^2 \quad (11)$$

Here, β_1 and β_2 denotes the exponential decay rates of the above moment estimates. After calculating c_t and v_t for each weight value, c_t and v_t will be modified by power of current epoch index value.

$$\hat{c}_t = c_t / (1 - \beta_1^t) \quad (12)$$

$$\hat{v}_t = v_t / (1 - \beta_2^t) \quad (13)$$

Finally, each weight value will be updated as its previous values \hat{c}_t and \hat{v}_t .

$$\theta_t = \theta_{t-1} - \eta (\hat{c}_t / \sqrt{\hat{v}_t + \varepsilon}) \quad (14)$$

Where, θ_t denotes the updated weight value, θ_{t-1} indicates the previous weight value, η represents the learning rate, and ε denotes tolerance parameter which is to prevent division from zero error. The weight parameters are updated to diminish the L_f . In the final layer softmax is used to classify the multiclass based on probability values.

RESULT AND DISCUSSION

The system is effectively executed in the working platform of Python. The Tamil HCR system's performance utilizing CNN classifier is appraised by the handwritten scan images which are taken as of the HP LAB data set. By utilizing Keras library the proposed system can easily load the data set, so out of 83,279 images in the dataset, 62,459 are given for training, 1,951 are given for validation and 20,820 are given for testing while splitting the considered dataset. While loading the dataset, and would contain the images, but and would contain the digits that those images signify. The sample query image is evinced in below Fig. 3,

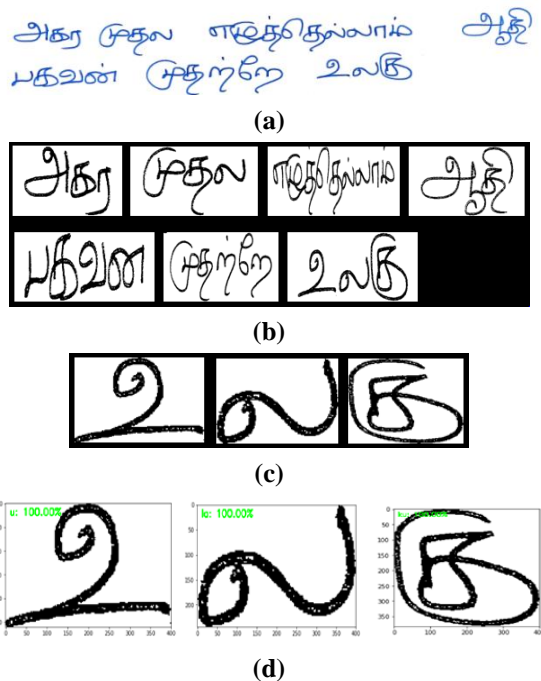


Fig. 3 Illustrated the sample Tamil handwritten image (a) Input image, (b) Word segmented image (c) Characters segmented image (d) characters recognized image

Discussion: Fig 3 shows the sample Tamil handwritten input image. This input image is considered as query

image. At first the preprocessing is applied on the input image. After the preprocessing step, the preprocessed image passed through the segmentation part. These split images are compared with the saved trained model file, which will provide the exact class of that image.

A. Performance analysis

The performance of the Tamil HCR utilizing CNN system is examined in statistical measures accuracy and loss function. The Accuracy is denotes as it gives the percentage of acceptably recognized characters. It is the basic metric for performance and it determines how accurately the recognized model is evaluating all classes. The proposed CNN model for Tamil handwritten character recognition obtains 83% with softmax classifier. The training loss and accuracy for CNN with Softmax Fig.4

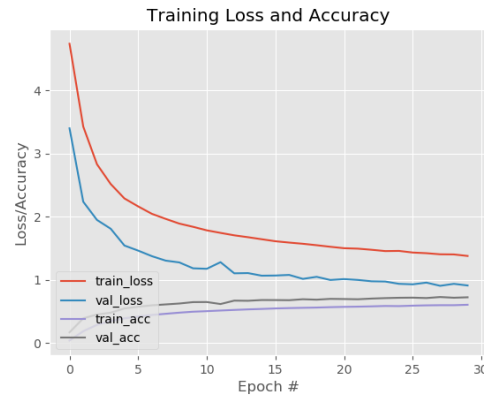


Fig. 4 training loss and accuracy graph based on epoch range

Discussion: Fig. 4 elucidates a plot of accuracy on the training (train_acc) and validation datasets (val_acc) over training epochs and a plot of loss on the training (train_loss) and validation datasets (val_loss) over training epochs for CNN system. For each epoch the training loss, accuracy (train_loss and train_acc) of the system is highlighted. The gap between training and validation accuracy is a clear indication of overfitting. In the above plot the gap between (train_acc) and (val_acc) is small. So this indicates that the system can give best performance with less overfitting. One of the most used plots to debug a neural network is a Loss curve during training. It gives a snapshot of the training process and the direction in which the network learns. The above loss plot between (train_loss) and (val_loss) shows that the system learnt with good learning rate.

B. Comparative Analysis

Here, the proposed CNN is contrasted to the prevailing techniques such as SVM, and NIP in respect of performance metric which is provided in Fig.5 and Fig.6.

Discussion: Fig. 5 contrasts the proposed CNN classifier with the prevailing SVM and NIP in respect of sensitivity, accuracy, and specificity. The CNN shows 83% accuracy which is also higher on considering the prevailing ones. Similarly, CNN also proffers higher performance in remaining performance metrics

sensitivity. Consequently, the proposed CNN is deduced to be a better method than the other prevailing methods

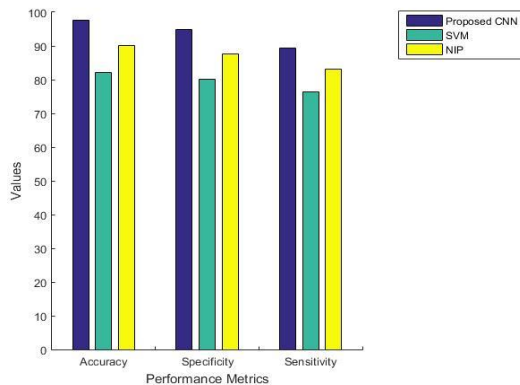


Fig. 5 Comparison graph for the proposed CNN with the existing classifiers based on accuracy

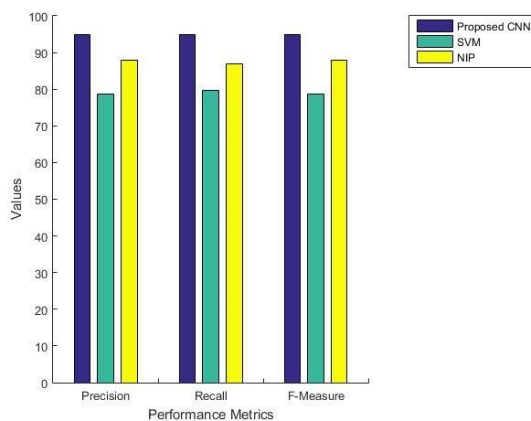


Fig. 6 illustrate the performances of the proposed CNN with the existing SVM and NIP based on precision, recall, and F-Measures

Discussion: Fig. 6 elucidates the performance proffered by CNN with the prevailing classification methods for Tamil HCR centered on F-Measure, recall, and precision. This discussion elucidates that the proposed Tamil HCR utilizing CNN acquired preeminent performance than the other methods.

CONCLUSION

Offline character recognition approach chiefly focuses on identifying the characters without regarding the intricacies that may emerge on account of the variations in writing style. The style of writing makes the HCR more complex since the characters may be in a curvy structure. An enhanced CNN is proposed for Tamil HCR utilizing AOA. The digit value of the considered input image is encoded and next, the encoded image is preprocessed. Now, the resulting preprocessed image is provided as input to the segmentation. In the segmentation process, the word and characters are segmented. Then, the segmented image is provided as input for the CNN. The proposed system's performance was examined utilizing Tamil handwritten images which are taken as of the HP LAB dataset which is publicly

existent on the internet.. The proposed CNN is contrasted to the prevailing techniques centered on accuracy. Experiential outcomes evinced that the proposed CNN recognized the handwritten characters more accurately than the other prevailing methods. In future, this work can concentrate on the overlapped characters and hybridization techniques which are utilized for classification.

REFERENCES

- [1] Abirami, S., V. Essakiammal, and R. Baskaran. 2015. "Statistical Features Based Character Recognition for Offline Handwritten Tamil Document Images Using HMM." *International Journal of Computational Vision and Robotics* 5(4): 422–40.
- [2] Adnan, Md. et al. 2018. "Handwritten Bangla Character Recognition Using Inception Convolutional Neural Network." *International Journal of Computer Applications* 181(17): 48–59.
- [3] Alom, Md Zahangir et al. 2018. "Handwritten Bangla Character Recognition Using the State-of-the-Art Deep Convolutional Neural Networks." *Computational Intelligence and Neuroscience* 2018: 1–12.
- [4] Aneja, Nagender, and Sandhya Aneja. 2019. "Transfer Learning Using CNN for Handwritten Devanagari Character Recognition." *1st IEEE International Conference on Advances in Information Technology, ICAIT 2019 - Proceedings*: 293–96.
- [5] Antony Robert Raj M., and S. Abirami. 2020. "Structural Representation-Based off-Line Tamil Handwritten Character Recognition." *Soft Computing* 24(2): 1447–72. <https://doi.org/10.1007/s00500-019-03978-5>.
- [6] Ashlin Deepa Roselet Nelson, and Ramisetty RajeswaraRao. 2017. "A Modified GA Classifier for Offline Tamil Handwritten Character Recognition." *International Journal of Applied Pattern Recognition* 4(1): 89.
- [7] Binu P. Chacko, V. R. Vimal Krishnan, G. Raju, and P. Babu Anto. 2012. "Handwritten Character Recognition Using Wavelet Energy and Extreme Learning Machine." *International Journal of Machine Learning and Cybernetics* 3(2): 149–61.
- [8] Bluche, Théodore, Hermann Ney, and Christopher Kermorvant. 2013. "TANDEM HMM WITH CONVOLUTIONAL NEURAL NETWORK FOR HANDWRITTEN WORD RECOGNITION CNRS , Spoken Language Processing Group c RWTH Aachen University , Human Language Technology and Pattern Recognition b LIMSI a A2iA." *Pattern Recognition*: 2390–94.
- [9] Biswas, Chandan, Ujjwal Bhattacharya, and Swapan Kumar Parui. 2012. "HMM Based

- Online Handwritten Bangla Character Recognition Using Dirichlet Distributions.” Proceedings - International Workshop on Frontiers in Handwriting Recognition, IWFHR: 600–605.
- [10] Darmatasia, and Mohamad Ivan Fanany. 2017. “Handwriting Recognition on Form Document Using Convolutional Neural Network and Support Vector Machines (CNN-SVM).” 2017 5th International Conference on Information and Communication Technology, ICoIC7 2017 (April).
- [11] Khare, Sonal, and Jaiveer Singh. 2015. “Handwritten Devanagari Character Recognition System: A Review.” International Journal of Computer Applications 121(9): 10–14.
- [12] Likforman-Sulem, Laurence, Abderrazak Zahour, and Bruno Taconet. 2007. “Text Line Segmentation of Historical Documents: A Survey.” International Journal on Document Analysis and Recognition 9(2–4): 123–38.
- [13] Jency Rubia J., Babitha Lincy R. “Digital Image Restoration Using Modified Richardson-Lucy Deconvolution Algorithm,” Image Processing and Capsule Networks. Advances in Intelligent Systems and Computing, Vol 1200. PP 100-112 Springer, Cham. https://doi.org/10.1007/978-3-030-51859-2_10
- [14] Lin, Chunmian et al. 2019. “Transfer Learning Based Traffic Sign Recognition Using Inception-v3 Model.” Periodica Polytechnica Transportation Engineering 47(3): 242–50.
- [15] Mahto, Manoj Kumar, Karamjit Bhatia, and R. K. Sharma. 2015. “Combined Horizontal and Vertical Projection Feature Extraction Technique for Gurmukhi Handwritten Character Recognition.” Conference Proceeding - 2015 International Conference on Advances in Computer Engineering and Applications, ICACEA 2015 (June): 59–65.
- [16] Maitra, Durjoy Sen, Ujjwal Bhattacharya, and Swapan K. Parui. 2015. “CNN Based Common Approach to Handwritten Character Recognition of Multiple Scripts.” Proceedings of the International Conference on Document Analysis and Recognition, ICDAR 2015-Novem: 1021–25.
- [17] Najadat, Hassan M., Ahmad A. Alshboul, and Abdullah F. Alabed. 2019. “Arabic Handwritten Characters Recognition Using Convolutional Neural Network.” 2019 10th International Conference on Information and Communication Systems, ICICS 2019 (January): 147–51.
- [18] Jency Rubia J, Salim A, Afindas A and Naveenkumar S, “Diagnosis of COVID-19 using ADAM Optimization technique in Convolutional Neural Network (CNN),” Tierärztliche Praxis, Vol 41, 2021, PP 415-425
- [19] J, J., & R, B. (2021). Design and analysis of QCA adder circuits for efficient computation. ITEGAM-JETIA, 7(30), 37-44. <https://doi.org/10.5935/jetia.v7i30.769>
- [20] J, J., & R, B. (2021). Detection of plant leaf diseases using recent progress in Deep Learning-Based identification techniques. ITEGAM-JETIA, 7(30), 29-36. <https://doi.org/10.5935/jetia.v7i30.768>
- [21] J, J., R, B., & Al-Heety, A. (2021). Moving vehicle detection from video sequences for Traffic Surveillance System. ITEGAM-JETIA, 7(27), 41-48. <https://doi.org/10.5935/jetia.v7i27.731>
- [22] Patel, Monica, and Shital P. Thakkar. 2015. “Handwritten Character Recognition in English: A Survey.” Ijarcce (July): 345–50.
- [23] Ramakrishnan, A. G., and K. Bhargava Urala. 2013. “Global and Local Features for Recognition of Online Handwritten Numerals and Tamil Characters.” ACM International Conference Proceeding Series.
- [24] Shanthi, N., and K. Duraiswamy. 2010. “A Novel SVM-Based Handwritten Tamil Character Recognition System.” Pattern Analysis and Applications 13(2): 173–80.
- [25] Wakahara, Tom, Yoshimasa Kimura, and Mutsuo Sano. 2001. “Handwritten Japanese Character Recognition Using Adaptive Normalization by Global Affine Transformation.” Proceedings of the International Conference on Document Analysis and Recognition, ICDAR 2001-Janua(February 2001): 424–28.

Generating Computer Graphics Using DDA Algorithm

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Abstract:

Computer graphics are the primary and most efficient way to exchange information between humans and computers. They are also now used widely in many different areas such as teaching, education, entertainment, art as well as image processing, user interfaces, etc. Computer graphics are the chief way of visualization of an abstract idea or concept that can be portrayed by a computer. As technology progresses, the overall scope as well as the quality of these graphics and their generation will continue to improve and will get more popular and widely used. This paper focuses on the various computer graphics generation methods and their evolution. This needs to be done to get a better understanding of the topic overall and to get familiar with this increasingly important topic.

Keywords:

Computer graphics, visualization, graphical representation, human-computer interaction.

INTRODUCTION

The subject of computer graphics is a loose term but it mainly deals with the generation of images with the help of computers. Today computers are so widely spread and used and a proper graphical user interface has become the status quo, hence computer graphics are widely used and hence need to be studied well. They are now a core technology in any form of image-based or vision-based systems as well as many specialized applications with their graphics as per the need. In the past two or three decades, a lot of specialized hardware as well as software has been developed keeping computer graphics in mind and hence has allowed this sudden development of the field into a vast area. Apart from the computer science-related part of it, it has also very inseparably seeped into artistic expressions as well. It is a vast field with many different areas such as user interface design, rendering, ray tracing, geometry processing, animation, vector graphics, 3-D modeling, shaders, etc.

Computer graphics are the main tools used to display the image data or art meaningfully to the user and are also used to process the data obtained from the real world such as photos or video content by using image processing. The sudden developments in the field have allowed for a revolution in all forms of visual media with advertisements, movies, animations, and video games being the primarily noticeable ones. The term computer graphics usually means one of the several things-

- It is the representation and manipulation of the image data by a computer.
- The various technologies and tools used to create or manipulate the images.
- The methods which are used to digitally produce and control the visual content.

Visual representations are always easier to understand and make sense of than the complex statistics or the data they are trying to convey eg- graphs. They are easy to interpret and hence are a widely used form to convey information. With the help of computer graphics, this can all now be computer generated and hence allows the easily interpretable form to be more widely available and accessible. The precursors to modern-day graphics are the advancements in electrical and electronic engineering and screens could display art ever since the early 20th century. But the discipline of computer graphics as a whole was not fully established till after the second world war. The 1950s made the cathode ray tube viable as a display and introduced the light pen as an input device. In 1968, the first form of ray tracing algorithm was made, which has now become fundamental in achieving photorealism in computer graphics by simulating the path of light rays from the source to the surfaces in a scene.

In the 1970s the transformation of computer graphics from utilitarian ones to realistic ones was started. Along with that, the popularity of home computers was increasing and hence a new demand in the field of computer graphics was being made as well. As a result, the discipline which was strictly academic at first now got a lot of popularity and a much larger audience. In the next two decades, the overall hardware technology will also be improved drastically which will allow the betterment of the topic.

In the 2000s computer-generated images were found everywhere and media like movies and video games further popularised Computer Generated Imagery to the mainstream and have continued to do so even now. Since the 2010's even video generation can be done using computer graphics and photorealism has reached a level that on a high-end system it's difficult to point out the differences between real images and computer-generated images.



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LITERATURE REVIEW

[1] McConnell, Jeffrey & Carson, George. In-depth study of all the varied technologies and methodologies employed in the study of computer graphics generation. Lacking in terms of actual generation methods still as modern-day relevance.

[2] W. Jack Bouknight. 1970. A description of an algorithm to come up with a 3-dimensional polygonal surface. The algorithm is far faster than the Warnock algorithm from Utah. This paper helped a lot to understand the scope of computer graphics during that time as well as the evolution of graphics algorithms as time went on. The limitation of the paper is its relevance is totally gone as it is from over 40 years ago.

[3] J. Amanatides, This paper tells us about the trends and development of realism in computer-generated graphics. This paper goes into detail and explains various rendering processes and surface determination algorithms.

[4] Przemyslaw Rokita, This paper proposes a new and replaceable technique to generate depth in computer-generated scenes because it would be visible to human eyes. The algorithm mentioned in this paper is suitable for real-time applications such as visual simulators.

[5] J. Amanatides, This paper tells us about the trends and development of realism in computer-generated graphics. This paper goes into detail and explains various rendering processes and surface determination algorithms.

[6] A. Shamir, M. Rubinstein, and T. Levinboim, This paper is a unique take on computer graphics with a different application. It is regarding a system that can convert important parts of a storyboard and interactions in 3D graphics to a comic book-like 2D art style.

PROBLEM STATEMENT

Designing catalogues, Creating Commercial Arts, and Scientific Modeling (Ex: Meteorological data, Weather Forecasting). In this project, we are generating computer graphics by using DDA Algorithm. This algorithm can produce various figures and shapes which can further be used for many applications that are useful in the current scenarios. Some of its applications include the development of computer programs, producing films,

Video- Games (Ex: Platformers, Role-playing games, sidescrollers, first-person shooter games).

[7] V. Cantoni, P. Dondi, L. Lombardi, and A. Setti, This paper is about the teaching of computer graphics to people and is interesting in branching out a study about the topic. It talks about the key challenges and methods used to teach computer graphics using 3D modelling of a city and makes us think about the topic from a different aspect and point of view.

[8] Julie Dorsey and Leonard McMillan. This paper talks about the long run and the future scope of the topic and the technology that is currently state of the art. It is from 1998 and hence allows us to check retrospectively the condition in which computer graphics was a couple of decades ago as well as the future scope according to then.

[9] H. Wang, W. Chen, X. Liu, and B. Dong, This paper is about terrain modelling using fractals. Virtual realistic terrain modelling can be achieved using this algorithm which is a modification of the classical Diamond-Square algorithm and implemented using OpenGL and Visual C++.

[10] Canlin Li, Chao Yin, Jiajie Lu, and Lizhuang Ma, This paper is about automatic 3D scene generation using Autodesk Maya. This paper tells about the disadvantages of using manual 3D scene generation and it aims to solve them by automating the process. This paper is related to computer graphics and the exact problem statement is about automation.

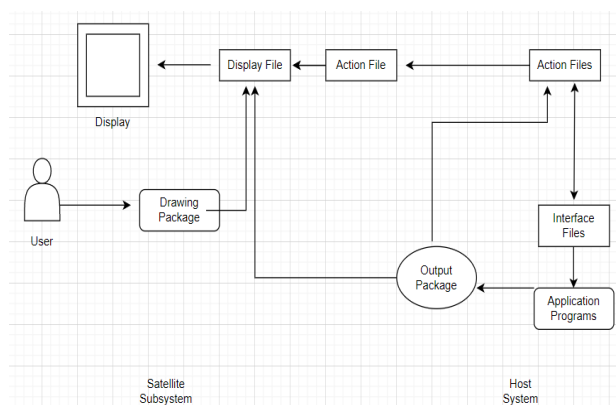
[11] R. Pickles, This paper surveys and gives information about the Vulkan libraries which are considered to be the next generation of embedded graphics or computer graphics libraries after OpenGL and CUDA.

[12] V. L. Paucar, O. S. de Sousa, I. O. Almeida, M. J. Rider, M. F. Bedrinana and J. H. Santos,

This paper is about software development primarily and isn't based on computer graphics but talks a fair and good amount about it and helps us understand better the application of computer graphics clearly.

[13] M. Oku, This paper proposes a simple algorithm to generate 2D graphics like bubbles, as well is useful for graphs, geographical data visualization, and image warping. It's a modern as well and a simple algorithm but the uses of this algorithm might be limited as it is based on 2 dimensions.

FLOWCHART



Examples of some Computer Graphics Packages:

- 1) LOGO(Language of Graphics Oriented)
- 2) Corel Draw
- 3) Auto Cad
- 4) 3D Studio
- 5) Core
- 6) GKS(graphics kernel system)
- 7) Pigs
- 8) CAM
- 9) CGI

METHODOLOGY/IMPLEMENTATION

For this project, we decided to use a simple algorithm to implement and generate computer graphics. The algorithm is called a “digital difference analyzer” or DDA for short. It is used for the insertion of variables over an interval between a start and endpoint. This is mainly used to pixelate and convert any given lines/polygons into raster images. This algorithm can also be further applied to non-linear functions but that is much more advanced and currently beyond the scope of our implementation.

For the most basic cases in linear implementation, the model uses slope to find out whether the pixel between the interval satisfies based on the slope (the simplest case is a line).

Further is a mathematical representation of the algorithm.

Algorithm:

Step 1: Start the Algorithm

Step 2: Declare the following terms: X1, Y1, X2, Y2, DX, DY, X, and Y as integer variables.

Step 3: Enter the values of X1,X2,Y1,Y2.

Step 4: Calculate the avlue of DX: $DX = X2-X1$

Step 5: Calculate the value of DY: $DY = Y2 - Y1$

```

Step 6: If (absolute(DX) > absolute (DY))
           Steps = absolute (DX)
       else
           Steps = absolute(DY);

```

Step 7: $X_{\text{increment}} = DX/\text{Steps};$
 $Y_{\text{increment}} = DY/\text{Steps};$

Step 8: Set pixel (x, y)

Step 9: `for(int i=0; i<Steps; i++);`

```

{
    X      =      X      +      Xincrement;
    Y      =      Y      +      Yincrement;
    Set pixels(Round (X), Round (Y));
}

```

This is a brief mathematical explanation of the algorithm which we will be using. The algorithm is not intensive at all for linear cases and can easily be implemented. The proper implementation of this algorithm leads to quite clear lines/ polygons. The algorithm essentially interpolates the values between the starting and ending points provided and paints the pixels accordingly. It is an easy and simple algorithm and is a base for all the advances that have taken place further in the field of computer graphics generation. Hence we used DDA to generate some simple graphics and get a better idea as well as hands-on experience in computer graphics generation.

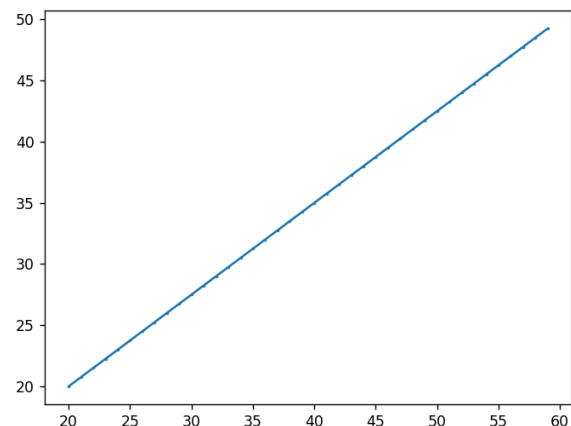


Fig 1: Sample Output

SCOPE OF THE PROJECT

- 1] It can create figures and graphical structures which are used for displaying purposes in many commercial industries.
- 2] Not just drawing 2D figures but doing some modifications using other graphics generating techniques we can display 3D figures too.
- 3] The objects or shape is drawn by connecting the previous points to the consecutive points, and geometry concepts along with the DDA algorithm are involved while drawing the required figure.

FUTURE SCOPE

The scope of computer graphics as well as designing is increasing day by day because without both of them no business can run smoothly, efficiently, and effectively. Every business use digital illustration, colours, images, and photo editing software to create designs. As we all

know that designing is very essential for all purposes like advertising, packaging, logos, hoardings, flex, publishing houses, production houses, brochures, pamphlets, and many more sectors. Everybody wants the latest and [unique designs](#) for their business, and to make those designs we need computer graphics. So, it is very true to say that computer graphics and designs are the leading sectors in which we can make our careers bright and fruitful.

CONCLUSION

Computer graphics is a vast topic and the generation of computer graphics has evolved and developed a lot throughout the past few decades and is continuing to grow at an exponential rate. Increasing popularity, development in software as well as hardware, the evolution of new algorithms to generate specific structures or elements, and overall more focus on the topic has caused the development to be significant throughout the years. Its scope is very broad and it is a vast topic with numerous opportunities for research and development as well as efficient application.

REFERENCES

- [1] V. Cantoni, P. Dondi, L. Lombardi, and A. Setti, "Teaching Computer Graphics Through a Digital Humanities Project," in *IEEE Computer Graphics and Applications*, vol. 39, no. 2, pp. 89-94, 1 March-April 2019, DOI: 10.1109/MCG.2019.2895487.
- [2] "IEEE Computer Graphics and Applications," in *Computer*, vol. 54, no. 6, pp. 58-58, June 2021, DOI: 10.1109/MC.2021.3078281.
- [3] "IEEE Computer Graphics and Applications," in *IEEE Intelligent Systems*, vol. 36, no. 6, pp. 31-31, Nov.-Dec. 2021, DOI: 10.1109/MIS.2021.3132472.
- [4] V. L. Paucar, O. S. de Sousa, I. O. Almeida, M. J. Rider, M. F. Bedrinana and J. H. Santos, "Software development with computer graphics, distributed database, and OOP for deregulated power systems analysis," 2004 Large Engineering Systems Conference on Power Engineering (IEEE Cat. No.04EX819), 2004, pp. 198-202, DOI: 10.1109/LESCPE.2004.1356300.
- [5] Colin Li, Chao Yin, Jiajie Lu, and Lizhuang Ma, "Automatic 3D scene generation based on Maya," 2009 IEEE 10th International Conference on Computer-Aided Industrial Design & Conceptual Design, 2009, pp. 981-985, DOI: 10.1109/CAIDCD.2009.5375246.
- [6] Ying Gui, Yuling Wang, and Niande Jiang, "Research and realization of visualization instruction on Computer Graphics," 2011 3rd International Conference on Computer Research and Development, 2011, pp. 344-347, DOI: 10.1109/ICCRD.2011.5764147.
- [7] R. Pickles, "White Paper - Next Generation Graphics GPU Shader and Compute Libraries," 2020 AIAA/IEEE 39th Digital Avionics Systems Conference (DASC), 2020, pp. 1-6, DOI: 10.1109/DASC50938.2020.9256444.
- [8] H. Wang, W. Chen, X. Liu, and B. Dong, "An improving algorithm for generating real sense terrain and parameter analysis based on a fractal," 2010 International Conference on Machine Learning and Cybernetics, 2010, pp. 686-691, DOI: 10.1109/ICMLC.2010.5580560.
- [9] M. Oku, "Bubblid Algorithm: A Simple Method for Generating Bubble-like Line Drawings," 2019 8th International Congress on Advanced Applied Informatics (IIAI-AAI), 2019, pp. 954-959, DOI: 10.1109/IIAI-AAI.2019.00191.
- [10] "Generating Interactive Computer Graphics," PapersOwl.com, 28-Mar-2019. [Online]. Available: <https://papersowl.com/examples/generating-interactive-computer-graphics/>. [Accessed: 20-Mar-2022]
- [11] "IEEE Transactions on Visualization and Computer Graphics," in *IEEE Transactions on Visualization and Computer Graphics*, vol. 26, no. 5, pp. i-i, May 2020, DOI: 10.1109/TVCG.2020.2978985.
- [12] "IEEE Transactions on Visualization and Computer Graphics - 2014 IEEE Virtual Reality Conference [title page]," in *IEEE*
- [13] *Transactions on Visualization and Computer Graphics*, vol. 20, no. 4, pp. iii, April 2014, DOI: 10.1109/TVCG.2014.44.
- [14] Vayadande, Kuldeep, Ritesh Pokarne, Mahalaxmi Phaldesai, Tanushri Bhuruk, Tanmai Patil, and Prachi Kumar. "SIMULATION OF CONWAY'S GAME OF LIFE USING CELLULAR AUTOMATA." *International Research Journal of Engineering and Technology (IRJET)* 9, no. 01 (2022): 2395-0056.
- [15] Vayadande, Kuldeep, Ram Mandhana, Kaustubh Paralkar, Dhananjay Pawal, Siddhant Deshpande, and Vishal Sonkusale. "Pattern Matching in File System." *International Journal of Computer Applications* 975: 8887.
- [16] Vayadande, Kuldeep, Neha Bhavar, Sayee Chauhan, Sushrut Kulkarni, Abhijit Thorat, and Yash Annature Spell
- [17] VAYADANDE, KULDEEP. "Simulating Derivations of Context-Free Grammar." (2022).
- [18] Varad Ingale, Kuldeep Vayadande, Vivek Verma, Abhishek Yeole, Sahil Zawar, Zoya Jamadar. Lexical analyzer using DFA, *International Journal of Advance Research, Ideas and Innovations in Technology*, www.IJARIIT.com.
- [19] Kuldeep Vayadande, Harshwardhan More, Omkar More, Shubham Mulay, Atahrv Pathak, Vishwam Talanikar, "Pac Man: Game Development using PDA and OOP", *International Research Journal of*

Engineering and Technology (IRJET), e-ISSN: 2395-0056, p-ISSN: 2395-0072, Volume: 09 Issue: 01 | Jan 2022, www.irjet.net.

- [20] Kuldeep B. Vayadande, Parth Sheth, Arvind Shelke, Vaishnavi Patil, Srushti Shevate, Chinmayee Sawakare, "Simulation and Testing of Deterministic Finite Automata Machine," International Journal of Computer Sciences and Engineering, Vol.10, Issue.1, pp.13-17, 2022.
- [21] Rohit Gurav, Sakshi Suryawanshi, Parth Narkhede, Sankalp Patil, Sejal Hukare, Kuldeep Vayadande, "Universal Turing machine simulator", International Journal of Advance Research, Ideas and Innovations in Technology, ISSN: 2454-132X, (Volume 8, Issue 1 - V8I1-1268, <https://www.ijariit.com/>).
- [22] <https://www.semanticscholar.org/paper/A-Computer-Graphics-System-for-Block-Diagram-Belady-Blasgen/552dfc9d542097b5b21ab770b0d64faa1d309497/figure/1>.
- [23] Kuldeep Vayadande, Krisha Patel, Nikita Punde, Shreyash Patil, Srushti Nikam, Sudhanshu Pathrabe, "Non-Deterministic Finite Automata to Deterministic Finite Automata Conversion by Subset Construction Method using Python," International Journal of Computer Sciences and Engineering, Vol.10, Issue.1, pp.1-5, 2022.
- [24] Kuldeep Vayadande and Samruddhi Pate and Naman Agarwal and Dnyaneshwari Navale and Akhilesh Nawale and Piyush Parakh, "Modulo Calculator Using Tkinter Library", EasyChair Preprint no. 7578, EasyChair, 2022.

QoS Protocols for IoMT

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Abstract:

With the immersive growth of the Internet of Things (IoT) and real-time adaptability, quality of life for people is improving. IoT applications are diverse in nature and one crucial aspect of it is multimedia sensors and devices. These IoT multimedia devices form the Internet of Multimedia Things (IoMT). It generates a massive volume of data with different characteristics and requirements than the IoT. The real-time deployment scenarios vary from smart traffic monitoring to smart hospitals. Hence, Timely delivery of IoMT data and decision-making is critical as it directly involves the safety of human beings. The multimedia information imposes a number of restrictions on the design of IoT, in addition to the challenges imposed by other heterogeneous devices which are part of the IoT. To meet given Quality of Service (QoS) requirements, the network characteristics defined in terms of end-to-end delay, jitter and error rate, among others, are required to be regulated to ensure acceptable delivery of the multimedia content. This paper is a Literature Review paper on the QoS protocol for IoMT.

Keywords:

IoT, IoMT, QoS.

INTRODUCTION

In 1989, the "Internet" was first introduced and quickly spread throughout the world. Since the birth of the Internet, the trend for connecting various things to the Internet has become very large. Coffee Pot Trojan is the first application of its kind. In 1990, John Romkey designed the first Internet device, a toaster that could be activated and deactivated with the Internet. Steve Mann developed Wear Cam in 1994. This happens almost in real time with a 64-processor system. In 1997, Paul Saffo gave first short description of censorship and his future actions. In 1999, Kevin Ashton created Internet of Things, Managing Director of the Auto-Id Centre at MIT[2]. They also formed RFID-based systems for identification of objects throughout the world. Therefore Everything we use today in our daily lives can be monitored and monitored via the Internet (IoT). Most of the processes in IoT are carried out with the help of sensors. This sensor is used in almost all devices. The sensor first receives physical raw data or data (data), converts it into a digital signal, and sends it back to the control centre. We can say that IoT has brought great comfort to our lives and made it very easy for all of us. In this way, we can also monitor changes in the environment in other parts of the world by using the internet remotely in the world. So, IoT has a big impact and plays an important role in our daily lives.

The core concept of the IoT is to connect the pervasive objects around us, such as Radio Frequency Identification (RFID) tags, mobile devices, sensors and

actuators to the Internet through a wired or wireless network. Hence, it enables the objects to interact with each other and their neighbours to enhance the efficiency of the system[3].

Vigorous growth in the connected devices to the Internet during the last decade and abrupt demand for multimedia traffic has given rise to the emergence of the Internet of Multimedia Things (IoMT). The equilibrium between QoS data and best-effort data is now in transit towards an increase in multimedia QoS data. IoMT smart objects are usually resource-constrained, in terms of energy, memory storage, and processing power. To make the devices smaller, cost-effective and energy efficient, sensors are usually designed to be battery operated or solar powered with only a few kilobytes of memory, and limited processing power in megahertz.

Real-world multimedia applications include an example of rescue vehicles based emergency response systems, traffic monitoring, GPS-based path tracking, agricultural monitoring, crime inspection, smart cities, smart homes, smart museums, surveillance systems, security system for authentication and authorization, multimedia-based e-health, patient monitoring in smart hospitals, and industrial monitoring systems. Fig. 1 conceptualize the multimedia communication in IoT in every domain-specific application.[4]

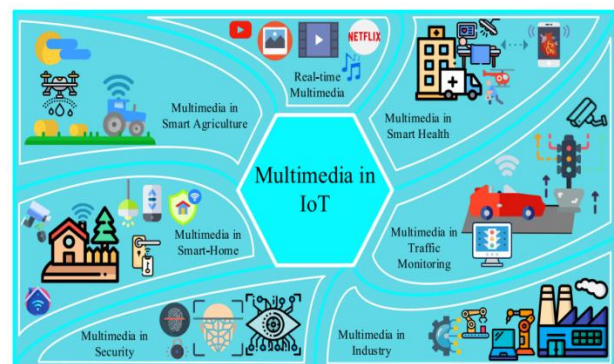


FIGURE 1. The overall vision of integrating multimedia applications of every domain in IoT, developing a smart city and transforming human lives, i.e., multimedia in agriculture, smart health, security, industrial process, road management systems, and real-time applications.

The main goal of IoMT includes carrying out multimedia communication with maximum QoE in terms of packet delivery ratio, throughput, and extending network lifetime while minimizing energy expenditure and preventing connectivity degradation. [4].

PROPOSED METHODOLOGY

Due to increasing Demand for Bandwidth, Resources for multimedia applications in Internet of things QoS framework has to be added to IoT protocol stack. In this paper, various Protocols which provide QoS for multimedia communication are explained.

Quality of service refers to the effectiveness of a network to provide more suitable or appropriate service to the application

QoS metrics for IoT:

Throughput and Efficiency Throughput is defined as the number of packets that are transferred from the source to destination within specific time period. Throughput is measured in bits per second.

Bandwidth: Amount of packet that can be transferred from source to destination within the specific time period is known as bandwidth. The term bandwidth can be measured in megabits per second. **Packet Loss Ratio** Packet loss is denoted as number of packets that are not delivered at the destination during transmission. It can be denoted by the total numbers of packets sent and total numbers of packets delivered.

Packet Delivery Ratio The packet delivered ratio presents the ratio of the number of received packets and the number of sent packet of nodes

Delay Time taken to transfer the packet from source to destination than the actual time is known as delay. $D = AT - TT$ where, D denotes delay, AT denotes Actual Time, TT denotes Time Taken to execute.

Differentiated Services (DiffServ, or DS) :

DiffServ, is a [protocol](#) for specifying and controlling network traffic by class so that certain types of traffic get precedence - for example, voice traffic, which requires a relatively uninterrupted flow of data, might get precedence over other kinds of traffic. Differentiated Services is the most advanced method for managing traffic in terms of what is called Class of Service ([CoS](#)). Differentiated Services avoids simple priority tagging and depends on more complex policy or rule statements to determine how to forward a given network [packet](#).

A new queue buffer management algorithm --Adaptive RIO-C based on the prediction (PARIO-C) algorithm was proposed by Du Li. The algorithm combined RIO-C algorithm applied to DiffServ networks with ARED algorithm, and used recursive least squares method to predict traffic. The purpose is to enhance the Assured Forwarding (AF) performance in DiffServ networks[5].

Leila Azouz Saidane proposed a solution to provide quantitative end-to-end real-time guarantees for flows in the EF class of the DiffServ model, assuming that this class has the highest priority and packets are scheduled FIFO within the EF class. The EF class is well adapted for flows with real-time constraints such as voice or video flows. In this paper mathematical models are developed to evaluate the probability of meeting a specified end-to-end delay for any EF flow in the DiffServ/MPLS domain. The MPLS technology reduces forwarding delays because of simpler processing and allows to indicate in a label the service class of the packet[6].

In Latest research A Reputation-based Network Selection in Multimedia IoT was proposed by Cristina Desogus. In this paper ReMIoT algorithm provides QoS

metric improvements with respect to IoT performances obtained using TYDER algorithm. The evaluation of the ReMIoT algorithm, was carried out by integrating Python code in models built using the OMNeT++ network simulator. ReMIoT architecture is as shown in Figure2

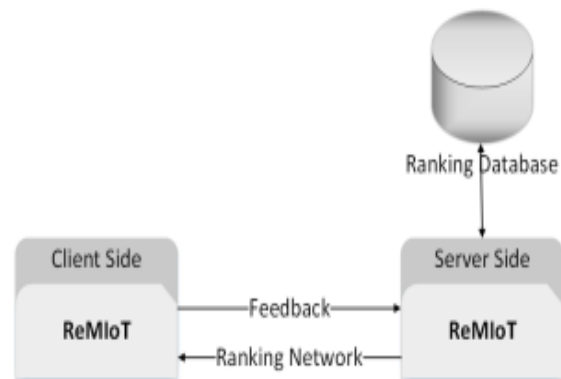


Fig2: ReMIoT architecture

RESULTS AND DISCUSSION

It was decided to test the algorithm in two different scenarios. The first case considers a static device placed in a smart city scenario, as shown in Fig. 3. Users can employ different types of devices (for example, smartphone, laptop, tablet, smartwatch, mobile devices, etc.). Within the scenario, 100 devices are globally considered and progressively added 5 at a time. All devices considered generate M-IoT traffic. In the second scenario, a mobile device in a smart city scenario was considered, moving at a speed of 3 Km/h along a linear path of 500 m. This allows to realistically reproduce the behavior of pedestrians and/or vehicles in urban environments with heavy traffic. Similar to scenario 1, the same number of devices with the same progression and the same type of traffic were considered. In this scenario, mobility was also introduced for all devices moving along an urban scenario (i.e., random way point) at a random speed between 0 and 3 km/h, in order to assess the effects of mobility on the calculation network reputation.

New connections at a time. Fig. 3 and Fig. 4 present packet delay values when TYDER and ReMIoT algorithms are compared. In both scenarios ReMIoT is more beneficial in terms of packet delay. When a user is moving at a constant speed of 3 m/s alongside and/or away from the transmitters as described in scenario 2, packet delay-related performance slightly decreases when compared to that in scenario 1. Fig. 5 and Fig. 6 show the latency in scenario 1 and scenario 2, respectively. It can be seen that ReMIoT presents better values than TYDER, even when mobility is considered. The trend in the two scenarios is substantially the same, although mobility introduces a slight decline in performance in scenario 2. Finally, Fig. 7 and Fig. 8 illustrate the packet loss ratio results. ReMIoT has a lower packet loss ratio than TYDER. The comparison between the two scenarios shows that the higher the

number of IoT devices the higher the impact on packet loss ratio. The mobility of the devices introduced in scenario 2 does not significantly affect the results in comparison with scenario 1

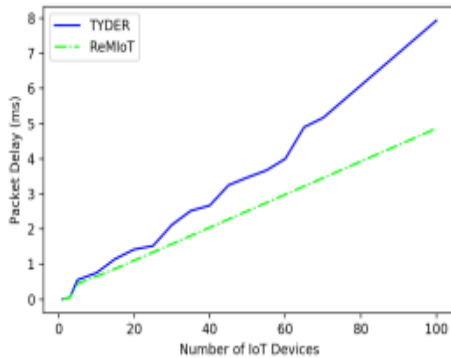


Fig 3: Packet Delay for Scenario 1

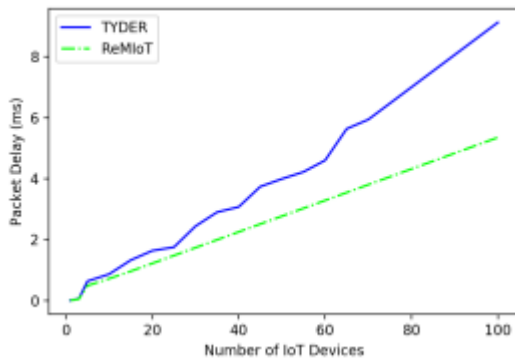


Fig 4: Packet Delay for Scenario 2

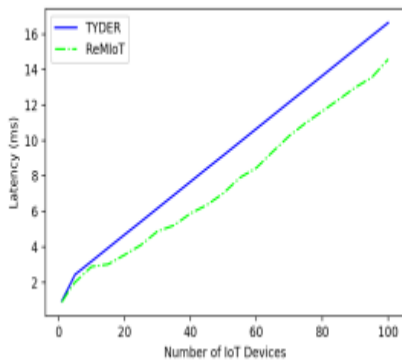


Fig 5: Packet Loss Ratio for Scenario 1

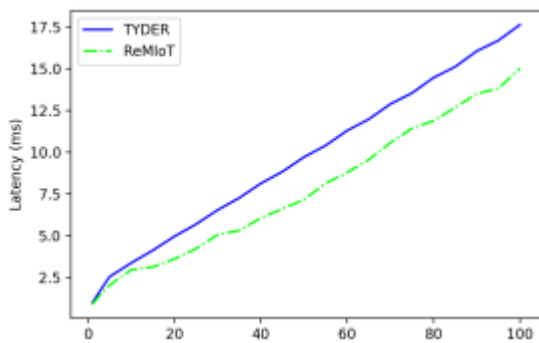


Fig 6: Packet Loss Ratio for Scenario 2

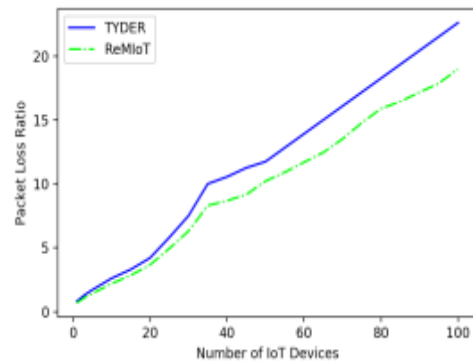


Fig 7: Latency for Scenario 1

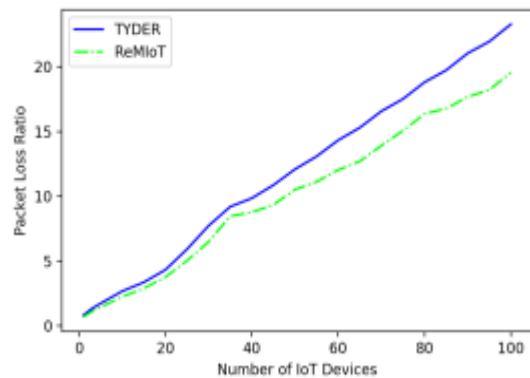


Fig 8: Latency for Scenario 1

CONCLUSIONS

In this paper various QoS strategies for Internet of multimedia things was discussed. All the strategies discussed are tested in simulation environments such as NS2, Omnet++, etc. Therefore there is a research scope for testing QoS of IoMT in real-time.

REFERENCES

- [1] Abhishek Malik, Amrit Thapa Magar, Harsh Verma, Meeta Singh, Pinki Sagar," A Detailed Study Of An Internet Of Things (IoT), International Journal Of Scientific & Technology Research Volume 8, Issue 12, December 2019 Issn 2277-8616
- [2] Ashton, K. (2009). "That _internet of things' thing," RFID Journal, 22, 97-114.
- [3] Atzori, L., Iera, A., Morabito, G. (2010). The internet of things: A survey. Computer networks, 54, 2787-2805
- [4] A. Nauman, Y. A. Qadri, M. Amjad, Y. B. Zikria, M. K. Afzal and S. W. Kim, "Multimedia Internet of Things: A Comprehensive Survey," in IEEE Access, vol. 8, pp. 8202-8250, 2020, DOI: 10.1109/ACCESS.2020.2964280.
- [5] D. Li and G. Yong-le, "A queue buffer management algorithm based on traffic prediction in DiffServ architecture," 2010 International Conference on Logistics Systems and Intelligent Management (ICLSIM), 2010, pp. 1176-1180, doi: 10.1109/ICLSIM.2010.5461145.

- [6] L. A. Saidane, P. Minet, S. Martin and I. Korbi, "Deterministic and probabilistic QoS guarantees for real-time traffics in a DiffServ/MPLS architecture," 13th IEEE International Symposium on Modeling, Analysis, and Simulation of Computer and Telecommunication Systems, 2005, pp. 337-340, doi: 10.1109/MASCOTS.2005.26.
- [7] C. Desogus, M. Anedda, M. Murrone, D. D. Giusto and G. Muntean, "ReMIoT: Reputation-based Network Selection in Multimedia IoT," 2019 IEEE Broadcast Symposium (BTS), 2019, pp. 1-6, doi: 10.1109/BTS45698.2019.8975410.

Document Text Search System Using Principles of Non-Deterministic Finite Automata

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Abstract:

Automata is one of those ground-breaking topics of computer science that has remained popular since its inception. Automata applications are numerous, and in this work, we suggest one such application and investigate all the numerous possibilities surrounding the area of non-deterministic finite automata by implementing it in a document text search application along with regex to NFA visualizer. We intend to undertake research into the specifics of the subject and how it is still relevant today through implementation. We hope that by publishing this paper, we will pique the interest of academics in automata and offer them with a reference implementation for the future.

Keywords:

NFA, Text Search, Filtering Technique, Multiple documents, Key-word Extraction.

INTRODUCTION

The concept of document text search refers to a search that compares every word in a document, as opposed to searching a summary or a set of keywords associated with the document. Rather than looking for a summary or a set of keywords about a document, it's often a search that compares every word in that document.

We are aiming to achieve document text search using Nondeterministic Finite Automata NFA, some of the pre-existing implementations can be used for text searching, for example if we are given a particular set of words and want to find the occurrence of those words, a beneficial way to do this is to Design a non-deterministic finite automaton, which signals, when we enter the acceptance state. In the next step,

the text of the document is sent, one character at a time, to the NFA, which then recognizes occurrences of keywords in the provided text. The Four distinct types of automata are push-down automata, finite automata, linearly bounded automata, and Turing machines. This finite automaton is used for designing lexical analyzers of a compiler of any language. Finite automata use regular expression for recognizing the pattern. It is also used in editors for text also used in spell checker and in communication protocols, DNA matching.

➤ Finite Automata

Finite Automata (FA) as discussed in [9] is the most fundamental pattern recognition machine. The finite automata, commonly known as the finite state machine, is a five-element or tuple abstract machine. It contains a set of states and rules for moving from one to the next, but the input symbol must be utilized. It's essentially a digital computer's abstract model. Some of the most

significant components of general automation are depicted in the diagram below.

➤ Non-Deterministic Finite Automata

- NFA is an abbreviation for non-deterministic finite automata. For a given regular language, it is easier to design an NFA than a DFA.
- When there are multiple paths for specific input from current to next state as discussed in [5], the finite automata are referred to as NFA.
- Any NFA is not a DFA, but every NFA can be converted to a DFA.
- NFA is defined in the same way as DFA, with the two exceptions that it contains numerous next states and transition.

PROBLEM STATEMENT

To solve the issue of going through piles of text-based documents, it is necessary to design tools and systems that can efficiently churn through these massive texts and give us pinpoint location of desired text or paragraph in the document. Finite automaton is very useful here, as it enables us to build fast and responsive document search engines. In this project we plan to solve this problem using non-deterministic finite automata and visualize regular expression to NFA conversion process.

LITERATURE REVIEW

1. NFAs are the best counterparts to right linear CFGs, according to the paper non-deterministic finite automata: current studies on description and computational complexity [1]. The study also demonstrates how NFA may save exponential amounts of space when compared to other models like DFA and so on. This article also discusses why NFA is preferable to other text search models and how NFA is used in document search text.
2. The article explains about how regular expressions are used to search for text. [21] The article demonstrates how to search for text using regular expressions while keeping them intact. The article offers a rule that is more semantically sound. This rule has various intriguing qualities and may be used in several text search applications, including source code analysis.
3. Goal of this research was to provide an algorithm that searches for substrings inside a string. Non-deterministic finite-state machine theory and vector drawing architecture are used to search for substrings

[22]. Abstract automation is a math model for discrete devices with inputs and outputs classed as finite automation and a finite number of internal states, as described in this white paper.

4. A survey of Finite Automata applications in text search [23], The textual content search of finite automata is discussed in this study. The process of converting non-deterministic automata to deterministic automata is thoroughly detailed. The keywords describe how to create the world's first non-deterministic finite automaton. The paragraph is used to search for the keywords that have been provided. The purpose of this study is to explain how finite automata search for textual information.
5. In this paper Authors stated a NFA and Keyword-Based Filtering for Document-Centric XML [24], a very valuable model for many software and hardware applications, may be employed in document text searches. When there are numerous ways for a specific input to go from one state to the next, finite automata are known as NFA. This paper explains how NFA may be used for text search. For example, if we are given a collection of terms and wish to identify occurrences of these phrases, designing a non-deterministic finite automaton that signals when we enter the accepting state is a good way to go.
6. For textual content, automatic keyword extraction is available. The paper explains the employment of NFA and TF-AIDF for summarization and keyword extraction performed much better than other techniques. Article summaries in multi-document e-Newspapers [25], This assignment paper [25] explains how to use NFA to extract significant terms from a report and summaries the information. For extracting relevant terms from the supplied document, methods such as TF-IDF, TF-IDF, NFA, and others were used
7. For text analytics, token-based dictionary pattern matching [26], The author has provided a token-based pattern matching system with token pattern sequence detection in this study. PSM is a pattern-finding algorithm that allows you to get higher performance in less area. Pattern sequencing is detected in this research, resulting in output rates of up to nine GBPS on twelve parallel streams.
8. The study [6] elucidates the mechanics and difficulty of the algorithm conversion from NFA to DFA. The paper also discusses how the NFA method may be used to search for text within the provided data. The study discusses how we can enhance the accuracy of text search by combining NFA with other factors to improve accuracy and minimize the time complexity of text searching. Also, the study explains utilizing NFA and some other characteristics, as well as lower the time complexity of text searching on given documents, for a better model experience.

9. The basic concepts of DFA, NFA, and Regular Expression are covered in this work [7]. It discusses regular expression to automaton conversions utilizing methods such as the transitive closure approach, Bronowski Algorithm, and Thompson's Algorithm.

PROPOSED SYSTEM

We will be developing a web application which will take an input string and a substring to search in the original string using non-deterministic finite automata. Results will contain the set of states, set of symbols, Initial State, Transition function, search result along with the time consumed for searching. Also, we will be having another module for conversion of regular expressions to NFA for reference and testing. The web application will be developed using HTML and JavaScript. We will be using jQuery and AJAX for using JavaScript asynchronously and avoid page reloading. We will use bootstrap library for styling purpose of the web pages.

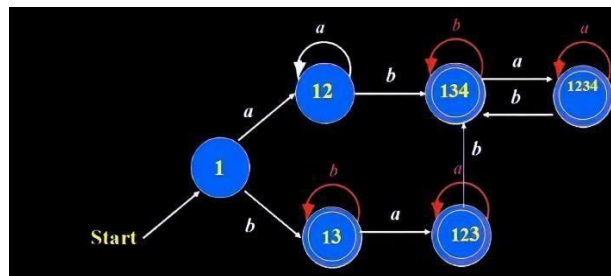


Fig 1. Document Text Search NFA 1

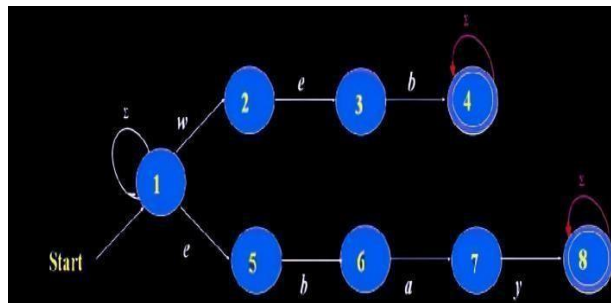


Fig 2. Document Text Search NFA 2

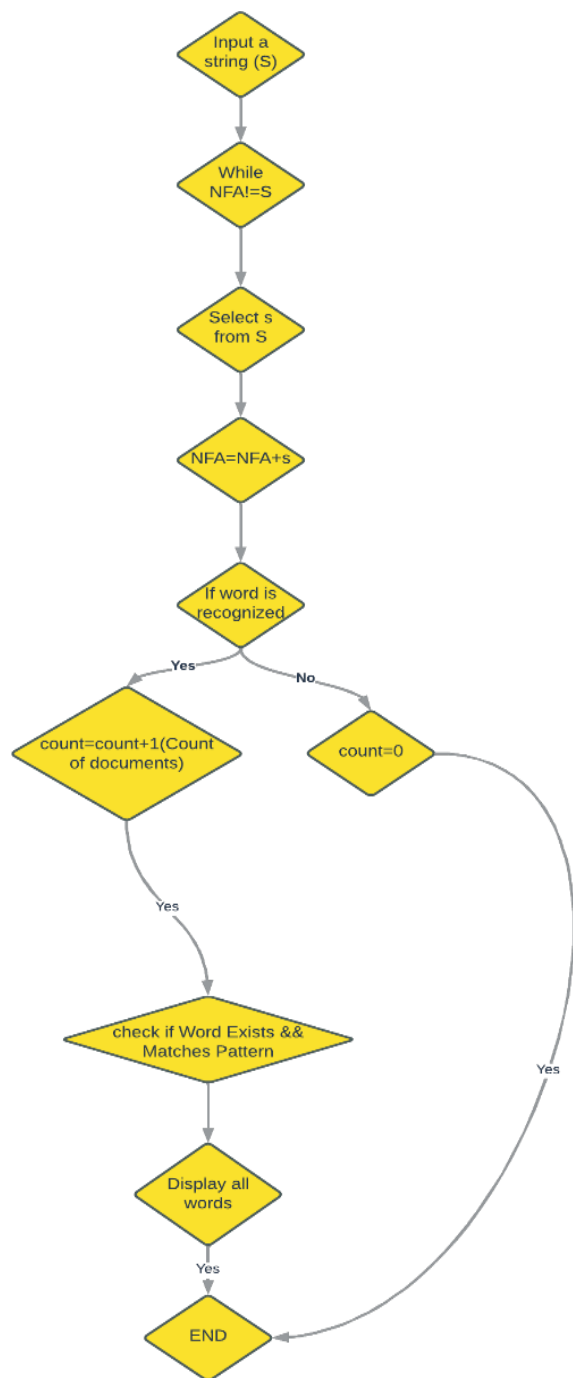


Fig 3. Flowchart

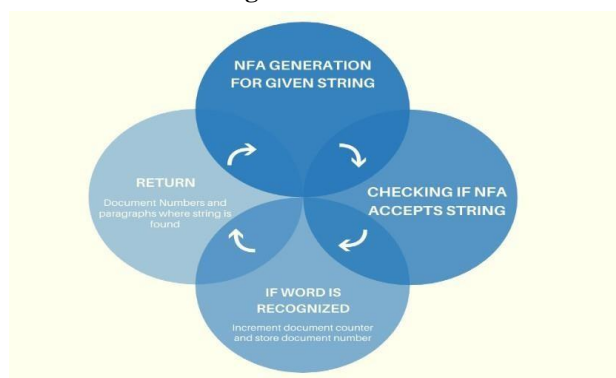


Fig 4. Document Text Search Life Cycle

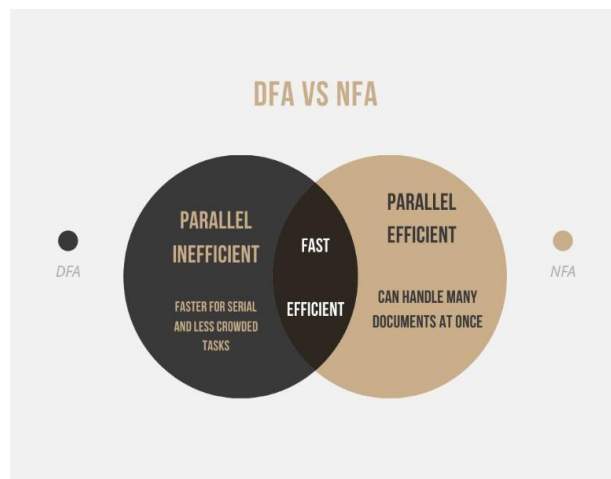


Fig 5. DFA vs NFA Venn Diagram

Table 1. Comparison of different text searching methods

ALGORITHM	MERITS	DEMERITS
Brute Force	Simple Implement	Higher time & space complexity & lower parallel processing performance
DFA	Fastest for less parallel tasks	Slow when it comes to parallel tasks e.g., many documents to search a string from
NFA	Fastest for parallel tasks and for many documents to search from (our application)	Slower than DFA and for smaller serial workloads

ALGORITHM(S)

Brute Force Method for String Search:

This algorithm compares a pattern symbol by symbol at any point in the text. Starting at the beginning of the text string, we sequentially compare the symbols in the pattern with the corresponding symbols in the text until either a mismatch is found, or the entire pattern is exhausted. When the pattern is exhausted, we claim to have found a match at the beginning of the text. If a symbol mismatch is detected before the pattern is exhausted, the pattern will not appear at the beginning of the text. The next symbol in the text will start pairing again and continue the same process.

String Search Using NFA:

1. S: string: = input from user
2. While NFA \neq S
3. Do: select s from S
4. NFA: = NFA + s
5. Count: integer: = 0
6. Do: Count= Count + 1 While: word is recognized
7. End

For this algorithm we first take input string from the user. As

NFA remains unequal to the given string, $s[n]$ is chosen from given string. We increase the NFA by the given string. Initialize counter to zero. Till the word is recognized, increment the count. Check if the input word exists and display the result.

Regular Expression to NFA:

We split the regex to NFA conversion into three pairs for modulus. These parts are:

1. `Modify_regex()`: Modify the regex for anomalies (it does not fully test anomalies as it is beyond the scope of this project)
2. `Infix_to_postfix (regex)`: convert regular expression Infix to regular expression postfix.
3. `Solve_for_nfa (regex)`: solve the postfix regex to get the resulting NFA

The first part is to convert the input regex to a regex without anomalies. It is not a very deep modification, rather just the addition of concatenation wherever there is no expression between two characters.

The second part converts the infix regular expression to a postfix regular expression.

The third part is to convert the postfix regex to NFA. The steps of this conversion are:

1. If you get a character, create an NFA for the unique character and push the NFA onto the stack.
2. If you get a keyword (any of `*`, `+`): one. If the keyword is `*`:
 - a. If stack is empty, return conversion failed
 - b. If not, remove the top of the stack, apply Kleene close and push back to the stack
3. If the keyword is `+`:
 - a. If the stack is empty, return failed conversion
 - b. else pop the top from stack, apply Kleene plus and push back to stack
4. If keyword is `'`:
 - a. If the stack has less than 2 elements, return failed conversion
 - b. else pop two elements apply concatenation and push the result in stack. D. If the keyword is `'`:
5. if the stack contains less than 2 elements, return conversion failed
6. else pop up two elements apply NFA (1) | NFA (2) and push results onto the stack.
7. Check the stack, if it contains exactly 1 element, return the result as the result, otherwise the conversion fails.

LIMITATIONS

This study was limited to automaton so more robust approaches for the problem statement like implementation using tries was not considered. A more robust solution/product in the form of webapp or native app was not built due to scale of the project.

OUR CONTRIBUTIONS

This study contributes by presenting a system for swiftly searching and retrieving documents. NFA Based Document text search technique is utilized here. This method allows users to access documents quickly and conveniently, allowing them to save time and use it for other purposes. This technology is quite efficient, and it also assists us with data retrieval and symbol manipulation. This approach makes it simple to determine the location of a certain phrase, and it also saves unique searches so that they may be reused. This approach works efficiently and quickly for everyone.

FUTURESCOPE

Our technique to implement text-search using NFA is highly scalable. The project can be used to search different string patterns. It has high scope in the bioinformatics field applications where we require different edit operations at different probabilities. The project has potential to engage with CPU and GPU and compare read aloud functionalities. Can be used for pattern recognition for deep packet inspection.

CONCLUSION

With the use of NFA we designed an algorithm which could search the text efficiently and which is easily scalable, also we built regex to NFA visualizer. This paper explains how we implemented text search using finite automata. We explain how finite automata is efficient and precise in pattern matching and text searching in the field of text editing, data retrieval and symbol manipulation. Using this paper, we wish to demonstrate the power of non-deterministic finite automata and how it can play a role in modern world with all the new technological advancements at play

REFERENCES

- [1] Holzer, Markus & Kutrib, Martin. (2008). Nondeterministic Finite Automata — Recent Results on the Descriptive and Computational Complexity. *Int. J. Found. Comput. Sci.* 20. 1-16. 10.1007/978-3-540-70844-5_1.
- [2] Pashchenko, Dmitry & Trokoz, Dmitry & Martyshkin, Alexey & Sinev, Mihail & Svistunov, Boris. (2020). Search for a substring of characters using the theory of non-deterministic finite automata and vector-character architecture. *Bulletin of Electrical Engineering and Informatics.* 9. 10.11591/eei.v9i3.1720.
- [3] Byun Changwoo & Lee, Kyoungan & Park, Seog. (2007). A Keyword-Based Filtering Technique of

- Document-Centric XML using NFA Representation.
- [4] Bharti, Drsantosh. (2017). Automatic Keyword Extraction for Text Summarization in Multi-document e-Newspapers Articles. *European Journal of Advances in Engineering and Technology*. 4. 410-427.
 - [5] R. Polig, K. Atasu and C. Hagleitner, "Token-based dictionary pattern matching for text analytics," 2013 23rd International Conference on Field programmable Logic and Applications, 2013, pp. 1-6, doi: 10.1109/FPL.2013.6645535.
 - [6] Maohua, Jing & Li, G.-R & Shi, W.-B & Cai, S.-X. (2012). Improved conversion algorithm from NFA to DFA. *DongbeiDaxueXuebao/Journal of Northeastern University*. 33. 482-485.
 - [7] Indu, Jyoti (2016), Technique for Conversion of Regular Expression to and from Finite Automata, Indu et al. *International Journal of Recent Research Aspects* ISSN: 2349- 7688, Vol. 3, Issue 2, June 2016, pp. 62-64
 - [8] Chang, Chia-hsiang & Paige, A.. (2000). From Regular Expressions to DFA's Using Compressed NFA's.
 - [9] Ezhilarasu P1, Krishnaraj N2 , Suresh Babu V (2015), Applications of Finite Automata in Text Search – A Review, Ezhilarasu P et al | *IJCSET*(www.ijcset.net) | May 2015 | Vol 5, Issue 5, 116-119.
 - [10] Vayadande Kuldeep, Ritesh Pokarne, Mahalaxmi Phaldesai, Tanushri Bhuruk, Tanmai Patil, and Prachi Kumar. "SIMULATION OF CONWAY'S GAME OF LIFE USING CELLULAR AUTOMATA." *International Research Journal of Engineering and Technology (IRJET)* nine, no. 01 (2022): 2395-0056.
 - [11] Vayadande Kuldeep, Ram Mandhana, Kaustubh Paralkar, Dhananjay Pawal, Siddhant Deshpande, and Vishal Sonkusale. "Pattern Matching in File System." *International Journal of Computer Applications* 975:8887.
 - [12] Vayadande Kuldeep, Neha Bhavar, Sayee Chauhan, Sushrut Kulkarni, Abhijit Thorat, and Yash Annapure. *Spell Checker Model for String Comparison in Automata*. No. 7375. EasyChair, 2022.
 - [13] Kuldeep Vayanande *Simulating derivations of Context- Free Grammar*." (2022).
 - [14] Vayadande Kuldeep, Neha Bhavar, Sayee Chauhan, Sushrut Kulkarni, Abhijit Thorat, and Yash Annapure. *Spell Checker Model for String Comparison in Automata*. No. 7375. EasyChair, 2022.
 - [15] Varad Ingale, Kuldeep Vayadande, Vivek Verma, Abhishek Yeole, Sahil Zawar, Zoya Jamadar. *Lexical analyzer using DFA*, *International Journal of Advance Research, Ideas, and Innovations in Technology*, www.IJARIIT.com.
 - [16] Kuldeep Vayadande, Harshwardhan More, Omkar More, Shubham Mulay, Atahrv Pathak, Vishwam Talanikar, "Pac Man: Game Development using PDA and OOP", *International Research Journal of Engineering and Technology (IRJET)*, e- ISSN: 2395-0056, p-ISSN: 2395- 0072, Volume: 09 Issue: 01 | Jan 2022, www.irjet.net.
 - [17] Kuldeep B. Vayadande, Parth Sheth, Arvind Shelke, Vaishnavi Patil, Srushti Shevate, Chinmayee Sawakare, "Simulation and Testing of Deterministic Finite Automata Machine," *International Journal of Computer Sciences and Engineering*, Vol.10, Issue.1, pp.13-17, 2022. Rohit Gurav, Sakshi Suryavanshi, Parth Narkhede, Sankalp Patil, Sejal Hukare, Kuldeep Vayadande," *Universal Turing machine simulator*", *International Journal of Advance Research, Ideas and Innovations in Technology*, ISSN: 2454-132X, (Volume 8, Issue V8I1, <https://www.ijariit.com/>.)
 - [18] Kuldeep Vayadande, Krisha Patel, Nikita Punde, Shreyash Patil, Srushti Nikam, Sudhanshu Pathrabe, "Non- Deterministic Finite Automata to Deterministic Finite Automata Conversion by Subset Construction Method using Python," *International Journal of Computer Sciences and Engineering*, Vol.10, Issue.1, pp.1-5, 2022.
 - [19] Kuldeep Vayadande and Samruddhi Pate and Naman Agarwal and Dnyaneshwari Navale and Akhilesh Nawale and Piyush Parakh," *Modulo Calculator Using Tkinter Library*", *EasyChair Preprint no. 7578*, EasyChair, 2022M. Mary, Dr. T. Beena, "Heart Disease Prediction using Machine Learning Techniques: A Survey", *International Journal for Research in Applied Science & Engineering Technology*, 2020.
 - [20] Charles L. A. Clarke, Gordon V. Cormack, *On the use of regular expressions for searching text*.
 - [21] Dmitry V. Pashchenko, Dmitry A. Trokoz, Alexey I. Martyshkin, Mihail P. Sinev, Boris L. Svistunov, Year- 2020, *Search for a substring of characters using the theory of nondeterministic finite automata and vector character architecture*.
 - [22] Ezhilarasu P, Krishnaraj N, Suresh Babu V "Applications of Finite Automata in Text Search – A Review".
 - [23] Changwoo Byun, Kyoungchan Lee, and Seog Park, Year- 2017, "A Keyword-Based Filtering Technique of Document-Centric XML using NFA Representation"
 - [24] Santosh Kumar Bharti, Korra Sathya Babu, and Anima Pradhan, year-2017," Automatic Keyword Extraction for Text Summarization in multi-document e-Newspapers Articles".
 - [25] Raphael Polig, Kubilay Atasu, Christoph Hagleitner, year- 2013, "Token-based dictionary pattern matching for text analytics".

Simulation of Pushdown Automata using Python

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Abstract:

In the same approach that we create DFA for regular grammar, a pushdown automaton (PDA) is a technique for implementation of context-free grammar. Because of an extra memory segment called stack, a PDA can remember an immense amount of information, whereas a DFA can only remember a certain amount of information. In our project, we have implemented PDA using Python, and made simulations of four PDAs. To check if the input string has n number of 0s followed by n number of 1s, palindrome, if no. of 0s and 1s are equal or not and last one to check if, number of 1s are twice as compared to number of 0s. We also print transition tables for better understanding of PDA transitions and stack operations.

Keywords:

python, pushdown automata, palindrome, automata theory, stack.

INTRODUCTION

Pushdown Automata is a type of finite automaton which includes an additional memory known as a stack that allows it to recognise Languages that are free of context. [5]

A Stack is a linear type of data structure where all insertions and deletions are made only from one end, the top. We can perform two basic operations on stack, insertion of an element known as 'push' and deletion of an element known as 'pop' strictly from the top only.

Pushdown Automata(PDA) is one of the extensively important and widely used topics in Theory of Computation(TOC). It has a huge number of applications and therefore, we decided to design some examples of Pushdown Automata and implement it with the help of Python programming.

Formal Definition of PDA can be given as :

- Q : Non empty finite set of states
- Σ : Input alphabets
- Γ : Stack alphabets
- q_0 : Initial state
- Z : Stack start symbol(bottom of stack)
- F : the final state, δ is a transition feature which maps $Q \times \{\Sigma \cup \epsilon\} \times \Gamma$ into $Q \times \Gamma^*$. In each state, PDA will read symbols from top of the stack and shift to a new state and change the symbol of stack.
- Components of Pushdown Automata[4] :

Input tape : The input tape is subdivided into cells or symbols. The input head is read-only i.e it can not change the symbol and can only move one symbol from left to right at a time.

Finite control : It has a pointer which points to the currently being read symbol.

Stack : This is a kind of data structure in which data could only be put or removed from one end. It's size is unlimited.. It is used to temporarily store items in a PDA.

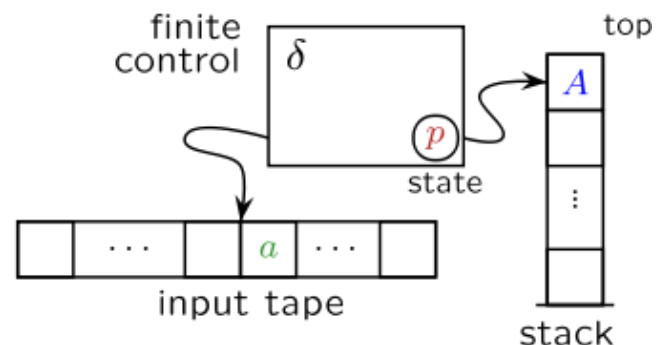


Fig 1

Image ref : <https://en.wikipedia.org>

According to [6] A state-transition table is used in automata and sequential logic to show which state (or states in NFA) a finite-state machine will transition to given the present situation and other inputs.[6]

Considering the fact that Pushdown automata have an extra memory segment called stack which makes it possible for PDA to remember infinite amounts of information, unlike finite state automata which can store only finite amounts of information. The paper covers certain languages which can be designed using pushdown automata. The programs are written in Python and have used Python's library named automata.

LITERATURE SURVEY

A. Non-Deterministic PDA Tool[1]

Similar to our project, this tool is being used for creating simulations of PDA. The program is in Java language. The user is able to run PDA with many inputs at around the same moment. User has to specify all necessary information in an input file. This tool is able to stimulate PDAs in the form of graphs so that it could assist the user to follow the steps as per simulation.

B. Pushdown Automata Simulator[2]

This is a GUI based java program which has created a simulator to study the behavior of PDA in the form of visualization. This type of simulator can handle both vacant stack as well as the end state techniques of approval. It allows users to easily transform the PDA which takes a vacant stack into a PDA which accepts by end state. It is a similar process the other way around.

C. *Autonomous push-down automaton built on DNA*[5]*

In this paper, the authors have presented a conceptual model on execution of pushdown automata built on DNA. They were persuaded by The Turing Machine model and the finite automaton model. Furthermore, they have discussed the basic introduction of the pushdown automaton being a non-deterministic finite automata and also a schema of the PDA. A few solved examples of PDA are also stated for better understanding of the concept. Then, it has been mentioned about the basic elements of the implementation of The PDA with respect to a DNA molecule. Further, they've discussed the empirical implementation and the transition rules along with their molecular representation. The paper concludes with successfully presenting a contemporary way to implement PDA contingent to DNA molecules along with restriction enzymes.

D. *Pushdown Automata in Statistical Machine Translation[6]*

This paper contains the application of PDA in relation with statistical machine translation. They've also mentioned SCFGs, HiPDT and described decoding in three steps: Translation, Language Model Application and Search. They've researched in such a way proving that PDAs are more worthy in decoding SCFGs and other language models.

E. *Pushdown Automata[7]*

This paper contains the theory and information about Pushdown Automata and then further discusses the similarities between Pushdown Automata and context free grammar and then they further talk about various properties and types of Pushdown Automata. The paper then discusses how recursion is the face and the building block of Pushdown Automata. The paper finally discusses some of the machine models based on Pushdown Automaton.

PROBLEM STATEMENT

1. We will be designing a PDA system for accepting the language in the form $0^n 1^n$ and $0^n 1^{2n}$. The important thing to note is, the order of 0's and 1's should be maintained.
2. $L = \{x \in \{0,1\}^* \mid \#0 = \#1\}$ where # represent no. of zero i.e. 0's = 1's.
3. We will be designing a Python implementation of palindrome numbers using Pushdown Automata with the alphabets 0 and 1.

METHODOLOGY

The python program to simulate PDA consists of two .py files and for text files of four different PDAs simulated.

First python file is FileHandler.py in which two functions namely readFile() and parseFile() are defined. readFile() reads the input file and displays an error message if the proper input file is not provided.

parseFile() function is used to assign a variable to each line from text files and returns a dictionary containing these variable and value(text) pairs.

PDA.py is the second python file which performs the main operations of the program. The compute() function does the stack operations and generates transition table. main() function asks for user input and displays relevant messages accordingly.

text files contain following details to define a PDA:

Total States on Line 1

Input Word Symbols(0,1) on Line 2

Stack Symbols 3

Initial State Symbol on Line 4

Initial Stack Symbol on Line 5

List of Final States on Line 6

Productions in the form of (Current State, Current Input Symbol, Current Top of Stack, Next State, Push/Pop Operation Symbol) from Line 7 and onwards.

Following PDAs are implemented in this program

1) $0^n 1^n$

1. So, initially a special symbol "\$" is being put in the empty stack.

2. Then, checking in the input string, if we encounter "0" and at the top of the stack lies "\$", we push "0" into the stack.

3. If the next letter we encounter is "1", and at the top of the stack lies "0", then we pop the "0" out of the stack.

4. So, overall we push the "0"s into the stack and pop out one "0" for every "1" we get in the input string.

5. Finally, after encountering all the letters of the input string, we found the "\$" symbol in the stack, then the string is being accepted otherwise not.

6. We also check that the input string is strictly of the form $0^n 1^n$, $n \geq 1$.

2) WCW^R (Palindrome)

1. Here, in an ideal case "W" is a combination of one string, "C" acts as a center/seperator of the input string and " W^R " is another string opposite of "W".

2. So, initially a special symbol "\$" is being put in the empty stack.

3. Then, all the alphabets of string "W" are being pushed into the stack.

4. The next alphabet encountered will be "C" which we are going to ignore.

5. The next set of strings will be of " W^R ", as the encountered alphabets start matching with the alphabets at the top of the stack, we'll start popping them out.

6. Finally, after encountering all the alphabets, if we find "\$" symbol in the stack, then the string will be accepted otherwise not.

7. We also check whether or not the input string is of the form WCW^R .

3) $0^n 1^{2n}$

1. So, initially a special symbol “\$” is being put in the empty stack.
2. Then, checking in the input string, if we come across “0” and “\$” is present as the up most element of the stack, we push “0” into the stack.
3. Again if we encounter “0” and the up most element of the stack is “0”, we push “0” into the stack.
4. When we encounter “1” and the up most element of the stack is “0”, we move to q_1 state from initial q_0 state.
5. If we again encounter “1” in q_1 state and the up most element of the stack is “0”, we pop a “0” out of the stack and move to q_2 state.
6. Again if we encounter “1”, we move from q_2 to q_1 state and then for immediate next “1” we as above(5).
7. Finally, after encountering all the letters of the input string, we found the “\$” symbol in the stack, then the string is accepted otherwise not.

4) *Number of 0s = Number of 1s*

1. Initially a special symbol “\$” is being put in the empty stack.
2. Then, checking in the input string, we encounter “0” or “1” and we push it into the stack. That means if “0” comes first, push it in the stack.
3. After “0” if again “0” comes then push it in the stack.
4. If “1” comes first, push it in the stack (“0” did not come yet). If again “1” comes then push it in the stack.
5. Now if “0” lies on top of stack and we encounter “1” then, pop “0”

Similarly if “1” is present on top of the stack and we encounter “0” then, pop “1”.

6. Finally, after encountering all the letters of the input string, we found the “\$” symbol in the stack, then the string is being accepted otherwise not.

RESULT

This project covers four examples of the implementation of pushdown automata. The results will be shown by a string which will be either “The string is accepted by PDA” or “The string is not accepted by PDA”. The user could select one out of the four options which are $0^n 1^n$, WCW^R , $0^n 1^{2n}$ and No. of 0’s equals to No. of 1’s. After running the program and inputting the string, the user will get to know whether or not the string is accepted by The Pushdown Automata.

FUTURE SCOPE

This model helps us to easily understand PDAs and study them properly with the help of transition tables. In the future we can design and add more PDAs in the format of text files and implement it using the same algorithm.

CONCLUSION

We have considered the problems of push down automata. These problems can be seen as model checking and context-free properties for pushdown models. We

have used Python for checking PDA for Palindrome, if number of 0s and 1s are equal or not and if no of 1s are twice as compared to number of 0s. We have seen how the system works and what are the methods of Data Collection and Analysis.

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REFERENCES

- [1] Another non-deterministic push-down automaton. available at <http://www.cs.binghamton.edu/~software/pda/pdadoc.html>.
- [2] Pushdown Automata Simulator by Felix Erlacher
- [3] <https://research.cs.queensu.ca/home/ksalomaa/julk/p47-okhotin.pdf>
- [4] <https://www.geeksforgeeks.org/introduction-of-pushdown-automata/>
- [5] https://www.researchgate.net/publication/51959108_Autonomous_push-down_automaton_built_on_DNA
- [6] <https://aclanthology.org/J14-3008.pdf>
- [7] https://www.researchgate.net/publication/242427937_Pushdown_Automata/link/0a85e532de95307b1e000000/download
- [8] https://www.tutorialspoint.com/automata_theory/pushdown_automata_introduction.htm
- [9] https://en.wikipedia.org/wiki/State-transition_table
- [10] Pushdown Automata Hendrik Jan Hoogeboom and Joost Engelfriet
- [11] Head Pushdown Automata Samson Ayodeji Awe
- [12] RE-DESIGNING THE PACMAN GAME USING PUSH DOWN AUTOMATA
- [13] Complexity of Input-Driven Pushdown Automata1 Alexander Okhotin2 Kai Salomaa3
- [14] Atig, M. F., Bollig, B., & Habermehl, P. (2017). Emptiness of Ordered Multi-Pushdown Automata is 2ETIME-Complete. *International Journal of Foundations of Computer Science*, 28(08), 945–975. <https://doi.org/10.1142/s0129054117500332>
- [15] Fransson, T. (2013). *Simulators for formal languages, automata and theory of computation with focus on JFLAP* [Student thesis, Mälardalens högskola, Akademin för innovation, design och teknik].

- <http://urn.kb.se/resolve?urn=urn:nbn:se:mdh:diva-18351>
- [16] LIN, H. J., & WANG, P. S. P. (1989). PUSHDOWN RECOGNIZERS FOR ARRAY PATTERN. *International Journal of Pattern Recognition and Artificial Intelligence*, 03(03n04), 377–392. <https://doi.org/10.1142/s0218001489000292>
- [17] Vayadande, Kuldeep, Ritesh Pokarne, Mahalaxmi Phaladesai, Tanushri Bhuruk, Tanmai Patil, and Prachi Kumar. "SIMULATION OF CONWAY'S GAME OF LIFE USING CELLULAR AUTOMATA." *International Research Journal of Engineering and Technology (IRJET)* 9, no. 01 (2022): 2395-0056.
- [18] Vayadande Kuldeep, Ram Mandhana, Kaustubh Paralkar, Dhananjay Pawal, Siddhant Deshpande, and Vishal Sonkusale. "Pattern Matching in File System." *International Journal of Computer Applications* 975: 8887.
- [19] Vayadande Kuldeep, Neha Bhavar, Sayee Chauhan, Sushrut Kulkarni, Abhijit Thorat, and Yash Annapure. *Spell Checker Model for String Comparison in Automata*. No. 7375. EasyChair, 2022.
- [20] VAYADANDE KULDEEP. "Simulating Derivations of Context-Free Grammar." (2022).
- [21] Vayadande, Kuldeep, Neha Bhavar, Sayee Chauhan, Sushrut Kulkarni, Abhijit Thorat, and Yash Annapure. *Spell Checker Model for String Comparison in Automata*. No. 7375. EasaafyChair, 2022.
- [22] Varad Ingale, Kuldeep Vayadande, Vivek Verma, Abhishek Yeole, Sahil Zawar, Zoya Jamadar. Lexical analyzer using DFA, *International Journal of Advance Research, Ideas and Innovations in Technology*, www.IJARIIT.com.
- [23] Kuldeep Vayadande, Harshwardhan More, Omkar More, Shubham Mulay, Atahrv Pathak, Vishwam Talanikar, "Pac Man: Game Development using PDA and OOP", *International Research Journal of Engineering and Technology (IRJET)*, e-ISSN: 2395-0056, p-ISSN: 2395-0072, Volume: 09 Issue: 01 | Jan 2022, www.irjet.net
- [24] Kuldeep B. Vayadande, Parth Sheth, Arvind Shelke, Vaishnavi Patil, Srushti Shevate, Chinmayee Sawakare, "Simulation and Testing of Deterministic Finite Automata Machine," *International Journal of Computer Sciences and Engineering*, Vol.10, Issue.1, pp.13-17, 2022.
- [25] Rohit Gurav, Sakshi Suryawanshi, Parth Narkhede, Sankalp Patil, Sejal Hukare, Kuldeep Vayadande, "Universal Turing machine simulator", *International Journal of Advance Research, Ideas and Innovations in Technology*, ISSN: 2454-132X, (Volume 8, Issue 1 - V8I1-1268, <https://www.ijariit.com/>
- [26] Kuldeep Vayadande, Krisha Patel, Nikita Punde, Shreyash Patil, Srushti Nikam, Sudhanshu Pathrabe, "Non-Deterministic Finite Automata to Deterministic Finite Automata Conversion by Subset Construction Method using Python," *International Journal of Computer Sciences and Engineering*, Vol.10, Issue.1, pp.1-5, 2022.
- [27] Kuldeep Vayadande and Samruddhi Pate and Naman Agarwal and Dnyaneshwari Navale and Akhilesh Nawale and Piyush Parakh, "Modulo Calculator Using Tkinter Library", EasyChair Preprint no. 7578, EasyChair, 2022

Effectiveness and Competencies of HR Professionals towards Human Capital Development

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Abstract:

The role of Human Resources is changing as fast as technology and the global marketplace. Human resources departments play a vital role in helping the organization meet its strategic goals by managing the workforce effectively and efficiently. Human Capital Trends change rapidly every year and organizations still face uncertainty every year. Slowing economies, geopolitical headwinds and instability due to automation, digitization and globalization are all contributing to this climate of caution. In an increasing world of change, there has never been a greater need to identify what Human Resource Professionals must be, know, do, and deliver to contribute more fully to their organizations. The positive result of these changes is that Human Resource Professionals have the opportunity to play a more strategic role in the business which will help Human Capital development.

There are many Human Resource Development Practices that are available as like millions of companies exist in the world. Then what is that which makes a company unique and successful? It is not the mere existence of practice but competent Human Resource Development Professionals which makes the company unique and successful. Thus this research is most important in current scenario.

The competent Human Resource Development Practices are those that create a value based, culturally strong, empowered organization where distances are notional. Human Resource Development deals with enabling people to get the best out of themselves and their lives.

Human Resource Development plays a vital role in meeting the changing requirement of competent human resources due to globalization. Based on this focus the researcher has conducted qualitative study to understand the effectiveness and competencies of HR Professionals towards Human capital development.

Keywords:

Competencies, Effectiveness, Human Capital Development, Human Resources.

INTRODUCTION

Global marketplace is rapidly changing over the years because of moderating variables like natural calamities, pandemic, geographic, demographic, social, cultural, political, economics and technology.

Since global market place is rapidly changing, *Human Capital Trends* including designing work for well-being, unleashing worker potential, building super-teams, governing workforce and accelerating the shift to re-architecting work, is speedily changing.

Because human capital trends are rapidly changing the *Role of HR* is also bound to change to a Business & Human-Centered role and propel transition from “People as a means to an end” to “People as the purpose of the business”.

While the role of HR changes, only the latest *HR Competencies* like accelerating business, advancing human capability, simplifying complexity, mobilizing information and fostering collaboration, can help deliver relevant human capital management and development practices.

Relevant *Human Capital Management and Development Practices* help to nurture a thriving workforce of effective, enabled and empowered employees.

In turn a *Thriving Workforce* helps to build *Successful Business Organizations* with *Sustainable Competitive Advantage*.

Based on this context and focus the researcher has conducted a qualitative study to understand the effectiveness and HR competencies of HR professionals towards human capital development.

Prominence of Human Capital Trends

Human Capital Trend means a general direction or fashion in which Human Capital is developing or changing rapidly over years in a VUCA World, where the business environment has become more volatile, uncertain, complex and ambiguous (VUCA).

Since the global marketplace scenario is swiftly changing, Human Capital Trends have changed, namely - governing workforce strategies, tapping into a broad talent pool, searching for technical & innately human skills, ensuring great-candidate-experience, building super-teams where productive-work happens, reskilling towards lifelong learning, unleashing worker potential beyond reskilling, redesigning hybrid-work, designing work for well-being, promoting work-life integration, re-inventing new forms of leadership, enhancing employee experience, sustaining company culture, aligning performance with purpose, enabling greater trust and shaping the future of work.

Significance of Human Capital Management

Work, Workforce & Workplace are the three pivotal dimensions of Human Capital Management, for any organization previously and during the on-going global pandemic, that are being influenced and impacted by the

following disruptors like, The Great War for Talent, The Era of Great Resignation, The Great Race to Reskill and The Great Leap to Energize the Employee Experience - created by new players, new business models & new customer-behaviour-shifts that are reshaping industries.

Human Capital Management in any organization has become more important than ever, to enable organizational success by working with the business teams, to pivot from traditional to future-workplace models, from hierarchal leadership to mindful leadership, from low-trust to high-trust, from stagnation to innovation, from instruction to self-direction, from worker-mind-set to entrepreneur-mind-set, from performers to high outperformers, from silos to collaboration, from thought leadership to unified execution leadership, from individualized best practices to institutionalized best practices, from employee engagement to employee experience, from career reversion to career progression and from conservatory work culture to participatory work culture, for rapid business transformation.

Impact of HR Competencies on Human Capital Management

Human Resource Competency means, the ability to do something successfully or efficiently with 'Application' of 'Expertise (specific learned activities)' in Human Capital Management. HR needs to transition effectively between strategic and functional roles, as they may be required to play different hats in different business situations.

Human Resource Competencies should evolve and be used by HR to create value inside with employees and organizations, and outside with customers, investors and communities in line with changing Human Capital Trends.

HR professionals have increasingly been urged to develop new competencies as 'HR business partners' in their ongoing search to integrate business strategy with people management practices. Large organizations have developed very sophisticated and role-specific competency models for business partners, and an academic research and consultancy industry has grown up around this area, especially for organizations.

According to Dave Ulrich et.al, (2007), 'In the world of business, familiar themes continually surface. Globalization has made the world a global village, and new markets offer new challenges and opportunities. Global issues like trade barriers, exchange rates, tariffs, and distribution become important elements of managerial choice. Technology has increased accessibility, visibility, and connection. The connected world is smaller, rapidly changing, and transparent. Customers have become increasingly segmented, literate, and demanding. Investors have become increasingly attuned to and actively concerned about not only financial results, but also intangibles. Competitors come from both traditional large global players and increasingly smaller investors. Employees represent

increasingly diverse demographic backgrounds. In some parts of the world, employees are aging more than in others. Employee expectations are constantly rising as they gain in education and skills. Most of these trends are outside the control of any one individual or any one company. They occur in both predictable and unpredictable ways. They affect all aspects of business from how to fund a firm to how to position the firm in customers' minds and how to engineer and deliver products. They also affect human resources. HR practices are becoming more integrated, aligned, and innovative. HR departments are operating more like a business within the business, with a clear strategy and channels of distribution'.

Dave Ulrich, has been tracking the ever-evolving competencies of HR professionals. In the mid-1980s, the primary effort was to study broad-based HR competencies. Eventually his research on competencies was with the desire to resolve three issues, namely (i) Define the competencies that add the greatest value to key stakeholders (ii) Figure out how HR professionals develop these competencies in the fastest and most effective ways (iii) Determine how HR competencies and HR practices align to business performance. In 1987, 1992, 1997, 2002, 2007, 2012, 2016 and 2021 surveys were conducted to evolve the HR competency models, once in a gap of 5 years and not each year. But HR Competencies and its real-time application has to rapidly change, to rapidly changing Human Capital Trends.

Effectiveness and Competencies

Human Capital Development Practices positively impact business performance considerably. But while identifying and understanding HR Competencies and their relationship to Human Capital Development Practices, there is a dire need to sustain the transformation of the HR function.

HR professionals must develop and demonstrate a new set of competencies to fulfil their changing roles and create sustainable competitive advantages. Given this requirement, it is clear that HR professionals must be fully competent in strategy development, implementation and evaluation.

Effectiveness of HR professionals towards human capital development matters more than ever because leaders of business have increasingly recognized the importance of individual abilities (talent), organization capabilities (culture) and leading skills (leadership) as key to the success of their organizations.

In an increasing world of change, there has never been a greater need to identify what HR professionals must be, know, do, and deliver to contribute more fully to their organizations.

Being an effective HR professional is not just knowing the body of knowledge and HR Competencies that defines the profession but being able to apply that knowledge to Human Capital Development Practices.

Statement of the Problem

Globally, the 21st century economic landscape has become volatile and unstable. Thus, firms must continue to reinvent themselves in order to maintain the competitive edge.

The current rise in knowledge work, as well as reduced product life cycle time, workforce diversity, flatter, leaner and more participative organizations have put priority on human capital as the major strategic asset of organizations that strive for sustainable competitive advantage (Akinyemi, 2007; Becker, Huselid, & Ulrich, 2001; Kearns, 2004; Mercer, 2003; Pfeffer, 1998; Torraco & Swanson, 1996; Ulrich, 1998; Wright, 1999).

Human Resources Development departments play a vital role in helping the organization meet its strategic goals by managing the workforce effectively and efficiently. The role of Human Resources is changing as fast as technology and the global marketplace. Human Resource Development plays vital role meeting the changing requirement of highly skilled and competent human resource due to globalization. Best Practices in HR are subjective and transitory. In the business world there are changes and challenges every minute, unlike Human Resource Development in most companies. Since the future and success of any organization depends upon its dynamic and skilled personnel, it is thus important to understand the effectiveness and competencies of HR professionals towards human capital development.

This study focused on various domains of HR competencies such as Efficient Talent Acquisition, Productive Power and Time, Teaming and Leading the Talent, Optimize Talent Strategies, Transformative HR Actions, Engaging and Employees Energy, Workforce Innovation and Utilization, Effective Imitativeness, Sustainable competitive advantage, Strategies to retain Human resources, and Proactive HR Approaches.

Need and Importance

Human Resource Development practice is multi-dynamical. It is about developing the people, place and organization. Real development of any organization will get propelled only if there is proper development of manpower or personnel. There can be no organization without Human Resource Development Practices. There are many Human Resource Development Practices are available as like millions of companies exist in the world. Then what is that which makes a company unique and successful? It is not the mere existence of practice but unique competencies of Human Resource Development professionals which make the company unique and successful. "For HR professionals to respond to changing business conditions, they must demonstrate new competencies. HR professionals who would have been successful in previous decades would not be effective today. We have worked for the last 20 years to identify the competencies that enable HR professionals to respond to business conditions. HR competencies are

the values, knowledge, and abilities of HR professionals. HR professionals with the right competencies will perform better. They will be more likely to engage employees, to serve customers, and to create intangible shareholder wealth. HR competencies define what is expected from those who work in HR and form the basis for assessment and improvement in the quality of HR professionals" (McLagan, 1983). The study focuses on the influence of rapidly changing Human Capital Trends on HR Competencies and to analyze the effectiveness of HR Competencies of HR Professionals and its real-time application in Human Capital Development Practices. Thus this research is most important in the current business scenario.

Objectives of the Study

- 1) To determine the influence of Human Capital Trends on HR Competencies.
- 2) To evaluate how HR professionals develop these HR competencies in the fastest and most effective ways.
- 3) To assess the effectiveness of HR Competencies of HR Professionals towards Human Capital Development Practices.

Research Methodology

The scientific and systematic way of solving a research is research methodology. It refers to the various sequential steps adopted by a researcher in studying the research problem with certain objectives to solve the issue. The research design considered to be the basic framework of research methods and techniques which are selected by the researcher based on the suitability for their study. The research design for this study is Descriptive Research Design. The descriptive study is used to analyze and understand the Effectiveness and Competencies of HR Professionals towards Human Capital Development. The researcher adopted Qualitative method to the study. Case study was the research tool used to collect the data from the respondents. Six senior HR Professionals were interviewed personally in consideration to the objectives of the study. The Universe of the study was HR Professionals from various HR Forums. The purposive sampling technique (Non-Probability sampling) was used in the study for data collection. Using the sampling techniques mentioned, the sample of six respondents were identified and selection for the purpose of the study. The data was analyzed systematically and the information gathered was presented with the interpretation of categories of various domains. The researcher used thematic analysis for interpretation of the collected data.

Result and Discussion

Contemporary organizations are essentially people driven. Termed as Human Resources in HR parlance, the contribution of people towards success is established. Organizational environment is characterized by

competition and performance, thus making traditional human resource practices in managing people redundant. Creating new forms of competitive advantage has thus become a major area of concern for organizations. It gets all the more complex in the contemporary knowledge based industry with knowledge workers contributing to the organization in the form of human capital. The search for newer forms of competitive advantage in organizations are being seen in the name of competencies at the individual level and creating value to the human resource management (Berardine 1997, Hagan 1996, Nordhaug 1993).

The overview of each case study with respondents in the HR fraternity, from multiple industries, is summarized below.

Case Study 1

This respondent is the CHRO of a manufacturing firm. His organization follows contemporary hiring practices for candidate experience. Rate of quality production, sales volumes and new product development propels productive power and innovation. Cross-generational workforce and skill-match to job-role helps workforce management. Regular cadences, online performance management system, automation of repetitive tasks, meaningful engagement, job-rotation, multi-skilling, enhanced benefits and reward mechanisms are few talent management strategies used. Culture transformation, grade re-structuring, balance score-card, role clarity and buddy program, were few Transformative HR Actions. Month end movie outing, sponsoring for special education, family & annual get together are few employee engagement interventions followed to boost employee morale & energy. Individual passion related KRA, Execution excellence awards, unique sales contribution awards, Star performer awards and Budgets for small experiments promotes workforce innovation & utilization. Compensation benchmarking, quality targets, systems and process improvement supported sustainable competitive advantage of organization in the marketplace. Employee Engagement survey, long term service awards, retainer bonuses, attrition limit awards to managers handling teams, performance linked bonus linked with full year of service and quarterly town hall meeting to hear employee voice, were few strategies to retain employees. Updating of policies, leadership communication with line managers and engagement conversations from HR to employees were few pro-active HR approaches taken.

Managing aged workforce and fast track growth for millennials continues to be a challenge.

Case Study 2

This respondent is the HR Leader of a shipping port. Hiring of locals and diverse workforce, were few efficient talent acquisition practices undertaken. Knowledge sharing sessions and employee work's committees helped improve productivity. Mentoring, reduced micromanagement and employee empowerment helped better workforce management. Tailoring

employee experiences and optimizing workforce planning were few talent strategies adopted. Data analytics in decision making and periodical department meetings were few notable transformative HR actions taken. Innovation Club was a unique intervention used to boost employee morale & energy. Digitization of routine activities and skill upgradation were interventions for better workforce innovation & utilization. Right skilled-people for right job and consistency in customer outreach, helped HR to support for sustainable competitive advantage.

Pro-Active HR approaches and unique strategies to retain employees has more scope for improvement.

Case Study 3

This respondent is a HR Business Partner in an IT Infrastructure Management Company. Reducing the number of interviews for a position was a unique talent acquisition practice followed. Flexibility in work timings and decentralization of roles were few transformative HR actions taken.

No pro-active HR approaches, interventions and talent strategies were deployed for enhanced productivity, teaming, workforce management, workforce innovation & utilization to retain employees.

Case Study 4

This respondent is a HR Business Partner in an IT Software Company. No innovative talent acquisition practices were followed, owing to increased open positions to be closed. Mentoring programs increased productivity. Division of labour, work-life balance, weekly learning sessions and spot-feedback on performance are few talent management interventions deployed. Process simplification was a transformative HR action taken. Manager-Worker trust and intense technical trainings helped workforce utilization. HR automation of process increased enhanced efficiencies.

Not much of importance for pro-active HR approaches, employee engagement interventions, innovation and strategies to retain employees, for sustainable competitive advantage.

Case Study 5

This respondent is an L&D professional in the hospitality sector. Hiring of physically challenged is a unique talent acquisition practice followed. Team huddle before shifts and leave sharing policy helped boost productivity. Learning and development programs helped better workforce management. Maximum utilization of available resources continues to be key to optimization. Interim retention bonus is a strategy to retain employees. Memorable customer service is considered key for customer loyalty.

Ongoing pandemic, has not paved way for new talent strategies, transformative HR actions, employee engagement and pro-active HR approaches.

Case Study 6

This respondent is a recruitment professional in a technology start up. Exponential salary to attract the

crème of top technology talent is the most preferred talent attraction strategy. Innovative technical projects and hybrid work policy helps in productivity and work-life balance. Workforce management is easy given the lean headcount in the start-up. Employee Engagement events happen virtually and sometimes in office.

Fear of business progress owing to recession in information technology sector prevails. Talent strategies, transformative HR Actions, strategies to retain employees and pro-active HR approaches, are yet to gain momentum since the company is in a start-up stage.

Summary of Case Studies

Human Capital Trends differ from industry to industry and is changing at a rapid pace, due to moderating variables like natural calamities, pandemic, geographic, demographic, social, cultural, political, economics and technology. Not all HR Professionals are aware of the rapidly changing Human Capital Trends in their industry, due to low industry-awareness. HR Competencies within HR, differs from one role to another, one job level or grade to another and one industry to another. The need and importance of relevant HR Competencies and Framework is largely not valued, except by Senior HR professionals. Evolving HR Competencies that add the greatest value to key stakeholders are not well defined, understood, developed and evaluated by many HR Professionals across industries. The maturity levels of HR Competencies vary from novice, beginner, intermediate, expert to world class, in HR Professionals, based on their level of experience and exposure. HR Competencies like accelerating business, advancing human capability, simplifying complexity, mobilizing information and fostering collaboration that are evolving, can help deliver relevant human capital management and development practices. There is a lack of understanding in many HR Professionals on how HR Competencies and Human Capital Development Practices align to business performance, due to low business acumen. HR Competencies and its application towards Human Capital Development Practices has not rapidly changed, to the rapidly changing Human Capital Trends and largely cause ineffectiveness.

Majority of HR Professionals have an inability to predict future skill needs and fulfil them on time, despite the best talent acquisition practices. Hybrid work that is driving business transformation, is a balancing act on productive power, productive time and productivity. Building culture with purpose, helps in teaming and leading talent. Only Organizational Design and Change Management as a HR competency, can help build winning talent strategies. The competency of harnessing analytics with objective and actionable insights can propel transformative HR actions at a desired level. Irresistible employee experiences, will promote employee engagement, and largely boost employee morale & energy. Implementing best practices around Innovation paves way to growth and efficiency.

Competency to identify the future of work trends, most relevant to each business, will provide a sustainable competitive advantage to organizations in the marketplace. Pro-Active HR approaches and strategies to retain employees need to be more contemporary than conventional.

Suggestions and Recommendations

- 1) There is a lack of understanding in many HR Professionals on how HR Competencies and Human Capital Development Practices align to business performance, due to low business acumen so the organization should provide them proper training to understand the significance of competencies to face the HR challenges in the contemporary world.
- 2) HR professionals need to be aware that a new model for HR is emerging. Hence the presence of competency-consciousness will help diagnose, design, develop and evaluate the latest and best of HR Competencies in HR Professionals.
- 3) HR Professionals in organization will need to adopt a consequential and accountable DEIB Strategy (Diversity, equity, inclusion and belonging).
- 4) While rising turnover is increasing competition for talent and pandemic-disruption overturns workforce planning - talent intelligence and skills taxonomy will have to become the cornerstone of any people strategy.
- 5) An effective talent management model should pivot from essential talent activities, to critical talent growth, to managed talent relationships and finally blossom into an inclusive talent system.
- 6) Learning, skills, and career progression tracks will have to become business critical for human capital development.
- 7) Companies will need to invest in a digital future, re-architect their HR technology and rethink HR.
- 8) People analytics will require to touch on every aspect of business, with objective and actionable insights and propel transformative HR actions at a desired level.
- 9) HR Professionals will require to increase overall workforce health and drive resilience.

Conclusion

In this research an attempt has been made to study the effectiveness of HR competencies of HR professionals towards human capital development. While the existing practices serve as key practices which bring the desired organizational growth and better results, there is an urgent need to introduce more effective human resource development practices. Thus the competencies of human resource development professionals which constructively work towards the successful attainment of personal and organizational-vision and objectives, is pivotal.

This research study will be useful in providing knowledge, experiences of human resource development

professionals and organizations on how effective they contribute to human capital development. It is not the mere existence of the existing human resource development practices which make an organization visible but it is the best human resource development competencies which will be utilized properly and constantly will bring greater glory, high employee satisfaction, increased profits and human capital development.

Organizations are becoming more agile, more flexible, more empathetic, and more digital than ever. The coming years will bring in newer and unforeseen challenges. But, HR Competencies and its real-time application towards Human Capital Development Practices will have to rapidly change, to the rapidly changing Human Capital Trends.

While HR Professionals are increasingly aware of gaps and the ineffectiveness between rhetoric HR-competencies and the actual reality of Human Capital Development, it is increasingly important to develop a critical awareness of HR competencies and their effectiveness in transforming HR roles and the HR function for long-term strategic success, to build a Thriving Workforce that in turn helps to build Successful Business Organizations with Sustainable Competitive Advantage.

REFERENCES

- [1] Akinyemi, B.O. (2007). Organizational Knowledge Management in the new economy. *Management Journal*, Vol. 43, 24-32, 2007.
- [2] Berardine T., "Human resource information systems improve management decision-making", *Canadian Manager*, 22 (4), pp 17-18, 1997.
- [3] B. Becker, M. Huselid, & D. Ulrich D., "HR as A Strategic Partner: The Measurement Challenge", "In the HR Scorecard: Linking People, Strategy, and Practice", Harvard Business School Press, Boston, pp 1 - 26, 2001.
- [4] Dave Ulrich, Wayne Brockbank, Dani Johnson, and Jon Younger, "Human Resource Competencies: Responding to Increased Expectations, *Employee Relations Today*", 2007, <https://deepblue.lib.umich.edu/bitstream/handle/2027.42/57368/20159?sequence=1>
- [5] Junko Kaji, Blythe Hurley, Aparna Prusty, Rupesh Bhat, Sayanika Bordoloi, Nairita Gangopadhyay, and Abrar Khan, "2021 Deloitte Global Human Capital Trends", *Deloitte Insights*, pp 4 - 7, 2020, <https://www2.deloitte.com/global/en/pages/human-capital/articles/gx-human-capital-trends-library-collection.html>
- [6] Josh Bersin, Kathi Enderes, Janet Mertens and Nehal Nangia, "HR Predictions for 2022", pp 6 - 7, 2021, https://joshbersin.com/wp-content/uploads/2021/12/WT-21_12-HR-Predictions-for-2022-Report.pdf
- [7] Dave Ulrich, Mike Ulrich, Erin Wilson Burns and Patrick Wright, "New HRCS 8 Competency Model Focuses on Simplifying Complexity", pp 1 - 2, April 2021, <https://df42wlfgr5mw.cloudfront.net/Articles/New+HRCS+8+Competency+Model+Focuses+on+Simplifying+Complexity.pdf>
- [8] C.M.Hagan, "The Core Competence Organization: Implications for Human Resource Practices", *Human Resource Management Review*, 6 (2), pp 147 - 164, 1996.
- [9] Nathan Bennett G. James Lemoine, "What VUCA Really Means for You", *Harvard Business Review*, Vol.1, Issue No. Jan-Feb 2014, pp 1 - 2, 2014, <https://hbr.org/2014/01/what-vuca-really-means-for-you>
- [10] O. Nordhaug, "Human Capital in Organizations", Oslo: Scandinavian University Press, 1993.
- [11] J. Pfeffer, "The Human Equation: Building Profits By Putting People First", Boston: Harvard Business School Press, 1998.
- [12] Karen Lo, Keith Macky & Edwina Pio, "The HR competency requirements for strategic and functional HR practitioners", *The International Journal of Human Resource Management*, Vol.26, Issue No.18, pp 2308 - 2328, 2015, https://www.researchgate.net/publication/276910921_The_HR_competency_requirements_for_strategic_and_functional_HR_practitioners
- [13] P. Kearns, "How Strategic Are You? The Six "Killer" Questions", *Strategic HR Review*, 3, pp 20 - 23, 2004.
- [14] P. McLagan, D. Bedrick, "Models for excellence: The results of the ASTD training and development study. *Training and Development*", 37(6), pp 10 - 20, 1983.
- [15] Mercer, "Building A Human Capital Strategy", *Strategic HR Review*, 2, pp 12 - 16, 2003.
- [16] Dave Ulrich, "What's Next For HR?", *HR Magazine*, pp 2 - 18, 2010, https://www.hrmagazine.co.uk/article-images/99364/HR_ebook_WhatsNext%20for%20HR.pdf
- [17] Raymond Caldwell, "HR business partner competency models - Re-contextualising effectiveness", *Human Resource Management Journal*, Volume 18, No 3, pp 275 - 294, 2008, <https://pdfs.semanticscholar.org/fa11/7bc14d70dc1c7595cb4ec95f1d6e3fe1b376.pdf>
- [18] Dave Ulrich, Wayne Brockbank, Dani Johnson, & Jon Younger, "Human Resource Competencies - Rising To Meet The Business Challenge", *RBL Group*, pp 2 - 7, 2010, <https://c.ymcdn.com/sites/www.hrexecutiveforu>

- m.org/resource/resmgr/Articles/HRCSRisingto
meetthebusinesschallenge.pdf
- [19] Sunil J. Ramlall, "Identifying and Understanding HR Competencies and their Relationship to Organizational Practices", *Applied H.R.M. Research*, Volume 11, pp 27 – 38, 2006.
- [20] R. Torraco, R. Swanson, "The Strategic Roles of Human Resource Development", *Human Resource Planning*, 18, pp 10 - 21, 1996.
- [21] D. Ulrich, "A New Mandate for Human Resources", *Harvard Business Review*, Jan-Feb, pp 124 - 133, 1998.
- [22] P.M. Wright, "What next? Key findings from the 1999 state-of-the-art practice study", *Human resource Planning*, 22, pp 12 - 20, 1999.

Randomly Generating Music Using Context Free Grammars

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Abstract:

This paper aims to discuss the creation of music with the help of sequence generators with the aim of assisting artists in their integration. The series of steps is summarized to show the composition as nothing but a tabular flow of data refinement, and each and every step involved in the process is designed to benefit its functions. The basis of the proposal is a context-free grammar i.e. CFG method which was basically developed to produce random strings. A sequence of strings is then modelled to produce an output like a song.

Keywords:

Automata, Context-Free Grammars, Music Algorithm, etc.

INTRODUCTION

Music, though it is a masterpiece in its entirety, tends to follow a set of man-made rules to turn sounds into fun things on the toes. These rules are primarily subjective and their meaning differs in a number of cases, mostly when time is involved, but this issue does not make it difficult to hide and for this reason, the creation of music was possible through computer science. The general process of creating a musical instrument is one of extreme perfection and should be considered in all human music genres possible, for this very reason we tried to provide a tool in this paper to support the artist's creative work using musical suggestions[7]. We have developed a program to define grammatical grammar (CFGs) and extensions sequence of non-terminal terminals using random production.[11] This is in contrast to the most common function of analyzing a series of pre-produced terminals into high-level nonterminals, which is a retrospective process. A series of inputs can be processed to give a sound or a song as an output.[5]

PROBLEM STATEMENT

As we know, the use of Context Free Grammar is nothing but to generate all possible patterns or sets of strings. These strings are not given in an informal language. Sometimes, it becomes easy to classify and sometimes difficult. Context free grammar, hence makes it easier to play with strings and generate randomly various types of files. Context Free Grammar and Finite automaton are very useful here, as it enables us to build fast and responsive document search engines. The model is aimed to solve this problem using Context Free Grammars.

LITERATURE SURVEY

Authors Salim Perchy, Gerardo Sarria in their paper on Creation of Music using context free grammars,[1] suggest that the Basics of the project are grounded in context-free grammars and discrete mathematics. In this paper, the authors discussed the overall design of a music sequence generator for the sake of helping musicians and artists in their work and making their tasks simpler. And they have successfully created an algorithm to generate strings from Grammar. The paper was so helpful for us to proceed further.

According to the paper 'Automatic Learning of Context-Free Grammar' published by Tai-Hung Chen, Chun-Han Tseng,[16] learning context-free grammar from a given text sample is not an easy task. In the research paper, they have studied the problem to learn context-free grammar from the masses. Also, they researched a technique that is completely dependent on the motion of minimal description of its whole length.

Authors Abhishek Singh, Andre L M dos Santos, published a paper 'Context-Free Grammar for the Generation of a One Time Authentication Identity'.[17] According to the paper, the authentication protocol has been proposed to generate a temporary authentication that can be used as a disposable password and then can be used for the creation of a loan card numbering number. The proposed protocol was developed using free grammar by context and was in the field of learning theory. The protocol may be difficult to explore by the situation used in the authentication procedure. This article explains the relationship between learning theory and theories of theories. Based on experimental constraints to study the context of free grammar, They discuss an algorithm to generate these context-free grammars that are difficult to learn.

Author Darrell Conklin published a paper 'Music Generation from Statistical Models'. According to the paper,[2] the statistical models are not only useful to build such models but also solve the problem of musical style imitation.

They think that to generate a piece from an analytic version is consequently to sample a piece that has an excessive probability in line with the version; probably better than its chance consistent with competing fashions. it's far essential to be aware that an excessive probability piece now does not include the simplest excessive opportunity events. The paper definitely helps

in the development of the required domain in the field to generate random music.

In the paper ‘Grammar Based Music Composition’ published by Jon McCormack,[15] the authors saw that parametric extension in the grammar part allowed and the specification of the data which is continuous for modulation as well as control. The data which is continuous is under a certain type of control of the context grammar. They use non-deterministic context grammar along with the context-sensitivity. It also allows the simulations of Markov’s model which is of the n th order with a more accurate and slightly better economical representation than the previous transitive matrices used to give. Also, it has given not only more flexibility than the last models of the composition which were based on finite state automata or the Petri nets. When we use different symbols in the grammar, one can surely represent the relationships between any notes, in sync with hierarchical grammatical representations, allowing the emergence of complex music compositions from comparatively simple grammar.

Michelle P. Banawan, in the paper ‘A Context-Free Grammar for Requirements Modeling’ published in 2012,[18] proposed a CFG that aims to restrict the identification of the use cases of a system to adhere to the discipline of requirements engineering. Rules that govern the identification of events (designated as syntactic categories), use cases and other information system requirement components (designated as the set of valid terminals) were modelled and captured with the use of the proposed CFG.

CONTEXT FREE GRAMMAR

Typically, a phrase structure grammar is a fixed grammar which contains specific rules of a certain form while creating.

A formal grammar can be called "context-free" only if the production rules can be applied in any way in the context of nonterminal. It is not important which symbols encircle it, the only nonterminal on LHS can every time be replaced by the RHS. This is the key point that makes it different from context-specific grammar. The dignified grammars are the set of rules which explain all possible strings for the provided language.

Context-free languages are the languages that are taken from context free grammar. Various categorical grammars can produce similar lexical language. It is important to differentiate the contents of language from that of grammar.

Context free grammar was invented by Noam Chomsky in linguistics to describe the sentences in general language and word formation. As the use of concepts that were repeatedly used increased, they started using grammar to elaborate the organization of programming languages. Nowadays, we can observe Document Type Definition as an essential part of Extensible Markup Language (XML).

Sometimes, some authors refer to context-free grammars as phrase structure grammars, however, they are distinct from what dependency grammars are. Although, in computational science, context-free grammar is also known as Backus-Naur form or BNF.

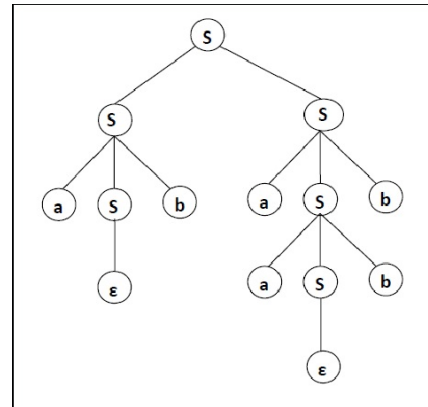


Fig. 2: CFG generator

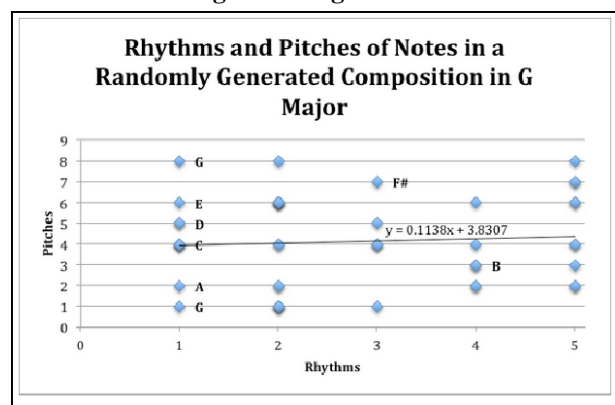


Fig. 3: Graph of pitches VS rhythms

ADVANTAGES

- provides a precise mathematics definition that clearly rules out certain types of languages.
- The formal definitions mean that CFGs are computationally TRACTABLE - There is a possibility to write a computer program and it determines whether sentences are grammatical or not.

DISADVANTAGES

- Lexically rules are often difficult in specific cases of Context-free grammar.
- Notations described in Context-free grammar are quite complex.
- By using context-free grammar, it sometimes becomes very difficult to reconstruct the recognizer.

PROPOSED SYSTEM

We propose a system similar to those which generate random characters using context free grammar and then sequence them with musical chords and then generate waveforms of the same which will then be converted

into playable songs or sounds. New grammars can now be produced to generate different and unique sounds.

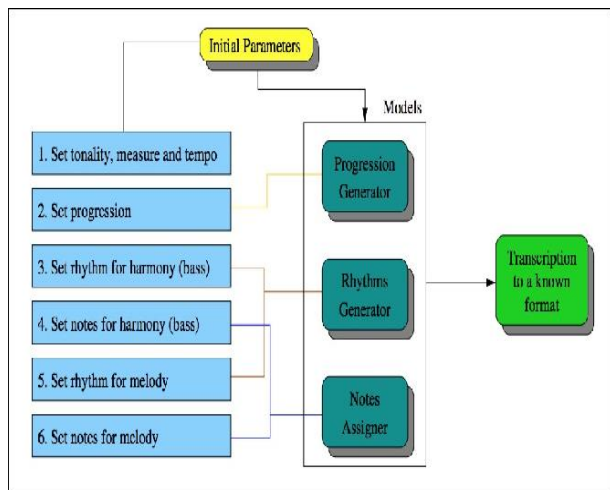


Fig. 4: Initial Parameters

OUR APPROACH

We need to discover a solution for cfg to generate random music. There were various steps in between to perform the tasks. Algorithms used are:

```

sound:
  init any+ : 1

init:
  '+sin([220-880])' : 2
  '+saw([220-880])' : 1
  '+square([220-880])' : 5

any:
  '+sin([220-880])' : 2
  '+saw([220-880])' : 1
  '+square([220-880])' : 1

'+sin([220-880])' : 5
'+saw([220-880])' : 3
'+square([220-880])' : 3
  
```

Fig. 5: Code

Here is an example of gen.py using this grammar, which is saved in sound.yaml:

```

$ python gen.py "sound" sound.yaml
['sound']
['init', 'any+']
['+square([220-880])', 'any', 'any*']
['+square(349)', '*sin([220-880])', 'any', 'any*']
['+square(349)', '*sin(426)', '*sin([220-880])']
['+square(349)', '*sin(426)', '*sin(645)']
  
```

Fig. 6: Implementation of grammar

```

song:
  - note note note note+ : 1

note:
  - C : 1
  - D : 1

  - E : 1
  - F : 1
  - G : 1
  - A : 1
  - B : 1

A: {sin(440) : 1}
Bb: {sin(466) : 1}
B: {sin(494) : 1}
C: {sin(523) : 1}
Db: {sin(554) : 1}
D: {sin(587) : 1}
Eb: {sin(622) : 1}
E: {sin(659) : 1}
F: {sin(698) : 1}
Gb: {sin(740) : 1}
G: {sin(784) : 1}
Ab: {sin(831) : 1}
A2: {sin(880) : 1}
  
```

Fig. 7: Composing the grammar

SCOPE OF THE PROJECT

This project gives an end to end solution to generate music using context free grammar. Each note is assigned to a language and as grammar is generated, new music sequences can also be generated. This will lead to new innovations in music and will open doors to new types of music for the world. Automata of Music in the rhythmic sense of the music described in a certain set of symbols or the and the nodes and also whenever one is repeatedly the same or by making this thing rhythmic makes the good music, they give a brief idea to the musicians how to play, like each of the stroke defines the frame of sound in that particular music played at that moment they are like some encoded language for musicians here are some of the music strokes(automata) of some famous song which you may know.

OUR CONTRIBUTION

We have developed a program to define grammatical grammar (CFGs) and extensions sequence of non-terminal terminals using random production. This is in contrast to the most common function of analyzing a series of pre-produced terminals into high-level non-terminals, which is a retrospective process. A series of inputs can be processed to give a sound or a song as an output. We propose a system similar to those which generate random characters using context-free grammars and then sequence them with musical chords and then generate waveforms of the same which will then be converted into playable songs or sounds. New grammars can now be produced to generate different and unique sounds.

CONCLUSION

We can hereby conclude that music can be generated randomly using context free grammar by correlating strings to waveforms and compiling them to form a sound as an output. So we have .yaml files to do so. Common python libraries used in the project are contextlib, scikits.audiolab, wavgen, NumPy and operator. The research paper gives a deep idea of context free Grammar and its implementation in the domain to generate random music. The paper also describes automation in the field.

FUTURE SCOPE

We will try to make formal rules easy in lexical grammar. Also, we will try to simplify the notation described in CFG. Then we will try to make the task of reconstructing the recognizer easy using lexical grammar. We will try to increase the speed of getting output. We will also try to propose a different system that generates random characters using CFC and then sequence them with musical chords.

REFERENCES

- [1] Salim Perchy, Gerardo Sarria. Musical Composition with Stochastic Context-Free Grammars. 8th Mexican International Conference on Artificial Intelligence (MICA I 2009), Nov 2009, Guanajuato, Mexico.
- [2] Conklin, D.: Music Generation from Statistical Models. In Proceedings of the AISB 2003 Symposium on Artificial Intelligence and Creativity in the Arts and Sciences. Aberystwyth, Wales (2003)
- [3] An Efficient Recognition and Syntax-Analysis Algorithm for Context-Free Languages: Kasami, T. (1966)
- [4] Vayadande, Kuldeep, Ritesh Pokarne, Mahalaxmi Phaladesai, Tanushri Bhuruk, Tanmai Patil, and Prachi Kumar. "SIMULATION OF CONWAY'S GAME OF LIFE USING CELLULAR AUTOMATA." International Research Journal of Engineering and Technology (IRJET) 9, no. 01 (2022): 2395-0056.
- [5] Vayadande, Kuldeep, Ram Mandhana, Kaustubh Paralkar, Dhananjay Pawal, Siddhant Deshpande, and Vishal Sonkusale. "Pattern Matching in File System." International Journal of Computer Applications 975: 8887.
- [6] Vayadande, Kuldeep, Neha Bhavar, Sayee Chauhan, Sushrut Kulkarni, Abhijit Thorat, and Yash Annapure. Spell Checker Model for String Comparison in Automata. No. 7375. EasyChair, 2022.
- [7] WAYADANDE, KULDEEP. "Simulating Derivations of Context-Free Grammar." (2022).
- [8] Vayadande, Kuldeep, Neha Bhavar, Sayee Chauhan, Sushrut Kulkarni, Abhijit Thorat, and Yash Annapure. Spell Checker Model for String Comparison in Automata. No. 7375. EasyChair, 2022.
- [9] International Journal of Advance Research, Ideas and Innovations in Technology, Jamadar. Lexical analyzer using DFA, Varad Ingale, Kuldeep Vayadande, Vivek Verma, Abhishek Yeole, Sahil Zawar, Zoya www.IJARIIIT.com.
- [10] Kuldeep Vayadande, Harshwardhan More, Omkar More, Shubham Muley, Atahrv Pathak, Vishwam Talanikar, "Pac Man: Game Development using PDA and OOP", International Research Journal of Engineering and Technology (IRJET), e-ISSN: 2395-0056, p-ISSN: 2395-0072, Volume: 09 Issue: 01 | Jan 2022, www.irjet.net
- [11] Kuldeep B. Vayadande, Parth Sheth, Arvind Shelke, Vaishnavi Patil, Srushti Shevate, Chinmayee Sawakare, "Simulation and Testing of Deterministic Finite Automata Machine," International Journal of Computer Sciences and Engineering, Vol.10, Issue.1, pp.13-17, 2022.
- [12] Rohit Gurav, Sakshi Suryawanshi, Parth Narkhede, Sankalp Patil, Sejal Hukare, Kuldeep Vayadande, "Universal Turing machine simulator", International Journal of Advance Research, Ideas and Innovations in Technology, ISSN: 2454-132X, (Volume 8, Issue 1 - V8I1-1268, <https://www.ijariit.com/>)
- [13] Kuldeep Vayadande, Krisha Patel, Nikita Punde, Shreyash Patil, Srushti Nikam, Sudhanshu Pathrabe, "Non-Deterministic Finite Automata to Deterministic Finite Automata Conversion by Subset Construction Method using Python," International Journal of Computer Sciences and Engineering, Vol.10, Issue.1, pp.1-5, 2022.
- [14] Kuldeep Vayadande and Samruddhi Pate and Naman Agarwal and Dnyaneshwari Navale and Akhilesh Nawale and Piyush Parakh, "Modulo Calculator Using Tkinter Library", EasyChair Preprint no. 7578, EasyChair, 2022
- [15] McCormack, J.: Grammar-Based Music Composition. Complexity International Vol. 3 (1996)
- [16] 'Automatic Learning of Context-Free Grammar' published by Tai-Hung Chen, Chun-Han Tseng
- [17] Authors Abhishek Singh, Andre L M dos Santos, published a paper 'Context Free Grammar for the Generation of a One Time Authentication Identity'. Salim Perchy, Gerardo Sarria. Musical Composition with Stochastic Context-Free Grammars. 8th Mexican International Conference on Artificial Intelligence (MICA I 2009), Nov 2009, Guanajuato, Mexico.
- [18] Michelle Banawan, 'A Context Free Grammar for Requirements Modeling'

Finite Automata Application in String Identification

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Abstract:

Automata Theory is very useful in programming languages. It can have various applications. One of its applications is for the evaluation of regular expressions. In this paper, the discussion of pattern matching is done. The given input will be searched for the pattern. This proposed model will give the information about the content of the given input string. This concept needs a complicated programming model. Many techniques are present for the process of pattern matching. Finite Automata can be used in the pattern matching process to identify the patterns. It can also be used for making memory efficient by minimizing the number of states, minimize the number of transitions.

Keywords:

Pattern Matching Machine, Finite Automata, C++.

INTRODUCTION

Method of taking input and performing some required operations at the center to provide the output based on a set of rules or algorithms is called Computation [2]. Automata principle is the study of abstract machines and automata. It also deals with computational problems and their solutions. It's miles a concept in theoretical PC technological know-how. A finite state machine abbreviated as FSM, can be used for representing any language . A language is what basically consists of a set of strings. Finite automata are used in diverse fields in solving complex problems, the use of algorithms and different techniques [1]. Finite automata requires input as a string from enter tape hence the enter tape is split into cells and each cellular can have one enter image [2].

Finite automata is basically divided into two subtypes, deterministic finite automata (DFA) and non-deterministic which is also known as finite type of automata(NFA) [5]. Non-deterministic finite automaton is nothing but a finite set with one start state and a set of accepting states. It allows 0, 1 or more transitions from a state for the same input symbol.

A DFA consists of a finite set of states and the finite set of some input tapes. This allows you to switch while having an input symbol other than the same input symbol.

Pattern Matching checks a given sequence of tokens/strings for the presence of some pattern. Basically input string is compared with a predefined stored pattern[6]. This paper discusses the same concept. It tells what the input string contains. Whether it contains a number, character or a symbol. This paper discusses finite automata construction based on programming. This machine is created by using C++ programming language.

LITERATURE REVIEW

1. Jiwei Xue, Yagao Li and author of eighty Nan [1] use Finite Automata with a basic schooling which is one of the key to organizing a lifelong studying software. The corresponding paper describes a finite type automata theory, and to ensure records protection, prioritizes -automaton restrained to reveal and filter out text statistics entered using well suited or asynchronous communicate gear furnished by the network have a look at.
2. Ms.J.Nirmala , Mrs. V.Rajathi authors [4] used numerous finite automata set of rules, size and time complexity is reduced the use of various techniques. Programming languages are used for building numerous types of finite automata and to accept binary input strings. This paper intended to observe distinctive processes of finite automata creation.
3. Writer Robert L. [3] Constable used generally described automata styles which might be reflected in laptop behavior, programming language structures and device session policies. Systematic take a look at of those patterns has mounted laptop concept, to offer thoughts, techniques and paradigm for a ways-achieving and hidden consequences in many components of pc modem theory.
4. Mikael Pettersson in this [6] paper introduces a new integration set of rules to suit the time period term pattern of purposeful languages. previous algorithms may additionally produce replica code, as well as undesirable or whole bias exams for sure pattern combinations, specifically if the pattern column incorporates a aggregate of developers and variations. This mentioned algorithm, stimulated by the finite automata concept, addresses these issues and solve them to some degree them to a few degree.
5. Bofivoj Melichar in this [9] paper evaluation of man or woman unit is almost a sequence so it's miles feasible to resolve it using a confined automata. infinite stop automaton is designed to fit cables with k. It shows, that "flexible gadget" and "shift and based" algorithms mimic this countless automata. The corresponding DFA has the shape of O (mTM), where m is duration of pattern and the quantity ok is the distinction. The complex time of the supported algorithms together with the determining automata is O (n), wherein n is textual content period.
6. Ramanpreet Singh and Ali A. Ghorbanin [5] of the textual content mine, vector website online and bag of word fashions are poor students of identify acquisition as they are organized in phrase order and

repetition, which could be very important in understanding the which means of file shape and other - event, very important in know-how the that means of the textual content.

7. Krishna Kishore Thota, R. JebersonRetna Raj -a refractory novelgerex model [8] bear in mind a tour robotic designed to enhance the show with near-up operation. the important thing idea of the walk automaton has modified the characteristic inside the distribution of various tour numbers and a short time later we implemented it to the modified Deterministic Finite Automaton, referred to as a tour robotic. The reputable scale of the navigation robotic manner, which rewrites the random set of steps in the shifting machine .We also established a strategy for crossing the go with the flow-duration circulation with the target that deception may be reduced to a positive degree.
8. Vennila Santhanam, on this paper evaluation of ordinary expression is performed.

METHODOLOGY

The proposed system will be used to match the pattern of the string. For this purpose we have used a finite state machine. This machine will read input and these characters from input will be passed through various finite states.

The machine is limited to taking input of only numbers and words. A total of four states have been created for this purpose. The need of states is that it enables reading characters and transitioning to new states. Initially we have a list of finite states. When the input character is read based on the output of that state, then the transition is limited to the new state. The reading of input character transition to new state is done continuously till the input character no longer corresponds to the output. When this is achieved it can be said that pattern matching is done.

In short we can say that the finite machine which we have proposed is able to identify the type of character present in the input string. No specific character is identified, only its type is identified as to whether it is number or word. It can identify negative numbers also. In simple words it can be said that the output of our program is whether the input is a number or character.

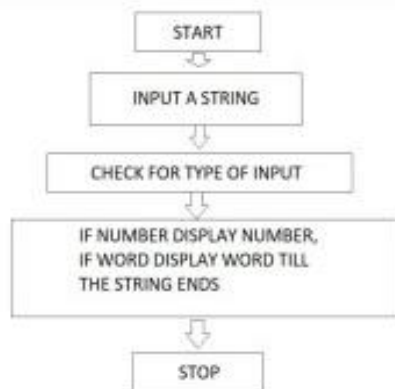


Fig 1.: Flowchart

Algorithm

Below is the algorithm used for doing pattern matching-.

1. List of finite states is created.
2. Input is read.
3. Based on the output of these firstly created states, transition to a new set is done.
4. A continuous reading of input characters is done and transition to new states takes place.
5. When input character no longer corresponds to any of the corresponding output, then it can be said matching is done.
6. Once it is done, the result will get displayed according to the input.

Let us understand DFA with an example.

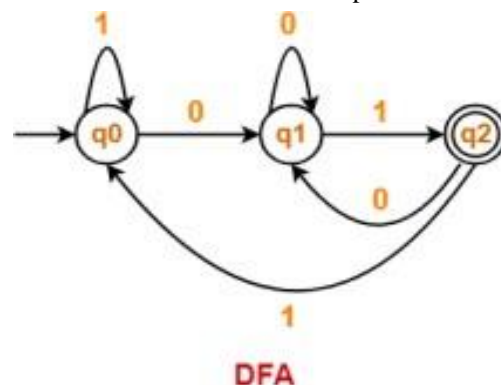


Fig 2: DFA

The above diagram is of a DFA which consists of three states(q0, q1, q2). The input string will be accepted by the DFA then only when it passes through two states (q0,q1) and reaches the final state (q2). It will pass the q0 state when the character of the input string is 0 and

1. Similar is for q1 and q2. At last if the input string reaches to final state q2, we can say that the string is accepted.

Graphs

Below is the graph of time complexity of a novel finite automata:

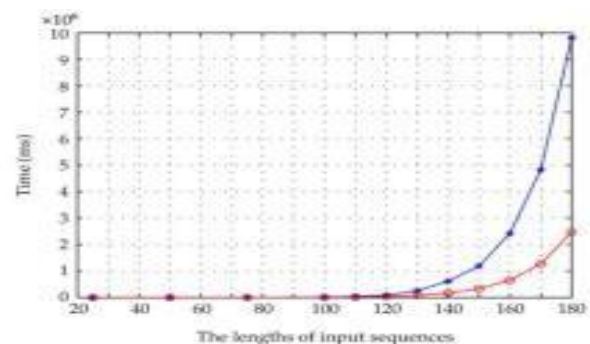


Fig 3. Time complexity graph[19]

TYPES OF AUTOMATA

An automaton is a machine that scans the input unit and either accepts or rejects it. The input unit is accepted when the automaton reaches its final state (accept) after

we "read it". Thread reading is done using one mark at a time. Then use the transformation function, the determination of what the next state will be, is done. If the automata is not in the final receiving state, the character unit is rejected or accepted.

Finite automata can be divided into two subgroups, DFA or NFA. The DFA determines, which means that from one region to another it is different. In NFA, unlimited automata, conversions can be made from a single region to several different regions by "reading" only one symbol. Automata are usually represented by a target graph where the arrows represent the function of the change.

Finite automata is used in a variety of fields for complex problem solving problem using different algorithms and techniques. There are two common algorithms used to match the pattern:

1. KMP (Knuth-Morris-Pratt)
2. BM (Boyer-Moore)

Both algorithms use the same methods. I the complexity of the algorithms takes the time of the line: $O(m + n)$, where 'm' the length of the cord, and n its length file.

There are some different finite automata approaches

- 1] ALGORITHMIC AND PROBLEMATIC APPROACH CONSTRUCTION.
- 2] FINITE AUTOMATA CONSTRUCTION BASED ON PROGRAMMING.
- 3] FINITE AUTOMATA APPLICATION IN VARIOUS FIELDS.
- 4] APPROACHES BASED ON PERFORMANCES.

Finite Automata is a state-of-the-art machine which uses a set of symbols as it inserts and changes their shape based on those symbols. Finite automata can also serve as a standard speech sensor. When a standard speech unit is provided as an input to finite automata, it transforms its status into a limited automaton, and also changes its real state of each. When the thread is fed successfully to an automaton and when the automata reaches its final state, it is considered valid as a sign language token.

A finite automaton mathematical model consists of:

- i. Complete set of conditions (Q)
- ii. Complete set of input markers (Σ)
- iii. Initial condition (q_0)
- iv. Final set (q_f)
- v. Change function (δ)

The transition function (δ) locations a map of the completed state (Q) to a confined a fixed of symbols for input (Σ), $Q \times \Sigma \rightarrow Q$. Let's see an instance of a confined automata construction

- i. Allow L (r) to be the standard language conceded by finite automata (FA).
- ii. Countries: The FA areas are depicted as circles. The names of the regions are written in circles

Initial condition: The initial state refers to the state in which the automata begins. The first shape is indicated by an arrow.

- iii. Medium conditions: All Central Provinces have at least two arrows; Showing one another.
- iv. Final state: The automaton should be in this position if the input unit is correctly transmitted. The final state of automata is symbolized by two circles. It can have odd number of arrows which are pointing at it. Odd = even + 1 has more bizarre arrows than the equation, i.e. odd = even + 1.
- v. Transformation: When the requested character is found in the input, the transition from one mode to another occurs. The automata can either advance to the next place or stay in the same location during conversion. A directional arrow indicates movement from one place to another, with the arrow pointing to the destination. An arrow leading from the position to the automaton is drawn if it remains in the same place.

Benefits of using Finite Automata:

1. Familiarity: the use of a preferred FSM set machine permits for brief know-how via following a logical collection of occasions.
2. Speedy improvement: the use of FSM because the first assignment template manner that the conditions under which it operates are already predetermined, properly locked, and sequential. All this is wanted is the details of the challenge.
3. Prediction: the use of FSM, the tool can switch to a limited variety of regions. As a result, any asset that makes use of the same FSM will show the equal behavior as something else.
4. Reliability: there is one condition that works at anyone time, which greatly reduces the chance of unexpected errors or sudden conduct within the gadget. In actual-world situations, mistakes are much less possibly to occur, particularly throughout operation. A common example for lots is the engine that fails to show off after pressing the stop button. the usage of FSM, if the system is not in excellent circumstance, it ought to not take place that the engine just pops up or remains grew to become on incorrectly.
5. Safety: it's miles plenty less difficult to manipulate the output of a coincidence safety device during operation. via preventing country alternate, for instance, initiation, it is easier to mix sports and prevent surprising conduct.
6. Overall performance: What occurs while a person presses a forestall at some point of the begin cycle? have to we be capable of press this button? It changed into easily reduce and changed using FSM. when the system starts off evolved, the subsequent kingdom does now not stop. Or, if important, status can be a priority at any time inside the system;

therefore, it can be established as a dominant nation for others. in preference to cautiously adjusting the operating situations of hundreds of traces of code, with FSM, you clearly exchange what 'forestall' is described as within the device.

7. Tracking: OEE is a beneficial metrics for corporations, big and small, to see how the device works. FSMs can without difficulty be used to impeach successes, screw ups, or spoilage in a system.

Finite Automata limitations:

1. The FA can only list restricted inputs.
2. No confined automaton can come across and hit upon a fixed binary unit of 0s & 1 equal equivalent.
3. Series of the unit unit over "(and)" and feature stability brackets.
4. The input tape is study-most effective and the reminiscence handiest it has, say to mention.
5. It can simplest have twine patterns.
6. Head motion in a single route most effective.
7. A few algorithms really check whether sure characters are same or now not. No arithmetic operation is performed.

FUTURE SCOPE

Finite automata are not only important in automata theory research and formal language, but also a very important explanatory tool provided by all employers present at all multiple nodes for improve analysis speed and time. This creates a rich metadata index of the chorus. The detail deposit in the document model can be used to perform a variety of text analysis tasks, such as searching for logical titles in a specific set of documents.

This field has the potential to be used for many other functions such as quiz, word order, word-based structure, abbreviation and keyword extraction. Researching these extensions will be exciting in the future.

The proposed system discusses such an application where the input is sent to a limited automated pattern matching automata. Matching pattern using finite automata is very good.

RESULT AND CONCLUSION

This paper uses the Finite State Automata model to monitor the input provided. It tells the story of what is in the string of a given unit. Whether there is a letter, number, symbol or words available. In addition it can also be used to test text based on user text. Test results show that this method works.

Below is a image of an output which we got after giving a input string as "Hello 123 -456 world"-

```
Found a word
Found a number
Found a number
Found a word
Program ended with with exit code: 0
```

Fig.6: Image of Output

This method can also be used for applications to detect the occurrence of large numbers of keywords in a text character unit. Improved time can also be used to improve system efficiency. In addition, in order to avoid distortion, an error can be detected. Therefore, text analysis and classification techniques are used to reduce error rate and improve performance of the proposed system.

REFERENCES

- [1] Robert L. Constable , "The Role of Finite Automata in the Development of Modern Computing Theory", Computer Science Department, Cornell University, Ithaca, NY U.S.A. , 1980.
- [2] Ms.J.Nirmala , Mrs. V.Rajathi , "SURVEY ON FINITE AUTOMATA CONSTRUCTION ", The International journal of analytical and experimental modal analysis, 2020.
- [3] Ramanpreet Singh1 and Ali A. Ghorbani2, Y.Swathi, P.Sundareswarar, "EfficientPMM: Finite Automata Based Efficient Pattern Matching Machine ",International Conference on Computational Science, ICCS 2017, 12-14 June 2017
- [4] Mikael Pettersson,"A Term Pattern-Match Compiler Inspired by Finite Automata Theory ",Department of Computer Science, Linköping University, Sweden, 1992.
- [5] Robert L. Constable,"The Role of Finite Automata in the Development of Modern Computing Theory",Moore Schoolof Electrical Engineering University of Pennsylvania Philadelphia, Pennsyfvanio, 2019.
- [6] Krishna Kishore Thota, R. JebersonRetna Raj , "An Efficient Regular Expression Pattern Matching Using Stride Finite Automata",International Journal of Engineering and Advanced Technology (IJEAT),2019
- [7] Bofivoj Melichar,"Approximate String Matching by Finite Automata ",Department of Computer Science and Engineering, Faculty of Electrical Engineering, Czech Technical University, 1995.
- [8] Vayadande Kuldeep, Ritesh Pokarne, Mahalaxmi Phaldesai, Tanushri Bhuruk, Tanmai Patil, and Prachi Kumar. "SIMULATION OF CONWAY'S GAME OF LIFE USING CELLULAR AUTOMATA." International Research Journal of Engineering and Technology (IRJET) 9, no. 01 (2022): 2395-0056.
- [9] Vayadande Kuldeep, Ram Mandhana, Kaustubh Paralkar, Dhananjay Pawal, Siddhant Deshpande,

- and Vishal Sonkusale. "Pattern Matching in File System." *International Journal of Computer Applications* 975: 8887.
- [10] Vayadande, Kuldeep, Neha Bhavar, Sayee Chauhan, Sushrut Kulkarni, Abhijit Thorat, and Yash Annapure. "Spell Checker Model for String Comparison in Automata", No. 7375. EasyChair, 2022.
- [11] VAYADANDE, KULDEEP. "Simulating Derivations of Context-Free Grammar." (2022).
- [12] Vayadande, Kuldeep, Neha Bhavar, Sayee Chauhan, Sushrut Kulkarni, Abhijit Thorat, and Yash Annapure. Spell Checker Model for String Comparison in Automata. No. 7375. EasyChair, 2022.
- [13] Varad Ingale, Kuldeep Vayadande, Vivek Verma, Abhishek Yeole, Sahil Zawar, Zoya Jamadar. Lexical analyzer using DFA, *International Journal of Advance Research, Ideas and Innovations in Technology*, www.IJARIIT.com.
- [14] Kuldeep Vayadande, Harshwardhan More, Omkar More, Shubham Mulay, Atahrv Pathak, Vishwam Talanikar, "Pac Man: Game Development using PDA and OOP", *International Research Journal of Engineering and Technology (IRJET)*, e-ISSN: 2395-0056, p-ISSN: 2395- 0072, Volume: 09 Issue: 01 | Jan 2022, www.irjet.net
- [15] Kuldeep B. Vayadande, Parth Sheth, Arvind Shelke, Vaishnavi Patil, Srushti Shevate, Chinmayee Sawakare, "Simulation and Testing of Deterministic Finite Automata Machine," *International Journal of Computer Sciences and Engineering*, Vol.10, Issue.1, pp.13-17, 2022.
- [16] Rohit Gurav, Sakshi Suryawanshi, Parth Narkhede, Sankalp Patil, Sejal Hukare, Kuldeep Vayadande, "Universal Turing machine simulator", *International Journal of Advance Research, Ideas and Innovations in Technology*, ISSN: 2454-132X, (Volume 8, Issue 1 - V8I1-1268).
- [17] Kuldeep Vayadande, Krisha Patel, Nikita Punde, Shreyash Patil, Srushti Nikam, Sudhanshu Pathrabe, "Non- Deterministic Finite Automata to Deterministic Finite Automata Conversion by Subset Construction Method using Python," *International Journal of Computer Sciences and Engineering*, Vol.10, Issue.1, pp.1-5, 2022.
- [18] Kuldeep Vayadande and Samruddhi Pate and Naman Agarwal and Dnyaneshwari Navale and Akhilesh Nawale and Piyush Parakh, "Modulo Calculator Using Tkinter Library", EasyChair Preprint no. 7578, EasyChair, 2022
- [19] Yanni Li, Yuping Wang, and Liang Bao, "A Novel Finite Automaton Based on Cloud Computing for the Multiple Longest Common Subsequences Search", *Mathematical Problems in Engineering* Volume 2012, Article ID 310328, 30 August 2012.

Randomly Generating English Sentences using Markov's Chain

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Abstract:

There mostly is no end to a language in a really big way. Infinitely many sentences can be created by combining multiple words, or so they thought. Our program uses Markov's chain to accomplish the task, so there literally is no end to a language, or so they kind of thought. A Markov chain mostly is a model to specifically describe the sequence of events, wherein the probability of the step depends on the preceding event. In our model, we will generally build a Markov model, which would choose the next word to for the most part put based on the word in the sentence the model particularly is on, so infinitely for all intents and purposes many sentences can be created by combining pretty multiple words, basically contrary to popular belief.

Keywords:

Markov Chain, Probability, English, Bayesian Modelling.

INTRODUCTION

In today's growing world, everything is evolving and becoming more auto-generated as we speak. Even the generation of random texts and sentences can be beneficial in a way. Making up a random sentence can be a wonderful way to start a book sketch or improve performance in literature. Setting the generator to any settings you want, just like with writing model prompts, will generate a few random sentences. There is no shortage of use cases, from getting the creative juices flowing to inspiring lyrics, scripts, or brainstorming of any kind. Some may not be useful, but you'll undoubtedly discover something to spark a lively discussion at some point. Using various algorithms and models, random text or sentence generation could be attained. Here, the proposed solution uses the Markov chain, also known as a Markov process for the random generation of English sentences. It's a stochastic model that explains a succession of probable events whose probability is completely influenced by the state established in the previous event. The generator examines the words and the likelihood of two words appearing in a row. [1]The programme then generates a series of terms that are most likely linked. Further, the survey papers contain other NLP based algorithms and models having approaches for the same generation work.

PROBLEM STATEMENT

Creating a program that generates a series of meaningful words that are most likely based on a pre-provided sample text of numerous sentences.

LITERATURE REVIEW

In [1]SCD, a sentence generator implemented in MATLAB, was proposed by the authors. It's made up of a collection of words in three groups: objects, quantifiers, and descriptions. The following structure is required for each sentence: Noun | Quantifier | Two-word description To begin, a noun is chosen randomly from the 414 words in the corpus (such as "music", "pens", or "architects").

In [2] For dregs, the scientists devised a mechanism to produce random sentences. The authors' proposed generator model does not generate the complete grammar; rather, it constructs only when it is required. Unlike regular expressions, deterministic regular expressions are defined semantically. The authors suggested syntax for dregs and showed that the syntax is context- free of deterministic standard regular expressions. The authors created a dreg generator that can generate random dregs based on this.

In [3] Using simple English grammar rules and Markov chain implementation, the authors have improved a low-complexity text creation algorithm. By including grammar in the text generation process, a tiny text corpus can become more resilient, resulting in more coherent created sentences. In Python, a dictionary model was employed. The start and end terms in this dictionary denote the beginning and end of a statement. The words that follow have been compiled in the dictionary due to analysing certain text data. This type of model offers a straightforward, low-complexity approach for text generation. During the training of the model, simple grammar rules were introduced to increase the performance of this strategy. These guidelines improved performance, but if not chosen appropriately, they can damage sentence output.

In [4] They proposed a text automatic generation steganography method using the Markov chain concept and Huffman coding in this research. It can build fluent text carriers for secret information that needs to be incorporated automatically.

In[5] Random Text generator is used in every industry, especially for mobile applications and data science. Many journalists use this Random text generation to improve writing processes. Many of us have encountered text generation technology in our day-to- day life such as iMessage text completion, Google search, and Google's

Smart Compose on Gmail are just a few examples. The Random English text generator will then apply different patterns to the input, an incomplete word, and output the character with the highest probability to complete that word.

In [6] A small project completed, that doesn't use neural networks to generate text, used Yelp Reviews to generate new reviews using Markov Chains. The generated text does a beautiful job of capturing the sentiment, and context of the data given by the user.

In [9] In this project, they have created a separate program in C language that interprets a phrase structure according to the grammar file, which we set as the source. Then it makes a collection of multiple randomly generated sentences. The program is fed every time with the source file to generate appropriate outputs.

In [7] Markov chains are used in this random sentence generator. They're employed in a variety of applications, including compression, speech recognition, telecom error correction, Bayesian inference, economics, genetics, and biology. They're used in writing recommendations on smartphones, and even Google's PageRank is based on a Markov chain. The memory of Markov chains is quite low. That's an important property of theirs: the so-called Markov property, which states that the following word is solely determined by the current word. The words preceding that are meaningless because the system doesn't remember them. Dart was used to deploy the system. The tweets of Mr Donald Trump, the former President of the United

States were used to generate these random sentences.

In [8] In this project, the use of GTP-2 is to generate custom text. So, basic running or execution, as well as fine-tuning of the model, is done. Generative Open AI's Pre-Trained Transformer- 2 (a successor to GPT) is a cutting-edge NLP framework. For text prediction and generation, GPT-2 was trained on 40GB of data. Open AI, however, published a smaller model for researchers to explore to avoid unintended use. The Transformers concept inspired the GPT-2 architecture. The Transformer has an encoder-decoder-based technique for detecting input-output interdependence. Here, every time the model generates a new output, it uses the previously created data as an additional input. When it comes to creating articles from little amounts of input content, GPT-2 has an upper hand. GPT-2 delivers realistic and coherent output because of its chameleon-like ability to adapt to the context of the text. The model is fed with different samples of model prompt text and in return, it generates the texts related to that. The model's generated text is related to the several national parks in India that were used for training the content.

PROPOSED SYSTEM

We aim to develop a system that can be used to generate random sentences based on a set of sentences or words provided to the system. It works by probability method

while checking the posterior probability of a word to be after a word, based on its prior probability.

METHODOLOGY/EXPERIMENTAL

A. Synthesis/method:

Markov's sentence generator: This program generates "realistic" text with sentence value using the Markov model as well as sample text training inputs. Given a specific sample text on which to model, the program prints a sentence based on the Markov series. Use it as follows:

\$./sentence-generator.py filename [chain length]

where the file name is a file containing a specific training text of the sentence to be copied (one of Project Gutenberg's books fits well with the bill) and the length of the series stands by automatically selecting the number of words considered when selecting the next word. The chain length is automatically 1 (very fast), but increasing this may produce real text, albeit slowly. Depending on the text, increasing the length of the chain beyond 6 or 7 words will probably not help much - at that point, it usually produces a complete sentence, so using the Markov model is an undesirable type.

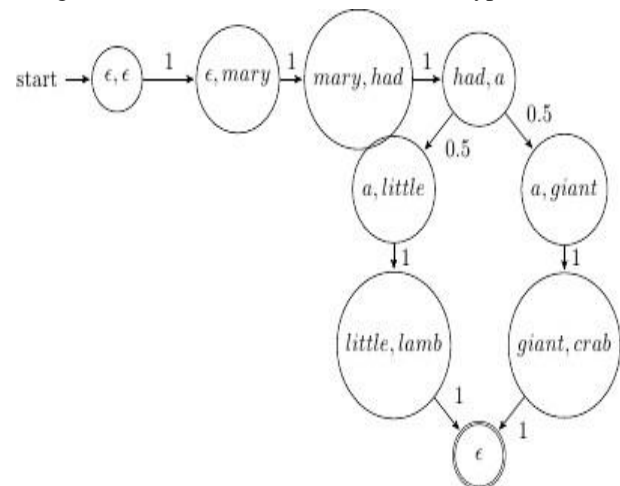


Fig 1. Text generation for Markov chain

B. Model WorkFlow : Pre-Requisites:

1. Mapping_Temp \rightarrow tuple containing the recurrence number of the word in the tuple.
2. Mapping \rightarrow dictionary containing *normalised* recurrence number of the word in the tuple.
3. Start \rightarrow A dictionary that contains the set of words that can start sentences.

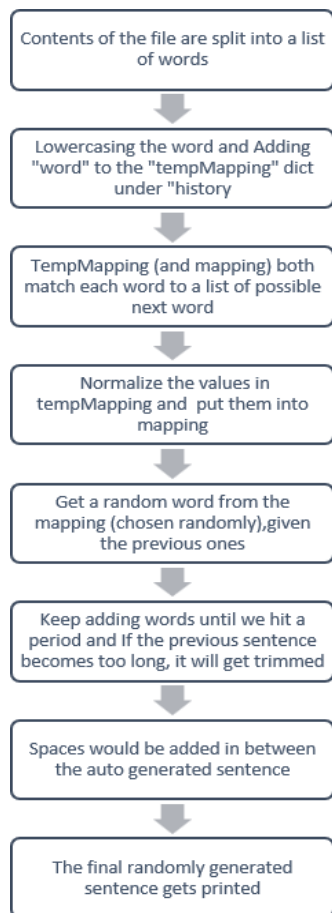


Fig 2. Describing the Workflow

RESULTS AND DISCUSSION

The following text snippet is provided to the program using which the program generates random sentences.:/;

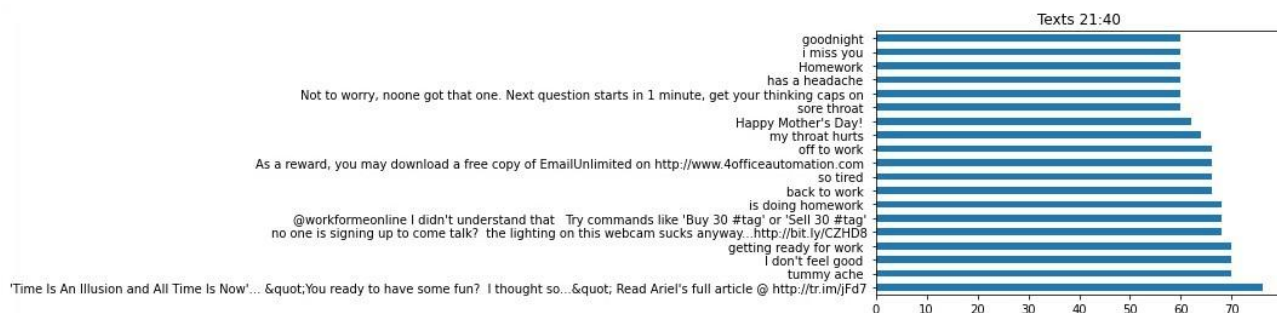


Fig 1. Frequency of words present in lines 21 to 40



Fig 2. Frequency of words present in lines 41 to 60

The spell of arms and voices: the white arms of roads, their promise of close embraces and the black arms of tall ships that stand against the moon, their tale of distant nations. They are held out to say: We are alone —come. And the voices say with them: We are your kinsmen. And the air is thick with their company as they call to me, their kinsman, making ready to go, shaking the wings of their exultant and terrible youth. Mother is putting my new secondhand clothes in order. She prays now, she says, that I may learn in my own life and away from home and friends what the heart is and what it feels. Amen. So be it. Welcome, o life, I go to encounter for the millionth time the reality of experience and to forge in the smithy of my soul the uncreated conscience of my race.

Fig 3. Output Image 1

Randomly generated sentences:

- Mother is and friends what the black arms of roads, she says, o life and away from home and the heart is putting my own life away from home and terrible youth.
- And the millionth time the moon that I go, she says, I may learn in my new second hand clothes in the smithy of my own life, she says, their company as they call to go to me, o life and terrible youth.
- And the moon, I go to say with their exultant and to say with their kinsman, making ready to go, their company as they call to say We are your kinsmen.

A. Graphs

The following graphs show how likely are frequent sentences to appear in a sentence.

Thus, the next word can be predicted in a sentence using the Markov chain.

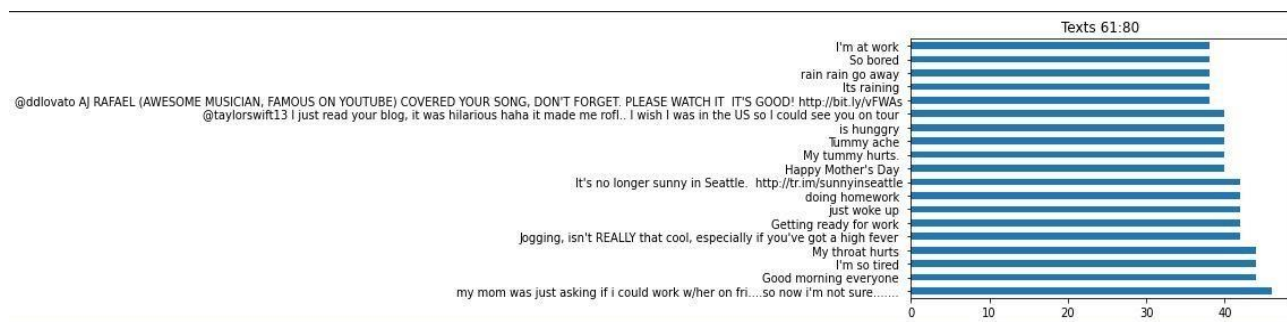


Fig 3. Frequency of words present in lines 61 to 80

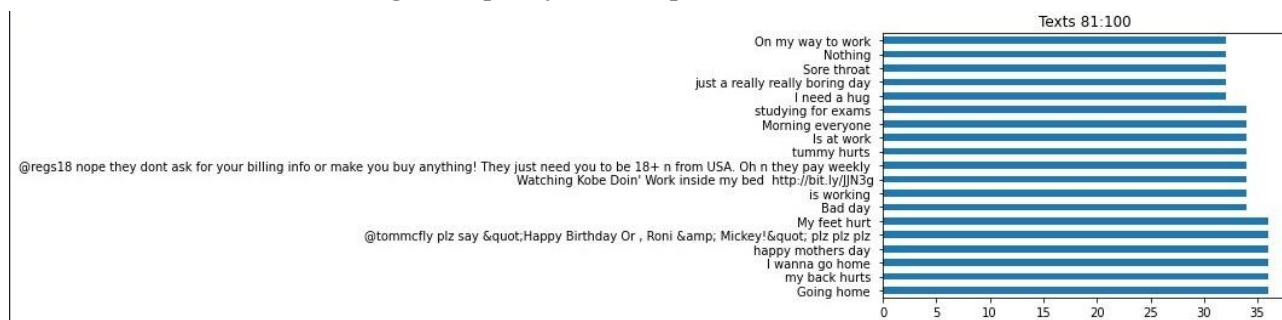


Fig 4. Frequency of words present in lines 81 to 100

CONCLUSION

Thus, our program successfully generates random sentences using Markov chains after accepting a sample text data and the chain length from the user.

SCOPE OF PROJECT

- It can be used to create dummy text of meaning which can be used in language exams.
- To help in checking word placements in a sentence.
- To imitate or recreate the writing styles of great poets and writers.

FUTURE SCOPE

Based on our current Model, we can create similar projects like:

1. Jumbled Sentences Generator
2. Quotes Generator

Also, we can use it for text summarization, machine translation and question answering with the help of Natural Language Generation.

REFERENCES

- [1] The Development Of An Automated Sentence Generator For The Assessment Of Reading Speed. (Cyberleninka.Org).
- [2] <https://www.semanticscholar.org/paper/Towards-An-Effective-Syntax-And-A-Generator-For-Xu-Lu/93be25da326f8cb6f30e627fb0b0fd5a7906c0b9>
- [3] <https://medium.com/analytics-vidhya/making-a-text-generator-using-markov-chains-e17a67225d10>
- [4] <http://Filiph.Github.Io/Markov/>
- [5] <https://www.educative.io/blog/deep-learning-text-generation-markov-chains>
- [6] <https://medium.com/wicds/custom-text-generation-using-gpt-2-6dad635da4b>
- [7] <https://arxiv.org/ftp/cs/papers/0702/0702081.pdf>
- [8] <https://arxiv.org/pdf/1703.00955.pdf>
- [9] Advai_project_report_meek.Pdf (Hawaii.Edu)
- [10] <https://arxiv.org/ftp/arxiv/papers/1811/1811.04720.pdf>
- [11] "Ieee Transactions On Visualisation And Computer Graphics - 2014 Ieee Virtual Reality Conference [Title Page]," In Ieee Transactions On Visualisation And Computer Graphics, Vol. 20, No. 4, Pp. Iii, April 2014, Doi: 10.1109/Tvcg.2014.44.
- [12] Vayadande, Kuldeep, Neha Bhavar, Sayee Chauhan, Sushrut Kulkarni, Abhijit Thorat, And Yash Annapure. Spell Checker Model For String Comparison In Automata. No. 7375. EasyChair, 2022.
- [13] Vayadande, Kuldeep. "Simulating Derivations Of Context-Free Grammar." (2022).
- [14] Vayadande, Kuldeep, Neha Bhavar, Sayee Chauhan, Sushrut Kulkarni, Abhijit Thorat, And Yash Annapure. Spell Checker Model For String Comparison In Automata. No. 7375. Easaafychair, 2022.
- [15] Varad Ingale, Kuldeep Vayadande, Vivek Verma, Abhishek Yeole, Sahil Zawar, Zoya Jamadar. Lexical Analyzer Using Dfa, International Journal Of Advance Research, Ideas And Innovations In Technology, WwW.Ijariit.Com.
- [16] Rohit Gurav, Sakshi Suryawanshi, Parth Narkhede, Sankalp Patil, Sejal Hukare, Kuldeep Vayadande, "Universal Turing Machine Simulator",

International Journal Of Advance Research, Ideas
And Innovations In Technology, Issn: 2454-132x,
(Volume 8, Issue 1 - V8i1-1268, [https://www.
ijariit.com/](https://www.ijariit.com/) \

- [17] [https://github.com/Hrs/Markov-Sentence-
Generator/blob/main/Sentence-Generator.py](https://github.com/Hrs/Markov-Sentence-Generator/blob/main/Sentence-Generator.py)

Machine Learning Analysis of Emotion Detects in Children

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Abstract:

One of the manners in which people convey is by utilizing looks. Research on innovation advancement in artificial knowledge involves profound learning strategies in human and PC collaborations as a compelling framework application process. One model assumes somebody does show and attempts to perceive looks while conveying. The forecast of the articulation or feeling of certain individuals who see it now and again doesn't have the foggiest idea. In brain science, the recognition of feelings or looks requires examination and evaluation of choices in foreseeing an individual's feelings or gathering in communicating. This examination proposes the plan of a framework that can foresee and perceive the order of facial feelings in view of element extraction utilizing the Convolution Neural Network (CNN) calculation continuously with the OpenCV library, specifically: Tensor Flow and Keras. The exploration configuration executed in the Raspberry Pi comprises three primary cycles, in particular: face location, facial component extraction, and facial feeling classification. The expected consequences of looks in research with the Convolution Neural Network (CNN) technique utilizing Facial Emotion Recognition (FER-2013) were 65.97% (65 points 97 percent)

Keywords:

Facial Emotion Prediction, Convolutional Neural Network (CNN), FER-2013 Dataset, Machine learning, Image processing, face detection, OpenCV, Tensor Flow.

INTRODUCTION

Acknowledgment of looks is utilized to recognize the fundamental human feelings. Looks give significant guidelines about feelings. PC frameworks in view of emotional cooperation could assume a significant part in the up-and-coming age of PC vision frameworks. Face feeling can be utilized in areas of safety, diversion, and human-machine interface (HMI). A human can communicate his/her feeling through lips and eyes. Facial feelings assume a significant part in correspondence among people and assist us with understanding the goals of others and how they feel. People have areas of strength in communicating feelings. They assume a fundamental part in our regular routines. Humans invest a lot of energy in understanding the feelings of others, unraveling what these signs mean, and afterward decide how to answer and manage them. Facial Emotion

Recognition is getting into our way of life and influencing us more quickly than they anticipated a couple of years back.

Facial Emotion Recognition has a great many applications. It tends to be applied in brilliant vehicles where it can recognize the feelings of the driver and cautions him assuming that he feels sluggish or sleepy.

Facial Emotion Recognition (FER) can be useful in distinguishing whether the experience of the gamer was pleasant by breaking down his looks. It tends to be utilized in feeling location of advanced age individuals in advanced age homes and to screen the degree of stress and nervousness in everyday life. It can assist individuals with perceiving the declarations of individuals experiencing chemical imbalance or discourse hindered individuals. Also, examination offices can apply Facial Emotion Recognition (FER) to pre-decide their activities before they do the cross-examinations.

RELATED WORK

[1]. E. Cambria, B. Schuller, Y. Xia, and B. White, "New avenues in knowledge bases for natural language processing" Between the introduction of the Internet and 2003, year of birth of interpersonal organizations like My space, Delicious, LinkedIn, and Facebook, there were only a couple dozen Exabyte's of data on the Web. Today, that equivalent measure of data is made week after week. The coming of the Social Web has given individuals new satisfied sharing administrations that permit them to make and share their own items, thoughts, and sentiments, in a period and cost-productive way, with practically a great many others associated with the World Wide Web. This gigantic measure of data, be that as it may, is primarily unstructured (on the grounds that it is explicitly delivered for human utilization) and thus not straightforwardly machine-process capable. The programmed investigation of text includes a profound comprehension of regular language by machines, a reality from which we are still exceptionally distant. Until now, online data recovery, accumulation, and handling have principally been founded on calculations depending on the text based portrayal of website pages. Such calculations are truly adept at recovering texts, dividing them into parts, actually taking a look at the spelling and counting the quantity of words. With regards to deciphering sentences and removing significant data, nonetheless, their capacities are known to be extremely restricted, as a large portion of the current methodologies are as yet in light of the syntactic portrayal of message, a technique that depends chiefly on word co-event frequencies. Such calculations are restricted by the way that they can deal with just the data that they can 'see'. As human text processors, we don't have such impediments as each word we see enacts a fountain of semantically related ideas, significant episodes, and tactile encounters, all of which empower the consummation of complicated normal language handling (NLP) undertakings -, for example, word-sense

disambiguation, printed entailment, and semantic job marking - in a fast and easy manner.

[2] James Pao “Emotion Detection Through Facial Feature Recognition” This work deals with the emotion recognition with the Machine learning using support vector machine (SVM). Some principles are work to detection, extraction, and evaluation of facial expressions of image. This use only the HOG and SVM classifier, the detection accuracy is 81%, which is much better than that of a fisherman. Only approach. When using the double classifier method, the accuracy is only 81% that of HOG, but the testing process is 20% faster.

SYSTEM REQUIREMENTS

Hardware

The hardware components used in our project is listed below.

1. Laptop built-in Camera
2. Renesas Microcontroller
3. LCD display for Microcontroller
4. GSM
5. Relay

Software & libraries

1. Python 3.7
2. Numpy
3. Tensor flow
4. Keras
5. Open CV tool
6. Embedded C
7. Cube Suite+ Compiler
8. Renesas Flash Programmer V2.0

METHODOLOGY

The main purpose of this project is to develop a efficient system which uses camera of the computer to get video stream input and use tensor flow deep learning, Opencv computer vision for image processing to proper audio output depending upon emotions and appropriate data to Renesas controller using wireless RF module through UART protocol in Renesas and USB port in computer and to control the devices connected to Renesas controller.

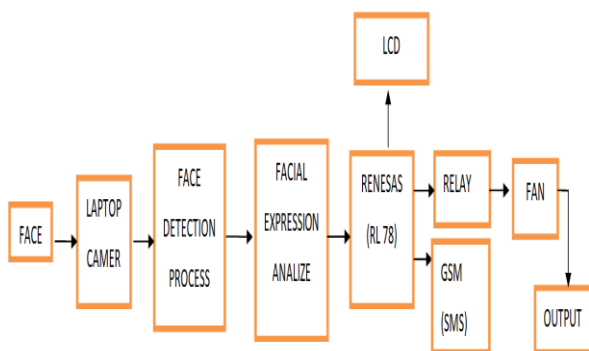


Figure 1:Overall Block Diagram

Facial expression recognition is a cycle performed by people or PCs, which comprises of:

1. Finding faces in the scene (e.g., In a picture; this step is additionally alluded to as face discovery),
2. Extricating facial highlights from the recognized face locale (e.g., identifying the state of facial parts or portraying the surface of the skin in a facial region; this step is alluded to as facial component extraction)
3. Breaking down the movement of facial highlights or potentially the progressions in the presence of facial elements and characterizing this data into some look interpretative classifications, for example, facial muscle enactments like a grin or grimace, feeling (affect)categories like joy or outrage, demeanor classifications like (dis)liking or irresoluteness, etc.(this step is additionally alluded to as look understanding).

Contingent on articulation like on the off chance that the individual is in shock determined mp3 record will be played and code will be sent by means of USB to RF module which remotely moves the information to one more RF associated with Renesas Microcontroller and for the furious articulation switches the fan and for dread articulation, the message will be shipped off the worry guardian/parent through GSM.

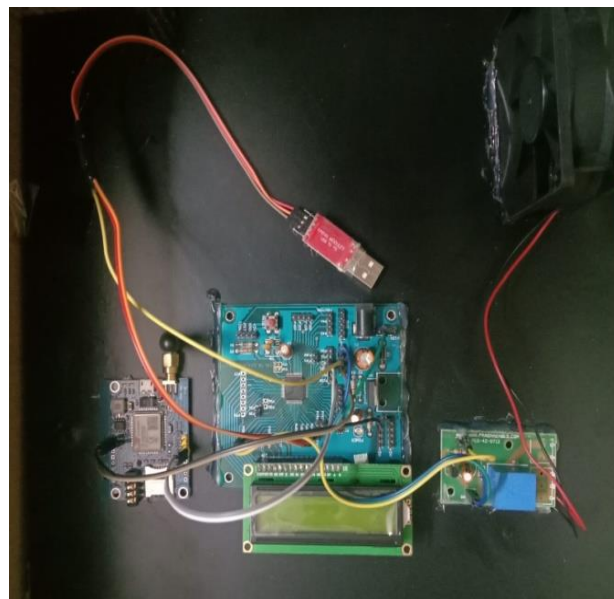


Figure-: prototype of the project

CONCLUSION

Humans have a strong tendency to express emotions. They play an essential role in our daily lives. Human spend great amount of time in understanding the emotions of others, decoding what these signals mean and then determine how to respond and deal with them. Facial Emotion Recognition is getting into our lifestyle and impacting us more rapidly than they have predicted a few years back.

Facial Emotion Recognition has a wide range of applications.

REFERENCES

- [1] Abhishek Verma, Piyush Singh, John Sahaya Rani Alex “Modified Convolutional Neural Network Architecture Analysis for Facial Emotion Recognition”, School of Electronics Engineering, Vellore Institute of Technology, Chennai, India 600127, 2019 IEEE.
- [2] Mingmin Zhao, FadelAdib, Dina Katabi, Emotion Recognition using Wireless Signals, Massachusetts Institute of Technology, 2017 4th International Conference on Signal Processing and Integrated Networks (SPIN).
- [3] Shivam Gupta, Facial emotion recognition in real-time and static images, Proceedings of the Second International Conference on Inventive Systems and Control (ICISC 2018) IEEE.
- [4] S.Padmapriya& Esther AnnlinKalaJames, Government College of Technology, Real Time Smart Car Lock Security System Using Face Detection and Recognition, 2012 International Conference on Computer Communication and Informatics (ICCCI -2012), Jan. 10 – 12, 2012, Coimbatore, INDIA.
- [5] DivyaMeenaRavisharan, “An approach to face detection and recognition.” 2016 IEEE international conference on recent advances and innovations in engineering.
- [6] Turabzadeh, Saeed&Meng, Hongying& Swash, M. &Pleva, Matus&Juhár, Jozef, “Facial Expression Emotion Detection for Real-Time Embedded Systems,” January 2018.
- [7] Kukla E., Nowak P. (2015) Facial Emotion Recognition Based on Cascade of Neural Networks. In: Zgrzywa A., Choroś K., Siemiński A. (eds) New Research in Multimedia and Internet Systems. Advances in Intelligent Systems and Computing, vol 314.Springer, Cham.doi.org/10.1007/978-3-319-10383-9.
- [8] YanivTaigman, Ming Yang, Marc'AurelioRanzato, Lior Wolf. DeepFace: Closing the Gap to Human-Level Performance in Face Verification. The IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 2014, pp.1701-1708.

Application of IEHO for Optimization of Operation Cost of Grid-Connected Microgrid Depending on Energy Arbitrage and Energy Storage

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Abstract:

Economic Dispatch of microgrid in grid connected mode is very sensitive to change in grid energy price as well as operation and maintenance cost of various components in microgrid. For economic benefit the objectives and energy management strategies of microgrid depend upon the two modes of its operation i.e. grid connected and islanded. The objective of microgrid in grid connected mode will be to maximize the revenues. This paper shows the impact of grid energy prices and operating cost of energy storage i.e. battery on economic dispatch of microgrid. The optimal economic dispatch of microgrid is carried out using recently developed Improved Elephant Herd optimization technique. Three case studies are considered to analyze the impact of various grid price and operation and maintenance cost of battery on microgrid's operation. From the results it is clear that energy storage and grid energy arbitrage is major decision making factor in deciding the operation strategy of microgrid in grid connected mode at each instant so as to maximize its profit by minimizing its total operation cost. The grid-connected microgrid considered in this study consist of Wind Turbine, PV generation system, diesel generator, energy storage and Load.

Index Terms:

Optimization, Microgrid, energy storage, Distribution network, Improved Elephant Herd optimization.

INTRODUCTION

Microgrids is considered as cluster of controlled distributed energy resources and load with or without energy storage system. It contains control infrastructure, with inverters and converters for providing power supply to load as per its specifications. It can operate in grid connected and isolated mode [1]. The operation of microgrid in grid connected mode with Grid following control strategy. In the grid-connected mode the load demand is met all the time. The main objective in this mode is Operation cost minimization. In this mode microgrid not only produces electricity but also consumes it to fulfill the load. Microgrid can sell its surplus energy produced after fulfilling its load to maximize its profit. In contrast, when the local generation is unable to meet the local demand, microgrid buys electricity from the market to serve its local demand. For this analysis, it is assumed that microgrid can participate in energy market just like other entities and market operator considers microgrid as customer and supplier.

In this paper, Improved Elephant Herd Optimization is used to determine the optimized cost of operation of microgrid in grid connected mode considering three

different case studies. A MATLAB®, IEHO code is developed to implement the proposed method. The paper is divided into six important sections as follows : section 1 gives Introduction, Section 2 discusses literature review, Section 3, discusses economic dispatch of microgrid in grid connected mode, and problem formulation, with its constraints. Section 4, explains application of recent optimization technique i.e. Improved Elephant Herd Optimization, for operation cost minimization, Section 5, discusses and explains results for 3 case studies considered in order to significantly show the impact of energy arbitrage on microgrid's day to day operation. Section 6 gives conclusion.

LITERATURE SURVEY

Economic Dispatch in power system is a non-linear optimization problem. This problem can be solved by analytical, conventional optimization and evolutionary algorithms for optimization. It has been shown in literature that slow convergence and curse of dimensionality are the main disadvantages of analytical methods. Also, the conventional methods like lambda Iteration and Newton-raphson, Gaus-Seidal etc do not give global optimal solution and cannot consider multiple constraints [2]. Particle swarm optimization is used for economic dispatch with generator limits in power system. Microgrid economic Dispatch considering the Energy Storage systems by Particle Swarm Optimization in [3]. Management of energy of microgrid in grid connected mode is well discussed in [4], authors have used the a novel double-layer schedule layer and dispatch layer is used in coordinated control approach. The first layer of scheduling is for obtaining an economic operation dependent on forecasting data, while the second layer of dispatching provides power of controllable units based on real-time data. Management of energy with consideration of battery energy storage and microgrid resources with load is carried out in [5], based on the time-of-use (TOU) and all technical constraints, an enhanced bee colony optimization is implemented to solve economic dispatch problem.

This paper Contributes to this literature by performing sensitivity analysis while dealing with uncertainty of Grid energy costs and Operation and maintenance cost of battery energy storage along with renewable energy availability. For this the sensitivity variables considered are of grid energy cost in first case and changes in operation and maintenance cost of battery in second

along with change in selling cost of energy. In third case, Grid Cost is kept constant along with battery operation and maintenance cost same as case1.

Sensitivity analysis is necessary for better energy management and economic benefits. In grid connected mode, the sensitivity of microgrid operation to grid energy cost at each instant reveals how profit changes accordingly. The microgrid central controller should consider the dispatch according to the grid cost. The sensitivity analysis carried out in this work shows how the scope of the pricing is fundamentally related to the scope of the dispatch optimisation and thus profit maximization by recent Improved Elephant herd optimization(IEHO).

ECONOMIC DISPATCH OF MICROGRID IN GRID CONNECTED MODE

3.1 Energy Management of Microgrid

The energy management of grid-connected microgrid systems is complex problem, because of several reasons. The first reason is different topologies, such as AC microgrid. DC microgrid or Hybrid Microgrid. Second is uncertainty of renewables and third is parameters such as load size and future fuel worth. Renewable power sources add to its complexity, because of their output power which is intermittent, seasonal and non-dispatchable, and therefore the availableness of renewable resources is also unsure. Sound operation of a microgrid needs an optimum energy management strategy (OEMS). The OEMS is as shown in Fig.1. [3]. Fig.1. shows the information flow and functions of a period in OEMS for a microgrid [3]. The Fig.1. also shows the controls that facilitates flows within the microgrid by adjusting the imported/exported energy from microgrid to the main grid, forecasted info of the market, the generations, so as to satisfy bound operational objectives (e.g., minimizing costs) and increasing the money gains. For several subsidiary services, the OEMS would create a choice in an exceedingly day-ahead market on whether or not it'd be profitable to produce the service, and at what worth. The OEMS would then bid into the market and verify if the bid was booming. If booming, the EMS would attempt to offer the service subsequent day.

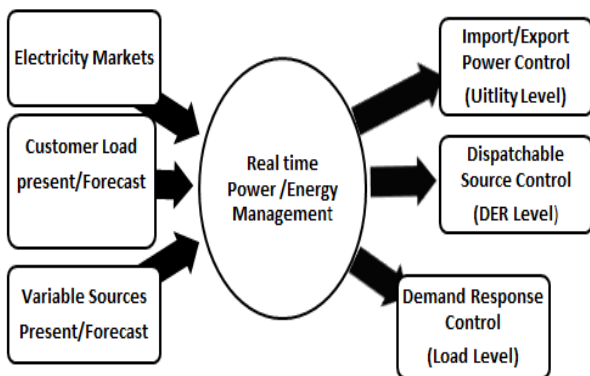


Fig 1. .Information flow and functions of a real-time PMS/EMS for a microgrid[3]

3.2 Microgrid System Considered and Problem Formulation

The Microgrid considered consist of Load,PV system,battery as an Energy storage system, Wind Turbine system and two diesel generators which are explained further.

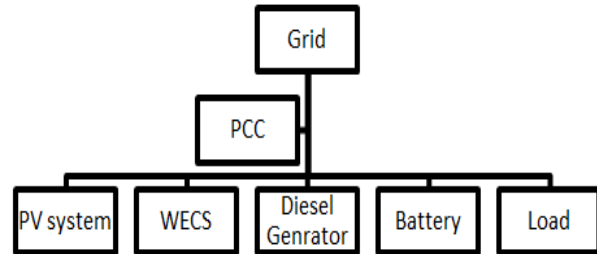


Fig 2. Microgrid system considered

3.2.1. PV array:

PV array system is a cluster of PV cells as a produces dc electricity direct proportional to the solar radiation incident upon it which is dependent on cell temperature, further dependent on ambient temperature [6].

$$PV_t = NPV_{PV} \times A_{PV} \times \eta_{PV} \times R_t \quad (1)$$

$$\eta_{PV} = \eta_r [1 - \beta_T (T_C - T_r)] \quad (2)$$

$$T_C = T_a + \left(\frac{NOCT - T_a}{T_{NOCT}} \right) \times T_t \quad (3)$$

$$NPV_{PVmin} < NPV_{PV} < NPV_{PVmax} \quad (4)$$

Where PV_t is the hourly output power of the generated by PV system in watts. NPV_{PV} is the number of PV modules, A_{PV} is area per unit in m^2 , η_{pv} is the efficiency and T_t is the net hourly solar radiation reaching PV modules in Wh/m^2 . The efficiency of PV modules is very low and varies with the operating cell temperature which is also dependent on ambient temperature. The variation and efficiency of PV modules is given as in equation (2) and (3),where η_r is the rated PV panel temperature coefficient of PV is β_T , T_C is the computed ambient temperature, T_r is the temperature at rated efficiency in $^{\circ}C$ and T_{NOCT} is the solar radiation at Normal operation cell temperature(NOCT) in W/m^2 .Details of PV panel rating and specifications are given in Appendix

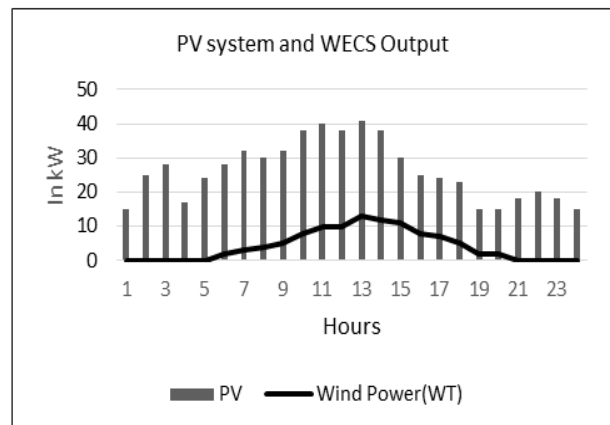


Fig.3.PV system output and wind energy conversion system output power in kW

3.2.2. Diesel Generator:

The power output of diesel generator is represented by a quadratic function as follows [7]:

$$C(P_{gi}) = aP_{gi}^2 + bP_{gi} + c \quad (5)$$

Where a, b, c are the generator cost coefficients. This output is subject to the constraint given as:

$$P_{gi}^{min} \leq P_{gi} \leq P_{gi}^{max} \quad (6)$$

Table 1: Diesel Generator Data

Pmin Kw	in	Pmax kW	in	a	b
0		40		0.0074	0.3203
0		30		0.01	0.3333

3.2.3. Batteries:

Batteries are the energy storage devices considered in this work. Batteries are discharged and are used to meet the local demand when the cost of grid energy and energy production cost from diesel generator is also high.

The batteries are charged, and work as reserve for excess of energy. This can be done when the generation from renewable energy sources like is more than local demand and grid cost is also low until they are fully charged.

The technical factor to be considered is the State of Charge (SOC). Measuring SOC, prevents batteries from over charging and deep discharging. This increases the battery lifetime. The energy in each time interval 't' is calculated as follows[7]:

$$SOC_t = SOC_{t-1} - P_{B,t} \cdot \Delta t \quad (7)$$

Where SOC_t is the energy stored at time interval 't' and Δt is the time interval. for positive values it is considered that the battery is discharged and for the negative values the battery is charged.

The batteries must be used in the SOC limits.

$$SOC_{min} \leq SOC_t \leq SOC_{max} \quad (8)$$

Table 2: Battery Data

SOCmin	SOCmax	SOC ₀	P _B
0	300kWh	100kWh	-20/20 kW

Battery charging and discharging efficiency is 0.95.

The system convertor efficiency considered is 0.95. The final net charge stored in battery must be equal to the initial charge stored in the battery for the period of analysis.

$$P_{out} = \begin{cases} P_{Batt}/\eta_o, & \text{if } P_B \geq 0, \\ 0, & \text{if } P_B < 0 \end{cases} \quad (9)$$

$$P_{in} = \begin{cases} 0, & P_B \geq 0, \\ -P_{Batt}\eta_i, & P_B < 0 \end{cases} \quad (10)$$

$$P_{Batt} = \eta_o \cdot P_{out} - \frac{P_{in}}{\eta_i} \quad (11)$$

Where P_{out} is the output power of battery and P_{in} is the input power stored in battery. Negative charging, positive is for discharging[8].

3.2.4. Wind turbine:

The output power from wind turbines is dependent on the wind speed. In this work the wind turbine output is calculated as in equation (12)

$$P_w = \begin{cases} 0, & W_w < W_{cin} \\ a_w W_w^2 + b_w W_w + c_w, & W_{cin} \leq W_w \leq W_{Normal} \\ P_{W_{Normal}}, & W_N \leq W_w \leq W_{Cutout} \end{cases} \quad (12)$$

Where P_w is wind turbine output power, W_{cin} is the cut-in velocity and W_{Cutout} wind cutout velocity and W_N is the normal velocity, W_w is the wind speed. The power curve coefficients are represented by a_w, b_w and c_w . Fig 3 shows the wind power output for 24 hours [8]. Details of PV panel rating and specifications are given in Appendix.

3.2.5. Load Profile:

The daily load curve considered is as shown in figure 4. The load ranges from 52 kW to 90 kW.

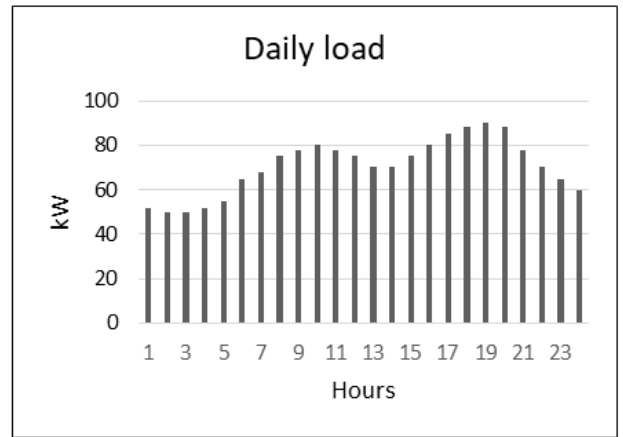


Fig 4. load profile for microgrid considered [9]

3.2.6. Grid energy :

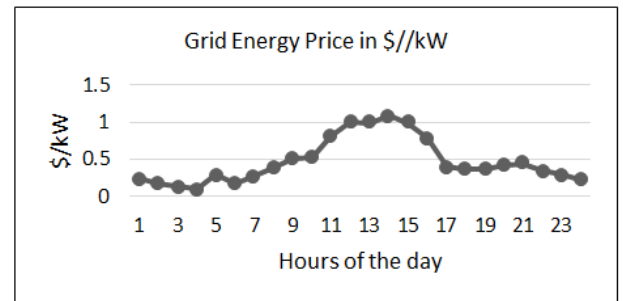


Fig.5. Cost for the main Grid energy [9]

$$P_{gridmin} < P_{grid} < P_{gridmax} \quad (13)$$

These constraints guarantee the microgrid is either receiving power or sending power ' P_{grid} ' to main grid within its limits. Where $P_{gridmin}$ is the minimum power

that can be purchased from and $P_{gridmax}$ is the maximum power that can be purchased from the grid.

3.2.7. Problem Formulation

The ultimate objective of microgrid in grid connected mode is minimization of operation cost,

Mathematically this can be expressed as ,

$$\min TotCOP = \sum_{t=1}^T [(\sum_{i=1}^{N_G} (COP_{gi}(P_{gi,t}) + P_{giopmain,t})) \pm P_{grid,t} \cdot G_{pr,t} + C_{Batt}(P_{B,t})] \quad (14)$$

Where, ' $COP_{gi}(P_{gi,t})$ ' output energy of diesel generator ' i ' at hour ' t ' with its maintenance and operating cost $P_{giopmain,t}$ generator ' i '; $P_{gi,t}$ is the output of generator ' i ' at hour ' t '. $P_{grid,t}$ is the grid power output and $G_{pr,t}$ grid energy cost, respectively. The battery power at hour ' t ' is represented by $P_{Batt,t}$. C_{Batt} is cost of battery operation and maintenance. Grid power when purchased indicate positive values, at time ' t ' to satisfy the local demand while microgrid when selling energy to the grid indicates negative value. the overall operation cost when minimized using IEHO results in maximization of profit to the microgrid.

3.2.8. Constraints

Several constraints like power generation limits, SOC constraints, power balance etc can be considered for objective function in (14).

- Power balance constraint :

The instantaneous demand is to be met by output from renewable energy sources with consideration to losses [9].

$$\sum_{i=1}^{N_G} P_{gi,t} + P_{Batt,t} + P_{V,t} + P_{WECS,t} + P_{grid,t} = P_{DE,t} + P_{loss,t} \quad (15)$$

$P_{DE,t}$ is load demand and the hour ' t ' considered. $P_{loss,t}$ is the system losses at hour ' t ', here losses considered are zero.

- Generator real power limits

$$P_{g,min}^j \leq P_g^j \leq P_{g,max}^j \quad (16)$$

Where,

g =generator it can be conventional generator and renewable energy-based generator.

j = bus number,

$P_{g,min}^j$ = minimum output of generator

$P_{g,max}^j$ = maximum output of generator

- Network flow constraints

Power flow limits of Power lines

$$P_{lk} \leq P_{lk}^{max}, \quad lk = 1 \dots M \quad (17)$$

Where,

lk = Power flow Line joining bus ' l ' and bus ' k '

P_{lk} = Active Power flow on line ' lk '

P_{lk}^{max} = Maximum active power flow limit on line ' lk '
 M = maximum number of power flow lines.

APPLICATION OF IMPROVED ELEPHANT HERD OPTIMIZATION FOR MICROGRID'S OPERATION COST MINIMIZATION

4.1. Basic Elephant Herd Optimization (EHO):

Wang et al. [10] presented the EHO method recently in 2015. The calculation is based on elephants' tendency to congregate together. Female elephants (FEs) guard their young from hungry hunters by conveying along the ground with seismic waves created by foot stepping and low-recurrence of elephants induced by their meandering, according to studies. According to the research, elephants may be able to detect the vibrations through their feet and interpret them as indicators of a reduced risk [11]. In nature, the elephant is also seen as a sociable animal, with certain families of FEs and their calves forming part of the group. Every tribe's movement was put out.

Elephants are also considered sociable creatures in nature, and the group includes several families of FEs and their calves. Every tribe movement is guided by the presence of a woman leader or a pioneer elephant. Even while male elephants (MEs) segregate when they mature, the female elephants (FEs) maintain in touch with their familial clan through low-recurrence vibrations [11]. The number of elephants in each clan might be set to be equal.

Steps followed while finding out the optimal solution:

Step 1 is updating position: In this step, the role of each elephant in distinct clans is updated except the matriarch and ME that holds the fine and worse solution in each of the clan, respectively, this location is update as $E_{new,cc,i} = E_{cc,i} + \alpha (E_{best,cc,i} - E_{cc,i}) \times r$ (18)

where $E_{cc,i}$ and $E_{new,cc,i}$ are the current and new locations of the i th elephant in the cc th clan, scale factor is α is set between 0 and 1, $E_{best,cc,i}$ is best location of the i th elephant in the cc th clan, and r is between [0 1] any random number.

Step 2 is fittest elephant's location is updated in each clan: The location of elephant which is fittest is updated as

$$E_{new,cc,i} = \beta \times E_{center,cc} \quad (19)$$

$$E_{center,cc} = \sum_{i=1}^{ne} E_{cc,i} / ne \quad (20)$$

The individual elephant is ' i ', ' ne ' is number of elephants in total, in each clan and ' β ' is a scale factor between [0 - 1].

Step 3 Segregation of elephant which is worst:

The worst elephants, often known as MEs, are separated from their families.

$$E_{worst,cc,i} = E_{min} + r \times (E_{max} - E_{min} + 1) \quad (21)$$

where $E_{worst,cj,i}$ is the worst or matured i th ME in the cc th clan. E_{max} and E_{min} are the maximum and

minimum value of allowable boundary limits for elephant's clan.

Step 4 is stopping criteria: The above steps 1 to step 4 are followed again till the stopping criteria is reached.

Stopping Criteria can be number of maximum iterations.

4.2. "Improved Elephant Herd Optimization (IEHO)"[11][12]:

- **Improvement I:** By following the mean response of the respective clan, the location of matriarch elephants is updated around the current best position, instead of matriarch location[11].

$$E_{new,cj,i} = E_{best,cc,i} + \beta (E_{center,cj}) \quad (22)$$

Here, $E_{best,cc,i}$ is the current best location reached so far by the leader elephants of all clans. This enhances the ability to find the global best solution.

Improvement II: Elephants are known to keep their young ones close to the stronger females to protect them from hungry predators. This is incorporated because the freshly generated young ones will occupy a spot close to the clan leader. This is reflected in the algorithm as,

$$E_{worst,cc,i} = E_{fitness_{cc}} \quad (23)$$

$E_{fitness_{cj}} = \mu \times E_{local,cc}$, where random proximity factor 'μ' is a between [0.9 - 1.1] and $E_{local,cj}$ is the local best location of the elephant of the cc th clan.

4.3. Strategy for analysis of impact of energy arbitrage and energy storage participation on microgrid operation.

The strategy for analysis is such that purposely in this work, the operation and maintenance cost for PV system and Wind energy is zero, in order to accurately evaluate the impact of grid energy arbitrage and battery maintenance cost on overall operation cost of microgrid to fulfill the load. In this study, in Grid connected mode of operation of microgrid the PV source, wind energy source and Battery have priority in energy dispatch over Diesel generator to fulfill the load as they are emission free sources.

In this work Priority of resource usage to fulfill the load demand considered is as follows:

- ✓ 1st priority goes to PV+ WECS output
- ✓ 2nd priority to Battery
- ✓ 3rd priority to Grid / Diesel Generator
- ✓ 4th and last priority to Diesel generator /Grid, whose ever cost is less as Diesel Generator is a polluting source of energy.

In each period of analysis i.e $t=1$ hour here, the load demand is fulfilled according to the priority listed above. The total generation is compared with demand to be fulfilled. If the total generation from renewable sources are not sufficient to fulfill the load demand then load is fulfilled from main grid power and at last the diesel generators are used to satisfy the load demand. In this study it is assumed that the battery SOC in initial and final period of analysis will be same. In this sensitivity

analysis main grid energy price is continuously compared with the generation cost, if the main grid energy price is lower than generation cost renewables of energy from then energy is purchased from grid to fulfill the load demand. Last priority is given to the diesel generators. When the generation is greater than the load the microgrid can sell energy to the main grid.

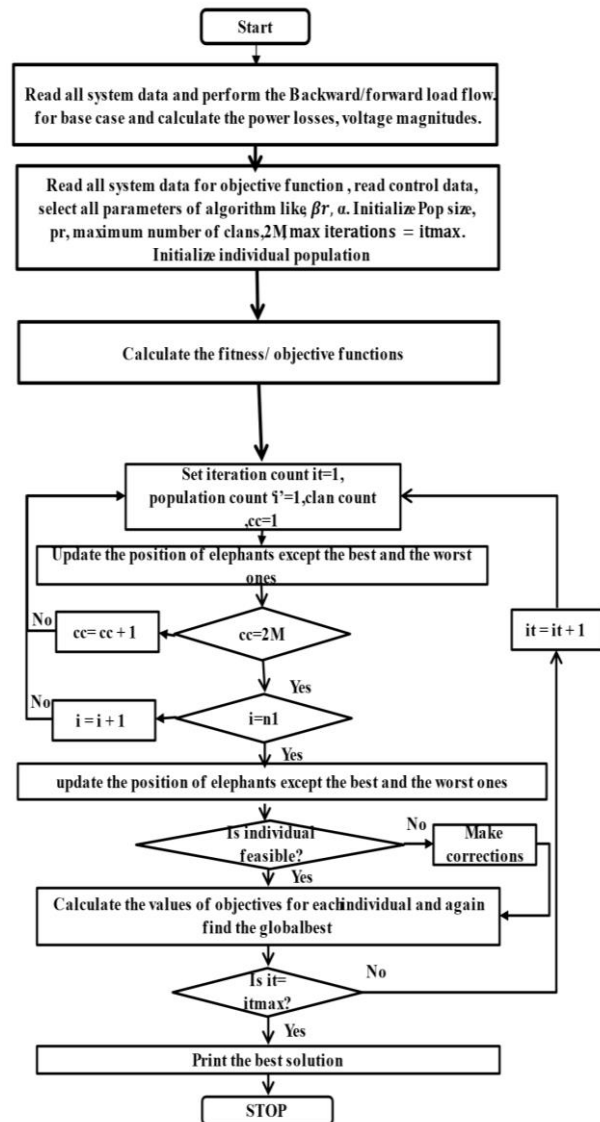


Fig.6. Flowchart for application of IEHO to optimize the microgrids operation cost

SIMULATIONS AND RESULTS

The IEHO approach is simulated using MATLAB ®, 2018 a, intel Pentium core i5 and results are verified. In this work, renewable generations have priority over polluting source i.e Diesel generator because.

Three cases are considered to optimize the microgrid operation using IEHO, consideration three different scenarios for operation of microgrid in grid-connected mode.

- Case 1:** Battery operation and maintenance cost considered is 0.18 \$/kW.

2. **Case 2:** Battery operation and maintenance cost considered is 0.5 \$/kW. The renewable energy sources operating cost is zero. The selling cost of energy to grid is 80% of grid cost of the respective hour.
3. **Case 3:** The Grid Cost is kept constant at 0.7\$/kW. Battery operation and maintenance cost is kept 0.18 \$/kW. Rest of the components and constraints remaining the same.

5.1. Case 1:

Battery operation and maintenance cost considered is 0.18 \$/kW.

The renewable energy sources operating cost is zero. The renewables and battery are the first options for fulfilling the requirement. As seen from fig.7. The total generation from renewables is less than Load and therefore always battery and if necessary, diesel generator s are used to fulfill the load. But at every instant as shown in fig 8. the operating cost to fulfill the load from grid is compared with that cost required to fulfill the same load from Diesel Generator and then the decision is implemented to maximize the benefit. As seen from fig.8. the results show us that from hour 1 to 8th Hour and from 17th Hour to 24th Hour also the grid cost to fulfill the requirement is less than cost of energy from Diesel generator to fulfill the load requirement. Therefore, microgrid purchases energy from the grid during this period to fulfill the load requirement. From 9th Hour to 16th Hour the grid cost is more to fulfill the load demand. At instants, where the renewable energy generation is greater than load demand battery output is more than the demand, then the battery is charged, and energy is stored. Also, the diesel generator operation cost is lower than the grid energy price for fulfilling the load requirement, therefore it is profitable for the microgrid to sell energy during this period. This load demand is the remaining load after using PV supply, wind and Battery output together to satisfy the load. Therefore, the last priority i.e. diesel generator operation cost is considered and the cost is determined to fulfill the remaining load demand always as last priority as it is a polluting source. Total Cost of operation for the 24 hours=\$308.0611/day.

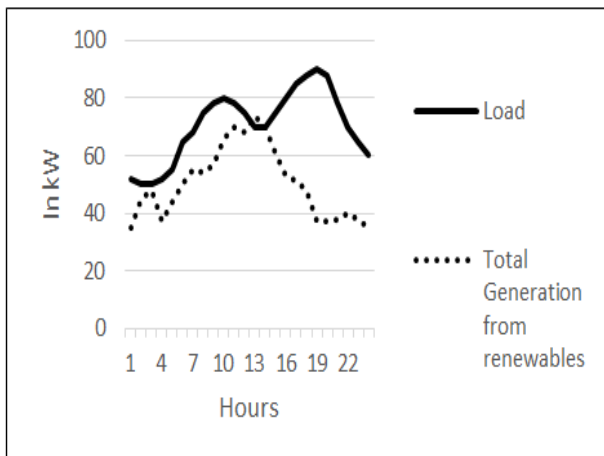


Fig.7.load and total supply from renewables

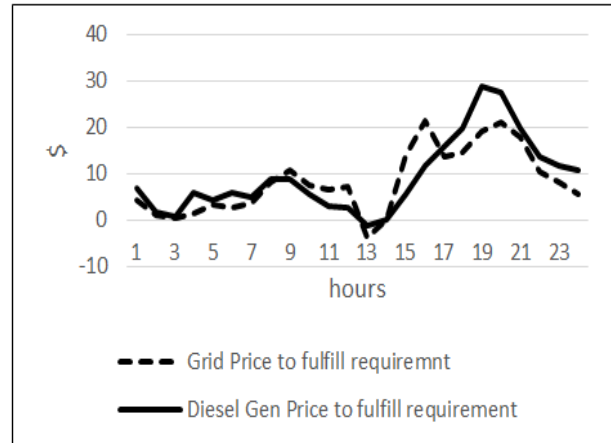


Fig.8. Comparison of grid cost and Diesel generator operation cost for satisfying the demand for case 1.

5.2. Case 2:

Battery operation and maintenance cost considered is 0.5 \$/kW. The renewable energy sources operating cost is zero.

The selling cost of energy is 80% of grid energy price of the respective hour.

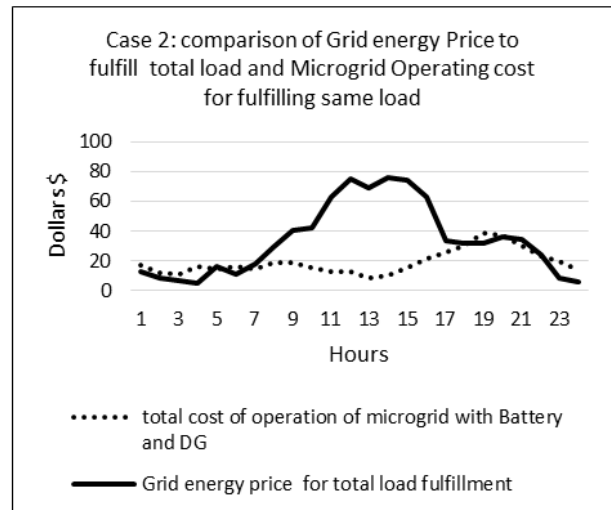


Fig 9: Comparison of Grid Cost and total Operating cost of microgrid.

In this case, from 1st hour to 6th Hour the microgrid buy's energy from grid. From 7th Hour to 18th hour, when the Grid energy price is high, and the Battery maintenance cost is increased, Diesel generators are considered to fulfill the load demand. Therefore, the total Microgrid operation cost is less as compared with high cost of Grid energy. Therefore, the microgrid can sell energy to the grid. This shows that the dispatch is significantly affected by battery reserve constraint, and it must be accounted for in the pricing system. Total operation cost is 452.661 \$/day when only microgrid is used to fulfill the load. It is almost 50% of the cost, required for grid to fulfill the same load at 818 \$/day. The Microgrid can sell the reserves energy as capacity to the grid when the grid cost is very high. Thus, microgrid can maximise its profit.

5.3. Case 3:

The Grid energy price from market is assumed to be constant at 0.7\$/kW. Battery operation and maintenance cost is kept 0.18 \$/kW.

As shown in Fig.10 the Grid energy cost is high as compared to the Cost of Diesel Generator operation to fulfill the same load demand in a day. Therefore, this sensitivity analysis shows that as a prosumer, if the grid energy price for that period, is high, then the microgrid will use all its resources, which will be profitable for microgrid owner. It depends on the owners choice to consider the environmental impact, while using Diesel Generator to fulfill the load. Economically, if the grid does not contribute in operation of microgrid, optimum cost of operation is 221.11\$/day found using IEHO. It is almost 40% less than the cost incurred when the same load is completely fulfilled by grid for the same time period as shown in Fig.10.

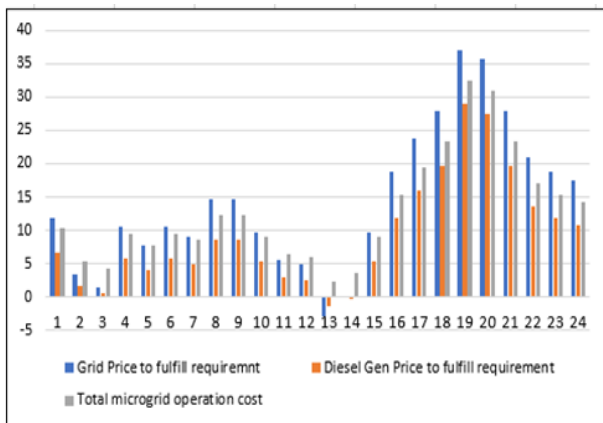


Fig.10. Shows the comparison of grid cost to fulfill requirement and Diesel Generator Cost and overall microgrid operation cost to fulfill requirement for case 3.

CONCLUSION

Impact analysis of Grid Energy arbitrage and energy storage on microgrid economic dispatch is clearly evaluated in three different cases by optimizing the operation cost of grid connected microgrid using IEHO and therefore it is well established that in Grid connected mode of operation, microgrid must strategically use renewable sources along with energy storage, so as to maximize its profit and minimize its operation cost. Due to renewable energy uncertainty, the Energy storage plays very important role to significantly reduce the operation cost and is the key component to decide the operation strategy of microgrid at each instant. Uncertainty due to seasonal changes that lead to intermittent renewable energy output and variations in the grid energy price is reduced due to energy storage present in system. As it is stable dispatchable and non-pollutant source. Due to recent technological developments, the per unit cost of energy storage is reduced. And therefore, Community storage, Grid interconnected storages are becoming the future of power system reliable operations.

Appendices:

Table 1: Technical Specifications[6][8][9]

Each wind turbine	Converter/ Inverter	Diesel Generator	Battery	PV SYSTEM each panel
Rating =1 kW	Rating=2kW	Rating =9.875kW	Charging Efficiency =95%	Rating =260 W
Cut in speed=3m/s	Efficiency=80 %	Continuous output=8.750kW	Discharging Efficiency =100%	
Cut out speed=20m/s	Voltage=24V		DOD=0.8 Voltage=12V	
Nominal speed=9m/s			Self discharge rate=0.002	

REFERENCES

- [1] "Connection criteria for distributed generation" Information from Cigré, Cigré task force C6.04.01 was formed by study committee C6 with the title "Connection Criteria at the Distribution Network for Distributed generation (DG), energize – July, 2007.
- [2] M Vijay Karthik, Dr A Srinivasula Reddy, "Particle Swarm Optimization to solve Economic Dispatch considering Generator Constraints" International Journal Of Engineering And Science (IJES), ISSN (e): 2319 – 1813 ISSN, pp 2319 – 1805, Pages: 94-100, 2014.
- [3] Quanyuan Jiang, Member, IEEE, Meidong Xue, and Guangchao Geng, Student Member, IEEE, "Energy Management of Microgrid in Grid-Connected and Stand-Alone Modes", IEEE Transactions On Power Systems, Vol. 28, No. 3, August 2013.
- [4] Whei-Min Lin 1, Chia-Sheng Tu 1 and Ming-Tang Tsai, "Energy Management Strategy for Microgrids by Using Enhanced Bee Colony Optimization", Energies 2016, 9, 5; doi:10.3390/en9010005, Published: 23 December 2015".
- [5] Mohammad Dehghani Sanij1, Mahdi Dehghani-Ashkezari1 and Hamed Hashemi-Dezaki, "Optimum Reserve Estimation in Micro-Grids containing Renewable Distributed Generation Resources", Indian Journal of Science and Technology, Vol 8(28), October 2015, ISSN (Print) : 0974-6846, ISSN (Online) : 0974-5645
- [6] Ranjay Singh, Ramesh Bansal, Arvind Singh, Raj Naidoo, "Multi-Objective Optimization of Hybrid Renewable Energy system Using Reformed Electric System Cascade Analysis for Islanding and Grid Connected Modes of operation", IEEE Access, date of publication, August 28, 2018. DOI, 10.1109/Access.2018.2867276.
- [7] Akbar Maleki, Mehran Ameri and Fathollah Pourfayaz, "Techno-economic Analysis and Optimal Design of Off-Grid Hybrid

- PV/Wind/Diesel System with battery storage”, *International Journal Of Engineering and Applied Sciences(IJEAS)*, Vol,6,Issue 4,(2014),23-29.
- [8] Arya Abdolahi, Javed Salehi, farhad samadi Gazijahani, Amin Safari, “Probabilistic Multi-objective arbitrage of dispersed energy storage systems for optimal congestion management of active distribution networks including Solar/wind/chp hybrid energy”, *Journal of Renewable and Sustainable Energy*, August 2018.
- [9] www.researchgate.net/Publications/281557339
- [10] Gai-Ge Wang; Suash Deb; Leandro dos S. Coelho, "Elephant Herding Optimization", 3rd International Symposium on Computational and Business Intelligence (ISCBI), Bali, Indonesia, 18 January 2016
- [11] Nand Kishor Meena, Sonam Parashar, Anil Swarnkar, Nikhil Gupta and Khaleequr Rehman Niazi, "Improved Elephant Herding Optimization for Multiobjective DER Accommodation in Distribution Systems", *IEEE Transactions On Industrial Informatics*, Vol. 14, No. 3, March 2018.
- [12] Pushpendra Singh, Nand K. Meena Jin Yang*, Eduardo Vega-Fuentes, Shree Krishna Bishnoi, "Multi-criteria decision making monarch butterfly optimization for optimal distributed energy resources mix in distribution networks", *Applied Energy* 278 (2020).
- [13] S. Chowdhury, S.P.; Chowdhury, P. Crossley, *Microgrids and Active distribution network*, Published by The Institution of Engineering and Technology, London, United Kingdom 2009 The Institution of Engineering and Technology.
- [14] K.M. Kurundkar and Prof. Dr. Mrs. G.A. Vaidya, "Ancillary services through microgrid for grid stability and reliability", *Electrical India*, pp. 50-54, *Electrical India*, vol 57, No. 9, Chary publication, Sept, 2017.
- [15] Anderson Hoke, Student Member, IEEE, Alexander Brissette, Student Member, IEEE, Shawn Chandler, Annabelle Pratt, Senior Member, IEEE, and Dragan Maksimović, Senior Member, IEEE, "Look-ahead Economic Dispatch of Microgrids with Energy Storage, Using Linear Programming" 1st IEEE Conference on Technologies for Sustainability (SusTech), 2013.
- [16] Nima Nikmehr, Nima Nikmehr, Sajad Najafi Ravadanegh, Sajad Najafi Ravadanegh, "Optimal Power Dispatch of Multi-Microgrids at Future Smart Distribution Grids" *IEEE Transactions on Smart Grid* 6(4):1-1, July 2015.

An Efficient and Intelligent Decision Making for Eco-Fertilization

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Abstract:

Fertilizer use is typically under the limited control of farmers. For the farmers to achieve higher yields and reduce fertilizer loss, competent guidance is required for the best use of these fertilizers. Additionally, there is a connection between rainfall volume and nutrient loss for various fertilizer applications after each rainfall event. Rainfall that is moderate and falls at the right moment can help nutrients penetrate the soil's rooting zone and dissolve dry fertilizer. However, too much rain can increase the possibility of runoff and the pace at which nutrients like nitrogen (N) which is quintessential, phosphorus (P), and potassium (K) which are crucial, manganese (Mn), and boron (B) that are present in the soil. This research presents nutrient recommendations using an updated iteration of the random forest algorithm which is based on time-series data to forecast the required quantity of nutrients for various crops by examining rainfall patterns and crop fertility. The method suggested in this study, comes in handy for improving soil fertility by providing nutrients recommendations for optimum conditions for crop growth and reducing leaching and runoff potential.

INTRODUCTION

Agriculture plays a very important role in national economic growth. Agriculture contributes 17-18% to India's GDP and ranks second worldwide in farm outputs. Plants need fertilizers and fertilizers replace the nutrients which crops take from the top layer of the soil. The absence of fertilizers can cause a drastic reduction in the volume of crop output. But fertilization requires precise action. Rainfall patterns and the amount of nutrients needed for a certain crop must be considered when using fertilizers. Machine learning is the current technology that can solve this problem by using available data for crop fertility and rainfall. Farmers can greatly benefit from the support of robust information about crops. The proposed model also uses a machine-learning algorithm (random forest regression algorithm with k-fold cross-validation technique) and takes two inputs from the user that are crop and location. After applying the algorithm, the model predicts the amount of nutrients required along with the best time to use fertilizers. The website is built using Flask Python (web framework) to provide access on all platforms and can be shared among users.

RELATED WORKS

A comprehensive study of the available literature presents a catalog of previous studies to address this issue. The authors show in [1] that predicting fertilizer usage can assist farmers to attain a proper yield with little waste by preventing toxicity and deficiency in

plants to some extent. Paper [2] makes use of fuzzy logic systems that enable the reduction of fertilizer usage which results in an increase in crop productivity. Additionally, [10] shows that the enhanced efficiency of fertilizers is not sufficient for complications that can be caused by compaction. These issues can be prevented by improving the fertilizer recommendation which requires the establishment of a quantifiable relation under N and P for fertilizer usage amongst crop yield, nitrogen need, and nitrate residue level which is shown in [11] and paper [4] seconds this by providing a comprehensive measure to estimate the weightage of nutrient requirements and also the role of the chemical properties of soil.

It is a difficult task to predict crop yield due to stochastic rainfall patterns and also temperature variation. So we can apply different data mining techniques as propounded in [3] for crop yield prediction. Laura J.T. Hess *et al.* in [5] state that nitrogen leaching is prone in areas that have no-till management and this may cause crop loss. In [7] the authors suggest a novel metric for 'soil health and quality' including refinement of soil's health.

The goal of the paper [8] is to investigate the intrinsic changes in the composition and functions of soil populations and functions as a result of the interaction between long-term fertilization and rainfall fluctuations, in order to determine whether fertilization history has an impact on the water- resistance of soil microbes. Also, Paper [13] predicts agricultural yield as a function of rainfall. This is accomplished by giving a general summary of how production is affected by rainfall and how much a given crop can yield given the amount of rainfall received. Because it examines all regression procedures, the suggested method of evaluation is superior to other existing methods of evaluation.

Potnuru Sai Nishant *et al.* in paper [6] predict the yield of practically all types of crops in India. This script makes innovative use of simple criteria such as state, district, season, and area, allowing the user to forecast crop yields in any year. Paper [12] suggests the use of Transfer Learning techniques to create a pre-trained model for detecting patterns in the dataset, which we then used to predict crop yields. In [14], supervised algorithms that boost crop yields, reduce human labor, time, and energy exerted on various agricultural tasks, and plant suggestions based on particular soil parameters are used to produce a complete way to predict crop sustainability. The study [16] demonstrated the capabilities of a machine learning model that can

interpret and evaluate results, can be utilized to create the most useful information in long-term fertilizer studies, and that these techniques can be employed in other long-term experiments. Paper [17] develops an interesting decision-based system on climatic, crop, and insecticide/pesticide data.

Senthil Kumar Swami Durai *et al.* in [18] propose an integrated solution to Pre-Cultivation activities. The goal of this study is to assist a small farm in becoming more efficient and achieving a high production at a low cost. It also aids in the estimation of total growth expenses. It will assist one in planning forward. Pre-cultivation activities lead to an integrated solution in agriculture. M.S. Suchithra and Maya

L.Pai propose solutions to soil nutrient classification problems utilizing the rapid learning classification technique called an Extreme Learning Machine (ELM) with various activation functions in [19].

Crop diseases are one of the primary causes that impact the overall yield. Paper [15] conducts this study using an IoT system in the Kashmir Valley, it proposes an apple disease prediction model using data analysis and machine learning. The challenges of incorporating new technology into traditional agricultural practices are discussed in this paper.

PROPOSED MODEL

In this study, a predictive model for the nutrients required for crops was obtained using random forest. Random forest regression with the k-fold cross-validation technique represents the model and the model with acceptable accuracy for the prediction is then obtained. A total of 7 features have been used to evaluate the algorithm.

As shown in Fig 3.1, the algorithm requires input from the user (such as location and crop). The location is fed to the Weather API which will return certain characteristics (e.g. temperature, humidity, rainfall) and if there is a possibility of heavy rainfall, a precautionary message is displayed to the user, otherwise, the proposed algorithm is followed.

Random Forest Algorithm

Random forest (RF) is a collection of multiple decision trees that have variable hyper-parameters and are trained using varying subsets of data. In our project, we are going to take crop and location as input, and based on it, we will predict the value of N, P, and K. First, we will divide our dataset into training and test datasets, where the training dataset is 80% of the original data and the rest 20% is test data. Then we will create three different random forests of size 50 (decision tree) for each N, P, and K and outputs the mean of the classes as the prediction of all the trees.

Input Features

- **Crop:** *rice, cotton, mango, orange, lentil, etc.*
- **Temperature:** *temperature measured in Celsius*
- **Humidity:** *measured relatively in percentages*

- **Rainfall:** *rainfall in mm*

Output Features

- **Label N:** *ratio of Nitrogen content in the soil*
- **Label P:** *ratio of Phosphorous content in the soil*
- **Label K:** *ratio of Potassium content in the soil*

Dataset

Crop Recommendation Dataset [22] Last access date: 16.11.2021

Data Preparation

Actual Dataset contains (features 14). All of the features are not useful for the proposed model. Therefore, a dimension reduction technique called feature selection is applied.

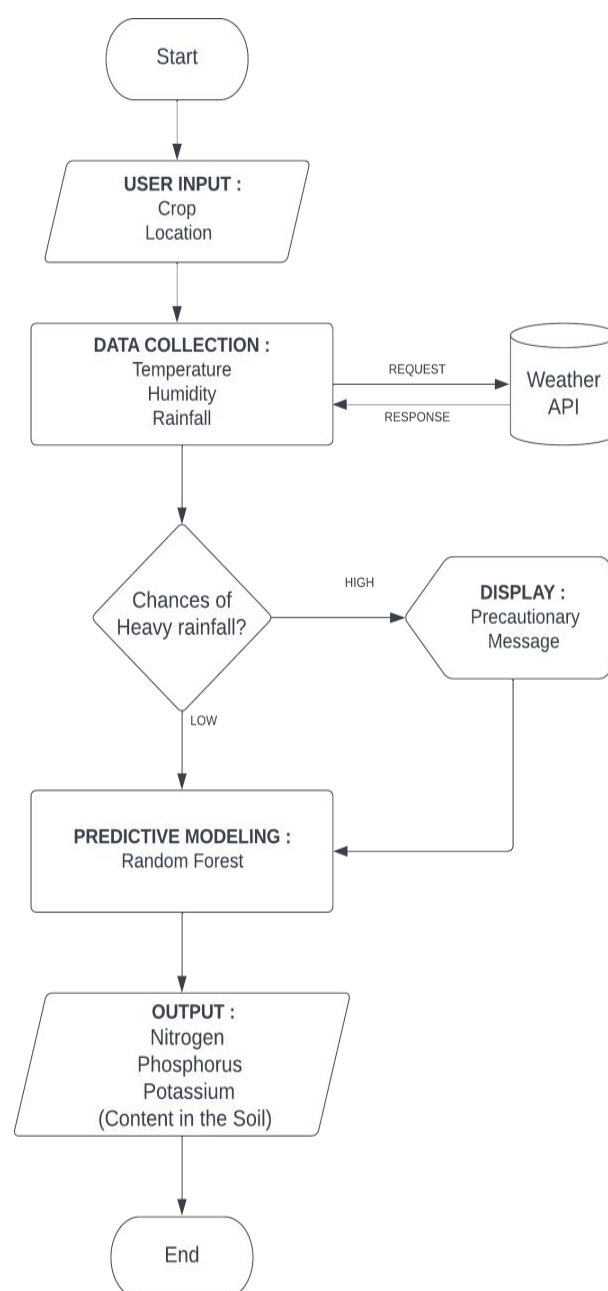


Figure 3.1: Project Flow

BEGIN:
Step 1: The dataset of size $n=2200$ is divided into training and test dataset (where the training set is 80% and the test set is 20% that is training set=1,760 and the test set=240).
Step 2: Apply random forest regression to each N, P and K (Nitrogen, Phosphorus & Potassium) value with n estimators=50 (n estimators is the number of decision trees).
Step 3: Train the N label, P Label and K Label with the training dataset and dependent variable (Where the dependent variable is N for N Label, P for P Label and K for K Label).
Step 4: Each N Label, P Label and K Label generates a 50 decision tree as an output based on the training dataset.
END

Figure 3.2: Random Forest Algorithm

CONCLUSION

This research aims to provide an intelligent and optimistic decision for the farm system to optimize fertilizer usage.

REFERENCES

- [1] Krutika Hampannavar, Vijay Bhajantri, Shashikumar G. Totad "Prediction of Crop Fertilizer Consumption," Fourth International Conference on Computing Communication Control and Automation (ICCUBE), 2018, PP.1-5
- [2] G. Prabakaran, D. Vaithiyanathan, Madhavi Ganesa, "Fuzzy decision support system for improving the crop productivity and efficient use of fertilizers," Computers and Electronics in Agriculture, vol-150, 2018, PP. 88- 97
- [3] Shital Bhojani, Nirav Bhatt, "Data Mining Techniques for Crop Yield Prediction," Computers and Electronics in Agriculture, vol-6, 2018, PP. 357- 358
- [4] Yulong Yin, Hao Ying, Huifang Zhen, Qingsong Zhang, Yanfang Xue, Zhenling Li, "Estimation of NPK requirements for rice production in diverse Chinese environments under optimal fertilization rate," Agricultural and Forest Meteorology, vol-279, 2019, PP. 1-6
- [5] Laura J.T. Hess, Eve-Lyn S. Hinckley, G. Philip Robertson, Pamela A. Matson, "Rainfall intensification increases nitrate leaching from tilled but not no-till cropping systems in the U.S. Midwest," Agriculture, Ecosystems & Environment, vol-290, 2020, PP. 1-10
- [6] Potnuru Sai Nishant, Pinapa Sai Venkat, Bollu Lakshmi Avinash, B. Jabber, "Crop Yield Prediction Based on Indian Agriculture using Machine Learning," 2020 International Conference for Emerging Technology (INCET), 2020, PP. 1-4
- [7] Tony Yang, Kadambot H.M., Siddique, Kui Liu, "Cropping systems in agriculture and their impact on soil health," Global Ecology and Conservation, vol-23, year, PP. 1-13
- [8] János Káta, Ágnes Oláh Zsuposné, Magdolna Tállai, Tarek Alshaal, "Would fertilization history render the soil microbial communities and their activities more resistant to rainfall fluctuations?," Ecotoxicology and Environmental Safety, vol-201, 2020, PP. 1-11
- [9] Usman Ahmed, Jerry Chun-Wei Lin, Gautam Srivastava, Youcef Djenouri, "A nutrient recommendation system for soil fertilization based on Evolutionary Computation," Computers and Electronics in Agriculture, vol- 189, 2021, PP. 1-7
- [10] A.Hussein, Diogenes L. Antille, Shreevatsa Kodur, Guangnan Chen, Jeff N. Tullberg, "Controlled traffic farming effects on productivity of grain sorghum, rainfall and fertilizer nitrogen use efficiency," Journal of Agriculture and Food Research, vol-3, 2021, PP. 1-17
- [11] Zujiao Shi, Donghua Liu, Miao Liu, Muhammad Bilal Hafeez, Pengfei Wen, Xiaoli Wang, Rui Wang, Xudong Zhang, Jun Li, "Optimized fertilizer recommendation method for nitrate residue control in a wheat-maize double cropping system in dryland farming," Field Crops Research, vol-271, 2021, PP. 1-10
- [12] Janmejy Pant, R.P. Pant, Manoj Kumar Singh, Devesh Pratap Singh, Himanshu Pant, "Analysis of agricultural crop yield prediction using statistical techniques of machine learning," Materials Today: Proceedings, vol-46, 2021, PP. 1-10
- [13] Benny Antony, "Prediction of the production of crops with respect to rainfall," Environmental Research, vol-202, 2021, PP. 1-5
- [14] Akash Manish Lad, K. Mani Bharathi, B. Akash Saravanan, R. Karthik, "Factors affecting agriculture and estimation of crop yield using supervised learning algorithms," Materials Today: Proceedings, 2022, PP. 1-10
- [15] Raves Akhtar, Shabbir Ahmad Sofi, "Precision agriculture using IoT data analytics and machine learning," Journal of King Saud University - Computer and Information Sciences, 2021, PP. 1-17
- [16] Saheed Garnaik, Prasanna Kumar Samant, Mitali Mandal, Tushar Ranjan Mohanty, Sanat Kumar Dwibedi, Ranjan Kumar Patra, Kiran Kumar Mohapatra, R.H. Wanjari, Debadatta Sethi, Dipaka Ranjan Sena, Tek Bahadur Sapkota, Jagmohan Nayak, Sridhar Patra, Chiter Mal Parihar, Hari Sankar Nayak, "Untangling the effect of soil quality on rice productivity under a 16-years long-term fertilizer experiment using conditional random forest," Computers and Electronics in Agriculture, vol-197, 2022, PP. 1-10
- [17] Rubby Aworka, Lontsi Saadio Cedric, Wilfried Yves Hamilton Adoni, Jérémie Thouakessah Zoueu, Franck Kalala Mutombo, Charles Lebon Mberi Kimpolo, Tarik Nahhal, Moez Krichen, "Agricultural decision system based on advanced

- machine learning models for yield prediction: Case of East African countries,” *Smart Agricultural Technology*, vol-3, 2022, PP. 1-9
- [18] Senthil Kumar Swami Durai, Mary Divya Shamili, “Smart farming using Machine Learning and Deep Learning techniques,” *Decision Analytics Journal*, vol-2, 2022, PP. 1-30
- [19] M.S. Suchithra, Maya L. Pai, “Improving the prediction accuracy of soil nutrient classification by optimizing extreme learning machine parameters,” *Information Processing in Agriculture*, vol-7, 2022, PP. 1-11
- [20] Kaggle, “ <https://www.kaggle.com/datasets/atharvaingle/crop-recommendation-dataset> ” (accessed on 16th November 2021)

Traffic Sign Recognition System using YOLO

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Abstract:

One of the primary criteria for autonomous cars and most advanced driving assistance systems is the capacity to perceive and interpret all static and dynamic objects around the vehicle under diverse driving and climatic circumstances (ADAS). convolutional neural networks have the potential to give safe ADAS in current vehicles (CNN). in this research, we describe a yolo-based traffic sign identification programmed that has been enhanced using a CNN. because real-time detection is necessary for safe driving, the yolo network utilized in this study was pre-trained to identify and classify just five items, which are divided into categories such as automobiles, trucks, people, traffic signs, and traffic lights.

compared the colour properties of a source picture and a candidate image using a colour matching model. This model is inaccurate. [1]

The detecting module, comprises colour and form analysis. SVM classifier and edge detection are included in the classification module, which improves results. It is vital to use the best procedures in order to achieve the greatest results, which will increase driving safety and comfort greatly. It worked with the German Dataset rather than a bespoke dataset. [2]

In the training and testing dataset, over 2,728 sign samples were collected for 24 different traffic signs. The dataset was pre-processed before being put into the network. It was broken down into three sections: training, testing, and validation. The final Deep CNN architecture presented in this study consists of two convolutional layers, two max pooling layers, one dropout layer, and three thick layers. For epoch 150, 100 percent accuracy was attained for all batch sizes. [3]

The system's objectives are to find and categorize indications initially. The localization U-Net is identified using CNN with the encoder-decoder architecture. To eliminate salt and pepper noise from the image, we may use image pre-processing techniques like the median filter, followed by contrast normalization across all channels. Although SqueezeNet may be used for classification, the HOG classifier can enhance accuracy. [4]

INTRODUCTION

Traffic sign recognition has a lot of promise in intelligent autonomous vehicles and driver assistance systems, and traffic quality and safety can't be improved without properly applying and maintaining road traffic signs, signals, and road markings. Because of the benefits that such a system may give, traffic sign detection and recognition has become more important with developments in image processing. The benefits that such a system might give have also risen as a result of recent breakthroughs and interest in self-driving automobiles. The interest in self-driving automobiles has grown as a result of recent breakthroughs and interest.

PROBLEM STATEMENT

A driving assistance system must have automated traffic sign recognition. Detecting traffic symbols and providing expected results with better accuracy. After capturing the video sequences under different conditions (illumination, weather, speeds, etc), using vehicle mounted camera, the following objectives are expected:

- To propose a method to extract the image frames from the video segment.
- To propose an algorithm to identify the regions of interest
- To propose a method to extract the symbol of the traffic warning sign
- To propose a method to identify the symbol of the traffic warning sign.

LITERATURE REVIEW

This study provided 10 additions to the current state-of-the-art methodologies in the Traffic Sign Detection and Recognition system. The investigations were carried out based on colour behaviour in response to changes in lighting and other environmental circumstances. It also

METHODOLOGY

In this project, YOLO is used which is a CNN based network to detect objects. It performs real-time object detection. YOLO doesn't consider detection as several classification problems but it considers detection as a regression problem. It is a single-stage detection network that takes input as image pixels and predicts bounding box coordinates with class probabilities. With YOLO, the entire object identification procedure is completed in a single image assessment. YOLO splits the input picture into grids and predicts bounding boxes, box confidence, and class probability all at the same time.

a) Data Collection

All the images used for this project are collected randomly from different sites of the dataset like Kaggle, machine learning repositories, etc. While collecting this dataset care has been taken about the inclusion of almost all types of traffic signs from different locations get into the dataset. As of now for the demonstration and testing purposes, we have used 5 classes for the recognition.

Following are some of the images from the dataset:



b) Data Pre-processing

To prepare the dataset, we need to create annotations for the corresponding image of the traffic sign. We have created a .txt file with the same name for each image file in the same directory. Each .txt document contains the explanations for the comparing picture record, that is object class, object directions, level and width.

The model of the YOLOv4 consists of Bounding Box Pre-Processor. In this extraction and preparation of the detected traffic sign image takes place for classification. The regressed bounding box's centre is then established. The box is then enlarged by 25% to correct for any regression errors and to guarantee that the traffic sign is completely included in the zone. After being cropped and resized to 48*48 size, the expanded boxes are handed up to the classifier system for detection of the traffic sign class.

OVERVIEW OF THE PROPOSED MODEL

a. YOLOv4 for Traffic Sign Recognition

For our Traffic Sign Recognition System, we employed the YOLOv4 model. YOLOv4 is an object detection model that works in real time. It's an updated version of the YOLOv3 model that includes several additional tricks and modules. The traffic sign recognition system has a YOLOv4 detector trained to recognize potential traffic signs, a boundary box pre-processor that expands the detected boundary box, trims and resizes the candidate traffic sign box, and candidate traffic. Consists of a CNN- based classifier that classifies. A sign that belongs to one of five classes. These are for demonstration purposes and can be expanded in the future as needed.

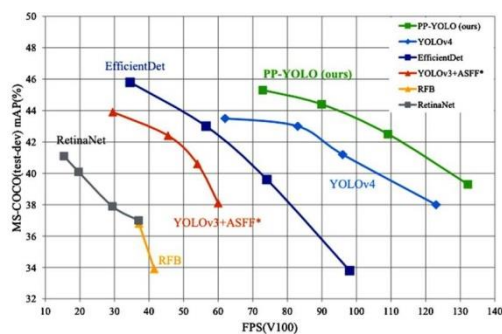


Figure 1 Comparisons

b. Activity Recognition Phase

As shown in Fig. 1. In the first step, the image is captured by the model. Then the captured image is pre-processed by the Bounding Box Pre-processor where the image is enlarged, cropped and resized to be fitted into the region. To make the image analysis easier, segmentation is done by the model itself after that object

is detected. After the detection of a traffic sign, the model throws the output of the recognized traffic signs with its class.

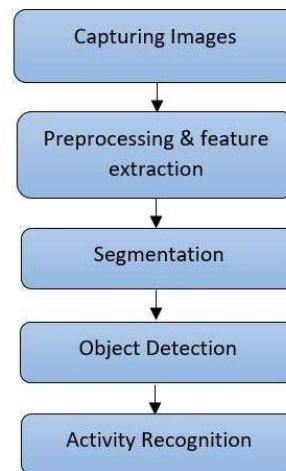


Figure 2 Activity Recognition Phase

YOLOV4 ARCHITECTURE

YOLOv4 is a design based on CSPDarknet53 which is considered as a most important factor, Path Aggregation Network and the Spatial pyramid pooling which are mainly referred as a Neck and for the Head YoloV3. CSPNet is an optimization strategy that envisions segmenting the base layer feature map into two sections and shuffling them in order between stages, as shown in Figure 3. The Spatial Pyramid Pooling is a method which is mainly used for acquiring both coarse data and the fine data by the pooling with different sizes of Kernel at the same time. PAN (Path Aggregation Network) is a method of using the data of the layer near the post by passing various backbone level elements to the detector.

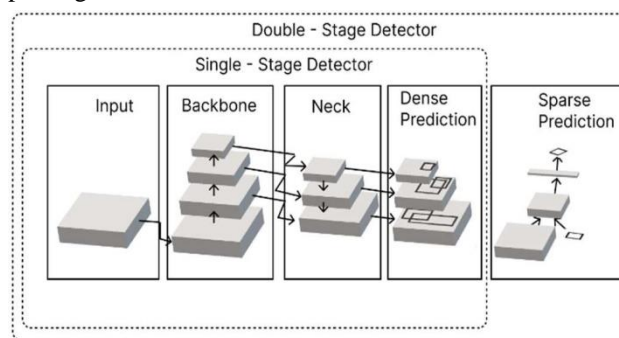


Figure 3 YOLOv4 Architecture [7]

DATA ANALYSIS

Data would be collected from various sources like Kaggle and would be working on a variety of images, by customizing the dataset for better accuracy.

Firstly, we would acquire a video through a particular medium source and extract the images from a video segment would perform a few image filtration processes eventually detecting the traffic symbol.

As soon as the symbol is extracted it would perform computation to get the appropriate result for the extracted image and return the result.



Figure 4 mAP Graph



Figure 5 Zoomed Image

OUR APPROACH

The existing systems have very less accuracy whereas we have worked on enhancing the accuracy of our system. We have worked on the YOLO algorithm which is latest than the other algorithms that exist and are used for traffic sign recognition. To achieve better accuracy, we have used customized dataset.

SCOPE OF RESEARCH

The yolo algorithm helps to classify the classes at real time as well as with better accuracy. The particular research would elaborate the better use of convolutional neural network thus providing better results as well as learning techniques.

LIMITATIONS

- Data is directly proportional to the accuracy. Hence more data is expected.
- Data needs to be annotated before training.
- Model training requires a GPU.
- Takes lots of time to train models.

FUTURE SCOPE

The particular project could be integrated with the application to detect at real time with better accuracy for the road signs also further voice assistant could be especially abled persons using special hardware. The application further could be used for driverless vehicles in upcoming days.

CONCLUSION

The traffic sign recognition system using you only look once(yolo) comes up with better results at real time, the better version of the convolutional neural network has made things easier in terms of accuracy.

The model would be beneficial in upcoming days as the expected technology would be YOLO thus aiming to have better results rather than the other models. The model would easily recognize traffic signs out from the input videos, images and provide the most accurate result.



Figure 6 Results

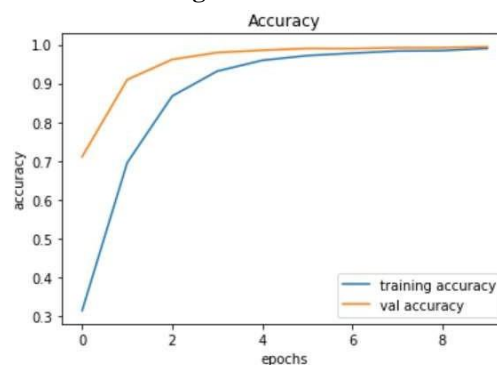


Figure 7 Accuracy of the model

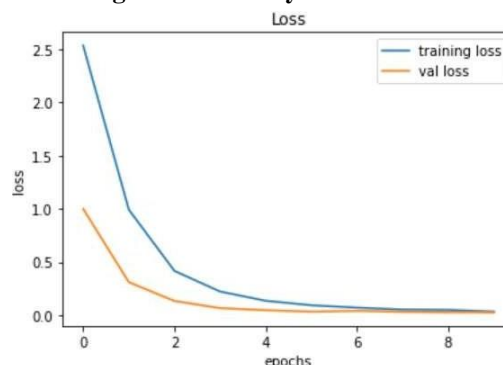


Figure 8 Training Loss in the model

REFERENCES

- [1] Traffic sign detection and recognition: Review and analysis by Amar Faiz Zainal Abidin, Bahzifadhli Bakri, Ezreen Farina Shair, and Nur Rafiqah Abdul Razif
- [2] A Survey on Road Sign Detection and classification by Priyanka a. Nikam1, prof.nitin b. Dhaigude

- [3] A Survey on Traffic Sign Recognition and Detection Albert Keerimolel, Sharifa Galsulkar, Brandon Gowray
- [4] Automatic Detection and Recognition of Traffic Signs By Prasanna Mahesh Gunawardana
- [5] YOLOv4: Optimal Speed and Accuracy of Object Detection by Alexey Bochkovskiy, Chien- Yao Wang, Hong-Yuan Mark
- [6] A New Backbone That Can Enhance Learning Capability Of CNN by Alexey Bochkovskiy, Chien-Yao Wang, Hong-Yuan Mark.
- [7] <https://www.researchgate.net/>

Fashion Classification Model

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Abstract:

These days there are 2 main problems which the ecommerce industry is facing, the first problem is where the sellers find it difficult to post a picture of a clothing item on their website or any platform for sale, sometimes it can lead to misclassifications of any clothing item or can lead to absence from search results. Another problem which concerns is in placing an order when the customer is unaware of the product or doesn't know the name of the product but has the picture representation of it. Hence by allowing buyers to click a picture of an object and search for related products without actually typing for the product name, an image-based search algorithm can help ecommerce reach its full potential.

Keywords:

Dense, Optimizer, Inception V3, CNN.

INTRODUCTION

By delivering a hassle-free shopping experience as well as delivery to an individual, e-commerce has unleashed a bigger desire for products because of the amount of consumers we have globally. We discuss two difficulties facing the industry, one from the standpoint of the seller and the other from the standpoint of the buyer.

Whenever the seller wants to sell his product online on a platform he has to click a picture and tag with the help of appropriate labels to make sure it reaches the buyer or appears in the search list. It becomes difficult for a human to process each and every image and put them into respective categories, so here machine learning comes to the rescue the machine classifies the image and puts them into respective categories hence the problem of classification arises. Therefore a model is required to classify the images and put them into the right category. We are creating our own model where we are using "fashion_mnist" will train the dataset and test the dataset. This dataset is more diverse as it enables us to learn complicated properties, to distinguish the images. Generally the accuracy for these models is around 70-80% but we are able to get the accuracy of 93.1% by applying different layers to the model like dense, max pooling, convolutional layers etc. We have created such a model by which the error rate is low which will help the seller to upload their image and the model will classify the image and put them into that specific category and the buyers as well to search directly by the image rather than typing the name of that clothing item.

LITERATURE REVIEW

2.1 VGGNet-16:

VGGNet-16 contains 16 convolutional layers and is very different as it has a uniform architecture. Similar to Alexnet it has 3X3 convolutions, but contains a lot of

filters. Also, it can be trained in 2-3 weeks on 4 GPUs. Nowadays in the community this method is preferred for extracting features from the images. We can load a pre-trained version of the network trained model on more than a million images from the ImageNet database and the pretrained model can classify the images as dog, cat, cow, calf etc. Hence, this network has learned rich feature representation from a vast range of images. 224 X 224 is the input image size which is accepted by the network.

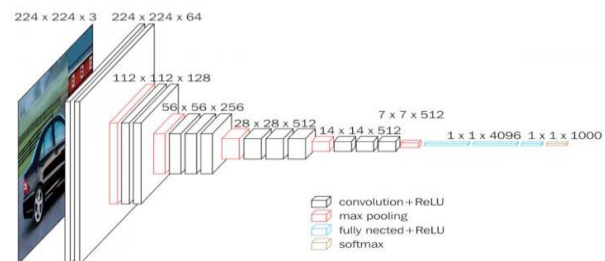


Fig : VGG16 - Convolutional network for classification and detection.[10]

2.2 Inception :

Inception V3 is a deep learning model which is based on convolution neural networks generally used for image classification. Inception V3 is a superior model to inception V1 which was introduced back in 2014 by GoogleNet. It is an image recognition model that gives an accuracy of more than 78.1% on ImageNet dataset. In a model when multiple amount of deep layers of convolutions were used, overfitting of data was shown hence to avoid this from happening inception model was used. It uses multiple filters of different sizes on the same level. Thus in this model rather than having too deep layers we have parallel layers which makes the model wide instead of making it deeper.

2.3 ResNet 152 V2:

Resnet is the short form for Residual Networks, it is a classic neural network mainly used for many computer vision tasks. Residual network is a CNN (convolutional neural network) architecture that overcomes the "vanishing gradient" problem. Deep ResNets are formed by stacking the residual blocks on top of each other and they go up to hundred layers per network. It is effective in deriving parameters from early activations further down the network. On the other hand the model ResNet deals with very deep neural networks with 150+ layers. Resnet 152 V2 has a very deep network up to 152 layers in itself. Instead of learning the signal representation directly the model learns the representation functions first.

METHODOLOGY

1. Data Collection :

The first step to start a project is data collection wherein we select the subgroup of the data that we have and will be working with. All the machine learning algorithms or problems start with data which can consist of examples or the observations for which we already are familiar with the target answer. The data for which we already know the target answer is known as labeled data. Here for our model we have used the "fashion_mnist" dataset.

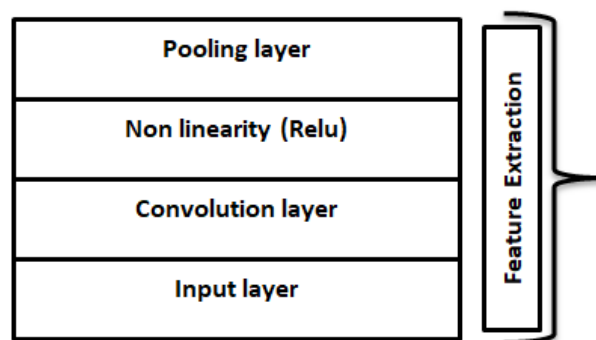
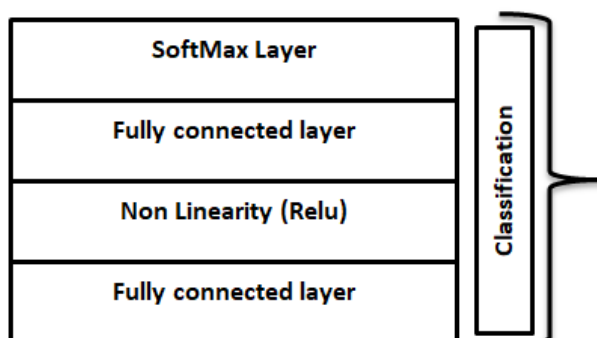
2. Dataset Analysis :

Fashion-MNIST is a dataset of Zalando's substance pictures which consist of 60,000 examples in the training set whereas 10,000 examples in the test set. Each substance in the dataset is a grayscale image which is connected to any one of the ten classes mentioned and is of size 28x28. For benchmarking machine learning techniques, Fashion-MNIST is a direct drop-in substitute for the original MNIST dataset.

There are some particular reasons as to why we rely the most on fashionMNIST dataset. First reason is that we have a huge amount of modern results to compare with, as some researchers use new methods and it has a good level of accuracy and undoubtedly any classifier can attain a perfect score on it, so there remains a scope for optimization. In short the FashionMNIST dataset is more diverse, requiring machine learning (ML) methods to learn more complicated properties in order to consistently distinguish specific classes.

PROPOSED MODEL

Deep neural networks have recently been applied to a wide range of problems to achieve remarkable results. Convolutional neural networks, in particular, have demonstrated outstanding results in image classification, image segmentation, laptop vision problems, and language communication process problems. Some probabilistic models, such as Bayesian Belief Networks and Hidden Markov Models, have been used to classify images with options that include gray level, color, motion, depth, and texture. We have a propensity to investigate the topic of classifying Fashion MNIST images with convolutional neural network versions in this paper.



ALGORITHMS

A. Machine Learning

That work on building software applications being accurate in predicting the results and outcomes which will not need any external programming help. Algorithms of machine learning use the data which is already present in the past as an input so that it can predict the new outcomes. Machine Learning can help industries and companies to understand as well as examine their customers and consumers subordately. In addition to this, this predictive learning method can help in the formation of operating systems (OS) of self-driving cars, for example, Tesla. Data of the consumers is collected and correlated with their behaviors all the time. Machine Learning is used as an important as well as the primary driver for the business models of the companies such as Uber. They use certain ML algorithms which help in finding the driver to a rider (user). In search engine industries like Google, the algorithms of machine learning are used in the advertisement sector while surfing and searching. Machine Learning always focuses on making the prediction more accurate. Four basic approaches to the Machine Learning are as follows:

- Supervised Learning
- Unsupervised Learning
- Semi-supervised Learning
- Reinforcement Learning.

The selection of approach, as well as algorithm, solely depends upon the type of data and information which is to be predicted.

B. CNN :

CNN (convolutional neural networks) is a deep learning neural network mainly used for processing the structured array of data such as portrayals. The main feature of CNN is that it doesn't need any preprocessing; it can run directly on any underdone image. Also, this algorithm is very competent in recognizing lines, circles, gradients or even face or eyes in an image. This characteristic makes this algorithm very strong.

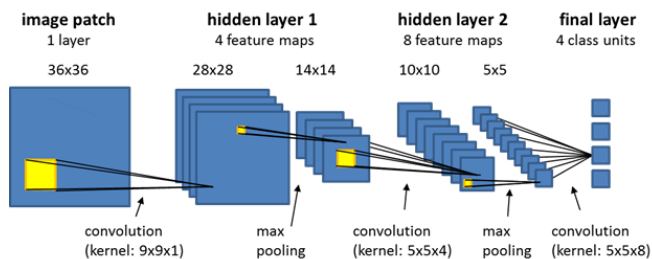


Fig: CNN (convolutional neural network)

C. Dropout:

Dropout layer is a layer used in the CNN algorithm, mainly applied to the input vector where it nullifies some of its features or can be applied to the hidden layers where it nullifies the hidden neurons. The main reason why dropout layer is being used is it prevents overfitting in the training dataset. Inputs which are not set to 0 are scaled up by $1/(1 - \text{rate})$ so that the total sum remains exact same.

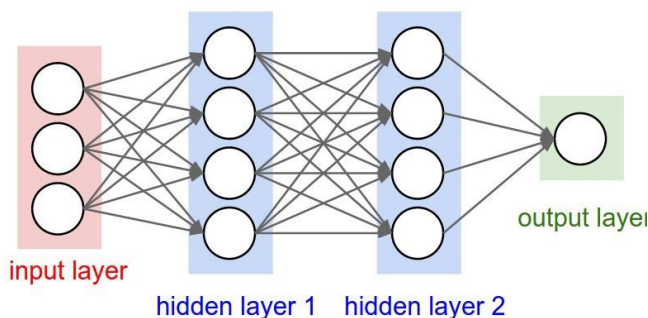


Fig: dropout layer [9]

D. Optimizer:

Optimizers are methods or algorithms in neural networks which help to change the attributes such as weights etc to reduce the losses and improve the accuracy. Optimizers help to get the results faster. They shape or mold the model to get the most accurate form.

E. Dense:

Dense layer is a commonly used layer. It is a deeply connected neural network layer. It consists of a layer of neurons in which neurons receive input from the previous layer hence it is known as a dense layer. This layer classifies the images based on the output from the convolutional layer. Here one layer contains multiple amounts of neurons.

OUR APPROACH

For excellent performance, deep neural networks are applied to various issues in deep neural networks. In image classification, image segmentation, laptop vision issues and linguistic communication process issues, CNN has shown magnificent results. Some probabilistic models supported by Bayesian Belief Networks and Hidden Markov Models have conjointly been applied to image classification issues with options supported by gray level, color, motion, depth, and texture. During this paper, we have a tendency to explore the concept of classifying

Fashion MNIST pictures with variants of convolutional neural networks

LIMITATIONS

By the use of low-resolution photos and product mislabelling, the accuracy of the current study may be reduced. Low-resolution photos, on the one hand, are easier to train with. However, in terms of accuracy, the model represents a compromise. On the other hand, the model's use of high-resolution photos may result in a longer training time for the models, but with higher precision. The trade-off between speed and precision is something that the company must determine for itself.

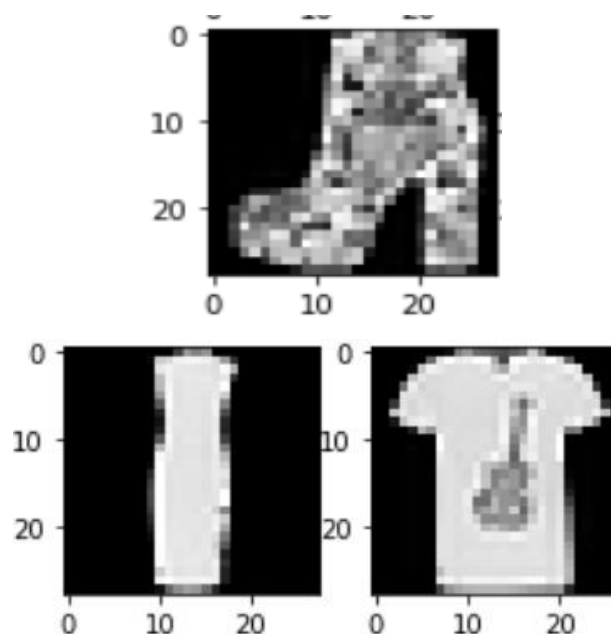
FUTURE SCOPE

Deep neural networks have been used to solve a variety of problems in recent years.

The potential application for picture classification is the detection of counterfeit goods (Nvidia, 2018). An in-depth examination of a brand's logo's characteristics, such as design, colors, and placement, can aid in the detection of counterfeit goods. We may potentially use a generative adversarial network (GAN) to come up with new fashion accessory designs and reduce our reliance on human creativity, thanks to significant advances in processing power and machine learning methods. Despite the fact that training a GAN model is a tedious task, these (GAN) models in the fashion industry could have substantial commercial value in the near future.

RESULTS

Product	Val Accuracy	Val loss
Category	0.9324	0.4631



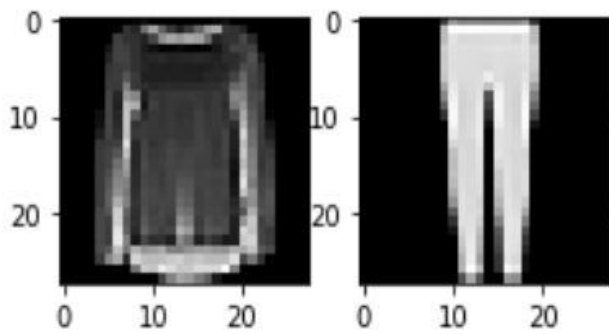


Fig: classify the class

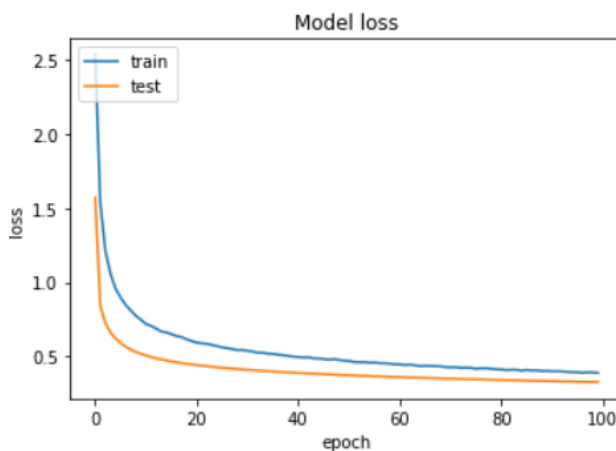
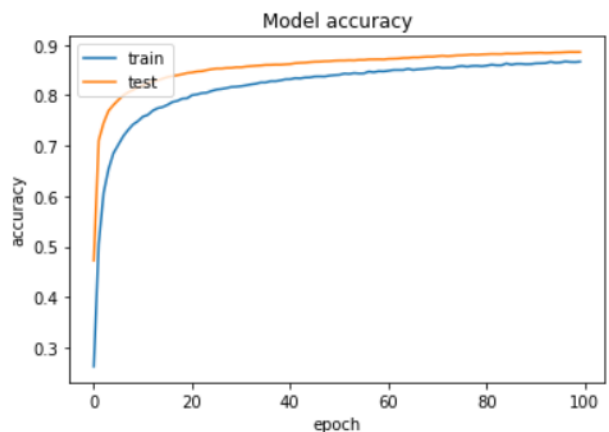


Fig: validation accuracy from classification

REFERENCES

- [1] O. Russakovsky, J. Deng, H. Su, J. Krause, S. Satheesh, S. Ma, Z. Huang, A. Karpthy, A. Khosla, M. Bernstein, A. C. Berg, and L. Fei-Fei, "ImageNet Large Scale Visual Recognition Challenge," IJCV, 2015.
- [2] T. Iwata, S. Watanabe, and H. Sawada, "Fashion coordinates recommender system using photographs from fashion magazines," in IJCAI, 2011.
- [3] A. Veit, B. Kovacs, S. Bell, J. McAuley, K. Bala, and S. J. Belongie, "Learning visual clothing style with heterogeneous dyadic co-occurrences," ICCV, 2015. [Online]. Available: <http://arxiv.org/abs/1509.07473>
- [4] S. Liu, J. Feng, Z. Song, T. Zhang, H. Lu, C. Xu, and S. Yan, "Hi, magic closet, tell me what to wear!" in ACM Multimedia, ser. MM '12, 2012, pp. 619–628.
- [5] K. Chen, K. Chen, P. Cong, W. H. Hsu, and J. Luo, "Who are the devils wearing prada in new york city?" in Proceedings of the 23rd ACM international conference on Journal of Information and Computational Science Volume 10 Issue 3 - 2020 ISSN: 1548-7741 250 www.joics.org Multimedia. ACM, 2015, pp. 177–180.
- [6] S. C. Hidayati, K.-L. Hua, W.-H. Cheng, and S.-W. Sun, "What are the fashion trends in new york?" in Proceedings of the 22nd ACM international conference on Multimedia. ACM, 2014, pp. 197–200.
- [7] S. Liu, Z. Song, G. Liu, C. Xu, H. Lu, and S. Yan, "Street-to-shop: Cross-scenario clothing retrieval via parts alignment and auxiliary set," in CVPR, 2012, pp. 3330–3337.
- [8] M. H. Kiapour, X. Han, S. Lazebnik, A. C. Berg, and T. L. Berg, "Where to buy it: Matching street clothing photos in online shops," in ICCV, 2015, pp. 3343–3351.
- [9] <https://ai-pool.com/a/s/dropout-in-deep-learning>
- [10] <https://neurohive.io/en/popular-networks/vgg16/>

Driver Drowsiness Detection Software

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Abstract:

Road accidents kill over 1.5 Lakh people in our nation. Globally, the toll is 6 times this figure. A large proportion of this figure is credited to alcohol use. Road accidents also lead to a loss of 1.5% in GDP due to the mitigation in productivity of the workers of the nation due to shrinkage in working population.

Keywords:

Drowsiness, Alcohol-use, Data pre-processing, Algorithmic detection, Model Architecture, BACL levels.

INTRODUCTION

Sleep deprived driving is defined as getting behind the wheel while physiologically impaired because of improper and insufficient sleep. To drive while fatigued can be considered as one of the most common causes of car accidents. A person's ability to work properly is harmed when they don't get enough sleep. They have a slower reaction time, poor memory, and poor judgement when their capacity to perform is damaged. Numerous studies have demonstrated that poor sleep has the same effect on operating as alcohol intoxication. Around 20% of drivers confess to feeling tired behind the vehicle, with 40% confessing to doing at least once throughout their employment. According to studies, drowsy driving is responsible for 40% of road accidents or near-collisions across India, while alcohol is responsible for over half of all deadly road fatal crashes more than two vehicles. And over 65% of all fatal solitary accidents are caused by inebriation. With all these statistics in mind, developing a driver safety mechanism is crucial. If we were to create a system like this, one must first determine driver's health behind the steering. Here's a quick rundown of the research paper we looked at. Here's a quick rundown of the papers we looked at. The paper proposes an arithmetic-mathematical solution to the drowsiness detection issue. The procedure was divided into three sections. The three methods are facial recognition, eyeball location detection, and eye movements. This study proposes a method for identifying the current status of the driver. This framework uses eye movement to identify the driver's status & delivers an alert in limits of half a second. In the graph given, driver's performance is depicted. There is a novel approach for detecting weariness. The YCbCr colour scheme, as well as advanced edge detection techniques, are employed. Using these methods, we can predict if the driver is tired or not. When the driver becomes drowsy, a warning system is activated. The goal is to develop a one-of-a-kind plan that relies on computer vision. The decision is made to develop a software algorithm. This method has been evaluated and

found to be effective in part. The creation of a fully functional system is currently underway. The developed the technology is able to detect drowsiness in real time. The system can tell the difference between regular eye blink and drowsiness-induced eye blink. It can be utilised in dim light conditions and also in conditions where the driver has glasses on. To expand this, further sensors can be added. The system is built using computer vision. The Viola Jones and CAMSHIFT algorithms are used in the system. The purpose of this study is to develop a viable framework for accurately and quickly identifying weariness. As inputs, a range of facial characteristics were used. The study proposed a method for detecting tiredness based on time data of the steering wheel's angular motion. This strategy provides a number of advantages over the previous system. It divides sleepiness detecting methods into two categories. They're separated into two groups: drivers and vehicles. It also examines a number of driving and car approaches. A sleepiness detection system based on a "shape forecasting algorithm" and eye movement rate is being developed. It works on the basis of image processing. The technique employs a non-invasive manner. This technique also proposes the use of yawn as a tiredness detection indicator. Certain face traits were identified in order to determine a driver's status. To study them, Python libraries were employed. The researchers looked at eye closure rate, ECD, per closure, head postures, and yawning rate.

LITERATURE REVIEW

In this section we will be referring to other papers which have worked on the same project. This will help us gain some perspective and ideas that were used over time. In [1] a HAAR-based cascade predictor is employed for detecting face. An object tracking technique is utilised for tracking the eyes in real time. The eyes of the driver will be monitored with the help of a camera. By using an algorithm, the signs of driver fatigue can be caught before time just to prevent accidents. The motorist gets a warning in the form of noise when the tiredness indications are identified. [2] deals with the use of Electroencephalography-based sleepiness detection system (ESDS) to evaluate the driver's sleepiness level through cerebral activity. The ESDS is most prevalent in producing a timely warning to prevent the decline in performance efficiency and to prevent sleep related Accidents. In an attempt to understand the ways this system can be developed using SVMs [3] goes into an in-depth analysis of current models and tries to improve them. The test results generated from ANOVA give us four major indicators to differentiate between normal

condition and fatigue driving status. These indicators include night vision, simple reaction time, choice reaction time and speed perception.

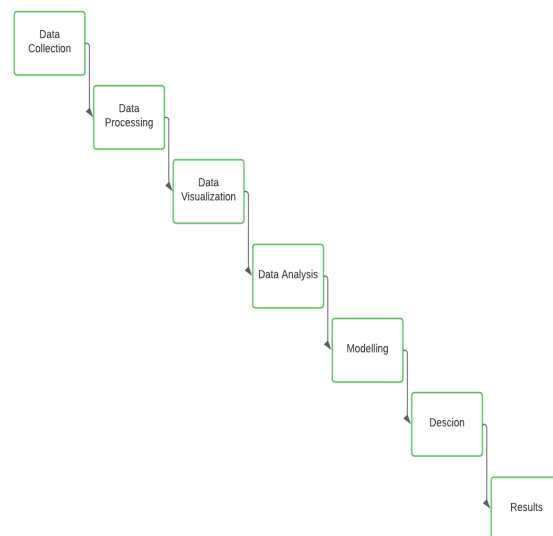
While [4] suggests an approach based on face recognition. Here we try to gauge a driver's capability by discerning changes in facial features. According to [4] multiple studies conducted showed that when drowsiness occurs there are significant changes in the eyes, head, mouth and sitting position.[5] gives an overall summary on many driver drowsiness systems. It also tries to present a model within the internet of cars.[6] This paper uses active contour model and viola-jones method to detect pixel patterns. The number of black and white pixels are measured to detect yawning. It is experimentally observed that while yawning black pixels are more in number. The chosen area of interest is closely observed to do this. Author uses CogniVue to match video with systems. Erosion, dilation, and locating the largest linked components as eyeballs are a few of the pre-processing procedures needed. In [7] due to different postures, illuminations, and occlusions, face identification and alignment in an unrestricted environment is difficult. Recent research demonstrates that deep learning techniques can do quite well on these two challenges. In this study, the authors offer a deep cascaded multi-task framework that improves the performance of detection and alignment by taking use of their natural association. In specifically, to predict face and landmark placement in a coarse-to-fine way, our approach uses a cascaded architecture with three levels of properly constructed deep convolutional networks. On the difficult Fddb and WIDER FACE benchmarks for face detection, as well as the AFLW benchmark for face recognition, this solution outperforms state-of-the-art techniques in terms of accuracy.

[8] Yawns are one of the most noticeable signs of sleepiness. The primary goal of a real-time application like yawning driver detection is for the detector to respond as quickly as feasible. A two agent expert system-based innovative yawning detection technique is suggested. To identify yawning in the driver's face, facial characteristics must be retrieved. The skin detection component of the face detection algorithm is used as the initial portion of detection in the suggested system. The area of the skin is removed. The borders of each skin area block that was discovered are established. The segmented face is then split in half. For the extraction of the mouth region, the lower half of the face is taken into account.

[9] Even while correlation filter-based trackers produce results that are competitive in terms of accuracy and robustness, the total tracking capacity still has to be enhanced. In this research, authors introduced a tracker built on the correlation filter architecture that is quite attractive. They propose a powerful scale adaptive technique to address the issue of the fixed template size in kernel correlation filter tracker.

METHODOLOGY

The process of obtaining a model through data science is a long one but we by fulfilling every part of it we get closer to obtaining what we desire.



3.1 Dataset Collection:

For the DPS(Drowsiness Prediction System) we used a dataset which was based on different parameters used in detecting a drunk person. It includes amount of sleep and BACL Levels. The parameters are important in the following manner:

Amount of Sleep: Each individual needs at least 6 hours of sleep. Otherwise, that individual would not be able to focus on driving

Alcohol Levels: If a person has 30 mg of alcohol in 100mg of his blood then he will start feeling drowsy and will incapable in driving.

Speech Coherence:

By rating a person's diction we can check if he is under the influence of any kind of substance.

Hours Of work:

By calculating the amount of time he works we could also tell if they are tired and need a break from driving.

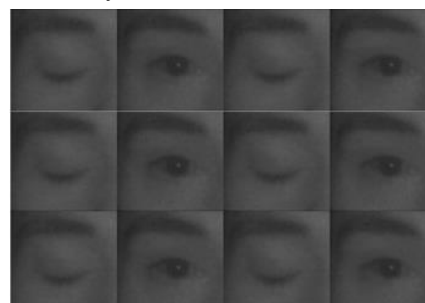
Contact: Phone Number of the person.

Email: Email of the person

Capability:

Overall capability score of a driver.

As for the face recognition system we used images of open and closed eyes.



3.2 Data Pre-Processing:

The data was created in an excel sheet and we spent the first few days cleaning it and filling up blank values and trying to remove null values.

3.3 Data Analysis/Visualization:

We ran several kinds of analysis to understand the data we were working with.

Initially when we were developing the DPS we had taken many parameters into consideration but eventually we narrowed it down to the following into the data sheet you see below

Name	Contact	Email	Alcohol Level	Amount Of sleep	Capability I
Pavan	433441114	pavan20@vit.edu	12	6	0.8
Anita	418783269	Anita20@vit.edu	10.5	7	1.02
Yashodhan	420783270	Yashodhan20@vit.edu	5.4	5.5	0.936667
Rangappa	445783271	Rangappa20@vit.edu	15	4	0.334

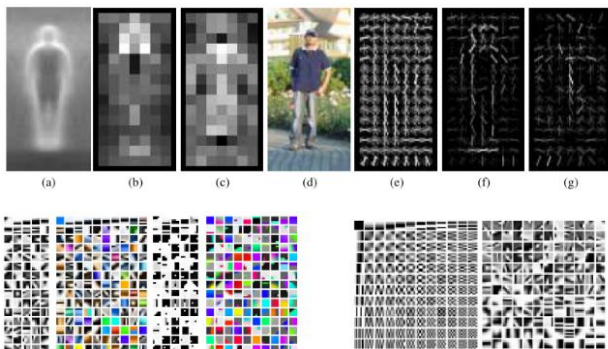
The face recognition system on the other hand was already ready to be trained.

3.4 Algorithm:

For the face recognition system we use a modified version of the census transform.

The census transform (CT) is an image operator that assigns a binary string to each pixel of a grayscale image, one for each bit, expressing whether the pixel has lower intensity than its neighbors.

Sl.No	Name	Contact	Email	Amount of	Alcohol Le	Speech Co	Hours of v	Capability
1	Asmita	433441114	pavan20@vit.edu	6	30	7.5	7	0
2	Anita	418783269	Anita20@vit.edu	7	10.5	5	8	1
3	Yashodhar	420783270	Yashodhan20@vit.edu	5.5	5.4	8.8	9	0.6
4	Rangappa	445783271	Rangappa20@vit.edu	4	15	9	6	0.4
5	Kamala	490783272	Kamala20@vit.edu	6.5	7.5	4.5	4	0.6
6	Kirti	490783273	Kirti20@vit.edu	3.5	2	6.8	7	0.2
7	Abhijit	490783274	Abhijit20@vit.edu	8	8.9	3.5	3	0.36



[10]Figure-1:Features used in existing computer vision

(www.deepbaksuvision.github.io)

It's a non-parametric transform that only considers relative ordering of intensities rather than actual intensity values, making it insensitive to monotonic shifts in illumination. It also works well in the presence of multimodal intensity distributions, such as along object borders.

This algorithm calculates the eye aspect ratio of critical parts of the regions and decides whether an eye is open or closed.

As for the DPS it works on the multiple linear regression model. It computes the alcohol level and the amount of sleep and predicts whether the person is capable of driving or not.



[11]Figure2: Example of autonomous vehicle with speed sign recognition system.

3.5 Overview of proposed model architecture

The user first has to go through the precaution system which checks the persons amount of sleep and alcohol levels. If he succeeds, then he will be allowed in the car which will use the face recognition model to make sure he does not fall asleep while driving.

PROPOSED SYSTEM AND ALGORITHM

Our proposed system consists of the following to detect driver capability:

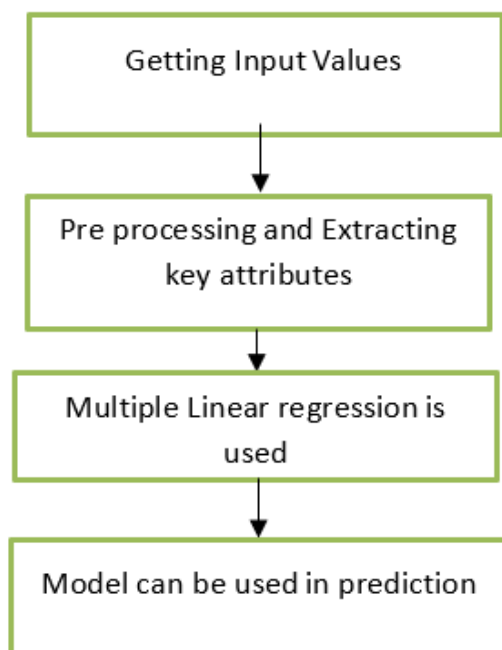
4.1 Pre Power-On Checks

The Drowsiness Prediction System (DPS) requires the driver's alcohol level and amount of sleep. It then calculates the fitness to drive based on a capability score. If the capability score is above 1 the person is cleared for driving or else the person fails the test. A breathalyzer and a wrist worn accelerometer are the sensors use to obtain data and work as below:

- 1) Before the ignition comes on, the driver needs to breathe into the specially provided breathalyzer. The camera available to measure eye movements can also be used to detect if the sample was provided by the driver or some other person. The alcohol content is correlated with the driver's capability (from the database) before the car powers ON.

- 2) A simple accelerometer based tracker like a fitbit or apple watch can provide the system with the data on the sleep that the driver has had in the last 24 hours but this tracker can be fooled easily. If the government of the day mandates and forces all drivers to be hooked up with such a device permanently, this can be ensured at in a regulatory level.

Due to the limited scope of this project we have simulated the breathalyzer and accelerometer data for this paper- this is future work. The process flow chart is below:



4.2 Surveillance using Face Recognition Software:

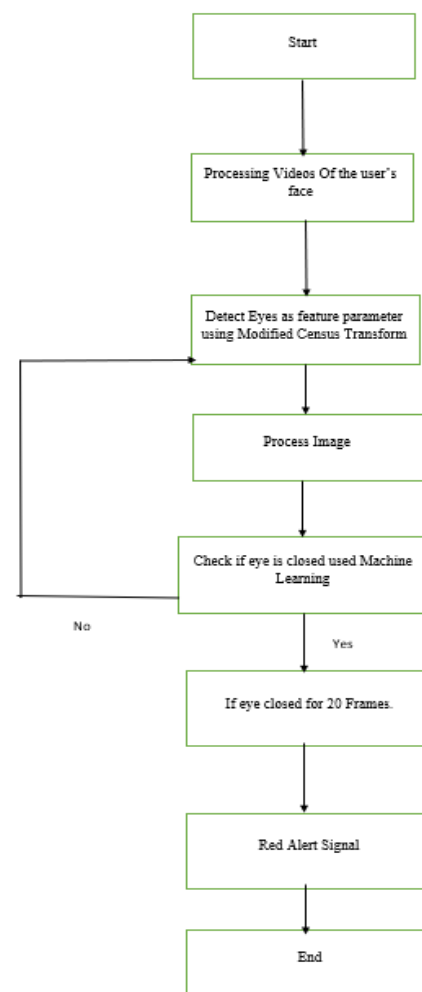
The face recognition software works on the basis of the modified census transform which uses an Adaboost classifier. This algorithm calculates the eye aspect ratio of critical part of the regions and decides whether an eye is open or closed. Here we used the dataset and trained to recognize when the person's eyes were open and closed.

So first the person is placed in front of a camera. The software processes different parts of the face and isolates the eyes. Now the application marks the eyes with a green line.

Let's assume that the person driving the car falls asleep at the wheel the software waits 20 frames that would be in milliseconds before sending an alert and waking up the driver.

After he wakes up the software goes back to normal and resets and the cycle continues to repeat on and on. This system tries to make sure the driver stays alert at all times when he is driving.

It stops execution after we terminate the program.



LIMITATIONS

This technology is limited to the amount of enforcement by the government. If enforced to the fullest degree it could undermine the democratic values of a country and turn it into a police state. This software can also be very inconvenient as some days require people to sleep less. Overall more changes are needed before complete deployment of the software.

CONTRIBUTIONS

In terms of contribution we have tried to propose a much more innovative method to deal with this problem. While people have developed many algorithms to stop car accidents in the moment. We have taken it a step further by trying to prevent drowsiness on the roads in general. With more time we can add to this to make it more effective in judging drowsiness.

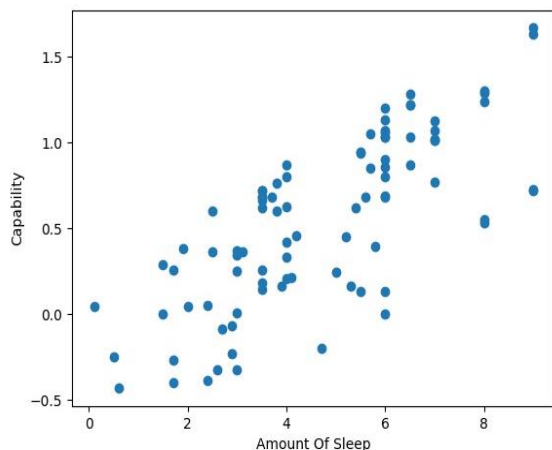
FUTURE SCOPE

One of the major problems to resolve in the future would be the enforcement of this application. We have to take in a lot more of a realistic approach in conditioning rather than an idealistic approach. This would involve adding and modifying attributes to work in favor. As a whole this project can also be extended to other domains such as drug abuse and so on.

RESULTS

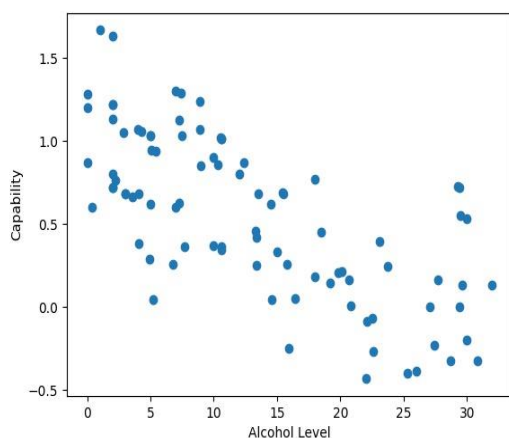
These two systems work together and attempt to solve the problem of drowsy driving. One tries to prevent the problem while the other, tries to ensure the driver is awake while driving. We have created an efficiently working software with over 97% efficiency. This software not only attempts predicting Drowsiness but also strives to protect a person who is currently under its influence.

Below is a graph which depicts the relation between the amount of sleep and the capability of a person



As You can see our capability score is influenced by the amount of sleep in a positive way. The slope without considering the outliers shows a relatively increasing value.

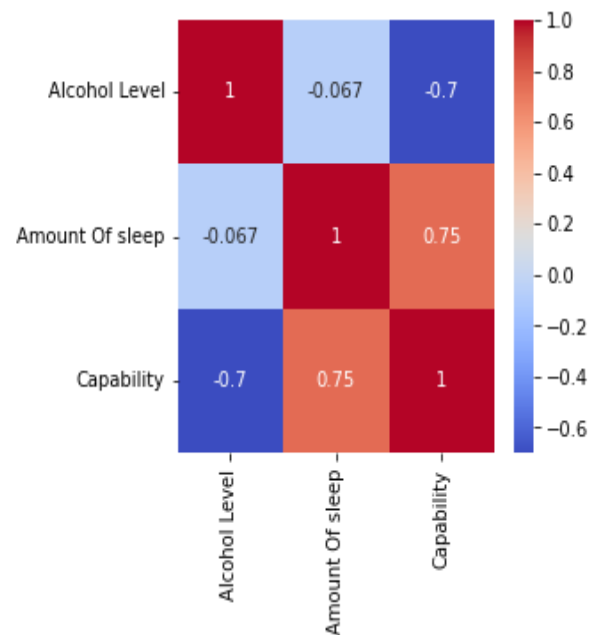
Below is a graph which depicts the relation between the alcohol levels of a person and their capability.



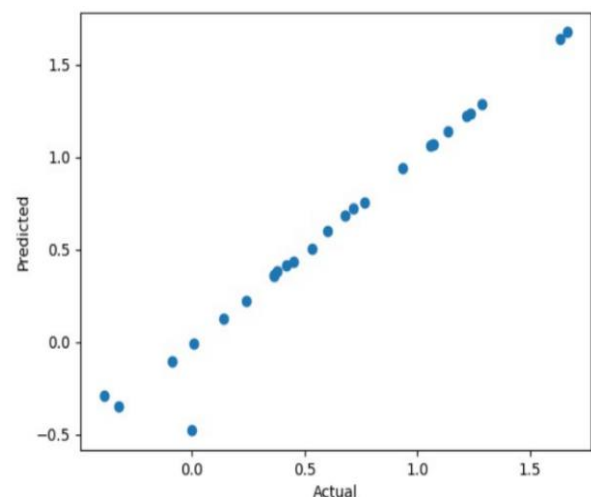
On the contrary the alcohol level influences our capability score negatively. This observation is significant very much in reality.

The maximum score a person can get is approximately 1.667.

This is a heat map which gives us a better picture of the three variables and their corelativity. This was instrumental in development of the system as a whole.

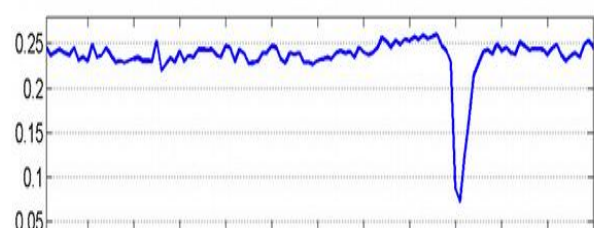


While amount of sleep has a correlativity of 0.75 with capability alcohol level has a correlativity of -0.067.



Below is the graph that gives us the efficiency of the DPS(Drowsiness Prediction System).

This is a graph of the output of the face recognition model. Initially when the eye is open you can see the eye aspect ratio is at a constant distance of approximately 0.25. The line is partially jagged because of the blinking. But the minute the person closes his eye for two long there is a sudden decrease in the slope of the graph. At the lowest point the alarm goes off in our system.



CONCLUSION

This application has begun a long phase of fixing the problem of drowsy driving which has caused so many accidents in our country. Programming and software development have always existed to solve such problems and create a better world. Hence with constant updates to this model we can one day make a system that can ensure safe driving. I would like to thank everyone involved in this project which could shape the future of humanity.

REFERENCES

- [1] V B Navya Kiran, Raksha R, Anisoor Rahman, Varsha K N, Dr. Nagamani N P, 2020, Driver Drowsiness Detection, INTERNATIONAL JOURNAL OF ENGINEERING RESEARCH & TECHNOLOGY (IJERT) NCAIT – 2020 (Volume 8 – Issue 15)
- [2] R. P. Balandong, R. F. Ahmad, M. N. Mohamad Saad, and A. S. Malik, "A review on EEG-based automatic sleepiness detection systems for driver," *Ieee Access*, vol. 6, pp. 22908–22919, 2018.
- [3] Z. You, Y. Gao, J. Zhang, H. Zhang, M. Zhou, and C. Wu, "A study on driver fatigue recognition based on SVM method," in *Proceedings of the 4th International Conference on Transportation Information and Safety ICTIS*, pp. 693–697, Banff, Canada, August 2017.
- [4] M. Karchani, A. Mazloumi, G. N. Saraji et al., "Presenting a model for dynamic facial expression changes in detecting drivers' drowsiness," *Electronic Physician*, vol. 7, no. 2, pp. 1073–1077, 2015.
- [5] A. Kulathumani, R. Soua, F. Karray, and M. S. Kamel, "Recent trends in driver safety monitoring systems: State of the art and challenges"
- [6] S. Abtahi, B. Hariri and S. Shirmohammadi, "Driver drowsiness monitoring based on yawning detection", *Proceedings of the IEEE International Control, Measurement and Instrumentation (CMI)*, IEEE, pp. 1-4, May 2011.
- [7] K. Zhang, Z. Zhang, Z. Li and Y. Qiao, "Joint face detection and alignment using multitask cascaded convolutional networks", *IEEE Signal Processing Letters*, vol. 23, no. 10, pp. 1499-1503, Oct. 2016.
- [8] D. B. Lucas and T. Kanade, "An iterative image registration technique with an application to stereo vision", *Proceedings of the 7th International Joint Conference on Artificial Intelligence*, vol. 2, pp. 674-679, 1981.
- [9] Y. Li and J. Zhu, "A scale adaptive kernel correlation filter tracker with feature integration", *Proceedings of the European Conference Computer Vision*, pp. 254-265, 2015.
- [10] Oh-Seol Kwon, "Example of autonomous vehicle with speed sign recognition system", www.jmis.org

- [11] Donghyun Hwang, Jaewon Lee, Chanhee Jung, "Features used in existing computer vision", www.deepbaksuvision.github.io

Robust Chatbot Application for Student Admission Process

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Abstract:

A software system that possesses the ability to interact with not only a single human user in natural languages but also with a group of systems to perform certain tasks efficiently is known as Chatbot. Chatbots with enhanced functionalities and applications such as responsive nature, manipulative responses and spontaneous adaptation to messages at the users' end, are certainly in the trend and are now seeping into the mainstream and cultured in widespread applications like smartphones, and web engines. Chatbots respond well to human users and thus counter with human-like responses. These adaptive methodologies are possible due to the fast-paced advancements in the field of AI and its technologies. A chatbot can be considered as a software which can act like virtual human beings that respond to human queries with help of human-based trained texts.

Keywords:

Chatbot, AI, Deep learning

INTRODUCTION

The advancements of technology in the fields of human-machine interaction and information technology have proven very vital in the development of Artificial Intelligent (AI) based software's and systems. These software-based systems are replicating human activities, for example, natural language processing, image processing, robotics and so forth.

A chatbot is defined as a software-based system or algorithm

that can respond to or "chat" with a user in a normally used communication languages such as English or Hindi.

ELIZA was the first chatbot designed in 1966 by Joseph Weizenbaum. The aim of developing this chatbot was to replicate a psychotherapist. Many chatbots have been made since then.

Chatbots are now even seeping into mainstream applications like smartphones, home automation devices, and even web-engine. Chatbots have numerous applications in real life, including customer service on e-commerce platforms, museum guides, retail outlet assists. There are many commonly used chatbots such as 'Watson' by IBM, 'Siri' by Apple, 'Bixby' by Samsung, 'XiaoIce' by Microsoft, 'Alexa' by Amazon, etc.

Chatbots are also being considered as human replacements at various sites which have conversational applications, such as telephone-based customer care services, and call centers to keep up with the increasing volume of requests for services, which are repetitive and may not require a higher level of expertise to deal with, also minimizing the operational costs involved with employing extra attendees.

'Global Market Insights' products that the market size for chatbots worldwide to be over \$1.3 billion by the year 2024, enough to convince us that the chatbot industry will soon become a major component in business communications.

This paper discusses the proposed chatbot designed for the 'College Enquiry System' for Vishwakarma Institute of Technology, Pune.

LITERATURE REVIEW

[1] The authors have done a survey about chatbot applications which is used by people to interact with the software or machine through the chatbot-based interface or end-user application. Human users can input queries in the form of text or voice queries and responses. Then the chatbot can respond to the user inputs. Chatbots are implemented generally only for solitary purposes. The referred paper focuses on AI-based chatbots.

[2] The authors of this paper have proposed a survey introducing the various design frameworks for the development of chatbots, especially for the speech-based conversation. Such chatbots require a programmer who should have great knowledge of such frameworks. The technologies required in the implementation of the chatbot are pattern matching, language tricks, parsing, SQL and relational database, etc.

[3] The authors have proposed the paper on how a chatbot is created using ML and deep learning. They discussed all the components of machine learning that are to be used in making AI chatbots like Neural networks, units, weight, biases, and hyperparameters. Also, a chatbot can be created by using Wat Son assist.

[4] Authors H.N. Io and C.B, Lee of the University of Macau discuss how chatbots are making their way into the areas traditionally looked after by humans, like the roles of online customer-service agents and website navigators, etc. The widespread adoption is attributed to the development in the spheres of AI and deep learning, which made the chatbots work with more accuracy and efficacy.

[5] The authors have presented a survey on 'Chatbots using AI'. The paper highlights the fact that a major role is played by AI along with NLP integrated with ML algorithms in modern technology. Different platforms are available which can be utilized in the process of making chatbots oriented to different applications. Many tech giants have created chatbots like- 'Watson' by IBM, Microsoft's Xiaoice and Cortana, etc.

METHODOLOGY

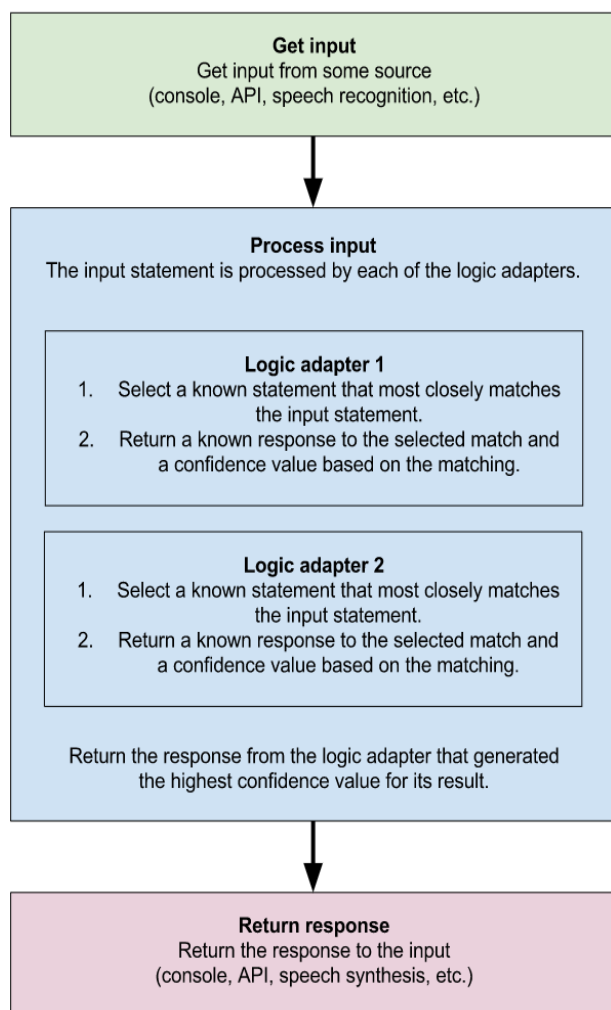


Figure 1.

Chatterbot module: We are implementing our chatbot with help of the chatterbot library, ChatterBot is a Python library

Which is mainly required for the development of chatbots. Chatterbot is used to get appropriate responses from the chatbot to a user's query. ChatterBot different types of machine learning-based algorithms to give various types of responses from chatbots. This library makes it handy for programmers to make chatbots to automate and improve conversations with users.

The Chatterbot library is language-independent which allows chatbot developers to train the chatbot to speak any human language. In Addition, the machine-learning techniques in ChatterBot allows a chatbot to improve its understanding of trained responses as it works more and more with users.

Intent Collection is one of the most important steps of the chatbot, providing proper intents to the chatbot is essential. As our chatbot is a college inquiry chatbot, it would require greetings, college information, and important links in intents for the chatbot. In this project, the proposed system requires custom intents for the college enquiry chatbot. These intents contain a

collection of required links according to query, brief information about the college, etc.

While implementing the chatbot using the chatterbot module, we need to specify storage and logic adapters for the chatbot. Logic adapters in chatterbot determine how ChatterBot selects a response from a set of intents to a given query by the user. We have used the Bestmatch adapter as well as the maximum_similarity_threshold logic adapter. The BestMatch logic adapter is used to select the best possible response (output) to a given input query. The maximum similarity between the user input query and stored intents which is required for the search process to stop is called the maximum similarity threshold.

The hunt for the best-possible matching response continues until a response with same or more value of similarity is found or the set of intents provided is completed.

Chatterbot Storage adapters provide a feature that allows any ChatterBot to connect with different databases to store trained intents. The storage adapter used by any chatbot is defined by providing the desired storage_adapter parameter at the import path of the storage adapter that we are using. We have given SQL storage adapter and SQLite database.

We have used a list trainer from chatterbot trainer to train the chatbot. Intents are collected in the python list and passed to the list trainer to train our chatbot.

ALGORITHMS

The Chatterbot module, which is used in this project uses different kinds of machine learning based algorithms to generate responses for chatbot. Chatbot uses search algorithms to find appropriate statements from set of intents.

Chatterbot module uses classification algorithms to check whether the input statement matches the required response as specified by particular logic adapter.

Many logic adapters in chatterbot use naïve bayes classification algorithms to find the required response statement for the logic adapter.

CHALLENGES IN OLD SYSTEMS

We plan to build our chatbot in the python environment with the aid of data science and machine learning concepts. We are mostly focused on chatbots developed using similar kinds of technologies for literature review. The problem that arises in these chatbots is due to the kind of set of intents used in the implementation. Choosing the wrong set of intents or dataset with a small size does have an effect on the efficiency and functionality of the chatbot.

you:hii
 Bot: Hi there, Welcome to VIT Pune 🙋 If you need any assistance, I'm always here.
 Go ahead and write the number of any query. 😊 Which of the following user groups do you belong to? 1.Student's Section Enquiry. 2.Faculty
 you:1
 Bot: STUDENT The following are frequently searched terms related to student . Please select one from the options below : 1.1 Curriculars 1.2 Ex
 you:1.1
 Bot: CURRICULAR These are the top results: 1.1.1 Academic Calendar 1.1.2 Syllabus
 you:1.1.1
 Bot: 1.1.1 Academic Calendar The link to Academic Calendar 🖱 href=https://www.vit.edu/images/News/Academic_calendar_sem2-21-22.pdf Click Here
 you:

Figure 2

RESULTS AND DISCUSSION

This paper follows for implementation of a chatbot for college admission inquiries using the chatterbot module. This chatbot can be used as a part of a college website

that can guide students and parents regarding college information. This will ease the navigation process through the website and will thus ensure minimalistic confusion and eventually, feasibility will increase.

Bot: Hi there, Welcome to VIT Pune 🙋 If you need any assistance, I'm always here.
 Go ahead and write the number of any query. 😊 Which of the following user groups do you belong to? 1.Student's Section Enquiry. 2.Faculty Section Enquiry. 3.Parent's Section
 you:3
 Bot: PARENTS The following are frequently searched terms related to Parents. Please select one from the options below : 3.1 About Us 3.2 Notices 3.3 Fee Payment 3.4 Placements
 you:3.2
 Bot: NOTICES These are the top results: 3.2.1 All Notices
 you:3.2.1
 Bot: 3.2.1 All Notices The link to All Notices 🖱 href=<https://www.vit.edu/E-TC/index.php/announcements/notices> Click Here
 you:

Figure 3

This Chatbot implemented using such technology has many applications in the industry and corporate sector and can prove beneficial in terms of ease of use and an additional asset. Apart from this, the chatbot will improve the website, giving an overall boost.

CONCLUSION

As per the end-user requirements, chatbots can be designed and used for a variety of purposes like finding information about some services or gathering some general information, or making bookings. In some instances, they are even utilized to collect customer feedback. As a result, the service delivery is becoming quicker and smoother, even ensuring 24-hour availability. It is therefore pretty evident that chatbots are, and will play a major role in about every domain, right from education, transportation, sales and services, to even the field of medicine. The nature and the end-user of the application thus decide the design, and functionalities of the chatbot. In an era where digital technologies and automation are prevalent, it becomes important for companies to make use of modular technologies and principles, like the chatbots, which are now among those crucial tools to fortify association with their clients and safeguard their growth prospects.

FUTURE SCOPE

The current version of this project is implemented for college enquiry and admission chatbot. In future, the chatbot can be implemented for many other uses. Currently the chatbot can only give response in textual format, In future, we can implement chatbot with voice based response as well as we can develop a chatbot which can take voice based input.

ACKNOWLEDGEMENT

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REFERENCES

- [1] P. McIntire, L. K. McIntire and P. R. Havig, "Methods for chatbot detection in distributed text-based communications," 2010 International Symposium on Collaborative Technologies and Systems, 2010, pp. 463472, doi: 10.1109/CTS.2010.5478478.
- [2] Sameera & John, Dr. (2015). Survey on Chatbot Design Techniques in Speech Conversation Systems. International Journal of Advanced

- Computer Science and Applications. 6.10. 14569/IJACSA.2015.060712.
- [3] H. N. Io and C. B. Lee, "Chatbots and conversational agents: A bibliometric analysis," 2017 IEEE International Conference on Industrial Engineering and Engineering Management (IEEM), 2017, pp. 215-219, doi: 10.1109/IEEM.2017.8289883.
 - [4] H. N. Io and C. B. Lee, "Chatbots and conversational agents: A bibliometric analysis," 2017 IEEE International Conference on Industrial Engineering and Engineering Management (IEEM), 2017, pp. 215-219, doi: 10.1109/IEEM.2017.8289883.
 - [5] M. Ganesan, D. C., H. B., K. A.S. and L. B., "A Survey on Chatbots Using Artificial Intelligence," 2020 International Conference on System, Computation, Automation and Networking (ICSCAN), 2020, pp. 1-5, doi: 10.1109/ICSCAN 49426.2020.926236.
 - [6] Kumar, Praveen et al. "Designing and Developing a Chatbot Using Machine Learning." 2018 International Conference on System Modeling & Advancement in Research Trends (SMART) (2018): 87-91.
 - [7] Rafael E. Banchs and Haizhou Li. IRIS: a chat-oriented dialogue system based on the vector space model. In The 50th Annual Meeting of the Association for Computational Linguistics, Proceedings of the System Demonstrations, July 10, 2012, Jeju Island, Korea, pages 37–42, 2012.
 - [8] Rawat, S., Gupta, P. and Kumar, P., 2014, November. Digital life assistant using automated speech recognition. In Computational Intelligence on Power, Energy and Controls with their impact on Humanity (CIPECH), 2014 Innovative Applications of (pp. 43-47). IEEE.
 - [9] Cahn, J.: CHATBOT: Architecture, design, and development. In: University of Pennsylvania School of Engineering and Applied Science Department of Computer and Information Science (2017)
 - [10] A. Mondal, M. Dey, D. Das, S. Nagpal and K. Garda, "Chatbot: An automated conversation system for the educational domain," 2018 International Joint Symposium on Artificial Intelligence and Natural Language Processing (iSAI-NLP), 2018, pp. 1-5, doi: 10.1109/iSAI-NLP. 2018.8692927.
 - [11] A. Ramaditiya, S. Rahmatia, A. Munawar and O. N. Samijayani, "Implementation Chatbot Whatsapp using Python Programming for Broadcast and Reply Message Automatically," 2021 International Symposium on Electronics and Smart Devices (ISESD), 2021, pp. 1-4, doi: 10.1109/ISESD53023. 2021.9501523.
 - [12] S. -H. Lin, R. -S. Run and J. -Y. Yan, "Chatbot Application in Laboratory Equipment Management and e-assistant," 2020 International Symposium on Computer, Consumer and Control (IS3C), 2020, pp. 39-42, doi: 10.1109/IS3C50286.2020.00017.
 - [13] M. M. Khan, "Development of An e-commerce Sales Chatbot," 2020 IEEE 17th International Conference on Smart Communities: Improving Quality of Life Using ICT, IoT and AI (HONET), 2020, pp. 173-176, doi: 10.1109/HONET50430. 2020.9322667.
 - [14] E. Kasthuri and S. Balaji, "A Chatbot for Changing Lifestyle in Education," 2021 Third International Conference on Intelligent Communication Technologies and Virtual Mobile Networks (ICICV), 2021, pp. 1317-1322, doi: 10.1109/ICICV50876.2021.9388633.
 - [15] D. Bailey and N. Almusharraf, "Investigating the Effect of Chatbot-to-User Questions and Directives on Student Participation," 2021 1st International Conference on Artificial Intelligence and Data Analytics (CAIDA), 2021, pp. 85-90, doi: 10.1109/CAIDA51941.2021.9425208.
 - [16] W. Mahanan, J. Thanyaphongphat, S. Sawadsitang and S. Sangamuang, "College Agent: The Machine Learning Chatbot for College Tasks," 2022 Joint International Conference on Digital Arts, Media and Technology with ECTI Northern Section Conference on Electrical, Electronics, Computer and Telecommunications Engineering (ECTI DAMT & NCON), 2022, pp. 329-332, doi: 10. 1109/ECTIDAMTNCN53731.2022.9720420.
 - [17] H. K. K., A. K. Palakurthi, V. Putnala and A. Kumar K., "Smart College Chatbot using ML and Python," 2020 International Conference on System, Computation, Automation and Networking (ICSCAN), 2020, pp. 1-5, doi: 10.1109/ICSCAN 49426.2020.9262426.
 - [18] B. Shivashankar, A. M. A. Sundari, H. Surendra, S. S. Atul Sai and M. Moharir, "Deep Learning-based Campus Assistive Chatbot," 2021 IEEE International Conference on Computation System and Information Technology for Sustainable Solutions (CSITSS), 2021, pp. 1-4, doi: 10.1109/CSITSS54238.2021.9683551.
 - [19] A. Huddar, C. Bysani, C. Suchak, U. D. Kolekar and K. Upadhyaya, "Dexter the College FAQ Chatbot," 2020 International Conference on Convergence to Digital World - Quo Vadis (ICCDW), 2020, pp. 1-5, doi: 10.1109/ ICCDW 45521.2020.9318648.
 - [20] R. Parkar, Y. Payare, K. Mithari, J. Nambiar and J. Gupta, "AI And Web-Based Interactive College Enquiry Chatbot," 2021 13th International Conference on Electronics, Computers and Artificial Intelligence (ECAI), 2021, pp. 1-5, doi: 10.1109/ECAI52376.2021.9515065.

Comparative Analysis of Regression Algorithm for Student Grade Prediction

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Abstract:

In today's world all big companies store their records together in some kind of database or Excel spreadsheet and it is very important to keep this data clean and up to date to avoid confusion and to be safe. Data Science is used in such cases where we can not only store data in Excel spreadsheets but also used to find patterns in our data set. We then use these patterns to generate valuable insights and some data-derived decisions, e.g. B. Predicting values for the dataset, or classifying the data into some parts and comparing it to known values to verify the accuracy of the build model. There are several processes like data extraction, pre-processing and cleaning that our dataset has to go through to get a final result that is required for better prediction and then our main model code is deployed as we want to work with the data and get the result.

INTRODUCTION

Nowadays the importance of studies and getting good grades for a child is very important in any class for their progress and getting admission in higher divisions. The student grade prediction system uses various factors that are responsible for the final score of the student and builds the model according to it. The dataset is from two schools in Germany Gabriel Pereira [GP] and Mousinho da Silveira [MS] together in random order with male and female records. It finds the student's final grade [G3] and the dataset takes into account many different factors that may or may not affect the grade and there are 357 student records that we worked with on this project and identified the most important factors. The process used in the project to make the prediction is prediction using regression and not classification as in classification the complications increase drastically having to find out the grade from 1-20 which means for every entry the machine learning model developed has to calculate the 20 different types meaning a 20 dimensional graph which is not possible and even if we divide the dataset into three types taking into consideration the grades like A,B,C like in [1] and so on still the classification doesn't give the accuracy required to build a reliable model. The first method used for predicting is the support vector machine(SVM) regression in which graphically when all factors are plotted, it gives a margin of tolerance equal length from the regression line giving a cushion for the line while predicting and the rest method is done same as the multiple linear regression but with this margin helps to increase the accuracy of the system.

The second method is the decision tree classification which builds the model in a tree like structure to determine each and every condition. This tree like

structure is basically the splitting down of the dataset into smaller sets while the regression model will work simultaneously on the dataset to predict the marks. The Last and final method based on the accuracy every model gives is the random forest which is a /further upgradation of decision tree where it makes decision trees on different samples rather than one tree and then uses the method of average for in case of regression like in our model thus predicting the grade of a student using those multiple variables.

PROBLEM STATEMENT

The primary goal of the research is to predict student grade from the student course completion with regression model by using R. The relationship between course completion and course grade is an important part of any service-oriented web application, so that researches on this topic are still a major trend today.

LITERATURE REVIEW

Multiclass Prediction Model for Student Grade Prediction Using Machine Learning

This approach employs a multiclass prediction model for predicting student grades. It entails a multi-attribute analysis and data sampling from a range of sources in order to predict student grades in various outcomes. However, in education areas, the performance of predictive models for unbalanced datasets is still infrequently studied. The performance of six well-known machine learning approaches in terms of accuracy, including Decision Tree (J48), Naïve Bayes (NB), K-Nearest Neighbor (KNN), Support Vector Machine (SVM), Logistic Regression (LR), and Random Forest (RF) was done using the students' course grade dataset. In this paper, a multiclass prediction model was proposed in order to minimize the overfitting and misclassification which is based on SMOTE or known as the Synthetic Minority Oversampling Technique with two feature selection methods. The highest accuracy was achieved by using the Random forest method i.e. 99.5%.[1]

Machine Learning-Based Student Grade Prediction: A Case Study

In this paper we have studied various methods like Collaborative Filtering (CF), Matrix Factorization (MF), and Restricted Boltzmann Machines (RBM) methods to analyze the student data and after calculating the result of all the methods mentioned above we found that, RBM

i. e. Restricted Boltzmann Machines were seen to be more accurate than other methods. [2]

A Review on Predicting Student's Performance using Data Mining Techniques

The main aim of the paper is to analyze and overview various approaches in data mining that is used to calculate the grade of the students. Using educational data mining approaches, we can enhance student success more effectively and efficiently. This system has various advantages like it benefits students, instructors, and other academic institutions like tutorial classes.[3]

Linear Regression Analysis Using R for Research and Development

In this paper, we have studied linear regression and how to predict the outcome of a data

using historical data and how to find a linear relationship for the data.[4]

METHODOLOGY

4.1. Description of Dataset

Table 1: Description of Dataset

Variable name	Type
1) School	Categorical
2) sex	Categorical
3) age	Numerical
4) address	Categorical
5) famsize	Categorical
6) Pstatus	Categorical
7) Medu	Numerical
8) Fedu	Numerical
9) Mjob	Categorical
10) Fjob	Categorical
11) reason	Categorical
12) guardian	Categorical
13) traveltime	Numerical
14) studytime	Numerical
15) failiures	Numerical
16) schoolsup	Categorical
17) famsup	Categorical
18) paid	Categorical
19) activities	Categorical
20) nursery	Categorical
21) higher	Categorical
22) internet	Categorical
23) romantic	Categorical
24) famrel	Numerical
25) freetime	Numerical

26) goout	Numerical
27) Dalc	Numerical
28) Walc	Numerical
29) Health	Numerical
30) Abscences	Numerical
31) G3	Numerical

The dataset is a record of the research done on 2 schools of Portugal Gabriel Pereira [GP] and Mousinho da Silveira [MS] which has the records of a 357 students. There are 30 independent variables on which the whole machine learning takes place. Students are taken both male and female and the age group is 15-19 years of age because they are in college at that time. The next data is an address telling whether the person is from a rural or urban area. famsize which tells whether the size of the family is greater than or less than 3. P status or parent status tells whether the parents are together or apart. Medu and Fedu ranking the education of both mother and father with 0-none, 1-primary (4 standard), 2- 5-9 standard, 3-secondary or 4 – higher . Mjob and Fjob giving information about the education of the parents teacher ,health services civil services at home or other reason to mention the reason of choosing the particular school guardian to tell between mother and father who is their guardian travel time to show how much time the child takes to go to school from their home.

Studytime data shows the time for which the child studies divided into categories like less than 2 hours, 2-5 hours, 5-10 hours, and greater than 10 hours. failures to give the data how many times the person has failed activities for recording any extra co-curricular activities done or not nursery for attended nursery school or not higher to record if the child wants to take higher studies or not. Internet data gives information if the student uses internet at home .romantic to tell if the person is in a relationship or not famrel to tell the relationship between the family from a counter of 1 to 5. freetime to denote the free-time student gets after the school. goout is used to record the time student goes out with the friends. Dalc to tell the alcohol consumption during weekdays and Walc to tell the alcohol consumption on weekends both from a counter of 1 to 5. Health to tell the current health status from 1 very bad to 5 excellent .absences denotes the number of school absences from 0 to 93. Then in the end 3 target variable to work with namely G1, G2, G3 being the grades for each term from 0-20.

4.2. Data cleaning:

So after importing the dataset in our model, we understood that the value of G3 is dependent on G1 and G2 also so it will be better if we use only G3 as our target variable out of the three than we will have a better result and only one final grade predicted rather than 3 reducing the confusion around all 3 variables. Then the independent variable G3 which is our final output had some students' data showing their final grades as 0 which could be not attending the exams due to some

unavoidable reasons so we removed those values using the code filter and then gave the exact data frames who values we wanted to remove which further cleaned our data and is also shown with the help of a graph.

4.3. Encoding the categorical variable

As there were many categorical variables in our dataset it was not possible to directly include them into the regression procedure as there were many chances of the accuracy is decreased. So all the categorical variables were encoded using the `as.factor()` code which converts the variables internally making the `r` studio know that the variables are now given some numeric value and the process of regression analysis can be used on them now. All the categorical variables visible from the dataset like `school`, `address`, `famsize`, and so on were converted using this method itself.

4.4. Split the dataset for training and test set

This is the final process before starting to build the exact regression model in which we divide the dataset into a training set and the test set done randomly by the `r` studio using an external library known as `catools` which enables the splitting feature in the program. The syntax is very simple `.split` and then the data frame is being specified and the ratio in which we want to divide our data is to be mentioned there. Normally for optimum results all the split ratios are 80:20 or 75:25. So we have used the first one at the moment and will change if the accuracy changes drastically. Now the dataset has been divided into 2 new subsets `train_set` and `test_set` for making the regression model for the student grade prediction system. After analyzing the variables that were decided to be used as the independent ones rather than using all of them to increase the accuracy of the model namely `study time`, `failures`, `schoolsup`, `famsup`, `gout` and `absences` of the student.

EXPLORATORY DATA ANALYSIS

In our model some data visualization part is been performed for the better understanding of the dataset, the target variable and relationship between target variable and other attributes.

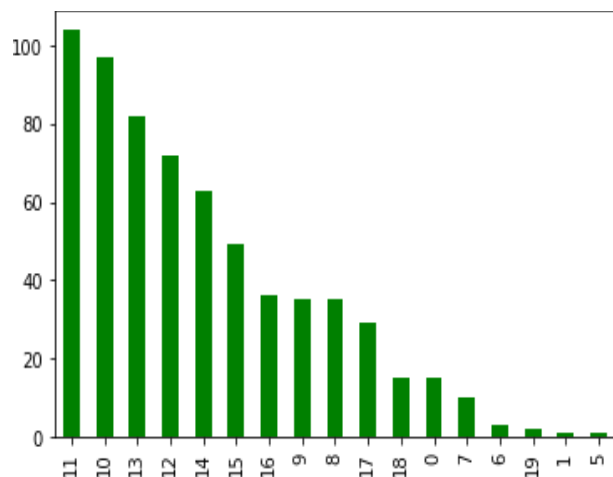


Figure 2 : Maximum G3 Score of the students

The Figure 2 shows the Maximum G3 score of the students versus the number of students. From this graph most of the students have scored 11 marks in G3 test and followed by other marks.

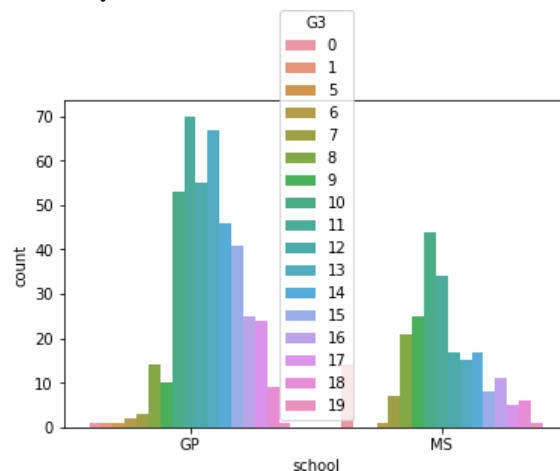


Figure 3: Different Institute G3 Score

The Figure 3 shows the amount of students in different schools keeping in mind the G3 score.

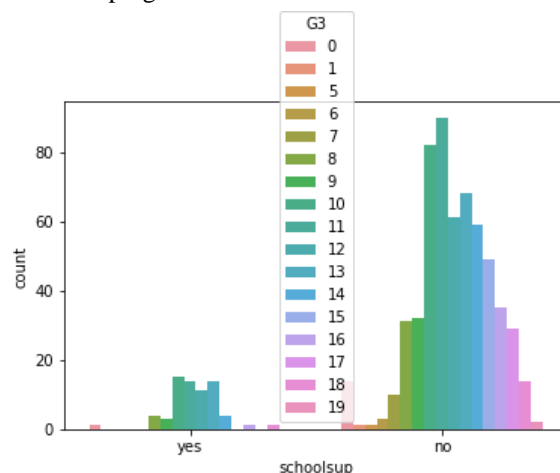


Figure 4: School Support vs G3 Score

The Figure 4 shows the amount of students which has school support. From the graph most the students are not interested in school support they try to manage by themselves.

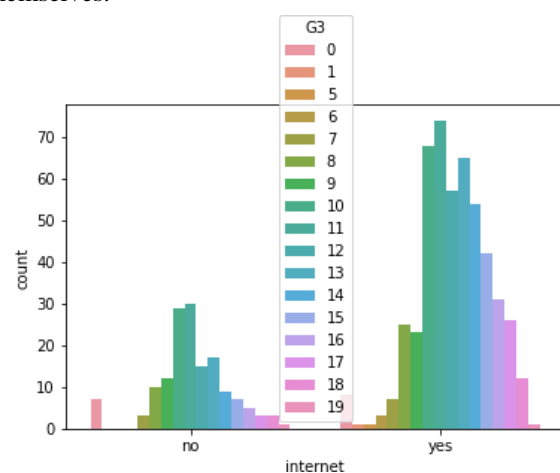


Figure 5: Internet Access vs G3 Score

The Figure 5 shows the amount of students which has internet access for their studies. From the graph most the students have the internet access for their studies and also those students have scored good marks in G3 test as compared to those how not have internet access.

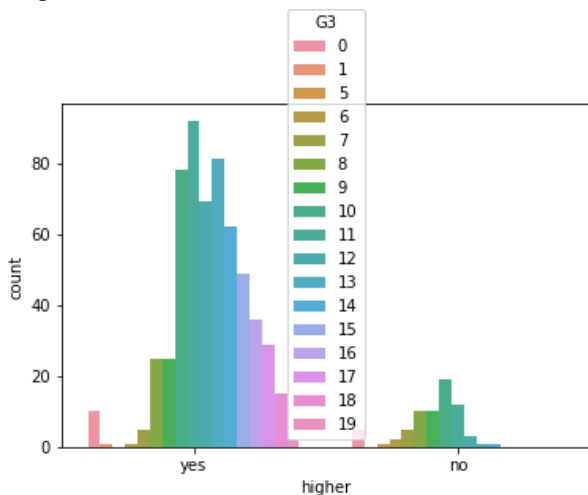


Figure 6: Higher Education vs G3 Score

The Figure 6 shows the amount of students which has interested in higher studies. From the graph most the students are interested in higher studies and those are only one's which have scored good in G3 test as compared to those how are not interested in higher studies.

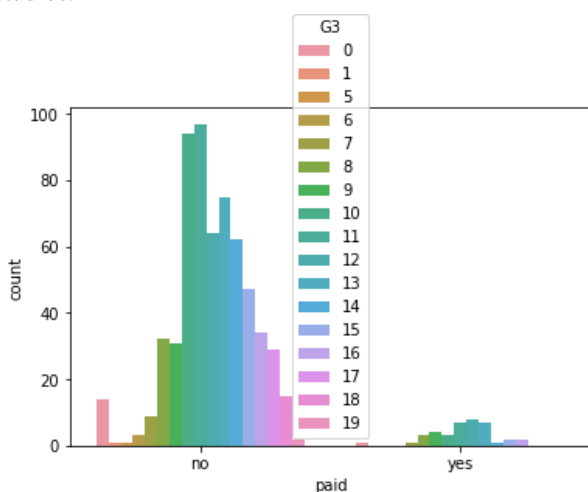


Figure 7: Extra Classes vs G3 Score

The Figure 7 shows the amount of students which are going for extra classes for their studies. From the graph most the students are not going for extra classes for their studies.

PROPOSED MODELS:

6.1. Algorithm

6.1.1. Linear Regression

Linear Regression is a machine learning approach that uses supervised learning to complete a regression task. Linear regression, which is most commonly used to find the link between variables and forecasting, produces a target prediction value based on independent variables.

Different regression models change depending on the relationship between the established and independent variables, as well as the number of independent variables evaluated and applied.

$$y = mx + c$$

The data labels are displayed in y , and the input training data is displayed in x in the above formula (input parameter). During model training, the value of x is used to forecast the value of y , which offers the best fit line for obtaining the best values of m and c values.

c = intercept

m = slope of line

We get the best fit line when we receive the best m and c esteems. So, if we ultimately apply our model to forecast it, the equation of y will be predicted using only the knowledge of x .

6.1.2. Decision Tree

The Decision Tree's Regression is a non - linear and non entity. Describes a function that receives the attribute's value vector as input and provides the resolution. The Supervised Learning part

consists decision trees. It can be used to address problems involving regression and classification. After making a succession of decisions, the decision made.

6.1.3. Random Forest

Bagging in the random forest is a technique. In random forests, trees grow in parallel. In during installation of a trees, there is no interaction between them. It accomplishes this by training a large number of trunks and then releases a class that would be in tree mode (sorting) or intermediary prediction mode (backing). A random forest is indeed a meta measure (i.e., it takes into account the results of several predictions) that integrates multiple decision trees and other useful features. The series of things that can be separated in each area is restricted to a proportion of the overall value. (This is referred to as a hyper parameter). Each forest takes a random selection from the original data set's variance and adds another random element to avoid overfitting.

6.1.4. CatBoost

The CatBoost calculation depends on Gradient Descent and is a strong procedure for directed AI errands. It will be appropriate to issues that include unmitigated information. It is generally utilized for relapse and characterization errands and it is additionally quite possibly the most involved calculations in Kaggle contest.

The CatBoost calculation depends on inclination choice trees and while preparing this model a bunch of choice trees is constructed continuously. As preparing advances, each progressive tree is worked with a decreased misfortune contrasted with the past tree.

6.2. Our Model Architecture

6.2.1. Stacking Regressor

Stacking regressions is a way to design linear combinations of different predictors to improve prediction accuracy. To find the coefficients in the combination, cross-validation data and least squares under non-negativity constraints are used.

So in our proposed model Linear regression, Decision Tree, Random Forest these three algorithms are been combined with the help of Stacking Regressor

RESULTS AND DISCUSSIONS

The results which we have obtained are as follows –

Figure 8 : Accuracy Table for the Models

Models	Accuracy
Linear Model	0.81
Decision Tree Model	0.75
Random Forest Model	0.82
CatBoost Model	0.82
Stacked Model	0.83

The Stacking Regressor model was the best performing model followed by CatBoost, Random Forest, Linear Model, Decision Tree Model. The reason behind is the number of model are used in Stacking Model are three model so the variety of options to select and power of three model.

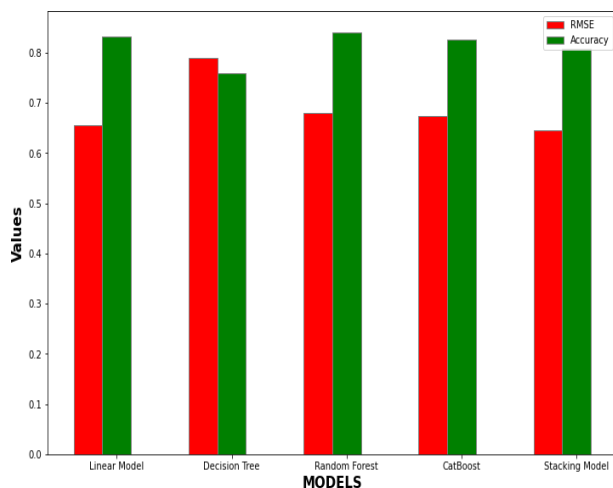


Figure 9: Comparison Graph of Models

This fig represents the Comparison of R2 score and Accuracy for all the 5 model which are there in our system.

FUTURE SCOPE

The project can be made more advanced , efficient and beneficial by using different ways such as an attempt to seprate variables that are most important for regression which would decrease the burden to work with so many variables also the model can be more efficient. Another thing is that, different classification algorithms can be

used for the reason that categorical variables are best suited for classification itself based on their properties and then check which among the regression or classification gives the best results so that stronger model can be built and if both the algorithms are used, the model result will be best of two.

CONCLUSION

A student grade prediction system has been designed by predicting the grade G3 of students including the most important independent variables and dependent variables for making the regressors and using three regression methods namely Linear regression ,Decision Tree Model, Random Forest, Cat Boost Model, Stacked Model giving a prediction accuracy as 81%, 75%, 82%, 82%, 83% respectively. These models RMSE score is as follows 0.65, 0.61, 0.68, 0.67, 0.64 respectively.

REFERENCES

- [1] Multiclass Prediction Model for Student Grade Prediction Using Machine Learning by SITI DIANAH ABDUL BUJANG, ALI SELAMAT,
- [2] Machine Learning Based Student Grade Prediction: A Case Study by Zafar Iqbal, Junaid Qadir , Adnan Noor Mian, and Faisal Kamiran
- [3] A Review on Predicting Student's Performance using Data Mining Techniques by Amirah Mohamed Shahiri, Wahidah Husain, Nur'aini Abdul Rashid,
- [4] Linear Regression Analysis Using R for Research and Development by Anjali Pant, R S Rajput
- [5] E. Alyahyan and D. Düşteğör, "Predicting academic success in higher education: Literature review and best practices," Int. J. Educ. Technol. Higher Educ., vol. 17, no. 1, Dec. 2020
- [6] V. L. Miguéis, A. Freitas, P. J. V. Garcia, and A. Silva, pp. 36–51, Nov. 2018.
- [7] K. L.-M. Ang, F. L. Ge, and K. P. Seng, "Big educational data & analytics: Survey, architecture and challenges," IEEE Access, vol. 8, pp. 116392–116414, 2020.
- [8] X. Zhang, R. Xue, B. Liu, W. Lu, and Y. Zhang, "Grade prediction of student academic performance with multiple classification models," in Proc. 14th Int. Conf. Natural Comput., Fuzzy Syst. Knowl. Discovery (ICNC-FSKD), Jul. 2018, pp. 1086–1090.
- [9] A. Hellas, P. Ihtola, A. Petersen, V. V. Ajanovski, M. Gutica, T. Hynninen, A. Knutas, J. Leinonen, C. Messom, and S. N. Liao, "Predicting academic performance: A systematic literature review," in Proc. 23rd Annu. Conf. Innov. Technol. Comput. Sci. Educ., Jul. 2018, pp. 175–199.
- [10] L. M. Abu Zohair, "Prediction of student's performance by modelling small dataset size," Int. J. Educ. Technol. Higher Educ., vol. 16, no. 1, pp. 1–8, Dec. 2019, doi: 10.1186/s41239-019-0160-3.
- [11] X. Zhang, R. Xue, B. Liu, W. Lu, and Y. Zhang, "Grade prediction of student academic

- performance with multiple classification models,” in Proc. 14th Int. Conf. Natural Comput., Fuzzy Syst. Knowl. Discovery (ICNC-FSKD), Jul. 2018, pp. 1086–1090.
- [12] S. T. Jishan, R. I. Rashu, N. Haque, and R. M. Rahman, “Improving accuracy of students’ final grade prediction model using optimal equal width binning and synthetic minority over- sampling technique,” *Decis. Anal.*, vol. 2, no. 1, pp. 1–25, Dec. 2015.
- [13] A. Polyzou and G. Karypis, “Grade prediction with models specific to students and courses,” *Int. J. Data Sci. Anal.*, vol. 2, nos. 3–4, pp. 159–171, Dec. 2016.
- [14] Z. Iqbal, J. Qadir, A. N. Mian, and F. Kamiran, “Machine learning based student grade prediction: A case study,” 2017, arXiv:1708.08744. [Online]. Available: <https://arxiv.org/abs/1708.08744>
- [15] I. Khan, A. Al Sadiri, A. R. Ahmad, and N. Jabeur, “Tracking student performance in introductory programming by Means of machine learning,” in Proc. 4th MEC Int. Conf. Big Data Smart City (ICBDSC), Jan. 2019, pp. 1–6.
- [16] M. A. Al-Barrak and M. Al-Razgan, “Predicting students final GPA using decision trees: A case study,” *Int. J. Inf. Educ. Technol.*, vol. 6, no. 7, pp. 528–533, 2016.
- [17] E. C. Abana, “A decision tree approach for predicting student grades in research project using WEKA,” *Int. J. Adv. Comput. Sci. Appl.*, vol. 10, no. 7, pp. 285–289, 2019.
- [18] F. Ahmad, N. H. Ismail, and A. A. Aziz, “The prediction of students’ academic performance using classification data mining techniques,” *Appl. Math. Sci.*, vol. 9, pp. 6415–6426, Apr. 2015.
- [19] T. Anderson and R. Anderson, “Applications of machine learning to student grade prediction in quantitative business courses,” *Glob. J. Bus. Pedagog.*, vol. 1, no. 3, pp. 13–22, 2017.
- [20] S. Hussain, N. A. Dahan, F. M. Ba-Alwib, and N. Ribata, “Educational data mining and analysis of students’ academic performance using WEKA,” *Indonesian J. Electr. Eng. Comput. Sci.*, vol. 9, no. 2, pp. 447–459, 2018.

Farmer Savior - The Optimal Way to Investigate Crop Diseases and Predict Crop Yields Using Deep Learning and Machine Learning

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Abstract:

Recently a massive growth in the information technologies and communications (ITC) field has taken place, as a result, the vast majority of cities have become smart cities. Agriculture is one area that has a significant impact on people's lives and economic well-being. Agricultural products are lost in the process of bad administration. Farmers are clueless about illness, resulting in lower yields. production. The population of our planet has increased dramatically and along with that, so has the need for a better quality of living. Crop protection is critical in addressing the rising supply of agricultural quality and quantity. The proposed model is able to predict the crop disease with help of provided plant images and also it will recommend the crop according to the p-H and N-P-K values of the soil.

Index Terms:

ICT, Neural Network (NN), Deep convolutional neural networks(CNN), p-H, N-P-K..

INTRODUCTION

In recent years, massive growth in the field of information technologies and communications (ITC) has taken place, as a result, the vast majority of cities have become smart cities. The population of our planet has increased dramatically and along with that, So has the desire for a better standard of living. According to projections, an estimated 70% of the people in the world will live in advanced cities by 2050 which ultimately leads to an increase in demand for the land to develop the area for stay for the people which in leads to pave the way for smart agriculture. According to Jeevaganesh R[1], this research study has presented a machine learning algorithm: AdaBoost to forecast agricultural production based on parameters such as district, state, area, rainfall, seasons, area, and temperature. This research study also offers a fertilizer depending on soil characteristics such as NPK levels, soil type, soil PH, humidity, and wetness to increase yield. The Random Forest algorithm is typically used for fertilizer suggestions. Crop prevention is critical in addressing the rising supply of agricultural quality and quantity. However, agricultural crop security is still jeopardized by a variety of issues such as climate change, increased weed development, pest assault, and so on Crop diseases cause around 35 percent of crops to be compromised each year. This ended up causing grave concern and necessitates the development of a powerful solution to the specific challenge. According to Nidhi H Kulkarni [2], the ensembling approach is used to create a model

that integrates the predictions of many machine learning techniques to select the best crop depending on soil type and attributes with high accuracy. Random Forest, Naive Bayes, and Linear SVM are the ensemble model's independent base learners. Each classifier generates its own set of acceptable class labels. The majority vote mechanism is used to merge the class labels of single base learners. Plant pathology is becoming a more prominent study area. In recent years, an increasing number of farms have become automated. To be totally automated, farms must be able to identify plant illnesses without the need for human involvement. Deep learning using CNN has invested significantly in diagnosing many plant diseases.

LITERATURE REVIEW

Research [3] has revealed a comprehensive CNN-based strategy for predicting two of the most common diseases, temporary decay and premature damage, and healthy potatoes. They achieved a high accuracy of 98.33% compared to other image classification techniques. This study could be expanded to predict deadly diseases in some plants. A program that is assisted by smartphones to automate the identification process can be created as future development.

The method [3] provided

- a) Image collection Data set- Plant Village
- b) Image pre-processing
 - I. Gray scaling Removing
 - II. Blurriness from Images
 - III. Removing Noise from Images
- c) Image labeling -Late Blight, Early Blight, Healthy
- d) Training Model- Deep Learning Algorithm- CNN
- e) Testing model
- f) Measure model accuracy
- g) Result:
 - For a healthy plant - 97% accuracy
 - For an early blight - 96% accuracy
 - For a late blight plant - 99% accurate

The study [4] highlights a project that uses CNN to construct a smartphone-assisted crop disease prediction model. The trained deep learning model, as well as the

app, are subjected to a variety of tests to guarantee that the proposed solution can be used in production. The app provides a high level of confidence in predicting 38 different diseases. Farmers around the world can use the Crop app without even the internet. The software can be used by anyone with a cell phone to help protect their plants. In the future, the software could also be customized to work in several regional languages to make it easier for farmers to use. Furthermore, without internet access, the pesticide or fertilizer to use for the diagnosed disease can be forecast.

The method [4] provides

- Data set
- Annotation of the data set
- Splitting the dataset
- Model Saving and Conversion
- TensorFlow Serving
- Crop App
- Result

The study [5] highlighted Deep CNN applications designed to distinguish plant species and diagnose disease in images. The proposed method was validated for five plant phases and three plant diseases for each phase. In terms of effectiveness and loss of validation, test results have shown that the InceptionV3 model exceeds the MobileNet model. This study will be expanded to include the classification of non-recorded images in a controlled environment that includes images of various shapes. Furthermore, the number of crop types and diseases can be expanded. This technology can be linked with smartphone applications to create a user-friendly GUI and flexibility of use.

The method [5] provided

- Data set- Plant Villa
- Image Pre-processing- Gray Scaling 3. The disease classification is divided into two stages - the first is to identify the type of plant, and then to determine the type of disease.
- Result- In the experiments for crop type detection, both the MobileNet as well as InceptionV3 models perform well, with 99.62% percent and 99.74% percent, respectively.

The proposed system [6] captures data in the form of plant disease pictures, which are then utilized to detect various plant and agricultural illnesses. It has the capacity to facilitate growers since it can identify illnesses with minimum human involvement and provide immediate findings. Furthermore, the proposed approach aids in the early detection of illnesses in order to protect production. To identify plant diseases and plant species, an NN-based model is being trained. During testing, the model detects the accuracy of 96.78 percent of the disease, which is very helpful for farmers. In addition, the algorithm proposes pesticides that can be used in each disease group.

Crop Yield Prediction Using Deep Neural Networks: In the 2018 Syngenta Crop Challenge, we presented a machine learning technique for crop yield prediction that outperformed the competition utilising massive datasets of corn hybrids. Based on genotype and environmental data, the method employed deep neural networks to predict yield (including yield, check yield, and yield difference). In order to predict the yields of new hybrids planted in unfamiliar locations with known weather conditions, deep neural networks that had been carefully constructed were able to learn the complex and nonlinear relationships between genes, environmental factors, and their interactions from historical data. The model's performance was discovered to be rather sensitive to the accuracy of the weather forecast, which indicated the significance of weather prediction methods [7]. This paper attempts to give an overview of the most recent agricultural yield prediction techniques using deep learning. To find and evaluate the most pertinent studies, we conducted a Systematic Literature Review (SLR). After applying selection and quality evaluation criteria to the relevant research, we were able to recover 456 relevant papers, of which 44 primary studies were chosen for additional analysis. Regarding the main motives, the target crops, the algorithms employed, the characteristics used, and the data sources used, a detailed review and synthesis of the primary research was conducted. We found that the most popular technique, the convolutional neural network (CNN), performs the best in terms of root mean square error (RMSE). Lack of a large training dataset, which increases the possibility of overfitting and, ultimately, worse model performance in reality, is one of the biggest obstacles. Given that they frequently concentrate on the significance of unexplored research subjects, it is helpful for researchers in this discipline to highlight the existing difficulties and the potential for more study [8,9,10].

METHODOLOGY

As per the analysis of previous related works, it is clear that there are several techniques for crop disease detection. Our project focuses on two features, the first one is crop recommendation and the second one is a prediction of disease.

A. Crop Recommendation

- Data Pre-processing-
 - Data Description
 - Training Model- This proposed model employs five different types of ML models to analyze recommendation accuracy.
1. A decision tree is a flowchart-like tree structure.
Internal node - an attribute test.
Branch- the test's outcome [11].
Leaf node- class label. The naive Bayes
 2. classifiers- A set of basic "probabilistic classifiers" relying on Bayes' theorem and strong (naive) independence assumptions

amongst the features, which yields a 99 percent accuracy rate [12].

3. SVM- It is ML model that can generalize between two classes given a collection of labeled data is provided in the training set. It has a 10.68% accuracy rate [13].
4. Logistic regression- It is used for analysis, modeling, and prediction has a 94 percent accuracy rate [14].
5. XGBoost- A toolkit for achieving greater gradient boosting tree models in a short amount of time [15].
6. Random forest, This is a ML algorithm work on the ensemble learning principle
 - Testing Model, a testing set is used to evaluate the performance of a fully trained model.
 - Measure Model Accuracy The efficiency and accuracy of the proposed model is measured and optimal predicted the optimal output.
 - Result- Predict

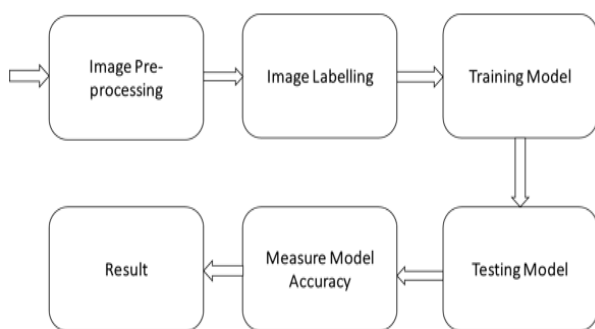


Fig.no :01 (Block Diagram- Plant Recommendation)

B. Prediction of Disease

1. Image Pre-processing

Preparing images for use in model training and inference Tensor (torch. Tensor) is a PyTorch class that stores and operates on homogeneous multidimensional rectangular arrays of numbers. PyTorch predicts using a diverse range of Tensorsted subtypes [16].

2. Image Labelling

The process of recognizing and marking distinct aspects in an image.

3. Training Model

Identifying appropriate values for all weights and biases using labeled images.

- a) Utility function- This function is used in the proposed model to perform the validation phase. Another function 'fit_one_cycle' will perform the entire training process [17].
- b) ResNet- In ResNets, unlike traditional NN, every other layer supplies into the next layer. To minimize overload, use a network with the remaining blocks, where each layer eats the next layer and directs it in layers 2-3 from a

distance. This also aids in the prevention of the [vanishing gradient problem [18].

4. Testing Model

To examine the performance of a fully trained model, a testing set is used

5. Measure Model Accuracy

The efficiency and accuracy of the proposed model are measured and optimal predicted the optimal output

6. Result: Predict the disease

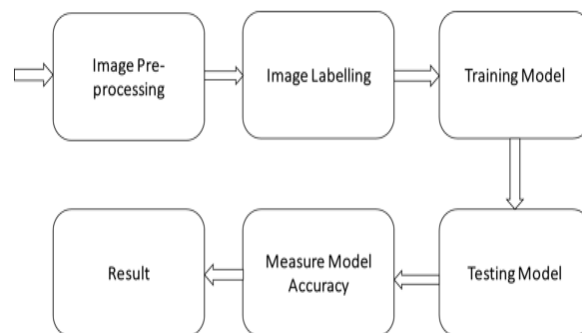


Fig.no: 02 (Block Diagram- Disease prediction)

RESULT AND DISCUSSION

A. Disease Prediction

To diagnose the disease, the user must upload a photograph of the unhealthy plant, which is then tested automatically by a deep learning architecture model [19,20,17]

- Taking input from the user

Here the model takes input images in the jpeg, png format. After clicking on the predict button the image is fed the model and further classification is performed.

- Predicted crop disease

After processing the input image, the model classifies the image according to the leaves' distinct features and gives the predicted output. Also, the website provides in-depth details about the diseases from its database containing information about the cause of the disease, cure for it, etc.

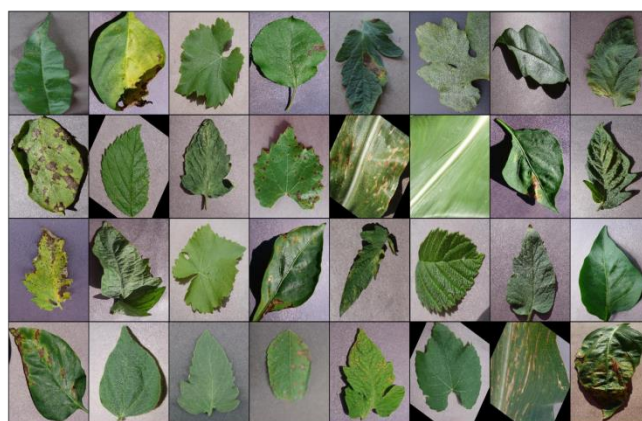


Fig.no: 03
(training batch)

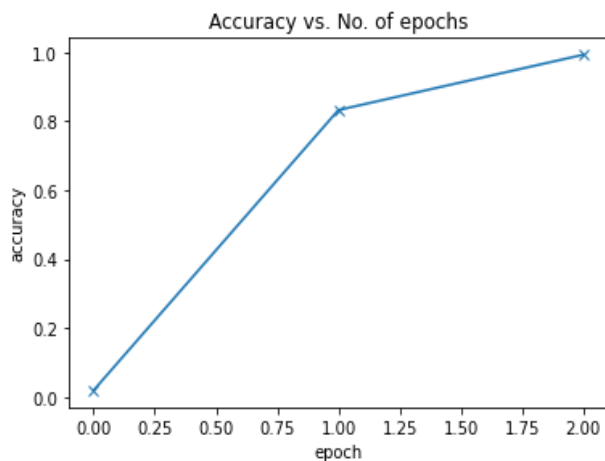


Fig.no: 02
(The accuracy rate)

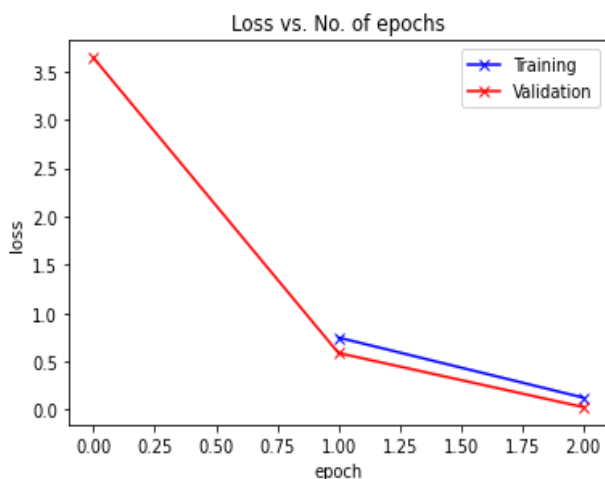


Fig.no: 03
(Validation Loss)

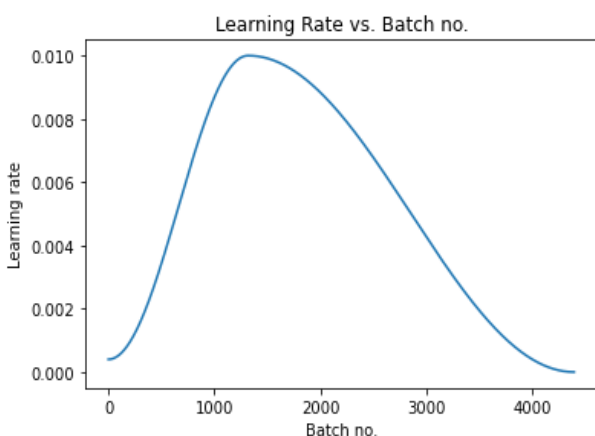


Fig.no: 04
(Learning Rate)

B. Crop Recommendation

- Users need to put the soil parameters according to the condition of the soil to predict the recommended crop through the random forest model which works as a backend [18].

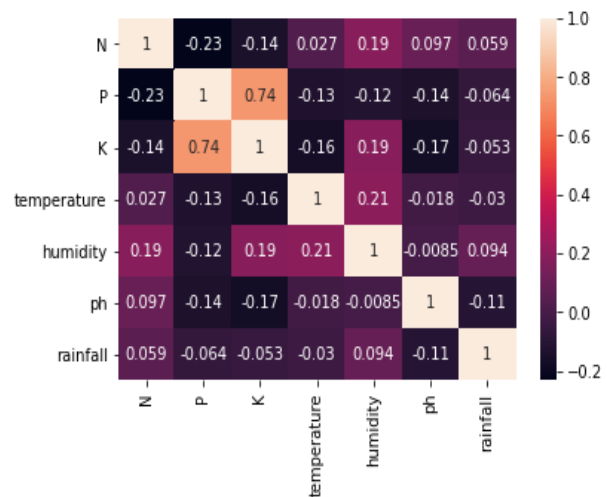


Fig.no:05
(Correlation between features)

• Soil Information

After Providing the information user has to click the predict button to feed the provided information into the model for further processing.

Recommended crop/plant After taking the input and processing it the model finds the suitable crop to grow based on the parameters like ph level, phosphorus level, rainfall [21,22].

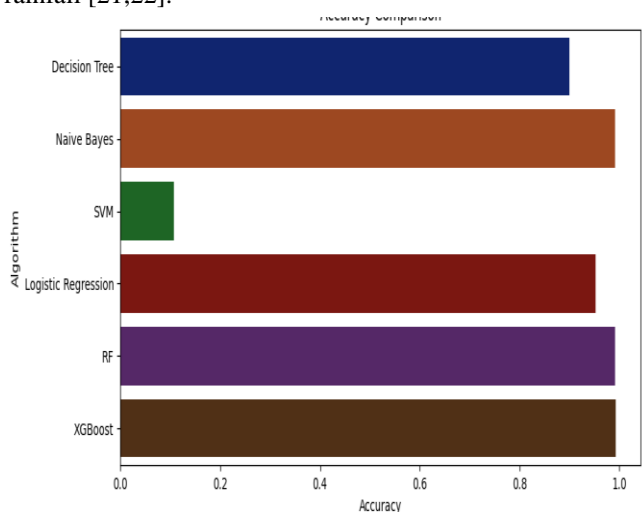


Fig.no: 06
(Accuracy plot)

Table: 01 (Model Accuracy)

Algorithm	Accuracy
DT	90%
SVM	11%
NaiveBayes	99%
Logistic Regression	95%
Random Forest	99%
XGBoost	99%

CONTRIBUTION

- Cost Effective: User do not need to pay anything to get the desired output
- Availability: Anyone can access it at any time. Easily reachable to Farmers
- Accuracy: Our Project gives more accurate results than the existing projects.

FUTURE SCOPE

In the future, performance can be improved by augmenting the dataset's photos. As further work, a smart-gadget-assisted system might be developed to make this automatic crop disease detection process. A nutrient management store can be added so that farmers can easily order nutrients, insecticides and pesticides

SCOPE OF THE PROJECT

This Project is highly useful in terms of their applications since they present each recommendation as well as the benefit to buy suggested items. It is beneficial for farmers to boost crop productivity. It is simple to use. Less memory is required. Plant disease automation in agriculture science is the key worry for every country, as food demand is rapidly growing due to population growth. Furthermore, modern technology has improved the usefulness and precision of identifying illnesses in plants and animals. The application of technology in the detection and analysis procedures improves their accuracy and dependability.

CONCLUSION

The proposed model will help farmers in a lot of ways. It can identify different kinds of diseases which their crops might have and also they can check the best suitable crop for their soil for better yields. The proposed model uses CNN to predict diseases and ML algorithms to classify soil type. The models are deployed on a web app which is easy to use for farmers

REFERENCES

- [1] J. R. H. D and P. B, "A Machine Learning-based Approach for Crop Yield Prediction and Fertilizer Recommendation," 2022 6th International Conference on Trends in Electronics and Informatics (ICOEI), 2022, pp. 1330-1334, doi: 10.1109/ICOEI53556.2022.9777230.
- [2] N. H. Kulkarni, G. N. Srinivasan, B. M. Sagar and N. K. Cauvery, "Improving Crop Productivity Through A Crop Recommendation System Using Ensembling Technique," 2018 3rd International Conference on Computational Systems and Information Technology for Sustainable Solutions (CSITSS), 2018, pp. 114-119, doi: 10.1109/CSITSS.2018.8768790.
- [3] Al-Amin, M., Bushra, T.A., & Nazmul Hoq, M. (2019). Prediction of Potato Disease from Leaves using Deep Convolution Neural Network towards a Digital Agricultural System. 2019 1st International Conference on Advances in Science, Engineering and Robotics Technology (ICASERT), 1-5.
- [4] Kur, S., Joshi, G., & Vig, R. (2019). Plant Disease Classification using Deep Learning Google Net Model. International Journal of Innovative Technology and Exploring Engineering.
- [5] Gupta, A.K., Gupta, K., Jadhav, J., Deolekar, R.V., Nerurkar, A.K., & Deshpande, S. (2019).
- [6] Plant Disease Prediction using Deep Learning and IoT. 2019 6th International Conference on Computing for Sustainable Global Development (INDIACom), 902-907.
- [7] Kaur, P., Harnal, S., Tiwari, R., Upadhyay, S., Bhatia, S., Mashat, A., & Alabdali, A. M. (2022). Recognition of Leaf Disease Using Hybrid Convolutional Neural Network by Applying Feature Reduction. Sensors (Basel, Switzerland), 22(2), 575.
- [8] Thomas van Klompenburg, Ayalew Kassahun, Catagay Catal, Crop yield prediction using machine learning: A systematic literature review, Computers and Electronics in Agriculture, Volume 177, 2020, 105709, ISSN 0168-1699
- [9] P. Parameswari, N. Rajathi and K. J. Harshanaa, "Machine Learning Approaches for Crop Recommendation," 2021 International Conference on Advancements in Electrical, Electronics, Communication, Computing and Automation (ICAECA), 2021, pp. 1-5, doi: 10.1109/ICAECA52838.2021.9675480.
- [10] P. A, S. Chakraborty, A. Kumar and O. R. Pooniwal, "Intelligent Crop Recommendation System using Machine Learning," 2021 5th International Conference on Computing Methodologies and Communication (ICCMC), 2021, pp. 843-848, doi: 10.1109/ICCMC51019.2021.9418375.
- [11] J. R, H. D and P. B, "A Machine Learning-based Approach for Crop Yield Prediction and Fertilizer Recommendation," 2022 6th International Conference on Trends in Electronics and Informatics (ICOEI), 2022, pp. 1330-1334, doi: 10.1109/ICOEI53556.2022.9777230.
- [12] R. K. Ray, S. K. Das and S. Chakravarty, "Smart Crop Recommender System-A Machine Learning Approach," 2022 12th International Conference on Cloud Computing, Data Science & Engineering (Confluence), 2022, pp. 494-499, doi: 10.1109/Confluence52989.2022.9734173.
- [13] N. H. Kulkarni, G. N. Srinivasan, B. M. Sagar and N. K. Cauvery, "Improving Crop Productivity Through A Crop Recommendation System Using Ensembling Technique," 2018 3rd International Conference on Computational Systems and Information Technology for Sustainable Solutions (CSITSS), 2018, pp. 114-119, doi: 10.1109/CSITSS.2018.8768790.

- [14] Anakha Venugopal, Aparna S, Jinsu Mani, Rima Mathew, Vinu Williams, 2021, Crop Yield Prediction using Machine Learning Algorithms, INTERNATIONAL JOURNAL OF ENGINEERING RESEARCH & TECHNOLOGY (IJERT) NCREIS – 2021 (Volume 09 – Issue 13),
- [15] M. Kalimuthu, P. Vaishnavi and M. Kishore, "Crop Prediction using Machine Learning," 2020 Third International Conference on Smart Systems and Inventive Technology (ICSSIT), 2020, pp. 926-932, doi: 10.1109/ICSSIT48917.2020.9214190.
- [16] I. Ahmad, U. Saeed, M. Fahad, A. Ullah, M. Habib-ur-ahman, A. Ahmad, J. Judge Yield forecasting of spring maize using remote sensing and crop modeling in Faisalabad-Punjab Pakistan J. Indian Soc. Remote Sens., 46 (10) (2018), pp. 1701-1711, 10.1007/s12524-018-0825-8
- [17] Dharani, M & Thamilselvan, R & Natesan, P & Kalaivaani, PCD & Santhoshkumar, S. (2021). Review on Crop Prediction Using Deep Learning Techniques. Journal of Physics: Conference Series. 1767. 012026. 10.1088/1742-6596/1767/1/012026.
- [18] A. Mondal and S. Banerjee, "Effective Crop Prediction Using Deep Learning," 2021 International Conference on Smart Generation Computing, Communication and Networking (SMART GENCON), 2021, pp. 1-6, doi: 10.1109/SMARTGENCON51891.2021.9645872.
- [19] Grinblat G L, Uzal L C, Larese M G, and Granitto P M, 2016, Deep learning for plant identification using vein morphological patterns, Comput. Electron. Agric., 127, 418–24
- [20] Bu F and Wang X, 2019, A smart agriculture IoT system based on deep reinforcement learning, Future Generation of Computing System, 99, 500–07.
- [21] Apolo-Apolo OE, Martínez-Guanter J, Egea G, Raja P, Pérez-Ruiz M. 2020. Deep learning techniques for estimation of the yield and size of citrus fruits using a UAV. European Journal of Agronomy. 115.
- [22] Filippi P, Jones EJ, Wimalathunge NS, Somarathna PDSN, Pozza LE, Ugbaje SU, Jephcott TG, Paterson SE, Whelan BM, Bishop TFA. 2019. An approach to forecast grain crop yield using multi-layered, multi-farm data sets and machine learning. Precision Agriculture. 20(5):1015–1029.

Identify Vulnerabilities in Mobile Banking System using Vulnerability Assessment and Penetration Testing

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Abstract:

Presently a day's everybody is associated with the web due to web use is rising world wide step by step so security has likewise turned into a significant feature to the internet. Security of the web server, Web Application, Websites and portable financial framework in the present world is vital. So in this, we discuss about VAPT. VAPT are two distinct Vulnerability or shortcoming testings. These tests have different intensity and consolidated to get a flat out VAPT testing conduct two unique errands, generally all around stamped results inside a similar application. For any organization Vulnerability appraisal and Penetration Testing really look at appropriate working of looking through game plan. On the off chance that portable financial application has a weakness, aggressor utilize different sort of assaults like SQL Injection, Cross-Site Scripting, Cross-Site Request Forgery, Session Exploitation, DoS or DDoS and Misconfiguration and so forth. These attacks are described in OWASP top 10.

Index Terms:

VAPT (Vulnerability Assessment and Penetration Testing), SQL Injection, XSS (Cross-Site Scripting), CSRF (Cross-Site Request Forgery), OWASP Top 10, Mobile Banking Application.

INTRODUCTION

Presently a days, Web or web application hacking exercises have been utilized in web or web applications. In digital world for the most part fundamental objective of assailant would be site or web application. Security of web application or site is vital on the grounds that, in latest years every one of the correspondences, sharing the assets, Online Banking, Payment of utilities bills, Social Networking, E-Governing and so forth, through the web. Security weaknesses in web application are generally found as, Breach of information uprightness, taking of classified information or influence web application accessibility. So getting web application is one of the significant or significant assignments in digital world [1]. Web Application security is exceptionally significant difficulties in light of the fact that numerous digital dangers are implies in it, since security of web application issues can't be compromised. Security shortcoming is seen by Vulnerability Assessment and Penetration testing procedures [2]. Weakness Assessment is a course of, pen analyzers checks a site escape clauses. After finished examining task then, at that point, pen analyzers find weaknesses which are the certain security provisos inside the sites or web application. During the time spent infiltration testing, pen analyzers fragrance activities to take

advantage of those shortcomings and make a proof of the test. OWASP, open web application security project top 10 comprises of different assaults to which sites or web application is powerless. The major or primary effect of these sorts of assaults is a monetary misfortune, information misfortune or notoriety misfortune [3].

To perform a task to analysis vulnerabilities in website or web application, there are two methods, Manual and Automated. In manual method, that is done by human being. Manual testing, Vulnerability and risk of a hardware, software or web application is tested by a pen tester.

Generally, in manual testing, Penetration tester doing some tasks like, Data Collection, Vulnerability Assessment, Actual adventure (Exploit) and Report Preparation.

There are two kinds of manual testing is Focused Manual Testing and Comprehensive Manual Testing. In Automation testing technique, we have a great deal of weakness evaluation devices, which are accessible either as free (Open Source) or paid (Commercial) instruments with different functionalities. Presently the principal disarray is to pick the best entrance testing device. Another issue is nobody device is totally finished in nature to distinguish the provisos or weakness in a framework, programming, sites or web application.

In this paper, we discussed about a relative and aggregate examination of the web application weakness evaluation and entrance testing cycle, strategies and procedures. In segment II we furnish the current work model related with web application weakness appraisal. In segment III we examined about testing techniques for weakness evaluation and entrance testing of a web application and we likewise give a portion of the testing boundaries which help to pick best weakness evaluation and entrance testing devices alongside the near examination. In segment IV we likewise give which entrance testing technique is ideal to give the thorough security examination consequence of a web application. In area V and VI we examined end with appropriate outcome and approaches towards weakness evaluation and entrance testing tests.

VULNERABILITY

Vulnerability, loophole or weakness in the web application or in any system software, design, implementation or any software code. A particular weakness could appear as anything from a shortcoming

in framework plan to the execution of a functional system. Vulnerability might be eliminated or reduced by the right security countermeasures.

Web application pen testing is the process of finding vulnerabilities in web application or websites.

Web Application Hacking: In web application hacking, the attacker to identify uncover application and to understand their process or techniques. If the application is belongs any commercial or company product, the attacker can verify for known weaknesses or begin to probe the application.

INFILTRATION TESTING IS EXPECTED TO FIND WEAKNESSES (VULNERABILITY) CONNECTED WITH THE ACCOMPANYING:

- Injection Flaws: SQL Injection, Command Injection, File Injection, LDAP Injection, XML injection.
- Parameter/ Form Tampering: Parameter or form tampering is the process of manipulation of parameters passed between the client and the web server application.
- Invalidated Input, Failures resulting in SQL injection.
- Cross Site scripting and cross site request forgery attacks
- Others web application attacks: DoS, DDoS, Session fixation, URL encoding, path traversal, Buffer Overflow.

a) SQL Injection:

SQL injection is a weakness that permits an assailant to impact the Structured Query Language. That is every one of the inquiries passes to a back end database. SQL injection is embed at the hour of refreshing information, Deleting Data, embedding information by SQL order on the server to sidestep verification.

The Attacker get access to user name or password from the database by inserting "OR" or "=" into the user name and password location.

User Name: "or ""="

Password: "or""="

This is one of the questions in the client input:

'or then again '1' =1

"or"1"="1

1 or 1 =1

'or then again 1 = 1; - -

'or then again 1=1-

b) Cross-Site Scripting and Cross-Site Request Forgery

Cross-Site Scripting is a most extremely popular in the last few years. Cross-Site scripting and cross-site request forgery both attacks implemented with input that is not properly sanitized.

1. XSS (Cross-Site Scripting exploit trust so that an attacker uses a web application to send malicious code to an end user. XSS exploit vulnerabilities in dynamically generated web pages.
2. One way to exploit XSS is through HTML forms.
3. If an attacker attack a website that echoes anything write into the search box

<Script> You're Web Application Hacked </script>

Process to complete this attack is as follows:

- a. Track down a weak site that gives the required treats.
- b. Fabricate the assault code and confirm that it will work true to form.
- c. Create your own URL or implant the code in an email or site page.
- d. Trick the user into executing the code.
- e. Hijack the account.

Eg;<X HREF=''http://mywebsite.com/comment.cgi?mycomment=<SCRIPT>malicious code</SCRIPT>''>Click here</X>

c) Session Hijacking

Session Hijacking is to get confirmation to a functioning framework. Meeting capturing is the cycle to go after casualty machine they are on a similar portion. Meeting seizing furnishes the aggressor with a verified meeting to which he can then execute orders.

For meeting seizing to find true success, numerous things should be finished:

1. Find and recognize a functioning meeting.
2. Predict the arrangement number.
3. Take one of the gatherings' disconnected.
4. Take control of the meeting

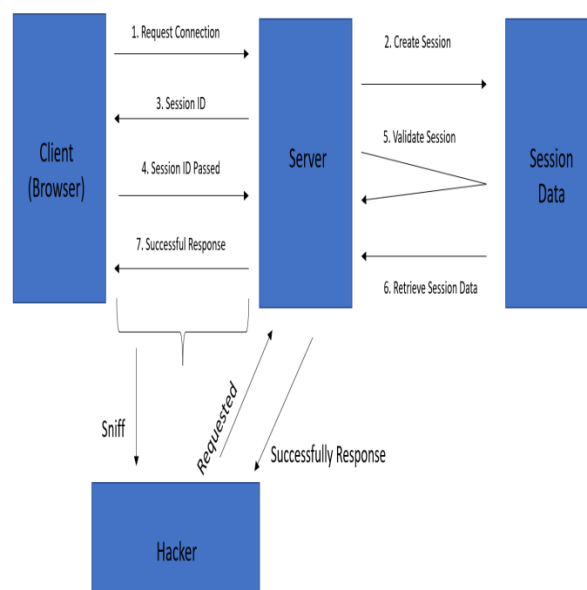


Fig. 2 Session Hijacking

d) Privilege Escalation

Privilege is about a permission, that a user has on a system or a web app. Once a user escalates that privilege, breaking the rules and taking more advantages over the system or web app then it's called privilege escalation. In privilege escalation

The user bypasses the in-built restriction in administrator and makes himself as root of the system because a root has all

types of access permission of any file. If a user gets that permission then he/she can easily view the encryption key, password, modification in content or in password.

There are two types of privilege escalation

1. Vertical Privilege Escalation- In this privilege escalation, a user increases their access field like move from read-only permission to write permission then move to modification stage.
2. Horizontal Privilege Escalation- if a user wants to access another same position user system's account then Horizontal Privilege Escalation takes place.

e) Browser Replay Attack

When an authorized session has established between two users, a unique ID and password are released and also the ending of the session that unique ID and password become invalid. In this type of attack, the attacker sets himself in the middle of the session and monitors the network traffic, sniffs the unique ID and password. After getting the session ID, the attacker sends the data or communication to the authorized destination like an authorized sender.

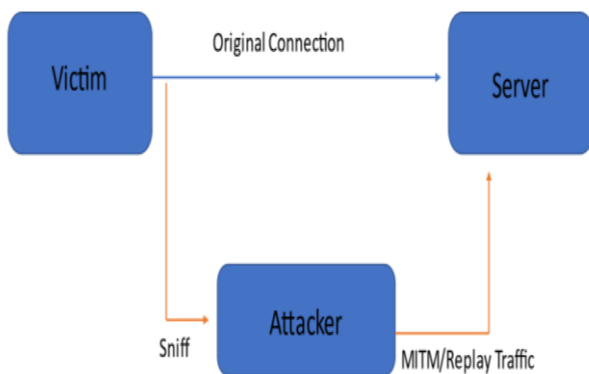


Fig.3 Browser Replay Attack

f) Clickjacking

In this type of vulnerability, the attacker creates a fake web page on the original web page in order to do unauthorized activities. When a user clicks on the fake web page then the original web page runs in the back-end. For example, suppose a user works on a web page, suddenly he/she gets a pop-up web page which reminds about a notification and the user clicks on 'remind me later' but behind the note 'remind me later', a user actually clicks on 'allow me' program which is designed by the attacker to monitor your system activities illegally.

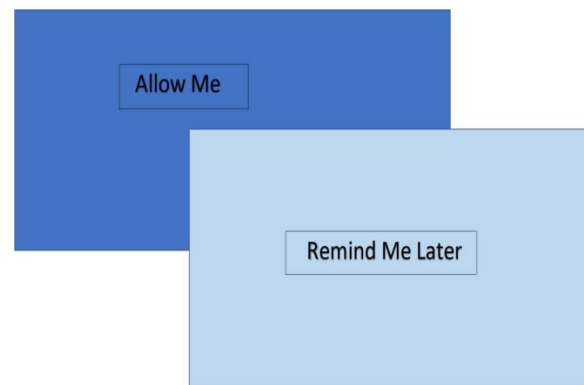


Fig.4 Clickjacking

g) Browser Cache Weakness

When sensitive data is typed into the browser by the user, such data is captured by the browser and stored into the cache and history field for future quick access to the user. A user can easily access the previous data or links by using the 'BACK' button. But the cache and history field gives birth to the same vulnerability by showing the sensitive data history.

A user can stop the 'BACK' button by:

1. Delivering the data over HTTPS.
2. Setting Cache-Control

h) File upload

File upload is one of the most common features which are found in web applications where a user can upload any particular file on a remote web server. An attacker can try to upload something malicious on a remote server and these malicious scripts are nothing but web shells. So if an attacker is successfully able to upload their web shell on a remote server then the attacker can remotely access the server. This is all about the file upload vulnerability.

i) Authentication Bypass

This is a process where the user bypasses the authentication barrier in order to gain unauthorized access into the target's environment without using the login ID or username and password.

j) Session Fixation

In this type of attack, the attacker hijacks the authorized live session. Websites with user accounts typically implement an authentication mechanism to identify returning users post authentication. A session will be established between the server and the browser to exchange a session ID, so the server knows which user sends a request. If a hacker gets access to a user's session ID then they can impersonate like a real user. Session fixation is one of the methods that an attacker can use to do this.

METHODS OF VULNERABILITY TESTING

There are two techniques for Vulnerability Testing: for example Manual Testing, Furthermore Automation Testing.

1. **Manual Testing:** Manual Testing is the concept of scanning and identified vulnerabilities by manual testing because of many vulnerability is difficult to find using automated testing tools.

Manual Testing is basically the procedure as the name suggests which involves manually or testing the software by performing some sort of quality analysis and much more and this is done by Quality Analysts. it is one of the most widely used method till date even through the world is moving towards automation, it is one of the classical methodology used to find and basically remove any bugs, defect or anything else which is not supposed to be present in a software which is under development.

This type of testing involves-

- **System Testing-** Entire system will check in a end to end format.
- **Regression-** checks the daily routine activities.
- **Retesting-** retesting is related to the bug verification. The function of retesting is to find and fix the bug issues.
- **Smoke-** it is basic function feature that check the login field and links are working properly or not.
- **Sanity-** it is little advanced than smoke testing because it work on high level scenario.
- **Database-** checking the user can easily store or fetch the data or not.
- **White Box-** tester has good knowledge regarding code, framework and architecture of the software.
- **Black Box-** tester has no knowledge regarding the testing software
- **Grey Box-** combination of (black+white) box.
- **Monkey Testing -** this type of testing conduct a random testing of any part of a particular application.
- **GUI-** the tester checks that, there are proper alignment, images, colours, texts are not overlapping, or not.

2. Automation Testing

Automation Testing is a couple of procedures which are actually carried out by the computers or with the help of a lot of codes/test scripts. Testers make use of automation tools and these tools are used to develop a certain things called as test scripts and these test scripts actually perform all the use cases on the software and eventually validated. the main goal of Automation testing is to ensure that we complete test execution in less amount of time.

Some types of testing involves-

- **regression testing-** recent code change should not affected existing features.
- **smoke testing-** we check the stability of the system, duration of time and conditions.
- **unit testing-** we check individual unit of code.

- **integration testing-** we check interaction between modules.

Some testing tools are as follows-

- Burpsuit
- Acunetix
- OWASP Zed Attack Proxy (ZAP)

Features / Tools	Burpsuit	Acunetix	OWASP ZAP
Vulnerability Assessment	★	★	★
Penetration Testing		★	
Manual Testing	★		★
Passive Testing	★		★
Active Testing	★	★	★
Login Sequence		★	
Availability	Free/ Paid	Paid	Free/ Paid

Table 1. Comparison Chart of Automation Tools

MANUAL VS AUTOMATION TESTING

Some comparisons are as follows-

- **Meaning**
 - **Automated Testing** involves making use of various automation tools to execute use cases for this purpose.
 - **Manual Testing** involves test cases which are executed by a human tester on a piece of software.
- **Processing Time**
 - **Automated Testing** is significantly faster when directly compared to manual testing.
 - **Manual Testing** consumes human resources and is time-consuming in general.
- **Exploratory Testing**
 - **Automated Testing** does not allow for exploratory testing or random testing in general.
 - **Manual Testing** does allow for exploratory testing and random testing methodologies to be implemented.
- **Initial Investment**
 - **Automated Testing** involves spending a bigger amount upfront but it pays off well because the ROI is better for the long term.
 - **Manual Testing** involves spending a significant smaller amount upfront but, ROI is comparatively low.

- Reliability
 - **Automated Testing** is very robust and reliable as the task is carried out by various tools and scripts.
 - **Manual Testing** does not have a high rate of accuracy because it involves human error.
- UI Changes
 - **Automated Testing** has a small disadvantage because scripts need to be changed completely if there is a UI change.
 - **Manual Testing** can work fine with changes comparatively simple and quicker when compared.
- Resources
 - **Automated Testing** calls for testing tools and automation engineers.
 - **Manual Testing** calls for investing in human resources.
- Value For Money
 - **Automation Testing** will work out if the test content volume is large.
 - **Manual Testing** will not be cost effective for high volume testing.
- Performance Testing
 - **Automated Testing** allows tests like load testing, stress testing etc. which can be done very easily.
 - **Manual Testing** does not offer feasibility when performance testing is a main point of concern.
- Programming Knowledge
 - **Automated Testing** involves a lot of programming, hence it is a must.
 - **Manual Testing** does not call for any requirement for programming knowledge.
- Use In DevOps
 - **Automated Testing** helps in build verification and testing which are integral to the DevOps life cycle.
 - **Manual Testing** defeats the automated build principle of DevOps entirely and lower efficiency.
- Ideal Use Case
 - **Automation Testing** is very well suited for regression testing, load testing, highly repeatable functional test cases and more.
 - **Manual Testing** is suitable for AdHoc testing exploratory testing and cases where there are frequent changes.

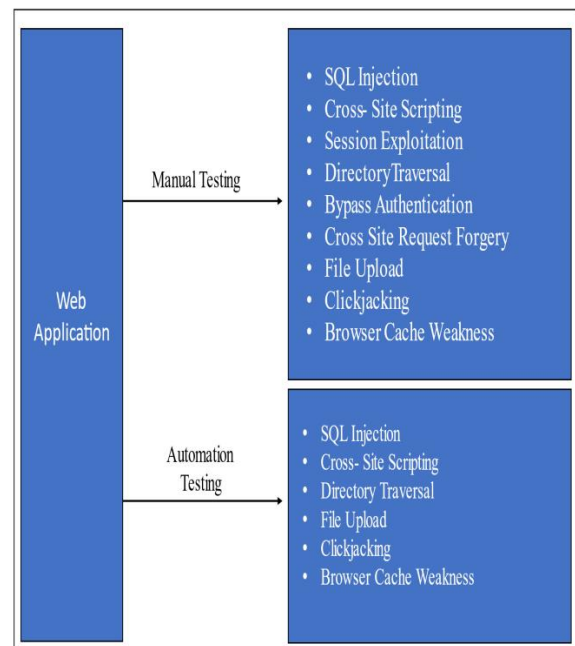


Fig. 5 Manual VS Automation Testing

RELATED WORK

Figures and In 2015, several parts of Ukraine had been faced a electric ran out issues but it was not related to a electrical department. it was a cyber attack indeed.

In 2014, Khushal Singh and Vikas [1] have support the innovation which identify all meeting issues and examination the quantity of issues to assess exhibitions of these meeting double-dealing discovery methods. They profoundly examination the meeting double-dealing usefulness exhaustively alongside the avoidance risk component and strategies. web application protections issues take put can be distinguished by backtrack. Backtrack is an adaptable useful framework that determines with number of infiltration testing instruments and security evaluation.

Arijit Kumar Bose & Rohan Vibhandik, [3] have presented another testing strategy in regards to the weakness evaluation of web applications for breaking down and involving a bunch of devices for security issues. Their methodology shows that weakness by utilizing Nikto and W3AF instruments.

In 2007, Estonian banks online services had been affected by attacker, by sending over internet traffic i.e. DOS and DDOS attack

In 2006, The US retail trader company analysis that 45.6 million credit and debit card information were stolen. it was one of the first largest-ever cyberattacks involving the lose of personal data.

In 1999, a cyberattacker attacks on NASA computers system and installed backdoors on their server. the hacker was 15 years old JONATHAN JAMES.

RESULT

We performed testing (Manual Penetration testing and Automation Penetration Testing) on two application and one over cell phone testing to really take a look at clone App.

1. E-Commerce Application
2. Cloud Application
3. SpyHuman Application

At the time of penetration testing we used paid or free (commercial web penetration testing tool or open source penetration testing tool) to performed or find known vulnerabilities in web application and mobile application.

The weaknesses find out by utilizing the manual entrance testing techniques.

- SQL Injection
- File Upload
- Directory Traversal
- Authentication Bypass
- Cross Site Scripting
- Clickjacking
- Cross Site Request Forgery

The weaknesses find out by utilizing computerized entrance testing strategies.

- Acunetix tool find out only cross site scripting, clickjacking, Browser cache weakness, SQL Injection, File Upload, and directory traversal but acunetix tool did not performed to detect bypass login confirmation and cross website demand phony in any portable or web application.
- Destroy apparatus figure out just cross site prearranging, Clickjacking, Directory Traversal, SQL Injection, Browser Cache Weakness however destroy can't identify sidestep login confirmation, Session abuse checks, File Upload and cross site demand fraud usefulness in any application .
- Burpsuit find out Browser Cache weakness, Clickjacking and Directory traversal vulnerabilities in any web application or mobile application.
- SpyHuman mobile application detects Mobile cloning function, SIM cloning function, bypass login authentication, SMS bypass and OTP bypass.

Table II. Automation Tools Overview

Tools	Vendor	Version
Acunetix	Acunetix	10.5
Zap	OWASP	2.5.0
Burosuit	PortSwigger	1.6
SpyHuman	SpyHuman	1.2

The diagram which show the examination of computerized automation testing and manual testing.

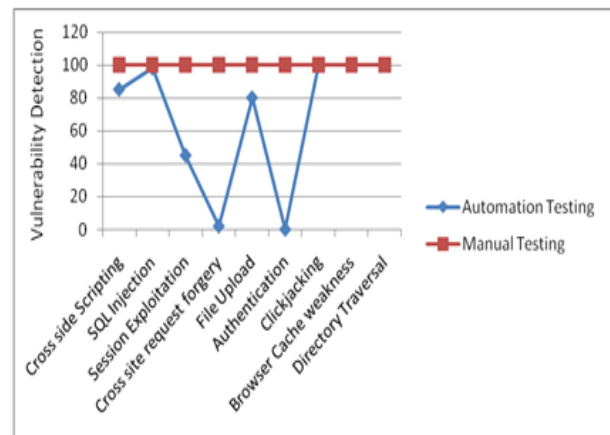


Fig. 4 Result Analysis Line Graph

After completing penetration testing through automation penetration testing and manual penetration testing we observed that accuracy of manual testing (VAPT), 100% accurate in compare of automated (Vulnerability Assessment and Penetration Testing) so robotized instruments not give 100 percent precision.

CONCLUSION

In this paper, Attacks on applications is more harmful to us. As attackers become more knowledgeable, so this is very important that organization provide tanning to educate themselves on the attack that they are facing. The process of web and mobile application is of high priority since web and mobile and cloud vulnerability outcomes as publicly. Subsequent to going after on application, secret information, impact portable application accessibility or breaking of information dependability.

After doing many experiment or study using automation and manual testing us find manual penetration testing is so much working in term of correctness. On the behalf of mobile or web application expertise information on the devices tools, machine and system, pen tester can perform better attacks to find accurate vulnerability using manual testing method. Bypass login authentication, file upload, XSS, CSRF, SQL injection, clickjacking, Browser cache weakness and Directory traversal attacks are find out in web and mobile application and cloud application also. If we discussed about automation testing on the basis of time and money to findout the vulnerability in web application and mobile application so automated testing methods is used. Web and mobile application scanners are used for executing automation penetration testing.

Our purpose to write this paper for vulnerability assessment to organization should make plan for these type of attack and integrate manual and automated penetration testing methods to make sure accuracy in identification of actual vulnerability in any type of application we use in daily work.

REFERENCES

- [1] Khushal Singh Vikas "Examination of Security Issues in Web Applications through Penetration Testing", International Journal of Emerging Research in Management & Technology, Volume 3, March 2014."
- [2] Prashant S. Shinde, B. Ardhapurkar "Network protection investigation utilizing weakness evaluation and entrance testing", IEEE 2016."
- [3] Rohan Vibhandik, Arjit Kumar "Weakness Assessment of Web Applications-A Testing Approach", IEEE 2015 gathering."
- [4] Ossama B. Al Khuraji, Mohd A. AL Ahmad "Study of Web Application Vulnerability Attacks", International Conference on Advanced Computer Science Applications and Technologies, IEEE 2016."
- [5] Tanjila Farah, Moniruzzaman Shojol, Maruf Hassan "Evaluation of weaknesses of web uses of Bangladesh: A contextual investigation of XSS and CSRF", IEEE 2016"
- [6] Insha Altaf, Jawed Ahmad Dar "Weakness Assessment and Patching Management", "International Conference on Soft Computing Techniques and Implementations, IEEE 2015"
- [7] Mahim Mirjalili, Alireza Nowroozi "An overview on web entrance test", Advances in Computer Science: an International Journal, Vol. 3, Issue 6, No.12, November 2014.
- [8] Shah sugandha, B. M. Mehtre "A Reliable Strategy for Proactive Self-Defense in Cyber Space utilizing V APT Tools and Techniques", School of Computer and Information Sciences, University of Hyderabad, Computational Intelligence and Computing Research (ICCIC), 2013 IEEE International Conference on."
- [9] Zoltan Panczel "Burp Suite(up) with extravagant checking components", SANS Institute InfoSec, December twentieth, 2015."
- [10] Russ McRee "OWASP ZAP Zed Attack", ISSA part, Puget Sound (Seattle), USA, November 2011"
- [11] Prof Sangeeta Nagpure & Sonal kurkure "Weakness Assessment and Penetration Testing of Web Application" International Conference on Computing, Communication, Control and Automation (ICCUBE) 2017. [2] Prashant S. Shinda, Shrikant B. Ardhapurkar, "Cyber Security analysis using Vulnerability Assessment and Penetration Testing" IEEE 2016."

Comparison and Performance Investigation of 4 and 16 QAM-OFDM Based on ROF LINK

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Abstract:

RoF technology is an amalgamation of microwave and optical networks, with optical fiber serving as the backbone technology due to the numerous benefits it provides. However, due of the nonlinear effects of the channel, the performance of RoF systems can suffer significantly. Furthermore, to improve overall system performance, Orthogonal Frequency Division Multiplexing (OFDM) is being proposed as a standard for broadband wireless networks for deployment with RoF systems. Because of recent technological advancements in bandwidth for access networks, there has been an increase in demand for high-speed data rates and high-capacity bandwidth. The use of a combination of RoF and OFDM techniques has resulted in wireless networks with higher data rates and reduced costs. The network's performance was compared to that of other digital quadrature amplitude modulation techniques (such as 4-QAM and 16-QAM for optical fiber lengths of 70 km and higher and data rates of 15 Gbps). For 4 and 16 QAM, the performance analysis is based on constellation diagrams, bit error rate (BER), and quality factor analysis (depending on transmission length used). Our findings suggest that 16-QAM-OFDM outperforms 4-QAM modulation techniques. Furthermore, 16 QAM-OFDM delivers the maximum noise ratio with a difference in signal-to-noise ratio, as well as a superior quality factor graph for more noise figures. The proposed system link was designed and simulated using the OptiSystem "version 19" software package, which is a commercial optical system simulator.

Keywords:

RoF (radio over fiber), QAM (quadrature amplitude modulation), OFDM(orthogonal frequency division multiplexing), Modulation.

INTRODUCTION

Converting a radio frequency wave (RF) to light by modulating the intensity of a light source (often a laser) in conjunction with the RF signal. There is no digitization in this process because it is analogue. The light signal is subsequently sent across a fiber optic cable, which replaces and outperforms standard copper coax cable in terms of performance. It is an analogue technological communication in which a laser diode is used to modulate radio frequency, as well as various kinds of wired and wireless networks such as fiber optic, and the same signal is used to modulate other signals. It shows a simplified representation of a RoF link, in which the radio signal is converted into an optical signal and detected through the fiber.

The Radio over Fiber (RoF) technology is a potential technique for microcell and Pico cell applications in the future deployment of wireless data networks. It is an amalgamation of microwave and optical networks, with optical fiber serving as the backbone technology due to the numerous benefits it provides. However, due of the nonlinear effects of the channel, the performance of RoF systems can suffer significantly. Furthermore, to improve overall system performance, For implementation with RoF systems, Orthogonal Frequency Division Multiplexing (OFDM) is being proposed as a standard for broadband wireless networks. There has been a rise in demand for high-speed data rates and high-capacity bandwidth as a result of recent technological developments in bandwidth for access networks. The usage of a combination of RoF and OFDM techniques yielded some intriguing results.

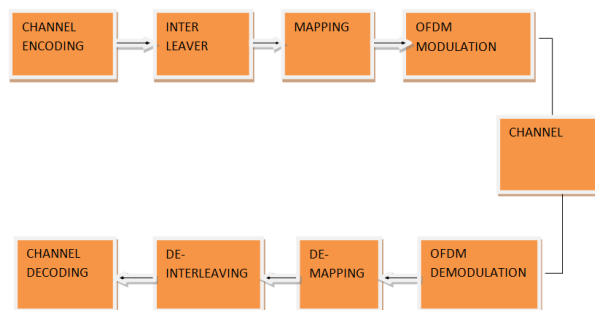


Fig. 1 Simple ROF Link

Different forms of digital quadrature amplitude modulation algorithms (primarily: 4-QAM, 16-QAM) are used to analyze network performance over various lengths of optical fiber and at various data rates. The optical spectrum of the sent signal, constellation diagrams, and symbol error for various channels are used to analyze the given performance. The 16-QAM-OFDM outperforms the 4-QAM-OFDM, according to our findings.

MULTIPLEXING SCHEMES USED in ROF for WIRELESS

A. OFDM (Orthogonal Frequency Division Multiplexing)

For wireless communications, the modulation technology orthogonal frequency division multiplexing (OFDM) is preferred because it allows for high data rates while remaining durable enough to endure radio

channel degradation. OFDM, on the other hand, is a transmission system that uses multiple sub-carriers to convert serial high-rate data streams into several parallel low-rate data streams.. As a result, the symbol's duration is lengthened, which aids in the elimination of Inter Symbol Interference (ISI). The transfer method between the base stations (B.Ss) and the antenna, when there is an electronics rack, is usually a single mode or multimode optical fiber. However, the current study aimed to offer the performance of a RoF optical link that was analyzed both with and without OOFDM.

Because OFDM is a good solution to the problem of inter-symbol interference generated by a dispersive channel, it is widely used. It is commonly used in communication systems Furthermore, OFDM is distinguished by the fact that it conveys the complexity of from analogue to digital transmitters and receivers domain. The underlying concept of OFDM, on the other hand, is a method of data transmission. Divide a high-data-rate stream into many lower-data-rate streams, which are then delivered at the same time via .There are a certain number of orthogonal subcarriers

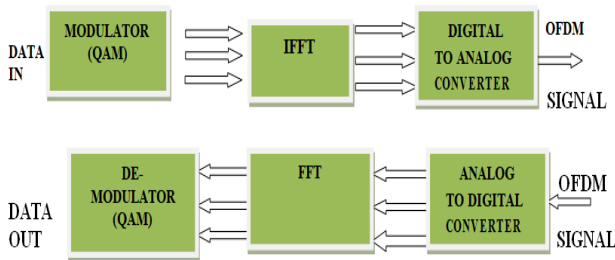


Fig. 2 OFDM BLOCK DIAGRAM

B. Waveform Division Multiplexing (WDM):

The main premise of WDM technology is to combine numerous optical channels with different wavelengths from different optical sources onto a single fiber using multiplexers at the transmitter and de-multiplexers at the receiver to separate the WDM channels. WDM technology, on the other hand, is an effective approach to enhance the capacity of RoF systems, increase the useable bandwidth of the fiber, and increase the number of base stations powered by the central office in the optical fiber feeder network. Furthermore, the topologies of WDM-RoF networks are similar to the topologies of other optical networks, such as bus, ring, and star networks.

C. Subcarrier Multiplexing (SCM):

One of the multiplexing strategies that can be utilized in optical systems to boost bandwidth usage efficiency is the SCM approach. Because the SCM is more susceptible to noise, data rates and maximum subcarrier frequencies are limited. The SCM optical system's fundamental configuration. Multiple Radio Frequency (RF) signals are multiplexed in the frequency domain and sent through a single wavelength in this RoF system technology. Combining SCM with WDM techniques, on the other hand, may provide more flexibility for high-

speed optical transmission with low dispersion and high optical bandwidth efficiency. Optical subcarrier multiplexing (OSM) is a technology that multiplexes multiple signals in the radio frequency domain and then transmits them using a single wavelength. As a result, microwave devices are more mature than optical devices, with analogue cable television in fiber optic systems being the most popular application. When compared to an optical oscillator, the microwave oscillator has far better frequency selection and stability. As a result, due to low phase noise RF oscillators, coherent detection in the radio frequency domain is easier, as compared to sophisticated modulation formats and the optical domain, which are both easily applicable.

SYSTEM DESIGN

The Transmitter, Fiber Channel, and Receiver sections are the three main components of the RoF system. The transmitting portion, on the other hand, is divided into two parts: an electrical portion for generating RF signals with SCM and an optical side for creating optical signals with WDM. The receiver part, on the other hand, is made up of two parts: RF and optical. This section describes how to construct a RoF system employing various modulation methods, such as 4-QAM, 16-QAM, and 64-QAM with and without OFDM in multi-channel transmission using WDM and SCM approaches.

A. Direct Model for SCM-RoF System

2-RF channels are simulated in this part using the 4-QAM, 16-QAM; modulation schemes using the OFDM technique at a data rate of 15GBps Figure 4 demonstrate the suggested simulation setups for the SCM with (4-QAM-OFDM) and (64-QAM-OFDM) RoF systems, respectively. The data bits are encoded first, and then turned into a constellation map of a well-known modulation algorithm employed in this study for the transmitter section in these figures. The data is understood as frequency-domain data in the OFDM approach, and it is then converted to a time domain signal via the IFFT process, after which the IFFT output is broadcast to the channel with the addition of a cyclic prefix (CP). After that, the OFDM time signals are processed.

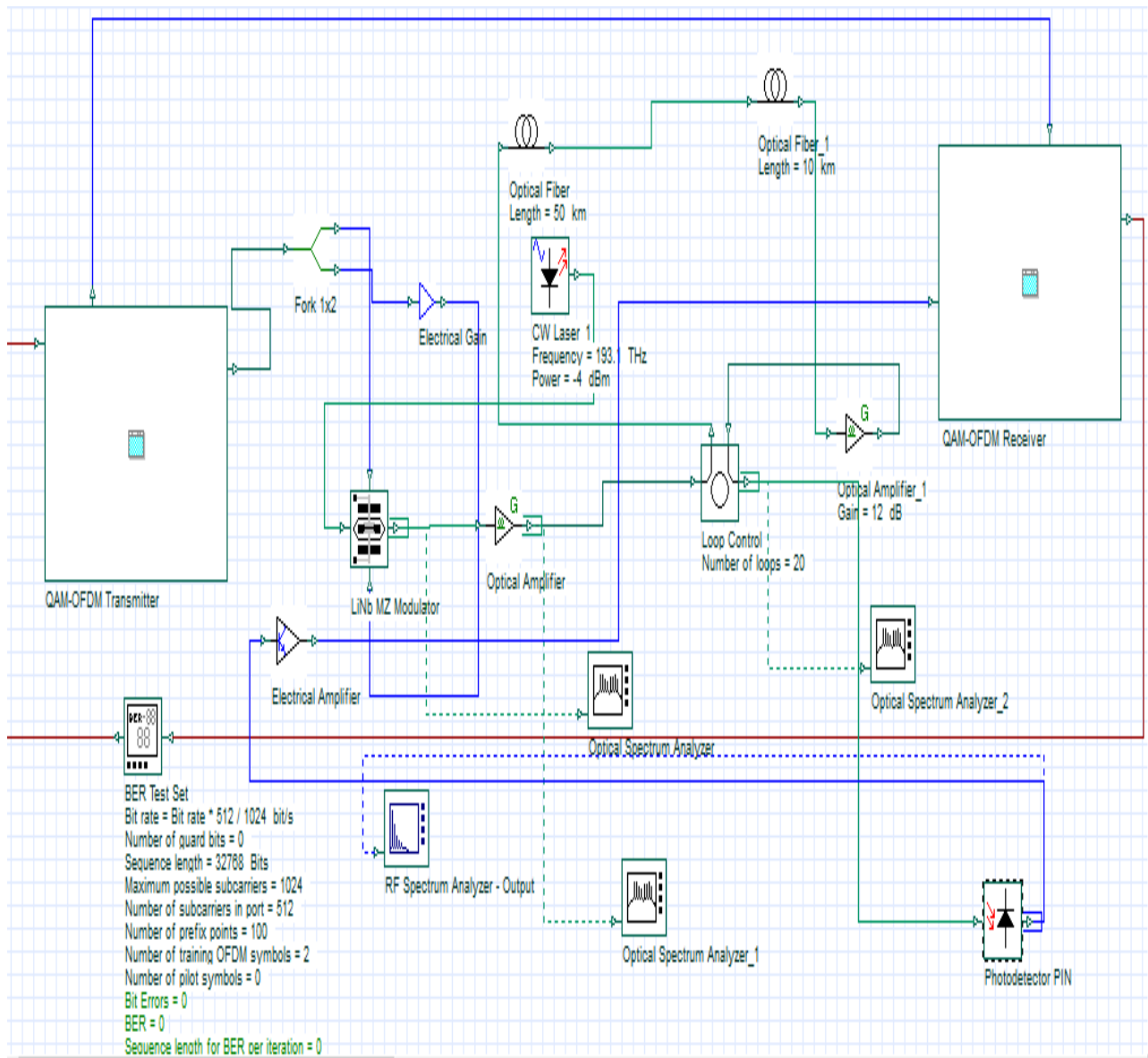


Fig. 3 Proposed simulation setup for the SCM (4and 16QAM-OFDM-RoF) system

B. Layout of transmitter section

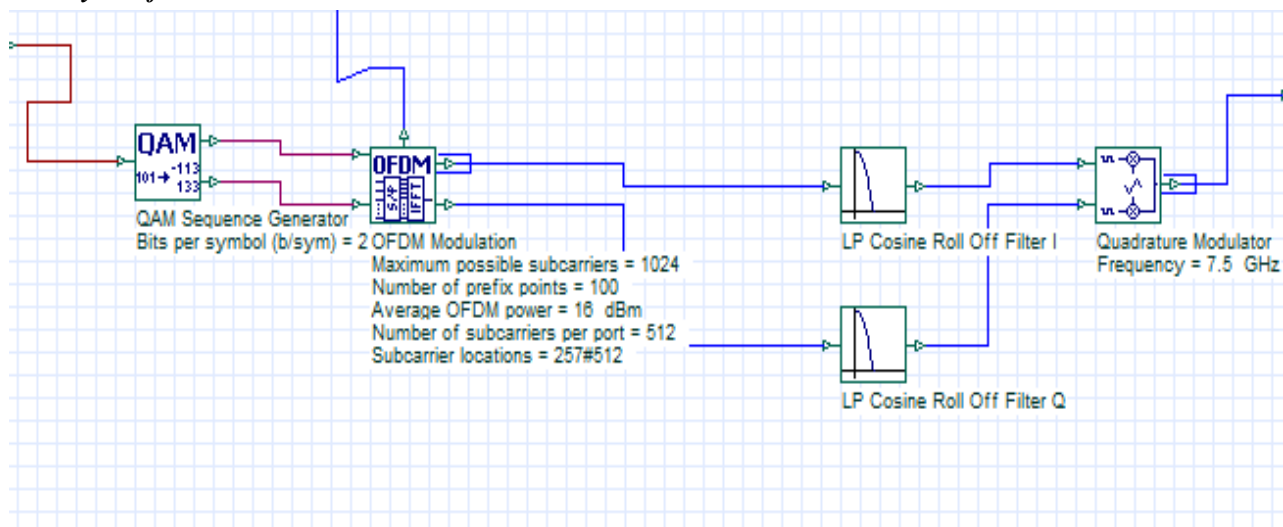


Fig. 4 Proposed simulation setup for the transmitter part (4and 16QAM-OFDM)

C. Layout of receiver section

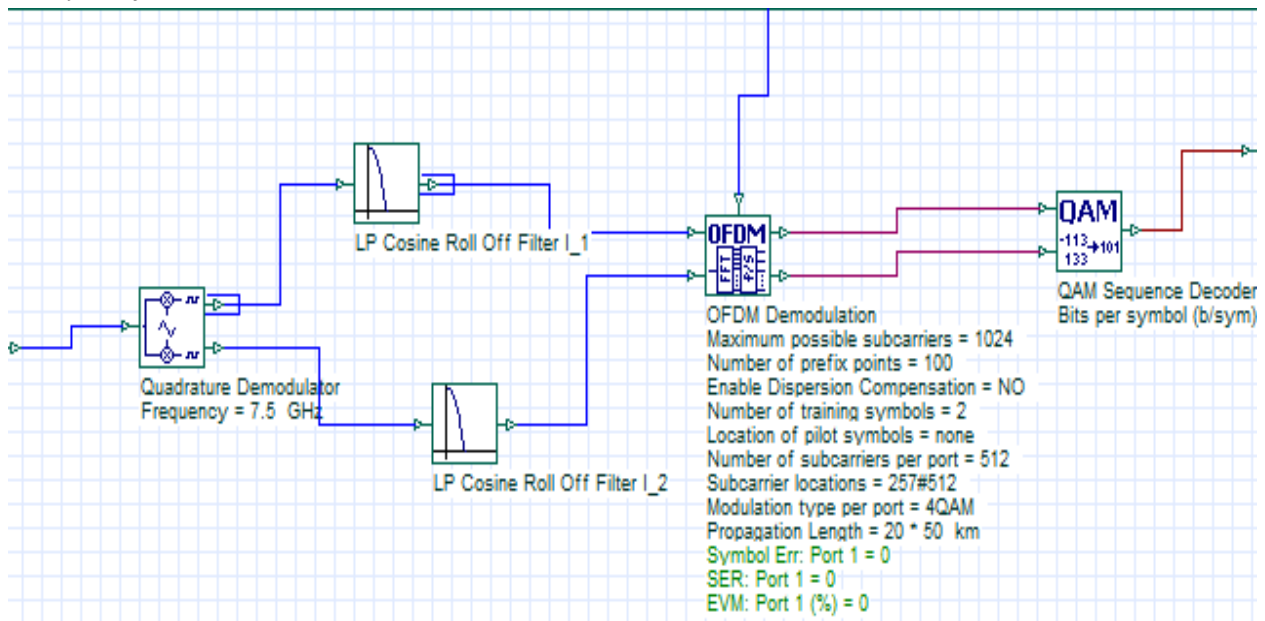


Fig. 5 Proposed simulation setup for the receiver part (4 and 16 QAM-OFDM)

RESULTS AND DISCUSSIONS

In this section, the simulation results of 15 Gbps data rate of RoF system have been conducted for the OFDM technique and then QAM modulation technique is used on RoF system. However, in this simulation, QAM signal which uses (4, 16) bits per symbol is used. The number of bits in each symbol is (2, 4) and the constellation result is given by formula 2^n . However, this study assumes that all simulation parameters setting for the proposed system are available and fully known as shown in Table 1, while the rest will be assigned to the default value of the Optisystem software.

Figure 4 shows the results for the radio frequency (RF) spectrum and optical spectrum modulation of broadcast and received signals for the RoF-OFDM system of 4 and 16 QAM-OFDM after 70 km with higher harmonics in the sideband of the spectrum.

In other words, these figures represent the results of both optical signals with amplification before and after filtering in the optical domain, based on an optical transmission link. Furthermore, the composite signal is modulated onto a frequency-modulated signal optical carrier. Furthermore, the composite signal is modulated on a signal optical carrier at a frequency of 193.1 THz. However, due to the poor quality OFDM spectrum produced by the baseband and transmission path, a spectrum improvement option via optical amplification is required.

A. CONSTELLATION VISUALIZER ANALYSIS (4, 16 QAM-OFDM)

The performance is impeded primarily by the system transmission channel, accumulated amplifier noise, and internal performance system components. After filtering, the RF carrier's optical spectrum modulation yields

single sideband signals. Furthermore, after filtering, the RF carrier's optical spectrum modulation creates signals with a single sideband.

The transmitted signal of optical spectrum analyzer of 4QAM-OFDM system is shown below with 193.1 frequency and transmitted length above 70 km is shown in the Fig. 6 depicts the RoF link constellation diagram for the, 4-QAM-OFDM and 16-QAM-OFDM after 70 km of fiber optic length, with data rate values for 15 Gbps. The RF-channels' bandwidth expands as the number of channels grows.

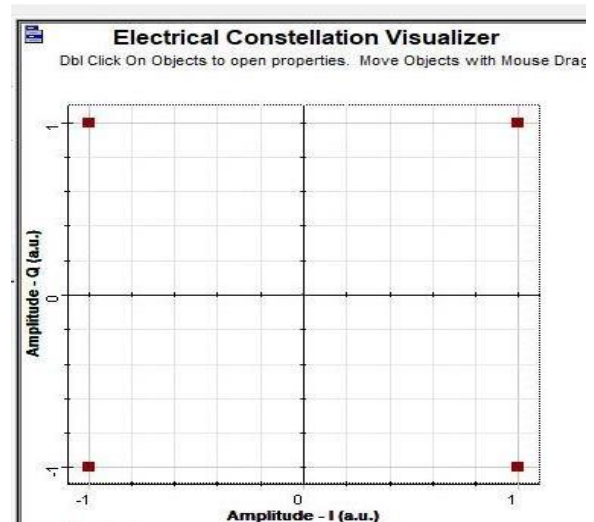


Fig. 6 Constellation diagram for 4QAM-OFDM

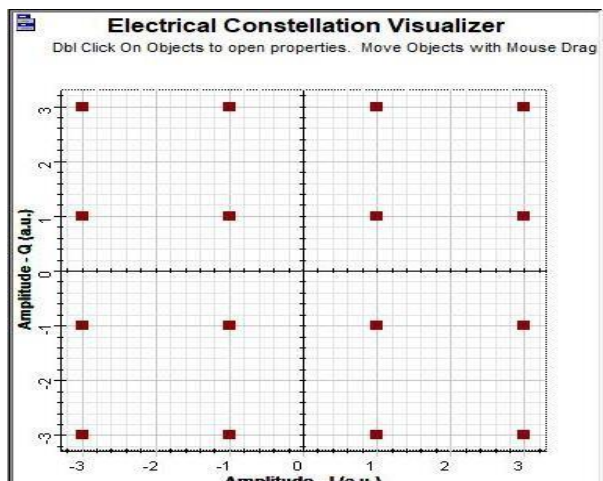


Fig.7 Constellation diagram for 16QAM-OFDM

B. EYE DIAGRAM (4,16QAM-OFDM)

In this paper, the architectures of a transmitter side with an actual signal are proposed for making the RF OFDM signal a complex intermediate frequency in order to suppress one of the problems. Furthermore, a photodiode is employed to detect and demodulate the optical signal at the receiver end. In addition, the RF frequency must be set in this job to remove the single-side band.

For the evaluation of the combined effects of channel noise, dispersion and inter symbol interference we have used eye diagram as the reference. Figure 8 and 9 shows the eye diagram of both 4QAM and 16 QAM respectively. As depicted 16 QAM performs better than 4 QAM

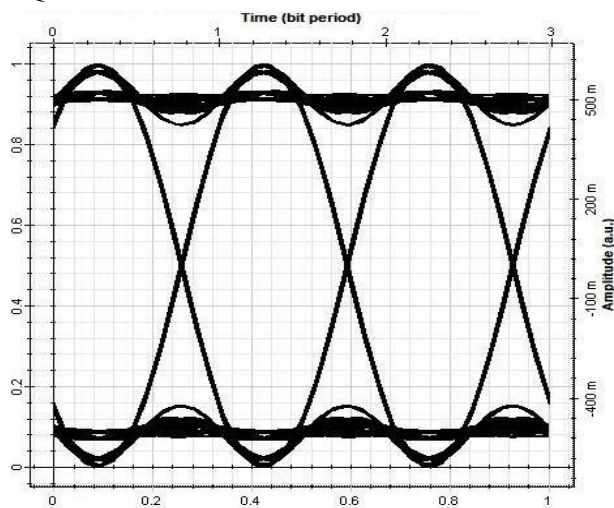


Fig 8 Eye Diagram for 4QAM

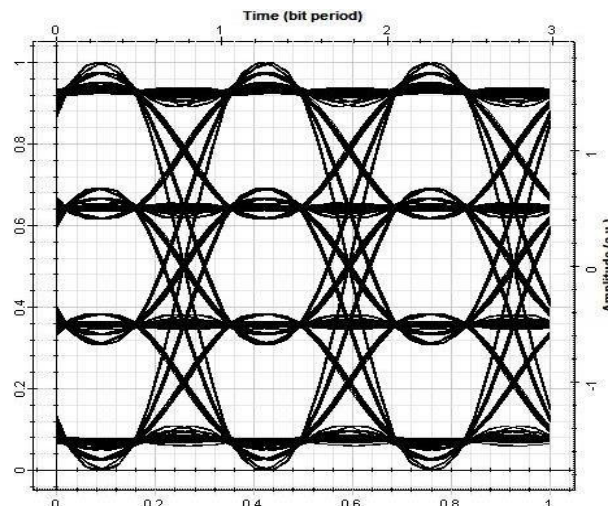


Fig 9 Eye Diagram for 16 QAM

C. Q-FACTOR ANALYSIS (4,16QAM-OFDM)

Fig.10 and 11 represents the 4QAM-RoF links data speed chosen is 15 GB/s for 4-QAM modulation scheme, the received signal quality factor (Q factor) vs. optical fiber length is plotted.

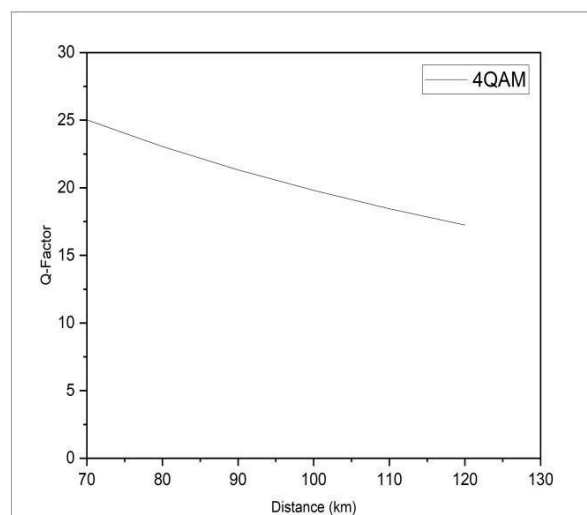


Fig 10 Q-Factor 4QAM

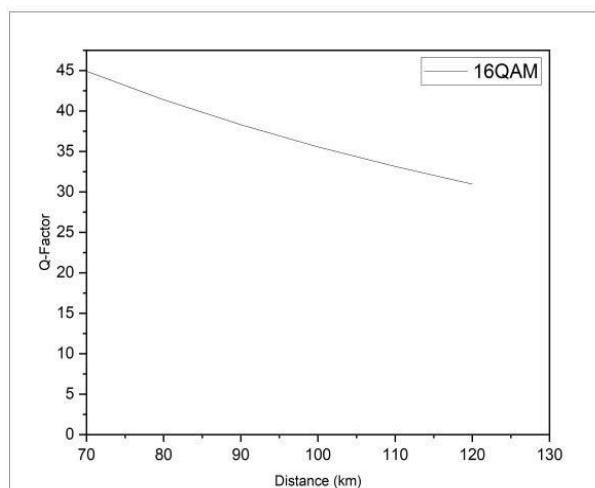


Fig 11 16QAM Q-Factor

D. BIT ERROR RATE ANALYSIS (4,16QAM-OFDM)

OFDM is distinguished by its high peak-to-average power ratio (PAPR), which renders it extremely susceptible to nonlinear distortions that can degrade channel estimate accuracy, resulting in BER loss. This article compares the BER performance of 4QAM/OFDM with different scenarios of noise addition utilising the OptiSystem OSNR block. We calculate the BER by manually adding noise to the signal, measuring the mistakes at the receiver end, and then calculating the BER. The number of bit errors per unit time is known as the bit error rate (BER). The bit error ratio (also known as BER) is calculated by dividing the number of bit errors by the total number of transferred bits over a given time interval. The BER of a signal modulated using 4QAM and 16QAM is shown in Figures 12 and 13. As can be seen, SNR 16 QAM performs better for higher SNRs, however SNR 4 QAM shows no signal beyond 10dB of SNR.

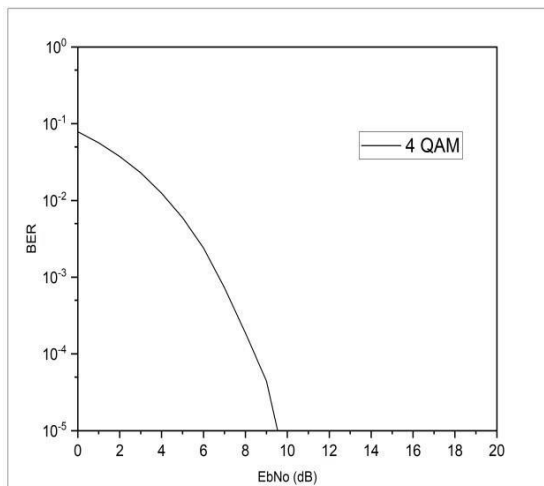


Fig 12 BER of 4QAM

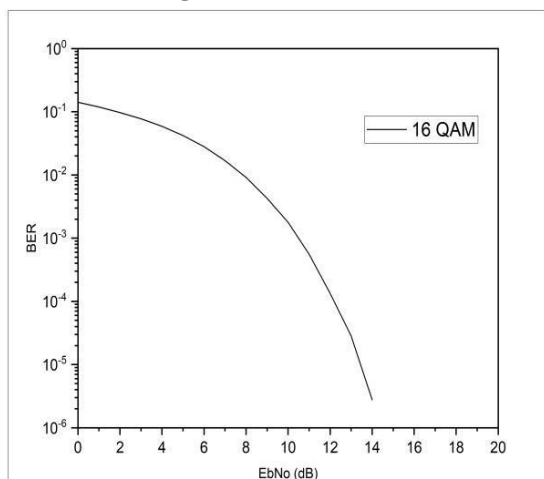


Fig 13 BER of 16QAM

E. COMPARISON

In this paper we have used two modulation schemes i.e.: 4QAM-OFDM and 16QAM-OFDM where we have observed that 16QAM-OFDM outputs are much better

than 4QAM-OFDM because of various factors that include Q factor, Constellation diagrams, BER factor and Eye diagrams. In this paper we have compared both the schemes with transmission length more than 70km and for more SNR 16QAM-OFDM gives better results than 4QAM-OFDM as depicted in graph we can see that after 10 dB SNR, 4QAM-OFDM does not give any output results

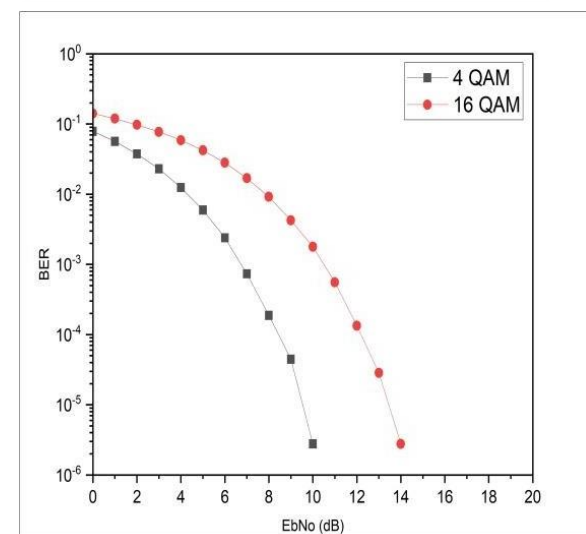
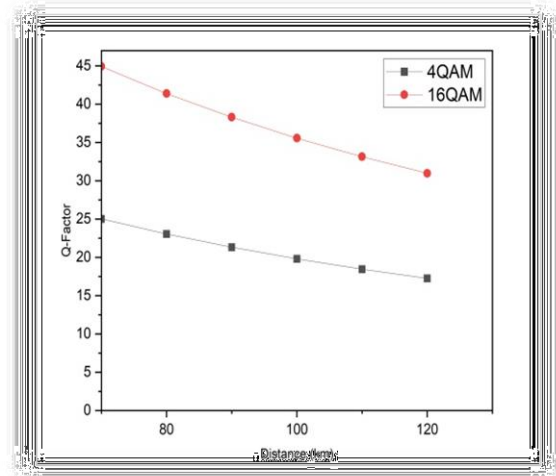


Fig 14, 15 Comparison based on Q- factor and BER factor

CONCLUSIONS

When combined with the RoF system, OFDM can be employed in optical access networks, resulting in a system with extremely high communication efficiency and effective bandwidth use. In comparison to existing communication standards, the OFDM-ROF system has a higher efficiency. To put it another way, by combining OFDM and RoF, a powerful communication standard can be built that effectively utilizes the optical fiber's benefits. The performance of the system is improved in this study by combining the properties of WDM and SCM techniques to achieve high data rates using RF channels carried via optical channels using three modulation schemes: 4-QAM, 16-QAM, and OFDM.

According to the simulation results, the 16-QAM-OFDM system has the maximum value. By merging OFDM with the RoF system in optical access networks, a system with extremely high efficiency communication that effectively utilizes bandwidth can be created. As a result, when compared to previous systems, the OFDM-ROF system is more efficient. As a result, we may infer that the 16-QAM-OFDM system provides acceptable performance by 44.4% than that of 4QAM-OFDM while reducing the complexity of systems that employ sophisticated modulation methods. When the data rate is increased, however, the analyzer's output waveforms, the optical spectrum and the RF spectrum, begin to broaden, lowering the quality. Similarly, there appears to be an increase in constellation points in the constellation output.

REFERENCES

- [1] Shao, Y., Chi, N., Fan, J., & Fang, W. (2012). Generation of 16-QAM-OFDM signals using selected mapping method and its application in optical millimeter-wave access system. *IEEE Photonics Technology Letters*, 24(15), 1301-1303.
- [2] Shao, Y., Chi, N., Fan, J., & Fang, W. (2012). Generation of 16-QAM-OFDM signals using selected mapping method and its application in optical millimeter-wave access system. *IEEE Photonics Technology Letters*, 24(15), 1301-1303.
- [3] Kosari, A., Moosavifar, M., & Wentzloff, D. D. (2018, November). A 152 μ W– 99dBm BPSK/16-QAM OFDM Receiver for LPWAN Applications. In 2018 IEEE Asian Solid-State Circuits Conference (A-SSCC) (pp. 303-306). IEEE.
- [4] Yeh, C. H., Chow, C. W., & Chen, H. Y. (2012). Simple colorless WDM-PON with Rayleigh backscattering noise circumvention Employing M -QAM OFDM downstream and remodulated OOK upstream signals. *Journal of lightwave technology*, 30(13), 2151-2155.
- [5] Tsai, C. T., Peng, C. Y., Wu, C. Y., Leong, S. F., Kao, H. Y., Wang, H. Y., ... & Lin, G. R. (2017). Multi-mode VCSEL chip with high-indium-density InGaAs/AlGaAs quantum-well pairs for QAM-OFDM in multi-mode fiber. *IEEE Journal of Quantum Electronics*, 53(4), 1-8.
- [6] Retamal, J. R. D., Oubei, H. M., Janjua, B., Chi, Y. C., Wang, H. Y., Tsai, C. T., ... & Ooi, B. S. (2015). 4-Gbit/s visible light communication link based on 16-QAM OFDM transmission over remote phosphor-film converted white light by using blue laser diode. *Optics express*, 23(26), 33656-33666.
- [7] Liu, X., Chandrasekhar, S., Chen, X., Winzer, P. J., Pan, Y., Taunay, T. F., ... & Dimarcello, F. V. (2011). 1.12-Tb/s 32-QAM-OFDM superchannel with 8.6-b/s/Hz intrachannel spectral efficiency and space-division multiplexed transmission with 60-b/s/Hz aggregate spectral efficiency. *Optics express*, 19(26), B958-B964.
- [8] Chow, C. W., Yeh, C. H., Wang, C. H., Shih, F. Y., Pan, C. L., & Chi, S. (2008). WDM extended reach passive optical networks using OFDM-QAM. *Optics Express*, 16(16), 12096-12101.
- [9] Sha, Y., Gao, M., Liu, M., Zhang, C., Chen, W., & Yan, Y. (2021). IM/DD probabilistically shaped 64-QAM OFDM-PON transmission assisted by selective-mapping and flexible systematic polar code. *Optics Communications*, 490, 126912.
- [10] Sun, X., Zhang, Z., Chaaban, A., Ng, T. K., Shen, C., Chen, R., ... & Ooi, B. S. (2017). 71-Mbit/s ultraviolet-B LED communication link based on 8-QAM-OFDM modulation. *Optics express*, 25(19), 23267-23274.
- [11] Wu, K., He, J., Zhou, Z., & Shi, J. (2019). Probabilistic amplitude shaping for a 64-QAM OFDM W-band RoF system. *IEEE Photonics Technology Letters*, 31(13), 1076-1079.
- [12] Riche, L., Sujae, K., & George, R. (2012, March). The performance of high order modulation QAM-OFDM in the presence multipath fading channels. In 2012 Proceedings of IEEE Southeastcon (pp. 1-3). IEEE.
- [13] Ghosh, A., Majumder, B., Paul, P., Mullick, P., Thakurta, I. G., & Ghosh, S. K. (2012). Comparative BER performance of M-ary QAM-OFDM system in AWGN & multipath fading channel. *International Journal on Computer Science and Engineering*, 4(6), 1185.

Early Stage Brain Tumor Detection Using Image Segmentation & Machine Learning Techniques

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Abstract:

Detection of brain tumor depends on the s knowledge and experience of the physician. An automated tumor classification would support radiologists and physicians to identify brain tumors. In this paper, we propose machine learning techniques to detect brain tumor at an early stage. The accuracy of our system is 99.6%.

Index Terms:

Brain tumor, MRI scan, Image segmentation, machine learning, CNN algorithm.

INTRODUCTION

Brain tumor is an unnatural growth of cells in brain and can be classified into malignant and benign. Malignant tumors are the ones which cause cancer and non-malignant or the benign tumors are the ones which don't cause cancer. Tumor is a major cause of death in the world and usually is very less detected at the initial stages. It is important to detect tumor in the earlier stages so that it can be treated properly. Tumor is not easy to locate and can be a strenuous task. Common symptoms of tumor includes headaches, continuous vomiting, nauseated feelings and having problems while maintaining balance to walk and stand. In this paper we focus on extracting the tumor from the brain images using segmentation and then classifying the image using convolution neural networks. We in this project try to create a better solution for the doctors to better locate the tumor and make it easier for the doctor to analyze and work on it and save lives in a better way. Usually MRI scans and CT are used for scanning the images but it is preferred to use MRI because it is safer compared to CT scans as CT scans uses radiations whereas MRI uses magnetic resonance. Also CT scans cannot be performed a number of times but MRI scans can be used. Here in this paper we use MRI scans.

1.1 TYPES OF BRAIN TUMORS

Brain tumors are of two types:

- 1) Primary brain tumor
- 2) Secondary brain tumor.

Primary brain tumor arises from glial cells and is described as either high grade or low grade. Low grade tumor grows slowly, whereas growth of high grade tumor is faster. Depending on the location and size, tumors can be classified as grade I, grade II and grade III. In most of the people with primary brain tumors, the cause of the tumor isn't clear. But doctors have identified some factors that may increase the risk of a brain tumor that include exposure to radiation and family history of

brain tumors. The Symptoms, prognosis and treatment of a malignant tumor depend on the person's age, the exact type of tumor, and the location of the tumor within the brain. Detection at an early stage would increase the chances of patients survival. Previously many techniques were applied to detect the brain tumor at an early stage but were less accurate. In our work we are making use of automatic segmentation and CNN to make it more accurate[1-6].

PROPOSED METHOD

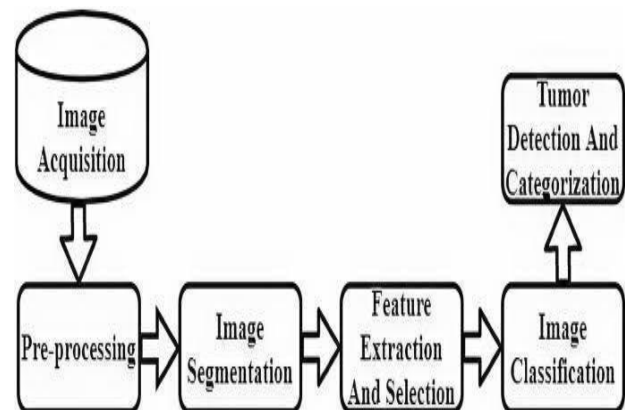


Fig1: Block diagram of the proposed method

The block diagram of the proposed method is as shown in Fig 1. Acquired image is converted to gray scale image which becomes easier for computing other parameters. The image is then preprocessed where the noise removal is done for providing clarity to the images. This is then filtered using Gaussian filter. The filtered image is adjusted with the required contrast and is segmented. Segmentation using morphological operations make the image for classification. This also provides good amount of security of the segmented brain image. It is later classified using convolutional neural networks with trained database. Classification of tumor using CNN provides the accuracy of the presence of tumor and also the probability of the image being tumor or normal.

RESULTS AND DISCUSSIONS

We have used the Matlab tool with 2017a version to perform segmentation and classification of the MRI brain images. The tumor is segmented using basic morphological operations

and classified using Convolution Neural Networks. The below is the fine classification result which tells whether there is a tumor present or not. The figures below shows

the result of conversion of input image to the segmentation image step by step.

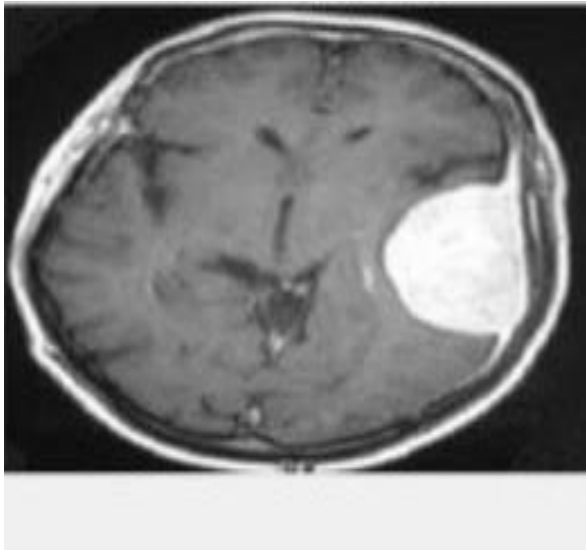


Fig 2 : Input image

Fig 2 shows the input image of MRI which contains Brain tumor.

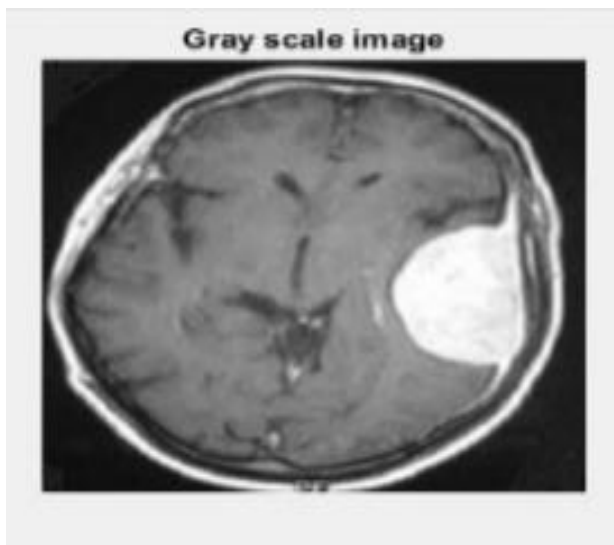


Fig 3: Gray scale image

The image is cropped vertically as well as horizontally. Intensity enhancement of the cropped image is done using histogram equalization. Global thresholding is then applied to convert the cropped histogram image to a binary image.

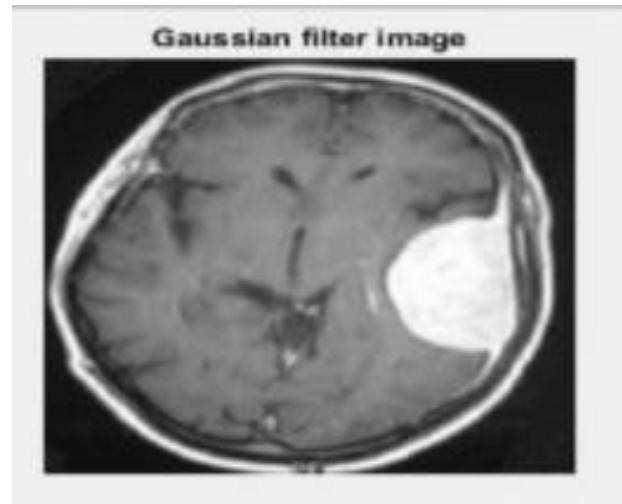


Fig 4 : Gaussian filter image

Gaussian filter is then used to reduce noise and blurring regions of an image. The filter is implemented as an Odd sized Symmetric Kernel (DIP version of a Matrix) which is passed through each pixel of the Region of Interest to get the desired effect as shown in Fig 4.

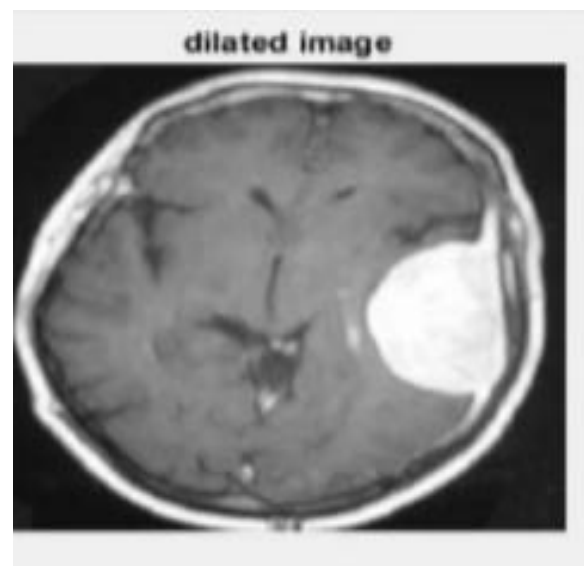


Fig 5 : Dilated image

Pixels are added to the boundaries of an image by dilation. Fig 5 shows the dilated image. Erosion is done to remove pixels on object boundaries. The number of pixels added or removed from the objects in an image depends on the size and shape of the structuring element. Fig 6 shows the eroded image.

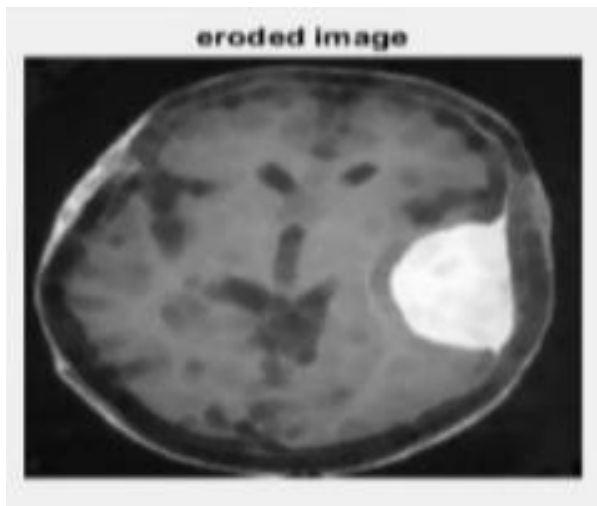


Fig 6: Eroded image

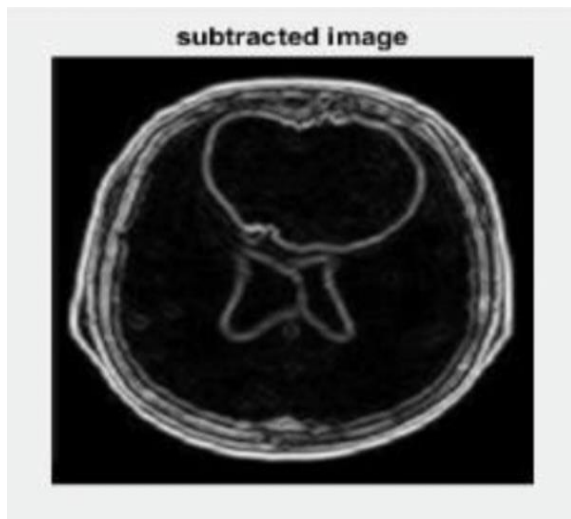


Fig 7: Subtracted image

Image subtraction or pixel subtraction is done to level uneven sections of the image. Fig 7 shows subtracted image.



Fig 8: Inverse subtracted image

Invert reverses the colors present on an image or portion of an image as shown in Fig 8.

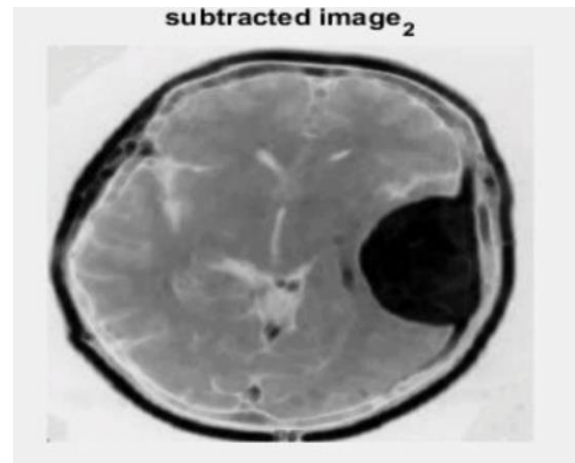


Fig 9: Subtracted image 2

The negative of an image is achieved by replacing the intensity 'i' in the original image by ' $i - 1$ ', i.e. the darkest pixels will become the brightest and the brightest pixels will become the darkest. Image negative is produced by subtracting each pixel from the maximum intensity value as shown in Fig 9.

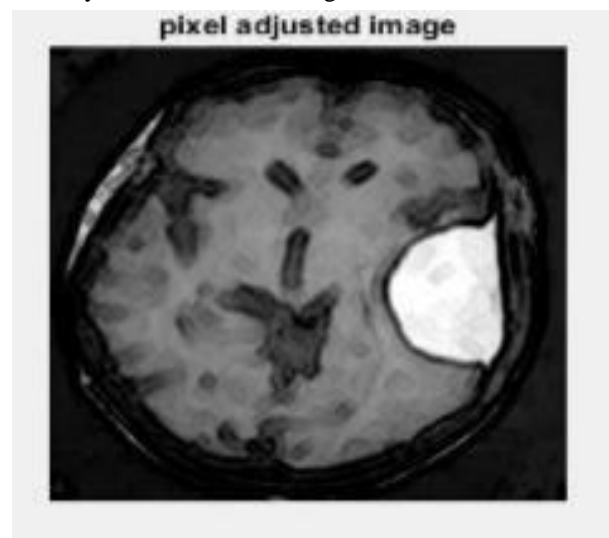


Fig 10: Pixel adjusted image

Images are stored digitally as an **array of pixels**. Every pixel has a color and the way colors are defined is called the **color space**. The most used color space is the **RGB color space**. In this model, every color is defined by three values, one for **red**, one for **green**, and one for **blue**. Usually, these values are 8-bit unsigned integers (a range of 0–255), this is called the **color depth**. The color (0, 0, 0) is **black**, (0, 255, 0) is **green**, (127, 0, 127) is **purple** as shown in Fig 10.

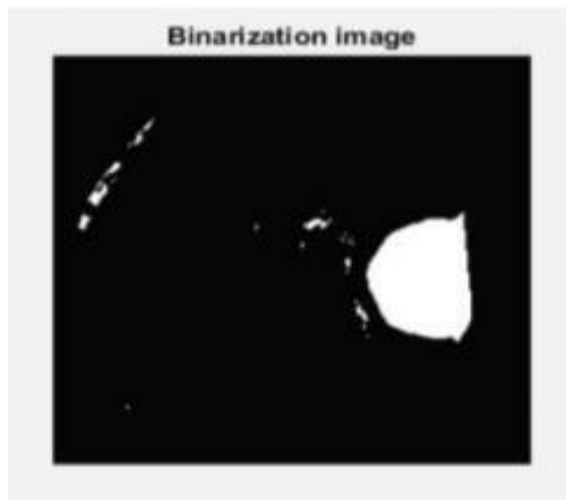


Fig 11: Binarization image

Global binarization is applied to the whole image choosing the threshold depending on the neighbourhood pixels. Fig 11 shows global binarized image.

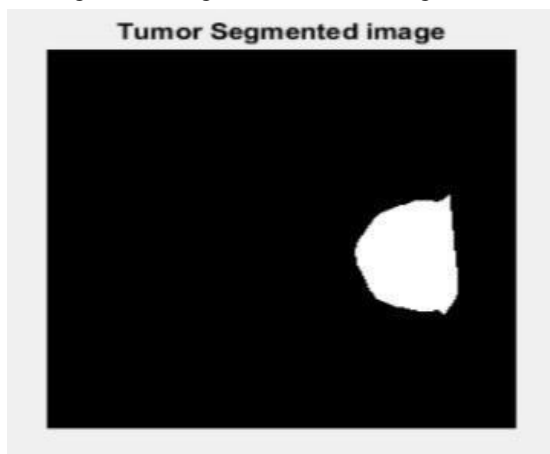


Fig 12: Tumor segmented image

Fig 12 shows tumor segmented image from normal brain tissues. Threshold based segmentation is applied.

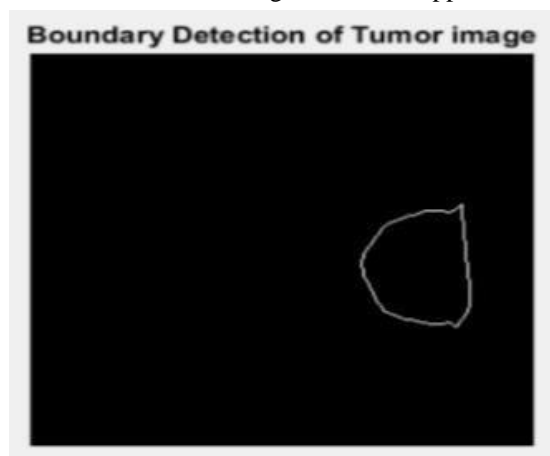


Fig 13: Boundary detection of tumor image

A radial search technique is applied to detect the borders of the tumor. Initially 2 rounds of radial search is done and a second round search which is knowledge based is applied. Then a rescan with a new center is used to solve

the blind-spot problem. The algorithm is tested on model images with excellent performance as shown in Fig 13. The morphological operations discussed here are used intensively in the various stages of this project. The common morphological operations include dilation, erosion, thinning, edge extraction, opening and closing.

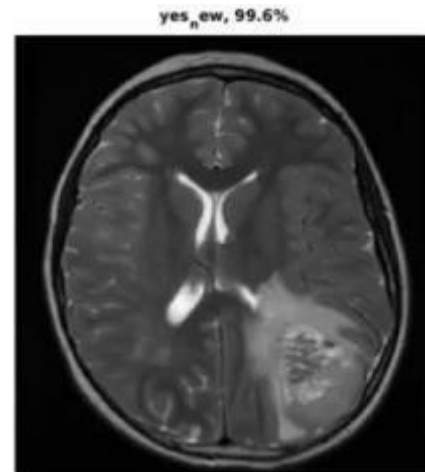


Fig 14: Accuracy of the image

The results of this study showed that: the overall accuracy of classification process was 99.6%, and for the tumor; the sensitivity was 99.3% at 30 iteration. White matter and grey matter showed a classification accuracy of 99.7% and 99.4% and for CSF the accuracy was 98.9%.

COMPARISON

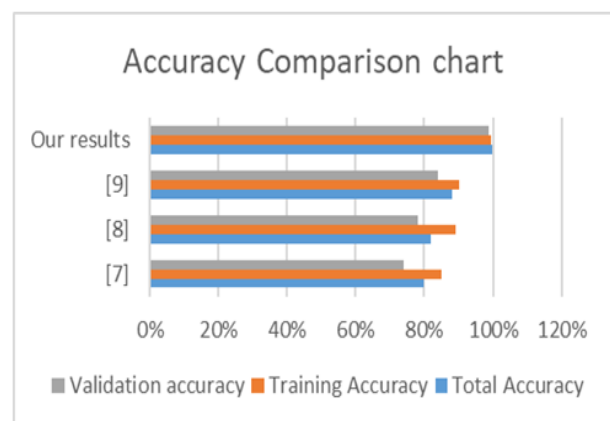


Fig 15: Comparison of our work with previous work done

CONCLUSION

The input color image is converted into a gray scale image and many image processing techniques like filtration, segmentation is applied on the image. After removing the noise and performing morphological operations like erosion and dilation the segmented tumor output is achieved which helps in accurately detecting and analyzing the tumor. The segmented output is then classified using convolution Neural Networks which helps in accurately detecting when there is a tumor or not with many data sets.

FUTURE SCOPE

The algorithm used here can accurately detect the presence of tumor. This is accurate only for the segmentation and for classifying the presence of tumor or normal. But the improved version of this method can be found where it is able to detect whether the tumor is benign or malignant. And also, detection of stages of tumor can be found by improvising the further techniques.

BIBLIOGRAPHY

- [1] Narmada M. Balasooriya and Ruwan D. Nawarathna, "A Sophisticated Convolutional Neural Network Model for Brain Tumor Classification", 2017 ICIIS conference.
- [2] K. D. Kharat, V. J. Pawar, and S. R. Pardeshi, "Feature extraction and selection from mri images for the brain tumor classification," in 2016 International Conference on Communication and Electronics Systems.
- [3] N. N. Gopal and M. Karnan, "Diagnose brain tumor through MRI using image processing clustering algorithms such as Fuzzy C Means along with intelligent optimization techniques," 2010 IEEE International Conference on Computational Intelligence and Computing Research, 2010.
- [4] J. selvakumar, A. Lakshmi and T. Arivoli, "Brain Tumor Segmentation and Its Area Calculation in Brain MR Images using K-Mean Clustering and Fuzzy C-Mean Algorithm" 2012 IEEE-International Conference
- [5] Rajesh C. Patil, Dr. A. S. Bhalchandra, "Brain Tumor Extraction from MRI Images Using MATLAB" International Journal of Electronics, Communication & Soft Computing Science and Engineering, April 2012.
- [6] R. Ahmmed, A. S. Swakshar, M. F. Hossain, and M. A. Rafiq, "Classification of tumors and its stages in brain mri using support vector machine and artificial neural network," in 2017 International Conference on Electrical, Computer and Communication Engineering (ECCE),.
- [7] P Gokila Brindha "Brain Tumor Detection From MRI Images Using Deep Learning Techniques" 2021.
- [8] Mohamed Nador "Detection and Localization of Early Stage Multiple Brain Tumor Using a hybrid Techniques of Patch Based Processing k-mean Clustering and Object Counting " 2020.
- [9] G Hemanth, M Janrdhan, L Sujihelen "Design and implementing Brain Tumor

Sugarcane Disease Classification

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Abstract:

Agriculture is critical to the Indian economy because it employs about half of India's workers and accounts for 17% of the country's GDP. Since 1947, India's crop yield and production have increased dramatically. Despite this, crops worth over 50,000 crore are destroyed each year due to pest and disease attacks. Pests and diseases are responsible for roughly 40% of agricultural production worldwide, according to the United Nations Food and Agriculture Organization. Each year, this costs the global economy more than \$220 billion. Sugarcane is one of the most important cash crops farmed by Indian farmers. In India, epidemics of red rot and red rust have been widespread among sugarcane farmers. With the advancement of technology and artificial intelligence, there are a variety of approaches that might be used to address the problem. Our research goes through how to detect Red Rot and Red Rust diseases in sugarcane leaves using DenseNet201, a transfer learning model, and Support Vector Machine in the output layer.

Keywords:

DenseNet201, Disease Detection, Sugarcane Crop, SVM, Transfer Learning

INTRODUCTION

In today's complex environment, plant disease detection is the cornerstone for effective and precise plant disease prevention. On the other hand, determining the health of a field crop requires a high level of expertise [1]. Depending on the plant species or even variety, a disease might present in a variety of ways.

Three factors influence the onset of disease -

- Disease-susceptible host plants
- Favorable temperature or environment setting
- Viable Pathogens

A plant disease is classified as a physiological anomaly since it must have all three qualities in order to appear.

When a plant becomes afflicted with a disease, it displays specific symptoms. These symptoms are the overt changes in one's physical appearance that can be seen with the naked eye over time. Wilting, spotting, drying, rotting, cankers, and other disease symptoms are all visible [3].

A single symptom can be caused by a number of different problems, and these problems can coexist on the same plant. Nutritional deficiencies and pests can sometimes mimic the symptoms of certain diseases.

Disease detection takes time, and huge farms can't afford to monitor the state of each plant several times throughout the season. The difficulty of sourcing specific crops can make prospecting more challenging. The automatic detection of diseases by photographs, using automatic prospection or expert help tools, has the

potential to solve all of these problems. As smart farming has evolved, plant disease identification has become digitised and data-driven, enabling for advanced decision support, smart analytics, and planning. It enables farmers to carry out effective measures at the right time and in the right place to avoid unhealthy plants from reducing yield further [4]. However, determining the health of a plant from an image is difficult. Crops are, indeed, complex and diverse environments. Seasonally, leaves, flowers, and fruits alter, showing that they are always changing. When analysing images taken in the field, other obstacles occur, such as the ability to interpret complex components like foliage or non-uniform backdrops [5].

A method for classifying illnesses of an infected sugarcane leaf is discussed in this research. It is divided into three categories: Red Rot, Red Rust, and Healthy. It uses the DenseNet201 Transfer Learning model, which has been combined with SVM to improve accuracy.

LITERATURE REVIEW

The authors of this work used a metric-based method to tackle the problem of data scarcity using a few-shot learning technique called SSM-Net. They were able to extract the features in the network's very first layers using this method. The proposed SSM-Net model combines two metric-based techniques – Siamese Network and Matching Network – and takes advantage of the characteristics collected by Transfer Learning – VGG16 Net. On a sugarcane dataset with 700 photos divided into 11 classes, the approach had a 94.3 percent accuracy [6].

To detect and categorise diseases in sugarcane crops, this research investigates three CNN architectures: StridedNet, LeNet, and VGGNet. A total of 14,725 pictures of healthy and diseased sugarcane leaves were utilised to train the models stated. The VGGNet model had the highest accuracy of 95.40 percent, followed by LeNet with a score of 93.65 percent and StridedNet with a score of 90.10 percent [7].

The authors of this study discuss a method for determining the severity of a disease found on sugarcane leaves. The goal of this method is to provide insight into better plant disease management. It uses the Support Vector Machine to extract texture features using the Gray Level Co-Occurrence Matrix and colour features using the L*a*b colour space. The proposed model may detect diseases such as Ring, Yellow Spot, and Rust. SVM's Linear Kernel is capable of achieving an accuracy of 80% [8].

A Support Vector Machine Classifier with colour and texture extraction is used in this study to identify Rust

illness in Sugarcane disease. The linear kernel achieves 97.5 percent accuracy, 93.5 percent accuracy for polynomial and quadratic kernels, and 84.5 percent accuracy for the Gaussian RBF kernel [9].

A Back-propagation (BP) Neural Network is proposed for disease spot classification of sugarcane crops, which can distinguish between the diseased spot of red rot and the ring spot present on the sugarcane leaf. It has a 94 percent accuracy rating, which is higher than the 91 percent accuracy rating of the Fuzzy K-NN classifier [10].

METHODOLOGY

Using Convolutional Neural Networks, the research provides a method for detecting the Red Rot and Red Rust variants of Sugarcane crop diseases. The technique that was employed in the project is given in Fig 1. A more extensive description of this flowchart may be found in our publication.

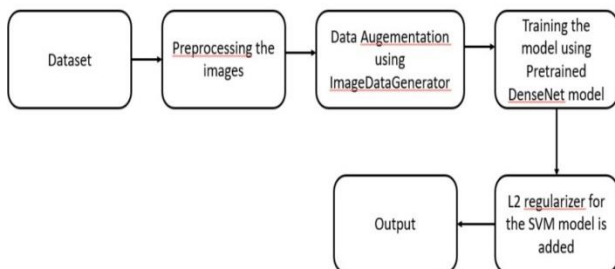


Fig 1. Flowchart for the Methodology

A. Dataset

The data for this model was gathered by touring sugarcane crop farms near Pune's Loni Kalbhori district. The data was then sorted and cleaned, with duplicate photos removed, before being saved in labelled directories. It features a total of 224 photographs and is divided into three classes: Healthy, Red Rot, and Red Rust, each with 75, 74, and 75 images of leaves.

The photos in Figure 2 were chosen at random from the dataset and represent both healthy and sick Sugarcane leaves.

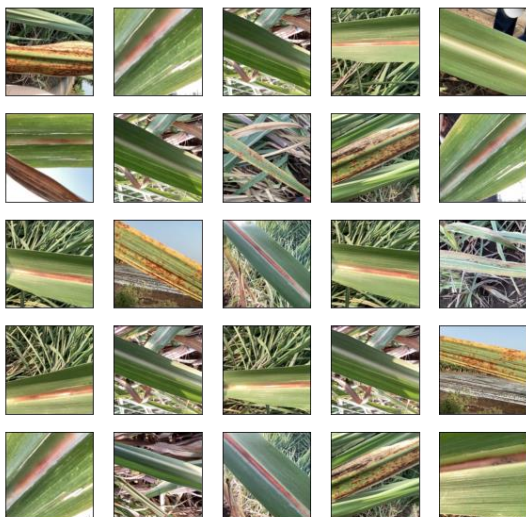


Fig 2. Healthy and diseased leaves in the dataset

B. Data Preprocessing

Before utilising the dataset to train the model, pre-processing procedures were done to it. The photos in the dataset were downsized to a 224x224 pixel input size, translated to NumPy, and image sharpening was applied. The sharpen kernel is initialised with a 3x3 matrix for the image sharpening operation. Following that, a function is created to iteratively employ the kernels. The image is first transformed to Y'UV channel, on which the sharpen kernel is applied, to remove the distortions caused by the original RGB channels. Finally, the image is transformed back to RGB. The sharpening approach is used to boost the image's contrast and aid the model's identification of features. The sharpen kernel is only applied once to each image in the dataset in the proposed model. Figure 3 depicts the effects of resizing an image in the dataset, as well as the effects of image sharpening.

C. Data Augmentation

A lot of data is usually needed to implement a Convolutional Network Model. However, data(image) augmentation was utilised due to the lack of an existing open-access dataset for Sugarcane crops and the modest quantity of the obtained dataset. The ImageDataGenerator from the Keras Library was utilised to do this. Rotations, shifting, zooming, shearing, and flipping were all defined.

D. Model Architecture

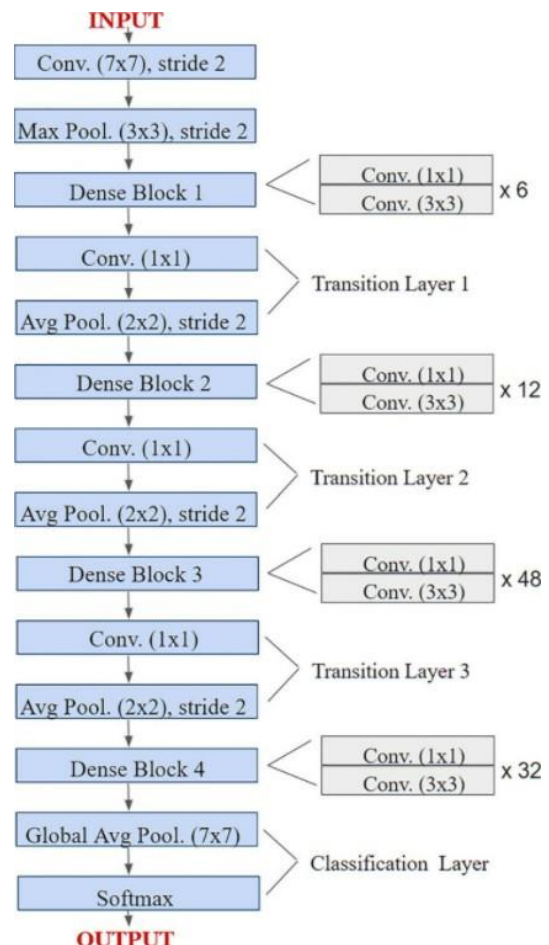


Fig 3. The architecture of ResNet

E. Training & Testing the Model

The dataset was split in half using the Scikit-Learn Library's train test split() method in a ratio of 0.2. Transfer Learning is used to train the model proposed in the research. The model for classifying sugarcane crop illnesses was trained using DenseNet201, one of the most prominent CNN Architectures with 201 layers. The weights have been loaded and the base layers have been frozen for DenseNet201, which has been pre-trained on ImageNet. After that, a sequential model with new trainable layers was used.

Support Vector Machine (SVM) was used in the last layer of the model utilising the L2 Regularizer and the loss function – squared hinge to increase the model's accuracy. After that, the model was trained over 10 epochs using the Adam optimizer. The accuracy was 98 percent, and the validation accuracy was up to 97.78 percent.

RESULT AND DISCUSSION

Figure 4 is a bar graph which represents the distribution of the dataset. It features a total of 224 photographs and is divided into three classes: Healthy, Red Rot, and Red Rust, each with 75, 74, and 75 images of leaves.

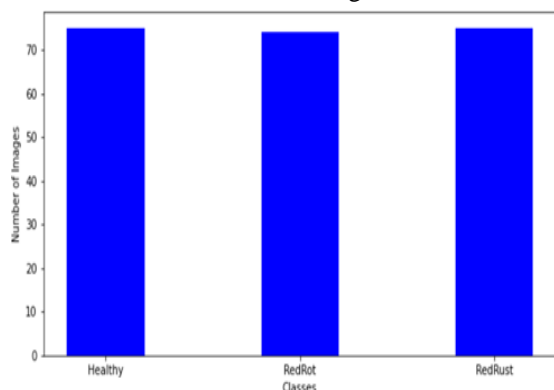


Fig 4. Data visualization

The graph between Accuracy on the Y Axis and Epoch on the X Axis is presented in Figure 4. As can be seen, as the epoch progresses, the accuracy improves. The training accuracy is shown in blue, while the validation accuracy is shown in orange. We infer that there is no overfitting because the two plots are so near to each other.

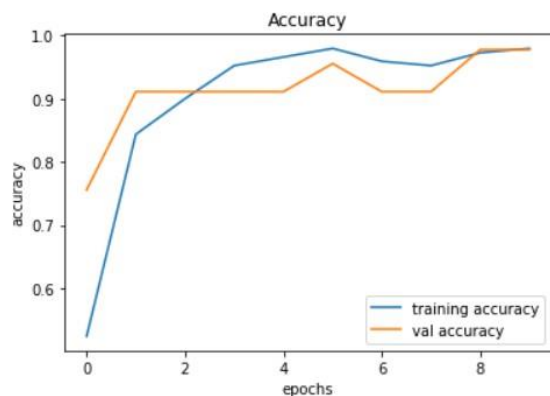


Fig 5. Accuracy Vs Epochs Curve

The graph of the Loss Vs Epoch curve is displayed in Figure 6. Loss decreases as the epoch rises. The training loss is shown in blue, while the validation loss is shown in orange. There is no overfitting in the model because the training and validation losses are near to each other, with the validation curve slightly bigger than the training curve.

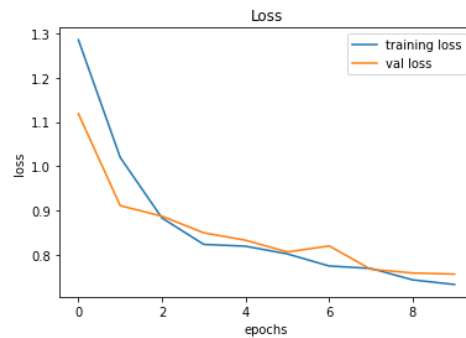


Fig 6. Loss vs Epoch Curve

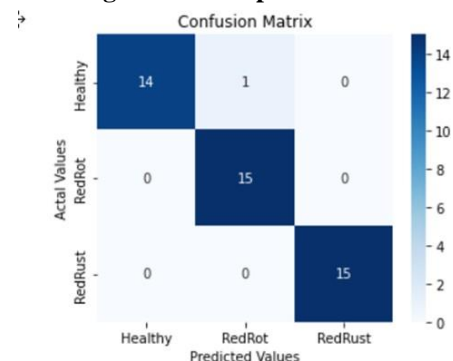


Fig 7. Confusion Matrix

[INFO] evaluating network...

	precision	recall	f1-score	support
0	1.00	0.93	0.97	15
1	0.94	1.00	0.97	15
2	1.00	1.00	1.00	15
accuracy			0.98	45
macro avg	0.98	0.98	0.98	45
weighted avg	0.98	0.98	0.98	45

Fig 8. Accuracy Scores

The model is evaluated on various classification metrics. The precision, recall, F1-score for the three class are shown in the figure

[[0.01192356 0.96799153 0.02008496]]



Fig 9. Red Rot

The figure 9 shows the correct prediction of Red Rot disease with an accuracy of 96.79 %.

```
> [[0.00116129 0.03361803 0.96522063]]
```

2

Disease detected: Red Rust

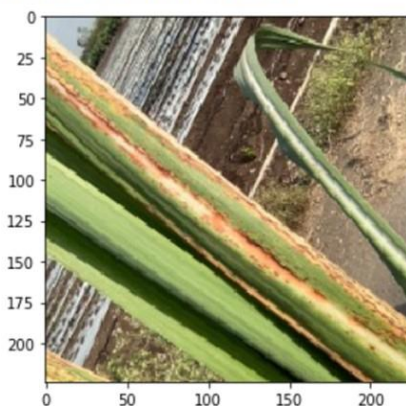


Fig 10. Red Rust

The figure 10 shows the correct prediction of Red Rust disease with an accuracy of 96.52 %.

```
> [[9.9922681e-01 7.7226263e-04 9.0016675e-07]]
```

0

It is a Healthy Leaf

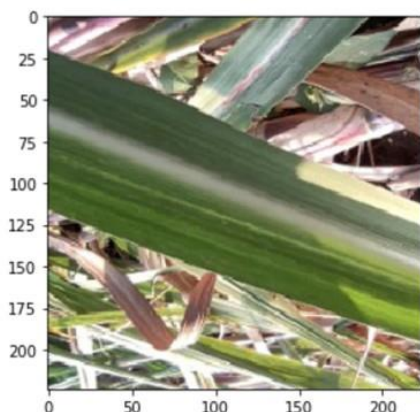


Fig 11. Healthy Leaf

The figure 11 shows the correct prediction of a Healthy leaf with an accuracy of 99.9 %.

FUTURE SCOPE

The project could be expanded to forecast other disease classes in other crops as well as sugarcane. More photos could be collected to guarantee that the model does not overfit. Feature extraction and image processing techniques could be investigated to improve illness identification and accuracy. On the website, treatments for the disorders could be suggested.

CONCLUSION

The paper looks at how to use a CNN-based deep learning model to detect two of the most frequent sugarcane diseases, Red Rot and Red Rust. The accuracy rating came in at 98 percent. The implementation of a model that employs the DenseNet201 Architecture with SVM integration to improve accuracy was covered in the study.

REFERENCES

- [1] K. P. Ferentinos, "Deep learning models for plant disease detection and diagnosis." *Computers and Electronics in Agriculture* 145 (2018): 311-318.
- [2] A. C.Velásquez, C.Castroverde, & S. Y. He, (2018), "Plant-Pathogen Warfare under Changing Climate Conditions.", *Current biology* : CB, 28(10), R619–R634.<https://doi.org/10.1016/j.cub.2018.03.054>
- [3] G. Prem R. Kranth, M. H. Lalitha, L. Basava and A. Mathur, "Plant Disease Prediction using Machine Learning Algorithms," 2018, *International Journal of Computer Applications*
- [4] Y. Guo, J. Zhang, C. Yin, X. Hu, Y. Zou, Z. Xue, and W. Wang, "Plant Disease Identification Based on Deep Learning Algorithm in Smart Farming", 2020 *Cognitive Modeling of Multimodal Data Intensive Systems for Applications in Nature and Society* (COMDICS) <https://doi.org/10.1155/2020/2479172>
- [5] J. Boulent, S. Foucher, J. Théau, and P.L. St-Charles, 2019. Convolutional neural networks for the automatic identification of plant diseases. *Frontiers in plant science*, 10, p.941.
- [6] S. Jadon, "SSM-Net for Plants Disease Identification in Low Data Regime," 2020 *IEEE / ITU International Conference on Artificial Intelligence for Good (AI4G)*, 2020, pp. 158-163, doi: 10.1109/AI4G50087.2020.9311073.
- [7] S. V. Militante and B. D. Gerardo, "Detecting Sugarcane Diseases through Adaptive Deep Learning Models of Convolutional Neural Network," 2019 *IEEE 6th International Conference on Engineering Technologies and Applied Sciences (ICETAS)*, 2019, pp. 1-5, doi: 10.1109/ICETAS48360.2019.9117332.
- [8] E. K. Ratnasari, M. Mentari, R. K. Dewi and R. V. Hari Ginardi, "Sugarcane leaf disease detection and severity estimation based on segmented spots image," *Proceedings of International Conference on Information, Communication Technology and System (ICTS) 2014*, 2014, pp. 93-98, doi: 10.1109/ICTS.2014.7010564.
- [9] R. K. Dewi and R. V. Hari Ginardi, "Feature extraction for identification of sugarcane rust disease," *Proceedings of International Conference on Information, Communication Technology and System (ICTS) 2014*, 2014, pp. 99-104, doi: 10.1109/ICTS.2014.7010565.
- [10] J. Zhao, X. Luo, M. Liu and M. Yao, "Application of BP Neural Network to Sugarcane Diseased Spots Classification," 2008 *Second International Symposium on Intelligent Information Technology Application*, 2008, pp. 422-425, doi: 10.1109/IITA.2008.447.

Design and Implementation of Wireless Black Box for Vehicle Tracking and Accident Alert System Using Arduino and GPS Module

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Abstract:

Since Road accidents are frequently occurring events, providing help for the injured person has to be the highest priority. When the vehicles reach the speed limit the message alert is sent by the GSM module. 24 hour & GPS tracking modules is enabled where the live locations with latitude and longitude marking are being updated through the Blynk app. Sending message alerts to the updated contacts for e.g. family members, ambulance and nearby police station in case of emergency. The threshold algorithm and speed system of motorcycles or cars are used to determine or accident in real time. The accelerometer detects the sudden change in the axis of the vehicle and the GSM module sends the alert messages on to the Mobile phone with location of the accident.

Keywords:

Road accidents, Blynk app..

INTRODUCTION

The motorcycle was involved in the majority of the accidents. This problem is still growing today as a result of poor riders' actions such as speeding, intoxicated driving, riding without a helmet, riding without enough sleep, and so on. The number of people who have died as a result of delayed help to those who have been involved in an accident. As a result, the research organization and major motorcycle manufacturers, such as Honda, have developed safety measures to safeguard riders from injuries caused by accidents. A good motorcycle safety equipment is difficult to implement and expensive to purchase. Only a tracking system can notice an accident. For unintentional monitoring, a black box with a MEMS accelerometer sensor and a GPS location tracking system is built in this research. GSM will send the approved mobile phone if the accident occurs at the same moment. The vehicle's location sends a short message to a family member via a GPS gadget. An accelerometer sensor, Arduino Uno microcontroller, GPS gadget, and GSM module for transmitting a short message make up the system. An accelerometer sensor is used to detect an accident in the X, Y, and Z directions. The motorcycle's speed and a threshold algorithm are utilized to determine whether a fall or accident occurs in real time. When a motorbike accident is detected, a mobile short message with the location from GPS (latitude, longitude) will be delivered. The sturdy box design is used to keep the product safe from water spray and dust in the environment. Under the motorcycle seat, this system is installed. The real-time readings from an accelerometer

sensor are processed and stored using a high-performance microcontroller. As a result, this gadget is comparable to a black box on an Aeroplane. The police and insurance examiners can collect accident history from the data-logger in this device utilizing a black box to investigate accident conditions. For one minute before and after an accident, the gadget records track and acceleration data. Furthermore, this gadget can be used to track a stolen motorcycle, but it will not be able to do it in real time. In this instance, the user can send an alphabet request instruction to the device, which will return the position along with some basic information.

RELATED WORK

[1] Manuel Fogue, Piedad Garrido, Francisco J Martinez, Juan-Carlos Cano, Carlos T Calafate, "Automatic Accident Detection: Assistance Through Communication Technologies & Vehicle" The symbiotic relationship between communication technology and automobiles provides a precious potential to improve aid to persons injured in traffic accidents by providing information about the incident and shortening emergency response times. More precisely determining the required human and material resources for each accident could result in a large reduction in the number of victims. This article describes a revolutionary system prototype that is specifically designed to identify traffic accidents and deliver speedier assistance, hence reducing the health risks to passengers. The proposed system calls for each vehicle to be equipped with an Onboard Unit (OBU) that detects and reports accidents to an external control unit (CU) that assesses the severity of the situation and allocates the required resources for the rescue mission.

[2]. Hoang Dat Pham, Micheal Drieberg, Chi Cuong Nguyen, "Development of vehicle tracking system using GPS and GSM modem" Car tracking is beneficial for a variety of purposes, including personal vehicle security, public transportation systems, fleet management, and more. Furthermore, the global number of automobiles on the road is predicted to significantly expand. As a result, the development of a car tracking system based on the Global Positioning System (GPS) and the Global System for Mobile Communications (GSM) modem is underway with the goal of allowing customers to easily and conveniently locate their vehicles. Users will be able to track vehicles remotely via the mobile network with the help of the technology. The hardware prototype for a vehicle tracking system is shown in this paper. The

system will use GPS to determine a vehicle's coordinates and transfer them to the user's phone via the mobile network using a GSM modem. The u-blox NEO-6Q GPS receiver module, u-blox LEON-G100 GSM module, and Arduino Uno microcontroller are the system's major hardware components.

[3]. Saddam, "Arduino based Vehicle Tracker using GPS and GSM" Fleet management and asset tracking programmes frequently employ vehicle tracking technologies. These systems can now not only track a vehicle's position, but also record its speed and even control it remotely. In general, vehicle tracking is a method in which we track the location of a vehicle using latitude and longitude coordinates (GPS coordinates). The value of a location is determined by its GPS coordinates. For outdoor applications, this method is quite effective. This type of vehicle monitoring system project is commonly used to track taxis, stolen automobiles, school/college buses, and other vehicles. In this project, we take GPS a step further by utilizing Arduino to create a GSM and GPS-based vehicle tracking system. By adding a few hardware and software adjustments, this Vehicle Tracking System can be used to track a vehicle using GPS and GSM, as well as an Accident Detection Alert System, Soldier Tracking System, and many more applications.

[4] N Watthanawisuth, T Lomas, A Tuantranont, "Wireless black box using MEMS accelerometer and GPS tracking for accidental monitoring of vehicles" For inadvertent monitoring, a wireless black box with a MEMS accelerometer and a GPS tracking system is designed in this study. An accelerometer, microcontroller unit, GPS gadget, and GSM module work together to form the system. In the case of an accident, this wireless device will send a short text message to a family member, EMS, and the nearest hospital, indicating the location of the vehicle through GPS. The real-time detection of a fall or accident is based on the threshold algorithm and the motorcycle's speed. The system is small and simple to install beneath the rider's seat. Bicycles were used to test the system in real-world scenarios. The results of the tests reveal that it can accurately recognise linear, non-linear, and normal rides.

SYSTEM REQUIREMENTS

Hardware

The hardware components used in our project is listed below.

1. Atmega 48 Microcontroller
2. Node MCU (ESP8266)
3. ADXL 335
4. GSM module
5. GPS module
6. 16 x 2 LCD Display
7. 18650 Li-ion Battery

Software

1. Arduino IDE tool
2. Blynk app

METHODOLOGY

In this project, we have used two microcontrollers ATmega-328 and Node MCU

Here, ATmega-328 is connected with the GSM module sim 800A using digital I/O pins 4 and 5 with

GSM module's Rxn and Txn respectively and using digital I/O pins 2 and 3 with GPS module 7m with Rxn and Txn respectively.

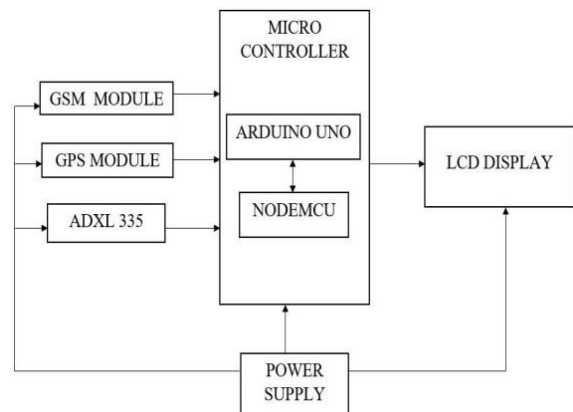


Fig 1: Block Diagram

And another microcontroller Node MCU which has been mainly used for cloud application is connected to microcontroller ATmega-328 which receives the data from GPS module and GSM module for the purpose of using it for the purpose of synching the data to the mobile application for the purpose of vehicle and its speed analysis.

Here, we are going to use ESP 8266 microcontroller of the family of Node MCU, its Digital pins D0 and D1 are connected with microcontroller ATmega- 328's Analog I/O pins A4 and A5 respectively.

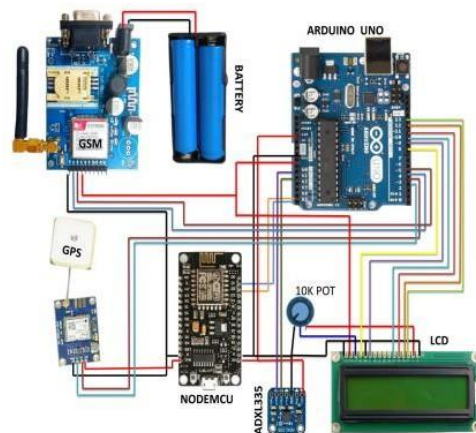


Fig 2: Circuit Diagram

ADXL 335 is a another sensor used in the project for sensing the axis of the vehicle. Its X-axis output is connected to A0 and its Y-axis output is connected to A1 of the microcontroller ATmega-328.

Finally, the 16x2 LCD display we have used for the purpose of readability of the prototype and a 10k potentiometer for adjusting the brightness of the LCD's digital I/O pins 4,6,11,12,13 and 14 are connected with microcontroller ATmega-328 through the digital I/O pins 8,9,10,11,12 and 13 respectively for the purpose of receiving the data from all other sensors and LCD's Pin-2 has been connected with 10k pot for purpose of adjusting limunesense.

At last, we have used 18650 li-ion batteries for power supply. This is directly connected to the GSM module which gives Vout of 9V, and and through GSM module we have powered ATmega-328 microcontroller and 16x2 LCD display, since this are capable of operating at Vin of 9V, we have powered Node MCU and ADLx335 using pin 3.3V of ATmega-328 microcontroller and GPS module from pin 3V od Node MCU. Since all this are of operating voltage at 3-5V.



Fig 3: Prototype of the Project.

CONCLUSION

The main goal of our project is to develop a system of black box that can be installed into any vehicle. The prototype provides information about the accident and the accident locality. It sends alert message to the pre-coded numbers; this message contains the Longitude and latitude of the accident site. Through this project we can rescue lives by providing necessary service when the hazard take place. The automated location and accident discovery provide security and safety to the vehicles. Providing security serving the highest priority is the most important aspect of the project

REFERENCES

- [1] Manuel Fogue, Piedad Garrido, Francisco J Martinez, Juan-Carlos Cano, Carlos T Calafate, "Automatic Accident Detection: Assistance Through Communication Technologies & Vehicle", IEEE, DOI: 10.1109/MVT.2012.2203877, Volume 7, 2012.
- [2] Hoang Dat Pham, Micheal Driberg, Chi Cuong Nguyen, "Development of vehicle tracking system using GPS and GSM modem", IEEE, DOI:10.1109/ICOS.2013.6735054, Volume 5, 2014.
- [3] Saddam, "Arduino based Vehicle Tracker using GPS and GSM", IEEE, DOI:10.1109/ICOS.2017.6735024, Volume 6, 2017.
- [4] N Watthanawisuth, T Lomas, A Tuantranont, "Wireless black box using MEMS accelerometer and GPS tracking for accidental monitoring of vehicles", IEEE, DOI:10.1109/BHI.2012.6211718, Volume 6, 2012.
- [5] S Nithya, V Senthilkumar, "A Black Box Alert System for Crash Recovery and Prediction using MEMS Technology" IJERT, DOI:10.17577/IJERTCONV31S16102, Volume 3, 2015
- [6] Nakrop Jinaporn, Sodsai Wisadsud, Prasit Nakonrat, Atipong Suriya "Security system against asset theft by using Radio Frequency Identification Technology", IEEE, DOI: 10.1109/ECTICON.2008.4600542, Volume 4, 2008.
- [7] V Thirumalai Venkatesan, "GSM & GPS Based Road Vehicle Accident Report System Using Mems Sensor" IJCRT, ISSN: 2320-2882, Volume 7, 2018
- [8] <https://zenodo.org/record/3630231/files/%2085-12%20ARDUINO%20based.pdf>
- [9] <https://www.ijert.org/a-black-box-with-sms-alert-for-road-vehicles>
- [10] https://www.researchgate.net/publication/338157166_Automatic_Vehicle_Accident_Detection_and_Messaging_System_Using_GPS_and_GSM_Module
- [11] https://link.springer.com/chapter/10.1007/978-981-15-4932-8_39

When are Tweets by Start-Ups More Likeable?

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Abstract:

Twitter has impacted the businesses and start-ups worldwide. This study attempts to understand the likability of tweets posted by the start-ups. The study uses extensive tweet data of more than 1 lakh tweets. The key findings of the study are that tweets should be sufficient length and use additional features such as hashtags, mentions etc. to increase their likeability and spread across the networks.

Keywords:

social media, Twitter, start-ups, data mining

INTRODUCTION

Social media has emerged as a key engagement tool across business organizations. Social media has been defined as “A group of Internet-based applications that build on the ideological and technological foundations of Web 2.0 and that allow the creation and exchange of user-generated content” [1]. Social media offers minimal barriers to entry and provides firms with an opportunity to be part of many diverse communities. Benefits of social media extend across domains such as Marketing and customer service, business communications and networking [2].

Among various social media platforms, Twitter is widely used by researchers. Twitter is a microblogging site wherein a message less than 280 characters can be posted and it is visible across your network. Twitter is considered to be more dynamic and less time-consuming [3] and has been found to enhancing the business value of a firm in comparison to Facebook and other such sites [4]. Finally, Twitter provides an easy and generous access to data for academic research without breaching the data protection laws (Russell & Klassen, 2014).

Existing stream of research has highlighted that how actively using Twitter is beneficial for start-ups and helps bridge the information asymmetry problem faced by them [5]–[7]. Extending this stream of research, this paper investigates how can a favourable response to social media activity of the start-up be generated.

THEORETICAL BACKGROUND

Signaling theory is a widely used theory to explain how signals reduce information asymmetry faced by various entities [8]. Signaling theory has four major components – signal, sender, receiver and feedback [9]. Signal is the information that the insiders may communicate with the outside world while feedback is the response on the outsiders to the information conveyed.

Entrepreneurship literature on social media usage is rich and has consistently highlighted the role of feedback in success achieved by start-ups. [10] studied 367 start-ups that went for IPO and concluded that posting more

tweets and encouraging audience response such as likes and retweets leads to IPO success. [7] studied USA based start-ups that went for IPO between 2009 and 2011 and found that it is just not firms’ engagement on Twitter that led to IPO success but also the retweets received that led to increased IPO success. Feedback of audience is one of the key sources of legitimacy and credibility of the firm [7], [11]. This study attempts to explore which tweets by start-ups lead to better feedback in form of likes and retweets by the social media users. The research question for the study is - 2. Do tweet specific information lead to increased likability and retweet-ability of tweets.

LITERATURE REVIEW

[5] deliberated on the role of social media in venture financing and also investigated the role of social media in alleviating or exacerbating existing biases in venture funding faced by start-ups founded by women and others at the periphery of the investor network. The study tracked about 20,000 USA based early-stage start-ups across 10 years. The study used ordinary regression, 2SLS regression and event / survival analysis. Log of funding amount was used as the dependent variable in the study. Social media variables such as twitter presence, twitter engagement and Investor network data constructed from database named CrunchBase were used as dependent variables. The major inference drawn from the study was that early-stage firms should engage in social media, especially those that are information disadvantaged. Firms on the periphery of the investor networks and firms with female founders gain more financial benefits from using social media than others.

[12] studied the effect of start-ups social media activities and signals on funding outcomes using 2SLS regression and Heckman selection model. They focused on the effect of twitter presence, twitter influence and sentiment on 2nd round of funding using the data collected between 2007-2015 from 2880 firms. The study revealed that social media signals investors additional information channel about start-ups quality. It thereby reduces the search cost and encourages investors to explore a wider pool of startup firms. They concluded that Startups that generate more influence on social media have higher chances of receiving funding, from a larger pool of investors and getting larger amount of funding overall.

[13] conducted literature review incorporating the works on retweeting and, explored the underlying reasons for spreading information in forms of retweets. According to it, many contradictory views have emerged on retweeting – such as while few studies concluded shorter tweets are widely retweeted, few concluded the longer ones are more retweeted. Overall, the major variables

explored for retweeting were length of tweet, sentiment, authors credentials etc.

[14] examined the impact of board member composition and board members' social media presence on the performance of software/IT startups based in USA. Board composition and board member social media presence was measured by presence of VC on board and presence of VC on twitter respectively. Using multiple linear regression, the study concluded that board composition and informal social networks of board members have a direct influence on startups' performance. The sooner a startup is able to access the VC network, the higher its chances to benefit from the brand awareness of the VCs.

[15] explored how the financial success of blockchain firms' ICOs is linked to their social media utilization and the overall blockchain trend. The objective has been addressed by analysing tweets with NLP tools and utilizing this output as an independent variable in regression model along with other independent variables namely online search statistics and financial ICO data. NLP was applied in the study to find out sentiment in all tweets preceding the ICO and use of emotive words in tweets. Overall 231,758 tweets related to 524 ICOs were analysed in the study. The study concluded that higher search volume, positive sentiment and increased use of emotive language on Twitter are linked to a higher raised funding volume.

HYPOTHESIS

H1: The length of the tweet posted by the start-up is positively related to number of likes/retweets received by the tweet.

H2: Number of hashtags is positively related to number of likes/retweets received by the tweet.

H3: Number of mentions is positively related to number of likes/retweets received by the tweet.

H4: Presence of URL is positively related to number of likes/retweets received by the tweet.

H5: Presence of poll is positively related to number of likes/retweets received by the tweet.

H6: Presence of media object (i.e., image/video) is positively related to number of likes/retweets received by the tweet.

METHODOLOGY

Tweet data of 835 twitter accounts of start-ups were downloaded using Twitter API. These accounts posted more than 1.3 lakh tweets. Retweets were removed from these and we had a final usable data of 113653 tweets. Extensive pre-processing of data was carried out to precisely calculate the variables such as tweet length, number of mentions and hashtags etc. Pre-processing was carried out in Jupyter Notebook that uses Python language. The major preprocessing steps were – separating hashtags, mentions and URLs from the tweets, counting hashtags and mentions. Following this

number of characters in a tweet were counted. All the tweets were checked for presence of URL or poll in it.

Following pre-processing, descriptive analysis was carried out. Multiple linear regression was used to test the hypothesis. Descriptive and statistical analysis of the data was carried out in Rstudio, that uses computer language R. Dependent variable for regression analysis were – number of likes, and number of retweets. Independent variables were – availability of URL, poll, media in the tweet; number of hashtags and mentions in the tweet; and total number of characters in the tweet. We also controlled for tweet category i.e., original tweet, reply tweet and quote tweet in the regression.

ANALYSIS

The descriptive analysis of the variables is presented in Table 1. As can be seen, the average length of tweets is just 24 characters, though Twitter allows a maximum of 280 characters. Hashtags in comparison to mentions are widely used in the tweets with each tweet having at least 2 hashtags. URLs are embedded in almost 60% of the tweets and media object is present in 48% of tweets. Average number of likes on a tweet is 1.6 while average number of retweets on a tweet is 0.72.

Table 1: Descriptive data

Variable	Mean / counts
Avg no. of hashtags	2.5
Avg no. of mentions	0.48
Avg. Tweet length	24
Avg. no. of likes	1.6
Avg. no. of retweets	0.72
No. of tweets with poll	235
No. of tweets with URL	68298
No. of tweets with media object	54413

Table 2 highlights the result of the regression model with dependent variables as number of likes and number of retweets. In the tables, the coefficient is presented, followed by standard error in parentheses. It can be inferred from the table that both the models are significant. Tweet length is positively related to the feedback received on a tweet i.e., more are the number of characters in a tweet, the higher are the chances that it will be favorably liked by other users. Similarly, number of hashtags and number of mentions in a tweet entices more favorable response from other users. Availability of a media object or a poll in the tweet is also favorable. However, attaching URLs in a tweet in fact does not lead to a positive response. Thus, we accept hypothesis 1,2,3,5 and 6. We reject hypothesis 4.

DISCUSSION

It is imperative for start-ups to not just actively use social media but to also get favorable support from other users to build legitimacy. To gain the active support of the network, the content that is posted by the start-ups should focus on posting elaborate messages and not extremely short messages that are not able to convey sufficient information to the users. The social media strategy should focus on additional features that can be posted along with the content i.e., hashtags for topic identification; mentions for recognizing other users etc. URLs do not lead to a favorable response and one of the probable reasons could be that the when user clicks on the URL he is directed away from the page. Thus, a better strategy could be posting a URL along with a media object.

Table 2: Regression analysis

Explanatory variables	Dependent variables	
	No. of likes	No. of retweets
tweet_category	0.2035*** (0.0117)	0.0646*** (0.0091)
quote_tweet		
tweet_category	-0.2147*** (0.0076)	-0.2343*** (0.0059)
reply_tweet		
poll_available1	0.2635*** (0.0444)	0.2462*** (0.0345)
No._of_hashtags	0.0060*** (0.0008)	0.0028*** (0.0006)
No._of_mentions	0.0782*** (0.0019)	0.0507*** (0.0014)
media_available1	0.1371*** (0.0044)	0.0637*** (0.0035)
url_available1	-0.1318*** (0.0043)	-0.0974*** (0.0034)
tweet_length	0.0082*** (0.0002)	0.0031*** (0.0001)
Constant	0.3122*** (0.0059)	0.2183*** (0.0045)
Observations	1,13,653	1,13,653
R ²	0.0757	0.0437
Adjusted R ²	0.0757	0.0436
Residual Std. Error	0.6774	0.5267
F Statistic	1,164.0330***	649.2470***

Note: "+" 0.1, "*" .05, "***" .01, "****" .001

REFERENCES

- [1] A. M. Kaplan and M. Haenlein, "Users of the world, unite! The challenges and opportunities of Social Media," *Bus. Horiz.*, vol. 53, no. 1, pp. 59–68, 2010, doi: 10.1016/j.bushor.2009.09.003.
- [2] K. Morales, J. Sosa-Fey, and J. Farias, "Social Media: Are the Benefits Worth the Risks for Business?," *Int. J. Bus. Public Adm.*, vol. 14, no. 1, pp. 87–97, 2017, [Online]. Available: <https://liverpool.idm.oclc.org/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=bth&AN=127980564&site=eds-live&scope=site>.
- [3] E. Fischer and A. R. Reuber, "Social interaction via new social media: (How) can interactions on Twitter affect effectual thinking and behavior?," *J. Bus. Ventur.*, vol. 26, no. 1, pp. 1–18, 2011, doi: 10.1016/j.jbusvent.2010.09.002.
- [4] S. Agarwal, S. Kumar, and U. Goel, "Stock market response to information diffusion through internet sources: A literature review," *Int. J. Inf. Manage.*, vol. 45, pp. 118–131, 2019, doi: 10.1016/j.ijinfomgt.2018.11.002.
- [5] X. Wang and L. Wu, "Can Social Media Alleviate Inequalities? Evidence from Venture Capital Financing," in *Proceedings of the 40th International Conference on Information Systems*, 2019, pp. 1–17.
- [6] N. Singhal and D. Kapur, "Does social media activity lead to more funds? – a study on Indian start-ups," *J. Entrep. Emerg. Econ.*, 2022, doi: 10.1108/JEEE-07-2021-0290.
- [7] L. W. Lundmark, C. Oh, and J. C. Verhaal, "A little Birdie told me: Social media, organizational legitimacy, and underpricing in initial public offerings," *Inf. Syst. Front.*, vol. 19, no. 6, pp. 1407–1422, 2017, doi: 10.1007/s10796-016-9654-x.
- [8] M. Spence, "Job Market Signaling," *Q. J. Econ.*, vol. 87, no. 3, pp. 355–374, 1972.
- [9] B. L. Connelly, T. Certo, R. D. Ireland, and C. R. Reutzel, "Signaling theory: A review and assessment," *Journal of Management*, vol. 37, no. 1, pp. 39–67, Jan. 2011, doi: 10.1177/0149206310388419.
- [10] A. Mumi, M. Obal, and Y. Yang, "Investigating social media as a firm's signaling strategy through an IPO," *Small Bus. Econ.*, vol. 53, no. 3, pp. 631–645, 2019, doi: 10.1007/s11187-018-0066-9.
- [11] E. Blankespoor, "Firm communication and investor response: A framework and discussion integrating social media," *Accounting, Organ. Soc.*, vol. 68–69, pp. 80–87, 2018, doi: 10.1016/j.aos.2018.03.009.
- [12] F. Jin, A. Wu, and L. Hitt, "Social Is the New Financial: How Startup Social Media Activity Influences Funding Outcomes: Working Paper," 2017.

- [13] S. N. Firdaus, C. Ding, and A. Sadeghian, “Retweet: A popular information diffusion mechanism – A survey paper,” *Online Soc. Networks Media*, vol. 6, pp. 26–40, 2018, doi: 10.1016/j.osnem.2018.04.001.
- [14] P. A. Gloor, A. Fronzetti Colladon, F. Grippa, B. M. Hadley, and S. Woerner, “The impact of social media presence and board member composition on new venture success: Evidences from VC-backed U.S. startups,” *Technol. Forecast. Soc. Change*, vol. 157, p. 120098, 2020, doi: 10.1016/j.techfore.2020.120098.
- [15] S. Albrecht, B. Lutz, and D. Neumann, “How Sentiment Impacts the Success of Blockchain Startups – An Analysis of Social Media Data and Initial Coin Offerings,” in *Proceedings of the 52nd Hawaii International Conference on System Sciences*, 2019, pp. 4545–4554, doi: 10.24251/hicss.2019.551.

Air Quality Sensing and Monitoring

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Abstract:

Air is getting polluted because of release of toxic gases by industries, vehicle emissions and increased concentration of harmful gases and particulate matter in the atmosphere. This creates a need for measurement and analysis of real-time air quality monitoring so that appropriate decisions can be taken in a timely period. This system presents a real-time air quality monitoring. The setup will show the air quality in PPM in LCD display so that we can monitor it very easily. The sensor MQ135 is able to detect smoke, CO, CO₂ and NH₄. To alert the user who is far away or busy the red led blinks and the buzzer starts buzzing .

Keywords:

Toxic Gases, LCD, PPM, CO, CO₂, NH₄.

INTRODUCTION

Continued exposure to environments with poor air quality is a major public health concern in developed and developing countries. It is estimated that the pollutants responsible for poor air quality cause nearly 2.5 million premature deaths per year world-wide. Significantly, around 1.5 million of these deaths are due to polluted indoor air, and it is suggested that poor indoor air quality may pose a significant health risk to more than half of the world's population. Due to its link with industrialization, societal health problems associated with poor air quality disproportionately affects developed and developing nations – it is estimated that air pollution is responsible for the premature deaths. Remedial action to improve air quality is often easy to implement once airborne pollutants have been detected.

PROPOSED WORK

In the proposed project real-time air quality monitoring will be done and alert message will be displayed on LCD and if the user is far from the device his attention will be grabbed through buzzing a buzzer or by blinking LED so that appropriate decisions can be taken in a timely period. The sensor MQ135 is used to detect smoke, CO, CO₂ and NH₄.

HARDWARE AND SOFTWARE REQUIREMENTS

Arduino Uno:



Fig.1 Arduino Board

The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

MQ-135 Gas Sensor:

This sensor has 4 pins for connecting to the arduino. leftmost pin of mq135 sensor is connected to +5v and second pin from left is connected to ground and rightmost pin (A) is connected to analog a0 of the arduino uno and another pin (D) is left unconnected.



Fig. 2 MQ-135 Sensor.

The MQ-135 gas sensor senses gases like ammonia nitrogen, oxygen, alcohols, aromatic compounds, sulfide, and smoke. The operating voltage of this gas sensor is from 2.5V to 5.0V. The MQ-3 gas sensor has a lower

conductivity to clean air as a gas sensing material. It has the potential to detect different harmful gases. The MQ-135 gas sensor is a low cost to purchase.

16*2 LCD Display:

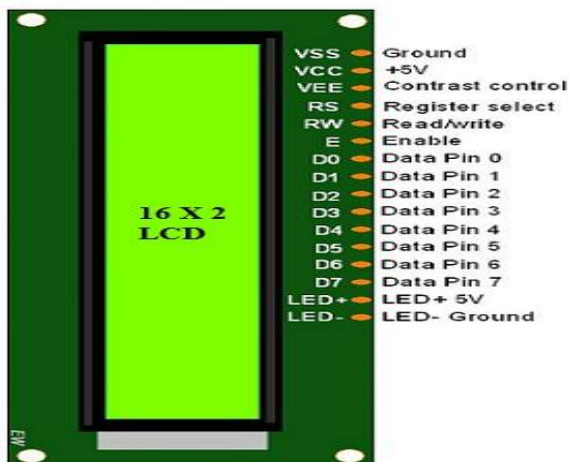


Fig.3 LCD Display

The operating voltage of this LCD is 4.7V-5.3V. It includes two rows where each row can produce 16-characters. The utilization of current is 1mA with no backlight. Every character can be built with a 5x8 pixel box. LCD display can work on two modes like 4-bit & 8-bit.

Buzzer:



Fig.4 Buzzer

Buzzer has operating Voltage of 4-8V DC. It's rated current <30mA. Resonant frequency ~2300 Hz.

Light Emitting Diode:

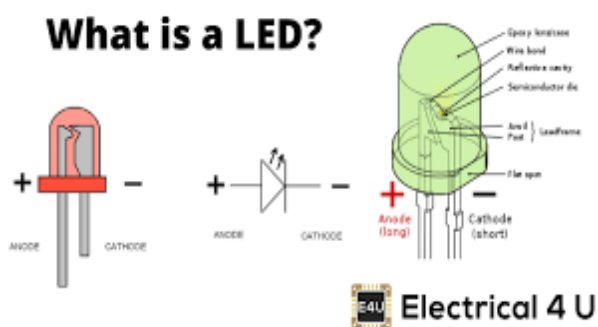


Fig.5 LED

In the simplest terms, a light-emitting diode (LED) is a semiconductor device that emits light when an electric current is passed through it. Light is produced when the particles that carry the current (known as electrons and holes) combine together within the semiconductor material. Typically, the forward voltage of an LED is between 1.8 and 3.3 volts.

Arduino IDE

The Arduino Integrated Development Environment (IDE) is a cross platform application (for Windows, macOS, Linux) that is written in functions from C and C++.

DESIGN AND IMPLEMENTATION

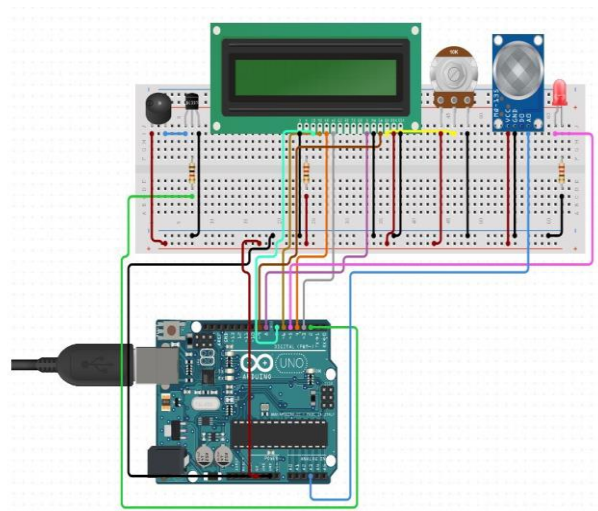


Fig.6 Circuit Design

The above diagram shows the circuit design of the proposed project. mq135 sensor is connected to +5v and second pin from left is connected to ground and rightmost pin (A) is connected to analog a0 of the arduino uno and another pin (D) is left unconnected. The pins D4, D5, D6, D7 of LCD are connected to 5, 4, 3, 2 pins of the arduino respectively, E and Rs are connected to 11 and 12 of the arduino respectively.

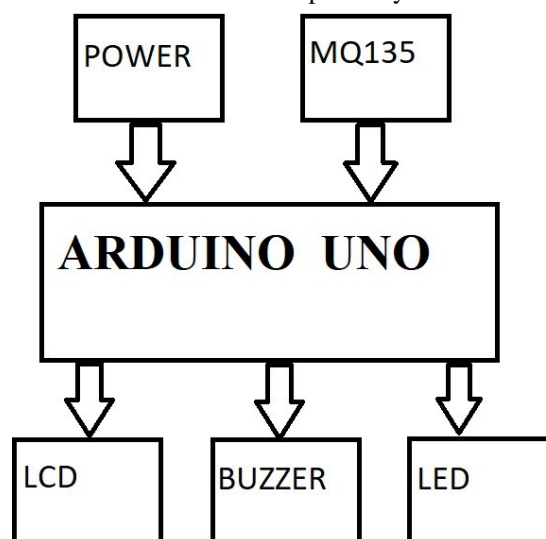


Fig.7 Block Diagram

Working

Arduino microcontroller is turned on by USB (connected to pc / laptop) or battery. The arduino initiates the MQ 135 sensor which sends the analog voltage to Arduino according to the purity of the gas present in the environment. The arduino process the analog input voltages received from MQ135 sensor. If the MQ 135 sensor senses hazardous gases in the air, it will send analog voltage which is greater than the threshold voltage and LCD will displays air quality is bad with parts per million. To alert the user who is far away or busy the red LED blinks and the buzzer starts buzzing. LED and the Buzzer will turn off automatically and displays the air quality in ppm when hazardous gases are cleared.

Flow Chart:

The below figure is a flowchart of the software implementation. The program is written in c language

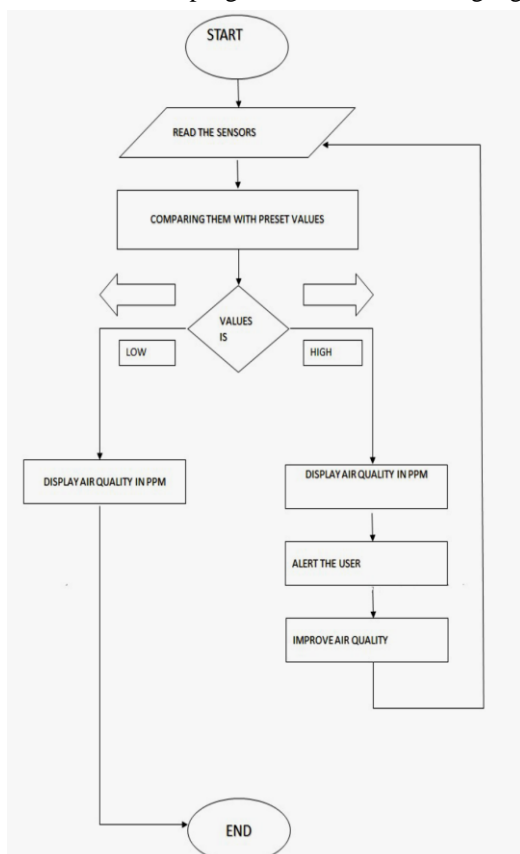


Fig.8 Flow Chart

CONCLUSION

The air pollution monitoring system using MQ135 gas sensors senses the pollutant levels and display it, thus making the public alert to the pollution level in their area. MQ135 sensor detect smoke, CO, CO₂ and NH₄. The sensors can be deployed at any geographic location. This is of wide use to offices, factories, residential areas and education institutions, if installed in their premises, because staying in tune with the changes in our environment is the most necessity of today.

FUTURE ENHANCEMENTS

- In future the project can be upgraded in more ways than one.
- Interface more number of sensors to know detail content of all gases present in air .
- Design Webpage and upload data on webpage with date and time. Interface SD Card to store data.
- Interface GPS module to monitor the pollution at exact location and upload on the webpage for the citizens.
- Wearable devices which are rugged and compactable which shows accurate result.
- It can be made as multipurpose device because as we know MQ 135 sensor detects pollution gases, alcohol and heat.

REFERENCES

- [1] <https://www.electroduino.com/air-pollution-monitoring-system-using-arduino-andmq135-air-quality-sensor/>
- [2] <https://microcontrollerslab.com/interfacing-mq-135-gas-sensor-arduino/amp/>
- [3] MQ-135 Air Quality Sensor Circuit - Working and Interfacing with Program Code Homemade Circuit Projects (homemade-circuits.com)
- [4] <https://www.instructables.com/Air-Quality-Monitoring-Device-Using-Arduino.>

Internet of Things Enabled Power Theft Detection and Smart Meter Monitoring System

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Abstract:

Power theft, at low voltage distribution give up has been concerning about the problems together with distribution agencies will need to face losses of billions of Rupees sales annually. With the help of smart grid technology, clever meters with Information Communication Technology (ICT) could be capable of offer an answer for detecting and alerting the power theft. This paper presents the application of Internet of Things (IoT) in strength robbery detection and actual-time clever meter tracking. Linear Regression method is getting used for detecting electricity robbery by using constantly monitoring the customer and distribution cease smart meters facts. Android programs are advanced for tracking intake and additionally billing data of consumers and alerting the government in the occasion of robbery. The offered gadget is able to detecting strength theft because of meter skip, meter tampering and direct line hooking and etc. . As an extra characteristic, direct manage of smart meters from distribution authorities is implemented for imparting get entry to/denial of power deliver for a person patron. A prototype circuit is advanced the usage of ATmega328 micro-controller with Arduino and a Wi-Fi module, for validating the presented machine.

Keywords:

Power Theft, Smart Meters and IoT.

INTRODUCTION

Power loss is one of the important issues that have to be taken care in the distribution network. It can be addressed as the difference in power, between the generation and metered consumption. This power loss is classified into technical losses and non-technical losses. Majority of the power loss are nontechnical losses and are due to power theft. Power theft can be defined as the illegal or un-metered utilization of electricity from distribution utilities. The distribution utilities incur huge financial losses due to this power theft. It has been estimated that around 6-10 billion INR of revenue will be lost in India because of the theft every year. Consumers commit power theft in various ways which include meter bypassing, direct line hooking, meter tampering etc. A very common way of bypassing the meter include, connecting the supply wire directly to the distribution network in parallel to the meter. The other way to access electricity is by tampering the meter. This type of theft is generally practiced in the village and suburban areas where, insertion of foreign objects, magnetic interfering materials into meters or shortening meter terminals are done so that meter is not operated. Apart from these, consumers also commit direct line hooking on low voltage overhead lines to access the electricity. Hence power theft is a critical issue for the

distribution utilities as it directly reflects on the revenue of the utility. Substantial research has been carried out on power theft detection algorithms. The Presents the power theft detection methods using consumer load profile analysis. But these methods have a limitation that they cannot identify complete bypass and line hooking type of thefts. The presented a method to identify power theft using temperature based predictive models which uses meter data and distribution transformer information. In work applied state estimation for power theft detection where, a privacy preserving theft detection algorithm has been developed by applying Kalman filtering approach. The presents the linear regression method for theft detection. However, it mainly concentrates on mathematical design of theft detection algorithm and less on real-time implementation. Apart from these, presented a power line communication-based approach for theft detection. In this paper designed an inspection device to detect power theft based on the magnetic oscillations of the distribution line. Various approaches have been presented in the literature for theft detection. However, these methods are more complex, computationally difficult and the utility has to invest in building dedicated infrastructure at consumer premises which is not feasible. Moreover, majority of methods concentrate only on detecting the theft and there is less research explored in building communication technologies to alert the authorities about the theft.

LITERATURE SURVEY

[1] In the year of 2011, the authors "Landi, C.; Dipt. di Ing. dell'Inf., Seconda Univ. di Napoli, Aversa, Italy ; Merola, P. ; Ianniello, G" presented a paper titled "ARM-based energy management system using smart meter and Web server", in this paper they described such as a low cost real-time ARM-based energy management system is proposed. It is conceived as part of a distributed system that measures the main power system quantities and give the possibility to manage the whole power plant. An integrated Web Server allow to collect the statistics of power consumptions, power quality and is able to interface devices for load displacement. The device is characterized by easy access to the information and the combination of a smart meter and data communication capability allow local and remote access. In this way it is possible to manage the power consumption of the power system leading to an overall reduction in consumption and costs.

[2] In the year of 2012, the authors "Garraab, A.; Bouallegue, A.; Ben Abdallah" presented a paper titled

"A new AMR approach for energy saving in Smart Grids using Smart Meter and partial Power Line Communication", in this paper they described such as the growing demand of energy, the capacity limitations of energy management, one-way communication, the need of an interoperability of the different standards, the security of the communication and the greenhouse gas emissions, leads to emerge a new infrastructure grid: Smart Grid. Smart Meters are one of the proposed solutions for the Smart Grid. In this paper, an AMR solution which provides enhanced end-to-end application. It is based on an energy meter with low-power microcontroller MSP430FE423A and the Power Line Communication standards. The microcontroller includes an energy metering module ESP430CE1. The aim of this work is to realize a real time pricing thanks to the proposed communication infrastructure. This solution is with great interest in economical and low carbon society point of view.

[3] In the year of 2012, the authors "B. S. Koay, S. S. Cheah, Y. H. Sng, P. H. Chong, P. Shum, Y. C. Tong, X. Y. Wang, Y. X. Zuo and H. W. Kuek" presented a paper titled "Design and implementation of Bluetooth energy meter", in this paper they described such as Presently electronics energy measurement is continuously replacing existing technology of electro-mechanical meters especially in China and India. By the year 2004, digital meter has start replacing electromechanical meters in Singapore. A wireless digital energy meter would definitely offer greater convenience to the meter reading task. Bluetooth technology is chosen as a possible wireless solution to this issue. In this paper, we present the design and implementation issues of a Bluetooth-enabled energy meter. The energy reader can collect the energy consumption reading from the energy meter wirelessly based on Bluetooth. Two methods, which can retrieve the meter reading with little human intervention, are proposed and implemented in the targeted applications. They are AMR (automatic meter reading) and the APM (automatic polling mechanism). Few commercial applications are suggested to apply for the Bluetooth-enabled energy meter. We have successfully implemented the Bluetooth-enabled energy meter for these suggested commercial applications to demonstrate the advantage of reading the electricity consumption wirelessly via Bluetooth technology.

SYSTEM REQUIREMENTS

Hardware

The hardware components used in our project is listed below.

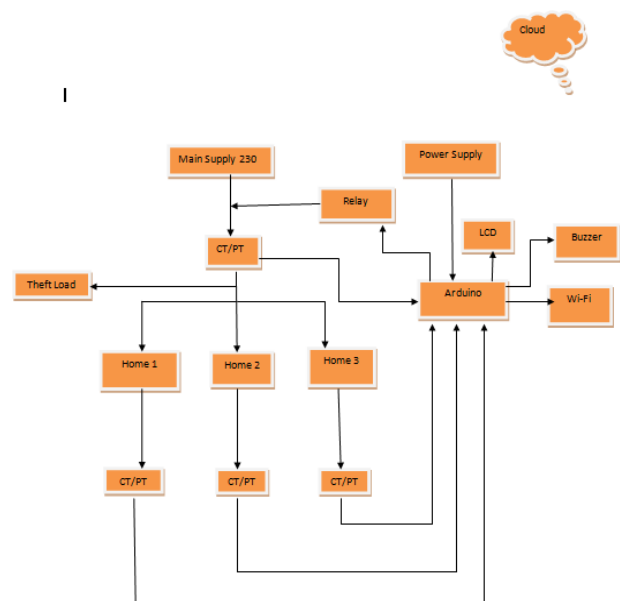
1. Arduino ATMEGA 328
2. Regulated Power Supply
3. Relay Circuit
4. Wi-Fi Module (ESP8266)
5. Current Sensor
6. Voltage Sensor

Software

1. Arduino IDE tool
2. Embedded C

METHODOLOGY

In this paper we are explaining a technique of electricity reading based on IoT concept. This design implements the energy meter using the IoT concept. This whole procedure based on the Arduino. The internet of things is the internet operational of physical devices which permits object to exchange data in the above system energy meter is connected to the internet by using IoT. The smart meter is designed to have communication features so that it can connect to IoT server. The presented meter uses Arduino/ATMEG 328 as main controller and adding Wi-Fi feature. Voltage and current sensors are used to read the corresponding voltage and current information and generate equivalent analog signals. These analog signals are passed to the Arduino microcontroller where active power (P), reactive power (Q), power utilized (KWH) and Power Factor (PF) is calculated. These values are updated to server through ESP8266. A Passive sensor is used to detect the tampering. If there was any tampering, the output of sensor will be HIGH. Based on the output of sensor an alert message is passed. A circuit breaker is used to control the access/denial of power to a consumer. In this paper designed an inspection device to detect power theft based on the magnetic oscillations of the distribution line. Various approaches have been presented in the literature for theft detection. However, these methods are more complex, computationally difficult and the utility has to invest in building dedicated infrastructure at consumer premises which is not feasible. Moreover, majority of methods concentrate only on detecting the theft and there is less research explored in building communication technologies to alert the authorities about the theft.



RESULTS

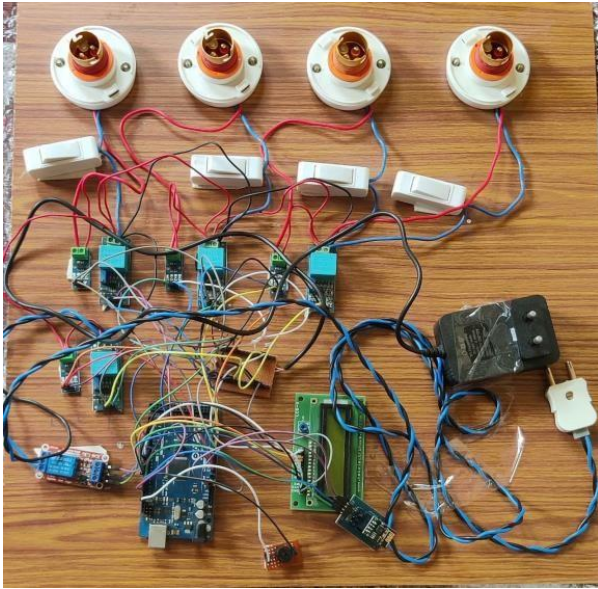


Figure: IoT Enabled power theft detection

CONCLUSION

IOT based totally Power theft detection and manage systems had been proposed in this paintings. The machine might provide a simple manner to hit upon an electrical strength theft without any human interface. In this system we are searching forward to implement smart meter. As the Indian Government has additionally proposed formation of Smart Cities as a way to have a powerful power management, transportation, waste disposal and aid conservation approach the usage of more often than not Internet of Things primarily based sensors as completed globally.

REFERENCES

- [1] G.L. Prashanthi, K .V. Prasad, “Wireless power meter monitoring with power theft detection and intimation system using GSM,” International journal of engineering science and computing, Volume9, pp. 330-348, 2016.
- [2] J.L. Parra and E.A.S. Calderon, “Use of shunts detecting equipment for the identification of illegal power outlets,” International Journal of Innovative research in Science, Engineering and Technology, pp. 1–4, 2013.
- [3] S.K.A. Zaidi, H. Mansoor, S.R. Ashraf, and A.Hassan, “Design and implementation of low cost electronic prepaid energy meter,” IOSR Journal of Electronics and Communication Engineering, Volume: 02, pp. 548–552, 2014.
- [4] Pradeep Mittall, “Wireless Electricity billing system,” International Research Journal of Engineering and Technology (IRJET) Volume: 02, pp.21-34, 2015.
- [5] M.Jamil, F.Munir, A.A.Khan, and A.Mirza 2014, “Telemetry & billing system for spatially distributed electrical power clients,” Electrical power system research pp. 35–40, 2014.

Enhancement of Seismic Response of Multistory Base Isolated Building Equipped with Tuned Mass Damper

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Abstract:

The objective of the present paper is to study the effectiveness of control strategies in combining Lead Rubber Base Isolator and Tuned Mass Dampers (TMD) in suppressing structural vibrations of G+9 structure. The study was conducted by modelling four models with different control strategies assigned with Bhuj Earthquake data by Non-linear Time History Analysis with Direct Integration Method. Non-linear models of the base isolation system and linear model of tuned mass damper system and combination of both systems were employed in the analysis. It is concluded from results that the response of high-rise buildings during earthquakes could be significantly reduced using combinations of control systems i.e. base isolation device (BI) and tuned mass damper (TMD). It is also concluded that the effectiveness in enhancement of structural behavior substantially depends on the type of control system assigned in the model. Nonlinear BI model is analyzed with linear TMD. In the case of buildings analyzed in the study, the response of building assigned with combination of base isolator and TMD reduced by more than 78%.

Keywords:

Tuned Mass Damper, Lead Rubber Base Isolator, Non-linear Time History Analysis, Active Control System, Passive Control System.

INTRODUCTION

Earthquakes cause damage to civil engineering structures due to vibrations caused during earthquakes. Different ideas regarding improve behavior of structure during earthquake motions are developed. This is important in the case of public buildings such as hospitals, commercial buildings, and other buildings. Among them Base Isolation System (BI) is popular nowadays. Tuned Mass Dampers are able to reduce the fundamental vibration mode. The BIS combined with the TMD therefore a 3DOF system is analyzed for practical purposes. Throughout the paper, Non-Linear Dynamic System are considered to analyze seismic response of G+9 base isolated building equipped with TMD.

OBJECTIVE

1. To analyze the seismic performance of a multi-story building.
2. To carry out Non-linear TH analysis of same building with Lead Rubber Base Isolator.
3. To examine the effect of seismic excitations in proposed multi-story building installed with Tuned Mass Damper.
4. To analyze the seismic performance of multistory building equipped with combination of Lead

Rubber Base Isolator and Tuned Mass Damper. And compare the results of above four models.

2.1 Methods of control

As Earthquake is dangerous and unpredictable many advanced construction technologies are evolving to design earthquake reinforcement. The control systems can be classified as passive control device, active control device, semi-active control, and hybrid control.

2.1.1 Passive Control Devices

These are the systems which do not require external source of power e.g., tuned mass damper, viscoelastic damper, base isolation.

2.1.2 Active Control Devices

These are the systems driven by an externally applied force which tends to oppose the unwanted vibrations. The control force is generated depending on the feedback of structural response.

2.2. Types of passive control devices

1. Viscoelastic dampers.
2. Viscous Fluid dampers
3. Metallic yield dampers
4. Friction dampers
5. Tuned liquid damper
6. Tuned mass dampers
7. Base Isolation system

2.2.1 Base Isolation

Base Isolation is a Passive Energy Dissipation system. It represents the building is detached or isolated from the ground in such a way that on a very small portion of seismic ground motions is transmitted up through the building. To minimize the effect of ground motion on the superstructure and, thereby, reduce its force and response. The system detaches the structure from horizontal components of the ground motion by separating structural elements with low horizontal stiffness between the structure and the foundation.

2.2.2 Lead Rubber Bearing

In seismic isolation part or all the superstructure is separated from the lower part of the structure by an interface that is soft and flexible in the horizontal direction. Generally, the interface is placed between the foundation or basement and the ground or and so the term base isolation can be accurately applied.

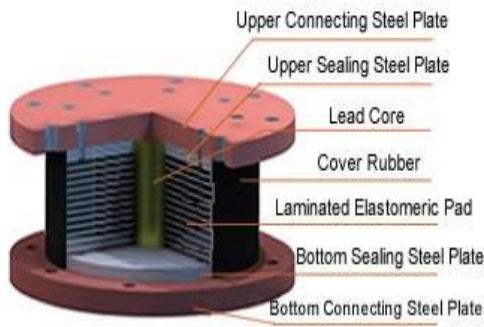


Fig. 1. Components of Lead Rubber Base Isolators.

Characteristics of LRB

A bearing can be designed to have the characteristics desired by adjusting:

- shear modulus of rubber compound;
- plan area;
- thickness and number of rubber layers;
- thickness of steel reinforcing plates.

2.3 Tuned Mass Damper

It is also called a "harmonic absorber", which is mounted to a specific location in a structure, so as to reduce the amplitude of vibration up to a limiting level whenever a strong lateral force such as an earthquake or high-speed winds. Tuned mass dampers have been used to enhance the seismic behavior of structures under wind and seismic excitation. There are two basic types of TMD; the Horizontal TMD, which is used in high rise buildings and the other type is the Vertical TMD. Vertical TMD is usually applied in long span horizontal structures such as flyovers, elevated walkways. Horizontal and vertical both types have similar functions, though there might be slight differences in working of mechanism.

Several buildings in the world that are equipped with TMD are as follows:

1. Statue of Unity, India
2. Atc Tower in New Delhi, India.
3. Burj Al Arab, Dubai.
4. Taipei 101, Taiwan.
5. Chiba Port Tower, Japan.
6. Citicorp Centre, New York.
7. John Hancock Tower, Boston.

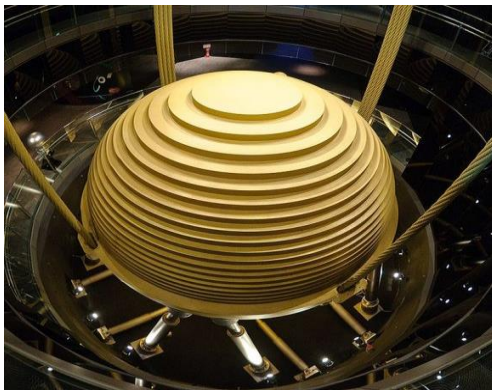


Fig. 2. Tuned Mass Damper in Taipei Tower

2.3.1 The equation of motion for the Tuned Mass

$$u\ddot{u}dd + 2\xi\ddot{u}dd\omega\ddot{u}dd + \omega\ddot{u}dd2u\ddot{u}dd = -u\ddot{u}i(1)$$

The design of the mass damper involves specifying the mass $mmdd$, stiffness $kkdd$, and damping coefficient $ccdd$. The damper is tuned to the fundamental frequency of the structure such that adding mass damper limit the motion of structure when it is subjected to excitation

$$\omega\ddot{u}dd = \omega(2)$$

The stiffness's for this frequency combination are given by

$$kkdd = mmkk(3)$$

By considering the primary mass is subjected to the following periodic curve excitation,

$$pp = p\hat{p} \sin \Omega\Omega\Omega\Omega(4)$$

then the response is given by

$$uu = uu \sin (\Omega t + \delta 1)(5)$$

$$uudd = uudd \sin (\Omega t + \delta 1 + \delta 2)(6)$$

where 'uu' and 'δ' denote the displacement amplitude and phase shift, respectively. The critical loading scheme is the resonant condition, $\Omega = \omega$.

2.3.2 Design of Tuned Mass Damper

The design of Tuned Mass Damper involves the following steps:

1. Calculate the base force (Fz) of structure.
2. Determine Mass Ratios. Select largest value of mass ratio.
3. Calculate the damping ratio
4. Calculate mass ratio
5. Calculate angular frequency
6. Calculate mass ($mmdd$), stiffness ($kkdd$) and damping ($ccdd$)

2.4 Details of Model considered for analysis

The structure is 36m high has an arrangement measurement if 20x20m. Consist of 4 bays of 5m in 'X' and 'Y' direction. Four models of the 9-story building have been made with "SMRF" (Special Moment Resisting Frame) auxiliary arrangement. The analysis and structure programming carried out in ETABS 2019. Four models with different and combination of control systems were analyzed in present study are recorded in **Table 1**. Details of model as per **Table 2**.

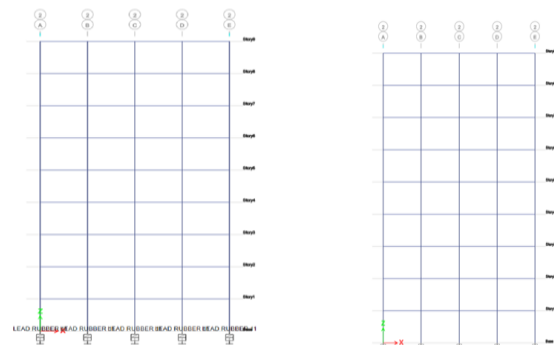


Fig. 3. Elevation of Model with Isolated Base and Fixed Base

Table 1. Models taken for analysis with different control strategies.

Model No.	Description
Model-1	Model with Fixed Base
Model-2	Model with Isolated Base
Model-3	Model with Fixed Base and Tuned Mass Damper
Model-4	Model with Combination of Isolated Base and Tuned Mass Damper

Table 2

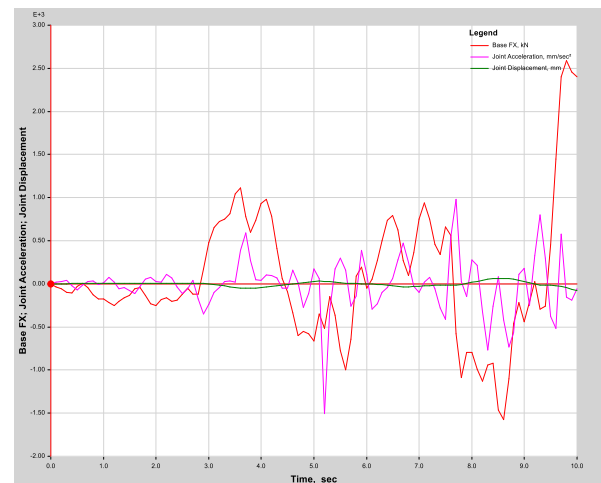
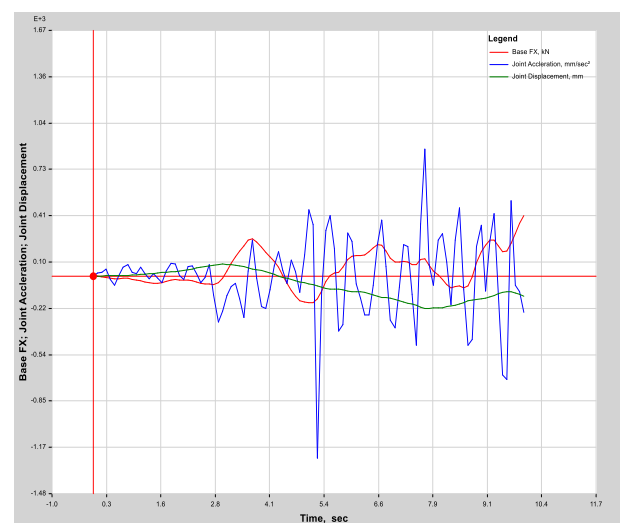
Structure Type	Special Moment Resisting Frame
No. of story	G+9
Typical story height	4.0 m
Type of building use	Public building
Structure Type	V
Soil type	Medium
Material Properties	
Grade of concrete	M40
Grade of steel	Fe 415
Density of reinforced concrete	25 kN/m ³
Poisson's Ratio of reinforced concrete	0.20
Material Properties	
Thickness of slab	0.150 m
Beam size 0.230 x 0.400 m	0.300 x 0.400 m
Column size (9-storeyed building)	0.300 x 0.600 m
Thickness of external masonry wall	0.230 m
Dead Load Intensities	
Roof finishes	2.0 kN/m ²
Floor finishes	1.0 kN/m ²
Partition wall load	1.0 kN/m ²
Live Load Intensities	
Roof	3.5 kN/m ²
Floor	3.5 kN/m ²

RESULTS AND DISCUSSION

Four models with seismic isolation and TMD, as well as their combinations, were analyzed in the study of G+9 story buildings under Bhuj Earthquake excitation data. Large number of results were obtained; the representative examples are presented in the present

paper. Fig.5-8 represents the Time History Curve of individual models M1, M2, M3, M4 for joint acceleration, joint displacement, base force. Comparison of story displacement, story acceleration, story drift and story moment is shown in Fig. 9-12 respectively. Comparison of Time History Curve for Joint Acceleration, Base Force for Bhuj of Model M1, M2, M3 and M4 shown in Fig. 13 and Fig. 14. displacement on X axis and time on It is confirmed that significant reduction of structural response in case of BI as compared to TMD.

In the case of a fixed base with TMD the reduction in response like story drift, story displacement, story acceleration, story shear is very less. The application of BI gives much enhancement in seismic behavior of structure. The use of BI causes reduction of story moment by 65% and the reduction in acceleration is 60%. In case of TMD with fixed base results in decrease in story moment and acceleration by 19%. However, large reduction in story moment, story drift, story acceleration up to 78% is observed in case of combinational approach.

**Fig. 4. TH Curve for Model 1.****Fig. 5. TH Curve for Model 2.**

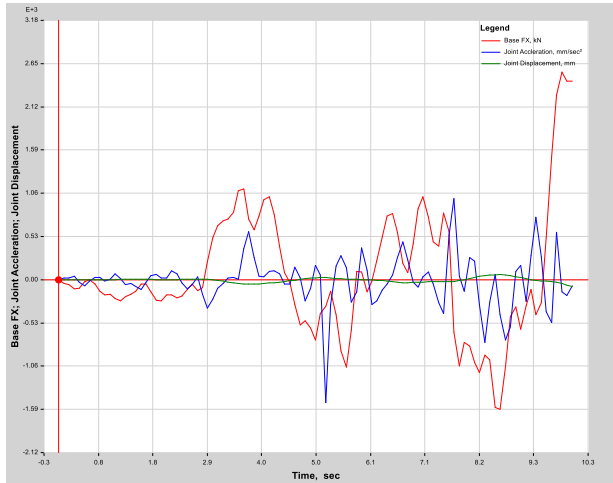


Fig. 6. TH Curve for Model 3.

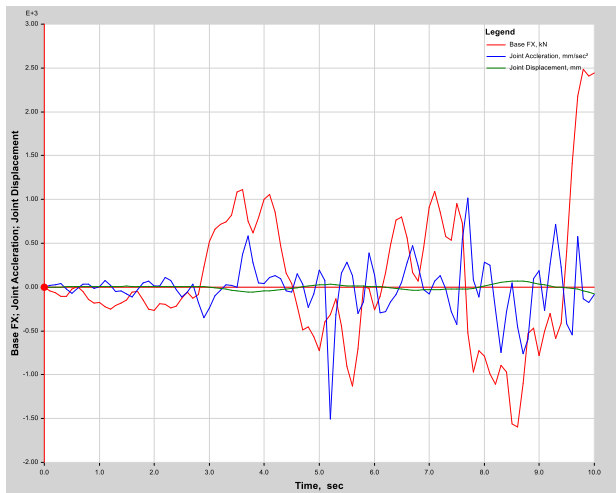


Fig. 7. TH Curve for Model 4.

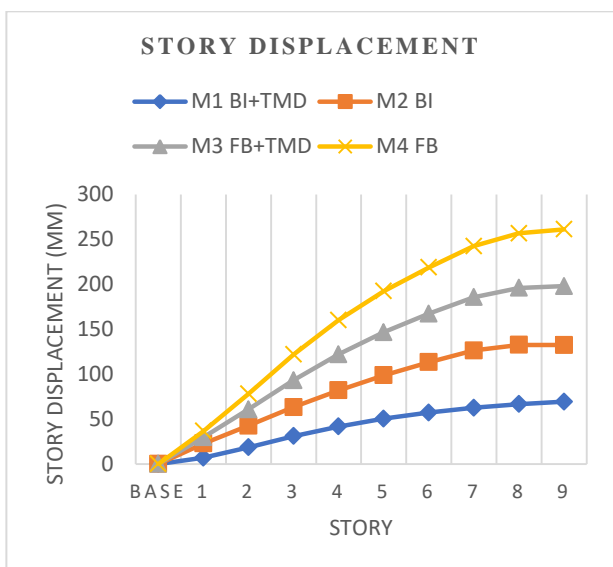


Fig. 8. Maximum story displacement for Nonlinear Time History output case

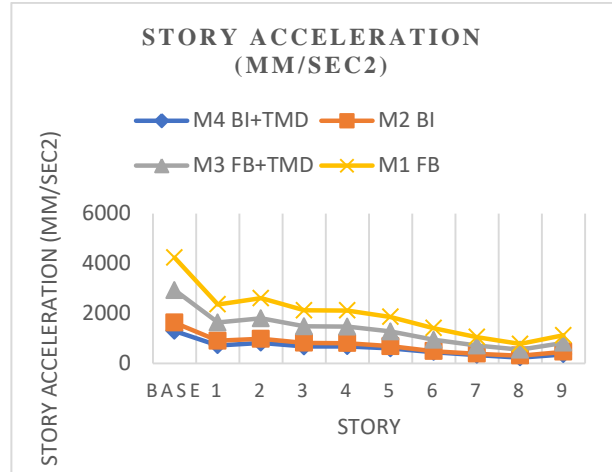


Fig. 9. Maximum story acceleration for Nonlinear Time History output case

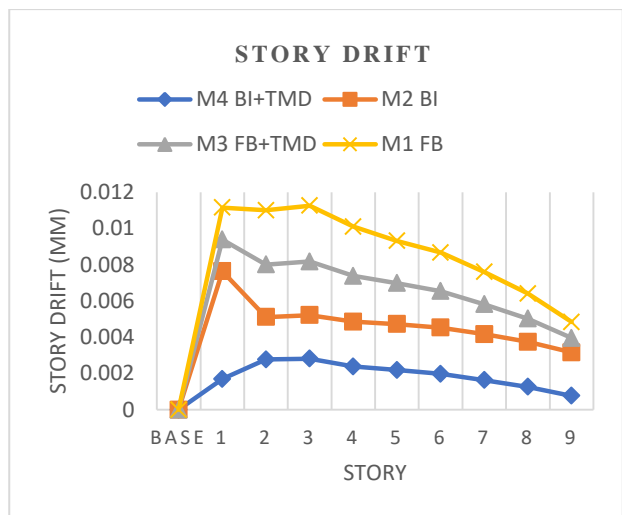


Fig. 10. Maximum story drift for Nonlinear Time History output case

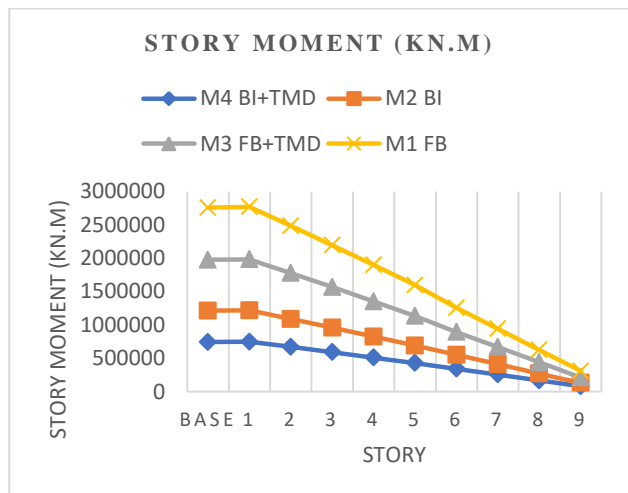


Fig. 11. Maximum story moment for Nonlinear Time History output case

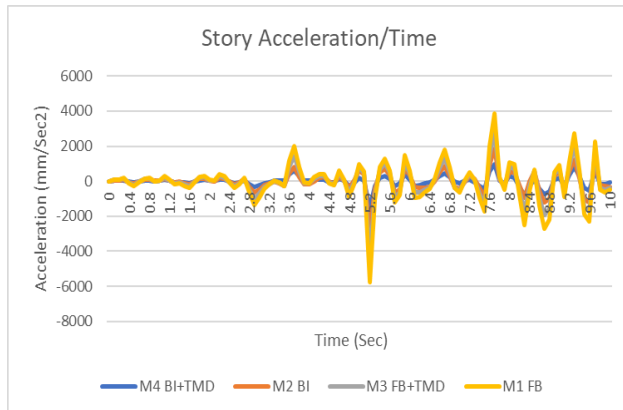


Fig. 12. Comparison of Time History Curve for Joint Acceleration for Bhuj of Model M1, M2, M3 and M4.

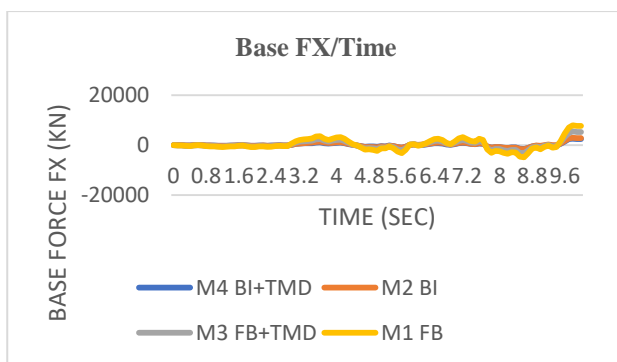


Fig. 13. Comparison of Time History Curve for Base Force for Bhuj of Model M1, M2, M3 and M4.

SCOPE OF THE STUDY

There have scientists working on to cope up with this hazards phenomena. Controlling seismic behavior is possible only through faithful design that ensures all behavioral actions considered in buildings during analysis. Also, there is a need to work on the following areas to overcome the gap areas –

- National level guidelines and codes are not available presently for the reference of engineers and builders.
- Engineers and scientists have to accelerate the pace of their research work in the direction of developing and constructing base isolated structures combined with TMDs and come out with solutions which are simple in design, easy to construct and cost effective as well additional mass on the structure provided in such way that the oscillations of the structure are reduced to the considerable extent.
- Detailed analysis will be carried out to explore the possibility to adopt Mass Damping to improve the seismic non-linear response of base isolated structures.
- Based on sensor information about the ground motion, each member equip with sensor, a feedback control device. By attaching sensors, we can measure displacements along the. Then the

feedback control device specifies the proper correction to the uncontrolled response, and the actuator exerts the required force then property of structure is changed in real time to try to optimize the control force exerted on the structure.

CONCLUSION

Four models Present study focused on scrutinizing effectiveness of enhanced BI equipped with TMD using acceleration data of Bhuj by Nonlinear TH analysis by Direct Integration Method. Simple model with fixed base primarily analyzed and remaining three models are modeled with control systems.

1. Maximum story displacement and story drift of the building is reduced by 20% with TMD, 67% with BI and 78% in combinational approach.
2. Story acceleration is reduced by 19.2% with TMD, 65% with BI and 79% in combination with BI plus TMD.
3. Fig. 11 shows there is significant reduction in overturning moment in case of BI system than model with TMD alone and larger than 78% reduction in case of BI model equipped with TMD.
4. It is underlined that enhancement of seismic behavior is dependent upon the type of control system used.

It has been demonstrated that the systems can enhance seismic behavior at its best when rubber bearing isolators are considered. Further research will be intended at exploring the optimum design of this system.

ACKNOWLEDGEMENT

This study was undertaken at the Computer Lab of MIT College of Engineering, Pune for a modelling and analysis in ETABS 2019. I would like to express my gratitude to my guide for guiding me throughout the ME Project work. I also offer profound gratitude to Dr. Mrs. S. A. Bokil (HOD Department of Civil Engineering), MIT College of Engineering, Pune.

REFERENCES

- [1] Chopra AK. Dynamics of Structures. 4th edn. USA: Pearson Prentice Hall; 2012.
- [2] Palazzo B., Petti L., De Iuliis M. (2006). Seismic response of base-isolated benchmark building model controlled by Tuned Mass Damper, proceedings of Fourth World Conference on Structural Control and Monitoring, San Diego (USA)
- [3] Ubair Gul Khan Mirza Aamir Baig (2020) "Behaviour of tall buildings using tuned mass damper"
- [4] ShinozukaM. Stochastic fields and their digital simulation. In: Schueller GI, ShinozukaM, eds. Stochastic methods in structural dynamics. Dordrecht: Martinus Nijhoff Publishers; 1987:93-133.

- [5] Hosein Naderpour, Naghmeh Naji, Daniel Burkacki and Robert Jankowski (2019) “seismic response of high-rise buildings equipped with base isolation and non-traditional tuned mass dampers”
- [6] Den Hartog JP. Mechanical Vibrations. New York: McGraw-Hill; 1934.
- [7] Soong TT, Spencer BF. Supplemental energy dissipation: state-of-the-art and state-of-the-practice. Eng Struct. 2002;24:243-259.
- [8] Kareem, A., Kijewski, Y, “Mitigation of Motions of Tall Buildings with Specific Examples of Recent Applications,” Wind and Structures., Vol. 2, No. 3, pp. 201-251 (1999).
- [9] Kareem, A., and M. Tognarelli. (Oct. 1994), Passive & Hybrid Tuned Liquid Dampers, Structural Engineering Forum: 26-30.
- [10] Sakamoto, M. (9-10 Dec. 1993), Practical Applications of Active Structural Response Control and Earthquake & Strong Wind Observation Systems, Planning Workshop for the Hong Kong International Full-Scale Control Test Facility, Hong Kong University of Science & Technology.
- [11] Dario De Domenico Giuseppe Ricciardi (2017) “An enhanced base isolation system equipped with optimal tuned mass damper inerter (TMDI)”
- [12] Xiaoyu Bai, Qigang Liang, Linsheng Huo (2020) “Vibration control of beam-model using tuned inerter enhanced TMD”
- [13] IS1893 (Part-1): 2016 ‘Criteria for Earthquake Resistant Design of Structures’.
- [14] IS 875 (Part-1): 1987 ‘Code of Practice for Design Loads (Other Than Earthquake) For Buildings and Structures Part 2 Dead Loads’.
- [15] IS 875 (Part-2): 1987 Code of Practice for Design Loads (Other Than Earthquake) For Buildings and Structures Part 2 Imposed Loads’.

Implication of Double Taxation Treaties: A Systematic Literature Review and Bibliometric Analysis

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Abstract:

In the contemporary global economic scenario, international trade and investment are highly correlated with the implementation of Double taxation treaties. Research on the topic has gained momentum in recent years because it helps eliminate trade barriers, boost trade and investment cooperation, and facilitate foreign direct investment (FDI) flows between two contracting states. The study aims to identify key contributors, key areas, and current publication trends and suggest future research directions on the topic. A systematic literature review (SLR) methodology is used along with bibliometric analysis to review 59 papers taken from six electronic databases and applied Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) from 1990 to 2022. The study has analyzed co-authorship based on authors and countries, keyword occurrence, citation analysis and co-citation analysis to identify the most influential papers, most influential authors, key journals, key publishers and collaboration of researchers all over the world. Bibliometric mapping is done better to understand the intellectual structure of this field of study. In addition, the research has highlighted the research limitations of the current study and opportunities in the literature, along with a scope of directions for future research.

Index Terms:

Double Taxation Treaty, Foreign Direct Investment, Systematic Literature Review, Bibliometric Analysis, PRISMA, Co-Authorship, Co-Citation.

INTRODUCTION

In the current era of global trade, the double taxation of income is one of the most evident barriers to international trade and investment. Double taxation is defined as "the imposition of comparable taxes in at least two countries on the same taxpayer concerning the same subject matter and for the identical periods" (organization for economic cooperation and development 2005). This double taxation may occur if one country claims taxing rights based on the taxpayer's residence while another country claims taxing rights based on the source of the income origination (Doernberg, 2004). Such double taxing treatment can be a significant hurdle to the growth and development of international trade and investment and a significant reason for income tax embezzlement (A.D Pham 2019). To overcome the issue, governments enter into a bilateral agreement known as a "double taxation avoidance treaty", "double taxation agreement", or simply "double taxation treaty". These treaties are signed to avoid double taxation of the same income of an investor by the contracting states, thereby eliminating trade barriers and boosting trade and

investment cooperation between two countries (K.V. Bhanu Murthy and Niti Bhasin 2015).

The basic purpose of a tax treaty is to prevent double taxation and tax evasion. These treaties are mainly signed to reduce the FDI barriers between two or more countries (Shah, 2010). FDI inflows are essential for trade development because they help segment production processes, allowing MNEs to diversify their product mix and market structure (Braunschweig 2014). The relationship between tax treaties and international trade is generally considered to be positive because empirical studies show that tax treaties generally stimulate FDI between the two contracting states. In the nexus between international trade and foreign investment by an MNE, substitution and complementary effects are potentially possible (A.D Pham 2019). As a result, a rise in demand for intermediate goods in the vertical chain network may result in substitution and complementary implications for trade-in final goods. Blonigen (2005) examines disaggregated product-level data to separate the two types of effects in the FDI-exports relationship and reveals that the complementary effect arises from the multi-product nature of the firm in the production chains, as well as MNEs' expectations of positive interaction between FDI and foreign trade. The impact of double taxation treaties on bilateral trade has not been explored to the same depth as FDI flows, leaving a substantial vacuum for those seeking to research the full range of double taxation treaty implications.

With increased globalization and economic integration, today's double taxation treaties play an important role in stimulating cross-border trade and investment. Over the past two decades, the number of international tax treaties signed has crossed 3000, constituting up to 65% of the worldwide treaties (Braun and Zagler 2014). These treaties constitute the largest chunk of all international agreements. Among these agreements, India is a signatory to 97 comprehensive agreements and eight limited agreements, the first going back with Greece in 1967. A significant number of economies are restructuring their tax policies to make them more conducive to foreign trade and investment. Bilateral tax treaties are part of the effort to eliminate the obstacles to double taxation of income.

Most of the studies have been conducted to investigate the empirical relationship between tax treaties and FDI. The systematic literature review, on the other hand, received the least amount of attention. The necessity for this study stems from researchers' desire to learn

more about a literature review on the subject of tax treaties. Using the SLR technique and bibliometric analysis, this study seeks to systematically analyze the literature on double taxation treaties. To the best of the researcher's knowledge, no study on a systematic literature review on tax treaties has been undertaken yet. This shortcoming formulated the basis of this study, which attempts to provide a complete, extensive, and up-to-date literature analysis on the implications of tax treaties by evaluating 59 refereed journal articles, review articles, proceeding papers and book reviews from 1990 to 2022.

METHODOLOGY

The systematic literature review is conducted based on an iterative cycle of outlining suitable protocols, including keywords search, literature searching and accomplishing the analysis (Saunders, Lewis, and Thornhill, 2009). Although, a plethora of studies have examined the impact of tax treaties on foreign direct investment (Blonigen 2000), (Blonigen and Davies 2002), (Blonigen and Davies 2004), (Egger et al. 2006), (Neumayer 2007), (Orlova, and Skiba 2009), (K V Murthy and Niti Bhasin 2015) and few studies analyzing the effect of these treaties on tax revenue of a country (McGauran 2013), (ActionAid 2016), however, there is no systematic review that summed up all these

studies and provided a deeper insight to this critical research area. Therefore, this section represents the entire procedure of the systematic review process followed in this paper.

2.1 Systematic Review Process

According to Fink (2019), in order to evaluate the literature, a methodology with a systematic approach that describes the whole mechanism of its operations and incorporates all relevant material pertaining to the field of research is required. As a result, we applied the SLR approach based on such properties, as suggested by Aquilani et al. (2017) and Tranfield et al. (2003). The starting point of every systematic review is defining the research question, which will help achieve the aim of the study in a proper direction. The first step involves selecting the most suitable search method, i.e., electronic databases, and identifying the search terms. This study selected the databases like Web of Science, SSRN, OECD Library, Emerald, Wiley Online Library and Google Scholar as digital sources. Different keywords representing the same meaning were used using the Boolean operators for reviewing a comprehensive set of the literature for the study. Different electronic databases and keywords used to search the suitable papers are described in detail in table 1 below.

Table 1 Keywords and searching information strategy

Online journal databases	Key string/Keywords used	Results
Web of Science	TOPIC= ("double taxation treaties" OR "double taxation avoidance agreements" OR "double taxation agreements" OR "double taxation avoidance treaties" OR "bilateral tax treaties" OR "tax treaties."	61
OECD Library	TOPIC= ("double taxation treaties" OR "double taxation avoidance agreements" OR "double taxation agreements" OR "double taxation avoidance treaties" OR "bilateral tax treaties" OR "tax treaties"	27
SSRN	TOPIC= ("double taxation treaties" OR "double taxation avoidance agreements" OR "double taxation agreements" OR "double taxation avoidance treaties" OR "bilateral tax treaties" OR "tax treaties"	13
Emerald	TOPIC= ("double taxation treaties" OR "double taxation avoidance agreements" OR "double taxation agreements" OR "double taxation avoidance treaties" OR "bilateral tax treaties" OR "tax treaties"	5
Wiley Online Library	TOPIC= ("double taxation treaties" OR "double taxation avoidance agreements" OR "double taxation agreements" OR "double taxation avoidance treaties" OR "bilateral tax treaties" OR "tax treaties"	13
Google Scholar	TOPIC= ("double taxation treaties" OR "double taxation avoidance agreements" OR "double taxation agreements" OR "double taxation avoidance treaties" OR "bilateral tax treaties" OR "tax treaties"	80

2.2. Preferred Reporting Items for Systematic Reviews and Meta-Analyses

This systematic review was guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA). Using the PRISMA checklist, researchers can improve their paper drafting. The PRISMA statement, according to Liberati et al. (2009),

consists of a 27-item checklist and a four-phase flowchart. Because of the nature of the research area, not all of the 27 items were suitable for use in this study. The PRISMA technique aids in the development of a relevant research question and explains the materials that may and cannot be included in the study. In order to prevent receiving a massive number of papers from the keywords used, only papers published

from the year 1990 to 2022 were included. The initial search identified 199 papers from different electronic databases used in the study, and the result of these keywords was saved related to all identified papers, such as authors' name, article title, name of the journal, volume and issue number, affiliation, keyword, abstract and document type. These papers were then checked for duplication using the same keywords to search for papers from seven different databases. After removing the duplicate documents and missing records like authors' names/journals, 105 papers remained for further screening and eligibility.

The next step involves screening the papers based on titles and abstracts. After applying inclusion and

exclusion criteria, as mentioned in Figure1, ten studies were eliminated which did not match the area of the study. The remaining papers were further examined based on document type, and only articles, proceeding papers, review articles, and book reviews were included, and the rest were excluded, which accounted for 23 papers. Finally, there were four papers written in languages other than English. After removing these four papers, 59 papers were selected for classification and analysis, as shown in Figure 1. All steps for systematic review have been performed following the PRISMA statement, which comprises these steps already explained above

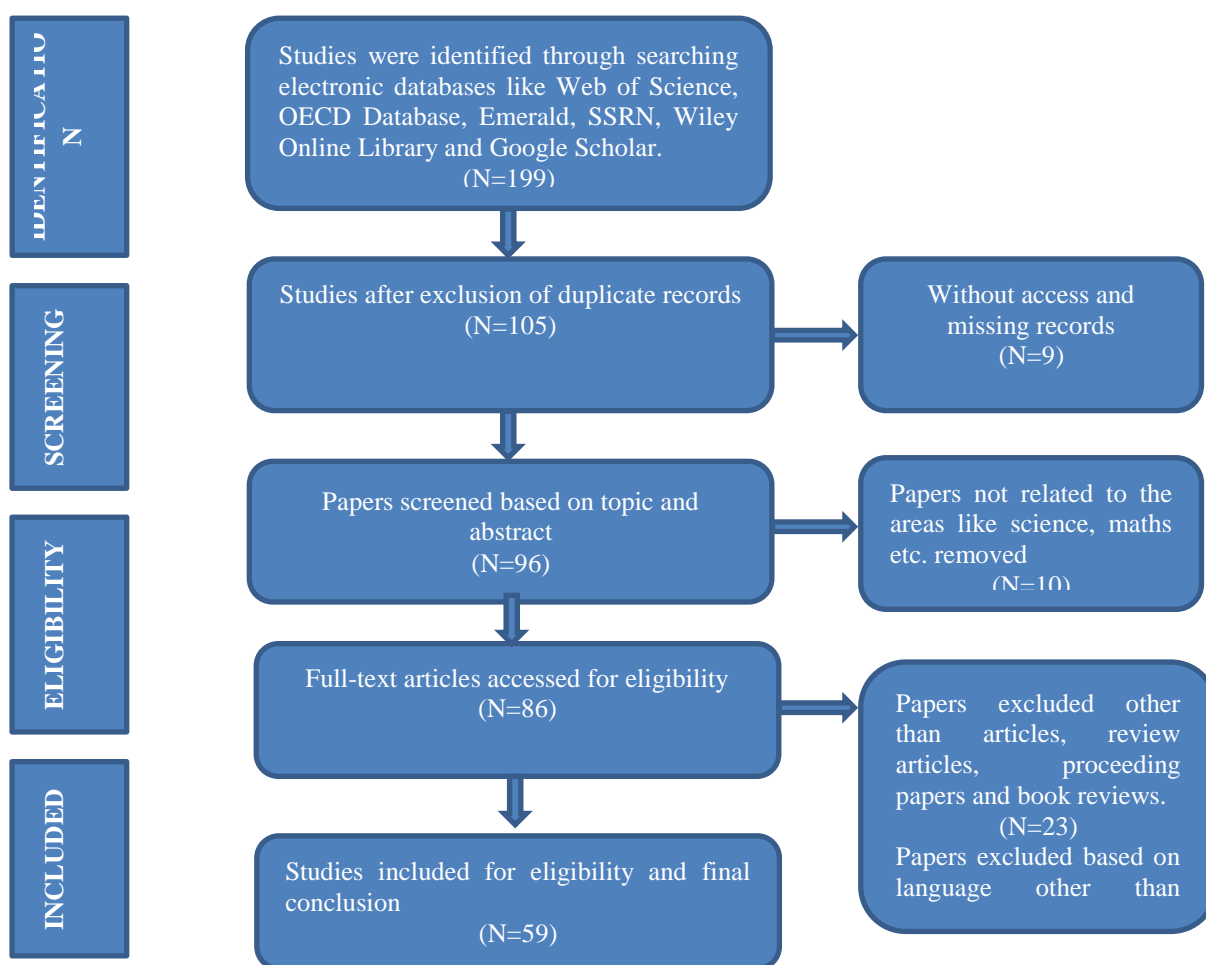


Figure 1 PRISMA flowchart for the paper selection process

2.3. Bibliometric Maps

We employed VOS-viewer (version 1.6.15) in this review, a bibliometric mapping visualization software instrument. The inventors of this programme, Van Eck and Waltman (2020), state that "it may be used to construct maps based on network data and for visualizing and analyzing these maps". Different electronic database sheets used in the study were exported to VOS-viewer software for visualization, mapping and analysis. Co-authorship based on authors

and countries, keyword occurrence, citation analysis and co-citation analysis are the items in this study that concern the researcher. For example, the association between one country and another shows the number of papers co-authored by two linked countries for co-authorship analysis. Similarly, the author's keyword link strength displays the number of articles in which two keywords are co-occurring. All this bibliometric analysis is presented in the next section of this study.

RESULTS AND ANALYSIS

The analysis in this section is based on 59 publications chosen from six different digital database sources. The analysis of papers is done based on publication year, document type, journal, countries of study, nature of the publications and research area, and bibliometric analysis. This analysis will provide insight into the topic, highlight major trends and identify future research needs and directions.

3.1. Distribution based on publication year and times cited

Figure 2 depicts the number of paper publications per year from 1990 to 2022. The publication distribution from 1990 to 2022 shows a steady and gradual growth of studies, the highest in 2022. It can be seen that the

majority of the papers were published in recent years, notably from 2009 to 2022, accounting for 67% of all articles, demonstrating a growing tendency over time. This implies that the topic of double taxation treaties remains a significant area and is likely to remain so in the future. The number of citations of these papers increases during the study, which is a suitable benchmark for evaluating the quality of studies. From figure 2, it can be seen that the highest number of times these papers were cited is recorded in the year 2021, accounting for 112 citations out of 835 total citations from 1990 to 2022. Based on the citation data of all publications, an average citation was recorded to be 32.12 per year. The average number of citations for these papers is 14.14 per item. This indicates the quality of papers used in this systematic review process.

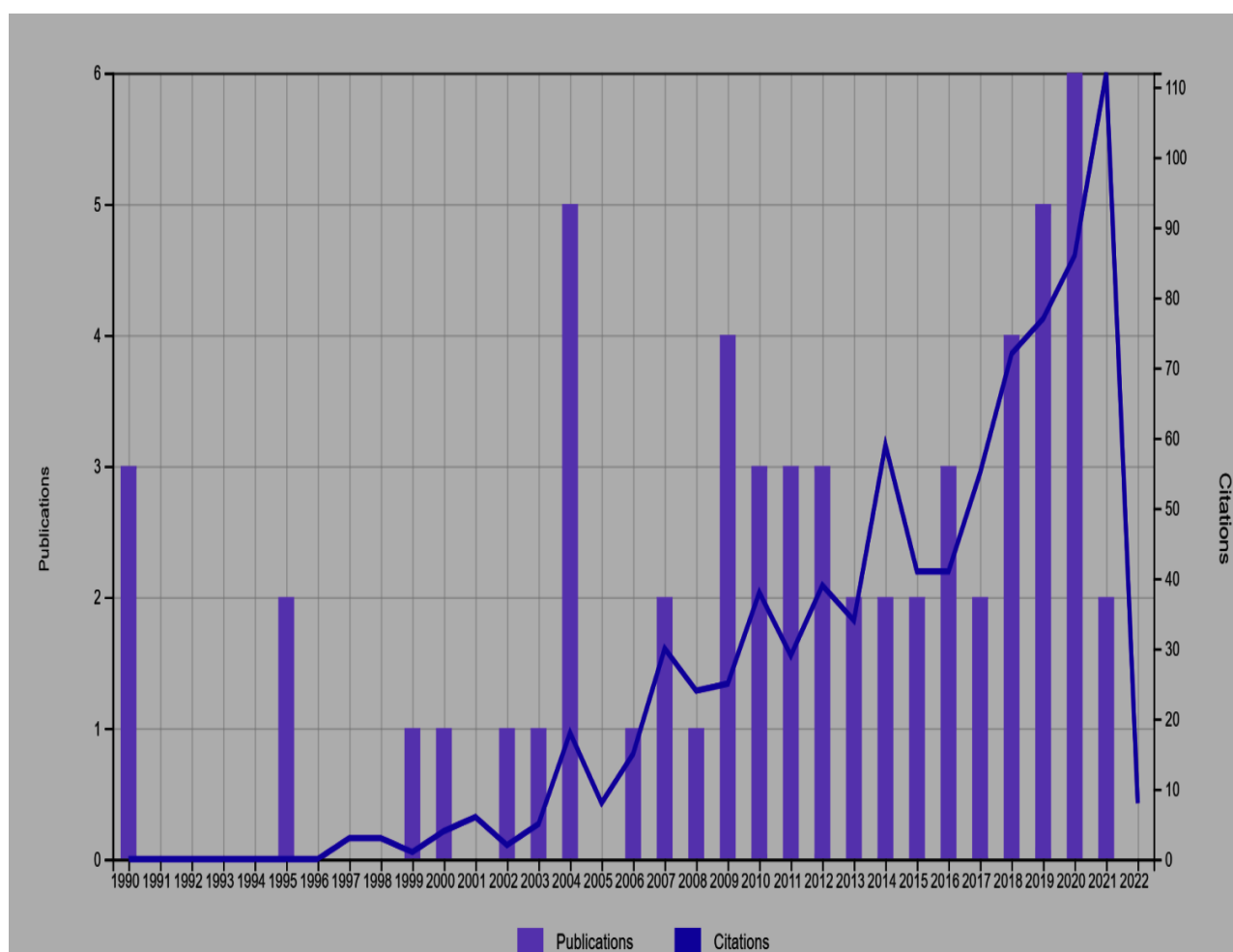


Figure 2 Times cited and publications over time.

3.2. Distribution based on journal

Table 2 shows the number of articles published by the journal and the percentage distribution of journals which publishes the most papers on double taxation treaties worldwide. International Tax and Public Finance is the journal that discusses this topic the most frequently, with 32.72% (14 articles). British Tax

Review, Finanzarchiv, Journal of Public Economics and World Economy published three articles each. International Economic Review, Journal of International Economic Law and Review of International Economics published two articles each. The remaining papers were published in other journals, described in detail in the table below.

Table 2 Frequency of articles published by the journal

Publication Titles	Record Count	% of 59
International Tax and Public Finance	14	23.72
British Tax Review	3	5.08
Finanzarchiv	3	5.08
Journal of Public Economics	3	5.08
World Economy	3	5.08
International Economic Review	2	3.39
Journal of International Economic Law	2	3.39
Review of International Economics	2	3.39
American Economic Journal Economic Policy	1	1.69
Banking Law Journal	1	1.69
Canadian Journal of Economics Revue	1	1.69
Contemporary Economic Policy	1	1.69
Economic Policy	1	1.69
Economics The Open Access Open Assessment E-Journal	1	1.69
European Journal of International Law	1	1.69
European Journal of Law and Economics	1	1.69
Fiscal Studies	1	1.69
International Business Review	1	1.69
Iowa Law Review	1	1.69
Journal of Development Studies	1	1.69
Journal of International Development	1	1.69
Journal of International Economics	1	1.69
Journal of International Trade Economic Development	1	1.69
Journal of Real Estate Taxation	1	1.69
Leiden Journal of International Law	1	1.69
Showing 25 out of 35 entries		

3.3. Distribution based on the countries

The segregation of papers based on the country of publication is essential in establishing the global status of the research on the topic. It demonstrates the overall development of the literature all around the world. The main objective of this segregation analysis is to investigate the region in which the majority of tax

treaty work has been done. Figure 3 shows that the United States is on the top of the list by publishing 21 papers accounting for 35.59% of total papers published, followed by England (9), Austria (6), Germany (6) and Nederland (4). Further, the number of papers published in developing nations is much lower than in developed countries.

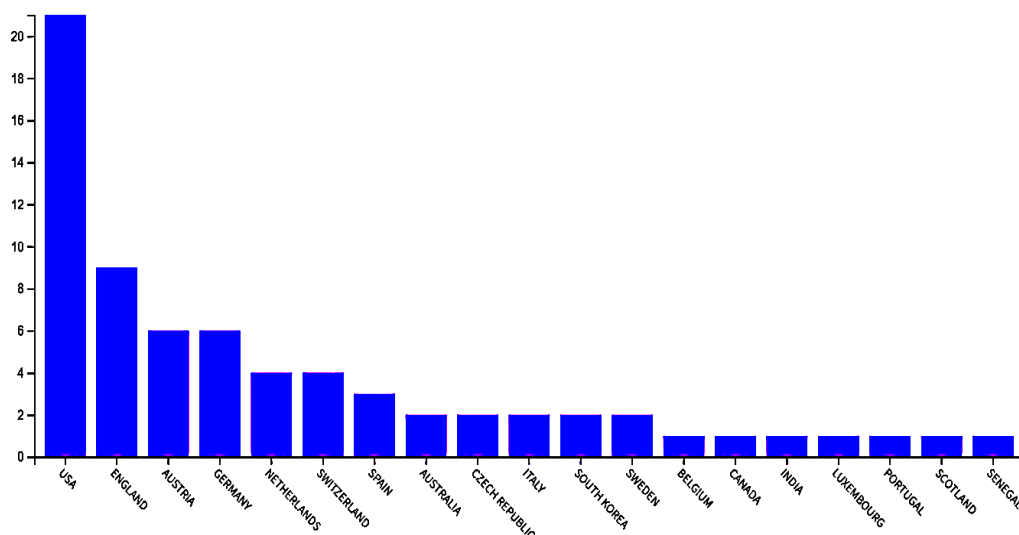


Figure 3 Country-wise paper publications

3.4. Distribution based on the type of document

Table 3 depicts the type of document, whether the type of paper is a journal article, conference, proceeding paper or book review. Most of the papers are published in the form of journal articles accounting for 93% of the total documents, followed by book reviews (5%), proceeding papers (5%) and review articles (1.69%) from the year 1990 to 2022. This is because academics and practitioners value the information and findings of articles published in the journal.

Table 3 Distribution based on the type of publication

Document type	Record count	% of 59
Articles	55	93
Book review	3	5
Proceeding papers	3	5
Review articles	1	1
Total	59	

3.5 Distribution of papers based on publishers

Figure 4 reflects that most of the papers are published by Springer Nature, accounting for 25% of the total, followed by Wiley 20%, Elsevier 8% and Oxford University Press 8%. Elite publishers of the word published the majority of the papers. Further detail on the publishers can be seen in the figure below.

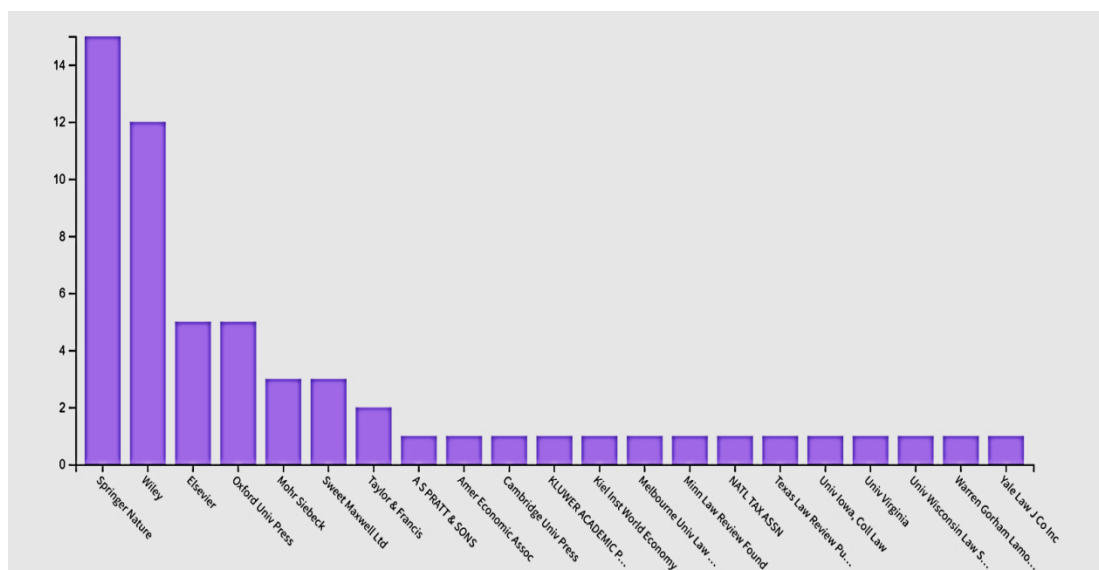


Figure 4 papers based on publishers

Co-authorship based on countries

This analysis is important to examine the countries' collaborative efforts in writing the research papers. To include only highly referenced articles, the minimum number of documents for a region was set at one, and the minimum number of citations for each country was set at five. Out of 20 countries, 16 met the threshold. The results in figure 7 showed that the USA had published the most papers among these 16 countries

accounting for 20 papers with the highest number of citations (408) and with total link strength of 4. This is followed by Germany, having eight papers with 134 citations and total link strength of 4. At the same time, the highest total link strength was associated with Austria (5), with seven papers and 70 citations. This was followed by England (3 links), Italy (3 links), Netherlands (2 links), Switzerland (2 links) and other countries with a link strength of one or zero.

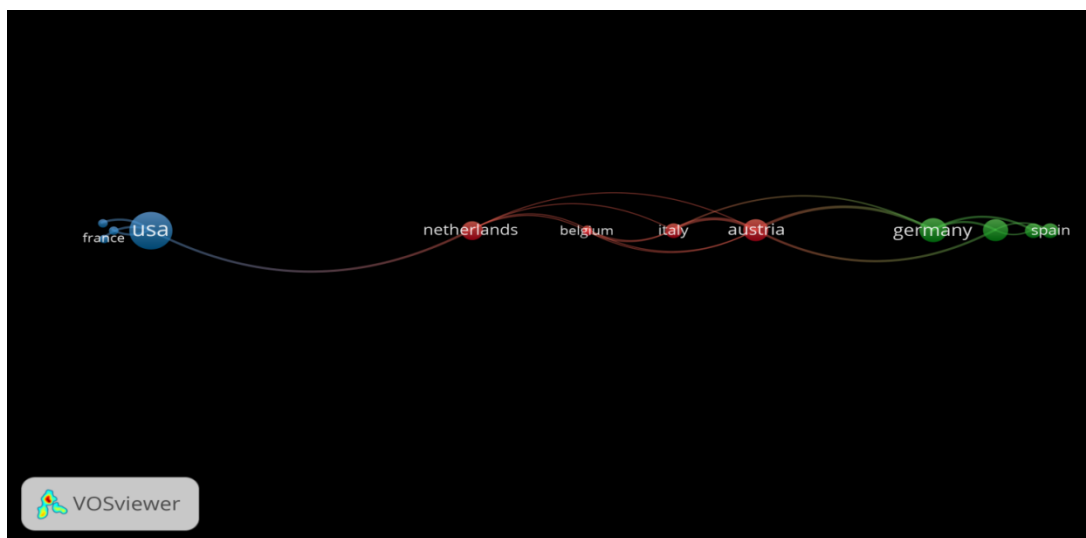


Figure 7 Bibliometric map created based on co-authorships based on countries.

Citation analysis based on documents

The amount of literature published is alone not a good metric to evaluate the quality of papers published because different papers have different standards. Thus, the quality of papers on the included studies must be kept in mind while interpreting the outcomes. To address this problem, we used citations reported in the database for each article. The citation analysis is the most often used approach for determining the quality of a paper. The citation analysis based on documents is done by keeping a minimum threshold of 5 citations per paper. Out of 59 papers, 34 papers meet the

threshold, and out of these, only 27 documents were found to be connected. For example, Figure 7 shows that the paper titled "the effects of bilateral tax treaties on US FDI activity" written by Blonigen and Davis in 2004 has the highest number of citations, accounting for 121 and 18 link strengths. This is followed by the paper authored by Davis (2004), having 58 citations and the highest link strength of 20. The other papers following the list are Jabeen (1995) with 58 citations and 12 links, Weyzing (2013) with 48 citations and seven links and others reflected in figure 8 below.

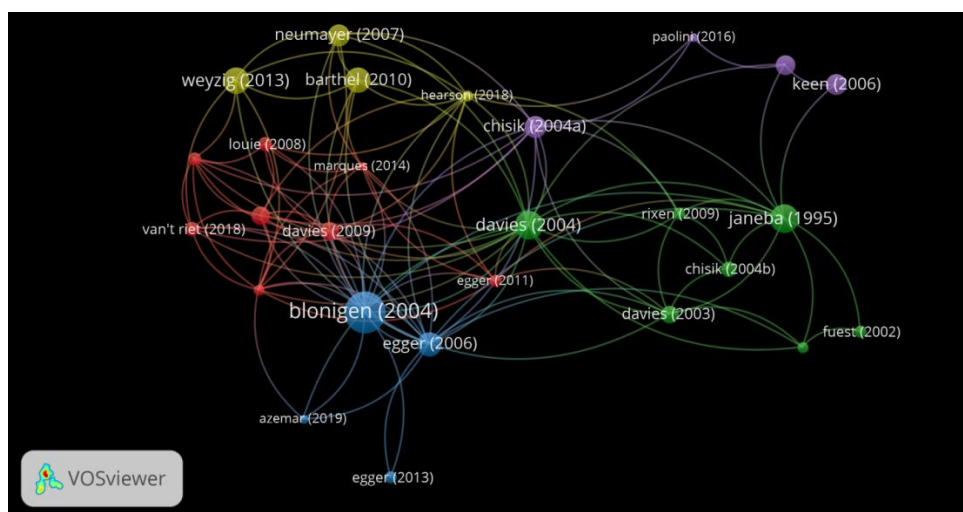


Figure 8 Bibliometric map created based on Citation analysis of papers.

CONCLUSION AND FUTURE DIRECTIONS

The purpose of this study was to carry out a detailed evaluation of the literature on the implications of double taxation treaties. The SLR methodology was adopted using the PRISMA framework to achieve the objective. A comprehensive literature search was conducted using online databases like Web of Science, SSRN, OECD Library, Emerald, Wiley Online Library and Google Scholar. The period of study was chosen from 1990 to 2022. The initial search identified 199 papers from these databases. The sample was further delimited by refining the papers based on duplication, area of interest, type of documents and language framework. As a result, only 59 papers were considered for further analysis and interpretation using the PRISMA shortlisting criteria. Following an extensive review of these publications, the papers were analyzed based on the number of papers published each year, revealing a growing tendency over time, notably from 2009 to 2022, accounting for 67% of all papers. Furthermore, the available literature was analyzed based on the source journal, country, type of article, co-authorship, citations and keyword occurrence. The findings of these analyses were discussed in this paper, which are:

- ✓ The majority of the papers were published in recent years, notably from 2009 to 2022, accounting for 67% of all articles, demonstrating a growing tendency over time. This implies that the topic of double taxation treaties remains a significant area and is likely to remain so in the future.
- ✓ Ronald B Davis has contributed the most to the literature among all the authors on the topic.
- ✓ Based on the paper citations, an average citation was recorded to be 32.12 per year, and the average number of citations for these papers is 14.14 per item. This indicates the quality of papers used in this systematic review process.
- ✓ The key journal giving the most attention to this topic is the *Journal of International Tax and Public Finance*, with 32.72% of total papers publication, followed by the *British Tax Review*.
- ✓ Most of the papers are published by reputed publishers like Springer, Wiley, Elsevier and Oxford University Press.
- ✓ The USA has published the most papers among all countries, accounting for 20 papers with the highest number of citations (408) and with total link strength of 4. This is followed by Germany, having eight papers with 134 citations and total link strength of 4.
- ✓ The most repeated keywords in the papers are Foreign direct investment (FDI), followed by tax treaty, competition and taxation.
- ✓ "The effects of bilateral tax treaties on US FDI activity", written by Blonigen and Davis in 2004,

is the most important paper based on the number of citations and link strength.

There are various recommendations based on the systematic review approach and the findings of this study that can be used as a reference for future studies. First, most of the studies analyzed the impact of double taxation treaties on foreign direct investment. Less attention was given to the other implications of tax treaties like revenue forgone, trade and other aspects of the economy. Second, the study used only six databases like Web of Science, OECD, SSRN, Wiley Online Library, Emerald and Google Scholar. Other databases like Scopus, JSTOR etc., can also be considered and also increasing period, which can provide more comprehensive findings on the topic. Third, as a review of related literature, this study lacks empirical results, which is its sole shortcoming. Finally, while this study only utilized one software program, VOSviewer, other bibliometric analytic tools could be used in future analysis.

REFERENCES

- [1] Aquilani, B., Silvestri, C., Ruggieri, A. and Gatti, C. (2017), "A systematic literature review on total quality management critical success factors and the identification of new avenues of research", *The TQM Journal*, 29(1), 184-213. <https://doi.org/10.1108/TQM-01-2016-0003>
- [2] Arel-Bundock, V. (2017). The unintended consequences of bilateralism: Treaty shopping and international tax policy. *International Organization*, 71(2), 349-371. <https://doi.org/10.1017/S0020818317000108>
- [3] Azémar, C., & Dharmapala, D. (2019). Tax sparing agreements, territorial tax reforms, and foreign direct investment. *Journal of public economics*, 169, 89-108. <https://doi.org/10.1016/j.jpubeco.2018.10.013>
- [4] Bacchetta, P., & Espinosa, M. P. (2000). Exchange-of-information clauses in international tax treaties. *International Tax and Public Finance*, 7(3), 275-293. <https://doi.org/10.1023/A:1008753629558>
- [5] Barthel, F., & Neumayer, E. (2012). Competing for scarce foreign capital: Spatial dependence in the diffusion of double taxation treaties. *International Studies Quarterly*, 56(4), 645-660. <https://doi.org/10.1111/j.1468-2478.2012.00757.x>
- [6] Barthel, F., Busse, M., & Neumayer, E. (2010). The impact of double taxation treaties on foreign direct investment: evidence from large dyadic panel data. *Contemporary Economic Policy*, 28(3), 366-377. <https://doi.org/10.1111/j.1465-7287.2009.00185.x>
- [7] Beer, S., & Loeprick, J. (2021). Too high a price? Tax treaties with investment hubs in Sub-Saharan Africa. *International Tax and Public Finance*, 28(1), 113-153. <https://doi.org/10.1007/s10797-020-09615-4>
- [8] Blonigen, B. A. & Davies, R. B. (2004). The effects of bilateral tax treaties on US FDI activity.

- International Tax and Public Finance, 11(5), 601-622. <https://doi.org/10.1023/B:ITAX.0000036693.32618.00>
- [9] Blonigen, B. A. (2005). A review of the empirical literature on FDI determinants. *Atlantic economic journal*, 33(4), 383-403. <https://doi.org/10.1007/s11293-005-2868-9>
- [10] Blonigen, B. A., Oldenski, L., & Sly, N. (2014). The differential effects of bilateral tax treaties. *American Economic Journal: Economic Policy*, 6(2), 1-18. <https://doi.org/10.1257/pol.6.2.1>
- [11] Blonigen, Bruce A., and Ronald B. Davies. 2000. The Effects of Bilateral Tax Treaties on US FDI Activity. National Bureau of Economic Research Working Paper No. 7929 Cambridge, MA: National Bureau of Economic Research. <https://doi.org/10.3386/w7929>
- [12] Blonigen, Bruce A., and Ronald B. Davies. 2002. Do Bilateral Tax Treaties Promote Foreign Direct Investment? National Bureau of Economic Research Working Paper No. 8834 Cambridge, MA: National Bureau of Economic Research. <https://doi.org/10.3386/w8834>
- [13] Braun, J., & Zagler, M. (2014). An economic perspective on double tax treaties with (in) developing countries. *World Tax Journal*, 6(3), 242-281.
- [14] Braunschweig, Anna. (2014). Double Taxation Treaties' Impact on International Trade. Master's Thesis, Lund University School of Economics & Management, Lund, Sweden.
- [15] Chisik, R., & Davies, R. B. (2004). Asymmetric FDI and tax-treaty bargaining: theory and evidence. *Journal of Public Economics*, 88(6), 1119-1148. [https://doi.org/10.1016/S0047-2727\(03\)00059-8](https://doi.org/10.1016/S0047-2727(03)00059-8)
- [16] Chisik, R., & Davies, R. B. (2004). Gradualism in tax treaties with irreversible foreign direct investment. *International Economic Review*, 45(1), 113-139. <https://doi.org/10.1111/j.1468-2354.2004.00119.x>
- [17] Coupé, T., Orlova, I., & Skiba, A. (2009). The effect of tax and investment treaties on bilateral FDI flows to transition countries. In 9th annual global development conference, Brisbane (Vol. 29, p. 98).
- [18] Daniels, J. P., O'Brien, P., & von der Ruhr, M. B. (2015). Bilateral tax treaties and U.S. foreign direct investment financing modes. *International Tax and Public Finance*, 22(6), 999-1027. <https://doi.org/10.1007/s10797-014-9340-1>
- [19] Dao, N. T., Pham, V. N., & Doan, Q. H. (2014). Analyzing the determinants of services trade flow between Vietnam and European Union: Gravity model approach, MPRA Paper No.63982. <https://mpra.ub.uni-muenchen.de/63982>
- [20] Daude, C., & Stein, E. (2007). The quality of institutions and foreign direct investment. *Economics & Politics*, 19(3), 317-344. <https://doi.org/10.1111/j.1468-0343.2007.00318.x>
- [21] Davies, R. B. (2003). Tax treaties, renegotiations, and foreign direct investment. *Economic Analysis and Policy*, 33(2), 251-273. [https://doi.org/10.1016/S0313-5926\(03\)50020-0](https://doi.org/10.1016/S0313-5926(03)50020-0)
- [22] Davies, R. B. (2003). The OECD model tax treaty: tax competition and two-way capital flows. *International Economic Review*, 44(2), 725-753. <https://doi.org/10.1111/1468-2354.t01-1-00087>
- [23] Dickescheid, T. (2004). Exemption vs credit method in international double taxation treaties. *International Tax and Public Finance*, 11(6), 721-739. <https://doi.org/10.1023/B:ITAX.0000045328.78142.d9>
- [24] Doernberg, Richard L.(2004). International Taxation in a Nutshell, (6th ed.). Thomson West, St. Paul.
- [25] Egger, P., & Merlo, V. (2011). Statutory Corporate Tax Rates and Double-Taxation Treaties as Determinants of Multinational Firm Activity. *FinanzArchiv / Public Finance Analysis*, 67(2), 145-170. <http://www.jstor.org/stable/41303585>
- [26] Egger, P., & Merlo, V. (2012). BITs bite: An anatomy of the impact of bilateral investment treaties on multinational firms. *The Scandinavian Journal of Economics*, 114(4), 1240-1266. <https://doi.org/10.1111/j.1467-9442.2012.01729.x>
- [27] Egger, P., & Wamser, G. (2013). Multiple faces of preferential market access: their causes and consequences. *Economic Policy*, 28(73), 143-187. <https://doi.org/10.1111/1468-0327.12003>
- [28] Egger, P., Larch, M., Pfaffermayr, M., & Winner, H. (2006). The impact of endogenous tax treaties on foreign direct investment: theory and evidence. *Canadian Journal of Economics/Revue canadienne d'économique*, 39(3), 901-931. <https://doi.org/10.1111/j.1540-5982.2006.00375.x>
- [29] Fink, A. (2019). Conducting research literature reviews: From the internet to paper. (2nd ed.) Sage publications.
- [30] Rosa Forte, 2004. "The relationship between foreign direct investment and international trade. Substitution or complementarity? A survey," FEP Working Papers 140, Universidade do Porto, Faculdade de Economia do Porto.
- [31] Fuest, C., & Huber, B. (2002). Why capital income taxes survive in open economies: The role of multinational firms. *International Tax and Public Finance*, 9(5), 567-589. <https://doi.org/10.1023/A:1020969604309>
- [32] Hearson, M. (2018). Transnational expertise and the expansion of the international tax regime: imposing 'acceptable standards. *Review of International Political Economy*, 25(5), 647-671. <https://doi.org/10.1080/09692290.2018.1486726>
- [33] Hearson, M. (2018). When do developing countries negotiate away their corporate tax base? *Journal of International Development*, 30(2), 233-255. <https://doi.org/10.1002/jid.3351>
- [34] Hong, S. (2018). Tax treaties and foreign direct investment: A network approach. *International Tax*

- and Public Finance, 25(5), 1277-1320. <https://doi.org/10.1007/s10797-018-9489-0>
- [35] Hong, S. (2021). Tax treaties and foreign equity holding companies of multinational corporations. *Review of Managerial Science*, Springer, 16(2), 483-520. <https://doi.org/10.1007/s11846-021-00448-x>
- [36] Howard, M., & Pancak, K. A. (2019). Do Taxes Matter to Foreign Real Estate Investors? Evidence from FIRPTA Reform. *The Journal of Portfolio Management*, 45(7), 160-171. <https://doi.org/10.3905/jpm.2019.1.100>
- [37] Janeba, E. (1995). Corporate income tax competition, double taxation treaties, and foreign direct investment. *Journal of Public Economics*, 56(2), 311-325. [https://doi.org/10.1016/0047-2727\(94\)01424-M](https://doi.org/10.1016/0047-2727(94)01424-M)
- [38] Janský, P., & Šedivý, M. (2019). Estimating the revenue costs of tax treaties in developing countries. *The World Economy*, 42(6), 1828-1849. <https://doi.org/10.1111/twec.12764>
- [39] Jogarajan, S. (2011). Prelude to the international tax treaty network: 1815–1914 early tax treaties and the conditions for action. *Oxford Journal of Legal Studies*, 31(4), 679-707. <https://doi.org/10.1093/ojls/gqr021>
- [40] Kirsch, M. S. (2009). The Limits of Administrative Guidance in the Interpretation of Tax Treaties. *Texas Law Review*, 87(6), 1063-1135
- [41] Kudrle, R. T. (2016). Tax havens and the transparency wave of international tax legalization. *University of Pennsylvania Journal of International Law*, 37(4), 1153-1182
- [42] Kysar, R. M. (2015). Interpreting tax treaties. *Iowa Law Review*, 101, 1387-1445
- [43] Kysar, R. M. (2020). Unravelling the Tax Treaty. *Minnesota Law Review*, 104, 1755-1837.
- [44] <https://scholarship.law.umn.edu/mlr/3256>
- [45] Lejour, A. (2014). The foreign investment effects of tax treaties. CPB Netherlands Bureau for Economic Analysis Discussion Paper, 265.
- [46] Liberati, A., Altman, D. G., Tetzlaff, J., Mulrow, C., Gøtzsche, P. C., Ioannidis, J. P., ... & Moher, D. (2009). The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: explanation and elaboration. *Journal of clinical epidemiology*, 62(10), e1-e34. <https://doi.org/10.1016/j.jclinepi.2009.06.006>
- [47] Ligthart, J. E., Vlachaki, M., & Voget, J. (2011). The determinants of double tax treaty formation. Unpublished manuscript.
- [48] Loretz, S. (2007). Determinants of bilateral effective tax rates: Empirical evidence from OECD countries. *Fiscal Studies*, 28(2), 227-249. <https://doi.org/10.1111/j.1475-5890.2007.00055.x>
- [49] Louie, H. J., & Rousslang, D. J. (2008). Host-country governance, tax treaties and U.S. direct investment abroad. *International Tax and Public Finance*, 15(3), 256-273. <https://doi.org/10.1007/s10797-007-9020-5>
- [50] Marques, M., & Pinho, C. (2014). Tax-Treaty Effects on Foreign Investment: Evidence from European Multinationals. *FinanzArchiv / Public Finance Analysis*, 70(4), 527–555. <http://www.jstor.org/stable/43297221>
- [51] Murthy, K. B., & Bhasin, N. (2015). The impact of bilateral tax treaties: A multi-country analysis of FDI inflows into India. *The Journal of International Trade & Economic Development*, 24(6), 751-766. <https://doi.org/10.1080/09638199.2014.960442>
- [52] Neumayer, E. (2007). Do double taxation treaties increase foreign direct investment in developing countries? *The Journal of Development Studies*, 43(8), 1501-1519. <https://doi.org/10.1080/0022-0380701611535>
- [53] Nguyen, Quynh Huy. (2018). Determinants of Vietnam's Exports: An Application of the Gravity Model. *Journal of Asian Business and Economic Studies* 25, 103–116.
- [54] Paolini, D., Pistone, P., Pulina, G., & Zagler, M. (2016). Tax treaties with developing countries and the allocation of taxing rights. *European Journal of Law and Economics*, 42(3), 383-404. <https://doi.org/10.1007/s10657-014-9465-9>
- [55] Petkova, K. (2021). Withholding tax rates on dividends: symmetries versus asymmetries or single-versus multi-rated double tax treaties. *International Tax and Public Finance*, 28(4), 890-940. <https://doi.org/10.1007/s10797-020-09637-y>
- [56] Petkova, K., Stasio, A., & Zagler, M. (2020). On the relevance of double tax treaties. *International tax and public finance*, 27(3), 575-605. <https://doi.org/10.1007/s10797-019-09570-9>
- [57] Pham, A. D., Pham, H., & Ly, K. C. (2019). Double taxation treaties as a catalyst for trade developments: a comparative study of Vietnam's relations with ASEAN and E.U. member states. *Journal of Risk and Financial Management*, 12(4), 172. <https://doi.org/10.3390/jrfm12040172>
- [58] Poulsen, L. S. (2009). The Effect of Treaties on Foreign Direct Investment: Bilateral Investment Treaties, Double Taxation Treaties, and Investment Flows. , *European Journal of International Law*, 20(3), 935–938, <https://doi.org/10.1093/ejil/chp050>
- [59] Rixen, T., & Schwarz, P. (2009). Bargaining over the avoidance of double taxation: Evidence from German tax treaties. *Finanzarchiv/Public Finance Analysis*, 65(4), 442-471. <http://dx.doi.org/10.2139/ssrn.2502529>
- [60] Roin, J. (1995). Rethinking Tax Treaties in a Strategic World with Disparate Tax Systems. *Virginia Law Review*, 81(7), 1753–1799. <https://doi.org/10.2307/1073641>
- [61] Rosenzweig, A. H. (2012). Thinking Outside the (Tax) Treaty. *Wisconsin Law Review*, 2012(3), 717-786. <https://ssrn.com/abstract=2079346>

- [62] Saunders, M., Lewis, P., & Thornhill, A. (2009). Research methods for business students. Pearson education.
- [63] Shah, M. H. (2010). Bilateral Linkages with OECD and FDI Inflows in Leading Developing Countries. *International Journal of Interdisciplinary Social Sciences*, 5(7), 255-269.
- [64] Singhanian, V.K., and Monica Singhanian. 2009. Corporate Tax Planning and Business Tax Procedures. Delhi: Taxmann.
- [65] Sundgren, P. (1990). Interpretation of Tax Treaties- A Case Study. *British Tax Review*, (9), 286-302.
- [66] Taylor, C. J. (2010). Twilight of the Neanderthals, or are bilateral double taxation treaty networks sustainable? *Melbourne University Law Review*, 34(1), 268-312. <https://search.informit.org/doi/10.3316/ielapa.201100502>
- [67] Tranfield, D., Denyer, D., & Smart, P. (2003). Towards a methodology for developing evidence-informed management knowledge by means of a systematic review. *British journal of management*, 14(3), 207-222.
- [68] Valderrama, I. J. M. (2020). BEPS principal purpose test and customary international law. *Leiden Journal of International Law*, 33(3), 745-766. <https://doi.org/10.1111/1467-8551.00375>
- [69] Van de Poel, J. (2016). In search of a new balance: The impact of Belgian tax treaties on developing countries. *European Network on Debt and Development*. https://www.eurodad.org/in_search_of_a_new_balance_the_impact_of_belgian_tax_treaties_on_developing_countries.
- [70] Van Eck, N., & Waltman, L. (2020). Manual for VOSviewer version 1.6.15. CWTS Meaningful Metrics. Universiteit Leiden. https://www.vosviewer.com/documentation/Manual_VOSviewer_1.6.15.pdf
- [71] Van't Riet, M., & Lejour, A. (2018). Optimal tax routing: A network analysis of FDI diversion. *International Tax and Public Finance*, 25(5), 1321-1371. <https://doi.org/10.1007/s10797-018-9491-6>
- [72] Ward, D. A., Avery Jones, J. F., Depret, H. R., van de Wiele, M., Ellis, M. J., van Raad, K., ... & Maisto, G. (1990). The Other Income Article of Income Tax Treaties. *Can. Tax Journal*, 38, 233.
- [73] Weyzig, F. (2013). Tax treaty shopping: structural determinants of Foreign Direct Investment routed through the Netherlands. *International Tax and Public Finance*, 20(6), 910-937. <https://doi.org/10.1007/s10797-012-9250-z>

Reflecting on the Pandemic: Its Impact and Opportunities for India

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Abstract:

The New Normal is being used to describe the rapid adjustment that Nations are making in order to survive and subsequently thrive in a drastically new environment. What was once unimaginable, is now the new normal. With the onset of the global pandemic, several economies were severely hit and had to do its best to ensure the survival of the hardest hit industries, along with promoting the ones hinting opportunities for returns.

The economic impact of the global pandemic in India has been largely disruptive. The government had to make a very conscious choice of saving lives over jobs and the economy of the country, which according to a survey resonated with the people's sentiment. However, concerns rose regarding funds for fighting the pandemic and keeping the economy alive. Such rapid changes and concerns brought forth the hybrid mode of work, thus, creating huge opportunities for every sector and setting a stage for the new normal. Not only has this impacted the current industries, but continues to push for change in all the elements of a human's survival, like, environmental concerns.

This paper will focus on the economic impact, opportunities, challenges, and trends that have emerged in India due to the onset of the global pandemic, and how India copes with hybrid mode as the new normal in a globally growing economy.

Keywords:

economic variables, opportunities, trends, industry impact, sectors impacted, government policies, investment and consumption, economy.

INTRODUCTION

The COVID-19 pandemic in India is a part of the worldwide pandemic of coronavirus disease 2019 (COVID-19) caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). Taking hint from the global surge in cases, the government was quick to take action and imposed a nationwide lockdown on March 25, 2020. This showcased the government's decision to prioritise human safety and assess the implications of the said virus. However, even before the pandemic, the Indian economy was already slowing down with deficiencies evident in both consumption and investment demand. Unlike some other countries, consumption and investment have been the main drivers of growth in India in recent times (ORF Occasional Paper, 2021). Thus, with lockdowns and restrictions, the economy had to take a massive hit in its activities, impacting growth, employment, consumption, etc. As per a report published by the Reserve Bank of India (RBI) in 2022, the Indian economy may take more than a decade to overcome the losses emanating from the COVID-19 pandemic.

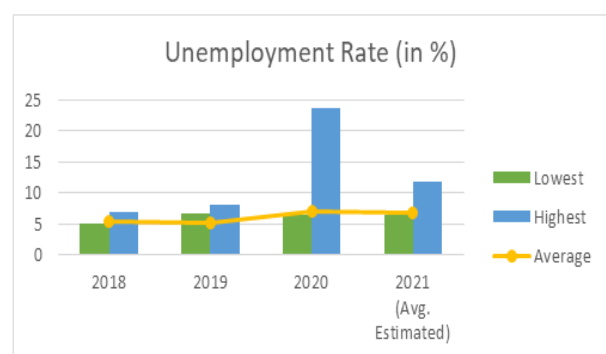
In order to propel a fast recovery and harvest the opportunities that arise in the future, we have to understand the major economic variables that have been impacted and focus on stabilising the same. The purpose of this paper is to help identify the economic impact, opportunities, and trends that have emerged in India due to the onset of the global pandemic.

ANALYSING AND IDENTIFYING THE MAJOR ECONOMIC VARIABLES IMPACTED

This segment will evaluate the pre-pandemic and pandemic period of India and attempt to identify the key economic variables that were impacted because of the global pandemic. We look into variables that have reportedly recovered, and ones that still need to recover. We also analyse newer variables that need attention post-resumption of economic activities.

2.1 Employment:

Employment was severely impacted with the onset of the pandemic as companies across various industries at different levels had shed their workforce. India also has a large number of unorganized workforce that was severely impacted, but is hard to keep a track of. The figure below takes in the highest-lowest unemployment rates of each year, along with the average for that year. The data has been sourced and compiled from CMIE and Macro Trends LCC.



Under the first lockdown measures, 26.4% of formal employment and 24.8% of informal employment was expected to be directly struck. The second lockdown impact was reduced to 20.6% and 16.6% (ILO Report, 2021).

Formal Workforce: Almost 18.9 million salaried jobs were lost due to the first wave of the pandemic. However, employment went back to pre-pandemic levels very soon. Employees Provident Fund Organisation (EPFO) is the country's principal organization

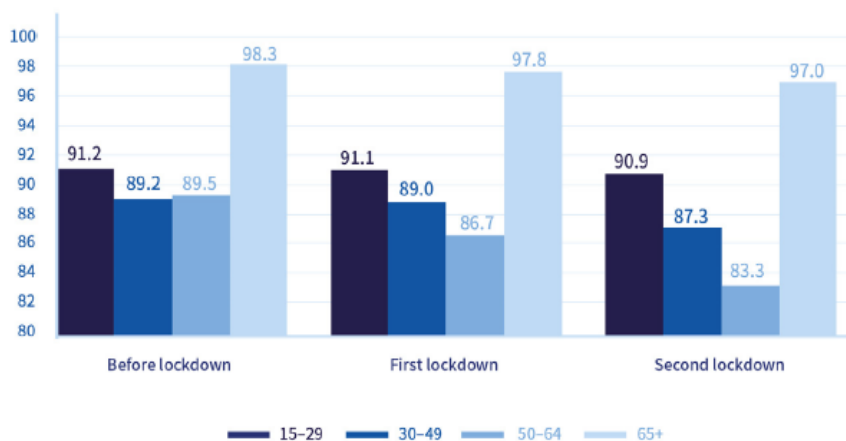
responsible for providing social security benefits to the organized/semi-organized sector workforce covered under the statute of EPF & MP Act, 1952. The labour ministry on July 2021 said that the cumulative net payroll additions to the EPFO last year was at par with the preceding year despite the Covid-19 pandemic, suggesting there were no formal sector job losses during the pandemic (Economic Times, 2021).

This does not mean there was an improvement in their salaries, as many worked with reduced salaries, or constant salaries. "If we adjust for inflation, we find that 97 per cent of the households in the country have witnessed a decline in incomes during the pandemic," said CMEI CEO Mahesh Vyas in interview with news agency PTL.

Informal Workforce: This segment not only constitutes the major workforce of India, but was also the most severely impacted. The closure of workplaces had an immediate impact on most workers, especially those who lack job or income security with a specific focus on those in the informal economy, including the own-account/self-employed workers. In April 2020, nearly 1.1 billion *informal economy workers* were in a whole lockdown scenario, with an additional 304 million workers in countries in partial lockdown (ILO, 2021).

Lockdown, reduced or complete halt of manufacturing factories, workforce dismissal, and lack of employment opportunities forced many informal workers to reverse migrate, in hopes of finding work opportunities in their hometown.

Figure 14. Share of informal employment in total employment before and after lockdown by age groups (in percentage)



Source: Authors' calculations for 2020 based on 2017-18 NSSO data.

Source: ILO Report, Impact on Labour Supply India (2021)

2.2 Growth (sector-wise impact, overall GDP estimate)

India's projected economic growth for 2022 has been downgraded by over two per cent to 4.6% by the United Nations, a decrease attributed to the ongoing war in Ukraine, restraints on energy access and prices, reflexes from trade sanctions, food inflation, tightening policies and financial instability, according to a UN report released on Thursday (Economic Times, 2022). On the other hand, credit-rating agencies have a more positive outlook for India and forecast a growth of around 6-8%, citing forward-looking trends and opportunities that can be invested and harvested for a higher growth.

Agriculture and Allied Sector (Agriculture, Horticulture, Poultry, Dairy, Fisheries and Pig/Sheep/Goat): During 2020-21, the agriculture sector came up with a robust growth rate of 3.4 percent at constant prices (PIB, 2022). However, allied sectors such as poultry, fisheries and pig/goat/sheep sector witnessed a drastic fall in demand due to misplaced rumours leading to declining production as well as declining farm gate prices, thus hampering their growth. Rural

institutions including SHGs grabbed the opportunities provided by the situation of stitching face masks, PPEs and preparation of sanitizers thereby helping the society as also earning some income for their members. These rural institutions like SHGs and FCs were also active in creation of awareness in rural areas about COVID 19 and its preventive measures.

MSME Sector: According to a survey by NABARD in 2020, the MSME sector was the worst hit sector by the COVID pandemic in terms of impact on price level of raw materials, employment, production level, consumer demand and disruptions in supply chains. Decline in production level and employment was reported in 97 per cent and 96 per cent of the sample districts, respectively. Similarly, adverse impact was reported on consumer demand and cash flow of MSME sector, thereby increasing hardship of the people at large.

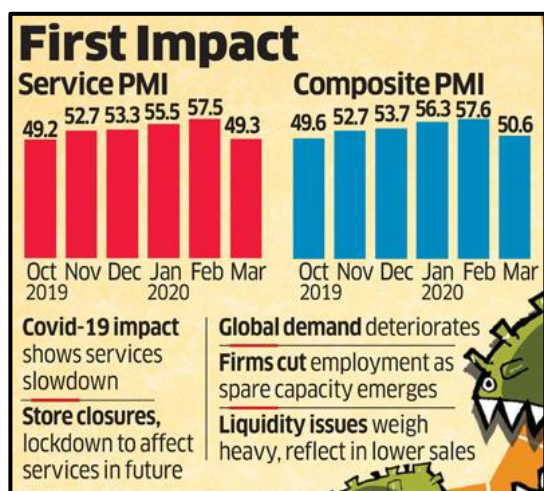
Manufacturing Sector: Manufacturing was at the receiving end in both the first and the second wave. To control the coronavirus spread, most of the manufacturing sector had to work at a lesser capacity or

shut down, and faced a liquidity crisis. Non-essentials manufacturing was hit for longer and with more severe restrictions. The fear of prolonged lockdowns led to reverse migration of workers. In addition, the global and local supply chains had also not fully normalized after the first wave. This has meant higher cost of procuring raw materials for both small and large industries.

The Purchasing Managers' Index (PMI) in May 2021, slumped to 50.8 from 57.5 reported in February, reflecting the cautious sentiments of the industry.

Tertiary Sector: The services sector was at an all-time high just before the pandemic, as its Services Purchasing Managers' Index (PMI) provided by HIS Markit was estimated at around 57.5 in February 2020. However, due to the pandemic, subsequent lockdowns (initially nationwide, later local) and stringent restrictions, the index plunged to 33.7 by June 2020, slowly recovering to 41.2 in June 2021. A reading of below 50 indicates contraction, and above 50 expansion.

Nonetheless, for an industry that contributed to more than 50% of the GDP, the services industry was the hardest hit among all sectors. Some of the major industries impacted were: Tourism Aviation, Recreation and Transport, Telecom, Hotel and Food Services, and Financial and Professional Services.



Source: Economic Times, 2020

2.3 Consumption, Investment and Savings

This segment will study the impact of the pandemic on the aggregate demand. Main focus has been on the consumption, investment, and saving patterns of the Indian households.

2.3.1 Consumption:

The consumption pattern of households drastically changed. By June 2020, the overall spending reduced by nearly 40% as compared to 2019. Even after a period of slight recovery and resumption of economic activities, households remained wary of their expenses due to anticipation of job losses or salary cuts (ET Money, 2020).

Households were able to differentiate their “needs” from their “wants” and carefully handled their expenses,

sticking to essential items for consumption and use. They held back on any discretionary, non-essential expenses.

The money that was held back from such households were more importantly used for: grocery/ration/essential items, and fixed expenses (like rent, EMIs, insurance premium, etc.). Households also made sure to keep their liabilities to a minimum or tolerable level, and instead focused their spending on items such as: sanitizers, medicines, health and life insurance, everyday essential items, personal finance. There was a noticeable decline in the following frontiers: shopping, entertainment, dining in/out, travelling.

2.3.2 Savings

Savings during the Pandemic surged, as households in India saved a massive Rs 7.1 lakh crore during the pandemic stricken financial year 2020-21, a report by State Bank of India (SBI) economists showed.



Household consumers focused on savings due to two reasons: to plan for contingencies due to the pandemic, and forced savings due to salary cuts, restricted travel (office, tour, or day-today), and meeting other liabilities. Households focused on increased savings and decreased liabilities. Cumulatively, households saved Rs. 8.5 lakh crores in 2 years' time, between 2020 and 2022.

Despite higher borrowings from banks and housing finance companies, the flow in financial liabilities from households was marginally lower in Quarter 3 of 2020-21, following a marked decline in borrowings from non-banking financial companies. India's household debt to percentage of GDP is one of the lowest across the major economies globally, at 35.8% (SBI Ecowrap, 2022).

The sentiments further recovered around March 2021 as the Reserve Bank's consumer confidence survey of November 2020 round showed a marginal improvement over the all-time low recorded in the September 2020 round, indicating scope for further moderation in household financial saving, going forward (Economic Times, 2021).

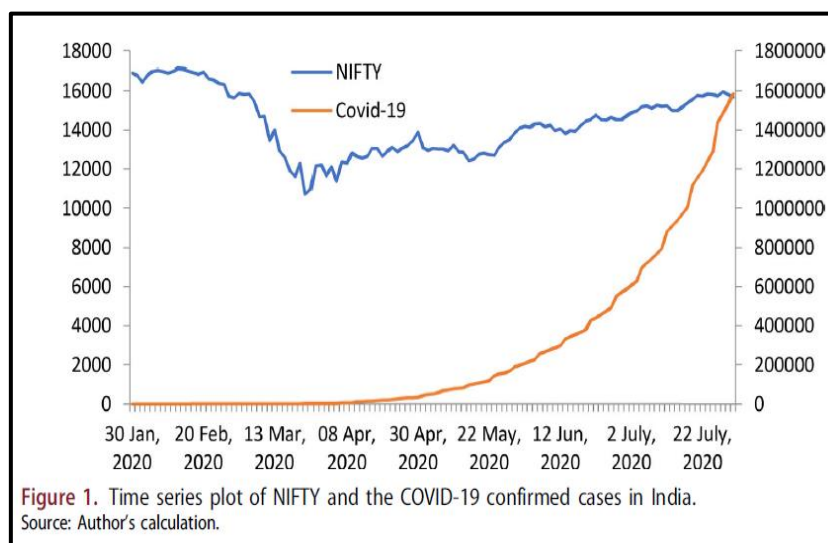
2.3.3 Investments and The Indian Stock Market

Ravi (2020) has compared the pre-COVID-19 and during COVID-19 situation of the Indian stock market. Before COVID-19, at the beginning of January, trade of NSE and BSE were at their highest levels, hitting peaks of 12,362 and 42,273 respectively, showing favourable stock market conditions. After the outbreak of the COVID-19, the stock market came under fear as BSE Sensex and NSE Nifty fell by 38%. It leads to a 27.31% loss of the total stock market from the beginning of 2020. The stock of some other sectors such as

hospitality, tourism, and entertainment had been dropped by more than 40% due to transport restrictions.

The figure below showcases the movement of Nifty alongside the number of covid cases that emerged during

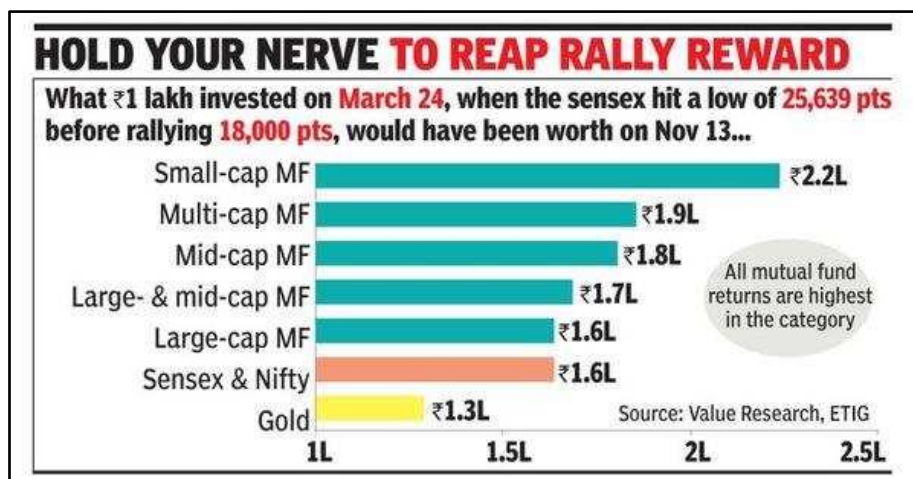
the first wave, i.e., over the months of January and July, 2020.



Source: Naik, Shaikh & Huynh (2021)

There was also a shift from momentum investing towards value investing as investors mounted huge losses due to high volatility in the market with sharp highs and lows, many losing 2-3 years' gains within a few weeks because of the pandemic. However, despite high volatility, both the indices (Sensex and Nifty) continued a steady climb, albeit slowly. As of February 2022, according to an article by the Times of India, Sensex has more than doubled since March 2020, and Nifty gained nearly 130% since March 2020.

There has also been a surge of new retail investors. In April-November 2021, nearly 221 lakhs individual demat accounts were added. Share of individual investors in total turnover at NSE increased from 38.8 per cent in 2019-20 to 44.7 per cent, from April-October 2020 (TOI, 2021). Lower valuations, increased savings potential, ease of access to digital infrastructure for trading and social norms have attracted many first-time individual investors, causing a phenomenon identified as the "new investor boom."



However, there have also been concerns of herd investing (a common phenomenon worldwide) in the mid-cap segment of the Indian stock market (RBI Article, 2022). The article conducts the analysis for the period from January 2019 to March 2020 and uses data from the National Stock Exchange, the Centre Monitoring Indian Economy and the CEIC database. This process can lead to pricing distortions in stocks and

lead to greater volatility. The article noted herding to take place only in the mid-cap segment, during foreign equity investment outflows or a down market.

"Our results are consistent with Christie and Huang (1995) who stress that a 'herding' is more likely to form under conditions of market stress. We found no evidence of herding in respect of small and large-cap stocks either for up or down market."

2.4 Government Policies and Action

The actions of the government can be broken down into the various areas of focus:

- Response to Covid
- Businesses Measures
- Employment Related Measures
- Main Measures
- Economic Measures

For further reference and reading, one can refer to the article provided by KPMG^[22].

Handling the Crisis: As per Debata, Patnaik, and Mishra (2020), Government authorities have responded to the pandemic at various levels. It had imposed travel restrictions, curfews, stay-at-home orders, and facility closures to check the movement of people. Due to the nationwide lockdown, operations of manufacturing and service sectors, school and colleges, training and research institutes, places of worship, public and private transport were suspended, as these are places of a large public gathering. Sanitization of public places which were either infected or prone to infection was encouraged at a state level. Various sports, religious, political, and cultural events were cancelled or postponed to restrict the transmission of the virus. However, essential services such as pharmacies, hospitals, banks, and grocery shops were functioning owing to their everyday requirement.

Furthermore, the Prime Minister of India appealed the people of the country to install the “Arogya Setu App” to get better awareness of the disease and connect to essential health services. The Government of India with the financial support from the World Bank had identified measures to tackle the situation (Rajagopal, 2020). The central government released Rs.28,379 crore to the states for effective handling of COVID-19. Quarantine centres and special COVID hospitals were opened to provide for the proper treatment of patients. Shelter homes for displaced people, migrant labours, and people stranded in different states was opened. The government with the help of NGOs and self-help groups continuously worked to provide for food to the people residing in these shelter homes. In addition, grocery and cash was provided to people with low socio-economic status.

Some areas where the government can further focus are as follows:



2.5 Foreign Exchange Reserves

Foreign exchange (forex) reserves are assets held on reserve by a central bank in foreign currencies, and are used to back liabilities and influence monetary policy. The forex reserves saw a significant decline during the

onset of the pandemic due to a nationwide lockdown and fear of uncertainty, however, had soon recovered. In June 2020, the forex reserves of India were rising. In the month of May 2020, reserves jumped by \$12.4 billion to an all-time high of \$493.48 billion (around Rs 37.30 lakh crore). The forex to GDP ratio was around 15%. The rise was primarily due to an increase in FDIs and FIIs, which had fallen during March-end and April.

Currently, as of June 2022, India's forex reserves currently stand at roughly \$600 billion and has been projected as a key factor in limiting the impact of global volatility on the domestic economy and markets. These reserves are crucial to combat the sharp fall in the currency amid the likely continued fight against the rising inflation, higher oil prices, and FII outflows (Economic Times, 2022).

TRENDS AND OPPORTUNITIES FOR BUSINESSES AHEAD

In this segment we analyse the rising trends and opportunities that have arisen out of the global pandemic, and how businesses can gain from the same. There has been special focus on the socio-cultural shifts and change in consumer patterns due to the pandemic and what these changes entail for any business.

3.1 Work from Home and Work-Life Balance

Due to the nationwide lockdowns, and subsequent localised lockdowns, businesses had to adapt as quickly as they could in order to survive. Work from home became essential during complete lockdowns, and companies managed to operate in this new environment of online and no-contact workspaces. Reported by many business news agencies, companies also saw a decline in their capital and rental expenses due to this new work model and many IT companies decided to completely give away with offline, at-office work style.

As of 2022, work from home is a work model that will stay as many stakeholders benefit from this. Employees saw a sharp decline in their travel time and expenses, and could spend more time with their families. Employees have also come to prioritise work-life balance, quality living, and reasonable working hours. Many are also willing to settle for lower salaries as long as it helps them sustain a better lifestyle for themselves. Health, savings, minimalism, family time have all come under the focus of many employees during their time adjusting and coping with the lockdowns and onslaught of the pandemic. In this, companies also benefitted due to lower operational costs and higher women in the workforce. The hybrid work model (few days work from office and rest from home) has turned to be the best solution for many companies, and have implemented the same.

3.2 Healthcare, Health, and Life Insurance

Another shift in consumer expenses indicated their rising focus on health and life insurance, all because of the pandemic and its brutal affect on the lives of the people.

The insurance industry has undergone a significant transformation since the pandemic struck, with demand for policies rising.



Figure: Life Insurance Funds of Households (Indian Express, 2021)

Life insurers' new business premium income had declined 27.9% in April and May 2020. However, for the full fiscal 2020-21, premium income recovered and rose by 7.49%. The insurance industry ended the last financial year at 9% growth in life and non-life combined. During the April-May period of 2021, it grew by 17%.

Similarly, healthcare has become one of the largest sectors of the Indian economy, in terms of both revenue and employment. India's healthcare industry has been growing at a Compound Annual Growth Rate of around 22% since 2016. At this rate, it is expected to reach USD 372 Billion in 2022 (Indian Express, 2021).

3.3 Manufacturing Industry

As the worst hit industry, there is a lot of scope for recovering and improving the performance of this sector. Manufacturing sector in India needs immediate attention and calls for radical policy framework to cope up from the economic hiccups caused due to COVID-19. Some areas of opportunities have been highlighted below:

- Simpler taxation system
- More flexible labour laws
- Initiatives to attract higher FDIs
- Developing the Small-Scale Industries
- Prioritising the relief and recovery of worst-hit sectors

3.4 Sustainability and ESG

The global Pandemic left experts and leaders across the globe reflecting on the decisions made over the decades of growth and development; the emphasis on sustainable economic development has only reinforced. A paradigm shift is necessary in order to prepare and build resilience for the upcoming challenges after the global Pandemic. Experts are becoming less focused on ambitious targets and commitments, values and purpose, and high-profile executive leadership as the drivers of recognized sustainability leadership. Instead, putting sustainability at the core of the business models and strategy is the most frequently cited factor as to why companies are considered leaders.

Some key developments that are pushing for sustainability are as follows:

- Shareholder activism
- UNIFIN: United Nations' Biodiversity Finance Initiative
- Growing Circular Business Models
- Improving Open Data Finance for Sustainability and Financial Inclusion

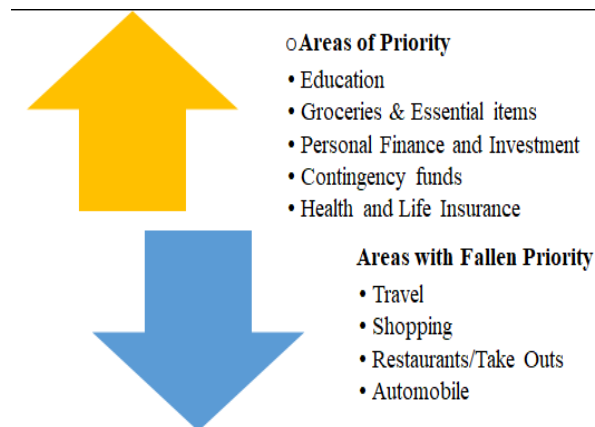
3.5 High and Ultra High Net Worth Individuals (HNI/UHNIs)

Even though the pandemic have left both the rich and the poor vulnerable it has affected the health of the affluent by a significant amount. A study has revealed that the mortality rate is low in the areas where hygienic condition is poor and instances of the spread of communicable diseases are more, compared to areas where proper hygiene is maintained and instances of non-communicable diseases like diabetes, hypertension etc are more (Financial Express, 2021). Thus, the HNIs and UHNIs are focussing on areas that safeguards and grows their wealth. According to an interview with Rajmohan Krishnan, Principal Founder and MD, Entrust Family Office – who has a long experience of handling wealth for HNIs and UHNIs, he has indicated the following key developments:

- Focus on Diversification of Assets
- Creation of Will to Avoid Family Disputes
- Investing in Real Estate as a Recovering Sector
- Need of Advisor/Custodian for Wealth Management

3.6 Growing Personal Finance Literacy

As the pandemic left many people without jobs, or with salary cuts, personal finance became one way for saving, investing, and growing their limited money. A majority of the adults under the age of 40 did not have saving habits, as against people above the age of 40. With the onset of the pandemic and sudden loss/reduction of income, the importance of saving and building contingency funds shot up as a priority and many shifted to understanding and managing their personal finances better.



3.7 Government Focus Points

Highlights: In the Union Budget for FY 2020-21, the government allocated USD 3 billion for reforms in the power, renewable energy, and infrastructure sector. A package of approximately USD 9.6 billion is being provided to restructure debt repayment for the power sector as an added aid. USD 23.4 billion was allocated for the transport sector, which included investments in roads, highways, railways, shipping, ports, and civil aviation. The introduction of the Production Linked Incentive (PLI) plan, massive infrastructure boosts - both physical and digital, as well as steps to minimise transaction costs and increase ease of doing business—all will help speed the recovery of the economy. As of 2022, India collected over USD 90 billion in GST, a growth of over 20% from previous year, showcasing that businesses have not entirely slowed down.

Opportunities: India needs to improve its current infrastructure in order to support potential firms planning to shift their manufacturing bases to the country, to aggressively promote domestic tourism, and reduce the growing inequality. Some key economic variables like, inflation, fiscal deficit, and wealth distribution must be carefully handled. Efforts to recover the severely affected industries should be of prime importance to the government in order to revive economy and boost employment.

3.8 Other Emerging Trends and Opportunities

India has a clear advantage in terms of its workforce, policy, and infrastructure. However, to build confidence amongst firms across the world, the country will have to overcome certain hurdles that would need to be addressed in the short- and long-term, post stabilization of the spread of COVID-19.

3.8.1 Opportunities for Recovery (for Businesses)

As per various industry experts, the pandemic exposed various areas for improvement in order for businesses to become more resilient. In an interview by Economic Times, the following were key strategies for a string recovery:

- Push towards digital
- Business agility
- Supply chain resilience
- Focus on localisation
- Business cost reduction
- Logistics and distribution

3.8.2 Opportunities for Start-Ups

As per various sources and articles, the following present opportunities for emerging companies and start-ups in 2022. The trends have been bifurcated for India and globally.

Indian trends: The trends in India for 2022 highlight the following possible areas for business opportunities: hyper local, clean technology, women entrepreneurship,

data analytics, supply chain resilience, biotechnology, cybersecurity.

Global Trends: The trends globally for 2022 highlight the following possible areas for business opportunities: internet of things (IoT), artificial intelligence, blockchain, cryptocurrency, no-code tech, sustainable business models and esg, flexibility, and personalisation

CONCLUSION

This paper has tried to focus on the overall impact of the pandemic on the Indian economy, and what opportunities lay ahead for a faster recovery. Most of the variables affected had recovered and even outpaced pre-covid levels. However, careful analysis suggests otherwise. Recovery is still a long way, as also stated by the RBI. However, keeping updated with the various trends and opportunities that take shape can help increase this pace of recovery. At the end of the day, India is stated to be a country with a huge market and tremendous growth potential, rivalling that of other developed and globally strong economies.

REFERENCES

- [1] <https://onlinelibrary.wiley.com/doi/epdf/10.1002/pa.2372>
- [2] <http://www.igidr.ac.in/pdf/publication/WP-2020-013.pdf>
- [3] <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7597717/>
- [4] <https://www.emerald.com/insight/content/doi/10.1108/IJPC-06-2020-0053/full/pdf?title=social-economic-impact-of-covid-19-outbreak-in-india>
- [5] <https://pdfs.semanticscholar.org/f496/f1e11d2d35ba1c652e7fb3bd41d25ac5eda6.pdf>
- [6] <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7255281/>
- [7] <https://www.orfonline.org/research/post-pandemic-economic-recovery-seven-priorities-india/>
- [8] <https://www.indiatoday.in/india/story/coronavirus-in-india-tracking-country-s-first-50-covid-19-cases-what-numbers-tell-1654468-2020-03-12>
- [9] <https://journals.sagepub.com/doi/pdf/10.1177/0020731420983749>
- [10] <https://www.nabard.org/auth/writereaddata/tender/1211203145Impact%20Assessment%20of%20COVID.pdf>
- [11] <https://www.ndtv.com/india-news/indian-economy-may-take-12-years-to-recoup-pandemic-losses-rbi-report-2934043>
- [12] <https://pib.gov.in/PressReleasePage.aspx?PRID=1793829>
- [13] https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3947856
- [14] <https://prepp.in/news/e-492-sectors-of-indian-economy-indian-economy-notes>
- [15] <https://www.financialexpress.com/economy/impact-on-indian-economy-after-the-covid-19-second-wave/2275353/>

- [16] <https://www.macrotrends.net/countries/IND/india/unemployment-rate>
- [17] <https://unemploymentinindia.cmie.com/>
- [18] <https://timesofindia.indiatimes.com/business/india-business/investment-in-the-time-of-covid-insurance-savings-take-top-slot/articleshow/79239087.cms>
- [19] <https://indianexpress.com/article/explained/pandemic-impact-on-household-savings-deposits-and-debt-explained-7381835/>
- [20] <https://timesofindia.indiatimes.com/business/india-business/household-savings-at-record-high-in-fy21-where-people-are-putting-their-money/articleshow/89340885.cms>
- [21] https://www.rbi.org.in/Scripts/BS_PressReleaseDisplay.aspx?prid=51776
- [22] <https://home.kpmg/xx/en/home/insights/2020/04/india-government-and-institution-measures-in-response-to-covid.html>
- [23] https://www.indiaonline.com/article/news-economy/year-end-review-2021-economy-shows-sign-of-recovery-from-covid-121123000438_1.html
- [24] <https://economictimes.indiatimes.com/news/economy/policy/emerging-market-economies-including-india-need-to-keep-foreign-exchange-reserves-liquid-rbi-paper/articleshow/92259632.cms>
- [25] <https://www.forbes.com/sites/bernardmarr/2021/12/13/the-5-biggest-internet-of-things-iot-trends-in-2022/?sh=7f1e5d465aba>
- [26] https://locus.sh/resources/future-of-hyperlocal-delivery-and-trends/?utm_source=resources&utm_medium=Vistors&utm_campaign=infographic
- [27] <https://uxdesign.cc/here-are-top-startup-trends-to-look-out-for-in-2020-5a37ba6c10ac>
- [28] <https://www.ibef.org/blogs/women-entrepreneurs-shaping-the-future-of-india>
- [29] <https://www.forbes.com/sites/kjartanrist/2022/01/05/2022-startup-predictions-the-trends-sectors-and-tech-worth-watching/?sh=2b662ec76082>
- [30] <https://www.fastcompany.com/90711067/5-startup-trends-to-watch-in-2022>
- [31] <https://inc42.com/features/five-indian-tech-and-startup-predictions-for-2022/>

The Concept of the Boundary Layer in the Study of Fluid Flow

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Abstract:

This paper presents review of concept of boundary layer, boundary layer theory, Prandtl's Concept of boundary layer and applications of boundary layer theory. The effect of boundary layer theory on aerodynamics, hydrodynamics, transportation, heat exchangers. Over the boundary layer, a range of velocities from maximum to zero exist as long as the fluid is in contact with the surface. Boundary layer is the term used to describe the fluid layer close to the surface when there is a general slowing down. The prior foundation of fluid dynamics is boundary layer theory. The basis of the boundary-layer theory was Ludwig Prandtl's paper On the motion of a fluid with very minuscule viscosity, which was presented at the Third International Congress of Mathematicians in Heidelberg in August 1904 and published in the Congress's Proceedings the following year. Modern science owes its significance to its continual advancement in various fields of research and technology. The boundary layer idea in fluid dynamics is distinctive and its origins date back more than a century.

Index Terms:

Boundary layer, Fluid, fluid dynamics, viscosity.

INTRODUCTION

A boundary layer in the field of fluid mechanics is a thin film of a flowing gas or liquid in contact with a surface, such as the interior of a pipe or the wing of an aeroplane. The fluid in the boundary layer experiences shear forces. There is a range of velocities over the boundary layer from maximum to zero as long as the fluid is in touch with the surface. Because of the fluid's viscosity, as fluids flow over surfaces, the molecules close to the surface come to rest. However, the slowdown in the next layers is getting smaller and smaller. Only a thin layer close to the surface is discovered to be slowing down. The fluid that lies above this layer is unaffected by the surface's existence [1].

BOUNDARY LAYER THEORY

The condition of no slip arises when a real fluid flows past a solid body or a solid wall because the fluid's particles cling to the boundary. This implies that the fluid's velocity near the barrier will be equal to that of the boundary. The velocity increases if the boundary is stationary. The condition of no slip arises when a real fluid flows past a solid body or a solid wall because the fluid's particles cling to the boundary. This implies that the fluid's velocity near the barrier will be equal to that of the boundary. Boundary layer theory is the branch of mathematics that deals with boundary layer flows [2]. Modern science owes its importance due to its progressive submission in different branch of science and technology.

PRANDTL'S CONCEPT OF BOUNDARY LAYER

The boundary-layer theory was established on Ludwig Prandtl's paper "On the motion of a fluid with very minuscule viscosity", which was presented at the Third International Congress of Mathematicians in Heidelberg in August 1904 and published in the Congress's Proceedings the following year. The boundary layer can alternatively be described as a layer in which the fluid particles are moving relative to one another. A potential flow can also be used to describe the outer flow. The Navier-Stokes equations were simplified by Prandtl's work and are now referred to as boundary layer equations.

The boundary layer begins at the leading edge of the plate. As more and more of the fluid is slowed down, the thickness of the layer increases [3]. The flow in the first part of the boundary layer (close to the leading edge of the plate) is entirely laminar. With increasing thickness, however, the laminar layer becomes unstable, and the motion within it becomes disturbed. The irregularities of the flow develop into turbulence, and the thickness of the layer increases more rapidly. The changes from laminar to turbulent flow take place over a short length known as the transition region. Now, with the progressive development of the flow down the flat surface, the boundary layer thickens. With the reducing of thickness of boundary layer and large proportion of higher speedy fluid in it, the consequence is inevitable. At low Reynolds number, viscous force dominates the whole boundary layer and flow becomes laminar, but the inertia force governs the boundary layer regime at high Reynolds number and forms turbulent flow. The one thing that he overlooked is the viscous effect i.e. the hindrance against the flow. Sakiadis [4] studied the boundary layer flow on continuous solid surfaces. He observed that the flow of this type represents a new class of boundary layer problems, with solutions substantially different from those for boundary layer flow on surfaces of finite length. Turcotte [5] developed a theory for finite amplitude, steady cellular convection.

APPLICATIONS OF BOUNDARY LAYER THEORY

In a boundary layer, the viscosity of a fluid under no-slip conditions might be crucial. Aerodynamics, hydrodynamics, transportation, wind, and ocean engineering are all impacted by boundary layer theory.

(a) Transportations (Automobiles, Trucks, Cycles)

Limit layer or boundary layers are other names for all of these slow-moving air zones. Because air is viscous, the

air molecules nearest to the surface of the car become "glued" to it. On top of these particles, the following layer of air particles moves slowly. The following layer goes a little more quickly, and so on. Undoubtedly, a car with more streamlined texture is more effective than one with less streamlined texture. An additional streamlined texture suggests that the border layer will not separate from the texture due to air movement, resulting in decreased drag [6]. Less drag causes to reduce resistance and enhance the velocity of the car and thereby escalating fuel efficiency plus economy.

(b) *Aerodynamics (Airplane, Rockets, Projectiles)*

Numerous aerodynamic problems, such as an object's skin friction drag and the heat transfer that takes place during high-speed flight, depend heavily on the flow within the boundary layer. The impacts of boundary layers are crucial in deciding how much the aircraft will drag. Therefore, it is important to reduce drag when designing the wing. The molecules in the boundary layer's uppermost layer travel at the same rate as ones outside of it. The free-stream velocity is the name given to this speed. The boundary layer starts to slow down as it travels toward the centre of the wing because of skin friction drag. As one advances away from an object's surface, the velocity changes consistently from laminar to turbulent at the boundary layer's transition point, where the velocity is characterised by erratic swirling flows. The specifics of the flow within the boundary layer are crucial for many aerodynamics issues, including the development of airfoil stall and the heat transfer that takes place during high-speed flight. The most important aspect of an aeroplane is its airfoil design [7]. Hence, airfoils are constructed to meet the desired condition for smooth take off plus landing of airplane. At the take off time airfoils need to trounce the airy resistance, consequently the airfoils are designed so that there is no separation of boundary layer but the identical airy resistance is utilized while landing because it can effectively reduce the speed of the plane.

(c) *Dimple texture of golf ball and astronautical engineering:*

Golf ball dimples have allowed engineers to rethink how they adapt aircraft machinery. Low Reynolds number turbulence is induced by the dimple patterns, which delays the flow separation inside the boundary layer. As a result, the golf ball with dimples goes farther while feeling less drag. The same dimple texture is intended to be used in spacecraft, and it is predicted that efficiency may rise by 11%, which would be a significant improvement [8]. Additional useful qualities can be found in species transport, mixing enhancement, and heat transfer mechanisms, among others.

(d) *Heat Exchangers*

The term "heat exchanger" refers to the device used to transfer heat between two fluids of different temperatures. The heat exchangers are frequently employed in a variety of applications, such as the radiator in a car where hot engine water is cooled by

ambient air. The heated refrigerant from the compressor in a refrigerator is cooled naturally into the atmosphere by flowing through finned tubes. The latent heat of condensation in a steam condenser is eliminated by moving water through the tubes. The usage of heat exchangers is also common in chemical processing, waste heat recovery, and space heating and cooling [9]. Boundary layer premises effectively manage such complexity as a result.

REFERENCES

- [1] L. Prandtl, "Über Flüssigkeitsbewegung bei sehr kleiner Reibung." Verhandl. III, Internat. Math.-Kong., Heidelberg, Teubner, Leipzig, pp. 484-491, 1904.
- [2] L. Euler, "Principes généraux de l'état d'équilibre des fluides; Principes généraux du mouvement des fluides; Continuation des recherches sur la théorie du mouvement des fluides." Histoire de l'Académie de Berlin, vol 11, pp. 274- 315, 1755.
- [3] C.L.M.H. Navier, "Mémoire sur les lois du mouvement des fluides—presented in (1822)." Mémoires l'Acad Royale des Sciences de l'Institut de France vol 2, pp. 389-416, 1827.
- [4] B.C. Sakiadis, "Boundary layer behavior on continuous solid surfaces: boundary layer equations for two dimensional and axisymmetric flows." AIChE J., vol 7, pp 26-28, 1961.
- [5] D.L.Turcotte, D.L. "Boundary layer theory for cellular convection." Int. J. of Heat and Mass Transfer, vol 10, pp.1065-1074, 1967.
- [6] G.G. Stokes, "On the theories of internal friction of fluids in motion," Trans. Camb. Phil. Soc., vol 8, pp. 287, 1845.
- [7] Schlichting, H.: Boundary Layer Theory. Eighth Ed., McGraw-Hill, New York, 2004.
- [8] C. K. Chear and S. S. Dol, "Vehicle Aerodynamics: Drag Reduction by Surface Dimples." International Journal of Mechanical, Aerospace, Industrial and Mechatronics Engineering 9, pages 202–205, no. 1 (2015)
- [9] Leong, Jik-Chang, and Chien-Yao Lin. "Effects of Golf Ball Dimple Configuration on Aerodynamics, Trajectory and Aeroacoustics" Journal of Flow Visualization and Image Processing, pages 183-200 14, no. 2 (2007).

Cyber Security for the Identification and Analysis of Anomalous Detection in the Smart Home Systems Using Machine Learning Algorithms

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Abstract:

An evolutionary development in the IT field has given rise to an online based system. Such online systems are connected to cyber. However, the connections to the Cyber are not safe as they are prone to attacks commonly called as *Cyber-attacks*. Protection of systems from these cyber based systems is important and makes one of the interesting areas of research. In the gradual progress towards *industrialization* there has been an increase in Smart City projects and thus Internet of Things (IOT) becomes important. Data sources based out of IOT such as interaction with outside world within various interacting domains, including manufacturing, transportation, healthcare sector, utility organizations etc. The working of smart cities depends on this *large data from sensor networks* and other sources. The traffic from network - a smart environment via internet is booming and posing new cyber security challenges since such IoT devices are being connected to sensors that connect directly to massive cloud servers. To eradicate such cyber-attacks development team needs to enhance its functionalities to identify the infected devices. Providing a promising affordability and sustainability in smart meters while also ensuring that it is free of cyber-attacks, we propose a work in which we identify the anomalous behavior in smart meters based on Machine Learning algorithms.

Keywords:

Affordability, Cyber, Manual inspection, simulated study, Smart Cities Sustainability.

INTRODUCTION

Over the last years, the smart cities throughout the globe has concern towards the installation of elements in technology in the lane capturing a wide view of information from urban to populate information systems that provides an opportunity for the finer services to be delivered to citizens which in turn to take an approach towards data management[1]. For installment of the networks in lane, despite all the measures undertaken the concern towards the security still exists. Even though the external providers have a proper analysis and implements accurate security methods to ensure integrity of the data, in practice, admin of smart city can't guess the range to which the information that is received are accurate and a provide a precise measure[2]. To counter this problem, application of anomaly detection measured by the smart city IT administrators is important because that they can analyze and detect when anomalous patterns in the data occurs [3]. The duty of the people in data science field is of primary significance with respect to this aspect [4]. Smart cities generate enormous data, analysis and examining this data to which they are reliable is of the concern [5]. A breakdown approach to

this issue could lead to the emergence in the description of important factor called edge values on variables of the system to identify the behaviors in abnormality[6]. Understanding and usage of the complex algorithms becomes important in the environments with huge of heterogeneous data [7]. The multivariate analysis must be supported by the anomaly detection where the patterns in the data are effective and where the usage of uncomplicated rules can be used to interpret the behavior if it is deviating from the standard or tends to be normal [8]. The standard state of the systems will be periodically learned with the help of these algorithms. In order to represent the normal state, we need to construct mathematical models hence training mechanisms must be conducted [9]. The mathematical models will be used to identify when a different value must be considered as outlier [10]. Because of the success that Machine Learning has seen in various areas, the outline, the techniques relying on machine learning can without a doubt produce adequate analysis [11]. A smart city is a complex environment in which heterogeneous data can be identified. The main purpose of this work is identifying anomalous detection by the analysis and evaluation of Machine Learning algorithms. The different applications of smart city can be connected to huge IoT components which have beneficial to the life in urban [12]. Our work is based on usage of Machine Learning algorithms in order to predict the anomalous point in the water behavior. Understanding the trend and behavior of the data is of the primary importance. The threats in the cyber security still remain as an open issue [13] and rapid increase in the technology elements in the IOT sector has led to cyber-attacks and these needs to be stopped [14]. Main goal is to develop a reliable model that helps in understanding and classifying the behavioral patterns as normal or anomalous and that model must efficiently distinguish between normal point and anomalous point with maximum accuracy [15]. Due to the enormous network traffic generation from the smart cities with respect to the various data sources especially the one that is associated with the commonly used mechanical water meters [16] on day to day basis, understanding this data becomes the primary concern [17]. Further analysis is done to address the cyber security issue that is arising in smart cities. Understanding how machine learning can be used to distinguish between normal and abnormal readings on smart water meters is crucial.

RELATED WORK

Today due to the technological advancements in the smart based solutions, these smart based solutions are connected to IOT which has increased cyber-attacks it is important to bring a solution to the smart based system which are prone to cyber-attacks. To measure the meter readings of the electricity supply and gas supply on day to day basis every homes/flats are installed with smart meters. These smart meters are connected to IOT. Therefore, it is important for us to understand the nature of cyber-attacks with respect to smart based solutions. We have proposed a solution which is based on validation of Machine Learning Algorithms to detect anomalous behavior in smart water. Giovanni Perrone *et al* [1] have presented a survey on MQTT protection solution which is based out of the biggest Cyber-attack accomplished via a military of IoT devices. The discussion of the fact that a malware named Mirai has been causing this attack which is specifically designed to attack and hack devices of IOT, converting them into bots which can be further used to carry out attacks and present a security based solution called IOT ecosystem. The researchers have focused on mqtt. The researchers have concentrated on security concepts in mqtt by explaining the network layers including transport, network, physical, application and the methods that can be used for mqtt in these layers to provide security has been explained. The detailed discussion on how the different layers can be provided with security is the result that the author has tried to explain. However, the attacks related to the other malware including spread malware attacks, ddos, and brute force attack isn't included in this paper. Our proposed work is different from this because in our work the usage of different validation of Learning of the Machine Learning algorithms to extrapolate results. E. Ciklabakkal et al [2] has proposed a study on ARTEMIS which is a detection of intrusion system for Attacks on intrusion in IOT. The study looks at a reality world IoT industrial scenario by creating a smart home automation system that employs machine learning to identify cyber-attacks. Using MQTTset, another dataset was used to assess the efficiency of algorithms in classification on malware in IOT infections and IoT innocuous traffic. This data collection includes the sensors have been put to good use. The dataset is based on MQTT set, a new IoT dataset. MQTT set, in particular, incorporates interactions regarding protocol, as well as a protocol publish/subscribe and the OASIS group's IoT standard protocol. The dataset has been validated using the MQTT set in question. Various IoT sensors are deployed and connected to a MQTT broker. Mosquitto v1.6.2 is the broker under consideration is built on Eclipse. The researcher demonstrated that after the pre-processing and feature extraction stages completed, data were mingled to produce one dataset that included both the legitimate as well as malicious traffic data. As an alternative, the network is constructed using the Keras (Sequential) sequential method. Our work differs greatly

from this because it uses the decision tree algorithm and ada boost to demonstrate how to achieve accuracy and an F1 Score. S. Andy, B. Rahardjo *et al* [3] have proposed work which is based on Attack eventualities and protection MQTT investigation verbal exchange In the IoT system, protocol. The paper discusses potential MQTT protocol attacks (How an attack on the MQTT protocol is carried out). The information on the victim system where the attack was carried out is presumed to be unknown. Many IoT systems lack proper security mechanisms for a variety of reasons. It then shows and evaluates how one can easily attack the protocol employing a variety of attack modus operandi. At last, after investigating flaws one can raise the security awareness, particularly with relation to MQTT protocol, and thus implementing the security mechanisms in the MQTT system to avoid such attacks. Black box penetration testing is the term for this type of assumption. The search result showed Shodan indexes 24998 brokers with the default port at the time, (April 27 2017). Aside from the result, each broker's MQTT connection code is provided to the right of the result. All brokers with a connection code of "0" are more vulnerable to attack because they do not use a client authentication mechanism, making them anonymous publishers or subscribers. Data privacy, data security, port secrecy, authentication and botnet over MQTT are some of the security challenges that need to be addressed. According to the findings, one of the used protocols is MQTT, in the IoT systems, and this article discusses many possibilities for attacking this protocol. The first scenario commences in a Using the Shodan search engine, one can scan the public network for MQTT public servers and launch an attack of smurf the servers or broadcast false information to the clients' connected devices (clients). However, depending on the nature of MQTT publish and subscribe, this public broker could be a viable option to control the botnet. An attacker can then sniff the local network from there. Furthermore, utilizing a nonstandard port (port obscurity) has no effect on MQTT security. Hindy, H et al [4] have introduced a system which is on machine learning that consists of Case Study of a System for detecting IoT intrusions using MQTT (Data set on MQTT-IoT- IDS2020). This paper includes a study on MQTT employing the MQTT-IoT- IDS2020 data set. Analysis of a new MQTT dataset containing both events of benign and malicious. Considering value on employing features which are high-level (based) for the construction of the IDS. Six discrete machine learning approaches are considered to evaluate the suggested model. Examining the differences between MQTT-based and general attack detection, which emphasizes the unique configuration and consequently needs of MQTT (IoT) networks. The study concludes with a discussion of the dataset generating setup as well as an overview of the dataset and retrieved characteristics. The dataset was created with MQTT sensors in mind. The dataset contains five regular operating scenarios and four attack scenarios. Tcpdump was used to collect the data.

Gathering of Ethernet trac and then exporting to pcap les, the packets are collected. The following instruments were used: For scanning assaults Nmap is used, for replication of the camera feed stream VLC and MQTT brute-force attack.¹² is used for the MQTT-PWN. Sensors of MQTT, a broker, a machine simulation of feed from camera, and an attacker consists the network. Using the MQTT command "Publish," all 12 sensors broadcast randomized messages during regular operation. Simulating different usage scenarios, the messages length varies amongst sensors. The content of the messages is produced using a stream on UDP, for the replication of the camera feed. To provide a more realistic environment, each network emulator drops packets at a rate of 0.2 percent, 1percent and 0.13 percent. This dataset is significant in four ways: The dataset represents a real- world normal operation on MQTT IOT network. Both the generic networking scanning attack and a MQTT brute-force attack included in the dataset. This dataset can be utilized by scientists to create IoT intrusion detection systems should be tested. For the first time in this dataset, MQTT scenarios and attack data have been included. Five-fold cross validation was used to evaluate each experiment. Overall accuracy is calculated using the following formula: Positive (P) represents the overall number of attack instances, Negative (N) represents the overall number of benign cases. True Positive (TP) stands for accurately identified attack instances, True Negative (TN) for accurately identified benign instances. Decision Trees (DT), Support Vector Machine (SVM), k-Nearest Neighbors (k-NN), Gaussian Naive Bayes (NB), Logistic Regression (LR), and Random Forests (RF) were some of the machine learning methods used Based on testing results, ML based features are better fitting for distinguish MQTT-based attacks and benign attacks because of their shared traits. The weighted average for unidirectional and bidirectional features recall increased 75.31 to

93.77 percent and 98.85 percent. Meanwhile, the weighted average precision for unidirectional and bidirectional features rose from 72.37 to 97.19 and 99.04 percent, respectively. Test results focused on the unique issues that IoT IDS encounter as a result of their unique communication patterns. The difficulties in distinguishing MQTT-based assaults from routine operations exemplified the issues. Vaccari, *et al* [5] has proposed a new Data set on MQTT for machine learning strategies. A dataset on MQTT devoted to the protocol on MQTT has been proposed. Combining cyber-attacks on the MQTT network along with data from the legal system made it possible to demonstrate the creation of the dataset as well as validate through a hypothetical detection system. The results demonstrate how MQTT set could mode training for machine learning for the detecting systems which are capable of securing IoT environments. To connect IoT sensors, a MQTT broker is used. The network I comprised of eight sensors and is built on an "Eclipse Mosquitto v1.6.2". Scenario under

consideration comparable to a smart house setting for sensors with unique IP addresses retrieve information such as Motion, smoke, CO-Gas humidity, door opening/closing, light intensity, temperature, CO-Gas humidity, and fan status at various time intervals. The sensors are divided into two rooms. In a restricted access area, sensors communicate with the broker (both physically and digitally). Broker's traffic is indeed captured. It was decided that "random" communication would be used. Each sensor possesses a topic and data profile that the MQTT broker can use. During creation of MQTT set data, traffic created by MQTT is collected as a "packet capture (PCAP)" file. The algorithm was validated by considering cyber-based attacks. Neural networks, random forests, Naive Bayes, Decision trees, Gradient boost, and Multilayer perceptron were taken into account as algorithms for validation. The findings indicate that future studies will concentrate on the implementation and validation of this dataset in an industrial setting, like a network for industrial IoT or a smart building (Industry 4.0). In this work researchers have compared the analysis and shown the validation of different machine learning algorithms, however, the discussions regarding the accuracy and F1 score of the algorithms hasn't been shown. We propose a work to detect the anomalous behavior in the smart water meters by validating Algorithms of various Machine Learning. Our outcome states that the machine learning is important in understanding the behavioral pattern as well as trend in the flow of data with respect to smart meter. Dataset on MQTT The project's goal is to create a dataset focused on IOT communications-IOT dataset. The dataset was created with IOT flock. It is a tool for creating IoT traffic that is open source. The tool employs various cyber-threats against MQTT. We use IOT Flock to generate the dataset because we are focusing on cyber security in smart meters. The dataset that we have used for our proposed work consists of train_70.csv (training dataset) and test_30.csv (testing dataset). When the model is new and we want to train the model, we use the dataset which is called training data or training dataset. A training dataset is required to better understand the characteristics of a model. After training a model with the training dataset, we need

a testing dataset to assess the model's effectiveness. Is model able to perform as per our predictions, will be better understood using test dataset. The broker that we have used in our implementation is based on EMQ X. while the network is composed of sensors. In order to achieve connectivity, we use IP address to uniquely identify the sensors.

SYSTEM DESIGN AND PROPOSED ARCHITECTURE

Similar to how a conventional metre records data on energy usage, a smart metre does the same [18]. A metre reader is no longer necessary thanks to the smart metre, a digital device that communicates with the utility remotely by sending the consumption data to them every

15 to 60 minutes [19]. apart from monitoring the energy consumption the smart meter alerts the usage right away if the region experiences a power outage smart meter

notifies the resolution once everything comes to normal [20].

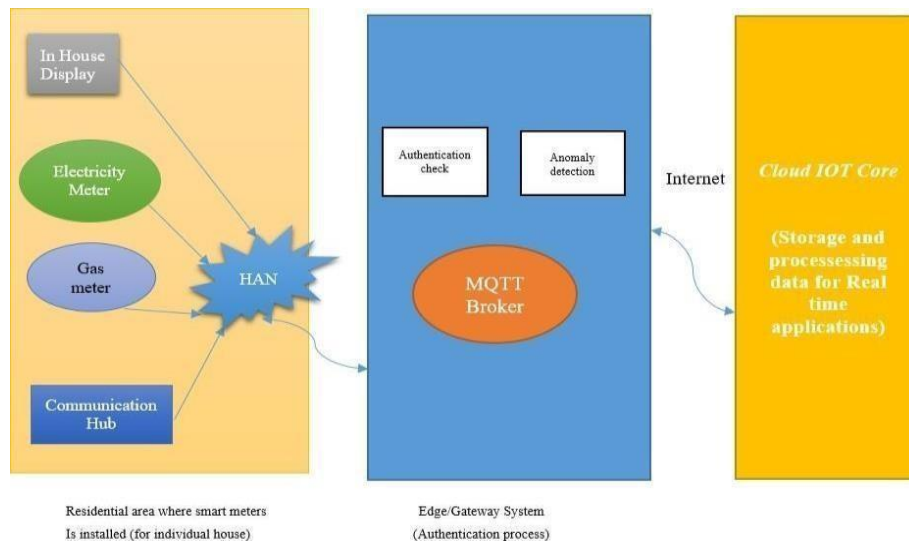


Figure 1: Proposed Architecture of work The detailed description of proposed work

As shown in (figure 3). The block diagram can be divided into 3 blocks. 1st block consists of Consumer premises. This consumer premises are individual house where the smart meter is installed, here is where the metering installments and smart meter readings in real time takes place. This consumer premises consists of Gas meter, electricity meter, in house display in our work we have used SMETS2. (SMETS2) basically stands for Smart Metering Equipment technical specifications. Since we have used the gas meter, electricity meter, these readings must be recorded. SMETS2 records this information and send it for consumer premises. The second block is Authentication process, the data collected from communication hub is passed on to authentication check to verify the

authenticity of the data that is received This authentication check, classifies the data into anomalous and non- anomalous. This step is referred to as anomaly detection. Once the data has been classified it is passed on to MQTT broker, MQTT broker acts as a gateway, it acts as an intermediate between sensors and Server. The purpose of anomaly detection is to identify patterns whose behavior is regarded abnormal in comparison to typical nodes. Anomalies can be caused by an intrusion detection system, fraud detection, or data leaking. Gateways act as the entry and exit points for the network and require data to pass through or communicate with them before being forwarded. The third block is Cloud IOT Core which is used for data storage and data processing in real time. Proposed Architecture

Table 1: Devices selected for study in this work along with their functions:

Device	Function
Smart Electricity meter	Smart meters enable electricity distribution firms to do near-real-time power-quality analysis.
Smart Gas meter	A smart meter is an updated version of traditional meters used to measure electricity and gas.
In house Display	The IHD displays your current electricity and gas consumption.
HAN	Through a network connection, the Home Area Network allows smart devices to communicate and share resources.
Communication HUB	A centralized communication hub, on the other hand, consolidates all communication in one location. It's smooth and easy.
Communication Service provider	Utilizing network infrastructure as a rich and useful platform.
Authentication process	Process of conforming the originality of the data
Authentication check	It is a verification process done in order to check authenticity
One factor authentication	SFA is a method of securing access to a specific system, such as a network or website that uses only one type of credential to identify the party requesting access.
Anomaly detection	Identify patterns whose behavior is regarded abnormal in comparison to typical nodes.
MQTT broker	Represent network's entry and exit points
Cloud IOT core	Storage and data processing needed for real time applications

MQTT validation

Data validation is the process of ensuring the model is giving the accuracy for the considered dataset. In our work, for validation purpose, we have used different machine learning algorithms to understand how the model is performing for the given dataset and generating F1 score. Accuracy is how well the model is performing, identifying patterns and relationship among variables used in dataset. F1 score is a measure of how many correct predictions the Machine learning model has made. In our work we have used Neural Network, KNN, Naïve Bayes, Decision tree, Ada boost algorithms. With the intention of gathering the information required to define anomalous, and thus attackable, traffics/

connections. The stage goes critical as the algorithm used may produce varying results depending on the features selected. Furthermore, because they must represent and characterize a distinct type of network traffic, the specified characters must be accurately picked up. Following the definition of the proposed architecture, we decided to use the dataset generated by IOT flock, which is a publicly available MQTT dataset, for detection purposes. The purpose of data preprocessing has been to characterize anomalous behavior and extract important features from the dataset. This step is critical because the algorithm used may produce different results depending on it.

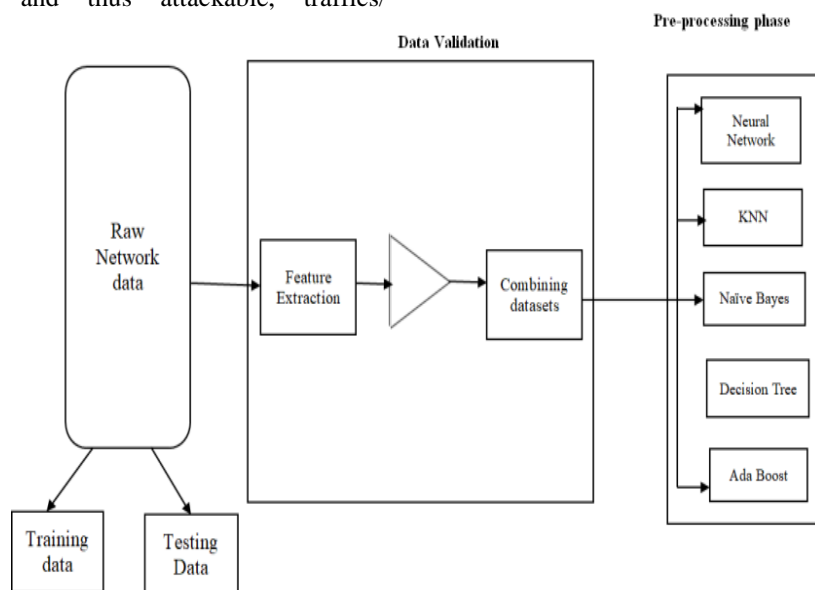


Figure 3.1: Considered workflow for the dataset

EXPERIMENTATION AND TEST RESULTS

Once the workflow has been designed as shown in (figure 3.1). The objective now is to assess each of the earlier selected intrusion detection techniques after the pre-processing and feature extraction processes are finished

Step by step experimentation has been discussed.

We first propose an architecture which is used for identifying anomalies in smart water meter using cyber security and IOT. These anomalies are the patterns that deviate from the normal behavior. The anomalies associated with smart water meters can be recognized as 1) Data in the communication network can be received incorrectly, 2) Behavioral change in the consumption of water. 3) Manipulation or fraud in the digital metres. Furthermore, it continues to be challenging to connect a specific pattern to a departure from typical water consumption behaviour. To put it another way, figuring out what constitutes normal behaviour heavily depends on context—not just the context of a specific person, but also the patterns displayed in the area in question. The

first challenge, according to the authors, is figuring out what constitutes typical, expected behaviour. When it comes to water intake, normal behaviours have tendency to change over time and reveal a cyclical pattern. This causes different definitions of normality to emerge, some of which are perceived as more widespread. In this study, we examine time series that, when viewed in isolation, exhibit patterns that could be interpreted as deviations from typical (i.e., more frequent) intake. Although the patterns can be categorised as normal behaviour when they are examined in their context. In other words, the context of a particular circumstance informs the determination of abnormal behaviour (i.e. region and fare). The dataset that is been used for our work is based on MQTT dataset, training and testing dataset is used. For the execution we have used Jupyter, where the training and testing dataset are first uploaded, data validation is performed and code is executed. Once the validation is performed the best algorithm resulting with the maximum accuracy is considered as the algorithm that best suits our proposed work. Selected algorithms are

written in Python and implemented with popular Modules and tools. To avoid deviations or data changes, all algorithms were tested on the identical dataset and host (in particular, Intel® Core™ i-7-8565U CPU@1.80GHz). Using a sequential algorithm, the neural network is constructed, except for final hidden layer, which is initialized using a softmax activation function, the hidden layers are distinguished. Finally,

Gaussian Naive Bayes technique is used for configuration of the naive Bayes approach (Gaussian NB). We used a seed with the value 7 from the algorithms to duplicate the tests. The dataset must be split into training (70 percent of newly created records) and test (the remaining 30 percent of newly created records) portions in order to test the selected intrusion detection methods (30 percent of generated records).

Table 2: Accuracy, F1 score, and execution time for each machine learning algorithm

Algorithm	Accuracy	F1 Score	Training Time(s)	Testing Time(s)
Neural Network	87.1368	0.86665	144.09592	0.25088
Decision Tree	90.31322	0.90090	161.49860	0.03487
KNN	59.71195	0.58506	173.51887	508.420
Ada Boost	0.780511	0.74058	14683.561	0.05037
Naïve Bayes	67.08631	0.75816	144.09592	0.25088

The F1 rating takes both recall and precision into account; the combined result is the F1 score in general. From the above analysis we find that the Decision tree which gives the accuracy of 90% is the best algorithm according to our analysis. Decision tree is the best algorithm as it gives the predictions 90% correctly. Whereas, Ada boost with Accuracy of 0.780511 is the worst algorithm according to analysis of our work because it gives correct predictions only 0.78 percent. Bar graph is used to compare the elements between groups over the time intervals. (In our work, we have used Bar graph to explain how the distribution of accuracy vs. machine learning algorithms is used). As shown in (figure 4)

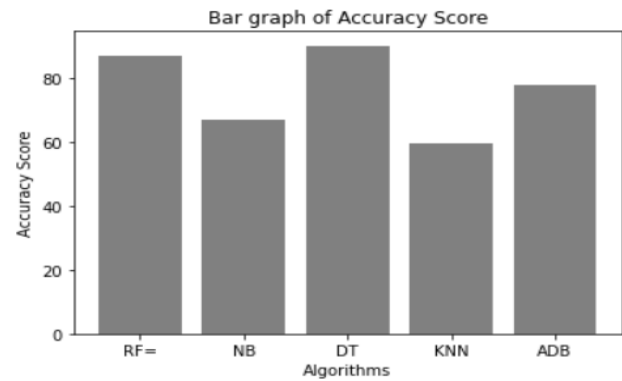


Figure 4: Bar graph (Accuracy score vs. Algorithms)

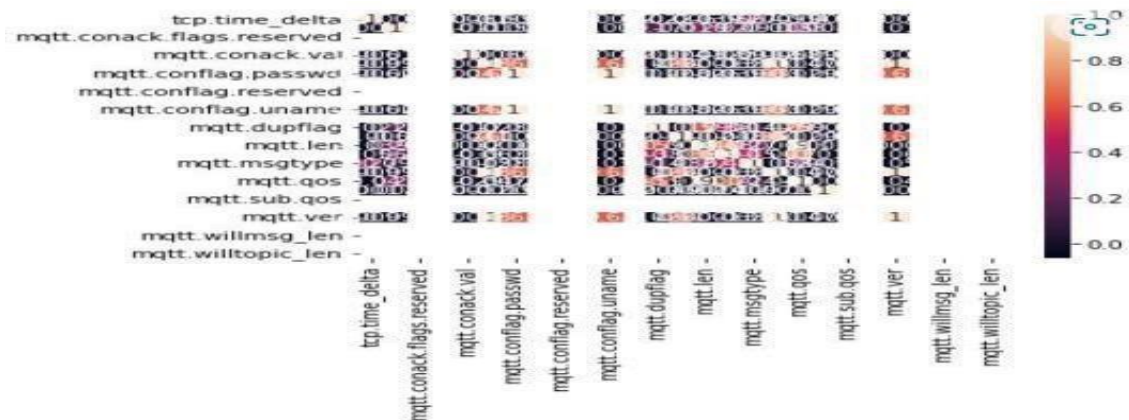


Figure 4.1: Correlation matrix

The above Correlation matrix as shown in (figure 4.1) we have 14 coefficients represented on X axis and Y axis as Coordinates. Now, let us understand each coefficient present in Correlation matrix

- The values obtained from above Correlation Matrix are [0.0, 0.2, 0.4, 0.6, 0.8, 1.0].
- The description of the values as obtained from the above table is as follows:

- The value 0.0: explains that there is no linear relationship between the 2 coefficients.
- The correlation between the two coefficients is positive, but it is not very strong, as indicated by the value 0.2. (Very slightly the coefficients are related and this is less likely important).
- The value 0.4 in correlation matrix means that it is less correlated.

- 0.6 is more(moderately) correlated than 0.4, while
- 0.8 is stronger(Higher) correlation and is the strongest (highest) correlation.
- For further understanding the range above 0.4 are strong correlations,
- Range values: While 1.0 being the highest correlation.
- Range 0.2 to 0.4 are intermediate correlation.
- Range Below 0.2 are least correlated.
- To explain the analysis of our considered work. We have set the threshold of 0.4 that is the coefficients from 1.0 to 0.4 are explained.
- The cream color in the correlation matrix is the region of 1.0 in accordance with our analysis, and the correlation matrix considers the region of 1.0 to have the highest correlation. According to analysis tcp.time.delta, tcp.time.delta which is present in the 1st coordinate of X axis (tcp.time_delta) and 1st coordinate of Y axis (tcp.time_delta) and according to our code analysis of correlation matrix it is cream color. Since the 1st coordinate of X axis and 1st coordinate of Y axis is represented in cream color, we conclude that the coefficients tcp.time_delta, tcp.time_delta are highest correlation.
- Further Mqtt.conack.flags.reserved which is present in 2nd coordinate of X axis and mqtt.conack.flags.reserved which is present in 2nd coordinate of Y axis and according to our code analysis of correlation matrix it is cream color. Since the 2nd coordinate of X axis and 2nd coordinate of Y axis is represented in cream color, we conclude that the coefficients "mqtt.conack.flags.reserved", "mqtt.conack.flags.reserved" are highest correlation.

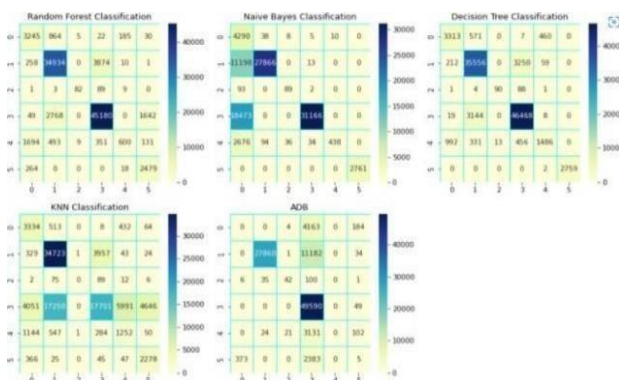


Figure 4.2: Multi Class Confusion matrix

Our dataset is large, in which we have 33 features, the representation of this (33 columns and 33 Rows) isn't an easy task also we would not get an accurate visualization since the dataset is large. Hence we need to consider the part of dataset and then represent that in the form of correlation matrix. In our analysis of Multi Class

Correlation Matrix as shown in (figure 4.2) we have considered the 6 features as the 6 Classes, let's assume this 6 features as, "Class 0", "Class 1", "Class 2", "Class 3", "Class 4", "Class 5". Predicted values are shown in rows, while actual values are shown in columns. When we represent this in the form of matrix, we get the above figure which is shown above. Let's try to understand what each class represents

- Firstly, we have the feature tcp.flags it is a TCP flag. The first feature has been considered as Class 0 for the simplification purpose.
- The second feature is tcp.time_delta which describes that TCP establishes a connection with the recipient first before sending data in PDUs, or packet data units, which are carried by IP packets.
- Because it maintains the stream of data between the two ends during transfer, it is known as a stream.
- For simplification purpose the second feature (tcp.time_delta) is considered as Class 1.
- The third feature is tcp.len which describes TCP segment length for simplification purpose we have considered the third feature (tcp.len) as Class 2.
- The fourth feature is mqtt.conack.flags which is the Acknowledged Flags of MQTT.
- For simplification purpose we have considered the fourth feature as Class 3.
- The fifth feature is mqtt.conack.flags.reserved which is the reserved flags of MQTT.
- For simplification purpose we have considered the fifth feature as Class 4.
- The sixth feature which is mqtt.conack.flags.sp which indicates the session presence in MQTT. For simplification purpose we have considered this as Class 5.
- Thus we can represent the 33 features (However for simplification purpose only the first 6 features we have represented).

Table 3: Table consisting of Multi class confusion matrix features, description of the feature, how we have considered the feature (The first 6 features from the overall 33 features are represented in this table)

Feature Name	Represents	Considered as
Tcp.flags	TCP flags	Class 0
Tcp.time_delta	Time TCP stream	Class 1
Tcp.len	Length of TCP flag	Class 2
Mqtt.conack.flags	Acknowledged Flags of MQTT	Class 3
Mqtt.conack.flags.reserved	Reserved flags of MQTT	Class 4
Mqtt.conack.flags.sp	Session present in MQTT	Class 5

- True Positive= Diagonal value
- True Negative= Sum of all column and row, except that column values.
- False negative= Values in the corresponding row added up, excluding True Positive.
- False Positive= Summation of column values excluding diagonal except diagonal value. The cross wise values represent true positive of corresponding class.
- Example in our work, for Random Forest Classification we have the value
- 3245, a true positive (A Class is classified as A Class).
- 34934 is a true positive number (B Class is classified as B Class).
- 82 is true positive (C Class is classified as C Class).
- 45180 is true positive (since Class D is classified as Class D).
- 600 is true positive (since Class E is classified as Class E).
- 2479 is true positive (since Class F is classified as Class F).
- In other words, the cross wise values are True Positive, represented as Tp.
- The total number of examples text of any class would be the sum of the corresponding row (i.e.: TP+FN for that class).
- The sum of the values in the corresponding row (excluding the TPs) represents the total number of False Negatives for a class. (Abbreviated FN)

- The sum of the values in the corresponding column represents the overall number of False Positives for a class (excluding the TP). (Standardized as FP)
- The sum of all columns and rows, excluding the column and row for that class, will represent the total number of True Negatives for each class (Represented as TN).
- Example for Class D, we sum up the Class A+ Class B+ Class C +Class F, Class E (we exclude Class D, because Class D with Class D is True Positive. The value is equal to 4,459 i.e.: $(49+2768+0+0+1642=4,459)$. This value is False Negative
- For Class D in Random Forest Classification, False Positive is

Sum of columns, excluding Diagonal Value. $(22+3874+89+351+0= 4,336)$.

- True Negatives for Class D in random Forest classification is $3245+864+5+185+30+258+34934+0+10+1+1+3+82+9+0+1694+493+9+600+131+264+0+0+0+18+2479 = 45,315$. This value is True Negative
- Correct classifications are Diagonal Values (TP). = 45,180
- Precision of Class D is calculated as $TP/(TP+FP)$.
- Recall of Class D which is commonly called as Sensitivity, "true positive rate".
- "Recall=Sensitivity = $TP/(TP+FN)$ ".
- "Specificity" of Class D also called "True Negative Rate."

Table 4: True positive, True Negative, False Positive, False Negative values of the Machine Learning Algorithms used in our work (are listed in this table Considered Class D)

Algorithm	True positive	True negative	False positive	False negative
Random Forest	45,180	45,315	4,336	4,459
Naïve Bayes	31,166	49,597	54	18,473
Decision Tree	46,468	45,387	3,801	3,171
KNN	17,701	42,274	4,383	31,938
ADB	49,590	28,741	20,959	49

Table 5: Table consisting of Precision values of Machine Learning Algorithms used in our work (Considered Class D)

Sl. No	Algorithm	Precision Values
1	Random Forest	0.91243
2	Naïve Bayes	0.99827
3	Decision Tree	0.92438
4	KNN	0.80153
5	ADB	0.70291

Table 6: Table consisting of Recall, Specificity of Machine Learning Algorithms used in our work (Considered Class D)

Sl. No	Algorithm	Recall	Specificity
1	Random Forest	0.91243	0.91267
2	Naive Bayes	0.99827	0.99891
3	Decision Tree	0.92438	0.92438
4	KNN	0.80153	0.80153
5	ADB	0.70291	0.70291

R2: The coefficient of determination, also known as the R2 score, is a crucial metric that is used to assess how well a regression-based machine learning model is performing. It operates by calculating the variance in the predictions that the dataset can explain. Simply put, it is the discrepancy between the model's predictions and the dataset's samples. If the r squared score is 1, the model is perfect; if it is 0, the model will perform poorly on a dataset that has not yet been observed. This implies that the model is trained more precisely the closer the value of the r squared score is to 1. Thus, R2 Values obtained for our dataset is illustrated in below table.

Table 7: Machine learning Algorithms used in our work along with their R2 Values

Sl.No	Algorithm	R2 Value
1	Naïve Bayes	-0.514028
2	Decision Tree	0.6179794
3	Ada Boost	0.6217522
4	Neural Network	0.5643667
5	KNN	-0.3426251

- Dataset has been pre-processed earlier.
- By analyzing the dataset, we understand it is classification type. The target column is dependent column which depends on all other independent column
- From here we can conclude that with the help of sklearn. model selection we have imported train_test_split. for this feature we have assigned a variable named "X_train", "X_test" "Y_train" "Y_test".
- From this we are trying to predict the value of dependent and independent variable.
- Train test are independent variables.
- By using this dataset (train and test) data preprocessing has been done earlier.
- Formula: $R2_score(y_test, y_pred)$
- We have split the data set in train and testing using sklearn library where in y_test, train are the models we get from depended variable and y_pred is the predicted values we get with the help of algorithm.
- In decision tree score is 0.61 it good enough score for the model.
- Coming to the KNN R2 value is down to -0.34 which is less and not a good score
- Whereas Ada boost Value of R2 is 0.62 which is a good value
- Neural Network R2 score is 0.5643667182895484
- The good score of R2 must be close to 1.
- According to analysis Decision Tree R2 Score 0.6179794195825462 and Adaboost we get R2 Score 0.6217522700960354 which concludes

that Decision tree and Ada Boost have best R2 Score.

- The other algorithms (Naïve Bayes, Neural Network, and KNN) do not have a best R2 Score (as the R2 value is approaching negative).

CONCLUSION

We worked on the MQTT dataset, which is associated with the MQTT protocol. The dataset was created with IOT Flock, an open traffic generation tool. For the validation purpose we combined the legitimate traffic with anomalous traffic targeting the MQTT network. From this we extracted the features which are necessary to develop the proposed system. We later demonstrated how the machine learning algorithms results in the accuracy and F1 score. Once the accuracy has been generated, we included the analysis graph (in our case we have used bar graph to show the resulting solution) as shown in (figure 4). Thus this work concentrates on how the anomalies behavior can be identified in the smart water meter using Machine Learning algorithms and Cyber Security.

REFERENCES

- [1] V Perrone, G., Vecchio, M., Pecori, R. and Giffreda, R., 2017, April. The Day After Mirai: A Survey on MQTT Security Solutions After the Largest Cyber-attack Carried Out through an Army of IoT Devices. In *IoTBDs* (pp. 246-253).
- [2] E. Ciklabakkal, A. Donmez, M. Erdemir, E. Suren, M. K. Yilmaz, and P. Angin, "ARTEMIS: An Intrusion Detection System for MQTT Attacks in Internet of Things," 2019 38th Symposium on Reliable Distributed Systems (SRDS), pp. 369–3692, Oct. 2019.
- [3] S. Andy, B. Rahardjo and B. Hanindhito, "assault eventualities and safety analysis of MQTT conversation protocol in IoT machine," 2017 4th worldwide convention on electrical Engineering, laptop technology and Informatics (EECSI), 2017, pp. 1-6, doi: 10.1109/EECSI.2017.8239179.
- [4] Hindy, H., Bayne, E., Bures, M., Atkinson, R., Tachtatzis, C., Bellekens, X. (2021). system gaining knowledge of based IoT Intrusion Detection device: An MQTT Case observe (MQTT- IoT-IDS2020 Dataset). In: Ghita, B., Shiaeles, S. (eds) decided on Papers from the twelfth international Networking conference. INC 2020. Lecture Notes in Networks and systems, vol 180. Springer, Cham. https://doi.org/10.1007/978-3-030-64758-2_6
- [5] Vaccari, G. Chiola, M. Aiello, M. Mongelli, and E. Cambiaso, "MQTTset, a New Dataset for Machine Learning Techniques on MQTT," *Sensors*, vol. 20, no. 22, p. 6578, Nov. 2020, doi: 10.3390/s20226578.
- [6] O. Kainz, E. Karpiel, R. Petija, M. Michalko, and F. Jakab, "Detection of non-standard situation in smart water metering," 2019 IEEE 15th

- International Scientific Conference on Informatics, Nov. 2019, doi: 10.1109/informatics47936.2019.9119280.
- [7] "SMART ENERGY METER USING IoT," International Journal of Recent Trends in Engineering and Research, pp. 234–239, Apr. 2018, doi: 10.23883/ijrter.conf.02180328.042.ednso.
- [8] D. T. McGimpsey and G. R. Krevda, "Government Utilities Need to Be Smart When Implementing a Smart Meter Program," Journal - American Water Works Association, vol. 111, no. 6, pp. 74–76, May 2019, doi: 10.1002/awwa.1310.
- [9] Janardhana S, "SMART METER PARAMETERS FOR SMART GRID," International Journal of Research in Engineering and Technology, vol. 05, no. 03, pp. 134–137, Mar. 2016, doi: 10.15623/ijret.2016.0503028.
- [10] Dr. S. A. Joshi, S. Kolvekar, Y. R. Raj, and S. S. Singh, "IoT Based Smart Energy Meter," Bonfring International Journal of Research in Communication Engineering, vol. 6, no. Special Issue, pp. 89–91, Nov. 2016, doi: 10.9756/bijrce.8209.
- [11] S. Rajasekaran, P. Kalyanchakravarthi, and P. S. Subudhi, "Anomaly Detection of Smart Grid Equipment Using Machine Learning Applications," Distributed Generation & Alternative Energy Journal, Jul. 2022, doi: 10.13052/dgaej2156-3306.37518.
- [12] M. M and S. K, "Securing Smart Meter Data in Smart Grid Transmission using Attribute Based Encryption," SSRN Electronic Journal, 2019, doi: 10.2139/ssrn.3431174.
- [13] Mohammed. I. Ibrahim et al., "Anomaly Detection to Counter DDoS Attacks on Smart Electric Meter Systems," International Journal of Cryptocurrency Research, vol. 2, no. 1, pp. 12–18, May 2022, doi: 10.51483/ijccr.2.1.2022.12-18.
- [14] J. Hong, C.-C. Liu, and M. Govindarasu, "Integrated Anomaly Detection for Cyber Security of the Substations," IEEE Transactions on Smart Grid, vol. 5, no. 4, pp. 1643–1653, Jul. 2014, doi: 10.1109/tsg.2013.2294473.
- [15] F. Zemene and V. Khedkar, "Survey on Machine Learning based Electric Consumption Forecasting using Smart Meter Data," International Journal of Computer Applications, vol. 180, no. 6, pp. 46–52, Dec. 2017, doi: 10.5120/ijca2017916052.
- [16] "SMART ENERGY METER USING IoT," International Journal of Recent Trends in Engineering and Research, pp. 234–239, Apr. 2018, doi:10.23883/ijrter.conf.02180328.042.ednso.R. Moghaddass and J. Wang, "A Hierarchical Framework for Smart Grid Anomaly Detection Using Large-Scale Smart Meter Data," IEEE Transactions on Smart Grid, vol. 9, no. 6, pp. 5820–5830, Nov. 2018, doi: 10.1109/tsg.2017.2697440.
- [17] F. Z. Abera and V. Khedkar, "Machine Learning Approach Electric Appliance Consumption and Peak Demand Forecasting of Residential Customers Using Smart Meter Data," Wireless Personal Communications, vol. 111, no. 1, pp. 65–82, Jan. 2020, doi: 10.1007/s11277-019-06845-6.
- [18] E. Ibhaze, "Smart Meter Solution for Developing and Emerging Economies," International Journal of Automation and Smart Technology, vol. 8, no. 3, pp. 119–126, Sep. 2018, doi: 10.5875/ausmt.v8i3.1529.
- [19] Prof. A. Gaigol, "Survey on IOT based Smart Electricity Meter Control and Surveillance for Prediction Future Meter Consumption using Machine Learning," International Journal for Research in Applied Science and Engineering Technology, vol. 9, no. 5, pp. 186–196, May 2021, doi: 10.22214/ijraset.2021.34086.

Splinternet : Perspective of Cyber Sovereignty and Challenges in Indian Context

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Abstract:

The action of adding boundaries to the borderless, global internet is known as Splinternet. In other words, a country achieves Cyber sovereignty through Splinternet even though the phrases "splinternet" and "cyber sovereignty" are synonymous. Detachment from the global web is quite difficult in terms of a number of factors, even though nations that have attained cyber sovereignty are much more privileged with regard to issues of peace and security. In order to understand the public's opinion on India achieving cyber sovereignty, this paper carried out a survey, analyzed the results, and discussed the various challenges in implementing Splinternet.

Index Terms:

Splinternet, Cyber sovereignty, Firewall, Virtual Private Network, Challenge.

INTRODUCTION

The Internet, telecommunications networks, computer systems, and embedded processors and controllers are only a few examples of the interconnected network of information systems infrastructures that make up cyberspace, a worldwide realm inside the information environment. The notion of the "Splinternet," which is strongly related to policy and national security issues as well as tensions surrounding the coordination of legal frameworks, has its roots in discussions on network filtering and fragmentation. The idea that parties must have sovereignty over their own digital data is known as "Digital Sovereignty,"[1] and it is a crucial one in the internet age. As a result, there is a phenomenon known as Network or Cyber Sovereignty. In essence, cyber sovereignty refers to a state's or other governing body's attempt to establish boundaries on a network and then exercise control—often in the form of law enforcement—over those boundaries[2].

The numbers showing an increase in cyberattacks, cyberespionage, data leaks, and theft in India, one of the most populous nations, are worrying. In contrast, underdeveloped nations must put in a lot of effort to establish their infrastructure if they want to become internet-sovereign. However, in order to maintain its cyber sovereignty, China, which has the highest internet connectivity in the world, prefers to use Chinese versions of Google, Facebook, and Twitter which are Baidu and Sina Weibo[3]. In order to achieve Cyber sovereignty, all nations should be treated equally in terms of Legislation, Internet governance and critical concerns.

In the Indian context, the need for cyber sovereignty goes with the fact that it implies complete independence

in cyberspace. Along with the fact that the abundant data could be stored more securely, Cyber sovereignty suppresses public outcry and prevents the public from learning about alternative (possibly superior) forms of governance and living, thereby preventing dissidents and, consequently, expensive and potentially dangerous riots.

This paper seeks to ascertain the public's viewpoint on the splinternet and the challenges India may have in attaining cyber sovereignty.

A survey was conducted with around 496 participants ailing from 47 countries, different age groups and professions in order to obtain real time data on their perspectives on Splinternet. Analyzing the obtained data along with technical recommendations on how firewalls might be set up to prevent the agile use of VPNs to access blocked websites accomplishes the aforementioned goals.

The contributions of this paper are to:

- Study on the people's perspective on drifting towards cyber sovereignty
- Identify the challenges and possible measure involved in implementing splinternet
- Deduce the future of Cyber sovereignty in India

REVIEW OF LITERATURE

Although the early design of the Internet was decentralized, Li, H., and Yang, X [4] had noted that the governance of the fundamental technical architecture displayed a strong centralized form. In order to meet the demands of future network development and achieve decentralized control of domain names by technical methods, it is essential to propose a new network design. By efficiently realizing international co-management and co-governance of cyberspace, the sovereignty network based on MIN (Multi Identifier Network) architecture presented in the cited research puts an end to centralized management under a single IP identification.

Kshirod Kumar Moharana [5] has identified that the development of cyber-sovereignty is a response to the cyberthreat. A group of hackers are working on a specific project from all over the world. Although they deny it, China is said to have such a team that has frequently attacked the United Nations, the United States, and India[5]. Because it is also fueling terrorist activities, cyber-sovereignty is essential to ensuring national security and strategic interests.

Xu, Wenhong, outlined the difficulties that must be overcome to establish network sovereignty, including the identification of cyber boundaries and the use of firewalls and VPNs [6].

ANALYSIS OF SURVEY DATA

A survey was conducted to understand the global view on splinternet. Around 496 responses were received in which around 80% i.e., 396 were from India and the rest from the U.S.A, Nigeria, Tanzania and 43 other countries.

Country	Record count
India	396
U.S.A	14
Nigeria	9
Tanzania	8
Others	69

Let us discuss the questionnaire, their relevance and the results deduced:

1. Which of the following Social media do you use most frequently?

The question tries to figure out the spread of our target audience, who use different social media platforms.

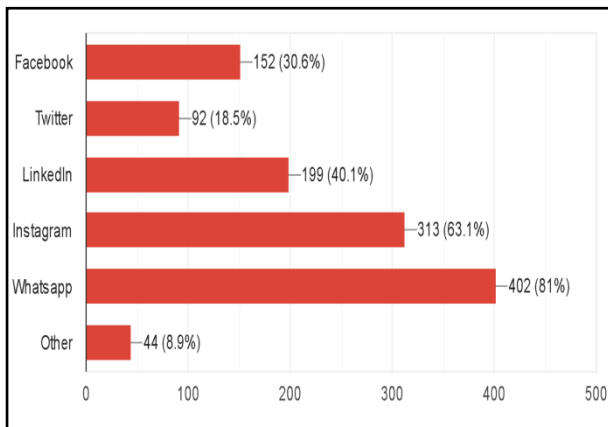


Fig 1. Frequently used social media by the participants

The most used social media platforms are Whatsapp and Instagram. Around 81% and 63% of the respondents, try to maximum rely upon the information circulated on whatsapp and Instagram respectively. It is also evident that most respondents not just rely on one source of information or social media. Therefore, it is inferred that incase of splinternet being implemented, the above mentioned platforms need to be mimicked internally, and also these platforms could be used as a tool to educate people about cyber sovereignty.

2. How likely are you to share the information related to SPLINTERNET on your social media handles?

The question helps in understanding the mindset of the responders with respect to their willingness to spread awareness about Internet fragmentation. This implies how well the responders are acquainted with the Splinternet.

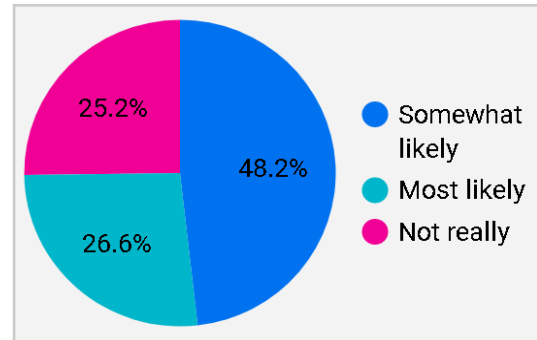


Fig 2. Participants' likeliness to share information on Splinternet

Around 78% of the active social media users find the concept of splinternet fascinating and debatable, hence are ready to share information, posts, tweets, etc., to create awareness among the ongoing internet fragmentation around the world.

3. Would you rather encourage or suppress SPLINTERNET?

The question aids in understanding if the responders truly understood the pros and cons of the internet fragmentation so that he/she recommends or disregards it.

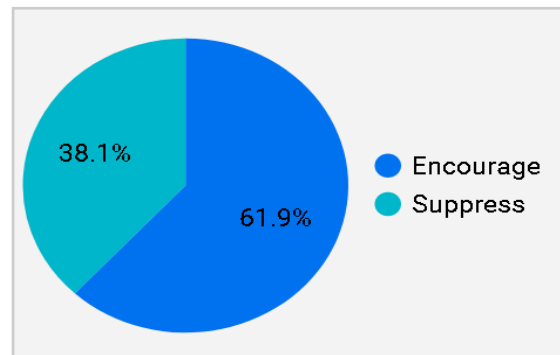


Fig 3. Participants' opinion on Splinternet

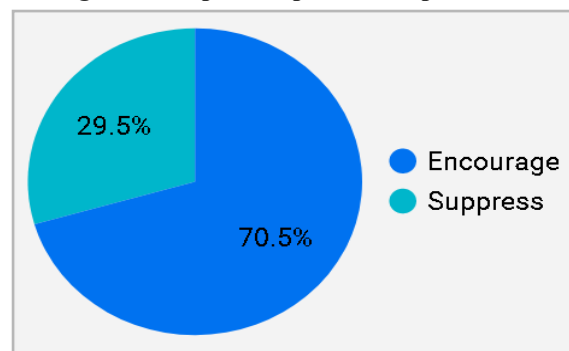


Fig 4. Young adult (18-25 years) participants' opinion on Splinternet

Around 62% of the total respondents believe that encouraging splinternet will definitely lead to a better control on the spiritual pollution and prevent the spread of anti-war propaganda. But if we ought to have a better and deeper understanding of the trend, an age filter with the range of 18-25 years for responders (young adults) could be applied. It is inferred that nearly 71% voted to encourage Splinternet (Fig 4). The responses of young adults are slightly better than the mean response of all age groups, inferring that the current tech consumers have really understood the outliers of Global web.

4. Internet is all about "Global Connectivity". Do you think SPLINTERNET will re-define this meaning?

The question helps in receiving the awareness of the responders about how splinternet works internally.

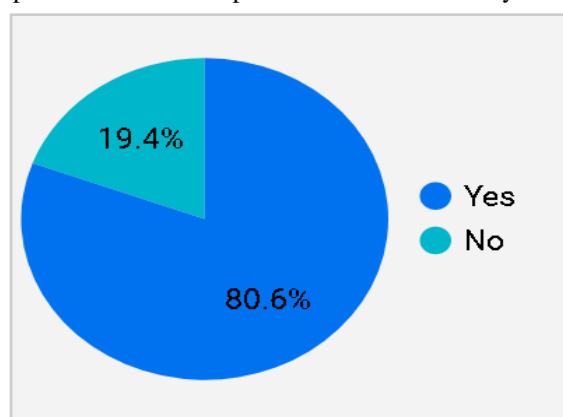


Fig 5. Participants' opinion on Splinternet redefining Internet

It is evident from the responses obtained that, definitely the growing internet fragmentation will re-define the meaning of the internet which actually is meant for global connectivity. That is, the perks of global internet connectivity would never be matched by splinternet though.

5. Are you aware about how SPLINTERNET is gaining its importance in the current scenario of Russia-Ukraine war?

The question is to find out the people's awareness of the rise in splinternet being implemented in the scenario of ongoing Russia-Ukraine war.

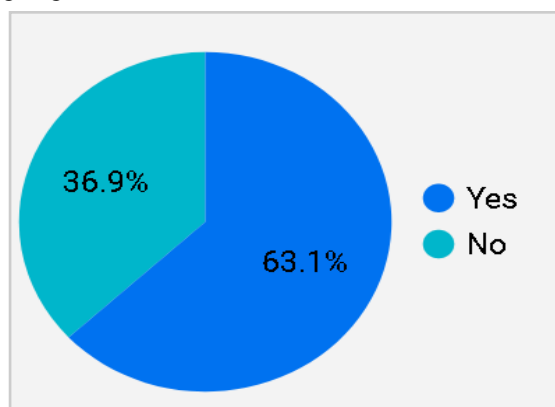


Fig 6. Participants' awareness on Splinternet in Russia-Ukraine war scenario

Merely 63% of the respondents are aware about the rising internet restrictions in Russia, in the current scenario of war between Russia and Ukraine, that is the ban of Twitter, Facebook and other social media platforms where the information free flow is notable.

6. Do you think isolating itself to create a new cyberspace will prevail over Russia's need for the Global internet completely?

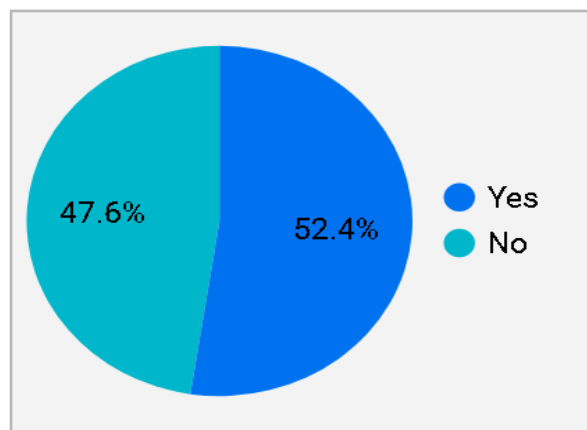


Fig 7. Participants' opinion on future of Splinternet in Russia

The response for this question is found to be quite ambiguous, with around 52.4% responders believing the fact that isolated cyberspace will prevail over Russia's need for global internet and connectivity is the common opinion.

7. Can SPLINTERNET help the Government and Corporate bodies to understand the Psychology of the users in a better way?

The question aids up to find out how splinternet can politically help a nation to build on a stronger basis.

Among the 494 responses which we received via survey we found out that around 74% of respondents who are postgraduates, software professionals and researchers and belong to an age group of 18 to 50 years think that splinternet can help the government and the corporate bodies to understand the psychology of the users in a better way whereas the rest 26% deny this statement.

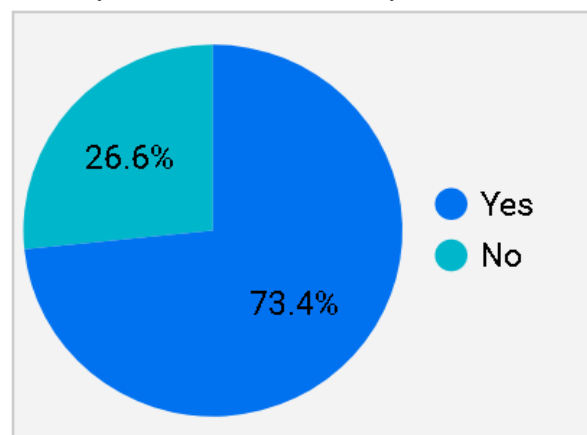


Fig 8. Participants' opinion on Splinternet assisting the control bodies of the country

8. Which of the following sectors could be possibly affected by the emergence of SPLINTERNET?

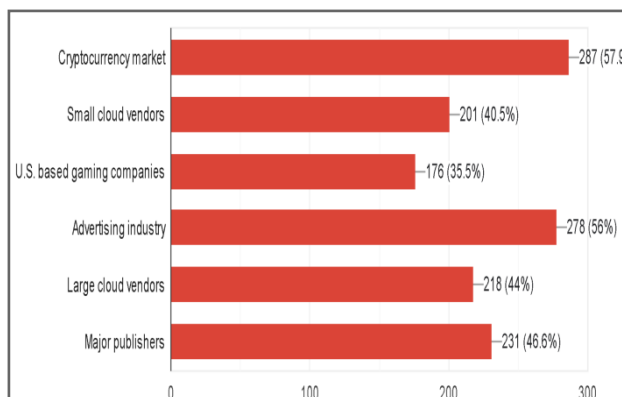


Fig 9. Participants' opinion on possibly affected sectors due to Splinternet

It is evident from the above graph that global connectivity is the driving factor in the success of Crypto market as well as advertising agencies. Splinternet emergence would definitely affect these markets along with cloud vendors and major publishers.

9. What is your opinion about SPLINTERNET being the future of the Internet?

Taking opinions of the responders helps in analyzing if splinternet could be effectively implemented in nations that have still not opted out to it.

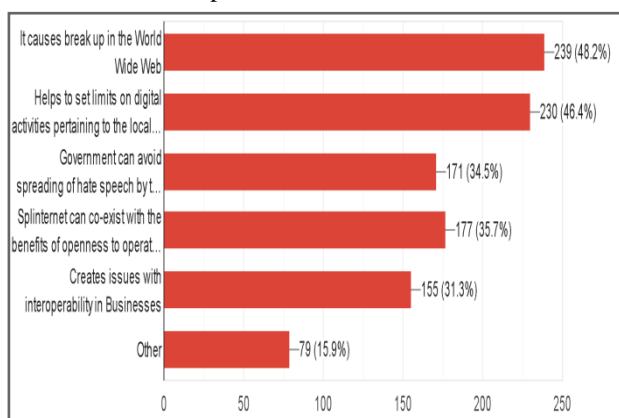


Fig 10. Participants' opinion on Splinternet as the future of Internet

In peoples opinion 239 people i.e., 48% of the respondents believe that It causes break up in the WorldWide Web, around 230 people i.e., 46% of respondents believe that splinternet helps to set limits on digital activities pertaining to the local laws and regulations, around 171 people i.e., 34% of respondents believe that Government can avoid spreading of hate speech by the public over web, around 177 people i.e., 35% of respondents believe that splinternet can co-exist with the benefits of openness to operate in public interests, around 153 people i.e., 31% of respondents believe that splinternet Creates issues with interoperability in Businesses and the rest 79 people whereas the rest 16% of respondents are of some other opinion.

CHALLENGES IN IMPLEMENTING SPLINTERNET

The borders between various inter-networks are known as cyber boundaries[7]. Cyber borders are crucial for cyber security because they are the significant factor of the cyber and are primarily in charge of the initial and final filtering of cyber traffic[5]. Theoretically, the dividing line between cyberspaces with various levels of security should be characterized as cyber frontiers. In reality, it is challenging to

set and maintain such boundaries in a clear manner in order to complete assurance of cyber sovereignty.

Firewall: Inorder for the nations to start with implementing Splinternet, the primary step is to set up the firewall. Network borders in cyberspace are created by firewalls. The initial and last security gateway for various cyber connections is a firewall. It functions as a "wall" established between the cyberspace of several states.[5] There are national boundaries in the cyber with the firewall. It serves as a representation of the cyber sovereign boundary and is safeguarded by it. Incorporating firewalls into the security plan for cyber borders is essential. Good fences make good neighbors, as the cliché goes.

VPN: A private network that connects to the public Internet using an encrypted multilayer tunneling protocol is the VPN. Even if the firewall is excellent, the VPN is still more powerful. Internet users can use a VPN or connect to proxy servers to connect to the outside internet while maintaining their anonymity[5]. Users won't be violating cyber sovereignty if they simply surf foreign websites without accessing any inappropriate content, but if they copy and distribute rumors for political motives, disturb public order, encourage regime subversion, etc., this will be a significant offense.

To summarize, the challenges that India would have to face in implementing splinternet would be:

- Define a clear frontier in the cyberspace
- Plan for huge infrastructure rather than depending on external cloud vendors
- Defining strong and layered firewalls with various protection loops

POSSIBLE MEASURES

Strict legislative protocols will help set upright standards on the internet access patterns of the people[8]. More countries should be included in the research of cyber sovereignty through increased international visibility and discussion.

Another way would be for India to increase the intensity of negotiations and communication with the United States. In recent years, the United States has also passed a number of bills, including the Cybersecurity Enhancement Act of 2010 [5], and the emphasis on cyber security has reached a peak. An in depth understanding of the U.S policies would help India frame its own legislation since U.S's sustainable upkeep of

cyber security reflects the intention and determination to safeguard the country's cyber sovereignty. Firewalls should be set up in accordance with how sensitive the data is, which calls for multilayer firewalls for instances such as financial reports, military secrets, and confidential info about citizens. Given the significance of network infrastructure, network systems, and data in some domains, multiple firewalls are required to protect important databases and to bolster security for specific critical network infrastructure and systems.

People's moral principles and legal awareness[5] have been somewhat compromised by the network's virtual nature, which could result in hypocritical behavior. Education and training on network sovereignty, cyber ethics, and network laws can be strengthened in order to gradually enhance people's capacity for moral judgement, foster a proper understanding of network ethics and values, and prevent the misuse or harmful use of the internet.

CONCLUSION

According to an analysis of the survey's findings, it is clear that most people are aware of what a splinternet is, how it operates in countries like China and Russia, and that participants support the internet's fragmentation in India. It is extremely important to focus on firewalls and VPNs even though IPv9 addressing and Multi Identifier Network Architecture may be the primary technologies that enable the splinternet.

With Splinternet, the different kinds of information that are gathered in a country must be processed and stored securely within the frontier, which necessitates a reasonably large infrastructure and rigorous security principles. The major drawback here is the virtual private networks, which gets around any firewall and allows access to restricted websites.

Nevertheless, improper content monitoring, i.e., with bad firewall configuration, cyber-sovereignty actually turns into cyberbullying. If the filter is not implemented correctly, it leads to violation of Article 19(2) [9] and restricts the right to dissent, speech and the right to information. The development of technology has access to proxy sites and other tools that provide quick access to the restricted websites. After all, these proxy sites constitute a much bigger threat, exposing national security at risk.

With internet restrictions, the "Digital India" of the twenty-first century would require a few reasoned actions. India has a better position in the IT sector when compared to China, but because it is a sovereign, secular, and democratic nation globally, strong legal policies, ample infrastructure, secure multi layer firewalls and most importantly time is required for the concept of cyber-sovereignty to be introduced in the Indian context.

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REFERENCES

- [1] <https://www.techopedia.com/definition/33887/digital-sovereignty#:~:text=Digital%20sovereignty%20is%20a%20key,and%20digital%20assets%20are%20treated>, accessed on 2nd August 2022
- [2] <https://www.thalesgroup.com/en/markets/defence-and-security/cyberdefence-solutions/cyber-sovereignty>, accessed on 2nd August 2022
- [3] <https://www.caixinglobal.com/2020-08-05/baidu-search-sino-weibo-on-secret-list-of-chinese-apps-banned-in-indias-latest-purge-101589178.html>, accessed on 2nd August 2022
- [4] Li, H., Yang, X. (2021). Architecture of Sovereignty Network. In: Co-governed Sovereignty Network. Springer, Singapore. https://doi.org/10.1007/978-981-16-2670-8_3
- [5] Kshirod Kumar Moharana, "Cyber-Sovereignty in Indian Context," Information Technology/Cyber Law, Bharati Law Review (2018), <http://docs.m>
- [6] Xu, Wenhong. (2020). Challenges To Cyber Sovereignty And Response Measures. 64. 79-89. 10.20542/0131-2227-2020-64-02-.
- [7] World Walled Web: the national firewalls shutting out the internet, <https://eandt.theiet.org/content/articles/2018/02/world-walled-web-the-national-firewalls-shutting-out-the-internet/>, accessed on 23rd July 2022
- [8] Digital sovereignty - steps towards a new system of internet governance, <https://www.fondapol.org/en/study/digital-sovereignty-steps-towards-a-new-system-of-internet-governance/>, accessed on 23rd July 2022
- [9] <https://indiankanoon.org/doc/493243/>, accessed on 07th august 2022

Data Fortification & Confidentiality

Predicting How Vulnerable is Our Data using Machine Learning Algorithms

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Abstract:

Software security concerns have gained attention due to the speedy progression of cybercrime happenings due to which increasingly most of our devices are being harmed. As around 90% of all attacks use well-known security flaws to identify weak points. By applying contemporary vindicating methods is a possible practical and a workable, effective strategy for combating cybercrime. Here, we examine the Machine Learning methods, like KNN algorithm, decision tree algorithm and Naïve Bayes algorithm and their effectiveness in predicting functions and applications that are easily vulnerable to the cyber-attacks through malwares due to the flaws in JavaScript applications and various functions in the back-end programs. For identifying the best prediction results, use of exhaustive grid-search procedures and static source code metrics as predictors was done. Since the dataset had an imbalanced nature hence the impact of different resampling techniques to address this was also taken into consideration to achieve the results.

Index Terms:

algorithms, cybercrime, functions, predictors.

INTRODUCTION

Functions, programs and applications that are written using JavaScript have become increasingly and more vulnerable to numerous security concerns. Data security and privacy related matters are progressively an area of concern due to the speedy growth of cybercrime. The malware and virus that enter unknowingly are increasing due to which there is a rapid increase in the number of devices they affect, even though they are frequently unnoticed. Nearly 90% of cyber-attacks take advantage of the existing and well-known but ignored security flaws. Consequently, to apply existing moderation methods, the need to determine vulnerable modules leads to the concrete approach to combat cybercrime.

A dataset that involves great attention to details regarding JavaScript vulnerabilities with information mined from three different sources which include nsp (Node Security Platform) and the Snyk Vulnerability Database inevitably coordinated with statistics accessible on GitHub repository by determining commits and patches.

The JavaScript functions and applications vulnerability dataset comprises of 12,125 functions out of which 1,496 are vulnerable and can be easily attacked [1]. Also the static source code metrics has been generated with the

help of the *OpenStaticAnalyzer* [2] and *escomplex* tools [3].

Predicting the extremely vulnerable functions has been constructed on the computation of the static source code metrics. Comparisons between performances of three machine learning algorithms for the prediction of vulnerabilities include the K-Nearest Neighbors algorithm (KNN), a decision tree classifier (Tree) and the Gaussian Naive Bayes algorithm (Bayes). A range of resampling techniques to address the dataset's imbalance have been incorporated.

The major objectives to be achieved are:

- 1- Identification of vulnerable components in JavaScript functions and applications using the static source code metrics and grid-search methods.
- 2- Predicting possible vulnerabilities in the obtained components by performing machine learning techniques.
- 3- Comparative analysis of various Machine Learning predictive algorithms for the deployment model.

LITERATURE SURVEY

Rudolf Ferenc et al. [4] target inclusive assessment of 8 widely used machine learning algorithms for the calculation and figuring out functional level vulnerabilities in the JavaScript written source codes [5]. They have also provided a new public database which contains some of the inert analysis results on exemplary JavaScript functions added with the statistics whether the functions contain a vulnerability or not.

Yu et al. presented HARMLESS [6], an efficient dynamic learner method to calculate vulnerabilities. They have made use of a sustenance vector machine that generates an outcome that can be used for predicting under-sampled dataset used in training, along with the semi-supervised estimation mechanism that provides the lingering vulnerabilities of a program. HARMLESS predicts and points out the files that can be easily attacked. They also included Mozilla's back-end program and code in the results. A diverse characteristics set of values was also included [7]. The back-end code calculations and measurements processed in this work is similar to that of Shin and others.

Shin et al. [8] accomplished an experimental research on two outsized code databases: Mozilla Firefox along with Red Hat Enterprise Linux, exploring if some of the program based metrics can be tried in prediction of vulnerabilities. They measured complexity, code blend, and developer action metrics. The outcomes indicated that the used metrics are biased and do give predictions of vulnerabilities. But, the model was moreover built on the file level rather than on the JavaScript functions.

Neuhas et al. [9] presented a methodology along with a conforming tool called Vulture, capable of predicting vulnerable components in the basis code, majorly depending on the relationships between the various files. Although the outcomes are very favorable, the projected tool is not readily available online. They evaluated the Mozilla code database to calculate estimations from SVM for classification. We carry out predictions on vulnerabilities on JavaScript functions and JavaScript based applications and majorly apply three machine learning algorithms to make the predictions and for comparisons.

APPROACH AND METHODOLOGY

The data has been collected from different sources and has been processed to form a database on which different methods are applied to figure out the functions and the applications that are the most susceptible to the cyber-attacks. Figure 1 represents the method of collection and processing of the data:

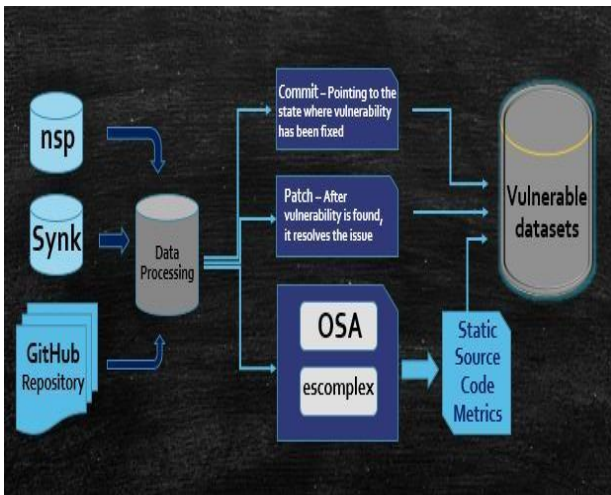


Figure 1: Preparation of Dataset

A. *Collection of Dataset* - For applying machine learning algorithms, a training dataset with features of JavaScript functions labeled as vulnerable or non-vulnerable has been used. The dataset has been collected in the following manner:

1. *Combining nsp and Synk public databases along with GitHub repository:*
 - i. If any particular URL gave indication to a particular commit, the appropriate commit hash value is added to a list referred as fixing list.
 - ii. If a particular URL indicated towards an application that could contain a command for

pull/merge, all the commit hash values were put in the fixing list [10].

- iii. If a particular URL pointed towards any issue command, the comments were thoroughly traversed.

3. *Mapping JavaScript functions along with patches:* All the functions that were modified by every vulnerability fixing commit were mapped with the previous descriptions in sha value of the previous function to spot them as vulnerable preceding the primary commit given for fixing the patch [11].

Metric	Description	Tool
CC	Clone Coverage	OSA
CCL	Clone Classes	OSA
CCO	Clone Complexity	OSA
CI	Clone Instances	OSA
CLC	Clone Line Coverage	OSA
LDC	Lines of Duplicated Code	OSA
MeCC, CYCL	Cyclomatic Complexity	OSA, escomplex
NL	Nesting Level	OSA
NLE	Nesting Level without else-if	OSA
CD, TCD	(Total ²) Comment Density	OSA
CLOC, TCLOC	(Total) Comment Lines of Code	OSA
DLOC	Documentation Lines of Code	OSA
LLC, TLLOC	(Total) Logical Lines of Code	OSA
LOC, TLOC	(Total) Lines of Code	OSA
NOS, TNOS	(Total) Number of Statements	OSA
NUMPAR, PARAMS	Number of Parameters	OSA, escomplex
HOR_D	Nr. of Distinct Halstead Operators	escomplex
HOR_T	Nr. of Total Halstead Operators	escomplex
HON_D	Nr. of Distinct Halstead Operands	escomplex
HON_T	Nr. of Total Halstead Operands	escomplex
HLEN	Halstead Length	escomplex
HVOC	Halstead Vocabulary Size	escomplex
HDIFF	Halstead Difficulty	escomplex
HVOL	Halstead Volume	escomplex
HEFF	Halstead Effort	escomplex
HBUGS	Halstead Bugs	escomplex
HTIME	Halstead Time	escomplex
CYCL_DENS	Cyclomatic Density	escomplex

Table 1: Fixed Source Code Measurements

4. *Fixed source code measurements:* For the important features that can be the indicators for the predictions, fixed source code measurements has been computed for all functions by means of the available tools escomplex as well as OpenStaticAnalyzer (OSA). 35 measurements that have been calculated are represented in Table 1:
5. *Dataset configuration:* CSV format is used so that the different machine learning algorithms can be implemented easily for the output that has been generated. In the created CSV file, for each line the functions signify a Node.js program. The various columns have different significance and descriptions.

In the database columns 1-8 represent the susceptible functions and their identification along with the exact location and indicate the beginning and ending of the lines in the code they exist. In Table 1 all the 35 measurements that have been considered represent the values from columns (9-43) in the database. The end column (44) in the database is the value (0/1), where 0 means non-vulnerable and 1 means vulnerable.

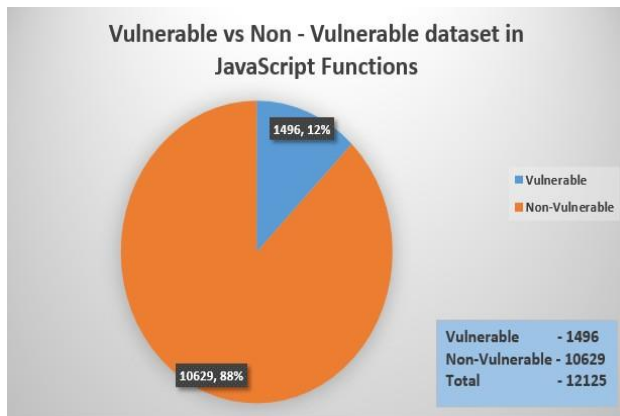


Figure 2: Vulnerable vs Non-Vulnerable JavaScript Functions

The above shown Figure 2: shows graphically that the whole dataset that was examined contains 12,125 JS functional module and amongst them 1,496 are susceptible and the remaining 10629 are non-vulnerable.

B. Analysis of the dataset - For implementing the three algorithms KNN, DT and Bayes, Scikit-learn framework has been used to execute all the three Machine Learning algorithms in Python environment. Scikit-learn is a powerful tool for executing machine learning algorithms [12]. The approach begins by taking a value that is very large then reduced continuously till the F-measurement shows promising results.

1. *Extensive Grid-searching to identify preeminent parameters:* Grid search method was applied to the hyper parameters in the machine learning algorithms to identify the optimal configuration for each algorithm. Various values for machine learning algorithm parameters were used again and again and training for multiple models was done using various combinations of hyper parameters. Once we calculated multiple outcomes for each model, selection of the best performing one was easy.

Algorithm	None	↑25%	↑50%	↑75%	↑100%	↓25%	↓50%	↓75%	↓100%
KNN	0.7586	0.7282	0.6899	0.6608	0.6485	0.7492	0.7359	0.7217	0.5852
Tree	0.688	0.6769	0.6805	0.6796	0.6422	0.689	0.6725	0.6359	0.5442
Bayes	0.0892	0.0734	0.0882	0.0695	0.0492	0.089	0.082	0.0797	0.0786
Avg.	0.5119	0.4928	0.4862	0.47	0.4466	0.5091	0.4968	0.4791	0.4027
Med.	0.688	0.6769	0.6805	0.6608	0.6422	0.689	0.6725	0.6359	0.5442

Table 2: Data representing Extensive Grid-Search Approach

For training the machine the trained, developed, and tested sets were in ratios of 80%, 10%, and 10% correspondingly along with the 10-fold cross-validation approach. Precision, recall, and F dimension value were computed the values of which are depicted in Table 2. To select the most dominant parameters the structure takes the results of the development set which ensures that no information is taken for selection [13]. The F metric is the primary performance indicator, as both precision and recall are important in security.

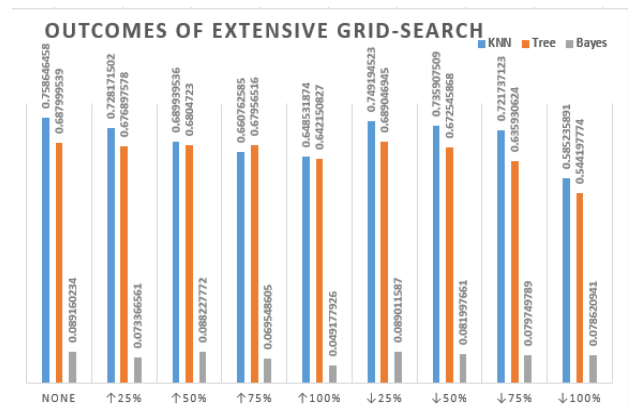


Figure 3: Graphical representation regarding Outcomes of Grid-Search Approach

When the values obtained after the cross-validation method and the grid-search approach were compared to elucidate the outcomes which are graphically depicted in the above Figure 3.

2. *Re-Sampling approaches:* Only 12% of the functions are vulnerable in the dataset that has been considered. The unjust and imbalanced irregularities of the training dataset is undesirable because the prediction models get misleading by the skewed dispersals. By random under and over-sampling approaches better results can be achieved [14].

Repeatedly extensive grid search is applied using re-sampling methods: without re-sampling termed as None; sampling above the normal (↑) with percentages shown in Table 2; sampling below the normal (↓) with percentages shown in Table 2 respectively.

RESULTS

Structuring the three algorithms based prototypes took a significant extent of duration for computations and expedients. Training for three different algorithms namely KNN, Decision Tree and Bayes for the predictions of the vulnerability on the created dataset consumed substantial extent of computations and means.

- Results on the imbalanced dataset:* The imbalanced dataset is presented based on the values determined from KNN, DT and Bayes algorithms which results in achieving values related to F-Measure, precision and recall. By selecting an appropriate algorithm along with suitable parameters, creation of effective functional and utility based susceptibility prototype that has been used for predicting solutions with the help of fixed source code measurements as indicators is possible.

When no technique of re-sampling was applied to set of collected data from different sources, the value that we calculated are represented graphically in Figure 4.

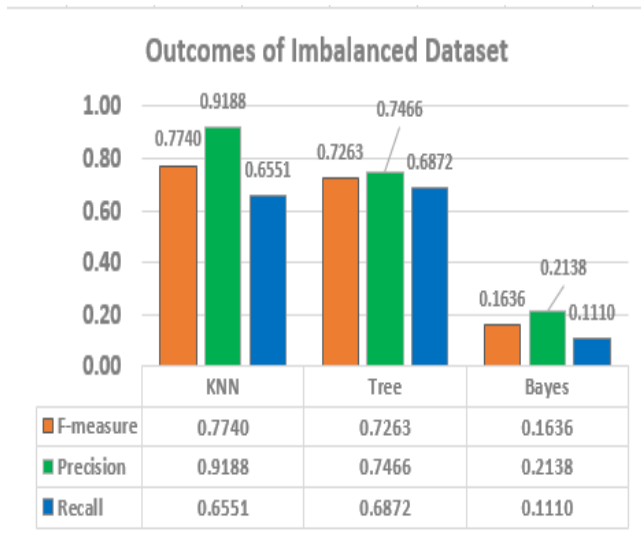


Figure 4: Outcomes of Imbalanced Dataset

From the results shown above in the graph which clearly explains all the three algorithms Naïve Bayes algorithm gave least values and hence, cannot be used for making predictions using the extreme collected set of data. Naive Bayes algorithm could not produce a feasible prototype for predicting the solution from the actual, extreme susceptibility database. Moreover, KNN along with Tree algorithm both attained F-measure scores beyond 0.70 by not applying any methods for re-sampling on the data.

B. Evaluation of the prototypes on the basis of the re-sampling outcomes: F- Measures that have been achieved by applying the different algorithms and the techniques of re-sampling is summarized in the Table 3:

Algorithm	None	↑25%	↑50%	↑75%	↑100%	↓25%	↓50%	↓75%	↓100%	Rand
KNN	0.7740	0.7605	0.7304	0.6895	0.6917	0.7675	0.7615	0.7542	0.6514	0.1452
Tree	0.7263	0.7183	0.7222	0.7214	0.7150	0.7124	0.6845	0.6820	0.5839	0.1362
Bayes	0.1636	0.1724	0.1749	0.2169	0.2116	0.1687	0.1700	0.1912	0.1791	0.0837
Avg.	0.5547	0.5504	0.5425	0.5426	0.5394	0.5495	0.5387	0.5425	0.4715	0.1217
Med.	0.7263	0.7183	0.7222	0.6895	0.6917	0.7124	0.6845	0.6820	0.5839	0.1362

Table 3: Calculation of F-Measures for all 3 algorithm with normal, above the normal, below the normal and random values for Re-sampling.

The first column in the table represent the outcomes of actual skewed set of data by not applying technique of re-sampling. Subsequent column values such as 25%, 50%, 75% and 100% show the outcomes of the sampling above the normal set of data [15], whereas the further values which are 25%, 50%, 75% and 100% shows the outcomes of the sampling below the normal set of data. The end value(rand) in the table 3 represents outcomes of an arbitrary stability check.

Graphically the approach has been represented in Figure 5, where the values can be easily understood and the difference can be seen.

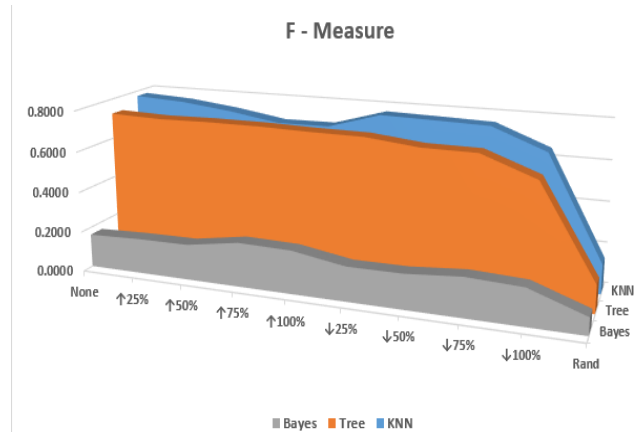


Figure 5: Graphically F-Measures represented after applying Re-Sampling

C. Comparative analysis of various Machine Learning predictive algorithms for the deployment model: Table 3, gives the outcomes of the KNN, DT and Bayes algorithms respectively. Depicting graphically the comparisons are visible in Figure 6:

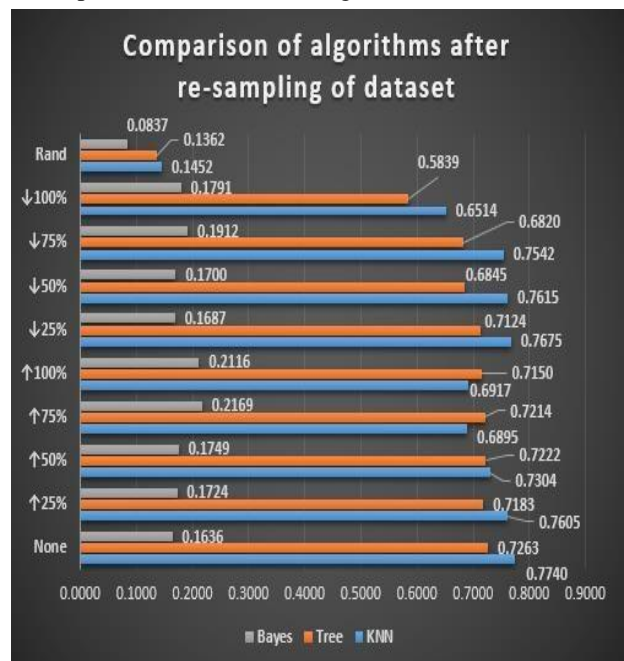


Figure 6: Bar graph regarding Comparative analysis of the algorithms

The finest performance procedure used for calculating susceptible JavaScript based manuscripts and back-end codes as per the F-metric values is KNN algorithm showing value of F-metric as 0.774 along with the calculated value of precision is 0.9188 as well as the value of recall has been calculated as 0.6551.

The calculation of the precision value done after re-sampling on the set of data is depicted in Figure 7:

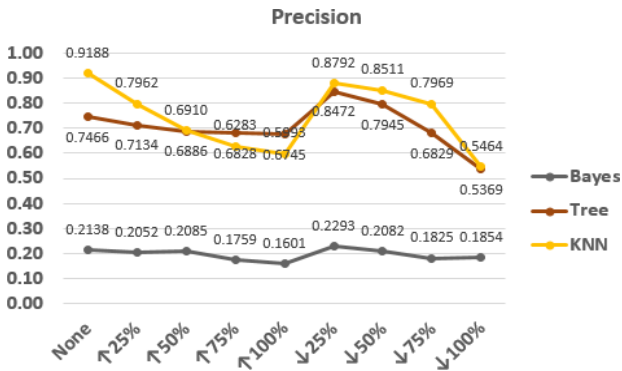


Figure 7: Line graph regarding Impression of re-sampling on precision values

Whereas the calculation of the recall value done after re-sampling on the set of data has been graphically depicted in Figure 8:

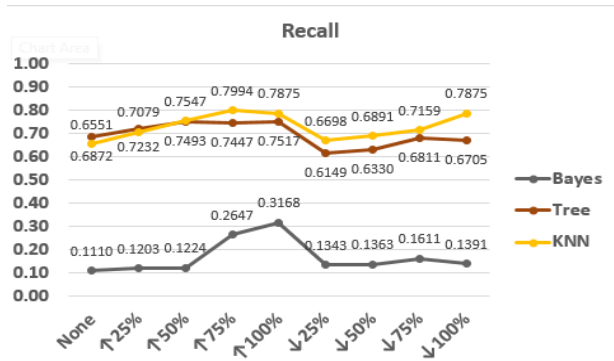


Figure 8: Line graph regarding Impression of re-sampling on recall values

Out of all the three algorithms that were used with and without re-sampling the Naive Bayes method was a complete failure in the prediction. The computed values are indicated in Figure 9:

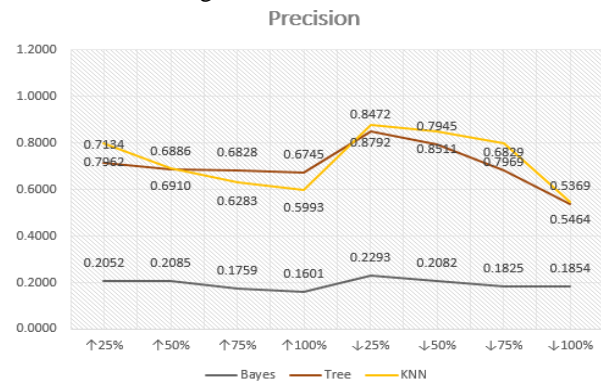


Figure 9: Comparison of precision achieved by different algorithms.

CONCLUSIONS

All efforts are in the direction to highlight majorly on the JavaScript vulnerable dataset that has constructed estimation prototypes. The collected set of facts comprises of a variety of JavaScript set of codes that contain a number of functions that can be easily attacked along with the fixed source code measurements and a

label value signifying that the function covers a susceptible value or non-susceptible value.

This statistic has been collected by processing the readily available susceptibility databases like nsp database together with Snyk database furthermore gathering patches that are used for the fixing of susceptible codes and functions from GitHub repository. Evaluations hereby are made from already available algorithms based on the ML techniques that are used in structuring the functional and utility based susceptibility estimation prototypes using the collected set of information.

Using the methodology of training on the collected set of data and a variety of resampling techniques, the outcomes delivered by three distinct types of algorithms were studied. There is a visible relation between the calculated values for the parameters relating to precision considering the computed values for the recall parameter as well; sampling above the normal inclines to increase the value related to the recall parameter decreasing the value related to the precision parameter, whereas sampling below the normal progresses the value relate to the precision parameter thereby reducing the value related to the recall parameter considerably. The relationship is inversely proportional to each other.

REFERENCES

- [1] N. R. Mead, J. H. Allen, M. Ardis, T. B. Hilburn, A. J. Kornecki, R. Linger, and J. McDonald, "Software assurance curriculum project volume 1: Master of software assurance reference curriculum," CARNEGIE-MELLON UNIV. PITTSBURGH PA SOFTW. ENG. INST., Tech. Rep., 2010.
- [2] "OpenStaticAnalyzer-GitHub," <https://github.com/sed-inf-uszeged/OpenStaticAnalyzer>.
- [3] "escomplex - GitHub," <https://github.com/escomplex/escomplex>.
- [4] Rudolf Ferenc, "Challenging Machine Learning Algorithms in Predicting Vulnerable JavaScript Functions," 2019 IEEE/ACM 7th International Workshop on Realizing Artificial Intelligence Synergies in Software Engineering (RAISE), 28 May 2019.
- [5] Y. Shin and L. A. Williams, "Can traditional fault prediction models be used for vulnerability prediction?" Empirical Software Engineering, vol. 18, pp. 25–59, 2011.
- [6] Z. Yu, C. Theisen, H. Sohn, L. Williams, and T. Menzies, "Cost-aware vulnerability prediction: the HARMLESS approach," CoRR, vol. abs/1803.06545, 2018.
- [7] Y. Shin, A. Meneely, L. Williams, and J. A. Osborne, "Evaluating complexity, code churn, and developer activity metrics as indicators of software vulnerabilities," IEEE Trans. Softw. Eng., vol. 37, no. 6, pp. 772–787, Nov. 2011.
- [8] Y. Shin and L. Williams, "An empirical model to predict security vulnerabilities using code complexity metrics," in Proceedings of the Second

- ACM-IEEE international symposium on Empirical software engineering and measurement. ACM, 2008, pp. 315–317.
- [9] S. Neuhaus, T. Zimmermann, C. Holler, and A. Zeller, “Predicting vulnerable software components,” in Proceedings of the ACM Conference on Computer and Communications Security, 01 2007, pp. 529–540.
 - [10] “Node Security Platform - GitHub,” <https://github.com/nodesecurity/nsp>.
 - [11] “Vulnerability DB — Snyk,” <https://snyk.io/vuln>.
 - [12] C. L. Mariano, “Benchmarking javascript frameworks,” Ph.D. dissertation, Dublin Institute of Technology, 2017.
 - [13] J. S. Bergstra, R. Bardenet, Y. Bengio, and B. Kegl, “Algorithms for hyper-parameter optimization,” in Advances in neural information processing systems, 2011, pp. 2546–2554.
 - [14] G. E. A. P. A. Batista, R. C. Prati, and M. C. Monard, “A study of the behavior of several methods for balancing machine learning training data,” SIGKDD Explor. Newsl., vol. 6, no. 1, pp. 20–29, Jun. 2004.
 - [15] M. Siavvas, D. Kehagias, and D. Tzovaras, “A preliminary study on the relationship among software metrics and specific vulnerability types,” in 2017 International Conference on Computational Science and Computational Intelligence – Symposium on Software Engineering (CSCI-ISSE), 12 2017.

Multiple Carrier Optical Frequency Comb Generation Based on Cascading of Three Different Types of Modulator in an Optical Networks

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Abstract:

In the proposed work, a new methodology of optical frequency carrier generation based on serial cascading arrangement of the phase modulator, electro-absorption modulator, and Mach Zehnder Modulator is proposed. In this scheme, we are taking an input frequency of 15 GHz, and approximately 91 healthy carriers are generated. We have also tested for higher frequencies and observed the output signal. The OSNR and total noise power are also calculated with the help of the WDM Analyzer. The total OSNR is approximately 47 dBm and total noise power comes out to be approximately 80 dBm.

Index Terms:

Optical frequency comb, Carrier Generation, Modulators, Cascading.

INTRODUCTION

Due to its numerous benefits for transmitting faster data rates at a reduced cost, optical frequency comb creation has drawn the attention of many academics. It has been extensively utilized in various applications in the field of Telecommunication, Optical communication, and Satellite communication.

Due to its important significance and numerous applications in data transmission, it has been a hotspot for researchers.

Various techniques and configurations have been put forth in recent years for the creation of optical frequency combs (OFCs). Parallel and serial cascading of modulators and feedback loops are the most often employed configurations for producing OFC lines (R. Ullah et al., 2021).

In recent years, various methods and configurations are proposed for OFC generation. The most common configurations used for generating OFC lines are mode-locked lasers (MLL), recirculating frequency shifting (RFS) loops, and nonlinear effects in a highly nonlinear medium (S. Ullah et al., 2020). The first method is based on MLL, the generated OFCs have high bandwidth but it is not easy to control and adjust the OFC generator. The second method is based on the RFS loop, a variety of research articles have reported that the RFS loop can obtain more comb lines, however, the structure of the RFS loop is complex and requires more components (S. Ullah et al., 2020).

There is another method that uses optical modulators more frequently. The most common method of phase

modulators and intensity modulators utilized in this technique are cascaded setups. Due to its ease of usage and low cost, this approach is frequently employed to make optical frequency comb.

Phase Modulator (PM)

A phase modulator is an optical modulator that can be used to modify a laser beam's optical phase. The wavelength of a laser having a single frequency can be adjusted using a phase modulator inside the laser resonator. In laser frequency stabilization techniques, phase modulation of a beam with a moderate modulation strength is frequently employed. Frequency combs can be created by directing a single-frequency beam into a phase modulator for some optical metrology purposes. In that instance, obtaining a significant number of optical sidebands frequently requires a considerable phase modulation. Phase modulators may be employed in data transmitters for optical fiber communication systems to encode the data being delivered. One illustration is the PSK technique.

Electro Absorption modulator (EAM)

A device called an electro-absorption modulator (EAM) can be utilize to modify optical signal of a laser. Its working principle is, it produces change in absorption spectrum when we apply voltage across its terminal.

Mach-Zehnder modulator (MZM)

An interferometric structure called the Mach-Zehnder modulator (MZM) is composed of a semiconductor material such as LiNbO₃, and In-P. Phase modulation results from changing the path of optical lengths caused by the varying voltage to the arms. This is also utilized in various sectors such as telecommunication, and high-speed data transmission. Mach Zehnder Modulator is shown in Figure 1.

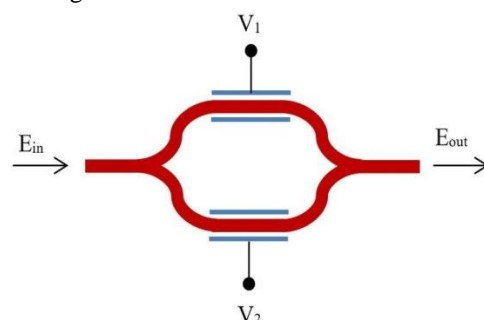
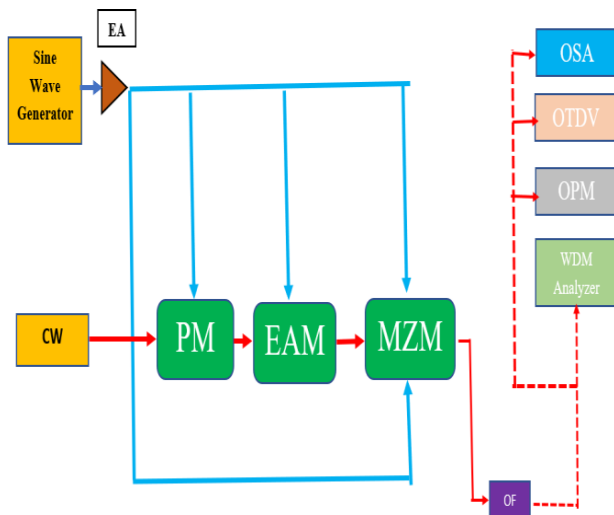


Figure 1: Mach Zehnder Modulator

PRESENT WORK

The input signal is amplified and divided into four parts with the use of a 1x4 fork without any change in the frequency and signal power. The optical arm of the phase modulator (PM) is derived by the Continuous laser (CW) source and the electrical arm is derived by the sine wave input signal. Then output produced by the phase modulator (PM) is given to the optical arm of the electro-absorption modulator (EAM) and the electrical arm is derived by the sine wave input signal. Further, the output produced by EAM is given to the optical arm of the Mach Zehnder modulator and two electrical input signal is given to its electrical arms. The output signal of the electro-absorption and phase modulator are having limited and unstable carriers which are enhanced and provided stability by the Mach Zehnder modulator (MZM).



BLOCK DIAGRAM

In the presented work, the output signal is visualized and analyzed with help of an optical spectrum analyzer (OSA), Wavelength division multiplexing WDM analyzer, optical power meter (OPM), and optical time-domain visualizer (OTDV). In this scheme, approximately 91 healthy and stable carriers are successfully achieved.

WDM analyzer is utilized in to obtain the values of parameters such as Noise power, Signal to Noise Ratio (SNR), and Optical signal to noise ratio (OSNR). An optical power meter (OPM) is utilized to obtain the power in the designed network. An optical spectrum analyzer (OSA) is used to analyze the spectrum of the generated signal. An optical time domain visualizer (OTDV) is also utilized to observe the carrier signal in the time domain.

RESULTS AND DISCUSSION

The output of the Sine wave generator is given by the expression:

$$Y(t) = m \cdot \sin(2\pi ft + \phi)$$

The output of the Sine wave generator is shown in Figure 2.

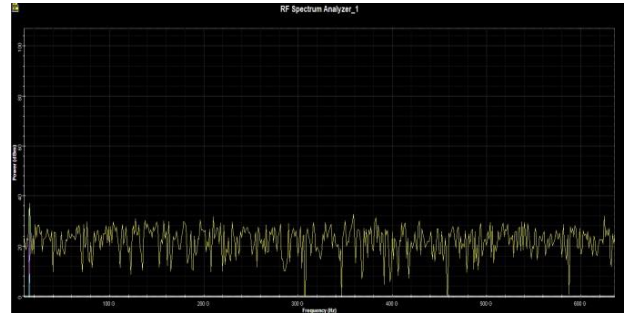


Figure 2: The output of the Sine wave generator

A Continuous-wave laser source of frequency

193.1 THz and line width of 10 MHz is also used to produce an optical input in the system (S. Ullah et al., 2020).

The output of the Continuous Wave laser source is given by the expression:

$$E_c = E_0 e^{j2\pi ft}$$

The output of the Continuous Wave laser source is shown in Figure 3.

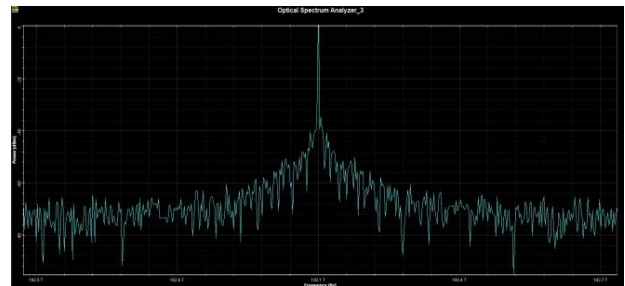


Figure 3: The output of the Continuous Wave laser source

The output of the phase modulator is shown in Figure 4.

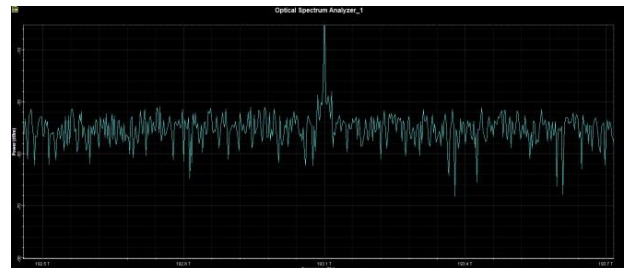


Figure 4: The output of Phase Modulator

The output of the Electro Absorption modulator is shown in Figure 5.



Figure 5: The output of the EA Modulator

The total Noise power comes out to be approximately 80 dBm, Signal To Noise Ratio (SNR) is 45 decibel and Optical signal-to-noise ratio (OSNR) is 45 decibel.

All values of different parameters are shown in Table 1 as below:

Table 1: Noise Power and SNR values

	Signal Power (dBm)	Noise Power (dBm)	SNR (dB)	Noise Power: 0.1nm (dB)	OSNR (dB)
Min value	-36.420884	-79.341946	42.921062	-81.383146	44.962262
Max Value	-36.420884	-79.341946	42.921062	-81.383146	44.962262
Total	-36.420884	-79.341946		-81.383146	
Ratio max/min	0	0	0	0	0
	(THz)	(THz)	(THz)	(THz)	(THz)
Frequency at min	193.1	193.1	193.1	193.1	193.1
Frequency at max	193.1	193.1	193.1	193.1	193.1

CONCLUSION

In this, a new mechanism of multiple carrier generation is proposed and demonstrated. In this scheme serial cascading of the phase modulator, EAM and MZM are utilized. In this scheme we are taking a frequency of 15 GHz and approximately 91 healthy carriers are generated. This scheme can be deployed in various sectors such as Telecommunication, Optical communication, and Satellite communication.

REFERENCES

- [1] Cheng, Y., Yan, J., & Zhao, S. (2019), "Self-Oscillating Parametric Optical Frequency Comb Generation Using an Electro absorption Modulated Laser-Based Optoelectronic Oscillator", IEEE Photonics Journal, vol. 11, 4, pp. 1-9.
- [2] Dai, J., Xu, X., Wu, Z., Dai, Y., Yin, F., Zhou, Y., ... & Xu, K. (2015), "Self-oscillating optical frequency comb generator based on an optoelectronic oscillator employing cascaded modulators", Optics Express, vol. 23, 23, pp. 30014-30019.
- [3] Das, B., Mallick, K., Mandal, P., Dutta, B., Barman, C., & Patra, A. S. (2020a), "Flat optical frequency comb generation employing cascaded dual-drive Mach-Zehnder modulators", Results in Physics, vol. 17, pp. 103152.
- [4] Fukuchi, Y., Hirata, K., & Ikeoka, H. (2014), "Wavelength-tunable and bandwidth-variable ultra-flat optical frequency comb block generation from a bismuth-based actively mode-locked fiber laser", IEEE Photonics Journal, vol. 6, 1, pp. 1-9.
- [5] Guo, Y., Liu, Y., Li, D., & Wu, S. (2021), "Ultra-flat optical frequency comb generation based on a polarization modulator and a Butterworth band-stop filter", Applied Optics, vol. 60, 19.
- [6] Ishizawa, A., Nishikawa, T., Mizutori, A., Takara, H., Takada, A., Sogawa, T., & Koga, M. (2013), "Phase-noise characteristics of a 25-GHz-spaced optical frequency comb based on a phase- and intensity-modulated laser", Optics Express, vol. 21, 24, pp. 29186-29194.
- [7] Jiang, W., Zhao, S., Li, X., & Tan, Q. (2017), "Optical frequency comb generation based on three parallel Mach-Zehnder modulators with recirculating frequency shifting loop", Optical Review, vol. 24, 4, pp. 533-539.
- [8] Li, J., Ma, H., Li, Z., & Zhang, X. (2017), "Optical frequency comb generation based on dual-polarization IQ modulator shared by two polarization-orthogonal recirculating frequency shifting loops", IEEE Photonics Journal, vol. 9, 5, pp. 1-10.
- [9] Li, X., Yu, J., Zhang, J., & Chi, N. (2013). "Flattened optical frequency-locked multi-carrier generation by cascading one DML and one phase modulator is driven by different RF frequency clocks," Laser Physics Letters, vol. 10, 11, pp. 116-121.
- [10] Li, X., & Xiao, J. (2015), "Flattened optical frequency-locked multi-carrier generation by cascading one EML and one phase modulator driven by different RF clocks", Optical Fiber Technology, vol. 23, pp. 116-121.
- [11] Liu, J., Zheng, B., & Shu, C. (2017), "Self-oscillating optical frequency comb based on a Raman-pumped Brillouin optoelectronic oscillator", IEEE Photonics Technology Letters, vol. 29, 12, pp. 1003-1006.
- [12] Melo, S. A. S., do Nascimento, A. R., Cerqueira, S. A., Carvalho, L. H. H., Pataca, D. M., Oliveira, J. C. R. F., & Fragnito, H. L. (2014), "Frequency comb expansion based on optical feedback, highly nonlinear and erbium-doped fibers", Optics Communications, vol. 312, pp. 287-291.
- [13] Mohsin, M. J., & Mudas, I. A. (2022), "Designing an optical frequency comb generator for visible light communication applications", International Journal of Electrical and Computer Engineering, vol. 12, 1, pp. 471-477.
- [14] Preussler, S., Wenzel, N., & Schneider, T. (2014), "Flat, rectangular frequency comb generation with tunable bandwidth and frequency spacing", Optics Letters, vol. 39, 6, pp. 1637-1640.
- [15] Qu, K., Zhao, S., Li, X., Zhu, Z., Liang, D., & Liang, D. (2016), "Ultra-flat and broadband optical frequency comb generator via a single Mach-Zehnder modulator", IEEE Photonics Technology Letters, vol. 29, 2, pp. 255-258.
- [16] Shen, J., Wu, S., & Li, D. (2019), "Ultra-flat optical frequency comb generation based on phase modulation with simple digital driving signal", Optik, vol. 198, pp. 163254.
- [17] Song, G., Wang, T., Dong, F., & Zhang, Y. (2020), "Transmission characteristics of 24.5 Gb/s atmospheric laser communication based on optical frequency comb", Optics Communications, vol. 465, pp. 125602.

- [18] Tang, J., Sun, J., Zhao, L., Chen, T., Huang, T., & Zhou, Y. (2011), "Tunable multiwavelength generation based on Brillouin-erbium comb fiber laser assisted by multiple four-wave mixing processes", *Optics express*, vol. 19,15, pp. 14682-14689.
- [19] Tian, F., Zhang, R., Ullah, R., Wang, B., Zhang, Q., Tian, Q., Liu, B., Wang, Y., & Xin, (2019), "Theoretical analysis of high-quality multicarrier generator based on double complementary recirculating frequency shifter", *Optics Communications*, vol. 445, pp. 222–230.
- [20] Ullah, R., Bo, L., Ullah, S., Yaya, M., Tian, F., & Xiangjun, X. (2018), "Cost effective OLT designed from optical frequency comb generator based EML for 1.22 Tbps wavelength division multiplexed passive optical network", *Optical Fiber Technology*, vol. 43, pp. 49–56.
- [21] Ullah, R., Liu, B., Zhang, Q., Saad Khan, M., Ahmad, I., Ali, A., Khan, R., Tian, Q., Yan, C., & Xin, X. (2016), "Pulsed laser-based optical frequency comb generator for high capacity wavelength division multiplexed passive optical network supporting 1.2 Tbps", *Optical Engineering*, vol. 55, 9, pp. 096106.
- [22] Ullah, R., Ullah, S., Ali, A., Yaya, M., Latif, S., Khan, M. K., & Xin, X. (2019), "Optical 1.56 Tbps coherent 4-QAM transmission across 60 km SSMF employing OFC scheme", *AEU - International Journal of Electronics and Communications*, vol. 105, pp. 78–84.
- [23] Ullah, R., Ullah, S., Khan, G. Z., Mao, Y., Ren, J., Zhao, J., Chen, S., Li, M., & Khan, J. (2021), "Ultrawide and tunable self-oscillating optical frequency comb generator based on an optoelectronic oscillator", *Results in Physics*, vol. 22, pp. 103849.
- [24] Ullah, S., Tian, F., Qi, Z., Ali, A., Khan, J., Khan, M. S., & Xin, X. (2022), "Performance evaluation of optical carrier suppressed RZ-DPSK signal in WDM networks employing OFC", *Microwave and Optical Technology Letters*, vol. 64, 5, pp. 839–844.
- [25] Ullah, S., Ullah, R., Zhang, Q., Khalid, H. A., Memon, K. A., Khan, A., Tian, F., & Xiangjun, (2020), "Ultra-wide and flattened optical frequency comb generation based on cascaded phase modulator and LiNbO₃-MZM offering terahertz bandwidth", *IEEE Access*, vol. 8, pp. 76692–76699.
- [26] Wang, C., Zhou, W., & Yu, J. (2019), "392 GHz THz vector signal generation based on ISB and multi-frequency signal generation using cascaded phase modulator and I/Q modulator", *Optics Communications*, vol. 452, pp. 181–184.
- [27] Wang, W. T., Liu, J. G., Sun, W. H., Chen, W., & Zhu, N. H. (2015), "Multi-band local microwave signal generation based on an optical frequency comb generator", *Optics Communications*, vol. 338, pp. 90–94.
- [28] Wang, Q., Huo, L., Xing, Y., & Zhou, B. (2014), "Ultra-flat optical frequency comb generator using a single-driven dual-parallel Mach-Zehnder modulator", *Optics Letters*, vol. 39, 10, pp. 3050-3053.
- [29] Yan, J., & Liang, A. (2018), "Self-oscillating frequency comb generation with a stimulated Brillouin scattering based optoelectronic oscillator", *Optical Fiber Technology*, vol. 46, pp. 68–71.
- [30] Zhang, F., Wu, J., Li, Y., & Lin, J. (2013), "Flat optical frequency comb generation and its application for optical waveform generation", *Optics Communications*, vol. 290, pp. 37–42.
- [31] Zhang, Y., Liao, S., Wang, G., Yang, K., Zhang, Z., Zhang, S., & Liu, Y. (2021), "Robust Optical Frequency Comb Generation by Using a Three-Stage Optical Nonlinear Dynamic", *Frontiers in Physics*, vol. 9, pp. 711959.

Analysis of Network Intrusion Using Classifier Algorithms

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Abstract:

Intrusion detection is a system that monitors the network intrusion in a particular network. This system detects malicious attacks on the network using machine learning algorithms which will result in various attacks on the data as well as the network. These attacks can be stealing of data, misuse of the current data, third party access etc. To prevent such mishaps this system is introduced which will detect the network intrusion and third-party access into a network.

Index Terms:

intrusion detection, cyber-attacks, machine learning.

INTRODUCTION

Nowadays the most valuable asset one can possess is the data that is why security of the data is the most important task. Cyber security is one such stream where it provides security to the data. There are a number of cyber-attacks like phishing, spreading of fake news on social media, cyber bullying, cyber stalking and other forms of attack. There are various ways to detect and prevent these attacks. one such attack is network intrusion; it is a device or a software which monitors a system for malicious activity. it also detects malicious activities in a network. if any such activity is detected then it reports to a centrally managed system. There are 3 types of IDS:

- a. Intrusion detection based on “Network”
- b. Intrusion detection based on “Host”
- c. Intrusion detection based on “Application”

a. Intrusion detection in “Network”

It is a framework that analyzes approaching organized activity. these systems are set at a few focuses within the arrange which screens the activity from all the devices within the organization, it investigates on activity passing on the subnet and try to match them on the subnet with the many of the known assaults, on the off chance that the assault is distinguished or any anomalous behavior is distinguished an caution will be sent to the administrator. Such frameworks will be installed in subnets where firewalls are found in order to check on the off chance that somebody is attempting to break into the firewall. NIDS can also be combined with other technologies to increase the detection and prediction rate.

b. Intrusion detection based on “Host”

It could be a framework that screens imperative working framework records. It runs on personal hosts or devices on the website. it takes depictions of existing framework records and matches it with the past previews. HIDS are utilized in mission basic machines which are not anticipated to alter their arrangement.

c. Intrusion detection Based on “Application”

Here the abnormal function of the application is the main focus but sometimes even if such a scenario does not exist still the intrusion might have happened with the running of the application. This comes under host based itself.

Objectives

1. Analyzing the traffic in the transport layer data to detect the intrusion in the network.
2. Applying classifier machine learning algorithms on the Transport layer protocol.
3. Comparing which algorithm is best based on the accuracy.

LITERATURE REFERENCE

[1] “An Intrusion Detection System using Machine Learning Algorithm” by Chibuzor John Ugochukwu and E. O Bennett. The paper tells which algorithm is best suited by comparing the accuracy of the results as random forest and random tree. The tool used is WEKA which is used to perform correlation-based feature selection and the parameters used in the computation are Precision, Recall, and F-Measure.[2] “A Review of Intrusion Detection System Using Neural Network and Machine Learning Technique” by Deepika P V and Alpa Reshamwala To overcome some challenges in technological problems the neural network and machine learning play a major role.. Anomalies in intrusion detection systems can be found using a number of techniques. Dimensionality can be performed using principal component analysis. You can specify a classifier building problem using support vector machines. This paper describes many techniques to detect the anomalies.[3] “A review on cyber security datasets for machine learning algorithms” by Ozlem yavanoglu and Murat Aydos. Data sets used in artificial intelligence and machine learning techniques. It is the primary tool for analyzing network traffic and detecting anomalies.[4] “Cyber Security in Social Media: Challenges and the Way Forward” by Kutub Thakur, Thaier Hayajneh, Jason Tseng. This paper is about the issues, challenges associated with current cyberattacks on social networks, and prevention of cybercriminals from accessing and damaging social networks. Finally, we present key recommendations for protecting social networks from cyberattacks and deepen our understanding of this area.

INTRUSION PREVENTION SYSTEM

IDPS is known as an Intrusion detection and prevention system(IDPS) . It monitors the network on your system

for malicious activity. The crux is to identify spiteful activity, list the activity and report about the activity. It altry to block or stop it. The main focus would be identifying if the intrusion has happened or not using much information like log information etc and identify security policy issues, threats existing in documents and prevent users from violating security policies. To ensure the necessary security and integrity, an IPS has become an important complement for almost every organization. The main difference between IDPS over IDS is they are placed in line and are able to prevent or block intrusions that are detected. The system sends an alarm if intrusion has happened. Another use of IDPS is it corrects CRC errors, TCP sequencing issues and defragmented packet stream and cleaning the unwanted transport and network layer options.

METHODOLOGY

Various algorithms applied like Gaussian Naive Bayes, Decision tree, KNeighborsclassifier and Logistic regression.

A. Dataset

It is a collection of data through which research can be carried out. We collected an already existing dataset for the analysis of intrusion detection happening in the TCP/IP model in the transport layer. The dataset consists of some set of features along with the values applicable to the particular feature. It is a set of relevant Data.

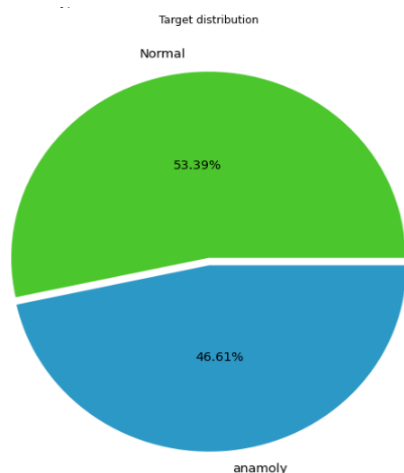


Fig 5.1 Dataset target distribution normal v/s anomaly

B. Data preparation

To run machine learning algorithms data scientists perform data preparation which is a process which transforms into raw data. This process is also called data processing. Data preparation helps in reducing invalid data which will result in deteriorating the accuracy of the algorithm or give misleading results. Proper data preparation produces clean and accurate data, resulting in more accurate model results.

- Scaling Numerical Attribute
- Encoding Numerical Attributes

C. Data cleaning

One of the crucial components of machine learning is data cleaning, it plays a significant role in building a model.

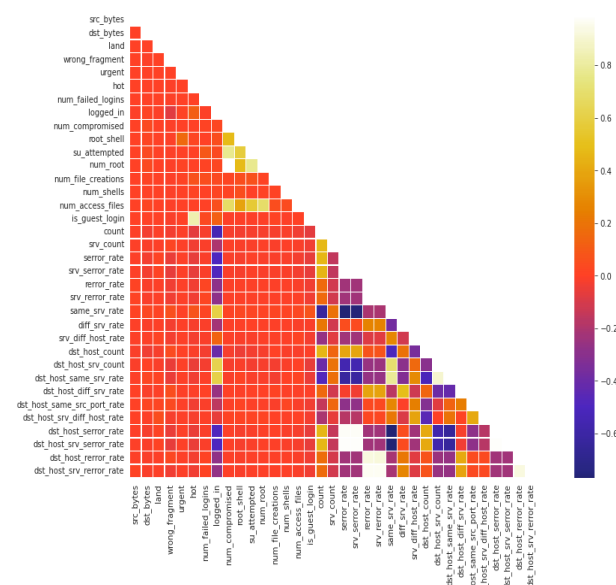


Figure 4.1 Correlation heat map after data cleaning

Correlation Heat map will be generated from the correlation matrix and which is used to visualize a large dataset as the dataset we used contains nearly 23000 rows.

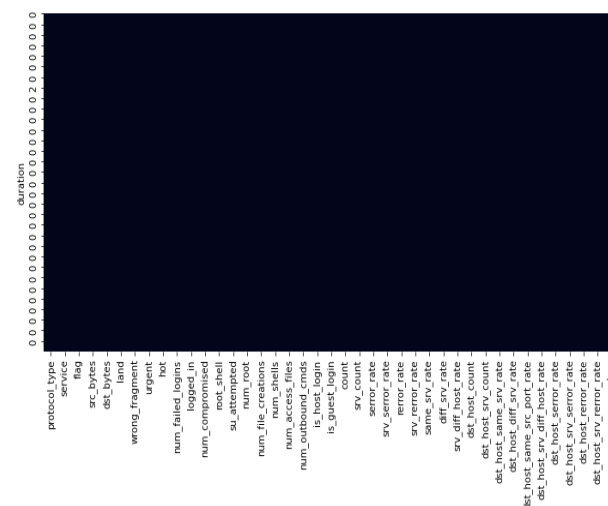


Figure 4.2 Heat map of data with no missing values

The above diagram shows the dataset does not contain missing values so need to fill the values. As there are no missing values now the next step would be getting the important features as many values will be 0 and we can't consider those features for analysis as it does not convey anything.

D. Getting the important features from the data set

Once data cleaning is done for further analysis the important features need to be extracted. Hence used feature extraction method.

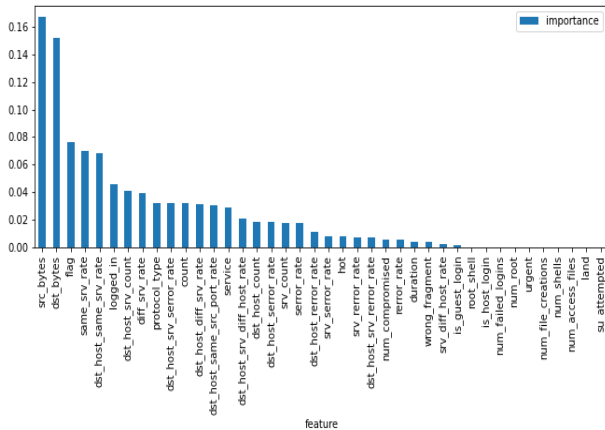


Fig 4.2 Important features selection from dataset

The above graph shows which are the features that can be taken as important for analysis to use to classify the data .

The classification is based on whether the intrusion has happened or the normal communication is happening

E. Data splitting

The obtained data will be divided into categories based on the training and test dataset. taking 70% as training size.

The data splitting is done because of overfitting of the data in the dataset while testing the classification. Usually data will be divided in 3 sets.

F. Modeling (Evaluating Models)

Confusion matrix

The confusion matrix clearly explains the ratio of Actual versus predicted data if it is true or false. The confusion matrix is used to know the performance of the model or a classifier algorithm.

Terminologies used in the Classification Report of every classifier

Precision:

Precision is the Number of Positively predicted and it is actually positive.

Precision = True Positive values/(True Positive and False Positive Values)

Here it signifies true normal network and false normal network.

Recall:

Recall is the correctly identifying positive predictions considering all the examples which are positive the complete dataset

$$\text{Recall} = \text{True Positive values}/(\text{True positives and false negatives})$$

F Score:

F1 score is balance of precision and recall with a single score.

Support:

Support is the actual occurrence of data in the dataset used

ANOMALY:

Represents the intrusion has happened so in the dataset under feature class the anomaly has been written to notify the data row is intruded.

NORMAL:

Network is in normal condition no intrusion has happened.

A. K-Nearest Neighbor classifier Algorithm(KNN)

This algorithm implements learning based by considering the nearest K neighbors where k is an integer and value of k is dependent on the data. This algorithm is really lazy as it does not classify the data at first . The training time is really low and it classifies the data when the new data is added.

The Model accuracy is 99.16% the training data has taken as 70 % .

The confusion matrix for KNN is

[[3458 40]]

[23 4037]]

Model accuracy rate is 99.37%

Table 4.1 The Classification Report for KNN

	PRECISION	RECALL	F1 SCORE	SUPPORT
ANOMALY	0.99	0.99	0.99	3498
NORMAL	0.99	0.99	0.99	4060

ACCURACY			0.99	7558
MACRO AVG	0.99	0.99	0.99	7558
WEIGHTED AVG	0.99	0.99	0.99	7558

B. Logistic regression

The logistic regression is basically predicting or will be calculating the probability of an event occurring or not . In terms of machine learning it comes under supervised learning and it predicts the categorical dependent values/variables for the given independent variable.To map the values of logistic regression the sigmoid curves have been used and possible output considered is 0 or 1.

The confusion matrix for Logistic regression:

[[3297 201]]

[138 3922]]

Model accuracy rate is 95.48%

Table 4.2The classification Report for Logistic regression

	PRECISION	RECALL	F1 SCORE	SUPPORT
ANOMALY	0.96	0.94	0.95	3498
NORMAL	0.95	0.97	0.96	4060

ACCURACY			0.96	7558
MACRO AVG	0.96	0.95	0.95	7558
WEIGHTED AVG	0.96	0.96	0.96	7558

C. Decision tree making

This is a computational model where algorithms are essentially viewed as decision trees. H. A sequence of adaptively executed queries or tests such that the results of previous tests affect the next executed test. This is a supervised learning. The decision is based on the features present in the dataset.

The confusion matrix for Decision tree making

[[3483 15]

[25 4035]]

Model accuracy rate is 99.47%

Table 4.3 The classification report for Decision tree modeling

	PRECISION	RECALL	F1 SCORE	SUPPORT
ANOMALY	0.99	1.00	0.99	3498
NORMAL	1.00	0.99	1.00	4060

ACCURACY			0.99	7558
MACRO AVG	0.99	0.99	0.99	7558
WEIGHTED AVG	0.99	0.99	0.99	7558

D. Gaussian - Naive Bayes classifier

It is a probabilistic classification based on application of Bayes' theorem with a strong assumption of independence. This classifier is based on the bayes theorem where the covariance (independent ones) does not come between the dimensions. The main focus is to get the mean and standard deviation of each point obtained from the curve it generates from the dataset to fit this model.

The confusion matrix for Gaussian Naive Bayes classifier

[[2981 517]

[188 3872]]

Model accuracy rate is 90.67%

Table 4.4 The classification report for Gaussian Naive Bayes classifier

	PRECISION	REC ALL	F1 SCORE	SUPPORT
ANOMALY	0.94	0.85	0.89	3498
NORMAL	0.88	0.95	0.92	4060

ACCURACY			0.91	7558
MACRO AVG	0.91	0.90	0.91	7558
WEIGHTED AVG	0.91	0.91	0.91	7558

RESULT

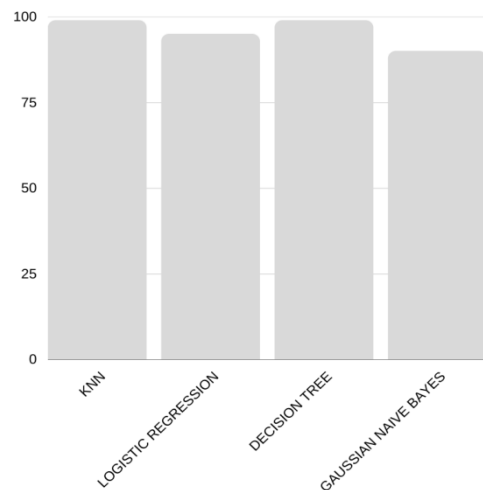


Figure 5.1 Graphical representation of accuracy of the algorithms used

By the above bar graph representation 4 algorithm models are used and the result is such as Gaussian Naive Bayes model with the least accuracy rate of 90%. The highest accuracy rate is KNN classifier and decision tree model with 99% accuracy.

Table 5.1 Result from various ML algorithms

Algorithm	Accuracy rate
KNN classifier	99.37%
Logistic Regression	95.48%
Decision Tree making	99.47%
Gaussian Naive Bayes classifier	90.67%

CONCLUSION

As there are many classifiers in machine learning but we have chosen four classifier algorithms. By observing all the four classifier models and calculations of their accuracy,

We can conclude the Decision tree algorithm and KNN classifier are the most accurate models with 99% of accuracy which are efficient and to be precise Decision Tree classifies it accurately.

REFERENCES

- [1] Chibuzor John Ugochukwu and E.O Bennette "An Intrusion Detection System using Machine Learning Algorithm", 2021.
- [2] Deepika P Vinchurkar and Alpa Reshamwala, "A Review of Intrusion Detection System Using Neural Network and Machine Learning Technique", 2020
- [3] Ozlem yavanoglu and Murat Aydos, "A review on cyber security datasets for machine learning algorithms", 2021
- [4] Kutub Thakur, Jason Tseng and Thaier Hayajneh, "Cyber Security in social media: Challenges and the Way Forward", 2021
- [5] Jayesh Surana, Jagrati Sharma, Ishika Saraf, Nishima Puri and Bhavna Navin, "A Survey On Intrusion Detection System", 2019
- [6] Anish Halimaa A and Dr K Sundarakantham, "Machine learning based intrusion detection system" 2022
- [7] Rohith kumar singh Gautam and Amit deogar, "An Ensemble approach for Intrusion detection system using Machine learning algorithms" 2019
- [8] Sukhachandra Bhumihaar, "Intrusion detection using Machine learning: A comparison study" 2020
- [9] Mohammad Almseidin, Maen Alzubi, Szilveszter Kovacs, Mouhammd Alkasassbeh, "Evaluation of machine learning algorithms for intrusion detection system" 2017
- [10] T Saranya, S Sridevi, C Deisy, Tran Du Chung and K A Ahamed Khane, "Performance analysis of machine learning algorithms in intrusion detection system: A review", 2020

Detection of Phishing Attack in Cryptocurrency Using Different Machine Learning Algorithms

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Abstract:

Blockchain technology has recently gained attention, but it has also become a breeding ground for several cybercrimes. Among these, Cryptographic based phishing scams have been discovered to produce a substantial sum of money, posing a major threat to the blockchain ecosystem's trading security. An effective phishing detection technology is urgently needed to establish a very safe environment for financiers. Purpose of this paper is to detect phishing attacks, by applying various machine learning algorithms to the dataset, and a confusion matrix for each algorithm is obtained, based on this parameter the best algorithm is selected in order to detect phishing attacks in Cryptographic transactions.

Keywords:

BlockChain, Confusion Matrix, Cybercrimes, Ethereum, Machine Learning, Phishing.

INTRODUCTION

Block chain is an open, distributed ledger that can permanently, effectively, and verifiably record transactions between two parties. Digital assets, sometimes known as cryptocurrencies, are one of the most significant and well-known applications of block chain in economics. Ethereum is one of the large block chain platform which mainly supports all smart contracts, ether is an second largest cryptocurrency. Financial reliability is an essential building ingredient for the blooming of blockchain technology. The ecosystem's plenty of scams will make the users to adopt blockchain technology and further impede the flourishing of the technology. As a result, identifying these scams has gained significant attention from researchers and has become an immediate and vital topic in the blockchain environment. A brand-new cybercrime that has emerged in tandem with the growth of internet commerce is the phishing scam. Ethereum has, nevertheless become a hub for numerous cybercrimes due to its rapid development. A type of funding for the block chain industry known as a first-ever coin offering (ICO) involves the issuance of tokens as a source of capital. However, up to this point, more than 10% of ICOs published on Ethereum have claimed to have fallen prey to a different variety of scams, which even includes phishing, ponzi schemes, and many more.

There are many information which is obtained from an Ethereum Transaction Records, that even include features of an account, even we can extract different features of an account to check whether, it is a phishing account or not, and all the transaction records are

obtained. Here in this research paper we have used "Random Forest, KNN, Naïve Bayes, Decision Tree, Logistic Regression and SVC" supervised machine algorithms. Purpose of this study is to compare all these machine learning algorithms, and to find which algorithm gives the highest accuracy to detect phishing attack and determine whether the transaction is fraud or not.

REVIEW OF LITERATURE

An Ethereum transaction network is been created based on the collected transaction records. Next, an network embedding technique known as node2vec, is utilized to extract accounts' latent properties.[1] Lastly, to determine an account is phished or not, in this paper they have used an one-class approach and to categorize using support vector machines (SVM). The trial outcome gives information that, phishing attack detection method's F-score may reach to 0.85 that validates an accuracy of their model, this study is first to look into an transaction-based phishing frauds on Cryptographic Network. The topic of blockchain cybersecurity became especially important following a number of attacks on blockchain initiatives across the globe. [2] These article group the primary phishing attack kinds and tactics against the blockchain, explores the threats they pose and recommends defenses against them, development of blockchain phishing attack defense.

The blockchain ecosystem urgently needs a reliable approach for identifying phishing scams in order to foster an atmosphere that is conducive to investment. To that goal, [3] this article suggests a method to identify by mining Ethereum's transaction logs, phishing scams can be detected. To be more precise, here they first crawl all the phishing address from an two legitimate website, then rebuild these transaction network according to an transactional records which is being gathered, this paper present an unique network-embedding approach known as "trans2vec" which is mainly used to extract all the properties of address later for phishing identification while taking an transaction amount and timestamp into account. Last but not least, here they have used "one-class support vector machine" i.e SVM, used to separate nodes to an legitimate, fraudulent ones this study was the first to examine how to identify phishing attack on Ethereum through embedding network, and even it offers understanding of how large scale transaction network are possible. [4] Accounts on the digital currency market can easily and freely link with one

another to transact in goods, information, services, and so forth. Due to the market's inherent qualities of anonymity, unregulated organization, and other crimes, the market for cryptocurrencies breeds many of them. This paper deals in contrast to pure feature engineering, GCN can strengthen the topology information by examining more implicit aspects of the structure, here few developing technologies has been used to incorporate different nodes characteristics even structural information to an under-researched and urgent security issue, called as anti phishing action in an Ethereum network, in contrast with other typical feature mining methods that take topology into consideration. Throughout the blockchain ecosystem all phishing-scam have an amassed, sizable sum of money and even that have grown to be a serious threat to users' financial security, [5] this paper suggests an methodology to identify different phishing accounts which is based on blockchain transactions and even to take an appropriate action which is mainly used to assist and resolve this issue, using Ethereum as an example, we can confirm that an efficiency what they provide is an light GBM based, dual sampling and ensemble approach which is to construct an identification model, and even by using graph-based feature extraction, which is mainly based on transaction records of all ethers. Extensive testing demonstrates that the suggested algorithm is capable of accurately detecting phishing frauds.

METHODOLOGY

Data Description

Dataset is originally written by Chiticariu Cristian. This dataset basically contains about 9841 data and 50 features which is divided into 70:30 proportion as training and testing data. It contains 0 and 1, where 0 represents for non-fraud record and 1 for fraud record, The system does not understand the human language and understands only values in binary i.e 0s and 1s. It's crucial to pre-process the data after it has been collected, including cleaning, filling it out and adding significant identifiers that computer can understand.

Data Cleaning

Data cleaning is one of the crucial and important step as if done incorrectly, then it can lead to yield wrong results. Dataset obtained is quite raw and there can be features that highly correlate or even in some situations values may be missing. So to understand better we can use heat map and correlation matrix.

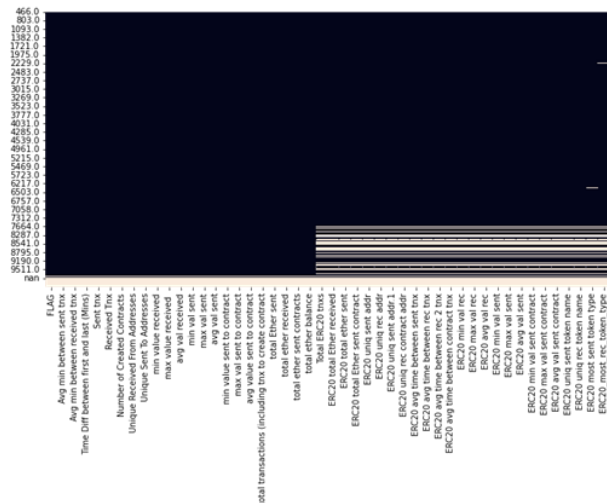


Figure 1. Heat map that represents missing values in data set

Figure 1 represents the heatmap that gives information about the missing values in some columns or features. The white space represents the missing values in that specific feature. So to fill those missing values one can use any functions. In this paper, we have used median to fill the missing data. Missing values has to be handled because, if the dataset with missing values is made to fit into the model, then that wouldn't be possible as the model expects the input dataset to be with none missing values. Absence of missing values can be verified by heat map representation.

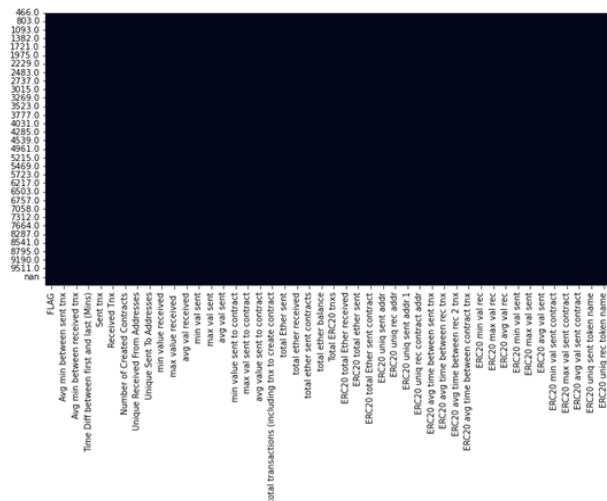


Figure 2. Heat Map representation of zero missing values in the dataset

To drop columns we used correlation matrices. Correlation matrix gives information of the highly correlated features. So to drop features, one can group all the intended features and then drop them together. So to reduce the complexity, we drop few features that does not affect the modeling. Figure 3 represents the correlation heat map after reducing the no of features from 50 to 19.

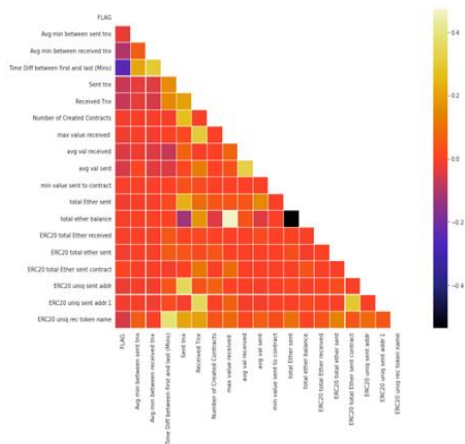


Figure 3:Correlational heat map after dropping few features

Handling The Imbalance

In the dataset collected, one label has more values associated to it compared to the other label. This leads to over fit condition and the results obtained can be imperfect. To handle this imbalance condition, we have applied resampling to the data. Figure 4 represents the percentage of scam records and non-scam records before resampling and Figure 5 represents the percentage of scam and non-scam records after resampling.

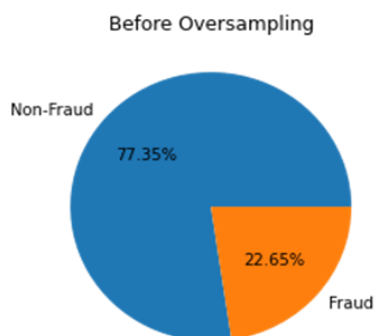


Figure 4. Percentage Before Applying Resampling

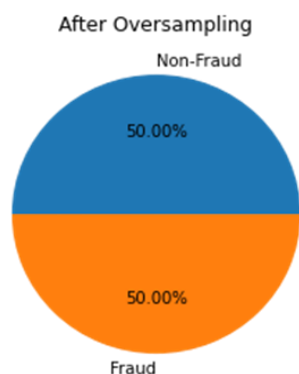


Figure 5. Percentage After Applying Resampling

Data Preparation

Data preparation is one of the important step before applying any machine learning algorithm on the dataset. Data preparation is also known as data processing .The dataset is divided in terms of X and y where y includes

the important feature and X includes other features to which the classification has to happen. Then dataset is broken into two sets one for training and the other for testing. The ratio we divided is 70:30, which means 70 percent is needed to train the model and 30 percent is needed to test the model.

Data Modeling And Analysis

After preparing the data, we apply various machine learning algorithms and perform analysis on it. Choosing the algorithms depends on the data. So algorithms suitable for our dataset is classification algorithms. Few ML classification algorithms, we have used is “Naive Bayes, Random Forest, Decision Tree, SVC,KNN and Logistic Regression”. After using these algorithms we analyze the results obtained based on precision, recall,F1-score,support,accuracy score and confusion_matrix and chooses the best algorithm suitable for the dataset.

RESULT AND DISCUSSION

For the following dataset we use supervised machine learning algorithm. The dataset is divided into “training data set and testing data set” where the model is fitted into the “training set” and the predictions are made on the “testing dataset”. For each algorithms accuracies are obtained and compared with each other to obtain the best one suitable for the dataset.This dataset is of classification type which means the transaction record is classified as phishing or non-phishing. Algorithms used is “Logistic Regression, Random Forest, SVM, Decision Tree, KNN and Naive Bayes”. Logistic Regression is one of the most used classification algorithm and gives prediction in terms of binomial. On the other hand, we use Naïve Bayes as it yields faster results on the test data and saves a lot of time.

We have, divided the data as 70:30 meaning 6888 to be training data and 2953 to be testing data. The training data has to be fitted to the model because if anything wrong occurs, then the outcome achieved is not accurate. We obtained various accuracies from algorithms like 97.15% for Random Forest, 87.63% for Logistic Regression,96.24% for SVC, 95.49% for KNN, 62.41% for Naïve Bayes and 95.97 for Decision Tree. These accuracies are arranged in the order of highest to lowest in the Table 1.

Table 1 .1 Accuracy result table of various Algorithms

Algorithm	Accuracy in %
Random Forest	97.15
SVC	96.24
Decision Tree	95.97
KNN	95.49
Logistic Regression	87.63

So the accuracy results of the algorithms is represented in the form of bar chart shown in the figure 6.

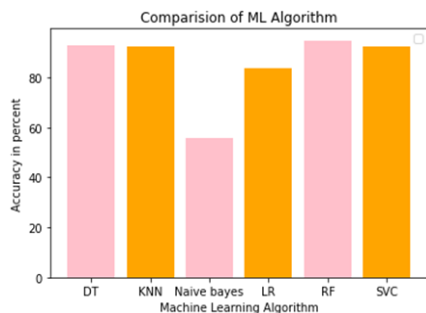


Figure 6: Bar graph comparison of various Algorithms

Confusion matrix is the data represented in the tabular form to represent the working of the classification algorithm on the testing data. It is divided into four quadrants where first represents the true positive meaning both predicted and original is true and valid, second represents true negative where original is true but prediction is false. Third represents false positive meaning original is false but prediction is true and final quadrant represents false negative where both original and predictions are false.

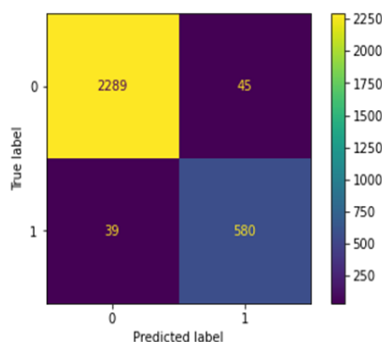


Figure 7. Random Forest Algorithm's confusion matrix

From the above figure for random forest, we can conclude that 2289 were the real non-scam transaction and also were also predicted as no scam whereas 45 of transaction which were non-scam were predicted as scam by the algorithm. But 39 of the scam records were predicted as non scam where as 580 were both real and predicted scam records

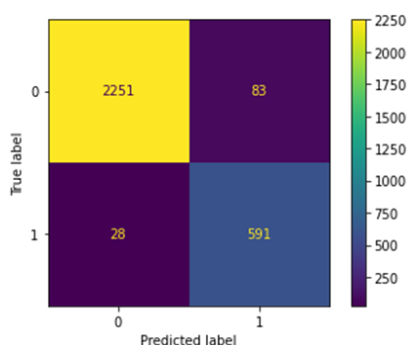


Figure 8 SVC algorithm's confusion matrix

SVC algorithm predicted that 2334 were non scam where 2251 were originally non scam records and 83 were really scam records. Out of 619 records predicted to be scam by the algorithm, 28 were originally non scam whereas 591 were scam.

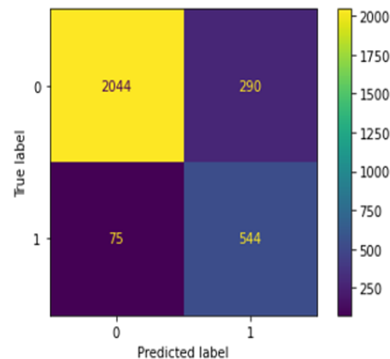


Figure 9 Logistic Regression algorithm's confusion matrix

In the dataset of 2334 scam records and 619 non scam records, Logistic regression predicted 2044 to be non scam and 290 to be scam. 75 were predicted as non-scam which were truly scam where as 544 were scam from both side.

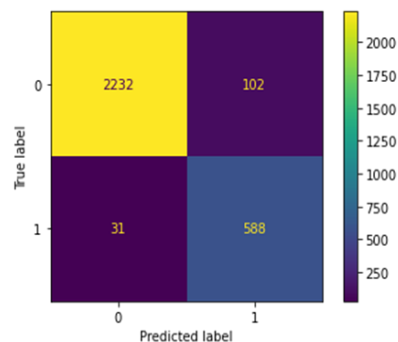


Figure 10. KNN algorithm's confusion matrix

KNN algorithm predicted that 2232 records were non-scam and 102 to be scam where both were really non scam records. Out of original scam records, 31 were predicted as non scam and 588 were as scam

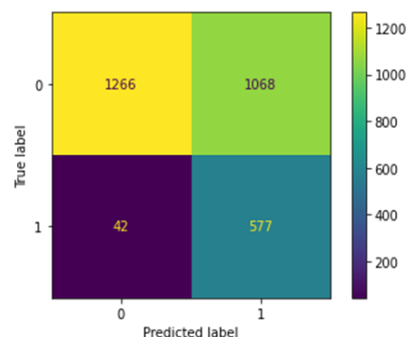


Figure 11: Naive Bayes Algorithm's confusion matrix

Naive Bayes predicted 1266 as non scam and 1068 as scam which were originally non scam. It also predicted that 42 as non scam and 577 as scam which were originally scam records.

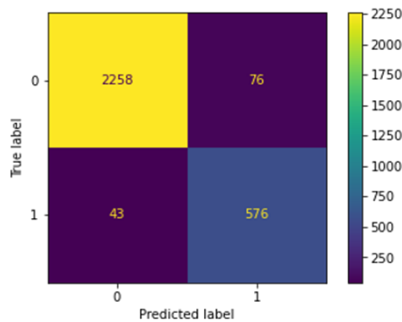


Figure 12. Decision Tree algorithm's confusion matrix

“Decision Tree algorithm” predicted 2258 records to be non scam and 76 to be scam which were really non scam records. On the other hand, 43 records were predicted as non scam which were originally scam records and 576 to be both predicted and really scam.

From the above results obtained from various accuracies, we can conclude that “Random Forest Classifier” algorithm was the best algorithm suited for our dataset and provide the better classification compared to other algorithms.

CONCLUSION

Intruders utilize phishing attacks, which have been around for years, to steal sensitive data such as financial information and personal information. Phishing is pervasive that it successfully applies to emerging technologies like blockchain, increasing mistrust of them and impeding their development. So one must be careful and follow safety points to be protected from phishing attack. It is always suggested that one must check for spell errors or avoid unknown accounts informing you for false rewards of ethers or cryptocurrencies. One must also be aware of the fraud messages or links that are received and thus should not click on it which may lead to loss of cryptos in your account. So to prevent the phishing attacks on ethers, one has to check for the timings of sending and receiving of transactions from an account that was measured in minutes.

In this paper, transaction records are differentiated as scam and non scam using various machine learning algorithms and those fraud transaction records are the one that are responsible for the phishing attack. So by avoiding it, one can be safe from phishing attack.

REFERENCES

- [1] “Detecting Phishing Scams on Ethereum based on Transaction Records Qi Yuan , Baoying Huang, Jie Zhang , Jiajing Wu, Haonan Zhang and Xi Zhang School of Data and Computer Science, Sun Yatsen University, Guangzhou 510006, China College of Electronic and Information Engineering, Southwest University, Chongqing 400715, China School of Automation, Beijing Institute of Technology, Beijing 100081, China Corresponding Author: wujiajing@mail.sysu.edu.cn-2020”
- [2] “Phishing Attacks and Preventions in Blockchain Based Projects A.A. Andryukhin KCD Moscow, Russia Alexandr@kcdigital.ru-2019”
- [3] “Who Are the Phishers? Phishing Scam Detection on Ethereum via Network Embedding Jiajing Wu, Senior Member, IEEE, Qi Yuan, Dan Lin , Wei You, Weili Chen , Chuan Chen , Member, IEEE, and Zibin Zheng , Senior Member, IEEE-2022”
- [4] “Phishing Scams Detection in Ethereum Transaction Network LIANG CHEN, JIAYING PENG, YANG LIU, JINTANG LI, FENFANG XIE, ZIBIN ZHENG, Sun Yat-Sen University, China-2020”
- [5] “Phishing Scam Detection on Ethereum: Towards Financial Security for Blockchain Ecosystem Weili Chen^{1,2} Xiongfeng Guo^{1,3} , Zhiguang Chen^{1,2} , Zibin Zheng^{1,3} and Yutong Lu^{1,2} ¹School of Data and Computer Science, Sun Yat-sen University ²National Supercomputer Center in Guangzhou, Sun Yat-sen University ³National Engineering Research Center of Digital Life, Sun Yat-sen University chenwli28@mail.sysu.edu.cn, guoxf6@mail2.sysu.edu.cn, zhiguang.chen@nsc-gz.cn, zhzibin@mail.sysu.edu.cn, yutong.lu@nsc-gz.cn-2020”
- [6] “Blockchain-based decentralized trust management in vehicular networks, IEEE Internet Things, Z. Yang, K. Yang, L. Lei, K. Zheng, and V. C. Leung, vol. 6, no. 2, pp. 1495-150 2018.”
- [7] “<https://www.kaggle.com/code/chiticariucristi/an/fraud-detection-ethereum-transactions/data>”
- [8] “A survey on security and privacy issues of bitcoin, IEEE Commun. Surveys, M. Conti, E. S. Kumar, C. Lal, and S. Ruj, Tuts vol. 20, no.4, pp3416–3452, 1st Quart-2018”
- [9] “Extracting and exploring blockchain data from Ethereum, IEEE, P. Zheng, Z. Zheng, J. Wu, and H. N. Dai, XBlock-ETH OpenJ.Comput.Soc, vol. 1, pp 95–106, 2020”
- [10] “Analyzing the Bitcoin ponzi scheme ecosystem in Proc. In Conf. Finance Crypt. Data Security, M. Vasek and T. Moore-2018”
- [11] “Dissecting ponzi schemes on Ethereum Identification, analysis, and impact, M. Bartoletti, S. Carta, T. Cimoli, and R. Saia-2017”

Analyzing Credit Card Fraud Detection Algorithms

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Abstract:

Due to the fact that credit card fraud is one of the biggest Cybercrimes. Cybercrimes can come in a variety of forms, and many of them involve credit cards. The way burglars target data and information has evolved because of the internet. While some criminals concentrate on stealing huge information files that they can resell online, others just target one victim or swipe one card. We require a fraud detection and prevention strategy that concentrates on the dangers of cybercrimes if we want to stop credit card fraud. Consumers are aware of this danger on an intuitive level. In order to detect it, we shall analyze how the Machine Learning classifiers or algorithms can be used in detecting transactions that are fraudulent. We have gathered our dataset, and made use of four different Machine learning Classifiers such as Ada Boost, Decision Tree, Random Forest and Gradient Boosting. As the dataset is imbalanced, we will make use of a 70:30 dividing ratio to balance the dataset and also to train and test the dataset thereby building a Detection system. Later compare the results of accuracy and precision with each and every other classifier in deciding which classifier can be best used in building a detection system.

Index Terms:

Ada Boost Classifier, Decision Tree Classifier, Gradient Boost Classifier, Imbalanced Dataset, & Random Forest Classifier.

INTRODUCTION

Globally, billions of credit card transactions are completed each day. Using the extensive usage of smartphones and the Internet on the planet, an increasing number of individuals are using their credit cards to buy things online, pay for things with applications, etc. In a situation like this, it is crucial for credit card issuers to be able to tell whether a transaction is the product of fraud or a legitimate purchase, in order to prevent customers from being charged for goods they did not purchase. The Credit Card Fraud Detection dataset includes credit card transactions done by European customers over the course of two days in September 2013.[1].The feature time in the dataset displays the number of seconds that passed between each transaction and the dataset's initial transaction.

The feature amount, which includes the transaction amount and the feature class, tells us if a certain transaction is legitimate or fraudulent, with 1 denoting the former and 0 the latter. We tested the efficacy of several prediction models in our kernel to determine whether a transaction is legitimate or fraudulent. We made use of 4 different classifiers and the result obtained from it will help us analyze their precision and accuracy, & which classifier's precision and accuracy is finest when compared among each other classifiers. Our initial major goals was to gather the data and understand the

dataset, on observing the dataset it was found that the dataset is found to be imbalanced, in order to balance the dataset, our approach involved of creating and adding fake entries, hence it is balanced & co-operates well with the classifiers while testing. And our final major goal was to compare the accuracy of the classifiers.

REVIEW OF LITERATURE.

1. 91.87% Recall with Ada Boost – Credit Card Fraud Detection.[1]

This paper articulates on how to understand the dataset, what factors of the paper should be considered and should be carried to work on. Distribution of class based on amount made analysis deeper and effective and thereby making it easier to obtain Fraudulent and Non-fraudulent transactions. split our data into training set and testing. Let's split them into a 70/30 proportion, where 70% of our data will be used for training while the 30% left will be used for testing. They had made use of the Scikit-learn library to develop the prediction models, and the classifier used here is Ada Boost which claims to be the classifiers whose accuracy scores and precision scores are close enough, hence proving to be the best classifier when compared with other classifiers. Since we too have Ada boost as one of our classifiers, we will get the chance to test its accuracy, precision and differentiate it with other classifiers as well.

2. Credit card Fraud // Dealing with Imbalanced Datasets[2]

As mentioned earlier as the dataset obtained was imbalanced, this paper specifies the strategies used to handle the imbalanced data such as 'Understanding the data' which uses PCA Transformation & Scaling, followed by 'Preprocessing' wherein the Distribution and splitting of the data happens. The next strategy has few important procedures and they involve Anomaly Detection, clustering, logistic regression & oversampling with SMOTE and the final strategy is 'testing' which determines whether our basic neural network can accurately predict both non-fraud and fraud situations, we will examine how it performs in both the random undersample and oversample dataframes. This Paper helped us think of other approaches that can be implemented to treat the imbalanced data. Such as dividing the data in the ratio of 50:50, 70:30, or add up fake entries of transactions to balance the dataset, as it is important to balance the data when training the models. We divided our dataset in the ratio of 70:30 to work with imbalanced data, 70% of the dataset for training the model and 30% for testing the model.

3. Undersampling & Oversampling imbalanced Data with Credit Card Fraud Detection Dataset.[3]

In this paper, we learnt about over- and under-sampling, what they are, what issues they address, how to use them in sklearn, and how to apply them simply to a problem of detecting fraudulent credit card transactions. The two simplest sampling techniques are under- and over-sampling, and dealing with class imbalance issues using sampling techniques is similarly straightforward. Custom error functions (such as creating your own kernel for the SVM) and more complex sampling algorithms, such as SMOTE and other tools, are further methods for solving class imbalance concerns. The strategy that we had used to treat imbalanced data was implementing undersampling techniques, this paper helped us on learning how to implement the undersampling technique.

4. Credit Card Fraud Detection based on Machine Learning & Deep Learning.[4]

It discusses the techniques used on the dataset, and the evaluation model carried out is known as 'Area under the Receiver operating characteristic curve (AUC)'. Indicates how deep learning methods and machine learning algorithms can be implemented in tracking fraud transactions made out of credit cards. IEEE-CIS Fraud Detection was taken as dataset, and on testing it with a number of machine learning & deep learning models, to determine whether an online transaction is legitimate or fraudulent. They had also developed their own model, called, BiLSTM-MaxPooling-BiGRU-MaxPooling, which is based on bidirectional LSTM and GRU. They also experimented with SMOTE, undersampling, and oversampling in order to handle severely unbalanced datasets. a collection of measures for measuring the performance of the models. According to the findings of machine learning classifiers, hard voting with undersampling and oversampling techniques produced the best AUC scores of 80% and 81 %, respectively. In contrast to the model's 91.37 percent AUC, the outcomes from machine learning classifiers were less encouraging.[4]

METHODOLOGY

i. Obtaining The data

The data was sourced from Kaggle[1]. It contains transactions which occurred in the month of September 2013 by European Cardholders. It has a total of 284,807 transactions having a total of 28 features, the transaction amount, the type of transaction and the transaction time in seconds elapsed between each transaction and the first transaction. There are no "Null" values hence it is not needed to replace any values.

ii. Getting to know the Data

Amongst the 284,807 transactions only 492 transactions were found to be fraudulent which means the available data is highly imbalanced.

The visualization of the class function was done and represented in the form of a pie chart (Figure 1).



Figure1

All the features have inputs in numerical form, most of them are in decimal which are of the type floating point numbers and class contains input in integer form. The statistics of the amount feature was found to be as follows

Attribute	Value
Count	284,807
Mean	88.35
Max value	25,691

Table 1

Table 1 tells us that the total number of transactions were 284,807, the maximum amount in a transaction was found to be €25691 and the average transaction amount was found to be €88.35.

The statistics of the amount feature of fraud transactions was found to be as follows

Attribute	Value
Count	492
Mean	122.211
75%	105.9
Max value	2125

Table 2

Table 2 tells us that the number of fraud transactions were 492, the mean value of a fraud transaction was €122.2, the maximum amount in fraud transactions was found to be €2125 and 75% of the frauds occurred in the transactions whose value was below €105.

iii. Preparing the Data

We will not be considering the time attribute in the analysis. StandardScaler() function is used to put all the data into the same scale. Amount feature is normalized using the StandardScaler function in order to avoid Data leakage. The data is split into a training set and testing set in the proportion of 70:30, where 70% of the data will be used for training while the 30% will be used for testing. As the data is imbalanced, the SMOTE function is used in order to oversample fraudulent data. SMOTE will synthetically generate more samples of fraudulent data based on the fraud transactions in the original dataset. Only the training set is balanced whereas the test

set maintains its original form as the testing should be conducted in real-time conditions.

iv. Analysis

The filtered and modified data is analysed and using the following classifiers

- Random Forest
- Decision tree
- Ada-Boost
- Gradient Boosting

a. Random Forest Classifier

Random Forest classifier works on the concept of Ensemble Learning, in which multiple classifiers are combined to solve a problem and increase the performance of the model. It contains many decision trees of the subsets present in the dataset and finds the average to improve the accuracy of the dataset. To achieve high accuracy, we need to have a high number of decision trees. The results obtained by using Random Forest classifier on the dataset is given in table 3

Metrics	Results
Accuracy	0.999450
Precision	0.874172
Recall	0.825000
F1_score	0.848875

Table 3

The accuracy of this classifier was found to be 99.9% which is a very high value. The precision helps us to determine if the classifier is predicting a genuine transaction as a fraud transaction and it has a value of 87.4%. Recall helps us to determine if the classifier is predicting a fraud transaction as a genuine transaction and it has a value of 82.5%. F1 score helps us to seek a balance between Precision and Recall and it has a value of 0.848. The confusion matrix for Random Forest classifier is given in Figure 2.



Figure 2

It can be observed that 19 of 85283 genuine transactions were predicted as fraud transactions, the least amongst all the four classifiers which is why it has the highest

precision amongst the four classifiers. 28 of 160 fraud transactions were predicted as Genuine transactions.

b. Decision Tree Classifier

It is a supervised technique where the classifiers are structured in the form of a tree. The features of the dataset are represented by internal nodes. There are two types of nodes which are decision nodes whose outcomes are stored in leaf nodes. Leaf nodes do not have any further branches. Classification and regression tree algorithms are used to build a tree. The tree asks a question whose output is binary (True/False). Based on the answer to the question, the tree is further split into two.

The results obtained by using Decision Tree classifier on the dataset is given in table 4

Metrics	Results
Accuracy	0.997209
Precision	0.382090
Recall	0.800000
F1_score	0.517172

Table 4

The accuracy of this classifier was found to be 99.7% which is a very high value. The precision helps us to determine if the classifier is predicting a genuine transaction as a fraud transaction and it has a value of 38.2%. Recall helps us to determine if the classifier is predicting a fraud transaction as a genuine transaction and it has a value of 80%. F1 score helps us to seek a balance between Precision and Recall and it has a value of 0.517. The confusion matrix for Decision Tree classifier is given in Figure 3.



Figure 3

It can be observed that 207 of 85283 genuine transactions were predicted as fraud transactions and 32 of 160 fraud transactions were predicted as Genuine transactions.

c. Ada Boost Classifier

Adaptive boosting technique is used as the Ensemble Method. The efficiency of the classifier is improved by improving the weak learners into strong learners. In

this algorithm a model is built on the training dataset after which a second model is built on the first model to correct and rectify the errors. This process is repeated until the errors are minimized and maximum accuracy is achieved. The results obtained by using Ada-Boost classifier on the dataset is given in table 5

Metrices	Results
Accuracy	0.984387
Precision	0.100136
Recall	0.918750
F1_score	0.180590

Table 5

The accuracy of this classifier was found to be 98.4% which is a very high value. The precision helps us to determine if the classifier is predicting a genuine transaction as a fraud transaction and it has a value of 10%. Recall helps us to determine if the classifier is predicting a fraud transaction as a genuine transaction and it has a value of 91.8%. F1 score helps us to seek a balance between Precision and Recall and it has a value of 0.180. The confusion matrix for Ada Boost classifier is given in Figure4



Figure 4

It can be observed that 1321 of 85283 genuine transactions were predicted as fraud transactions, which is the highest amongst the four classifiers because of which it has a low precision value. 13 of 160 fraud transactions were predicted as Genuine transactions, which is the lowest amongst the four classifiers because of which it has the highest Recall value amongst the four classifiers.

d. Gradient Boosting

In this process a weak algorithm is chosen and altered and improvised to make the algorithm stronger and to achieve better results. It is an improvised version of Ada Boosting classifier by adding weighted minimization. Unlike Ada Boost which is used only in binary classification models, this can be used on multi-class classification models and also in regression problems. The results obtained by using Ada-Boost classifier on the dataset is given in table 6

Metrices	Results
Accuracy	0.987547
Precision	0.120168
Recall	0.893750
F1_score	0.211852

Table 6

The accuracy of this classifier was found to be 98.7% which is a very high value. The precision helps us to determine if the classifier is predicting a genuine transaction as a fraud transaction and it has a value of 12%. Recall helps us to determine if the classifier is predicting a fraud transaction as a genuine transaction and it has a value of 89.3%. F1 score helps us to seek a balance between Precision and Recall and it has a value of 0.211. The confusion matrix for Gradient Boost classifier is given in Figure5



Figure 5

It can be observed that 1047 of 85283 genuine transactions were predicted as fraud transactions and 17 of 160 fraud transactions were predicted as Genuine transaction.

RESULTS & DISCUSSIONS

The dataset on credit card transactions was collected from Kaggle for the analysis.

The dataset was analysed by using ML classifiers and the fraud predicting accuracy was observed and their efficiency was calculated based on their metrics. The accuracy of all four classifiers was found to be above 98% which is a high value but the efficiency of the classifier cannot be determined based on the accuracy alone.

AdaBoost classifier was found to be the best amongst the above classifiers in predicting fraudulent transactions as it had the highest Recall value and it predicted 147 out of 160 fraudulent transactions as fraud. Its precision value was very low as it predicted 1321 non-fraudulent out of 85283 genuine transactions as fraudulent. Random forest classifier seems to be the most efficient in predicting the fraudulent as well as non-fraudulent. It had a precision value of 87.4% and the recall value was 82%.

REFERENCES

- [1] <https://www.kaggle.com/code/lusfernandotorres/91-87-recall-with-ada-boost-cc-fraud-detection> visited on 4th August 2022
- [2] <https://www.kaggle.com/code/janiobachmann/credit-fraud-dealing-with-imbalanced-datasets> visited on 4th August 2022
- [3] <https://www.kaggle.com/code/residentmario/undersampling-and-oversampling-imbalanced-datasets> visited on 5th August 2022
- [4] <https://www.kaggle.com/code/sujataroy/credit-card-fraud-detection> visited on 6th August 2022
- [5] Dal Pozzolo, Andrea & Boracchi, Giacomo & Caelen, Olivier & Alippi, Cesare & Bontempi, Gianluca.(2017). Credit Card Fraud Detection: A Realistic Modeling and a Novel Learning Strategy. *IEEE Transactions on Neural Networks and Learning Systems*. PP.1-14.10. 1109/TNNLS.2017.2736643.
- [6] A. C. Bahnsen, D. Aouada, A. Stojanovic, et al. Detecting credit card fraud using periodic features. In *14th International Conference on Machine Learning and Applications*, pages 208–213. IEEE, 2015.
- [7] M. Carminati, R. Caron, F. Maggi, I. Epifani, and S. Zanero. BankSealer: An Online Banking Fraud Analysis and Decision Support System, pages 380–394. Springer Berlin Heidelberg, Berlin, Heidelberg, 2014.
- [8] A. Dal Pozzolo, G. Boracchi, O. Caelen, C. Alippi, and G. Bontempi. Credit card fraud detection and concept-drift adaptation with delayed supervised information. In *the International Joint Conference on Neural Networks*. IEEE, 2015.
- [9] M. Krivko. A hybrid model for plastic card fraud detection systems. *Expert Systems with Applications*, 37(8):6070–6076, 2010.
- [10] V. Van Vlasselaer, C. Bravo, O. Caelen, T. Eliassirad, L. Akoglu, M. Snoeck, and B. Baesens. Apate: A novel approach for automated credit card transaction fraud detection using network-based extensions. *Decision Support Systems*, 2015.

Cyber Crimes against Women in India

Analysis of Data Based on Machine Learning Regression Techniques

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Abstract:

In the virtual reality known as the "cyber world," each person hides their own identity. Numerous crimes occur which may be known or unknown to average people, and the victims are mostly ladies. Many criminals, including hackers, crackers, and stalkers, have developed techniques and security protocols to block internet accounts and get access to a user's computer system and potentially steal crucial user data. If the user is a woman, then crimes such as releasing pornographic content online, cyberbullying, cyber-grooming, non-consensual pornography, cyber-defamation, photo morphing, and e-mail harassment may occur. In this paper, we discuss about different types of cybercrimes against women in India, states that prone to cybercrimes and check for the accuracy of the data about the cybercrimes in India.

Keywords:

Cybercrime, Defamation, Machine learning, regression techniques, women.

INTRODUCTION

Cybercrime is the term used to describe any illegal activity involving a computer, networked device, or a network. One of the main consequences of cybercrime is financial loss. A few instances of the countless profit-driven criminal actions that fall under the category of cybercrime include ransomware attacks, email and internet fraud, identity fraud, and attempts to steal financial account, credit card, or other payment card information. Private information about an individual or company data may be targeted by cybercriminals for theft and sales. Due to the pandemic and the availability of work from home choices, a rise in cybercrimes has been observed in 2021, making backup data protection even more crucial.

India is growing quickly, and one of the main drivers of this development is technical progress. The drawback of this quick advancement is also there. Women are more likely than men to fall victim to online criminal activity among netizens. Due to a number of circumstances, like unawareness, a lack of privacy, etc., women are more vulnerable to these online cyberattacks. Because of the general decline in regard for women in modern society and the fact that many individuals still struggle to accept the idea that merely uploading someone's image online constitutes a crime, cybercrimes against women are still tolerated in India. Cybercrimes like email spoofing and morphing lack the moral support of society and are therefore treated leniently. The victim and society at

large are severely harmed by crimes of any kind. Everywhere there is an impact, no matter how small or large it may be.

India publishes up-to-date list for the cybercrimes committed and also the cybercrimes committed against women state-wise. For our work we consider this list as data and use it for analysis. We perform a comparative analysis on different regression techniques on our dataset to check how true the data is based on Root mean square error and R2 score.

REVIEW OF LITERATURE

Dr. Vineeta Choudhary [1] in her paper talks about how social networking sites have become an integral part in every person's life and how various online crimes, such as email spoofing, cyberstalking, cyberdefamation, and cyber harassment, affect women. Due to the victim's hesitancy, shyness, and worry about being disparaged by her family, the majority of these crimes go unreported. This paper also talks about the reasons of cybercrime against women. "This research had taken a survey on awareness about internet and social culture of 49 girl students in Dehradun, and concludes that 90% of the women are aware about the social culture as they are from well-educated schools and family support".

Prof. Jay Bhongale [2] discusses about what are the different things that women are going through online. What are the different harassments that women go through online, and if anything happens, how women will be the victimized? This paper highlights that if a woman is victimized online, there is no criminal justice system in India. Although the accused is subject to severe punishment for committing such a horrific crime, there is no mechanism in place to protect the victim's right to have offensive images removed from an online platform.

In her work, Jaspreet Singh [3] mainly focuses on what are the key reasons behind the cybercrimes. This paper also gives some suggestions and steps to tackle the cybercrime.

G Tanuja Reddy [4] in her paper discusses about several cybercrimes and laws and IPC's pertaining to those cybercrimes. It discusses about the legal provisions against cybercrime. The paper also segments about lack of specific legislation relating to cybercrimes against women.

S.Poulpunitha, K.Manimekalai, P.Veeramani [5] focus on the different types of cybercrimes committed against women and girls, how women can be protected from them, and what can be done to stop them. The study was conducted considering a few colleges and collecting samples from them. A total of 100 samples were analysed in the research.

After carrying out the literature survey, in order to enhance the pre-existing research, this paper has identified some objectives to be achieved.

The objectives of this study are:

1. To identify different types of cybercrimes and how they are committed against women.
2. To analyse the total number of cybercrimes state-wise.
3. To inspect specific cybercrimes in each state.
4. To find out maximum occurrence of cybercrimes in ascending order with justification.
5. Comparative analysis on the dataset to check the best model that fits the dataset and to check how true the data is.

METHODOLOGY

In this part we discuss about the methods we used in each step of our analysis.

A. Collection of datasets:

The dataset was obtained from the website <https://ncrb.gov.in>, which is a government website which stands for National Crime Records Bureau. The information in this dataset includes the year, states in which the cybercrimes were committed, types of cybercrimes committed and the total number of cybercrimes committed against women. In this paper, we will consider the state, year and type of crimes committed.

B. Cleaning the dataset:

The data is cleaned and prepared to help plot graphs. To plot the graphs, first extra labels such as "Total States", "Total ALL INDIA" were removed from the dataset. Using python, labels such as "Sl.no", "Category" and "State/UT" were removed to train the model. The dataset was divided into training set which is of 80% and testing set which is of 20%.

C. Analysis of data:

In this paper, Google data studio was used to analyse our objectives mentioned in section II. The analysis of data is done using the datasets and the graph that is plotted. The plot is used to represent the total number of cybercrimes committed and also the specific cybercrimes state-wise.

D. Proposed work using different regression techniques:

In this paper we will be using machine learning techniques to do a comparative analysis of different algorithms that best fit our dataset. The root mean

squared error (RMSE) and R-squared (R2) are two measures used to assess how well a model fits a dataset.

Root mean square error (RMSE): a statistic that reveals the average distance between a dataset's expected and observed values. The better a model matches a dataset, the lower the RMSE.

It is determined by:

$RMSE = (\sqrt{\text{mean_squared_error(actual, predicted)}})$

R2: A statistic that indicates how much of the variance in a regression model's response variable can be accounted for by the predictor variables. This value is between 0 and 1. The better a model fits a dataset, the greater the R2 score.

It is determined by:

$r2 = r2_score(\text{actual, predicted})$

The relation between one or more predictor variables and a response variable is quantified using regression models. To determine how well a regression model "fits" the data, we always fit the model. What this means is how well the model can predict the value of the response variable using the values of the predictor variables.

The regression model applied in this study includes:

1. Linear Regression
2. Random Forest Regression
3. Decision Tree Regression
4. Lasso Regression
5. Support vector Regression

RMSE and R2 metrics are used with these regression models to evaluate how well the model fits the dataset.

RESULT AND ANALYSIS

The objectives outlined in the second section serve as the foundation for the research's analysis.

1.To identify different types of cybercrimes and how they are committed against women.

- **Harassment through e-mails:** Blackmailing, threatening emails, sending love letters repeatedly under false names, and sending embarrassing emails frequently are all examples of email harassment.

How it is carried out: sending threatening or unsolicited email. encouraging others to flood the victim with unwanted, threatening, or otherwise distressing emails. Viral e-mail transmission (electronic sabotage).

- **Cyber stalking:** It entails tracking a person's online movements by sending emails to the victim on a regular basis, entering chat rooms the victim frequents, posting messages (often threatening ones) on bulletin boards the victim frequents, etc. Typically, a stalker communicates with no valid reason other than to inflict mental discomfort.

How it is carried out: The female individual is stalked in every group she joins, and her posts, own writings, and

online actions are constantly monitored on the walls of her connections.

- **Cyber Pornography:** The act of using cyberspace to produce, present, disseminate, import, or publish pornographic content is known as cybernetic pornography.

How it is carried out: Using obscene poses, the victim's photograph is utilised, altered, and shared online. Additionally, the harasser may write offensive things on her wall. By hacking the female member's profile, one can also engage in cyber obscenity. The original pictures uploaded to the stated profile are then altered, and the name, contact information, and altered pictures are all utilised to send vulgar messages to the "friends" of the original profile owner as well as to a wider audience.

- **Cyber defamation:** The deliberate violation of "another person's right to his good name" is known as cyber defamation, sometimes known as cyber smearing. With the aid of computers and/or the Internet, cyberdefamation takes place.

How it is carried out: The male member may transmit false information about the female member to other members through his own posts, community walls, etc. as a result of an emotional breakup.

- **Cyber bullying:** an act of harassment or bullying committed using a computer, a mobile phone, a laptop, or another electronic or communication device.

How it is carried out: The target of the harassment may experience ongoing bullying in the SNW (Social Networking World), both on her wall and in the groups or communities to which she belongs. Despite the fact that this cybercrime is gender-neutral, women are more frequently targeted because of their sexuality, emotional breakups, or even domestic abuse. The ex-partner or ex-lover harasses the woman relentlessly in an effort to express his wrath in public.

- **Morphing:** The term "morphing" refers to the use of online morphing tools to change from one image to another without making any adjustments. Girls are typically harmed by this kind of morphing, which involves downloading images of girls from numerous social media platforms using either fake or actual profiles before morphing them. "Lack of awareness of these types of crimes encourages criminal to commit this mischief" [3].

How it is carried out: The female members' pictures are obtained from personal albums and modified for pornographic purposes by using selected images.

2.To analyze the total number of cybercrimes state-wise

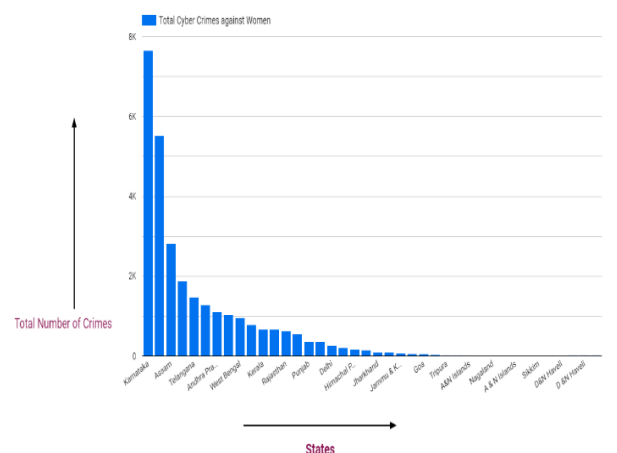


Fig-1: Total number of cyber-crimes against women, State-wise

The total number of cybercrimes against women in India is depicted in the figure-1. The data span the previous four years (2017, 2018, 2019, 2020). With 7660 incidents, Karnataka has had the most cybercrimes perpetrated in the past years, followed by Assam, Telangana and Andhra Pradesh. As per the "Bangalore Mirror article, cyber-crime rate was highest in Karnataka with 16.2% followed by Telangana (13.4%), Assam (10.1%), Uttar Pradesh (4.8%) and Maharashtra (4.4%)" [6]. The data that was collected from NCRB (National Crime Records Bureau) was analyzed using Google data studio for overall cybercrimes against women and the graph was obtained for the same data state-wise.

3.To inspect specific cybercrimes against women in each state.

The first objective provides an overview of cybercrimes committed against women. The analysis presented here is based on such cybercrimes in various Indian states.

Cyber Blackmailing/Threatening

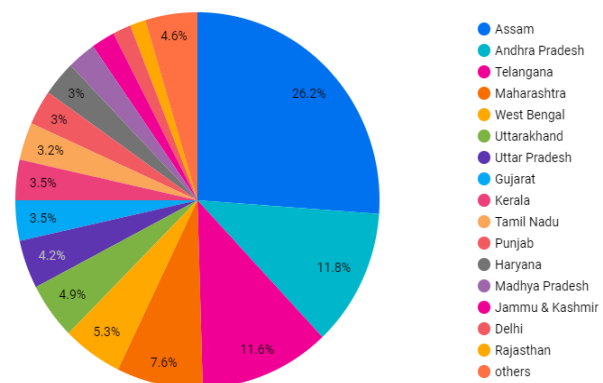


Fig-2: Cyber Blackmailing/Threatening

As shown in the figure-2 statistic, Assam has the greatest percentage of cyber-threatening/blackmailing instances in India (26.2%), followed by Telangana (11.6%) and Andhra Pradesh (11.8%).

“The cybercrime cases in Assam are highly increased. In 2019 the cybercrime cases were 99% increase from 2017” [8]. “Apart from the common people, Assam police and politicians also victimize by cybercrime in Assam” [8].

Cyber Pornography/Hosting/Publishing Obscene Sexual Materials

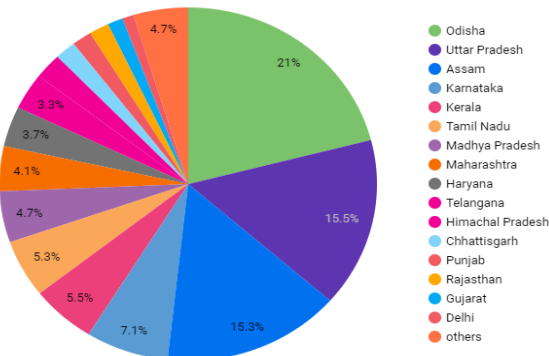


Fig-3: Cyber Pornography/Hosting/Publishing Obscene Sexual Materials

According to the aforesaid statistic, Assam is third with 15.3 %, followed by Uttar Pradesh with 15.5 % and Odisha with 21 % of all incidents of cyber pornography in India. As per the article in Times of India “NCRB places Odisha on top in child pornography cases for 2nd consecutive year” [9]. The cases saw a significant increase during the pandemic.

Cyber Stalking/Cyber Bullying of Women

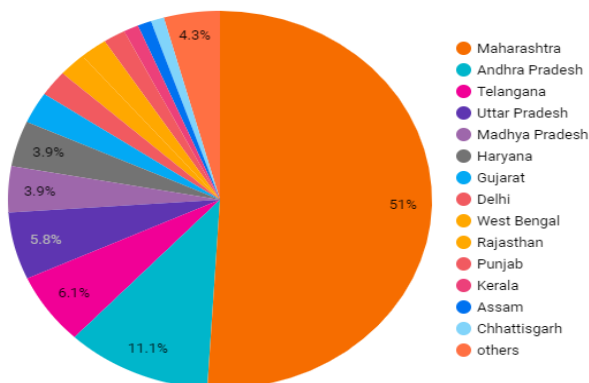


Fig-4: Cyber Stalking/ Cyber Bullying of women

According to the Figure-4, Maharashtra accounts for 51% of all cyberstalking incidents in India, followed by Andhra Pradesh (11.1%) and Telangana (6.1%). “In India, 2017 report of the National Crime Records Bureau (NCRB) for the first time included data pertaining to cyberstalking/cyberbullying against women/children and found total 543 cases were registered under this head in that particular year” [10]. “As per the latest 2019 data released by the National Crime R Records Bureau, Maharashtra reported the highest number of cases of cyberstalking/bullying of women for three years in a row” [10]. “Maharashtra also accounted for one-third of the total cyber stalking or bullying cases reported across India from 2017 to 2019” [10].

Defamation/Morphing

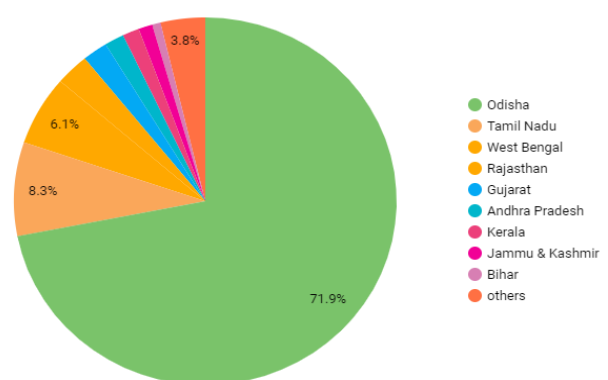


Fig-5: Defamation/Morphing

According to the aforementioned graph, Odisha has the most defamation cases in India with 71.9%, followed by Tamil Nadu with 8.3 % of the cases and West Bengal with 6.1%.

Fake Profile

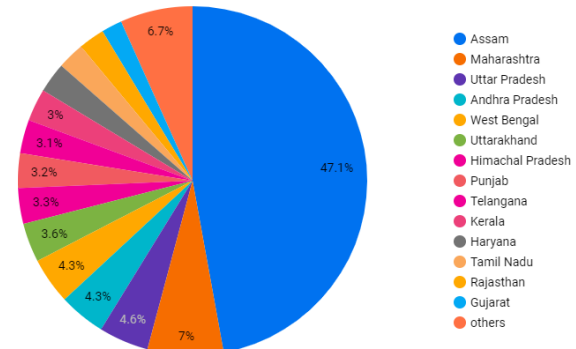


Fig-6: Fake profile

According to the graph above, Assam accounts for 47.1% of all cases of fake profiles in India, followed by Maharashtra with 7% of cases, while other states have an average amount of cases nationwide.

4.To find out maximum occurrence of cybercrimes in ascending order with justification.

Top 5 Cyber Crimes against women in India

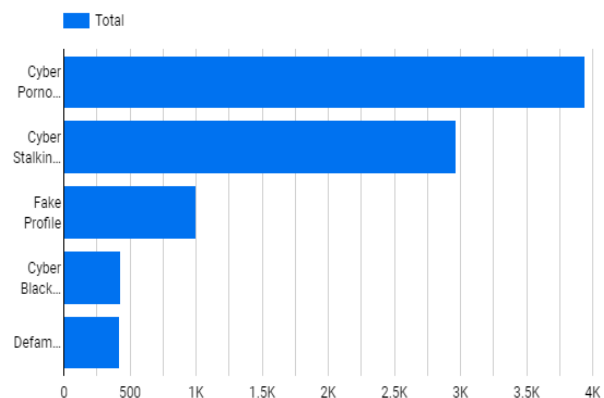


Fig-7: Top 5 Cybercrimes against women

The top 5 cybercrimes in India against women are depicted in the figure-7 and the reasons for those crimes are given below.

1. Cyber pornography:

Due to the fact that cyberspace is a borderless environment that cannot be contained by a country's borders, no nation can assert exclusive jurisdiction over an offence committed through an electronic media.

In addition, anonymity is available in cyberspace, which adds to the difficulty of the investigating officer's job. Without a consistent resource locator, it is impossible to pinpoint the offender's location, making it difficult to determine where the crime was done or which state, district, or court has the authority to look into and try the case.

The main argument made by those who oppose pornography is that they think that the prevalence of pornographic websites is to blame for the sexual exploitation of women and the rise in crime against women. They contend that since youngsters can still access pornographic websites, their minds will be defiled.

2. Internet stalking/ Cyber Stalking:

There are several causes of online stalking, including:

- **Harassment**
Stalker's primary goal is to torment. The stalker repeatedly harasses the women in a sexual manner.
- **Fascination**
This is an online or one-sided romance. If the victim rejects his offer, the stalker will turn into a stalker because he loves and cares for her.
- **Revenge**
It's a form of retaliation against the victim. If the victim rejected the stalker's proposal, they exacted revenge on them.
- **Boasting/Show-off**
The stalker's ability to harass a girl is sort of demonstrated here. This often takes place among friend circle. The stalker made a bet with his pals that he could make the woman cry with ease, and that occasionally it would escalate.

3. Fake Profile:

A fake profile is created when online con artists use the victim's personal data, including name, address, email address, and photo, to create a social network presence without the victim's knowledge or agreement. In order to hurt the victim, the scammers fabricate false profiles. Scammers use the fake profile to spread untrue information, damage the victim's reputation, and perhaps even send friend requests to the victim's other friends in order to make money.

4. Cyber blackmailing:

Threats of bodily harm, mental anguish, emotional harm, or legal action are made against the victim or someone who is extremely close to the victim. The most prevalent personal gains from these crimes are position, money, property, and sexual desires.

5. Defamation:

Cyber defamation occurs when someone publishes false information about a person or an organization on a website, social media platform, or messaging app, or sends emails to that person or organization that include false information with the goal to harm that person or organization. It is often done to threaten the victim and to tarnish the victim's reputation in the society. These criminals feed on the fear of the victim.

Table 1: Total Cybercrimes against women in India

Total Cyber Crimes in India				
Cyber Crimes against women	Year			
	2017	2018	2019	2020
"Cyber Blackmailing/Threatening"	132	113	113	74
"Cyber Pornography/Hosting/ Publishing Obscene Sexual Materials"	271	862	1158	1655
"Cyber Stalking/Cyber Bullying of Women"	555	738	791	887
"Defamation/Morphing"	50	62	61	251
"Fake Profile"	147	207	289	354
"Other crimes Against Women"	3087	4048	5967	7184

Source: "NCRB (year - 2017, 2018, 2019, 2020)" [11]

5. Comparative analysis of different machine learning techniques on dataset to determine which model best fits it and to evaluate the accuracy of the data.

Table 2: RMSE and R2 score for different regression techniques

Regression Techniques	RMSE (Training set)	R2(Traini ng set)	RMSE (Test set)	R2(Test set)
Linear Regression	2.4602688	1	0.02469641	0.999390087
Decision Tree Regression	2.34577428	1	0.661375444	0.562582521
Support vector Regression	0.48331492	0.76640668	0.522267889	0.727236252
Lasso Regression	0.1417593	0.97990429	0.126477114	0.984003539
Random Forest Regression	0.22715201	0.94840196	0.374953106	0.859410168

The RMSE (Root Mean Square Error) and R2-score of the several regression approaches that best suit our dataset is displayed in the above-mentioned table.

The training set's RMSE value for the first regression technique, linear regression, was 9.0040, and the test set's RMSE value was 0.0246. The training set's R2 score from the regression technique was 1, and the test set's R2 score was 0.99939. The same way the data was tested for other regression techniques for comparison and the values are given in the table above.

The model fits the dataset more accurately the lower the RMSE is. R2 values can be between 0 and 1. The model fits the dataset more accurately the higher the R2 value.

The two regression procedures that best match our data and provide assurance that the data is accurate are linear regression and decision tree regression, according to the aforementioned table.

CONCLUSION

In conclusion, the population of India has been shown to have a high rate of cybercrimes against women during the past years. This paper highlighted a few of the highly committed crimes state-wise and in totality considering the data from NCRB (National Crime Records Bureau). Machine learning techniques were used to get accurate analysis of the data obtained.

As a result, it is critical that the government pass strict legislation that makes all forms of cybercrimes illegal.

Additionally, it is crucial to organize education programmes for women on how to maintain their personal safety online, safeguard their identities, and respond to instances of cybercrimes. Further, media campaigns should be launched to modify public perceptions of women who are victims of cybercrimes.

Finally, more research is required to identify the necessity for raising awareness and obtain adequate representations of this issue among women.

REFERENCES

- [1] Cyber Crime against Women by Dr. Vineetha Choudhary.
- [2] Cyber Crime against women in cyber world by Prof. Jay Bhongale.
- [3] Violence against women in cyber world: a special reference to India – by jaspreet singh.
- [4] Regulation of Cyber Crimes against Women – A Critique by G. Tanuja Reddy
- [5] Strategies to Prevent and Control of Cybercrime against Women and Girls by S. Poulpunitha, K.Manimekalai, P.Veeramani
- [6] Karnataka records highest cyber-crime rate in India – Article
- [7] Cases targeting women with explicit content double in 3 years – Article
- [8] cybercrime in assam: an analysis by Debasis Barhoi - Article
- [9] NCRB places Odisha on top in child pornography cases for 2nd year – Article
- [10] Analyzing the crime of cyberstalking as a threat for privacy right in India by Pritam Banerjee & Dr. Pradip Banerjee

Alerting Drowsy Driver by Detecting Eye, Yawn and Head Movements Using MT-CNN

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Abstract:

Nowadays driver's drowsiness is the major cause for road accidents. The proposed system is designed to alert the drivers who are in drowsy state by analyzing human facial emotions. Human face acts as the main indicator for the behavioural state of the individual face. The mean of the system is to detect the Facial features conspire by utilizing the MT CNN Algorithm. Facial feature analysis is used in a different way to detect human behavioural state. Facial Landmark algorithm is used here to get the facial feature points. Here we are obtaining feature points like left and right eyes, left and right ear, mouth. The buzzer and focus alert sound alerts the drowsy driver according to the behavioural state of the driver which was analyzed from the captured video.

Index Terms:

Drowsiness Detection, Face Detection, Face Landmark Detection, Multi Task Cascaded Convolution Neural Network, Open CV, Python.

INTRODUCTION

Many people took a drive without taking sleep for continuous hours or being tired [1]. A report said that driver fatigue is the main cause for huge number of road accidents [2]. Driver's fatigue detection is a preventive technology which detects driver's drowsiness and prevents accidents [2]. Fatigue may caused due to lack of rest, pill etc., Physical and mental fatigue are small time failures of body's execution [3]. In some cases due to fatigue, driver can't able to pay attention and it followed by yawn, closure of eyes and head movements led to accidents. Facial feature is one of them which show that technology works very differently in today's world. Recognition of facial feature points is used to identify the basic state of features. The feature point we recognized here are left and right eyes, left and right ears, mouth, chin. To recognize these features, we are using Face landmark detection and Multi Task Cascaded Convolutional Neural Network Algorithm and we have the different trained data set of the states of features. In our mechanism, we have a buzzer sound and focus alert corresponding to the state of driver's facial features. In recent times there are so many mechanisms available to alert the driver by detecting their heart beat rate and pressure but those devices are wearable. These features are very useful but sometimes it's quite irritating for the

driver's. We can't assure that the driver wear the devices throughout the travel. So, our proposed system locate the facial landmarks and detects the feature points and alert the user according to the driver's state. To provide the users with the best possible and effortless alert system, Facial Landmark detection based systems have been adopted. It provides more accurate and efficient results faster with less effort. It can develop human centered user interfaces that respond promptly to present, multimodal, human communication. The high performance and therefore the less time demand of the system create it appropriate to an feature detection systems and the rate accuracy is very high.

PROBLEM STATEMENT

Most of the road accidents caused due to drowsiness of the driver. The common objective is to create a model that will detect and indicate whether driver is feeling drowsy or not. The developed model takes image for every second and check for eye blinking, mouth opening and head movements of driver. If blink rate is high and simultaneously if eye is closed for certain amount of time or if the mouth is opened for continuous amount of time or head movement is found along with eye closure then it will alert the driver through buzzer.

LITERATURE REVIEW

The authors Maninder Kahlon and Subramaniam Ganesan detects driver drowsiness based on algorithm. The position of driver's eye is determined through his iris visibility. System object has been created by Matlab using Viola Jones algorithm [4] [8] to detect the facial objects such as nose, mouth. Once image has been captured the noise rectangular eyes area were adjusted. Conversion of RGB to Gray scale and then to Binary image is done with suitable threshold value. The drowsiness detection is done based on conditions like pixels ratio, shape of eye and number of pixels in Column greater than the threshold value.

The authors Jun-Juh Yan, Hang-Hong Kuo, Ying-Fan Lin and Teh-Lu Liao develops a model based on gray scale image processing and PERCLOS [5] to detect if the driver is fatigue. It is real time drowsiness detection system. It approximately finds the position of driver's face in gray scale images and to analyze the eye position

it uses small template. Second, to establish a fatigue model, it uses the data from the previous step and PERCLOS.

The authors Ratna Kavya M, Ramya V and Ramya G Franklin proposed a system which uses Raspberry Pi and various sensors which sense Gad and Vibration Sensor are used to detect drowsiness. The car's location is sent using IOT modem which is fixed in the car [6].

The authors Murat Aslan and Rahib Abiyev developes real-time drowsiness detection based on computer vision. Viola Jones face detector is implemented to detect the faces and to detect drowsiness of driver Convolutional Neural Network has been used [7].

The authors Avigyan Sinha, Aneesh R P and Saradha K Gopal uses Haar features to recognise landmarks. Haar features are extracted and they are used in various architectures for analysis of performance of fatigue detection. Modified LeNet is used for classification [9].

The authors Najila and Reshma V K developed driver's drowsiness detection system using hybrid deep learning approach. Facial and eye behaviours such as yawning and eye-blink patterns are analyzed based on the live facial video focused on the driver's face. Facial landmarks present in the detected segments are pointed and the eye aspect ratios [10][11][12] are computed and detect the drowsiness based on the adaptive thresholding ratio.

The authors Melissa, Brian and Natalia developed a system to detect drowsiness detection using eye state. The system isolate section of interest from face i.e. eyes and it analyse characters such as moment of closing eyes and distance of opening eyes. The alert system warns the driver if it detects drowsiness. Matlab is employed to carry out the process [13].

The authors M. Ghazal, Y. Abu Haeyeh, A. Abed and S. Ghazal developed real-time embedded system with low cost to detect driver's drowsiness using CNN. The system uses real-time face detection algorithm to process the video signal. It also establish region of interest and minimize the number of computations. Camera attached on car dashboard provides a video signal. The faces which are detected are then given to CNN binary classifier which is optimized fatigue recognition to detect the whether it is fatigue moment or normal driving. When fatigue is detected the system warns the driver by sending alerts to the driver's smart phone and sends the alert to others to take preventive measures before accidents happen [14].

PROPOSED SYSTEM

Let us see about our proposed system which detects driver drowsiness in this section. The complete flowchart of the developed system is shown in Figure 1.

A. Design Methodology

The system requires only a web camera and a decent computing system to work. Relatively good camera is required to capture the eyes because eye blinking rate of

human is very fast. The software that the system is based on is Python, which is an open-source free programming language. It will be cheap and can be easily modified and upgraded at any time with libraries available.

B. Feature Points Detection

1) Video Capturing: Open CV is the library of programming functions. It captures live video stream using web cam and allow us to make a video capture object. The web cam should be placed at front of the driver. Using CV2 library video are captured by calling `cv2.VideoCapture()` function.

2) Pre-Processing: The captured frame is passed to pre-processing stage. Gaussian blur is applied to the real image to avoid unwanted noise. This is a commonly used technique to provide smooth edges and eliminate noise from an image. Extract the region which contains face from blurred image, DLIB's library is used on that image. Perform a histogram equalization to adjust the contrast of the image and avoid unnecessary details.

3) Face Detection: The module process the frontal face direction images so the faces are detected by using dlib based HOG and linear SVM face detector. They have good accuracy and they are computationally efficient. Deep learning-based face detection is done with the help of dlib by using trained model from disk. Perform conversion of dlib to Open CV bounding boxes. Coordinates which exceeds the bound of input are need to be trim. It will return a detector that is a function used to retrieve the face information. It detects facial features like eyes, mouth, nose. The objects which are detected is considered by the feature point location detection phase for further processing.

Features points of driver's face are obtained by using Facial Landmark Detection algorithm. Face landmark detector has pre-trained model and it predict continuous numbers. The iBUG-300 W dataset is used for training the model.

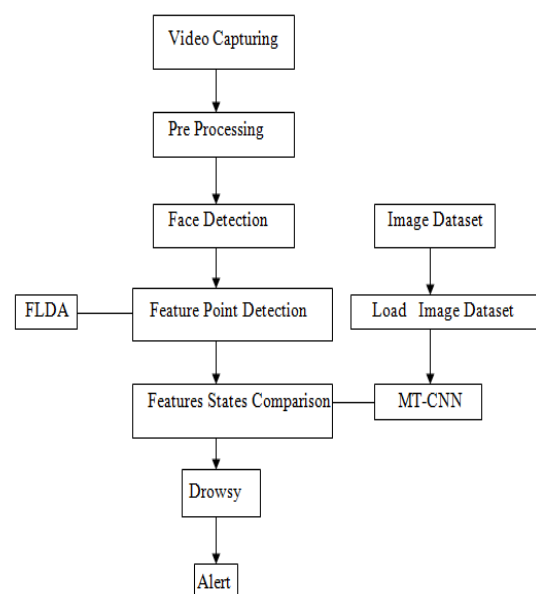


Figure 1: Proposed system

Set of images along with corresponding 68 face landmark points are present which is given in Figure 2. The pre-trained facial landmark feature which is in the dlib library of Open CV will plot a 68(x, y) points on the face of any given input image. The landmark marks eyes, nose, mouth and jaw with those 68 points the feature points like left and right eye, Mouth (Upper lips and lower lips), chin to detect driver's fatigue.

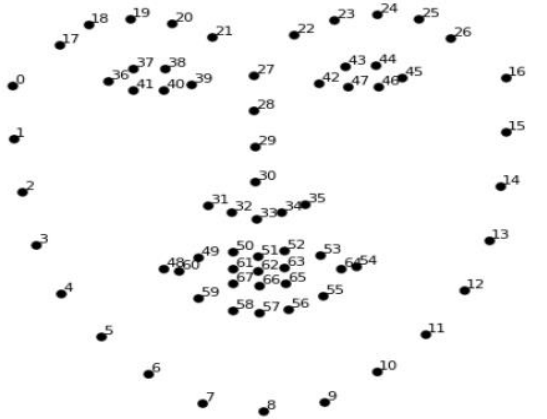


Figure 2: Face Landmark Points

MT-CNN is a deep cascaded multitask framework it exploits correlation between detection and alignment to boost up the performance. The model consists of three stages which are Deep Convolutional neural network to predict the facial feature points in fine grained manner. The overall architecture of MT-CNN was given in Figure 3.

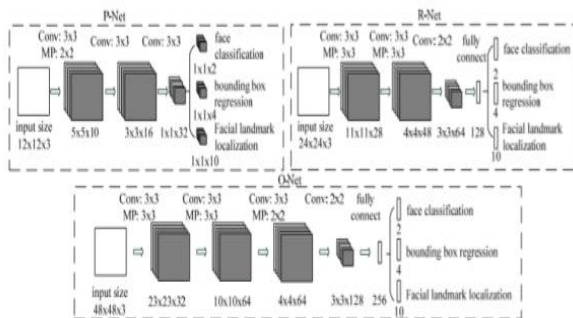


Figure 3: MT-CNN architecture

Stage 1: The first network is Proposed Network (P-Net). Here all images in the image pyramid are obtained through a shallow full convolution neural network P-Net to obtain the candidate face frame and the face frame regression. Calibrate the face frame using regression vectors which are estimated earlier. The P-Net weights and biases have been trained. The trained weights and biases of P-Net gives bounding box with relative accuracy. The network compares few boxes and P-Net is parsed to get bounding box confidence list. Lesser confidence level bounding box gets deleted. Then use Non-Maximum Suppression to merge candidates which have high overlapping rate.

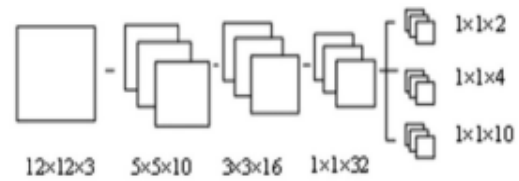


Figure 4: P-Net

Stage 2: The second stage is Refined Network(R-Net). The candidate frames generated in previous stage is passed to the Refined Network. Bounding boxes coordinates with high accuracy are present here. The input image sent through the convolutional layer. Applies many different filters to it pixel block by pixel block to the input image. R-Net consist of complex Network which can remove most of the wrong candidate face frame and then use the face frame regression vector to fine-tune the position of the candidate face frame. Then use NMS to reduce further frames.

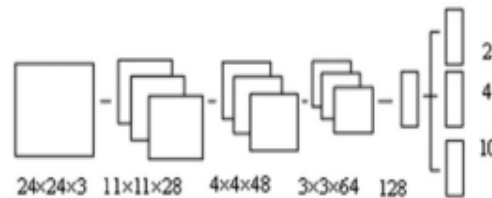


Figure 5: R-Net

Stage 3: The third stage is Output Network (O-Net) which is same as the Refined Network but network of O-Net are more complex and it provides accurate results. It provides coordinates of bounding box, coordinates of landmark regions and confidence level of each box. Adjust the position of face frames with wrong candidate frame.

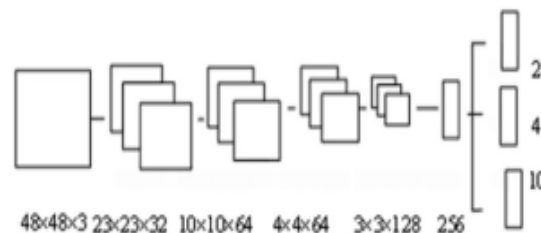


Figure 6: O-Net

The VGG-net classifier is used here to classify the frames based on their facial feature points. The alert is played according to the classes of features. The training set used to detect face part is WIDER_Face_train data set. The training sets of face key point detection are LFW_5590 and NET_7876 data sets.

RESULTS AND ANALYSIS

The system was built and implemented on Python 2.7.18. The testing was done on various images for real-time facial recognition. The system is tested in both low and high light conditions. Following are snapshots of working system.

If the eye blink rate is lesser than threshold and it gets closed then the driver is alerted through the buzzer sound which is shown in Figure 7.



Figure 7: Drowsy Body Posture

If the yawn occurs then the driver is alerted through buzzer sound which is shown in Figure 8.



Figure 8: Yawn Detection

If the yawn occurs and followed by eye closure then the driver is alerted through focus alert sound which is shown in Figure 9.



Figure 9: Drowsy after Yawn

If the head movement along with eye closure occurs then the driver is alerted through the focus alert sound which is shown in Figure 10.

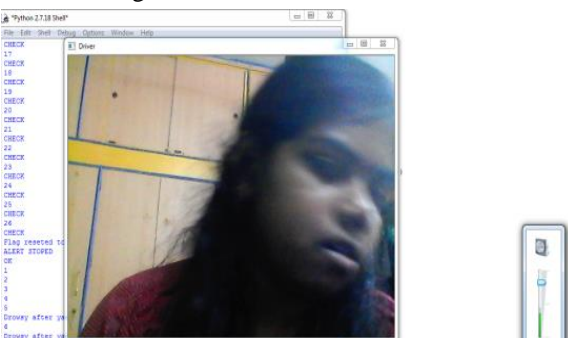


Figure 10 : Drowsy detection during head movement

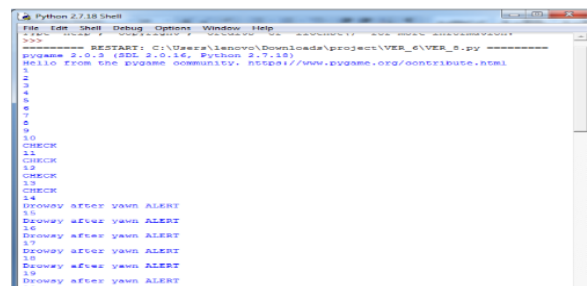


Figure 11: Python Shell during Drowsy detection

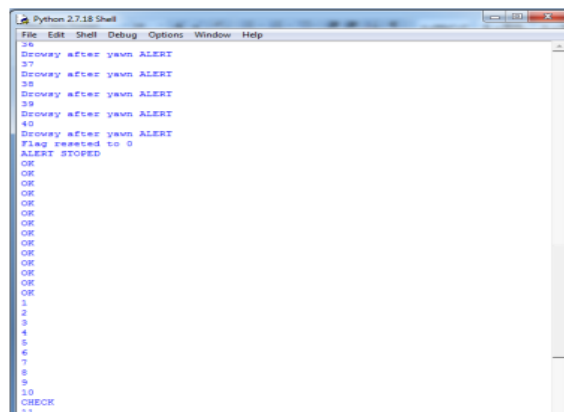


Figure 12: PyShell after Drowsy detection

Once when the alert is played and driver gets wake up the system gets reset and repeat the process by checking the facial features.

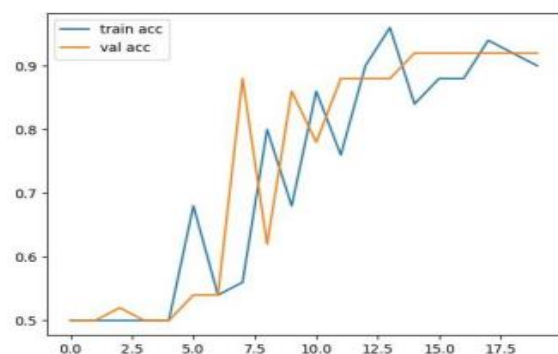


Figure 13: Model Accuracy

CONCLUSION

The model is proposed for alerting the drowsy driver by classifying the states of features. The model is implemented by using Deep Learning algorithm. Multi Task Cascaded Convolution Neural Network is employed to classify and to identify the states of features. In this proposed system the states are predicted by the user's facial image. The proposed model is justified by a properly made dataset and deep learning algorithm. The accuracy for facial feature state classification is more appropriate than existing methods. This system would be used to design a mechanism that would be helpful in providing the better alert mechanism to the drivers.

FUTURE WORK

The aim is to develop an alerting system which can detect drowsiness using a webcam and alert the driver in a simulation manner. In future, this system will be extended by incorporating it with a hardware device. The hardware device is attached with a water sprayer kit which is used to alert the driver in efficient way. Water is sprayed according to the conditions and states of detected facial feature points. Different algorithms will be used in the developed model in order to provide better accuracy.

REFERENCES

- [1] Hemant Kumar Dua ,Sanchit Goel Vishal Sharma "Drowsiness Detection and Alert System" International Conference on Advances in Computing, Communication Control and Networking (ICACCCN2018)
- [2] Rashmi Bhargava, Ravina Panchal, Preeti Verma, Shivam Sharma, "Drowsiness Detection while driving using Eye Tracking" International Research Journal of Engineering and Technology (IRJET) Vol:07 2020 .
- [3] Shreya A Kulkarni, Dr. Sathish S Kumar, "Driver Drowsiness Monitoring System" International Research Journal of Engineering and Technology (IRJET) Vol:06 June 2019
- [4] Maninder Kahlon and Subramaniam Ganesan," Driver Drowsiness Detection System Based on Binary Eyes Image Data" IEEE 2018
- [5] Vidhu Valsan A and Paul P Mathai,"Monitoring Driver's Drowsiness state at night based on Computer Vision" International Conference on Computing, Communication, and Intelligent Systems (ICCCIS) 2021
- [6] Ratna Kaavya M, Ramya V, Ramya G Franklin "Alert System for Driver's Drowsiness using Image Processing" International Conference on Vision Towards Emerging Trends in Communication and Networking (ViTECoN) 2019
- [7] Murat Arslan, Rahib Abiyev "Vision-Based Drowsiness Detection System Using Convolutional Neural Networks" 2nd International Conference on Electrical, Communication and Computer Engineering (ICECCE) 12-13 June 2020
- [8] Bahjat Fatima, Ahmad R.Shahid, Sheikh Ziauddin,Asad Ali Safi and Huma Ramzan, "Driver Fatigue Detection Using Viola Jones and Principal Component Analysis" Applied Artificial Intelligence An International Journal Vol:34, 2020
- [9] Avigyan Sinha, Aneesh R P, Sarada K Gopal" Drowsiness Detection System Using Deep Learning" Seventh International conference on Bio Signals, Images, and Instrumentation (ICBSII)2021
- [10] Najla I, Reshma V K2," Drowsy Driving Detection via Hybrid Deep Learning" International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 Volume: 07 May 2020
- [11] S. Sathasivam, A. K. Mahamad, S. Saon, A. Sidek, M. M. Som and H. A. Ameen," Drowsiness Detection System using Eye Aspect Ratio Technique," IEEE Student Conference on Research and Development (SCoReD), 2020
- [12] C. B. S. Maior, M. J. D. C. Moura, J. M. M. Santana, and I.D Lins,"Real-time classification for autonomous drowsiness detection using eye aspect ratio," Expert Systems with Applications, vol. 158, 2020
- [13] Melissa Yauri-Machaca, Brian Meneses-Claudio, Natalia Vargas-Cuentas, "Design of a Vehicle Driver Drowsiness Detection System through Image Processing using Matlab" IEEE 2018
- [14] M. Ghazal, Y. Abu Haeyeh, A. Abed and S. Ghazal, "Embedded Fatigue Detection Using Convolutional Neural Networks" 6th International Conference on Future Internet of Things and Cloud Workshops (FiCloudW)2018

Image Based Occupancy Detection in Smart Buildings

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Abstract:

Nowadays Occupancy detection is gaining significant uses in various applications like management of manpower, optimization of energy usage in smart buildings, and improvement of public services in future smart city environments. In terms of Energy Optimization, detecting the occupancy state can greatly reduce the unnecessary lighting and heating cost in smart buildings. Most of the current building automation systems rely on sensors for occupancy detection, which turns out to be cost-effective. It also still creates a dependency on the end users which requires human intervention for doing the corrections in case of its false triggering. This paper makes use of cheap Image-Based Detection methods to detect occupancy in an indoor environment.

Index Terms:

Occupancy Detection, Energy Optimization, Human Intervention, Image Based Detection.

INTRODUCTION

At present days there is a rising huge interest in smart buildings and it creates a pace for new innovations in this booming field which triggers so much research in different applications like simplified building management systems, efficient energy management, the comfort of occupants, security of residents, management of the alarming system, intruder detection, and management, protection of assets, etc.

The already existing automation systems for buildings are facing problems in maintaining compatibility with the recent techniques. This may result in the wastage of electrical energy leading to the poor management of various appliances and devices. It also leads to the lack of accuracy and reliability of the system. Unless we reduce the human inputs, the system won't be reliable and error-free.

The building automation system should have the proper control of lighting as well as Heating, Ventilation, and Air Conditioning (HVAC) systems, which highly rely on detecting the number as well as the movement of occupants inside the building. Many authors have analyzed the various techniques of occupancy detection and attempted their solutions. More research work in this concerned area covers both sensors based and image-based methods.

REVIEW OF LITERATURE

The review of relevant literature survey for our research work is very crucial. Only through the review process knowledge can be gained on our topic.

Building indoor efficiency is essential to facilitate Heating, Ventilation and Air Conditioning (HVAC) control, lighting adjustment, and geofencing to achieve occupancy comfort and energy efficiency [1]. Ventilation plays an important role in high occupant density indoor environments. The use of a smart low-cost ventilation control strategy based on an occupant density detection algorithm increases the energy efficiency in an indoor environment [2].

Various researchers have reviewed the occupant information sensing system as well as the OCC studies using it. The studies implement OCC [3] and summarized the sensors and control strategies used by the OCC studies, building type, and experiment duration.

The comfort-oriented control studies of occupants presented the average energy-saving performance and comfort improvement performance [4]. The extensive investigation of devices that sense occupancy-related and comfort-related information senses and control performances based on the information [5,6]. The resolution and performance of various sensors are analyzed using the occupancy detection algorithm [7].

SMART BUILDINGS



Fig.1 smart buildings

- A smart building, is called an intelligent building or connected building. It usually refers to all the computer-based technology in a building that makes it feasible to collect different types of data such as rate of occupancy, temperature, lighting, etc. in real-time, and make it accessible to the operators and managers.
- It is more evasive, has a greener option, and is low-priced to operate. Most of the processes are operated in a centralized control unit.
- The key technology that sets smart buildings apart from traditional structures is the sensors that are continuously collecting data.
- They trace and note everything from occupancy, the amount of traffic to particular rooms, and the outside weather. This data is worthy, as it gives managers perception of what resources are being used or wasted, and can forecast the needs of users.

SMART BUILDING FRAMEWORK

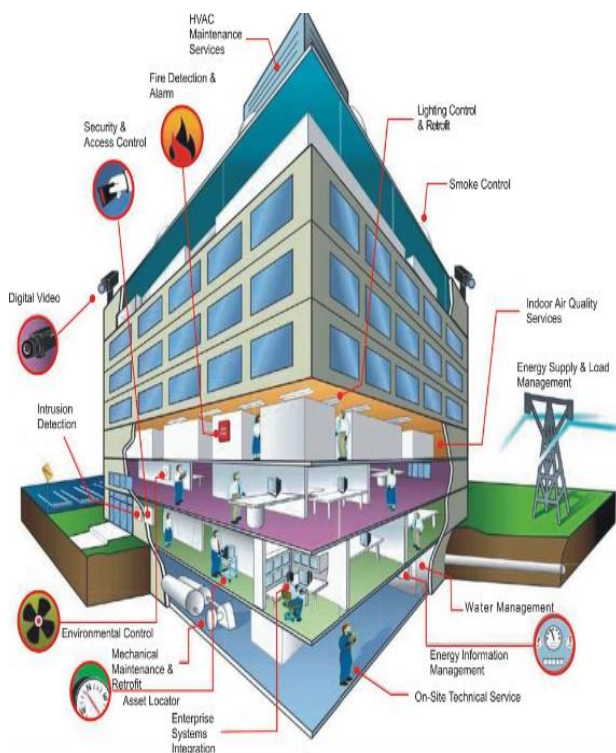


Fig.2 Smart building framework

The above figure depicts the key components of the smart building framework. It consists of HVAC Control and maintenance, lighting control, fire detection and alarm, smoke control, security, and access control, Indoor air quality services, intrusion detection, occupancy detection, water management, energy supply, load management, etc.

WHY SMART BUILDINGS?

The use of sensors built into infrastructure and data collected in smart buildings allows for more benefits in the management of buildings in the service sector.

Benefits of smart buildings



- Predictive maintenance
- Saving Energy
- In time equipment replacement
- Optimized site cleaning
- Redesigned space

Fig.3 Benefits of smart buildings

IMPORTANCE OF OCCUPANCY DETECTION

- Occupancy detection is the basis of smart lighting and smart ventilation systems with a substantial role in energy cost reduction and improving occupants' comfort.
- Trustability and expandability are two main issues of the existing occupancy detection solutions.
- A usual and efficient optimal plan is to detect, with high accuracy, room occupancies, incidents, and ventures that occur within a building, hence controlling the energy usage.

OCCUPANCY DETECTION USING SUBTRACTION ALGORITHM

In our work, occupancy detection is made by making use of image processing algorithms. The input images from the camera are RGB images. The first step is to convert them to gray Images. The raw images may contain noise signals. So, filters are used to remove the noise signals. Then the subtraction algorithm is applied to detect the occupant by subtracting the foreground from the background which is mathematically given by the equation:

$$SI = F - B$$

Where SI is the subtracted image, F is the foreground image, and B is the background image. Finally, Morphological processing is performed to detect the shape and features of the occupant.

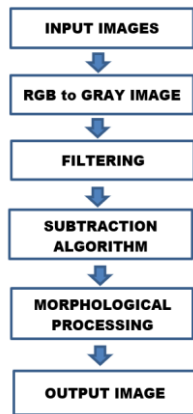


Fig 4. Image-Based Detection Method

IMAGE DATASET

The input images for our work are taken from the surveillance camera present in the Simulation lab, which belongs to the Electrical and Electronics Engineering department in our college shown in Fig. 5 given below. From the collected image dataset only 50 images are used as test images for our work.



Fig.5 Real-time test environment

RESULTS AND DISCUSSION

The results of our work are shown in the figures given below.

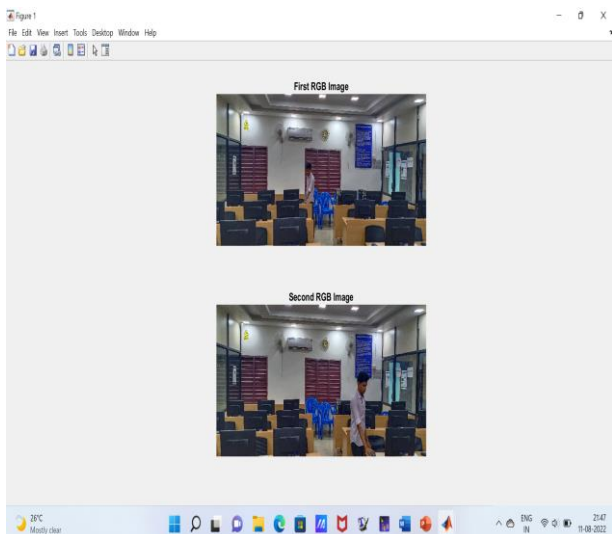


Fig.6 Input RGB images

Fig.6 shows the images that were given as test inputs. These images were probably RGB images.

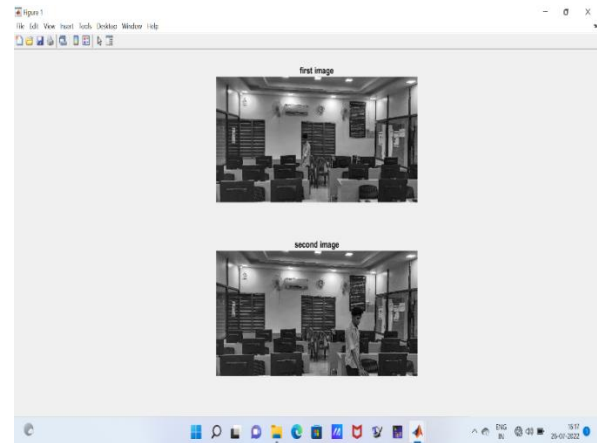


Fig.7 Gray Images

The next step is to convert them to gray images. The RGB to gray image conversion is done in order to remove the color information and to leave only the luminance of each pixel.

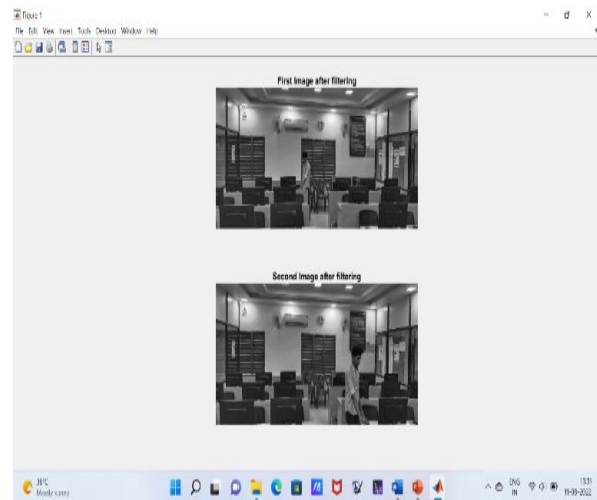


Fig.8 Filtered images

Figure.8 shows the result of the filters. In our work Gaussian filters are used for the removal of noise signals.

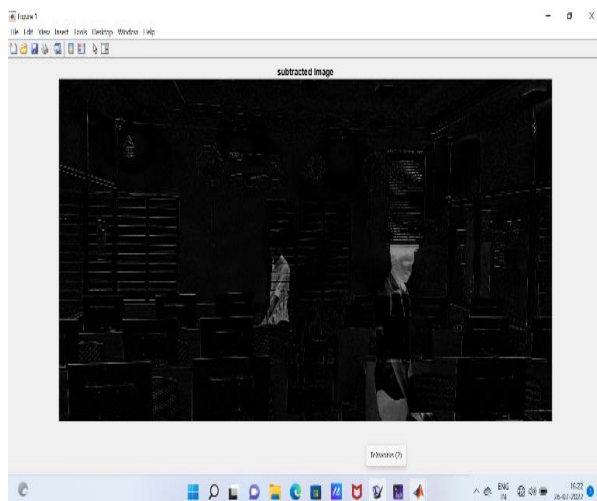


Fig. 9 Subtracted Image

Figure.9 shows the resultant image after applying the subtraction algorithm. The algorithm subtracts the foreground image from the background image and gives the output image.

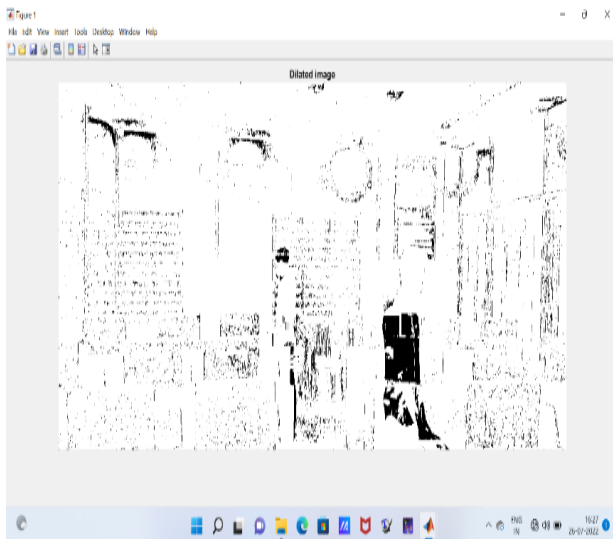


Fig 10. Dilated Image

Figure.10 shows the output image after the morphological processing. The morphological operation Dilation is performed to expand the foreground object. It selects the intensity value in the neighborhood of the structuring element, which is used for delving and expanding the shapes in the input image.

In our work 50 test images have been used. The image-based detection method gives the correct output for 46 images. The accuracy of detection can be calculated using the formula given below.

$$\text{Accuracy} = \frac{\text{Number of correctly identified output images}}{\text{Total number of input images}}$$

Thus, we achieved an accuracy of 96% using the above formula for our test images.

CONCLUSION

Detection of occupancy plays a crucial role in smart buildings. By detecting the occupancy accurately energy savings in smart buildings can be achieved. In the future, more accuracy can be achieved by increasing the test images and by using advanced image processing techniques.

REFERENCES

- [1] Ming Jin, Nikolas Bekiaris-Liberis, Kevin Weekly, Costos J Spanos, and Alexandre M. Bayen, "Occupancy detection via environmental sensing", IEEE Transactions on Automation science and Engineering, VOL.15, NO.2, pp. 443-454, April 2018.
- [2] Junqi Wang, Jingjing Huang, Zhuangbo feng, Shi-Jie Cao, Fariborz Haghighat, "Occupant-density detection based energy efficient ventilation system: Prevention of infection transmission", ELSEVIER- Energy and Buildings- 240 (2021) 110883.
- [3] J.Y. Park, M.M. Ouf, B. Gunay, Y. Peng, W. O'Brien, M.B. Kjærgaard, Z. Nagy, A critical review of field implementations of occupant-centric building controls, Build. Environ. 165 (2019) 106351.
- [4] J. Xie, H. Li, C. Li, J. Zhang, M. Luo, Review on occupant-centric thermal comfort sensing, predicting, and controlling, Energy Build. 226 (2020) 110392.
- [5] W. Jung, F. Jazizadeh, Human-in-the-loop HVAC operations: a quantitative review on occupancy, comfort, and energy-efficiency dimensions, Appl. Energy 239 (2019) 1471–1508
- [6] S. Naylor, M. Gillott, T. Lau, A review of occupant-centric building control strategies to reduce building energy use, Renew. Sustain. Energy Rev. 96 (2018) 1–10.
- [7] B. Dong, V. Prakash, F. Feng, Z. O'Neill, A review of smart building sensing system for better indoor environment control, Energy Build. 199 (2019) 29–46.

Cyber Hygiene in Education Sector

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Abstract:

Cyber Hygiene refers to the safety precautions that users of the internet should take. Due to the Covid-19 pandemic all forms of communication, teaching, and transaction in the schools and colleges are now hybrid. In order to collect data for the study described in this paper, a survey of schools and colleges was administered, and the results of 200 responses were used to evaluate the vulnerability using a variety of machine learning algorithms. The accuracy rate of each algorithm was measured, and the most effective algorithm for the given data was determined.

Keywords:

Education sector ; Cyber-Hygiene ; Algorithm; Cyber Attacks ; Machine Learning

INTRODUCTION

Cyber hygiene is a collection of practices that organizations and people do on a regular basis to protect hardware, networks, and data. Communication and Information Technology has become an essential component of daily life. It has recently changed how we interact with one another, share updates, make new friends, go shopping, play games, and other activities. Most activities of our daily lives have been touched by technology. Good cyber hygiene includes securing governmental data, personally identifiable information, protected health information, and sensitive data. Children are extremely vulnerable since they have minimal knowledge of online hazards and safety precautions and are exposed to the internet [13]. The experimental age group includes kids. They enjoy trying new things, learning new things, and employing new technologies. Trying new things is a terrific way to learn, it's also crucial to provide kids the right advice so they can guard against the negative effects of cyber technology. Since our culture is increasingly digital, it is crucial that the next generation learns appropriate online conduct. Students need to be aware of the best strategies to fend off cyber attacks. Cyber bullying is the deliberate use of the internet or mobile technology to harass or bully someone by sending nasty messages, comments, photographs, or videos. A cyber bully may include abusing others using text messages, social media sites, emails, websites, chat rooms, and other channels. Another industry that has changed as a result of the development of information technology is gaming. Children are joining the internet gaming scene in increasing numbers. The availability of a wide range of platforms and easy access have contributed to an increase in online gaming in India. On mobile devices, gaming consoles, PCs, portable gaming devices, and social networks, kids can play online games. The gaming consoles function similarly to computers which require

creation of an account, log in, wear a headset, activate a webcam, and use other devices. Interaction takes place with millions of online users by talking to them, sharing opinions, making friends, joining clubs, teams and more. There are several sites that offer free online gaming. Additionally, some people could get links in emails or text to download fun online games. Before the user can create an account, some games ask for a huge amount of personal information like name, age, mobile number, and other personally identifiable information may be compromised and misused. Free online games downloaded from unsafe websites may also contain viruses or malware that can harm a user's computer, smartphone, or other gaming equipment.

To know the level of understanding of cyber hygiene among students a poll was conducted to find out how high school and college students handled their online safety. Questions were asked regarding social media, cyber hygiene, online bullying, and online gaming. For the proposed dataset, various machine learning algorithms are used to obtain the accuracy.

REVIEW OF LITERATURE

A. R. Neigel, V. L. Claypoole, G. E. Waldfogle, S. Acharya, [1] conveyed about how the internet is used in classrooms. The demographics are based on age and educational attainment; as age rises, so does internet usage among students. Here, certain cyber hygiene practices are covered, including those related to social engineering, virus attacks, and authentication. Age and education level are independent variables in the demographic components, whereas cyber hygiene is a dependent variable. The institution's staff was polled to learn more about the devices they were using, why they were using the internet, and how well-versed they were in cyber hygiene.

A. A. Cain, M. E. Edwards, and J. D. Still [2], made an interpretation on malware, social engineering, mobile security, and passwords. Education of high school and college students on cyber threats is strongly advised, as security dangers are escalating on a daily basis. Governments and companies from all around the world have created programmes like Cyber Watch and US-CERT to increase awareness of and response to threats to computer security. Since then, attempts have been taken by schools and universities to teach pupils about cyber security

A. Vishwanath, L. S. Neo, P. Goh, S. Lee [3] quoted that cyber hygiene is a key element associated with lowering human-initiated cybersecurity breaches. Cyber hygiene is the adaptive knowledge and activity used to reduce harmful behavioural patterns that endanger a person's

social, financial, and personal information. This risk is considerably increased when considering the risk to entire nations as opposed to a single person. Even though people pose the biggest threat to cybersecurity, relatively little research has looked at the latent individual differences that can arise from the adoption of knowledge, attitudes, and practices linked to cyber hygiene. Polling was done and results from 173 participants from universities showed that a number of variables, including information handling, incident reporting, and management of password was extremely vulnerable to cyber threats

Cyber security breaches frequently have a significant impact on end consumers' online activities [4]. Therefore, we require a deeper comprehension of the user variations connected with either good or bad cleanliness, as well as a modern viewpoint on what users do to encourage good hygiene. People those follow good cyber hygiene adhere to security practices and safeguard their personal data. 268 participants were polled to learn more about their attitudes on cyber hygiene, their knowledge of potential hazards, and their behaviours in this area.

Cyber hygiene is a crucial feature [5] associated with lowering human-initiated cyber security breaches. Cyber hygiene is the adaptive knowledge and activity used to reduce harmful behavioural patterns that risk a person's social, financial, and private info. Results from 173 participants from universities showed that a number of variables, including information handling, incident reporting and better cyber hygiene was linked to password management. Individual factors like intrinsic drive and technology trust were able to predict higher cyber hygiene, but there were notable sex differences. Academic major differences, such as those between science and technology majors, also became apparent. On Cyber Security Education for Non-Technical Learners. In order to defend themselves from cyber risks and to be aware of how to preserve their privacy online, the average individual needs to be at least somewhat educated. As more and more devices are linked to networks and the Internet as a whole, this demand will expand.

METHODOLOGY

Data description

To obtain the real-time data from numerous institutions, a survey form was developed which included twenty questions regarding social media, cyber bullying, cyber hygiene and online gaming. There were two to four options for each question. The cornerstone for these questions was to determine whether a student's network or device was vulnerable to cyber-attacks. 200 replies were obtained from the students from various schools and colleges.

Data cleaning

The proposed dataset was a collection of categorical data.

The label encoder function in python is used to convert the data to numerical form so that machine learning algorithms could be applied

Data Analyzing

After the data was prepared, multiple machine learning algorithms were used to analyse it. Therefore, classification algorithms are the right methods for our database. In this study, we used a few classification techniques, including Gradient Boost, Ada Boost, Random Forest, Decision Tree, and Logistic Regression. These algorithms provided the accuracy needed to determine the best algorithm.

RESULTS AND DISCUSSION

These are some of the questions that were asked while conducting the survey.

1. Will you update your device frequently?

From this question it can be analysed whether the device is vulnerable to security breaches.

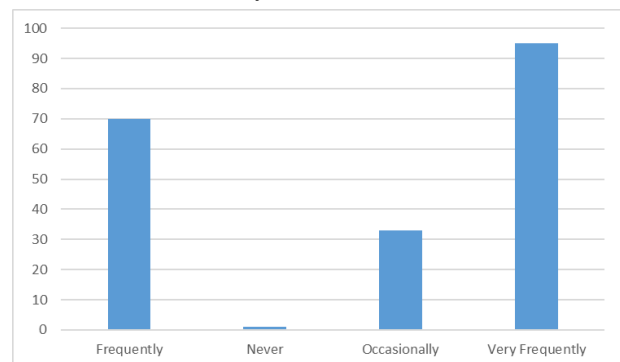


Fig 1 : Result of responses on device management

According to the above mentioned Fig 1, 93 students update their devices very regularly, making them immune to security breaches, whereas 70 students update their devices frequently, 34 students update their devices sporadically, and 3 students are the most vulnerable to security breaches.

2. Which type of locking credentials of your device will you share with your friends?

As the locking credentials are highly important for the privacy and security of the data it should be confidential and never be shared.

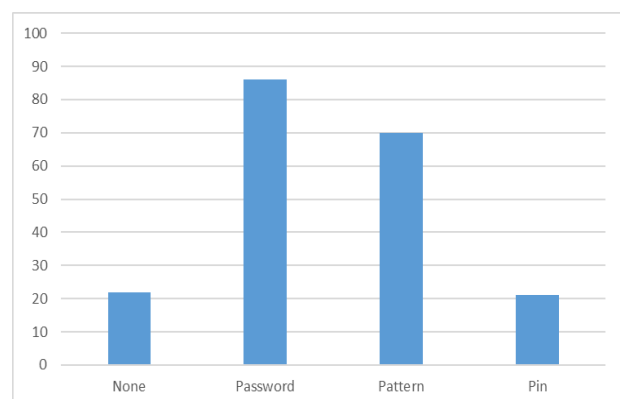


Fig 2 : Result of responses on security credential

According to the Fig 2, 87 students use passwords, 70 students use patterns, and 22 students use pins as their security credentials, leaving 21 students vulnerable because they don't use any security measures.

3. Have you ever felt harassed on social media?

One of the main factors that upsets a person's mental health is cyber bullying, which can happen when a person feels uneasy while surfing social media.

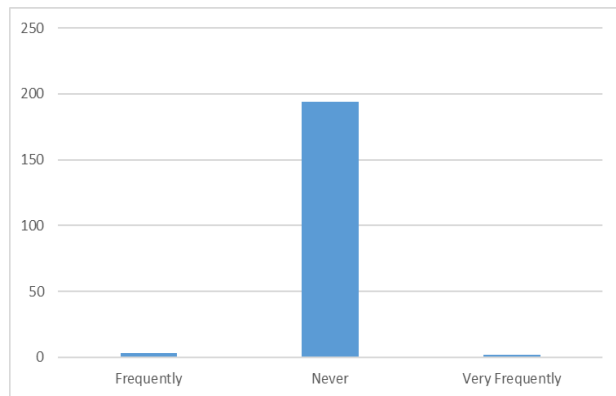


Fig 3 : Result of responses on social media

According to the Fig 3, 1 student experienced harassment on social media very regularly, 2 students experienced harassment frequently, and 197 students never experienced harassment. This shows that the privacy settings on social media were regularly updated.

4. If you get a message stating “you have won a quiz and can claim the prize by clicking on the link below”, will you click the link?

These kinds of spam communications are becoming more common these days because kids are less aware of how spam can get them into trouble.

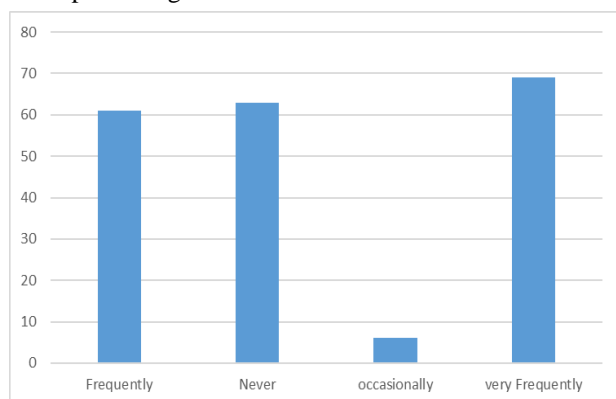


Fig 4 : Result of responses on device management

From the above Fig 4, it can be seen that 62 students fell for the prey of spamming, 64 students never underwent spamming, 5 students occasionally experienced spamming and 69 students have very frequently clicked the link which led to spamming.

5. Do you accept friend requests on social media from strangers?

Students who readily accept friend requests from total strangers put themselves at a significant risk of cyberbullying.

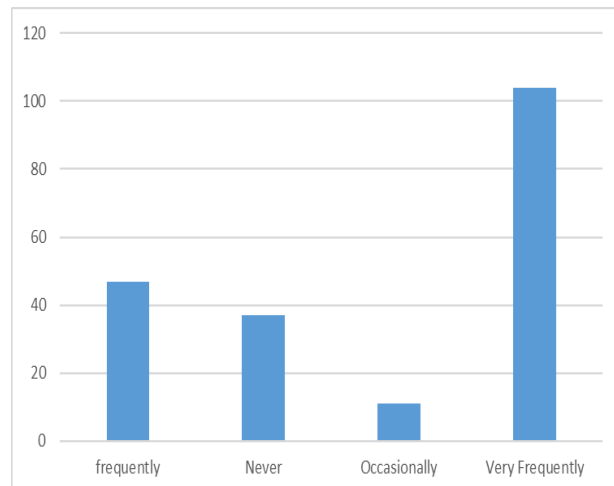


Fig 5 : Result of responses on cyber bullying

From the Fig 5, it can be seen that 45 students have accepted friend requests from strangers, 10 students have accepted friend requests from strangers occasionally, 109 students very frequently accepted friend requests from strangers and 36 students have never accepted friend requests from strangers hence only 36 students are not vulnerable to cyber bullying.

6. Do your friends have access to your social media account?

Privacy is the most important factor in social media and any of the security credentials of it should not be shared with others. If shared that information can be misused and the device may be exposed to vulnerability.

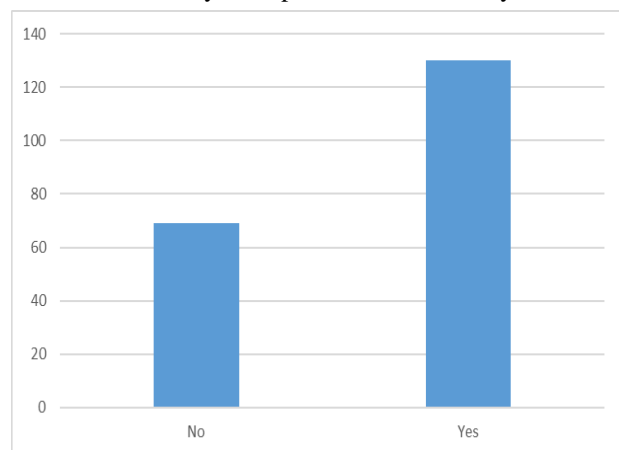


Fig 6 : Result of responses on social media

From the above Fig 6, it can be seen that 70 students never shared their access to social media with their friends and 130 students have shared their access to social media with their friends and are most vulnerable.

7. Which information will you share while playing online games?

Nowadays students have a tendency of playing online games by connecting globally. Many of the online games include usage of microphones through which personal or professional information can be shared. This may lead to cyber-attack like cyber bullying.

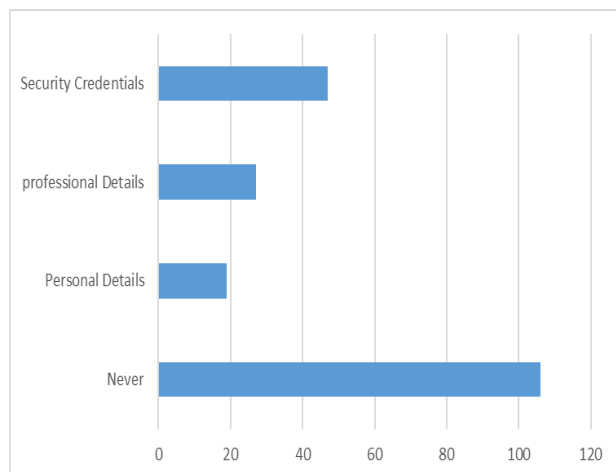


Fig 7 : Result of responses on online gaming

From the Fig 7, it can be seen that 110 students never shared any sought of information, 19 students shared their personal details, 24 students shared professional details and 47 students shared security credentials.

8. Have you ever accessed your social media account from other devices?

If social media account is accessed from other devices there are chances that the sensitive data may be stolen and personal data can be misused.

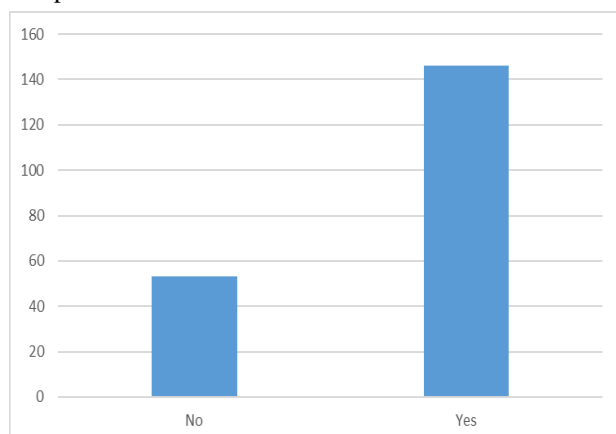


Fig 8 : Result of responses on social media

From the Fig 8, it can be seen that 55 students are vulnerable to security threats and 145 students are non-vulnerable to security threats.

Various machine learning methods were applied to the data set in order to analyse it. Datasets are classified into multiple classes using the logistic regressor. By combining several weak predictors in the dataset, gradient boosting creates an additive predictive model. AdaBoost classifier can be used to overcome any odd observations in the dataset, ensuring reliable predictions. A supervised machine learning technique called a random forest classifier generates a decision tree from a variety of samples and selects the best one for classification. When using a decision tree classifier to do classification, the interior nodes are labelled with an input feature.

In our dataset, the classification techniques were applied. 80:20 is the split between the training and testing data for the model, with 80 percent of the data being used to train the model and 20 percent being used to test the model. Following this stage, algorithms such as gradient boosting, ada-boosting, decision tree classifiers, random forest classifiers, and logistic regression were used to obtain the results. Conclusions was on random forest classifier's superior accuracy with 0.976 over other algorithms for the proposed data set.

■ Vulnerable ■ non-vulnerable

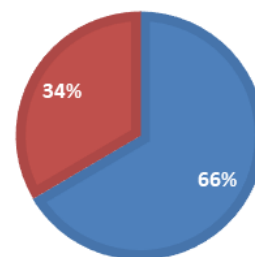


Fig 9 :Pie chart representing the percentage of students who are vulnerable and non-vulnerable.

From the Fig 9, analysis was made that 66% of students were vulnerable to cyber-attacks and 34% students were non-vulnerable to cyber-attacks. Table 1 shows prediction accuracy of the dataset by applying various machine learning.

Table 1 : Consolidated Results from various Machine Learning Algorithms

Algorithms	Accuracy
Logistic Regression,	0.731
Random forest classifier	0.9756
Ada Boost Classifier	0.82926
Decision tree	0.82926
Gradient Boosted Classification	0.85365

CONCLUSION

Nowadays, the vast majority of people prefer online commerce, online schooling, and online gaming, which makes them particularly susceptible to cyber attacks. A cyber attack is an offensive strategy that targets any computer equipment, including personal computers, networks, and infrastructure. Users need to be aware of cyber hygiene in order to defend themselves from cyber attacks. The results of this study suggest that social media and online gaming expose the majority of children to risk. This can be reduced by taking certain measures to maintain excellent cyber hygiene.

REFERENCES

- [1] A. R. Neigel, V. L. Claypoole, G. E. Waldfogle, S. Acharya, and G. M. Hancock, "Holistic cyber hygiene education: Accounting for the human factors," *Computers & Security*, vol. 92, p. 101731, 2020.

- [2] A. A. Cain, M. E. Edwards, and J. D. Still, “An exploratory study of cyber hygiene behaviors and knowledge,” *Journal of information security and applications*, vol. 42, pp. 36–45, 2018.
- [3] A. Vishwanath, L. S. Neo, P. Goh, S. Lee, M. Khader, G. Ong, and J. Chiain, “Cyber hygiene: The concept, its measure, and its initial tests,” *Decision Support Systems*, vol. 128, p. 113160, 2020.
- [4] A. A. Cain, M. E. Edwards, and J. D. Still, “An exploratory study of cyber hygiene behaviors and knowledge,” *Journal of information security and applications*, vol. 42, pp. 36–45, 2018.
- [5] A. R. Neigel, V. L. Claypoole, G. E. Waldfogle, S. Acharya, and G. M. Hancock, “Holistic cyber hygiene education: Accounting for the human factors,” *Computers & Security*, vol. 92, p. 101731, 2020.
- [6] A. A. Cain, M. E. Edwards, and J. D. Still, “An exploratory study of cyber hygiene behaviors and knowledge,” *Journal of information security and applications*, vol. 42, pp. 36–45, 2018.
- [7] A. Vishwanath, L. S. Neo, P. Goh, S. Lee, M. Khader, G. Ong, and J. Chin, “Cyber hygiene: The concept, its measure, and its initial tests,” *Decision Support Systems*, vol. 128, p. 113160, 2020.
- [8] A. A. Cain, M. E. Edwards, and J. D. Still, “An exploratory study of cyber hygiene behaviors and knowledge,” *Journal of information security and applications*, vol. 42, pp. 36–45, 2018.
- [9] De Bruijn, H. & Janssen, “Building Cybersecurity Awareness: The need for evidence-based framing strategies”. *Government Information Quarterly*
- [10] Aurigemma S, Panko R. “A composite framework for behavioral compliance with information security policies”. *Proceedings of the 45th Hawaii International Conference on System Sciences (HICSS)*.
- [11] Choucri, N., Madnick, S., & Ferwerda, J. (2014). “Institutions for Cyber Security: International Responses and Global Imperatives”. *Information Technology for Development*, 20(2), 96-121
- [12] Tsohou, A., Kokolakis, S., Karyda, M., & Koutouzis, E. “Investigating information security awareness: Research and practice gaps”. *Information Security Journal: A Global Perspective*
- [13] [Ztps://www.mha.gov.in/sites/default/files/ Cyber Safety_English_Web_03122018.pdf](https://www.mha.gov.in/sites/default/files/Cyber_Safety_English_Web_03122018.pdf)

Discern Emotions Using Signal Procured From the Brain by EEG

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Abstract:

Emotion is one of the actions controlled by the brain. BCI can be used as an advantage to detect emotions through the signals produced by the human brain. EEG is part of BCI. This research presents emotion recognition for emotions such as neutral, disgust, happiness, surprise, anger, fear, and sadness using the EEG signal. Firstly, the captured data is pre-processed by re-sampling, filtering, and re-referencing. Artifacts are removed from the data for next steps to be carried out without noise. The classification algorithms are applied in the next part, to classify the emotions. The Support Vector Machine algorithm has good accuracy for the emotions, which are disgust, happiness, surprise, and anger, with 83%, 89%, 83%, and 84%, respectively. From the results obtained, Support Vector Machine has good accuracy when compared to other machine learning classification algorithms for emotion classification, and disgust emotion has good accuracy when compared to other emotions.

Index Terms:

BCI, Classification algorithm, EEG, Emotion recognition.

INTRODUCTION

The brain is an organ that controls emotions, vision, hunger, and the functions of many parts of the body. It receives five senses such as touch, smell, sight, hearing, and taste and assembles messages received in a meaningful way and then stores them. The brain has four lobes which are responsible for certain tasks, such as the frontal lobe is responsible for speech, emotion, problem solving, etc., the parietal lobe is for sense of pain, touch, and vision interpretation, and the temporal lobe is for memory and hearing [1].

Emotion is the way humans express whatever they feel at that moment [2]. It can be divided into happy, sad, angry, delight, fear, disgust, neutral, hate, excitement, tense, and so on. Emotions that are extreme, such as tense or excitement, are considered high arousal. Emotions that are both positive and negative, such as angry and delighted, are considered valence.

The brain receives the signal and responds in terms of the signal. The human brain contains waves such as alpha, beta, gamma, theta, and delta [3]. Each of these waves has a different frequency range. Using brain signals, emotions can be recognized. Slight variation in the brain causes variation in the brain signal. Emotions such as valence and arousal can be recognized using this signal.

EEG means electroencephalography. It detects the electrical activity inside the brain [4]. The device named EEG is gaining popularity nowadays. This device helps

in capturing the brain signal. Electrodes are placed using 10-20 standard placement system. As the signals will be produced from many parts of the brain, the number of electrodes to measure such activity will also be high. Based on how many channels the EEG device has, the electrode quantity will be selected. If there are many channels, EEG data with high resolution can be captured. If there are 32 channels in an EEG device, it captures more details from the brain when compared to 8-channel devices. The EEG signal usually has a voltage of 10 micro-volts or even less. Therefore, amplification is required. The signal which is captured from the electrode will be passed through the device which is intended for amplification, which will magnify the signal. These signals from the amplifier system can be recorded using a computer.

In the medical field, emotion detection of a person is adopted. In some patients who cannot express facially, but if the emotions are just being felt, in that case, the patient's EEG signals can be very helpful in analyzing the emotion or current state of the patient. By monitoring the state, doctors can further analyze the present condition and medication requirements. Hence, it is important to know about the emotions felt by patients in the medical area.

LITERATURE SURVEY

Emotion Recognition using EEG Signal

The importance of machine learning for emotion recognition is described with the help of the EEG signal obtained [5]. The self-assessment is used to assess the emotions felt during the stimuli presentation. The research provides theoretical information about algorithms that can be used for classification. ML algorithm takes the database's input and performs the training and testing tasks to draw a conclusion. In the research, it has been mentioned that SVM, Decision Tree, and KNN are used for the classification of emotions.

In the research, the DEAP database was used, which has 32 participants' data. The SVM and Random Forest classifiers are used in this research [6]. The data was initially pre-processed by applying a band pass filter at 4–45 Hz, which removes the noise and makes the dataset clean. Then the feature extraction was performed, followed by the classification. The classification of the was carried out successfully, but the SVM algorithms' accuracy is less comparable.

If there are unlabeled and labelled data available for emotion classification, for which a semi-supervised learning method can be used [7]. The INTERSPEECH database has been used to recognize the emotion. An auto encoder is used, which recognizes patterns in the data. Emotions were detected in the dataset which contained the unlabeled data.

The DEAP dataset [8] is used in this research for valence and arousal classification. Pre-processed data is normalized and then the frequency is divided into some bands. The K-Nearest Neighbor classifier model is applied to that data. The accuracy of the K-Nearest Neighbor classifier has been good for certain frequency band channels [9].

The different databases and classification of emotions for those databases are included in the research [10]. The DEAP database for this purpose provides satisfactory results for KNN and SVM algorithms. For valence and arousal, DEAP and other datasets give average accuracy, whereas for some other emotions such as sadness and surprise, the accuracy has been greater than 80% with SVM and Gaussian method Kernel. Likewise, the research intends to provide useful information on the classification of emotions using EEG signals taken from the brain.

METHODOLOGY

The AMIGOS dataset was collected by the researchers, Juan Abdon Miranda Correa and Mojtaba Khomami Abadi [11]. 40 participants consented to have their EEG data recorded. The researchers played the stimulus to the subjects. The participants had electrodes attached to their scalps, and while they watched the video, those electrodes recorded the signals coming from their brains. These researchers captured this data on an external device, like a computer. Raw EEG data are those types of data. Stimuli: Stimuli can be audio, such as a song or video clip, or a combination of the two, which is a video clip. Participants give their response to the stimuli through self-assessment.

Emotion Recognition block diagram using EEG

Fig. 1 indicates the general flow diagram for emotion recognition using an EEG diagram.

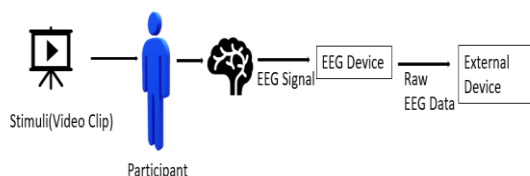


Fig. 1 Emotion Recognition block diagram

Participant: The person who agrees to the terms and conditions for the EEG recording process. The participant gets to choose whether the identity is revealed or not.

Response: The participant watches and reacts to the video clip, which will be in the form of the signal in the brain. Brain waves such as alpha, beta, gamma, theta, delta will be formed according to the reaction of the participant.

EEG Device: An EEG device will have electrodes that will be placed on the participant's scalp. Brain signals will be recorded by the device. This signal is called the "Raw EEG signal." A participant will give a self-assessment, which is an emotion felt during watching the video, such as neutral, anger, sadness, happiness, disgust, surprise, anger, fear.

Pre-Processing: After obtaining the EEG signal, pre-processing will be performed, the noise will be filtered out, and bad channels have to be dealt with. Next, features from the pre-processed signal will be extracted to obtain the useful information.

Classification: Classification machine learning algorithms will be applied for the pre-processed data.

Dataset

The dataset used is the Amigos Dataset [20]. This contains the long and short video experiments. In the first experiment, 16 short videos were watched by 40 participants. In the next experiment, 37 participants watched 4 long videos; 17 and 20 participants watched individually and in groups, respectively. Both the short and long videos were taken from the movies. During these experiments, the EEG of the participants was recorded. These participants completed a self-assessment in which they rated emotions such as fear, happiness, disgust, sadness, surprise, anger, and neutral on a scale of 0 to 9, with 0 representing an emotion not felt and 9 representing an emotion felt while watching the video. These were scaled to 0 to 1. An external assessment was performed by three annotators who rated on the scale of 0 to 9 for both long and short videos. Also, the face video of the participant was recorded.

Proposed work

Proposed work is intended on pre-processing and classification of the EEG data obtained from the existing work. The pre-processing will be initially performed. Pre-processing such as filtering, re-sampling, re-referencing is performed. 128Hz sampling rate is applied, a common reference named the referencing method is used, a band pass filter is applied, which is 4–45Hz. Since the raw EEG signal will have noise such as eye blink, this has to be removed for the further processing. The artifacts removal such as removal of bad channel, bad data, removing eye blink data is performed. Followed by this the classification algorithm applied for the pre-processed EEG data. The data is splitted as 70 to 30% in which 70% is training data and the prediction is made on 30% of test data set. Accuracy of the classification algorithm is obtained.

Data importing and pre-processing

The data importing, pre-processing, and artifact removal are performed using the application MATLAB. The pre-

requisite is to install the latest version of MATLAB and the EEG lab. Initially, the path for the EEG lab is set in MATLAB. The EEG lab will be loaded, which in turn loads all the necessary plugins.

Importing the data:

Data can be imported using the File option. A path is to be selected where the data set is present.

Pre-processing the raw EEG data:

Filtering, re-sampling, and referencing are applied in the pre-processing step. The data set has to be clean before proceeding to the classification, hence these steps are necessary.

Filtering: In filtering, low and high band pass filters are applied. Filtering helps in minimizing artifact removal. This option can be opened from the Basic FIR filter in the tool option.

Re-sampling: The sampling rate can be changed to save memory. This option can be selected from the change sampling rate in the tools. A sampling rate of 128Hz is applied.

Re-referencing: While recording data, if a different referencing method is used, it can be changed using the re-referencing option. This option can be selected from the re-referenced data in the tools. The referencing method can be. Rather than taking a particular channel as a reference point, the common average referencing method is considered. It is known to perform better compared to other referencing methods and helps in reducing the noise.

Artifacts removal: The noise in the channel or eye blink moment can be a hurdle for further processing of the EEG data. Hence, artifacts have to be removed. Bad channels, bad data, and eye blink moments can be removed in this step.

Bad channels: If the channel is too noisy, then such channels can be removed. First, data has to be plotted using channel data scroll from the plot option. The plot is shown in the Fig. 2.

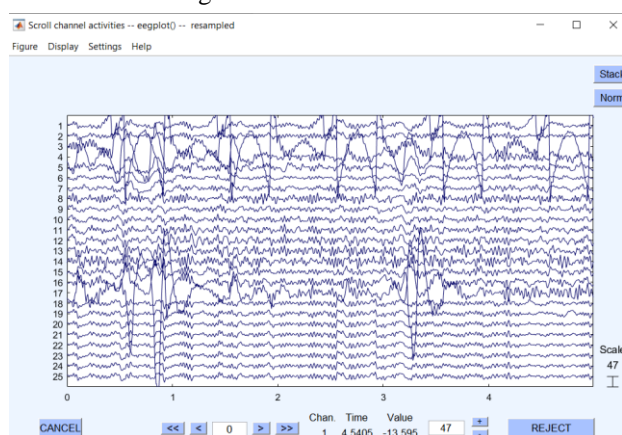


Fig. 2 Plotting the data

Whichever channel is noisy can be noted down. Then that channel can be removed by selecting data from the edit option and typing the required channel that has to be removed.

Bad data and eye blink artifacts: Bad data can be deleted using the inspect/reject data by eye tool option. Data that has to be removed can be selected as shown in the Fig. 3, then the reject option can be selected to remove it.

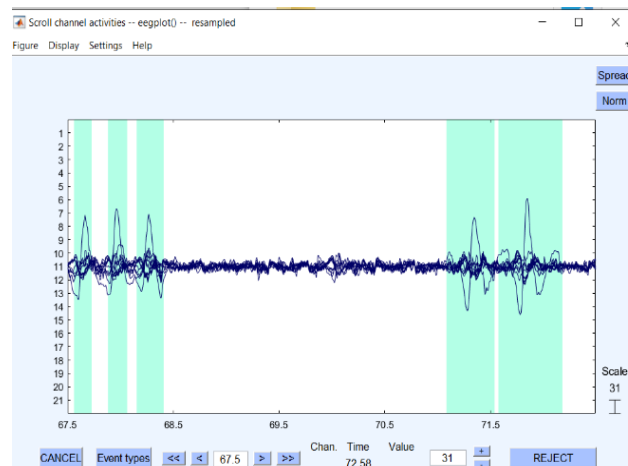


Fig. 3 Removing bad data

Sample data is as shown in Fig. 4. The pre-processed data consists of 17 channels, which are EEG channels, which are AF3, F7, F3, FC5, T7, P7, O1, O2, P8, T8, FC6, F4, F8, AF4; the remaining three channels are ECG (Electro Cardiogram) and GSR (Galvanic Skin Response).

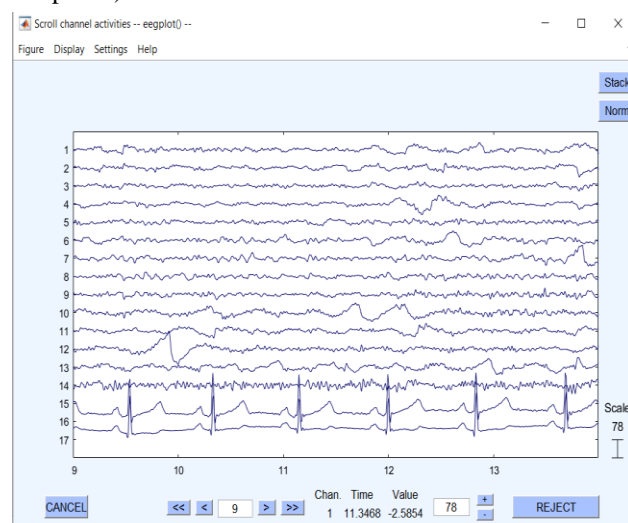


Fig. 4 Participant 3's pre-processed data

Emotion classification algorithm

The classification algorithms such as SVM, KNN, Logistic Regression, Decision Tree, Naïve Bayes are applied for the Pre-processed data. The data is splitted as 70% training data and 30% test data, on which the classification is performed. The model learns to predict using the emotion labels, and then predicts for the test set.

Algorithm:

Step 1: Read the EEG dataset, which is pre-processed

Step 2: Divide the pre-processed EEG data into 70% train set and 30% test set

Step 3: Select the parameter for the classification algorithms

Step 3.a: For SVM, select kernel type as the linear SVM Kernel

Step 3.b: Select K value as 11 and weights as uniform for the KNN algorithm

Step 3.c: Select the solver name as liblinear for the Logistic Regression algorithm

Step 3.d: For the decision tree algorithm, select the Attribute Selection Method as Gini Index

Step 3.e: For the Naïve Bayes algorithm, select the Gaussian Naïve Bayes Model

Step 4: Fit the classification models SVM, KNN, Logistic Regression, Decision Tree and Naïve Bayes to the training data set

Step 5: Prediction is performed for the remaining 30% of the data which is the test set

Step 6: Obtaining the accuracy for the prediction for all the classification models

RESULTS AND DISCUSSION

The raw data is pre-processed initially. Then, the classification algorithms are applied to the same, and the accuracy for each algorithm with respect to each emotion is obtained.

The best boundary between the data of distinct classes is created by SVM. This approach employs a decision function that employs a support vector, a small portion of the data that aids memory efficiency. In SVM, selecting an appropriate kernel is tricky. When the dataset has several features, this algorithm performs well. Despite the fact that the EEG data has several features, SVM performs well.

KNN is a supervised algorithm that predicts based on feature similarity. When there is no noise in the dataset, this approach can be employed. It does not require any training and efficiently does the prediction, when new data is presented. KNN is a lazy learner which evolves constantly. The value of K and the distance measuring method used are used to make decisions. KNN does not perform well if the dataset is large. The EEG dataset is huge and has many features in it, hence KNN performance is comparatively less.

For predictive analytics, the Logistic Regression method is utilized. One of the most widely used classification techniques is logistic regression. Binomial predictions are made by the algorithm. This essentially calculates the probability using a logistic function to measure the relationship between dependent and independent variables. The importance for features in logistic regression is uncertain. As the importance attributed to the features in the EEG data that make up specific emotions is uncertain, the algorithm slightly has less performance for the dataset.

A decision tree is one of the supervised learning algorithms; it is mostly used for classification. It consists

of a decision and a leaf node. The decision node contains the features based on which the decision is made. The leaf node has the output of the tree, which cannot be further divided. The decision tree technique is complex as there will be many layers and it suffers from overfitting. As there are many values in the dataset, constructing the decision tree is complex.

The Bayes theorem is used in Naïve Bayes technique to perform classification. Because the Naïve Bayes method predicts test results quickly, it saves time. If the data is categorized rather than numerical, it performs better. It is possible that Naïve assumption is incorrect. In real-world applications of the Naïve Bayes algorithm, the assumption of naïve or independent features is rarely accurate, so it underperforms for the EEG data.

For the above reasons, SVM performs better compared to other algorithms.

Time Frequency Plot

Time-Frequency plot is plotted for participant 3 for channel 1 using MATLAB. The four time-frequency plot figures have different frequencies representing theta, alpha, beta, and gamma. The ERSP (Event Related Spectral Perturbation) is a power spectral fluctuation. ERSP and ITC (Inter-trial coherence) are plotted for time-frequency. The changes in the graph indicate that there is a change in the state of mind of the participant.

The data was pre-processed to a 4-45Hz band pass frequency. Delta signal comes between 0.2-2Hz, there was no data because of the pre-processed frequency filter. Furthermore, delta waves occur during dreamless sleep and meditation. However, because the participant was watching video during the EEG signal recording, the likelihood of this signal occurring is low.

Fig. 5 shows the time-frequency graph for the theta signal. There is a lesser amount of data in this graph comparatively. During the theta signal, a person usually is in a dream state or in a reduced state of consciousness and deep state, which may rarely occur for a participant.

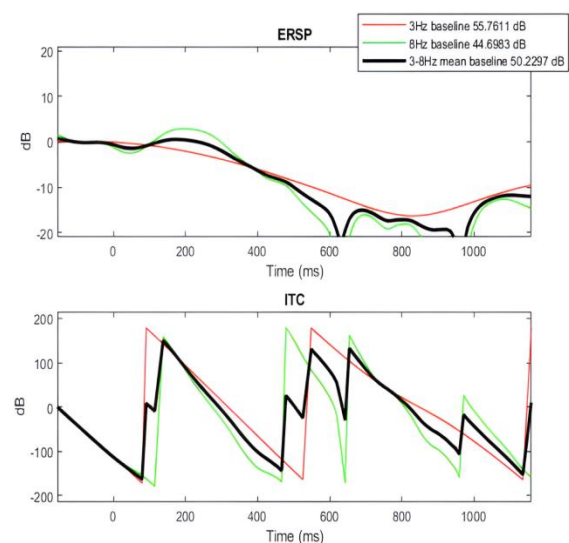


Fig. 5 Time-Frequency graph with 3-8Hz frequency

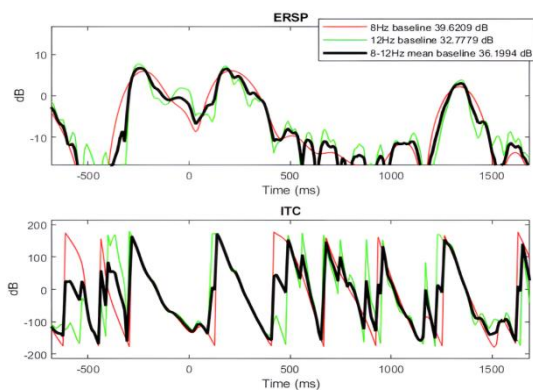


Fig. 6 Time-Frequency graph with 8-12Hz frequency

Fig. 6 indicates the graph during the alpha wave. This wave usually occurs during a calm and relaxed state of the participant.

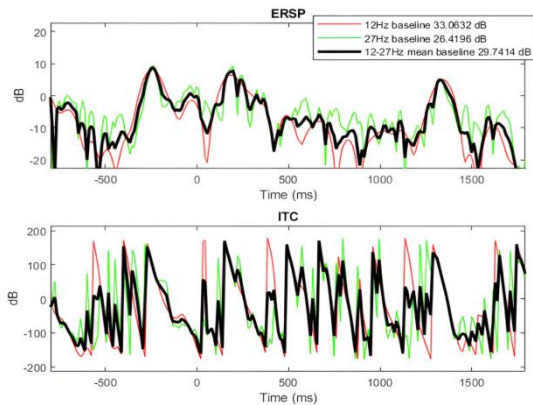


Fig. 7 Time-Frequency graph with 12-27Hz frequency

Fig. 7 indicates the graph during the beta wave. This wave usually occurs or is formed when a person's brain is in an alert state. As the participant is supposed to watch the video, react to that video, and take self-assessment to update the emotions felt throughout the video, the participant is likely to be in an alert state.

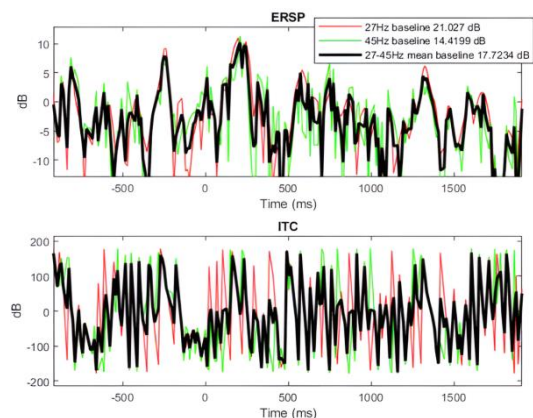


Fig. 8 Time-Frequency graph with 27-45Hz frequency

Fig. 8 indicates the graph during the gamma wave. This wave occurs when the person is in an aware state or in a

cognition state. This indicates that the person is trying to understand the video's situation through their senses.

Considering the accuracy chart, SVM detects disgust, happiness, surprise, and anger well comparatively. KNN classifies disgust, happiness, and anger well. Logistic regression classifies happiness in a good manner compared to other emotions. A decision tree can detect disgust well. Naïve Bayes has an average classification result for all the emotions.

Consolidated Result

Table 1 Consolidated accuracy for the classification algorithms

	Neutral	Disgust	Happiness	Surprise	Anger	Fear	Sadness
SVM	0.63	0.85	0.89	0.83	0.84	0.63	0.61
KNN	0.60	0.83	0.80	0.83	0.58	0.69	0.60
Logistic Regression	0.59	0.71	0.88	0.72	0.62	0.63	0.59
Decision Tree	0.64	0.86	0.54	0.78	0.55	0.60	0.53
Naïve Bayes	0.67	0.77	0.75	0.76	0.60	0.62	0.48

The consolidated table represents the result for each emotion with respect to the machine learning classification algorithms is shown in Table 1. For disgust, happiness, surprise, and anger, the SVM's accuracy is 83%, 89%, 83%, and 84%, respectively. For disgust, happiness, and surprise, the KNN's accuracy is 85%, 80%, and 83%, respectively. The accuracy of the Logistic Regression algorithm for happiness emotion is 88%. The accuracy of the decision tree algorithm for the emotion of disgust is 86%. Naïve Bayes has average accuracy for all the emotions. SVM performs well for emotions like disgust, happiness, surprise, and anger when compared to the results for all the classification algorithms for the emotions neutral, disgust, happiness, surprise, anger, fear and sadness. SVM performs well with four emotions, while KNN performs well with three emotions, Logistic Regression works well with one emotion, and the Decision tree performs well with one emotion.

Accuracy

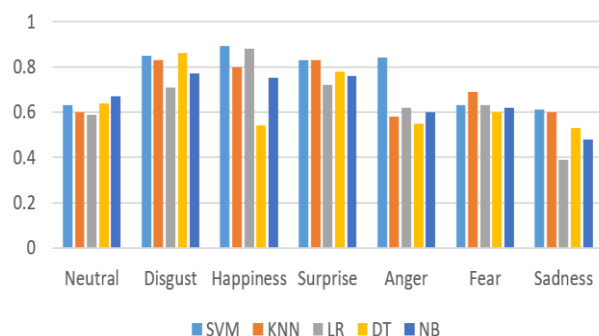


Fig. 9 Accuracy chart for classification algorithms

Fig. 9 represents the accuracy bar chart of the classification algorithms with respect to each emotion.

By considering this, SVM performs well compared to other algorithms.

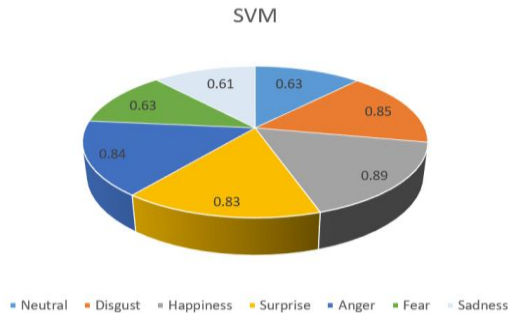


Fig. 10 Pie Chart indicating SVM algorithm accuracy

Fig. 10 indicates that the SVM algorithm performs well with the emotions of surprise, happiness, anger, and disgust.

CONCLUSION

An emotion is a reaction expressed by people in a certain context, such as when they are speaking with someone, watching videos or any other context. The brain contains many neurons, which are connected by dendrons. These neurons pass electrical signals to send a message to another neuron. When a person expresses emotion, it will be sent as a signal across the neurons through these electrical signals. Emotions can be any form, such as happiness, sadness, or anger, depending on the situation.

BCI is a technology that provides an interface for the communication between the brain and a machine. An EEG device contains many electrons which will be placed on the scalp of a person in order to obtain the brain signal. As a whole, signals in the brain are powerful, which will be captured by the device. The received signal will be transmitted to the external device in order to understand the signal. This EEG data can be used in the medical field.

Raw EEG data will usually have artifacts such as noise or eye movement that have to be removed. In the pre-processing part, the artifacts will be removed, the required band pass filter will be applied, the sampling frequency will be selected, and any bad data and bad channels will be removed. This signal is further passed to the classification algorithms. The pre-processed data is split into test and training sets. The training set is initially passed to the algorithm, then it detects the label for the test set data. The accuracy for such a prediction is obtained.

As observed, compared to other emotions such as anger, happiness, sadness, fear, neutrality, and surprise, disgust can be classified well. The SVM classifier gives good accuracy compared to KNN, Logistic Regression, Decision Tree, and Naïve bayes algorithms for emotion classification in the EEG data.

The drawback in this research work is that some emotions have less accuracy than others. So do the

algorithms for the emotions. Thus, the future scope of the research is to explore other techniques for emotion classification to improve the accuracy.

REFERENCES

- [1] MD-Health.com (2022). Positions and Functions of the Four Brain Lobes. [online]. Available: <https://www.md-health.com/Lobes-Of-The-Brain.html>.
- [2] Verywell Mind (2022). Emotions and Types of Emotional Responses. [online]. Available: <https://www.verywellmind.com/what-are-emotions-2795178>.
- [3] Brainworksneurotherapy.com (2022). What are Brainwaves. [online]. Available: <https://brainworksneurotherapy.com/what-are-brainwaves>.
- [4] Wikipedia Contributors (2022). Wikipedia, The Free Encyclopedia. Electroencephalography. [online]. Available: <https://en.wikipedia.org/wiki/Electroencephalography>.
- [5] K. Kotowski, and K. Stapor (2022). Machine Learning and EEG for Emotional State Estimation. The Science of Emotional Intelligence. London, United Kingdom: IntechOpen. [online]. Available: <https://www.intechopen.com/chapters/75970>.
- [6] Nilkamal More, Varun Parmar, Ameya Tathavadkar, Tanish Shah, Meet Shah, "Classification of Emotions From EEG Signals using Machine Learning Algorithms," IJERT, Volume 10, Issue 05, May 2021.
- [7] J. Deng, X. Xu, Z. Zhang, S. Frühholz and B. Schuller, "Semisupervised Autoencoders for Speech Emotion Recognition," in IEEE/ACM Transactions on Audio, Speech, and Language Processing, vol. 26, no. 1, pp. 31-43, Jan. 2018.
- [8] Sander Koelstra (2022). Eecs.qmul.ac.uk. DEAP: A Dataset for Emotion Analysis using Physiological and Audiovisual Signals. [online]. Available: <https://www.eecs.qmul.ac.uk/mmv/datasets/deap/index.html>.
- [9] Li M, Xu H, Liu X, Lu S, "Emotion recognition from multichannel EEG signals using K-nearest neighbor classification," Technol Health Care. 2018;26(S1):509-519.
- [10] Ramprasad Kumawat, Manish Jain, "EEG based Emotion Recognition and Classification: a Review," Special Issue of First International Conference on Information Technology, Computing & Applications, Volume 03 Issue 05S May 2021.
- [11] J. Correa (2022). Eecs.qmul.ac.uk. AMIGOS: A Dataset for Affect, Personality and Mood Research on Individuals and Groups. [online]. Available: <http://www.eecs.qmul.ac.uk/mmv/datasets/amigos/index.html>.

Analysis of Motives behind Cyberattacks Using Machine Learning Algorithms

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Abstract:

Cyberattack is the one of the most sensitive issue of internet security across the world. Cyberattacks have an effect on all the sectors like economical and businesses of the world, with inflicting full-size damage. India faced around 18 million cyberattacks, to avoid attacks one needs to understand the motives behind any of the cyberattacks. The goal of this paper is to analyse the motives behind cyberattacks and identify the most common motive using Google studio visualization tool. Google data studio is a data visualization tool, which we used to visualize data using different charts and plots. We have applied various machine learning regression algorithms to know the accuracy of our data set

Keywords:

Google data Studio, Motives, Cyber Attacks, Regression Algorithms.

INTRODUCTION

A cyberattack is the method of trying to steal records or gaining unauthorized admission to computer systems and networks using computer systems. Phishing, Malware, MITM, Denial of Service, Password Attacks are some of the wellknown Cyberattacks. It's crucial to have a clear understanding of the attacks that are there in order to properly defend oneself against such assaults. The rationale behind cyberattacks are growing is that there are folks who are continuously using the technology for their personal gain or for his/her non-public advantage. All the sectors in the country is getting attacked day by day. Cyber assaults are occurring with the cause of blackmailing, non-public issues, Financial advantage, Fraud etc., These assaults have impacted the monetary fame of citizens in India. Motives of cyberattack analysis refers to analysis of the most common motives behind any cybercrimes using Google data studio visualization tool. A raw dataset can be transformed into a variety of graphs and charts using Google Data Studio, including pie charts, bar graphs, and line graphs.. Google data studio provides convenience for the user to make analysis of large set of data.

The different machine learning regression techniques, include linear regression, random forest regressor, decision tree, KNN, SVM are used. In this research paper, the concept of data visualization is used to analyze the top 5 motives behind any cyberattack data collected from <https://data.gov.in/>. From the analysis we made, the motives can be predicted which helps people to be safe and avoid themselves from becoming victims of cyberattacks.

REVIEW OF LITERATURE

Motives behind cyberattacks is analyzed using Tableau [1]. The motives are classified and analyzed with respect to each states in India. To find out the maximum value of the motive each motive is compared with 2 other motives. For visualization and comparison of different motives the dashboard feature is applied. To display more number of sheets within a single frame a dashboard is used. There results stated that revenge, harassment and greed are motives for maximum number of Crimes. Observable behavioural Indicators for insider cyber sabotage and for many more attacks [2] is analysed, and provides interdisciplinary framework that includes modeling, human factors, behavioural cyber security and simulation. They have examined 74 actual cyberattack cases by constructing logistic Regression Model. There results proved that revenge, addiction and poor work performance are the main indicators for insider cyber sabotage. Insights on the behavioural aspects of Cyber Security is Reviewed [3]. An interdisciplinary framework is created, and a concept model for reducing human error is suggested. Understanding the significance of social, behaviour, environment, biases, perceptions, deterrence, intent, attitude, norms, sanctions, decision-making, alternatives, and environment, biases, environment, and norms was the aim. Bias in the study of cybercrime. The multidisciplinary framework that incorporates modelling and simulation, behavioural cybersecurity, and human factors. Analysis of DDos Attack by analysing attackers aim [4]. A new hybrid model that analyses the targeted infrastructure and the targeted victim using postulates from various criminal opportunity models.. 27 distinct attack events from different cities is analyzed by using this model. There results stated that motives for DDOS attacks and advised companies to always takes care of political and socio-cultural environment. Accessibility and visibility are main reasons of infrastructural attacks. The data breaches investigation report [5] for the year 2022 the murky realm of cybercrime. The financially driven criminals and evil nation-state actors have rarely, if ever, come out swinging the way they did during the past 12 months, from well published attacks on vital infrastructure to significant supply chain compromises. The DBIR team examined 23,896 security incidents this year, of which 5,212 resulted in data breaches that were verified. The count of various incidences with the number of confirmed data breaches with their motives behind the acts and the composition of the data compromised for the different industries, web

applications, denial of services Malicious errors, recreation and entertainment fields and many more.

METHODOLOGY

In this part we discuss about the methods we used in each step of our analysis.

A. Collection of datasets:

The dataset is obtained from a government website <https://data.gov.in>. The information in the dataset includes the count of the particular motives behind the cyberattacks with respect to each state.

B. Cleaning the dataset:

The collected dataset is pre-processed here. The data is cleaned and prepared to help plot graphs. To plot the graphs, first extra labels such as “Total States”, “Total All India” were removed from the dataset. To plot the graphs we use Google Data Studio and we have obtained the Graph for States versus Count of motives for cyberattack.

C. Analysis of data:

The analysis of data is done using the dataset and the graph that is plotted. The plot is used to represent the total number of motives and also the count of the corresponding motive. We have identified the Top 5 motives for year 2018,2019 and 2020. We have applied Linear Regression, Random Forest Regressor, Decision Tree Regressor, SVM, KNN Machine Learning Algorithms to compare the Accuracy of Each Algorithm.

1. Linear Regression Algorithm: It is a Machine Learning Algorithm that performs Regression Tasks and is based on Supervised Learning. The relationship between dependent and independent variables is determined using this algorithm.

The following result is obtained after using Linear Regression Algorithm on the dataset

R2 Score = 0.941

2. Random Forest Regressor Algorithm: The ensemble learning method is used by the Supervised Learning Algorithm for Regression. In order to create an accurate predictive model, this technique combines multiple models

The following result is obtained after using Random Forest Regressor Algorithm on the dataset

R2 Score = 0.685

3. Decision Tree Regressor Algorithm: It is a Regressor model which has a tree structure, it is generally divides the dataset into subsets. The result of Decision Tree is associated with the last node.

The following result is obtained after using Decision Tree Regressor Algorithm on the dataset

R2 Score = 0.80261

4. SVM Algorithm (Support vector Machine) It is a supervised machine learning algorithm that is used to solve problems involving classification

and regression. It is used to identify the plane with the best fit and the greatest number of points.

The following result is obtained after using SVM Algorithm on the dataset

R2 Score = 0.8026

5. KNN Algorithm (K-Nearest-Neighbour): It is a supervised machine learning algorithm that is used to solve problems involving classification and regression. It does it by averaging the K-Nearest-Neighbour targets.

The following result is obtained after using KNN Algorithm on the dataset

R2 Score = 0.8026

RESULT AND DISCUSSIONS

The objectives outlined in the second section serve as the foundation for the research's analysis.

The dataset on Motives behind Cyberattacks was collected from <https://data.gov.in> for the analysis. we have found out the Top 5 motives behind Cyberattacks in India using Google data Studio Tool.

For the following dataset we use the supervised Machine learning algorithms. The collected dataset is segregated as Training dataset and testing dataset. The model is fitted into Training dataset and the predictions are made on the Testing dataset. The accuracy (R2 score) is obtained for each of the Algorithms and are compared with each other algorithms to obtain the best one that is suitable for the Dataset.

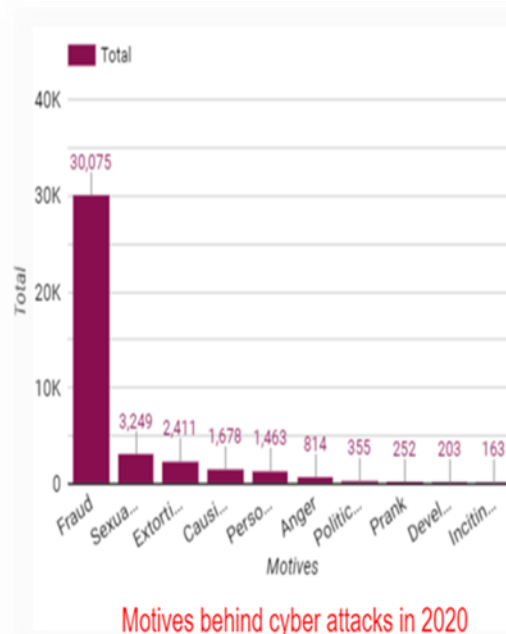


Figure 1: Motives count for the year 2020

In the year 2020, we have identified the top motives to be Fraud (30,075), Sexual Exploitation(3249), Extortion(2411), Causing disrupte(1678) and Personal Revenge(1469).

The bar graph is used to represent the motives with the respective count in the figure 1

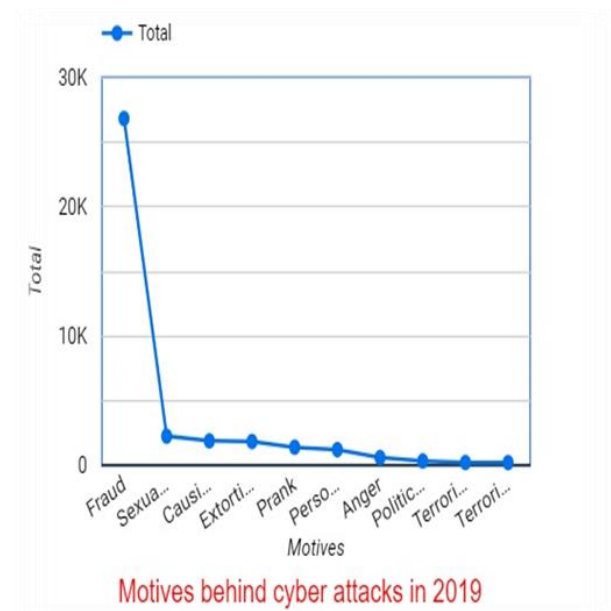


Figure 2: Motives count for the year 2019

In the year 2019, we have identified the top motives to be Fraud with the count of 26,853, Sexual Exploitation (2,238), Causing Disrupt (1,874), Extortion (1,827) and Prank (1,384).

The Line graph is used to represent the motives with their respective count in figure 2.

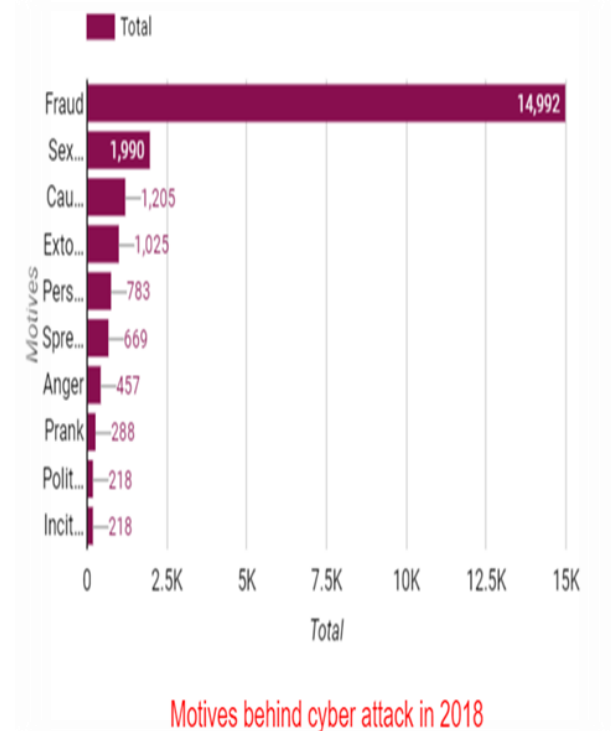


Figure 3: Motives count for the year 2020

In the year 2018, we have identified the top motives to be Fraud with the count of 14,992, Sexual Exploitation (1,990), Causing Disrupt (1,205), Extortion (1,025) and Personal Revenge (783).

The stacked bar graph is used to represent the motives with the respective count in the figure 3

According to our analysis from the above three years, we conclude the Top 5 motives of any cyber attacks to be Fraud, Sexual Exploitation, Causing Disrupt, Extortion and Personal Revenge.

This Dataset is of Regression type. Like Classification Algorithms, Regression is an important and is very much used in statistical and the machine learning tool. The main objective of this kind is to predict the results or the responses that are numerical values, for any of input data that is provided. What the model learnt throughout the training phase determines the output.

The dataset was analyzed by using ML Regressions and compared the accuracy with various algorithms. Linear Regression was found to be the best amongst all the Regressions with an Accuracy of 94%, followed by Decision Tree, SVM and KNN with the accuracy of 80%. Random Forest Regressor has the least accuracy of 68%.

Table : 1 Accuracy Result Table of various Algorithms

Algorithm	Accuracy in %
Linear Regression	94.12
Random Forest	68.57
Decision Tree	80.26
SVR	80.26
KNN	80.26

The Above table represents the various machine learning Regression algorithms with their respective Accuracy in percentage.

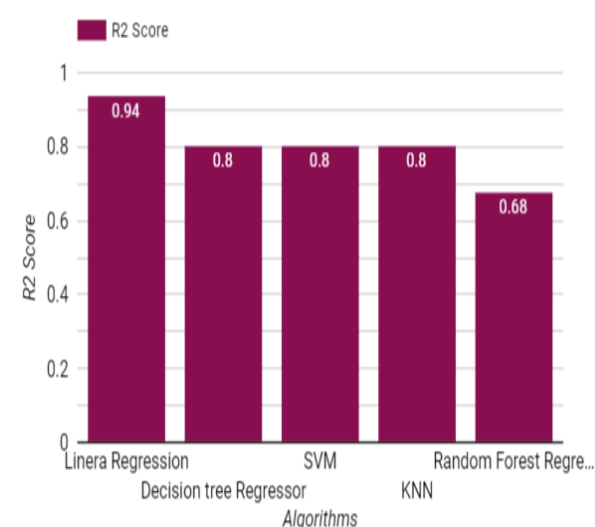


Figure 4: Comparison Bar Chart representation of Various Machine Learning Algorithms

The above bar chart gives the plot of various regression algorithms that are used with their respective R2 score , that gives the Accuracy of the dataset. It depicts, the Linear Regression algorithm to have maximum R2 score of 0.94(94%) and the Random Forest Algorithm to have least R2 score of 0.68(68%).

REFERENCES

- [1] Cyber Crime against Women by Dr. Vineetha Choudhary.
- [2] Cyber Crime against women in cyber world by Prof. Jay Bhongale.
- [3] Violence against women in cyber world: a special reference to India – by jaspreet singh.
- [4] Regulation of Cyber Crimes against Women – A Critique by G. Tanuja Reddy
- [5] Strategies to Prevent and Control of Cybercrime against Women and Girls by S. Poulpunitha, K. Manimekalai, P.Veeramani
- [6] Karnataka records highest cyber-crime rate in India – Article
- [7] Cases targeting women with explicit content double in 3 years – Article
- [8] cybercrime in assam: an analysis by Debasis Barhoi - Article
- [9] NCRB places Odisha on top in child pornography cases for 2nd year – Article
- [10] Analyzing the crime of cyberstalking as a threat for privacy right in India by Pritam Banerjee & Dr. Pradip Banerjee

Mediation of Study Habits between Social Networking Sites and Academic Performance of Management Graduates

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Abstract:

The study was intended to assess the mediation effect of study habits in the link between social networking sites and academic performance. A total of 406 students were selected conveniently to collect the data from different colleges in the state of Andhra Pradesh. A structured questionnaire was developed with the established scales for the variables. structural equation Modeling has been adopted for the analysis and interpretation using SPSS and AMOS. The results of the study stated that social networking sites were significantly influencing study habits, and negatively influencing academic performance. While academic performance was influenced by the study habits of the students largely. Further, study habits were mediating the relationship between social networking sites and academic performance.

Keywords:

social networking site, student study habits, academic performance, SEM, CFA

INTRODUCTION

At present, the forthcoming innovations/ technologies have attempted to satisfy their parts in students' academic outcomes by prompting the generous medium of collaboration in the present world and in educating and learning. Throughout the years' experts in education have investigated the energizing opportunities, presented to institutions, educators, instructors, and students through online social media sites. Social media sites have changed the manner of student cooperation and had realized the rise of an open social stage, for example, different social media sites that enable the occupants to interface with one another and make the world a worldwide town. Social media sites, for example, are being utilized for learning with the end goal of helpful collaboration with different students and conceivably with others outside classes, for example, students of a similar theme and subject specialists. The mechanism of these sites affected the learning concept of students and the teaching methods of educators. In today's world of education, has influenced educators, students, and others to participate with one another in the undertakings of information development in learning and instructing situations (Knight-McCord et al., 2016).

Social media can reinforce the class materials and accordingly affect the dialogues, community work, and creating teachers and analysts are always experimenting with different things with upcoming technologies, wanting to inculcate basic reasoning abilities,

coordinated effort, and information that these social media sites provide by and large to the entire world, suggests a need to practically think about its advantages, effects, and dangers of transparency and requirement for progressing collaboration with students, with the end goal to address their worries and manage issues during the utilization of social media sites as they emerge (Asiedu, 2017).

In the universe, the use of social media among consumers continues to involve a major part in student life, and the use of this media among students continues to expand in the future. In particular, most students spend almost all of their time on social media, while paying less attention to their educational obligations and spend a lot of time in these locations, studying or communicating with each other. Both active and regular participation in social media can influence their research and hide their presence in workers' countries. The direction is dangerous because parents are very worried that their children are addicted to using social media sites that they usually pay to socialize. And talk to whoever they really require. The use of social media by students in a class (Education) is aggregate (knowledge about doing many activities at one time). This type of participation distorts thinking, as some students use social media to send text messages, explore their books, or do homework that distracts them from their educational activities. It has also turned out the character of a large number of students who walk on the streets connected to mobiles beyond actually being aware of the current situation. The next problem for students involved in using social media is the motivation for their academic activities. These students choose to be in the world of potential rather than see some general curriculum such as academic forums and group gatherings (Mpungose, 2020).

Young students tend to experience mood swings and self-control on a regular basis which automatically influences their appearance and often triggers anxiety or suffering in their personality as individuals. Thinking this way can sometimes cause dissatisfaction. Most university professors and the wider community are concerned that there are strict procedures or misuse of high-tech facilities developed by many institutional authorities. In this case, this study will explore the impact of social media on mental behavior and student academic performance (Ahn, 2011).

This study explores the link between social media sites, study habits, and student academic performance. This study is important for understanding the relationship between social media sites, and the impact of social media networking sites, on academic performance to determine student attitudes in education.

LITERATURE REVIEW

Interrelationships among social networking sites, Study Habits, and Academic Performance

Alghizzawi et al., (2018) have explored the impact of social media networking sites on academic performance through their personal observation and follow-ups of these sites especially Facebook in the Middle East and the world. They revealed that most numbers of university students were addicted to Facebook and there was a negative effect of these networks on their academic performance.

Paul et al., (2012) have conducted a study on the impact of social networking sites on the academic performance of business students at state universities. SEM was used to analyze direct and indirect effects. The results stated that there was a significant negative effect of social media networking sites on the student's academic performance. Additionally, an inverse relationship was found between time spent on social media increase and the academic performance of the students.

(van Vu, 2021), have made an investigation to identify the impact of social networking sites on student habits by taking the student responses from different universities of Hanoi. A total of 225 student responses were found valid to make an analysis. Analysis of the data was carried out using frequencies, percentages, means, *t*-tests, and Pearson correlation statistics. The findings revealed that students' level of using social networking sites had a negative influence on their study habits and their interpersonal relationships. Similar results were found Tezci & Icen, (2018). Even a study Ezeji & Ezeji, (2018), which has examined the impact of social media on the study habits of students of Alvan Ikoku Federal College of Education, Owerri. The data were collected using a structured questionnaire with suitable statistical techniques like frequencies, descriptive and Spearman's Rho were used. The results showed that there was an impact of social media on the study habits of the students in the study area. These results were matched to the study of Gok, (2016), which was carried out to test the negative and positive effects of social media on students' study habits by conducting a study on a total of 220 students from vocational higher education. A standard questionnaire was designed and distributed to collect the data from the students. The results indicated that social media networking negatively influenced the study habits among the students.

(Tus, 2020), have tested the impact of students' study habits on their academic performance. Data were collected from 130 student respondents related to Catholic senior Schools in Bulacan, Philippines. Results were analyzed and described as there was an influence of

students' study habits on their academic performance. (Chuks Danie, 2017) have investigated the effect of reading habits on the academic performance of students of Afe Babalola University, Ado-Ekiti, Nigeria. The study used a structured questionnaire to collect the data and analyzed it with frequency, descriptive and inferential tools. The study result revealed that the majority of the students were studying only at the examination time. Further, the study proved the impact of reading habits on the academic performance of the students. Rabia et al., (2017) examined the association between students' study habits and academic performance. A total of 270 responses were collected from two reputed colleges in Sialkot. A Chi-square test was applied to assess the data. The results postulate that there was an association between study habits and academic performance. The results were proved by Owusu-Acheaw & Larson, (2014), who studied reading habits among students and their effects on student academic performance. The data were collected from 1000 student respondents located Eastern Region of Ghana. A questionnaire was used for the data collection. The study confirmed that reading habit has an influence on academic performance and there is a relationship between reading habit and academic performance.

Many studies were found on the relationship between social media and study habits (Ezeji & Ezeji, 2018; Gok, 2016; Tezci & Icen, 2018; van Vu, 2021). Studies also existed that explained the relationship between social and academic performance (Alghizzawi et al., 2018; Paul et al., 2012). studies on the relationship between study habits and academic performance (Chuks Danie, 2017; Owusu-Acheaw & Larson, 2014; Rabia et al., 2017) were found in the literature. But no study was found with the intervention of student study habits in the relationship between social networking sites and academic performance. Hence, the research model is proposed with all the interconnections.

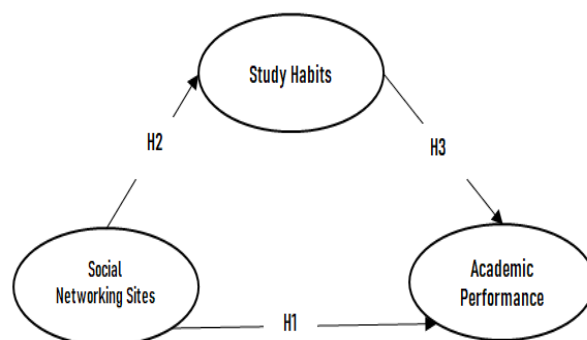


Figure 1 Hypothesized Conceptual Model

H1: Social Networking Sites positively influence students' academic performance

H2: Social Networking Sites positively influence student's study habits

H3: Student's study habits positively influence student's academic performance

H4: Study habits mediate the relationship between social networking sites and academic performance

MATERIALS AND METHODS

Methods:

The study adopted a mixed approach for assessing the impact of social media on academic performance with the mediation of study habits. The researcher implemented a Convenience sampling technique for the collection of the sample data.

Participants:

A total of 450 student respondents were approached and 406 responses were identified as suitable to execute the analysis.

Instruments:

The questionnaire was designed on a 5-point Likert scale ranging from strongly disagree to strongly agree. Suitable scales were adopted from established sources.

Social Networking Usage Questionnaire: A 25-item scale developed by (Gupta & Bashir, 2018) was adopted for the study to measure the mobile learning practices among student respondents.

Student study habits scale: A eight-item scale established by (Magulod, 2019) was adapted and slightly adjusted to suit the present study requirement.

Academic performance scale: A eight-item scale developed by (Ramprathap & Sriram, 2017) was adopted to assess the student's academic performance.

RESULTS AND DISCUSSION

The data analysis was carried out using different statistical tools and techniques. Reliability for assessing the internal consistency, validity for assessing the predictability of the measure, and Structural equation modeling for assessing the direct and indirect effects with model fit values were applied using SPSS and AMOS.

Model fit, Reliability, and Validity Measures

A model was developed by constructing the study variables such as social networking site dimensions, study habits, and academic performance. This model is then verified with fitness, reliability, and validity. The model fit was adjudged with the help of various important fit indices like Goodness of Fit Index (GFI), Comparative Fit Index (CFI), Root Mean Square Error Approximation (RMSEA), and chi-square/df ratio.

Table:2 Model fit measures

Measure	χ^2	Df	χ^2/df	GFI	CFI	RMSEA
Estimate	427.860	74	5.68	0.958	0.976	0.045
Threshold			1-8	>0.90	>0.95	<0.08

The results of the model fit measures show that the GFI value of 0.958 and RMSEA value of 0.045 are meeting requirements of >0.9 and <0.045 denotes that the sample is the approximation of the total population. The resulted CFI value of 0.976 was also found greater than 0.95 indicating that the model is a better fit and the chi-

square/df value of 5.69 reflects the model acceptance (Hair Jr. et al., 2014; Hu L.-T. & Bentler P. M., 1999).

Convergent and discriminant validity

Table:3 Convergent and discriminant validity

Variables	CR	AVE	MSV	SN_S	S_H	A_P
SN_S	0.919	0.739	0.224	0.860		
S_H	0.887	0.610	0.505	0.474	0.781	
A_P	0.877	0.589	0.505	0.066	0.711	0.768

Construct Reliability sometimes called composite reliability is a measure of internal consistency of a particular scale (Netemeyer et al., 2003). The construct reliability values for all the constructs like social networking sites, study habits, and academic performance are above the standard requirement of >0.70. it denotes that the measurement model possesses reliability.

Convergent Validity was assessed through standardized factor loadings and Average Variance Extracted (AVE). The resulted standard estimates of all the items of the measurement model and AVE values of the constructs range between 0.58 to 0.73 and 0.50 to 0.70 respectively, also meeting the minimum requirement of 0.50. It indicates that measured variables of concern construct share a high proportion of variance in common (Byrne & van de Vijver, 2010; Hair Jr. et al., 2014).

Discriminant validity was judged through comparison of Maximum Shared variance (MSV) with AVE or Square root of AVE with Inter construct correlations. The MSV values for all the constructs were found greater than the AVE values of the concerned constructs and the square root of the AVE values of all the constructs were greater than inter-construct correlations. This indicates that the constructs were dissimilar in the model (Byrne & van de Vijver, 2010; Hair Jr. et al., 2014).

Structural Equation Modeling Results

The structural model explains the relationship among constructs. The model explains the correlational links among observed variables like social networking sites and latent variables like study habits and academic performance. Social networking sites are treated as an exogenous variable, academic performance as an endogenous variable, and study habits are treated as mediating variables.

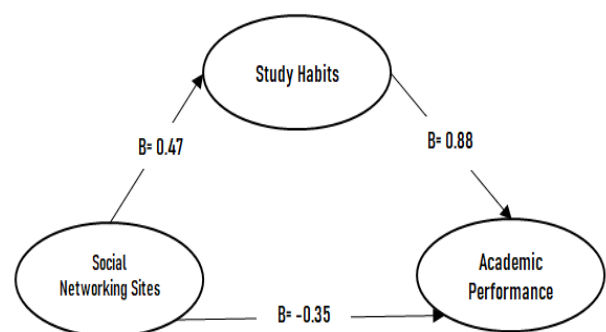


Figure 3 Validated Model Direct Effects

The direct effects are the paths from the independent variable to the dependent variable without any intervention variable. The direct effects and hypotheses results connected to the structural model are presented in table 4.

Table 4 Direct effects

Path	Estimate	SE	CR	P-Value	Result
SN_S --> A_P	-.351	.051	-6.266	***	Supported
SN_S --> S_H	.470	.043	8.662	***	supported
S_H --> A_P	.880	.079	12.861	***	Supported

The standardized coefficient value -0.317 for the paths from social networking sites to academic performance (p-value 0.000) denotes that the social networking sites were having a direct negative effect on academic performance. Hence, H1 is not supported. While the standard coefficient value of 0.369 for the path SN_S --> S_H was found significant (p-value 0.000) indicates that social networking sites have a significant positive effect on the study habits of students. Hence, hypothesis H2 is supported. The path weight value from study habits to academic performance (0.880), was significant (0.000) and so, hypothesis H3 was supported.

Mediation of student's study habits

Mediation effect is the intermediary effect in the causal relationship between exogenous and endogenous variables. Study habits (HA) is assumed as a mediator in the link between social networking sites and academic performance.

Table 5 Indirect Effects

Indirect Path	Unstandardized Estimate	Lower	Upper	P-Value	Standardized Estimate
SN_S --> S_H --> A_P	0.376	0.268	0.511	0.000	0.415

The unstandardized coefficient values for the indirect path from social networking sites to academic performance through study habits (0.376) is significant (0.000) and hence, hypothesis H4 was also supported.

DISCUSSION AND CONCLUSION

The present study was initiated with the aim of assessing the impact of social media usage on students' academic performance through their study habits. The structural equation Modeling was applied for this purpose and executed with software like Amos. The study results revealed that social networking sites affect student performance negatively. Social networking sites also affect the study habits of students. Study habits of the students mediate the link between social networking sites and academic performance.

REFERENCES:

- [1] Ahn, J. (2011). Digital divides and social network sites: Which students participate in social media? *Journal of Educational Computing Research*, 45(2), 147–163. <https://doi.org/10.2190/EC.45.2.b>
- [2] Alghizzawi, M., Habes, M., Khalaf, R., Salloum, S. A., & Ghani, M. A. (2018). The relationship between social media and Academic Performance: Facebook Perspective Related Papers the Use of Mobile Technology in the Marketing of therapeutic Tourist Sites: A Critical Analysis the Relationship between social media and Academic P. *International Journal of Information Technology and Language Studies (IJITLS)*, 2(1), 12–18. <http://journals.sfu.ca/ijitls>
- [3] Asiedu, N. K. (2017). Influence of social networking sites on students' academic and social lives: The Ghanaian perspective. *Library Philosophy and Practice*, 2017(1).
- [4] Byrne, B. M., & van de Vijver, F. J. R. (2010). Testing for measurement and structural equivalence in large-scale cross-cultural studies: Addressing the issue of non-equivalence. *International Journal of Testing*, 10(2), 107–132. <https://doi.org/10.1080/15305051003637306>
- [5] Chuks Danie, O. I. (2017). Effect of Reading Habits on the Academic Performance of Students: A Case Study of the Students of Afe Babalola University, Ado-Ekiti, Ekiti State. *Teacher Education and Curriculum Studies*, 2(5), 74. <https://doi.org/10.11648/j.tecs.20170205.13>
- [6] Ezeji, P. O., & Ezeji, K. E. (2018). Effect of social media on the Study Habits of Students of Alvan Ikoku Federal College of Education, Owerri. 12(1), 220–224.
- [7] Gok, T. (2016). The effects of social networking sites on students' studying and habits. *International Journal of Research in Education and Science*, 2(1), 85–93. <https://doi.org/10.21890/ijres.10682>
- [8] Gupta, S., & Bashir, L. (2018). Social networking usage questionnaire: Development and validation. *Turkish Online Journal of Distance Education*, 19(4), 214–227.
- [9] Hair Jr., J. F., Gabriel, M. L. D. da S., & Patel, V. K. (2014). Modelagem de Equações Estruturais Baseada em Covariância (CB-SEM) com o AMOS: Orientações sobre a sua aplicação como uma Ferramenta de Pesquisa de Marketing. *Revista Brasileira de Marketing*, 13(2), 44–55. <https://doi.org/10.5585/remark.v13i2.2718>
- [10] Hu L.-T., & Bentler P. M. (1999). 103. Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. *Structural Equation Modeling*, 6(July 2012), 1–55.
- [11] Knight-McCord, J., Cleary, D., Grant, N., Herron, A., Jumbo Success, Lacey, T., Livingston, T., Robinson, S., Smith, R., & Emanuel, R. (2016). What social media sites do college students use the most? *Journal of Undergraduate Ethnic Minority Psychology*, October 2015, 21–26.

- <https://leveragenewagemedia.com/blog/social-media->
- [12] Magulod, G. C. (2019). Learning styles, study habits and academic performance of Filipino university students in applied science courses: Implications for instruction. *Journal of Technology and Science Education*, 9(2), 184–198. <https://doi.org/10.3926/jotse.504>
 - [13] Mpungose, C. B. (2020). Are social media sites a platform for formal or informal learning? Students' experiences in institutions of higher education. *International Journal of Higher Education*, 9(5), 300–311. <https://doi.org/10.5430/ijhe.v9n5p300>
 - [14] Netemeyer, R. G., Bearden, W. O., & Sharma, S. (2003). *Scaling procedures: Issues and applications*. Sage Publications.
 - [15] Owusu-Acheaw, M., & Larson, A. G. (2014). Reading habits among students and its effect on academic performance: A study of students of Koforidua Polytechnic. *Library Philosophy and Practice*, 2014(1).
 - [16] Paul, J. A., Baker, H. M., & Cochran, J. D. (2012). Effect of online social networking on student academic performance. *Computers in Human Behavior*, 28(6), 2117–2127. <https://doi.org/10.1016/j.chb.2012.06.016>
 - [17] Rabia, M., Mubarak, N., Tallat, H., & Nasir, W. (2017). A Study-on-Study Habits and Academic Performance of Students. *International Journal of Asian Social Science*, 7(10), 891–897. <https://doi.org/10.18488/journal.1.2017.710.891.897>
 - [18] Ramprathap, K., & Sriram, V. P. (2017). Effects of social media on student's academic performance with special reference to engineering students in Tamilnadu. *Journal of Advanced Research in Dynamical and Control Systems*, 9(7), 62–68.
 - [19] Tezci, E., & Icen, M. (2018). High School Students' Social Media Usage Habits. *Journal of Education and Practice*, 8(27), 99–108. <https://www.uppsala.se/organisation-och-styrning/engagera-dig-och-paverka/>
 - [20] Tus, J. (2020). The Influence Of Study Attitudes and Study Habits ON THE ACADEMIC PERFORMANCE OF THE STUDENTS. *International Journal of All Research Writings*, 2(4), 11–32.
 - [21] van Vu, T. (2021). The impact of social networking sites on study habits and interpersonal relationships among Vietnamese students. *Journal of Language and Education*, 1(1), 206–218. <https://doi.org/10.17323/jle.2021.9818>

Automatic Music Recommendation Based on Face Recognition Using Tree CNN and Other Features

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Abstract:

The system is recommend the music by analyzing facial micro-expressions and other features. The user emotions and behaviour is identified by the human face. The mean of this system is to extract the Facial Expression by Using the Tree Convolutional Neural Networks (Tree CNN) algorithm. Human emotions are detected in a different way by using the Facial expression analysis. In this system the various types of emotions are predicted: happy, surprised, sad, angry, scared, disgust, neutral based on the mood and limited number of features. Decision making and prediction of song is improvised by more number of attributes. This paper is effective because the different algorithms called Tree CNN model, Cascade Classifier, Depth First Search are used. These algorithms provides high accuracy and reduces the time to predict the emotions.

Index Terms:

Cascade Classifier, Deep Learning, Emotion Detection, Face Detection, Tree Convolutional Neural Networks

INTRODUCTION

Music is mainly used to elevates the mood and reduces the stress of the user. Facial expression is one of them which shows that technology works very differently in today's world. Facial expression is recognized to identify the emotions of the user. In this paper various types of emotions are predicted i.e. Happy, Sad, Angry, Neutral, Surprised, Scared, Disgust. The face occupies the less amount of space in each image. Every face is based on the Facial expression into one to different categories (happy, sad, angry, neutral, surprised, scared, disgust). Most of the time some music lovers couldn't find the songs that match to their mood when they are in a hectic situation. So, this system recommend the music which match the songs with the human's current mood. Users get irritate and it's more time consuming process to manually browse through the playlist for their mood and emotion. This system is more useful to the music therapist to treat the different kind of disorders due to stress. The problem of time consuming and the difficult work of manually play the songs from any playlists accessible on the net or in the other application is solved by this system. In this work 4 main modules are implemented by the system, that are face detection, feature extraction, emotion detection and song classification. Face detection is done by using cascade

classifier algorithm. The feature extraction module and emotion detection is handled using Tree CNN. Region of interest (ROI) of face detected is the input to the feature extraction module. Finding the more number of user activities will improve decision and recommendation of song.

Finally, the emotion that has been recognized and set of features is fed as input into the music player which plays songs accordingly.

RELATED WORKS

Emusic application is designed based on the activity recognition and user mood in real time. This music player keeps learning user habits and plays the song that based on the user past habits and activities, current emotion etc. and this is a personalized playlist generator [1].

Two kinds of classification methods are used in this paper; that is based on the heart rate and based on the facial image methods [2]. Minimal processing, multilayer perceptron are obtained by implementing CNNs. Convolutional Neural Network is used to detect the emotion and songs are played according to the user emotion [3].

Support Vector Machines (SVM), KNN, Support Vector Machines (SVM), Random Forest and MLP these models are directly training using predicting a song arousal and valence values and by selected audio features. The maximum accuracy of 81.6% is attained by SVM model [4].

This paper uses two convolutional neural networks (CNN); that is a global average pooling (GAP) and five layer model. Transfer-learning models are combined with these CNN models like SeNet50; ResNet50; VGG16 [5]. To identify a model that recognizes facial micro-expressions and recommendation of the song based on the user current mood. 62.1% recognition rate with facial micro expression recognition model FER2013 is used in this paper [6]. Using the Weak Deep learning package, models were implemented and using different sets of features, a number of experiments were carried out with data and varying segmentation.[7].

For a face detection from a face joint haar like features are used. Co-occurrence of multiple haar like features is

called joint haar like feature. Adaboost technique is used to detect the face from the image [8]. Visual variations in image due to the pose, expression and lightning conditions, the above challenges are addressed by cascade architecture built on convolutional neural networks [9].

This paper, the residual network is combines with the self-attention mechanism in order to solve the poor performance and proposes facial expression recognition model with new features [10]. The JAFFE datasets with deep convolution neural networks produces accuracy rate around 97.01% [11].

For music classification and regression tasks transfer learning approach is used and using the activations of feature map (trained convolutional network) it use a pre-trained convent feature, a concatenated feature vector [12]. This paper proposed a method where convolutional neural network is used to extracting the image features [13]. The polynomial and radial basis function kernels uses the support vector machines, two classifiers are trained and these classifiers are tested with 10-fold cross validation and compared these classifiers the polynomial kernel gives the better results [14].

PROPOSED SYSTEM

In this work Tree based deep learning, Cascade Classifier are used for emotion recognition. The proposed system identifies the similarity of the emotion by classifying human emotion using Tree CNN.

- A window to display the scene capture will created by the program using web camera and another window is used to representing the probabilities of detected emotions.
- These image are given as input to the Cascade Classifier and Tree CNN for face detection, emotion classification and using some of the activities like checking the weather condition, system activity, location and time of the user.
- Based on the emotion classification and features, the corresponding music will be played.

METHODOLOGY

A. Face Detection Module

Many of the algorithms are used for face detection and this paper uses the Cascade Classifier algorithm for detecting the face. The steps involved in the Cascade classifier algorithm are:

- Calculating HAAR feature
- Calculating Internal image
- Adaboost Learning Algorithm
- Cascading Filter

B. Facial Feature Extraction Module

Two-part Tree convolutional neural network is used in Facial Expression Recognition:

- The background of the input image is removed in the first part using ROI
- Facial feature vector extraction is concentrated in the second part.

For feature extraction, Tree CNN is used.

In this paper, the image dataset is seperated into smaller ones and that comprised of objects share similar appearance categories. Tree Convolutional Neural Network is gives the higher accuracy of finding the similar categories in the image dataset and it is the main advantage of Tree-CNN.

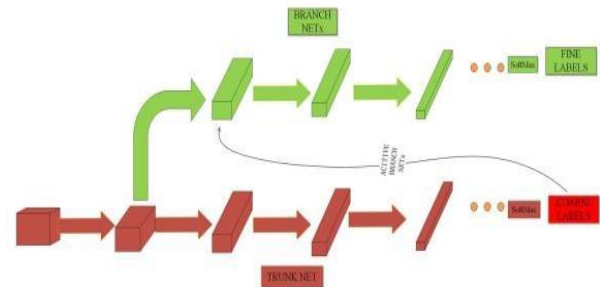


Figure 1: processing flow chart of the Tree-CNN

First step: Trunk-Net (Tree CNN) is used to obtain coarse category of the images.

Second step: The Tree-CNN identifies a appropriate Branch-Net according to the first step (coarse category). Special feature map of the input image is obtained in this category and this category is called as fine category. When the dataset contains many categories, the common CNN is not used to find the similar categories of the features but the Tree Convolutional Neural Network is good at differentiate the categories of the similar features.

C. Time, Weather, Location and System Activity Detection

Microsoft's cognitive services and Google own activity recognition API are used in this paper for finding the user activities. User preferences are studied to predict the appropriate song and listening the habits by time, weather condition, current mood, activity, etc. Training on this collected data from the user can make better playlist for future listening and for better music recommendation, daily factors are considered. This module also detects the time, date, location and these data are collected from the google. These activities results are current location (city), current system time (HH:MM). It stores them into one variable.

D. Emotion Detection and Song Classification Module

The result of the Tree Convolutional Neural Network and Cascade Classifier is the predicted emotions of the user with probabilities that emotion labels are happy, scared, disgust, neutral, surprised, anger, sad. User interface (HTML pages) is designed to show emotion and corresponding probabilities for each emotion and the detected songs that matches to the user emotion will be showed in the screen. From the detected songs, the first song is played based on the detected emotion.

IMPLEMENTATION

A. Video capturing and conversion

Video is captured lively by using the webcam of the system. To capture the images webcam in an “infinite” loop OpenCV is used and thus give the impression of watching a video. This process is done by using `cv2.VideoCapture(0,cv2.CAP_DSHOW)`.

Step 1: Getting the image from webcam.

Step 2: Converting that captured image into a gray scale image and we need to call the `CvtColor` function, which allows to convert the image from a color space to another by using the function. `cv2.cvtColor(image,cv2.COLOR_BGR2GRAY)`.

B. Cascade Classifier

or implementing Cascade Classifier detection, to detect the faces OpenCV's HAAR Cascades is used. Haar feature based cascade classifiers is the most effective face detection method when compared to other classifiers. OpenCV's HAAR Cascades is used for both static and dynamic or web cam feed. OpenCV's HAAR Cascades (pre-trained classifiers) is used to detection of faces. First the required XML classifiers is loaded, in this paper we use haar cascade_frontalface default.xml file for the detection of the static images.

`cv::CascadeClassifier::load` a .xml classifier file and to perform the detection task the following line is used.

`cv::CascadeClassifier::detectMultiScale`

For feature extraction, in the XML files to detect the face (training data is used). First convert our captured image to gray scale mode. From the input image the face is detected using the detect Multiscale function and detected faces positions are returned as `Rect(x,y,w,h)` using this function. ROI for the face is created, after we get these locations from the detect Multiscale function.

For face detection,

Step 1: First, through the Dlib face detector library the image is sent.

Step 2: if the function doesn't find the face, then it is passed to the opencv Haar Cascades.

Both the dlib detector and HAAR detector is set as the face detectors for initial process.

Resize function is used to change the resolutions of the image. `cvtColor` function is used to convert the resulting images into grayscale with parameter `color_bgr2gray`.

C. ROI for Tree-CNN

From the grayscale image, the roi of the face is extracted and finding the ROI for Tree CNN, its resized into fixed pixels for further process.

`roi = cv2.resize(roi,(64,64))`

`roi = roi.astype("float") / 255.0`

`roi = img_to_array(roi)`

The resulted region of interest of the detected image is stored. Detect Multiscale function is used for detecting the face with parameters as the input image, the scale

factor, minimum neighbours needed, minimum and maximum size allowed.

For converting a loaded image in PIL format into a NumPy array `img_to_array()` function is used and this function is provided by the keras.

From `keras.preprocessing.image` import `img_to_array`

PIL stands for Python Image Library. Its reads the images in RGB format by default. A numpy array is indexed by a tuple of non negative integers and grid of values of the same type.

D. Tree based CNN

In this paper the code of Tree-CNN is used in the emotion detection module. The required packages are loaded to the entire process of the module. The images from dataset are read from file and the images that are converted to readable arrays. The pre trained tree CNN is used in this paper. We created our own dataset for music classification which consists of seven emotions such as anger, fearless, happy, sadness, disgust, contempt and surprised. Each audio clip is of duration of 45 seconds. These audios are given as input to the classifier to classify the music based on the emotion. The human image is given as input to the cascade classifier and depth first search which detects the face of the input image. Tree CNN which classifies the type of emotion by calculating the maximum probability. Then the obtained emotion is compared with the emotions in music dataset.

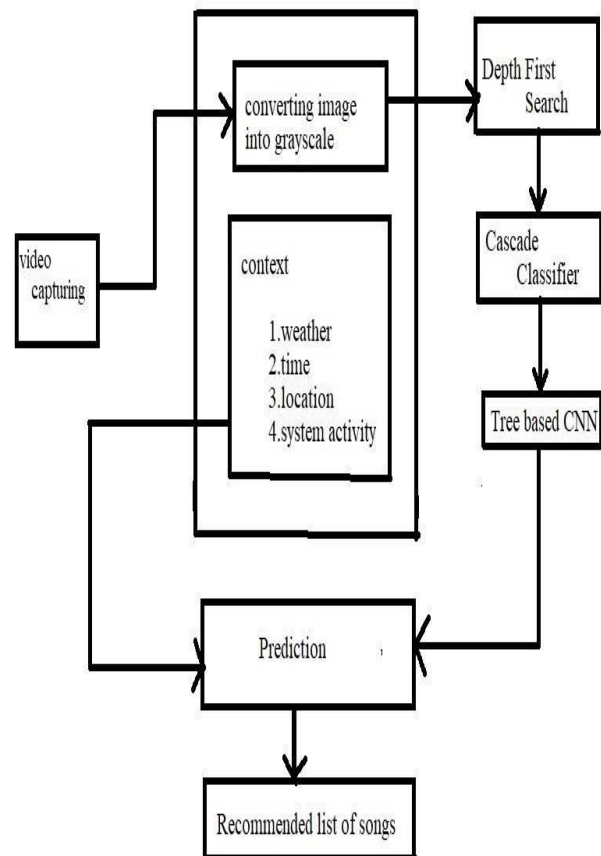


Figure 2: Architecture of proposed system

RESULTS AND DISCUSSION

In this project, pretrained model (Tree Convolutional Neural Network) is used for human emotion classification. Tree Convolutional Neural Network is trained with CIFAR-10 and CIFAR-100 dataset. Compared to the other models Tree CNN is a better learning model and it is based on hierarchical classifiers. It is adapted to the new information over time.

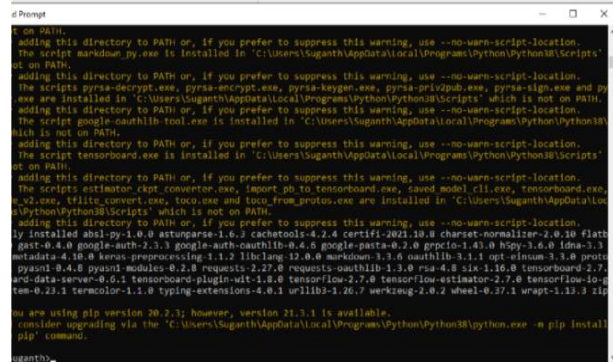


Figure 3: Required library installation

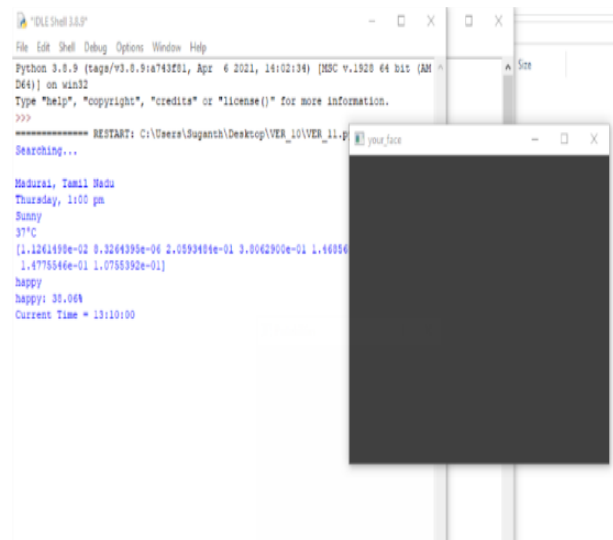


Figure 4: Activity Detection

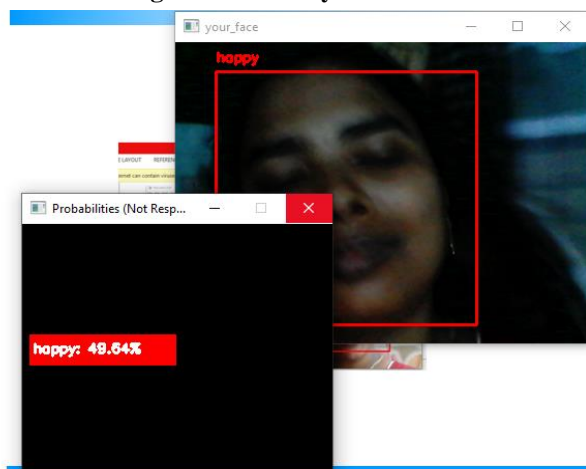


Figure 5: predicted human emotions with percentage

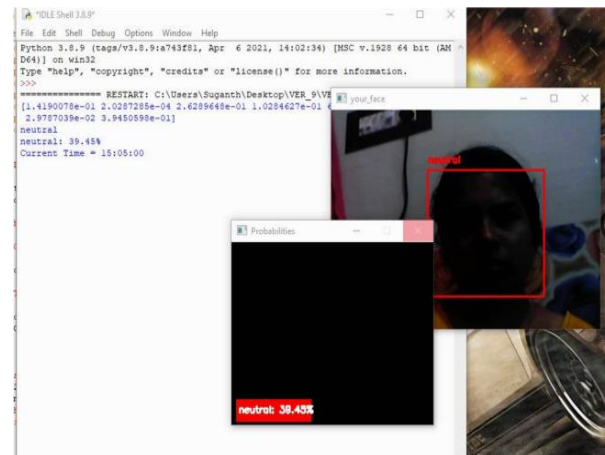


Figure 6: predicted human emotions with percentage

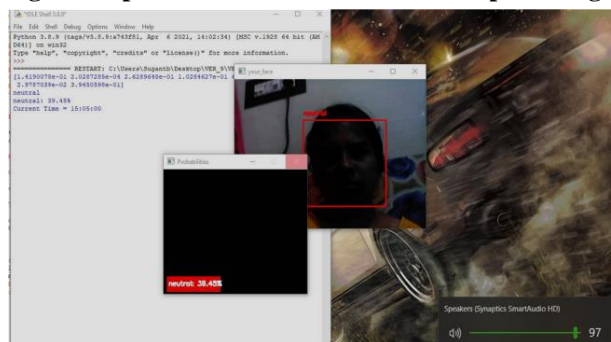


Figure 7: play song based on the user emotion and activities

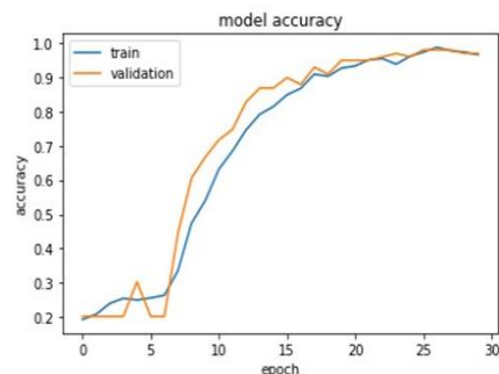


Figure 8: Performance Evaluation

CONCLUSION

This system works based on the principle of Facial Expression Recognition to recommend the song based on the user emotion and activities of the individual user. It makes use of Cascade Classifier alongside Tree-CNN approach to extraction of facial features. In this proposed system the emotions are predicted by the users facial image, features like weather, time, location, system activity and audio songs are played based on that. The proposed model is justified by a properly made dataset and deep learning algorithm. The accuracy for human emotion classification and music emotion classification are more appropriate than existing methods.

FUTURE WORK

In future, this system will be developed as an application. Emotions are identified by recognizing users face through mobile phone. This system is improved by adding more features like age, climate, etc. Prediction of song and making of decision will improved by using the more number of attributes. Every user have our own preferences about what kind of for the current mood. Collecting this information from each user can used to construct better user specific music recommendation and this will give the better music experience to user. In future, this system will be developed by more efficient classification algorithm than tree cnn and cascade classifier.

REFERENCES

- [1] Pranav Sarda , Sushmita Halasawade, Anuja Padmawar and Jagannath Aghav, "Emotion & Activity based Music Player using Machine Learning", College of Engineering Pune, Wellsley Road, Pune, Maharashtra, India (2019).
- [2] Krittrin Chankuptarat, Raphatsak Sriwatanaworachai , Supannada Chotipant, "Emotion-Based Music Player", King Mongkut's Institute of Technology Ladkrabang Thailand Bangkok, Thailand (2019).
- [3] Deebika, K.A. Indira, Dr. Jesline, "A Machine Learning Based Music Player by Detecting Emotions", Fifth International Conference on Science Technology Engineering and Mathematics (2019).
- [4] Anuja Arora, Aastha Kaul, Vatsala Mittal, "Mood Based Music Player", Jaypee Institute of Information Technology Noida, India (2022).
- [5] Sulaiman Muhammad, Safeer Ahmad, Dinesh Naik, "Real Time Emotion Based Music Player using CNN Architectures", 6th International Conference for Convergence in Technology (12CT) Pune, India Apr 02-04, 2021.
- [6] Ziyang Yu, Mengda Zhao, Yilin Wu, Peizhuo Liu, Hexu Chen, "Research on Automatic Music Recommendation and Algorithm Based on Facial Micro-expression Recognition", Proceedings of the 39th Chinese Control Conference Northeastern University (2022).
- [7] Jacek Grekow, "Music emotion recognition using recurrent neural networks and pretrained models", Journal of Intelligent Information Systems, Bialystok University of Technology, Wiejska 45A, Bialystok 15-351, Poland (2021).
- [8] Integration and Software. IEEE 2008.
- [9] Castrilln-Santana, Modesto, et al, "Multiple face detection at different resolutions for perceptual user interfaces", Iberian Conference on pattern recognition and Image Analysis. Springer, Berlin, Heidelberg, 2005.
- [10] Jiang Daihong, Hu yuanzheng, Dai Lei, and Peng Jin, "Facial Expression Recognition based on Attention Mechanism", "Scientific Programming" volume 2021.
- [11] Chowdhury Mohammad Masum Refat, Norsinnira Zainul Azlan, "Deep Learning methods for facial expression recognition", "27th International Conference on Mechatronics Engineering (ICOM) 2019.
- [12] Keunwoo Choi, Gyorgy Fazekas, Mark Sandler, Kyunghyun Cho, "Transfer Learning for music classification and regression tasks", Proceedings of the 18th ISMIR Conference, Suzhou, China (2017).
- [13] Fan, Yin, et al. "Video-based emotion recognition using CNN-RNN and C3D hybrid networks." Proceedings of the 18th ACM International Conference on Multimodal Interaction ACM, 2016.
- [14] Yading Song, Simon Dixon, Marcus Pearce, "Evaluation of Musical features for emotion classification", 13th International Society for Music Information Retrieval Conference (ISMIR 2012).

A Comprehensive Review on Artificial Intelligence Driven Smart TV Recommendation System

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Abstract:

In the last decades, excessive use of web contents in terms of movies, books, advertisement etc. increased the importance of web recommendation systems and emerged as a bloom in e-business and e-commerce sector. Recommendation system is a model to classify and categorise the subscribers choice based on their profile information and interests. In this paper, the concept of recommendation system is applied on Smart TV. Smart TV is a multi-user, web enabled device, hence it is essential to predict the multiple users choices based on their preferences and activities. This paper presents a modified recommendation system for smart TV to suggest the predicted contents by considering the subscribers portfolio and watching history as reference, hence by accurately utilizing the capacity and resources of the system, converts the smart TV as personalized device. Main parameters incorporated for content predication are the multiple users profile, their channel interests, time duration of watching a particular channel and health conditions. This paper proves that there is a significant need to improve the existing recommendation system in order to enhance the subscribers satisfaction and making smart TV a more customized device.

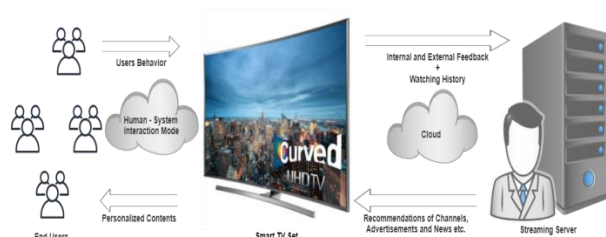
Index Terms:

Smart TV, Recommendation System, IoT, User behaviour analysis, Artificial Intelligence, Machine Learning.

INTRODUCTION

Due to enormous rise of data and information on the web, searching of desired content without overhead is a complex task

There are multiple approaches available in literature to overcome this issue such as web directories [1], search engine [2], recommendation system [3] etc. which suggest the nearest results as required. Recommendation system can be considered as a tool to suggest the web-based contents as per the users choice and activities. Main components of a recommendation system are intelligent behaviour analysis, intelligent human-device interaction, decision making and data modeling. An overview of basic smart TV recommendation system is shown in Figure I. Based on the user's watching behaviour, activities and feedback, the system recommends the watching updates to user.



An overview of Smart TV Recommendation System Smart TV were developed to entertain the web based contents in a group manner comfortably at home. It's functions got extended with the extreme use of digital platform such as playing games, watching movies, songs, drama, reading books, video conferencing and video on demand [4] etc. As the advantage increases for a new development, it comes with the limitation or drawback in parallel. Similarly, with the advancement in the features of smart TV, the problem of security, accessibility, processing speed and built-in support arises. Due to these problems, most of the subscribers are not able to take the advantage of full features of the smart TV, for example, some time due to the security issues, they switch-off the camera or mute the microphone [5] [6] [7]. All these activities affect the behaviour of recommendation system as camera is used to detect the user profile and activities, microphone is used to capture the comments or ratings or interact with the smart TV. Normally, smart TV is a device which is used in passive mode and interaction is very less between device and user but as the television broadcasters are also switching their data over the web, again it is a complex task to search on the data based on users choice and requirements.

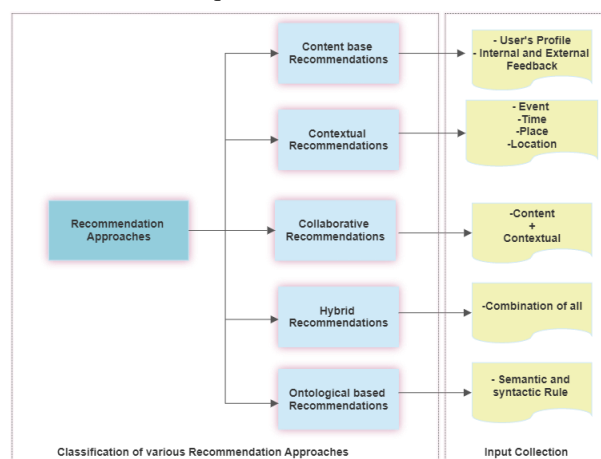


Fig. 1. Classification of Existing Recommendation Approaches and their input parameters

To solve all these issues, there is an extreme need to develop the most advanced techniques of recommendation systems for smart TV. In this paper, the authors have highlighted on the same issue to contribute towards recommendation systems for smart TV.

Hence, the remarkable question to be solved in this article is "How to predict the next watching content

for a Smart TV by a particular user group based on their historical watching behaviour and interests?"

To answer this question, the authors have developed a modified recommendation system for Smart TV. This paper basically intended towards three convincing objectives. The first objective is to generate the group user profile based on their 'age', 'watching content', 'watching time' and 'watching duration'. Next objective is to model the ranking of items based on profile and the final module is to aggregate the profile and items ranking to suggest the next predicted content for the smart tv user.

Various approaches are available in literature to recommend the quality content based on artificial intelligence algorithms. Basic overview of existing approaches can be shown in Figure 1. The main contributions of this paper are as follows:

- 1) A descriptive analysis is presented on existing recommendation approaches, their limitations and chances of modification in the view of Smart TV.
- 2) A personalized recommendation system for Smart TV group user's is designed based on watching contents, context, time duration and their feedback.
- 3) The proposed recommendation system consists of three modules, i.e. Users Profile Generation Module, Items ranking Module and Recommendation Module.
- 4) Proposed methodology was applied on real data sets to analyse the results and performance was compared with literature work.

The rest of the paper is organized as follows. Section 2 presents the modelling of proposed recommendation system and architecture. Section 3 details about the results and analysis followed by Section 4 with concludes the paper.

MODELLING OF SMART TV RECOMMENDATION SYSTEM

A. Parameters Accumulated in Proposed Recommendation Model

1) Watching Conduct

The most commonly used device for family entertainment, watching movies, playing games, videos and music is smart TV in recent trends now a days [8], [9]. It has the capability to stream any kind of available web content without any limitation. Although the watching conduct is dependent on the users or subscribers. Basically, the smart TV recommendation works on pull mechanism, in which it generates the suggestions from explicit and implicit feedback given by the users. Explicit feedback contains the channel selection and preference given to that particular channel. After watching a content, subscriber can give rating or feedback or any comment to that content, and based on that feedback, decision making is done for that content in future. This is the best way to interact with users and take their direct input for the upcoming decisions. Another way of data collection for decision making is

implicit feedback, in which the user is indirectly involved with the system. It is the responsibility of the system to track the choices of the users by analysing their watching conduct.

2) Multi-Subscriber Device

Since, smart TV is a device which is shared among multiple group of peoples, it is a difficult task to update, maintain and predict each and every user's choice. A number of approaches are available in literature to make the intelligent and quality recommendations for the multiple users but these approaches may lead to security and privacy issues [10]. Proper use of profile identification and recognition should be done by using sensors in order to increase the security of the device [11].

3) Unforeseeable Annotations

Social Meta data involves a significant role in decision making [12]. Social meta data can be helpful in improving the recommendation results [13]. Sometime, it is not possible to check out the latest web content or news which is relevant to particular user. Unforeseeable annotations appearing in between the streaming of a content will acknowledge the latest upcoming to that particular user and based on the users choice it will be notified to the recommendation system. Most famous video watching websites such as You-tube [14], Netflix [15] etc use social annotations to update their recommendation system.

4) Unassertive Contents

Interaction between user profile and smart TV generates the information for recommendation system to suggest the required decisions and choices [16] [17]. Accomplishing each and every criteria equally in decision making is a complex task and generates bloating up the Smart TV [18]. Latest Smart TV are enabled with virtual keyboard, camera and mouse but still most of the users are familiar with remote control to interact with the device, which makes it difficult to capture the proper input from the users [19].

5) Time Duration

Since, the time is a significant parameter to modify the preferences of recommended items and easy to be notified because of the availability of clock in almost every smart TV, it is an essential task to evolve watching time duration of a particular item with respect to a particular user profile [20]. It is recommended to give the higher ranking to an item who has more number of views and total time duration to watch that item is more with respect to other items. As mentioned in Merriam-Webster Dictionary [21], "Time is a non-spatial continuum that can be analysed in the sense of tasks occurring one after another from past to present till future." This definition inspires to make the ranking of recommended items on the basis of time to modify the decision making.

B. Architecture of Proposed Smart TV Recommendation System

The architecture of the proposed recommendation system is shown in Figure 2. The users are divided into four categories based on their age group and channel choices history. Certain parameters are kept in mind like age groups, channel preferences, watching contents, watching time for a particular channel, duration of channel watching and collected implicit and explicit feedback from the users. After analysing all the parameters, the proposed recommendation system suggests the watching content for a particular group of u

CONCLUSION AND FUTURE WORK

A modified recommendation system containing both user centric and data centric approaches for smart TV is proposed in this paper which suggests the decision based on user profile and behaviour. An open source machine learning library Tensor Flow with python is used to train the system by using the historical data. Proposed recommendation model captures the users activity and watching behaviour, that is used to update the users profile and based on users profile, the system improves the recommendation process. The proposed model was compared with the conventional recommendation algorithms over real data set and acquired results proved the significant accuracy of recommendation. The proposed recommendation system can be explored in future by incorporating the various parameters such as physical health condition and parental control in recommendations. The modifications can be done on enhanced security and privacy issues as well.

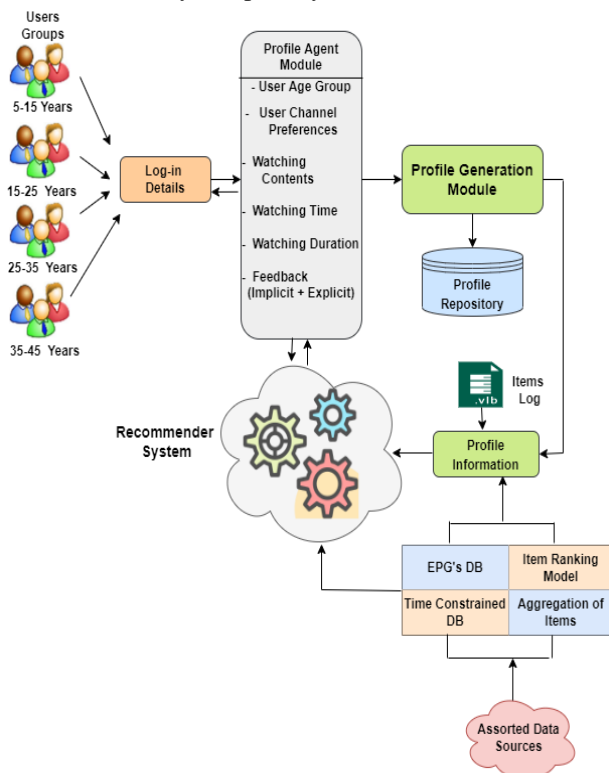


Fig. 2. Schematic Architecture of the Proposed Recommendation System for Smart TV

REFERENCES

- [1] K. Seshadri, A. Maruthappan, and M. Sundar Raman, "A scalable parallel algorithm for building web directories," *Concurrency and Computation: Practice and Experience*, vol. 33, no. 9, p. e6121, 2021.
- [2] D. Lewandowski and Y. Kammerer, "Factors influencing viewing behaviour on search engine results pages: a review of eye-tracking research," *Behaviour & Information Technology*, vol. 40, no. 14, pp. 1485–1515, 2021.
- [3] Q. Guo, F. Zhuang, C. Qin, H. Zhu, X. Xie, H. Xiong, and Q. He, "A survey on knowledge graph-based recommender systems," *IEEE Transactions on Knowledge and Data Engineering*, 2020.
- [4] I. Alam, S. Khushro, and M. Naeem, "A review of smart tv: Past, present, and future," 2017 International Conference on Open Source Systems & Technologies (ICOSST), pp. 35–41, 2017.
- [5] M. Ghiglieri, M. Volkamer, and K. Renaud, "Exploring consumers' attitudes of smart tv related privacy risks," in *Human Aspects of Information Security, Privacy and Trust*, T. Tryfonas, Ed. Cham: Springer International Publishing, 2017, pp. 656–674.
- [6] C. Chhetri and V. G. Motti, "Eliciting privacy concerns for smart home devices from a user centered perspective," in *International Conference on Information*, Springer, 2019, pp. 91–101.
- [7] S. Gray, "Always on: privacy implications of microphone-enabled devices," in *Future of privacy forum*, 2016, pp. 1–10.
- [8] S. Velusamy, L. Gopal, S. Bhatnagar, and S. Varadarajan, "An efficient ad recommendation system for tv programs," *Multimedia Systems*, vol. 14, no. 2, pp. 73–87, 2008.
- [9] A. Sa'nchez and B. Carro, *Digital Services in the 21st Century: A Strategic and Business Perspective*. John Wiley & Sons, 2017.
- [10] B. Michele, *Smart TV Security: Media Playback and Digital Video Broadcast*. Springer, 2015.
- [11] G. Giorgi, A. La Marra, F. Martinelli, P. Mori, and A. Saracino, "Smart parental advisory: A usage control and deep learning-based framework for dynamic parental control on smart tv," in *International Workshop on Security and Trust Management*. Springer, 2017, pp. 118–133.
- [12] J. Shokeen and C. Rana, "A study on features of social recommender systems," *Artificial Intelligence Review*, vol. 53, no. 2, pp. 965–988, 2020.
- [13] K. Kurapati, S. Gutta, D. Schaffer, J. Martino, and J. Zimmerman, "A multi-agent tv recommender," in *Proceedings of the UM 2001 workshop "Personalization in Future TV"*, 2001.
- [14] B. Nie, H. Zhang, and Y. Liu, "Social interaction based video recommendation: Recommending youtube videos to facebook users," in *2014 IEEE Conference on Computer Communications*

- Workshops (INFOCOM WKSHPS). IEEE, 2014, pp. 97–102.
- [15] B. E. P. Walter and I. Hennigen, “Problematizing the algorithmic governmentality from netflix’s recommendation system,” *Psicologia & Sociedade*, vol. 33, 2021.
- [16] A. Dash, D. Zhang, and L. Zhou, “Personalized ranking of online reviews based on consumer preferences in product features,” *International Journal of Electronic Commerce*, vol. 25, no. 1, pp. 29–50, 2021.
- [17] A. K. Sahu and P. Dwivedi, “User profile as a bridge in cross-domain recommender systems for sparsity reduction,” *Applied Intelligence*, vol. 49, no. 7, pp. 2461–2481, 2019.
- [18] S. Khusro, M. Naeem, M. A. Khan, and I. Alam, “There is no such thing as free lunch: An investigation of bloatware effects on smart devices,” *Journal of Information Communication Technologies and Robotic Applications*, pp. 20–30, 2018.
- [19] M. Khan, S. Khusro, I. Alam, S. Ali, and I. Khan, “Perspectives on the design, challenges, and evaluation of smart tv user interfaces,” *Scientific Programming*, vol. 2022, 2022.
- [20] D. Ahn, J.-G. Jang, and U. Kang, “Time-aware tensor decomposition for sparse tensors,” *Machine Learning*, pp. 1–22, 2021.
- [21] D. La Rosa, S. Pauleit, and W.-N. Xiang, “Unearthing time-honored examples of nature-based solutions,” *Socio-Ecological Practice Research*, vol. 3, no. 4, pp. 329–335, 2021.

Seismic and Wind Analysis of Different Lateral Load Resisting Systems

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Abstract:

The rapid increase in the population and scarcity of land has increased the demand of taller buildings. Expanding the building vertically seems to be an efficient option considering all the factors. The resistance of tall buildings to wind as well as to earthquakes is the main determinant in the formulation of new structural systems that evolve by the continuous efforts of structural engineers to increase building height while keeping the deflection within acceptable limits and minimizing the amount of materials. As the building height increases role of lateral load (Wind and Seismic) resisting systems becomes more prominent as compared to gravity load resisting system. Basically, there are three main types of buildings: steel buildings, reinforced concrete buildings, and composite buildings. The following research paper emphasizes on different types of lateral load resisting systems and how they react to different loads acting on them. The buildings modelled are done using Etabs software. The buildings are analyzed for both static as well as dynamic analysis. Static analysis is carried out using ESM (Equivalent Static Method) and dynamic analysis is carried out using RSM (Response Spectra Method). The modeling is done to examine the effect of different cases on seismic and wind parameters like base shear, lateral displacements, lateral drifts and stiffness for zone-IV in medium soil as specified in IS: 1893-2016

Keywords:

Shear wall system, Cross bracing system, combined system, Linear static method, Response Spectrum method, Storey Displacement, Storey drift, Storey stiffness.

INTRODUCTION

The rapid increase in the population and scarcity of land has increased the demand of taller buildings. Expanding the building vertically seems to be an efficient option considering all the factors. The resistance of tall buildings to wind as well as to earthquakes is the main determinant in the formulation of new structural systems that evolve by the continuous efforts of structural engineers to increase building height while keeping the deflection within acceptable limits and minimizing the amount of materials. As the building height increases role of lateral load (Wind and Seismic) resisting systems becomes more prominent as compared to gravity load resisting system. Basically, there are three main types of buildings: steel buildings, reinforced concrete buildings, and composite buildings.

Introduction to shear wall system:

In structural engineering, a shear wall is a vertical element of a system that is designed to resist in-plane lateral forces, typically wind and seismic loads. In many jurisdictions, the International Building Code and

International Residential Code govern the design of shear walls. A shear wall resists loads parallel to the plane of the wall. Collectors, also known as drag members, transfer the diaphragm shear to shear walls and other vertical elements of the seismic force resisting system. Shear walls are typically light-framed or braced wooden walls with shear panels, reinforced concrete walls, reinforced masonry walls, or steel plates.

Introduction to Bracing system:

For tall building, it has been found that Suitability and economic criteria of shear wall is limited up to some Heights Which leads to a requirement of the structural system which provides adequate stiffness And Strength Against the seismic loading and winds and satisfy economic criteria to a tall building. Bracing system provides better performance in term of the storey drift and storey displacement. With the same amount of material cost, which makes it economical compared to the other structural system, and it is the best option in economic criteria. With the addition of diagonals between floors, which act as truss members, better seismic performance can be achieved effectively. The primary purpose of diagonals is to transfer axial loads to columns and carry lateral loads, which behave as an effective natural structural system.

Diagonal bracing:

It is obstructive because it blocks the opening, which affects the look of building elevation. Diagonal bracing can be placed as a single diagonal bracing or double diagonal bracing. If it's architectural limitation is removed, it can be considered as the most efficient to resist lateral forces by earthquake and wind forces because they behave as proper triangular trusses

Introduction to Outrigger and belt truss system:

The lateral bracing system consisting of coupled shear walls with outriggers is one of the most efficient systems used for high rise construction to resist lateral forces caused by wind and earthquakes. Outrigger beams connected to the shear wall and external columns are relatively more complicated and it is understood that the performance of such coupled wall systems depends primarily on adequate stiffness and strength of the outrigger beams. Therefore overall rigidity is imperative in tall buildings in order to control lateral deflection and inter-storey drift.

METHODOLOGY

A. Details of the structural models:

For the present study three different models have been prepared with different lateral loads resisting systems i.e. beam column system, shear wall system and a models containing combination of different lateral loads resisting systems for the comparative study. Table 1 shows the geometric details of the structural models.

Table 1 Geometric detail of the structural models

Parameter	Beam Column	Shear wall	Combined
Bay	4m	4m	4m
No of bays	5	5	5
Plan dimensions	20m X 20m	20m X 20m	20m X 20m
Storey Height	3m	3m	3m
Height of Structure	124m	124m	124m

The maximum allowable slenderness ratio in seismic zone IV for structural walls + moment frame configuration as per IS 16700-2017 is 8.

A conventional model of 40 storey height has been modelled having frame elements i.e. beam and column, shear wall at the core of the structure and outrigger and belt truss system with bracing provided at all the four edges. The outrigger and belt truss are provided at the mid and top of the structure. The column beam and frame section for modelling are reinforced concrete sections and the outrigger, belt truss and braces that are modelled using structural steel.

Figure 1 shows a conventional frame system with beam and column elements with 40 storey height. Figure 2 shows a shear wall system at the core of the building. This shear wall acts as a vertical cantilever for the entire building and helps in resisting the lateral loads better. Figure 3 shows a combined lateral load resisting systems which includes a shear wall. In addition to that the structure also consists of a outrigger and belt truss system and bracing provided at the edge on all four sides.

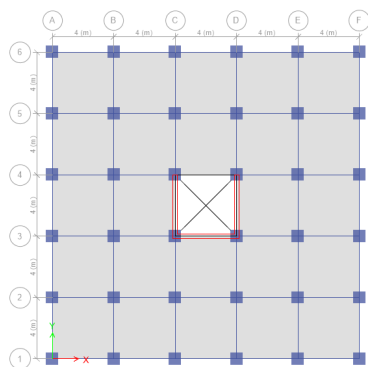


Figure 1: Plan view of the model with shear wall at its core

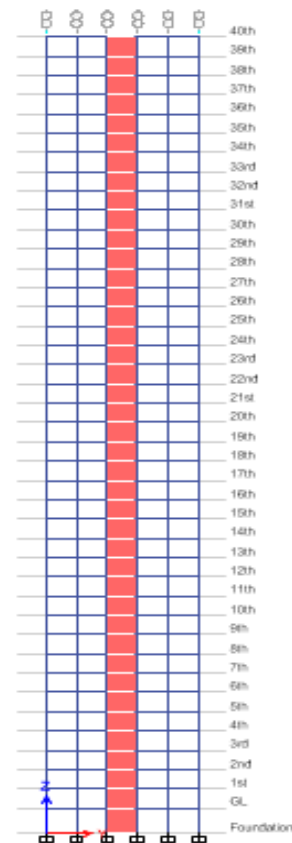


Figure 2: Shear wall System

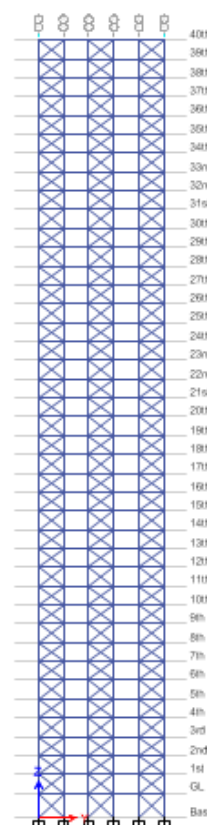


Figure 3: Cross bracing system

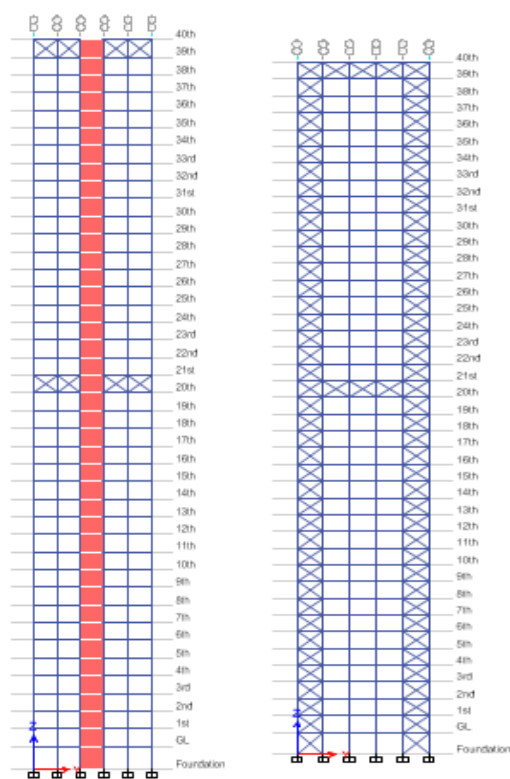


Figure 4: Combined lateral load resisting system

B. Loading and Analysis

The various loads are applied as per the relevant IS codes. Live load is applied as per the IS 875 (Part 2) – 1987 considering the mercantile building, seismic load is applied as per the IS 1893 (Part 1) – 2016 and wind load is applied as per IS 875 (Part 3) – 1987. The loading details are mentioned below:

Seismic loading details:

Live Load	2kN/m ² and 3kN/m ² on all the floors and 1.5kN/m ² on the roof
Dead Load	Self-weight of structural members is automatically calculated by ETABS 2017 software according to the section dimensions
Floor Finish Load	1.5kN/m ² on all the floors including roof
Wall Load	7.8kN/m
Seismic Zone	Zone IV
Seismic Zone Factor (Z)	0.24
Response Reduction Factor (R)	5 (SMRF)
Importance Factor (I)	1
Type of Soil	Type II – Medium soil

Wind loading Details

Live Load	2kN/m ² and 3kN/m ² on all the floors and 1.5kN/m ² on the roof
Dead Load	Self-weight of structural members is automatically calculated by ETABS 2017 software according to the section dimensions
Floor Finish Load	1.5kN/m ² on all the floors including roof
Wind speed V _b (m/s)	44
Terrain category	2
Importance factor	1
Risk Coefficient	1
Topography	1

All the models are analyzed by the linear static method i.e. Equivalent Static Method (ESM) and the linear dynamic method i.e. Response Spectrum Method (RSM). The parameters considered for this comparative study are lateral displacement, storey drift and fundamental time period. The load combinations for ESM are considered as follows:

a. Seismic Loading combinations:

1. 1.5 (D.L + L.L)
2. 1.2 (D.L + L.L + EQ_x)
3. 1.2 (D.L + L.L – EQ_x)
4. 1.2 (D.L + L.L + EQ_y)
5. 1.2 (D.L + L.L – EQ_y)
6. 1.5 (D.L + EQ_x)
7. 1.5 (D.L – EQ_x)
8. 1.5 (D.L + EQ_y)
9. 1.5 (D.L – EQ_y)
10. 0.9 D.L + 1.5 EQ_x
11. 0.9 D.L – 1.5 EQ_x
12. 0.9 D.L + 1.5 EQ_y
13. 0.9 D.L – 1.5 EQ_y

b. Wind loading combinations:

1. 1.5 (D.L + L.L)
2. 1.2 (D.L + L.L + W_x)
3. 1.2 (D.L + L.L – W_x)
4. 1.2 (D.L + L.L + W_y)
5. 1.2 (D.L + L.L – W_y)
6. 1.5 (D.L + W_x)
7. 1.5 (D.L – W_x)
8. 1.5 (D.L + W_y)
9. 1.5 (D.L – W_y)
10. 0.9 D.L + 1.5 W_x
11. 0.9 D.L – 1.5 W_x
12. 0.9 D.L + 1.5 W_y
13. 0.9 D.L – 1.5 W_y

The response spectrum function is defined in ETABS 2017 as per IS 1893 (Part 1) – 2016. The response spectrum curve is selected for Zone IV and Type II Medium Soil for the damping of 5%. An eccentricity of 0.05 is taken for all the diaphragms to account for any accidental eccentricity arising in the structure. CQC method is implemented for combining the responses of various modes. The following load combinations are considered for response spectrum analysis:

1. $1.2 (D.L + L.L + RS_x)$
2. $1.2 (D.L + L.L + RS_y)$

3. $1.5 (D.L + RS_x)$
4. $1.5 (D.L + RS_y)$
5. $0.9 D.L + 1.5 RS_x$
6. $0.9 D.L + 1.5 RS_y$

C. Section details:

The details of the reinforced concrete and steel sections provided for various structural members in the structural models of beam column, under consideration are shown in Table 2. The sections are designed and checked as per the relevant IS codes using the ETABS 2017 software package.

Table 2 Section properties of the structural members

Shear wall System	Cross Bracing System	Combined resisting system
Beams – 230mm x 600mm (M30)	Beams – 230mm x 600mm (M30)	Beams – 230mm x 600mm (M30)
Columns – 900mm x 900mm (M30)	Columns – 900mm x 900mm (M30)	Columns – 800mm x 800mm (M30)
Columns – 850mm x 850mm (M30)	Columns – 850mm x 850mm (M30)	
Columns – 800mm x 800mm (M30)	Columns – 800mm x 800mm (M30)	
Columns – 750mm x 750mm (M30)	Columns – 750mm x 750mm (M30)	
Slabs – 130mm thick (M30)	Slabs – 130mm thick (M30)	Slabs – 130mm thick (M30)
Shear walls – 300mm thickness (M30)	Shear walls – NA	Shear walls - 300mm thickness (M30)
Outrigger Beams – NA	Outrigger Beams – NA	Outrigger Beams – ISHB350 (Fe250)
Outrigger Bracings – NA	Outrigger Bracings – NA	Outrigger Bracings – ISHB350 (Fe250) with 300mm x 40mm cover plates
Diagonal Bracing – NA	Diagonal Bracing – ISHB 150 (Fe250)	Diagonal Bracing – ISHB450 (Fe250)

RESULTS AND DISCUSSIONS

A. Lateral Displacement:

The results of conventional shear wall, cross bracing system and combined load resisting system of maximum roof displacement by ESM and RSM are shown in table 3. The introduction of shear wall at the core of the building reduces the storey displacement by 17 percent. While introducing a combined system of outrigger and bracing to the structure the displacement reduces by 14.8

percent when compared to the shear wall system. The combined system also shows a 23% decrease in the lateral displacement when compared with cross bracing. Therefore a subsequent change in the roof displacement is seen on introducing various load resisting systems to the structure. The table also shows a confident result when the models are analyzed using the Response Spectra Method (RSM). This means that adding lateral load resisting system to the structure helps reduce the displacement at the top.

Table 3 Maximum Storey Displacement at the top of the models

Type of model	Equivalent Static Method			Response Spectrum Method		
	Displacement (mm)	Change in Displacement (mm)	% Change in Displacement	Displacement (mm)	Change in Displacement (mm)	% Change in Displacement
Conventional	227.896	-	-	63.776	-	-
Shear wall	189.092	38.804	17%	57.417	6.36	10%
Cross bracing	208.193	-19.101	-10.10%	55.928	1.489	2.59%
Combined	161.081	28.011	22.63%	45.511	10.417	18.63%

B. Storey Drift:

The subsequent storey drift ratios and increasing the lateral load resisting structures like shear wall, cross bracing and a combination of various load resisting structures is shown in table 4.

Similarly to the lateral displacement parameter, storey drift also reduces by about a considerable magnitude by

employing shear wall at the core of the building. On adding bracing and outrigger the structure the model shows strong proof to both the conventional model as well as the one with shear wall. There is a decrease of around 15 percent when a combination of different lateral load resisting system is analyzed.

Table 4 Maximum Storey Drift of Models

Type of model	Equivalent Static Method			Response Spectrum Method		
	Drift (mm)	Change in Drift (mm)	% Change in Drift	Drift (mm)	Change in Drift (mm)	% Change in Drift
Conventional	0.002497	-	-	0.000669	-	-
Shear wall	0.001951	0.000546	21.87%	0.000596	0.000073	10.92%
Cross bracing	0.002188	-0.000237	-12.15%	0.000586	0.00001	1.68%
Combined	0.001669	0.000519	23.72%	0.000468	0.000118	20.14%

C. Storey Stiffness:

Table 5 shows the storey stiffness of different models that are discussed in this research paper. The results are same as that of the lateral displacement and storey drift. The introduction to shear wall at the core and cross bracing at the side of the

building increases the overall stiffness thereby leading to a stiffer structural configuration. In addition to that introducing outrigger at the mid height and top of the structure in addition to bracing at edges gives a boost to the stiffness that is then contained by the structure.

Table 5 Maximum storey stiffness of models

Type of model	Equivalent Static Method			Response Spectrum Method		
	Stiffness (mm)	Change in Stiffness (mm)	% Change in Stiffness	Stiffness (mm)	Change in Stiffness (mm)	% Change in Stiffness
Conventional	1848917.63	-	-	1889347.805	-	-
Cross bracing	3748015.13	1,899,097.5	102.71%	4001246.145	2,111,898.34	111.77%
Shear wall	4012777.926	264,762.796	7.06 %	4336296.358	335,050.213	8.37%
Combined	4851048.958	838,271.032	87.88%	5365707.138	1,029,411	23.74%

CONCLUSION

The following conclusions can be drawn on the basis of the results obtained from this comparative study by linear static and linear dynamic methods of analysis:

1. A conventional beam column system proves to be the most vulnerable to resist any kind of lateral loads. Introduction to lateral load resisting systems helps improve the overall stability and structural integrity of the structure.
2. Introduction of shear wall at the core and cross bracing to the side of the building provides good resistance to the coming lateral loads.
3. When a combined system is introduced the results achieved shows a better performance to the parameters discussed.
4. In comparison of shear wall and cross bracing system, shear wall shows more promising results in all the listed parameters in static analysis
5. While analyzing the models for dynamic method cross bracing has a less magnitude when compared to shear wall system
6. A combined lateral load resisting systems for high rise buildings proves to be efficient in every way possible but adding such elements to the structure makes it uneconomical. Hence some other structural elements must be incorporated in order to achieve further reduction in storey drift and displacement considerably

REFERENCES

- [1] Kiran Kamath, A Study on Static and Dynamic Behavior of Outrigger Structural System for Tall Buildings.
- [2] Khushbu Jani, Analysis and Design of Diagrid Structural System for High Rise Steel Buildings
- [3] N. Herath, N. Haritos, T. Ngo & P. Mendis, Behaviour of Outrigger Beams in High rise Buildings under Earthquake Loads
- [4] Yogesh Dudhe and Dr. Swati Ambadkar, Comparative Analysis of Different Lateral Load Resisting System for High Rise Building
- [5] Saif Azhar and Amit Pratap Singh, Comparative Study by Varying the Number of Outriggers for High Rise Building
- [6] Neeraj Kushwaha, N. Binnani, V. R. Rode and Saif Azhar, Comparative Study of Different Bracing System in Seismic Zone 3 and 4
- [7] IS 1893(Part I):2016, Criteria for Earthquake Resistant Design of Structures, Bureau of Indian Standard, New Delhi.
- [8] IS 16700:2017, Criteria for Structural Safety of Tall Concrete Buildings, Bureau of Indian Standard, New Delhi.

Women Safety Device Night-Patrolling Robot

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Abstract:

This paper depicts Security of women is a major topic concern of India. Although despite having so many laws for women, it doesn't stop thieves, assaulters, or molesters to abuse women. The main reason that a women is being victim is lack of public security and inability of a women to defend her. To be able to protect herself, she must train herself through various self-defence courses. To overcome the drawbacks of women security applications and self defence equipment's, an women safety device night patrolling robot is developed.

Keywords:

Security of women, Self-defence, India

INTRODUCTION

Not only this, we must create such an environment in our society that women must feel secured outside their house even when they are alone at any time. Women are not so physically fit as compared to men so in case of a need a helping hand would be a boon for them. Vision robot Patrolling System The best way to reduce probability of becoming a victim of violent crime (robbery, sexual assault, rape, domestic violence) is to recognize, defence and look up resources to help you out of hazardous situations. If a women is in dilemma or get split from friends during a night out or someone is following with bad intention (sexual assault) or don't know how to find back residence then this device with her will guard her and bring assistance when she needs it by giving her current location and health conditions to her associates and control center through SMS and call.

This device not only provides family and police support but also helps in getting medical support as fast as possible. In today's world, women safety has become a major issue in our country as women can't step out of their house at any time, especially during night. It is primarily due to fear of violence against them or being physically or sexually abused. The fear of harassment against women is not only the condition at outside but it may also happen at homes. The best way to reduce probability of becoming a victim of violent crime (robbery, sexual assault, rape, domestic violence) is to recognize, defense and look up resources to help you out of hazardous situations. If a women is in dilemma or get split from friends during a night out or someone is following with bad intention (sexual assault) or don't know how to find back residence then this device with her will guard her and bring assistance when she needs it by giving her current location and health conditions to her associates and control center through SMS and call. This device not only provides family and police support

but also helps in getting medical support as fast as possible.

LITERATURE SURVEY

[1]. "R. Devakunchari, s. Bhowmick, s. Bhutada, s. P. Bhutada, y. Shishodia, "evaluation of crimes against girls in India using regression," ladies strengthening bases on empoone canring each lady within the United States of America to make them self ruling with all views in most cases available, to care only about|some|roughly|more or less|around|or so the rights, and to induce preparedness. This paper focuses on presenting the challenges that women face in their daily lives, as one can plans for ladies empoone canrment in India and a self-help community that is successfully walking within the province of Tamil Nadu, proposals for self-help institutions for potential upgrades, and a contextual investigation of ladies empoone canrment mobile. Navya R Sogi created "smarisa: a Raspberry Pi-based smart ring for womens security across the internet of things." They are created a smart ring (smarisa) for women that includes a raspberry pi, a camera, a sign, and a seize to start the services. As a result, the package is small and can be activated by tapping the catch to bring her gift. Using a Raspberry Pi camera, locate the aggressor and send the picture to the disaster touch broad variety. Prof. Sunil created the smart gadget for girls and child safety & "A small device that allows for a one canight switch.

[2]. Thiru venkatasamy s, "night time creative and patrolling rover navigation device for ladies safety the use of computer studying," girls security is India's greatest challenge. Many parts of the country are unsafe for women. This must be rectified as soon as possible. Every generation evolves and improves in order to change the way people live. As a result, the emphasis of this paper is on updating the era system in order to strengthen women's safety mechanisms. one can implement a new protection system in this paper to protect girls when they participate in strange sports. A new safety system has been suggested, which is entirely based on the patrolling robot and the Raspberry Pi. A night vision digital camera can be used to secure any location in this situation. Various gadget learning models are used to boost the classifies accuracy. In ensemble, algorithms such as boosting, bagging, piling, and the more desirable re one canight mechanism are used. The accuracy of a confusion matrix with a man or woman classifier is When comparing results, this is taken into account. The results show that the proposed method

performs one canll when compared to existing algorithms.

[3]. "T.Chaitanya kumar, p.Raja rajeswari, p.Surya teja,p.Sri harsha, t.Raja rajeswari, "improving the overall efficiency of crime prediction technique using records mining," global journal of engineering & age, 7, 424-426,2018". Self-contained safety robots are a revolutionary new advancement in security and surveillance technology. Guards patrolling a location with flashlights and batons never worked very one canll; hoone canver, smart protection systems with clever sensors, embedded systems, are now common place.Everett, h., and gauge, d.W., 1999, in "cellular detection,"proposed the first safety surveillance robotic."Mdars" stands for "Measurement and Response System." Since then,security robots have evolved into a burgeoning hobby with increasing interest in research and application. Yoichi Shimosasa et al. created an autonomous defend robotic that can guide visitors during the day and patrol at night by integrating security surveillance and provider computer.Agroup of astute mobile security robots patrols different floors of a building. During the occurrence of a strange event, the cellular robotic transmits the event's connection position (ground quantity) to the supervised device. In the safety gadget, an autonomous patrolling car serves as a safety patroller, displaying the lifeless zones of the conventional constant surveillance system. With the help of the wireless network, far-reaching tracking capabilities can also be improved. The face recognition system, on the other hand, is designed to log and analyse the intruders.

[5] C. Micheloni, g. L. Foresti, c. Picciarelli, and l. Cinque, "An autonomous vehicle for video observance of indoor environments," today generation is everywhere. As a consequence, the virtual facts infrastructure is much too big.If one can have a propensity to use statistics correctly, one can would be able to obtain priceless data in a variety of ways..Many existing mechanisms lack an effective computerised framework for protecting women from abusive practises. The authors used the apriori algorithm in this scheme. They combined a prediction technique with a rule technique to predict the criminal's future intentions for crimes and the type of criminal most likely to commit them. Eighty percent accuracy was given by effects.Gender-based sexual and physical harassment is on the rise due to a variety of reasons. Both of these are referred to as "discrimination against women.

SYSTEM REQUIREMENTS

Hardware

The hardware components used in our project is listed below.

1. GSM module
2. GPS module
3. PIR Sensor
4. IR Sensor

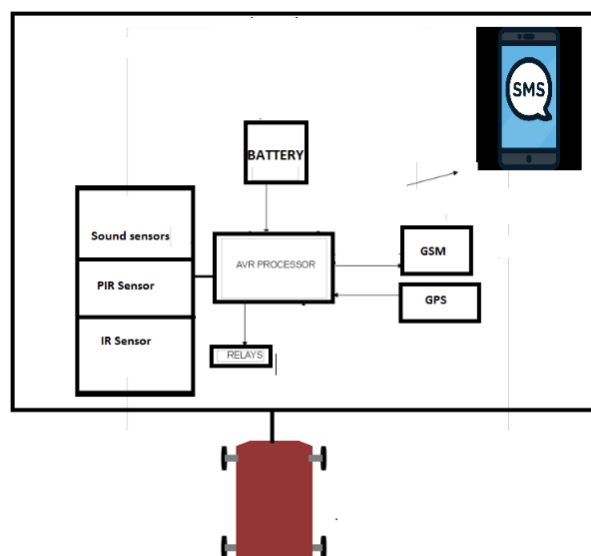
5. Sound Sensor
6. Atmega 48 Microcontroller
7. Regulator
8. Panic Button

Software

1. Arduino IDE tool
2. Embedded C

METHODOLOGY

Modern security systems are built on the basis of precise controls where it is possible to design a protection system that alerts the user by sending a text message and can use GPS for the purpose of tracking the victim and send a text message for the purpose of stopping it and can be used Internet stuff to do this work that these innovative and modern methods are capable to limit women harassment.



The main purpose of our project is to provide security to the women from dangerous situations. When the robot detects any warm bodies around with help of pir sensor connected to microcontroller pin and even senses the noise or sound around it if the sound to heavy it confirms there is some distress felt on women then it activates gps to trace the location which in turn is connected microcontroller rx pin and then sends the message like "women in distress" message also includes the location details like longitude and latitude which is got through help of gsm modem and this modem is connected to tx pin of the microcontroller. Here moving robot is connected with 4 motors and wheels and is used for the movement of robot and controlled using relays through microcontroller pins, ir sensor is connected to adc pin of the microcontroller used to detect any obstacle and avoids it by colliding.

Security is the condition of being protected against danger or loss. In the general sense, security is a concept similar to safety. The nuance between the two is an added emphasis on being protected from dangers that originate from outside. Individuals or actions that

encroach upon the condition of protection are responsible for the breach of security. The word "security" in general usage is synonymous with "safety," but as a technical term "security" means that something not only is secure but that it has been secured.

The main objective of this project is to develop ground vehicle for women safety with sound sensors and pir Sensor for detection of motion and sound if there is any motion detection with Loud noise robot will trigger Gps tracks the location and sends sms to guardians and police department.

RESULTS

Through this paper we have used women safety device night patrolling robot has been designed for providing safety for women's during night-time when they are alone in lonely areas.

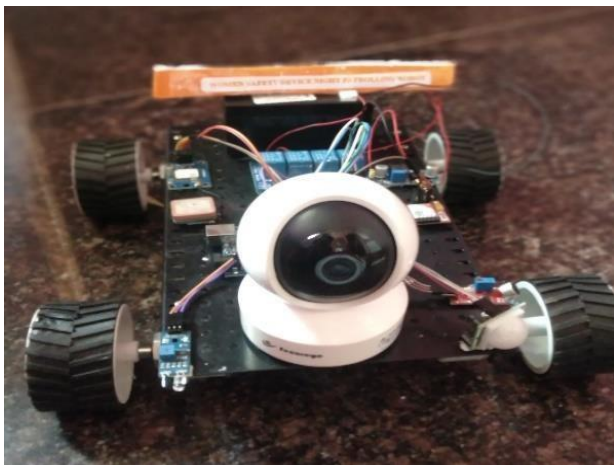


Fig: 5 Women safety device night patrolling robot.

CONCLUSION

Maximum Women's safety is the utmost concern of our project. So, we designed our project with few unique features. One of the key features is that our system can work in both online and offline mode. Police and volunteers who are positioned near the user's location in both modes, they will assist the user. On the other hand, the most important and unique feature of our app is that when the user is in trouble, she will get help by fixed volunteers and movable volunteers who are closest to the user. The app user will get help much faster because this app does the job of finding volunteers at its own discretion. We will add a camera module to the device which will have video and audio recording options. Through the camera, specific information about the attacker can be sent to the police. We will add a watch interface and pulse sensor and Blood Oxygen Sensor with Smart Band so that the user can provide information about her physical condition and her family can feel relaxed by receiving this information. In the app, we will also add a Walking Partner feature that allows users to find a partner with whom she can go to the destination together. This will make her journey safer and secure.

REFERENCES

- [1] N. R. Sogi, P. Chatterjee, U. Nethra and V. Suma, "SMARISA: A Raspberry Pi Based Smart Ring for Women Safety Using IoT," 2018 International Conference on Inventive Research in Computing Applications (ICIRCA), Coimbatore, 2018, pp. 451-454.
- [2] S. Pandey, N. Jain, A. Bhardwaj, G. Kaur and V. Kumar, "Reach360: A comprehensive safety solution," 2017 Tenth International Conference on Contemporary Computing (IC3), Noida, 2017, pp. 1-3.
- [3] T. M. R, Aishwarya, C. K. S, D. M. K and N. H, "IoT Based Smart Security Gadget for Women's Safety," 2019 1st International Conference on Advances in Information Technology (ICAIT), Chikmagalur, India, 2019, pp. 3328-352. [2] S. O. Report, "DU students give 328hr ultimatum to arrest 'rapist'," The Daily Star, 06-Jan2020. [Online]. Available: <https://www.thedailystar.net/city/dhaka-university-student-rapeprotest-sparks-on-campus-1850233>. [Accessed: 27-Mar-2020].
- [4] V. Sharma, Y. Tomar and D. Vydeki, "Smart Shoe for Women Safety," 2019 IEEE 10th International Conference on Awareness Science and Technology (iCAST), Morioka, Japan, 2019, pp. 1- 4.
- [5] P. A. English Desk, "21 women 'raped' on public transport in 13 months: Report," Prothomalo, 16Feb 2018. [Online]. Available: <https://en.prothomalo.com/bangladesh/21-women-'raped'-on-publictransport-in-13>. [Accessed: 27-Mar-2020].

Lane and Curve Detection System for Autonomous Car

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Abstract:

For vehicles to be able to drive by themselves, they need to understand their surrounding world like human drivers, so they can navigate their way in streets, pause at stop signs and traffic lights, and avoid hitting obstacles such as other cars and pedestrians. Based on the problems encountered in detecting objects by autonomous vehicles an effort has been made to demonstrate lane detection using the OpenCV library. The reason and procedure for choosing grayscale instead of color, detecting edges in an image, selecting the region of interest, applying the Hough Transform, and choosing polar coordinates over Cartesian coordinates have been discussed. we focus on implementing the Canny Edge detection algorithm for lane detection and appropriate travel behavior on a self-driving car prototype, which is based on the Raspberry Pi development board. Our method aims to provide seamless boundary detection for a prompt and accurate response of the vehicle's trajectory following lane changes on the road. The challenges in the task include analyzing the path and the boundaries of the lane and estimating the right degree of rotation of the wheel motor keeping the center of the vehicle in line with the frame center.

Index Terms:

Numpy, OpenCV, Canny, Lane Detection, Hough Transform, Matplotlib, Gaussian Blur.

INTRODUCTION

During the driving operation, humans use their optical vision for vehicle maneuvering. The road lane marking acts as a constant reference for vehicle navigation. One of the prerequisites to have in a self-driving car is the development of an Automatic Lane Detection system using an algorithm. Computer vision is a technology that can enable cars to make sense of their surroundings. It is a branch of artificial intelligence that enables software to understand the content of images and video. Modern computer vision has come a long way due to the advances in deep learning, which enables it to recognize different objects in images by examining and comparing millions of examples and cleaning the visual patterns that define each object. While especially efficient for classification tasks, deep learning suffers from serious limitations and can fail in unpredictable ways. This means that a driverless car might crash into a truck in broad daylight, or worse, accidentally hit a pedestrian. The current computer vision technology used in autonomous vehicles is also vulnerable to adversarial attacks, by manipulating the AI's input channels to force it to make mistakes. For instance, aforementioned issues caused by modifications in lane borders. The method used in this work is meant to recognize lane markings on the road by providing a video of the road as an input to the system utilizing computer vision technology, with

the primary goal of reducing the incidence of accidents. Accidents on the road may be avoided by installing a system in automobiles and taxis. It is used in school buses to ensure the safety of the students. Furthermore, the driver's performance may be monitored, and Road Transportation Offices may utilize the setup to check and report driver irresponsibility and lack of attention on the highways.

LITERATURE REVIEW

Many researches in image processing have dealt with lane detection. An overview of these researches shows that we can classify them into two principal categories. The first one applies the bird's-eye view transform in an input image from a rear-view camera to recognize lane markings [3]. The second category uses a front mounted camera. In this latter case, several different image processing algorithms have been developed such as

Likelihood of Image Shape (LOIS) algorithm [4], B-Snake algorithm [5] and others algorithms [6,7] using a feature-based method to extract features in an image (e.g. edges), with different techniques.

A feature-based method has the advantage of offering a large choice of techniques to be used in each step of the algorithm and then contributing to its optimization. However, it has two major problems. The first issue of lane detection is the amount of calculation required. Thus, for real-time application, the performances and the processing time of the algorithm proposed above can be improved by using other operators for edge detection on the one hand and for line tracking on the other hand. The second issue is the difficulty of identifying lane boundary lines because a real road image can contain other candidate edges (e.g. noise edges). That's why; it should be a judicious choice of an edge detection technique to reduce the number of edge points in the output image of this step. Indeed, the edges must be detected well for Hough transform to be efficient.

PROPOSED METHODOLOGY

The problem statement concerning this paper questions the ability of a self-driven to effectively detect, follow and switch between lanes on a road, detect obstacles and maintain a safe distance from other vehicles. The flow of the project consists of the inclusion of the OpenCV libraries to the Raspberry Pi and then the capturing of images through the HD megapixel mounted on the top of the prototype. A region of interest is created using the frame size and by defining the points in o the BGR scheme for the histogram pixels as x-y coordinates. The image is processed and converted from RGB color scheme to Grayscale and then passed to an algorithm

that allows the visualization of the frequency of data occurring over a specific interval. This data is fed to the Canny edge detection algorithm that uses the difference in contrast gradients to identify the road and the lanes. The output of the edge detection algorithm creates a frame of the lanes and the travel path. A variable is defined as the lane center which uses the left and right lane positions. The relative difference between the lane and the frame center is used to estimate the degree of turn that needs to be made to stay in the center of the road. This difference variable is passed to the Arduino using Parallel Communication and the Arduino then controls the motor drivers for appropriate speed and steering. This process is repeated until the car reaches the desired destination.

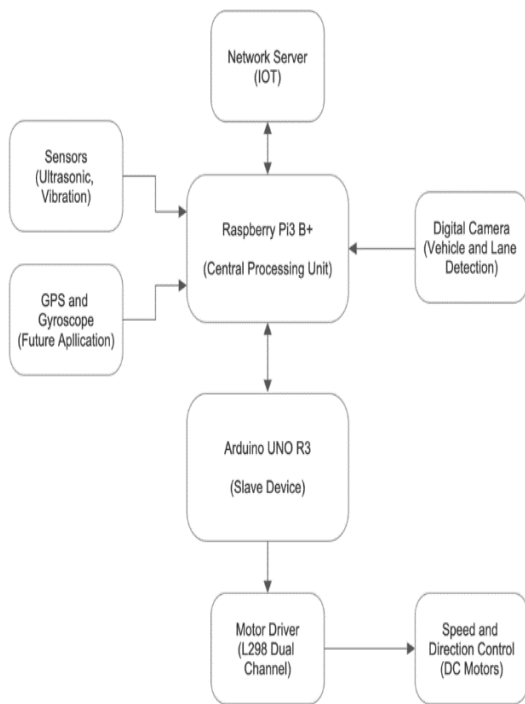


Fig 1: Block Diagram

The project involves the detection of lanes in an image using Python and OpenCV. OpenCV means “Open Source Computer Vision”, which is a package that has many useful tools for analysing images.

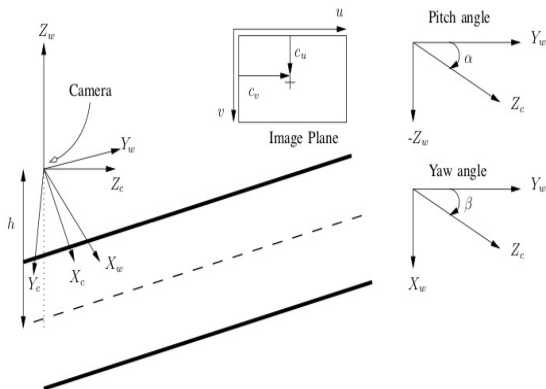


Fig 2: Angle detection

3.1 The Canny Edge Detection Technique:

The goal of edge detection is to identify the boundaries of objects within images. A detection is used to try and find regions in an image where there is a sharp change in intensity. We can recognize an image as a matrix or an array of pixels. A pixel contains the light intensity at some location in the image. Each pixel's intensity is denoted by a numeric value that ranges from 0 to 255, an intensity value of zero indicates no intensity if something is completely black whereas 255 represents maximum intensity something being completely white. A gradient is the change in brightness over a series of pixels. A strong gradient indicates a steep change whereas a small gradient represents a shallow change

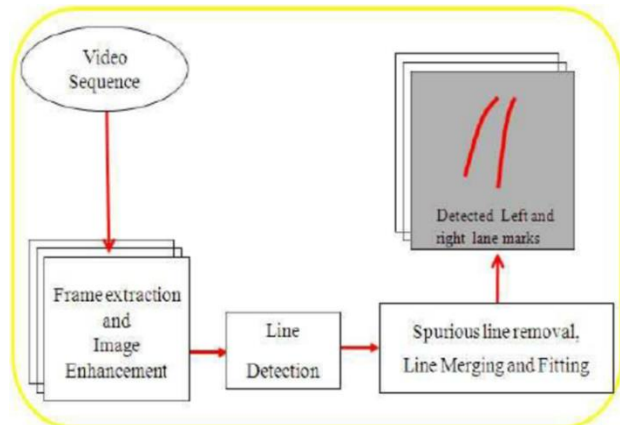


Fig 3: Curve and Line detection System

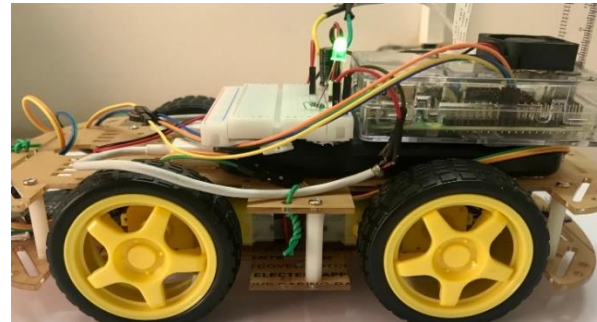


Fig 4: Autonomous Car

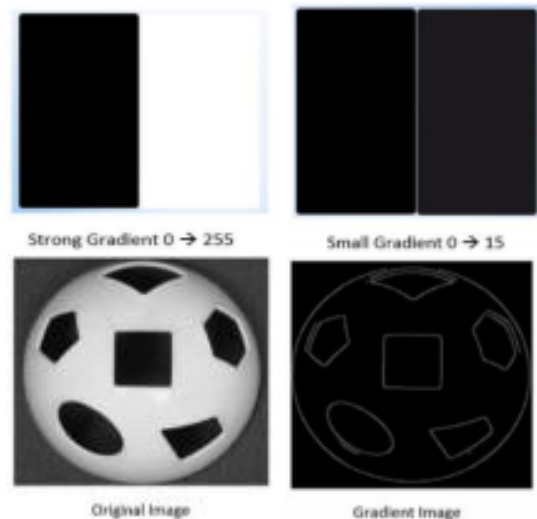


Fig 5: Canny Edge Detection System

On the right-hand side, there is a figure of the gradient of the soccer ball. The outline of white pixels corresponds to the discontinuity in brightness at the points the strengthen gradient. This helps us identify edges in our image since an edge is defined by the difference in intensity values in adjacent pixels. And wherever there is a sharp change in intensity (rapid change in brightness) i.e., wherever there is a strong gradient, there is a corresponding bright pixel in the gradient image. By tracing out all these pixels, we obtain the edges. We're going to use this concept to detect the edges in our road image.



Fig 6: Road and Lanes

In order to convert the image to grayscale we will first make a copy of the original image using Numpy:

A 3-channel color image would have an RGB channel, each pixel in the image is a combination of three intensities values. A grayscale has only one channel, each pixel has only one intensity value ranging from 0 to 255.

Now the image is converted to grayscale:



Fig 7: Gaussian blur:

Each of the pixels for a grayscale image is described by a single number that describes the brightness of the pixel. In order to smoothen an image, the typical answer would be to modify the value of a pixel with the average value of the pixel intensities around it. Averaging out the pixels to reduce the noise will be done by a kernel. Kernel numbers(`np.array([[1,2,3],[4,5,6],[7,8,9]])`) are run across our entire image and sets each pixel value equal to the weighted average of its neighboring pixels, thus smoothening our image. In our case we will apply a 5x5 Gaussian kernel:

Below is the image with reduced noise:



Fig 8: Edge Detection:

An edge corresponds to a region in an image where there is a sharp change in the intensity/colour between adjacent pixels in the image. A strong gradient is a steep change and vice versa is a shallow change. So in a way we can say an image is a stack of matrices with rows and columns of intensities. This means that we can also represent an image in 2D coordinate space, x-axis traverses the width (columns) and y-axis goes along the image height (rows). Canny function performs a derivative on the x and y axis thereby measuring the change in intensities with respect to adjacent pixels. In other words, we are computing the gradient (which is a change in brightness) in all directions. It then traces the strongest gradients with a series of white pixels. `canny = cv2.Canny(blur, 50, 150)`

Below is the image after applying the Canny function:



Fig 9: Region of Interest:

The dimensions of the image are chosen which will contain the road lanes and mark it as our region of interest or the triangle. Then a mask is created which is the same as the dimension of the image which would essentially be an array of all zeros. Now we fill the triangle dimension in this mask with the intensity of 255 so that our region of interest dimensions are white.

Below is the image of the mask:



Fig 10: Mask

Now we will perform bitwise AND operation with a canny image and mask it in the region of interest.



Fig 11: Hough Transform:

Now we make use of a hough transform technique that will detect straight lines in the image and thus identify the lane lines. We know that a straight line is represented by the below equation: $y = mx + b$. And the slope of the line is simply a rise over run. If the y intercept and slope is given then the line can be plotted in the Hough Space as a single dot. There are many possible lines that can pass through this dot, each line with different values for M and B. There are many possible lines that can cross each point individually, each line with different slope and y intercept values. However there is one line that is consistent with both points. We can determine that by looking at the point of intersection enough space because that point of intersection in Hough Space and that point of intersection represents the M and B values of a line consistent with crossing both the points. Now in order to identify the lines, we will first split our Hough space into a grid. Each bin inside the grid corresponds to the slope and y intercept value of the line. For every point of intersection in a Hough Space bin we're going to cast a vote inside of the bin that it belongs to. The bin with the maximum number of votes will be our line. But as we know that the slope of a vertical line is infinity. So to express vertical lines, we will use polar coordinates instead of cartesian coordinates. So the equation of our line becomes.

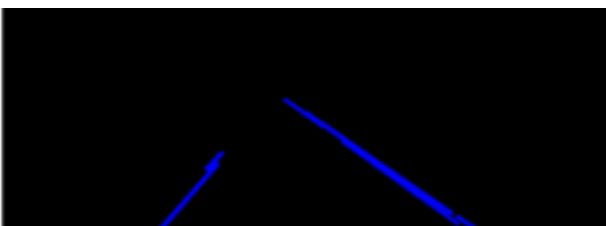


Fig 12: Zero Intensity Image



Fig 13: Combined image

HARDWARE:

Raspberry Pi OS Raspberry Pi OS (Raspbian) is a Debian-based (LINUX) operating system that is optimized for the Raspberry Pi hardware. Raspberry Pi OS is similar in appearance to operating systems such as macOS and Microsoft Windows. The menu toolbar is located at the top and it includes an application menu and shortcuts to Terminal, Chromium, and File Manager. Bluetooth menu, a Wi-Fi menu, volume control, and a digital clock are placed on the right side. It is an open-source operating system and is available on the Raspberry Pi website for free download.

Arduino IDE

The Arduino Integrated Development Environment (IDE) is an open-source software developed by Arduino which makes it easy to program the Arduino microcontroller. The Arduino IDE uses combined syntax from the programming languages C and C++ using special rules of code structuring.

OpenCV

Open Source Computer Vision (OpenCV) provides an open-source library of programming functions, tools, and hardware that are optimized for real-time optimized computer vision. OpenCV consists of more than 2500 optimized algorithms, for both real-time computer vision and machine learning. It can be used to detect and recognize faces, identify objects, classify human actions, track object movements, etc. It has C++, Python, Java, and MATLAB interfaces and is supported by Windows, macOS, Linux, and Android.

RESULTS:

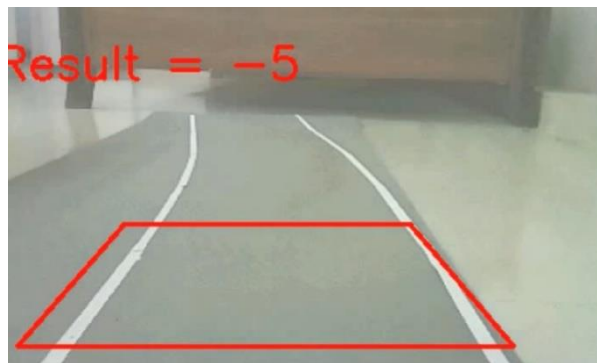


Fig 14: Left side turn with -5

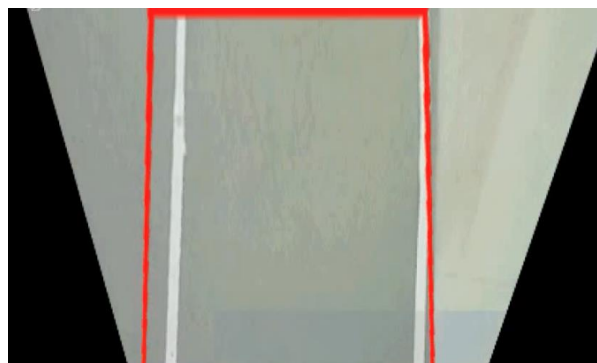


Fig 15: Straight Line direction

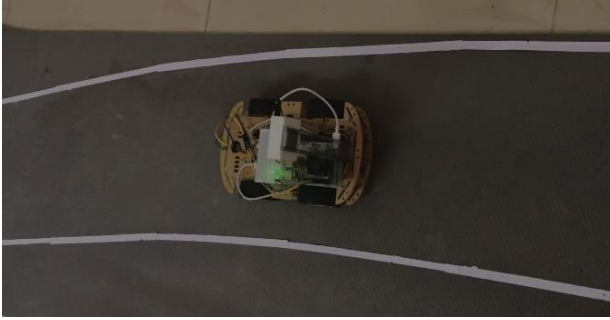


Fig 16: Right side turn

CONCLUSION

In this research methodology, we made use of the OpenCV library and its functions such as the Canny Function through which we achieved edge detection. Then we prepared a mask of zero intensity and mapped our region of interest by performing the bitwise operation. Then we used the Hough Transform technique that detected the straight lines in the image and identified the lane lines. We made use of the polar coordinates since the Cartesian coordinates don't give us an appropriate slope of vertical and horizontal lines. Finally, we combined the lane image with our zero-intensity image to show lane lines.

REFERENCES

- [1] <https://dev.to/divshekhar/lane-detection-opencvpython-0i6>
- [2] <https://www.intertraffic.com/news/autonomous-driving/ut-nomous-vehicle-technology-2020/>
- [3] <https://www.irjet.net/archives/V2/i3/Irjet-v2i3270.pdf>
- [4] <https://www.hindawi.com/journals/ddns/2012/273164/>
- [5] https://www.researchgate.net/publication/4356226_Realtime_lane_detection_for_autonomous_vehicles
- [6] <https://www.irjet.net/archives/V6/i1/IRJET-V6I1245.pdf>
- [7] https://www.researchgate.net/publication/282836573_Review_of_Lane_Detection_and_Tracking_Algorithms_in_Advanced_Driver_Assistance_System
- [8] http://www.ijcim.th.org/past_editions/2019V27N1/27n1Page58.pdf
- [9] <https://ieeexplore.ieee.org/document/790529810>.
<https://www.kdnuggets.com/2017/07/road-lane-line-detection-using-computer-vision-models.html>

Titania Ceramic Material as Thermal Barrier Coating for Piston in CI Engine to Investigate the Performance and Emission Characteristics of Diesel and Biodiesel.

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Abstract:

The main intention of present investigation was to study the performance and emission characteristics of an un-coated and coated piston with diesel and biodiesel blended fuels in compression ignition engine. To carry out the experiments a single cylinder, four stroke, water cooled Dongfeng diesel engine fixed with un-coated and coated piston are used. Titania was used as top coat ceramic material for the engine component such as crown of the piston. A non-edible michelia Champaca biodiesel's (MCB) blend 20BD (20% biodiesel and 80% diesel) was chosen with baseline fuel (Diesel) in both un-coated and coated CI engine to evaluate the performance and exhaust effects of engine.

M.S. Gad et al. used methyl esters of waste cooking oil (20%) and diesel blends with nanoparticles such as Titania, Alumina and Carbon nano-tubes about 25, 50 and 100ppm in diesel engine to estimate the performance and exhaust characteristics. Experimental results clearly showed that the thermal efficiency increased by 4%, 6% and 11.5%, reduction in carbon monoxide emission by 11%, 24% and 30%, Hydrocarbon by 8%, 17% and 25%, smoke by 10%, 13% and 19%, except emissions of NO_x increased by 5%, 12% and 27% when compared with B20 [3].

[Ali Sanli](#) et al. conducted an experiment in 4-stroke, 4-cylinder light duty diesel engine with 8% YSZ coated piston fueled by CH₄-CO₂-H₂ mixtures and achieved lesser NO_x emission[4].

In this experiment a novel biodiesel with ceramic material coated piston was used in a single cylinder four stroke diesel engine to evaluate the combustion, performance and exhaust emission. The biodiesel was derived from Michelia Champaca seeds and top surface of the piston was coated with Titania.

In this investigation biodiesel was extracted from non-edible potential feedstock Michelia champaca seeds. Michelia champaca tree belongs to Magnoliaceae family, commonly called as Magnolia champaca, and champak tree is native to India but found in tropical and sub-tropical areas, China, Thailand, Sri Lanka, Nepal, Bangladesh, Myanmar, Indonesia. Tree grows almost 18-to-25-meter height and 1.6-to-18-meter diameter. The grey stem is straight and contains several branches. The leaves are 18 to 28 cm long and 5 to 8 cm wide. The flowers are light yellow in early stage and becomes golden-orange in final stage gives pleasant smell to environment. Fruits are downwards because of its weight. Each bunch consists 7 to 25 fruits. A matured tree gives almost 75 to 150 kgs of seeds every year. The young fruits are green in colour and aged are in pale brown. Each fruit differs from 0.6 to 1 cm long and fruit shell contains 2 to 10 Red and pink coloured fleshy black seeds with tiny white fibres. The percentage of oil content in Michelia champaca seeds is 45 [13-16]

Novelty of the current work

It is confirmed from the above assessment; no research work has been carried out to evaluate the effect of michelia Champaca biodiesel fuel in compression

INTRODUCTION

Agriculture and automobile sectors are the main commerce in utilizing the compression ignition engine (diesel engine) and diesel fuel due to their power efficiency, consumption of fuel and price than other kinds such as spark ignition engine (petrol engine), gas turbines etc. On the other hand, emissions from both CI and SI engines pollute the environment and causes serious health issues on animals, aquatic animals and human beings. In addition, dependency for fuel is another issue which directly affects on nations growth and development due to huge currency is to be required to buy and import the crude oil. To overcome these, use of alternate fuels derived from animal fat, plant seeds, waste cooking oil, algae based biofuel in the form of blends (can be used up to 20% of biodiesel in CI engine without modification) and adding the additives such as liquid additives, gaseous additives and metal based additives to diesel fuel and biodiesel in CI engine is one technique. Another technique is coating on the surfaces of engine components which avoids the heat transfer from cylinder into cooling water [1].

Fuel and environment concerned researcher's intension is to enhance the performance as well as to reduce the exhaust emissions of engine. Presence of extra O₂ in biodiesel likely be improve performance of engine by reducing hydrocarbon plus particulate matter but increases the NO_x and fuel consumption due to its high viscosity and density. To conquer these, appropriate additives were added to diesel, biodiesel and its blends [2].

ignition engine with Titania ceramic material coated piston. This research gap inspires the author to use MCB 20 as fuel in TBC fixed engine. Firstly, to get baseline data the engine was run with B-0 (Diesel) and B-20 (Biodiesel 20% + diesel 80%) from no load to full load. Again the engine fitted Titania coated piston was run with same conditions. Obtained experimental results were compared with the baseline data to estimate the performance and emission characteristics of the TBC engine.

MATERIALS AND METHODS

Production of Bio-diesel:

Michelia Champaca fruits were collected at Smt.L.V. Government polytechnic campus, Hassan-573201, Karnataka, India. The fruits were sundried for about 24 hours to open its shell. To remove the moisture content, seeds were again sundried for about 48 to 96 hours. Then seeds were extracted in mechanical expeller to receive the bio-oil. A chemical modification process called trans-esterification is required to convert raw bio-oil into bio-diesel. Due to high free fatty acid, the bio-oil subjected to acid followed by base trans-esterification process.

Thermal barrier coating:

Surface of engine components such as piston crown and rings, cylinder liner, inlet as well as exhaust valves, cylinder head are subjected to TBC's to convert the conventional engine into low heat rejection engine. In LHR engine, surfaces of the engine components were coated by ceramic or metallic materials, acts as thermal insulation. These coats prevent the engine components by corrosion, high temperature, wear and tear and erosion. Among the total heat released by the engine, approximately one third of the heat would be received in coolant. Prevention or reuse of this one third heat, definitely improves the fuel efficiency. Therefore, thermal efficiency and power output of engine is raised and exhaust emissions decreased.

Ceramics are the most common materials used for TBC due to its high melting point, resistance against wear, corrosion and chemicals also having high modulus of elasticity. Normally, titanium di-oxide or Titania, Yttria-stabilized Zirconia and Zirconium dioxide were used for TBC. During the combustion, ceramic coating holds out almost 760°C in between cylinder and top of the piston, in addition to this coating reduces the thermal ooze to the coolant which boosts the performance and decreases the emission of the engine.

In the present investigation titanium di-oxide or Titania, a white colour powder shown in figure no.1 was used to coat the piston due its high melting point, 1843°C and shows better resistance against heat, wear and corrosion. The chosen Titania material was applied to the piston crown by using plasma spray coating technique.



Fig.No.1 Titania, a white colour powder

Plasma spray coating:

Elevated combustion temperature occurs in space, naval, automotive engines, gas turbines, chemical and medical industries; are effectively adopted the coating methods to enhance their thermal insulation property, corrosion and wear at high temperature. Coating can be geared up by either atmospheric or vacuum plasma spray coating method. In TBC, commonly APS coating technique is employed due to its applications such as material selection (powder form or wire form), adhesiveness of material and coating thickness etc. Coating consists two layers, bond coat which guards the component from oxidation, corrosion and acts as adhesive to top coat and object. Top coat, normally a ceramic layer, can efficiently lessen the heat flow rate [3]. In the current research work, Ni-Cr-Al and TiO_2 powders were opted as interface material for bond coat and top coat respectively [1, 6]. From the literature survey, bond coat thickness was $100\mu\text{m}$ and top coat thickness varies from $300\mu\text{m}$ to $400\mu\text{m}$ [2-6]. Compression ratio is the key aspect, plays an important role in performance and combustion of any fuel in IC engine and 17.5 to 18 is ideal for CI engine [6, 8]. Coating of piston crown can alter the compression ratio of CI engine; hence to overcome this, prior to coating $400\mu\text{m}$ thickness from the piston crown can be removed to maintain the original condition of engine for experimentation [3]. The figure no.2, represents the plasma spray coating equipment.

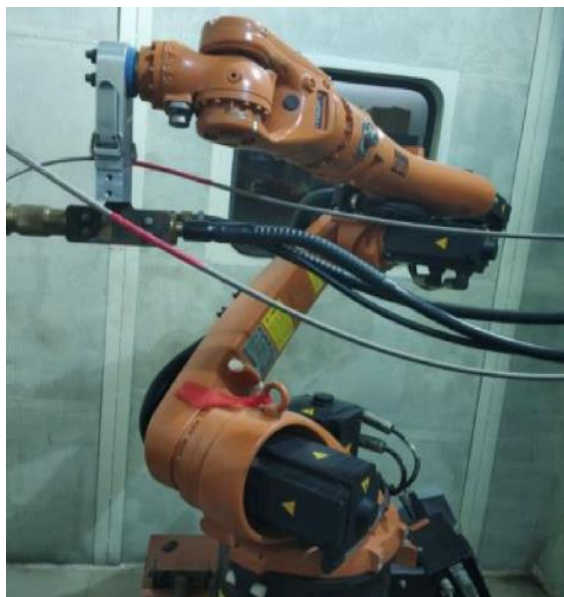


Fig.No.2 plasma spray coating equipment.

Engine setup for experiment:

Figure no 3 shows the pictorial diagram of the experimental setup of test engine at Department of Automobile Engineering, Malnad college of Engineering, Hassan. Tests were conducted in 4-stroke, 1-cylinder, water cooled DI compression ignition engine coupled with eddy current dynamometer for loading principle. In addition to this strain gauge, thermocouple, crank angle encoder and pressure transducer were included. The readings were taken for zero to maximum load condition at constant engine speed of 1500 rpm and constant compression ratio of 17.5:1. An AVL 5 gas analyzer was used to express exhaust parameters. Initially, conventional diesel fuel was used to start and warm-up the engine. Once the engine reached the steady state condition, the baseline readings were recorded for diesel followed by B20 for un-coated piston. Same procedure was repeated for coated piston to evaluate the performance and emission parameters.



Fig.No.3 Experimental setup

RESULTS AND DISCUSSION

In current investigation, combustion, performance and emission characteristics were estimated by applying different loads to the un-coated and coated piston fitted

CI engine running under conventional diesel fuel and MCB20 biodiesel. The subsequent segments shows the detailed results of Ignition delay(ID), brake thermal efficiency (BTE), brake specific fuel consumption (BSFC), exhaust gas temperature (EGT), carbon monoxide (CO), carbon dioxide(CO₂), nitric oxide(NO), hydrocarbons(HC), ignition delay (ID) and heat release rate(HRR).

Ignition delay:

Combustion phenomena can be understood on the basis of ignition delay and defined as the time gap between start of fuel injection and start of combustion. This process can be divided into physical delay and chemical delay period. Physical delay, in which atomisation, vaporisation and mixing of air fuel take place and chemical delay, endorsed to preparation of combustion process. Figure no 4 shows the ignition delay for uncoated and coated engine with load variation. Under low load, ignition delay is slightly higher for coated and uncoated piston running with B0 and B20 fuel than higher loading condition due to the rise in in-cylinder temperature. Also B20 shows the better ignition delay in coated and uncoated condition as a result of biodiesel concentration which improves the fuel atomization.

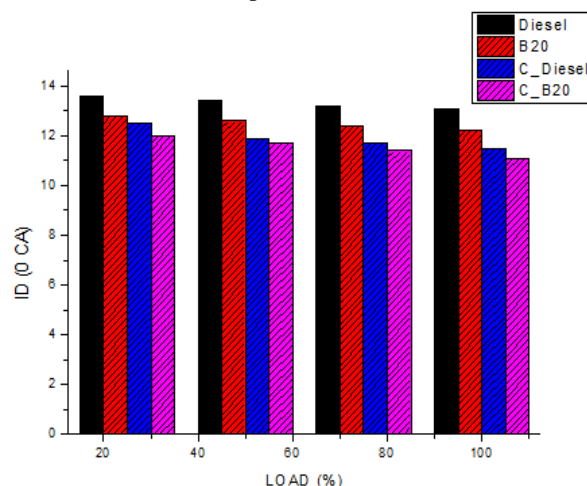


Fig.No.4 Variation of Ignition delay with load

Brake thermal efficiency:

Brake thermal efficiency is the capability of an engine to convert the fuel's chemical energy into mechanical work [9]. Brake power is an important parameter in determining the brake thermal efficiency. Figure no 5 illustrates the BTE v/s Load for coated piston and uncoated piston fixed engine fuelled by B0 and B20 under different loading conditions. From the graph, B20 and C_B20 revealed that the improved thermal efficiency than B0 at all loading conditions. Calorific value of biodiesel blend was slightly lower/equal to the diesel hence B20 could directly compete with B0. Sometimes, lower CV and greater rejection of heat to the other components of engine as well as coolant reduces the BTE of biodiesel compared with pure diesel but coating can enhance thermal resistance by holding the

heat and reduces the rejection of heat to the engine components or coolant [6,] . Graph shows increased thermal efficiency at C_B20 under all loading conditions than diesel and B20 respectively.

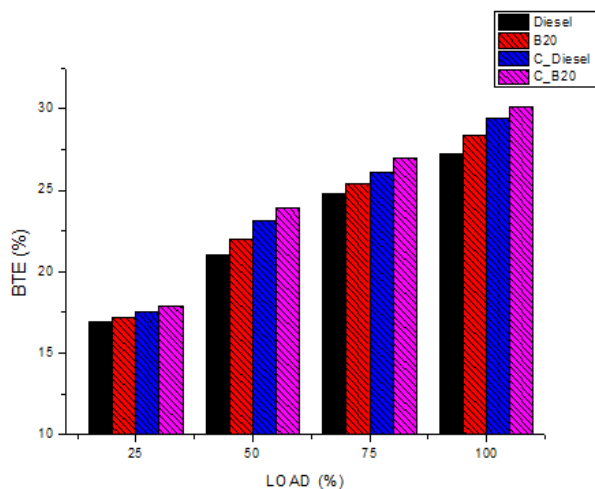


Fig.No.5 Variation of BTE with Load

Brake specific fuel consumption (BSFC):

Again brake power is the key parameter in determining BSFC and BSFC is defined as efficiency of an engine which converts the fuel power into cheerful work competently. Generally, fuel consumption is less when CV is higher and vice versa. Gradual raise in engine load and percentage of oxygen present in the fuel also reduces the fuel consumption in CI engines [10]. When the load of the engine gradually increases, atomisation and appropriate mixing of fuel will takes place in the combustion chamber due the turbulence as well as temperature present in the combustion chamber. This reduces the ignition delay and advances the combustion process. Figure no 6 illustrate the BSFC v/s Load for coated piston and uncoated piston fixed engine fuelled by Diesel and B20 under different loading conditions. From the graph, fuel consumption was more in Diesel and B20 due to the higher temperature in combustion chamber.

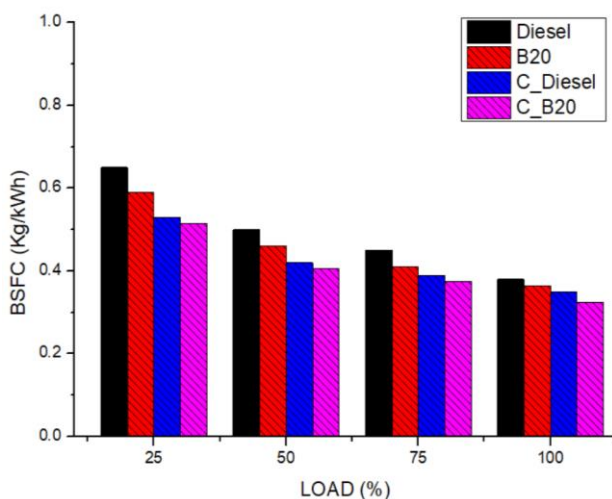


Fig.no.6 BSFC v/s Load

Emission of carbon monoxide:

Usually carbon monoxide is emitted from the engine due to lack of oxygen content present in the hydrocarbon fuel for complete combustion. In general, sufficient or surplus air is available for combustion, undeniably amount of CO as well as CO₂ emission will be reduced [11]. Biodiesels are rich in oxygen concentration which tends to complete combustion and thus reduces the CO emission [10]. In addition, extra oxygen molecule in the biodiesel converts the carbon dioxide from carbon monoxide. Figure no 7 shows the CO emission verses load.

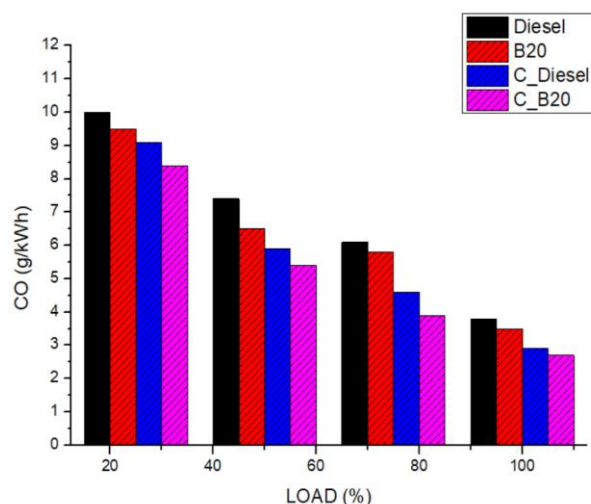


Figure no 7 CO emission verses load

Emission of nitrogen oxides:

Generally nitrogen oxide and nitrogen dioxide were the constituents in diesel engine emissions. These two constituents are jointly called as NO_x emissions. Of the total NO_x emission, main constituent is NO and NO₂ is about 2%. Load of the engine, oxygen quantity in fuel and temperature in the cylinder are the important parameters in developing the NO_x emission in CI engine. Due to the higher O₂ content in biodiesel and its blend, complete combustion takes place in engine which increases the combustion temperature. This may result in higher NO_x emission than that of the diesel fuelled engine [10]. In addition, coating of piston increases in-cylinder temperature which increases the NO_x emission [6]. Figure no 8 demonstrate the increased NO level in all loading conditions than diesel.

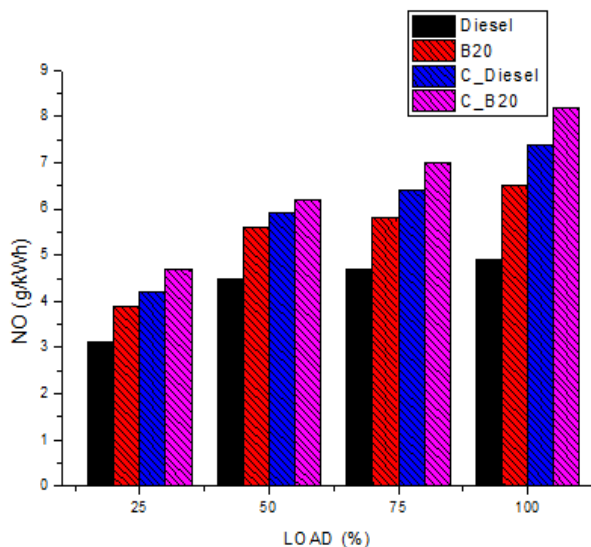


Fig.No.8 NO vs Load

Emissions of hydrocarbon:

In general, the diesel fuel is made up with carbon and hydrogen molecules. These were the outcome of incomplete combustion called unburned hydrocarbons due to lack of oxygen content in diesel fuel [6, 10, and 12]. Quality of fuel and temperature in combustion chamber also contribute NO_x emissions [9]. This UBHC decreased for B20, C_Diesel and C_B20 at higher engine loads due to the richness of oxygen in biodiesel and Titania coating of piston crown compared to diesel fuel. Figure no 9 shows the emission of hydrocarbon verses load.

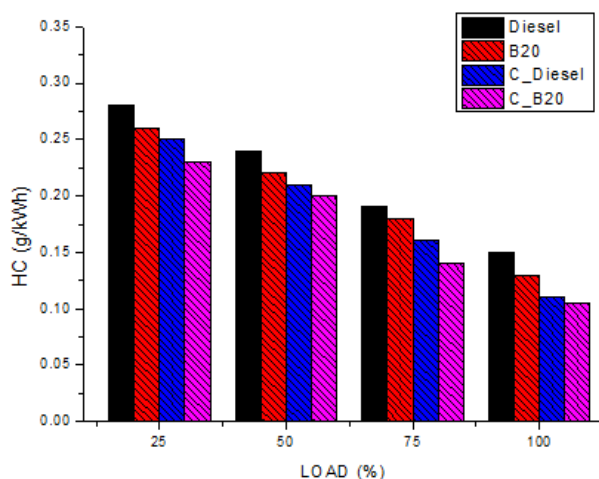


Fig.No 9 hydrocarbon verses load.

CONCLUSION

In this experimental investigation, the combustion, performance, and emission parameters of a CI engine run in Diesel, B20 operations without and with coated pistons were evaluated and compared with those of the baseline data. The important findings are given below;

- Increased thermal efficiency at C_B20 under all loading conditions were obtained.
- Fuel consumption was slightly more in diesel and B20 compared with C_diesel and C_B20.
- Emission of CO was very much less in B20, C_diesel and C_B20 at all loading conditions comparatively diesel fuel.
- Emission of HC was less in B20, C_diesel and C_B20 at all loading conditions comparatively diesel fuel.
- Unfortunately emission of NO is more in B20, C_diesel and C_B20 at all loading conditions comparatively diesel fuel.

REFERENCES

- [1] Ceramic Material for Thermal Barrier Coatings in Compression Ignition Engine for its Performance Evaluation with Biodiesel, H.R. Amriya Tasneem et.al., Materials Today: Proceedings 46 (2021) 7745-7751
- [2] Thermal analysis of Nano ceramic coated piston used in natural gas engine, Zhimin Yao et.al., Journal of Alloys and Compounds 768 (2018) 441-451
- [3] Combustion and emission performance of isopropanol-butanol-ethanol (IBE) mixed with diesel fuel on marine diesel engine with nano YSZ thermal barrier coating, Chunguang Fei et.al., <https://doi.org/10.1016/j.energy.2022.124683>
- [4] Optimization of the effect of thermal barrier coating (TBC) on diesel engine performance by Taguchi method, Serkan Özel et.al., Fuel 263 (2020) 116537
- [5] Experimental studies on the effect of TBC piston in a dual-fueled diesel engine, Jami Paparao et.al., Fuel 306 (2021) 121700
- [6] Experimental analysis of CI engine using titanium oxide and aluminum oxide alloy coated piston fuelled with biofuel made up of agricultural waste, Akshay Maruti Narad et.al., Results in Materials 8 (2020) 100140
- [7] Renewable energy sources from Michelia champaca and Garcinia indica seed oils: A rich source of oil, K.M. Hosamani et.al., biomass and bioenergy 33 (2009) 267–270
- [8] Effects of compression ratio, blending ratio and engine speed on fuel cost, performance and exhaust emissions of a diesel engine fueled with bio-derived alternative fuels, Mert Gülüm ., Sustainable Energy Technologies and Assessments 53 (2022) 102464
- [9] A study on performance, combustion and emission behaviour of diesel engine powered by novel nano nerium oleander biofuel, B. Dhinesh et.al., Journal of Cleaner Production 196 (2018) 74-83
- [10] Eco friendly biofuels for CI engine applications, B. Ashok et.al., School of Mechanical Engineering, VIT University, Vellore, India

- [11] Pine oil-soapnut oil methyl ester blends: A hybrid biofuel approach to completely eliminate the use of diesel in a twin cylinder off-road tractor diesel engine, V.Venkatesan et.al., Fuel, <https://doi.org/10.1016/j.fuel.2019.116500>
- [12] Experimental investigation of performance, emission and combustion characteristics of olive mill wastewater biofuel blends fuelled CI engine, Loubna Hadhoum et.al., Fuel 291 (2021) 120199
- [13] Renewable energy sources from *Michelia champaca* and *Garcinia indica* seed oils: A rich source of oil, K.M. Hosamani et.al., biomass and bioenergy 33 (2009) 267–270
- [14] Biodiesel production and fuel properties from non-edible *chompaca*(*michelia champaca*) seed oil for use in diesel engine, Siddalingappa R Hotti et.al., Journal of Thermal Engineering, Yildiz Technical University Press, Istanbul, Turkey, Vol. 1, No. 1, pp. 330-336, January, 2015.
- [15] An overview of *Michelia Champaca* based biodiesel and compared to other non-edible plant seeds – An optimum fuel, Mayank, IJGHC, December 2018 –February 2019; Sec. A; Vol.8, No.1, 214-220.
- [16] A comprehensive review of biodiesel production methods from various feedstocks, R. Selvaraj et.al., Biofuels, DOI: 10.1080/17597269.2016.1204584

Consumption Pattern of the NEO Middle Income Households in Chennai

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Abstract:

The household especially average Indian household is what runs the country's economy. The consumption of the middle-class households is so sure that any business can rely on them as a permanent source of demand. Specifically, if it is a household product or FMCG. The advent of foreign goods like Maggi and Kellogg's relied on the Indian household sector for their market. Though they faced fiasco in their infant stages, later they picked up and there has never been looking back since then. The market provided by households of India are literally main source or sometimes the only source of survival for many global brands. Colgate, Palmolive and Gillette are such examples where every day Indian is associated with these brands. The irony of this is the pandemic has changed the consumption pattern of the middle-class households. The belief that averages household spends the same irrespective of economic situations has taken a blow on its face. The tables have turned, now households are judgemental about what to spend and where to spend, above all how much to spend. The recent epidemic has taught us all a bitter lesson and the Indian middle-class households have learnt to reassign the priority list of their expenditure. This paper aims to study the CONSUMPTION PATTERN OF INDIAN MIDDLE CLASS. We will be using primary data, snowball sampling technique (structured questionnaire) for data collection.

Keywords:

Consumption Pattern, Income classification, Per capita consumption, GDP.

INTRODUCTION

The household especially average Indian household is what runs the country's economy. The consumption of the middle-class households is so sure that any business can rely on them as a permanent source of demand. Specifically, if it is a household product or FMCG. The advent of foreign goods like Maggi and Kellogg's relied on the Indian household sector for their market. Though they faced fiasco in their infant stages, later they picked up and there has never been looking back since then. The market provided by households of India are literally main source or sometimes the only source of survival for many global brands. Colgate, Palmolive and Gillette are such examples where every day Indian is associated with these brands. The irony of this is the pandemic has changed the consumption pattern of the middle-class households. The belief that average household spends the same irrespective of economic situations has taken a blow on its face. The tables have turned, now households are judgemental about what to spend and where to spend, above all how much to spend. The recent epidemic has taught us all a bitter lesson and the Indian middle-class households have learnt to reassign the priority list of their expenditure.

Defining the income tiers

The population in each country is divided into five groups: poor, low income, middle income, upper-middle income and high income. The poor live on \$2 or less daily, low income on \$2.01-\$10, middle income on \$10.01-\$20, upper-middle income on \$20.01-\$50 and high income on more than \$50. All dollar figures are expressed in 2011 prices.

The second wave of Covid-19 has left an indelible mark on India's self-image and public confidence. People are gasping even for an ounce of oxygen, while a bleak future stares at them.

According to a Pew Research Centre report, India's middle-class population shrunk by at least 32 million with 75 million people driven below the poverty line in 2020. India contributed 60 per cent to the worldwide drop in the middle-class population. This will surely impact India's already slowing economy.

Since 1990, the 20-fold rise in the middle group has set the tone of Indian economic growth. The middle-class makes up 28 per cent of the total population and 79 per cent of the total taxpayer base. It also contributes 70 per cent to the total consumer spending. It actively participates in the real estate and equity markets and promotes innovation.

However, the Covid crisis has caused a tectonic shift in the functioning of the economy. Priority consumer spending during the pandemic was a boon for the IT and pharma sectors, however, it devastated most labour intensive and consumer discretionary product industries, which together employ 30 per cent of the total population and majority of the lower middle-class.

NEO MIDDLE CLASS: DEFINITION

In India, the National Council of Applied Economic Research (NCAER) offers the utmost generally quoted guesstimates of the size and varying structure of the middle class. A NCAER report of 2010 based on household survey data projected a 7.2 percentage point growth in the ranks of the middle class (families having annual household incomes of ₹ 2-10 lakh) over the past decade to 12.8% of the population. It also recognized a class of wannabes directly below this middle class, earning between ₹ 90,000 and ₹ 2 lakh a year, and just above the ranks of the underprivileged, who earned less than ₹ 90,000 and reported for coarsely partial of the population. The ranks of the aspirers increased by 12 percentage points in the past decade to 33.9% of the total population.

LITERATURE REVIEW:

Sanghamitra (2018) Mostly the drivers of economy in a developing country turn out to be middle class people and this is the same in 2 major economies of the world, China & India. The size of the Chinese middle class being several times higher than that of India's definitely offers China an upper hand. Apart from the size of the neo middle class, their spending capacity is also great in China, whereas in India they are yet to stabilize themselves.

Vanessa & Vilma (2021) A nation's, especially a developing nation's growth is completely dependent to a great extent on the class that spends the most. In this regard, Brazil, Russia, China, South Africa and India have a huge Middle-Income class who unlike their previous generation do not intend on saving much rather they spend on different heads. This trend keeps the economy lubricated.

Xiang et al (2020) The macro-economic factors that determine the growth in GDP of a nation are Consumption, Investment, Savings and Trade. Out of all these, consumption is considered to be the most active and in fact pro active of all. The rise in consumption expenditure of any nation or region is due to its people spending, this is done mainly by the class with the greatest number of needs and ability to bear the expenses.

Jitender, Deodanker (2009) The new Middle class of India is definitely not the stereotypes. They intend to enjoy their life in a most rational way and for this rather from abstaining from spending they believe spending right at the moment will be optimal decision. This class has switched from, rental home to own flats, villas and building own houses, two wheelers to hatchback or sedan cars, government healthcare and schools to private services, cook at home to eat outs and also increased investment.

Simeon & Wilson (2011) The role played by this new generation of consumers is different from the rest of the population. They don't prioritize nor post pone their consumption, instead they borrow and spend to satisfy or fulfil their present needs. This attribute of theirs makes them prolific spenders of all the sections of income. In 2010 to 2011 march the amount spent by this emerging middle class on FMCG was whopping 53.7% out of the total amount spent on it.

Li Jian and Niu Xiaohan (2000) The economic reforms of China since the 1980s have caused a rise of national wealth, transformed the social and economic edifice and shaped a social group that many observers call China's "new rich". Some Western researchers have also identified this group as a "new middle class". The commonly believed view in China is that the middle class has risen from midst the "new white-collar workers" in joint-venture and foreign-owned enterprises, the owners-operators of small and medium-sized private enterprises and individual entrepreneurs.

Kujur & Ekka (2007) Conducted an independent study in 2005 to 2006 and established the result as that Neo Middle Income class or new middle class will not or does not play by the old rules and regulations. They rather want to spend on current consumption for present day and invest for future security. This class doesn't believe much in abstinence from consumption instead will want to spend for recreation purpose.

OBJECTIVE:

The study aims to understand the following topic:

1. The consumption structure of Neo middle class.

DATA & SAMPLE:

A questionnaire was circulated in order to obtain data. Questions were entered in a google form and the respondents were contacted through both personally and through email. Around 150 respondents were targeted, but only 63 were received. Due to financial and time constraint the questionnaires were only circulated within the respondents of Chennai.

SAMPLE DESCRIPTION

The demographic features or traits of the respondents are described as below. The targeted section of the population was Neo Middle Class Income, contrary and different from the conventional middle class. Following were observed in the collected information. The questionnaire consisted 14 questions directly and indirectly related to few chosen heads of expenditure. The paper deliberately chose the topics of consumption, like

- A) FOOD & ALLIED
- B) NON-FOOD (Education, Rent, Health Care, Fuel, Communication, Transport, Gifts and donations, self-care measures, FMCG and consumer durables)
- C) SAVINGS
- D) INVESTMENT
- E) RECREATIONAL/HOBBY

The main purpose behind clubbing of all components under non-food items is that, this study is seeing how the neo middle income class is balancing between the major heads of expenditure. 'They know what they are spending and they are indeed very calculative about it. The FMCG and consumer durables is also brought under non-food items. Electricity bill, water bill, housing EMI if any comes under Rent and Accommodation expenses.

Other than these, the data was collected for past 6 months only, then the average of the same was reported for every sample. This gave us single value and the intended objective was more or less answered.

DESCRIPTION:

Following observations were made about the respondents from the questionnaires returned by them.

a) **GENDER WISE CLASSIFICATION**

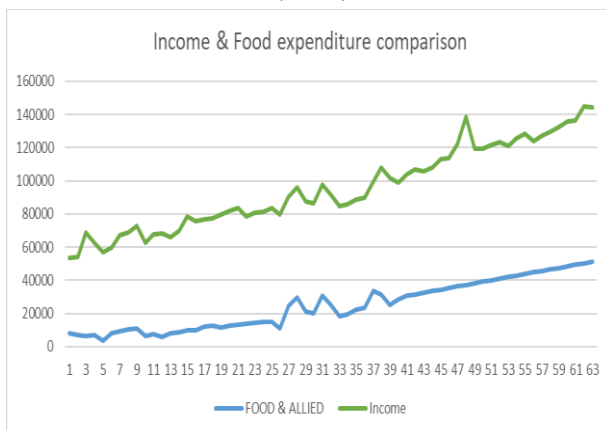
	MALE	FEMALE
MARRIED	21	14
SINGLE	15	13

b) **EMPLOYMENT TYPE (No of respondents)**

	Government	Self-Employed	Private Sector	Free Lancer
Male	7	5	21	3
Female	4	9	10	4

c) **SAVINGS TYPE (No of respondents)**

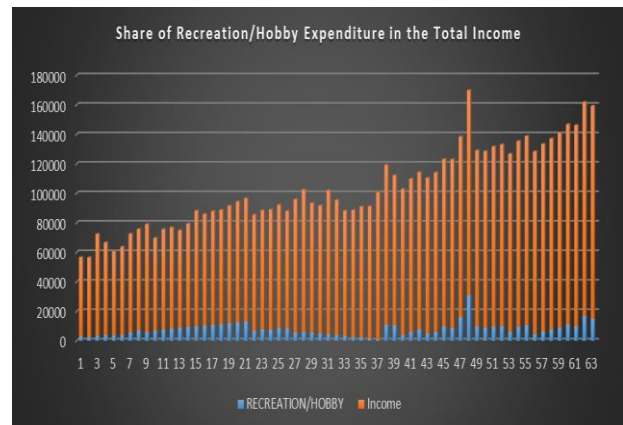
Govt Schemes	Pvt Chit Funds	Self-Savings	Local Groups
22	19	10	12

Table 1: Household Final Consumption Expenditure ('000s)

Ratio Statistics for FOOD_EXP / INCOME		
Price Related Differential	Coefficient of Dispersion	Coefficient of Variation
		Median Centered
.915	.326	36.9%

On an average around 37% of the income of a household is spent on the food and related expenditure. The coefficient of dispersion observed here is 0.326, indicating for an increase of income i.e. disposable income of a household is going to generate food related expenditure of the

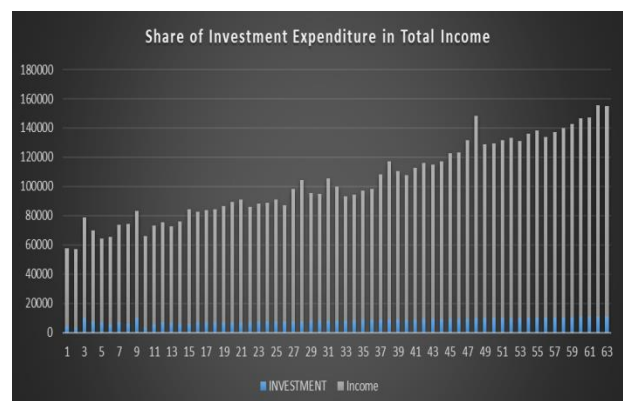
The samples gathered here are reflected in the x axis and the amount is depicted in y axis. The income and Food consumption clearly are unidirectional and the rise has been steady throughout all the samples.



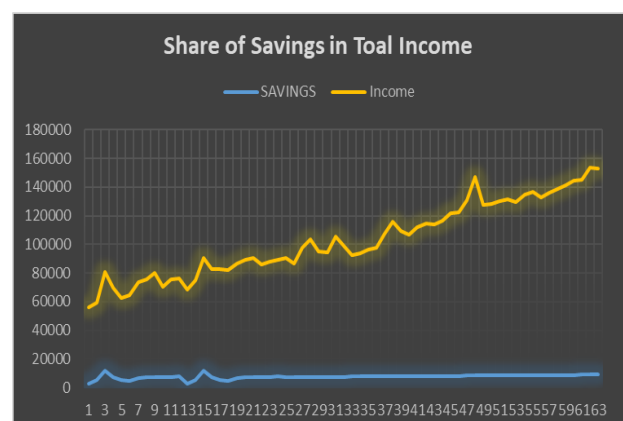
Source: Author's computation using Primary data collected

Ratio Statistics for RECREATION / INCOME

Price Related Differential	Coefficient of Dispersion	Coefficient of Variation
		Median Centered
1.006	.388	50.6%

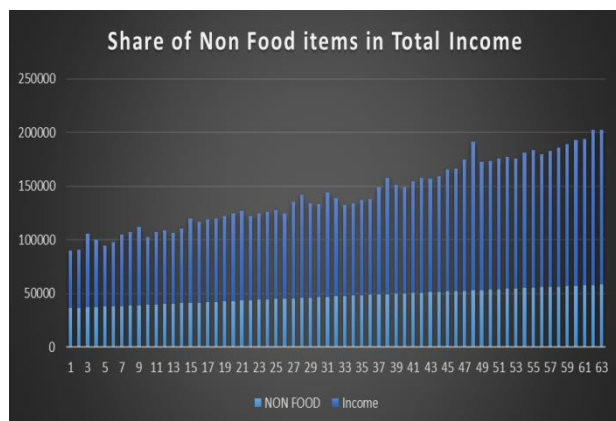
**Ratio Statistics for INVESTMENT / INCOME**

Price Related Differential	Coefficient of Dispersion	Coefficient of Variation
		Median Centered
1.017	.107	17.6%



Ratio Statistics for SAVING / INCOME

Price Related Differential	Coefficient of Dispersion	Coefficient of Variation
		Median Centered
1.036	.185	28.6%



Source: Author's computation from primary data

Ratio Statistics for NONFOOD_EXP / INCOME

Price Related Differential	Coefficient of Dispersion	Coefficient of Variation
		Median Centered
1.035	.111	13.4%

FINDINGS & CONCLUSION:

The respondents were given the right to remain private about some details that they were rounding off rather than giving specific figure. This is the direct reason to the Income column being unusual, the data was rounded off to the closest value. The income along with other values are average of 6 months' expenditure and they may or may not be the real value. All the questionnaires received from the respondents were completely different from each other. Every consumer was different from the other, so was his consumption pattern. For some people prioritized non-food expenditure like education and assets, while few people believed in living life to its fullest so never minded spending on hobbies and recreational activities.

In general, the consumption pattern of the neo middle income class is inclined towards investment and spending. Though there were some respondents who insisted on the importance of saving, majority of the new middle class were for spending in the present. Abstinence or delayed consumption was not development for many working people of age group 25 years to 40 years. This group forms the Neo middle Income age group which unanimously (more or less) agrees that investment and not savings is the optimal future plan. To conclude, this study found that the Non food expenditure occupies the highest place and major

part in the household consumption expenditure of the neo middle income group. The second and third in list being the Food and investment expenses, savings and recreation is fourth and fifth respectively in the order of priorities. This trend should be a guiding manual for future policy makers as to how and what kind of policy should cater to the major chunk of the demographic dividend.

REFERENCE:

- [1] KREI . Consumer evaluation and market revitalization strategy for Korean traditional foods. Seoul, Korea: 2006. pp. 14–23. [Google Scholar]
- [2] Changing Trends and Patterns of Food Consumption in Selected Areas Of Lakhimpur District, Assam, Urmimala Baruah, 2019
- [3] Increasing Trend Of Brand Consumption And Its Effects On Youth's Social Identity, Abd ul Waheed, Umme Kalsoom, June 2021
- [4] Consumption Patterns of Urban Household: Case in Sarimas Regency, Sukamiskin, Bandung, H Hapsari, 2019.

Consumers Perception towards Electric Vehicle - A Study

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Abstract:

Environmental challenges worldwide are forcing the automobile industry across the world to take a 360-degree shift from Internal combustion vehicles to zero contamination eco-friendlier technologies. Government of India is planning on implementing severe guidelines for use of combustion engines on account of continuously depleting ozone layer and air quality. The idea of electric vehicle is there for more a century, but because of the availability and convenience of internal combustion engines, electric vehicles was kept on hold until now. At present various factors like limited oil supply, increasing consciousness among users about the carbon footprint of conventional fuel-based engines, developments in the battery technologies and electric motors have recovered the interest in the electric vehicles. Thus a study is conducted to know the perception of customers towards electric vehicles. The study focuses on understanding the various factors that influences the purchase decision of the customers, their willingness to pay a higher price for electric vehicles and challenges faced by the users of electric vehicles. For carrying out this research study, a descriptive research design has been employed. A sample size of 112 is considered for the study.

Keywords:

Electrical Vehicle, Factor, Promotion.

INTRODUCTION

An electric vehicle (EV) is a vehicle that functions on an electric motor, whereas an internal-combustion engine functions on the power by igniting a combination of fuel and gases. Therefore, electric vehicles are considered as a potential alternative for present-generation internal combustion engines, to address the issue of increasing global warming, raising pollution, depleting natural resources etc.,

The introduction of electric vehicles in the transportation system requires a mentality change of the customers. This is because of the fact that the Electric vehicles have certain features that differ from conventional combustion engines like the initial purchase price of an electric vehicle is higher than the conventional vehicles, the battery pack is on the expensive end, limited availability of charging stations and also the limited driving range.

A complete shift towards electric vehicle will be witnessed but it may take considerable amount of time. From the past few years, electric vehicles have acquired a great deal of interest over conventional vehicles due to the expanded mindfulness among the individuals in identifying the problems caused by the combustion engines on environment. Numerous automobile manufacturers like Tata Motors, General Motors (GM), Tesla, Honda, and Toyota have begun large-scale manufacturing of combination/hybrid and electric

vehicles to answer the issues pertaining to fully fueled motorized vehicles.

REVIEW OF LITERATURE

(Goel, Sharma, & Rathore, 2021) study focused on the overview of barriers and problems of electric vehicle. In their study it was found the vehicle servicing, high capital cost, consumer perception and raw materials for batteries in market barriers, efficiency of batteries, driving range of electrical vehicle, charging time, safety and environmental factor under technical barriers, electricity traffic policy under policy, charging infrastructure, battery recycling under infrastructure barriers of electric vehicle.

(Varghese, Abhilash, & Pillai, 2021) focused on analyzing the consumer perception towards electric vehicles. The study concentrates on adverse effects of lack of charging infrastructure and driving range. The researchers concluded that the development of the battery industry, supporting charging infrastructure, and local supply chains are critical for EV adoption.

(Parmar & Pradhan, 2021) aimed to capture the views, sentiments and perception on the awareness and likeliness to buy the electric vehicles by the respondents so that sustainability in environment can be maintained. The study concluded by stating that the consumers expect changes like travel efficiency, comfort, maintenance, average and durability from E-vehicle.

(Jose, Cyriac, & Joseph, 2022) explore various factors affecting consumer willingness to adopt EV. The study uses a deep learning technique to predict the individual's willingness to spend on purchasing an EV. The study concentrated on various factors like driving range, battery capacity, technological advancements etc.,

(Tupe, Kishore, & Johnvieira, 2020) highlights that with the depletion of fossil fuels and constant hike in fuel prices, there is a need for energy transition in vehicles in India. It focuses on various initiatives taken by the government to promote EV. Researchers conclude by saying that the Government and manufacturers should join their hands to build the infrastructure and create positive environment for EVs.

(Khurana, Kumar, & Sidhpuria, 2019) their study focused to examine the factors that influence adoption Electrical vehicle. The result shows that perceived economic benefit is not related to behavioral intention to adopt electric vehicle but has a strong positive effect to attitude.

(Bhalla, Ali, & Nazneen, 2018) analyzes the factors influencing the consumer acceptance of these EVs. According to researchers' various factors that influence

the purchase decision of buyers are individual perception on dimensions like environmental issues, cost, trust, technological advancement, infrastructure, and societal acceptance. The results of the study show that environmental concerns and consumer trust on technology are prime factor for perception about Electric vehicle purchase and the factors which give adoption blow back are cost, infrastructure, social acceptance. The researchers conclude that the government has to play a key role to promote EV.

(Ghasr, Ardeshiri, & Rashidi, 2019) concludes that consumers' perception towards EV's benefits has a significant impact on their purchase decision. Here researchers define that the perceived advantage is the reflection of individual's perception towards the concept of EV. The study concludes that the perception is gradually formed by acquiring knowledge and experience from the technology, and wouldn't change noticeably by a change in features of available alternatives.

OBJECTIVE OF THE STUDY

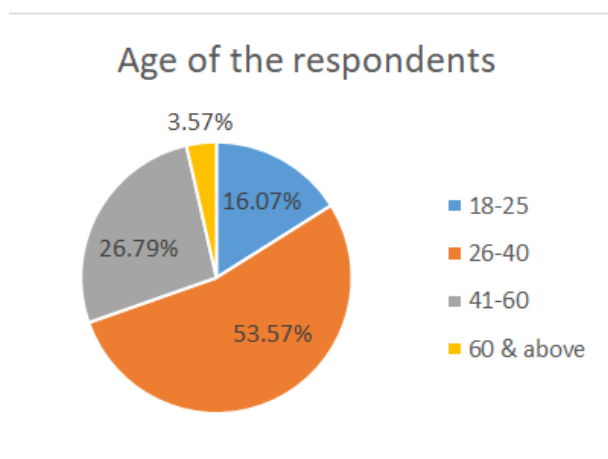
- To study the perception of consumers towards electric vehicles
- To study the factors influencing the buying behavior of consumers towards electric vehicles

RESEARCH METHODOLOGY

For carrying out this research study, a descriptive research design has been employed. A sample size of 112 is considered for the study. Both primary data and secondary is used.

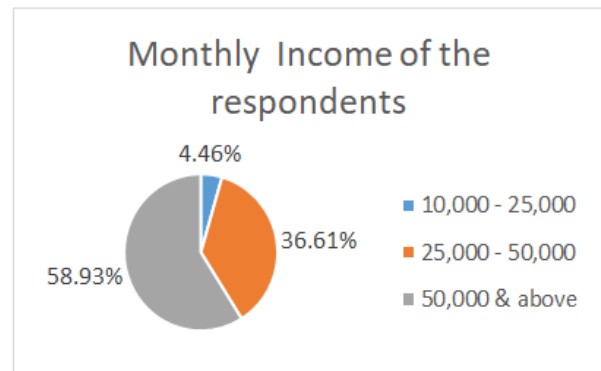
DATA ANALYSIS

Graph 1 showing age of the respondents



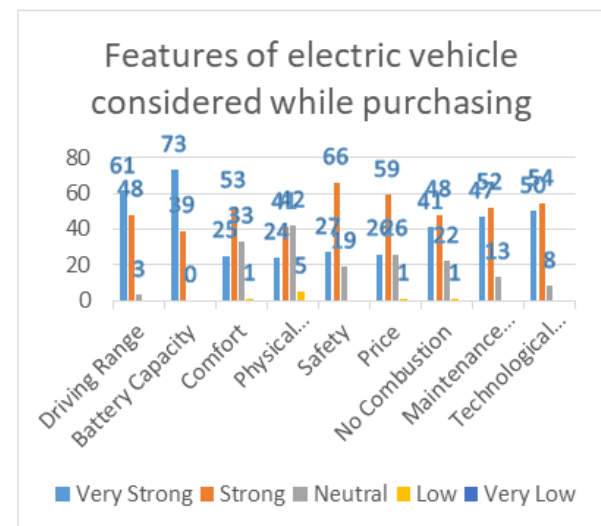
From the above graph it is observed that 54% of the respondents belong to 26-40 age group, followed by 41-60, 18-25 and 60 and above age group.

Graph 2 showing monthly income of the respondents



The above graph shows that 59% of the respondent's monthly income is 50,000 and above, 37% belongs to 25,000 to 50,000 and 4% of the respondent's monthly income is 10,000 to 25,000.

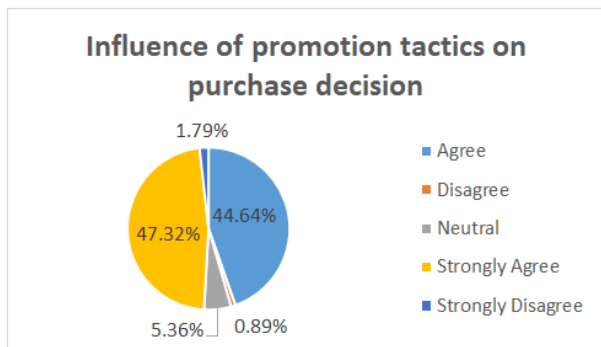
Graph 3 showing features considered while purchasing electric vehicle



Among different features of the electric vehicle, 73% of the respondents consider battery capacity and 61% of the respondents consider battery driving range as the most important factor while purchasing an electric vehicle.

Safety, price of the electric vehicle, maintenance cost and technological features of the vehicle are also given importance while purchasing an electric vehicle. Majority of the respondents did not consider the physical appearance as an influencing factor while making purchase decision. This shows that customers are concerned about the battery life and about the distance they can travel once the battery is fully charged. Price of the electric vehicle, maintenance cost and technological features are also considered a strong influence when buying an electric vehicle.

Graph 4 showing influence of promotion tactics on purchase decision



Automobile companies use various promotions tactics to promote the sale of electric vehicles. A majority of the respondents consider these promotion tactics to be useful in making a purchase decision. Around 8 percent respondents feel promotion tactics has no influence on their purchase decision.

HYPOTHESIS TESTING

H₀: There is no significant influence of promotion tactics of the electric vehicle company on the purchase intention of the respondents.

H_A: There is a significant influence of promotion tactics of the electric vehicle company on the purchase intention of the respondents.

Correlations

		Would you consider purchasing an electric vehicle in the near future	Promotion tactics used by electric vehicle companies influence my buying decision
Would you consider purchasing an electric vehicle in the near future	Pearson Correlation Sig. (2-tailed) N	1 112	.628* .002 112
Promotion tactics used by electric vehicle companies influence my buying decision	Pearson Correlation Sig. (2-tailed) N	.628* .003 112	1 112

*. Correlation is significant at the 0.01 level (2-tailed).

Interpretation:

From the above table, the significance level is 0.003, which is less than the level of significance at 1% (0.01), Hence we reject the null hypothesis (H₀) and accept the alternate hypothesis. Here the correlation between the promotion tactics and purchase decision is 0.628 which implies that the variables have a positive correlation between them. Since the correlation coefficient is 0.628, the variables are strongly correlated to each other. Hence, we can conclude that the promotion tactics used by the electric vehicle company has an influence on the purchase decision of the respondents.

CONCLUSION

The analysis of the survey clearly shows that the majority of the respondents are conscious of the environmental advantages of these electric vehicles. Since sustainability is one of the critical concerns to be addressed and electric vehicles is expected to help in reduction of carbon footprint as carbon emission in electric vehicle is almost negligible when compared to a conventional fuel-based vehicle. Along with manufacturers, Government should strive hard and bring in more initiatives to spread awareness about the benefits of using electric vehicles and leverage positive opinion about electric vehicles among potential customers.

BIBLOGRAHPY

- [1] Khurana, A., Kumar, V., & Sidhpuria, M. (2019). A Study on the Adoption of Electric Vehicles in India: The Mediating Role. *Vision*, 24(1), 23-34.
- [2] Bhalla, P., Ali, I. S., & Nazneen, A. (2018). A Study of Consumer Perception and Purchase Intention of Electric Vehicles. *European Journal of Scientific Research*.
- [3] Goel, S., Sharma, R., & Rathore, A. K. (2021). A review on barrier and challenges of electric vehicle in India and vehicle to grid optimisation. *Transportation Engineering*, 4, 1-14.
- [4] Jose, S. P., Cyriac, S., & Joseph, B. (2022). CONSUMER ATTITUDE AND PERCEPTION TOWARDS . *Academy of Marketing Studies Journal*.
- [5] Parmar, A., & Pradhan, P. T. (2021). A study on Consumer perception towards e-vehicle in Vadodara City. *IJCRT*.
- [6] Tupe, O., Kishore, P. S., & Johnvieira, D. A. (2020). Consumer perception of Electric vehicles in India. *European Journal of Molecular & Clinical Medicine*.
- [7] Varghese, A. T., Abhilash, V., & Pillai, S. V. (2021). A Study on Consumer Perception and Purchase Intention of EElectric Vehicles in India. *AJEFM*.

Use of Complex Fuzzy Matrices in the Diagnosis of Gestational Diabetes, Gestational Anemia and Gestational Hypertension

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Abstract:

Pregnancy is the most exciting and blessing time for any women. At the time of pregnancy, several health issues may develop even in healthy women also. Almost 90 % of such health issues can be easily detected and prevented during the time of prenatal visits. Three most common health complications that occur during pregnancy time are diabetes, high blood pressure and anemia. But uncontrolled gestational diabetes increases the risk of preterm delivery and health of the baby. The diagnosis has a lot of confounding alternatives. So, through this paper we use the concept of complex fuzzy matrices and data we presented a new fuzzy mathematical method for the medical diagnosis of these gestational diseases. We apply the concept of relation matrices and modified the algorithm for enhance the precision in the diagnostic process. An example is also illustrated to verify the developed procedure.

Index Terms:

Complex Fuzzy Sets; Complex Fuzzy Matrices; Relation Matrix; Comparison Matrix; Diabetes; Anemia; Hypertension.

INTRODUCTION

Zadeh [1] was the founder of the concept of fuzzy set theory about 1965. The most important and interesting areas of applications of the theory of fuzzy set are the field of medicine and treatment. Fuzzy matrices are now very rich topic in modeling situations including uncertainty occurred in science, treatments, medical diagnosis, automata etc.

Fuzzy matrices were introduced by Thomson [2] in 1977 and these concepts was developed by Kim and Roush [3]. K. T Atanassov [4] was the founder of the notion intuitionistic fuzzy sets, which providing a flexible model to elaborate uncertainty and vagueness in decision making problems. The concept of fuzzy matrices is used in almost all the branches of science. Fuzzy matrices are a better implement for modelling different problems occurring in uncertain situations in different fields of science like computer science, robotics, medical science, artificial intelligence and may others.

In 2002, Ramot et. al [5] defined the Complex Fuzzy sets as a generalization of fuzzy sets whose co domain is not restricted to $[0, 1]$, but it is expanded on the unit disc in the complex plane (the set of all complex numbers with modulus ≤ 1).

Ramot[5] used the idea of complex degree of membership in polar coordinating, where the amplitude is the degree of an object of the Complex Fuzzy Set and

the role of phase is to add information which is related to spatial or temporal periodicity of the specific fuzzy set. In 2015, Zhi- Quig Zaho and Shong-Quan Ma [7], were introduced the concept of complex fuzzy matrices.

Fuzzy mathematics is a powerful tool for modelling medical diagnosis process. By the use of complex fuzzy matrices, we presented a new algorithm which will make the medical diagnosis more precise.

PRELIMINARIES

A. Complex Fuzzy Set

A complex fuzzy set defined on the universe of discourse U , is characterized by a membership function $\mu_A(x)$, that assign any element $a \in A$ a complex valued grade of membership in A .

By definition, the value $\mu_A(x)$ may receive all lie within the unit circle in the complex plane, and are thus of the form $r_A(x)e^{i\omega_A(x)}$, $i = \sqrt{-1}$, $r_A(x)$ and $\omega_A(x)$ both real valued $r_A(x) \in [0, 1]$ and $\omega_A(x) \in [0, 2\pi)$ the complex fuzzy set may be represented as the set of ordered pairs.

$$A = \{(x, \mu_A(x)) : x \in U\}$$

B. Remark

If we consider [2] the average sunspot number of the year 1800. During the minimum solar activity, there are only few sunspots, and during the maximum solar activity there are so any sunspots. Using the findings of Ramot, the complex fuzzy sets are used to give information related to the monthly solar activity and also its position in the unit circle. Using the idea of complex fuzzy sets, the position in the unit cycle is represented by the phase variable, a real function, and is not a degree of membership and the solar activity for a particular month is represented by the degree of membership in a fuzzy set.

Let us consider an example, the complex fuzzy set induced by the assertion, "high solar activity". As we noted, if the cycle length is 11 years; it begins from a solar minimum move through a solar maximum and end at the next solar minimum. Let 0 be the initial point, let π be the solar maximum and 2π be the next solar minimum. Suppose the traditional grade of membership of a particular month M_i in the set with "high solar activity" is 0.6 and we assumed that the particular month is at the peak of solar activity for the cycle, then the complex grade of membership is denoted by $0.6e^{i\pi}$. On the other hand, M_j is characterized by the complex grade

of membership $0.6e^{\frac{i\pi}{2}}$, then we can say that the month M_j is in the increasing process of solar activity and it is in medium active.

C. Complex Fuzzy Matrices

A complex fuzzy matrix is a matrix which has its elements from the unit ball in the complex plane.

A complex fuzzy matrix A of order $m \times n$ is defined as $A = [\langle a_{ij}, a_{ij\mu} \rangle]_{m \times n}$, where $a_{ij\mu} = r_A(x)e^{i\omega_A(x)}$, where $r_A(x) \in [0,1]$ and $\omega_A(x) \in [0,2\pi)$.

D. Relative Values

We can say that, the relative values depend on other values. Here we use the following equation to find the relative values from the known values.

$$r_{ij} = \left(f \left(\frac{P_i}{d_j} \right) \right)_{i=1,2,3,4,5,\dots, j=1,2,3,4,5,\dots}$$

E. Comparison Matrix

A comparison matrix helps to compare attributes and characteristics of items and helps us to conclude the comparative and relative study. Here we use the following method to create the comparison matrix using the relative values.

Comparison matrix,

$$R = [r_{ij}]; r_{ij} = \left(f \left(\frac{P_i}{d_j} \right) \right)_{i=1,2,3,4,5,\dots, j=1,2,3,4,5,\dots}$$

Use of Complex Fuzzy Matrices in the Diagnosis of Gestational Diabetes, Gestational Anemia and Gestational Hypertension

Pregnancy is the most exciting and blessing time for any women. At the time of pregnancy, several health issues may develop even in healthy women also. Almost 90 % of such health issues can be easily detected and prevented during the time of prenatal visits. Three most common health complications that occur during pregnancy time are diabetes, high blood pressure and anemia.

Gestational diabetes is a condition in which the blood sugar level become higher. Usually, gestational diabetes develops in the second trimester of pregnancy and will most often returns to normal soon after delivery. Gestational diabetes can be controlled by certain dietary changes. In some cases, use of insulin is, the best remedy for maintain the blood sugar level normal. But uncontrolled gestational diabetes increases the risk of preterm delivery, large sized baby, C- section, newborn with low blood sugar level, breathing difficulties and jaundice.

Gestational hypertension is a form of high blood sugar level during pregnancy. Gestational hypertension can be diagnosed when the blood pressure level is higher tat 140/90 mm Hg. There are several difficulties occur as a result of severe gestational hypertension (more than 160/110 mm Hg), such as premature detachment of placenta from the uterus, some fetal health problems,

poor fetal growth, stillbirth. If gestational hypertension leaves untreated may cause the death of mother and the fetus also.

Gestational anemia is a common public health issue in India. Gestational anemia is characterized by the low oxygen carrying capacity of the blood during pregnancy. Main causes of gestational anemia are iron deficiency, vitamin B12 deficiency and folate deficiency. Severe or untreated gestational anemia may increase the risks of preterm or low birth weight baby, blood transfusion, postpartum depression, a baby with anemia and a child with developmental delays. The diagnosis has a lot of confounding alternatives. Therefore, the planning of treatment procedure is based on the study of combinations of variables with complex outcomes. At first, we consider various symptoms as the input variable with their membership functions. In second step, we use the concept of complex fuzzy sets and complex fuzzy matrices to identify the disease.

The input variables are: -

1. Headache- d_1
2. Fatigue - d_2
3. Dizziness - d_3
4. Blurred Vision - d_4
5. Chest Pain- d_5
6. Difficulty in Breathing- d_6
7. Excessive Thirst - d_7
8. Excessive Hunger - d_8
9. Weight Loss/ Gain - d_9
10. Tiredness - d_{10}
11. Pale Skin - d_{11}
12. Nausea - d_{12}

While considering these input variables, we assign some range for defining membership values for these input variables. That is, headache ranges between 0 – 4. Similarly for all the remaining variables we have no specific measurement methods or instruments for all the input variables. So, we assign a range from 0 to 5 to define its membership function. For example, let us consider the variable d_{10} , tiredness of a particular patient. If the patient doesn't feel lethargic or she feels healthy, we can say that her d_{10} input variable value is in the lower range. So, we choose his d_2 input variable value in the range 0 – 2 depending on her physical conditions. Similarly, we give 2 – 3 grade value if the patient experiences mild fatigue or lethargy. That is, we can say that her d_{10} input variable value is in the medium range. Or if the patient feels very tired or she is unable to do her job or she feels fatigue, we will give the grade value in 3 – 4 range depending on her physical condition. That is, we can say that her d_{10} input variable value is in the severe range. Similar argument can be use in another input variables.

i. Headache d_1

The d_1 variable stands for the headache which ranges from 0 to 4.

When d_2 range $0 \leq x \leq 1$ means that, the patient has occasional headache. We use the phase value 0 to represent the range.

When d_2 range is $1 - 2$ means that, the patient has continuous mild headache. We use the phase value $\frac{2\pi}{4} = \frac{\pi}{2}$ to represent the particular range.

When d_1 range $2 \leq x \leq 3$ means that, the patient has headache daily.

We use the phase value $\frac{4\pi}{4} = \pi$ to represent the particular range.

When d_1 range $3 \leq x \leq 4$ means that, the patient has continuous severe headache. We use the phase value $\frac{6\pi}{4} = \frac{3\pi}{2}$ to represent the particular range.

The defined membership functions are,

$$\mu_{d_1}(x) = \begin{cases} 0 & : 0 \leq x \leq 1 \\ \frac{2-x}{2} & : 1 < x < 2 \\ \frac{3-x}{2} & : 2 \leq x < 3 \\ 1 & : 3 \leq x \leq 4 \end{cases}$$

$$= \begin{cases} 0e^{i0} & \\ \frac{2-x}{2}e^{i\frac{\pi}{2}} & \\ \frac{3-x}{2}e^{i\pi} & \\ 1e^{i\frac{3\pi}{2}} & \end{cases}$$

ii. Fatigue- d_2

The d_3 variable stands for the dizziness which ranges from 0 to 5.

When d_3 range $0 \leq x \leq 1$ means that the patient has no or slight dizziness, we use the phase value 0 to represent the range.

When d_3 range is $1 - 3$ the patient has medium dizziness, we use the phase value $\frac{2\pi}{3}$ to represent the particular range.

When d_3 range $3 \leq x \leq 5$ the patient has intense dizziness, we use the phase value $\frac{4\pi}{3}$ to represent the particular range.

The defined membership functions are,

$$\mu_{d_3}(x) = \begin{cases} 0 & 0 \leq x \leq 1 \\ \frac{(3-x)}{2} & 1 < x < 2 \\ 1 & 2 \leq x \leq 3 \end{cases}$$

$$= \begin{cases} 0e^{i0} & \\ \frac{(2-x)}{2}e^{i\frac{2\pi}{3}} & \\ 1e^{i\frac{4\pi}{3}} & \end{cases}$$

Similarly, all other input variable range is 0 to 3, so we can use the same membership function such that,

$$\mu_{d_i}(x) = \begin{cases} 0 & 0 \leq x \leq 1 \\ \frac{(2-x)}{2} & 1 < x < 2 \\ 1 & 2 \leq x \leq 3 \end{cases}$$

$$= \begin{cases} 0e^{i0} & \\ \frac{(2-x)}{2}e^{i\frac{2\pi}{3}} & ; \text{ for } i = 4,5,6,7,8,9,10,11,12 \\ 1e^{i\frac{4\pi}{3}} & \end{cases}$$

REMARK

In all the membership functions of each fuzzy sets mentioned above, we introduced the phase value to represent the position of that particular input variable in that fuzzy set along with its degree of membership. For complex fuzzification So that all the above defined fuzzy sets become complex fuzzy sets. This aspect helps us to use the concept of complex fuzzy matrices and which is very helpful in the further developments of decision support system.

Suppose that for a patient say P_1 she feels continuous mild headache, then the membership value become $d_1 = 0.75e^{i\frac{\pi}{4}}$, obtained by substituting the value 1.5 in the corresponding membership function.

$$\text{Fatigue} = 2.8 \Rightarrow d_2 = 0.1e^{i\frac{2\pi}{3}}$$

$$\text{Dizziness} = 0.5 \Rightarrow d_3 = 0e^{i0}$$

$$\text{Blurred vision} = 1.5 \Rightarrow d_4 = 0.75e^{i\frac{2\pi}{3}}$$

$$\text{Chest pain} = 2.9 \Rightarrow d_5 = 0.05e^{i\frac{2\pi}{3}}$$

$$\text{Difficulty in breathing} = 0.6 \Rightarrow d_6 = 0e^{i0}$$

$$\text{Excessive thirst} = 2.1 \Rightarrow d_7 = 1e^{i\frac{4\pi}{3}}$$

$$\text{Excessive hunger} = 2.5 \Rightarrow d_8 = 0.25e^{i\frac{2\pi}{3}}$$

$$\text{Weight loss/ gain} = 0.3 \Rightarrow d_9 = 0e^{i0}$$

$$\text{Tiredness} = 4 \Rightarrow d_{10} = 1e^{i\frac{4\pi}{3}}$$

$$\text{Pale skin} = 2.1 \Rightarrow d_{11} = 0.45e^{i\frac{2\pi}{3}}$$

$$\text{Nausea} = 0.5 \Rightarrow d_{12} = 0e^{i0}$$

Then the first-row matrix for the patient P_1 is

$$P_1 \rightarrow \begin{bmatrix} 0.75e^{i\frac{\pi}{4}} \\ 0.1e^{i\frac{2\pi}{3}} \\ 0e^{i0} \\ 0.75e^{i\frac{2\pi}{3}} \\ 0.05e^{i\frac{2\pi}{3}} \\ 0e^{i0} \\ 1e^{i\frac{4\pi}{3}} \\ 1e^{i\frac{4\pi}{3}} \\ 1e^{i\frac{4\pi}{3}} \\ 1e^{i\frac{4\pi}{3}} \\ 0.25e^{i\frac{2\pi}{3}} \\ 0.75e^{i\frac{2\pi}{3}} \\ 1e^{i\frac{4\pi}{3}} \end{bmatrix}$$

Suppose that for a patient say P_2 she feels headache daily, then the membership value become $d_1 = 0.5e^{i\frac{2\pi}{3}}$, obtained by substituting the value in 2 the corresponding membership function.

$$\text{Fatigue} = 0.75 \Rightarrow d_2 = 0e^{i0}$$

$$\text{Dizziness} = 3.5 \Rightarrow d_3 = 1e^{i\frac{4\pi}{3}}$$

$$\text{Blurred vision} = 2.8 \Rightarrow d_4 = 0.1e^{i\frac{2\pi}{3}}$$

$$\text{Chest pain} = 4 \Rightarrow d_5 = 1e^{i\frac{4\pi}{3}}$$

$$\text{Difficulty in breathing} = 1.5 \Rightarrow d_6 = 0.75e^{i\frac{2\pi}{3}}$$

$$\text{Excessive thirst} = 3.9 \Rightarrow d_7 = 1e^{i\frac{4\pi}{3}}$$

$$\text{Excessive hunger} = 2.5 \Rightarrow d_8 = 0.25e^{i\frac{2\pi}{3}}$$

$$\text{Weight loss/ gain} = 4.5 \Rightarrow d_9 = 1e^{i\frac{4\pi}{3}}$$

$$\text{Tiredness} = 0.5 \Rightarrow d_{10} = 0e^{i0}$$

$$\text{Pale skin} = 4.5 \Rightarrow d_{11} = 1e^{i\frac{4\pi}{3}}$$

$$\text{Nausea} = 3.6 \Rightarrow d_{12} = 1e^{i\frac{4\pi}{3}}$$

Then the second-row matrix for the patient P_2 is

$$P_2 \rightarrow \begin{bmatrix} 0.5e^{i\frac{2\pi}{3}} \\ 0e^{i0} \\ 0e^{i0} \\ 0.1e^{i\frac{2\pi}{3}} \\ 1e^{i\frac{4\pi}{3}} \\ 0.75e^{i\frac{2\pi}{3}} \\ 1e^{i\frac{4\pi}{3}} \\ 0.25e^{i\frac{2\pi}{3}} \\ 1e^{i\frac{4\pi}{3}} \\ 0e^{i0} \\ 1e^{i\frac{4\pi}{3}} \\ 1e^{i\frac{4\pi}{3}} \end{bmatrix}$$

Suppose that for a patient say P_3 , she feels head ache occasionally, then, $d_1 = 0e^{i0}$ obtained by substituting 0.3 in the membership function.

$$\text{Fatigue} = 3 \Rightarrow d_2 = 1e^{i\frac{4\pi}{3}}$$

$$\text{Dizziness} = 2.5 \Rightarrow d_3 = 0.25e^{i\frac{2\pi}{3}}$$

$$\text{Blurred vision} = 2 \Rightarrow d_4 = 0.5e^{i\frac{2\pi}{3}}$$

$$\text{Chest pain} = 3.9 \Rightarrow d_5 = 1e^{i\frac{4\pi}{3}}$$

$$\text{Difficulty in breathing} = 4.2 \Rightarrow d_6 = 1e^{i\frac{4\pi}{3}}$$

$$\text{Excessive thirst} = 2.9 \Rightarrow d_7 = 0.5e^{i\frac{2\pi}{3}}$$

$$\text{Excessive hunger} = 4.6 \Rightarrow d_8 = 1e^{i\frac{4\pi}{3}}$$

$$\text{Weight loss/ gain} = 1.3 \Rightarrow d_9 = 0.85e^{i\frac{2\pi}{3}}$$

$$\text{Tiredness} = 1 \Rightarrow d_{10} = 0e^{i0}$$

$$\text{Pale skin} = 4.4 \Rightarrow d_{11} = 1e^{i\frac{4\pi}{3}}$$

$$\text{Nausea} = 2.1 \Rightarrow d_{12} = 0.45e^{i\frac{2\pi}{3}}$$

Then the third-row matrix for the patient P_3 is

$$P_3 \rightarrow \begin{bmatrix} 0e^{i0} \\ 1e^{i\frac{4\pi}{3}} \\ 0.25e^{i\frac{2\pi}{3}} \\ 0.5e^{i\frac{2\pi}{3}} \\ 1e^{i\frac{4\pi}{3}} \\ 1e^{i\frac{4\pi}{3}} \\ 0.5e^{i\frac{2\pi}{3}} \\ 1e^{i\frac{4\pi}{3}} \\ 0.85e^{i\frac{2\pi}{3}} \\ 0e^{i0} \\ 1e^{i\frac{4\pi}{3}} \\ 0.45e^{i\frac{2\pi}{3}} \end{bmatrix}$$

Similarly, we can find the 9 remaining row matrices for each of the patients, by substituting the range values in the corresponding membership functions.

$$P_4 \rightarrow \begin{bmatrix} 0.15e^{i\frac{2\pi}{3}} \\ 0e^{i0} \\ 0.5e^{i\frac{2\pi}{3}} \\ 0.5e^{i\frac{2\pi}{3}} \\ 0.33e^{i\frac{2\pi}{3}} \\ 0e^{i0} \\ 0.45e^{i\frac{2\pi}{3}} \\ 0e^{i0} \\ 0.25e^{i\frac{2\pi}{3}} \\ 1e^{i\frac{4\pi}{3}} \\ 1e^{i\frac{4\pi}{3}} \\ 0.15e^{i\frac{2\pi}{3}} \end{bmatrix}, P_5 \rightarrow \begin{bmatrix} 1e^{i\frac{4\pi}{3}} \\ 1e^{i\frac{4\pi}{3}} \\ 0e^{i0} \\ 0e^{i0} \\ 0.5e^{i\frac{2\pi}{3}} \\ 0.5e^{i\frac{2\pi}{3}} \\ 0.5e^{i\frac{2\pi}{3}} \\ 0e^{i0} \\ 0e^{i0} \\ 1e^{i\frac{4\pi}{3}} \\ 1e^{i\frac{4\pi}{3}} \\ 0e^{i0} \end{bmatrix}, P_6 \rightarrow \begin{bmatrix} 0.35e^{i\frac{2\pi}{3}} \\ 0.2e^{i\frac{2\pi}{3}} \\ 0.74e^{i\frac{2\pi}{3}} \\ 0.66e^{i\frac{2\pi}{3}} \\ 0e^{i0} \\ 0e^{i0} \\ 0e^{i0} \\ 0e^{i0} \\ 0.5e^{i\frac{2\pi}{3}} \\ 0.5e^{i\frac{2\pi}{3}} \\ 1e^{i\frac{4\pi}{3}} \\ 1e^{i\frac{4\pi}{3}} \end{bmatrix}, P_7 \rightarrow$$

$$\begin{bmatrix} 1e^{i\frac{4\pi}{3}} \\ 1e^{i\frac{4\pi}{3}} \\ 0.5e^{i\frac{2\pi}{3}} \\ 0.5e^{i\frac{2\pi}{3}} \\ 1e^{i\frac{4\pi}{3}} \\ 0.9e^{i\frac{2\pi}{3}} \\ 0.23e^{i\frac{2\pi}{3}} \\ 1e^{i\frac{4\pi}{3}} \\ 0.5e^{i\frac{2\pi}{3}} \\ 0.5e^{i\frac{2\pi}{3}} \\ 0.5e^{i\frac{2\pi}{3}} \\ 0.5e^{i\frac{2\pi}{3}} \end{bmatrix}, P_8 \rightarrow \begin{bmatrix} 0.013e^{i\frac{2\pi}{3}} \\ 0e^{i0} \\ 1e^{i\frac{4\pi}{3}} \\ 1e^{i\frac{4\pi}{3}} \\ 1e^{i\frac{4\pi}{3}} \\ 1e^{i\frac{4\pi}{3}} \\ 1e^{i\frac{4\pi}{3}} \\ 1e^{i\frac{4\pi}{3}} \\ 0.23e^{i\frac{2\pi}{3}} \\ 0.3e^{i\frac{2\pi}{3}} \\ 0.5e^{i\frac{2\pi}{3}} \\ 0e^{i0} \end{bmatrix}$$

$$P_9 \rightarrow \begin{bmatrix} 1e^{i\frac{4\pi}{3}} \\ 0e^{i0} \\ 0e^{i0} \\ 0e^{i0} \\ 0.5e^{i\frac{2\pi}{3}} \\ 0.11e^{i\frac{2\pi}{3}} \\ 0e^{i0} \\ 0.75e^{i\frac{2\pi}{3}} \\ 0.13e^{i\frac{2\pi}{3}} \\ 0.5e^{i\frac{2\pi}{3}} \\ 1e^{i\frac{4\pi}{3}} \\ 0e^{i0} \end{bmatrix}, P_{10} \rightarrow \begin{bmatrix} 1e^{i\frac{4\pi}{3}} \\ 0.9e^{i\frac{2\pi}{3}} \\ 0.23e^{i\frac{2\pi}{3}} \\ 1e^{i\frac{4\pi}{3}} \\ 0e^{i0} \\ 0e^{i0} \\ 0e^{i0} \\ 0.5e^{i\frac{2\pi}{3}} \\ 0.5e^{i\frac{2\pi}{3}} \\ 0.5e^{i\frac{2\pi}{3}} \\ 0e^{i0} \\ 0e^{i0} \end{bmatrix}, P_{11}$$

$$\rightarrow \begin{bmatrix} 1e^{i\frac{4\pi}{3}} \\ 0e^{i0} \\ 1e^{i\frac{4\pi}{3}} \\ 1e^{i\frac{4\pi}{3}} \\ 0.5e^{i\frac{2\pi}{3}} \\ 1e^{i\frac{4\pi}{3}} \\ 0e^{i0} \\ 0.5e^{i\frac{2\pi}{3}} \\ 1e^{i\frac{4\pi}{3}} \\ 0.5e^{i\frac{2\pi}{3}} \\ 0e^{i0} \\ 0.5e^{i\frac{2\pi}{3}} \end{bmatrix}, P_{12} \rightarrow \begin{bmatrix} 1e^{i\frac{4\pi}{3}} \\ 0e^{i0} \\ 0.5e^{i\frac{2\pi}{3}} \\ 0e^{i0} \\ 0.5e^{i\frac{2\pi}{3}} \\ 0e^{i0} \\ 0e^{i0} \\ 1e^{i\frac{4\pi}{3}} \\ 1e^{i\frac{4\pi}{3}} \\ 0.5e^{i\frac{2\pi}{3}} \\ 1e^{i\frac{4\pi}{3}} \\ 1e^{i\frac{4\pi}{3}} \end{bmatrix}$$

Hence, the patient- symptom complex fuzzy matrix is given by,

$$S = \begin{bmatrix} 0.75e^{i\frac{\pi}{2}} & 0.1e^{i\frac{2\pi}{3}} & 0e^{i0} & 0.75e^{i\frac{2\pi}{3}} & 0.05e^{i\frac{2\pi}{3}} & 0e^{i0} & 1e^{i\frac{4\pi}{3}} & 1e^{i\frac{4\pi}{3}} & 1e^{i\frac{4\pi}{3}} & 0.25e^{i\frac{2\pi}{3}} & 0.75e^{i\frac{2\pi}{3}} \\ 0.5e^{i\frac{\pi}{2}} & 0e^{i0} & 0e^{i0} & 0.1e^{i\frac{2\pi}{3}} & 1e^{i\frac{4\pi}{3}} & 0.75e^{i\frac{2\pi}{3}} & 1e^{i\frac{4\pi}{3}} & 0.25e^{i\frac{2\pi}{3}} & 1e^{i\frac{4\pi}{3}} & 0e^{i0} & 1e^{i\frac{4\pi}{3}} \\ 0e^{i0} & 1e^{i\frac{4\pi}{3}} & 0.25e^{i\frac{2\pi}{3}} & 0.5e^{i\frac{2\pi}{3}} & 1e^{i\frac{4\pi}{3}} & 1e^{i\frac{4\pi}{3}} & 0.5e^{i\frac{2\pi}{3}} & 1e^{i\frac{4\pi}{3}} & 0.85e^{i\frac{2\pi}{3}} & 0e^{i0} & 1e^{i\frac{4\pi}{3}} \\ 0.1e^{i\frac{\pi}{2}} & 0e^{i0} & 0.5e^{i\frac{2\pi}{3}} & 0.5e^{i\frac{2\pi}{3}} & 0.33e^{i\frac{2\pi}{3}} & 0e^{i0} & 0.45e^{i\frac{2\pi}{3}} & 0e^{i0} & 0.25e^{i\frac{2\pi}{3}} & 1e^{i\frac{4\pi}{3}} & 1e^{i\frac{4\pi}{3}} \\ 1e^{i\frac{3\pi}{4}} & 1e^{i\frac{4\pi}{3}} & 0e^{i0} & 0e^{i0} & 0.5e^{i\frac{2\pi}{3}} & 0.5e^{i\frac{2\pi}{3}} & 0.5e^{i\frac{2\pi}{3}} & 0e^{i0} & 1e^{i\frac{4\pi}{3}} & 1e^{i\frac{4\pi}{3}} & 0e^{i0} \\ 0.35e^{i\frac{\pi}{2}} & 0.2e^{i\frac{2\pi}{3}} & 0.74e^{i\frac{2\pi}{3}} & 0.66e^{i\frac{2\pi}{3}} & 0e^{i0} & 0e^{i0} & 0e^{i0} & 0e^{i0} & 0.5e^{i\frac{2\pi}{3}} & 0.5e^{i\frac{2\pi}{3}} & 1e^{i\frac{4\pi}{3}} \\ 1e^{i\frac{3\pi}{4}} & 1e^{i\frac{4\pi}{3}} & 0.5e^{i\frac{2\pi}{3}} & 0.5e^{i\frac{2\pi}{3}} & 1e^{i\frac{4\pi}{3}} & 0.9e^{i\frac{2\pi}{3}} & 0.23e^{i\frac{2\pi}{3}} & 1e^{i\frac{4\pi}{3}} & 0.5e^{i\frac{2\pi}{3}} & 0.5e^{i\frac{2\pi}{3}} & 0.5e^{i\frac{2\pi}{3}} \\ 0.013e^{i\frac{\pi}{2}} & 0e^{i0} & 1e^{i\frac{4\pi}{3}} & 1e^{i\frac{4\pi}{3}} & 1e^{i\frac{4\pi}{3}} & 1e^{i\frac{4\pi}{3}} & 1e^{i\frac{4\pi}{3}} & 1e^{i\frac{4\pi}{3}} & 0.23e^{i\frac{2\pi}{3}} & 0.3e^{i\frac{2\pi}{3}} & 0.5e^{i\frac{2\pi}{3}} \\ 1e^{i\frac{3\pi}{4}} & 0e^{i0} & 0e^{i0} & 0e^{i0} & 0.5e^{i\frac{2\pi}{3}} & 0.11e^{i\frac{2\pi}{3}} & 0e^{i0} & 0.75e^{i\frac{2\pi}{3}} & 0.13e^{i\frac{2\pi}{3}} & 0.5e^{i\frac{2\pi}{3}} & 1e^{i\frac{4\pi}{3}} \\ 1e^{i\frac{3\pi}{4}} & 0.9e^{i\frac{2\pi}{3}} & 0.23e^{i\frac{2\pi}{3}} & 1e^{i\frac{4\pi}{3}} & 0e^{i0} & 0e^{i0} & 0e^{i0} & 0.5e^{i\frac{2\pi}{3}} & 0.5e^{i\frac{2\pi}{3}} & 0.5e^{i\frac{2\pi}{3}} & 0 \\ 1e^{i\frac{3\pi}{4}} & 0e^{i0} & 1e^{i\frac{4\pi}{3}} & 1e^{i\frac{4\pi}{3}} & 0.5e^{i\frac{2\pi}{3}} & 1e^{i\frac{4\pi}{3}} & 0e^{i0} & 0.5e^{i\frac{2\pi}{3}} & 1e^{i\frac{4\pi}{3}} & 0.5e^{i\frac{2\pi}{3}} & 0e^{i0} \\ 1e^{i\frac{3\pi}{4}} & e^{i0} & 0.5e^{i\frac{2\pi}{3}} & 1e^{i\frac{4\pi}{3}} & 0.5e^{i\frac{2\pi}{3}} & 0.5e^{i\frac{2\pi}{3}} & 0.5e^{i\frac{2\pi}{3}} & 0e^{i0} & 0e^{i0} & 1e^{i\frac{4\pi}{3}} & 0.5e^{i\frac{2\pi}{3}} \end{bmatrix}$$

Calculate the relative values of $f\left(\frac{P_i}{d_j}\right)$ and form the comparison matrix $[r_{ij}]$

$$R = (r_{ij}) = \left(f\left(\frac{P_i}{d_j}\right) \right)_{i=1,2,3,4,5,\dots,12, j=1,2,3,4,5,6,7,8,9,\dots,12}$$

$$r_{ij} = f\left(\frac{P_i}{d_j}\right) = \frac{|\mu_{d_j}(P_i)| - |\mu_{P_i}(d_j)|}{\max\{|\mu_{d_j}(P_i)|, |\mu_{P_i}(d_j)|\}}$$

So, the comparison matrix is,

$$R = \begin{bmatrix} 0.000 & -0.80 & 0.000 & 0.866 & -0.95 & -0.35 & 0.000 & 0.948 & -1.00 & 0.000 & -0.555 & -1.00 \\ 0.800 & 0.000 & -1.00 & 1.000 & 0.000 & 0.733 & 0.000 & 1.000 & 1.000 & -1.00 & 1.000 & 1.000 \\ 0.000 & 1.000 & 0.000 & 0.000 & 1.000 & 0.266 & 0.000 & 0.000 & 1.000 & -1.00 & 0.000 & -0.10 \\ -0.86 & -1.00 & 0.000 & 0.000 & 1.000 & -1.00 & -0.10 & -1.00 & 1.000 & 0.000 & 0.000 & 1.000 \\ 0.950 & 0.000 & -1.00 & -1.00 & 0.000 & 1.000 & -0.50 & -1.00 & 0.000 & 1.000 & 0.500 & 0.500 \\ 0.350 & -0.73 & -0.26 & 1.000 & -1.00 & 0.000 & -1.00 & -1.00 & 0.280 & 1.000 & 0.000 & 0.500 \\ 0.000 & 0.000 & 0.000 & 0.100 & 0.500 & 1.000 & 0.000 & 0.000 & 1.000 & 1.000 & 1.000 & 1.000 \\ -0.94 & -1.00 & 0.000 & 1.000 & 1.000 & 1.000 & 0.000 & 0.000 & -0.69 & -0.40 & 0.000 & 0.000 \\ 1.000 & -1.00 & -1.00 & -1.00 & 0.000 & -0.28 & -1.00 & 0.693 & 0.000 & 0.000 & 0.000 & 0.000 \\ 0.000 & 1.000 & 1.000 & 0.000 & -1.00 & -1.00 & -1.00 & 0.400 & 0.000 & 0.000 & -1.00 & -1.00 \\ 0.550 & -1.00 & 0.000 & 0.000 & -0.50 & 0.000 & -1.00 & 0.000 & 0.000 & 1.000 & 0.000 & 0.000 \\ 1.000 & -1.00 & 0.100 & -1.00 & -0.50 & -0.50 & -1.00 & 0.000 & 0.000 & 1.000 & 0.000 & 0.000 \end{bmatrix}_{12 \times 12}$$

From the ranking of the problem, by taking maximum in each row, we can find the major symptoms occurring in each patient. Using these findings, we can conclude what type of gestational disease is occurring in that particular patient. For the patient P_1 is d_4, d_8 i.e., the blurred vision and excessive hunger. So, the corresponding chance of gestational disease is Gestational Diabetes. For the patient P_2 is $d_1, d_8, d_9, d_{11}, d_4, d_{12}$ i.e., headache, excessive hunger, weight loss or gain, pale skin and nausea. So, the corresponding chance of gestational disease is Gestational Diabetes and Anemia. For the patient P_3 is d_2, d_5, d_9 i.e., fatigue, chest pain and weight loss/ gain. So, the corresponding chance of gestational disease is Gestational Hypertension. For the patient P_4 is d_5, d_9, d_{12} i.e., chest pain, weight loss or gain and nausea. So, the corresponding chance of gestational disease is Gestational Hypertension. For the patient P_5 is d_6, d_{10} i.e., shortness of breathing and tiredness. So, the corresponding chance of gestational disease is Gestational Anemia. For the patient P_6 is d_4, d_{10} i.e., blurred vision and tiredness. So, the corresponding chance of gestational disease is Gestational Diabetes. For the patient P_7 is $d_6, d_9, d_{10}, d_{11}, d_4, d_{12}$ i.e., shortness of breathing, weight loss/ gain, tiredness, pale skin and nausea. So, the corresponding chance of gestational disease is Gestational Diabetes and Anemia. For the patient P_8 is d_4, d_5, d_6 i.e., blurred vision, chest and shortness of breathing. So, the corresponding chance of gestational disease is Gestational Hypertension. For the patient P_9 is d_1 i.e., headache. So, the corresponding chance of gestational disease is Gestational Hypertension. For the patient P_{10} is d_2, d_3 i.e., headache, head ache and dizziness. So, the corresponding Hypertension and Anemia. For the patient P_{11} is d_{10} tiredness. So, the corresponding chance of gestational disease is Gestational Anemia. For the patient P_{12} is d_1, d_{10} i.e., headache and tiredness. So, the corresponding chance of gestational disease is Gestational Hypertension and Anemia.

CONCLUSION

In this paper we use the concept of complex fuzzy matrices. The concept of complex fuzzy sets has undergone an evolutionary process since they first introduced. Medical field is one of the best fields in which the concept of complex fuzzy sets is applicable. The theory of fuzzy matrices in the field of human

diseases diagnosis was recognized quite early. the doctor generally gathers knowledge about the patient from the past history and laboratory test results, the knowledge provided by each of these factors carries with it varying degrees of uncertainty. This problem can be overcome by using the concept of fuzzy matrices. Hence in this paper, by the utilization of the new introduced concept of complex fuzzy matrices we identify the major risk symptoms of Some gestational diseases of several patients. The method infers the risk levels of being gestational disease affected based on the symptoms that appear on different patients. This method can assist physician in identifying disease, like if the risk factor occurring in a patient is pale skin and shortness of breathing, she may have Gestational Anemia. So, that the gynecologist will suggest her a healthy diet plan or some more treatments. Although the discussed method cannot provide a very accurate Gestational disease identification, it can be integrated with other identification methods such as blood and urine test. In future this method can be applied for other types of diseases.

REFERENCES

- [1] Zadeh, L. A: Fuzzy Sets, Inf. Control, Vol. 8, No. 1, pp 338- 353, 1965.
- [2] D. E. Tamir, Lu Jin, Abraham Kandel: "A New Interpretation of Complex Membership Grade", Int. J. Intell. System. Vol. 26, pp 285-312, 2011.
- [3] Thangaraj Beaula, Mallika, "Application of Fuzzy Matrices in Medical Diagnosis", Int. J. Fuzzy Mathematical archive, Vol. 14, pp. 163- 169, 2017.
- [4] T. Geetha and A. Usha, "Circulant Fuzzy Matrix in Human Body Diseases", Int. J. of Pure and Applied Mathematics. Vol. 117, pp. 99-106, 2017.
- [5] Rajeev Gajanan Sapre, Muktai Milind Desai, M. M Pokharanakar, "Use of Fuzzy Matrices for the Diagnosis of Diabetes, Anemia and Hypertension," Asian Journal of Fuzzy and Applied Mathematics, vol. 8, June. 2020.

Bibliometric Analysis of Minimum Support Price and Publication Output: A Research Agenda

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Abstract:

Procurement of crops under MSP is undertaken by government agencies during the Rabi and Kharif marketing season which is procured by the F.C.I and state government agencies. The procurement is done under minimum support prices decided by the C.A.C.P which are declared before the sowing of the crop each year. The Minimum Support Price (MSP) is declared by the Government of India at the onset of the sowing season of crops based on the recommendations of the Commission for Agricultural Costs and Prices (CACP) which decides the MSP based on the parameters like input cost of farmers plus family labour. The procurement target of the F.C.I is higher than the previous year. This paper endeavours to gather all the literature and statistics connected with Minimum Support Price and farm procurement and attempt to provide suggestions for future research. The study has from the data base of SCOPUS. Numerous techniques, such as bibliographic coupling, co-occurrence analysis & co-authorship were harnessed with homogenous methods to exhibit a thematic and bibliometric view. As per our due diligence on the topic so far there's no study that has work on the bibliographic data on the state of MINIMUM SUPPORT PRICE. This bibliometric research is new in the field of MSP. This study also delivers a presentation of the statistics with thematic view in the MSP. The study is an bibliometric study on the publication of MSP on Scopus referred journals with the help of tools like VOS viewer. This paper endeavours to facilitate researchers to know the latest trends and future research prospects which will enable upcoming authors to conduct their studies with a pre conceived plan. The paper intends to benefit the research scholars in providing information on minimum support price & agriculture marketing to enhance their knowledge before starting their work on this topic.

Keywords:

M.S.P, PROCUREMENT, MARKETING SURPLUS, F.C.I, BIBLIOMETRIC ANALYSIS, V.O.S VIEWER.

INTRODUCTION

India is primarily an agriculture-based economy, agriculture is one of the most vital sector as it provides livelihood support to nearly 55% workforce and also contributes around 14% to national GDP. The last decade was characterized by nearly stagnant farm sector growth and falling income of farmers. The agriculture sector and farmers are facing unprecedented distress owing to rising input cost and falling prices of crops due to bumper harvest by high yielding varieties. This problem has persisted for decades and thereby government has made many interventions for curbing farmers distress and increasing prices of farmers

produce. One of the government most prominent tool to address farmer's concern has been Minimum Support Prices.

MSP is a tool of market intervention by the Government of India to ensure the farmers from any sharp fall in the market price of the commodity. While the structural reforms of agriculture takes time to trickle down the effect on the grass root level, increase in minimum support prices has immediate effects on the farmers income, agricultural productivity and growth. Addressing the issue of agrarian distress of farmers in India this union budget 2018-19 has ensured MSP for all 23 crops with atleast one and half times of their production cost. Ensuring MSP is a significant and straight step in moving towards the goal of doubling farmer's income by 2022. To cope with this volatility in prices, MSP for agricultural products is fixed by the government, each year. The fortunes of industrial sector as well as service sector are intricately linked with the output and growth of the agricultural sector. MSP provides assurance to the farmers prior to sowing season that a fair amount of price is fixed to their upcoming crop to encourage higher investment and production of agricultural commodities. Efficacy of MSP has profound influence in the farming pattern of the country and its effective implementation can act as a catalyst in reviving the agriculture sector, alleviating the agrarian distress and increasing disposable income of the farmer's.

For researchers in the minimum support prices and farm procurement area, Bibliometric methods can facilitate the use of big data to make it more convenient in discovering contemporary trends in MSP literature publications. By mining the data network of authors, countries and journals, as well as the analysis of keywords the common things among them can be figured and a relationship can be made by the network formed. The bibliometric study has multiple benefits as it bring out the pattern of area of research in MSP by different authors and the study also provides the mechanism of the concept by different tools and techniques of bibliometric study. Finally, the study endeavours to provide recommendations for future research to the Government and research agencies, research scholars to comprehend and identify development of research in MSP and agriculture domain. The awareness on MSP has risen over the years among the farmers and the government is also extending it to other crops. Doubling farmers income is on the agenda of the government and Minimum Support Prices are

going to play are pivotal role in providing the right prices to the farmers on their crop. Kharif marketing season and rabi marketing season are the procurement periods run by government to procure the crops from the farmers directly at the pre determined MSP price which is run by F.C.I and the state agencies.

REVIEW OF LITERATURE

Vis-à-vis other literature reviews, besides thematic presentation of the research on MSP in India it also provides the limitation on the research. The Data selection for the research on MSP in India has been performed with due diligence as literature review has been taken from Scopus and web of science database. It covers the research progress of scholars, agricultural scientist and experts on minimum support prices. Therefore, I chose to search for “minimum support prices” on Scopus. The time period is from 2006 to 2022, which is 17 years. After sorting, a total of 120 papers were shortlisted, the closest papers to our topic on the Scopus and Web of Science page were selected, and keywords “minimum support price” were written in the search box to search for relevant studies. The time span is 2006–2022, and the search returned 38 copies. Out of the 38 copies only 35 were related to the topic minimum support prices. Then matching the research of this topic through “Correlation”, exported the Refworks text data to a txt format file, and used VOS software to analyze the selected documents.

At present the number of papers on Minimum Support Price has been surging swiftly, hence it is required that proper literature must be screened and summarise the related literature and then analyse the research on minimum support price. The new research scholars will benefit from this in the field of agriculture marketing/ agriculture economics as it is not easy to understand the past events and future development trends in the field. India is basically an agrarian economy and still more than 50% of the population dependent on agriculture so to improve the quality of research in the field of agriculture marketing and economics is also our moral duty.

Numerous research articles have suggested that the Scopus database is suitable for bibliometric analysis. For example, the Scopus database is more convenient to export data with, and the Scopus database covers a wider range of papers in the field of business and management, economics, marketing, agriculture economics. Vis-à-vis web of science Scopus emerged as a better alternative for bibliometric analyses owing to wider reach and huge database available. Web of science also had very few papers on the topic minimum support price.

The research browsed SCOPUS database for “MSP” or “MINIMUM SUPPORT PRICE” in the title, abstract, keywords and text of the article. The original results showed that on Minimum support prices 35 documents were found from different authors mostly in joint co-authorship, with a time span from 2006 to 2022.

This research endeavours to analyze the current developments in MSP research; hence we have limited time limit from 2006–2022. The area of research is set under category of “Business Management”, “agriculture economics” & “marketing” as this is the perfect category for research in MSP.

This article primarily uses analysis software for literature review: VOS viewer. VOS viewer is an open source software which works on JAVA and has been patented by V.Eck and Waltman of Leiden University in the Netherlands in 2009, to convert the literature data into thematic and easy to extract data from Scopus and web of science file (MDPI, 2020).

OBJECTIVES OF THE STUDY

The study seeks to investigate minimum support price research studies by India as indexed in Scopus database during 2006 to 2022 for assessing research performance of the country within the MSP. The analytical method applied in this research is bibliometric because it provides the exact answers to the questions of our research in Minimum support prices which is our research area. The bibliometric analysis provides benefits of objectivity of the data along with quantity analysis, and helps to avoid subjective biases. It also assists in providing assurance that the findings had frequently been mentioned in previous research. Bibliometrics means applying mathematical and statistical tools to analyse the bibliographic information of publications and extracting it into presentable data. This bibliographic data facilitates the research in creating linkages between authors or papers (Liu, 2021). The main objective of the research is to present the information available on MSP till date in thematic form with the assistance of V.O.S viewer.

The study aims to

- (i) Classifying of research publications by document type, source, year, co-authorship type;
- (ii) Compounded annual growth rate of publications in the subject,
- (iii) distribution of research publications by broad subject areas,
- (iv) identify pivotal channels of communications in research
- (v) describe utility of high-cited papers within the subject.

WHY THE NEED OF BIBLIOMETRIC ANALYSIS?

Bibliometrics means the unison of maths and statistics by analysing the quantitative data to a presentable and meaningful information. It is a classified system of quant, maths and statistics (Gao, 2020). The total documents in all the articles retrieved are synced with the bibliometric requirement like publications year wise, author wise, co-author wise, language, journal, citation etc. Bibliometrics can be utilised in searching articles,

making reviews, policy making, recommendations and suggestions, future works. Creating networks by mitigating cost by intelligence processing system and networks in minimum time is the crux of bibliometric analysis. The extraction of huge data and turning into quality data is the main crux of the Bibliometrics. Lately Bibliometric methods is in trend and is highly useful in analysing the Journals, subjects, language, disciplines, Institutes and Countries(Meng.2020)

This article applies the bibliometric method to analyze the progress of the literature in the area of Minimum Support Price. Bibliometric analysis is done with the help of VOS viewer, which is a software tool for constructing and visualizing bibliometric networks. These networks may for example comprises of journals, researchers, or individual publications, and they can be designed based on citation, co-citation, or co-authorship relations and bibliographic coupling. VOS viewer also offers data mining functionality that can be executed to perform and visualize co-occurrence networks of important terms extracted from the pool of scientific literature. The performance of the literature can be represented by the number of times the literature has been cited, and scientific mapping can visualize the structure and dynamics of the field with sophisticated thematic results in which bibliographic data can be easily presented and magnified. To accomplish the desired

research results, we mainly target the literature as follows:

- 1) Citation & Co-citation analysis.
- 2) Keyword co-occurrence analysis.
- 3) Bibliographic coupling

Citation, co-citation and bibliographic coupling primarily presents the literature and the similarity-variation between the themes of the literature in the form of networks . citation makes the scholar understand the influence of journals, papers or authors in the field, while co-citation analysis simplifies the complex relationship between many papers into the relationship between numerous homogenous groups through the computer and directly expresses the relationship between them. The analysis of co-occurrence of keywords primarily explores the homogeneity between words and infers the research hotspots of the subject by analyzing the relationship between keywords. Thematic clusters are the results of the data input which is processed in qualitative data by the assistance of this tool (Sanchez.2020).

PUBLICATIONS IN MINIMUM SUPPORT PRICES

The figure-1 shows the publication trend in the field of MSP RESEARCH

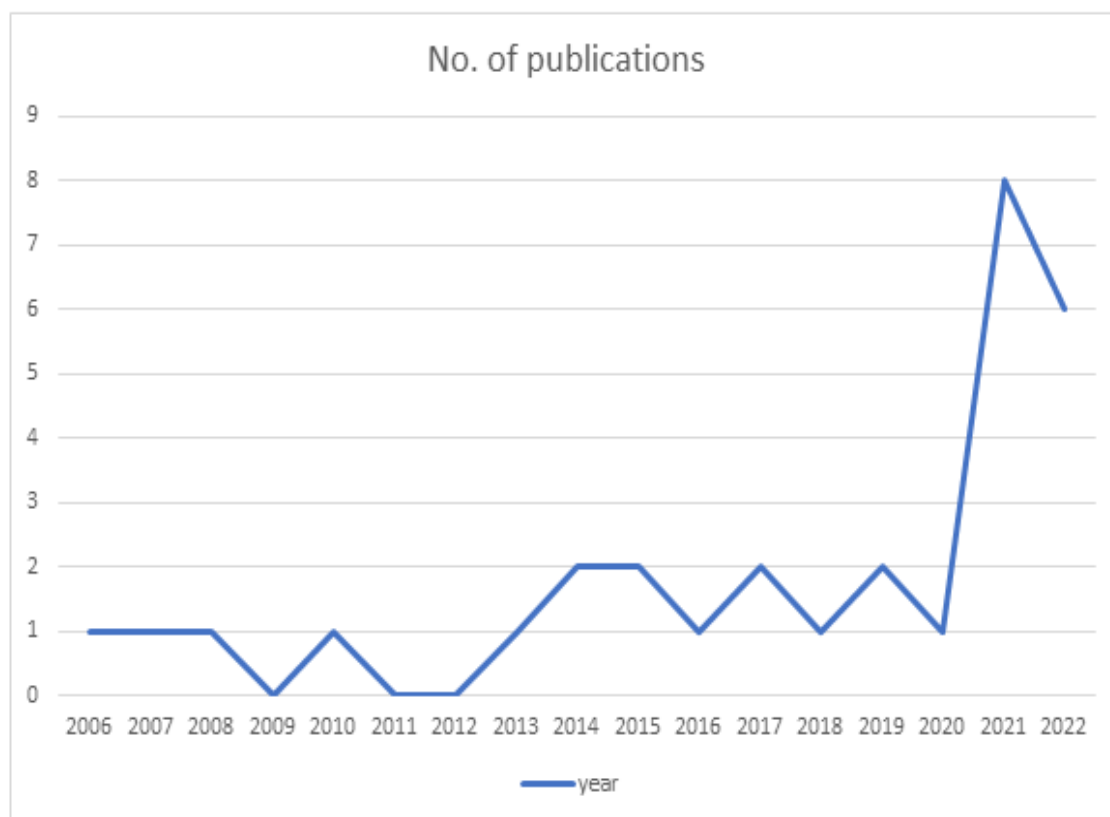


Figure-1

The publication trend in the MSP has seen a rise in the previous 2 years as the MSP is in the limelight owing to the protest by famers due to change in farm laws and

also MSP is at the centre of government policy making as the government intends to double the farmer's income and MSP is at its core. Year 2021 and till 15 June 2022

the publications are on rise. The MSP has been extended to 23 crops and procurement levels are also rising. The rising trend is proof to rising interest of authors in the field of Agricultural Marketing.

And also 2017 was the year with most cited paper which means that paper was highly impactful in the past three years the number of papers has increased 5 times. The trend depicts that initially the publication and awareness in the topic was less though the MSP is in existence since 1976. But the authors interest has risen in the past decade and prior to 2006 major publications were limited to government agencies like F.C.I annual report, ICRIER & Ministry of Agriculture etc. Total 35 publications on the minimum support price have been collected from the Scopus database.

CO-CITATION NETWORK-

The co-citation network has been to identify the literature having foundational significance. To find this map, co-citation has been chosen as the type of analysis, cited references as the unit of analysis, and fractional counting as the counting method, as preferred to get best results. Given the high number of cited

references an adequate minimum threshold of citations was mandatory for clarity. The normalization method was selected as the Association strength and the visualization weight was citations chosen as options in VOS viewer.

International Journal of economics and development Management are the prominent sources with most publications respectively, while other journals have one each of the remaining publications. All the authors have been presented in unique clusters with the orange cluster has four papers and are the earliest publications published between 2006 and 2022.

Figure 2- displays the map of Co-citation. The distance between two papers of Authors, the thickness of the lines linking them, and their size exhibits the strength of their co-citation links. These names represented in the form of connecting lines are the most influential Authors in this area at this time. It is significant to note that these authors have the most frequently cited papers in terms of bulk citations and also, they have been highly co-cited in papers which makes their contribution significant in the concerned topic. Lakshman.S is the author with most publications concerned in the area.

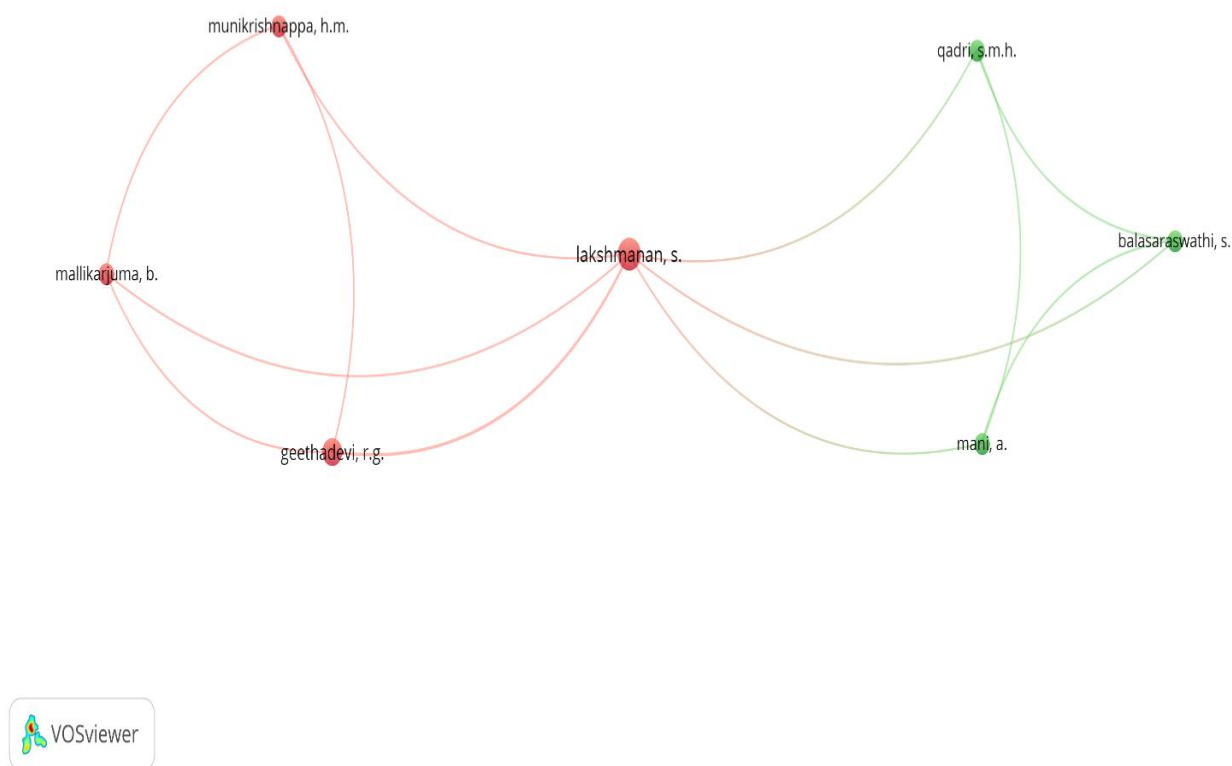


Figure 2

KEYWORDS NETWORK-

The co-word network map was created to find the significant research themes and burning issues. To develop this map, co-occurrence was marked as the unit of for analysing to ascertain the most used words, all

keywords as the unit of analysis and fractional counting as the counting method. The most common keyword used by the authors in the Scopus articles with number of occurrences are taken in this figure. These keywords will present the most utilised and words which are prominent in the field of MSP & Agricultural marketing.

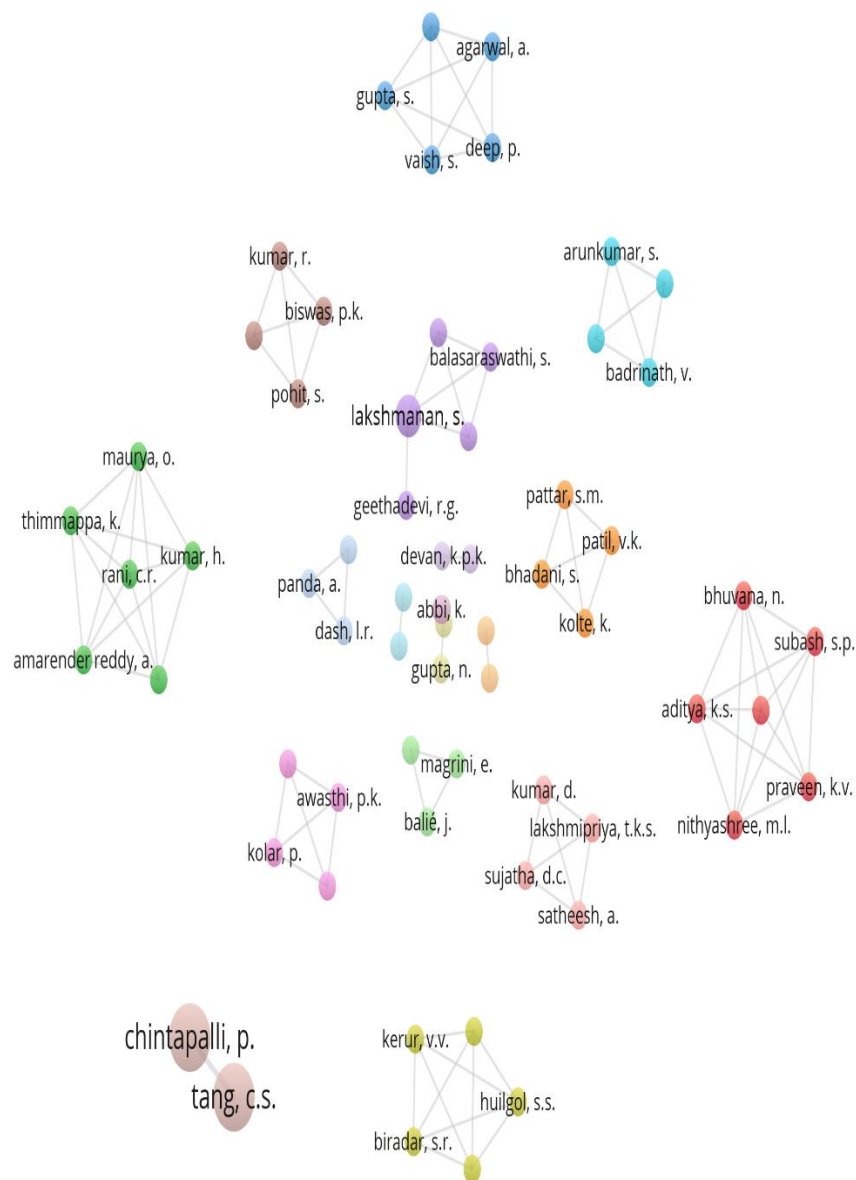


Figure 3

Figure 3 shows the main keywords that have been used in online literature reviews. The more frequently the word occurs as keyword the bigger the size of the node will be and the thickness of the line based on their closeness to each other presents their co-occurrence (Beatriz. 2020). The most frequent keywords, such as “msp” “procurement,” “remunerative price” “marketing surplus,” and “fci,” had the biggest sizes. VOS viewer inhibits the display of labels close to a bigger label so that the small labels don’t overlap over the small ones. Therefore the repeated keywords were removed from the database which were superfluous. Centrality measures have been calculated by us to get the exact network structure and search the keywords having critical positions. There are different centrality measures, all of which identify the most central elements in a network. These methods determine the significance of the keyword and identifies the correlation between these keywords, but some variations can be chalked out among them owing to differences in how the network has been configured. Thereby taking into account all the networks formed by the VOS viewer a furnished image is presented of the keywords occupying major central positions.

AUTHORS BIBLIOGRAPHIC COUPLING-

As per the concept of bibliographic coupling, the clusters have their own designated color representing common research area. Thereafter the minimum publications limitation has been set to 1, there are 45 left which meet the criterion.

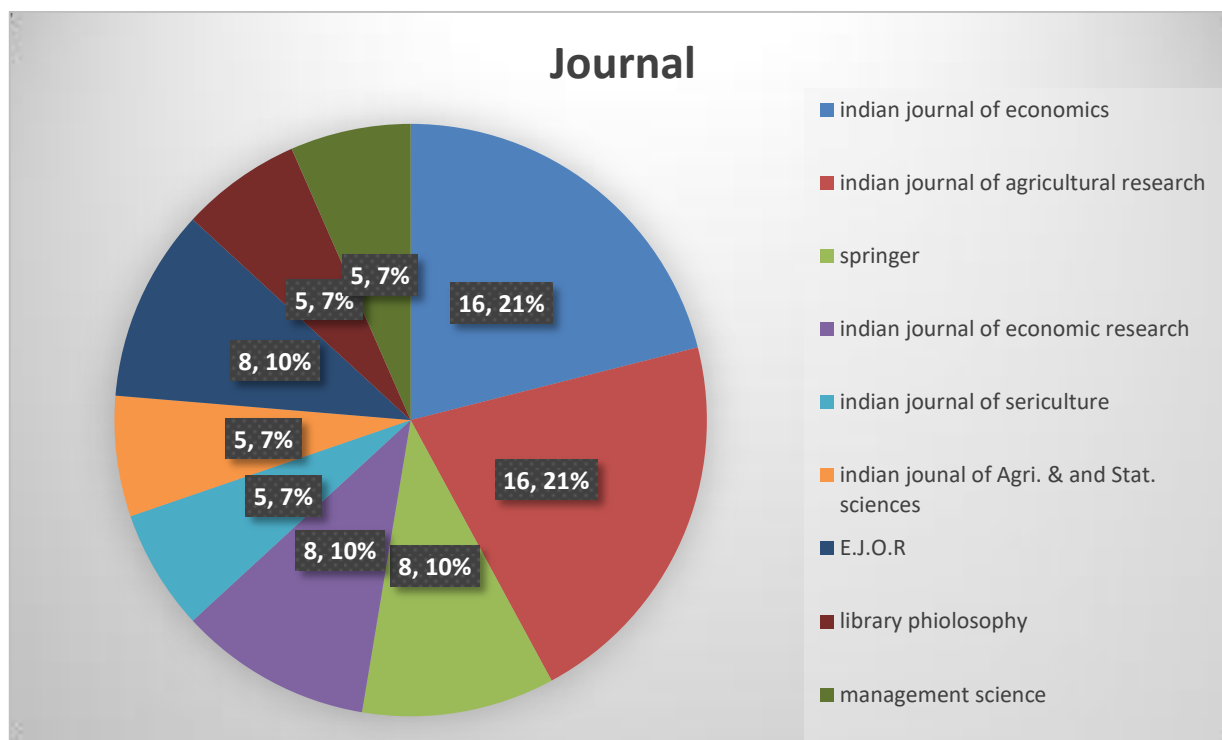


The result in Figure 4 shows the joint authorship in the field of MSP among authors. Each cluster has its own colour, which illustrates that they are core researchers in the field of minimum support prices. Among the authors with the similar interests, the graph with circle of larger size depicts major contribution in the respective field. For instance has the biggest circle means that Lakshman.S is the author with the most contributions of MSP in bibliographic coupling.

LIST OF JOURNALS-

The following table shows the most active journals publishing in the MSP, using a bar of 2 or more publications. The list comprises of the article in first quartile of the Scopus CiteScore under the marketing, management, agriculture & economics category. These journals have high impact factor and citations –

Journal	Total articles	Total citations	Quartile
European Journal of Operational Research	3	12	Q1
Production and Operations Management	3	15	Q1
Sikh Formations: Religion, Culture, Theory	2	12	Q3
Management Science	2	28	Q1
Indian Journal of Economics and Development	6	54	Q1
Springer Series in Supply Chain Management	3	35	Q1
Library Philosophy and Practice	2	25	Q1
International Journal of Asian Business and Information Management	2	30	Q1
Asia and the Pacific Policy Studies	2	35	Q1
International Journal of Economic Research	3	55	Q1
International Journal of Agricultural and Statistical Sciences	2	25	Q1
Indian Journal of Agricultural Research	6	30	Q1
Indian Journal of Sericulture	2	15	Q1



International journal of economics & development alongwith Indian Journal of Agriculture research had maximum publications; with combined sum accounting for 40% of total publications. International journal of economic research published articles with most impact, which have accumulated more citations than the others with about 20% of the total citations of all selected documents. Most of the publications occurred in past five years.

DISCUSSION & CONCLUSION

This study used a bibliometric approach to review the research on online reviews in minimum support price by analyzing relevant documents selected from the Scopus database published between 2006 and 2022. The study utilised co-citation and co-word analyses with an innovative visualization of the co-word network to explore the theoretical foundations, network structure, and thematic evolution in this research area. The study has been successful in carrying out an updated study on the topic by reviewing all the literature available on Scopus database to get the foundational knowledge on the topic for carrying out further research in the area by the researchers. It has also given prominent quantitative analysis of the data available on the literature reviews of the minimum support price to improve the understanding of this fast growing area of Agricultural marketing and has again proved previous findings by systematic evaluation of data with the bibliometric techniques and VOS software analysis.

So far the research available on the online platform is not so well established in the minimum support price with the limited top journals publishing literature in this research area. The farmer's protest in the late 2020

which carried for almost a year brought the MSP in the lime light and made the government rethink the entire policy.

The publications were important because they answered the fundamental question of whether MSP is relevant and measures to determine the prices. Hence these papers had a major role in determining the status procurement and remunerative pricing. Therefore, these documents have been frequently often co-cited by many publications in this research area to establish a theoretical base upon which to build their own research. The co-word analysis confirms the research that has been carried out in the past in the traditional cornerstones of the MSP, procurement and remunerative prices.

As far as the most productive authors are concerned Laksman S and Chintapalli P have the most publications. Through the analysis of the literature, we can see the keywords procurement, remunerative pricing, C2+fl, kharif & rabi marketing season as the burning issues. Karif & rabi marketing season undergo all round the year with the procurement numbers increasing every year owing to efforts made by government. How to make minimum support price more effective is the major issue raised by the authors and the performance of the MSP over the years. Through the study of keyword co-occurrence and keyword trends combined with a systematic literature review we propose the future directions to enhance the procurement and making MSP more effective. The research is helpful in providing directions and useful data for upcoming researchers who are not familiar with MSP and Procurement methodology. The study will be a torchbearer for the researchers in the agricultural marketing field who wants to work on better pricing policies of crops.

LIMITATIONS AND FUTURE WORK

Like other research studies this paper is also not devoid of limitations. As the data for the study has only been taken from the Scopus database and web of science. And web of science had only 5 publications related to the topic & Scopus has also 35 publications related to the topic. The data extracted from Scopus does not have any publication prior to 2006. In terms of the results, web of science and Scopus had over 100 publications but it has been curtailed down to eliminate non core essential topics which are not related to the MSP. The topic is ubiquitous as it is related to the farmers but still the publications on the topic minimum support price or its related topic remunerative price is limited. The more discussion and research on the topic is suggested to spread awareness as the price support scheme support millions of farmers and huge government investment is incurred on it. Furthermore, it is recommended that future research on the topic is required to bring out the plight of the farmers in terms of their income and marketing of agricultural products with more related search. The management and marketing researchers needs to interact with the farmers and source real time data of the cost of production incurred by farmers and the procurement. Thus, more promising fields of study could be explored by the association of relevant stakeholders together with the researchers which will benefit the literature in this area. The journal publishing in the area of agricultural marketing are also limited which should be increased.

REFERENCES

- [1] Yang, et al (2021)- vegetable prices at domestic and international markets, MDPI)
- [2] Gao, et al (2021)- mapping and clustering analysis on environmental, social, and governance field a bibliometric analysis, MDPI
- [3] Chintapalli, Tang, C.S (2021)-The implications of crop minimum support price in the presence of myopic and strategic farmers, journal of operation research.
- [4] Gupta, A.K(2021).- Developing Framework for the Implementation of MSP for Indian Farmers Using Integrated ISM and MICMAC Approach, IEEM.
- [5] Majumdar, S(2021).- A Class-Focused Theory of Minimum Support Price and Agricultural Distress in India, Rethinking .
- [6] Gupta et. al (2021) – Minimum Support Prices in India :Distilling the facts
- [7] Das.R(2020)- Minimum Support Price In India: what determines farmer's access?
- [8] Agrawal, R(2020)- Identification of minimum support price using linear and logistic regression, international journal on advance science & technology 2020.
- [9] Devan, K.P.K., Harikumar(2019), P-Computing minimum support price to promote agriculture as a sustainable model, international journal of advance science and technology.
- [10] Amarender Reddy, A., Kumar, H., Vajrala, A.S., Rani, C.R., Maurya, O., Thimmappa, K(2016).- Impact of adoption of new crops into new areas through introduction of improved varieties.
- [11] Gulati.A et.al(2018)- supporting Indian farms the smarter way.
- [12] Jain.M(2019) Minimum support price in India.
- [13] National Commission on Farmers (2006), "Serving Farmers and Saving Farming: Towards Faster and More Inclusive Growth of Farmers' Welfare," Fifth and Final Report, Ministry of Agriculture, Government of India.
- [14] National Sample Survey Organisation (NSSO) (2014), Situation of Agricultural Households in India.
- [15] Niti Aayog (2016), "Evaluation Study of the Efficacy of Minimum Support Prices on the Farmers,"
- [16] Bhalla, Surjit (2020), "Protesting Farmers are Arguing for the Perpetuation of Colonial Rule," The Indian Express, December 12.
- [17] K.Aditya, et al (2016)- MSP in India theory vs reality.
- [18] Saini.S et.al(2015)- modelling Indian wheat and rice sector policies.
- [19] Kumbhar.S(2011)- Impact of MSP on Area Under Cultivation and Level of Production: A Study of Selected Crops in India

Early Stage Brain Tumor Detection Using Image Segmentation & Machine Learning Techniques

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Abstract:

Detection of brain tumor depends on the s knowledge and experience of the physician. An automated tumor classification would support radiologists and physicians to identify brain tumors. In this paper, we propose machine learning techniques to detect brain tumor at an early stage. The accuracy of our system is 99.6%.

Index Terms:

Brain tumor, MRI scan, Image segmentation, machine learning, CNN algorithm.

INTRODUCTION

Brain tumor is an unnatural growth of cells in brain and can be classified into malignant and benign. Malignant tumors are the ones which cause cancer and non-malignant or the benign tumors are the ones which don't cause cancer. Tumor is a major cause of death in the world and usually is very less detected at the initial stages. It is important to detect tumor in the earlier stages so that it can be treated properly. Tumor is not easy to locate and can be a strenuous task. Common symptoms of tumor includes headaches, continuous vomiting, nauseated feelings and having problems while maintaining balance to walk and stand. In this paper we focus on extracting the tumor from the brain images using segmentation and then classifying the image using convolution neural networks. We in this project try to create a better solution for the doctors to better locate the tumor and make it easier for the doctor to analyze and work on it and save lives in a better way. Usually MRI scans and CT are used for scanning the images but it is preferred to use MRI because it is safer compared to CT scans as CT scans uses radiations whereas MRI uses magnetic resonance. Also CT scans cannot be performed a number of times but MRI scans can be used. Here in this paper we use MRI scans.

1.1 TYPES OF BRAIN TUMORS

Brain tumors are of two types:

- 1) Primary brain tumor
- 2) Secondary brain tumor.

Primary brain tumor arises from glial cells and is described as either high grade or low grade. Low grade tumor grows slowly, whereas growth of high grade tumor is faster. Depending on the location and size, tumors can be classified as grade I, grade II and grade III. In most of the people with primary brain tumors, the cause of the tumor isn't clear. But doctors have identified some factors that may increase the risk of a brain tumor that include exposure to radiation and family history of

brain tumors. The Symptoms, prognosis and treatment of a malignant tumor depend on the person's age, the exact type of tumor, and the location of the tumor within the brain. Detection at an early stage would increase the chances of patients survival. Previously many techniques were applied to detect the brain tumor at an early stage but were less accurate. In our work we are making use of automatic segmentation and CNN to make it more accurate[1-6].

PROPOSED METHOD

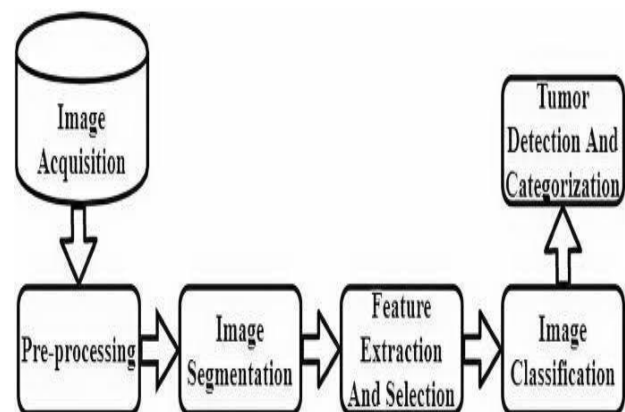


Fig1: Block diagram of the proposed method

The block diagram of the proposed method is as shown in Fig 1. Acquired image is converted to gray scale image which becomes easier for computing other parameters. The image is then preprocessed where the noise removal is done for providing clarity to the images. This is then filtered using Gaussian filter. The filtered image is adjusted with the required contrast and is segmented. Segmentation using morphological operations make the image for classification. This also provides good amount of security of the segmented brain image. It is later classified using convolutional neural networks with trained database. Classification of tumor using CNN provides the accuracy of the presence of tumor and also the probability of the image being tumor or normal.

RESULTS AND DISCUSSIONS

We have used the Matlab tool with 2017a version to perform segmentation and classification of the MRI brain images. The tumor is segmented using basic morphological operations

and classified using Convolution Neural Networks. The below is the fine classification result which tells whether there is a tumor present or not. The figures below shows

the result of conversion of input image to the segmentation image step by step.

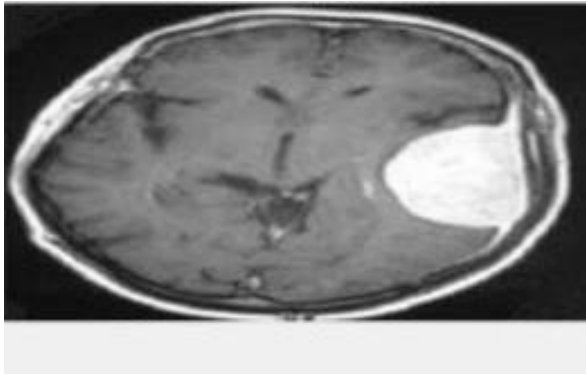


Fig 2 : Input image

Fig 2 shows the input image of MRI which contains Brain tumor.

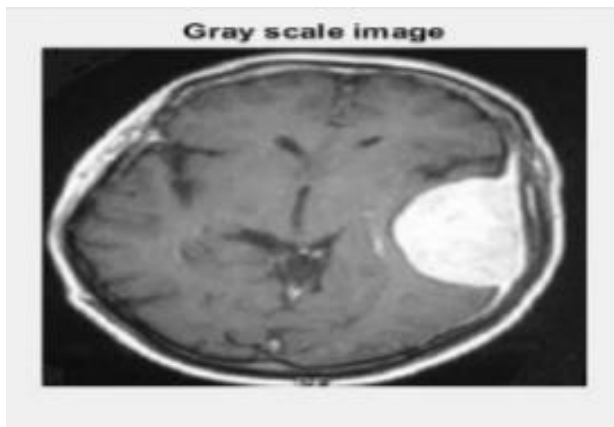


Fig 3: Gray scale image

The image is cropped vertically as well as horizontally. Intensity enhancement of the cropped image is done using histogram equalization. Global thresholding is then applied to convert the cropped histogram image to a binary image.

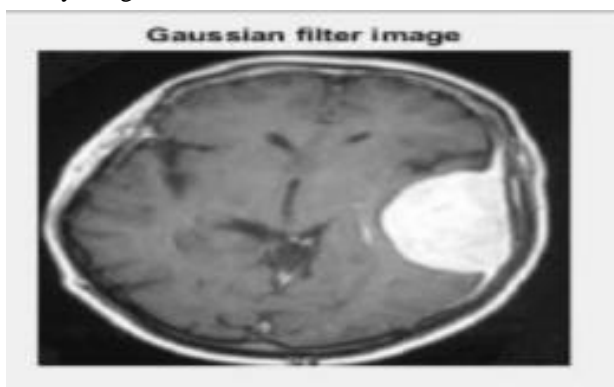


Fig 4 : Gaussian filter image

Gaussian filter is then used to reduce noise and blurring regions of an image. The filter is implemented as an Odd sized Symmetric Kernel (DIP version of a Matrix) which is passed through each pixel of the Region of Interest to get the desired effect as shown in Fig 4.

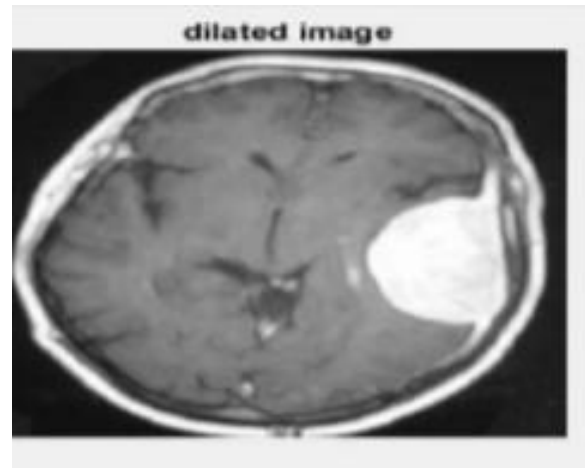


Fig 5 : Dilated image

Pixels are added to the boundaries of an image by dilation. Fig 5 shows the dilated image. Erosion is done to remove pixels on object boundaries. The number of pixels added or removed from the objects in an image depends on the size and shape of the structuring element. Fig 6 shows the eroded image.

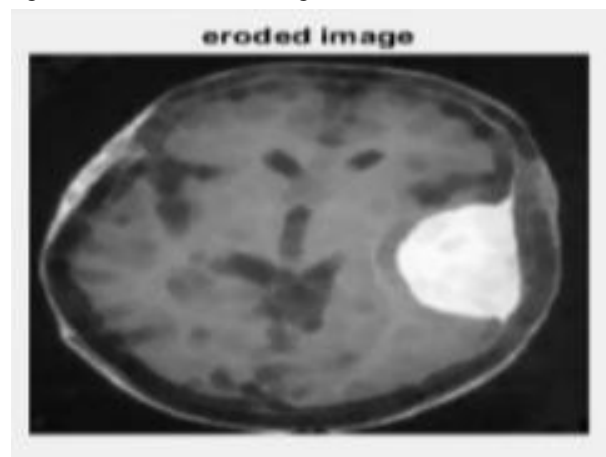


Fig 6: Eroded image

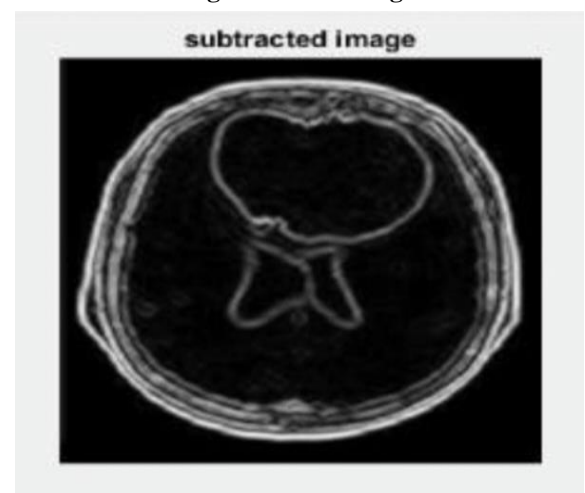


Fig 7: Subtracted image

Image subtraction or pixel subtraction is done to level uneven sections of the image. Fig 7 shows subtracted image.

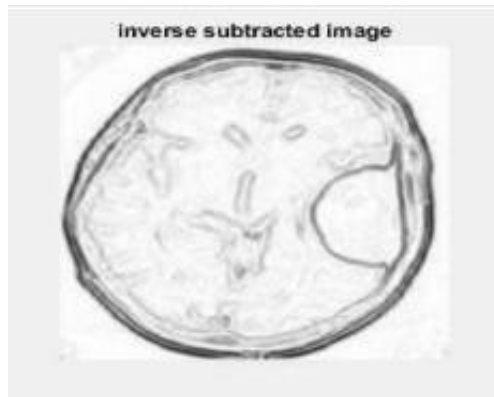


Fig 8: Inverse subtracted image

Invert reverses the colors present on an image or portion of an image as shown in Fig 8.

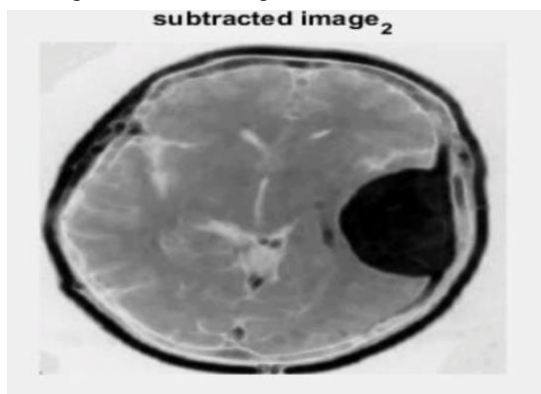


Fig 9: Subtracted image 2

The negative of an image is achieved by replacing the intensity 'i' in the original image by 'i- 1', i.e. the darkest pixels will become the brightest and the brightest pixels will become the darkest. Image negative is produced by subtracting each pixel from the maximum intensity value as shown in Fig 9.

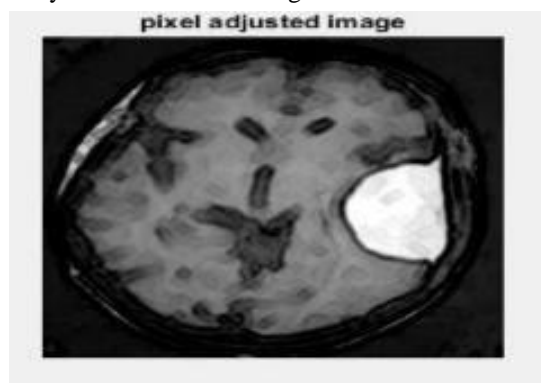


Fig 10: Pixel adjusted image

Images are stored digitally as an **array of pixels**. Every pixel has a color and the way colors are defined is called the **color space**. The most used color space is the **RGB color space**. In this model, every color is defined by three values, one for **red**, one for **green**, and one for **blue**. Usually, these values are 8-bit unsigned integers (a range of 0–255), this is called the **color depth**. The color (0, 0, 0) is **black**, (0, 255, 0) is **green**, (127, 0, 127) is **purple** as shown in Fig 10.

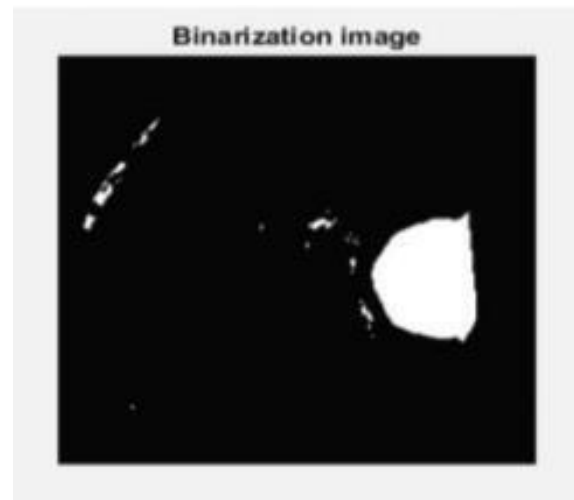


Fig 11: Binarization image

Global binarization is applied to the whole image choosing the threshold depending on the neighbourhood pixels. Fig 11 shows global binarized image.

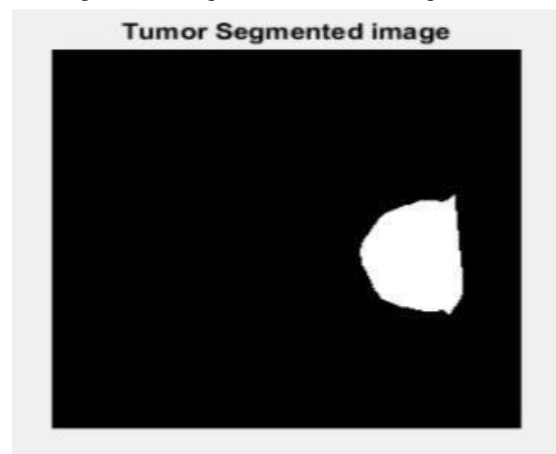


Fig 12: Tumor segmented image

Fig 12 shows tumor segmented image from normal brain tissues. Threshold based segmentation is applied.

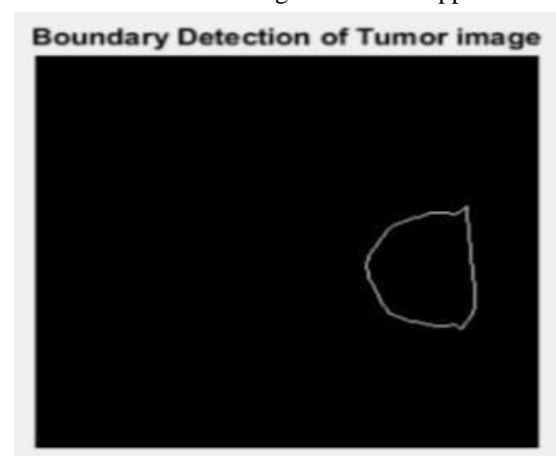


Fig 13: Boundary detection of tumor image

A radial search technique is applied to detect the borders of the tumor. Initially 2 rounds of radial search is done and a second round search which is knowledge based is applied. Then a rescan with a new center is used to solve

the blind-spot problem. The algorithm is tested on model images with excellent performance as shown in Fig 13. The morphological operations discussed here are used intensively in the various stages of this project. The common morphological operations include dilation, erosion, thinning, edge extraction, opening and closing.

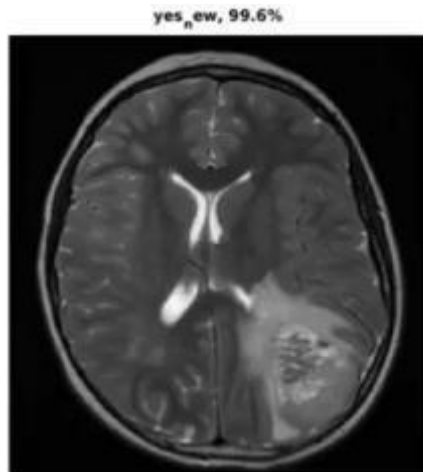


Fig 14: Accuracy of the image

The results of this study showed that: the overall accuracy of classification process was 99.6%, and for the tumor; the sensitivity was 99.3% at 30 iteration. White matter and grey matter showed a classification accuracy of 99.7% and 99.4% and for CSF the accuracy was 98.9%.

COMPARISON

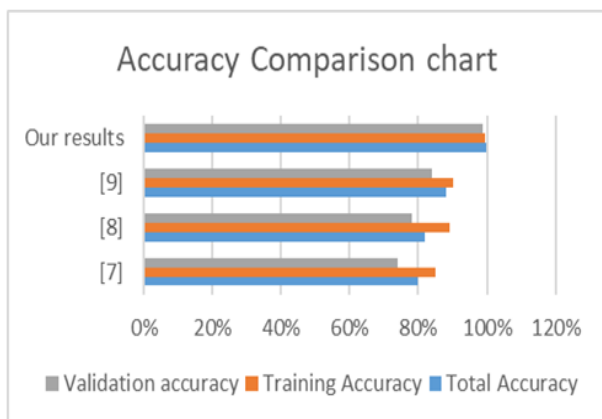


Fig 15: Comparison of our work with previous work done

CONCLUSION

The input color image is converted into a gray scale image and many image processing techniques like filtration, segmentation is applied on the image. After removing the noise and performing morphological operations like erosion and dilation the segmented tumor output is achieved which helps in accurately detecting and analyzing the tumor. The segmented output is then classified using convolution Neural Networks which helps in accurately detecting when there is a tumor or not with many data sets.

FUTURE SCOPE

The algorithm used here can accurately detect the presence of tumor. This is accurate only for the segmentation and for classifying the presence of tumor or normal. But the improved version of this method can be found where it is able to detect whether the tumor is benign or malignant. And also, detection of stages of tumor can be found by improvising the further techniques.

BIBLIOGRAPHY

- [1] Narmada M. Balasooriya and Ruwan D. Nawarathna, "A Sophisticated Convolutional Neural Network Model for Brain Tumor Classification", 2017 ICIS conference.
- [2] K. D. Kharat, V. J. Pawar, and S. R. Pardeshi, "Feature extraction and selection from mri images for the brain tumor classification," in 2016 International Conference on Communication and Electronics Systems.
- [3] N. N. Gopal and M. Karnan, "Diagnose brain tumor through MRI using image processing clustering algorithms such as Fuzzy C Means along with intelligent optimization techniques," 2010 IEEE International Conference on Computational Intelligence and Computing Research, 2010.
- [4] J.selvakumar, A.Lakshmi and T.Arivoli, "Brain Tumor Segmentation and Its AreaCalculation in Brain MR Images using K-Mean Clustering and Fuzzy C-Mean Algorithm" 2012 IEEE-International Conference
- [5] Rajesh C. Patil, Dr. A. S. Bhalchandra, "Brain Tumor Extraction from MRI Images Using MATLAB" International Journal of Electronics, Communication & Soft Computing Science and Engineering, April 2012.
- [6] R. Ahmmmed, A. S. Swakshar, M. F. Hossain, and M. A. Rafiq, "Classification of tumors and it stages in brain mri using support vector machine and artificial neural network," in 2017 International Conference on Electrical, Computer and Communication Engineering (ECCE),.
- [7] P Gokila Brindha "Brain Tumor Detection From MRI Images Using Deep Learning Techniques" 2021.
- [8] Mohamed Nasor "Detection and Localization of Early Stage Multiple Brain Tumor Using a hybrid Techniques of Patch Based Processing k-mean Clustering and Object Counting " 2020.
- [9] G Hemanth, M Janrdhan, L Sujihelen "Design and implementing Brain Tumor

Staff Leave Management and Attendance Tracking System Using IOT

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Abstract:

In the modern-day computer networks and mobile phones have scaled great heights. The usage of the internet, web, mobile phones etc. in our daily individual life as well as industry is huge. It is very useful to solve multiple problems. Every person including teachers and staff has access to the internet and can surf different websites etc. Attendance tracking is done manually every day for every staff member also the staff need leaves which has to be done manually again. A solution to this problem is given in this project. The main aim of this project is to develop a web app to solve the above issues. The web application will have two main functions attendance tracking and leave management application. Radio-frequency identification uses electromagnetic fields to automatically identify, and track tags attached to objects. An RFID system consists of a tiny radio transponder, a radio receiver and transmitter. An RFID chip can be inserted into the staff id which will be connected to the web application n. For an RFID one can get tags or cards that can be registered on the college database. Geolocation coordinates are set across the campus. Mobile location helps to trace the employee location. When the staff enters the campus area, they can use the RFID cards to login also another approach we have come up with is that the android device of the employee is automatically connected to the office internet and a message is sent to the office server with the employee id and time of the device which is considered as login time of that employee. The RFID model is an IOT based concept that tracks attendance in the google sheets. In the leave management system, the employee needs to login to the application and apply for leaves and check if the leave is accepted or rejected by the higher authority. According to the attendance and leaves taken analysis is done and a report is generated which is useful for the management to provide payroll to the employees. n.

Index Terms:

Attendance tracking, Geofence, Geolocation, Staff Leave management, RFID, Web application.

INTRODUCTION

HR is the organizational function that generally deals with issues related to people such as hiring, performance management, compensation, organization development, benefits, employee motivation, communication, safety, wellness, administration, and training (Heathfield, n.d.). In universities and colleges, the office staff takes care of this. Leave management is one of the most important office staff jobs that consumes a small but significant portion of managerial time. While the staff are usually overloaded with multiple tasks already, leave management is a tightrope walk. The traditional pen paper method is a very lengthy process, and these are not optimized processes hence there is a need for new techniques for leaves to be processed. In the current

system, staff fill a leave request form manually using pen paper and submit it to their respective authorities. After the authorities' consent, the letter is submitted to the department administration and the wait for approval begins. At the end of every month, the department administration calculates the leaves of every employee and generates reports. This process is very time consuming, and chances of data loss or errors are high. The workload is more yet subjected to human errors hence it is a challenging task. Maintaining such records is also a tedious task. The preoccupied minds of faculty results in them running out of time before entering their attendance, thus, being marked absent despite being present becomes a common issue that brings in many discrepancies. Due to this, we have an acknowledgement generator which can be in the form of a notification such that whenever the staff enters the college, they get a notification about the details. The attendance tracking needs to be much more hassle free compared to the existing system hence the RFID cards will help staff record the attendance instead of manually marking the attendance."

MOTIVATION

The process of leave application and leave approval through traditional methods such as pen paper methods, approval waiting etc. is very hectic and consumes a lot of time and effort of the staff as well as the office staff that need to process these requests as soon as possible and get them approved from the concerned authorities and revert to the staff that had applied for leave to give them the status of the leave application. In this process a lot of paper is also wasted and wasting paper is always harm to the environment.

From the start of the time, we've seen and have applied for leave using the old pen paper method. It has become quite general in today's fast paced world's technology. Also, the paperwork submitted to get approved by the authorities takes longer. Inconsistency is one of the constraints in traditional methods. To tackle such a problem, A Leave Management System is requiring. Both the leave applicant and approver can view the leave balance days as well as report of the leave applications. It will make the task of the staff and the admin to manage for leaves and attendance.

Another issue is the attendance tracking system which again is hectic maybe pen paper method instead of this an RFID system can be used to track the attendance and an alternative approach we have proposed a geolocation approach. The RFID approach is an Iot based approach

wherein a Nodemcu is connected to the RFID and is also connected to the system and every staff will be provided with a card, as soon as they pass through the receiver their attendance will be tracked in google sheets which can be viewed by the admin from the web application.

OBJECTIVE

The main objective is to build a Web application that would reduce paperwork and increase efficiency of attendance and leave management systems.

The tasks included in the web applications are:

- Staff
 - Login/Logout
 - Apply for Leave
 - View leave status
 - View pending leaves
 - View leave history
 - View/edit his profile
- Admin
 - Login/Logout
 - Receive notification for recent leave applications.
 - View/Add/Remove Staff
 - View/Add/Remove Department
 - View/Add/Remove Leave Types
 - Manage Leaves
 - Accept/reject leave application
 - View Attendance status
- Attendance tracking
 - Track attendance using RFID card
 - Track attendance using geolocation

SCOPE

The main purpose of the project is to ease the process of leave management by making full use of the facilities we already have such as the internet and access to web applications etc.

- Its aim is to replace the tedious paper works that the universities currently use.
- The application will collect and store data fast and easy reference.
- The application will provide the staff with a record of attendance and leaves.
- The application also provides information regarding the leave history.
- The application is helpful to reduce time and complexity of maintaining the leave records.
- It will take attendance using RFID cards and make a geofence and track the staff using geolocation.
- Leave application becomes easy.

PROPOSED SYSTEM

The proposed system consists of a web application which has 2 major functions. The first one being the attendance marking and the second one is the leave management.

The attendance marking is done using RFID. The data collected is stored in the database as a form of google sheets which can be viewed by the admin for their records.

In the leave management system, the employee needs to login to the application and apply for leaves and check if the leave is accepted or rejected by the higher authority.

According to the attendance and leaves taken analysis is done which is useful for the management to provide payroll to the employees.

- Attendance:
 - For attendance tracking a hardware setup is needed. A RFID is required which will contain a unique ID for each staff member.
 - In case attendance was not marked due to any error the buzzer attached to the RFID setup wont ring indicating the attendance is not taken.
 - When the staff places the RFID card over the RFID reader the attendance will be tracked with name date and time.
 - Another approach includes tracking the staff using geolocation. As soon as the person enters the geofence the attendance is being tracked.
- Leave:
 - For leave management the staff/employee first needs to login to the web application and apply for leaves.
 - The higher authority then needs to either approve or reject the leave request.
 - The record of each employee is stored in the database and can be accessed when needed.
 - Employees can view their leave history whenever needed.

PROBLEM STATEMENT

The existing Leave Management Systems and attendance tracking contains various flaws:

Use of pen paper method to apply for leave.

Based on the schedule manually checking if a substitute teacher is available or not Time consuming.

Records need to be maintained in a physical format.

In our proposed system, we will build a web application that takes attendance using RFID and staff can apply for leaves and check their history in a single application. Another approach is proposed wherein the attendance can be tracked using geolocation.

LITERATURE SURVEY

Attendance is one of the most important variables in determining mensuration eligibility, promptness, and commitment to the institution. Staying on time and keeping track of attendance records is critical for the evaluation of students and employees.”

In today's environment, where the teacher calls out students' roll numbers, a paper-based group action marking system is used in educational establishments.

This is usually a manual process that is prone to human error and takes a long time for each student as well as academics to complete the categories. Similarly, keeping track of daily staff group actions and preparing monthly/annual reports using the manual machine approach has become a difficult task. For these reasons, an effective Web-based program is designed to track students' activity in each category while also monitoring the arrival and check-out times of each worker using fingerprint verification.

This technique is made up of several modules: a system for monitoring and managing student group actions, a system for managing category routines, a system for managing student information, a system for managing employee group action and leave, and a system for managing employee information.

Every student and workers mandatory knowledge and data are stored in the generated dynamic information.

This application does staff group action utilizing fingerprint scanning devices and performs student group action electronically for all courses in a certain department, with the records of the group action recorded in the information.

Another paper from Stephen et al. [2] proposes a leave management method in which university tutorial staff' leave requests are processed using service delivery metrics such as employee rank and lecturer-to-student size relationship.

This leave management resolution is designed to work with a staff information system, a course registration system, and a system for employee evaluations.

It is a specific associate rule that assesses and organizes leave requests for periods with the least impact on employees, depending on rank and the volume of the lecturer-to-students relationship. Within the Nigerian university system, leave is typically limited in order to give tutoring employees with opportunities for training, research, and even rest.

Human resource planners could over-commit people to such goals, leaving the system vulnerable at critical times, or under-commit and miss out on the benefits. In either case, service delivery suffers a setback. The regulation was designed using an unchanging progressive method model in three increments, with each capital punishment having its own set of requirements. The rule was written in MATLAB. The job options generate sample data of educational employees during a specific engineering syllabus, the sort that data into

employees combined by rank, and then compute available and suggested employees combined by rank based on the number of scholars in the engineering programme.

The algorithm chooses the year with the smallest amount of deficiency in on-the-market employees combined, considering the suggested workers combine, to depart for periods with the least influence on university tutorial service delivery.

Ramanan [3] mentioned in the current Leave Management System, the University school uses a paper-based system to manage employee leave, and the administration department keeps track of the information in a book. The administration department calculates each employee's leaves at the end of each month, which is a time-consuming process with the potential for data loss.

The Web-based Leave Management System is an intranet-based programme that is accessible from anywhere in the school. An associate worker can use this application to apply for leave at any time and from any location. There is no need to manually fill out leave forms and wait for approval from higher authorities. The admin oversees creating, altering, and deleting the user's small print, as well as department and leave variations. Admin will also produce leave reports for all employees.

Within the worker's job, the worker will apply for leave and consider any past leave requests. Through this method, the Head of Department (HOD) will accept or reject leave applications from their department employees and may read the leave details of each member of their department.

The school's Chief Military Officer (CEO) may be a higher-ranking official. The CEO will review all worker leave information, accept or deny HOD leave requests, and generate leave reports. As a result, this method will be used to automate the workflow of leave requests and the manner of approval. A web-based leave management system can help you save time by reducing manual effort and keeping track of your leave records.

The intended research from Malathy et al. [4] effort addressed the recognition of biometric-based attendance systems for establishment colleges, as well as their relevance.

Due to a lack of associate degree existing systems that don't employ any alert or notification mechanism, such as sending an SMS to the faculty's mobile to remind them to record their attendance, they have a propensity to focus on the issue the school is facing.

This technique's main goal is to create machine-controlled alerts that support biometric fingerprint authentication for attendance. The approach eliminates the need for a central repository to deal with head inconsistencies and overheads.

Managing people can be difficult and keeping track of attendance is a major concern for many businesses. Meanwhile, in the industrial sector, an accurate employee attendance record system is critical for

businesses, notably for payroll purposes. Various existing technologies have been implemented to aid the Associate in Nursing industrial sector in managing their attendance data. The use of contemporary technology, such as fingerprint biometric scanners and mobile devices, as a supplement to software package creation, can benefit the economy by enhancing services.

This study from Osman et al. [5] proposed A Notify, a fingerprint biometric-based and web-based management system with short messaging service (SMS) notification for workers' attendance records. It was created specifically for the industrial sector, and it uses fingerprints as a biometric option for worker attendance. It can store records of employee attendance in an organized, systematic manner, as well as sending SMS alert notifications to supervisors about worker attendance reports. This method was developed to aid in the implementation of the System Development Life Cycle (SDLC). A user acceptance test with thirty (30) respondents was done to determine the system's effectiveness by examining the form, which was separated into three categories: contained programme satisfaction, perceived simplicity of use, and SMS notification integration. According to the system study, the system has a positive impact and is widely recognised by users as a convenient, cost-effective, and reliable method of notifying attendees of their attendance records.

The leave management and observance system automate the leave request method, permitting staff and management to manage worker leave requests, leave balances, track and grant leave additional simply. The human resource development workplace and therefore the higher authorities at the university square measure primarily guilty of managing, granting, and recording leave requests. With AN increasing variety of staff earning leave and leave applications being filed monthly, the university's human resource development workplace has been experiencing issues in their manual operations, like difficulties in handling data thanks to ancient storage of knowledge, and transparency problems as a result of staff don't having any direct access to their leave records. As a result, an automatic leave management system that's quicker, error-free, clear, and easy to manage is considered.

The event of a period web-based leave management system by the university changes the approach it manages and handles worker leave records. Agile Methodology was used as a package development method framework that utilizes AN repetitive approach, open collaboration, and method ability throughout the project's life cycle, reducing overall risk and permitting the project to adapt to changes additional quickly.

Individual Management, i.e., Human resources is essentially separated into numerous practice areas in business, but one that is significant and of paramount importance is People Management. Payroll management in any company can be a very important undertaking. Staff will be motivated to figure out whether they

receive their pay on time. Even though the attendance is biometric, there is still human intervention in the case of leave management, which takes up a lot of your time.

The most difficult and important aspect of time management is performance appraisal. There's a lot of document review work that takes up a lot of your time and is also inconvenient.

This study by Shukla et al. [7] is an experiment to create a model in which knowledge science will aid in the implementation of a technique for knowledge collection, analysis, improvement, and processing. This experiment aims to introduce the concept of RFID-based communication, which blends voice knowledge analysis with biometric-based features. This might be used to improve the payroll administration system, leave management system, and performance appraisal system all at once.

Though the proposed model in the study has more room for improvement, it also gives an Associate in Nursing a cost-effective method for successfully implementing a payroll administration system using biometric and RFID technology.

One of the most often used two-factor authentication algorithms is the Time-based only once arcanum (TOTP) rule.

It was used in the construction of the Human Resource e-Leave after internet App to improve the security and authentication methods for accessing the App. Even if the user arcanum is stolen or hacked, the attacker will be unable to access the account unless they have the passcode generated by the TOTP, which changes every thirty to sixty seconds.

The Plata et al. [9] study's abstract framework was designed to handle Multi-Factor Authentication, notably the TOTP rule, and the fast Application Development model - prototyping cycles were utilized as the system development technique's base. The three key parts of the study are the e-Leave following internet App event, evaluating the functions in terms of user authentication and account recovery, and finally, the technical analysis in terms of compatibility, dependability, and security. In terms of user authentication, recovery, and security, the net app demonstrated that the TOTP rule is worthwhile.

Academics decide the name or number of scholars to whom the scholars react or transmit the group action sheet to the scholars to sign in the ancient Asian group action system. The difficulties in the group action management system have risen dramatically as the number of academics has increased over the last 20 years. Some students sign numerous times while passing group action forms to the scholars, and proxy group action is taken. These two procedures are exceedingly time-consuming. This study provides a viable group action system paradigm to handle these difficulties. This study combines frequentness identification, biometric fingerprint sensing, and password-based technologies to provide a cost-effective, dependable group action

management system. A desktop application in the C# environment is built to observe the group action system.

“In view of recent advances in the building of deep convolutional neural networks (CNNs) for face detection and recognition applications, this research proposes a new deep learning-based face recognition group action system. The complete process of developing a facial recognition model is detailed in detail. This model by Arsenovic et al. [10] incorporates several critical elements generated by victimization's most advanced algorithms, including the CNN cascade for face detection and CNN for face embedding generation. The first purpose of this work was to employ those progressive deep learning algorithms for face recognition tasks. Because CNNs offer the easiest answers for larger datasets, which isn't the case in production, executing these approaches on smaller datasets was the most difficult aspect. It is intended to serve as a replacement approach for image augmentation in face recognition applications. On a small dataset comprising the first face photographs of personnel within the period setting, the overall accuracy was 95.02 per cent. The proposed face recognition model could be used as a supporting or major element for observation functions in another system with or without minimal changes.”

We currently use a Leave Application System that is managed by a central authority.

This will lead to corruption, the abuse of one authority, or the allocation of time for approval. As a result, in this post, they've produced a logical contract design for the Leave Management System using Solidity and Ethereum, which might be a distributed app design leveraging Blockchain Technology. They frequently include cell phones as IoT devices, implying that every customer can use this software. The smart contract app does not discuss an alternate centralized design that may be a classic client/server design with Associate in Nursing underlying Blockchain backend because of the resource-constrained nature of those gadgets.

The primary purpose of the research by Fortich et al. [12] was to develop a university-wide Personal Resource e-Leave Management System that would be considerably more cost-effective and coordinated than the current manual system. The web-based system was designed and implemented with modules inactive applications, leave balances monitoring, records management, administration, and installation of the business intelligence technique to assist in the higher cognitive process activities of the HRDM Officer and thus the Management in order to have Associate in Nursing economical and effective management of leave transactions. It provides efficient operations, ethical leave rules, many applied mathematics reports, and many productive hands.

The study's major findings revealed that the system complies completely with the quality System Usability Points. Similarly, the online Usability test revealed that the workers were unanimous in their support for the

system's installation in order to have quick responses and access to data.

Haumshini et al. [13] suggested Leave Management system's main purpose is to decrease paperwork as much as possible while also making record keeping easier by developing a separate system for leaves.

This system is used to track the number of leaves taken by students living in a corporation's dorms. This strategy also aids in reducing the formalities associated with requesting vacation as well as the time delays that students face in getting their leave approved. The Hostel Leave Management Project is a web-based system that may be used by all students at a certain university. This is a computer-assisted process for tracking and approving student leave. Each student is given a unique user id and password, as well as a leave request, to log into the system; however, in our project, their login is tied to the student system (SIS). Wardens can manage the request and accept or deny it based on the consent of the students as well as the specifics of the students' group activity only during working days. Using this way, multiple department staff can handle the request and make decisions before approving the leave. This method can be used to update the hostel's leave management system while saving time and money.

This enables students to check their personal leave balances and standings, as well as read prior leave histories and assist wardens in analysing and accepting leave applications. This leave management system is extremely beneficial for any dormitory or organization with a diverse population (students). It's a simple one-click procedure.

In most educational settings, tracking students' group actions is a common occurrence. Manual and semi-automated group action systems are time-consuming, inefficient, and insecure. As a result, the goal of this study is to create a cost-effective and secure group action system that might be valuable to all academic institutions.

As a result, a fully integrated, embedded, and machine-driven group action system is created by Khan et al. [14], which makes use of edge and cloud computing, biometric sensors, and real-time cloud data. In the following group action, the generated system was evaluated with fifteen participants in an extremely laboratory setting, and it was discovered that the projected system is reasonably inexpensive, secure, and favourable for academic institutes.

The Attendance Management System (AMS) is the simplest way for community organizations to keep track of group action and do force analysis daily. There are four types of AMS.

These systems may be manual, biometric, card-based, or e-commerce in nature. This study presents the implementation of an associate degree AMS that supports Bluetooth and NFC technologies in a multi-user environment.

To verify the user's identity, it employs the fingerprint as well as the Bluetooth address of the user's NFC-enabled phone.

The NFC tag IDs and other data associated with the portable are received by a Java-based desktop programme, which is then sent to an analyser for interpretation of the user's behaviour.

Because attendance and activity are intimately linked, attendance tracking, and management have become increasingly vital in today's climate. One of the job habits that employers value is punctuality. Many academic institutions and government agencies in poor nations still utilize a paper-based attendance system to keep track of attendance. There is a pressing need to replace these antiquated methods of attendance tracking with biometric attendance systems. Fingerprints are appropriate for use in attendance management systems because of their distinguishing character. Fingerprint-based attendance systems will be both secure and environmentally friendly. For many years, fingerprint matching has been widely employed in forensics. It's also useful in applications like identity and access management. This analysis by Walia et al. [16] discusses current attendance system concerns, the operation of a typical fingerprint-based attendance system, an examination of numerous systems, their benefits and limitations, and comparisons based on key aspects.

This paper could be a look at a fingerprint identification system by Jaikumar et al. [17] that uses trivia-based fingerprint algorithms in a variety of ways.

This line of research is primarily concerned with the extraction of trivia points from model fingerprint images, as well as fingerprint matching to support the number of trivia pairings between two fingerprints. This study also discusses the look approach for fingerprint-based student group activity with the help of GSM. This method disregards the requirement for stationary materials and employees to maintain records.

Memon et al. [18] discussed the latest developments in fingerprint device technology, as well as the pros and disadvantages of each. Technology, underlying physics, liveness detection, resolution, performance assessment, restrictions, and standards are all explored.

Finally, the long-term evolution of fingerprint sensors and systems is investigated.

According to Wahjono et al. [19] the purpose of this analysis is to assess the management data system and, as a result, the benefits of the InsideDPS package. The form, which was sent to 250 workers and 198 sets of analysed multiple statistical regression, was created as a quantitative instrument to assist prior analysis (MSQ).

Before and after qualitative analysis, the form was circulated twice. For time unit managers, IT managers, and elite personnel, informants were used to control interviews, observation, and document collection. The MIS InsideDPS package will help HRD performance improvement, which will be aided by increased worker satisfaction, according to this study. The technical

relevance of the study's conclusions is that the company would benefit from a more widespread web-based MIS tool.

Management of leave and payroll are critical operations for any company since they affect the payment of staff members of any establishment as well as the completion of it accurately and on time. Both the Leave Manager and the Payroll Manager are largely paper-based solutions. Even though the tracking is biometric, it is not very cost-effective in terms of leave management. Manual payment calculation of staff members is simply too hard, taking up a lot of your time and requiring a lot of effort. As a result, if these operations are machine-controlled, it may be profitable because it will take less time to calculate the regular payment of the workforce. As a result, an internet application that includes a payroll administration system is considered in tandem with the technique presented. These systems enable multiple user knowledge access. Employees, members, and administrators will log in to the package using the id and positive identity assigned to them by the organization. It entails keeping track of hours worked and maybe preserving a record of worker knowledge as well as their pay, allowances, deductions, and taxes on a monthly basis so that contemporary definitions are reflected from the month ahead while keeping all previous knowledge intact.

Similarly, they have a well-thought-out leave management system as the solution for managing the entire leave-related work, such as seeking leave and approving leave. The predicted leave and payroll system is very cost-effective since it allows for simple configuration, reduces human calculation errors, and improves security. Applying for leave, examining leave history, seeing leave stats, and granting/rejecting leave applications are some of the tasks that could be handled by exploiting the Leave Management module.

SYSTEM REQUIREMENTS

Hardware Requirements

1. Ethernet connection (LAN) OR a wireless adapter (Wi-Fi)
2. Hard Drive: Minimum 32 GB; Recommended 64 GB or more
3. Memory (RAM): Minimum 1 GB; Recommended 4 GB or above
4. RFID card
5. RFID reader
6. Nodemcu
7. Connecting wires
8. Buzzer

Software Requirements

1. Operating System: Windows XP, Vista, 7, 8, 10, Linux, Unix.
2. Languages used: HTML/CSS/JavaScript (Frontend), PHP(Backend)

3. Database: MySQL
4. Development Environment: Visual Studio Code

SYSTEM DESIGN

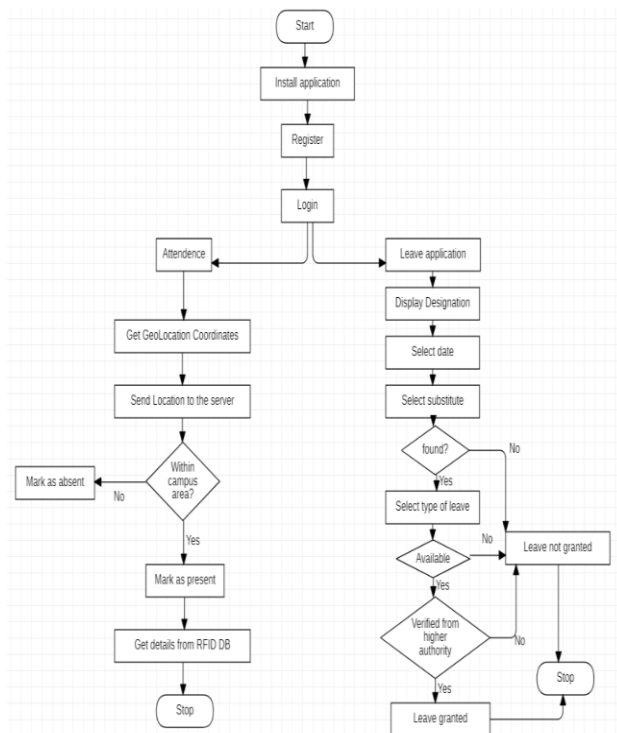


Fig. 1: Flow Diagram for web app and attendance tracking using geolocation

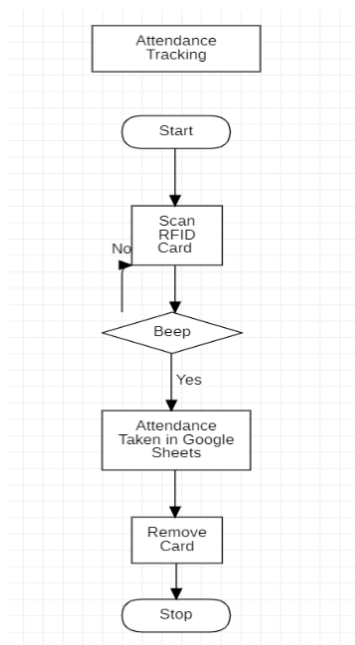


Fig. 2: Flow diagram for attendance tracking using RFID

IMPLEMENTATION

Below are the steps for creating RFID

1. Hardware Setup:

Below is the circuit diagram of the attendance system

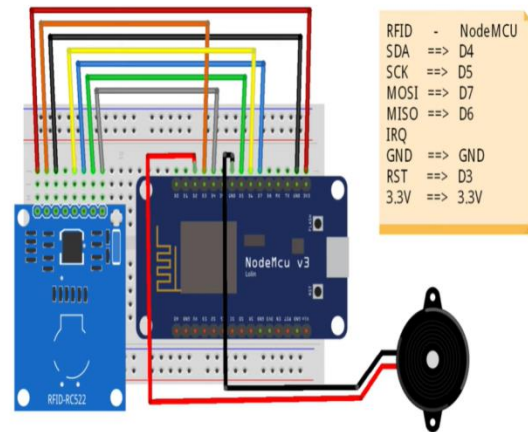


Fig. 3: Circuit Diagram for RFID connection

2. Using Arduino upload the card details using NodeMCU.
3. Create a google script and deploy it
4. Add the google deployment Id in the rfid upload file.
5. Upload the write google sheets file and read the card, the data will get stored in the sheets.

The web application is created using html/CSS/JavaScript and the connection of frontend to database is done using PHP. For database MySQL is used which is viewed from phpMyAdmin.

Another approach includes tracking of attendance using geolocation wherein a geofence will be created and when the user enters the geofence attendance will be marked.

RESULTS

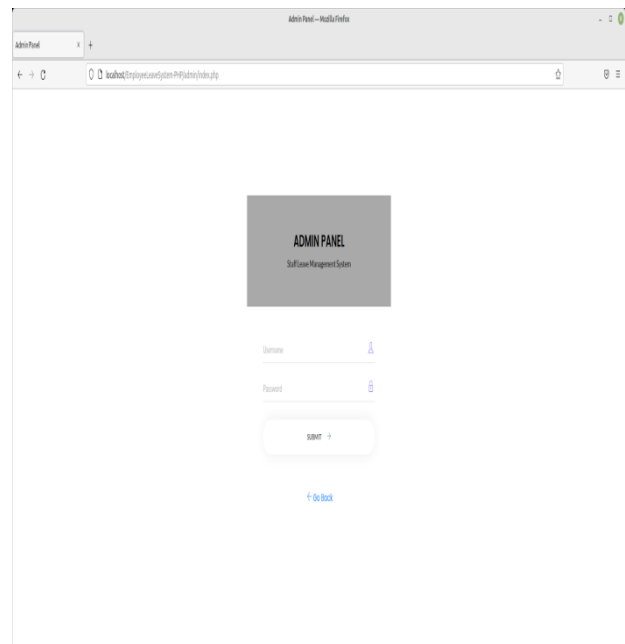


Fig. 4: Admin Login Page

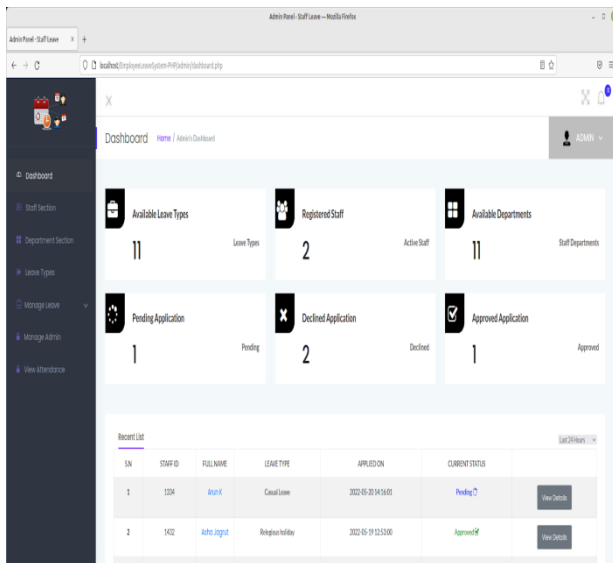


Fig. 5: Admin Dashboard Page

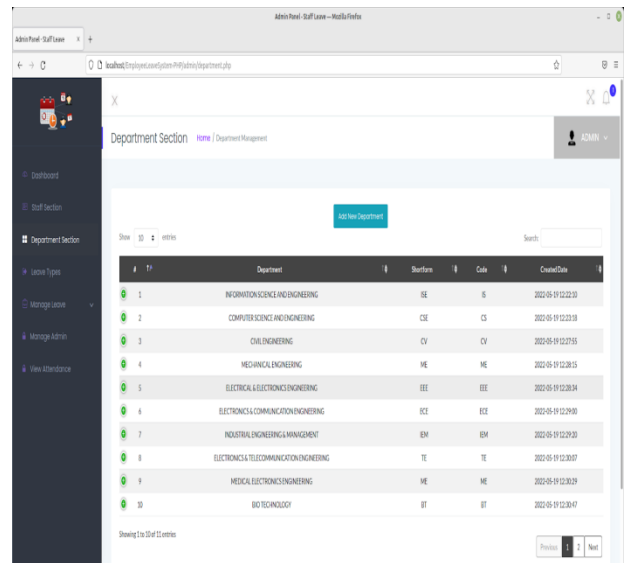


Fig. 8: Department Section Page

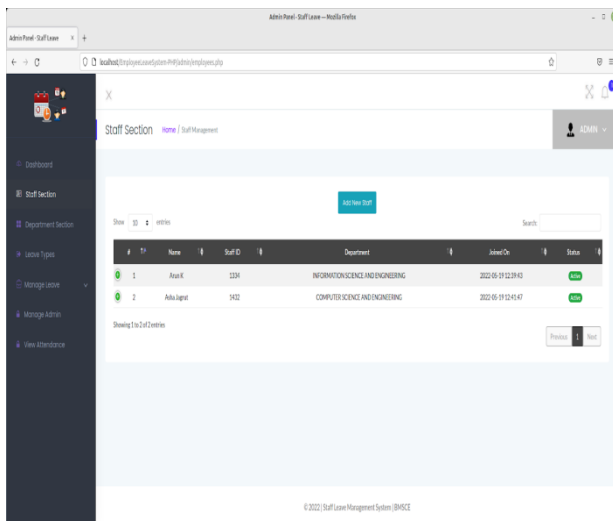


Fig. 6: Staff Section Page

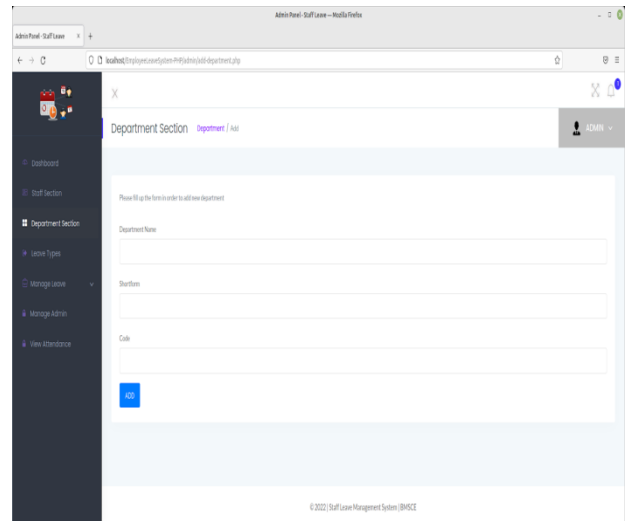


Fig. 9: Add department Section Page

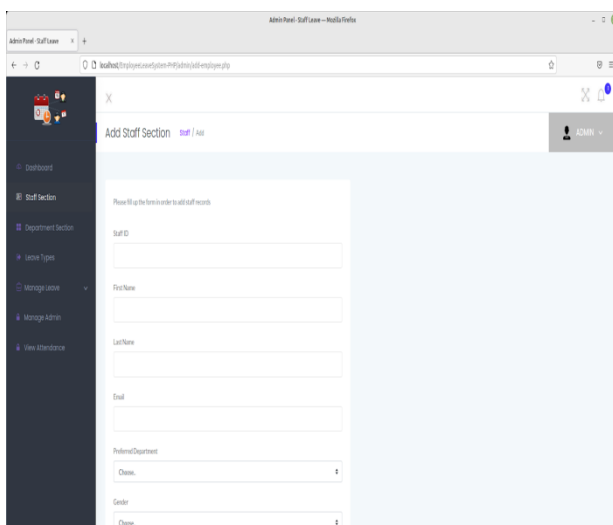


Fig. 7: Add Staff Section Page

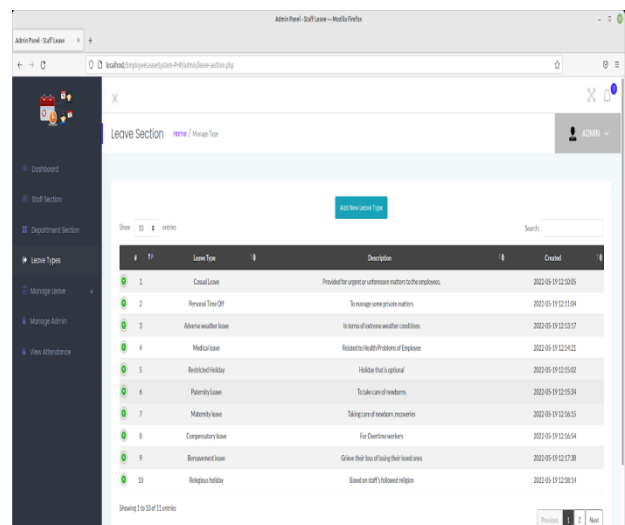


Fig. 10: Leave Type Section Page

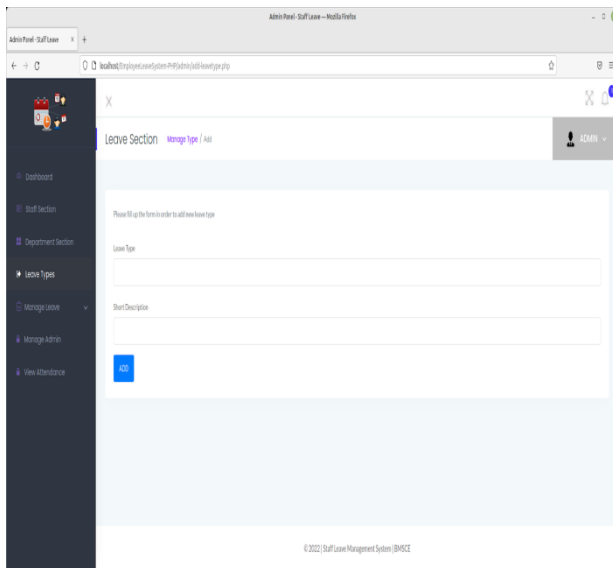


Fig. 11: Add Leave type Section page

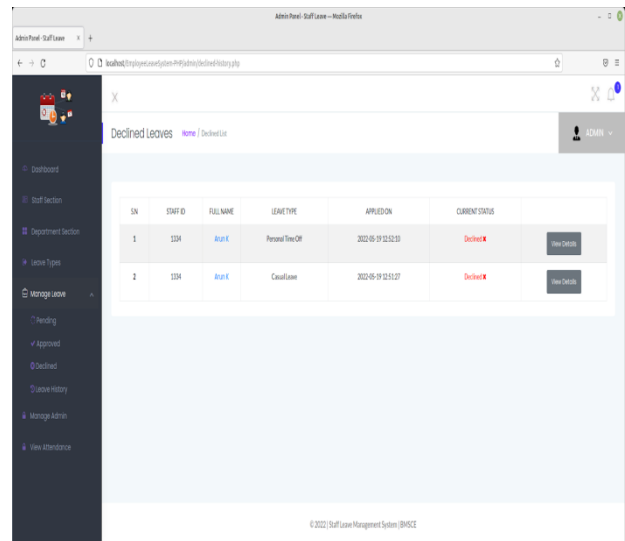


Fig. 14: View Declined Leaves page

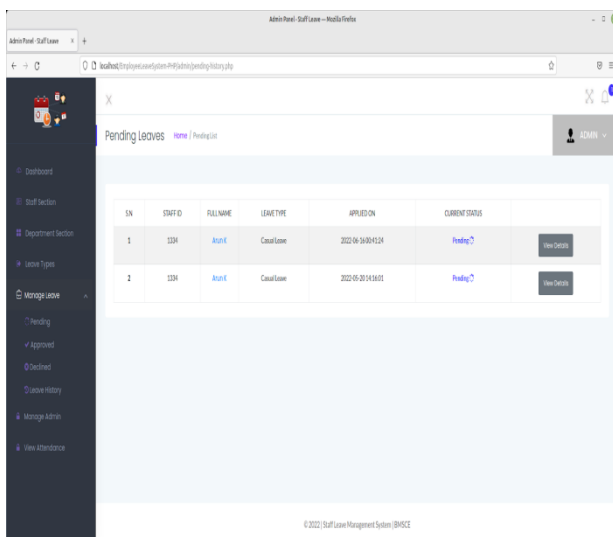


Fig. 12: View Pending Leaves Page

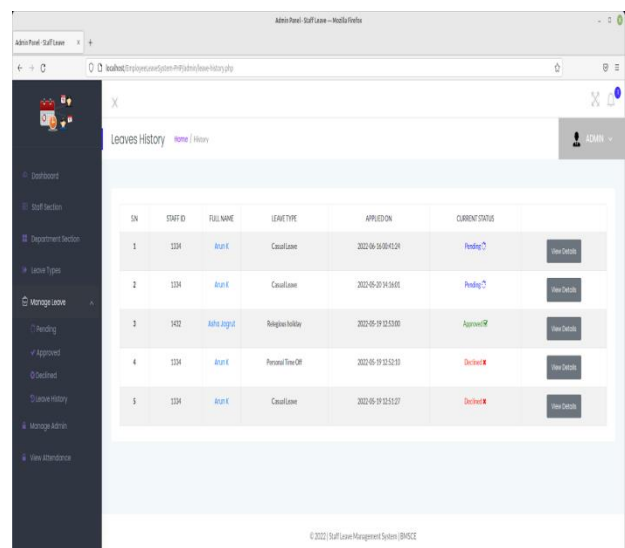


Fig. 15: View Leave History Page

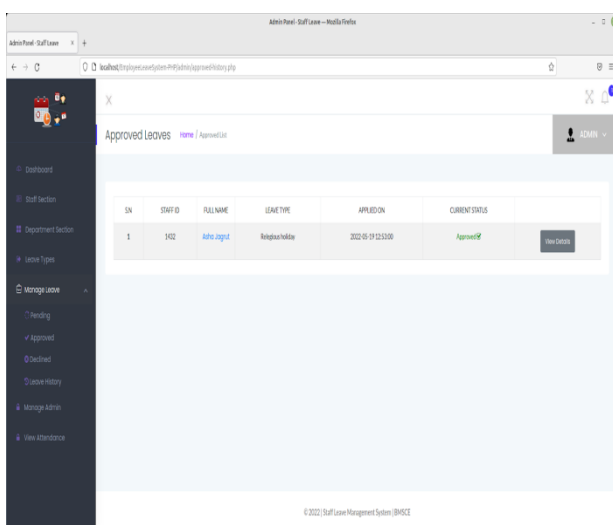


Fig. 13: Approved Leave Page

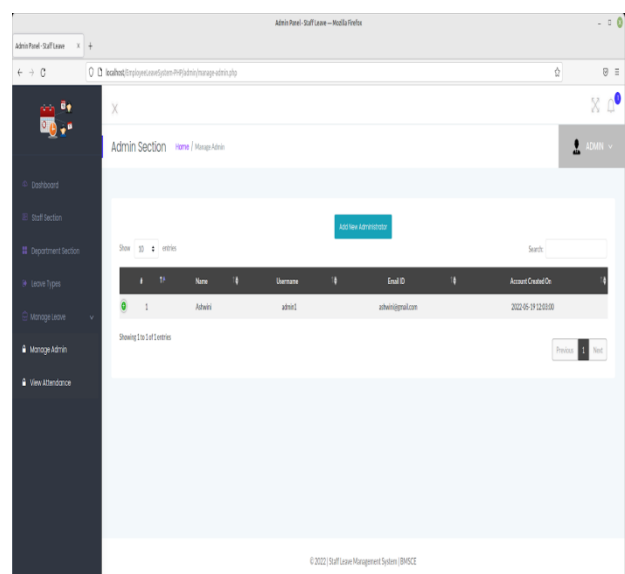


Fig. 16: View admin Page

Fig. 17: Add new admin Page

Fig. 20: Apply for leaves Page

Date	Time	Name	Status
05/05/2022	10:00:00	Admin	Approved
06/05/2022	09:00:00	Admin	Approved
07/05/2022	09:00:00	Admin	Approved

Fig. 18: Attendance tracker sheet collected using RFID

Fig. 21: Leave applied successfully message

Fig. 19: Staff Login Page

#	Type	Conditions	From	To	Applied	Admin's Remark	Status
1	Casual Leave	NA	2022-05-04	2022-05-02	2022-05-19 12:52:27	Not permitted at 2022-05-19 13:00:34	Not Approved
2	Personal Time Off	NA	2022-05-01	2022-05-07	2022-05-19 12:52:28	NA at 2022-05-08 14:57:39	Not Approved
3	Casual Leave	NA	2022-05-01	2022-05-01	2022-05-01 14:56:05	Pending	Pending
4	Casual Leave	NA	2022-04-21	2022-04-20	2022-04-20 14:56:05	Pending	Pending

Fig. 22: Viewing Leave History Page

Fig. 23: Staff Profile Page

```

01:08:11.410 -> Reading last data from RFID...
01:08:11.414 -> Authentication success
01:08:11.444 -> Block was read successfully
01:08:11.477 ->
01:08:11.477 -> Last data is: RFID-2 -> Akshata
01:08:12.223 -> https://script.googleusercontent.com/macros/#!/AfYdyep_dikxlVz6cM_380evr3h/45c2P6dM8v6hC_9d3H45307b67XCL3M4Bthcb0M000/#!/name=Akshata
01:08:12.323 -> [HTTP] begin...
01:08:12.327 -> [HTTP] GET...
01:08:15.749 -> [HTTP] GET... code: 302
  
```

Fig. 24: Connection of RFID to database

APPLICATIONS

A leave Management System Is used to automate the leave request method, creating it hassle-free for each of the management and therefore the staff. The answer of your selection ought to be sturdy enough to seamlessly handle all the stages concerned in an exceedingly leave management process: application, approval/rejection, filing leaves, managing leave balance, and analysis.

Few advantages are:

- All-in-one Dashboard
- Seamless Integration
- At-a-Glance Reporting
- Eliminates paperwork
- Removes manual interventions
- Improves communication
- Offers real-time visibility of data
- Hassle free attendance tracking

CONCLUSIONS

After going through the literature survey and analyzing the different solutions available, we have built a web application that can perform the required functions for staff leave management that is apply for leave, accept/reject leave by admin, view history, view attendance that is being tracked using RFID reader Ic.

For further enhancement we have the proposed geolocation model which can create a geofence, track whenever a device enters the geofence and send notification to the device this data can be connected to the web application.

REFERENCES

- [1] Kabir, Md Humaun, Sujit Roy, Md Tofail Ahmed, and Mahmudul Alam. "Smart Attendance and Leave Management System Using Fingerprint Recognition for Students and Employees in Academic Institutes."
- [2] Stephen, Bliss Utibe-Abasi, and Gloria A. Chukwudebe. "Leave management solution for improved service delivery in the Nigerian university system." In 2017 IEEE 3rd International Conference on Electro-Technology for National Development (NIGERCON), pp. 601-611. IEEE, 2017.
- [3] Ramanan, M. "Web Based Leave Management System for University College of Jaffna."
- [4] Malathy, E. M., V. Sivamurugan, and Sushmita Rajtilak. "Performance Analysis and Enhancement to Biometric based Attendance System." In 2020 4th International Conference on Computer, Communication and Signal Processing IEEE, 2020.
- [5] Osman, Mohd Nizam, Khairul Anwar Sedek, Mushahadah Maghribi, and Nadia Hidayah Mohd Faisal. "ANotify: A Fingerprint Biometric-Based and Attendance Web-Based Management System with SMS Notification for the Industrial Sector." Journal of Computing Research and Innovation 3, no. 1 (2018): 36-45.
- [6] Buhain, Jay-Arr C., and Christian. "Development of a Leave Management and Monitoring System for the Cavite State University Campus Network." International Journal of Business and Technology Management 3, no. 3 (2021): 124-135.
- [7] Shukla, Vinod Kumar, and Nisha Bhandari. "Conceptual Framework for Enhancing Payroll Management and Attendance Monitoring System through RFID and Biometric." In 2019 Amity International Conference on Artificial Intelligence (AICAI), pp. 188-192. IEEE, 2019.
- [8] Plata, Irma T., and Jomar L. Calpito. "Application Of Time-Based One Time Password (TOTP) Algorithm For Human Resource E-Leave Tracking Web App." International Journal of Scientific and Technology Research 9, (2020): 4070-4077.
- [9] Sarker, Dhiman Kumar, Nafize Ishtiaque Hossain, and Insan Arafat Jamil. "Design and

- implementation of a smart attendance management system using multiple step authentication." In 2016 International Workshop on Computational Intelligence (IWCI), pp. 91-95. IEEE, 2016.
- [10] Arsenovic, Marko, Srdjan Sladojevic, Andras Anderla, and Darko Stefanovic. "FaceTime—Deep learning based face recognition attendance system." In 2017 IEEE 15th International Symposium on Intelligent Systems and Informatics (SISY), pp. 000053-000058. IEEE, 2017.
- [11] Singla, Vinayak, Indra Kumar Malav, Jaspreet Kaur, and Sumit Kalra. "Develop leave application using a blockchain smart contract." In 2019 11th International Conference on Communication Systems & Networks (COMSNETS), IEEE, 2019.
- [12] Fortich, Mitzi S., and Dave E. Marcial. "Human Resource E-leave Management: a Decision Support System." *Informatika: Jurnal Teknologi Komputer dan Informatika* 10, no. 2 (2014): 66037.
- [13] Haumshini, R., Sathia Dev, and R. Mahendran. "Digitized Hostel Leave Management System." *International Journal of Emerging Technology and Innovative Engineering* 6, no. 01 (2020).
- [14] Khan, Nafiz Imtiaz, Sumaiya Nuha Mustafina, Farzana Faruk Jhumu, A. H. M. Zobyer, Masrur Hasan Mahin, Md Ariful Islam Tarek, Raiyan Rahman, and Muhammad Nazrul Islam. "Towards Developing an Automated Attendance Management System using Fingerprint Sensor." In 2020 Emerging Technology in Computing, Communication and Electronics (ETCCE), pp. 1-6. IEEE, 2020.
- [15] Opoku, Samuel King. "An automated biometric attendance management system with dual authentication mechanism based on Bluetooth and NFC technologies." *International Journal of Computer Science and Mobile Computing* 2 (2013): 18-25.
- [16] Walia, Hitesh, and Neelu Jain. "Fingerprint Based Attendance Systems-A Review." *International Research Journal of Engineering and Technology* 3, no. 5 (2016): 1166-1171.
- [17] Jaikumar, K., M. Santhosh Kumar, S. Rajkumar, and A. Sakthivel. "Fingerprint based student attendance system with SMS alert to parents." *Int. J. Res. Eng. Technol* 4, no. 2 (2015): 293-297.
- [18] Memon, Shahzad, Mojtaba Sepasian, and Wamadeva Balachandran. "Review of fingerprint sensing technologies." In 2008 IEEE International Multitopic Conference, pp. 226-231. IEEE, 2008.
- [19] Wahjono, Sentot Imam, Anna Marina, Ismail Rasulong, and Fam Soo Fen. "Leave management information system using Inside DPS software for the efficiency of human resources management." *Kinetik: Game Technology, Information System, Computer Network, Computing, Electronics, and Control* (2020): 211-218.
- [20] Singh, Manish, Prachi Singh, Rohil Singh, Shubham Singh, and Shiwani Gupta. "Leave and Payroll Management System." *IOSR Journal Of Computer Engineering (IOSR-JCE)* (2017).

Optimal Allocation of FACTS Devices in Transmission System Using Social Group Optimization (SGO)

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Abstract

This paper presents the application of Social Group Optimization (SGO) techniques to find the optimal location of Flexible AC transmission system (FACTS) in the transmission line to enhance the power transfer capability. The Three types of FACTS devices, like Thyristor Controller Series Compensator (TCSC). Static Synchronous Series Compensator (SSSC) and Static Synchronous Compensator (STATCOM) are used.

The impact of using a combination of TCSC and SSSC has been analyzed in minimizing the power loss and maintaining the voltage stability of the system. Simulations are performed on standard IEEE-5, IEEE-10 and IEEE-62 bus system. The results obtained are quite encouraging and will be helpful in power and system voltage for maintaining stability.

A Smart Review on Hybrid Forecasting Systems Based on Solar and Wind Energy Sources

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Abstract

The growth of India's solar and wind energy systems may be hampered by several unique limitations. Power quality concerns such as voltage and frequency fluctuations and harmonics affect both grid-connected and independent systems, and they have a significant influence when the grid is weak. However, India has plenty of sunlight and a constant wind speed. In the past few years, electricity generation for solar and wind energy applications has grown significantly. However, PV and wind power generation fluctuations can negatively impact the connecting grid's reliability, stability, and testing. Proper PV and windmills forecasting are critical to stabilizing the operation of a power plant. This article addresses the challenges and potential for PV and wind- based hybrid energy integration systems. This may be handled by correct design, superior quick response control capabilities, and excellent hybrid power system optimization to a significant extent. The study reviews published original research on optimal size design, power electronics architecture, and control.

Keywords:

Solar, wind, grid, forecasting, harmonics, transient response.

Analysis of Model Order Reduction Techniques in Discrete Time Control System

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Abstract

In modern scenario people are in a computer era where all machines are controlling by the computer. To achieve this, the control system plays an important role. To reduce higher order discrete time system is a big challenge in to the digital control system. This paper represents an analysis of a proposed and the existing model order reduction (MOR) techniques in discrete time system. It propose a combined modeling techniques based on Time Moment (TM), Markov Parameter (MP) and Bilinear Routh Approximation (BRA) in w-domain. The Bilinear transformation method has been used to convert a z-domain transfer function model to w-domain and obtain a reverse conversion process by inverse bilinear transformation (IBT) method. The denominator coefficient and numerator coefficient of the combined proposed model are achieved by using BRA technique, TM and MP techniques respectively. To find out the numerator coefficient, it used only TM and MP as case 1 and only TM as case

The flexibility of proposed techniques is explained by examples. On the basis of quantitative parameters of step response (SR) and impulse response (IR), it compares the combined techniques with existing model order reduction techniques. The obtained result has confirmed that case 1 and case 2 are quite simple and able to generate a stable model.

Index Terms:

Model order reduction, Discrete-time system, Digital control system.

Design and Implementation of Automatic Fire Extinguisher Using Acoustic Sound Waves

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Abstract

The need of fire extinguishing techniques is vital as fire accidents are catastrophic in nature, leads to unrecoverable loss. The current fire extinguishing comes with various drawbacks. The present existing techniques are not eco-friendly. The need for new fire extinguishing techniques is vital as fire accidents cause deaths and injuries. Sound wave could be one of the potential alternatives as fire extinguishers. The low frequency acoustic waves spilled from a speaker tend to extinguish the flames.

Keywords:

fire extinguisher with sound wave.

Text Corrector for English Language

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Abstract

Everyone's life revolves around time, and some people find it difficult to set aside enough of it. Time is of the essence in situations where a person must maintain precise track of spelling legibility and websites to be mentioned. As a result, it's crucial to use technologies like spell checkers to guarantee that human mistakes are kept to a minimum. Deterministic Finite Automata are used to determine which language a given string of characters belongs to, as well as to check whether the order of the strings represents the structure of a valid URL. After a while, a DFA will run out of string. Then, if possible, there will be a match.

Keywords:

Deterministic Finite Automata, Levenshtein edit-distance, Spell checker, Non- Deterministic Finite Automata.

Design & Finite Element Analysis of Pressure Vessel Using ANSYS

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Abstract

Pressure vessels are of immense importance in most of the industries today & are drastically used in many fields such as chemical, petroleum, military industries as well as in nuclear power plants. Catastrophic accidents can occur due to rupture of pressure & as a result they should be designed & analysed with immense care & precision. The exact estimation of stresses due to the applied mechanical & thermal loads are the common problems faced by any engineer while designing the vessel. This paper aims to design of pressure vessel using ASME Code Book, accordingly model the vessel in Solidworks & carrying out the finite element analysis for the Pressure vessel using ANSYS. The critical parameters of pressure vessel that are taken into account includes internal pressure, seismic, wind loads & operational loadings. The paper focuses upon the design of thin walled pressure vessel particularly a tall vessel where the vessel is designed using manual calculations & performed FEA to determine the stress in the vessel due to multiple loadings. It consists of design of thin walled pressure vessel made up of homogeneous material where the stresses are plotted along with the contour plots & have verified the FEA results with the analytical solution.

Keywords:

Pressure vessel, finite element analysis, ANSYS.

Demystifying the Implications of Environment Impact Assessment, 2020

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Abstract

Right to live in a healthy environment is an undisputed and undoubted basic human right to which every individual shall be entitled. From the legal point of view, in India, although, right to a clean environment is not enshrined precisely as one of the fundamental rights under the Constitution but the same can be attained by the virtue of Article 21 (Right to Life). In addition to this, there had been a continuous effort from the legislators in order to protect and improve the environment for a better living by enacting numerous legislations such as the Environment (Protection) Act, 1986, the Wildlife (Protection) Act, 1972, the Water and Air (Control and Prevention of pollution) Acts etc. The Environment Impact Assessment (EIA) is one of the fragment of an attempt towards environmental protection. This research paper aims to demonstrate the implications of EIA, 2020 in India. The EIA notification in India have a history of nearly about 20 years but whether the latest amendment is boon or bane from the industrial perspective, that is what the question of the hour is. The paper intends to critically analyze the extent to which EIA, 2020 is successful in achieving its objectives. To sum up, the research paper concludes with a comparative study of the old and new norms of Environment Impact Assessment through the lens of environmental protection and restoration.

Keywords:

Environment Impact Assessment, Environment, power plants, India.

Sustainable Development of Indian Smart Cities and Their Focus on Resilient Growth: A Policy Review

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Abstract

Indian smart cities are epitome of fast paced urban growth in a developing country. Post-Independence India has been forced to grow at a tremendous pace to keep up with the global pace of development and has been successful in establishing itself as a leading geo-political force to be reckoned with. Since 2014, the pace of urbanization has accelerated further with the identification of more than 100 smart cities, urban centers which are beacons of growth and development.

In the overall Indian urban growth agenda, sustainable development is presumed to be an embedded thought, something which is anticipated to happen on its own by virtue of spontaneous growth and development. The present paper focuses on the role of Indian urban development strategies in encouraging resilient growth thereby leading to sustainable development. The paper reviews the post independence policy focus on urban development in general and assesses post-2014 urban development policies with respect to their focus on infusing resilient growth in the targeted smart cities. The paper concludes with a gap assessment in policy framework and recommendation for a way forward.

Enhanced Power Factor of Mg₂Si with the Addition of SiGe Particulates

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Abstract

Mg₂Si alloys are promising thermoelectric materials as they successfully replace toxic materials. However, its low figure-of-merit limits the usage of thermoelectric power generators. The SiGe compound particulates were added to the Mg₂Si material to overcome these issues and enhance the thermoelectric performance. The Mg₂Si-SiGe compound was synthesized using the reactive spark plasma sintering technique. The crystal structure and microstructure analysis were performed using X-ray diffraction analysis and Field Emission Scanning Electron Microscopy. Adding SiGe particulates increases the power factor value by ~ 50% higher than the pure Mg₂Si. The significant increase in electrical conductivity ~ 40% higher value in Mg₂Si-SiGe compounds compared to the pure Mg₂Si is mainly due to carrier electrons enhancement.

Keywords:

Thermoelectric materials, Mg₂Si, Power factor, Spark Plasma Sintering.

An Intelligent “Multi – Level” Model for Optimizing Loan Portfolio of Retail Banks

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Abstract

The research discusses multi-level portfolio selection problem, which combines hierarchical optimization of credit portfolio, incorporating regulatory & capital constraints, in the context of emerging retail banking loans. The model allows for twin objectives of risk minimization, simultaneously providing scope for maximizing returns.

Though many researchers have used Markowitz theory for portfolio optimization, it cannot be used for credit portfolio optimization problem, due to its underlying assumption on normality in distribution of returns and losses. There are other peculiarities with credit portfolios such as its illiquid nature of assets, because of paltry existence of secondary market and consequent inability to balance the portfolio, which can lead to inappropriate results, when traditional mean-variance approach is used for credit portfolio optimization.

The existing research studies follow a piece meal approach towards loan optimization and provide solution for local optimization problems. We analyze the portfolio optimization problem, as a holistic 3 -stage optimization problem:

- (a) At loan level to reduce the default risk through efficient credit evaluation method to decide whether to include the loan within the given portfolio or not.
- (b) At head office/ Bank level, to balance the return and risk objectives and decide the right asset allocation at bank level, under the regulatory constraints

The current study uses machine learning and evolutionary algorithms, to solve multi-level optimization problem, of risk minimization and return maximization. We use publicly available datasets for modeling the solution and comparing multiple Algorithms.

Relevance of Existing Sales and Marketing Strategies in FMCG Start Up – Case Study Approach

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Abstract

India has entered the age of 100 unicorns now with 1 billion revenue. Venture Capitalists search for the following features for investments. Innovative Ideas, Innovative Product, Innovative Route to plug, Exceptional Growth Strategy, Management Team, Societal Impact. Also now the buyer mind-set is changing. It's but obvious that this is the era of digitisation. The Covid-19 pandemic has sensitized the consumer's awareness of health and wellness. There's an increasing demand for organic and natural products with customers paying attention to sustainability across the value chain, and selecting brands that support their personal goals as well as lifestyle adaptations. Consumers also are trying digital-first involvements, alongside relevant communication. This may result in the delivering personalized products delivery engaging effectively and enhancing customer experience in the FMCG sector using data insights. FMCG industry has also inclinations are towards digitalization, environmental consciousness and health.

Omni Channel retailing means a hassle free experience from mobile laptop or store. Even after lockdown restrictions removal, e-marketplaces, and online purchasing still grow as this has given purchasing flexibility. Only a consumer gathers information about a product from a variety of sources to support his purchase decision, and then he decides to shop for. Thus, digitalization becomes extremely important to capture market share.

With the change in purchasing habits with the increasing competition with the connectivity communication and spatial reduction what should be the strategy further for brand artificial intelligence-based, will take into consideration the macro and micro points and will forecast the sales performance of the future period.

While marketing has a long-term focus and always a broad scope, it is benefits- and opportunities-driven and proactive; in Covid times which occur once in 100 years many small companies lost their existence and are still finding it difficult to stand again. Only those with huge moat were able to survive and are still burning the cash. It panicked all the industries for the right reasons as the losses were Multifood as personal, emotional, financial physical psychological and many others. Such difficult times should be overcome through methodical and well planned actions. After all, research and these times has shown that some companies that took proactive and novice stance and treated the recession as an opportunity also come out of the crisis stronger than before. Unique marketing activities have proved to be beneficial to companies during the lockdown.

So this paper shall analyse what are the existing strategies on market of the top FMCG Companies and how is it relevant in the dynamic green organic product in the Start-up sector through case study approach.

A Study on Blood Pressure Monitoring for Life Style Changes

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Abstract

In today's fast-paced world, people tend to be affected by hypertension. Hypertension brings on the root causes of fatal diseases like stroke prognosis, cardiovascular disease, artery damage, blood clots, osteoporosis etc. Many parameters are the root cause of hypertension. Initially, Bp varies slightly for any of those parameters, which is called a short-term Bp variation. Finally, it contributes to Bp increases in our long-term period, called long-term Bp variation. To study blood pressure monitoring, various mobile apps for creating reports and wireless home blood pressure monitors have been developed as a personal device to continuously monitor the blood pressure even during daily activities. However, none of the mobile applications do not study the short-term Bp contribution factors of lifestyle. Here, we proposed a mobile application to monitor the blood pressure and also monitor the instantaneous blood pressure changes for a specific user's lifestyle activities. Additionally, if any of these activities are the root causes of high blood pressure, we give recommendations on how to prevent them from such activities, as well as some other simple recommendations for regulating the users' blood pressure values.

Keywords:

Blood pressure, Blood pressure variability, Short-term and long-term BP variation, Monitoring blood pressure, Lifestyle activities, Mobile applications and specific recommendations

An Efficient Two Phase Intrusion Detection System (IDS) Using Deep Learning Techniques

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Abstract

An intrusion refers to any forcible or unauthorized activity on a digital network. These unauthorized activities almost always imperil the security of networks and their data. Nowadays, online brands and companies are the usual subjects of these attacks. However, to properly deal with this, we continuously monitor the network input traffic to recognize the intrusion and this type of monitoring system is called an Intrusion detection system (IDS). Although intrusion detection systems monitor networks for suspicious or potentially malicious activity, they also look out for false alarms. This means that organizations need to adequately set up intrusion detection systems in order to recognize what regular traffic on the network looks like compared to malicious activity. Many such systems exist in the real time scenario, but they have critical issues of performance like low accuracy and high false positive rate. These issues are addressed as a part of this research work of Two phase IDS using Deep learning techniques. The TP-IDS is designed in two phases for increasing accuracy. In phase I of TP-IDS, a vision transformer is used. In phase II of TP-IDS, NFNet is used, where phase II is the validation phase of the system for increasing accuracy and reducing false positive rate.

Students Marks Prediction

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Abstract

In better academic institutes, many college students ought to war tough to finish one-of-a-kind guides on account that there's no committed guide presented to college students who want unique interest within side the registered guides. Machine gaining knowledge of strategies may be applied for college students' grades prediction in one-of-a-kind guides. Such strategies could assist college students to enhance their overall performance primarily based totally on anticipated grades and could allow teachers to become aware of such folks who would possibly want help within side the guides. The predictive version is educated and examined the usage of diverse system gaining knowledge of (ML) and deep gaining knowledge of (DL) algorithms to symbolize the gaining knowledge of conduct of college students in line with their have a look at variables. The overall performance of diverse ML algorithms is in comparison via way of means of the usage of accuracy, precision, guide, and f-rating. The ML set of rules that offers the nice bring about phrases of accuracy, precision, recall, guide, and f-rating metric is in the end decided on for growing the predictive version at one-of-a-kind probabilities of direction length. The predictive version can assist in prediction of pupil marks in exams.

Development of Health Tracker System for Elderly People

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Abstract

This paper presents a health tracker system for elderly people to develop an Ambient Assistive Living (AAL) environment so as to facilitate them with necessary support during an emergency situation. The system consists of body sensors which are used in measuring the body temperature, pulse rate of the person, position of the person to ensure that the person has not fallen and also the ECG signal that is used to monitor the heart activity by looking into the ECG waveform. It provides facilities to store all of the sensors data in the cloud platform and to process the data. It also has a threshold based approach to decide if an abnormality has occurred based on the data stored in the cloud and then a notification is triggered to help in case of any emergency. A mobile application is developed to access the stored data which makes the caretaker as well as the doctor to keep precise track of the elder person's health status.

System C Modeling of Write Combining Burst Generator for Bus Protocols to Boost System Performance

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Abstract

Many processor cores and bus masters in MCUs primarily designed for control, do not have burst support. Even though the external memories such as SDRAM and the memory controllers support burst accesses, the system throughput benefit is not completely realized because of the limitation imposed by the masters. Enhancing the cores/masters for burst support is more often than not, the least preferred solution, due to the time and complexity involved in the same.

The solution is to introduce the burst generator module in between non burst master and burst supporting slave to improve the performance gap. This comprises of 2 sub-modules: Write combining FIFO and READ CACHE. In this work, focus is on the write combining FIFO that combines single write accesses from the master and issues write burst accesses to the slave. This module is modelled using SystemC. Simulations with different write accesses and different FIFO depths are run to analyze the performance boost.

Keywords:

SDRAM, Burst generators, Write combining FIFO, Read cache, System C.

Auto Billing Shopping Cart Using Arduino

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Abstract

Nowadays purchasing and shopping at big malls is becoming a daily activity in Smart cities. This technique is select to decrease the Queue at a billing counter in a shopping mall. This system performs the displaying the total price of the product kept inside the cart. In this way the customer can directly pay the amount at the billing counter and leave with the commodities they bought. It removes the traditional scanning of item at the counter and in turn speeds up the entire procedure of shopping, also with this system the customer shall know the total amount to be paid and hence can accordingly plan his shopping only buying the essential items resulting in enhanced set aside. Since the entire procedure of billing is automated it reduces the possibility of human error essential. Also, the system has a characteristic to remove the scanned products to advance optimize the shopping experience of the customer. The hardware for the test run is based on the Arduino platform and We use inventory method for Mobile Applications, are very popular in small-scale research. Tracking of the product can be done in Mobile Applications.

Keywords:

Arduino, Mobile Applications, RFID, Shopping cart.

Determining Effects of New Expansions in Existing Urban Pattern of Patiala City, Punjab

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Abstract

Expansion of towns and cities is an unceasing process since antiquity. As per innovative concepts and technologies interfering with the traditional urban fabric of cities. This objects to the survival of the existing city. Even though we as urban designers, urban planners, landscape architects, etc. put our own thought processes into developing the cities without knowing the facts of making them chaotic, overcrowded, and more vulnerable. Instead of releasing urban pressure from the old pattern of cities, we are more focused on new development by making the collage of the city but together those patches or collage leads to discontinuity in the urban pattern. We need to prepare the stage-wise development plans so that cities develop in the right direction. To provide continuity in the urban pattern and integrated development with the new progress we need to implement urban development guidelines, urban design guidelines, and sustainable urban development guidelines along with other infrastructure agencies for upholding an urban connection between deep-rooted and new-fangled.

α -Amylase Inhibition by Using Different Plant Sources to Check Antidiabetic Property

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Abstract

Diabetes is one of the top ten most lethal diseases in the world. According to a 2019 WHO report, the dating rate has climbed by 70% since 2000. Diabetes is also entirely responsible for an increase in the male death rate of approximately 80% since 2000.

Diabetes mellitus is characterized by hyperglycemia (increase in blood glucose level). In type 2 diabetes, the pancreas either does not make enough insulin or does not utilize insulin properly. There are many pharmacological approaches available to treat diabetes (type-1 & type-2), for type one diabetes oral hypoglycemics drugs are available like insulin secretion enhancers – sulfonylureas, meglitinides, dipeptidyl peptidase-4 inhibitors, and to overcome insulin resistance drug-like biguanides and thiazolidinedione. Till now there is no cure available for the same. One of the areas of our research is in antidiabetic drugs Alpha-amylase inhibitors, the enzyme involved in the digestion of carbohydrates which is secreted by the pancreas and salivary glands specifically acting on α -1,4 glycosidic linkage of carbohydrate/starch polysaccharides hydrolyses to them into small chain dextrin's. alpha-amylase can greatly decrease the post-prandial rise in glucose levels and is a hence essential technique for the management of diabetes mellitus. In this research work, we have done work on some new plants having anti-diabetic activity plants and medicinally active parts like Fresh leaves of Peepal (ficus religiosa), Hibiscus, Mango (mangifera indica), Tulsi (ocimum sanctum), Seeds of Fenugreek (trigonella foenum-graecum), Pulp of Gooseberry (Phyllanthus emblica), Bitter gourd (momordica) and Jamun (eugenia jambolana) were collected from the Bichpuri Village, Uttar Pradesh, India.

In this study we found that, the highest percentage of inhibition on 1ml concentration is 39.13% Peepal (ficus religiosa) leaves. The highest percentage of inhibition on 2ml concentration is 36.95%.

Mango (mangifera indica). The highest percentage of inhibition on 2.5ml concentration is 32.60% Jamun (eugenia jambolana).

Keywords:

Diabetes, Polysaccharides, Inhibitors, Colorimeter, Di-peptide peptidase.

Production of Single Cell Protein from Mosambi, Pea and Peanut Waste by *Saccharomyces Cerevisiae*.

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Abstract

Handling of waste is a key challenge which ultimately leads to a profit. The daily residue from the farms causes pollution and effects environment. The way to deal with this waste is produce a high proteinaceous product which reduce the scarcity of proteins and also reduce the risk of proteins deficiency that causes disease. These kinds of protein generated by residue are best alternative for meat and pulses. In this study, the amount of protein is determined after several pretreatments of Mosambi peel, Pea peel, Peanut Shell. Due to high moisture content in mosambi it takes time to dried and also suffer with other problems like when you hydrolyzed mosambi with water and HCL then solution become thick rapidly and create difficulties to handle. Yeast utilized in the process it influences the quality of SCP feed and provide a potential route for recycling the agriculture waste into a valuable product. No additional steps are required to minimize the effect of nucleic acid that ultimately makes SCP Production cost effective. The final yield of SCP is calculated by Lowry's method and the maximum quantity was obtain in Mosambi peel than Pea and least in Peanut.

Keywords:

SCP, Mosambi peel, Peanut peel, Pea peel, Saccharomyces Cerevisiae.

“Vaccine Storage Unit Using Peltier Effect and Power Management Technique”

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Abstract

Refrigerators that run on gas or kerosene have long been thought to be the best option for storing vaccines in locations where energy is unreliable. Despite this, flaws in these devices have made storing vaccinations within the safe temperature range of +2°C to +8°C both difficult and expensive. Some of the flaws have been solved by battery-powered solar refrigerators, but the batteries they rely on are expensive and typically only last three to five years. A novel refrigerator technique known as "solar direct-drive" (SDD) eliminates the need for batteries, potentially resolving battery-powered vaccine refrigeration issues and extending the cold chain to locations that would otherwise be underserved. Gas or kerosene-powered refrigerators have long been thought to be the best option for keeping vaccinations.

Conventional cooling systems such as those used in refrigerators utilize a compressor and a working fluid to transfer heat. Thermal energy is absorbed and released as the working fluid undergoes expansion and compression and changes phase from liquid to vapour and back, respectively. Semiconductor thermoelectric coolers (also known as Peltier coolers) offer several advantages over conventional systems. They are entirely solid-state devices, with no moving parts; this makes them rugged, reliable, and quiet. They use no ozone-depleting chlorofluorocarbons, potentially offering a more environmentally responsible alternative to conventional refrigeration. They can be extremely compact, much more so than compressor-based systems. Precise temperature control ($< \pm 0.1^\circ\text{C}$) can be achieved with Peltier coolers. However, their efficiency is low compared to conventional refrigerators. Thus, they are used in niche applications where their unique advantages outweigh their low efficiency. Although some large-scale applications have been considered (on submarines and surface vessels), Peltier coolers are generally used in applications where small size is needed and the cooling demands are not too great, such as for cooling electronic components.

Structure Prediction and Molecular Docking Studies for Identification of Potential inhibitors against CotH Proteins in Fungal Species Causing Mucormycosis

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Abstract

Mucormycosis is defined as an insidious fungal infection caused by members of Mucorales and zygomycotic species. Mucormycosis is mainly caused by ubiquitous fungi in the order Mucorales, predominantly by *Rhizopus* species including *Rhizopus delemar* and *Rhizopus oryzae*. Lichtheimia (previously Absidia), Apophysomyces, and Cunninghamella species have also been reported to cause mucormycosis. During the last few years, mucormycosis has become the third most common invasive fungal infection in patients with hematological malignancies and organ transplantations. Incidence of Mucormycosis is particularly high in patients having immunocompromised health and individuals who have elevated level of iron and glucose in their blood. As there is increase in number of cases suffering from lifestyle diseases like diabetes mellitus and cancer, there has been tremendous spike in number of patients reported to suffering from Mucormycosis. Though there are many aggressive therapeutic strategies like disfiguring surgical debridement and adjunctive toxic antifungal therapy available, still rate of mortality reported from Mucormycosis is alarming. New strategies to prevent and treat mucormycosis are urgently needed. It has been reported that CotH receptor proteins have a potential role in binding of *Rhizopus delemar* and *Rhizopus oryzae* with the host cells. Further, CotH1, CotH2 and CotH3 are the spore coating protein of Mucormycosis which are mostly responsible for invasion of host cells and causing diseases. In our current work, we have predicted structure of CotH1, CotH2 and CotH3 receptors using homology modelling on SWISS Server followed by Insilico analysis of predominant 46 phytochemicals found in Uttarakhand region against these three receptors. Autodock vina was used for molecular docking for assessing Binding affinity of various phytochemicals followed by Molecular dynamics studies using GROMACS to estimate the RMSD parameters and stability of the protein ligand complex. ADMET and toxicity studies of potential ligands was done to assess the pharmacokinetic, pharmacodynamic and safety parameters. Our Insilico study suggests that Curcumin, Allosecurinine, Isoquercetin are effective drug molecules against the receptors CotH1, CotH2 and CotH3 in the mucormycosis causing fungal species, *Rhizopus delemar* and *Rhizopus oryzae*. Based on these findings, further wet lab experiments need to be conducted to investigate the efficacy of these phytochemicals under invitro and invivo conditions. This research will serve as a blueprint for development of effective drugs for treatment of Mucormycosis.

A Study on “Work Place Stress and Survival Strategies in India”

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Abstract

Pressure at the workplace is unavoidable due to the demands of the contemporary work environment. Pressure perceived as acceptable by an individual may even keep workers alert, motivated, able to work and learn, depending on the available resources and personal characteristics. However, when that pressure becomes excessive or otherwise unmanageable it leads to stress. Stress can damage an employees' health and the business performance.

Today, no organization is free immune to stress. All organizations large and small, profit and nonprofit, global or local, non-governmental or governmental agency are prone to workplace stress amongst their employees. In the recent past, workplace stress among employees has become a considerable issue especially due to worsening economic situations. Work-related stress can be caused by poor work organization (the way we design jobs and work systems, and the way we manage them), by poor work design (for example, lack of control over work processes), poor management, unsatisfactory working conditions and lack of support from colleagues and supervisors. Employees are no longer sure what the organizational cost cutting measures would be and a level of work place stress is developed. Most organisations are taking the options of employees' layoffs and budget cuts which contribute to increased fear, hesitation and high stress levels owing to increased working hours thereby fatigue. In addition, organizational restructuring, mergers, and Six Sigma initiative adoption among others are signs that the levels of workplace stress are not anywhere near going. This is because these are effective ways of coping with current market advances in technology, competition and demographic forces. Changes in organizational activities are another way of introduction of stress among employees especially in cases where the organization will be forced to alter how they do business. Work place stress is a common form of stress to employees and employers have to seek effective strategies to manage it. Workplace stress is a hazard to the health of workers now more than ever. This can be accredited to the nature of work that is changing within the workplace which has taken a whirlwind speed. Work related stress is social psychological stress. The conceptualization of work place stress has been seen as the interaction resulting between an employee and the work environment where he or she is represented. Today's business leaders must cope with a great deal of ambiguity as they make important choices about the future. Many worry that an unknown event will transform their entire industry in a matter of a few weeks or months. Too often in times of turbulence the temptation is to “batten down the hatches” and seek safety by focusing on what can be controlled. Typically that means turning inward and acting “defensively” to avoid damage and minimize risk. Therefore managing workplace stress and survival strategies should be wisely designed to combat with turbulent times.

Keywords:

work place stress, survival strategies, turbulent times

Stress Management & Emotional Intelligence – Increasing Incidences of Counselling in Workplaces

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Abstract

Every human being decides or tries hard to be at peace with his self. The inner peace directly helps him to attain greater heights professionally and personally. The life around an individual is the cocoon he or she has built around them. This cocoon has to give him enough nurture and safety to come out as butterfly. The American psychiatric association research points out clearly the nexus between a person's accomplishments and the serenity he has attained. Emotional intelligence is the straight outcome of a managed temper and composed character.

Compared to the work cultures of yesteryears or even previous decades, the present one is extremely stressful and competitive. Targets, appraisals and business plans and meetings have literally trapped a person and they are using their stamina just to off set all the stress around and within them. Now a days every office has a counsellor or a psychiatrist for the employees to approach. Most of the work places have recreational outings, get aways, music/play rooms, sleeping rooms for the employees to counteract the stress they are going through. This paper aims to study the relationship between managed stress and emotional intelligence and guidance and counselling. We also make an attempt to study the impact of stress or intelligence on a person's economic achievements or attainments.

Complete Replacement of Fine Aggregate by Secondary Waste: A Leap Towards 100% Secondary Raw Waste Concrete

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Abstract

The contribution of civil engineers to global warming is tremendous. For the past few decades Civil Engineers have been trying to negate this by developing sustainable building materials and technologies. One way to mitigate this is use of large scale industrial and agricultural waste in concrete production. This not only reduces the burden to dump/process the waste but also reduces the demand of non-renewable natural resources. There have been numerous studies that investigate the possibility of partially replacing one of the components of concrete with secondary raw waste (SRW) in non-structural concrete. The number of studies that investigate complete replacement of non-renewable natural resources in concrete with SRW are low. This study aims at developing concrete where 100% of fine aggregate (FA) is replaced by SRW. Two SRW materials, viz., waste ceramic tiles and recycled aggregates were finalized for the study. Specimens of concrete with partial and complete replacement of FA with these SRW were casted and tested for compression. From observations and results of testing it is proved that with further research FA in conventional concrete, both structural and non-structural can be completely replaced by SRW alternatives.

Keywords:

secondary raw waste, sustainable concrete, recycled aggregates, crushed fine sand, ceramic waste, sustainable materials, green concrete, green building.

Comparison of Dynamic Wind Load Using Indian and International Standards with Case-Study

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Abstract

Gusts at ground occurs because of turbulence due to friction, wind shear or by solar heating of the ground. These three factors can force the wind to rapidly change speed and direction. The main aim of this study is to understand provisions of international standards and compare them with Indian standard. In this paper a comparative study of dynamic wind load analysis of steel buildings using two different codes is done as per IS 875 (Part-3):2015, ASCE 7-16. Wind loads are determined based on gust factor method. This paper presents displacement occur in different storey due to dynamic wind in different terrain category for different shapes of building. Six models are analyzed using SAP 2000 for each shape considering both the codes mentioned before. Present works provides a good source of information about variation in deflection as height of model changes and percentage change in deflection of same model in different terrain category.

Keywords:

Dynamic wind load, IS 875 (Part-3):2015, ASCE 7-16, Gust, Deflection.

A Study on Impact of Work Stress on Labour Turnover in Garment Manufacturing Units

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Abstract

Textile Industry in India is one of the major sources contributing to the GDP and plays its role in export earnings. The source of textile industry is fiber which turns into output as Garment. Garments are one of the basic needs and manufacturing of garments yields a lot of revenue irrespective to the social status of an Individual. Ballari, a city in north Karnataka has its legacy in garment production since pre-independence period and turned out to be a hub in designing garments specialized in jeans apparels. Labour is second major elementary source required in conversion of fiber into garments. India being a labour intrinsic nation, management of labour is a hassle in industries. Grievances are customary for labour in manufacturing units which results in labour turnover. This study intends towards the work stress absorbed in the labour influencing the labour workforce and the factors generating the work stress in labour at Ballari city.

Keywords:

Garment Manufacturing units, Work stress, Labour turnover, Apparel, Fiber.

Home Security and Automation System

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Abstract

Home Security automation systems have gained popularity in recent years; it provides security, safety and comfort in our life at home. That is why in the competitive environment and fast world, home automation technology is required for every person. This purposed home automation technology provides smart monitoring and control of home appliances as well as door permission system for interaction between the visitors and home/office owner. The control and monitoring the status (ON/OFF of the appliances) have been implemented using multiple ways such as The Local Area Network (LAN) Using Wi-Fi or Ethernet, Over Internet, Electrical Switch and Graphical User Interface. The system has low-cost design, user-friendly interface, and easy installation in home or multi-purpose building. Using this technology, the people can reduce the wastage of electrical power by regular monitoring of home appliances or the proper ON/OFF schedule of the devices. Paralleling advances in the concept of the Internet of things. The current project presents the Implementation of an inexpensive home automation and safety system, within the framework of assistive technology. The system implementation is based on the Single Board Computer (Raspberry Pi), with Online and Offline communications capability, and it is designed for use by the elderly and people with disabilities. The system is user-friendly, with an intuitive interface implemented on a Mobile, Web and Smart Control Panel which has touch screen feature and runs software which can be used to control and monitor every single device connected to it. Demonstrations show that the system facilitates control of home appliances, lights, heating, cooling systems and security devices such as Gas leakage detector, fire alarm and authentication-based door locking system by the intended users, i.e., the elderly and the disabled.

A Novel Approach to Embedded System Design for Electrical Power Conservation through Flexible AC Transmission Using TSC (Thyristor Switch Capacitor)

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Abstract

In conventional AC transmission the power transfer capability has been limited by various dynamic and static limits as transient stability, voltage stability, thermal limits etc.

To minimise these issues we are using a parallel combination of thyristors switched capacitor (TSC). The microcontroller /Arduino is used to vary the firing angle of thyristor then we get smooth current control range from capacitive to inductive value.
