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Dr. Janahanlal PS

Joint International Conferences on

# AITC & CSSP 2023

18 FEBRUARY, 2023  
VIRTUAL CONFERENCE

Published by

Hinweis Research  
2023, First Edition



# **International Virtual Conferences on AITC & CSSP - 2023**

# International Virtual Conferences on AITC - 2023 and CSSP - 2023

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KP 7/581, Kazhakkuttam, Thiruvananthapuram, Kerala, India-695301

*Proceedings of the*

**Joint International Conferences on AITC and CSSP 2023**

**ISBN: 978-81-958173-5-1**

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# Table of Contents

1. Encoder-Decoder Approach toward Vehicle Detection <i>Pushan Deb, Sunny Kumar and Preethi N</i>	1-6
2. Home Automation with Node MCU & Firebase using Internet of Thing (IoT) <i>Aarya Pawar, Pratham Khinvsara, Revant Pund, Tushar Raikar, Rishikesh Dayma and Nishant Kulkarni</i>	7-13
3. Open-Source Workforce Administration System using Django <i>Ritika Rastogi, Riya Gupta and Ayushi Agarwal</i>	14-22
4. E-Learning: Research and Applications <i>Shantanu Sharma, Shreeyanshi Gautam and Ayushi Agarwal</i>	23-28
5. Medical Chat Bot for Ambulance During Emergency Situations <i>Dhyaneshwaran J, Farrel Deva Asir J and Saranya S</i>	29-32
6. A Comprehensive Study on Time Series Analysis in Healthcare <i>Karthick Myilvahanan J, Nivetha K, Krishnaveni A, Mohana Sundaram N and Santosh R</i>	33-42
7. Detecting and Isolating Black-Hole Attacks in Manet using Timer based Baited Technique <i>Paramjit and Saurabh Charya</i>	43-49
8. Design of Wideband Band Stop Filter using Signal Interference Technique <i>Madhukumar Patnala, Bachu Munideepika, Vetti Pavithra, Totthuku Sunil and Nallapothula Sreenivasulu</i>	50-54
9. Block Chain-based E-Voting System using Smart Contract <i>Priya Shelke, Suruchi Dedgaonkar, Nilesh Gopale, Rohit Desai, Ninad Deogaonkart and Nachiket Joshi</i>	55-60
10. Phishing E-Mail Detection and Blocking it based on the Header Elements <i>Sulaiman Awadh Ali Obaid Maeli and Ajay U Surwade</i>	61-66
11. IoT based Weather Detecting System <i>Priyanshi Patil, Nikhil Patil, Pratham Patil, Mohit Patil and Pratap Patil</i>	67-71
12. Automatic Depression Level Detection <i>Rupali Umbare, Vedant Bhamre, Danish Tamboli, Trushant Jadhav and Pranav Kurle</i>	72-76

13. Cryptocurrency Price Prediction by Integrating Optimization Mechanism to Machine Learning 77-84  
*Deepak Nandal and Pankaj*
14. A Comprehensive Study on Current Trends in Unsupervised Machine Learning Algorithms and Challenges in Real World Applications 85-92  
*Velvadivu P, Sujithra M and Priyadharshini R*
15. Variable Selection Methods, Comparison and their Applications in Machine Learning: A Review 93-101  
*Kirti Thakur, Harish Kumar and Snehmani*
16. Devanagari Characters Recognition: Extracting Best Match for Photographed Text 102-109  
*Neelam Chandolikar, Swati Shilaskar, Vaishali Khupase and Mansi Patil*
17. Dental Biometrics Segmentation on Panoramic X-Ray Images using Computational Intelligence Approach 110-115  
*Sujithra M, Rathika J, Velvadivu P, Abinanda P, Gayathri G and Rekha V S*
18. Credit Risk Analysis of Loans using Social media Information 116-121  
*Halkarnikar P P, Khandagale H P and Amol Dhakne*
19. Blockchain Enabled Marksheets and Degree Certificates 122-129  
*Sharon Christa and Tanusha Mittal*
20. Design of a Miniaturized Microstrip Antenna using Slots on the Radiating Patch for Wireless Applications 130-135  
*Susmita Bala, Biplab Bag, Sushanta Sarkar and ParthaPratim Sarkar*
21. Cloud-based Resource Distribution using a Blockchain Approach 136-139  
*Radha T Deoghare and Sapana A Kolambe*
22. Detecting Human Emotion by Text Classification 140-147  
*Brunda U, Palakuru Akhilesh and Kalaiselvi K*
23. Effects of Integration of Electric Vehicle Charging Stations into the Grid 148-154  
*Deepti Jagyasi and Ramchandra Adware*
24. Enhancement of Accuracy and Performance of Deep Learning System for Intrusion Detection System 155-162  
*Abhishek Kajal and Vaibhav Rana*
25. Real-Time Remote General Healthcare Clinic 163-167  
*Yashwanth M, Yoga Verma V and Saranya S*

26. Detection of Varicose Superficial Venous Thrombophlebitis in Vein using MSNN Algorithm <i>Shiyam R, Srividya R and Saranya S</i>	168-173
27. Email Automation and Database Management <i>Umakant Tupe, Shubham Ghalme, Kanchan Shelke and Rutuja Kadam</i>	174-177
28. A Novel Approach with Deep Learning Method with Effective Storage Security in Hybrid Clouds <i>Vijay Prakash, Aditya Tripathi, Shashank Saxena and Arshad Ali</i>	178-184
29. Video Surveillance Fire Detection System using CNN Algorithm <i>Tupe U L, Lakhan Jadhav, Shivanand Koli, Prasad Kulkarni and Mayur Gaikwad</i>	185-189
30. Smart Time Table Generation using Artificial Intelligence <i>Sukhwant Kour Siledar and Vijaya B Musande</i>	190-195
31. Review of AI/ML in Software Defined Network from Past to Present <i>Raghavendra Kulkarni</i>	196-206
32. Preprocessing and Segmentation of Retinal Blood Vessels in Fundus Images using U-Net <i>Sudha Abirami R and Suresh Kumar G</i>	207-216
33. COVID-19 Tracker <i>Malarvizhi N, Arun Kumar Dash, Aswini J and Manikanta V</i>	217-222
34. Smart Vision Goggles for Blind People <i>Manne Sowmya, Swathi N, Raja Sri A, Sai Prakash M and Jayadeep K</i>	223-230
35. Data Science based Recommendation System -An Application of Computer Science <i>Zeba Khan and Abdul Rahman</i>	231-236
36. Mobile Malware Attacks, Classification, Propagation, Analysis, Detection, Challenges and Future Directions – A Survey <i>Senthilkumar B, Sujithra M and Mani Barathi S P S</i>	237-243
37. A Survey on Hyperspectral Sensing Techniques for Identification of Fake Pharmaceuticals Medicines <i>Pravin V Dhole, Vijay D Dhangar, Sulochana D Shejul and Bharti W Gawali</i>	244-253
38. Electrical Design of Off-Road Electric Vehicle <i>Lipika Nanda, Nikita Lahon, Arjyadhara Pradhan, Babita Panda, Chitralekha Jena and Sourav Kumar Satpathy</i>	254-259

39. PM based Eddy Current Braking for Automobile Applications <i>Vinayak C Magadal and Mrityunjaya Kappali</i>	260-268
40. Skin Disease Identification using online and Offline Data Prediction using CNN Classification <i>Minakshi M Sonawane, Ali Albkhrani, Bharti W. Gawali, Ramesh R Manza and Sudhir Mendhekar</i>	269-275
41. Automatic Rail Track Inspection System <i>Chandrasekhar D, Sumalatha A, Poojitha K, Neeraj Manikanta Sai G and Kavya K</i>	276-281
42. Automatic Industrial Gas Leakage Detection and Control System <i>Teja Sai Ethesh, Swathi N, Sai Vamsi Reddy, Anusha N and Yashwanth Krishna A</i>	282-289
43. Polymer Conducting Nanocomposite Film to Improve Electromagnetic Compatibility of Electronic Devices <i>Vikas Rathi, Brijesh Prasad, Varun Mishra, Hemant Singh Pokhariya and Himanshu Pal</i>	290-294
44. Floating Sun Tracking Solar Panel <i>Anjani Pujitha PSVL, Umamaheswari K, Karthik A, Harshavardhan J and Gopi Sivanadh D V S</i>	295-302
45. Application of Grey Wolf Optimization Algorithm for Improving Inertia Constant Selection in Wind Farm Deployments <i>Deepesh Bhati and Sandeep Bhongade</i>	303-308
46. Negative Emotion Detection using ECG and HRV Features <i>Sindhu N and Jerritta S</i>	309-316

# Encoder-Decoder Approach toward Vehicle Detection

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**Abstract**—Vehicle Detection algorithms run on deep neural networks. But one problem arises, when the vehicle scale keeps on changing then we may get false detection or even sometimes no detection at all, especially when the object size is tiny. Then algorithms like CNN, fast-RCNN, and faster-RCNN have a high probability of missed detection. To tackle this situation YOLOv3 algorithm is being used. In the codec module, a multi-level feature pyramid is added to resolve multi-scale vehicle detection problems. The experiment was carried out with the KITTI dataset and it showed high accuracy in several environments including tiny vehicle objects. YOLOv3 was able to meet the application demand, especially in traffic surveillance Systems.

**Index Terms**— Surveillance video, vehicle detection, codec, convolutional neural network, YOLOv3, moving object detection and tracking.

## I. INTRODUCTION

Road accidents and crime are increasing day by day. An intelligent Road Monitoring System is becoming the need of the hour. Vehicles need to be identified with a license plate so that further research can be made on a specific vehicle to identify the driver and provide proper evidence to law enforcement.[1] Because of the increasing number of network cameras, locally manufactured visual data, and Netizens, it is difficult yet essential to analyze a large amount of background data at once. Moving object detection (MOD) is a technique for extracting dynamic foreground elements from video frames, such as moving pedestrians or automobiles, and removing the background that isn't moving. Due to the recent success of convolutional neural networks (CNN), there is a great deal of interest in deep learning-based object identification algorithms, and numerous models have achieved cutting-edge results [2]. Particularly opposed to artificially manufactured methodologies, deep learning techniques utilize proposal generation methods like MultiBox, DeepBox, and region proposal networks (RPNs) can provide fewer candidates of superior value.

YOLOv3 Algorithm is a pre-trained model on COCO dataset with over 80 classes that it can detect with a MAP to 69% under sunny weather condition. As YOLOv3 is a pre-trained model, the detection is very fast and can be implemented in live traffic conditions. As shown in fig 1, It can be shown that the distance of the item and the size of the vehicle are inversely related. This may lead to incorrect detection or even faulty detection in some contexts.

This paper improves the YOLOv3 network to address this problem. Given that features like SSD, YOLOv3, and FPN all use feature pyramid structures at the detection stage, this study proposes a novel multi-level feature pyramid structure introduced to the codec module to recognise vehicle targets at various forms. The multilayer characteristics that the backbone network had retrieved were first merged into basic features. The essential

properties listed above are then transmitted to the codec module via its decoder layer as the feature of the detection object. We eventually combine the multi-level properties of the backbone network with equivalent scales at the decoder layer to produce a feature pyramid for target identification. In section II. Related works are explained with the main algorithms. In Section III Proposed methodologies are explained and the various methods that are applied. In Section IV Conclusion and further works are given.

## II. RELATED WORKS

### A. Fully Supervised Object Detection

The fully supervised technique, which employs bounding box annotation for object recognition, may be split into two primary categories: single-stage detectors and multiple-stage detectors. The most popular single-stage object identification technique is called YOLO [1], which uses a Dark net architecture for real-time (30 fps) grid-based object recognition and predicts the centre of the item as well as the width and height of the bounding boxes for each grid cell. The author proposed Draknet19, which, inspired by ResNet [3], offers quicker detection (100 fps) by giving feature concatenation from the preceding layer, for a later version of YOLO, also known as YOLO9000. However, YOLO and YOLOv2 have trouble detecting tiny objects. The author suggested Darknet 53 as a replacement for YOLOv3[4], which is a bit slower (45 fps) than YOLOv2 but significantly more effective at identifying small things since it applies detection to objects on three separate sizes. Similar to YOLO, the single-shot multibox detector (SSD) is a grid-based real-time (59 fps) detection technique.

### B. Object Counting

Counting items in a scene that are visible to a model is known as object counting. Numerous techniques for doing item counting using clustering, either detection or regression, are available. Counting methods based on clustering are frequently used to count objects. These methods usually come after an unsupervised learning pipeline that divides features into categories based on an object's appearance. For instance, Tu et al.[13] employed expectation-maximization to count persons based on their shoulders and faces. Rabaud and Belongie published a counting method based on the observation of feature points over time. Since they often need a video sequence to do so, clustering-based algorithms find it difficult to follow feature points in the still picture.

### C. The Combined Loss Function

The mean squared error regression and binary cross-entropy classification are used to create the final loss function for training.

### D. Bounding Box Formation Technique

In the subsections that came before, the structure of the recommended network and its training loss function was discussed. This subsection described how to create a bounding box. Class activation maps (CAMs) and regression activation maps are used during the inference phase (RAMs). As previously mentioned, two more  $1 \times 1$  N convolutional layers are added in order to generate the CAMs and RAMs for the test picture, where  $1 \times 1$  signifies the kernel size and N is the number of classes.

- 1) The predictions from the classification output are thresholded by a value to check if a class instance is present. The best value of this threshold for testing empirically is 0.5 since multi-label categorization is frequently binary.
- 2) If a class has a value greater than the threshold value, the regression predictions are used to calculate the number of class instances for an item. At this point, further thresholding is carried out in order to determine the precise (integer) number of instances. If the regression forecast for the class's instance count is larger than 0.5, it is considered that this class has one instance (a threshold chosen based on the standard mathematical rounding concept in which values less than 0.5 are mapped to zero and values greater than 0.5 are mapped to one).
- 3) Once the number of occurrences for each class in the picture has been established, the regression activation map (a 28-28 grid) is normalized by the number of objects in order to eliminate the noise blobs. The largest of the remaining blobs is then chosen as the proper single-cell center. Because RAMs are learned by global average pooling, the prior RAM filtering method works well because this produces high activations for the region corresponding to the visual characteristic of the class with the highest level of activation; this one-cell activation is taken as the center of the object.
- 4) To do non-maximum suppression, the next step is to create the bounding box using the threshold CAMs (we used 1.0, 0.9999, 0.999, 0.99, and 0.9 for each set of classes). The extensions of the objects are

found in CAMs, and they can be scattered throughout the globe as multiple little portions or they can overlap. There are four types of class activations that can affect how the bounding box develops based on the amount of instances of each existing class:

- If a class has exactly one instance, there is just one instance of each item in the related CAM (a 28 x 28 grid). All of the active cells are counted. The locations of the top and leftmost activated cells on the vertical and horizontal axes, respectively, of the grid, are taken as the top left corner of the bounding box, and the locations of the bottom and rightmost are taken as the bottom right corner, regardless of the shape of the region in the CAM (i.e., whether it is unitary or fractionated in the CAM's grid)
- If there are several instances of a class and the number of instances equals the number of unique regions in the CAMs, then each centre has a corresponding instance represented by a linked area in the CAM. Each region's bounds are determined by the grid position's lowest and maximum indices.

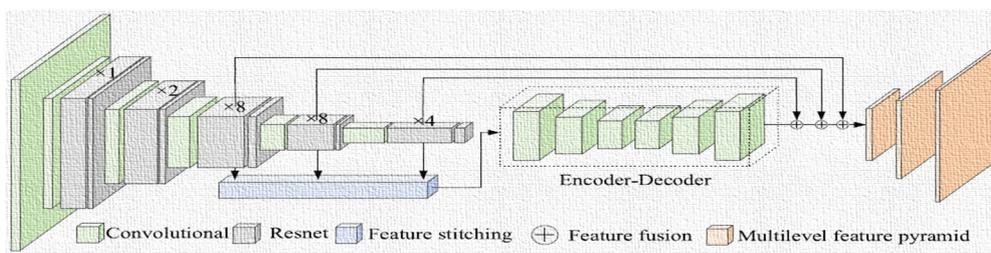


Fig.1. Vehicle Detection Model Network Structure.[3]

### III. METHODOLOGY

#### A. Yolov3

A real-time object detection system called YOLOv3 (You Only Look Once, Version 3) recognizes particular things in films, live feeds, or still photos. To find objects, YOLO employs features that a deep convolutional neural network has learned.

**Darknet-53:** Darknet-19 is the name of the network architecture that YOLOv2 uses. It has 24 layers in total, including 19 convolutional layers (thus the name darknet-19) and 5 maximum clustering layers. Due to the loss of several fine-grained information during input down sampling, YOLOv2 is not particularly good at recognizing small targets. In order to get low-level features, YOLOv2 uses identity mapping to connect feature maps from the preceding layer.

**Under Three Scales Detect:** When the input image size is decreased to 32, 16 or 8, respectively, YOLOv3 generates predictions at each of three scales that are precisely stated. The 82nd layer is in charge of making the initial prediction. The network lowers the visual resolution for the first 81 layers until the 81st layer's pitch is 32. The size of the resultant feature map, if we start with a 416 x 416 image, is 13 x 13. Here, we employ a 1 x 1 detection kernel to produce a detection feature map with dimensions of 13 x 13 x 255. The layer 79 feature map is then sampled twice to a dimension of 26x26 after passing through numerous convolutional layers. The feature map of layer 61 and this feature map are then thoroughly concatenated.

**Anchor Boxes:** 9 anchor boxes altogether are used by YOLOv3. In each ratio, three. If you train YOLO on your own dataset, you must create 9 anchor points using K-Means clustering.

**Additional Bounding Boxes:** More bounding boxes are predicted by YOLOv3 than YOLOv2 for input photos of the same size. When YOLOv2's original resolution is 416 x 416, for instance, it is assumed that 13 x 13 x 5 = 845 boxes. Five boxes are found in each grid cell using five anchor points. The prediction are given below[5]: -

$$b_x = \sigma(t_x) + C_x \quad (i)$$

$$b_y = \sigma(t_y) + C_y \quad (ii)$$

$$b_w = pw^{e^{tw}} \quad (iii)$$

$$b_h = ph^{e^{th}} \quad (iv)$$

**Softmax Abandoned :** YOLOv3 classifies items found in photos using several labels. Previously in YOLO, the author was accustomed to using softmax level scores and regarded the class of objects encompassed in the bounding box as having the greatest score. This was altered in YOLOv3.

#### Loss Function

$$Loss = \lambda_{coord} \sum_{i=0}^{S^2} \sum_{j=0}^B 1_{ij}^{obj} [(x_i - \hat{x}_i)^2 + (y_i - \hat{y}_i)^2]$$

$$\begin{aligned}
& + \lambda_{coord} \sum_{i=0}^{S^2} \sum_{j=0}^B 1_{ij}^{obj} (2 - w_i \times h_i) [(w_i - \widehat{w}_i)^2 \\
& + (h_i - \widehat{h}_i)^2] - \sum_{i=0}^{S^2} \sum_{j=0}^B 1_{ij}^{obj} [\widehat{C}_i \log(C_i) \\
& + (1 - \widehat{C}_i) \log(1 - C_i)] \\
& - \lambda_{noobj} \sum_{i=0}^{S^2} \sum_{j=0}^B 1_{ij}^{obj} [\widehat{C}_i \log(C_i) \\
& + (1 - \widehat{C}_i) \log(1 - C_i)] - \sum_{i=0}^{S^2} 1_i^{obj} \sum_{c \in classes}^{S^2} \times [\widehat{p}_i(c) \log(p_i(c)) + (1 - \widehat{p}_i(c)) \log(1 - \\
& p_i(c))] \quad (v)
\end{aligned}$$

### B. Fast R-CNN

By categorizing object suggestions with a deep ConvNet, the Region-based Convolutional Network approach (RCNN) provides excellent object detection accuracy. On the other hand, R-CNN has substantial disadvantages: Training involves several stages. A ConvNet on object suggestions is initially tuned using R-CNN using log loss. Then SVMs and ConvNet features are matched. These SVMs take the place of the SoftMax classifier that was trained through fine-tuning as object detectors. It is at the third training step when bounding-box regressors are learnt.

### C. Faster R-CNN

A step up from Fast R-CNN is Faster R-CNN. Due to the region proposal network, Quicker R-CNN is faster than Fast R-CNN, as the name suggests (RPN). A fully convolutional network that produces suggestions with various sizes and aspect ratios is the region proposal network (RPN). The RPN uses the language of neural networks with an emphasis on object detection (Fast R-CNN) what to watch out for.

Anchor boxes were proposed in this study as an alternative to pyramids of photos (several instances of the same image at various scales) or pyramids of filters (i.e. multiple filters with varied sizes). An anchor box is a reference box with a specific scale and aspect ratio. The same region can have multiple sizes and aspect ratios if there are many reference anchor boxes. This may be compared to a pyramid constructed of reference anchor boxes. The detection of objects with different scales and aspect ratios is made possible by the process of mapping each region to a distinct reference anchor box.

### D. Mask R-CNN

Mask R-CNN, sometimes known as Mask RCNN, is the most advanced Convolutional Neural Network (CNN) for instance and picture segmentation. Faster R-CNN, a region-based convolutional neural network, served as the foundation for Mask R-CNN. Knowing the idea of image segmentation is a prerequisite for understanding how Mask R-CNN operates. The task of computer visions, the technique of dividing a digital image into several parts is called image segmentation (sets of pixels, also known as image objects). In this segmentation, borders and objects are located (lines, curves, etc.).

### E. Pyramid Network

With the accuracy and speed of a pyramid notion in mind, a feature extractor known as the Feature Pyramid Network (FPN) was developed. It replaces detectors like Faster R-feature CNN's extractor for object identification and creates several feature map layers (multi-scale feature maps) with greater quality information than the traditional feature pyramid.

**Dataset:** The dataset used was Kitti Dataset and COCO Dataset and our own collected data from live city traffic. The Kitti Dataset consists of snippets got from a 360-degree camera, recorded in highway and roads of rural areas in Karlsruhe. The dataset almost depicts as if the video is a surveillance video.

**Analysis:** The picture that shows beneath the traffic film is quite similar to a real image that was really taken on the road by a car's camera and is included in the KITTI data collection. According to three distinct KITTI data set requirements, as shown in Table 2, the AP of the algorithm utilized in this work is 95.04%, 92.39%, and 87.51%, respectively. These outcomes outperform YOLOv3, whose results were, respectively, 2.49%, 3.68%, and 9.73%. Because the convolutional feature MAP at the bottom is only up sampled once by the YOLOv3 detection model's top stage before performing feature stitching.

TABLE I. AVERAGE PRECISION IN THREE DIFFERENT DIFFICULTY LEVELS UNDER THE KITTI DATASET

Algorithm Name	Average Precision %			Time
	Easy	Moderate	Hard	
R-CNN	32.23	26.04	20.93	-
Faster-R-CNN	87.90	79.11	70.19	142
YOLOv3	95.04	92.39	87.51	34

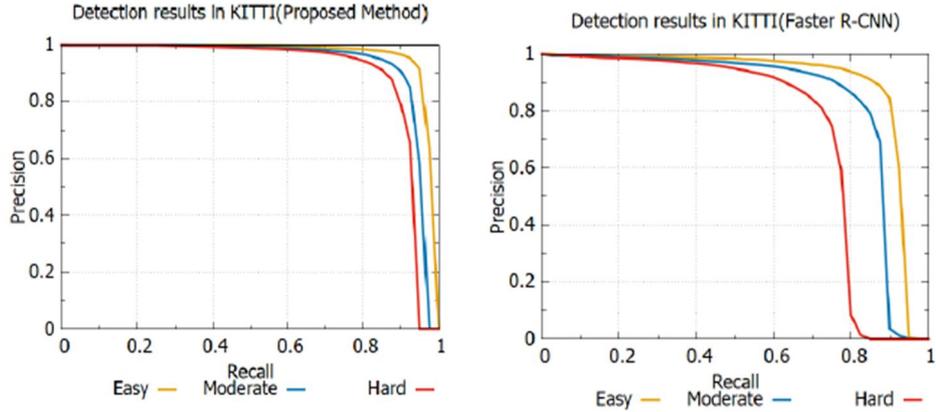


Fig 3.a & 3.b. P-R Diagram in YOLOv3 and Faster R-CNN in three difficulties

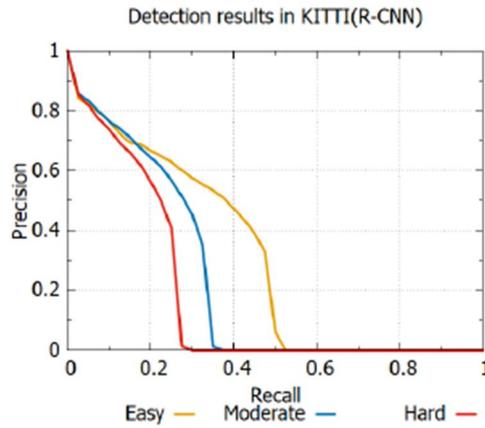


Fig.4. P-R Diagram in R-CNN in three different Difficulties

bus 66.52453541755676  
 car 92.02384948730469



(a)

The above Graphs show that the model worked with high accuracy and with high speed in YOLOv3 model rather than Faster R-CNN or R-CNN. The self-collected images also showed the same results in YOLOv3 model. The difficulties that were set for the images were of three levels easy moderate and hard. as showed in the fig 3a and 3b. The difficulties differed with according to several properties like rainy, sunny, cloudy, dark, bright, distorted images etc. In all the difficulties YOLOv3 gave very high accuracy.

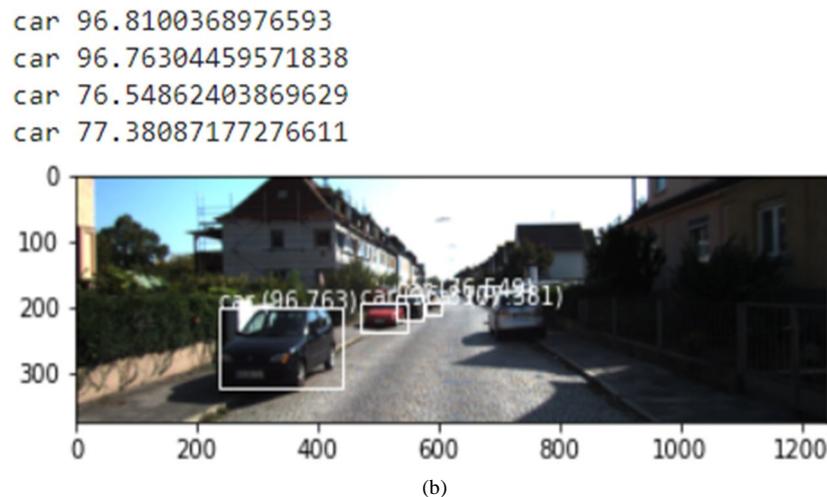


Fig 5a & 5b. Vehicle Detection YOLOv3

#### IV. CONCLUSION

In this study, the YOLOv3 network model is applied to the problem of vehicle recognition in videos of traffic surveillance. It was shown that during the actual detection phase, small scale autos frequently go undetected. To efficiently and effectively construct multi-scale features that can adapt to the identification of multi-scale target vehicles, we present a unique feature pyramid module built on the basis of YOLOv3 and based on encoding and decoding. After being tested on the KITTI dataset, the impact has been increased. Good detection results have been reached for vehicle targets of various sizes, especially for the identification of microscopic targets. The accuracy is significantly better than the YOLOv3 algorithm and can better meet the requirements of practical applications.

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# Home Automation with Node MCU & Firebase using Internet of Thing (IoT)

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**Abstract**—The Internet of Things is made up of objects with unique identities that are linked to one another online. The idea is to simply connect and keep an eye on numerous sensors and equipment via the Internet, which is widely used in this new era. This paper primarily explains the general overview and knowledge of IOT-based sensing systems and monitoring systems, which leverage databases and software to construct smart, automated household appliances. board, and an Android OS smartphone is used to remotely control the internet. This system's core part and brain, the Node MCU, can serve as an interface between a wide range of hardware parts and the real-time database. The system provides many cutting-edge switching features that turn on and off lights, fans, and other connected household equipment. It is widely used for switching lights, fan on/off by sensing and analyzing data. The cloud-based system is another notification element of this system architecture. The main feature of this system is that it can also be controlled from remote areas which can prove to contribute towards energy saving.

**Index Terms**— Node MCU, Flutter, Sensors, Voice Control ,Firebase.

## I. INTRODUCTION

In IOT(Internet of Things), devices communicate with each other . IoT devices can share contents based on function control in a predefined manner. This project focuses on the use of cloud to operate the home appliances over the internet from even remote areas.



Fig. 1 Illustration of IoT

This article explains how the home appliances can be controlled in a secure way even from remote areas A single device can be linked to several devices.

Wireless fidelity technology is used to connect the network. The frequency range that has been formally agreed upon [3] is 2.4GHZ. The node MCU used in this system must be connected to this WiFi to which the other appliances are connected. The above Fig.1 represents the flowchart of the system .This project consists of a flutter app which is platform independent and allows the user to change the states introduced in a real time database provided by firebase .A connection is established between the Node MCU and Firebase Database where the changes made in the Database are reflected .

II. RELATED WORK

Emerging technologies in the present and future are playing a significant role in automating human existence. In our fast-paced society, people are enamored with the internet and automated technology, and they are mostly reliant on them. As a result, automated houses or smart homes have become a buzzword, and their adoption is fast expanding. Smart homes should have secure connection as well as communication with physical devices over the internet. We learned a lot from excellent study on papers on Smart Home Automation and various designs used in leisure. Some of the existing designs that were utilized are detailed here. Kumar Mandala implemented home automation in two methods in his work, employing Bluetooth and Ethernet. Arduino is used here to programme and control numerous gadgets. Bluetooth is a short-range communication technology. As a result, with smart home automations that use Bluetooth, one can only activate the gadgets from home within a distance of 10-20m. This constraint has been solved in the forthcoming Ethernet-based architecture. This study just described how to operate various electrical gadgets in the home using mobile applications and did not contain any security aspects.

III. PROPOSED SYSTEM

As the cost of items in our daily lives rises owing to technological advancements, a little notion known as the smart home project is launched to minimize costs and inconvenience while also providing energy-saving solutions. A smart house is capable of controlling the home even when the owner is not present [6]. The IoT system may be constructed by combining an MCU with additional components such as a DC motor, L293D, USB cables, and software such as Firebase, which are used to operate various household appliances namely as fans, lights, and lamps. It provides status updates on the mobile app [7]. Data is uploaded to the cloud via Firebase, where it may be stored and accessed as required. The suggested system and its operation may be explained in detail in Fig.2.

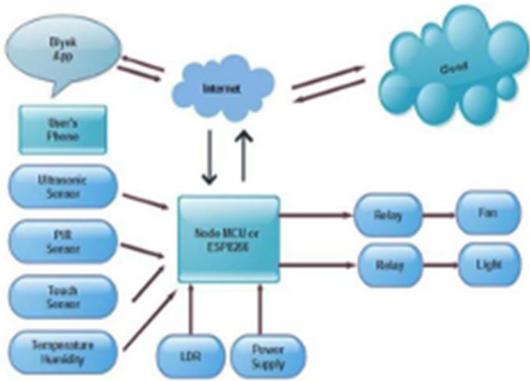


Fig. 2 Schematic of Home automation using node MCU

Various components like DC motor, L293D, etc. are connected to Node MCU microcontroller, these components help in acquiring data from surroundings, which include the state of appliances and send this collected data from microcontroller to the database .Users can access as well as update this data anytime, from anywhere using Android app developed using Flutter which uses Dart Programming language. Using this application the states of appliances in the database can be updated. The Microcontroller (Node MCU) fetches the data from the database and reflects the updated state on the Arduino program . This program then executes or operates the various appliances based on the updated conditions in the database . The state of the appliances can be updated using buttons or the voice control commands through the application.

#### IV. IMPLEMENTATION SETUP

*Components Required Hardware Requirements:-*

- 1) NODE MCU ESP8266
- 2) DC Motor
- 3) L293D
- 4) Male to female jumper wire
- 5) Connecting Wires
- 6) Breadboard
- 7) LED
- 8) Fan
- 9) Mobile phone
- 10) Power Supply Software requirements:
- 11) Android Flutter App

##### A. NODE MCU ESP8266

Node MCU The ESP8266 is an open source Internet of Things (IoT) platform that comprises both software and hardware (WHAT IS A NODEMCU?). The application is powered by Espressif's ESP8266 Wi-Fi SoC, which is a System-on-Chip. The ESP-12 module contains the hardware. The ESP8266 is a System-on-Chip (SoC) that combines a 32-bit CPU, an antenna, switches, filters, a power amplifier, power management modules, and standard digital peripheral interfaces in a small and simple package [8]. The ESP8266 is a low-cost microprocessor that works with a Tensilica Xtensa LX106 core and is used in a variety of IoT applications. This microcontroller is connected to the WiFi continuously which helps in fetching the states of the appliances from the database. Different appliances are connected to this controller.

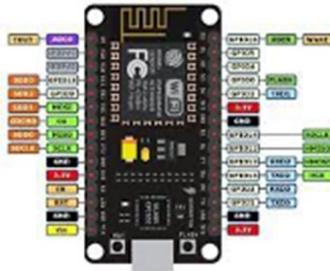


Fig.3 ESP8266 Module

##### B. DC Motor

The DC motor is a sort of electrical equipment that transforms electrical energy into mechanical energy. DC motors use direct current to convert electrical power into mechanical rotation. It is a type of rotary electric motor that transforms direct current (DC) electrical energy into mechanical energy. The most prevalent forms are based on magnetic field forces. We have used a DC motor to create a prototype of the rotating fan. The motor was controlled using a L293D Motor Driver to which when a high input is given the motor rotates at a certain default speed in a particular direction. The direction of rotation can be reversed by inverting the high voltage inputs and low voltage inputs.

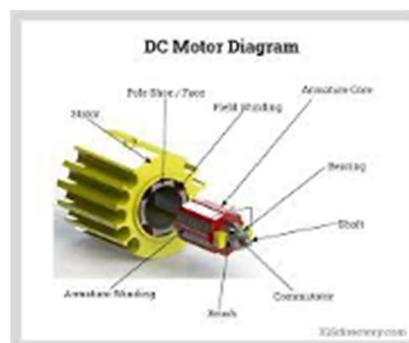


Fig.4 DC Motor

### C. L293D

L293D is a standard motor driver or motor driver IC that allows a DC motor to be driven in either direction. L293D is a 16-pin integrated circuit that can operate two DC motors in any direction at the same time. It means that a single L293D IC may operate two DC motors. The L293D can also power tiny and silent large motors. It is based on the H-bridge idea. The H-bridge circuit enables voltage to flow in either direction. Because voltage must change direction in order to rotate the motor in either a clockwise or anticlockwise direction, H-bridge ICs are perfect for controlling a DC motor. Fig 5 shows L293D motor driver. We have used a L293D motor driver to control a DC motor to which we have attached a fan .This can be used to prototype the switching on/off states of a fan.



Fig .5 – L293D Motor Driver

### D. Breadboard

For building a prototype and to mount our components at one place for connection purposes and creating a proper circuit ,we have used a breadboard. Many electrical components in electronic circuits can be coupled by placing their leads or terminals into the holes and then connecting them with wires as needed. The breadboard contains metal strips below it that link the holes on the top of the board.

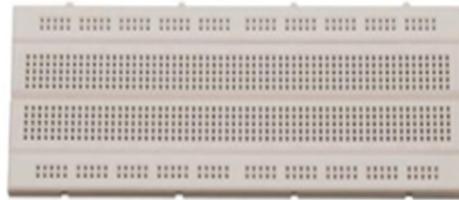


Fig. 6- Breadboard

### E. LED

The light-emitting diode (LED) is a common standard light source in electrical electronics. It can be used in various applications such as in mobile phone or large advertising billboards. They are mostly used in devices that include works related to time and displaying various types of data. Aviation, illumination, fairy lights, car headlights, marketing, general lighting, traffic lights, camera flashes, lit wallpaper, horticulture grow lights, and medical supplies are just a few of the uses for LEDs.



Fig .7- LEDs

### F. Android Flutter App

We can design our own application through a development platform which is provided by the Android Flutter Application. This application is connected to the Firebase Server using which we can establish a connection for transmission and reception between the microcontroller and the user which is shown in Fig.11. This Android Flutter Application can be developed by the user. The user must sign into this application to access the states of all the home appliances and switch ON/OFF their respective states through this app .

This Android Flutter App is in charge of generating an interface for user interaction by giving a dashboard from which the user may operate. This app is connected to hardware, and connection between them is facilitated via the Firebase server. These hardware components can communicate with the server with the help of commands defined in Firebase libraries.



Fig. 8 Representation of project using Android Mobile App

### G. Firebase

Google Firebase is an application development software provided by Google that enables developers to develop iOS, Android & web apps. Firebase offers capabilities for measuring statistics, reporting and troubleshooting app problems, and generating marketing and product experiments.

By giving safe access to the database directly from client-side code, Firebase Real-time database enables you to develop complex, collaborative apps. Data is saved locally, and real-time events continue to fire even when the user is offline, providing the finest responsive experience ever.



Fig. 9– Firebase

## V. RESULTS AND DISCUSSIONS

The main objective of developing the Home Automation system was to operate the home appliances from remote locations using a secure smartphone application which was developed using dart language and flutter IDE, which also allows cross platform usage. A fine working flutter application was successfully developed which was not only limited to control the appliances using buttons but also allowed the user to control the same by taking voice commands as the input. All the members in that family can share this Android flutter App so that, when one person from the family switches a device either fan or light or any other appliance. From this project we can confidently say that we can make a home automation system with readily and cheaply available components and can be used to operate multiple appliances such as lamps, televisions, and also the whole house lightning system. It is evident that we can make this easily as the components required are so small that they can be packed into a container. The Home Automation framework is utilized to be something which is extremely important & useful in this emerging digital world. In any case, as innovation progresses so rapidly, the normal people have prepared access to calculations that can do some really astonishing things. By interconnecting user's gadgets with user's Internet, user's WIFI, or other advanced gadgets, the user's home turns out to be progressively effective at warming, cooling, lighting, and, well, running.

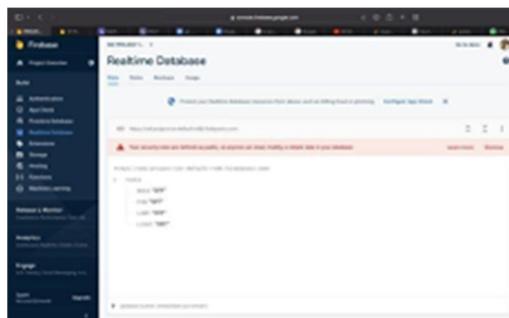


Fig .10– Real-time Database created by Google firebase



Fig. 11 – On/Off Buttons in Android Flutter App for turning on/off lamp, fan, light



Fig. 12– Button for Voice Command for turning Home appliance on/off

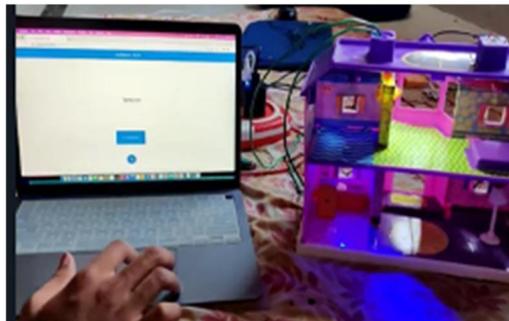


Fig .13 – Smart Home Automation Setup with Overall Functioning

## VI. CONCLUSION

With the help of IOT technology, we get to know or have basic idea on how we can control home appliances. As long as the user is connected to internet, this prototype of ours will help the user to control his home appliances irrespective of his location . The GUI System which we have created allows the user to easily control the appliances using a smartphone which is connected to internet ,so as any change occurs,the user will be notified immediately and he/she can control the appliances using the provided GUI interface.The microcontroller which we have used is Node MCU which acts like an interface between the components and the user. This Node MCU is connected to several appliances like light,fan,lamps,etc. To establish an application layer for connection between the user who is remotely located ,we have used a micro web server. This system communication between the user and the appliances was possible through internet. Notifications are delivered to users via the Android flutter app, which is installed on their smartphone. Users may operate remotely or automate household appliances by utilising components such as NodeMCU, DC Motor, L293D, Firebase, and so on. All these components together help in building a remotely controllable smart home automation system through which we can switch the lights , fan ON/OFF.

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# Open-Source Workforce Administration System using Django

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**Abstract**—The paper focuses on Workforce management using Django Framework. This open-source software application has a wide-spread use especially in small scale organizations who can't afford expensive software. Every organisation, public or commercial, uses an information system to keep information about their employees. However, it has been discovered that many small-scale enterprises in India still utilise paper and pen to preserve records. Even though there are many sophisticated technology systems that can perform this function, they are all too expensive for these low-level industries to afford. This essay addresses developing a method to handle their challenges at a lower cost. Our Workforce Administration System has 4 views namely HR, Employee, Team Lead and Fresher based on the different categories of users of this software application. There are several functionalities in these 4 views that makes this framework not only employee friendly but also helps builds a bond between the company and the staff by ensuring smooth interaction between the two.

**Index Terms**— Open-Source, Analytics, Secure, User-friendly interface, CRUD Operations, Cost Efficient, Interactive Dashboard.

## I. INTRODUCTION

Employees are an organization's most important resource for growth and seamless operation. The documentation that was previously completed to manage personnel was really onerous and demanded a lot of time in addition to extra labor. Conflicts might also result from it. For instance, manual searching would be necessary and take a lot of time if the information of any employee was required. The information was not secure in this type of system, and the registers' information could be simply altered. As a result, a system was required to automate everything, including the monitoring of attendance, the tracking of existing projects inside the companies, and the methodical training of new hires. There are several systems on the market that can assist in carrying out these tasks, but they are highly expensive and occasionally need to be handled by skilled experts. However, we're going to open-source this programme so that it may readily operate on any machine with a few installations. Additionally, using it wouldn't require a lot of technical knowledge.

Different portals would be included in the system that would be created for human resources, employees, trainees, and team leads. The human resource site, for example, would offer the ability to view employees, change their information, and add new hires, among other options. Examine staff attendance, the status of the organization's ongoing projects, and other things. Similar to this, the team lead, trainee, and staff would each

have unique features available in their respective portals. The organization would benefit from this application's contribution to efficient operation. Additionally, this programme would be much more secure than the currently available software in the market. We require a thorough system study before we can design this system. It calls for a thorough understanding of how the sector operates. We need to properly comprehend databases and construct them so that they can meet all of the system's requirements. Users should have access to a suitable

GUI when using the software. The whole system has mainly 4 types of users- HR, Employee, Team Lead and Freshers. We have assigned functionalities accordingly in each view. Some primary features of HR(Admin) view are: Viewing the Employees List, and their details, and executing other CRUD operations on them. The Employee view includes: Review of personal information and making any necessary changes, marking their attendance, Requesting leave etc. Similarly, the Fresher's view has features such as: Viewing their information and making any necessary changes, marking their participation in training, submitting a request for leave, and downloading reference materials and study guides. And lastly, the team lead view which provides functionalities such as: View team details, assign daily tasks to each team member, or uploading any necessary documents or plan for the current project.

This system hence will not only allow the users to perform basic tasks but also help the organization to have better co-ordination with the employees and achieve positive results. Not only does it solve the issue of better management of the employees but will also help the managers and owners of the small-scale industries to have a multi-functional dashboard to manage their business efficiently and at a minimal cost.

#### *A. Motivation*

The management of employees is still done manually on paper in many firms, especially small ones that cannot afford the cost of sophisticated software. To keep track of attendees, record contact information, etc., the organizations have a variety of registers. If they need to look up information for a specific day, an employee, etc., it becomes exceedingly challenging. Furthermore, this kind of system made it simple to make proxies, which made it difficult for businesses to manage their workforces and made it time-consuming to look for information on them. As a result, we sought to create an application system that could quickly and simply function on their machines after a few installations. This would also be affordable and assist in automating the system.

#### *B. Scope*

The project's primary goal is to develop a workforce administration system. The Software application provides 4 views namely-

1. HR
2. Employee
3. Team Lead
4. Fresher

The system's capabilities include keeping each employee's information, adding new hires, and eliminating those who leave the company. This system will also keep track of the employees' daily attendance as well as their absences. Moreover, along with these functionalities, the system will make it easy for the project teams and leads to interact with each other and would also make the working on the project and its progress very transparent.

Thus, this application would not only make the administration of employees easy but would also increase the performance rate of the employees as they would be offered bonuses and coupons for their good performance, which could be redeemed easily by the employees through the dashboard. We have made use of Vroom's expectancy theory here which states that people tend to put in greater effort when they believe that their efforts would increase their performance which in turn would help them gain rewards and recognition. Thus, it can be clearly stated that rewarding the employees for their good performance would increase their productivity and would also motivate their peer employees and increase and develop a healthy work environment.

## II. LITERATURE REVIEW

This section of the content shows the summary about the papers that we have followed for the research and understanding.

While the above literature review of previous works provides valuable information regarding the existing Employee Management Systems, there are certain aspects that we have analyzed for improvement and incorporated in our proposed Workforce Administration System using Django.

TABLE I. LITERATURE SURVEY RELATED TO THE PROBLEM DEFINED

Name	Author	Publishing Year	Published in	Techniques Used	Advantages & Limitations
<b>Employee Management System</b>	Rishabh Bajpai	December-2020	International Journal for Modern Trends in Science and Technology, 6(12): 225-234, 2020	<ol style="list-style-type: none"> <li>1. Cloud based data storage</li> <li>2. Firebase handles security and provides free support for email authentication</li> <li>3. Compatible with both android and iOS</li> </ol>	<p><b>Advantages</b></p> <ol style="list-style-type: none"> <li>1. On time salary calculation in just a click, help strengthen the employer - employee relationship.</li> <li>2. It is cheaper and easy to use.</li> <li>3. It gives errorless calculations</li> <li>4. Prevent any kind of malpractice by employees</li> </ol> <p><b>Limitations</b></p> <ol style="list-style-type: none"> <li>1. Since, labour might not be having smartphones and many of them would not be knowing usage of android system, it was a great task to make a system such that it can be used widely else it will not be useful.</li> <li>2. It is also difficult for this system to be used properly by companies because any type of mistake cannot be solved later.</li> </ol>
<b>Employee Management System</b>	Madya Ansari, Maviya Shaikh, Ansari Abdul Basit, Jigna Waghela	February-2018	International Journal of Scientific & Engineering Research Volume 9, Issue 2	<ol style="list-style-type: none"> <li>1. At front end 'HTML' and 'CSS' is used.</li> <li>2. At the backend 'php', is used and scripting languages are used such as 'JavaScript' and 'AJAX'</li> <li>3. For database, MySQL has been used.</li> </ol>	<p><b>Advantages</b></p> <ol style="list-style-type: none"> <li>1. Time saving due to digital management in software very less manual intervention.</li> <li>2. Secure data storage.</li> <li>3. Proper management of employee resources will lead to profit enhancement.</li> </ol> <p><b>Limitations</b></p> <ol style="list-style-type: none"> <li>1. Has only 4 modules that records data of the employee in the database, one for, workdays, salary and provident fund calculation.</li> <li>2. Employee view has very less functionalities mostly view only.</li> </ol>
<b>Employee Management System</b>	Mr. Pratik Udayshankar Singh, Mr. Hemant Singh Fartyal, Mr. Khan Abdul Ahad Zubair, Prof. Akshata Laddha	May-2019	International Research Journal of Engineering & Technology	<ol style="list-style-type: none"> <li>1. The application is actually a suite of applications developed using PHP</li> <li>2. This software project has been developed using the powerful coding tools of HTML, CSS and PHP at Front End and Microsoft SQL Server at Back End</li> </ol>	<p><b>Advantages</b></p> <ol style="list-style-type: none"> <li>1. Transparency to all the user of system.</li> <li>2. Less paper use and removal of redundancy.</li> <li>3. Less prone to errors.</li> </ol> <p><b>Limitations</b></p> <ol style="list-style-type: none"> <li>1. Has 2 views only i.e., HR and employee however there are other staff members who might want to have access to multiple functionalities.</li> <li>2. Restricted to limited members of the organization.</li> </ol>
<b>Administration in Employee Management System</b>	1-Mohammed Eshteiwi Ahmouda Shafter 2- Prof (Dr.) A.K.SINGH	January-2020	Journal of Emerging Technologies and Innovative Research, Volume 7, Issue 1	<ol style="list-style-type: none"> <li>1. The application has been developed using C language.</li> <li>2. File handling is used to store and retrieve data</li> </ol>	<p><b>Advantages</b></p> <ol style="list-style-type: none"> <li>1. It is a user-friendly system.</li> <li>2. It records various details of the employees.</li> <li>3. Each of the employees can update their own details but are authenticated based on administrator authorization.</li> </ol> <p><b>Limitations</b></p> <ol style="list-style-type: none"> <li>1. The areas of concern are – system reliability and the storage of data along with the operations needed to be performed.</li> </ol>

Firstly, we have tried to make this system user-friendly by making its UI simple enough so that it can be used even if the user is not highly skilled in using technologies.

Secondly, we have made our system more diverse by increasing the number of views to 4 that provides more functional capabilities to different types of users that include HR, Employee, Team Lead and Fresher.

Lastly, since we have used Django in building our system, it makes our system more reliable and secure.

### III. METHODOLOGY

To create this project, we have used Django, a high-level python web framework. For hr, team-lead, and employees, there would be various portals with varying rights and functionalities. For instance: While employees are not given these functionalities, the hr can add or delete employees. In this project, Django was used. Django requires a minimum of:

-4GB RAM

-an Intel Core i3

-Windows 7 or later

The architecture of the system mainly consists of the following parts: -

- i. Frontend-This is the interface with which the users will interact. This is being made simple, attractive and user-friendly so that the users could easily interact with the various services provided.
- ii. Backend-The backend of any application is basically what goes on behind the scenes. It consists of APIs, servers, operating systems, databases and more all of which come together to ensure that correct information is served to the user as quickly as possible. It is the backbone of the website and is responsible for fetching the information which is to be displayed on the front end. It responds to the requests made by the user and serves them with the required information.
- iii. Database-It is an organized collection of structured data. It is responsible for storing the information entered by the user and for storing the data which is displayed on the front-end of the application after being fetched from here.

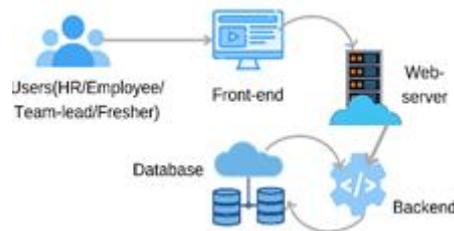


Figure 1. Architecture of the system

The various technologies used for implementing the application are discussed below: -

1). Django-It is a high-level python framework used to create websites that use python. It has many ready-to-use features like user login and authentication system and database connection and it supports various databases also. The database that we have used in this project is the default database that is being used by Django that is db.sqlite3. Django also helps in the re-usability of various components and features like template inheritance etc. Django follows MVT architecture that is Model, View and Template.

- i. Model-The data that we want to display on the frontend of the website or the data that we want to store in the database is done with the help of models.
- ii. View-It is responsible for handling the requests from the user. It renders and associated content on receiving request from the user.
- iii. Template-It is an HTML file that contains the layout of the webpage to be rendered.

Some of the features of Django that make it so popular are: -

1. High Security
2. Rapid Development
3. High Scalability
4. SEO optimized
5. Thoroughly tested

Django has one project and within which different modules are built which provide functionalities to the Project. The different apps have to include in the settings.py file of the project.

2.) HTML, CSS and JavaScript-HTML are used to provide structure to the website. CSS is used for styling the website and JavaScript is used to provide interactivity to the website. In this application, we have used two CSS frameworks: -

- i. Bootstrap-It is one of the most extensively used HTML, CSS and JavaScript frameworks. It is an open-source framework and is free to use. It follows a mobile-first approach. It helps to make the website fully responsive and has various built-in classes which could easily manipulate the styling of the web-page.
- ii. Materialize CSS-It is a UI component library developed and designed by Google. The main goal of building this was to allow for a unified user experience across all they products developed by them across all the platforms. We have used along with bootstrap to make the dashboards more interactive and to follow the dashboard convention.

This system offers four views with different functionalities as discussed below: -

#### A. HR View

- i. View the Employees List, and their details, and execute CRUD actions on them.
- ii. View the Organization's different departments.
- iii. Take a look at the projects the company is working on and keep track of their progress.
- iv. Verify any employee's attendance record.
- v. Distribute discounts and bonuses to various staff.
- vi. Send out crucial notifications.
- vii. Examine employee feedback.
- viii. Approve leaves
- ix. View issues and questions and address them.
- x. View fresh applications on the job portal of the organization and decide whether to accept or reject them.

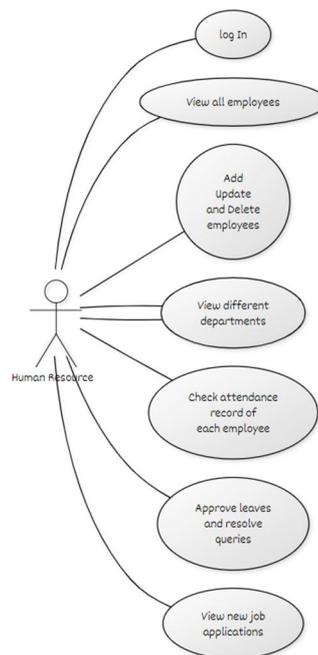


Figure 2. Use Case Diagram for HR View

#### B. Employee View

- i. Review their information and make any necessary changes.
- ii. Mark their attendance.
- iii. Request leave.
- iv. Verify the day's assignment.
- v. View discounts and rewards and redeem them.

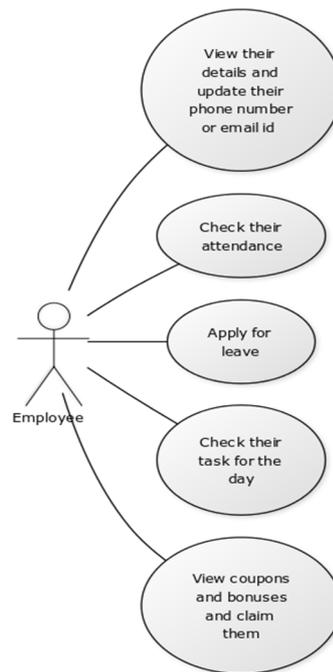


Figure 3. Use Case Diagram for Employee View

### C. Team Lead View

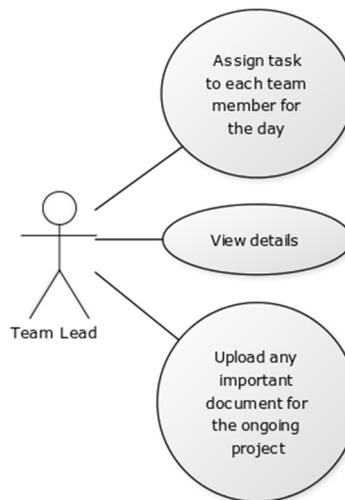


Figure 4. Use Case Diagram for team lead view

- i. View information
- ii. Assign daily tasks to each team member.
- iii. (Any necessary documents for the current project could be uploaded).

### D. Fresher's View

- i. View their information and make any necessary changes.
- ii. Verify their participation in training.
- iii. Submit a request for training leave.
- iv. Download reference materials and study guides.

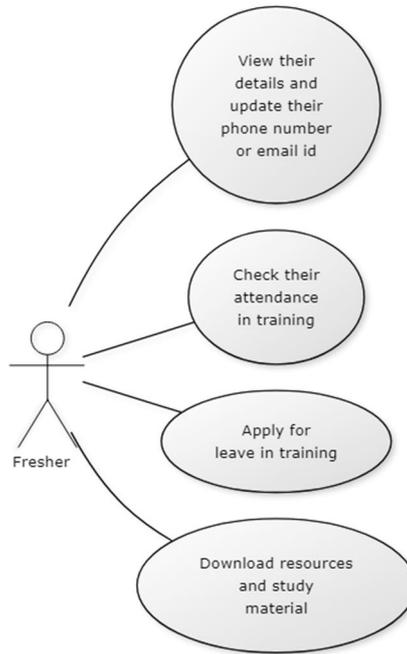


Figure 5. Use Case Diagram for freshers view

#### IV. RESULTS & DISCUSSIONS

1. On successful installation of the software, the user can login using the credentials to access the portal.

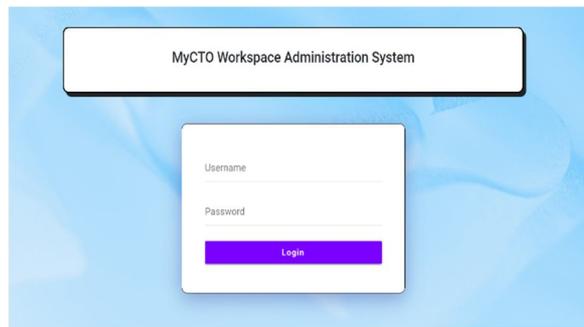


Figure 6. Login View of the System

2. When the HR of the company logs in, he is directed to the following page where he can take several actions as discussed under the functionalities of HR view.

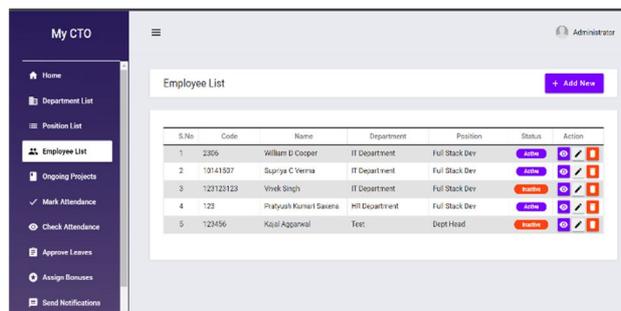


Figure 7. HR Dashboard

3. Below is the screenshot of the portal's detailed employee view. It will help the system admin or HR to see all the details of the employee like his employee code, department, position, his personal details etc. The HR also has the option to edit these details or remove any employee.

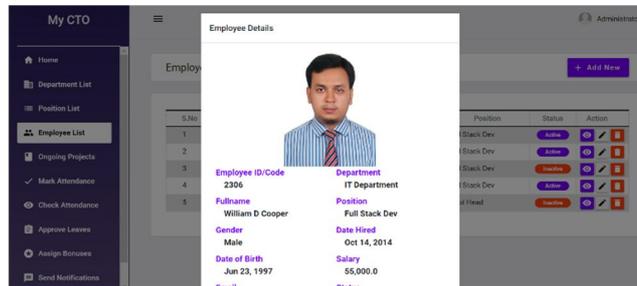


Figure 8. HR accessing the details of an employee

4. Every functionality in the dashboard has a different purpose. For instance, the ongoing projects functionality in the HR Dashboard will help the organization to see all the ongoing projects, their progress, project lead and the details of the team members.

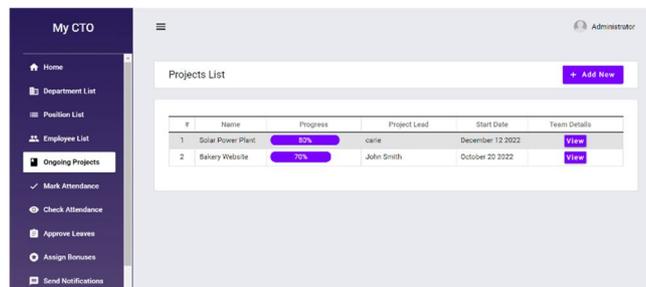


Figure 9. Ongoing Project Functionality of the HR Dashboard

Test Cases: -Some of the test cases that we have tested the system for are: -

**Test Case 1:** - We have tried to test if we are able to login using the wrong credentials.

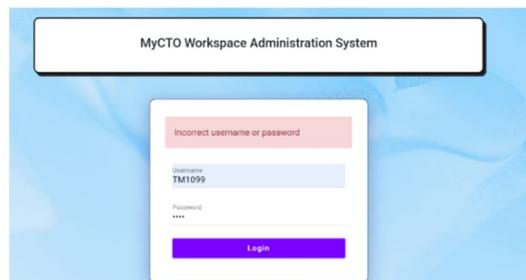


Figure 10. Trying to login into the system using wrong credentials

The test case has passed, we will not be able to login using the wrong credentials. Thus, the system is secure and the person who has the right credentials can only login and perform various operations.

**Test Case 2:** - Now, we are trying to see if we are able to delete the details of any employee from the system.

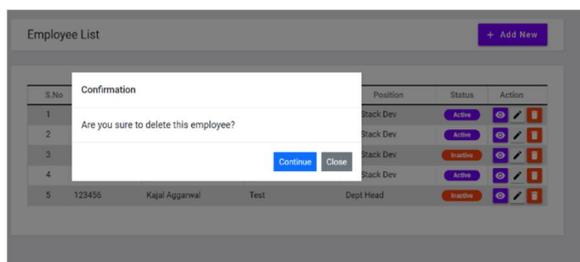


Figure 11. Testing if we are able to delete an employee



Figure 12. Thus, we have deleted an employee successfully

Test Case 3: - Now we are testing if we are able to add a new Department.

Figure 13. Testing if we are able to add a new department successfully in HR Dashboard

#	Department Name	Description	Status	Action
1	IT Department	Information Technology Department	Active	
2	HR Department	Human Resource Department	Active	
3	Marketing Department	Marketing Department	Active	
4	Test	Sample Department Only	Active	
5	Sales	Do sales	Active	
6	SEO Department	This department is going to manage all the digital marketing work of the organization	Active	

Figure 14. Thus, we are able to add a new department successfully

## V. CONCLUSION

Thus, we have created a system that will help organizations to manage their workforce efficiently. Thus, reducing the problems faced by the organizations earlier. This system will also ensure transparency in the organization and bridge the communication gap between the employees and the employers as they will be able to directly write their queries through the portal. This system in comparison to the other system will make use of analytics which would make it easier to analyze data and make important decisions based on them.

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# E-Learning: Research and Applications

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**Abstract**— The goal of educational institutions should be to find effective ways to provide new and efficient learning opportunities based on their environment, student characteristics, teacher preparation, economic crisis, and advancing technology in an effort to make learning more efficient, equitable, and innovative in higher education. This study paper identifies the need for and possibility for developing new online courses in order to engage and motivate students in accordance with their demands (e-Learning, blended learning, mobile learning).

This paper presents the insights and harmonizes the acquired knowledge since the implementation of a mobile learning solution, reviews a few definitions of e-learning, explores the motivating factors behind its development, and provides an overview of the circumstances in which e-learning is a perfect option, as well as the main e-learning component types. It is concluded that e-learning is a useful tool for the growth of the Indian educational sector. Considering the idea of e-learning and examining the different types of e-learning are the key objectives of this research work.

**Index Terms**— Electronic Learning(e-learning); education; learning 2.0; higher education; success; learning; internet; survey; educational development; formal e-learning; informal e-learning;.

## I. INTRODUCTION

E-learning is a crucial activity for each and every nation's advancement. Everyone involved in this new era is contemplating growth. We will achieve the desired outcomes if it is adequately planned. This research report examines the state of e-learning in India. Because of the great ease of use & accessibility, navigation, interaction, and user-friendly interface design of e-learning as in contrast to traditional learning, student satisfaction rates rise with continuous use. It has been determined that very few professional courses offered by higher education educators than that of the average national use e-learning, while few such non-professional courses are taught by teachers using e-learning. In recent years, there has been an increase in research into just how effective e-Learning performs. This is primarily due to greater opportunities for integrating IT and learning, but also because political and social focus on "what works" in learning is expanding.

## II. LITERATURE REVIEW

[1] The use of any new technologies or International Journal of e-Education, e-Business, e-Management and e-Learning 40 Volume 6, Number 1, March 2016 applications in the service of learning or learner support has been deemed to be the operational definition of e-learning, according to f Laurillard's (2006) research. According to Marc Prensky's study, particular learning activities are more effective for teaching various learning outcomes. He asserts that everyone learns: a) attitudes through restriction, criticism, and practice. b) using play to foster creativity.

- c. learning information through drill, questions, associations, and memories
- d. language acquisition through imitation, social interaction, and impression e) using examples, puzzles, and dilemmas from the real world to reason.

### III. WHAT IS E-LEARNING?

Internet-enabled learning is known as e-learning.

[2] E-learning is the process of delivering a wide range of solutions to facilitate learning and enhance performance using computer and Internet technology.

E-learning is the transfer of knowledge, skills, and information made possible by computers and networks. Web-based learning, computer-based learning, virtual learning possibilities, and digital collaboration are all examples of e-learning processes and applications.

It elevates the standard of learning and instruction. It addresses the demands and learning preferences of learners while also enhancing the efficacy and efficiency of the educational process. It enhances flexibility and user-accessibility for engaging students in the learning process.

E-learning incorporates a networked population of scholars, content providers, and experts as well as the delivery of content in a variety of formats and administration of the learning process. E-learning offers everyone involved in the learning process clear accountability, faster learning at lower costs, and expanded access.

Organizations which use e-learning give their staff the skills to use change as an advantage in today's fast-paced world. As people may now take charge of their own lifelong learning by removing barriers of time, distance, and socioeconomic status, e-learning will be the great equalizer in this new era.

### IV. WHY DEVELOP E-LEARNING?

E-learning is utilized by numerous institutions and businesses since it can be more economical and efficient than conventional learning. Especially compared to starting to make materials and training instructors, developing e-learning is more expensive, especially when highly interactive strategies are used. E-learning delivery costs, however, are significantly cheaper than those for classroom space, instructor time, participant travel, and lost productivity from missing work to attend classes. Additionally, e-learning engages students who find it challenging to attend traditional classroom training because they are:

- occupied with family or work
- geographically remote with little access to travel resources, time, or both
- located in volatile regions Consequently, they are limited in their mobility for security concerns.
- less involvement in class due to cultural or religious convictions.
- experiencing communication issues (e.g. foreigner or shy learners)

#### A. Can any kind of talent be developed through e-learning?

A training/learning programme aims to improve several kinds of abilities, including:

- Cognitive abilities include knowledge, comprehension, the ability to follow directions and apply new ideas to circumstances in order to solve issues.
- interpersonal abilities (such as those required for active listening, speaking, presenting, and bargaining), as well as
- psychomotor abilities, which entail learning bodily senses and motions (e.g. making sports or driving a car)

#### B. How does e-learning tackle a variety of domains?

Since the cognitive domain is the one most suited to online learning, the majority of e-learning courses are designed to enhance cognitive abilities. Because thinking abilities can only be learnt and developed "by doing them," they may require more interactive e-learning activities within certain cognitive areas. To alter attitudes and actions, for instance, interactive games might be used in conjunction with suitable feedback.

#### C. E-learning is a wise choice if

- To a big number of students, there is a lot of material that has to be provided.
- Geographically spread places make up the student body.
- Learners have limited mobility.
- Learners have less time to devote to learning because of other jobs.

- The goal of learning is to acquire uniform background information about a given subject.
- Learners like studying at their own speed and are highly motivated to pick up new skills.
- The course emphasizes long-term training requirements rather than urgent ones.
- when it is necessary to get the information.

#### V. QUALITY OF E-LEARNING

- The quality of an e-learning course/training is increased by:
- learner-centered content: learner-focused material The curriculum for online learning should be precise, pertinent, and tailored to each learner's needs, responsibilities, and roles in both their professional and personal lives. Information, knowledge, and skills should be offered in the conclusion.
- granularity: To aid in the assimilation of new information and to provide the student flexibility in their learning schedule, e-learning content has to be normalized (broken down into manageable chunks).
- engaging content: In order to create an engaging and inspiring learning environment, innovative use of instructional approaches, methods, and tactics is required.
- Interactivity: To keep students' interest, encourage learning, and create a positive learning environment for them, frequent
- learner-teacher interaction is essential.
- personalization: Self-paced courses must be altered to take into account the needs and interests of the student.
- Tutors and facilitators in instructor-led courses need to be able to monitor each learner's development and performance.

#### VI. HOW IS THE EFFECTIVENESS OF E-LEARNING DEFINED AND MEASURED?

According to several studies, when suitable teaching methods and approaches are used during the learning time, e-learning may be just as successful as face-to-face training, if not more so.

Employee feedback - In the first place, it is crucial to get employee feedback that will allow us to gauge how effective the training and learning were. Staff members must be questioned on if the course/training was a worthwhile experience and whether they approved of the subjects, resources, curriculum, and teachers' methods of instruction. Another study looked at how e-learning affected students' behavior, attitude, and academic achievement. The results revealed that learners using e-learning had mean scores that were statistically considerably higher than those using traditional teaching approaches. The effectiveness of e-learning as a tool or approach to improve the delivery of teaching and foster the development of learning abilities through transfer of learning was well received by instructors and students. The primary takeaway is that e-learning may be regarded as one of the greatest current approaches and methods for use in teaching and learning.

#### VII. WHAT MAKES E-LEARNING SOLUTIONS EFFECTIVE?

[5]If this was mentioned or implied in the abstracts, then all of the abstracts utilized in this study were coded for whether the e-Learning was effective, ineffective, or somewhat effective. This was the situation for 61 of the 111 abstracts analyzed, as illustrated in figure 1.

<b>Effective</b>	41
<b>Not effective</b>	6
<b>Partly effective</b>	14

Figure 1 shows the effectiveness of e-learning

Only 10% (6/61) of the studies are labeled as "not successful," which calls into question the validity of the classifications given the difficulties and issues that e-Learning must overcome. A closer examination of the abstracts reveals that many of the empirical studies and reachers on efficacy were carried out by scholars who seemed to have an interest in e-success. The literature review currently does not support the examination into whether e-Learning solutions are particularly successful due to the issue of "effectiveness bias."

As seen in figure 2, this model depicts the crucial elements (in gray) that the review found to be important in determining how effective e-Learning is according to various definitions. There must be a positive and helpful

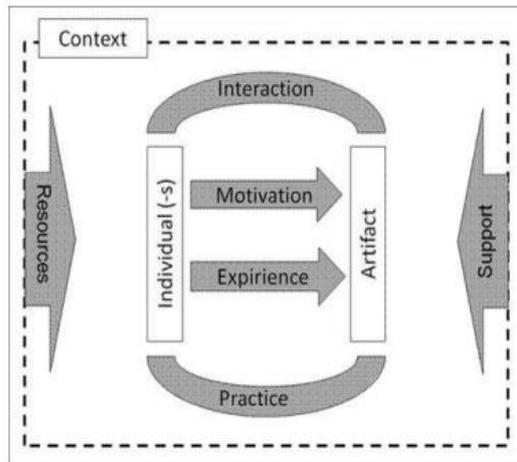


Figure 2 flow chart

learning atmosphere. The amount of motivation of the person(s) using the eLearning (artifact) affects how long they use it, and prior online or professional experience tends to have a generally beneficial effect on efficacy. Program designs that include peer and instructor interaction as well as opportunities for practise improve the efficacy of online learning. This model illustrates how the important variables that affect efficacy interact, however many studies in the literature review do not take into account the wide range of definitions.

## VIII. INDIAN E-LEARNING

Understanding the idea and principles of e-learning in its entirety as well as looking into and analyzing the many types of e-learning are some of the goals of this study. Additionally, it highlights several points of view in relation to the contrast between conventional learning, classroom learning, and online learning. This essay attempts to provide some answers by examining the benefits of both learning styles while taking into account the limitations of the scenario. It intends to analyze the benefits and drawbacks of both learning styles in depth. Such an objective secondary approach is used to achieve it. Books, magazines, journals, and published materials relating to e-learning were used to gather secondary data for the study.

### A. Indian Education Situation

For a long time, India's old educational system and practices were viable, but as educational demands change and a global education standard comes into force, the Indian educational system is being forced to make several adjustments. as seen by the Covid-19 epidemic. Though at a slower rate than in other nations, the idea of e-learning is undoubtedly growing in favor throughout the nation. The Indian Constitution aims to meet the country's educational demands, particularly for its many distinct communities and cultures. It also commits to provide high-quality education to all citizens. The development of the full person and the fostering of potential inherent qualities and features are what different educational categories such as elementary education, secondary school, higher education, adult education, and technical and vocational education are all about. The objective of education in rural regions may be achieved in India through the use of e-learning, which can also inspire students to pursue further education and empower women. Education must adapt to the new demands of the modern world, including the need to produce a workforce with global competency. The world is changing and evolving quite quickly.

### B. Concept and Aspect of e-Learning in India

The term "e-learning," sometimes known as "digital learning," refers to the use of a computer to offer all or a portion of a course or programme, whether it be at a school, college, as part of training, or as a full distance learning course. E-learning is essentially a method of accessing educational materials outside of a traditional classroom by using electronic technology. It frequently refers to a fully delivered course, programme, or degree.

*Education is what remains after one has forgotten what one has learned in school.* —**Albert Einstein.**

Although Einstein may have meant his remarks as a joke, they represent the truth that successful and high-quality education is ongoing and always changing as technology advances. In actuality, during the past several decades, there have been many changes to how education is seen. Learning has changed from being

characterized by the old classroom paradigm to learning that is immediate, online, self-driven, and available whenever a student desires. There have been several turning points in the path of education in India. In plain English, e-learning is defined as education that is provided online, over the internet, and includes a variety of formats and styles, including remote learning, computerized electronic learning, online learning, and internet learning.

### *C. E-Learning and Government*

The government can employ e-learning in a variety of ways, including the following:

- Effective policy and rule communication may aid the government.
- It can raise awareness among individuals about various programmes and goals.
- According to their demands, it will offer citizens/people a public forum for communication or education.
- Both unstructured and semi-structured information may be managed by it.
- It can carry out government policy.

The government may benefit from an effective e-learning system in many ways. The government may offer a learning portal centered on public private partnerships' (PPP) policies, rules, and regulations. A meaningful and worthwhile education among the populace through e-learning can help a government become more open in its governance.

### *D. E-Learning and Higher Education*

Studies conducted on a worldwide scale indicate that, after the United States, India has the second-highest number of students enrolled in online courses, with more than 1,55,000 coming from the nation. 32% of the over 1.2 million students globally are from the United States, while 15% are from India (but keep in mind that both nations' populations are large). There is an increasing need in higher education to develop an e-learning programme in which all components of a course are controlled through a standardized user interface throughout the whole school. Many of these programmes have been launched in our nation; students must attend orientation sessions at institutions, but the course material is distributed online. The majority of colleges do provide online advising and registration, e-counseling, and student newspapers, among other online learning assistance and services. E-learning has the capability to overcome India's rural areas' lack of access to professors and teachers with the necessary qualifications. Live online coaching, streaming films, and virtual classrooms are a few of the answers that e-learning may provide to these issues. E-learning is the greatest choice even though there is no replacement for efficient and well-organized classroom instruction.

## IX. CONCLUSION

According to the results of our study, we draw the essential conclusion that the fast expansion of internet connectivity is a key driver of the development of e-learning. Online learning will become more efficient and educational quality will rise thanks to a solid internet infrastructure with a wide range of regional and international actors. E-learning improves both the standard of education and the state of the economy in emerging nations like India.

Our research article addressed the following research queries: How are e-learning's metrics determined? How is the effectiveness of e-learning measured? Why are e-learning programmes so effective? The benefits of taking into account and making clear how these notions are utilized in study and practice were emphasized in this article. The bulk of studies, according to this survey, employed quantitative and comparative methods. This paper argues that practitioners and academics are prevented from uncovering unexpected and unintentional potential reasons of error by utilizing only quantitative measurements to satisfy preset learning objectives. Open-ended qualitative survey questions can significantly increase the validity of such methods [8] The environment in which the e-learning solution was employed and deployed as well as the users of the artifact were taken into account while categorizing these elements.

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# Medical Chat Bot for Ambulance During Emergency Situations

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**Abstract**—India is among the nations also with the greatest populations. One of India's biggest problems has continued to be health misinformation due to overcrowding. Death occurs every minute as a result of unforeseen and unplanned situations. Saving a life is lucky and good. Using the stretcher's embedded microcontrollers and sensors, a smart, intelligent healthcare system will be created. In the event of an accident, it will determine the condition of the corpse and send that information to the hospital in addition to sending a server-based alert to the closest police station to avoid any potential legal issues. If this process is followed, critical care units in hospitals can have their physical requirements improved before patients arrive, potentially saving many lives.

## I. INTRODUCTION

One of the biggest problems facing humanity is its health. The previous 10 years have seen a lot of attention focused on the healthcare industry. The main objective was to create a reliable method for patient monitoring that would let medical professionals keep a watch on patients who might be being treated in a hospital or going about their everyday lives as usual. Due to recently enhanced technology, patient monitoring systems have become one of the most significant developments. Currently, a more contemporary strategy is required.

In the conventional method, the main role is played by healthcare experts. They must go to the hospital ward to provide the required diagnostics and guidance. There are two fundamental issues with this strategy. First, the patient must always have a healthcare provider nearby, and second, the patient must spend some time being admitted to the hospital with biomedical equipment at their bedside.

To tackle these two difficulties, patients receive education and information on diagnosing and preventing illnesses. The second requirement is for a patient monitoring system (PMS) that is dependable and easily accessible. We can employ technology more wisely to improve the aforementioned situation.

## II. RELATED WORKS

Guanqun Zhang, Amber C. Cottrell, Isaac C. Henry, and Devin B. McCombie (2016) developed continuous heart rate monitoring in the arteries. Utilizing separate wearable sensors that might provide a different and maybe more useful evaluation of the vascular condition of a patient. An appealing method for continuously monitoring blood pressure is pulse wave velocity (PWV). However, because of the confusing impact of the ejection before the ECG, innovations in PWV relying on patients who are mobile have inaccurate time estimations between the ECG and a distal PPG (PEP). Inaccuracy in mobile patients (PEP). In this study, we introduced the ViSi Mobile, a portable, continuously-reading blood pressure device that can track and measure

PEP changes. PEP is determined using precordial vibrations captured by an accelerometer attached to the patient's sternum. The effectiveness of the PEP measures was evaluated on test participants who experienced a postural shift and patient activity. The accuracy of CBP in active patients may be improved, according to the results [1].

Radhika K. A., Raksha B, and Pruthviraj U. (2018) developed one of the main forces behind the growth of robotic technology: a combination of automated frameworks with the Internet of Things (IoT). Robots are controlled by smartphones in modern technology. In our method, a Driving Force GT joystick that offers accurate remote control is used. In order to remotely operate a robotic vehicle, manual control is used. A bicycle that is controlled by a joystick is more efficient than one that is web- or smartphone-driven because of the speed control. In this piece, a robotic automobile dubbed Pibot is controlled using a Raspberry Pi as a base controller to operate Using a USB joystick, real-time system and vehicle operations are remotely controlled from the ground station. For security purposes, the Pilot's camera transmits real-time video to a website through an HTTP server. Python programming is used to control the car from the remote station, utilizing consumer connection interaction (through strong Wi-Fi) [2].

The method to conserve the power of the probe circuit while remaining in contact with application requirements were created by Floriano De Rango and Domenico Barletta in 2016. Another critical issue that must be addressed while developing network technologies for WSN is Current studies have resulted in new guidelines designed specifically for sensing devices where energy monitoring would be a key component. "Internet of Things" (IoT) is a cutting-edge digital approach in which several intelligent gadgets related to the World Wide Web take part in knowledge exchange and group decision-making. Integration of Internet-connected devices for detecting or controlling energy consumption entails the integration of all types of energy-intensive equipment, including outlets, lightbulbs, air conditioners, etc. The system may occasionally be able to connect with the utility provider, which helps achieve equilibrium between energy consumption and production, or more generally, is most likely to optimize overall energy consumption. To facilitate power connectivity between connected devices and the Internet of Things infrastructures, various new trends and problems are identified in this study. To save energy and extend the system's lifetime, communication between devices is examined. By adjusting various communication settings, such as data size, the device's Radiofrequency interfaces and Internet access are examined in a variety of scenarios to determine the ideal setup for the gadget as well as the shortest device lifetime [3].

Electricity is a basic human requirement that is frequently utilized for home, commercial, and farming purposes. In this logic, energy waste costs the nation millions of dollars. Technology-based solutions, like the Internet of Things, make it possible to integrate the physical and digital worlds to manage and/or monitor resources, including, in this case, energy use. Additionally, the creation of communication devices like the XBee, which is extensively used for monitoring and controlling operations and makes it possible to swiftly and effectively create wireless sensor network while using very little energy, has been made possible by the advancement of micro- and nanoelectronics. By creating hardware and software solutions, the demonstrated prototype takes advantage of the prior benefits. Through a scalable and flexible platform employing XBee technology and a specially designed protocol for data exchange between the four modules that make up the system, it enables remote monitoring of power use in a home. Results are shown, showing how accurate the prototype is when compared to readings from a typical electricity meter. This was developed by Darwin Alulema and Mireya Zapata in 2018 [4].

The last few years have seen a variety of technological advancements. These technological advances could offer methods for obtaining and processing data that identify significant clinical features of the patients for medical care. The goal is to highlight the key functions of a voice-activated, clever expander prototype and a method for monitoring vital signs in individuals with disabilities or restricted mobility. The data processing hardware, which is integrated with the data collection software to create a global system, is Raspberry Pi and Arduino. Since this system was created using readily available technology and a fusion of several functions to provide a workable solution, its main contribution is to simplify medical treatments for patients. This was developed by Wilmer Calle and Manuel Eduardo Flores Moran in 2018 [5].

### III. COMPONENTS

The ESP32 was used to create the prototype. A fingerprint sensor, a heartbeat sensor, and a breathing sensor were also utilized. To reflect the best quality-price ratio, components are chosen from those sold at nearby retailers. Finding patient information to communicate to the doctor is done via a fingerprint sensor.

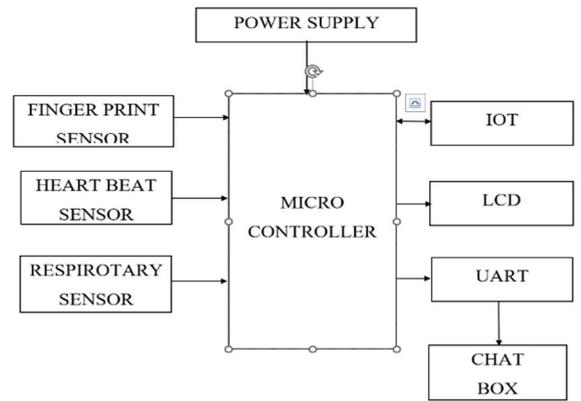


Figure 1: Block Diagram

#### IV. DESIGN

System-on-a-chip microcontrollers in the ESP32 family are low-cost, low-power devices that have Bluetooth and Wi-Fi built in. The ESP32 family, power amplifiers, low-noise receive amplifiers, RF baluns, integrated antenna switches, and power-management modules in addition to the Tensilica Xtensa LX6 dual- and single-core CPUs, the Tensilica Xtensa LX7 dual-core microprocessor, and the single-core Tensilica Xtensa LX7 processor. The ESP32 was designed and built by the Chinese business located in Shanghai, Espressif Systems, and is produced Via TSMC using their 40 nm innovation Excellent in functionality, this optical biometric fingerprint reader may be used in a range of finished goods, including automobile door locks, safe deposit boxes, attendance, and access control. Summary of the Product The fingerprint sensor R305 fingerprint module has a direct connection to a microcontroller UART or a PC through a MAX232 or USB Serial converter. A TTL UART interface is also possible.

The Respiration Sensor measures diaphragmatic breathing in real-world or fictitious biofeedback applications like stress reduction and relaxation training. This sensor measures breathing frequency in addition to displaying the relative depth of breathing.

A digital output of the heartbeat is created when one finger is positioned on the heartbeat sensor. When a heartbeat is detected, the beat LED blinks in time with each one. A microcontroller (BPM) may simply be linked to this digital output to calculate the beats per minute rate. It uses a finger to modulate the light.

Internet using the ESP32 controller. And the data in the cloud are in encrypted format for basic security purpose and for viewing the details an OTP generation method for the registered email id is used The data is available with the time stamps Once the website has verified the OTP, the message will be sent to the registered mobile number.

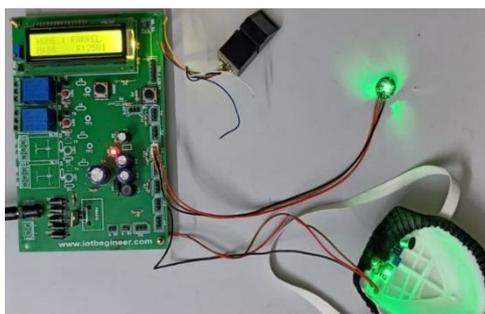


Figure 2a: Control Unit

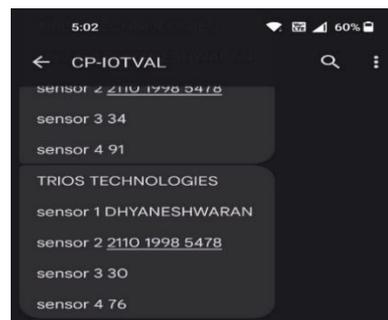


Figure 2b: send a text message

#### V. LIMITATIONS OF THE PRODUCT

The transformer that lowers the alternating current voltage to the necessary dc output level is connected to the alternating current voltage, which is typically 220 V RMS. Following that, a full-wave rectified voltage created by a diode rectifier is first filtered by a basic capacitor filter to provide a direct current voltage. In most cases, there are some waves or alternating current voltage shifts in the final voltage in dc. Despite changes in the point

#	Name	Id no	Respiratory	Heartbeat	Date & Time	Action
1	*****	*****	*****	*****	2022-12-01 19:17:52	🔍
2	FARRIEL	3452 4548 5476	2123	71	2022-12-01 19:16:49	🔍
3	*****	*****	*****	*****	2022-12-01 19:15:47	🔍
4	*****	*****	*****	*****	2022-12-01 19:14:44	🔍
5	*****	*****	*****	*****	2022-12-01 19:13:41	🔍
6	*****	*****	*****	*****	2022-12-01 19:12:39	🔍
7	*****	*****	*****	*****	2022-12-01 19:11:36	🔍
8	*****	*****	*****	*****	2022-12-01 19:10:33	🔍
9	*****	*****	*****	*****	2022-12-01 19:10:01	🔍

Figure 3: Live patient Monitoring

of common coupling to the output voltage or the input dc voltage, a regulator circuit reduces ripples while maintaining the same dc value. This voltage regulation is often accomplished using one of the widely used voltage regulator IC chips.

## VI. FURTHER IMPROVEMENTS

The current prototype has room for improvement. If, for some reason, the doctor is not in the ambulance, we can still communicate with the doctor via a chatbot created in Python. The physician will communicate with the paramedics via the chatbot and give them instructions on the necessary procedure.

## VII. CONCLUSION

Due to the significance of health care services to our society, automating them relieves human workers of stress and makes measurement easier. Patients are more likely to trust this system because of its transparency. The doctor may assess the patient's current condition while continuously monitoring the patient's condition, which will help him decide which treatment is most suited.

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# A Comprehensive Study on Time Series Analysis in Healthcare

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**Abstract**—There has been a lot of interest in time series forecasting in recent years. Deep neural networks have shown their effectiveness and accuracy in various industries. It is currently one of the most extensively used machine-learning algorithms for dealing with massive volumes of data due to the reasons stated above. Statistical modeling includes forecasting, which is used for decision-making in various fields. Time-varying variables may be forecasted based on their past values, which is the goal of forecasting. Developing models and techniques for trustworthy forecasting is an important part of the forecasting process. As part of this study, a systematic mapping investigation and a literature review are used. Time-series researchers have relied on ARIMA approaches for decades, notably the autoregressive integrated moving average model. But the need for stationary makes this method somewhat rigid. Forecasting methods have improved and expanded with the introduction of computers, ranging from stochastic models to soft computers. Conventional approaches may not be as accurate as soft computing. In addition, the volume of data that can be analyzed and the efficiency of the process are two of the many benefits of using soft computing.

**Index Terms**— ARIMA, Deep Learning, Healthcare, Survey, Time Series.

## I. INTRODUCTION

According to Time Series Data, a process is observed at predefined intervals and a predetermined sample rate. Developing rules from data and generating predictions about future values based on current observations are at the heart of time series analysis. There has been an increase in the use of time-series observation data across various industries and fields. Furthermore, the amount of time series data being produced is rising. One of the most prominent academic fields is forecasting time series data. Meteorological and weather forecasting, industrial production forecasting, and stock trend forecasting have benefited from its implementation. It might assist decision-makers in avoiding danger and making better choices. Traditional time series forecasting methods based on chance and statistics have succeeded in various fields, including meteorology, economics, and more.

Time series forecasting algorithms face substantial issues with the influx of large, non-linear time series data that follow various distribution patterns due to the introduction of data science in health care. Outstanding results have been achieved by using deep and machine learning to very sophisticated algorithms for forecasting time-series data. This article aims to categorize the many approaches for predicting time series that are currently available.

## II. BACKGROUND STUDY

### A. A survey on Health care Time series analysis using ARIMA MODEL

In our research study, Abdul Jalil Niazaï et al. [2] looked at the current and projected prevalence of COVID-19 in Afghanistan. From 22 March to 24 June 2020, to gather COVID-19 pandemic data from Afghan patients using the time-series model (ARIMA). Three ARIMA models were created and chosen: ARIMA (0,2,2) for recovered cases and (ARIMA 0/2) for death cases with the lowest AIC values.

Pratyaksa, Hans; et al. [44] Using daily data from Prof. Soeparwi Veterinary Hospital, an ARIMA model was used to forecast the quantity of povidone-iodine antiseptic treatment that was used. R software was used to create an ARIMA forecasting model. Results show that ARIMA(1,0,1) works well with the historical data.  $AR(1) = -0,6463$ ,  $MA(1) = 0.9436$ , and  $intercept/constant = 14.6796$  were the model coefficients. The chosen model's MAE value was found to be 24.769. By developing better resource management policies and forecasting future medicine demand, stakeholders and pharmacy departments may benefit from medication consumption prediction.

### B. A survey on Health care Time-series Analysis of Deep learning

Divya Gupta et al. [13] As shown in this study, cutting-edge medical technologies such as artificial intelligence (AI), distributed ledger technology (DLT), and robots — all of which are part of the current ubiquitous healthcare paradigm — may help enhance diagnostic procedures as well as patient care. The sheer volume of data makes it difficult for medical personnel to make timely decisions and implement new technologies, even while certain devices may aid in illness prevention, fitness promotion, and remote assistance in emergencies. A CNN model was trained using the original IoMT-based WESAD mental health dataset. Scalability difficulties have been addressed by restricting intra-cluster similarity computations by time and reducing processing costs in the k-medoid model. These researchers used the k-medoid approach to summarize the WESAD dataset. Data clustering reduced the execution time by half.

Fabien Viton et al. [15] An increasing number of researchers are looking at how to explain DL models, particularly in the healthcare industry. The work may be made easier by using visual-based solutions. This paper's CNN models for multivariate TS issues were explained using heat maps. A visual representation of the relevance of each TS variable over time was presented in addition to the forecasts. The research focused on predicting in-hospital mortality as a practical healthcare application. Using heat maps allows you to see which factors have the most impact and when it is most important to use them throughout your ICU stay. The model predictions are seen to be better supported by this visual explanation. Our next step is to study the heat map output with healthcare professionals interacting with patients in the intensive care unit (ICU).

Kristoffer Wickstrom et al. [30] Deep ensemble strategies for explainable CNNs are presented here. The suggested strategy was tested using both synthetic and real-world data. According to the findings, clinical time series may benefit from using deep ensembles to identify key traits, and modeling the uncertainty in relevance scores can help to give more accessible and reliable explanations for the results. New thresholding methods have been presented and tested. In this work, a single thresholding approach was explored; however, utilizing other thresholding strategies is an exciting area for future research. Using the results of this study, it is feasible to construct more reliable and precise decision-support systems than those based on deep learning.

### C. Multivariate Time-series Analysis in Healthcare

Kale, David C et al. [28] An rising need for fast and reliable time series comparisons, especially in healthcare, is shown in this study. According to experts, no one-time series similarity metric performs consistently well across all datasets and situations. Most of these approaches also have problems with large time-series datasets. Hashing a time series with kernelized hashing is flexible and consistent regardless of the format or distance measure. With KLSH and arbitrary time series similarity measures, an efficient and reliable framework is provided for searching for time series that are similar to each other.

Ordonez, P et al. [40] Each interactive and animated, multivariate time-series visualization customized to an individual patient and tailored to the physicians' baseline and thresholds was provided in this research. Visualizations were created to help physicians rapidly and efficiently identify important changes in a patient's state of health. In our study, visualizations are as accurate as or less than conventional techniques for detecting PDA. Hence these authors did not reject the null hypothesis. As a result, this is acceptable given its innovative interface despite a lower overall level of trust in the visualization. However, the research found that around two-thirds of the providers preferred to employ the conventional way following training and before usage.

Yanke Hu et al. [63] Although RNNs' slow processing speed is typically neglected, new research has shown that RNN-based strategies may be useful in numerous time series applications. By converting vital signs into a (0, 1) vector and treating the problem as a computer vision problem, this article proposes a novel method for the multivariate time series classification challenge in healthcare.

Zina M et al. [65] A Voronoi diagram-based approach for detecting outliers in time series data has been described. The technique has several major benefits. Outliers are dealt with by considering the multivariate nature of the data in the first place. Because the authors may choose whether or not to use a parametric model, it is versatile in extracting relevant characteristics for separating outliers from non-outliers (such as a regression model, as in this paper). Finally, Voronoi diagrams reveal the underlying geometric connection of the data points. According to Experimental Data, our MVOD technique can accurately, sensitively, and robustly identify outliers in a multivariate time series.

#### D. Multi-Dimensional Time Series Analysis

Dai, Xiangfeng et al. [12]. Researchers in this research provide three different ways of altering hypothesizing the HASF approach for finding patterns in fragmented time series. This technique has proven to be resilient because of the HASF's capacity (a) to retain the underlying trend, (b) to cope with the nonstationary and heteroscedasticity of data, and (c) to represent the relevance of data samples that remain after deleting nearby data.

Dugast, Mael, et al. [14] An early decision-making aid for Emergency Department administrators is crucial for financial and public health reasons. When respiratory-like infections spread, these authors know that ED admissions increase. Sometimes, the clinical signs of these disorders may be recognized. In particular, RSV is linked to bronchiolitis symptoms in children by doctors. It is thus possible to address the RSV pandemic by analyzing the temporal series of bronchiolitis admissions to pediatric emergency rooms. There is a need for a new and unique method for recognizing early on the start of epidemic-related aberrant arrival in emergency departments (EDs) and calculating the maximum number of arrivals, which indicates how soon the epidemic will fade away. Detrended Fluctuation Analysis was utilized to get the admissions time series variability, and the authors applied the persistent homology technique (DFA). To get the best DFA parameter value, solve a multi-objective optimization problem.

TABLE I: COMPARATIVE ANALYSIS OF VARIOUS MACHINE LEARNING TECHNIQUES IN HEALTH CARE

Author Name	Techniques Used	Merits	Demerits
Abbasi et al. (2011)	FRN	Efficiently enable the inclusion of extended sets of heterogeneous Ingram features	Irrespective of the feature subset sizes.
Chen & Tseng (2011)	Product reviews	An effective information quality framework	Classification problem
Jiang et al. (2011)	Twitter sentiment classification	Incorporating target-dependent features and good performance	Target-independent features
Xu et al. (2011)	Mining reviews from travel blogs	Using three supervised machine learning algorithms	Slightly improve accuracy
Sobkowicz et al. (2012)	Opinion formation framework	Content analysis of social media and socio-physical system modeling.	Accuracy
Liu et al. (2012)	Word based Translation Model (WTM)	To extract opinion targets and to generate a global measure	The problem of error propagation in traditional

			bootstrap based methods
Kamal et al. (2012)	A rule-based system and opinion mining system	To identify candidate feature-opinion pairs from review documents and product features	Opinions that are related either directly or indirectly
Lin et al. (2012)	JST, Reverse-JST and LDA	Detects sentiment and topic simultaneously from text	Weakly supervised nature of JST and no labeled documents.
Moraes et al. (2013)	Document-level sentiment analysis, SVM and ANN	Achieved better levels of classification accuracy	Unbalanced data contexts
Bagheri et al. (2013)	A novel unsupervised and domain-independent model	To learn multiword aspects, bootstrapping iterative algorithm and pruning methods	Accuracy
Kalaivani&Shunmuganathan (2013)	The performance for sentiment classification	Good accuracy	Compare various sentiment classification approaches
Hai et al. (2014)	Opinion features from online reviews	IEDR	Domain-specific and independent corpus
Stavrianou&Brun (2015)	Product reviews, NLP and fine-grained data like opinion	Improving the recommendation system	Review only particular product.
Agarwal et al. (2015)	Concepts extraction protocol	Semantic relations between words in natural language and Concept Net ontology	Basic problem of SA
Agarwal & Mittal (2016)	Machine learning protocols for SA	Bow representations	High dimensionality of features space
Ahmad et al. (2016)	Sentence-level lexical based domain independent sentiments classification technique	Text level corpus based machine learning techniques	The problem of domain portability

Garg, Bindu, et al. [19] New techniques described in this research produce the highest accuracy with the lowest mean square error among all forecasting-related work. The pioneering dynamic computational algorithm may be used to accurately and reliably estimate and anticipate the frequency of outpatient visits in any territory-care hospital. Health care planning, allocation, and management might benefit from using the model presented in this article. A decision support system for healthcare institutions may be developed using the design of the suggested technique. Such a decision assistance system may significantly impact healthcare service efficiency. The suggested model may be improved using a genetic algorithm in the future to cope with multi-dimensional time-series data.

Gunnarsdottir, Kristin, et al. [20] an efficient technique to categorize sepsis in intensive care units (ICUs) may be to use a generalized linear model. The concept is that the 781 probability model is updated each time a new

measurement is taken and utilized by ICU physicians to understand their patient's clinical status better. Instead of only considering demographic factors, these authors found that including physiological time-series signals improved classification accuracy and specificity. These authors were constrained by the number of patients in the MIMIC II database that could be included in this investigation. Even though these findings are early, they show that GLM can be used to monitor sepsis in real-time.

Liu, Bo et al. [34] MDLats is a method and system for discovering motifs in large-scale time series presented in this work. It utilizes the RP algorithm and the ED to swiftly and precisely locate the motifs, combining the benefits of both approximate and exact techniques. Hadoop is used to construct a production-level system. MDLats' ECG classification findings and real-world use in healthcare prove its usefulness. In the future, these authors want to use MDLats in various other areas, including air pollution, social networks, and logistical optimization and lot of other areas where the system is being use on a large scale.

#### E. A Survey on Time Series Analysis on General Health Care

Almeida, Rui Jorge, et al. [6] A straightforward method for obtaining medical data summaries in descriptive linguistic form is presented in this paper. Proposals incorporate categorical data and clearly show disparities between patients with distinct class labels from linguistic summary protoforms. These authors propose summarizing data in a new differential form based on a numerical criterion to compare linguistic summaries. Multiple occurrences were detected in the same individuals over long periods in the reviewed data set. Summaries of linguistic features are proposed that offer chronological context for the quantification of characteristics and time

Baldassano, Steven, et al. [8] ICU caregivers are alerted to crucial occurrences in real-time using a configurable platform established in this article. This platform developed and clinically applied open-source techniques for identifying defective EEG electrodes, tracking burst suppression ratios, and detecting problems in neuromonitoring data. When it comes to improving ICU workflow, easing the strain on nurses, and enhancing research data quality, these authors showed how this platform could do all of those things and calculate clinically significant trending indicators. Medical data analytics may greatly impact patient care, and this study provides a framework for understanding a broad range of ICU data streams.

Biem, A et al. [9] These authors introduced STAM as a domain-agnostic, multi-component, generic time-series analysis and management system and exhibited its capabilities via experiments on a real-time, large-scale anomaly detection application and generated tests. The STAM system is created with a specific emphasis on well-defined qualities. STAM is a general plug-and-play system. It gives the capacity to handle multi-dimensional time-series data of nearly any size. The user inputs the data source, and the system executes the processing. STAM stresses simplicity of use: the system needs minimum adjustment from the user and minimal settings to start, save for adding data sources. It also offers sophisticated user control (e.g., sensitivity modification and parameter selection).

TABLE II: COMPARATIVE ANALYSIS OF DIFFERENT HEALTH CARE DATA

Type of Model	Size of Data	Patient Age	Accuracy
Multiple Regression	1 M	> 65	0.66
LassoLarsIC-AIC	2.3 million	All	0.72
Decision Tree Regression	2.3 million	All	0.76

Cao, Xi Hang, et al. [10] Methods for learning continuous-time LDS from MTS with different types of imperfection, such as restricted time points and uneven sample intervals, are presented in this study. These authors used a support vector machine model for classification tasks and a sophisticated LDS kernel formulation.

These authors demonstrated that our suggested technique is successful and superior to other ways based on the outcomes of three diagnostic tasks with varying degrees of imperfection.

Hajihashemi, Zahra and Popescu, Mihail [22]. Elderly people at the highest risk of deterioration and adverse events may be identified using our methods in this research. Automated in-home monitoring systems will use our computational approach to track the health trends of older persons and notify healthcare practitioners so that they may take action before things worsen. The features of TSW are discussed in depth here, followed by the findings of the suggested approach's performance on a benchmark dataset.

This research was constrained by Helander, Elina, et al. [23] because it relied on data from just two healthy patients. However, some findings were consistent with previous research. Behavioral weight loss participants were tracked on average, 28 percent on weekdays and 17 percent on weekends. These two individuals showed a reduction in self-monitoring frequency throughout the weekend. Weight fluctuates during the day and over time. An average daily weight fluctuation of 2% to 3% may be regarded as typical, with daily weight fluctuations being more frequent than day-to-to-day weight fluctuations

Hochstein, Axel, et al. [25] Using static Bayesian network theory, these authors develop the concept of probabilistic event networks, which describe the relationships between regime shifts in time and their locations. These authors demonstrate how RSVAR inference and learning algorithms must be altered to take higher-order regime dynamics into account.

Lehman, Li-Wei H. et al. [32] This research aims to see whether the SLDS framework can be used to follow the evolution of patients' health status over time. An ICU patient cohort was studied using the framework during the first 24 hours of hospitalization. These authors found that the vital sign dynamics of patients who did not survive their hospital stays evolved differently from those who did. As patients' health improves or worsens, the distribution of their vital sign dynamics likewise changes. These findings confirm our idea.

Liu, junjian et al. [35] Using ontology, these authors developed a real-time monitoring system to monitor patient care flow and compare it to the specified CP treatment requirements. The suggested system's monitoring data is organized and stored in a database, making it easy for the computer to handle and evaluate.

Mei, Jianguan, et al. [37] Computer vision and pattern recognition applications rely on accurately measuring and categorizing motion tracking signals (MTS). A new method for measuring MTS has been presented. MTS's local distance is first determined using the Mahalanobis distance, as described in the new technique. The DTW is then used to discover the best route to align MTS out of synchronization or have various lengths. Once this is done, the difference between two MTS may be derived for MTS classification and clustering purposes. Learning the Mahalanobis function for the MTS dataset is another major issue in the proposed MDDTW metric. LogDet divergence-based metric learning with triplet constraints was developed in this study for the MTS example. Our technique was tested on several well-known datasets. The results showed that the recommended strategy was dependable and accurate. An issue with the suggested framework is that it is inefficient in computing.

According to this article, pealat, Clement et al. [41], Respiratory viruses significantly affect emergency departments (ED) in France each winter. To prevent this from happening, it's critical to have the means to monitor the passage of these viruses across the patient population. This is exactly what is being discussed in this paper.

Penfold, Robert B, and Zhang, Fang [42] it is a simple yet effective evaluation of policies and programs. Despite its drawbacks, few statistical techniques are as well-designed or as effective in their effect on the audience as this one

Pierleoni, Paola, et al. [43] When used for Parkinson's disease diagnosis and treatment, this new system presented in this research offers qualities that make it an excellent choice for ambulatory and home monitoring. Tremors may be classified using a basic IMU device and a set of algorithms that can measure the intensity of their symptoms in real-time using the UPDRS scale. The system also provides a mechanism for annotating illness severity and progression to the neurologist. The report, thus, is unaffected by subjective judgments, such as those made by medical experts who alternate in subsequent analyses of a patient.

Rusanov, Alexander, et al. [47] Data-driven, time-series clustering identifies people with managed and uncontrolled diabetes. Other illness factors or long-term medical issues may apply to this strategy.

Sana Imtiaz et al. [48] Using a fitness monitoring app or a wearable device, these authors develop an online system to predict a user's food habits and health statistics. To this end, these authors have developed and deployed a pipeline that can reliably forecast user behavior and utilize commonalities between people to increase model performance while ensuring data privacy. Assuming that the dataset and characteristics are consistent, our predictions are less than 0.025 percent out of whack with reality.

Shi, Yong, et al. [50] Researching the Home Health Care 690 logistics optimization is of major importance in this article since transportation expenses are one of the main kinds of spending in the business.

According to this research, Sindhu Shantha Nair et al. [52] Ethical considerations must be considered when applying these dimensions to the healthcare business. Healthcare businesses must practice these aspects to the letter to achieve a competitive edge. These fields may benefit from more education and training to improve productivity. These perceptions and characteristics of organizational pedestal morally contribute to health care excellence if they are understood, aware, and ready.

Stylianides, Nikolas, et al. [55] The suggested solution's usability and cost-effectiveness are shown in this paper's assessment scenario. As discussed earlier, many research institutions have formed common repositories to share medical data. Researchers may access the data they need to analyze in databases or binary files.

Vasco, Todor, et al. [57] Sensor data streams are modeled using semantics. WSN and WBAN data streams demand that adaptable architectures be designed based on multiagent systems to meet the needs of real-time vital signs monitoring. Semantically-driven sensor data streams are created by the system using the suggested approach. Attributes such as timestamps, vital signs, and values define each reading. Yandong Zheng et al. [61] These authors provide an efficient and privacy-preserving forward algorithm, which these authors then employ to build a healthcare monitoring system. A collection of mutually orthogonal matrices was the first thing these authors offered, and a strategy for building one was presented shortly after.

Zhang, Ying, et al. [64] in Consistent correlation between physiological and clinical events has been shown by this method for synchronized data collection and clinical annotations. Even though hardware capabilities might affect its performance, the system gathered and evaluated patient monitoring algorithms in real-time at the bedside.

### III. CONCLUSION

Two things are anticipated to occur in the future growth of technology and healthcare. First, the rising sophistication of computerization and software development will be a potent mix for predicting. Various complicated procedures and strategies now only imaginable may soon be realized and used in actual circumstances. The variances and degrees of complexity are also growing regarding the quantity of data. In addition, the healthcare departments requiring large-scale data forecasting will expand. In the future, there will be rapid growth in using these two technologies, which combine forecasting and data mining. There are various benefits to developing new forecasting methodologies, such as those based on soft computing technologies, which may produce more accurate forecasting results than conventional approaches and more efficient processes. A thorough evaluation of existing time series forecasting approaches is expected to serve as a direction for future field classifications and analysis research.

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# Detecting and Isolating Black-Hole Attacks in Manet using Timer based Baited Technique

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**Abstract**—The network model (MANET) is just a wireless system that has no established infrastructure. These nodes seem to be able to communicate without a central authority. MANETs are ideal for emergency circumstances, vehicle networks, including military activities. However, the MANET's flexibility makes it vulnerable to attacks like black hole attacks. The black hole attack is one of the most common threats to MANET. In this attack, an unauthorized node claims to have the best path to a target node, causing data packets to be misdirected and then dropped. Several fixes have been made now. An overview of black hole attack prevention measures and conclusion are presented in this work.

**Index Terms**— Cooperative Black Hole Attack, Black Hole Attack, Malicious Node, Packets.

## I. INTRODUCTION

This short-term network has only one mobile node, which is capable of sending and receiving data by itself, without the aid of any connections. Using multi-hop communication, MANET nodes can exchange information. There is no direct data link between a destination node and a source node if the two are not within communication range (G., P., Parmar, V., & Rishi, R., 2011). MANET has a dynamic topology since the nodes can link and disconnect fast. The network's dynamic topography makes it more vulnerable to a wide range of attacks. As a result, building this network and ensuring its route stability is extremely difficult. There are other forms of malicious attacks being carried out by MANET; however, our primary focus is on black hole attacks (Gerhards-Padilla, Aschenbruck and Martini, 2010). The healthcare industry demands round-the-clock monitoring, which includes both routine updates and real-time emergency alerts sent across the network. But the main problem in these situations is that the attacker nodes occur, causing unnecessary delays and potentially disastrous effects. Traffic jams and network delays are both caused by this. When an attacker uses a black hole assault, the node attacking it pretends to have the quickest pathway to the target node. Using this strategy, an attacker's node will generate a bogus route, and all traffic will be diverted to that node (Percher et al., 2004). As a result, the attacker node will be able to intercept all of the packets that are sent to or from the designated destination (Santhakumar and Prabha, 2017). To find and separate Black hole nodes inside a MANET, the (TBBT) Timer Based Baited Method includes both timers and baiting. Through the use of a Baited message, this strategy enhances the ability to detect black holes. False id baiting is used to find the network's black-hole nodes in this strategy. This method, on the other hand, increases network latency while decreasing throughput (Yasin and Abu Zant, 2018). The Counter & Timer Based Baited Technique (CTBM) in Splitting Black Hole Attacks with MANET is presented to address these issues. The baiting message, the non-neighbor reply, and the retort are all part of this strategy. The network's "Black hole nodes" are

distinguished by their performance in each of these three key areas.

## II. RELATED WORK

Black hole attack is among the belying attacks; likewise It has the moniker just a network packet drop attacks due to an open intermediate and also astir topology. The facade for black hole nodes occurs all ubiquitously route discovery step. Primarily, a sender node doesn't really present any appropriate path to the receiving node (Sarma, K. J., Sharma, R., & Das, R., 2014)). Black hole assaults can be classed into three categories of attacks including such multiple attacks, single hole attacks and also collaborative attacks. As their identification entail, a single entity alternatively moreover node may participate in attack actions (Nakayama et al., 2009). The nodes in the network could be easily assaulted by collaborative operations including such black hole attack, grey hole Attack and jellyfish attacks. Are the most significant attacks that drops the packet before transmission. Improved Cooperative Bait Detection technique is employed for maintaining against collaborative attacks. It is detecting malignant nodes in MANETs under active black hole and jellyfish assaults (Bala, Bansal and Singh, 2009). single hole attacks, Blackhole assaults can be classed into three sorts of attacks such as multiple attacks, and also collaborative attacks. As their identification imply, a single entity other additional node can engage in attackers actions (Woungang, Dhurandher, Obaidat GE and Peddi, 2013). The network nodes can be readily assaulted by collaborative attack vectors like black hole attack, grey hole attack as well as jellyfish attacks. These are the most significant attacks that drops a packet without transmission. Modified Collaborative Bait Detection technique is employed in maintaining against collaborative attacks. It is differentiating malignant nodes in MANETs during interactive black hole called jellyfish attacks (Sherif, A., Elsabrouty, M., & Shoukry, A., 2013). Anti black hole method which detects the Blackhole nodes. Here, assesses untrusting value by RREQ and RREP. If the node trusted value is extra than the edge then node shows a black hole within the network. Variation Network Routing knowledge is employed to determine in addition to lessen co-operative black hole and also grey hole attacks. . This table is employed to be aware the attacker node additionally maintain the history of its previous adverse exemplifies and include the grey hole conduct. Identification and elimination a Cooperative Black and Gray hole attack can notice in addition to eliminate the assault both sender and also in node (Patil and Kshirsagar, 2020). In Blackhole & Grayhole attackers purposefully interrupt data connectivity through delivering erroneous routing data. Ad hoc On-demand Length Variable (AODV) approach that such an in-between node finds the attacker node delivering bogus routing information; routing packets are applied to exceed routing data, and to spread data regarding cruel nodes (Kumar and Kumar, 2015). Behavioral and also Node functioning with AODV method to notice grey hole assault. Here, behavioral irregularity recognition for grey hole attack additionally node monitor the irregularity of data provided through grey hole node also send the grey hole node block message to each and every entering nodes for avoiding of this assault (PratapSingh, Pal Singh and Singh, 2013).

### A. Black hole attack

Both a single and a group assault on a black hole (Baadache and Belmehdi, 2017) are two forms of black hole attacks. The number of attacking nodes is used to classify black hole attacks.

### B. Single Black Hole Attack

For example, a single node may use a routing protocol to make a false claim that it is a "adjacent" route to a target, and then distribute data packets to other nodes(Baadache and Belmehdi, 2017). MANETs are vulnerable to just a single black holes attack. In the figure 1 shows us a single black hole attack.

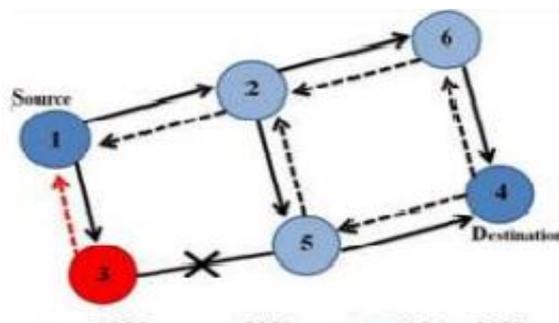


Figure 1 Representation of Source and Destination node (source:Kaur and Kaur 2017)



It is meant for such a non-cooperative Attacks, but it is unsuccessful inside a black hole since the black hole node transmits phony proof towards the audit node, making the attack ineffective. For the second time, the attacker node's origin is not recorded since the behavioral proof in React only stores information about transmission packets, not nodes.

#### D. Neighborhood based Routing Recovery System

Routing Recovery Scheme is based just on AODV protocol to identify black holes in the neighborhood. Routing recovery protocols are used to identify the assault and build the correct path(Baadache and Belmehti, 2017). A Modify-Route-Entry control message might be sent to the destination node if the paths are not same.

This method achieves a high detection rate while requiring less time to detect. When an attacker creates a forged RREP packet, the attack fails.

### IV. DIFFERENT DETECTION SCHEME FOR COOPERATIVE BLACK HOLE

#### A. Hybrid Routing Scheme

Bait DSR combines Watchdog and DSR, while Hybrid Routing Protocol associations both reactive and proactive route techniques. The RREP field in DSR contains information about other nodes' RREP(Zant, 2017). In order for the basis node to track down the intruder node. Bait-DSR designates a node by way of a Black hole if the dropped pack value surpasses the verge value(Zant, 2017).

A comparison is made between Bait DSR and the simulations of Watchdog and DSR. In comparison to DSR and Watchdog, its PDR is ninety-percent higher(Zant, 2017).

#### B. Hash-based Scheme

Hash-based method for generating proofs of node behavior that incorporates information on data traffic flowing along a routing path (Zant, 2017). Auditing techniques are used to prevent assaults like black hole & gray hole attacks as well as to fight against them in this growing system. React is used to find the answer. In this approach, another audit node is required, and this node is set up either by source node(Zant, 2017). All packets are sent to an auditing node, and a random number is added to the tail and each and every one. Using received packet and a random wide variety generated by using the intermediate node, the value is determined (Zant, 2017). After receiving a packet from an intermediate node, the audited node is able to continue the auditing process.

### V. RESULTS

#### A. Single Black-Hole Attack

Because the packet dropping brought on by the black-hole attack, when there is just one, the net was at its lowest. When a black-hole attack is not present-day in the network, the native AODV throughput result was the greatest. When a black-hole attack is present in the network, the throughput of TBBT is higher than native AODV, but it is lower than native AODV when there's not a black-hole assault. The suggested TBBT increases performance by discarding any answers from unidentified nodes who right to have a quicker pathway to the target node than any other node, which results in a reduction in throughput. Additionally, the location of a black-hole attack is crucial since it can be situated on the route that travels the shortest distance from source to destination.

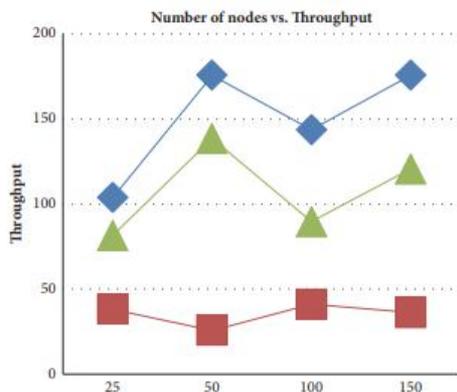


Figure 3: Results of Amount versus the number of nodes (source:Yasin and Abu Zant, 2018)

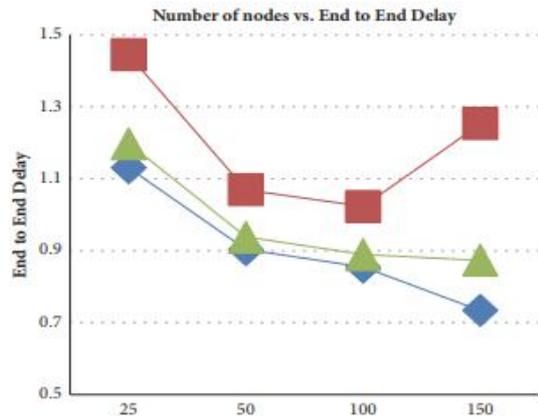


Figure 4: Results of regular End-to-End Stay versus the statistics (source:Yasin and Abu Zant, 2018)

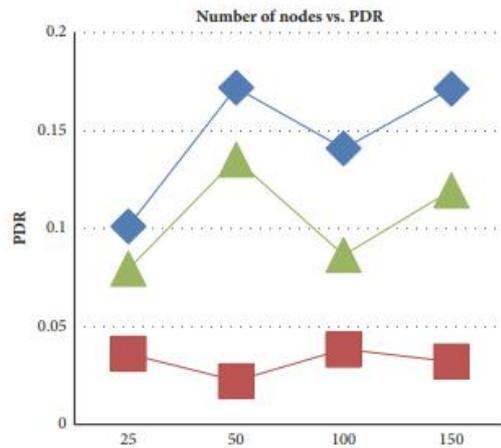


Figure 5: Results of PDR versus the amount of nodes (source:Yasin and Abu Zant, 2018)

### B. Cooperative Black hole attack

The fact that there are more black-hole transmissions will really make it impossible for the source node as well as the destination node to link causes cooperative black-hole attacks to have zero throughput. Throughput for TBBT AODV is reduced while the network's black-hole node count rises as a result. The black-potential hole's location in the pathway connecting the source node as well as the end point node, as well as the detail that TBBT discards any response on or after unidentified nodes, is the causes of the decrease in throughput.

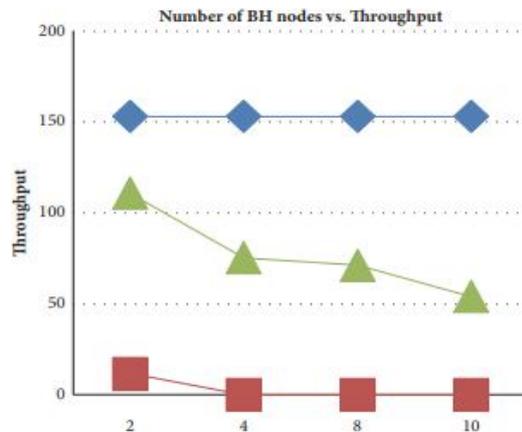


Figure 6: Results of Quantity against the amount of the black hole nodes (source:Yasin and Abu Zant, 2018)

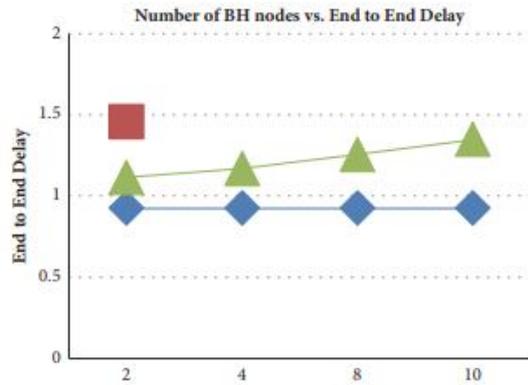


Figure7: Results of the average End-to-End Delay against the number (source:Yasin and Abu Zant, 2018)

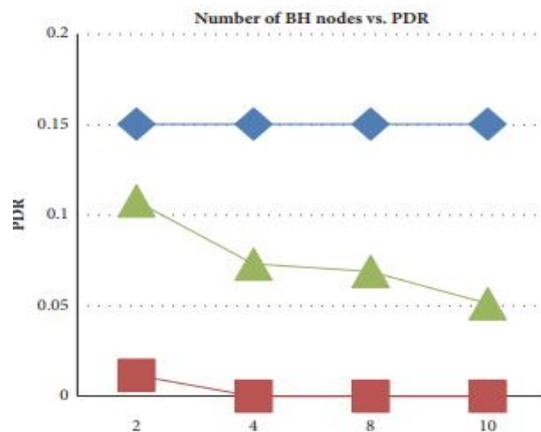


Figure 8: Results of PDR against the number of the black-hole nodes (source:Yasin and Abu Zant, 2018)

### C. Comparison with Other Proposed Models

We validated our proposed model against the alternatives discussed previously using two distinct data sets. We assigned the PAODV code to the proposed model. Unlike other proposed defenses, using a smart black hole node to defend against PAODV, as was discussed previously, is not possible. We simulated TBBT using the same number of nodes as PAODV (15–50). TBBT tripled its Throughput while simultaneously decreasing its End-to-End Delay by 22.31 percent. TBBT is more effective than PAODV in terms of throughput, but PAODV is more effective in terms of end-to-end delay, as demonstrated by these two experiments. The proposed model, which we will refer to as DAODV, is utilized for the second comparison. We conducted simulations of TBBT using the same metrics as DAODV, in which the mobility of nodes can range from 0 to 10, and generated conclusions based on these simulations. TBBT achieved a 3.78 percent increase in End-to-End Delay and a 15.60 percent reduction in Throughput when compared to the native AODV without a black-hole assault. In contrast to the native AODV, TBBT's black-hole assault reduced End-to-End Delay by 9.04% and increased Throughput by 542.85%. This model offers the best End-to-End Delay, but its Throughput is certainly not the best available. If no blackhole nodes exist in the network, the natural AODV throughput in a static topology is 151,529. Otherwise, it is 14,346. We believe this is significant enough to bring up. In the presence of a black hole, TBBT's throughput of 143.476 approaches that of native AODV. This is due to the fact that there is little variation in the topology and TBBT will not discard a packet if it originates from a node, it already knows about. This indicates that there are no answers from unidentified nodes.

## VI. CONCLUSION

Black-hole attacks are one of the most serious dangers to MANET. To keep the network against collapsing, black hole nodes must be identified and isolated. This work proposed Techniques for identifying and shutting down black holes which should be considered when developing black-hole aggressive protocols or methods. It

uses timing and baiting for improve black-hole identification without preserving End-to-End Delay, Throughput, and Packet Delivery Ratio. Throughput and Packet Delivery Ratios of the planned technique were determined to be almost identical to native AODV in simulation. We hope to improve this model's throughput & packet delivery ratios with reducing overall late latency.

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# Design of Wideband Band Stop Filter using Signal Interference Technique

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**Abstract**—A wideband band stop filter based on signal interference technique has been designed. The proposed filter is designed using coupled line and stepped impedance modified pi type transmission line with open circuited stubs in transmission path 1 and path 2 respectively. The proposed filter has been designed at a frequency of 0.9 GHz. The simulated 3dB fractional bandwidth is 0.8GHz and the insertion loss is well below -18dB or -20dB from 0.2 GHz to 2.14 GHz. Using path 2 ABCD parameters of the filter are found and these equations were solved to obtain the position of zeros.

**Index Terms**— Signal Interference Technique, Coupled Line, Open Circuited Stub, Fractional Bandwidth, Insertion loss and ABCD parameters.

## I. INTRODUCTION

The performance of the wireless system degrades if there is interference from the existing communication systems. In modern high data rate wireless communication applications for effective suppression of spurious signals there is greater demand for compact wideband band stop filters. With the advent in Microwave Integrated Circuits there is demand for such filters. A wideband band stop filter with larger fractional bandwidth and lower insertion loss are essential in GSM, Zigbee, WLAN applications. Several methods [1-6] were reported in designing wideband band stop filters. Rectangular micro strip open loop resonator with stub loaded resonator as building blocks offering tuneable low space occupying wide band stop filter (BSF) for wireless applications was reported [2]. A wideband BPF with an open coupled line in way 1 and transmission line in way 2 offering reduced and sharp selectivity with six transmission zeros dependent on signal interference technique was reported [3]. High selective fifth-order wideband band-pass filters (BPFs) with different transmission zeros based on signal-interaction concepts are proposed in this paper. Transmission ways comprising of a shorted stub and a couple of open coupled lines are utilized to acknowledge signal transmission originating from Port1 to Port2 [4]. The impacts of electromagnetic coupling in parallel-conductor inhomogeneous transmission lines were considered and it was demonstrated that the qualities of different coupled-line circuits implanted in an inhomogeneous dielectric, (for example, the suspended substrate) differ extraordinarily from those in a homogeneous domain [5]. This article presents a triple wideband band pass channel (TWB-BPF) with compact

size, distinguishable band to band segregation and numerous transmission zeros (TZs). The proposed TWB-BPF depends on a Multi-mode resonator (MMR), driven by the strategy for even and odd mode examination method [6]. A Branch line resonator be composed of shunt stubs and open stubs with multiple independent transmission zeros such that the open stubs length is designed to equal quarter wavelength near the unwanted frequency. A remnant stub is deployed here for establishing coupling between adjacent resonators. At different frequencies zeros can be planned to reduce the objectionable coupling between the stubs [7]. So far in the literature there are multiple topologies that were proposed for wideband band stop filters and yet there is requirement for compact, high selectivity and reduced insertion loss wideband band stop filters for wireless applications.

In this article we are proposing a topology where an open coupled line and stepped impedance modified pi type transmission line with open circuited stubs in transmission path 1 and path 2 respectively. Signal interference technique is used to obtain wideband band stop filter with sharp rejection characteristics.

The takeaways of the proposed work are as follows:

- A band stop channel with two zeroes and six poles are obtained at an operational frequency of 0.9GHz.
- 0.8GHz was the 3dB fractional bandwidth of the filter.
- The insertion loss is well below -18dB or -20dB from 0.2GHz to 2.14GHz.

The design theory with its analysis of proposed wideband band stop filter is presented initially, followed by design procedure and simulation results.

## II. PROPOSED WIDEBAND BAND STOP FILTER AND ITS ANALYSIS

The Fig.1 below describes the proposed filter design. The filter comprises an open coupled line and stepped impedance modified pi type transmission line with open circuited stubs in transmission path 1 and path 2 respectively. Here  $Z_E$  and  $Z_o$  are even and odd impedances of the coupled line,  $Z_1$  and  $Z_2$  are impedances of first and second transmission lines respectively and  $Z_s$  is the impedance of the open circuited stubs.  $\theta_c$ ,  $\theta_1$ ,  $\theta_2$  and  $\theta_s$  are the transmission lines electrical lengths respectively. The two zeroes in the rejection band obtained in the simulated result using Ansoft software are found theoretically, derived and proved to exist.

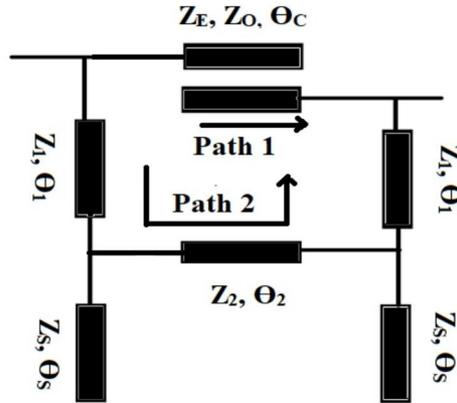


Fig. 1. Proposed Filter Topology

### A. Design Equations

In the proposed filter design ABCD Parameters of the transmission lines along path2 are given as:

$$m1 = \begin{pmatrix} \cos \theta 1 & jz \sin \theta 1 \\ \frac{j}{Z} \sin \theta 1 & \cos \theta 1 \end{pmatrix} \rightarrow (1)$$

$$m2 = \begin{pmatrix} 1 & 0 \\ \frac{j}{Z_s} \tan \theta 2 & 1 \end{pmatrix} \rightarrow (2)$$

$$m2 = \begin{pmatrix} \cos \theta 2 & jz \sin \theta 2 \\ \frac{j}{Z} \sin \theta 2 & \cos \theta 2 \end{pmatrix} \rightarrow (3)$$

$$m1 = \begin{pmatrix} \cos \theta 1 & jz \sin \theta 1 \\ \frac{j}{Z} \sin \theta 1 & \cos \theta 1 \end{pmatrix} \rightarrow (4)$$

$$m2 = \begin{pmatrix} 1 & 0 \\ \frac{j}{Z_s} \tan \theta 2 & 1 \end{pmatrix} \rightarrow (5)$$

$$B = -j \sin^3 \theta \left[ \frac{2Z1Z2}{Z_s} + \frac{2Z1^2}{Z_s} + \frac{Z1^2}{Z2} \right] + j \cos^2 \theta \sin \theta (2Z1 + Z2) + j \frac{Z1^2 Z2}{Z_s^2} \sin \theta \tan^2 \theta \rightarrow (6)$$

Let the variables be x1, x2, x3 where

$$x1 = -j \sin^3 \theta \left[ \frac{2Z1Z2}{Z_s} + \frac{2Z1^2}{Z_s} + \frac{Z1^2}{Z2} \right] \rightarrow (7)$$

$$x2 = j \cos^2 \theta \sin \theta (2Z1 + Z2) \rightarrow (8)$$

$$x3 = j \frac{Z1^2 Z2}{Z_s^2} \sin \theta \tan^2 \theta \rightarrow (9)$$

$$y_{21} = \frac{-1}{B} \rightarrow (10)$$

Equating (10) to Zero

$$\frac{2(Ze - Zo) \operatorname{cosec} \theta}{(Ze - Zo)^2 - 4ZeZo \operatorname{cosec}^2 \theta} + \frac{1}{(x1 \sin \theta \cos^2 \theta - x2 \sin^3 \theta + x3 \sin^3 \theta \tan^2 \theta)} = 0 \rightarrow (11)$$

$$2x1(Ze - Zo) \cos^4 \theta \sin^2 \theta - 2x2(Ze - Zo) \sin^4 \theta \cos^2 \theta + 2x(Ze - Zo) \sin^4 \theta + (Ze - Zo)^2 \sin^2 \theta \cos^2 \theta - 4ZeZo \cos^2 \theta = 0 \rightarrow (12)$$

Let us consider R1, R2, R3, R4, R5 where

$$R1 = 2x1 (ze - z0) \cos^4 \theta \sin^2 \theta \rightarrow (13)$$

$$R2 = x2 (ze - z0) \sin^4 \theta \cos^2 \theta \rightarrow (14)$$

$$R3 = 2x3 (ze - z0) \sin^4 \theta \rightarrow (15)$$

$$R4 = (ze - z0)^2 \sin^2 \theta \cos^2 \theta \rightarrow (16)$$

$$R5 = 4 Ze Zo \cos^2 \theta \rightarrow (17)$$

Replacing R Values in Equation (12)

$$R1 \cos^4 \theta (1 - \cos^2 \theta) - R2 (1 - \cos^2 \theta)^2 \cos^2 \theta + R3 (1 - \cos^2 \theta)^2 (1 - \cos \theta) + R4 \cos^2 \theta (1 - \cos^2 \theta) - R5 \cos^2 \theta = 0 \rightarrow (18)$$

$$\cos^6 \theta (-R1 - R2 - R3) + \cos^4 \theta (R1 + 2R2 + 3R3R4) + \cos^2 \theta (-R2 - 3R3 + R4 - R5) + R3 = 0 \rightarrow (19)$$

MATLAB Coding was done to obtain roots, out of which only one is a real root ( $\theta_1$ ) using which position of two zeros were found.

The frequencies at which zeros exists are obtained by Equation (20) where  $i = 2$ ,  $f_0 = 0.9 \text{ GHz}$  and  $\theta_2 = 180 - \theta_1$

$$f_i = \frac{\theta_i}{90} \times f_0 \rightarrow (20)$$

Two zeros are therefore proved to be residing at 0.67 GHz and 1.12 GHz respectively in coincidence with the simulation results.

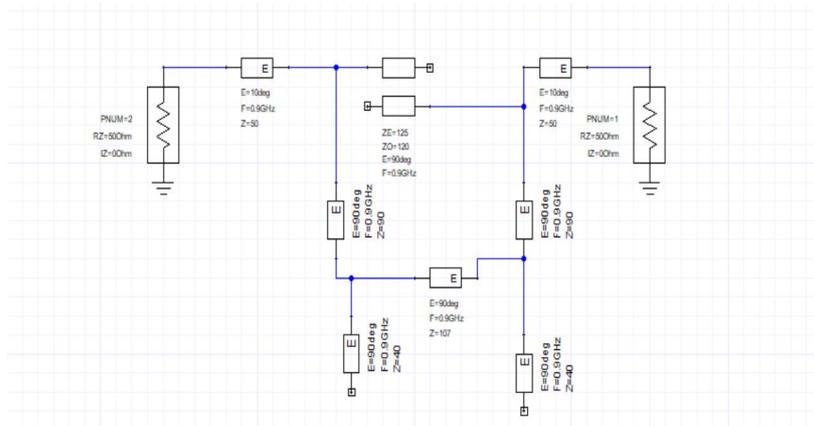


Fig. 2. Snapshot of Ansoft Circuit Schematic for the proposed topology where  $Z_E=125 \Omega$ ,  $Z_0=120 \Omega$ ,  $Z_1=90 \Omega$ ,  $Z_2=107 \Omega$ ,  $Z_s=40 \Omega$

### III. FILTER DESIGN AND RESULTS

The circuit simulation of the proposed model was performed using Ansoft designer SV and was reported in Fig.3. After the circuit simulation a 3D model has been constructed in HFSS to perform full wave simulations. The proposed filter's 3D model is exhibited in Fig. 4. Optimization has been performed to get the perfect results. Data tables of both the results have been collected to plot in the same graph using MATLAB so that both the results can be compared and was reported in Fig.5. In comparison it was found that both circuit simulation graph and full wave simulation graph are in good agreement.

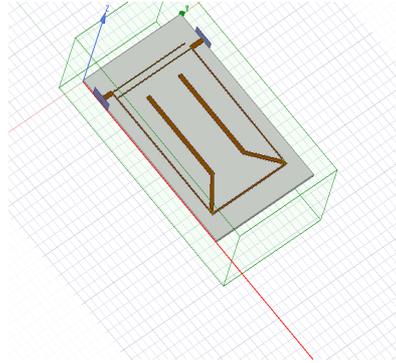


Fig. 3. Simulated Results of S-Parameters

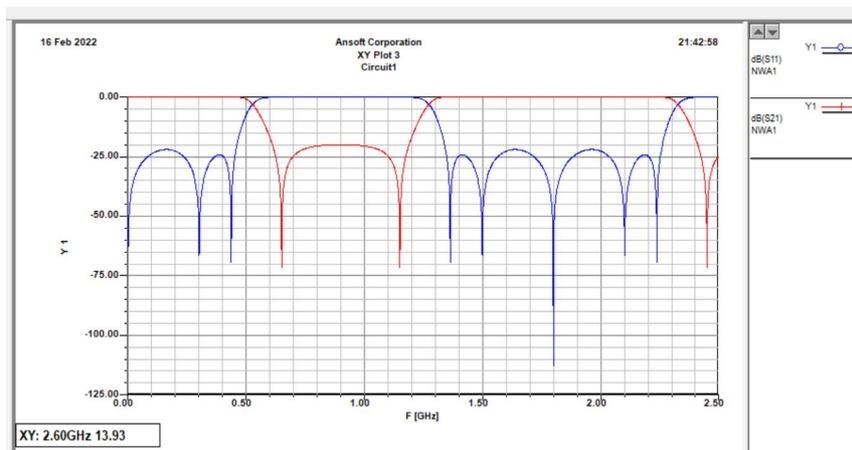


Fig. 4. 3D Model of Proposed Wideband band stop filter

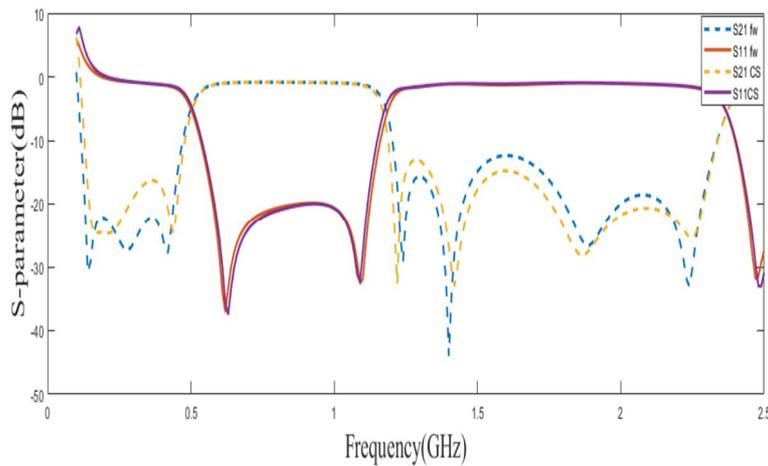


Fig. 5. Comparison of Full Wave and Circuit Simulation Results

#### IV. CONCLUSIONS

A compact filter response is recorded with a wideband band stop channel configuration utilizing micro strip transmission lines with open circuit stubs dependent on signal interference scheme. The claimed model utilizes in path 1 an open coupled line and in path 2 a transmission line. Due to the superposition of two transmission ways a band stop channel with two zeroes and six poles were obtained at an operational frequency of 0.9GHz. The location of obtained two transmission zeros within the rejection band at 0.67GHz and 1.12 GHz respectively were analysed and proved using design equations. Theoretical analysis and simulated analysis were approved and was seen that they were in great understanding.

The proposed channel configuration has to be manufactured on a Teslin sheet utilizing an adhesive copper sheet. The future work involves generating a Dxf file using the 3D model in HFSS. Using this fabrication has to be done on a Teslin sheet by pasting adhesive copper sheet on the design. Two connectors are to be connected on both the sides making a connection between ground plane and the design. These connectors should be used for measuring and obtaining results. Measurements has to be done using a device called VNA (Vector Network Analyser) where two ports of the device are to be connected to the two connectors. Before measuring the results Calibration of VNA should be performed. Various bending effects on the fabricated prototype can then be carried out on the fabricated model.

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# Block Chain-based E-Voting System using Smart Contract

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**Abstract**—Block chain is presenting new chances to develop new categories of digital services. Even though research on the topic is still in its early stages, it has mostly focused on the technical and legal challenges rather than utilizing this ground-breaking concept and creating better digital services. The study offers a novel block-chain based E-voting system that tackles some of the drawbacks of current systems and assesses some of the well-known block chain frameworks in order to build a block-chain based E-voting system. It has long been challenging to develop a secure electronic voting system that maintains the fairness and privacy of paper ballots while ensuring the transparency and flexibility afforded by electronic systems in current electoral schemes. We concretely assess the technology's potential by explaining a case study, including the election process and the implementation of a blockchain-based application that improves security and reduces the cost of holding national elections. A block chain is a type of distributed database that is this allows for the sharing of all data among all network users. By definition, a block chain system has several benefits that are suitable for electronic voting system. It is independent of a centralized server because its distributed architecture guarantees great system performance. Availability. Since each participant has full data, using the protocol, they may verify each block uploaded to the chain regarding the electronic voting system we propose, the double envelope encryption is combined here. Block chain technology and technique. This is the mechanism for turning the people's opinions into action in order to better manage system. Traditional elections have not pleased either the people or the government in recent years. They are not completely secure because ballots are easily tampered with. Additionally, it raises concerns about transparency and voter safety. Furthermore, it takes far too long to count the votes.

**Index Terms**— Voting, Block chain, Hashing of Fingerprint, Smart-Contract, Mining, Markle tree.

## I. INTRODUCTION

Democratic voting is an important and rigorous mechanism in all regions. Countries typically vote using traditional the paper-ballots, mechanical devices, and electronic voting systems. [1] However, it requires new digital technology. Digital voting uses electronic voting machines, and there are two types of digital voting: electronic voting and I-voting. Electronic voting is when voters use their devices to vote at a vote canter. I-voting needs a software interface because of this. The essential requirements for determining if a democratic process is legitimate include Accuracy, resilience against illegal conduct, efficiency, stability, and transparency of the

voting process. Digital voting methods can increase accuracy, confidentiality, and integrity while requiring less financial and human resources. Simply put, it makes sure that the votes cast and the outcomes are accurate [2]. Digital voting has certain disadvantages as well. False voting, cost-cutting, hastening results, and other unethical voting procedures are some examples. In fact, a number of unauthorized users could impair smart or IoT (Internet of Things) systems by materially altering voting or voting calculations in order to gain an advantage. A decentralized ledger that preserves a consistent perception of reality is block chain technology. Block chain is a peer-to-peer networking platform and mutual, tamper-proof ledger that has been utilized in cryptocurrencies like Bitcoin and Ethereum. In this instance, user anonymity is safeguarded by the public or private key's identification. There are numerous models built on the block chain that provide security and anonymity. Although block chain technology offers security, privacy, accountability, and durability, speed and scalability are the main implementation problems. Our team is developing a digital voting architecture that includes a smart contract to address the challenges of block voting adoption and ensure authentication, transparency, anonymity, accuracy, and autonomy, as well as uniqueness, integrity, and mobility. Based on the voter's information, a hash will be created in our system and placed in the chain [8]. Voters can remain anonymous because the data is hashed and kept in the block chain, which allows for scalability. Any modifications to the hash information will be quickly noticed. Smart contracts on the chain guarantee privacy and security. Smart contracts select miners to speed up transactions. Candidates are determined by many factors, including data transfer and power consumption. Each block has completed its voting procedure. The final vote count from the previous block can be simply evaluated. It reduces the amount of time spent counting.

## II. RELATED WORK

### A. Blockchain

Blockchain is a decentralized data management system in which data are spread across a peer-to-peer (P2P) network and subsequently stored in an encoded chain of blocks [3]. The electronic Bitcoin system put out by Satoshi Nakamoto is where the concept of blockchain was born [4].

These are some of the main characteristics of blockchain:

1. Keep the consensus mechanism in place, i.e., demand proof of work (POW) down the entire chain.
2. Put information into the blocks as a ledger.
3. Network-wide synchronization of the entire ledger.
4. Provides data Decentralization [5].

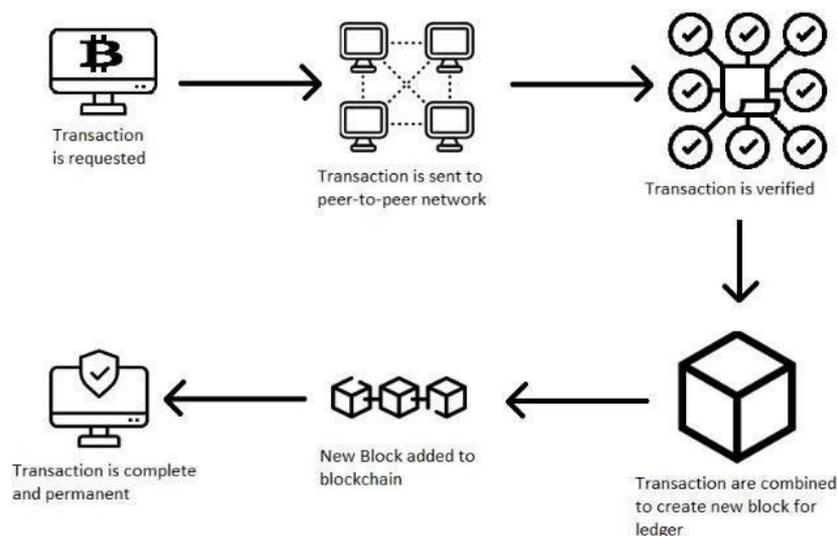


Figure 1. Flow of Transaction in Blockchain

Modern cryptocurrencies were developed in 2008 using the blockchain concept in conjunction with a number of other technologies and computing ideas. These digital currencies are rather than a centralized system or source, cryptosystems are used to secure data. Bitcoin was the first such blockchain-based cryptocurrency [6]. A cryptographic address is associated with information that represents electronic cash on the Bitcoin blockchain. Users of Bitcoins can digitally agree to and move ownership of that data to a different user, with a public record

of this transfer on the Bitcoin, enabling every connection user to independently confirm the authenticity of the exchanges. A dispersed group of individuals stores, upkeeps, and cooperatively manages the Bitcoin blockchain. Bitcoin deployments are typically developed with a specific objective or purpose in mind. Examples of these features include distributed ledger systems between businesses, cryptocurrencies, smart contracts (software loaded on a blockchain and executed by machines running that chain), and smart contracts themselves. A continual stream of innovations in the ledger technology sector have been made, and as the market landscape changes, new platforms are frequently unveiled.

### *B. Voting methods*

In a democracy, there are several ways to cast a ballot. Many nations have switched from straightforward elections with ballots on paper to computerized voting machines over time. The following are the most popular techniques [7]:

1. Ballot Paper
  2. Vote over Internet
  3. Electronic voting Machine
  4. Biometric voting Machine
- **Ballot Paper:** The act of writing down your preferences on a piece of paper and submitting it is one of the most basic election mechanisms. This is referred to as ballot paper voting. In the table's first column, which is left vacant for voters to express their preferences, are the names of the candidates and the parties running in the election. The guidelines are quite basic. You can mark your choice of candidate with a cross, place the paper in the voting booth after folding it. The Ballot Box must be taken care of and monitored by the Election Authority in charge of overseeing the election [7].
  - **Vote over Internet:** With such a method, we can vote in the convenience of our own homes. Contrary to other internet-based services, this platform has received harsh criticism for the way it operates. The administration has repeatedly asked teams of cybersecurity specialists from around the world to evaluate its voting platform. The testing team has frequently come to the conclusion that not only can they alter the vote total, but they can also erase all evidence that they ever existed. There won't be any digital fingerprint that can be used to identify them in the system. [8] This has sparked considerable division among the populace. Justice for everyone was a key democratic principle. One of the major democratic celebrations is the right to vote. Therefore, it is the responsibility of the government to make sure that the public has complete faith in the system and that any problems are resolved.
  - **Electronic voting Machine:** The Ballot button on the control unit is pressed by the electoral authority in charge of overseeing the election, which initializes the EVMs. When a voter presses a button that corresponds to the candidate he wishes to support, the voting system will then turn on an LED light to let him know that the vote was accurately recorded. The machine then locks by itself. Now, when a new voter casts their ballot, the lock can only be opened by a fresh ballot number, which the person in charge will push once more. This will prevent a single person from casting numerous votes.
  - **Biometric voting Machine:** They devised a voting system based on fingerprints, where a biometric machine helps identify the voter. Numerous investigations have established the uniqueness of each person's fingerprint. When casting a vote, this can be used to identify the voter. The entire process concludes fast and painlessly. The government must establish a nationwide scheme for voter registration, whereby everyone is fingerprinted and a final list of all eligible voters is compiled. In conclusion, because voters can cast ballots from any location in the world, we may run into a similar authentication issue while designing a blockchain-based system. Thus, to ensure that the voters who cast their votes are authentic, we may utilize biometric sensors or even face recognition software. [7]

### *C. EVM*

Voting is done using electronic machines, and a voting method is introduced. This system is centralized. Voting data can be easily changed in this way. There is no system in place for voters to check the accuracy of their vote. [9] Describe a voting system based on block chain in which each EVM is directly connected to another EVM in a network. This method has three parts: peer verification transactions, chain manipulation detection, and fingerprint authentication. It is subject to DoS (Denial- of-Service) attacks and eavesdropping.

### *D. Blockchain Based E-voting*

Due to the rise in popularity of currencies, blockchain, the technology that underpins them, is receiving increased attention from researchers. Numerous e-voting methods have been implemented in conjunction with blockchain.

Electronic voting is the term used to describe voting that relies on gear or software that is electronic. Such systems may be able to support/implement a wide range of tasks, from the voting process' startup to the storage of votes. There are many different types of method, including computers, mobile devices, and kiosks seen at voting offices [10].

For government and organizations to polling devices, Agora was created. It is an end-to-end verifiable blockchain-based voting system. Agora used tokens to identify eligible voters in elections, and each eligible voter received a token from an institution. However, in order to oversee the voting process, each of these methods leaned on reliable outside sources. The third party could collaborate with the candidates to manipulate the election. Additionally, the public can access and see the data that is kept in the blockchain. This compromises the security and dependability of Using block chain for voting.

Blockchain-based voting's protocols incorporate smart contracts and encryption algorithms to address this issue. The third party was typically replaced using smart contracts. Smart contracts enabled the Open Vote Network, an identity protocol. The following procedures were part of the E- voting systems: The first stage is voter registration (registration). Officials check voters' IDs on election day (verification and authentication). People who are qualified to vote may do so in the following phase (casting collation). The vote ought to be verified and encrypted. The votes' correctness, confidentiality, and anonymity must all be ensured and cannot be modified in any manner. The final step in the counting process for electronic voting systems is to add up all the votes in accordance with the design (counting display of results). The majority of e- voting applications use central authority control. Such systems have a number of shortcomings and perceived hazards. The majority of e-voting applications use centralized government control. Such systems have a number of shortcomings and perceived hazards. For instance, there are no standards for electronic voting systems, security and reliability risks, fraud and hacker vulnerabilities, expensive machine costs, and insecure transaction storage.

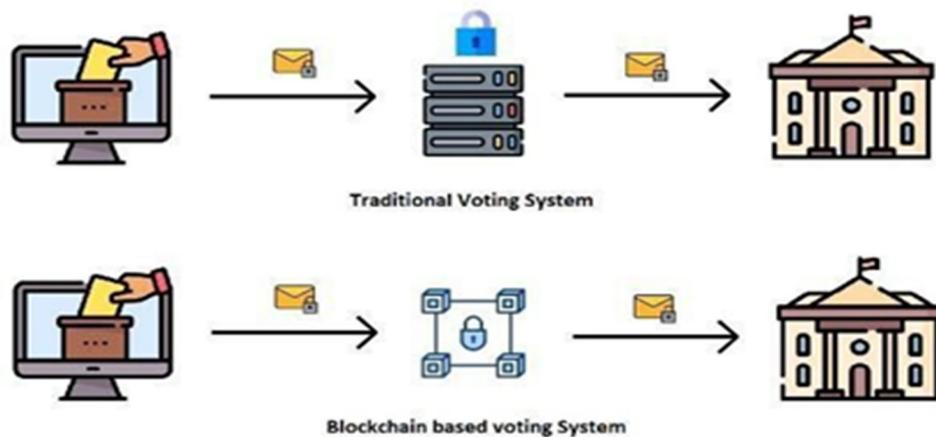


Figure 2. Block-chain based E-Voting System

#### E. E-voting Systems process

- Setup: Enter the security parameters or values, then encrypt (or decode) the processes after producing the private (or public) pair of keys.
- Register: Give the identifiers as IDs to generate the secret (or public) passcode as an output [11].
- Vote: After establishing a vote element or component, the electors calculate the cypher text and matching approval.
  - Credible: This helps to authenticate voting is integrity in the election server by selecting the input as a vote.
  - Validate Vote: Following the voting phase, voters may submit requests for the bitcoin contracts they voted at the time of polling advertising is occurring, and by entering the public parameters, voter status, and privacy information, they could confirm the outcomes given. Results the other legitimate or untrue when they are returned.
  - Counting up: After all votes have been cast and verified, the results are tallied with the input being the necessary secret key and the output being the polled box element. The system returns False if the result is incorrect.
  - Verify: When the publicity phase's public parameters are entered, a vote is authenticated as having been cast in accordance with the ballot's outcome in a valid and accurate manner. [12]

### III. PROPOSED VOTING MECHANISM

#### A. Data Management of the system

Huge amount of data is generated during the election process. As a result, data should be collected in a systematic manner. As shown, our system employs two types of storage- Database Storage and Cloud Storage.

#### B. Voter Registration

- Each person must visit their local voter registration office and submit the required documentation in order to cast a valid ballot.
- A set of public and private keys will be created using a key creation method.
- In the block chain network, voters are identified using their public key. The voter's mobile phone numbers receive the secret key. They can use this private key to cast a ballot and take part in the voting system.
- The hash is generated from voter's submitted fingerprint and the algorithm used is fingerprint hash generation. The whole procedure of creating hashes from data provided by voters is shown. [2]
- To create a new hash value, the created hash will be coupled with the voter's other information.
- The final hash value will serve as a voter list in the block chain's genesis block.  
, where hash value = membership proof.

#### C. Voting with a smart contract

The following are the functions of smart contracts running on the block chain:

- **Voter Verification:**
  - Using an internet-connected device, the voter logs into the voting system with their private key.
  - Submit your fingerprint, NID, and other data.
  - In the genesis block, smart contracts created on the block chain compare the information provided by the valid voter to the information submitted.
  - If the data matches, a list of candidates is shown to the voter. [13]
- **Make a Casted vote block:**
  - The voter selects one of the candidates from the list and votes.
  - Use a digital signature to sign the vote, then send the transaction to the smart contract (SC).
  - For each vote cast by the voter, smart contract creates a Voter ID for Identification of each vote.
- Increase the number of votes cast for the chosen candidate. Make a block containing the transactions made by the voter, together with their VID and Candidate Vote number. [2]
- **Selection of Miner:**
  - A miner selection algorithm is run by the SC.
  - In order to prevent record interference, all miners compete to generate outcome of the block's hash first in Bitcoin, which requires a significant amount of processing power. It has been suggested that the voting architecture choose a Miner based on heuristics extrapolated from that Miner's accomplishments. The SC compiles factors such node capacity, energy use, and delay. [5]

### IV. CONCLUSION

Securing vote security is a challenge for many nations. To guarantee voter participation and validity, the security of vote data, and the accurate measurement of votes, a smart contract-based block chain- based voting system can be developed. In order to cut down on computational expenses, this technique entails the SC providing voter authentication and participating in the choice of a Miner in the Block chain. Additionally, it promptly counts the votes, speeding up the election process. Citizens can vote using smart devices from anywhere thanks to this mechanism. This will help to raise the number of voters needed to establish democracy in any nation. The objective of this project is to develop an encryption method that will increase the security of our system in the future.

### ACKNOWLEDGMENT

The authors wish to thank the anonymous reviewers for their useful suggestions that helped in improving the quality of this paper. We would also like to thank Vishwakarma Institute of Information Technology, Pune for supporting this work.

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# Phishing E-Mail Detection and Blocking it based on the Header Elements

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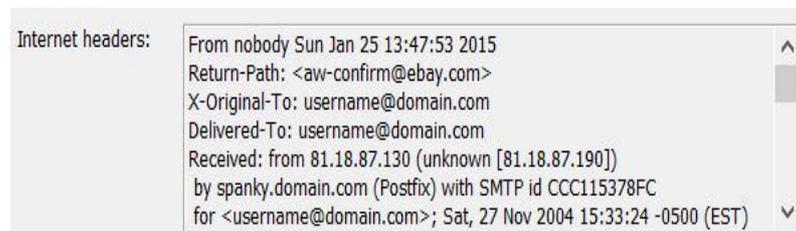
**Abstract**—E-mail is one of the most important modern official means of communication with high reliability, and this is the reason for its widespread and wide popularity. However, this does not make it safe from threats and attacks. The major threat to email is spamming and phishing, which cause a lot of financial losses to the victims. In this paper, we have described a filter based on analyzing the email header elements and its characteristics, extracting the most important features, and testing it on many rules and conditions that can detect and block phishing email messages. This filter is tested on five standard datasets containing spam and phishing emails using header information only and has achieved an overall average accuracy of about 96.31 percent.

**Index Terms**— Email header, features extraction, Phishing emails, Black-lists, White-lists.

## I. INTRODUCTION

Email is the most important and best way to communicate between companies, institutions, and offices, despite the wide spread of modern means of communication such as social media and others, due to its ease of use, strength of protection, and reliability. But it is not without some problems and defects that threaten protection, and the most prominent of these threats is phishing attack, which is the fraudulent act of pretending to be a reliable entity in a communication in order to obtain confidential user information (such as usernames, passwords, bank account information, or credit card information) and other information [1]. Due to the increase in phishing attacks and the significant financial losses it causes to individuals and companies, much research has appeared to study and block email phishing attacks.

In this paper, we have analyzed the elements of the email header and its various properties to create rules and conditions that can classify an email message as phishing email or non-phishing email. The email, like normal postal mail, contains two parts header part and body part. Fig. 1 shows the header elements in the email message.



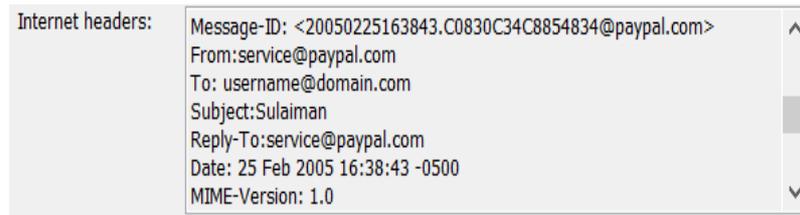


Figure 1. Message Headers in the E-mail

The header: represents an envelope of the E-mail containing information like the sender's and receiver's email addresses, email subject, message journey information across the various servers, cc, bcc, etc [2]. It consists of following fields such as:

- i. **From:** contains Email sender information like name and email address of the sender.
- ii. **To:** contains the email address(es) of the receiver(s) of the email, which may be delivered to a single recipient or several recipients. It's a mandatory field. The message has to have at least one recipient's address.
- iii. **Subject:** contains information about message content.
- iv. **Received:** contains information about the message journey, which involves details of mail transmission servers which it has travelled. It can be used to track the message's path.
- v. **Reply-To:** includes an email address that is immediately inserted in the "To" field when the user replies to the email message.
- vi. **Return-Path:** includes the sender's details, like their email and a link to reply to them. It is added by the server that delivers the message to the recipients.
- vii. **Message ID:** It is a special identifier that is given to each message by the host when the message is created. divided into two parts, local and domain, which are separated by an at-sign and enclosed in angle brackets. "<" local-part "@" domain-part ">" [3].

The email has another part called Body which contains the content to be read by the recipient; it could be text, an image, an attachment, or both [4]. The phishers or spammers used to modify these headers information by doing forgery. Thus, changes in these fields are important features.

## II. RELATED WORK

Tianda Yang, Kai Qian, Dan Chia-Tien Lo, K. Al Nasr and Ying Qian (2015) Combines different filtering techniques. In hard cases, email header meta features can be used to correctly classify spam. In his experiments, a Naive Bayes filter incorporates these meta features [5].

Ankit Kumar Jain & B. B. Gupta (2016) proposed approach for phishing web pages detection by checking the legitimacy of a webpage not in a whitelist using hyperlink features. Also, this approach detects various types of phishing attacks, like DNS poisoning, zero-hour attacks, etc [6].

D. Kaur and S. Kalra (2016) developed hybrid methods to detect phishing attacks by using whitelists with another technique to check and classify URLs as phishing or non-phishing [7].

Ghogare, Pramod, Surwade, Ajay and Patil, Manoj (2018) devised an approach for spam classification using feature selection and extracting sender email from the message header and used it for classification [8].

Omar Abahussain & Yousef Harrath (2019) have checked incoming mail and examined the email name and email address in the From field, as well as searching for URLs in the email content, extracting the domain name, and comparing it with known domain addresses on the blacklist [9].

T. Krause, R. Uetz and T. Kretschmann (2019) presented a new approach based on meta data for spam classification using a static set of engineered features with automatically extracted features from header data only, without analyzing an email's body [10].

Thashina Sultana, K. A. Sapnaz, Fathima Sana, and Mrs. Jamedar Najath (2020) proposed a model for detecting spam email and adding the IP address of the spam sender to the blacklist [11].

Anchit Bijalwan (2020) suggested the blacklists method for network traffic to filter infected packets. This technique is used to detect malware and botnets. He has described packet filtering procedure; all suspicious IP addresses are classified as blacklisted [12].

Kulkarni, Priti, Saini, Jatinderkumar, and Acharya, Haridas (2020) Investigated the header attributes of emails using five different feature selection techniques and five different machine learning classifiers [13].

Ajay U. Surwade (2020) developed Origin based Filter which blocks phishing e-mail by extracting header part information of e-mails using Blacklist approach [14].

Youness Mourtaji, Mohammed Bouhorma, Daniyal Alghazzawi, Ghadah Aldabbagh, and Abdullah Alghamdi (2021) developed a solution based on a hybrid rule-based approach that extracts features from six different methods, including the blacklisting method, which checks the domain name against two antiviruses blacklists that consider this domain blacklisted [15].

### III. METHODOLOGY

This work is based on analyzing the important header element to extract important features to design an origin-based filter that has some rules and conditions, as mentioned in Section-IV, to classify the email as phishing or non-phishing. The methodology adopted for this origin-based filter (OBF) as shown in Figure-2.

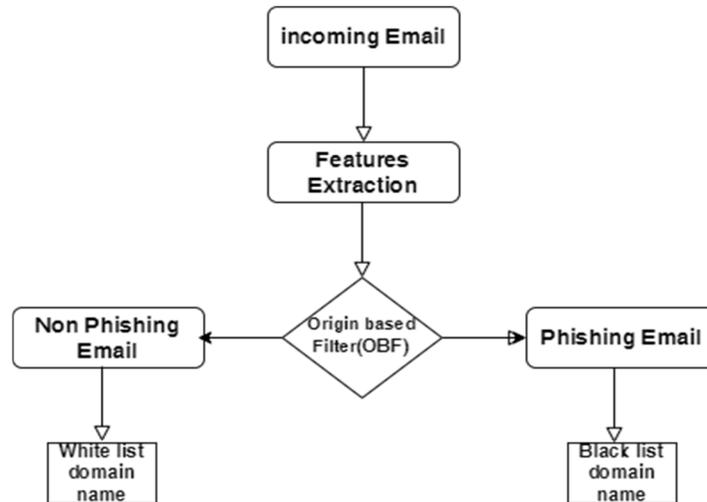


Figure 2. Structure of the OBF Filter

The features such as ‘From’, ‘Reply-To’, ‘Return-Path’ and ‘Message-ID’ as shown in Table-1, are extracted from the standard datasets such as Enron [16], Public Phishing Corpus [17], SPAM Archive [18], CSDMC2010\_SPAM [19] and Spam Assassin [20].

According to the RFC822 protocol, the message header has been extracted and four standard fields selected for features extraction as shown in table I:

TABLE I. STANDARD HEADER FIELDS WITH EXTRACTED FEATURES

Field	Extracted Features	Probability Value
From	invalid address (wrong or fake mail address)	0 or 1
Reply-To	mismatching domain names between “ReplyTo” and “From” addresses.	0 or 1
Return-Path	mismatching domain names between “Return-Path” and “From” addresses.	0 or 1
Message-ID	invalid address or mismatching domain names between “Message-ID” and “From” addresses.	0 or 1

The Python code is developed using the rules mentioned in Section-IV. This code is tested with the standard datasets as mentioned above. This architecture is classifying emails as Phishing or Non-Phishing emails. The Accuracy of classification has been calculated and reported in Table-II to VI. The IP addresses or domain names of classified Phishing emails are extracted and are stored as the Blacklists similarly, the IP addresses or domain names of classified Non-Phishing emails are extracted and are stored in the Whitelists.

### IV. IMPLEMENTATION DETAIL

The following rules and conditions for classification have been set after carrying out the detail analysis of the standard datasets which are described with necessary description:

- a) From field is invalid mail (wrong or fake mail address).

- A regular expression is used to validate the From field with various email address formats.
- From field and Reply-To field has different domain name.  
FROM != REPLY-TO
  - From field and Return-Path fields has different domain name.  
FROM !=RETURN-PATH
  - Reply-To or Return-Path or both is empty.  
len(REPLY-TO) == 0 OR len(RETURN-PATH) == 0  
OR (len(REPLY-TO) == 0 AND RETURN-PATH) == 0)
  - From field and message id has different domain name.  
from\_domain!= message\_id

There is one possible probability value for each condition mentioned above. "0" means "false" or "1" means "true.". The value "1" (ie, 'true') classify email as phishing email while, value "0" (ie, 'false') classify email as non-phishing email. The decision-making condition is as given below:

*If ((FROM != RETURN-PATH) or (FROM != REPLY-TO) or (len(REPLY-TO) == 0) or len(RETURN-PATH) == 0 or (len(REPLY-TO) == 0) AND (RETURN-PATH) == 0) or (from\_domain != message\_id))*

*Then classify email as Phishing Email and Extract it's IP addresses or Domain names and store it as Blacklists.*

*Else, classify email as Non-Phishing Email and Extract it's IP addresses or Domain names and store it as Whitelists.*

The results collected during experiments are reported in next sections.

## V. RESULT AND DISCUSSION

The Tables-II to VI represents the results collected after the classifications are reported with the help of confusion matrix.

TABLE II. EMAIL CLASSIFICATION IN ENRON DATASET

Enron				
SPAM				
Folder Name	Phishing	Non Phishing	Total	Accuracy in %
BG	9402	598	10000	94.02
GP	13719	0	13719	100
SH	9256	13	9269	99.85

TABLE III. EMAIL CLASSIFICATION IN PUBLIC PHISHING CORPUS DATASET

Public Phishing Corpus				
Folder Name	Phishing	Non Phishing	Total	Accuracy in %
Phishing 0	398	16	414	96.13
20051114	411	27	438	93.83
Phishing 2	1398	25	1423	98.24
Phishing 3	2225	54	2279	97.63

TABLE IV. EMAIL CLASSIFICATION IN SPAM ARCHIVE DATASET

SPAM Archive				
Folder Name	Phishing	Non Phishing	Total	Accuracy in %
01/2020	2528	115	2643	95.64
02/2020	6780	715	7495	90.46

TABLE V. EMAIL CLASSIFICATION IN CSDMC2010\_SPAM DATASET

CSDMC2010_SPAM				
Folder Name	Phishing	Non Phishing	Total	Accuracy in %
Spam	1315	63	1378	95.42

TABLE VI. EMAIL CLASSIFICATION IN SPAM ASSASSIN DATASET

Spam Assassin				
Folder Name	Phishing	Non Phishing	Total	Accuracy in %
20030228_spam	486	14	500	97.20
20030228_spam_2	1360	37	1397	97.30

The results for 'Spam Archive' dataset shown in Table-IV, the Folder name '02/2020' has minimum accuracy which is 90.46 %. This folder contains total 7495 spam emails which should have been classified as Phishing email but, only 6780 have been classified as Phishing and 715 are misclassified as non-Phishing.

The results for ‘Public Phishing Corpus’ dataset shown in Table-III, the Folder name ‘20051114’ contains total 438 phishing emails which should have been classified as Phishing emails but, only 411 have been classified as Phishing and 27 are misclassified as non-Phishing.

The results for Enron dataset shown in Table-II, the Folder name ‘BG’ contains total 10000 spam emails which should be classified as Phishing emails but only 9402 are classified as Phishing while, 598 have been classified as non-Phishing.

The results for ‘CSDMC2010\_SPAM’ dataset shown in Table-V, the Folder name ‘Spam’ contains total 1378 spam emails which should be classified as Phishing emails but only 1315 are classified as Phishing while, 63 have been classified as non-Phishing.

The above mis-classification suggests that, the features extracted from these emails are not sufficient and need some more features for accurate classification. So, we need to investigate the other features along with existing features so that accuracy can be improved. In future we are planning to investigate other header features ‘Subject’ field of the email.

## VI. CONCLUSIONS AND FUTURE WORK

A phishing e-mail is a real threat to individuals and entities that must be detected and blocked before it reaches its target. In this paper, a filter has been designed based on the characteristics of some elements of the message header, extracting the features, and then classifying the message according to the conditions and rules that detect and block phishing mail. The experiment has been carried out on some standard datasets such as Enron, Public Phishing Corpus, SPAM Archive, CSDMC2010\_SPAM, and Spam Assassin and has achieved 96.31% average accuracy of classification.

In future, we are planning to increase accuracy by selecting more elements from the header part and investigating those features which can improve the results in terms of accuracy of classification. We are planning to concentrate on the ‘Subject’ field of email header part which may help us to increase accuracy of phishing classification.

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# IoT based Weather Detecting System

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**Abstract**—The system proposed will be a project which will perform the work of weather detecting with IoT technology implemented in it. The system will be linked to a webpage to which data will be provided by the various sensors which will be used in the system for the different purposes. Then the website will analyze the data and accordingly weather conditions will be displayed on the screen along with the graphical representation of the data. Also, the data will be stored in the database for future references. Different parameters will be sensed by the device namely temperature, humidity, atmospheric pressure, sound, light intensity, carbon dioxide and monoxide levels in the air present there.

**Index Terms**— Weather, Humidity, Temperature, Pressure, Intensity, Detecting.

## I. INTRODUCTION

This is a simple weather detecting system powered by Arduino UNO, this system detects environmental parameters such as temperature, humidity, barometric pressure, air and sound quality and light intensity as well. The device is having IoT (Internet of things) technology applied in it. Weather detection have always been a standout topic for meteorologist.

Weather conditions need to monitored on frequent and daily basis as it assumes a significant role in metereology. Weather conditions are important for many other factors like farming, deciding schedules for export of goods, flight schedules and deciding various other outdoor activities. Forecasts depends on environmental parameters like temperature, Humidity, Wind, etc. To serve this purpose one needs to study these factors.

The proposed device is having different sensors for detecting different environmental parameters namely DHT11 for temperature and humidity, BMP180 for altitude and atmospheric pressure, MQ07 and MQ135 for carbon dioxide and monoxide levels respectively, sound sensor as FC04 and LDR for light intensity. Also, the project is linked to a website which will fetch all the data from the sensors and then will accordingly analyze it and will the output as graphs of the data. Also, the data will always be stored in the database of the website for future references.

Table I. Type Sizes for Camera-Ready Papers  
Methodology/Experimental

### Block Diagram

Below is the block diagram of the project. The functional diagram represents the main concept of the project. The project is powered by an Arduino Uno, on which various sensors are attached. Acoustic sensors such as FC04, MQ135 for carbon monoxide, DHT11 for temperature and humidity, BMP180 for altitude and barometric pressure and MQ07 for carbon dioxide levels in the air. In addition, we will use LDR to measure light intensity.



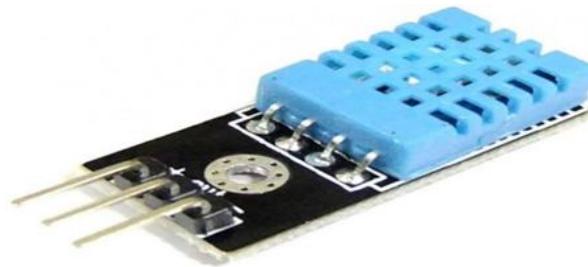
The I2C module allows multiple devices to be connected to each other using just two wires. The screen will show on the 16\*2 LCD. In addition, the ESP8266 Wi-fi module is used to enable ,internet connectivity with various vehicle system applications and will provide data for subsequent jobs i.e. the website will also show the output to the user on the screen with the data graph and also store it in the database.

## II. IMPLEMENTATION SETUP

The different components used in the project are:

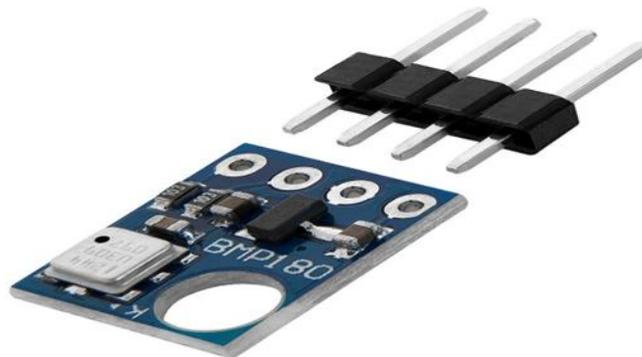
### 1)DHT 11

The DHT11 is a low-cost digital sensor for temperature and humidity detection. This sensor can be easily interfaced with any micro-controller like Arduino, Rasperry Pi, etc. to measure humidity and temperature instantly.



### 2)BMP180

BMP180 is a high-precision sensor designed for consumer applications. Air pressure is nothing but the weight of air acting on everything. Air has weight and wherever there is air its pressure will be felt. The BMP180 sensor detects this pressure and provides this information as a digital output.



### 3)MQ135

The MQ135 gas sensor is used in air quality monitoring equipment and is suitable for detecting or measuring NH3, NOx, Alcohol, Benzene, Smoke, and CO2. The MQ135 sensor module comes with a digital pin that allows this sensor to work even without a microcontroller and is very useful when you are just trying to detect a specific gas.



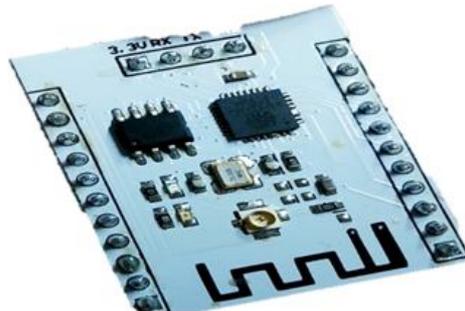
#### 4)MQ07

The MQ07 gas sensor is highly sensitive to carbon monoxide. The sensor can be used to detect different gases containing CO, it is inexpensive and suitable for different applications.



#### 5)ESP 8266

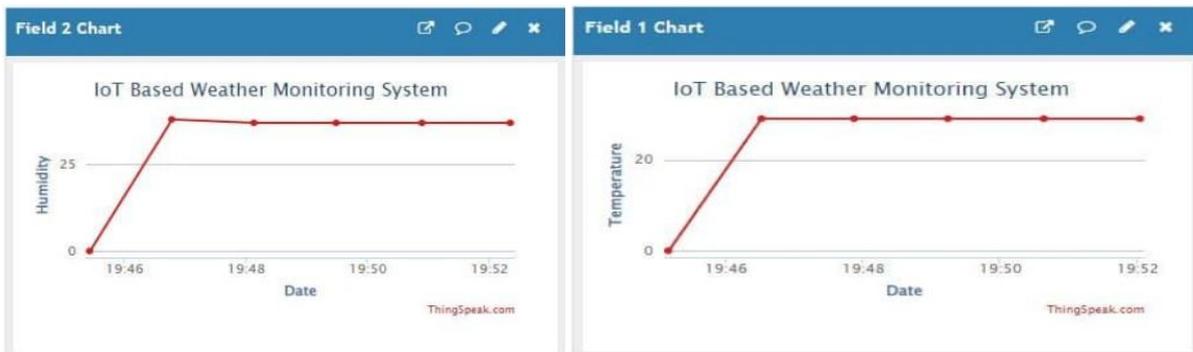
ESP8266 is a low cost WiFi module of the ESP series that you can use to control your electronic projects anywhere in the world. It has a built-in microcontroller and a 1MB flash that allows it to connect to WiFi networks.



### III. RESULTS AND DISCUSSIONS

The result is a weather detection system that will detect the weather based on various environmental parameters like humidity, temperature, barometric pressure, sound and light, etc. The system will be linked to a device via IoT, which will provide the graphical result of the forecast and will be stored in the database.





#### IV. FUTURE SCOPE

This system is very useful for farmers where they can ensure high crop yield and reduce the risk caused by weather through IoT. In particular, it is useful when drastic changes in the environment take place. In the future, we may also add different types of sensors such as earthquake detection sensor, light sensor, rain level sensors. We may also add machine learning and artificial intelligence algorithms to predict future weather and its effect on the environment

#### V. CONCLUSION

This system is used to detect environmental parameters such as temperature, humidity, pressure, air quality, etc. Sensors in the data collection environment. By implementing sensors in the system, we can bring the environment to life. The results of the collected data are then displayed on the screen via Wi-Fi. We can use this device to monitor a specific room or place where environmental parameters need to be monitored. Accuracy of this exact model with real data. The main purpose if this device is to make the system beneficial and useful.

#### ACKNOWLEDGMENT

"DESH VIT, Pune", "Principal VIT, Pune", "HOD, DESH" sincerely thank you for giving us valuable advice and suggestions in this project. "P.P Musale" would like to thank you for your valuable advice, enthusiastic attitude and support throughout our project. We are fortunate to work under your leadership.

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# Automatic Depression Level Detection

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**Abstract**— According to physiological research, there are a variety of variances in both speech and face movements. These facial and vocal expressions are shared by healthy and depressed people. On the basis of this information, we offer the Multimodal Attention Feature Fusion and a novel Spatio-Temporal Attention (STA) network technique that are utilized to get the multimodal representation of depression signals to be able to predict the amount of personal depression. Correctly, we first separate segmenting the speech amplitude spectrum and video into predetermined lengths and submitting them to the STA network, which focuses on the audio and video frames used to detect depression in addition to integrating the attentional processing of spatial and temporal information mechanisms. The output of the STA network's final full connection layer is where the audio and video segment-level functionality is acquired. In order to collect the changes in every aspect of the audio and segment-level features for videos and summarize them as an audio and video feature level, this study also provides the eigen evolution pooling approach. The MAFF is then used to create a multimodal representation composed of modal complementary data, which is then inputted into a support vector regression predictor to determine the severity of the depression. The utility of our strategy is illustrated by experimental findings on the depression databases for AVEC2013 and AVEC2014.

**Index Terms**— Convolutional Neural Network, Multimodal Audio/Video Segment-Level Depression Detection Feature, Machine Learning.

## I. INTRODUCTION

Depression is a condition that causes people to have extremely low moods and the inability to engage in typical social interactions. More gravely, we can observe that depression can also cause behaviors that contribute to self-harm and suicide. As a result, depression will overtake heart disease as the second biggest cause of death by 2030. Fortunately, we can state that early diagnosis and therapy can assist people in quickly getting out of problems. However, the diagnostic process is typically challenging and heavily dependent on the doctors, which can prevent some patients from receiving timely, effective therapy. Finding a system for automatically diagnosing depression is therefore vital to help clinicians work more effectively. The model of automatic depression identification has new opportunities thanks to new algorithms, and this could lead to model improvement by increasing model accuracy and accurately forecasting depressed clients. According to physiological research, depressive patients' speech and facial movements differ slightly from those of healthy people.

## II. REVIEW OF LITERATURE

[1] Yanfei Wang et. Al focused on multiple instances learning as well as Sampling, Slicing, Long Short-Term

Memory, and Multiple Instance Learning are methods for feature manipulation. Depression is detected by binary classification, uses the Support Vector Machine algorithm. It covered the capability to detect various small video clips of depression symptoms. Maximum accuracy of 81.06% is achieved by using this learning technique.

[2] Sri Harsha Dumpala et. al offer a multi-task learning framework for enhancing depression performance in terms of severity prediction based on the acoustic aspects of brief speech audio recordings, as well as the usage sentiment and feeling embeddings that are.. The suggested training for many tasks using regression and classification improves the assessment the level of depression, according to experimental findings. Additionally, we demonstrated that, when compared to two separate networks, a CNN that can perform multiple tasks achieves higher classification of sentiment and emotion performance. When paired with acoustic characteristics, sentiment-emotion embedded patterns in this multi-task CNN considerably enhanced the accuracy of estimating depression severity. These enhancements imply that the suggested methods may be applied to creating clinical applications.

[3] Anastasia Pampouchidou et. al Although there are many different approaches to related algorithms documented in the literature, automatic depression evaluation is still in need of considerable development compared to present practices ability to differentiate between various types of depression and how MDD differs from other mood disorders is just one clinical research concern that has to be addressed methodically. Further research is necessary to understand individual variation brought on by concomitant personality disorders or traits, as well as the impact of culture and ethnicity. It's intriguing that, despite the fact that such data can be useful in understanding ongoing emotional responses, physiological activity measured through EMG, BVP, skin conductance, and respiration has not been included in the reviewed multimodal studies, with the exception of those who recorded heart rate using a non-contact, facial video-based system.

[4] Yuan Gong et. al proposed that, as a common mental condition, major depressive disorder must be accurately diagnosed in order to provide targeted intervention and care. Participants in this challenge are asked to use audio, video, and text from an interview that lasts between 7 and 33 minutes to build a model that forecasts the severity of depression. It is difficult to find, collect, and keep crucial temporal details for such lengthy interviews because doing so will result in the loss of the majority of temporal facts. As a result, we suggest an unique topic modeling-based method for doing context-aware analysis. Our tests demonstrate that the suggested strategy outperforms the challenge baseline and the context-unaware method by a wide margin across all criteria. The ability of our approach to find a variety of temporal features that have an underlying relationship with depression and further to build models on them was also discovered by analyzing the features chosen by the machine learning algorithm, which is a task that is challenging for humans to complete.

[5] Asif Sa et. al Despite the fact that depression and social anxiety disorder are relatively widespread, many people who are depressed or anxious choose not to seek counselling. The majority of current tests for these diseases are based on client self-report and clinician judgement, making them cumbersome to perform, vulnerable to subjective bias, and unavailable to patients who have difficulty accessing therapy. The development of methods for identification, assessment, prevention, and therapy might benefit from objective indicators of depression and social anxiety. For the purpose of identifying symptomatic persons and state affect from extensive spoken audio data, we provide a weakly supervised learning system. We specifically present NN2Vec, a novel feature modelling approach that makes use of the innate relationship between voice states and symptoms/affective states. Additionally, we offer a novel MIL modification of the BLSTM classifier, known as BLSTM-MIL, in order to comprehend the temporal dynamics of vocal states in weakly labelled data. We tested our framework using spontaneous audio speech recordings from 105 participants, including speakers who were very socially uncomfortable.

[6] A technique for speech depression detection using deep convolutional neural networks was developed by Karol Chlasta et al. After analyzing five network typologies, ResNet-34 and ResNet-50 were determined to be delivering the best categorization results. The results suggest a workable new method that uses audio spectrograms and quick voice samples for initial screening of depressive individuals. The potential for the spectrograms to generate CNN learnable features was found. This held true despite the challenge of utilizing voice as a predictor of depressed symptoms. We think that the solution's use of 15-second sample intervals helped to reduce the effect of noise. Our system can be used independently or as a part of a more complex, hybrid, or multi-modal strategy.

[7] Richard Caruana et. al proven approach for training artificial neural networks with many outputs, we present multitask learning (MTL) in connection-ism. In actuality, MTL in connection-ism can be seen in the traditional NETtalk application and earlier work on giving suggestions to neural networks. We present an empirical example that demonstrates how MTL can still enhance generalization performance even when the similarity between numerous tasks is challenging to learn and recognize. We go on to show that this progress cannot be

attributed to anything other than a shared inductive bias resulting from the similarity of the tasks. We provide a brief explanation of how to create multitask decision trees from the top down in order to demonstrate the generality of the MTL methodology. Decision trees are not typically used to learn several tasks; therefore, this is noteworthy. By doing this, a system is created that generalizes particular conceptual clustering techniques, enhancing their applicability in fields where the separation between features (information that will become available in the future) and classes (objects we wish to forecast) must be maintained.

[8] Robert J. McAulay et. al worked-on analysis/synthesis method was used to analyze speech that was both clear and interfered with in various ways. In every instance, natural-sounding, high-quality synthetic speech was produced. The technique may also be applied to the parametric representation of non-speech sounds, such as music and particular marine biological noises. Finally, it is important to keep in mind that tools used to change the width of are essential for high-quality speech reconstruction in addition to updating the average pitch. It's vital to remember that, despite using the frequency analysis window, there are no voicing choices made during the analysis and synthesis process.

### III. METHODOLOGY

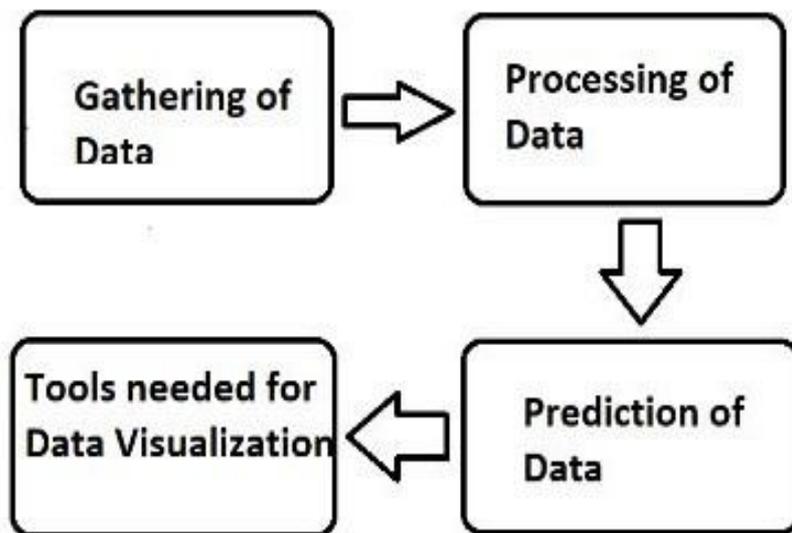


Figure 1: Methodology for gathering of data

1. Gathering of Data: Gathering of data is required at the first stage as we need to create a data-set which can be used to analyze and generate a better working model. The data will be collected in the form of audio and video and it will be collected sufficiently in order to create a better working model.

2. Pre-Processing Of Data: Steps involved in pre-processing of data are: Data Cleaning, Feature Selection & Data Transformation.

Data Cleaning is the process which involves removing and fixing the missing or incorrect data which is stored in the database as whenever we create a data set it is bound to have some errors and those errors should be cleaned which will give better and accurate results.

Feature Selection is the process of picking up appropriate and approximate features from the data-set and then accordingly we can direct a way in which our model can be influenced.

Data Transformation is a process where the needs and behavior of algorithm is taken into account and the data is changed accordingly such as the structure or the format of the data.

3. Projection/Prediction of Data: Is a step where we refer to the output after the model is trained on the data set which was provided for training where we can predict the face gestures from the video data set and the tone/audio notes of the voice collected from the audio data set to make predictions based on the previous data.

4. Tools needed for Data Visualization: Data Visualization tools provide a very easy way to create visuals on a data set which are huge. Statistics of the data which are generally not visible are clearly stated and the underlying patterns which are there can be easily uncovered.

The flow chart is shown in the following fig

#### IV. SYSTEM ARCHITECTURE

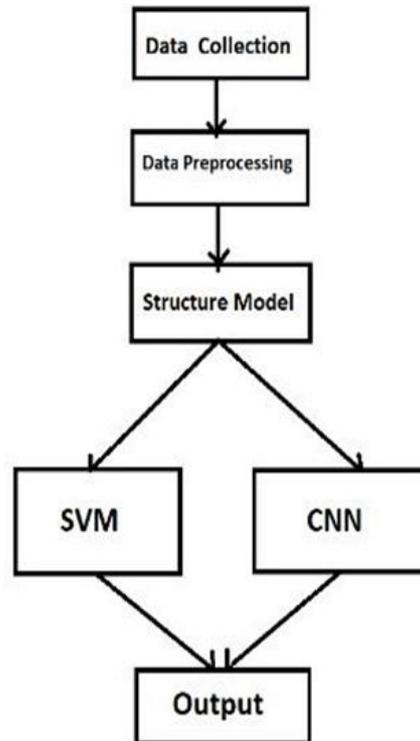


Figure 2: System architecture for our model

#### Algorithms Used:

##### A. SVM

The acronym SVM stands for "Support Vector Machine," a machine learning under supervision algorithm that the ability to create regression and classification models that perform well on both linearly and non-linearly distinguishable data. The SVM algorithm performs classification with the help of margin. The objective of the algorithm is to find the borderline which can most accurately distinguish the data points in n-dimension space as of which the boundary line is called the hyperplane.

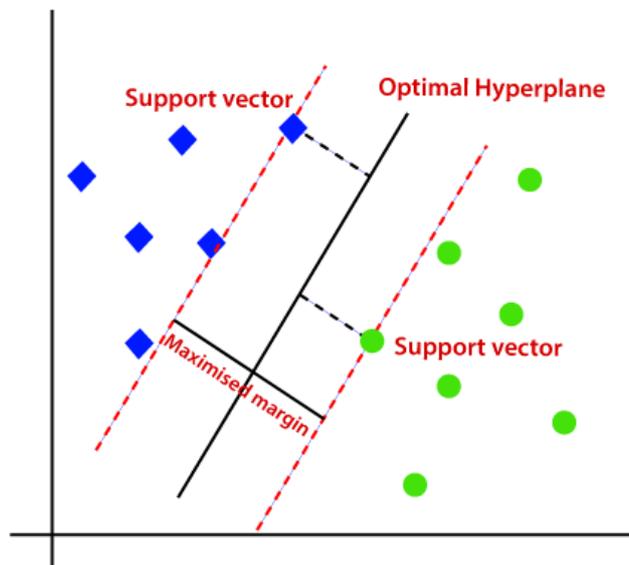


Figure 3: Support Vector Machine Representation

## B. CNN

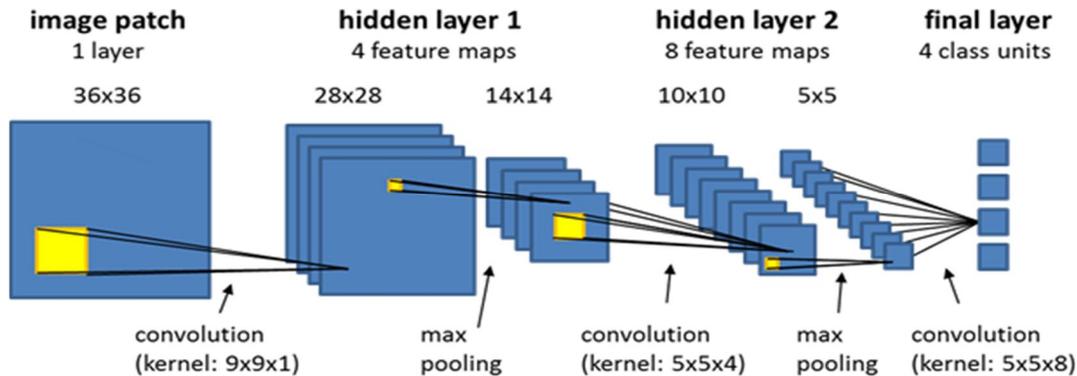


Figure 4: Convolutional Neural Network Representation

CNN: stands for a particular kind of (Convolutional Neural Network) DNN (Deep Neural Networks) and they are applied in visual memory which can be analyzed. This algorithm uses a technique called convolution which is an operation in mathematics in which the operation is performed on double number of functions which then creates 3rd function which shows how the size or form of one is modified by the other. The main aim or objective of the CNN is that to reduce the complexity of the images so that those images can be processed easily and additionally it will also not lose any of its features which will then give us better predictions.

## V. CONCLUSION

According to physiological research, both facial and verbal activity differ little between depressed and very healthy people. In light of this reality, we develop a multimodal spatiotemporal representation paradigm for automatic depression level identification. The suggested STA network focuses on frames relating to depression detection in addition to integrating secular information. In addition, by removing the information between processes, the suggested MAFF method enhances the multimodal representation's quality. Experimental AVEC2013 and AVEC2014 results show that our approach has a decent performance in terms of detection. Human speech is a sophisticated combination of words and feelings. Every word might mean something different depending on the context in which it is used. Every user will have a different mental state, making it challenging to understand their input. Their feelings can help us grasp what they're going through even better. Making a schedule and choosing the therapies are also aided by this. If the data is accessible, we also think about applying this approach to identify more diseases. To increase the detection accuracy, we will partition various tasks and train separate models in the future.

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# Cryptocurrency Price Prediction by Integrating Optimization Mechanism to Machine Learning

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**Abstract**—Research is being done right now to try to predict the future value of cryptocurrency. The possibility of using a python-based approach has been explored by the scientific community as a means of realizing this aim. In predictive analytics, it is becoming standard practice to use the same dataset for both training and testing purposes. Traditional studies have been slowed down by problems with precision and efficiency. This research makes use of optimization and the Python programming language to provide a versatile prediction model with little implementation time. Dataset size is decreased when classification is performed in Python, which shortens the training period. Eliminating extraneous information also improves the performance of the trained model. Because of this change, we want to develop a system that is both adaptable and extensible. To put it another way, such a system would help cryptocurrency investors make better decisions while buying and selling cryptocurrency. Using several factors, the study's results have significantly influenced Bitcoin price forecasts. Investment choices are often guided by such analyses for many fund managers and private investors. Scientists have developed a flexible and scalable strategy for determining an appropriate script's ideal value. Investors will need a mechanism to choose which currency to purchase at any given moment according to market circumstances as trading platforms progress.

**Index Terms**— Machine learning, Crypto currency, PSO, Accuracy, F1 score, recall value, Precision.

## I. INTRODUCTION

Cryptocurrency is a form of virtual currency that is encrypted to prevent forgery and double spending. The networks behind many crypto currencies are completely decentralized. The blockchain technology is crucial to these. Global computer networks keep a general ledger. Digital assets include cryptocurrency. It runs on a decentralized system. Numerous industries, including finance and law, are expected to be shaken up by blockchain and related technology, according to experts. Faster monetary transactions are one of the main advantages of cryptocurrency. The inconsistency of prices and the high cost of transactions are two major constraints. When using cryptography to safeguard digital or virtual money, simplicity in maintaining and managing the cryptographic information is a primary concern. It is facilitating the avoidance of complexity and the reduction of data processing time. Information may be accessed in this system through bitcoin and individuals with certain permissions. Present research is focusing on following objectives:

1. Estimating cryptocurrency's potential using data from the coin market cap
2. Keeping a tally of crypto assets over the course of a year to determine their best selling price
3. Developing an original method for forecasting optimal or appropriate pricing
4. Easing the burden on the investor by giving them the best possible pricing

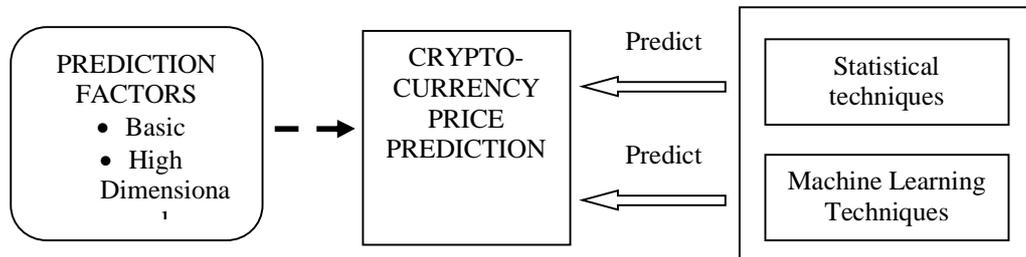


Figure 1. Cryptocurrency Price Prediction using machine learning

#### A. Machine learning

Understanding and developing 'learning' techniques, or methods that use data to enhance performance on some set of tasks, is the focus of ML, a subfield of computer science. It's considered a kind of AI. In order to generate predictions or judgments without being explicitly programmed, machine learning algorithms construct a model using sample data. This data is referred to as training data. In many fields, including health, email filtering, voice recognition, and computer vision, traditional algorithms would be too time-consuming or costly to design. This is where machine learning algorithms come in.

#### B. Particle Swarm Optimization

PSO was first suggested by Kennedy and Eberhart in 1995. Scientists that study social behaviour believe that individuals of a travelling school of fish or flock of birds "may profit from the experience of all other members." When one bird in a flock goes out in search of food, the others may benefit from the information it gathers by hearing from the other birds about the best spots to eat. In this context, "best" means "best" in a high-dimensional issue space, where several solutions exist.

#### C. LSTM

LSTM has been recognized as a prominent artificial RNN. Such is widely used in the field of deep learning. One of LSTM's distinguishing features is its capacity for connectivity and feedback. Contrast with a regular feed forward neural network, which this is not. This goes beyond handling individual pieces of information, like graphics. It's also the last step in a series of media files, such as an audio or video file. To accomplish classification tasks, LSTM networks are deemed appropriate. LSTM networks have been considered as a type of RNN. Aside from the regular units, LSTM also supports some unique ones. A single 'memory cell' makes up an entire LSTM unit. These memory cells can keep information stored for very long periods of time. Due of LSTM's improved customization options, users are increasingly switching over from RNN. They can control the inflow and distribution of Inputs based on learned Weights. Therefore, it allows for adaptability in output management. Accordingly, LSTM is enabling management skills and productive outcomes.

#### D. Crypto currency

Cryptocurrency, often known as crypto, crypto-currency, or just crypto, is a kind of digital money meant to function as a means of exchange on a decentralized network, rather than a centralized one backed by a government or a bank. A digital ledger is a database that keeps track of who owns currencies and when. It uses encryption to prevent unauthorized access to the database and ensure the integrity of all transactions and coin ownership transfers. Cryptocurrencies, despite their name, are not regarded to be currencies in the classic sense.

#### E. Role of Machine Learning in Crypto currency

Predicting cryptocurrency using Machine Learning is the best option available. In order to make a reasonably accurate prediction, the model needed to satisfy a number of criteria. Daily and 5-minute interval price predictions for Bitcoin are made using a wide variety of ML models, including as LDA, LR, RF, XGBoost, SVM, DT, QDA, and KNN. When it comes to blockchain and cryptocurrencies, the uses of machine learning go far beyond price prediction. By streamlining the back-end processes of crypto trading and mining, ML has the potential to address the security problems in this technology through deep learning and reinforcement learning.

## II. LITERATURE REVIEW

Various studies have been conducted to determine how to best predict the price of cryptocurrencies. In 2013, A. Cheung [1] received almost little attention from the academic community. As a result, individuals complete their prior knowledge gaps. As part of our research on the occurrence of Bitcoin bubbles, we deploy a newly created tool that is pretty effective at spotting bubbles. There have been a number of brief bubbles in the cryptocurrency market since 2010, but the three largest bubbles all occurred in the years between 2011 and 2013, lasting between six and six-and-a-half months each and ultimately leading to the downfall of Mt Gox. Numerous studies have shown that the hazards associated with Bitcoin may be mitigated. In 2019, GARCH-in-mean models were used by J. Liu [3] to investigate the link between volatility and returns of the dominant cryptocurrency and the ripple effects of the cryptocurrency market. According to E. Bouri [4] in Inn 2020, all three cryptocurrency have had considerable jump activity in their return series. These numbers suggest that the existence of one cryptocurrency boom raises the probability that subsequent cryptocurrency booms will occur as well. Conversely, co-jumping refers to jumping in sync with other traders to maximize volume. In 2020, N. Akbulayev [5] studied the theoretical and practical connections between Bitcoin and Ethereum. Expanding the scope of previous studies on the fundamental properties of Bitcoin and Ethereum and the correlations between their values has allowed for a better understanding of recent trends in the industry. The values of Bitcoin & Ethereum were shown to be correlated, and this connection might be leveraged to mitigate risk when trading cryptocurrencies on exchanges like Gemini. In [6], we looked at whether Bitcoin is a means of exchange or an asset, as well as its present and potential future applications. Their research demonstrates that Bitcoin's statistical properties are distinct from those of conventional asset classes like stocks, bonds, and commodities, and this holds true in both stable and volatile financial environments. Speculation, rather than usage as a means of trade or currency, is the most common use of Bitcoin, according to data collected from Bitcoin accounts. S. Corbet [7] published a study in 2018 that looked at the temporal and frequent connections between three major crypto currencies and many different types of financial assets. [7] Many indicators point to the fact that these possessions are distinct from monetary and material prosperity. The data suggests that Bitcoin investments may provide diversification advantages for short-term traders. The interconnectedness of things may change over time as a result of shocks to the financial system from outside the nation. In 2013, E. Turkedjiev [8] used the ANN to provide short-term stock value predictions, particularly for financial institutions. The nonlinearity of artificial neural networks makes them useful for analyzing stock market time data (ANN). The Hong Kong Straight Train and the QDII, both introduced in 2007, also had a substantial effect on the price gaps between A and H shares in 2010. Several legislative proposals are also made with the goal of narrowing the gap between A- and H-stock prices. According to L. Guoyi [10], the total equity & GDP, earnings after tax per share, & market index are all significant elements that affect a bank's stock price. To determine whether or whether this information has a relationship to the end-of-day share prices of the banks in question, a test model is employed for analysis and verification. According to S.Beng Ho [11], in order to have a good general learning machine, you need one that can solve a broad variety of problems fast in a dynamic environment.

## III. PROBLEM STATEMENT

There is an immediate need for a scalable and flexible methodology to estimate the value of cryptocurrencies. The research will take into account the results of previous studies on Deep Learning and Machine Learning. We want to look at the performance and computational expense of a traditional deep learning system. Price predictions for popular cryptocurrencies including Bitcoin, Litecoin, Ethereum, Waves, and BTT should be evaluated, and existing techniques should be compared to those that have been proposed. In order to suggest a new method for predicting the prices of ETH, BTC, LTC, & WAVE cryptocurrencies, research on existing methods and problems in this area is required.

## IV. PROPOSED WORK

### A. LSTM and Its Training Mechanism

The "net" network that has been trained is saved in the system so that it may be tested again later. Two LSTM layers were used in the implementation, which resulted in a trained network. During the training process, the proposed model makes use of not one, but two LSTM layers before resorting to a drop out layer. Seventy percent of the data set is used for training purposes, while the remaining thirty percent is used for testing. The LSTM-dependent neural network is trained based on the features. Training duration is affected by a number of parameters, one of which is batch size. Accuracy is improving thanks in large part to the hidden layers and

dropout layers. Once a dataset is obtained, characteristics are chosen to use in the training process. Then, a 12 hidden layer LSTM1 layer and a 5 hidden layer LSTM2 layer are implemented, with the training/testing ratio determined. Over fitting is fixed by dropout layers, and after that a fully connected layer and a softmax layer are utilized. Decisions on potential intrusions may be made with the use of a classification operation.

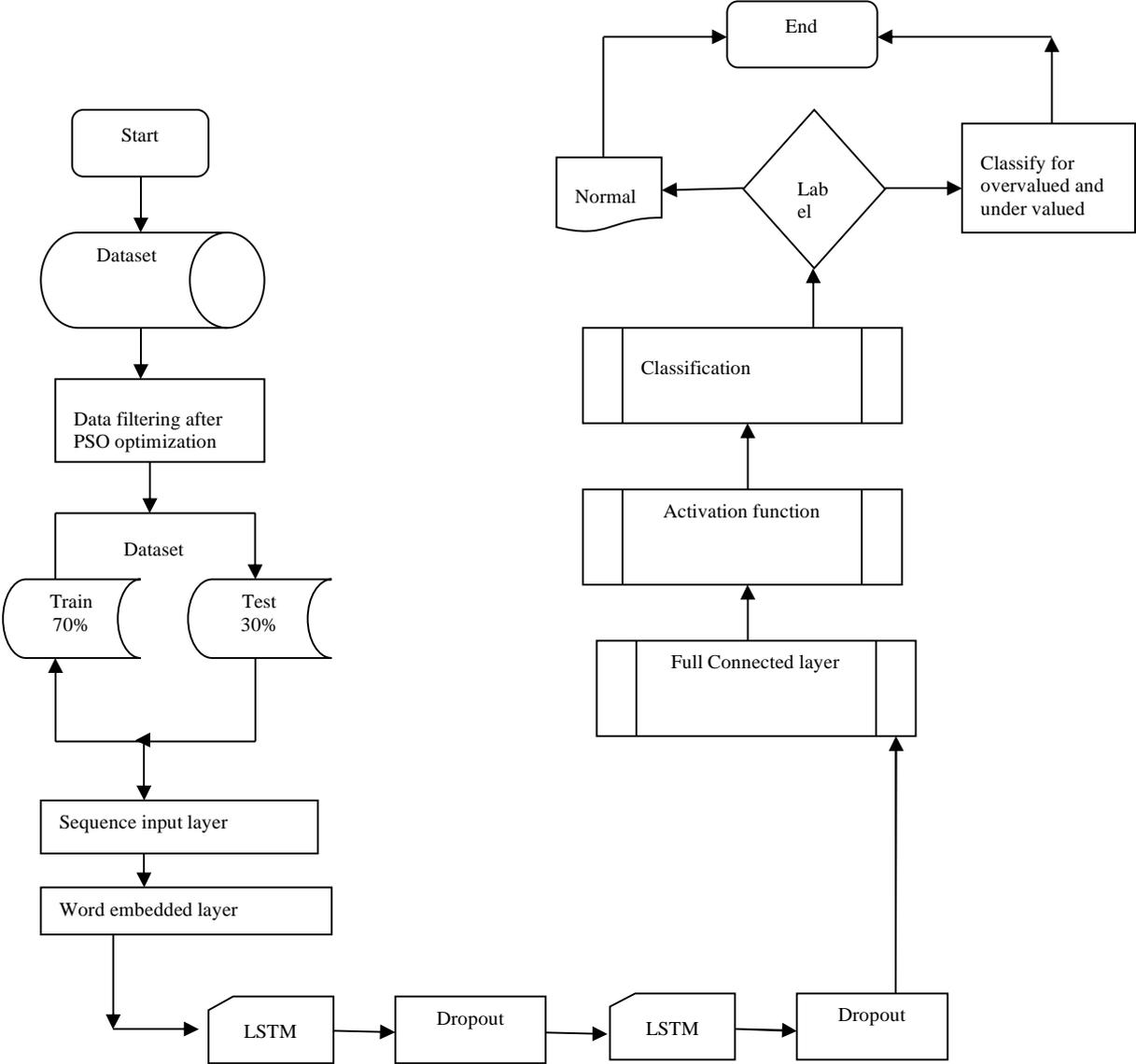


Figure 2. Process flow for proposed work

*B. Research Methodology*

The dataset of crypto currency are captured using python script and PSO is applied over dataset. The PSO is supporting in getting optimized price in order to support investor regarding best prices. Then dataset is filtered considering optimized value and machine learning approach is used for training.

Proposed objectives include study on the establishment of records of Bitcoin pricing. In the current study, categorization of cryptocurrency prices is recommended on the basis of undervalue, overvalue, and typical pricing. Researchers may now evaluate their findings with the help of the accuracy parameters they obtained.

V. RESULT AND DISCUSSION

Training operation is made after filtering optimized dataset in case of BTC, Etheriam, polygon matic, LTC and wave.

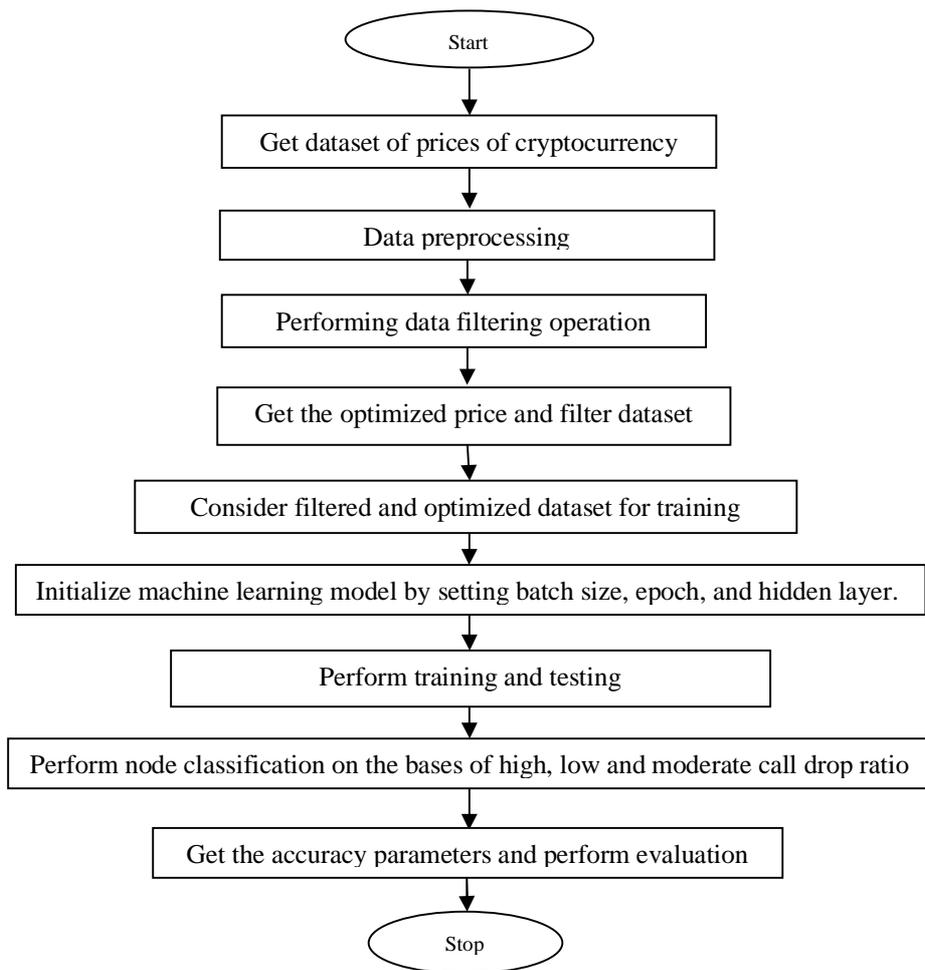


Figure 3. Process flow of proposed work

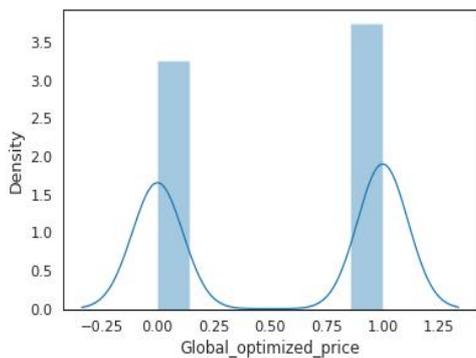


Figure 7. Global optimized price

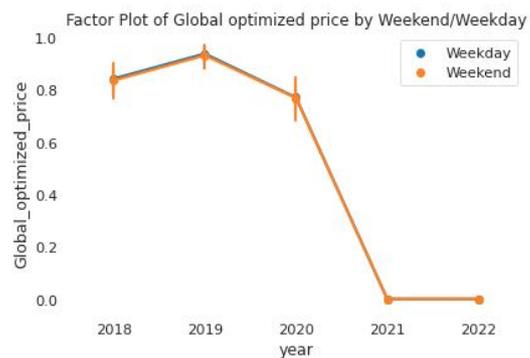


Figure 8. Factor plot of global optimized price by weekend/weekday

*Error and accuracy report after training of LSTM model*

- Train Mean Absolute Error: 0.10702336612861828
- Train Root Mean Squared Error: 0.16077715963351358
- Test Mean Absolute Error: 0.022237375378608704
- Test Root Mean Squared Error: 0.022237375378608704
- Train Accuracy: 0.8929766338713817
- Test Accuracy: 0.9777626246213913

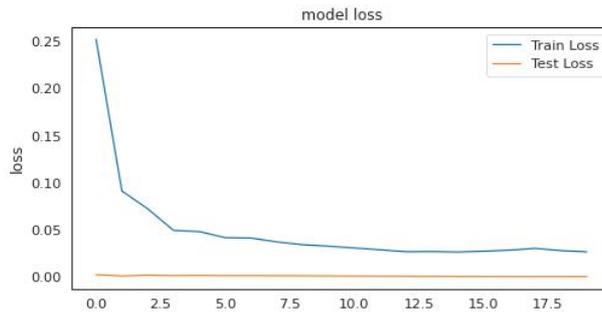


Figure 9. Simulation of training loss and testing loss

TABLE I. ANALYSIS OF ACCURACY OF CRYPTOCURRENCY PRICE PREDICTION

Date	BTC	ETHERIAM	WAVE	LTC	MATIC
10/9/2022	98.5317806	94.4814959	98.0737862	98.6103608	88.4602016
10/10/2022	99.783436	92.6781234	98.0465749	98.2668051	89.6173091
10/11/2022	96.9286016	97.6433739	98.5264403	98.670375	97.0969601
10/12/2022	97.7737	97.2695299	98.3237916	98.451252	99.5937368
10/13/2022	95.92523	96.4562918	98.3094838	98.1136046	99.5400505

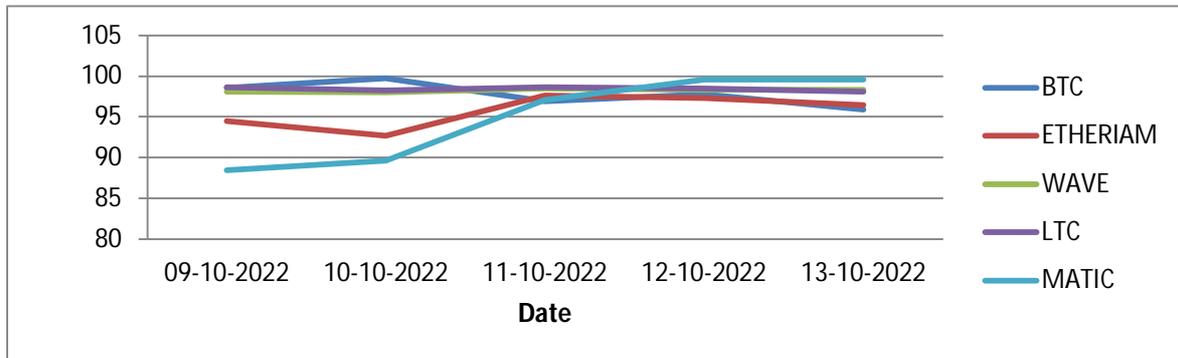


Figure 10. Comparison of accuracy for different cryptocurrency

## VI. CONCLUSION

The cryptocurrency industry has developed a complex cryptographic infrastructure to oversee its many operations. The issues that arise from manually handling a crypto currency's administration are addressed and avoided in this project. Information likes as users, crypto holders, author ids, and author biographies are being managed as part of the research. The research sphere is expansive. When handling data, this system took into account a number of factors. The simulation results show that the suggested technique is more precise than previous methods. Simulation results conclude that proposed LSTM model is providing accuracy above 97%.

## FUTURE SCOPE

Due to rapid growth in craze of cryptocurrency it has become essential for investors to take investment decision considering overvalue, under value and normal value. Present research has focused on the optimized value of cryptocurrency and proposed efficient machine learning approach. Such research could play significant role in predicting best prices in case of stock market also. Thus present research would contribute toward different investment options.

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# A Comprehensive Study on Current Trends in Unsupervised Machine learning Algorithms and Challenges in Real World Applications

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**Abstract**—In this technology fueled world, everyone is using smart devices, electronic gadgets, wireless products etc. and huge amounts of data are being generated, collected, and stored in the databases. To efficiently process and intelligently analyze the huge amount of data, the knowledge about subfield of Artificial Intelligence that is, Particularly Machine learning (ML) is required. There are various types of machine learning and its algorithms have been introduced to handle real world scenarios. This paper discusses the Comprehensive survey based on methodologies, techniques, algorithms, applications, and challenges faced by unsupervised machine learning and how unsupervised learning techniques can be helpful in real world business and environment. Thus, this study's key contribution is explaining the principles of different unsupervised machine learning techniques and their applicability in various real-world application domains, such as cybersecurity systems, smart cities, healthcare, e-commerce, agriculture, and many more.

**Index Terms**— Machine learning, Unsupervised learning, clustering, feature selection and feature extraction.

## I. INTRODUCTION

Very large and enormous amount of data and information are collected and stored from various sources like mobile phones, personal computers, sensors, cameras, satellites, log files, health care tracker, bio informatics, human generated data like social media data where enormous number of photos, videos, audios have been uploaded daily on the internet. Every day, 2.5 quintillion bytes of data generated roughly. Intelligently collecting, processing, analyzing huge volumes of data and developing corresponding smart gadgets, automated applications using the knowledge of Artificial Intelligence and Machine learning. Machine learning allows software applications and programs to automatically predict with accurate accuracy without being explicitly programmed. Machine learning is the most important field of Data Science. In real world, through learning capability and experience human tries to learn and Machine works based on human instructions. Machine learning is the one where machine automatically learns by experience as human does. The role of Machine learning is to learn, improve performance by experience and predict things with best accuracy. Machine learning have been classified into supervised, unsupervised and reinforcement learning

### A. Steps followed in Machine learning process

- *Gathering Data:* Raw data either from excel, access or text files. This step (Collecting past data) forms a strong foundation for future learning.
- *Data Preparation:* Raw data from any source contains missing values, irrelevant data, outliers etc. This technique involves data cleaning, normalization, dimensionality reduction, treatment of outliers and methods to remove irrelevant data.
- *Choosing a model:* Before choosing a model, there is a need to identify which type of machine learning the problem statement is. Then choosing a right machine learning model under any of the machine learning category plays an important role for future prediction.
- *Training:* Normally, 70% of data will be used for training part and remaining 30% of dataset will be used for testing or evaluation part. Training the machine learning model helps the model to understand and train by its own with well understanding of dataset.
- *Evaluation:* 30% of testing dataset is used to test the machine learning algorithm and check how well the algorithm is trained based on performance measures like accuracy, precision, recall etc.
- *Hyperparameter tuning:* Hyperparameter tuning is a parameter whose value will be set before actual training process begins.
- *Prediction:*

### B. Machine learning types

#### 1) Supervised learning

In Supervised learning, the model gets trained based on the labelled data. In training phase, the input data will get trained and tested with the target attribute. Supervised learning is also called task oriented because it mainly focusses on task and feed more data to train algorithm until it accurately predicts and perform. Supervised algorithm has been classified into two types, Classification and Regression. Some of the algorithms are K Nearest Neighbor, Random Forest, Decision tree, Support Vector Machine, Logistic Regression etc.

#### 2) Unsupervised learning

It mainly focusses on identifying underlying trends, patterns, and insights from the dataset. Here, unsupervised learning models are trained using unlabeled dataset and automatically extract patterns, facts and figures without any supervision. Unsupervised learning mainly classified into two types, Clustering and Association. Several algorithms follow these two types namely Agglomerative hierarchical clustering, K means clustering and FP Growth, Apriori algorithm (Association) problem. Some applications are Recommendation system, Identity management etc.

#### 3) Reinforcement learning

Feedback based reinforcement learning agent trains automatically using learning, feedback, and previous experience. The agent will be rewarded if it does right action in the environment, and it will be penalized if it does any wrong actions. Many applications have been developed using reinforcement learning techniques like, Gaming technology, Robotics, Self-driving cars etc.

#### 4) Difference between machine learning types

TABLE I. DIFFERENCE BETWEEN MACHINE LEARNING TYPES

Supervised learning	Unsupervised learning	Reinforcement learning
Machine learning model or algorithms learns from labeled data. It is also called as Task oriented approach.	Machine learning model or algorithms learns from unlabeled data. It is also called as Data Driven Approach.	Reinforcement learning models are based on reward or penalty. It is also called as Environment Driven Approach.
<b>Types:</b> Classification or Regression	<b>Types:</b> Clustering and Association rules.	<b>Types:</b> Classification and Control
<b>Algorithms:</b> Random Forest, Decision tree, K NearestNeighbor	<b>Algorithms:</b> K Means Clustering, DBSCAN Algorithm, Principal Component Analysis	It is formalized using Markov Decision process.
<b>Applications:</b> Medical Diagnosis, Spam Detection	<b>Applications:</b> Recommendation systems, Customer segmentation.	<b>Applications:</b> Robotics, Video games.

## II. UNSUPERVISED MACHINE LEARNING

Unsupervised learning, by the name itself it could be easily understood that it will not guide by any supervision. This type of learning should automatically extract knowledge, underlying hidden patterns, data groupings from the dataset without human intervention. It will group objects or items based on similarities. Unsupervised machine learning will deal with unlabeled dataset where there is no target output tagged with corresponding input. Hence unsupervised learning is helpful in real life scenarios because all real-world problems will not come up with input and output pattern.

### A. Steps involved in Unsupervised learning techniques:

- *Gathering Unlabeled data:* In unsupervised machine learning, gathering of data (raw unlabeled data) is the important part where it finds insights and trends from the data without supervision.
- *Interpretation:* It interprets the raw input data to find out the hidden patterns and trends.
- *Algorithm:* Then will apply suitable algorithms like clustering algorithms or association rules.
- *Processing:* Here, the data points divide into groups called clusters based on similarity which is measured using Euclidean or cosine distance.
- *Output:* When new data point arrives, the algorithm will push the data point into most similar groups and gives the predicted output based on similarity without any supervision.

### B. Advantages of using Unsupervised learning

- Unsupervised learning helps to solve problems without human intervention.
- It automatically learns from the data and discover underlying patterns and group items or objects based on similarities.
- It is less complex when compared with supervised machine learning, because in supervised it involves human intervention because one has to understand the input data and label them.

### C. Disadvantages of using Unsupervised learning

- It provides less accuracy of results because it has no labeled data and machine must discover automatically the underlying new patterns and relationships hence provides somewhat less accuracy compared to supervised machine learning.
- Evaluating an unsupervised machine learning model is quite difficult when compared to supervised model.

### D. Types of Unsupervised learning technique

In unsupervised we have input data and not having corresponding output data. If there is a set of image dataset, then algorithm does not know about the input features and not trained upon images provided. The unsupervised model should try to learn upon their own and perform the task by clustering or grouping the images based on similarities. Unsupervised have been classified into two types,

- Clustering
- Association

### E. Clustering

Clustering is grouping of objects based on similarities. It groups the given data points and objects that possess more similarity will remain in same group and objects that possess less similarity will move to other groups of clusters. It can be helpful in marketing sectors or industries where they group customers based on their behavior. Clustering has been used in wide range of applications like e-commerce sites, cybersecurity, health care analytics, behavioral analytics etc. Many clustering algorithms has been introduced, most popular and widely used clustering algorithms that is used in machine learning is,

- K-Means Clustering
- Agglomerative hierarchical clustering
- DBSCAN Clustering

### F. Association Rules

Association rules is a type of unsupervised learning method which is used to find the relationship between the objects in the large databases. Association rule mining makes effective marketing strategy. Market basket analysis is a one example for association rule mining since it finds relationship between the items purchased by

the customers. If a person buys product 'x', then he/she might buy product 'y'. If a customer who doesn't buy product 'y' followed by 'x' then they are said to be typical customers and marketing agents target them and cross sell the items to them. Association rule mining finds frequent items, pairs, associations etc. from relational or transactional or any kind of databases.

It has been divided into two parts,

- Antecedent
- Consequent

*"If customer purchases the product bread, then he is likely to buy Jam"*

- **Antecedent:** It can be found in datasets. It is bread from above statement.
- **Consequent:** It can be found in combination with Antecedent. It is Jam from above statement.

The relationship can be described in two parameters, "Support" and "Confidence". Support indicates how many times the if/then relation occurs in the datasets, whereas Confidence refers to number of times these if/then relationships have found to be true.

There are different types of algorithms in association rule mining,

- Apriori algorithm
- FP – Growth algorithm

### III. CLUSTERING ALGORITHM

#### A. K – Means Clustering

It is widely used clustering algorithms in Unsupervised machine learning. K- Means clustering is an iterative procedure where the data points are grouped into K clusters. Each data point belongs to one single cluster. It groups data points based on similarity, the similarity between the data points can be determined by calculating distance between them. The distance between data points and clusters centroid point (Initially, which is the random data point selected among all data points) can be calculated in many ways,

- Squared Euclidean distance
- Manhattan Distance
- Cosine Distance
- Correlation Distance

Similarity can be measured using any of these distance-based measurement and it is completely applicationspecific.

#### 1. Working of K – Means clustering

- Initially, determining the k-value, where 'k' is denoted as number of cluster centroids among all datapoints.
- Cluster centroids: Randomly selecting k data points that is, if k=5, then randomly choosing 5 data points from groups of data.
- After selecting centroids, calculating the distance between each data point with centroid using any of the distance-based measures.
- The minimum distance between centroid and corresponding data point will form a cluster formation.
- Similarly, calculating distance for all the data points, the data points which is at minimum distance from one cluster will get joined with that cluster group. Thus, forming k clusters.
- Since, this is an iterative procedure, there are two steps
  - Assigning the data points
  - Updating the clusters.
- Updating clusters will occur again and again until there is no assigning of data points from one cluster to another.
- Finally, it groups the data points with k clusters based on similarity.
- There are two ways of selecting k value, (a) Elbow Method and (b) Silhouette Method.

#### 2. Elbow Method

Elbow method is used to identify the optimal number of k clusters in the dataset. It determines whether the selected k value will provide optimal accuracy of grouping the data points. To understand, Initially, fix k: 1, it forms one single cluster where all data points belong to one cluster. Similarly, fix k value as 2, then data points have been divided into two clusters. When k value increases, the distance between data points and cluster centroid points decreases. It is said to be optimal if k value is above 3 because the distance decreases rapidly due

to increase in k value. When k is 3 or above, the distance between data point and centroid becomes minimum and become stable. So, selecting k points above 3 can be optimal solution for identifying the number of clusters.

### 3. Silhouette Method

It is used to find the accurate separation of k clusters in the dataset. It can be calculated using the formula,

$$s(o) = \frac{b(o) - a(o)}{\text{Max}\{a(o), b(o)\}}$$

$s(o)$  = silhouette coefficient of data point 'o'

$b(o)$  = computing average distance between data point 'o' to all other clusters.

$a(o)$  = computing average distance between data point 'o' to other data points in same cluster. Silhouette coefficient should range from [-1,1]. If silhouette coefficient is,

- 1: It is the best coefficient value and the number of k cluster selected will correctly groups between all the data points.
- -1: It denotes worst k value selection and it does not groups data points correctly.
- 0: It is said to be overlapping of clusters.

So, the silhouette value should be high as possible and closed to 1. Compared to elbow method, silhouette method gives the best separation of clusters between the data points.

### B. Agglomerative Hierarchical Clustering

Agglomerative hierarchical clustering is a type of hierarchical clustering and widely used clustering algorithm. Initially, all the data points are considered as one single cluster. Calculating Euclidean distance or any kind of distance measure between each single data point or each single cluster. The minimum distance between pair of clusters will be combined as one single cluster. Similarly, calculating each cluster's distance and that with minimum distance merges, thus forming one single cluster or k clusters finally.

#### 1. Working of Agglomerative hierarchical clustering

- All the data points are considered as single cluster.
- Computing proximity matrix for all the data points.
- Groups data points based on minimum distance.
- Updating the proximity matrix after merging the clusters.
- Similarly, repeating the process until it attains one single cluster or k cluster.
- Agglomerative hierarchical clustering can be visualized using a chart called "dendrogram"
- Initially if there are 5 data points say A, B, C, D, E, each data points are considered as single cluster.
- Distance between each data point is calculated.
- The minimum distance is found between A and B, D and E.
- Both clusters form a single cluster say, AB and DE
- Again, distance between AB, C, DE has been calculated.
- The minimum distance found between AB, C they form a single cluster.
- Similarly, Distance calculation is carried out for all the data points and finally they form a single cluster as ABCDE.

### C. DBSCAN Clustering

There is a drawback in k-means clustering and agglomerative hierarchical clustering as its fail to create arbitrary shapes. Thus, DBSCAN helps to overcome this issue. DBSCAN groups data based on high density. The most interesting part in DBSCAN is it is robust to outliers, and it can easily detect the noise from the group of data points. In k means clustering, there is a need to determine k value to form number of clusters, but in DBSCAN there is no need to specify k value or number of clusters. It requires two parameters,

- **Epsilon:** Radius of circle to be formed around data points.
- **Min-points:** Minimum number of points to be inside radius of circle.
- DBSCAN classifies data points into three types, (a) Core Point (b) Border point (c) Noise. Consider Min point: 3, then the number of data points with at least 3 inside the circle with including itself is represented as "core point". If the data point within 3 but greater than 1 can be represented as "border point". If it contains only one data point inside the circle it is noise. DBSCAN uses Euclidean distance-based measure to calculate distance between points. To use DBSCAN technique it is much more important to select epsilon and Minimum point value. Selecting epsilon value and Min point follows some criteria, the minimum point

should be one value greater than number of dimensions.  $\text{Min Point} = \text{Dimension} + 1$ . Epsilon value can be decided using elbow graph or k distance graph. The maximum curvature value can be selected as epsilon to get more accurate value. Hence, DBSCAN approach can be more useful for clustering related problem as when compared to k- means clustering or Hierarchical clustering. But K-means and hierarchical clustering can be useful for some applications also. Density based problems can be solved using DBSCAN algorithm.

#### IV. ASSOCIATION RULE MINING

##### A. Apriori Algorithm

Apriori algorithm is used in Market basket analysis, which is used to find the relationship between two products, items, or objects and find the frequent item set from candidate k items. If a person buys a product 'x', then he/she might buy product 'y' in combination with x. The main goal of Apriori algorithm is to find the association rules between items. It is also called as frequent pattern mining, which finds frequent items purchased by the customer. Hence, this is helpful in marketing companies or industries to find the customer behavior and cross sell items to the customers. Apriori algorithm operates on the databases with large number of transactions. Three main components to calculate Apriori algorithm is, support, confidence, and lift.

##### 1. Working of Apriori algorithm

- Consider for example if support count is 2 and confidence is 60%.
- The dataset contains transaction id and frequent item set purchased by a customer.
- If there are 5 items say, A, B, C, D, E. and k: 1 initially then find the number of transactions for each item.
- If the support count for each item is less than the minimum support count 2, then prune that item.
- Next, again check with k=2, combine 2 items and check the combination of transactions between two items. Again, if the support count for two items less than minimum support count prune it. Similarly, the process will be repeated until there is no itemset leftover with minimum support count.
- Finally, generate rules for result set of items and check with confidence value of item set with given confidence value i.e., 60%. If the confidence value less than given value, reject that pair and item set with maximum confidence value will be selected as frequent item pairs purchased by customers.
- This will get to know about the customer and enhance their purchasing experience and marketing sectors will gain more profit.

##### B. FP - Growth

There is a drawback in Apriori algorithm, since it must scan the database again and again to find the candidate k items it makes algorithm slower. To overcome this issue, FP Growth has been introduced. It is also called as Frequent pattern growth algorithm.

##### o Working of FP-Growth

- Consider the support value to be 3. The items with equal or maximum support value are sorted in descending order.
- Creating ordered item set, comparing the actual item set with sorted item (item with more than 2 support count) and considering only the item in ordered item creating a separate set.
- Now all the ordered item set will be inserted in trie data structure.
- Next step is to find the conditional pattern base by using the trie data structure.
- After that identifying conditional frequent pattern is important to identify frequent item pair. Thus, finding frequent pattern by using conditional frequent pattern.
- Finally, calculating confidence value for frequent item and comparing with given confidence value. Identifying, if then rules for frequent item sets by using confidence value.

#### V. APPLICATIONS OF UNSUPERVISED LEARNING

There are many real-world applications that make use of unsupervised machine learning and enhancing user experience by using any of the algorithms.

- Recommender system
- Customer segmentation
- Targeted Marketing
- Identity management, Item categorization

- In Genetics and Anomaly Detection
- Image, speech and pattern recognition

## VI. CHALLENGES AND RESEARCH DIRECTIONS

Unsupervised machine learning has lots of benefits and it is helpful in real world problems, and it is useful for users to enhance their experience and thus helpful in making end to end applications and software. Even though, it has some benefits there is a challenge in unsupervised learning technique since it automatically does everything without human intervention. Some of the challenges of unsupervised techniques are,

- Complexity in computation due to large volume of data.
- It may give inaccurate results too. Inaccurate results should be solved because it is important parameter to consider when it is applied in real world problems.
- Even though it automatically predicts, or groups data based on some criteria, there is a need of human intervention in validating the result.
- It may take longer time to train the data points.
- Collecting data in specific domain like IOT, Cyber security and agriculture, network traffic is not straight forward.
- In depth investigation is required while collecting real world data.

But when all these challenges are solved successfully, then unsupervised give more advantages in business environment like gaining profit to marketing entities, enhance user experience by providing more accurate results for example, recommender system, which recommends similar things what user likes the most, makes companies to understand about their customers to track their behavior, activities etc. The success of machine learning based solution in specific domain or application needs good quality of data and choosing appropriate algorithms. Hence, effectively handling features, processing, and good level of maintaining the dataset leads to best performance by the machine learning model with high accuracy and leads to build effective and intelligent application.

## VII. CONCLUSION

Unsupervised learning is a powerful tool which can be used for large databases. There are various kinds of applications developed using unsupervised learning technique. Variety of algorithms are there to solve problems and give more accurate results. Both advantages and disadvantages are there in unsupervised learning technique, when successfully solved these challenges faced by unsupervised learning, it gives more profit to companies, strengthen relationship between companies and their customers, improve user performance and there is a lot of advantages when using unsupervised machine learning technique. It automatically solves problems by grouping the data points based on similarity without any human intervention. Less human intervention, more automatic process with fairly good results is unsupervised machine learning. Hence, this paper describes the complete survey on unsupervised machine learning with its applications, algorithms and its challenges faced in real world scenarios.

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# Variable Selection Methods, Comparison and their Applications in Machine Learning: A Review

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**Abstract**—In the past decade, the availability of voluminous and high-dimensional datasets has immensely emerged with continuous technological innovations to foster new ways to gather and analyze data. Thus, feature selection has become a challenging task in areas of application like text classification, data analysis, prediction, information retrieval etc. Knowledge extraction using machine learning models usually depends on the quality and quantity of data that they operate on. Feature selection is one of the core concepts to identify and remove irrelevant as well as redundant information that may impact accuracy or have no impact on the results. Feature selection methods are discussed in this review paper along with practical limitations. Subsequently, the workflow to solve a feature selection problem is also elaborated with feature selection methods. In feature selection, many surveys and empirical assessments were performed in many areas like classification, prediction, regression, and clustering, respectively.

**Index Terms**— feature selection, feature ranking, filter, hybrid, wrapper, embedded.

## I. INTRODUCTION

The abrupt growth in volume as well as dimension of datasets is problematic for algorithms and leads to high computational cost and memory usage. Mobiles, social media, cameras, infrastructure-less wireless networks, weblogs, radio frequency identification (RFID) readers, internet search, web-based data are few names of information gathering sources. According to the IDC Digital Universe study, “By 2020, around 40 zettabytes will be the size of the digital universe” [1]. Apart from structured data in traditional datasets, a large volume of unstructured and semi-structured data is present.

In the late 19th century, feature selection emerged as an important technique for selection of most relevant, significant, and important features. Variable Selection is a part of Feature Engineering, also known as ‘feature selection’ (or attribute selection). It is the process to identify and removal of irrelevant or less vital features to achieve better accuracy and performance enhancement of the model [2]. The identification or extraction of most relevant features also known as dimensionality reduction techniques [1]. The advantage of feature selection is that no information loss of a single feature importance. In case, when original features are very diverse, and a small set of features is required then removal of some features may lead to a chance of loss of information. Whereas drawback of feature extraction is that the linear combinations of original features are not interpretable and the information about the contribution of each feature is often lost. Feature extraction often decreases the feature space size without losing a lot of information. The choice of feature extraction or selection methods totally depends on the data type of application domain [3].

“The objective of feature selection is three-fold: improving the prediction performance of the predictors, providing faster and cost-effective predictors, and providing a better understanding of the underlying process that generated the data.” [2]

## II. LITERATURE REVIEW

The feature selection method consists of four critical steps: feature subset creation, subset assessment, stopping criterion, and outcome validation. The objective of feature selection is to select a subset e.g.,  $b = \{f_2, f_4, f_8, f_9\}$  from the complete set of input features e.g.  $a = \{f_1, f_2, f_3, f_4, \dots, f_n\}$  where  $n$  is the total number of features in a dataset. The subset ‘b’ can predict the output with improved accuracy and reduced computational cost comparable to the performance of the set ‘a.’ All the features in a dataset are not always relevant and the redundancy in the features may not lead to potential results. Less number of highly relevant features gives a better generalization with less training and testing time. L. Ladha et al and N. Krishnaveni et al in [4] enlisted foremost benefits of performing feature selection before modelling the data:

- Reduces dimensionality of feature space,
- Less storage requirements,
- Removes redundant, irrelevant, and noisy data,
- Overfitting reduction,
- Accuracy improvement of resulting model,
- Training time reduction,
- Improve interpretation with complexity reduction,
- Performance improvement, to gain predictive accuracy.

According to literature review, many novel methods have been implemented based on local and global relations. Genetic Algorithm and Support Vector Machine are the most used methods on the other hand many authors consider high dimensionality to be crucial concepts to address [5]. Feature selection algorithms (FSA) are classified into Filter, Wrapper, and Hybrid feature selection methods [6]. While based on data type, FSA are broadly categorized into four groups: similarity-based, sparse-learning-based, information-theoretical-based, and statistical-based methods [7]. In 2013 using affinity propagation clustering, a fast feature selection algorithm was proposed named ‘Sequential Feature Selection’ (SFS). SFS provides high accuracy and was applied separately to each cluster of a dataset [8]. In 2014 Naïve Bayesian based novel hybrid algorithm was proposed to minimize the feature selection computing complexity using filter and wrapper algorithms [9]. On the other hand, Unsupervised and multivariate filter- based feature selection methods were proposed for analyzing the redundancy and relevance of features [10].

In paper [11], four feature selection methods are compared as Decision trees, entropy measure for ranking features, estimation of distribution algorithms, and the bootstrapping algorithm on the other side also proved that the elimination of noise is vital to consider in the classification process. Bi-Objective version outperforms Particle Swarm Optimization, Ant Colony Optimization, and Genetic Algorithms as an optimization technique for ensemble systems using filter-based feature selection approach [12]. Whereas Wrapper-based approach was used by many researchers for feature selection using different optimization techniques such as Ant Colony Optimization algorithm [13], a hybrid search method and particle swarm optimization [14], Harmony Search [15].

The output of feature selection algorithms is based on various dimensions such as ranking or subset, tasks involved as supervised or unsupervised, and principle as filter/ wrapper/ embedded. The feature selection method must be enhanced to reduce redundant data for large data analytics [4]. Various studies demonstrate that various algorithms are available for feature selection and each algorithm behaves differently for different types of datasets. Therefore, analysis is required to find out the suitable algorithm for feature selection.

This section provides introduction to feature selection and brief review on feature selection algorithms. In the following section 3, different feature selection algorithms are discussed to check situation-based suitability of feature selection techniques for classification/prediction and clustering algorithms; In section 4, feature selection algorithms are compared based on different merits such as efficiency, computation cost, feature dependencies, etc. Various application and technical domains for feature selection are provided in Section 5. Finally, conclude the paper with a discussion on advanced issues section 6.

### III. FEATURE SELECTION METHODS AND LIMITATIONS:

The feature selection problem has been studied form many years by statistics, researcher, and machine learning communities. With emerging data mining research, more attention has been given to feature selection techniques. Feature selection is also known as subset selection and a pre-processing technique used in machine learning to increase learning accuracy by removing irrelevant features [16]. Taxonomy of feature selection techniques for different datasets is shown in “Fig. 1”.

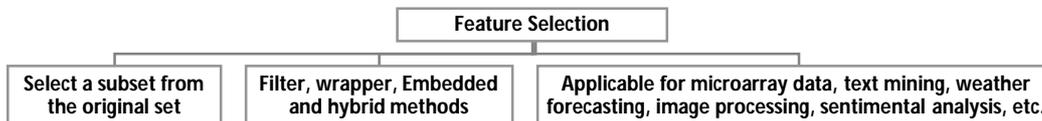


Fig 1. Taxonomy of feature selection techniques for different datasets

Complete (Exhaustive) search, Sequential Search, Exponential Search and Randomized Search are most common search Strategies used for feature selection. A large range of application areas (text analysis, microarray data analysis, climate change prediction, digital image processing, sentimental analysis, etc.) uses different types of feature selection algorithms (Filter, wrapper, Embedded and hybrid methods).

#### A. Filter Methods

Filter methods is the most generic approach among all the four and works irrespective of data modelling algorithm. Optimal feature set is selected by analysing general features of the dataset. In literature, methods with respect to filter class are as univariate (evaluate a single feature using ranking) and multivariate (evaluate an entire feature subset using search strategy). Filter methods cannot be applied universally for different knowledge discovery operations thus has been classified as regression, classification, or clustering [6], [10], [17]–[32] . Filter approach to feature subset is shown in Fig. 2.

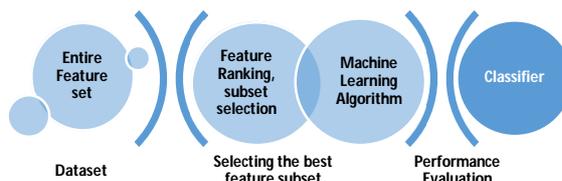


Fig 2. Filter method

According to [33], filter methods are faster and have low computational cost in contrast to wrapper and embedded methods but inefficient reliability in classification problems. As a result, this method is more popular to both academicians and industry practitioner. According to survey analysis, in Table I filter methods are summarised into 2 categories, along with application utility and references.

TABLE I. MOST COMMON FILTER METHODS

Filter feature selection	Filter class	Filter methods	
		Method	Application
Filter feature selection	Univariate Filter class	Information Gain (IG) [17]; Gain Ratio [18]; Chi-square [18]; Fisher Score (F-Score) [19]; Symmetrical uncertainty [20]	Classification
		ReliefC [21]	Clustering
		Laplacian Score (L-Score) and Spectral feature selection (SPEC) [22]	Classification, Clustering
		Correlation [22]	Regression
	Multivariate Filter class	Relief and ReliefF [23]; ANOVA / Term Variance/ Variance Threshold [24]; Count/frequency based or Count Vectorizer [25]; Gini Index (GI) [26]	Classification, Regression
		Fast Correlation based filter (FCBF) [22]; RRVSAO: Relevancy-Redundancy Variable Selection Ant Colony [10]; RSM: Random subspace (an ensemble) method [27] ; Relevance-redundancy feature selection (RRFS) [28]	Classification
		Correlation based feature selection (CFS) [20]; Minimal redundancy-maximal-relevance (mRMR) [6]	Classification, Regression
		Variable selection using sparse cluster analysis [29]; LFSBSS: Localized Feature Selection Based on Scatter Separability [30]; MCVS: Multi-Cluster Variable Selection [22]; Variable weighting K-means [31]; Graph Clustering Ant Colony (GCACO) [32]; Graph Clustering with Node Centrality (GNCC) [31]	Clustering
		Unsupervised Feature Selection Ant Colony (UFSACO) [10]	Classification, Clustering

### B. Wrapper Methods

In 1996, Ron Kohavi and George H. John proposed the wrapper procedure to decrease irrelevant features [34]. Black-box is used as a predictor to evaluate the variable subset using wrapper methods. Wrapper methods performs better in case of a smaller number of features in contrast it is expensive to be used for huge feature set due to high computational cost and feature selection process got slower if each feature is evaluated with trained classifier [16]. Another drawback is higher risk of overfitting as if using classifier model data learning rate is too high and provides poor generalization [4], [6], [9]. The induction technique (also known as the ‘black box’) has been used to represent the supervised problems. Each training instance is characterised by feature vectors and a class label as shown in Fig. 3. Further, ranking is used for irrelevant features elimination [34].

In 2015, Diao R and Shen Q. suggested that to form a hybrid approach with intellectual properties for feature selection, development of a meta-framework may be beneficial for dynamic identification of suitable algorithms [35]. According to [14], Genetic algorithms (GA), Particle Swarm Optimization (PSO), and Ant Colony Optimization (ACO) are widely used among existing heuristic methods for the variable selection problem. It has been observed that due to its cogent structure GA is preferable even though PSO and ACO provide higher accuracy for similar tasks. According to literature survey, Wrappers algorithms can be categorized into Sequential selection and Heuristic search. In Table II Wrapper methods are summarized, along with application utility and references.

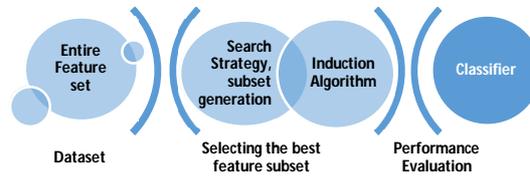


Fig 3. Wrapper method

Wrappers perform feature selection based on performance of modelling algorithm (black box). E.g., for classification tasks, features subsets will be evaluated based on classifier performance, whereas, for clustering, it will be based on performance of clustering algorithm [13], [36]–[42]. While implementing Wrappers, the subset generation is dependent on search strategy same as filter methods. The model evaluation steps are repeated for each subset until all features are ranked. According to literature, wrappers performance is better than filters because it evaluates subsets using real modelling algorithms. Generally, any combination of search strategy and modelling algorithms can be implemented for variable selection. While modelling methods like Naïve Bayes, linear support vector and Extreme Learning Machines are best with wrappers for greedy search problems.

TABLE II. MOST COMMON WRAPPER METHODS

Wrapper feature selection	Sequential/ Greedy selection algorithms	Sequential backward selection and Sequential forward [38]	Classification
	Global/ Heuristic algorithms	Random/ selection	Ant Colony Optimization (ACO) and Genetic Algorithm (GA) [39]; Particle Swarm Optimization (PSO-SVM) [42]; Artificial Bee Colony (ABC) [40]; Random mutation hill-climbing [36]; Simulated annealing (SA) [41]

### C. Embedded Methods

The filter methods have a major drawback that is independent of classifiers which results worse performance than wrapper methods. However, wrapper has high computational cost. A midway solution is the use of embedded or hybrid methods and both use the principal of the classifier to generate criteria to rank most optimal features [43]. Embedded methods are robust and effective while dealing with high dimensional dataset and have lower risk of overfitting in comparison to wrapper [44]. First, these methods train a machine learning model then drive feature importance. Finally, remove non-important features using the feature subset. Fig. 4 illustrates the embedded variable selection methodology.

Embedded methods consider not only feature dependencies via relationship between input and output feature, but also search features locally that allow local discrimination. In other words, it uses independent criteria to find optimal subset for known cardinality. The final optimal subset is selected among optimal subsets by using learning algorithm having best accuracy level. Various types of decision tree algorithms are used by different embedded methods as CART, C4.5, random forest, multinomial logistic regression, and its variants [45]. Among

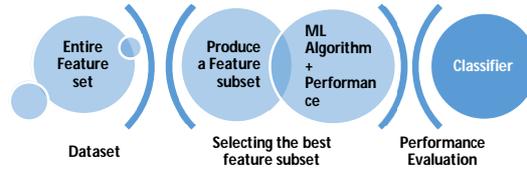


Fig 4. Embedded method

different embedded methods, Support Vectors based on Recursive Feature Elimination (SVM-RFE) is widely used [46] Whereas, regularization method also known as penalization, is one of the common embedded types of feature selection. Among regression based embedded methods, LASSO and RIDGE regression are mostly used for hyperspectral data to reduce overfitting through inherent correction [47], [48]. According to literature survey, some mostly used Embedded algorithms are mentioned in Table III. Embedded methods are summarised, along with application utility and references [45], [47]–[52].

TABLE III. MOST COMMON EMBEDDED METHODS

<b>Embedded feature selection</b>	Tree based methods / Decision tree algorithms	Classification and Regression Trees (CART) [45]	Classification, Regression, Clustering
		ID3 [50]; Random Forest [51]	Classification
		C4.5 Decision Trees [49]	Clustering
	Regularization Regression methods	LASSO regression (L1 regularization) [47]	Regression
		RIDGE regression (L2 regularization) [48]	
		Elastic nets (L1/L2 regularization) [52]	

#### D. Hybrid Methods

Hybrid methods are developed to utilize the advantages of filters as well as wrappers methods [44]. These methods are sequential based as the first step is commonly based on filter methods to reduce the number of features that help to remove redundant features then a wrapper method is applied to select the desired number of features from a reduced set for optimal feature selection [53]. It can be any combination of classical methods such as filter-filter, filter-wrapper, and filter-filter-wrapper where the output of one method as feature subset is provided as input to another. Independent test and performance evaluation functions are used by this approach for feature subset selection. Thus, it helps to improve the efficiency and accuracy for high dimensional dataset with better computational cost [54]. Hybrid feature selection method layout is shown in Fig. 5. Several methodologies are developed using hybrid methods, such as: hybrid ant colony optimization; fuzzy random forest-based feature selection mixed gravitational search algorithm or hybrid genetic algorithms.

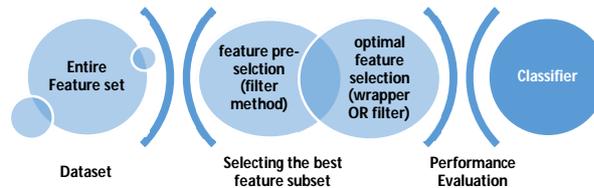


Fig 5. Hybrid method

## IV. COMPARISON

All above mentioned methods have been widely used by many researchers for different applications. The performance of feature selection methods totally depends upon the dimensionality of the dataset. Thus, new methods for feature selection are always needed. Table IV, summaries and compared the feature selection methods along with merits and demerits [9], [13], [14], [37], [43], [44].

## V. APPLICATIONS DOMAINS FOR FEATURE SELECTION

In this section, application and technical domains for feature selection are briefly discussed. Feature selection problems aim at selecting a subset of variables to describe the data with maximum accuracy. The chosen subset must be short in size and contain only the information required for the given application. In the literature, feature selection issues are often tackled using search strategies, where the assessment of a specified subset is performed

TABLE IV. COMPARISON OF FILTER, WRAPPER, EMBEDDED AND HYBRID METHODS

<b>Filter methods</b>	<b>Wrapper methods</b>	<b>Embedded methods</b>	<b>Hybrid methods</b>
High computational efficiency.	Better results than filter, but computational expensive for huge dataset.	The performance degrades if number of irrelevant features is high in target set.	Better computational complexity than wrapper methods.
No interaction with modelling algorithm.	Dependent on modelling algorithm performance.	Dependent on modelling algorithm performance.	Dependent on modelling algorithm performance.
Low computational cost for large dataset.	High computational cost for large dataset thus works better for small dataset.	Computational cost is less in comparison to wrapper methods.	More flexible and robust against high dimensional data
Fast execution than wrapper methods	Slow execution than filter methods.	Faster than wrapper methods.	High performance than filter methods.
Less prone to overfitting	High risk of overfitting as if data learning rate is too high.	Generally used to reduce over fitting; Least prone to overfitting	Overcomes the demerits of wrapper, enhanced search algorithm thus least prone to overfitting
Mostly ignores feature dependencies and consider each feature separately.	Consider feature dependencies.	Identification of small set of features may be problematic.	Depends on the combination of different feature selection methods.
The features subsets are evaluated by using statistical tests	Cross validation methods are used for method assessment.	Cross validation methods are used for valuation of methods.	Cross validation methods are used for assessment.

by an appropriate function (filter methods) or directly by the execution of a Data Mining tool (wrapper methods) [6], [22], [53].

In Table V, feature selection methods are summarized with respect to application domains and evaluation metrics. Although there is no ideal solution for a particular statement of problem and difficult to conclude until a significant number of test situations are efficiently addressed.

TABLE V. SUMMARY OF FEATURE SELECTION METHODS BY VARIOUS APPLICATION DOMAINS

<b>Application domain</b>	<b>Feature Selection methods</b>	<b>Evaluation metrics</b>	<b>Best performing</b>
Bioinformatics [13], [55]	Information Gain, Chi-square, t-Statistics, Gain Ratio, Symmetrical Uncertainty, ReliefF, Gini Index, Max Minority, Sum of Variance	Accuracy, Stability, AUC	Information Gain, Symmetrical Uncertainty, Chi-square and ReliefF
Text Classification [56], [57]	Probability ratio, Bi-normal Separation, Accuracy Balanced, F1 Measure, Information Gain, Power, Random, Correlation, Chi-square,	Recall, Accuracy, Precision, and F-measure	Information Gain and Bi-normal Separation
Clustering[21], [58]	Information Gain, Iterative Feature Selection, Document Frequency, Chi-square, Entropy based ranking	Entropy and Precision	Iterative feature selection
Rule Induction[15], [59]	RIPPER, Induction algorithms, Pruning, LEM1, LEM2, AQ, LERS, Multi-strategy approach	Accuracy, Recall, and Precision	RIPPER and Multi-strategy approach
System Monitoring[60], [61]	Distance, entropy, Wrapper (SVM/NN), Global geometric similarity scheme, Correlation, Principal component analysis, Frequency-domain analysis	Accuracy	Overall, all methods
Image Recognition [40], [62]	Genetic Search, K-mean, Relief, Sequential Floating Forward or Backward Selection (SFFS/SFBS), different combination of all, and Random Search	Accuracy and MSE	Relief, SFFS or SFBS and their combinations

## VI. CONCLUSION

In this paper, various strategies are reviewed in the context of feature selection. Each algorithm selects the variables without computing redundancy out of which some algorithms also do not consider performance and accuracy. On the other hand, some algorithms do not consider the existence of noisy data when picking features. According to literature, if the computational time is extended, then the learning process becomes negligible. Filter methods can be used on huge datasets with many features because they are faster. However, it has no effect on accuracy. Wrapper approaches pick the best characteristics with high precision. However, the computational cost is high. Some hybrid solutions attempted to address the shortcomings of both methodologies. The objective of this study is to provide an in-depth comprehension of feature selection. If the high dimensional dataset contains irrelevant, insignificant, and unimportant features which in turns prevents effective modelling and may produce less accurate as well as less understandable results or may fail to achieve desirable results. Based on the research, an efficient unified framework for any size of dataset with minimal computing cost, and highest accuracy is required for variable selection.

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# Devanagari Characters Recognition: Extracting Best Match for Photographed Text

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**Abstract**—Devanagari script is used by most of the people in India. There are some script-specific structural characteristics of Devanagari script which makes the character recognition problem more challenging. Many OCR tools are available for printed or handwritten Devanagari script recognition. In these systems the input is given in the form of images of the script which can be scanned or photographed. But the existing systems are not robust. They give unexpected results when the input to the system is not ideal that is the image is rotated or tilted or has illumination variance. Our goal is to build a robust OCR system for printed Marathi highlighted text where the variation with respect to font, size, orientation and illumination are allowed. This paper proposes appropriate image transformation techniques to get a robust Devanagari Character Recognition System.

**Index Terms**— Devanagari, PCA, Tesseract, Levenshtein edit distance, OCR, Perspective transform, Sauvola Thresholding, Highlighted word.

## I. INTRODUCTION

Humans have highly developed sense for several pattern recognition tasks; one such task we very easily perform every now and then is: recognizing the written text. Humans can develop their reading and writing skills in their first few years of education and when they grow up they can easily recognize text even if it is printed in different styles, sizes, font and orientation. Even the broken, distorted and misspelled words can also be recognized by human and all this is possible by past experiences. From lots of research it is found that reading skill of computers is still way behind the human. In this paper, the goal is to recognize highlighted Marathi words. An image of highlighted printed or handwritten word is taken as an input. The image can be scanned or photographed using smart-phone or web camera. Many OCR systems for Devanagari script recognition presently exists.

Existing systems have certain limitations like they cannot work on tilted images, images captured at different angles of rotation or in presence of illumination variance. Tilt angle and rotation angle are not the same. The Tilt angle is the angle made by the camera with the plane. Tilt angle is same as the elevation angle whose zero is at the horizon. If it is non-zero, the effects due to tilt are observed in the image and may not give correct results. The rotation angle is the azimuthal angle. Its axis of rotation is perpendicular to the plane. The existing systems may give unexpected result if angle of rotation is non-zero. Also, if there is uneven illumination or shading, the existing systems may fail to recognize the word correctly. So, a methodology is proposed to transform the image

appropriately to nullify the effect due to tilt and the rotation angle. Our system also handles the effect due to variation in background light and uneven illumination to some extent. So, the proposed system achieves desired robustness with respect to above mentioned variations.

The original objective of our OCR system was to provide an appropriate users friendly input method for a Devanagari knowledge search engine. The search engine we are developing is to be used by primary school students. The search queries to be given to the search engine as a photographed image of Devanagari text, taken by smart-phones. This way of searching queries is very easy and user friendly than traditional approach where we have to type Marathi letters from keyboard. Typically, it is quite tedious to input composite Marathi characters via a keyboard. Though main objective of our OCR system was to provide user's friendly input method to our search engine, it can easily be adapted to any other application which requires robust Devanagari character recognition such as Digitization of old documents, texts, Digitization of forms for banks, post offices, or any other government organization, recognition of handwritten name/ amount on cheques, etc.

## II. RELATED WORK

Quality of image is very important factor for text recognition. Image quality is degraded due to uneven illumination and when the image is captured in different orientations. Many researchers have developed techniques to improve quality of such degraded images. Authors Huimin Lu et.al worked on shadow removal method for text recognition [1]. It uses binarization of images for better performance. Taeyoung Kim et.al proposed PCA based computation for illumination invariant space. It helps to remove shadow effects from input color image [2]. H. El Bahi et al worked on offline character recognition system for images captured by camera phone. They analyze and compare different thresholding methods to avoid illumination effects. As a result they have chosen Sauvola thresholding method [3]. Sam S. Tsai et.al worked on image matching by using visual text feature of images captured by camera-phone. This work consists of word distance matching method to demonstrate false matches [4].

Annmaria Cherian et.al used Hough transform to correct orientation of perspective input image so that it could recognize text by SVM classifier [5]. Vidula T. V. et. al proposed SURF (Speeded Up Robust Feature) for perspective distorted image, which is faster than SIFT (Scale Invariant Feature Transform) method [6]. J. Sauvola et.al proposed a technique for image binarization. In which they used hybrid approach to adapt defective type images such as change in illumination, noise and resolution[7]. Yash Gaurav et.al. presented a Deep Convolutional Neural Network method for classification of inputted images[8]. Shalini Puria et.al proposed Devanagari character classification model their model is based on SVM which recognizes printed and handwritten text, they presented some unique preprocessing method for handling shirorekha of Indian scripts[9]. Tripathy et.al presented a SVM based method for Devanagari character recognition using OCR. They provided their work for bangla Devanagari script [10]. Agarwal et.al presented comprehensive survey of methods based on machine Learning Algorithms for Handwritten Devanagari Character Recognition[11]

## III. PROBLEM DEFINITION

To build a robust OCR system for printed Marathi highlighted text where the variation with respect to font, size, orientation and illumination are allowed.

## IV. INNOVATIVE CONTENT

This research offers a unique method to improve performance of OCR. the goal of this work is to recognize highlighted marathi word which is captured by mobile phone, or web camera or any other scanning device. the advantage of this work is that it is rotation invariant, tilt invariant and illumination invariant with maximum accuracy above 98%.

## V. PROPOSED METHODOLOGY

In the proposed methodology, we have focused on recognizing Marathi highlighted words in any orientation i.e. tilt or rotation, and also having different illumination effects. For recognizing the highlighted script Tesseract API is used. In case of Marathi Language, Tesseract fails to recognize the script correctly if the tilt and rotation angle are non-zero or have light variance. The paper focuses on improving these Tesseract API limitations. Figure 1 Shows the block diagram of the proposed system, which consists of different phases, beginning with input printed text image with a highlighted word, pre-processing, rotation invariant, tilt invariant, illumination

invariant, Tesseract implementation, finding the best match for the Tesseract output using Levenstein distance and final recognized text. The block diagram of the proposed system as follows:

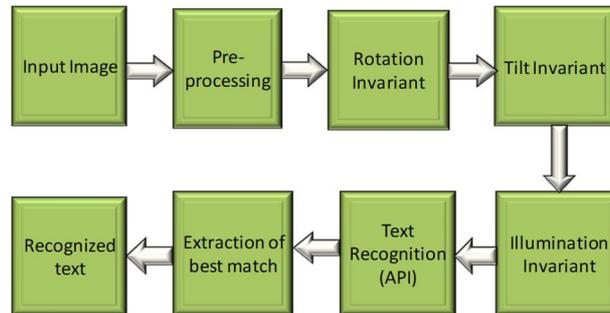


Figure 1. Block diagram of proposed system

### A. Pre-processing

Pre-processing steps (as shown in Figure 2) is applied on the input image to remove the noise from it and also to minimize the variations in the character styles. The scanned document sometimes has Salt and Pepper noise or Shaded areas. This noise must be filtered during preprocessing step. Sometimes image contains some black spots. To remove these black spots and noise along with black shade at the edges, filtering has been done. Here, we have used Median filter to remove high frequency components that cause noise in the image.

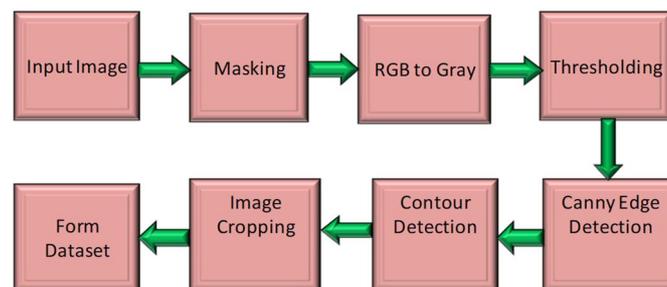


Figure 2. Overall flow of Pre-processing

- **Input Image:** The highlighted printed text is captured by mobile phone, and that captured image is an input to our system. Captured image contains one or more highlighted words. Recognition of these highlighted words is the goal of this project.
- **Masking:** Masking of highlighted part is done here, for that lower and upper bound of color is found out with the help of BGR values of particular color and then bitwise AND operation is done to extract color part only.
- **(RGB)Color image to Grayscale image:** The input contains color text image. In preprocessing phase the image is converted to grayscale image.
- **Thresholding:** Thresholding is also known as binarization. In this certain threshold value has been set, this will convert the pixels to black and white. If pixel value is above the threshold, the pixel is converted into white and if the pixel value is less than threshold value, the pixel is converted into black. Quality of binarized image depends on value of the threshold.
- **Canny Edge Detection:** Canny edge detection is a process to extract significant structural information from image and reduce the amount of data to be processed
- **Boundary Tracing or Contour Detection:** Contour detection means to find out the boundary of the area of interest using edges. It will identify connected components of an image and store that pixel values in the form of array. Contour can be found out by traversing the rows of image which is already filtered. The contour detection algorithm searches foreground pixel and store it into an array by marking it. Similarly, it will find all the neighborhood pixels. This process will continue till all the pixels of the image have been stored or it will continue to search in next row.

### B. Rotation Invariance

To make the system rotation invariant, first we need to find the angle by which the image is rotated and then compensate the rotation. This is implemented using step shown in Figure 3.

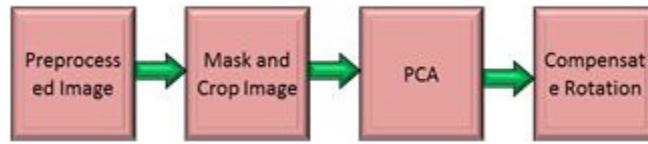


Figure3. Block diagram to make system Rotation Invariant

1. Mask the highlighted portion as already discussed in masking step of pre-processing part.
2. Crop the masked image to get only highlighted portion. This is required since the masked highlighted portion has black background which may give us improper dataset obtained in step 3.
3. Classify the pixels into background pixels and foreground pixels. The black pixels of the text are the foreground pixels and rest others are background pixels.
4. Implement Principal Component Analysis on the foreground pixels obtained in previous step. The brief explanation of PCA is given immediately after step 5.
5. Rotate the image by the negative of the angle obtained in step 4.

Principal Component Analysis (PCA) [12] is used for finding the direction of maximum variance i.e. the directions where the data is most spread out. For finding this direction of maximum variance, Eigen vectors of the covariance matrix associated with the dataset are calculated. The Eigen vector corresponding to largest Eigen value gives the vector in the direction of maximum variance. In this paper, the coordinates of the pixels lying inside the contour of the highlighted word forms the dataset.

Implementation of PCA ,steps are as follows

- I. A  $n \times 2$  matrix of the dataset is formed, where  $n$  is the number of pixels lying inside the contour of highlighted pixel.

$$Data = \begin{bmatrix} x_1 & y_1 \\ x_2 & y_2 \\ x_3 & y_3 \\ x_4 & y_4 \\ x_5 & y_5 \end{bmatrix}$$

- II. Find Covariance matrix of the Data matrix:

$$covariance\_matrix = \begin{bmatrix} var(x) & cov(x,y) \\ cov(x,y) & var(y) \end{bmatrix}$$

Where,

$$cov(x,y) = \frac{1}{(n-1)} \sum (x_i - \bar{x})(y_i - \bar{y}) \quad \text{and} \quad var(x) = \frac{1}{(n-1)} \sum (x_i - \bar{x})(x_i - \bar{x})$$

- III. Find Eigen values and Eigen vectors of the covariance matrix.

- IV. Find Eigen vector corresponding to the largest Eigen value. The direction of this Eigen vector can be obtained by

$$angle(in \ radians) = \tan^{-1} \left( \frac{y}{x} \right)$$

The value of angle gives us the angle made by highlighted word with the X axis. If the value is not zero then in order to make it parallel to X axis we need rotate the image by the angle , Rotate angle= 0-angle.

Figure 4 shows Input Image, its HSV Image then Masked Image, followed by Median Filter Image, its Gray Scaled Image,application of Binary Thresholding , Contour Detection, Rotated Image, Median Filter on rotated Image and Final Image.

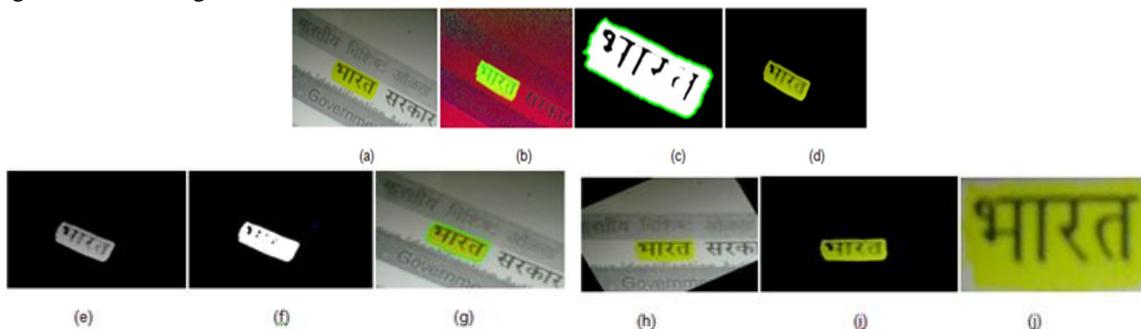


Figure 4.(a)Input Image, (b)HSV Image, (c)Masked Image, (d) Median Filter Image, (e)Gray Scaled Image, (f)Binary Thresholding , (g)Contour Detection, (i)Rotated Image, (j) Median Filter on rotated Image, (k)Final Image

### C. Tilt Invariant

When the photos taken at slightly tilted angle, the highlighted word is not visible properly. To make the word properly visible perspective transform method is used.

#### Implementation of Perspective Transform

To make this system tilt invariant Perspective Transform plays an important role. In the transformed image the letters are **not** slanted and straight. This algorithm is very useful for OCR.

Initially the contour for the highlighted word is found. For perspective transform, we need to define the region of interest which is in the form of rectangle. The coordinates of the vertices of rectangle are such that the top-left point have the smallest (x+y) sum, the bottom right have the largest (x+y) sum, the top-right have smallest (x-y) difference and the bottom-left has largest (x-y) difference. These points are then placed in consistent order. The height and width of the rectangle enclosing the highlighted word can be determined using the above obtained vertices. The first point is (0, 0) in the list of points it indicates the top-left corner. The second point is top-right corner given by (maxWidth - 1, 0), (maxWidth - 1, maxHeight - 1) gives the bottom-right corner and (0, maxHeight - 1) gives the bottom-left corner. In a consistent ordering representation these points are defined.

Top-down view of the image is obtained using cv2.getPerspectiveTransform function. It requires two arguments rect and dst. The rect is the list of four regions of interested points in the original image and dst is list of transformed points. The cv2.getPerspectiveTransform function returns the actual transformation matrix M. The transformation matrix is applied in cv2.warpPerspective function. The transform matrix M, image, height and width of output image pass in to cv2.warpPerspective function resulted into warped image, which is our top-down view. Figure 5 shows steps of making tilt invariant.

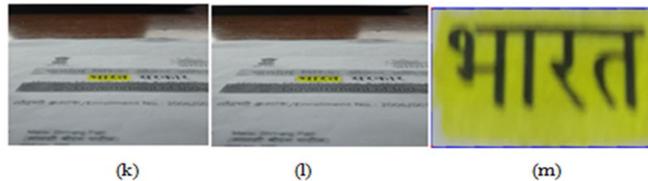


Figure5. (k) Tilted Image, (l) ROI image shown by rectangle, (m) Warped Image

### D. Illumination Invariant

To make this system illumination invariant Sauvola thresholding method is used.

#### Sauvola thresholding

Sauvola thresholding is a local thresholding technique. This technique is useful for text recognition where the background of images is not uniform.[7] In this method thresholds are calculated for every pixel by using formula which is mentioned below. The formula contains the mean and standard deviation of the local neighborhood which is defined by a window centered around the pixel. The local thresholding value will be calculated by the following equation:

$$T(x, y) = m(x, y) \cdot \left( 1 - k \cdot \left( 1 - \frac{s(x, y)}{R} \right) \right)$$

Where  $k$  is a constant equal to 0.5, and  $R$  denotes the dynamic range of the standard deviation  $s$  (defined as  $R = 128$  for a grayscale documents)

#### Algorithm:

input\_image

def\_mean\_std(image[ndarray(N, M)], int(window\_size))

{

$m$ =mean of each pixel of image

$s$ =standard deviation of each pixel of image

returns: $m, s$

}

def\_mean\_std (image[ndarray(N, M)], int window\_size,  $k$ =(float),  $r$ =None )

{  $T(x, y) = m(x, y) \cdot \left( 1 - k \cdot \left( 1 - \frac{s(x, y)}{R} \right) \right)$

returns: $T$ : [ndarray(N, M)]

}

Above function is used by Sauvola threshold, in which mean and standard deviation of each pixel of an image has been calculated and return by using neighborhood. Here, neighborhood is defined by rectangular window having size  $w*w$ . Where,  $window\_size(w)$  should be odd integer value such as (3, 5, 7, . . . .). Here, Parameter  $window\_size$  determines the size of the window that contains the surrounding pixels. Here, Sauvola thresholding is applied to an array, threshold value  $T$  is calculated using the formula given in algorithm. Where,  $m(x, y)$  is mean of pixel  $(x, y)$ ,  $s(x, y)$  is standard deviation of pixel  $(x, y)$ ,  $k$  is used to weights the effect of standard deviation,  $R$  is maximum standard deviation of grayscale image. This algorithm is used to compensate illumination effects of the image even if the image is captured in different light variations, this Sauvola threshold preserved information contained in an image. Figure 6. has two images, image (n) is the image having illumination effect and image (o) obtained by applying Sauvola thresholding which is very useful for OCR system to recognize text correctly.

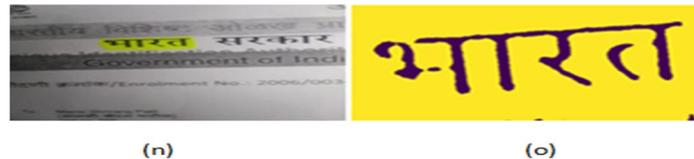


Figure6.(n) Image having illumination effect, (o) Sauvola Threshold image

### E. Text Recognition

Text recognition is the most important task of any OCR system, there are various OCR systems are available but they are not capable to produce correct output if there is a variation with respect to rotation, tilt and illumination. So aim of this project to make a robust system where variations with respect to rotation, tilt and illumination are allowed. In this work main focus is on these three aspects.

This text recognition system is implemented using Google API called Tesseract which supports more than 110 languages[13], where Long Short Term Memory neural network is used to train text file. It is used to convert image into text. It has 98% accuracy but when there are variations found in rotation, tilt effects, light effects its accuracy starts decreasing. So, we tried to overcome this problems using PCA to make system rotation invariant, perspective transform to make system tilt invariant and Sauvola thresholding to make system illumination invariant. So recognition rate get increases above 98%.

### F. Extraction of Best match

The goal of this work is to make robust OCR system which recognizes the word even if it is distorted, word is misspelled or some characters in the words are deleted. It should be recognized in its correct form and it is done by finding best match to the infected word. For this, the list of words is stored in text file. The word obtained from previous step is search in that text file, and if there is a match found for that particular word, that best match will be treated as a recognized text. This will increase the accuracy of our system.

To find out best match for the detected word, Levenshtein distance method is used. The Levenshtein distance [14] is a string distance measurement technique. It is used for measuring the difference between two sequences of string. In casual way, the Levenshtein distance between two strings is the minimum number of single-character edits i.e. insertions, deletions or substitutions which are required to change one string into the other. This Levenshtein edit distance method would help us in matching a word or string in its infected form with its original form.

The Levenshtein edit distance method is implemented in following order

- Minimum length of the two words
- Actual Levenshtein edit distance between the words
- Length of subset string match, starting from the first letter

In this project Levenshtein distance method is used to find best match to the recognized Marathi word from the Marathi keywords to increase the accuracy. The keywords list is already stored in the text file. The recognized words found in infected form it will get correct by using Levenshtein distance edit method as shown in **Error!**

**Reference source not found.**

Mathematically, the Levenshtein distance between two strings  $a, b$  is given by  $lev_{(a,b)}$

$$lev_{(a,b)} = \begin{cases} \max(i,j) & \text{if } \min(i,j) = 0 \\ \min \begin{cases} lev_{(a,b)} = (i-1, j) + 1 \\ lev_{(a,b)} = (i, j-1) + 1 \\ lev_{(a,b)} = (i-1, j-1) + 1_{(a_i \neq b_j)} \end{cases} & \text{otherwise} \end{cases}$$

TABLE I. LEVENSTEIN EDIT DISTANCE OBSERVATION

Incorrect Word	Correct Word
अशुद	अशुद्धी
विद्रयता	विद्रव्यता
नैसरिक	नैसवगिक
अनधाय	अन्नधान्य

Where  $1_{(a \neq b)}$  is the indicator function equal to 0 when  $a_i = b_j$  and equal to 1 otherwise, and  $lev_{a,b}(i, j)$  is the distance between the first  $i$  characters of  $a$  and the first  $j$  characters of  $b$ .

Note that the first element in the minimum corresponds to deletion from ( $a$  to  $b$ ), the second to insertion and the third to match or mismatch, depending on whether the respective symbols are the same.

## VI. PRACTICAL RESULTS AND ANALYSIS

In this section the current result is presented. Below figure show the output of image containing highlighted Marathi printed text 'भारत'. System becomes rotation invariant by implementing PCA on correct dataset. Even if image is rotated during scanning or capturing the system maintains its accuracy. In this work if the recognized word is sometimes infected, Levenshtein edit distance method is used to extract word which is the best match to the infected word from list which is stored in text file or Marathi dictionary. Implementation of Perspective Transform makes the system tilt invariant. Also the effect of uneven illumination is removed using the Sauvola algorithm.

The Perspective Transform and Sauvola Algorithm work efficiently and give good result. The practical results of each stage are shown in following figures. Figure7 shows rotation invariant result, Figure8 shows tilt invariant result and Figure9 shows illumination invariant result. The final recognized word is shown by Figure10.

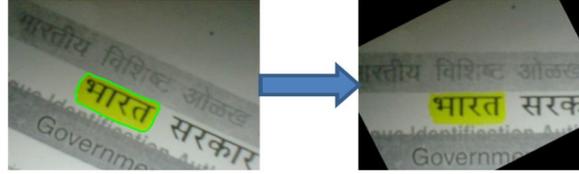


Figure 7. Rotation Invariant Result

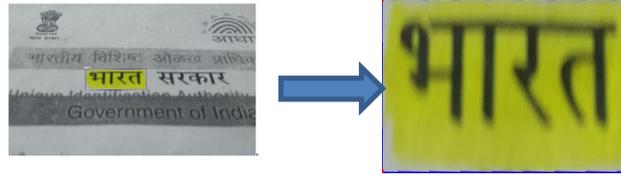


Figure 8. Tilt Invariant Result

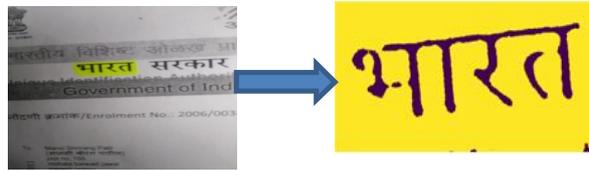


Figure 9. Illumination Invariant Result



Fig.10. Recognized Marathi Text

The experiment is done on 100 images. The experimental analysis shows that the proposed method work fine with long word i.e. word having more than two letters it gives 98% accuracy, the accuracy get reduced due to illumination effects on image.

## VII. CONCLUSION

In the context of the current project we are planning to use the character recognition system for knowledge search engine where users are school children, for whom handling complicated Devanagari keyboard might be difficult. For the children, transliteration facility to provide input Marathi words using English keyboard is difficult. So, we allow user to enter the search query by the captured image in which region of interest is highlighted by marker so that user can acquire more information through the knowledge search engine. We use the character recognition system to recognize the input and convert it into digital form and pass it on to our knowledge search Engine. This feature would enable the users to enter search queries in an easy and user friendly manner. The developed character recognition system has several standalone applications as well, such as digitization of documents, automating several systems in which ability to recognize the text/numbers play a crucial role (e.g. recognizing the amounts written on checks, recognizing the addresses written on the envelopes, recognizing names, addresses, phone numbers written on forms etc.), to list a few. The underlying algorithms and techniques which we aim at developing would be applicable to all these applications in general. This approach can be used in multilingual character recognition as well.

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# Dental Biometrics Segmentation on Panoramic X-Ray Images using Computational Intelligence Approach

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**Abstract**—Dental Biometric is a new field of study in the sector of biometrics identification. This technique can be sometimes used instead of the usual fingerprint biometric identification. In most of the cases, Dental Biometric credentials come handy to analyze the details of a dead person where, the Dental Biometrics of the person before death and the person after their death could potentially explain various reasons for their death and could justify their identity after death. Neural Networks have the potential to learn about anything using their complex construction structure. Here, x-ray copies of the dental teeth structure of a potential individual are given or fed to the network and the neural network with the help of an object detection platform such as OpenCV2 detects the teeth structure and can visualize the teeth structure with x-ray of that individual alone. As the neural is now able to see the teeth, it can learn a lot of crucial details about it from the picture it can understand. The interpretation about the teeth contours and the number of teeth is made along the way. The proposed methodology has better accuracy than the fuzzy clustering relevant methods. Also Suggested to use the appropriate values of parameters that should be opted for the algorithm.

**Index Terms**— Dental Biometric, UNet, OpenCV2, image processing.

## I. INTRODUCTION

As there is a greater availability of medical digital data, expanding processing power and advances in artificial intelligence, computer-aided diagnosis (CAD) has made tremendous progress during the previous two decades. CAD systems that aid radiologists, physicians in decision-making are used to solve a variety of medical issues, notably breast and colon cancer identification, lung disease classification, and brain lesion identification. Digital radiography's growing popularity encourages more research in the field. Radiographic image processing has now become a major issue of automation in dentistry, as radiographic information is a vital aspect of diagnosis of dental health monitoring, and treatment planning. Several investigations are done in the last decade to address the problem of teeth detection. There have been several suggested pixel-level techniques for tooth detection that were based on classic computer vision techniques like thresholding, histogram equalization etc. With enough recall (sensitivity) one can help the computer to be able to distinguish the teeth. On CT images too, various techniques have been utilized and a manual method to place coordinates surrounding each tooth has been developed.

### A. Teeth Analysis

There are basically two processes for tooth numbering: segmentation and classification. The width to height teeth ratio and crown size extract features from segmented teeth, whereas the wavelet Fourier descriptor is used to get the geometry of the teeth. The models like Support vector machines (SVMs), sequential based algorithms, and feedforward neural networks (NNs) are used to characterize teeth.

### B. Convolutional Neural Networks (CNN)

CNNs are used in this study for the purpose of tooth detection and tooth numbering. CNNs are a common type of deep feedforward neural network design, and they're frequently used for image recognition. CNNs are most popular NN for the past two decades, but the real revolution in deep learning came after the design of AlexNet architecture. As this architecture significantly outperformed other teams in the ImageNet Visual Recognition Competition challenge. Since then, CNNs have seen rapid development. CNNs are currently used in a wide range of applications and represent a cutting-edge solution to various computer vision challenges.

## II. DATASET

From January 2016 to March 2017, 1574, panoramic samples of radiographs is randomly selected from the X-ray's provided by Reutov Stomatological Clinic, Russia. The database doesn't not include any other features like gender, age, time etc. The tooth detection and identification models were trained in the training group, while the software's performance was verified in the testing group. The XG-3 - Sirona Orthophos X-ray machine was used to capture all panoramic radiographs (Sirona Dental Systems GmbH, Bensheim, Germany). Ground truth comments for the photographs were provided by five radiology professionals with varied levels of experience. Experts are instructed to draw bounding boxes around all teeth with high-resolution panoramic radiographs. Due to the skewness in the data collection, complete anonymized data is used. The Steklov Institute of Mathematics in St. Petersburg, Russia, made a formal decision that the use of radiographic material for this work was exempt from ethics committee or IRB approval.

## III. SYSTEM ANALYSIS

The technique demonstrated here uses panoramic radiographs as an input. To identify the borders of the teeth, the teeth detection module examines the radiograph. It is then cropped using the anticipated boundary boxes from the panoramic radiograph. The model classifies each cropped region using the FDI, then heuristics is used to produce the final teeth numbers. The system outputs the bounding box coordinates and matching teeth numbers for each detected tooth on the image. The diagram shows the entire architecture and workflow.

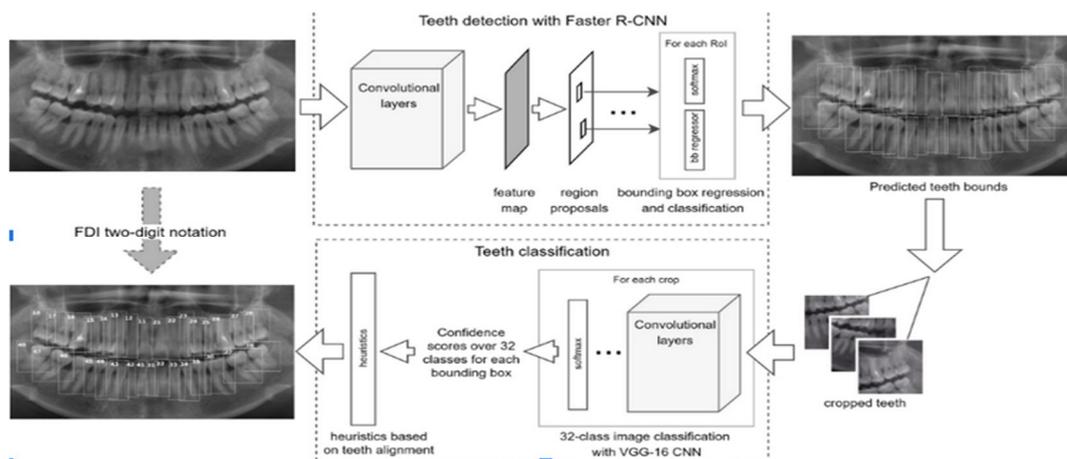


Figure.1: Process of Teeth Identification System

## IV. MODELS

### A. Deep Learning Models

The suggested approach makes use of deep learning techniques. Deep learning enables a computer programme to extract and learn attributes from the input data to understand previously unheard examples. Deep learning

techniques stand out because they can learn directly from raw data input, such as the pixels in pictures, without the requirement for manual feature engineering. [1] One of the most popular deep learning techniques for image recognition is deep CNNs. To efficiently represent and learn hierarchical features at various levels of abstraction, CNN designs take advantage of unique properties of image input information, such as spatial relationships between objects; see LeCun et al. for a thorough description of deep learning techniques.

#### *B. UNET Model Neural Network*

The encoder and decoder were the two essential parts of the introduced technology. The covenant comprises various first in the encoder, followed by the pooling layers. It is used to extract the image's factors. To enable translation, the second portion decoder utilizes transposed convolution. It's an F.C joined layers network yet again.

#### *C. Teeth Detection*

The Faster R-CNN model is used in the teeth detecting method. 15 Faster R-CNN arose from the A fast R-CNN infrastructure that used the R-CNN methodology (Region-based CNN). It is challenging to find the areas of interest through object detection. R-CNN offered a unified strategy for both regions of interest proposal generation and object localization. Using Fast R-CNN, which streamlined the pipeline and optimized computation, improved R-performance for CNNs. Finally, a CNN-based method that was much more sophisticated was presented by Faster R-CNN. The R-CNN is made up of two parts: the object detector and the regional proposal network (RPN). RPN proposes region of interest i.e teeth in this case. The object detector makes use of these recommendations to better localize and categories the objects. Both modules produce feature maps, which are condensed versions of the source image, by using the CNN convolution layers that lie beneath. In contrast to standard computer vision algorithms, which demand hand-engineering of the features, the features are derived during the training phase.

By moving the window over the feature map and creating potential bounding boxes called "anchors" at each window point, RPN creates regional suggestions. The RPN employs the specific regressor to narrow the bounding box and determines the likelihood that each anchor will contain an object or a background. The top N-ranked region ideas are then sent to the object detection network.[2] The object detector generates the final bounding box coordinates for a two-class detection task after refining the class value of a region to determine whether it is a tooth or a background. Model weights that had been pre-trained on the ImageNet data set were used to create the fundamental CNN. All of CNN's layers were adjusted because the data set is sizable enough and differs enough from ImageNet. With exponential decay following, the learning rate was initially set at 0.001.

#### *D. Teeth Numbering*

The teeth are numbered by a convolutional architecture called VGG-16. The model was taught to estimate the number of teeth using the two-digit notation. This module categorizes the teeth using the output from the teeth detection module. Based on the anticipated boundary bounds, it crops the teeth. Each clipped image is then given a two-digit tooth number by the VGG-16 CNN. The classifier begins with a set of confidence ratings for each of the 32 classes, estimating the likelihood that each bounding box will contain one of the 32 potential tooth numbers. The classified data is again processed by custom heuristic algorithm to enhance prediction results. This process is carried out so that each portion of the tooth appear only once.

Like how they were used for teeth detection, the weights learned on ImageNet dataset is then used to initialize the CNN model. Based on annotations X-rays, cropped images were created for training. [4] The cropping process was modified to include nearby structures, which increased the CNN's prediction quality by providing context. To further increase the variety of the data set, the images were improved. 64 batches were used to train the CNN. The Keras library and TensorFlow serve as the backend for the dental numbering module, which is developed in Python.

## V. RESULTS AND DISCUSSION

In the figure:2, a single input x-ray image from a large amount of input x-ray images loaded into the program has been displayed. This image is not the raw version of the input but is the processed clear image of the input given to the program.

In the Figure:3, another image of the same input image displayed in the figure.1 is displayed but with a renewed sense of perceptiveness. Here, the input image is filled with yellow color and through this one can understand that the program using yolo successfully detects the teeth in the x-ray image loaded to the program.

<matplotlib.image.AxesImage at 0x7f9e38ef19a0>

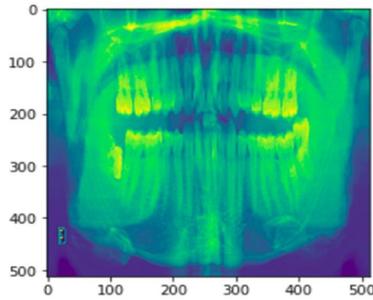


Figure.2: Clear Image of Input X-ray

<matplotlib.image.AxesImage at 0x7f9e37613220>

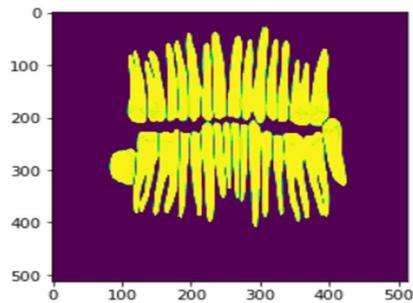


Figure.3: Another view of same image computer visionated

conv2d_14 (Conv2D)	(None, 256, 256, 64)	110656	concatenate_2[0][0]
dropout_7 (Dropout)	(None, 256, 256, 64)	0	conv2d_14[0][0]
conv2d_15 (Conv2D)	(None, 256, 256, 64)	36928	dropout_7[0][0]
batch_normalization_7 (BatchNor	(None, 256, 256, 64)	256	conv2d_15[0][0]
conv2d_transpose_3 (Conv2DTrans	(None, 512, 512, 64)	65600	batch_normalization_7[0][0]
concatenate_3 (Concatenate)	(None, 512, 512, 96)	0	conv2d_transpose_3[0][0]
			conv2d_1[0][0]
conv2d_16 (Conv2D)	(None, 512, 512, 32)	27680	concatenate_3[0][0]
dropout_8 (Dropout)	(None, 512, 512, 32)	0	conv2d_16[0][0]
conv2d_17 (Conv2D)	(None, 512, 512, 32)	9248	dropout_8[0][0]
conv2d_18 (Conv2D)	(None, 512, 512, 1)	33	conv2d_17[0][0]
-----			
Total params: 13,423,361			
Trainable params: 13,420,481			
Non-trainable params: 2,880			

Figure.4: UNet model operations

The above figure.4 shows the operations of the UNet Model that was implemented by the program. The UNet model primarily makes sure that the image detected by the yolo program already is understood further. The images loaded to the model are expected in the dimensions (512,512) so that the model is implemented better.

**0.955887187610973**

Figure.5: F1\_Score of the Model

In the figure.5, the f1 score of the UNet model implemented previously has been given. The score implies that the model is very good in the detection of the teeth x-ray images given to it. It can also be said that the model scored a 95% in the f1\_score calculated for this model.

In the figure.6, the successfully predicted mask or the teeth of the test images by the model fitted has been displayed. The model in the program now understands or reads from the x-ray images provided containing the teeth images and the proof that it detects the teeth successfully is implied by this figure.[5].

In the figure.7, a contoured x-ray image of the test images given to the model has been displayed. Contours are used here as a change in the view of the x-ray image. Here, only the boundary of the teeth detected has been marked providing a new perceptive. Like the previous image, even this figure is evidence of a proof that the model can detect the teeth in the x-ray image.

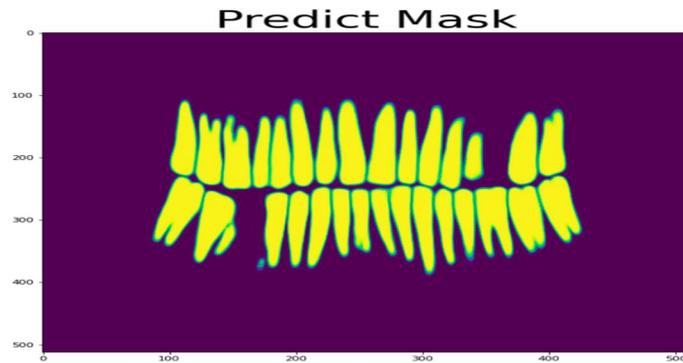


Figure.6: Successful predicted mask

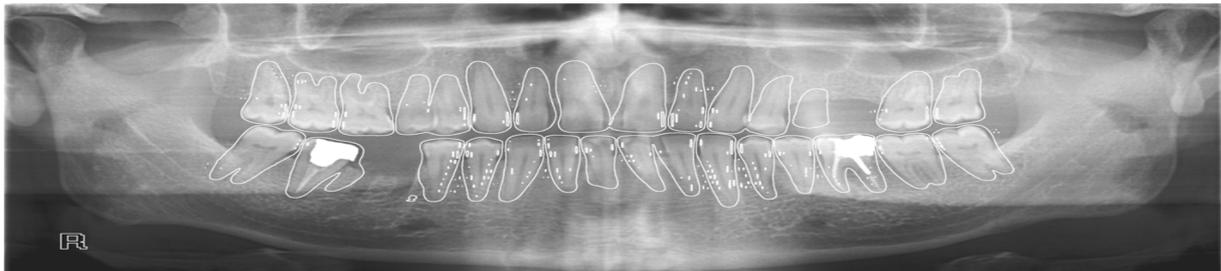


Figure.7: Contoured X-ray image

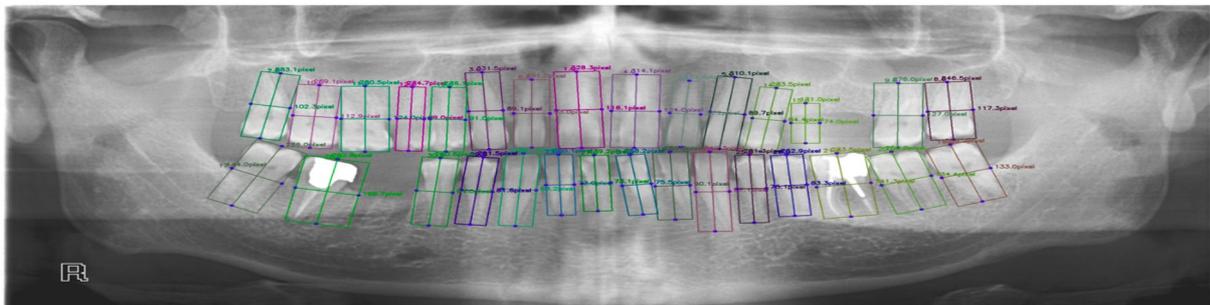


Figure.8: Detailed Detection of the teeth

In the figure.8, a detailed detection view of the teeth x-ray image given to the model as a test image is displayed. The pixel details of every tooth detected by the model has been displayed next to it. This can significantly help technicians as these details have been computed easily by the model now that it is detecting and understanding the x-ray image of the teeth given to it.

## 30 Teeth Count

Figure.9: Total teeth detected

In this figure, the total teeth that have been detected by the model so far in that image given to it as a test x-ray image has been given. Note that usually people can have about 28 to about 32 teeth in case of when some or all wisdom teeth have sprouted in that individual. In some cases, people may have less teeth as it would have fallen out. All these cases make it more important to know the number of the teeth in a person through the x-ray image provided.

## VI. CONCLUSION

The Dental Biometric System's UNET model-based design is particularly effective at identifying the biometrics of the teeth. Panoramic radiographs can be a very effective tool to support patients' diagnosis and to define a

treatment plan to them. The use of segmentation models to detect teeth and their exact limits can be of paramount importance for eliminating a task that is quite susceptible to human failure. Biometric traits can be used for authentication and personal security. [3,6]It is possible to collect even the pixel details and measurements of the teeth shown in the panoramic x-ray photographs. These findings are extremely helpful for forensic and dental research. Based on the F1-score, this model provides 95% accuracy. By ensuring that the UNET model effectively detects additional information about the teeth, such as their type and any surgical identification in them, this study can be further refined. The work's results are acceptable and offer directions for a more superior and efficient dental segmentation procedure. The results obtained in this work are satisfactory and present paths for a better and more effective dental segmentation process.

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# Credit Risk Analysis of Loans using Social media Information

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**Abstract**—The core business of the banking sector is sanctioning loans to different individuals and industries. The credit risk analysis of these elements gives guarantee about regular repayment of loan. As a result, healthy business firms repay their loan regularly thereby increasing good return on investment to bank. It is possible to increase the accuracy of credit risk calculation using current technology like Big Data and different analytical tools. In our approach, along with traditional parameters like profit/loss, financial history, financial status of directors, cash flow, we also included non-formatted data like news and informal information for analysis. This information can be included as positive, negative and regular. This information can be collected using Big Data techniques from websites, news websites, government agencies and external agencies. This is used to construct the credit scoring models and to predict the borrower's creditworthiness and default risk. Looking at the uncertainty associated with judging the credit of borrower, it is necessary to add new tools and methods to get maximum correctness. Our approach to use Big Data analysis tools to input informal sources available on internet, will increase the accuracy of finding good borrower for banks.

**Index Terms**— Financial Analysis, Credit risk, Big Data, Data mining.

## I. INTRODUCTION

The banking industry deals with capital flow and risk associated with it. The overall performance and profit of the bank depends upon the repayment of the loans distributed to different sectors. Bank distributes loans to individual and other businesses. An individual's credit can be calculated based on his income, tax paid, saving and assets. But for business firms it is a complicated process. Many banks are now using automated tools for risk calculation and credit determination. These tools take into consideration of profit/loss, sales history, and financial status of promoters, cash flow and other parameters. From these parameters, bank calculate the credit level of the firm. The bank's success greatly depends upon its decision of credit to firm. Banks are also exposed to different kinds of risk, but the most challenging risk is credit risk. The performance of loan contracts affects profitability and stability of a bank growth and development. The extent to which a borrower uses the credit facility efficiently will greatly impact the firm's repayment ability and performance, which in turn affects the lending institutions. Credit risk is the loss of bank's profit, since the customer does not adhere to his or her loan refund commitment. Financial institutions are facing the problem of loan proposals because of continuous changes in the business environment, credit regulations, marketing strategies and the competition in business

itself. The objective of credit scoring is to help credit providers to quantify and manage the financial risk involved in providing credit so that they can make better lending decisions quickly and more objectively. Various statistical and machine-learning techniques have been used to model company credit and bond ratings in the past. The present analysis depends upon the statistical figure gathered from various sources of business. Sanctioning of loans requires the use of huge and various data along with substantial processing time to process large number of variables. The development of Big Data technology has encouraged the researcher to add non statistical information as one of the parameters for credit risk analysis and default prediction. Today credit risk is concern by various stakeholders such as institutions, customers, regulatory bodies, depositors and investors. A lack of attention to changes in economic or other circumstances of business that can lead to a deterioration in the credit standing of a business will lead to bank's sustainability. Credit risk is interest topic for finance communities, researchers and banking sector.

The objective of this paper is to determine the utilization of Big Data techniques to develop a valid and useful mechanism for analyzing credit risk and estimating the allowance for credit default. The statistical data collected by bank is additionally supported by the data collected from social sites. This will help the loan distribution with less risk of failure. The loan applicant has been classified into two categories: good credit and bad credit. A good credit business is likely to repay the debt whereas a bad credit business is likely to default. An analysis of credit risk can provide indirectly an indication of whether bank's credit granting policies are proper.

## II. RELATED WORK

Kwaku D. Kessey in his paper discussed the issue of increase in nonperforming assets in the banking sector of Ghana.[1] the author discusses the challenges of risk management in the changing scenario of technology and automation. The risk to the banking sector due to poor risk calculation using traditional methods, has resulted in many bad debts. The study is limited to Ghana but it reveals the changing evaluation process is need of time for banking sector. Proper portfolio design for credit risk analysis is highlighted in this paper. The use of the latest technology in risk calculation is underlined in this paper. The primary data required is taken from the bank and secondary data is collected from firms' website and annual reports. Trend analysis is applied for previous years to understand the company growth.

Hamid EslamiNosratabadi et al.used different data mining tools for credit risk analysis of loans.[2]. Different data mining techniques like KNN, decision tree and others are applied to loan parameters using Clementine data mining software. After applying data mining tools, loans are classified into three groups: bad, medium and good. A fuzzy expert system is proposed for better risk prediction. Authors propose the fuzzification of risk classes for analysis of loans. Asrin Karimin in [3] develops similar techniques.

Ghatge and Halkarnikar, in this paper have proposed automated analysis of bank parameters for finding credit risk in sanctioning loans to firms.[4]. They proposed artificial neural network technique for credit risk analysis. The ANN technique is advance data mining tool which has self-learning capability. The parameters selected for credit risk are automatically weighted according to the training set. The work in this paper is further extended to incorporate non formatted data collected from websites and social media for calculation of credit risk. Khaled Alzeaiden also proposes the artificial neural network approach for credit risk analysis in his article.[9].

Sudhakar M et al. propose the use of dataming in the field of banking for prediction of credit risk for loans. [6]. In this paper credit risk is calculated using famous Weka tool of data mining. The decision tree technique is used for classification and predication of customers. Two stages are implemented for analysis. CIBIL credit score maintained by external organization is considered for risk calculation. In first step tree is built and pruning is done. In second stage prediction of loan is done for risk stage. Loans are recommended for selection or rejection of proposal. Sudhamathy G applies similar approach in his paper for risk prediction.[7] The tool used for tree development is R. He has used this approach of developing tree structure to predict possible risk in sanctioning individual loans.[10].

Somayeh Moradi et al. proposed dynamic model for credit analysis which is monthly trained for prediction.[11]. They also added fluctuating politico-economic factors for development of dynamic model. These factors work along with financial parameters set by bank, making robust prediction possible. For model they have considered the Iranian bank system. Fuzzy rules are formed to take into consideration of all internal and external factors.

The statistical methods are considered in many papers we referred. [3][5][8]. These papers provided valuable parameters used for credit risk analysis. Looking to the present state of credit risk analysis, data mining techniques are becoming popular for analysis. Salihu, Armend et al. provided a comprehensive survey of different data mining algorithms used for credit analysis. [12] In this paper advantage of use of modern tools is

highlighted by author. The data generated by social; site is unformatted and is termed as Big Data. The BigData tools are currently used for analysis of data generated by social sites and interne for credit risk analysis. Wenshuai Wu described the advantage of using Big data analysis for credit risk calculation. [13] The complex methods and parameters involved in risk calculation always need advance tools to incorporate in this process. Author has focused on modern tools and future trends in this complex process of credit risk calculation. The volume of data is huge; hence independent research is carried out for the effect of social information on risk calculation in our proposed system. The social site's information and news provided are valuable information that can provide the financial state of firms and their business domain. If this information is utilised for the calculation of credit risk, a bank may avoid a possible loss to its assets.

### III. DATA COLLECTION AND METHODOLOGY

#### A. *Methods of Data Collection*

Financial analysis of a potential borrower begins with an understanding of the firm, its business, sales figure, its key risks and success factors. The financial ratios are calculated from these values. Some qualitative variables are also derived from available data. For the development of our proposed model, data is collected from a nationalized bank with restricted area of commercial loans. These loans are disbursed to various firms in past five years. Their performance is known during this period. The decision of loan sanction is based on a perception of sanctioning persons. These authorities check the fact presented to them at the time of loan application. There is no other tool is used to collect the non- informal information about the business domain except the personal interview at the time of sanctioning of the loan. The data collected from the bank is as under:

- 1) History/Application of the Borrower.
- 2) Financial Statements/Balance sheet for 3 years before loan sanctioning.
- 3) Account Statements for each financial year.

#### B. *Data Collection from Social sites*

The data required for analysis is collected from other sites also. The following sources are used with a filter to specific firm name and period.

- CIBIL site.
- Web site of the firm.
- Facebook responses.
- Twitter responses.
- News site of financial newspapers.

All the information is filtered through Big data tools limited to a given firm and period. The data collected from these sources is non-structured type. So needs more complicated processing to bring it into a useful format. Information collected from these sources is processed using natural language processing and clustering algorithms for keywords. Based on keywords in contents of sites are graded as positive, negative and normal. The status and quantity of these grades will influence the final decision based on the weight assigned to these parameters. The final decision about the status of loan is calculated by adding these social site parameters with regular class decided by facts presented in the bank.

#### C. *Probable Methods of Data Analysis*

Normal parameters are derived by the bank from the previous balance sheet. The analysis of the balance sheet of the firm is done on the following risk factors:

#### D. *Credit Scoring*

Credit scoring is defined as a statistical method that is used to predict the probability that whether a loan applicant will default or become delinquent. This helps to determine the amount of credit that should be granted to a borrower. Credit scoring can also be defined as a systematic method for evaluating credit risk that provides a consistent analysis of the factors that have been determined to cause or affect the level of risk .The objective of credit scoring is to help credit providers to quantify and manage the financial risk involved in providing credit so that they can make better lending decisions quickly. [4] Credit scoring helps to increase consistency of the loan application process and allows the automation of the lending process. Based on the consumer's credit scores, the financial institutions are also able to determine the credit limits to be set for the business firms. For the calculation of credit score, the parameters discussed above are considered with different weights assigned by the bank. The pattern of loan repayment of previous or existing loans is also considered and called as behavioral

TABLE I. TRADITIONAL RISK FACTOR ANALYSIS

SR. NO.	RISK FACTORS	VARIABLES	DESCRIPTION
1	Leverage and Solvency Indicators	Capital	Funds raised by the firm/ borrower
		Net worth	Capital + reserves
		Debt Equity ratio	It is a proportion between firms total debt and total equity
2	Liquidity Indicators	Current Liabilities	Creditors, Loans to be repaid within one year, provisions of taxes and expenses.
		Current Assets	Cash in hand and bank balances, Inventory of the firm.
		Current Ratio	It measures the proportion of a party's current assets to its current liabilities and thus gives a measure of the short term liquidity of the firm.
3	Profitability Indicators	Sales	Sale of the Goods by firm
		Profit	Total sales minus Total expenses.
		Net Profit	Profit after depreciation of Building/machinery and furniture.
		Profit to sales ratio	It is the percentage of profit to total sales of the year.

scoring. The deductive credit scoring system awards points (weights) to particular relevant attributes of the credit parameters. The weightage value of attributes is aggregated to a total score. The relevant attributes and their weights are determined by the credit decision-makers based on their experiences. The cut-off for the score is considered by bank for rejection of the loan or determining risk associated with the credit sanctioned.

#### IV. PROPOSED SYSTEM

The proposed system is based on present parameters and parameters collected from internet. The data mining techniques are used to find the credit score using financial and internal parameters of firm, while the Big data tools are used to capture information from social sites and web sites. Web sites used by Big data tools are government sites and company web sites. The change in government rules or change in business patterns are detected which may affect the profitability of firm. The specific key words based on business of firm is selected to filter the information from social sites. The collected information is classified as positive, negative and normal. The accumulated score is again normalised by weight assign to them by bank. Both blocks give accumulated credit scores used to decide the firm's credit risk. The same system can be used for predicting credit default based on current parameters collected from both the stages. The details are shown in figure 1.

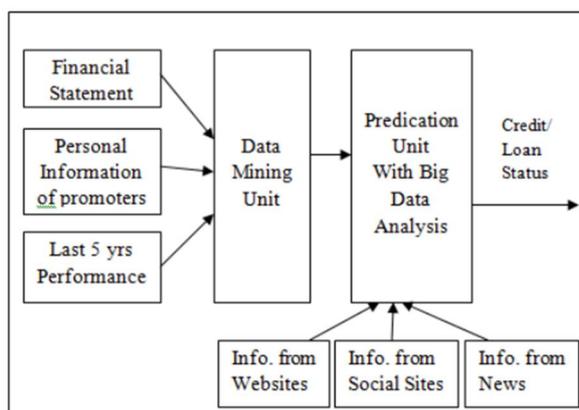


Figure 1. The architecture of Proposed System

Process flow diagram is shown in figure 2. Basic steps of data mining are not shown in the figure, but data cleansing and attribute pruning is necessary for proper application of data mining for prediction. Different

algorithms can be implemented here. We used decision tree technique for analysis of regular parameters. Similarly proper key words suitable to firms business are selected so that big data tools used for filtering data from social sites can give correct score. The Natural Language Toolkit is used for text tokenization of data collected form social site. Key words are separated and different clustering techniques are applied to classify the information into positive, negative and normal. These classes are provided different weights by bank depending upon the policies and processes adopted by bank. So total credit score is calculated from the two stages presented to decide on loans. Our system is capable of indicating the status of loan after it is also sanctioned. As it is continuously monitor the internet for information. Any change in domain policies, and company business news are picked up by the prosed system to predict the sanctioned loan condition in future.

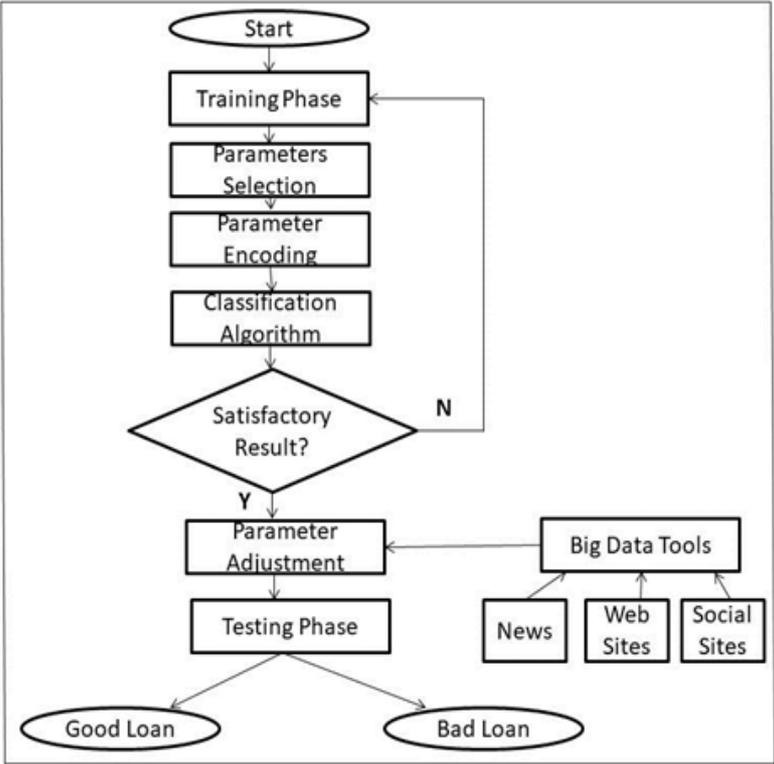


Figure 2. Flowchart of Proposed System

IV. THE IMPLEMENTATION AND RESULT

The dataset collected from the nationalized bank is considered as an input to the system. It contains 43 instances; with 30 cases of sanctioned loan proposals and 13 cases of rejected loan proposals. The database consist of attributes with each case is characterized by 13 decision attributes. Out of these, 10 were numerical and 3 categorical. From the given dataset 14 inputs are used as a training sample and remaining 29 are used as a testing samples.

For first step of data mining, decision tree classification C4.5, is used for classification of loan proposals based on their credit score. In the second stage social site information around the firms name is collected using HADOOP map reduce. The combined credit score is used to classify loan proposals in either good or bad credit. The results are compared with result using the existing system as shown in table 2. The proposed system shows more correct results as compared to the existing system.

TABLE II. COMPARISON OF RESULTS USING THE CONFUSION MATRIX

$\begin{bmatrix} 14 & 6 \\ 6 & 3 \end{bmatrix}$	$\begin{bmatrix} 18 & 2 \\ 4 & 5 \end{bmatrix}$
Existing System	Proposed System

## V. CONCLUSIONS

Credit risk is major risk parameter in the banking sector. Wrong calculation of credit score leads to credit defaulters. Irregular repayment leads to poor health of bank. This affects the interest of stock holders of the financial sector. For a good and healthy economy of the country, it is essential to have a strong banking sector. It is expected that banks should give loans by proper analysis of the firm's financial health. In this paper we have proposed the system which relies on the present automatic system using data mining techniques and adding social site information. The system takes into account non informal and non-structured data for analysis. This data works as sensor for detecting the health of firm and its business sector. The bank can decide using this system the credit limit, interest rate and repayment capacity of the firm. The implementation using decision tree and Hadoop shows good results at the primary work carried out by us. The correctness of system can be judged by evaluating it further using different evaluation matrix. This system not only helps the bank during the sanctioning process of loans but also helps monitor the firm's capability to repay the loan during its loan period.

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# Blockchain Enabled Marksheets and Degree Certificates

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**Abstract**—The certificates and grade reports are crucial records for anyone applying for a job or seeking higher education because they act as identification verification. The traditional paper-based certificate method makes obtaining such a crucial document highly time-consuming and expensive. A trusted authority issues the digital certificate, which is a document that may be used to demonstrate authenticity. Technology development has made it possible for the practice of producing fraudulent report cards and diplomas. Document fraud and forgery have gone unreported due to a lack of anti-forgery mechanisms. E-documents use digital signatures to enable authentication, integration, and non-repudiation, however forgery is possible when the key itself is compromised. In order to prevent certificate fraud and guarantee the security, legitimacy, and secrecy of diplomas, blockchain technology is deployed. Blockchain ensures correctness and trustworthiness of information and allows for quick authentication of degree certificates.

**Index Terms**— Blockchain, Digital Signatures, Digital Markcard, E-document.

## I. INTRODUCTION

In order to demonstrate a graduate's qualifications once they successfully complete the chosen course, universities provide certificates to the graduates. The crucial records needed to apply for jobs and further education are these marksheets and degree certificates. Validation and verification of documents have grown in importance. It is important to confirm that the graduate's diploma is authentic and that the owner is the rightful owner with the appropriate authorization [1]. Traditional paper certificates need a lot of time and money. They are even susceptible to fraud brought on by blunders and forgery. Mark sheets made of paper have a long procedure, little flexibility, and are not environmentally friendly. However, the forging of certificates has increased as a result of the availability of sophisticated and affordable technologies. Both the credential bearer and the university that granted the certificate are put in danger [6] as a result of this. This study suggests a system that uses blockchain technology to digitalize both the production of degree certificates and their verification. The markcards are protected from fabrication and falsification thanks to the immutable nature of blockchain technology. [11]

More than any other invention this century, blockchain technology will significantly influence the way we live in the future. Anyone who cannot comprehend it will soon feel left behind when they awaken in a technologically advanced world that increasingly resembles magic. The development of various techniques to verify academic records such as degree markcards has confused people on which architecture is best to identify real and forged markcards. [12] As blockchain has a very interesting feature of immutability this project uses permissionless blockchain such as Ethereum as a platform to build a system that issues and validates the degree certificates [16]. Traditional paper-based degrees and mark cards are susceptible to fraud due to typos and forgeries. Markcards

made of paper have a long processing time, little flexibility, high cost, and are not environmentally friendly. Students who are seeking for jobs right after graduation, students who are going to institutions abroad with the goal of pursuing higher education, and recruiters are all having difficulty validating their marksheets because bogus marksheets and degree credentials are widely available. [13] [14] Therefore, the goal of this study is to suggest a system that makes certificate fraud impossible.

#### A. Objectives of Blockchain

1. Digitalizing mark cards and degree certificates using blockchain technology.
2. Easy to check and verify the markcards through online. Students can obtain their certificates online and submit to the recruiter during the interview process, and recruiter can validate certificate using digital mark cards platform.
3. Digitalized mark cards are free from forgery and falsification and are secured using blockchain technology.
4. Digitalizing with blockchain technology reduces time consumption and is available at low cost.
5. Digitalizing the degrees and mark cards using blockchain technology provides confidentiality, integrity, non-repudiation and authentication.

## II. RELATED WORK

The Research Paper "Paper-based Document Authenticating using Digital Signature and QR Code" by M. Warasart and P. Kuacharoen gives us brief understanding of implementing paper based document authentication. This paper presents an implementation of paper-based document authentication. The integrity of the text message and the author of the document can be verified with the use of a digital signature and QR code. This model can be either automatic or semi-automatic [1]. When the OCR is not accurate and when it requires the user to visually compare the text message on the paper and the one obtained from the QR code the model is said to be semi-automatic; however, this method does provide convenience for the user in dealing with a large amount of documents. [2]

[3] The Research paper "Using Blockchain as a tool for tracking and verification of official degrees: business model" by Oliver, Miquel; Moreno, Joan; Prieto, Gerson; Benitez, David gives the brief knowledge of verification of degree certificates from business perspective. This paper presents two financial models balancing, the price for the service is balanced between the employer and the graduate as they are main stakeholders of that service. Students demand easy to check and less cost proof of certification, employers when recruiting demand quick and trustable verification of degrees. [4] [15]

The Research paper "A Graduation Certificate Verification Model via Utilization of the Blockchain Technology" by Osman Ghazali and Omar S. Saleh provides a theoretical knowledge of blockchain technology for issuing and verification of academic certificates [6]. The fundamental idea of using blockchain for issuing and verification of academic records closes all the gaps and difficulties in existing systems. This paper provides the knowledge of hash, public/private key cryptography, digital signatures, peer-to-peer networks and proof of work. The paper explains how to uses various elements to formulate the block which is divided into two main processes, namely issuing a digitally signed academic certificate and verifying the academic certificate.[5]

[7] The Research paper "CredenceLedger: A Permissioned Blockchain for Verifiable Academic Credentials" by R. Arenas and P. Fernandez gives the knowledge of using permissioned blockchain for verifying academic records. This paper describes how permissioned Blockchain can be applied to a specific educational use case - decentralized verification of academic credentials. CredenceLedger, is a system that stores compact data proofs of digital academic credentials in Blockchain ledger that are easily verifiable for education stakeholders and interested third party organizations. [8]

[9] The Research paper "A Permissioned Blockchain-Based System for Verification of Academic Records" by Ahmed Badr, Laura Rafferty, Quassy H. Mahmoud, Khalid Elgazzar and Patrick C.K. Hun gives us the idea of implementing our system for verification of degree markcards. In permissioned blockchain the verification of academic records using hyperledger fabric is the main focus to leverage the blockchain application in education domain. Various challenges in sending and receiving the transcripts between universities and difficulties in verifying the academic records by recruiters are solved using Hyperledger fabric. [10]

## III. DESIGN OF EXPERIMENT/ MATERIAL METHODS

### A. Algorithm

Step 1: User Logged in.

- Step 2: Admin User logged in,  
 Yes, Go to Next Step.  
 No, Go to Step 9.
- Step 3: Display dashboard, View Certificate and Issue Certificate for all the students list.
- Step 4: Logout  
 Yes, end the process. Stop,  
 No, Go to next step.
- Step 5: Click on view certificate.
- Step 6: Certificate available?  
 Yes, Click on View Certificate Go to Next Step.  
 No, Click on Issue Certificate Go to Step 8.
- Step 7: Get url from Certificate Table & Prompt Display window to download certificate. Go to Step 2.
- Step 8: Update CertificateAvailable True in Database and call enroll(id,certificateHash) to update into blockchain. Go to Step 2.
- Step 9: Company User logged in.  
 Yes, Go to next step.  
 No, Go to Step 16.
- Step 10: Display dashboard, Validate Certificate for students list.
- Step 11: Logout  
 Yes, end the process. Stop,  
 No, Go to next step.
- Step 12: Click on Validate Certificate, Upload the Certificate File & find md5sum of image.
- Step 13: ImageHash == blockChainStoredHash  
 Yes, Go to Next Step.  
 No, Display Failed message Go to Step 9.
- Step 14: Display message: Validation Success & Display Profile Page.
- Step 15: Click on dashboard. Go to Step 9.
- Step 16: Logged in as Student User.
- Step 17: Logout  
 Yes, end the process. Stop,  
 No, Go to next step.
- Step 18: Request for certificate
- Step 19: Certificate Issued by University?  
 Yes, Display the profile page. Go to Next Step,  
 No, wait for the certificate to be issued.
- Step 20: Logout  
 Yes, end the process. Stop,  
 No, Go to next step.

The modules are as follows:

1. **User Interface Design:** After the user login to user interface, the first page visible is the dashboard. In the dashboard, admin user can view the certificate, Issue certificate, able to see list of students and companies. Student user can request and view his certificate, whereas company user can validate and view certificate of the candidate. In general user interface has Student List, Company List, View Certificate, Issue Certificate, Request Certificate and Validate Certificate modules. These modules are visible based on the role of each user exists the digital certificate system.
2. **Verification:** Verification has steps to verify data from database using database connector and blockchain using web3 connector. Database connectors used to update Certificate availability in User table and Certificate URL in the Certificate table. Web3 Connector used to add student details to block chain and get student details from the blockchain. The purpose of the verification is to verify whether the uploaded certificate is valid or not using the connectors.
3. **Server:** In project, firebase database is used for storing the data. As shown in figure, User table stores student and user details like name, email id, usn number etc., each user is categorized using user role column. User role 1 is set for admin and 2 & 3 is set for company & student respectively. In the project, firebase database is used for storing the data. As shown in the figure, User ta student and user details like name, email id, usn number etc., each user is categorized using user role column. User role 1 is set for admin and 2 & 3 is set for company & student respectively. Certificate table stores the data URL

details. In project, firebase database is used for storing the data. As shown in the figure, User ta student and user details like name, email id, usn number etc., each user is categorized using user role column. User role 1 is set for admin and 2 & 3 is set for company & student respectively. Certificate table stores the data url details for the image.

4. **Blockchain:** Ganache is personal blockchain for Ethereum development, which can be used to deploy contracts, develop your applications and run tests. Records are stored in terms of blocks, each Ganache is personal blockchain for Ethereum development, which can be used to deploy contracts, develop your applications and run tests. Records are stored in terms of blocks, each of the records contains usn and certificate hash.

As shown in the below Fig. 4.3, Data Flow diagram for digital certification consists of three main entity. Admin, Student/Company and Blockchain. When admin click on View Certificate button, first in the system will verify in the user table, whether certificate is available is true, if its true then certificate url will be fetched from certificate table and url will be passed to admin user for download. If certificate is not available for particular student, then issue certificate will be shown to admin user. When admin user clicks on issue certificate, is puts the image url to the certificate table and update certificate available column in user table as true. And also, push's the details to blockchain using enroll methods with USN and certificate has detail. In case of company user, whenever they click on validate user, system verifies the certificate with newly uploaded certificate hash with hash available in the block chain for that particular student. If the certificate is valid then profile information of the student is displayed. In case of student user, student will request for the certificate, and wait for certificate to be issued, once certificate is issued, he will able to view and download the certificate.

### B. Sequence Diagram

User Click on login button, validate user will be called for validatin g user email and password. To validate the user, emailed and password verified in the database, when credentials match with the database credentials user Login will be successful. And the dashboard will display list of students.

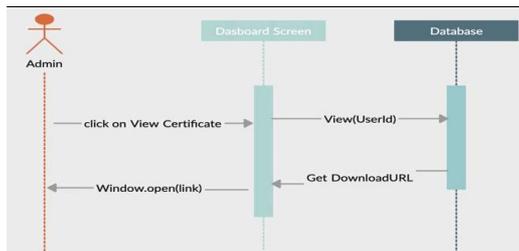


Fig. 1: Data Flow Diagram of Admin

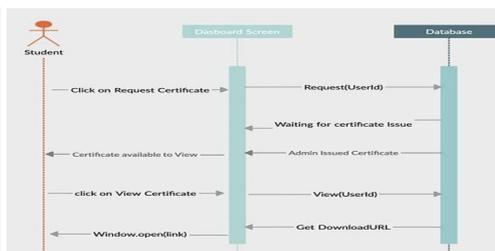


Fig. 2: Data Flow Diagram of Admin

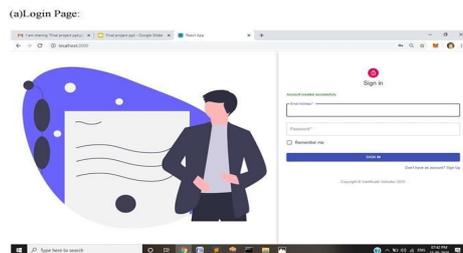


Fig. 3: Login Page

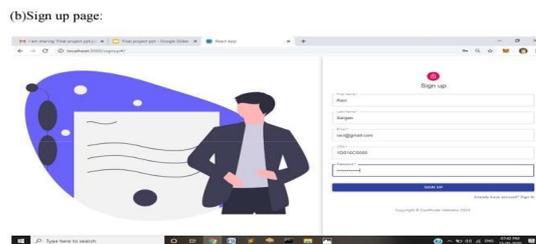


Fig 4: New User Registration

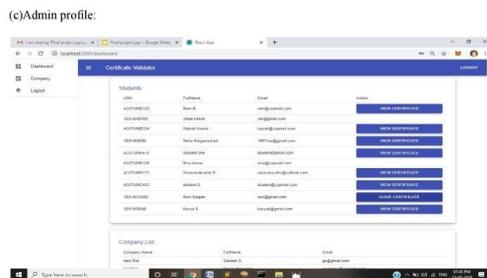


Fig. 5: Admin Profile

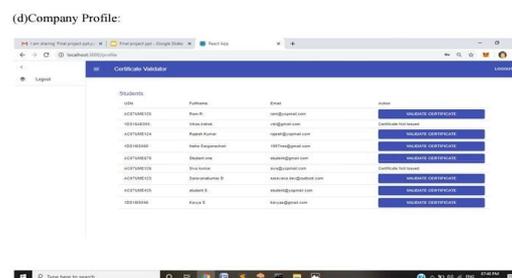


Fig. 6: University/ Company Details

(e) Student profile:

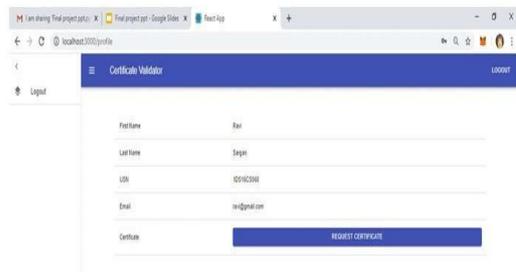


Fig. 7: Student Profile

(f) Verification Success: when original markscard is uploaded to validate.

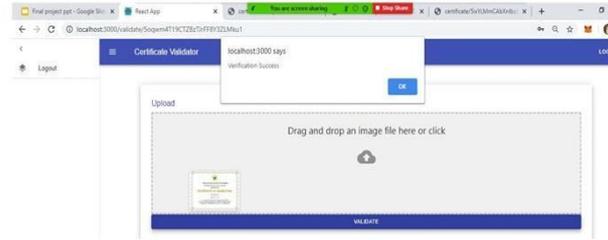


Fig. 8: Verification status Page after the validation of marksheet

(g) Verification Failed: when modified or fake markscard is uploaded to validate:

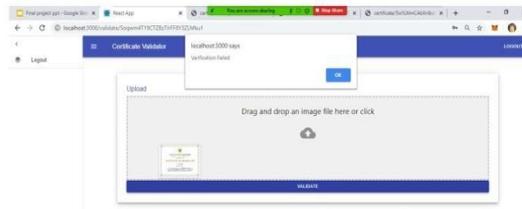


Fig. 9: Verification Status Page for an altered marklist

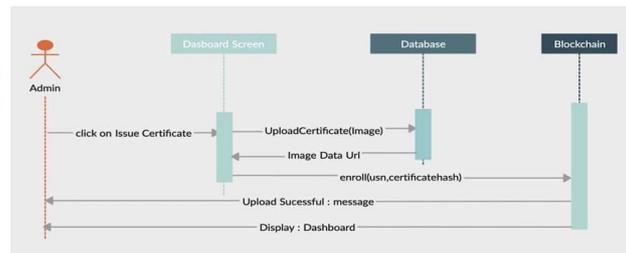


Fig. 10: Verification Data Flow

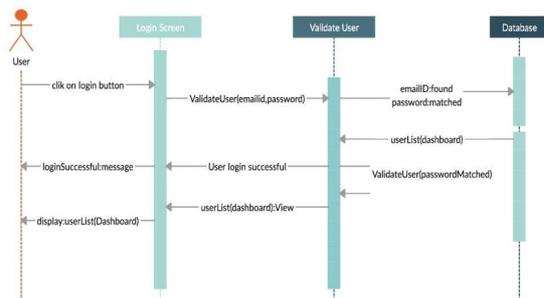


Fig. 11: User Validation Data Flow

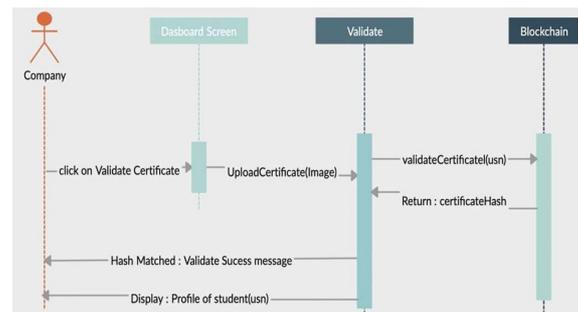


Fig. 12: University/ Company Certificate Validation Data Flow

The graphic below illustrates the five significant modules that make up the module flow diagram. The ensuing modules are combined to fulfil the needs of the suggested project. These are the modules:

1. User Interface Design
2. Server
3. Blockchain
4. Verification

The front-end web application that enables registration for students and universities through easy form filling is included in the user interface design module. Every time a user registers, the database of universities and students is updated. Only from the specific university that the student attends may they request a certificate. The university computes the hash of the certificate and uploads the requested document to the web server if the user is a legitimate student. Now the student can download their diploma. The blockchain stores the certificate's hash rather than the complete file because the valid transactions are committed to it. The certificate produced by the student may now be hashed using the same process, and prospective employers and other universities can compare the results to the hash stored in the blockchain for that specific certificate. The markscard is legitimate if the hashes of the two are identical; else, it is invalid.

#### IV. DEVELOPMENT AND TESTING OF THE PROPOSED SYSTEM

The project is stored in the certificate-validation folder. When the project executes it leads us to sign in page. It is having two entries: email id and password which are provided by the user during registration or sign up. If it is a new user then link to sign up page is available which takes required information. By default role 3 which means user as student is set. Whereas admin has role 1 and company has role 2. Admin user is directed to the

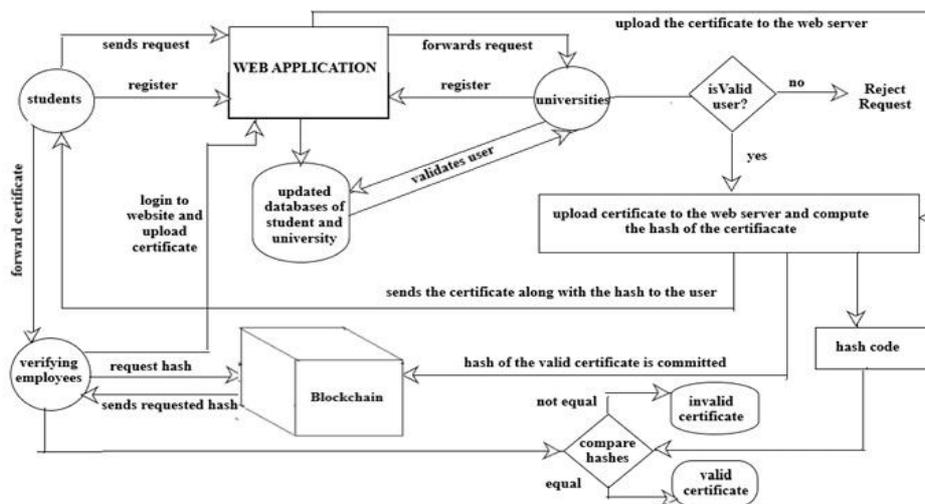


Fig. 13: Architecture Design

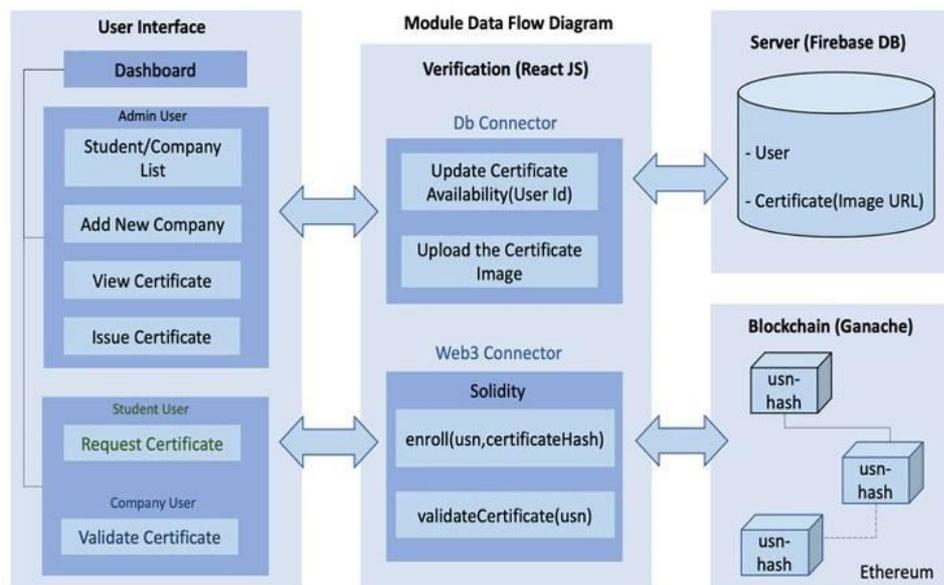


Fig. 14: Modules in the proposed architecture

dashboard comprising of student list, company list and logout option. Under the student list, the action column is either empty for particular user who just registered but not requested any certificates or if the particular user is requesting a certificate, then action column contains issue certificate button which is clicked to select the particular student certificate from the college database to upload it. If certificate is already issued to a student, then only view certificate button is visible to view certificate. The admin can add new companies by navigating to company list Company user is directed to the dashboard comprising of student list. The student list contains a column which is either empty for student who did not have any certificates yet or contains a validate certificate button if a particular student has the certificate. When a student user log into the system then he will be having all the details given by him during registration along with a certificate row either containing a button view certificate if the certificate is already issued otherwise request certificate button to request for certificate. When a student takes his certificate to a company, then company can simply login to the system and click on validate certificate button for particular student which redirects to a validation page where the certificate given by student is uploaded using cloud. If the certificate is same as issued by the admin/college then the certificate valid message pop up in the same window otherwise shows certificate invalid indicating the certificate is either forged or altered.

TABLE 1: TEST CASES

SI No.	Description	Input Object	Expected o/p	Actual o/p	Result
1	Valid certificate uploaded by admin	Valid certificate	Validation Success	Validation Success	Pass
2	Invalid certificate uploaded by company	Invalid certificate	Validation Failed	Validation Failed	Pass
3	Proper Login details	user details	Dashboard	Dashboard	Pass
4	Signup details	Valid details	Account created	Account created	Pass
5	Improper details in login n sign up	Wrong credentials	Shows error	Shows error	Pass

## V. CONCLUSIONS

Any record that is stored in the blockchain repository cannot be changed because to the immutable nature of blockchain technology. It offers security, integration, and authentication. Online access to digital degree certificates reduces costs and saves time. The ability to receive a replica of the original markcards or certificates online in the event of loss or damage to the originals offers a great deal of flexibility. Security is provided by the fact that the papers kept in the blockchain repository cannot be changed or removed. The main benefactors of this system are universities, students, and recruiters because it makes the process of creating and verifying certificates and marksheets easier. In conclusion, the suggested model avoids certificate fraud and falsification, and employers may be confident that they will receive accurate information from the blockchain repository. Digital certification also has huge scope for all the sectors of education like medical, engineering, pharmacy, law etc. which can adopt new certification and save a lot of manual work. Digital certification is essential for all the online courses, as digital certification avoid forgery so these online course certifications will be easily accepted by organisation. For example, company user creation option through online portal directly helps rather than university creating the same. So, university will only accept organisation request and allow them to use the digital certification if they match certain criteria. Using digital certificate, we can do a lot more. We may also incorporate the online test, so the student will receive their certification right away following the test's approval. Digital certificate has lots of future scope in future, as in current situation social distance has become very important aspect of life, so degree certificates and markscard can be obtained online.

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# Design of a Miniaturized Microstrip Antenna using Slots on the Radiating Patch for Wireless Applications

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**Abstract**—This paper proposed a miniaturized microstrip antenna (MMA). The design consists of a microstrip antenna having a radiating patch with modified U slots. Dielectric substrate of PTFE is used to design the antenna. Co-axial probe feeding technique is used to energise the MMA. HFSS software is used to model the design of the MMA. Initial patch antenna without slots, resonant at 6.65 GHz. After etching slots on the radiating patch, the MMA resonant at 3.85 GHz. So the 66.46% of miniaturization has been done. The MMA provides a maximum gain of about 5.54 dBi at 3.85 GHz. This design may be used to operate for wireless applications.

**Index Terms**— Miniaturization, Reflection co-efficient, Gain, Radiation Pattern, Modified U-slots, PTFE.

## I. INTRODUCTION

The design of a miniaturized antenna has emerged as one of the most important issues for modern broadcasting systems due to the rapidly expanding wireless networks. Due to its favorable characteristics, including as compactness, inexpensive manufacture, simplicity of structure, and effective compatibility with small electronic apparatus, microstrip antennas are the most suitable candidate for wireless applications [1-2]. For the purpose of shrinking the antenna's size, slots of various sizes and shapes have been inserted into the radiating patch, ground planes, or both [3,4]. S. Islam & et al. reports on a small antenna for RFID applications [5]. The antenna has slots of various sizes to accomplish its 32% compactness. It has been observed that employing slots for a multiband patch antenna reduced size by 30% presented in [6]. M.S.H. Ali & et al. [7] demonstrates a small Patch antenna. This offers two bands. The antenna has two L-shaped slots that are mirror images of one another, along with two slits and a square slot. This antenna offers a compactness of 41.2%. A comparison study has been done on a compact equilateral triangular patch antenna with various slot shapes, and the best compactness of 43.47% is reported in [8]. It is estimated that a small microstrip antenna for mobile communication can achieve 46.13% more compactness by employing two irregular rectangular slots at the patch's edge [9]. By utilizing open end meandering slots in the ground plane, a rectangular microstrip antenna reports an 83% compactness [10]. Using an H-shaped slot on the radiating patch and a U and L slot combination on the ground plane, it is reported that the compactness is 86% [11]. A circular patch antenna adds an open ended slot to the radiating patch to increase compactness by 86.5% [12]. A miniaturization of 50% has been reached by only using defected ground structure

in [13]. Koch fractal geometry was applied on the square patch to reach 45 % of size reduction in [14]. Miniaturization was done by altering not just the iteration but also the number of segments on the boundary while maintaining the same iteration of a patch in [15]. Complementary split ring resonators were used for size reduction of a patch in [16]. Fractal geometry of Mandelbrot reduces 58.5% of area in [17]. The insertion of slots in the various directions was proposed in [18] for miniaturization. A 33 % of size reduction has been achieved by using slits in a slot antenna in [19]. A slotted microstrip antenna provides 67 % of size reduction was informed in [20]. A CPW fed slot antenna achieves miniaturization using spiral ring resonator in [21].

In this paper, a miniaturized microstrip antenna (MMA) has been designed using slots. The miniaturization of 66.46% has been achieved by using only U slots on the radiating patch. This antenna may be useful in wireless applications.

## II. ANTENNA GEOMETRY

The layout of the proposed miniaturized antenna (MMA) is depicted in figure.1. The MMA is modeled using glass PTFE substrate material. Its specification is, dielectric constant ( $\epsilon_r$ ) = 2.5, height= 1.6 mm and loss tangent=0.002. The antenna is modeled by HFSS software. The MMA is excited by co-axial probe feed. The evolution process of the MMA is shown in figure.2. The evolution process consists of three steps. Three steps are Ant\_A, Ant\_B and Ant\_C. Dimensions of the Ant\_A are 13 mm and 17.75 mm. The Ant\_A is given in figure.2(x). An extended U-similar slot is placed on the Ant\_A. This modification on the patch is named Ant\_B. After this, other U-similar slot is placed on Ant\_B. This modification is named as the Ant\_C (figure.2.2 (z)). This Ant\_C is considered as MMA. The design parameters of the MMA are given in the Table I. The small black box presents the feed location of the MMA. The width of each section of the slots are fixed and it is 0.4 mm. The reflection co-efficient of different steps of the MMA is given in figure.3. The resonant frequency and its magnitude is given in the Table II.

TABLE I: DESIGN PARAMETERS OF THE PROPOSED REPORTED ANTENNA [MM]

<b>a</b>	<b>b</b>	<b>c</b>	<b>d</b>	<b>e</b>	<b>f</b>
50	50	13	17.75	10.6	7.6
<b>g</b>	<b>h</b>	<b>i</b>	<b>j</b>	<b>k</b>	<b>l</b>
10.6	7.6	8	6.6	1	1.4

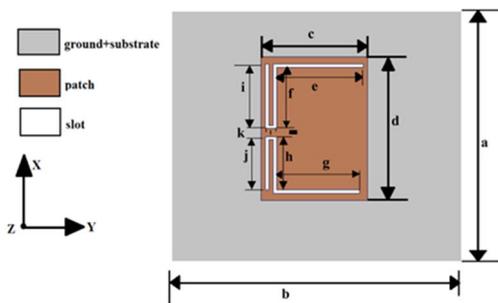


Figure.1: The layouts of the MMA

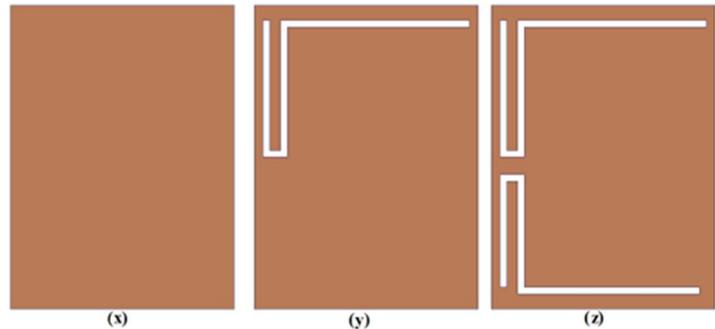


Figure.2(x-z): The evolution of the MMA (Ant\_A to Ant\_C)

TABLE II: COMPARISON INFORMATION TABLE REGARDING DIFFERENT STEPS OF THE PROPOSED ANTENNA

Steps	Resonant Frequency	Reflection co-efficient	Gain	Compactness (%)
Ant_A	6.65 GHz	-26.23 dB	6.64 dBi	Not applicable
Ant_B	3.93 GHz	-7.9 dB	5.45 dBi	Not applicable
Ant_C	3.85 GHz	-17.99 dB	5.54 dBi	66.46%

## III. RESULT AND DISCUSSION

This section presents simulated results of the MMA. Figure.6 shows the reflection co-efficient (S11) of the MMA. 3.85 GHz resonant frequency is obtained from the MMA. The gain of the MMA is 5.54 dBi at the

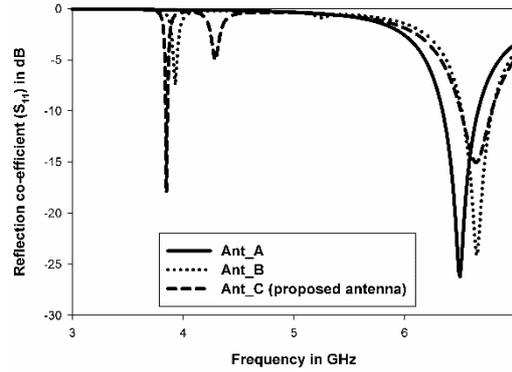


Figure.3: Comparison reflection co-efficient versus frequency plot for ANT\_A to ANT\_C

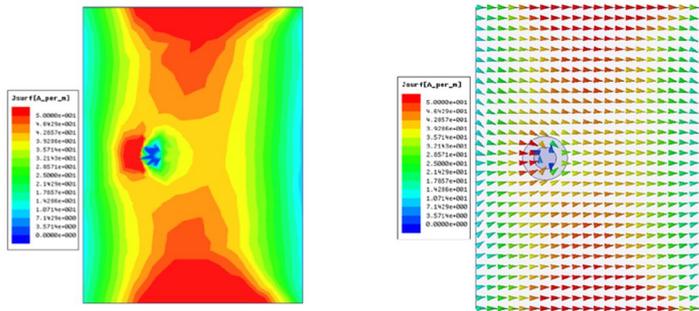


Figure.4(a): Surface current distribution( $J_{\text{surface}}$ ) at 6.65 GHz of the basic patch antenna (Ant\_A)

Figure.4(b): Surface current distribution ( $J_{\text{vector}}$ ) at 6.65 GHz of the MMA

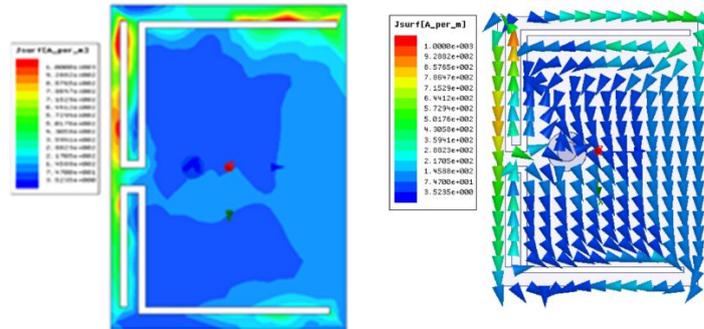


Figure.5(a): Surface current distribution ( $J_{\text{vector}}$ ) at 3.85GHz of the MMA

Figure.5(b): Surface current distribution ( $J_{\text{vector}}$ ) at 6.65 GHz of the MMA

resonant frequency of 3.85 GHz. The plot of the gain is given in figure.7. The radiation patterns (E and H plane) of the MMA are given in figure.8 and figure.9. In this article, initial rectangular patch antenna (Ant\_A) without slot gives resonant frequency of 6.65 GHz. After placing slots on the patch (Ant\_C), the frequency shifts from 6.65 GHz to 3.85 GHz.

Figure 4(a) shows the surface current distribution of the Ant\_A and its vector current distribution is shown in figure 4(b). Figure 5(a) shows the surface current distribution of the proposed antenna and its vector current distribution is shown in figure 5(b). Red color indicates maximum current density. In case of figure 4(b), it is shown that current flows from left to right on entire radiating patch but in case figure 5(b), the current path becomes leathery due to the presence of the slots. As the current path increases that means length increases and frequency decreases. So the frequency shifts from higher to lower range. This phenomenon is called miniaturization or compactness. The compactness of the proposed antenna has been calculated by using following equations (1-8).

Perimeter of the Ant\_A to resonate at the frequency of 6.65 GHz is  $=2 \times (17.75+13) \text{ mm}=61.5 \text{ mm} \dots (1)$   
 So, the perimeter of the proposed antenna to resonate at 3.85 GHz is  $(61.5 \times 6.65)/3.85=106.22 \text{ mm} \dots (2)$   
 Therefore, total length and breadth of proposed antenna=  $106.22/2=53.11 \text{ mm} \dots (3)$   
 The length of the proposed antenna with respect to initial antenna is  $(17.75/30.75) \times 53.11=30.65 \text{ mm} \dots (4)$   
 The breadth of the proposed antenna with respect to initial antenna is  $(13/30.75) \times 53.11=22.45 \text{ mm} \dots (5)$   
 The area of Ant\_A= $17.75 \times 13 \text{ mm}^2=230.75 \text{ mm}^2 \dots (6)$   
 The area of the proposed antenna is  $=30.65 \times 22.45 \text{ mm}^2= 688.1 \text{ mm}^2 \dots (7)$   
 So, the compactness=  $\{(688.1 - 230.75)/ 688.1\} \times 100\%=66.46 \% \dots (8)$

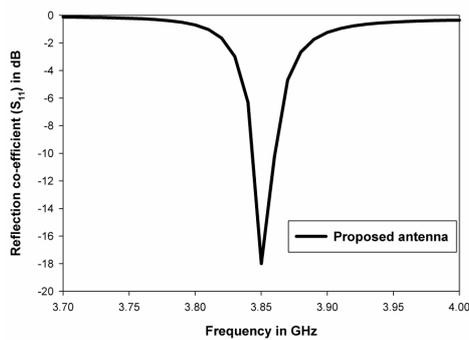


Figure.6: Reflection co-efficient plot of the MMA

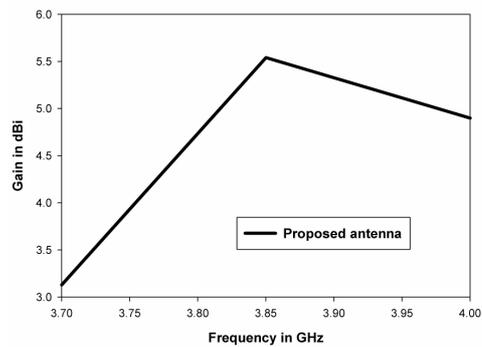


Figure.7: Gain plot of the MMA

#### IV. COMPARISON TABLE

In this section comparison of the proposed antenna with the previously reported antennas have been done (Table III). After comparison with respect to substrate area, techniques of miniaturization and % of miniaturization, it is concluded that proposed MMA provides very good results.

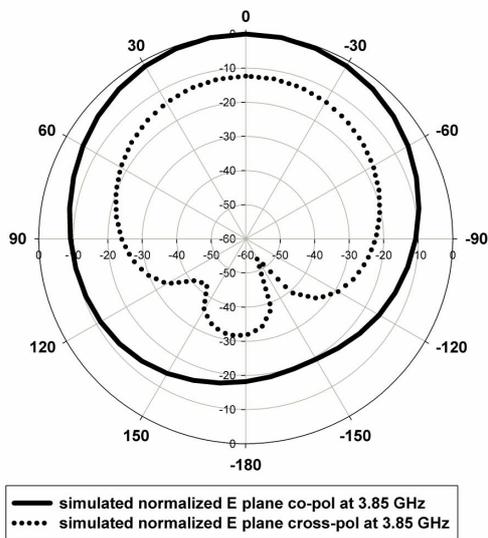


Figure.6: The radiation patterns (E plane) of the proposed MMA

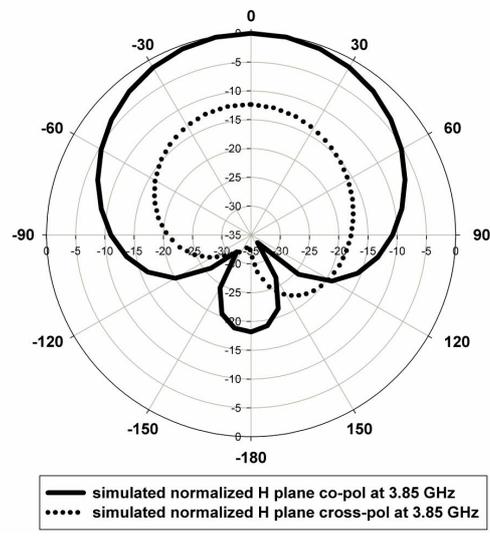


Figure.7: The radiation patterns (E plane) of the proposed MMA

#### V. CONCLUSION

This article presents a miniaturized microstrip antenna. Only insertions of slots on the radiating patch have been done. HFSS software simulation tool is used to model and simulate the proposed miniaturized microstrip antenna. The design is very simple and easy. It provides 66.46% of miniaturization. This antenna may be useful in wireless applications.

TABLE III: COMPARISON TABLE

Ref	Substrate area	Techniques to achieve miniaturization	% of Miniaturization
[5]	37.7×28.4	Slots on the patch	32%
[6]	24×24	Slots on the patch	30%
[8]	120×120	Slots on the patch	43.47%
[9]	24×30	Slots on the patch	46.13%
[13]	22×20	DGS on the ground plane	50%
[14]	60×60	Koch fractal geometry	45%
[19]	45×25	Slots and slits	33%
Proposed MMA	50×50	Slots on the patch	66.46%

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# Cloud-Based Resource Distribution Using a Blockchain Approach

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**Abstract**—It is difficult to divvy up and keep track of resources amongst several entities. This is particularly true for complex and ever-changing systems, such as those seen in cloud computing, software engineering, and the Internet of Things (IoT). Providing safe access control is crucial to the success of such a system. In particular, the safe, adaptable, and granular handover of privileges from one entity to another. Here, we introduce a blockchain-based multi-organizational delegation system. In our system, smart contracts on the blockchain specify how the consortium's member organizations interact and how their shared resources are divided up.

**Index Terms**— Resource Allocation, IoT, blockchain, Security.

## I. INTRODUCTION

Cloud computing is a method of remote, scalable resource provisioning that uses utility-based computing models. Parallel computing, grid computing, and distributed computing are all realized on the cloud [1]. Users can access a shared pool of resources in the cloud and use them as needed using an "on-demand" model [2]. Users can use cloud services whenever and wherever they like thanks to the cloud's powerful computing capabilities and massive storage capacity. IT assets such as databases, servers, communication devices, networks, and software systems are housed in a cloud data Centre. As more customers use the cloud, more servers or other gear will be needed to meet demand. Thus, the creation of more physical nodes will result in an increase in data center power usage. Today, 2% of all electricity used in the globe goes toward powering data centers. By the year 2030, projections show it will have reached 8%. Data centers have three major power users: servers, data Centre networks, and cooling systems. The network uses 10% to 25% of the energy, the cooling systems use 15%-30%, and the servers use 40%-55%, respectively [3].

Computing resources such as RAM, CPU, Network, and Storage are provided by IaaS (Infrastructure as a Service) and their use is typically governed by Service Level Agreements (SLAs) (Service Level Agreement). Use of resources is also influencing energy requirements. One of the causes of the data center's energy insufficiency is the inefficient use of its resources [4]. Even at 10% CPU utilization, the workload is light enough to cause the energy consumption to be more than 50% of the maximum. This is where IaaS's virtualization techniques come into play, which helps maximize the usefulness of any given cloud's assets [5]. Due to the shared resources made available by virtualization, VMs can take the place of PMs in processing user requests. Separating virtual machines (VMs), moving VMs, and merging VMs are all examples of what may be done using virtualization. VM migration is a method for moving active virtual machines from one physical host to

another. Consolidating virtual machines (VMs) that were previously spread across multiple hosts into a smaller number of hosts saves power by either shutting down the first host or placing it into hibernation [6]. One way to run virtual machines is through a method called Virtual Machine Placement (VMP). A powerful VMP method is required to improve energy productivity and maximize use of available resources [7]. When it comes to optimization, the VMP problem is NP-hard [8].

In this study, we combine the power of the genetic algorithm (GA) with that of the random forest (RF) algorithm to create a novel and effective hybrid VMP strategy. Our goal is to keep the load spread across a number of physical computers while decreasing the data center's energy consumption. One of the most important factors in determining how effective the proposed solution is is how well it makes use of the hardware's available resources. The goal of this study is to reduce the execution time, average start time, and average finish time required by the cloud, as well as the waiting time and request completion time, respectively. The proposed approach also aims to speed up the iterative metaheuristic algorithms like GA, ACO, PSO, and others by cutting down on the time it takes to identify the best solution. The goal of the model is to use the best possible optimal solution to train a machine learning model, which can then be used to forecast the optimal solution in a constant amount of time, bypassing the need for evolutionary processes to find the global best answer [9].

The genetic algorithm is one of the metaheuristic methods used to locate a truly optimal answer. First, using the mapping between virtual and physical machines as a training dataset, the GA creates an optimum schedule for resource allocation. The next step is to use the GA-created dataset to train the random forest algorithm, which then assigns virtual machines to physical machines based on the categorization it has made. With the GA-obtained data sample, the RF's classification accuracy may be evaluated.

#### *A. Problem Statement*

In this article, we take a look at the current state of blockchain-based cloud security and analyze its many benefits and drawbacks. The effectiveness of a smart contract can be measured in terms of its robustness, security, stability, and practicality. The model's capacity to generalize has proven superior. However, this paradigm needs to be implemented locally at each cloud data center. Attribute encryption using ciphertext has improved retrieval efficiency and validated the integrity of the data at rest. But the proposed model has poorer search efficiency. BloTHR ensures the confidentiality of cloud data while providing advantageous pricing and accessibility. The model does not make use of low-power Internet of Things gadgets. As far as usability, safety, privacy, and reaction speed are concerned, EACMS ensures the best possible results in every category. When compared to traditional medical systems, this concept has proven to be far more effective. Contrarily, it necessitates a more capacious memory system. When it comes to delay and throughput, DBDH performs at its best, and it also offers top-notch security. However, this paradigm is vulnerable to attacks that happen in real-time. In terms of latency, throughput, and resources, the modified Merkle Tree data structure excels. Resource consumption, latency, transaction response time, and throughput are all analyzed to guarantee the proposed model performs well. However, as the system's user base grows, so does its latency. Safeguarding private health information in less time than conventional methods, the timestamped algorithm is a significant improvement over the alternatives. This methodology does not, however, process or provide privacy for the little data bits. Smart contracts have been shown to increase data integrity and privacy by providing security and access control. For smart contracts that rely heavily on locally stored data, another approach is necessary. Researchers might use this analysis as support for proposing a novel blockchain-based approach for cloud data security.

#### *B. Contributions*

The growing popularity of blockchain technology offers a potential answer to the cloud computing resource management issue. It ensures users' data security in the cloud computing environment [14] while also cryptographically guaranteeing the irreversible and unforgeable features of the data. Additional identifying attributes of the alliance chain members are shared by cloud service providers and cloud computing environment customers.

In order to better integrate the blockchain system into the cloud computing network architecture, the fundamental objective of this work is to propose a cloud computing resource contribution model based on an alliance chain. A solution to the cloud computing resource management challenge is found in the application of blockchain's incentive and disincentive mechanisms to encourage nodes to actively contribute to the pool of available computing resources. By recording the resource-contribution behavior of cloud nodes and the degree of satisfaction upon task completion in blockchain form, an uncontrollable assessment system is created, which can address issues like malicious poor reviews and brush in real-world applications.

## II. RESEARCH METHODOLOGY

We propose Automatic software cloud resource allocation utilizing permission block, a policy-based and autonomic middleware that enables self-adaptiveness for data management in clouds, to address these issues. Therefore, the proposal combines three highly sought-after elements: Software cloud resource allocation is monitored in real-time, and the collected and aggregated metrics (such as write latency, read latency, uptime, free memory, etc.) Are secured on a blockchain for optimal privacy and integrity. Data management decisions are made based on what cloud service is best suited to help you satisfy your service level agreements (slas), and your data is transmitted securely. Moreover (iii), the cloud storage setup is automatically re-configured (based on the simple, reusable, and extendable configuration policies), meaning that a human operator is no longer needed to monitor and manually re-configure the cloud storage setup's security.

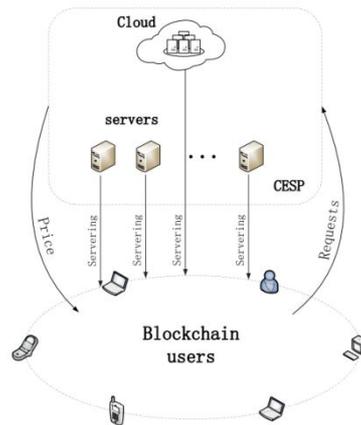


Figure 01: System model

## III. WORKING

Each node in a distributed ledger maintains a chain of records called "blockchain." The Bitcoin network's consensus issue was proposed by S. Nakamoto. Each block in the blockchain, with the exception of the initial block, includes the hash of the prior block, as illustrated in Figure 2. (Genesis block). The former block is always produced ahead of the latter, and each block contains transactions, which are logs of acts taken on the blockchain, such as the transfer of assets. Figure 02 further elucidates the technique by which a blockchain is created. As shown in the diagram, step one of a transaction involving Node0 involves a user signing it with his private key. As a result, the digital signature improves security and data integrity, and the transaction can be tracked using the user's public key. Afterward, Node0's immediate neighbor receives the transaction broadcast (i.e., Node1 and Node2).

Node1 and Node2 ensure the broadcast transaction follows the transaction protocol before broadcasting it to Nodes3 and 4. If the transaction does not follow the protocol, it will be dropped.

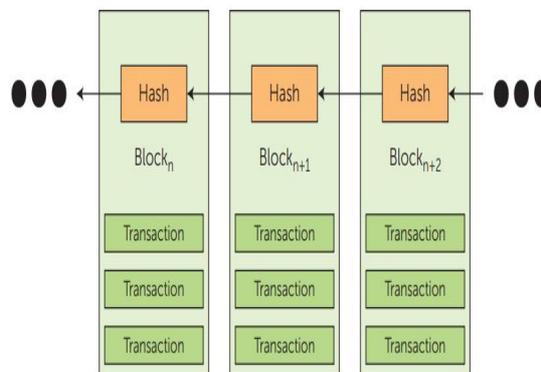


Figure 02: A blockchain network

Each network should make it clear to all participants what kind of protocol will be used for transactions before the blockchain is even created. Transaction protocol's primary goal is to maintain network order in the blockchain.

#### IV. CONCLUSION

This paper initially examines the privacy and security concerns surrounding edge computing-enabled IoT, before moving on to describe the features of blockchains that make them ideal for use in IoT applications. It was suggested to use a common framework for all Internet of Things (IoT) use cases that involve blockchain technology and edge computing. The entire process of a transaction was laid out in minute detail under the proposed framework. Additionally, the edge computing resources allocation problem was addressed by developing a smart contract in a private blockchain network that utilized the cutting-edge reinforcement learning, Asynchronous Advantage Actor-Critic algorithm. In particular, the efficiency of the suggested method is improved over the state-of-the-art edge computing resource allocation techniques by catering to various service users and differentiating between their Quality of Service (QoS) needs. That's an example of how AI and blockchains can work together. The simulation results were presented to prove the efficiency of the proposed resource allocation system for edge computing. Joint optimization of blockchain settings and edge computing resource allocation is something we plan to investigate more in future work.

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# Detecting Human Emotion by Text Classification

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**Abstract**— Nowadays, it's fairly usual to share moments on social media. By communicating thoughts, ideas, and enjoyable experiences over text, we can express our feelings without needing a lot of words. To investigate people's opinions, sentiments, and emotions, for instance, businesses may target YouTube as an abundant source of data. A greater comprehension of an author's emotions is often possible through emotion analysis. Analyzing expressions as positive, negative, or neutral has been the focus of almost all projects evaluating Telugu social media. We'll categorize the expressions in this essay into groups based on the emotions of happiness, fury, fear, disgust, and melancholy. Different approaches have been used in the case of other languages to automatically recognize textual emotions, however few of them were based on deep learning. Now let's talk about the system we utilized to classify the feelings stated in Telugu YouTube comments. For tasks requiring phrase classification, our model includes an XLM-RoBERTa and Multilingual BERT that was specifically trained on our dataset using trained word vectors. We contrasted the outcomes of our method with those of other machine learning techniques. The architecture of our deep learning technique is a word-based, end-to-end network, phrase, and document vectorization procedures. The proposed deep learning strategy was tested using the Telugu YouTube comments dataset, and the results were promising when compared to more traditional machine learning methods.

## I. INTRODUCTION

As social media has become more popular, internet users can now voice their opinions on a wide range of subjects. Social networking sites are increasingly being used for a variety of activities, such as the advertising of products, the sharing of news, and the recognition of achievements.

Emotion analysis, often known as opinion mining, is the study of how to infer from textual data how individuals feel about a particular thing, person, or organization.

Market analysis, e-commerce, social media monitoring, and many more areas are examples of contemporary applications for emotion analysis. Telugu is the fifteenth most frequently spoken language in the world, with more than 75 million native speakers. The creation of a technique for Telugu text emotion analysis will benefit several people and organizations.

Everyday life brings us into contact with a variety of events, which leads to the formation of opinions regarding those occurrences. A person's emotions are strong feelings they have in reaction to their circumstances or interpersonal relationships. It has a big impact on consumer decision-making in a lot of different areas, such e-commerce, restaurants, movies, interests, and satisfaction with a service or a product. Additionally, it affects our health! Users can now voice their opinions about a comment, picture, or event using Facebook's replies feature, which has just undergone some changes. These reactions include angry, happy, love, and surprise.

Examples for emotion analysis as given below:

1. నేనుపుట్టినసంవత్సరాలకేమానాన్నచనిపోయాడు...ఎలాఉంటాడోకూడాతెలీదు  
Nenu puttina sanvatsaralake ma nanna chanipoyadu.. Ela untadho kuda teledu – SAD
2. స్టోరీచండాలంగాఉంది  
Story chandalanga undi - ANGRY
3. ఈచిత్రం 200 గ్రాస్నుదాటవచ్చు  
Ee chitram 200 gross nu datavacchu – TRUST
4. సినిమా విఎఫ్ఎక్స్ చూసినేనుఆశ్చర్యపోయాను  
Cinema vfx chusi nenu ascharyapoya – SURPRISE
5. చాలాట్రీట్లుఉన్నందుననేనుసినిమానిఆత్రంగాచూడాలనుకుంటున్నాను  
Chala twist lu unnanduna nenu cinemani aatanga chudalanukuntunna – ANXIETY

In academic circles, emotional analysis is seen as a kind of higher, more developed version of sentiment analysis. Sentiment analysis is used to classify texts (posts, words, or documents) as neutral, positive, or negative. Emotional analysis, on the other hand, is a more extensive and in-depth investigation of user emotions with the goal of examining the psychology of various user behaviors and illuminating deeper human emotional meanings including anger, disgust, trust, grief, delight, and surprise.

The English language has a good reputation in the field of emotion detection, including the accessibility of datasets and dictionaries, in contrast to Telugu, which has a dearth of resources.

In this study, We look into automatic emotion recognition for Telugu language using MULTI LINGUAL BERT using four steps: word, sentence, document vectorization, and classification. Displaying the performance and precision that deep learning has so far attained, we also compared this methodology to other machine learning techniques. We applied our techniques to analyze user sentiment in the YouTube comments dataset.

## II. RELATED WORK

### A. NAILA ASLAM(2022) *Sentiment Analysis and Emotion Detection on Cryptocurrency Related Tweets Using Ensemble LSTM-GRU Model*

The methodological approach that they took. Random Forest, Decision Trees, KNN, and SVM, as well as the Metrics That They Employed in Order to Obtain the Output Precision, Accuracy, and the F1 score Remember, one of the problems with the model is that the balancing of the dataset through the use of the random under sampling shows that performance is diminished due to there being fewer training data.

### B. A Majeed (2022)*Emotion Detection in Roman Urdu Text Using Machine Learning*

This research develops detection of human for Roman Urdu sentences with a specific size of dataset and they are mapped to six different classes of emotions. They used methods like KNN, Decision tree, SVM, and Random Forest. The final result shows KNN as the best model with better F-measure score compared to the other approaches.

### C. T. Balomenos(2022) *Emotion Analysis in Man-Machine Interaction Systems*

This paper is developed for extracting the emotions from related image sequences. This uses an advanced intelligent rule-based system. It helps the MMI to deal with specific emotion states such as frustration and anger.

### D. Abdullah (2022) *Multimodal Emotion Recognition using Deep Learning Smsa*

This paper is a review of emotional recognition of multimodal signals and unimodal solutions as they have higher accuracy. This improves better understanding of physiological signals and emotional awareness.

### E. Omkar Gokhale, Shantanu Patanka, Onkar Litake, Aditya Mandke, Dipali Kadam(2022)

Emotion analysis in Tamil

It is the overview of shared task of emotion analysis in Tamil. The task is split into two in which one of the task includes social media Tamil comments that are annotated with specific suited emotions and in the other task fine-grained emotions are annotated for the social media comments in Tamil. The metrics used for evaluating models are Precision, Recall and Micro average.

*F. LINJIAN LI(2021) A Novel Emotion Lexicon for Chinese Emotional Expression Analysis on Weibo: Using Grounded Theory and Semi-Automatic Methods*

The downsides for the model include the methodology that was utilized (ALO and SC-LIWC), the metrics that were used to generate the output (Precision, recall, and F1), and the methodology that was used (ALO). Only users from China's Weibo were surveyed for this data set.

The strength of the relationship that each word has with the corresponding emotion category was not included in the lexicon.

*G. Chang Liu, Taiao Liu, Shuojue Yang, And Yajun Du(2021)*

Individual Emoticon Recognition Approach Combined Gated Recurrent Unit with Emotion Distribution Model. This paper proposes a model called semantic emoticon emotion recognition (SEER). First the input text is divided into four categories with emotion dictionary and emoticons. Then it is combined by a bidirectional gated recurrent unit (Bi-GRU) a network with an emotion-vector-capturing attention mechanism. Lastly, a emoticon distribution model is constructed to obtain emotion vectors from various social network data. Fourth, we combine the emoticon emotion characteristics in text with the texts semantic emotional components using various fusion weights based on the various types of input short messages. Depending on the resulting emotion vector, we finally divide the short text emotions into six categories.

*H. BHARATHI RAJA CHAKRAVARTHI (2021)Dataset for identification of homophobia and transophobia in Multilingual youtube comments.*

This paper describes the process of building the dataset, qualitative analysis of data, and inter-annotator agreement. In addition, we create baseline models for the dataset.

*I. FERDOUS AHMED(2020) Emotion Recognition from Body Movement*

The methodologies that were applied were SVM,LDA,GNV,DT, and KNN. The metrics that were applied for the purpose of obtaining the output were f-Score,p-Score, and Accuracy. The limitations of the model are as follows: Observed a marginal drop in performance across the board in action-independent cases

*J. ZISHAN AHMAD, RAGHAV JINDAL, ASIF EKBAL and PUSHPAK BHATTACHHARYY (2020)*

Borrow from rich cousin: transfer learning for emotion detection using cross lingual embedding. Expert Systems with Applications.

This paper is mapped with the emotions of disaster domain sentences in Hindi. Dataset is created for the disaster domain sentences. The models used here are CNN and Bi-LSTM (Bi-Directional Long Short Term Memory). For Hindi emotion categorization, the neural networks are trained on the available datasets, and then the weights are adjusted using one of four transfer learning techniques.

*K. Zhenzhong Lan, Mingda Chen, Piyush Sharma, and Rady Soricut (2019)*

ALBERT: A Lite BERT for Self-supervised learning of language representations.

For BERT to use less memory and train more quickly, we provide two parameter-reduction strategies. Detailed empirical data demonstrates that our suggested methods produce models that scale far better than the original BERT. We also employ a self-supervised loss that emphasises modelling inter-sentence coherence, and we demonstrate that it consistently facilitates tasks that require multi-sentence inputs.

*L. Alexis Connaeu, Kartikay Khandelwal, Naman Goyal, Vishrav Chaudhary (2019)*

Unsupervised cross-lingual representation learning at scale.

Using more than two terabytes of filtered CommonCrawl data, we train a Transformer-based masked language model on 100 different languages. On a number of cross-lingual benchmarks, including +14.6% average accuracy on XNLI, +13% average F1 score on MLQA, and +2.4% F1 score on NER, our model, called XLM-R, greatly surpasses multilingual BERT (mBERT). Low-resource languages are where XLM-R excels, with Swahili's XNLI accuracy increasing by 15.7% and Urdu's by 11.4% over earlier XLM models. The trade-offs between (1) positive transfer and capacity dilution and (2) the performance of high and low resource languages at scale are among the important aspects that must be considered in order to accomplish these advantages, and we also give a thorough empirical study of these factors.

*M. Stephen Merity, Nitish Shirish Keskar, And Richard Socher. (2019)*

An analysis of neural language modeling at multiple scales.

We provide a model architecture and training method that, when applied to the WikiText-103 data set, achieves state-of-the-art performance while being significantly quicker than an NVIDIA cuDNN LSTM-based model by a factor of two. using the Quasi-Recurrent Neural Network (QRNN), an Longer sequences within batches and softmax with weight tying.

*N. Jeremyhoward And Sebastian Ruder (2019)*

Universal language model fine-tuning for text classification.

We describe strategies that are essential for fine-tuning a language model and propose Universal Language Model Fine-tuning (ULMFiT), a powerful transfer learning method that may be used for any NLP application. On six text classification tasks, our approach greatly exceeds the state-of-the-art, lowering the error on most datasets by 18–24%. Furthermore, it matches the performance of training from scratch on 100x more data with only 100 labeled instances. Our pre-trained models and code.

*O. VINAY KUMAR JAIN, SHISHIR KUMAR, and STEVEN LAWRENCE FERNANDES (2019)*

Extraction of emotions from multilingual text using intelligent text processing and computational linguistics.

Every word of emotion in a tweet is significant in decision-making, hence an efficient pre-processing technique has been utilized to maintain the significance of multilingual emotional words. The Naive Bayes algorithm and Support Vector Machine (SVM) are used to classify tweets' sentiments in exquisite detail.

### III. PROPOSED METHODOLOGY

Using a masked language modeling (MLM) aim, a model was trained on the top 104 languages with the most content on Wikipedia. Maximum accuracy was thus possible. To make sure the outcomes were trustworthy, this was done. The inaugural release took place in the repository you are currently seeing, and this page acted as its introduction. This model can distinguish between distinct varieties of English because it is sensitive to capitalization, a feature that both varieties of English share.

The team in charge of Hugging Face has been in charge of writing this model card because the team in responsibility of releasing BERT was not accountable for doing so. This is so that Hugging Face can be released, which is the responsibility of the team in charge of it.

The XLM-RoBERTa of BERT model is a transformers model that has been pre trained on a big corpus of data that includes information in a variety of languages using an unsupervised learning approach. The BERT model has been trained using this data. The model in question has been designated as the XLM-RoBERTa model. This suggests that an automatic method was used to produce inputs and labels from those texts, and that it was pre trained exclusively on the raw texts, with no human tagging of them in any way (which explains why it can use a significant amount of data that is publicly available).This also suggests that the raw texts were not in any manner labeled by humans before it was pre-trained. Additionally, this implies that there were no human annotations of any kind on any of the raw texts. This also shows that the raw texts were not in any manner, shape, or form labeled by humans. This can be inferred from the absence of human labeling. To be more precise, it underwent pre-training with the idea of achieving the following objectives:

The first step in masked language modeling (MLM) is to take a sentence as input, randomly mask 15% of the words, then run the entire masked sentence through the model and ask it to predict the words that have been hidden. This procedure is carried out again and again until the model correctly predicts the words that have been obscured. This process is repeated multiple times until the model can correctly anticipate the words that are hidden. Multiple iterations of this approach are carried out until the model is able to correctly anticipate the words that have been hidden. Unlike traditional recurrent neural networks (RNNs), which normally view the words one after another, and autoregressive models like GPT, which internally mask the future tokens, this approach does not view the words in a sequential sequence. This approach instead presents the words in the order that a reader would use if they were reading them out to themselves. This approach examines the words in the same sequence as one would read them aloud to themselves. In other words, it adheres to the speech's organic flow. On the other hand, this approach takes into account the words in the presentation's order of arrangement. As a result, the model is able to obtain a complete representation of the text that takes into consideration both orientations.

While the model is being trained, the Next Sentence Prediction (NSP) method combines two masked sentences into a single input. This improves the model's capacity for learning. As a result, the learning efficiency of the model is increased. This is carried out in order to enable the model to produce predictions that are more accurate.

Although it is not always the case, it is possible that they will correlate to sentences that were written next to one another in the original text. Although not always the case. Do not, however, take this too literally because it is not always the case. But on the other side, they can decide not to follow through in the end. The model must then decide whether or not the two sentences were located in the text directly after one another. If you have access to a dataset with labeled sentences, for example, you may use the characteristics the BERT model produced as inputs to train a typical classifier.

The standard classifier will be able to learn from the tagged sentences as a result. As a result, the model is able to develop an internal representation of the languages that are included in the training set. This will give the standard classifier the chance to learn about the classification of sentences. Then, using this representation of the languages, features that are useful for later tasks in the process can be extracted.

#### A. Algorithm: Xlm-Roberta

1. Importing XLMRobertaTokenizer and XLMRobertaForSequenceClassification from transformers.
2. Model is named as xlm-roberta-base.
3. Input that is the tokenizer is given as XLMRobertaTokenizer.from\_pretrained(MODEL\_TYPE).
4. The module is downloaded of 100 percent.
5. Checking the size of the vocab.
6. Verifying whether the special tokens are present or not.
7. Model inputs are given such as
  - input\_ids (type: torch tensor)
  - attention\_mask (type: torch tensor)
  - labels (type: torch tensor)
8. The very first input is the 'input\_ids'. These represents the sentences which also represent tokens.
9. The second is the 'token\_type\_ids'.
10. Third is the 'attention\_mask'. It has the same length as of 'input\_ids' and it also tells the model which tokens in the 'input\_ids' are working and which are padding.
11. To indicate token or a special word '1' is used and for padding '0' is used.
12. Third input also consists of 'labels'.
13. A tokenizer is used to create XLM-RoBERTa input for both one and two input sentences.
14. The sequence of tokens are decoded.
15. The truncated tokens will return in a list called overflowing\_tokens.
16. Data is loaded.
17. Creates folds according to the requirement for training and testing.
18. Displays the required folds.

#### IV. IMPLEMENTATION

We'll outline the data in this part that was used, as well as our methodologies, in order to recognise emotions in Telugu YouTube videos using a deep learning approach XLM-RoBERTa.

The three modules of the project for implementation are:

- a. Dataset creation
- b. Training dataset
- c. Testing dataset

#### A. Dataset Creation

The dataset of Telugu YouTube comments was provided and used for the training of the model, which is an ordinal classification task based on the intensity of feelings: You must classify a comment into one of five ordinal classes of intensity for the emotion represented by the letter E if it is offered together with an emotion that begins with that letter. One comment has been added to the dataset for each of the following emotions, for a total of one thousand comments includes rage, fear, joy, disgust, and sadness.

Our dataset was split into two sets: 500 comments made up the training set, and 100 comments made up the testing set. 90% of the dataset had to be used for training, while just 10% was necessary for testing. The test dataset was only used to test the created model and offer an indicator of how well the trained model is working. To train the model, the training datasets were classifier and to optimise the parameters. The model was not given access to the test dataset.



```
[ ] import pandas as pd
from sklearn.model_selection import train_test_split

df = pd.read_excel('sample_data (1) 2.xlsx',names=['text','label'])

df.head()

[ ] import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
from collections import defaultdict

import torch
import torch.nn.functional as F
from torch import nn, optim
from torch.utils.data import Dataset, DataLoader
from sklearn.metrics import confusion_matrix, classification_report
```

### V. RESULTS & DISCUSSION

This model is trained using XLM-RoBERTa algorithm and Multilingual BERT algorithm with around 600 Telugu sentences mapped with the emotions happy, neutral, disgust and anxiety. This model gives the accuracy of 77 percentage for XLM-RoBERTa algorithm and for the algorithm Multilingual BERT it gives 53 percentage.

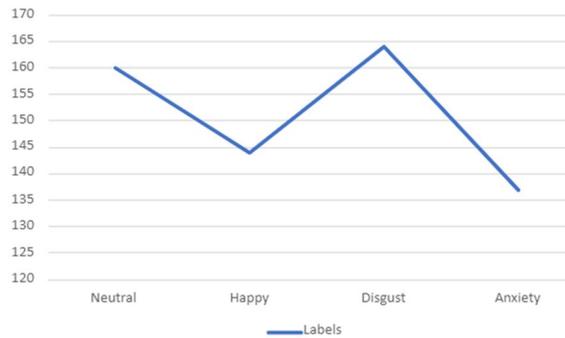


Fig 3: Graphical representation count of mapped dataset

	precision	recall	f1-score	support
anxiety	0.6500	0.7000	0.6700	70
disgust	0.7581	0.7059	0.7934	74
happy	0.7217	0.7636	0.8286	73
neutral	0.6886	0.6250	0.7085	64
accuracy		0.7789		161
macro avg	0.6896	0.6986	0.7801	161
weighted avg	0.6957	0.6959	0.7822	161

Fig 4: Accuracy of 77 Percentage using XLM-roberta algorithm

```
[ ] print(classification_report(y_test, y_pred, target_names=class_names))
```

	precision	recall	f1-score	support
anxiety	0.42	0.47	0.34	70
disgust	0.38	0.59	0.41	74
happy	0.32	0.38	0.39	73
neutral	0.56	0.76	0.66	64
accuracy			0.53	161
macro avg	0.42	0.55	0.45	161
weighted avg	0.45	0.52	0.46	161

Fig 5: Model with 53 percent accuracy for multilingual BERT algorithm

## VI. CONCLUSION

This study attempted to classify comments made on social media. We applied the XLM-RoBERTa and Multilingual BERT strategies. With a macro-averaged f1 score of 0.77 for XLM-RoBERTa and for Multilingual BERT f1 score is of 0.53. XLM-RoBERTa method outscored all other models. Overall, the models are seen to identify emotions like anxiety, happiness, neutral, and disgust. The models are far less accurate in classifying more complex emotions like fear, rage, and melancholy. To enhance the performance of the models, alternative strategies, such as genetic algorithm-based ensembling, can be tested in the future.

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# Effects of Integration of Electric Vehicle Charging Stations into the Grid

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**Abstract**— One of the best ways to address urgent sustainability issues like global warming, depletion of fossil fuel reserves, and emissions of greenhouse gases is to use electric vehicles (EVs). By reducing environmental damage and lowering emissions that contribute to climate change, incorporating electric vehicles into the distribution system will benefit public health. A microgrid is a tiny power network that collaborates with groups of loads as well as distribution generators, powerful software solutions, and other elements utilizing devices connected to the grid that function as a single controlled entity. Last but not least, the study states various ways to mitigate the effects of electric vehicles on distribution system power quality and get rid of harmonics.

**Index Terms**— Integration of electric vehicles, micro grid, power distribution systems, ecological damage, harmonics.

## I. INTRODUCTION

For ensuring a sustainable future, issues like global warming, the depletion of fossil fuel reserves, and emissions of greenhouse gases (GHGs) require immediate attention. The primary reason for the rising consumption of fossil fuels and emissions of greenhouse gases is the rapid rise in global energy consumption. As a consequence of these issues, the renewable energy sector has carried out substantial research for identifying ways and where to replace traditional fossil fuels and lessen environmental problems. The electrification of the transportation sector is seen as a promising solution to this issue because it is one of the largest contributors to rising emissions of pollutants. MG is regarded as the smartest option for optimal operation because of the power grid's rapid expansion and the intricate structure of DES over long distances. However, electric vehicles have been put on hold and restricted to golf carts and delivery trucks due to the readily available availability of fossil fuels, advancements in combustion technology, and the ease with which internal combustion engines can be utilized. However, EV penetration remains low due to concerns about cruising range, deteriorating batteries, a lack of charging infrastructure, and high initial costs. Even though electric vehicles have a significant impact on the reduction of air pollution, they may harm the quality of the grid's power supply. Rechargeable batteries are used to power electric motors and store energy in electric vehicles. EV battery chargers employ electronic power devices to transform DC voltage to AC voltage since non-linearity has an impact on electricity quality. Nonlinear loads have a detrimental effect on power quality. Microgrid has transformed into a key investigation part in wise the structure and movement systems. Microgrid principally incorporates different environmentally friendly power sources using different innovative advances, for example, Power electronic-based technology. EVs can have a negative impact on energy systems, particularly power quality, but they can also significantly reduce CO<sub>2</sub>

emissions and reliance on hydrocarbon-based generators. By reducing emissions that contribute to climate change and environmental damage, research into incorporating electric vehicles into the distribution system will improve public health. They may result in problems including power factor deterioration, voltage imbalance, or voltage variations, as well as harmonic or interharmonics in distribution systems. The harmonic frequency content is distorted by nonlinear loads like electric vehicle battery chargers. Harmonic distortion and poor power quality are the results of charging a lot of electric vehicles at once. Power transformer performance is harmed by harmonics as power losses rise and output power decreases. Power cables, capacitors, relays, and switch-based power electronic devices can all be affected by harmonic distortion. During the charging process, EV battery charging stations produce a lot of harmonic distortion. In order to resolve issues with the power distribution system, voltage and current harmonics must therefore be thoroughly investigated.

#### A. EV Chargers' Harmonics

Summing up the harmonics produced by a single charger is not the same as simultaneously charging multiple cars with the generated harmonics. The system where energy is stored of an EV charging station is made up of three main parts. They are battery, software, and power conversion system. There are no similarities between EV chargers systems and converters due to generating of harmonic voltages rather harmonic currents. Because they do not have a negative meaning as harmonic currents do, harmonic voltages are not included in the analysis [1]. The charging current and this charging voltage are virtually unrelated. There are three stages to the charger. These chargers are connected to end nodes, front nodes, and nodes that change at random. Taking into account that these charger levels represent 10 percent, 20 percent, and 30 percent of the total load on the feeder, the charger is connected to the feeder's end node for the front node, while it is connected to the source power supply for the end node. With his 6, 12, and 18 chargers each connected to a variable value, the supplier's test system was run.

#### B. EV Charging Station Harmonics

The controlling features of the EV battery chargers are included, and their operation is contingent on the ingredients. The performance of the power system is subject to appropriate opportunities and risks as a result of the adoption of electric vehicles, which have the potential to significantly increase loading. These chargers and current voltage have an impact rate design and flexibility of energy.

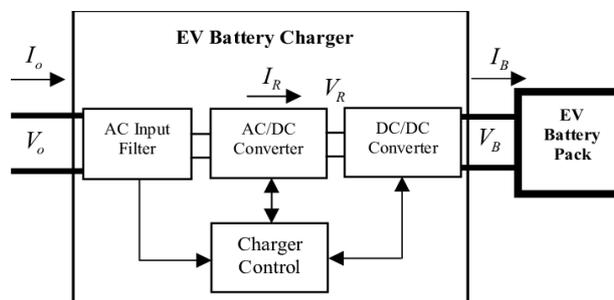


Figure 1: EV battery charger

#### C. EVs and Harmonics

The three types of EVs are BEV, HEV, and FCEV. Battery Electric Vehicle is abbreviated as BEV. Hybrid electric vehicle is the acronym for HEV. Fuel Cell Electric Vehicle is the acronym for FCEV [2]. Power quality is significantly affected by non-linear loads like electric vehicle charging stations, which cause voltage and current harmonics. In power systems, harmonics regarding voltage and current cause a variety of issues, including, damage to the equipment, a transformer that overheats, a low power factor, and a narrow range of voltage profiles.

#### D. AC Microgrids

There are three types of microgrid systems. AC, DC, and hybrid AC/DC are the three. With or without converters, this system permanently connects all DGs—consumers and storage—to the AC busbar network. Without the need for an inverter, AC generators like diesel, wind, and micro turbines can typically be connected directly to AC busbar. DC power sources like batteries, ESS, and PV systems also require DC/AC inverters. It is consequently associated in an orderly fashion with the air conditioner busbar. There are a lot of problems with AC MG, and these networks have complicated control and timing issues. This network, on the other hand, is still

widespread today. In AC MG, the three-phase AC bus serves as the power connection point between MGs and these primary power grids. Installing the common connection area between the Microgrids and the main power grid is simple. A quick switch serves as the disconnect point. The DG powers the load when normal events take place, and any extra power generated is sent to the power grid. The AC microgrid will receive the necessary power from the main grid if the DG's output power falls below the load demand. A significant detail to make reference to is that air conditioner Microgrids' power quality guidelines are managed in view of ordinary power conveyance frameworks and methods of activity.

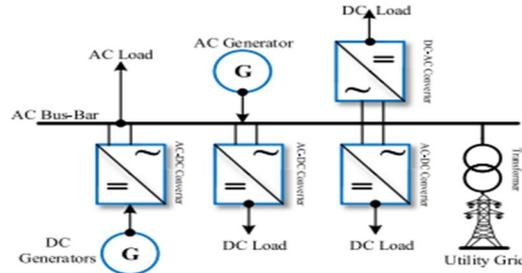


Figure 2: AC microgrid

### E. DC Microgrids

The majority of microgrid generators produce DC that must be converted to AC in order to keep up with the AC grids of today. Because some devices require AC power to function, DC conversion is required at the system's end. Be that as it may, AC MG successfully lessens the DC-AC-DC energy transformation, prompting energy misfortune. Using high DC voltage operation as a benchmark, DC MG aims to solve the AC MG issue. By reducing the number of converters in a single MG system process, the DC-MG structure, in contrast to AC-MG, can provide significant energy savings.. The necessity of the class converters to communicate the DESs, stockpiling gadgets, and loadings. It is evident that DC MGs are less likely to cause power quality issues than AC-distributed grids and are better suited for residential distribution systems. DC MG eliminates the need for DG synchronization and ensures that control is highly dependent on the DC bus voltage, removing several control challenges in microgrid. Additionally, primary control is made much simpler by the absence of reactive power flow management [3]. Additionally, the power supply is unaffected because many modern devices use direct current and do not contain power electronics. The switching phase transients must be properly controlled in MG to prevent device destruction. Thus, the issue of his PQ for this situation warrants extra examination.

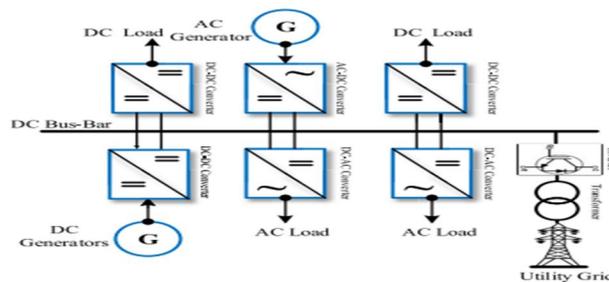


Figure 3: DC microgrid

## III. EVS' INTEGRATION INTO THE GRID

### A. Overview of Ev Technology

EV technology is utilized in PHEVs, also known as hybrid electric vehicles (HEVs). The hybrid electric vehicle, also known as a battery electric vehicle, was the first EV technology to enter the modern automotive market. The electric drive system of EV offers the necessary power to the EV motors at the time the vehicle is in motion. On the other hand, while the vehicle is parked and connected the EV charging system supplies the battery with energy from the grid. The controller, power converter, battery pack, and electric machine are the essential components of an electric vehicle's electric propulsion system [4]. By utilizing EVs to transmit owners, stored energy for the grid of electric vehicles can also actively participate in the electricity market. Electric vehicles can be controlled as auxiliary service providers to the grid through mechanisms known as V2G and G2V, which

control their discharge to and charge from the grid. When it comes to balancing power on the grid in unidirectional V2G, EV batteries are regarded as switchable loads. A single battery in an electric car is insufficient to affect the grid. A large number of electric vehicles known as EV Aggregators act as a link between individual electric vehicles and market participants. Electric vehicles can connect to third-party aggregators on their own or as part of a fleet across cities or regions. Microgrids can receive fewer communication signals from EV aggregators. As a result, market operators can benefit from EV aggregators' ability to lower complexity and mitigate cybersecurity risks.

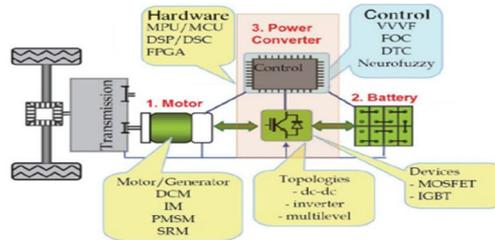


Figure 4: EV electric propulsion

### B. Effects of Ev Integration into the Grid

Electric vehicle grid integration may have an effect on the power system's power quality. The vast majority of the examinations directed so far have inspected what EV mix means for power quality boundaries, for example, voltage profile, voltage awkwardness, power misfortune, and music. In light of their growing popularity, numerous efforts have been made to investigate the impact of electric vehicle grid integration. The effects of voltage profiles, harmonics, power losses, and electric vehicle grid integration on grid stability issues are thoroughly examined in this study. Electric vehicle penetration in the power grid has a significant impact on electricity prices as well [5]. The stability of the grid's voltage may suffer as a result of the integration of electric vehicles. The location, prevalence, and charging time of electric vehicles all play a role in this. Uncertainty regarding EV connection points, their prevalence, and the duration of connections and disconnections raise load requirements.

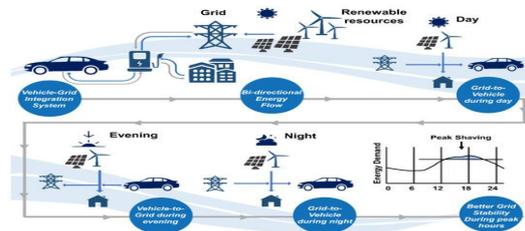


Figure 5: EV Utilization

### C. EV integration's effects on the stability of the grid

The capacity of a power system to return to a steady-state operating state following a fault is known as power system stability. The significance of stability studies is demonstrated by the numerous reports of outages caused by system instability. While charging from the framework, EVs show up as non-straight loads with unexpected attributes in comparison to typical loads and can pressure the power framework. Additionally, it is challenging to predict this new load's behaviour due to uncertainties regarding EV connection points, charging time, and duration [6]. As a result, the power system's stability may become uncertain if electric vehicles are refueled a lot.

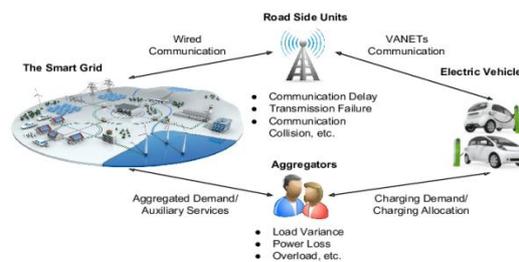


Figure 6: EV and grid interaction

- **Voltage stability impacts:**The term voltage soundness alludes to the power lattice's capacity to keep up with the voltage on all transports at voltage levels after an issue. Grid voltage stability can be significantly impacted by variations in demand for the load and features. After system contingencies, the power system may become more unstable if the load model's alpha is negative. For investigating a comprehensive examination of the effect of EV penetration on the stability of the grid's voltage of a test distribution network of 43 buses with interconnected EV charging stations was carried out [7]. The 43-bus test distribution network's weakest bus has a significantly shorter charging range when using an integrated EV charging station. The weakest buses' charging margins continue to decline as EV integration grows. However, the power grid's voltage stability is impacted by the location of EV charging stations,  $(P/P_0) = a(V/V_0)^a + b$

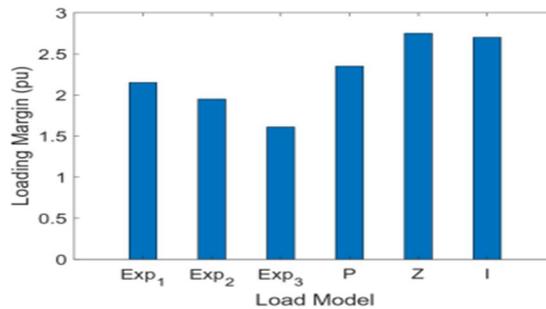


Figure 7: Graph between Load Model and Loading Margin

- **Frequency stability impacts:** The frequency may deviate from the permissible range if there is an imbalance in the power grid's load demand and generation demand. Frequency stability refers to a power system's capacity to maintain acceptable frequencies following a power system failure [8]. The charging grid's load demand will rise dramatically as more electric vehicles are sold, necessitating more power generation to maintain a frequency that is within acceptable limits.

#### D. Power quality impacts of EV integration

Investments in power generation, demand, prices, and emissions will undoubtedly rise with increasing EV penetration. The economic effects of incorporating electric vehicles into electricity markets have been the subject of numerous studies. The following are examples of how EV integration affects load profiles, energy prices, operating costs, and ancillary services.

### IV. HARMONIC AND SUPERHARMONICS CHARACTERISTICS

#### A. Characteristics of Harmonics

Sources of harmonic pollution in microgrid have high penetration and decentralization to form a complete network [9]. Traditional local harmonic mitigation has the disadvantage of being difficult to implement and expensive to maintain.

#### B. Characteristics of Superharmonics

SH emissions have increased as a result of efforts to reduce the number of low-frequency harmonics in inverter output current and improve power factor. In this instance, SH is sent to the grid whenever the inverter is running because it comes from the circuit of the inverter. An SH measurement and mitigation method and the device can be the inverter if it is not producing power or working properly.

### V. TECHNIQUES FOR MITIGATION

#### A. Harmonic mitigation

The effects of EV chargers and harmonic distortion as a whole can be enhanced by reducing odd harmonics to a minimum. The following techniques can be used to lessen harmonic distortion caused by EV chargers' odd harmonic current distortion:

- **Low-pass harmonic filters:**By connecting a capacitor to another resistor in parallel with the inductor, you can create a low-pass filter. Additionally, low-pass filters are regarded as the best and most efficient method

for reducing harmonics in power systems [10]. Due to its simplicity, economy, resistance to maintenance, and high reliability, it is primarily utilized in power transmission and distribution networks.

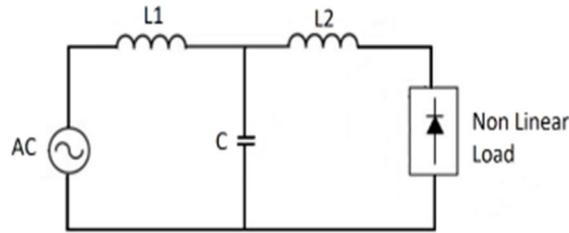


Figure 8: Low pass filter

- Active filter: A nonlinear load's harmonic current spectrum is out of phase with that of active filters. The active filter's harmonic current effectively eliminates all network harmonics when fed directly into the system in real-time. By continuously providing reactive power, both capacitive and inductive, active filters can improve power factors in addition to suppressing harmonic currents.

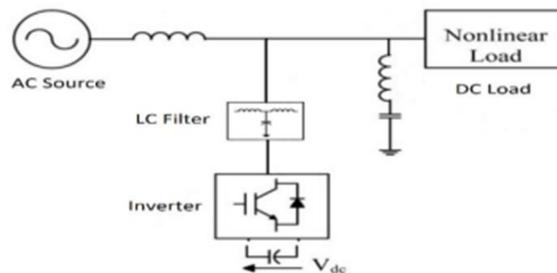


Figure 9: Active filter

- Hybrid control techniques: Grid-connected solar energy systems typically employ hybrid control technology. Passive-based control strategies have progressed to recover reactive power and avoid harmonic distortion by utilizing the current control loop of an attached inverter. This approach is planned to eliminate symphonies twisting by utilizing an ongoing control circle to create and follow the consonant substance [11]. Utilizing physics to model the energy of damped injections and locating system settings that will produce the appropriate response is the objective of control engineering.

### B. Superharmonics Mitigation

- For improving the power quality of the PV as well as batteries in MG, DVRs are used to deal with voltage drops and spikes. With his fuzzy logic-based DVR, he overcame the MG-connected mesh's waviness and slack [12]. MPC was used to make the DVR work better and deal with Sage and MG swelling made of PV, a super capacitor, and a battery.
- Other tools for addressing issues with power quality include STATCOM and SVC. Due to the high prevalence of DREs as MGs, voltage fluctuations were mitigated by STATCOMs [13]. In power system MGs, STATCOMs were also utilized for reducing fluctuation in voltage and compensating for reactive power.

## VI. CONCLUSION & FUTURE SCOPE

With significant progress in the mobility sector, high-efficiency electric vehicles of a new generation are gaining popularity. Electric vehicles should be used instead of gasoline vehicles due to the advantages of battery charging. The primary advantages of charging EV batteries include reduced oil pollution, high efficiency, and dependability. However, one of the problems energy providers face is poor power quality when charging EV batteries. In nonlinear loads, EV battery charging is taken into account because of power electronic components like rectifiers. In contrast, MG Grid is a novel power grid that can be utilized to fulfil energy demands in the future in the direction of green power and smart grids. In MG Grid, some power sources primarily use renewable energy. However, RES output is unstable and weather-dependent, despite the fact that numerous power electronics devices are required. Therefore, a crucial factor in the expansion of MG is the availability of PQ criteria, measurement, and mitigation strategies.

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# Enhancement of Accuracy and Performance of Deep Learning System for Intrusion Detection System

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**Abstract—** In post pandemic scenario, most studies have been realized that there is a need for more work on accuracy in IDS, taking into account the prior study in the field. Furthermore, various aspects are impacting the time consumption during training operations in existing literature. Conventional studies have only given a few solutions for effective intrusion detection. When used, the insights and recommendations from this study will have a significant effect on the strategy employed to reliably foretell IDS. Taking into consideration the training model, the current research ought to provide a flexible and scalable approach to IDS detection. The proposed model will train on a large dataset, increasing the likelihood that it would provide accurate results. Future research should continue utilizing the same paradigm in order to enhance IDS detection. The finding has significant implications for improving IDS forecasting.

**Index Terms—** Intrusion Detection System, Deep Learning, Accuracy, Performance.

## I. INTRODUCTION

The increased frequency of cyber assaults may be directly linked to the rising popularity of using online resources. Passwords, credit card numbers, and other sensitive information sent via a network are susceptible to attack from both within and outside the system. This attack may be carried either manually or automatically by the aggressor. The effectiveness and ferocity of these assaults are only increasing. This particular gang of cybercriminals has becoming tougher to stop. Cybercriminals or cyber attackers are the nefarious individuals responsible for these types of data breaches. Individuals or groups with deep domain experience in the field may sometimes suggest novel, flexible, and reliable intrusion detection systems (IDS).

### A. Background

Intrusion detection is a topic that will be explored in depth in this study. Although IDS studies have been conducted over decades, scholars continue to worry about how reliable their findings are. Multiple machine learning strategies would be used to enhance the IDS's detection capabilities. This research would examine the state of the art in intrusion detection systems in order to pave the way for future developments in the field. For the purpose of security analysis, researchers may think about using an RNN-based LSTM model. A filtering system would be used to enhance precision and efficiency. Furthermore, the suggested IDS model's performance will be compared to that of the standard model.

### B. Intrusion Detection System

In this context, "IDS" refers to an Intrusion Detection System. The fundamental aims of such systems are the detection and classification of intrusions, attacks, and other data-stealing activities. This system is used on the network and the host side, and it operates fully automatically in both environments. Both network-based intrusion detection systems (NIDS) and host-based intrusion detection systems (HIDS) exist.

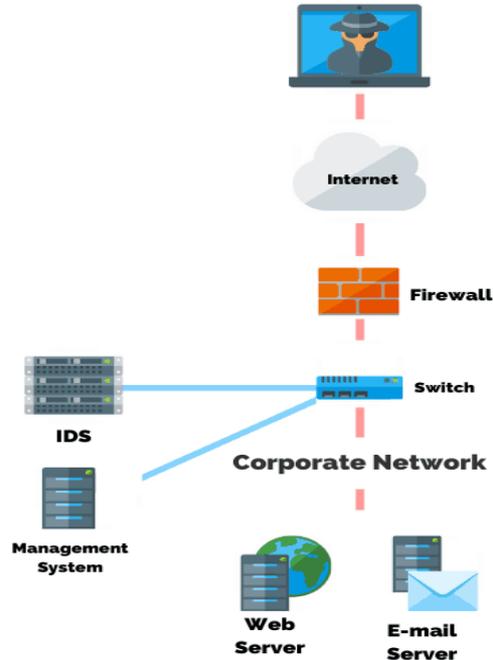


Figure 1. Intrusion detection system

IDS systems include things like burglar and thief alarms. A home's lock system, for instance, is one defense against intruders. However, a burglar alarm will generate noise (or "ring the alarm") to alert the homeowner(s) that a lock system has been compromised and an intruder is attempting to enter the residence. And now there's been an attempt at breaking into their house. Furthermore, IDS is greatly aided by firewalls and routers, which allow for near-instantaneous data transmission.

### C. Taxonomy of IDS

The IDS Classification is shown in Figure 2. Another categorization of intrusion detection systems may be utilized in terms of the protected system type when considering the area as the source of data. HIDS and network-based IDS are two families of IDS programs that leverage information gleaned from a single host (system) as well as information gleaned from a network segment.

Using a modem put in an organization's private network; external users might access the Intranet without detection from the firewall. IPS is network threat prevention system that analyses network traffic flows to identify & prevent vulnerability exploitation. Network (NIPS) and Host (Host) are two forms of preventive systems (HIPS). They monitor network traffic and take steps to safeguard networks and systems. False positives and false negatives are the IPS problem. In an intrusion detection system, a false positive occurs when an alert is triggered despite the fact that there was no assault. In the case of an attack, a false negative is described as an occurrence that fails to raise an alert. A single point of failure, marked updates, and encrypted communication might all be at risk if inline operations were used. IDS monitor the actions taking place in a system or network. It might be a piece of hardware or an application on a computer, depending on your preference. It keeps tabs on any suspicious behavior that may have occurred on a network or system. It makes a substantial contribution to the guarantee of data security. It's one of the most cutting-edge tools for spotting all kinds of network threats with pinpoint accuracy. A network-based system analyses activity such as the amount of traffic, IP address, service ports, and protocol to determine the network's health. Network traffic is monitored by Intrusion Detection Systems (IDS) to look for unusual behavior. In addition, it sends out warnings as soon as activity is identified.

This is referred to as a network-capable software program. It performs a full scan of the system to look for any potentially dangerous activity or policy violations.

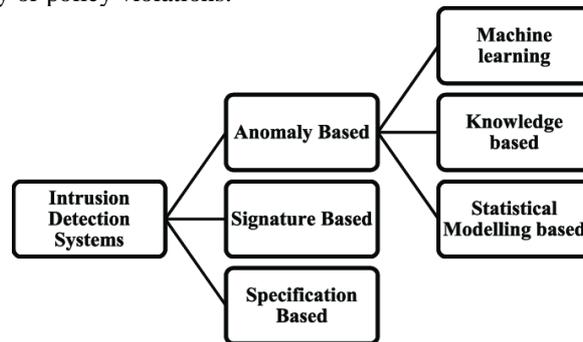


Figure 2. IDS classification

A variety of components make up an intrusion detection system. Sensors that generate security events are one component. It is causing the intrusion detection system to go into overdrive. There's also a console. During routine operations, intrusion detection systems look for signs of known assaults or deviations. Deviations and anomalies are forwarded up the stack and examined at the protocol and application layers.

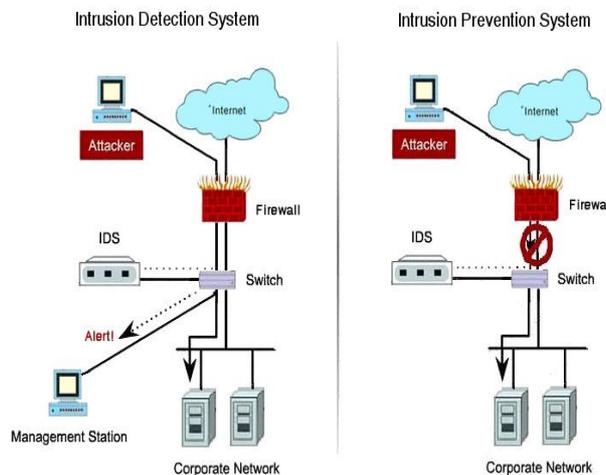


Figure 3. IDS detection and prevention system [17]

**Intrusion Prevention System:** As a safety measure, intrusion detection systems have long been explored. In the IoT system, it works mostly at the network layer. Designed for IoT-dependent intelligent systems, IDS must be able to function in a very limited processing capacity. Fast reaction time is required for this. This is designed to handle a large amount of data quickly.

#### D. Machine learning

ML can be cited as algorithms due to which the software applications predict output in a very accurate way and for this purpose no programming is required. In the algorithms of Machine Learning previous records are used in the form of input for the prediction of fresh output values. Fraud detection, waste filtering, malware threat detection, BPA, and predictive maintenance are all possible uses for machine learning. The way an algorithm improves its accuracy in making predictions in a common way to classify classical machine learning. Unsupervised learning and supervised learning are the two most common methods. Scientists want to make predictions about algorithm selection based on data.

**Working of supervised machine learning:** An algorithm can only be trained using labeled inputs and intended outcomes when using supervised machine learning.

**Working of unsupervised machine learning:** There is no need for data to be labeled when using unsupervised machine learning (ML) techniques. Their job is to seek for patterns in unlabeled data in order to divide it into manageable chunks for further analysis.

Uses of machine learning: Machine learning is now being used in a wide range of fields. Among its many uses is in Facebook's News Feed recommendation engine. It's possible that the recommendation engine may begin to prioritize postings from a certain group if a member often pauses to read them. The engine is working behind the scenes to strengthen the member's online habits. The News Feed will be adjusted if the member's reading habits change and he or she fails to keep up with postings from that particular group in the following weeks.

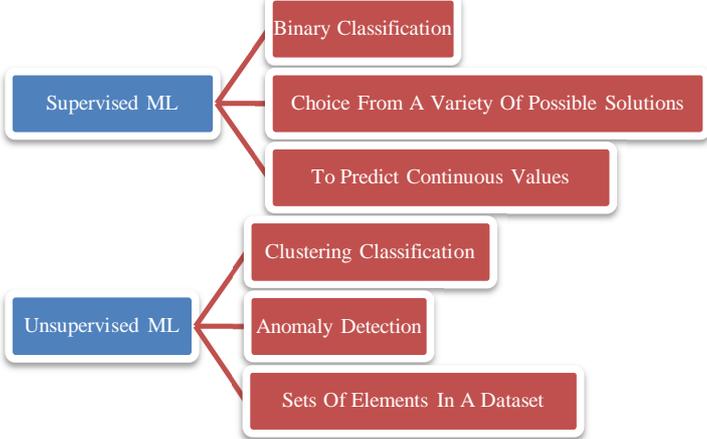


Figure 4. Working of ML-A glance

*E. Deep learning*

Computers are taught to learn by doing, and this is what is known as "deep learning" in machine learning. Autonomous vehicles rely on deep learning to identify things like stop signs and pedestrians, among other things. DNN (Deep neural networks) is used for prediction and classification whereas CNN is used for prediction, recognition and vision. RNN & LSTM is used for prediction and classification. Present research would make use of RNN & LSTM for IDS detection and classification.

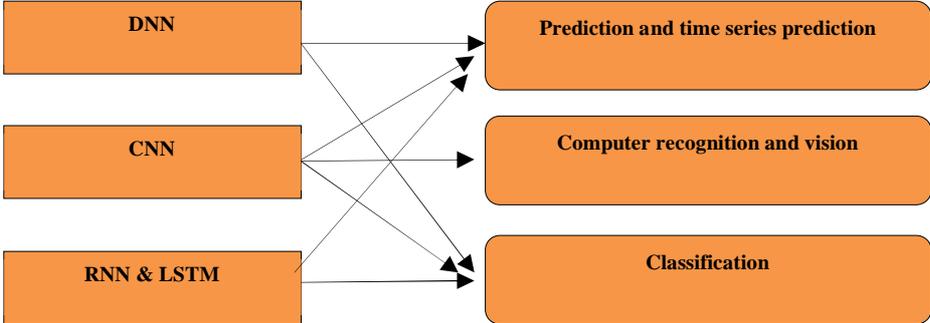


Figure 5. Role of DNN, CNN, RNN & LSTM

*F. Long Short-Term Memory (LSTMS)*

The usage of "LSTMs," a particular sort of recurrent neural network, may considerably assist several tasks. These discoveries are almost exclusively the result of recurrent neural networks. LSTMs explicitly avoid the long-term dependency issue. For them, it's a given that they can remember knowledge for long periods of time without having to put any effort into it. Every recurrent neural network has a basic structure i.e., a repeated series of neural network modules. LSTMs have a distinct recurring module structure than an LSTM chain. Instead of simply one, neural networks include four levels, each of which interacts differently.

II. LITERATURE REVIEW

For undertaking the research on title "Role of Machine Learning in Building Intrusion Detection System", a detailed comprehensive and in-depth study was undertaken on IDS, ML and LSTM. A brief description of those prior research articles is provided ahead:

Analysis by M Tavallaei et al. [1] of the KDD CUP 99 data set was completed in 2009. J. Martens and I. Sutskever [2] focused on learning recurrent neural networks in 2011. A new intrusion detection method was unveiled by M. Sheikhan et al. [3] in 2012. They employed a smaller RNN for their task. It was a feature grouping-based technique. S.Revathiet et al. [4] recommended a full investigation of the NSL-KDD dataset in 2013. Various machine learning algorithms were used. This was done in order to identify intrusions. Researchers W. Li et al. [5] studied the most recent intrusion detection systems under development in 2014. Based on KNN algorithmic programs their system was developed. A wireless sensor network mechanism was devised. Information extraction and automated learning algorithms were surveyed in 2016 by A. L. Buczak et al. [6]. They concentrated on ways to avoid intrusion detection in the first place. Detection of an intrusion was accomplished by the using approaches that combined information extraction with machine learning. Deep learning was cited by A. Javaid et al. [7] in 2016. Their efforts were also dedicated to the development of a more effective intrusion detection system. Classification algorithms for network traffic were examined by Bo Dong et al. [8] in 2016. They came to the conclusion that a variety of ways would be implemented as part of a free information package, and they then put those approaches into practice. They came up with the best method for detecting intrusions from this collection of realistic examples. For the time being, deep learning was the greatest option because of its ability to forecast. Because of this, deep learning approaches were already being used in industries such as structural identification or organizational structure. Monitoring security events provided data for intrusion detection analysis, which were used to determine the current state of the network. Existing intrusion detection approaches that used automated learning showed enhanced accuracy and efficiency. Deep learning was also suggested by T.A. Tang [9] et al. in 2016. The goal of their method was to identify network intrusions. Software defined networking was the focus of the study. Chuanlong Yin et al. [10] presented a model and technique for using a neural network-based identification system in 2017. In addition, they assessed the efficacy of design in the context of dual and multiple class structures. Other factors that affect accuracy include neuron density, as well as different learning speeds' impact on neuron number. NSL-KDD was utilized as the dataset. Using the RNN-IDS classification model, it was discovered that it's possible to accurately represent the data. Compared to other automated learning approaches, the categorization model was significantly more efficient and accurate. Using their architecture, intrusion detection was more accurate. It provided the most up-to-date research approach for detecting intrusions. Analysis of data pre-processing was carried out in 2017 by N. Paulauskas et al. [11]. They examined the impact of pre-processing data on IDS methods. The NSL-KDD dataset was utilized in their study. In 2017, P. S. Bhattacharjee et al. [12] proposed IDS. They utilized the NSL-KDD data collection for this purpose in 2017. R. A. R. Ashfaq [13] did work on fuzziness based semi-supervised learning approach in 2017. They did research for intrusion detection system. Sara A. Althubiti et al. [14] was the one responsible for putting the detecting system in place in 2018. To do it, their team used the Coburg Intrusion Detection data package. In addition, this researcher used the Long-Short-Term Memory (LSTM) and Deeply Structured Learning (DSL) methods (LSTM). Their research yielded an accuracy of around 85 microns. This level of precision was deemed acceptable. Their LSTM outputs were compared with the most elegant approaches in order to meet our assessment criteria. To do which, they employed a variety of measures such as authenticity and versatility. Meira, Jorge [15] did comparative Results with Unsupervised Techniques in 2018. Their research played significant role in detection of cyber attack novelty. Kolli [16] in 2018 focused on Cyber Situational Awareness (CSA) for PTC. They considered Distributed IDS System. Clotet [17] in 2018 considered real-time anomaly-based IDS. They considered this system for cyber-attack detection. Their system worked at the industrial process level of Critical Infrastructures. Intrusion detection was designed by Peisong Li et al. [18] using an enhanced DBN and GA in 2019. Iterative development of DBN network topologies yielded diverse network structures for different assaults, including low-frequency attacks and other forms of attacks. In order to provide intrusion detection, a DBN should be created that optimized network layout. There's no limit to the number of hidden layers that may be generated using a genetic algorithm. Neurons in the "hidden layer" develop in a manner similar to this. Speed of detection was provided by minimizing system complexity to the maximum degree feasible. Using this technique, an intrusion detection system's performance could be improved. Arul [19] makes use of ANN in their IDS based research in 2019. Khraisat [20] did survey of intrusion detection systems in 2019. Author considered techniques, datasets and challenges related to IDS. R. Vinayakumar [21] introduced Deep Learning Approach in order to implement Intelligent IDS in 2019. Many alternative approaches of automated learning were employed by Qusay H. Mahmoud et al. [22] in 2020, including SVM, DT, and random forest. Using the most recent IoTID20 information package, new IDS techniques in IOT networks might be supported. They considered hessian-free optimization in their research. Y. Zhou [23] proposed an efficient intrusion detection system in 2020. This system was based on feature selection and ensemble classifier. Y. J.

Chew [24] considered decision Tree in 2020. They considered sensitive Pruning in Network dependent IDS. Song, Yajie & Bu [25] proposed Novel Intrusion Detection Model in 2020.

TABLE 1. LITERATURE REVIEW

S.No	Author	Year	Topic	Methodology	Short coming
[8]	B. Dong and X. Wang	2016	Comparison deep learning method to traditional methods using for network intrusion detection	Deep learning	Lack of flexibility and accuracy
[10]	Chuanlong Yin, Yuefei Zhu	2017	A Deep Learning Approach for Intrusion Detection Using Recurrent Neural Networks	Deep learning	Limited scope
[11]	N. Paulauskas	2017	Analysis of data pre-processing influence on intrusion detection using NSL-KDD dataset	Data preprocessing and intrusion detection	Time consumption and complexity
[14]	Althubiti, Sara	2018	LSTM for Anomaly-Based Network Intrusion Detection	LSTM	Time consumption
[18]	P. Li and Y. Zhang	2019	A Novel Intrusion Detection Method for Internet of Things	Machine learning	Lack of accuracy
[19]	A. Arul Anitha	2019	Artificial neural network based intrusion detection system for internet of things	Artificial neural network	Performance issues
[20]	A. Khraisat, I. Gondal	2019	Survey of intrusion detection systems: techniques, datasets and challenges	Data processing, classifier, machine learning	Lack of technical work
[21]	R. Vinayakumar	2019	Deep Learning Approach for Intelligent Intrusion Detection System	Deep learning	Performance and accuracy issues
[22]	Ullah, Imtiaz	2020	A Scheme for Generating a Dataset for Anomalous Activity Detection in IoT Networks	Activity detection scheme	Lack of smart solution
[23]	Y. Zhou, G. Cheng	2020	Building an Efficient Intrusion Detection System Based on Feature Selection and Ensemble Classifier	Feature selection Classifier	Lack of feasibility
[24]	Y. J. Chew	2020	Decision Tree with Sensitive Pruning in Network-based Intrusion Detection System	Decision Tree	Slow and outdated approach
[24]	A. Kajal et al	2020	A Hybrid Approach for Cyber Security: Improved Intrusion Detection System using ANN-SVM	Genetic Algorithm (GA) and Artificial Bee Colony (ABC) algorithm for Feature Selection, Artificial Neural Network (ANN) with Support Vector Machine (SVM) as Classifier	Complex and scope of accuracy enhancement
[25]	Song, Yajie	2020	A Novel Intrusion Detection Model with the support of a Fusion of Network and Device States for Communication-Based Train Control Systems	Fusion of network	Complicated to implement in real life

### III. PROBLEM STATEMENT

Taking into account the findings of prior studies in IDS, it has become clear that further effort is needed to improve accuracy. Additionally, a number of variables have been shown to affect how much time is needed for each step of the training process. In terms of effective intrusion detection, the solutions supplied by traditional research are inadequate.

### IV. NEED OF RESEARCH

Although there have been numerous studies conducted on IDS, it has been noted that improving the reliability of IDS detection remains a significant obstacle. The current state of the art in IDS detection and categorization is inefficient and might benefit from the introduction of a deep learning technique that can achieve the same or better results in less time.

## V. SCOPE OF RESEARCH

The approach utilized to reliably forecast IDS will be significantly influenced by the thoughts and recommendations related to this study. Taking into consideration the training model, the latest research ought to provide a flexible and scalable method of detecting IDS intrusions. Since the proposed model will use a large dataset for training, its overall accuracy should improve. If we want to make progress in IDS detection, further research must use the same paradigm. The research will have significant implications for improving the ability to foresee IDS.

## APPENDIX A APPENDIX TITLE

Appendixes, if needed, is numbered by A, B, C... Use two spaces before APPENDIX TITLE.

## ACKNOWLEDGMENT

The authors wish to thank A, B, C. This work was supported in part by a grant from XYZ.

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# Real-Time Remote General Healthcare Clinic

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**Abstract**— Distributing medicines to people located in remote areas is a daunting not so easy for the Government and the Real-time remote general Healthcare Clinic help meet the above requirements. The model has basic and emergency medicines which is monitored and can be refilled. We can consider it to be a computerized drug stock-room system that people can access easily in an emergency without having to go near the pharmacy. The machine could be easily setup in remote regions, such as highways, deserts, tribal areas. It is a  $\mu$ controller and motors based system that dispenses the drug when the user accesses the event via input drug storage data can be obtained remotely based on this information refilling the machine will be hassle-free.

## I. INTRODUCTION

Some groups in India are biting the dust because they are not in leadership positions and medicine is not available in time. Most need regular access to the most basic medicines. This is due to the level of network needs and as a result there is a growing shortage of funds to hold these posts. If the need for medicine is so great that pharmacies are not open or medicines are not available in this mood in the evening, problems arise. In remote and remote areas and areas with low public turnover, the availability of medicines within reach of patients is a fundamental issue. Government accountability, prudent choice, adequate public sector support, productive circular structures, control of costs and commitments, and drug delivery by current and future prescribers to improve the enduring quality of healthcare in India.

Education in the culture of normal use. In the current situation where we want all devices to be programmed, this model will be of great help for the state of well-being. This framework is fully constrained by a 16-bit microcontroller. To improve efficacy and patient well-being, these frameworks provide potential components for PC-controlled capacity, management, observation, and tracking.

The World Wellbeing Association mentions 'Countries with less social finance classes has less of well-being. Happiness Inequality is tightly linked to levels of social status. Happiness has all the characteristics of being one of the anchor points that connect education and access to data. Competent electronic health checks with clever billing frameworks for remote areas are another idea, but very useful in an agricultural country like India, where healthcare is virtually rudimentary. Dispensing machines allow prescriptions to be stored securely in permissive payment units and the use of opiates and other controlled substances to be tracked electronically. The framework is customizable as new skills can be added or current skills can be modified according to requirements.

## II. RELATED WORKS

International Situation – According to work done by Shih Shih in 2016, he developed an intelligent medicinal dispenser in which the dispenser is fully programmed with the exception of setting up activities and retrieving

individual parts from the medicinal compartment. Suggested construction and operation. Improvement progresses through current connections and correspondences 2121 between parts that rely on broader collaboration [1].

According to a study proposed by Sarika Oundhakar in 2017 on information on equipment and innovations that deal with most of the ubiquitous confectionery machinery. It makes sense to use these candy machines to reduce reliance on labor and magnify their effectiveness [2].

In 2012 he proposed a framework that works for all sizes of pills and containers, done by Mukund. The concentrate also had a schedule he could change for 31 days for 21 drugs. The station broadcasts four warnings a day. In addition, a program gradually changes the number of doses and the number of doses as needed [3].

Based on a work by S. Gayathri on 2015, it aimed to monitor patients in remote regions by wearable sensors. Here, the framework includes temp, strain, heart rate, and rate increase sensors. Information is monitored and put to use by a  $\mu$ controller. Additionally, the framework uses the GSM modem method to send data to the expert wearable device via SMS [4].

Referring to a work of Varun Vaid in 2014, he proposed a procedural plan to promote candy vending machines. These candy machines have a variety of applications that can be deployed anywhere and used by anyone [5].

E-Health Checking with a superior management framework for remote areas is powered by an Arduino implementation. The planning and execution of this framework combine both management and observation parts to achieve better adaptation.

National Status - A 2018 study by Rajendra Prasad P showed that efficient e-health monitoring using a smart remote area dispensing system can be used to plan and execute a variety of well-selected medications using pre-defined A framework that contains the pill container used by Arduino to allocate a. Medicine with the help of the appropriate switch. Clean pillows and maternity units are added for the wellbeing of women. Monitoring sensors such as temp, heart rate and circulatory stress is present to really see the patient's condition. If conditions exceed normal, an emergency button can be pressed to provide assistance. [6]

A 2017 Vishal Tank study provides an adaptable, easy, and crude solution for extending basic healthcare to all positions at a very secure price. Machines can be adapted to any area or environment with minor changes in equipment and programming. This machine is hooked up to add a sharp drag unit that sends a top-off notification message to the nearest scientist when the number of drag strips falls below a certain level. [7]

In 2017 According to Mahaveer Penna's research, an automated drug dispensing machine proposal was planned and implemented to further develop medical care in remote areas by caring for patients with essential conditions such as fever, migraine. This frame utilizes state-of-the-art specialized perspectives such as implantable frames and Arduino to administer the medicine expected by the patient according to the patient's wishes through a keyboard interface, which has achieved great results in improving medical care. We've also consolidated medical development information into one place. Simple trial and error justification. [8]

### III. COMPONENTS

The prototype done is made using an ESP32. The other components used in the model are DC motors, switches, and IR sensors. Components are selected from those available in local stores to represent the most appropriate quality-price ratio. A DC motor is used to drive the trays and deliver the desired drug. A gear set converts that high speed into high torque. This is important for the design as the main job is to open the tray with the product on it.

A medical vending machine should be designed as a service to deliver medicines with special requests. This model's working requires a vending machine to dispense commonly used non-prescription medications on demand. The working principle of this method is illustrated in block diagram.

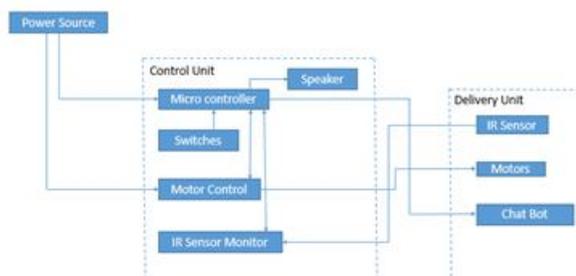


Figure 1: Block diagram

The block diagram above fully describes how the project works. As you can see, the whole project is divided into her two units, the control unit and the delivery unit. The control unit consists of parts necessary for data processing such as controllers and input switches, and the delivery unit consists of motors, infrared sensors, chat-bots, etc., all attached to the delivery tray.

The main component of the model is the microcontroller ESP32. Connect all peripherals and programmatically control all processes in the system. Panels are used as inputs for controllers. Separately, an infrared sensor is connected to the controller to monitor and update the availability of medicines in the medicine tray. push buttons in the system allow product selection. Each medicine becomes available at the push of a button.

DC motors are responsible for drug delivery by opening and closing the shell. Pressing a specific button turns on the motor for the respective drawer, opening it with the help of a gear set and closing it after a specified time as a pre-caution. Patients/consumers have access to medicines during business hours.

The prototype has a chat-bot feature that recommends medications that are appropriate for a patient's symptoms. This chat-bot uses embedded C and is trained with a certified list of symptoms and medication records.

Other than that the availability of medicines in the trays are monitored and continuously updated to the cloud via internet using the ESP32 controller. And the data in the cloud are in encrypted format for basic security purpose and for viewing the details an OTP generation method for the registered email id is used

The data is available with the time stamps.

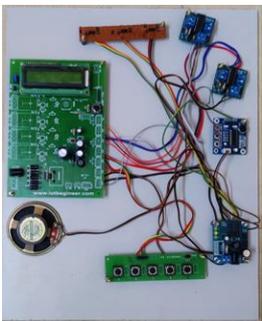


Figure 2a: Control unit



Figure 2b: Delivery unit



Figure 3: Chat-bot

IV. LIMITATIONS OF THE PRODUCT

One main limitation of the vending machine is the required supply voltage setting for the . This is determined by the input voltage for the element and its diversity. The Main Board runs up to 15V along with the DC motors also which also draws considerable amount of current and requiring input voltage of 10-30V, so we can't connect the machine straight to the main 220V power supply. In the prototype the Control board and the motor are powered by individual power supplies, can be considered impractical.

V. PROBLEMS AND POSSIBLE SOLUTIONS

A problem observed is when the IR sensor generated high output value. When inspected the reason for this malfunction was the bright lights in the environment where it was used. So the IR sensor works the best in dark conditions

Another problem is that since multiple components are used the availability of pins for connecting them lacked which resulted in making multiple compromises and it also reduces the availability of pins for additional components in the future

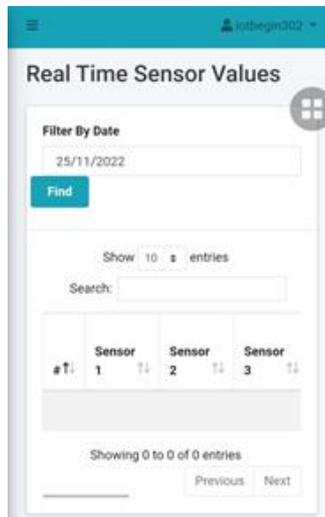


Figure 4: Live stock monitoring

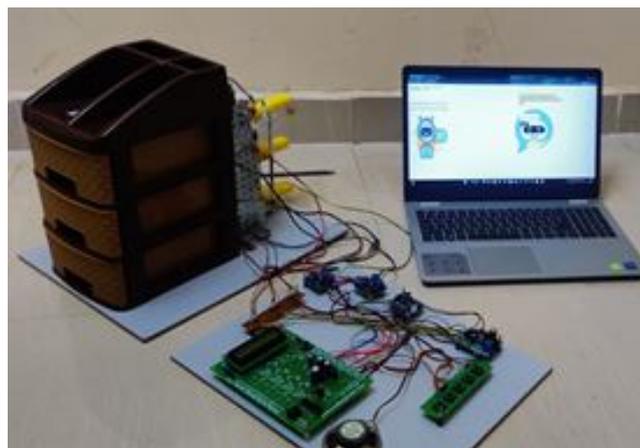


Figure 5: The final model

## VI. FURTHER IMPROVEMENTS

In the current prototype, there is a vast amount of improvements that can be made. Firstly the lack of user authentication. Since we are dealing with medicines to prevent cases of overdose or any other undesirable things from occurring authentication is a must and can be added. Which QR code method may be a good option with each person having their own QR code and when it is scanned the patient will be identified

The power supply, as mentioned above, consumes very little power considering its size, and the main advantage of the proposed vending machine is its remote location. So the system can be completely off-grid. this is a better option. , would be a better option A better option would be to use solar panels and batteries to store the extra power generated for running without the sun.

For pharmaceuticals, the issue of dosing must be addressed. To do this, we can use Young's rule, a formula that calculates dosage for different age groups using age and adult dosage as parameters. Depending on the patient's age, the system will provide the right drug with the right dosage.

Patient monitoring is not done by the model, sensors such as temperature and blood pressure sensors could be used in the future to monitor patients and recommend better drugs to them.

## VII. CONCLUSION

In this real-time remote general medicine clinic project, a basic model of a medication machine with inventory monitoring and consultation software (chat bot) was created. Its potential hasn't been fully realized yet, but there are a lot of additions that can be made to the model, so this project shows how to make a remote medication dispenser and what additional basics you can do with your project. Ideas include tethering chat-bots to hardware, the ability to physically monitor patients to prescribe better dosages, and software improvements for better counselling.

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# Detection of Varicose Superficial Venous Thrombophlebitis in Vein using MSNN Algorithm

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**Abstract**— A doctor uses the diagnosis of medical images to predict whether the person suffers from damaged tissues or organ. Therefore, object detection and image classification of medical images has received some concentration in medical field. This paper as put forward a varicose vein detection algorithm based on varicose superficial venous thrombophlebitis images and multi-level neural network algorithm (MSNN). The varicose vein diagnosis system has better accuracy and performance due to the uniqueness of the leg vein images. The proposed system used multi-scale technology by pre-processing the images and extracting features by feature extraction to create a detection system of varicose disease with high performance.

**Index Terms**— Vascular endothelial cells, inflammation, Multi-scale neural network, Sclerotherapy, Endovascular Laser Therapy.

## I. INTRODUCTION

Biometrics is an automated recognition system that is used recognize individuals by means of physical appearances. Veins is a blood carrying vessel that carries blood to every part of the body. Varicose veins appear as dark blue or purple veins which are swollen and enlarged. Digital medicine is a category in medical field, which is a combination of prescription medication and ingestible sensor component.

The deep learning algorithm proposed by Lau et al.[1] the algorithm is used to achieve a good recognition system by training with several skin damaged images of the patient. Mohammed et al.[2] used 3 dimensional convolution network to classify and recognize the patients with Alzheimer's disease. Kawahara et al.[3] used a CNN structure for obtaining structural connectivity map from DTI by MRI scans. Yuan[4] used a multi-dimensional CNN algorithm to classify the skin tissue damages, working with each CNN model with a different image resolution. Al-Antari et al[5] used a modified neural network combined with support vector machine to detect breast tumors, suggesting that the given model as a improved performance of the breast image classification.

Varicose veins present in the lower limbs of the body are the most common disease of outer vessels. Around 23% of the people present in the world suffer from varicoses in their legs and knees and at present, number of the people having varicose veins has exceeded 25 million in the world. In China, the ubiquity of the varicoses as exceeded 8%. In addition to affecting esthetics, varicose veins can also cause complications, such as bleeding in the lower limbs, superficial veins swelling, inability to walk for long distance and reduced work capacity.

Varicoses are generally valves that are enlarged and swollen that generally appear on the legs and feet of the patient body. This condition happens due to the flow of blood is against gravity and occurs after prolonged standing. Varicose veins cause aching pain in the legs and feet that cause discomfort in loss of joint function, which can lead to circulatory problem.

The main problem facing doctors today is the difficult access to veins for intravenous drug administration.

Several problems occur when veins are incorrectly detected, such as injuries, lesions, thrombus, etc. Hence a non-surgical varicose diagnosis system based on MRI imaging using MSNN algorithm has been successfully developed which classifies the varicose veins from the given dataset.

Thrombophlebitis is an blood clot in leg and feet vein that causes an inflammation superficial veins and affected at the surface of the exterior skin. If a blood clot grows inside a swollen part of the vein, the vein appears puffed up and intensified.

Deep vein thrombophlebitis(DVT) appears due to the blood clot formed in the deep veins of the human body usually in the lower limbs. Varicose veins constitute and acts as a primary reason for many diseases, especially of the lower limbs.

## II. RELATED WORKS

Varicose veins are broadened veins in the hypodermis tissues of the lower legs or legs and varicose veins are quite easily visible to the naked eyes. In the today's world, the improvement of society and changes in the life style of the people, varicose veins have become a universal disease in the world. Most people with varicose veins usually don't detect any changes in the superficial layer of the skin. Due to this people don't give enough attention to the changes in the lower limbs of their body due to varicose veins. Prolonged obstruction of the superficial valve of the lower limbs can cause severity in the varicose disease. Spider veins is mild type of varicose veins which are smaller in size and appear in red or blue in colour and frequently appear in lower legs. Varicose veins can be prevented by regularly exercising, maintaining a healthy weight, wearing loose clothes which are not that tight to the body. Fig.1 shows the comparison of normal and varicose veins.

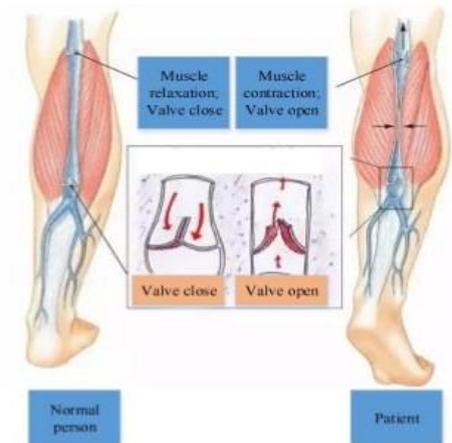


Figure 1. Comparison of varicose veins and normal veins

Figure 1

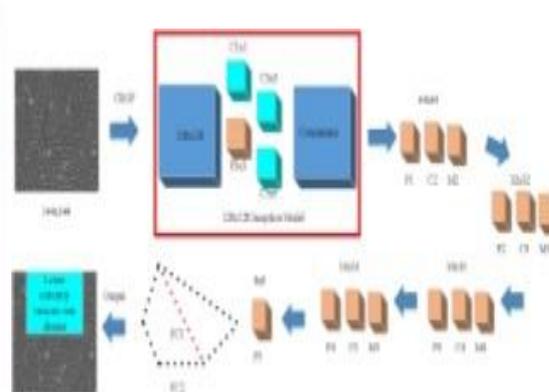


Figure 2. Lightweight deep convolutional neural network with enhanced feature extraction

Figure 2

The first work is done by Lau et al.[6] in which a network algorithm has successfully achieved a good detection system using 100 MRI images of the skin damages. By Kawahara et al.[7] applied a MSNN structure that connects the structural connectivity map that is obtained by DTI and MRI images. The main advantage of the MSNN algorithm is that it makes use of the spatial coherence that is it gives equal importance to all the edges of the network and it is independent of the geometrical transformations. The treatments that are used for varicose vein disease are injection treatment(sclerotherapy), laser treatment and vein surgery. Surgery is considered as one of the painful methods as it involves interceding by tubal ligation and also pulling out of the veins, these causes the patient massive pain and also the patient takes a long period of time to recover from the surgery. Sclerotherapy is a methodology that done by injecting medicine through the blood vessels or lymph vessels and this makes the swelling to shrink. This causes enormous pain in the swollen area as it is difficult to exactly find the affected vein. Sclerotherapy is commonly used in the treatment of spider veins which is a mild version of the varicose veins and this procedure is a non- surgical treatment as it only requires injection for treatment of the varicose vein disease. Complications of the varicose veins includes draining of blood, skin changes of the patient, rash, ulcers, infection, bleeding, blood clots. Endovascular varicose laser surgery is a method that is used to treat varicose veins by penetrating laser into the body and produces heat which shrinks the varicose veins. A model is designed to examine the bandwidth of the ultrasound devices and various values of the return

speed. The conclusion of the simulation is that the bandwidth in which necrosis in the valves of the blood vessels can be determined.

### A. Multi-level Neural Network

Specialists and various exploration results that have extraordinarily advanced the advancement of clinical picture research favor the use of profound convolutional brain networks in clinical pictures. In any case, because of the absence of open huge scope data sets, most examination utilizing profound convolutional brain networks is completed on restrictive little data sets, and the heartiness of the organization isn't excellent. Fig.2 represents the multi-level neural network.

Furthermore, profound convolutional brain networks utilize managed preparing strategies. To further develop the organization speculation execution, it is important to extend the organization progressive system or look for a more sensible organization structure. As the level of the organization develops, more marked preparing information is required for variation. This paper joins the elements of Google-Net organization structure, VGG, and the writing to build a lightweight profound convolutional brain network with further developed highlight extraction. The letter "C" demonstrates the pack base layer. "M" indicates the MFM enactment layer. "P" demonstrates most extreme pooling and "Fc" shows a completely associated layer.

### B. Inception Layer

Google Net is a kind of neural network that uses inception model for training and evaluating the given dataset. Google Net is a model that utilizes multiple size of the filter sizes present in the inception layer and rarely max pooling, two filter sizes for making the resolution of the images halved. There are some changes present in the Google Net from the other similar architectures of the neural network, that is Google Net uses 1x1 convolution layer and also global mean pooling. Fig.3 shows the inception model structure.

### C. Activation Function

An activation function is a module that is used to provide compact outputs for compact inputs whereas it provides huge values if the input surpasses a threshold limit. There are few examples for activation function such as Relu, Sigmoid, Step function, Leaky Relu. The mathematical representation of the activation function is given as in the Figure.4

### D. Relu

Relu is a rectified function in which the function tends to zero if the input values are less than zero and the function tends to the input value if the input values are greater than or equal to zero. Fig.5 shows the equation and Fig.6 shows the graph of relu function.

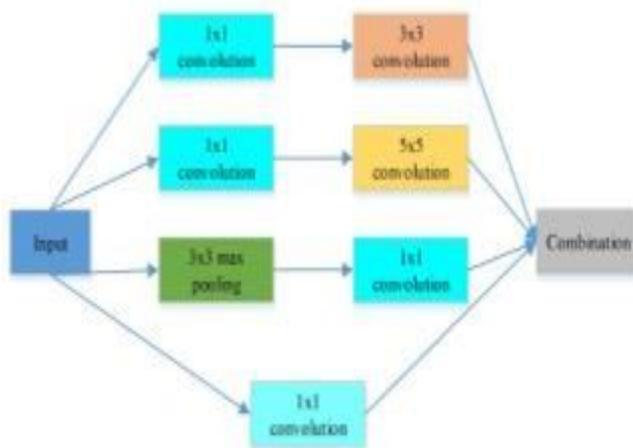


Figure 9. Inception Model unit structure

Figure 3

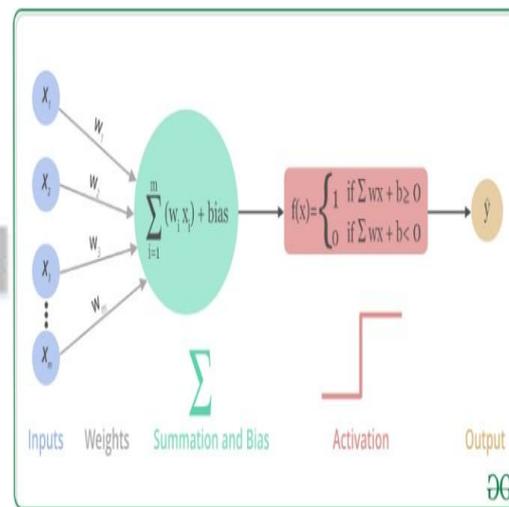


Figure 4

$$\sigma(x) = \begin{cases} \max(0, x) & , x \geq 0 \\ 0 & , x < 0 \end{cases}$$

Range: [0 to infinity)

Figure 5

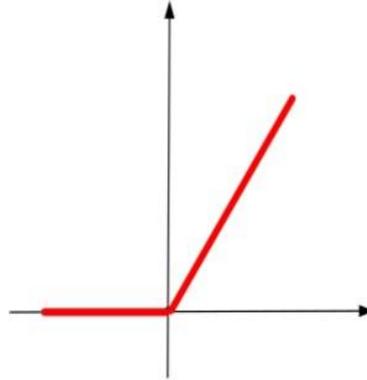


Figure 5.ReLU activation function

Figure 6

### III. PROPOSED WORK

Varicoses is classified into many types based on the severity of the disease in the patient's body. In this paper, each part of the image segmentation is developed to detect the varicoses by image pre-processing, feature extraction and at the end segment the images over the original images. By using the algorithm, the classification results determine the efficiency of the infected veins. Fig.7 and 8 shows the block diagram of training set and testing set of the network.

### IV. WORKING

#### A. Image Preprocessing and Feature Extraction

The images present in the dataset are pre-processed and the features are extracted by using mean pixel value method. These images are then separated into training set and testing set.

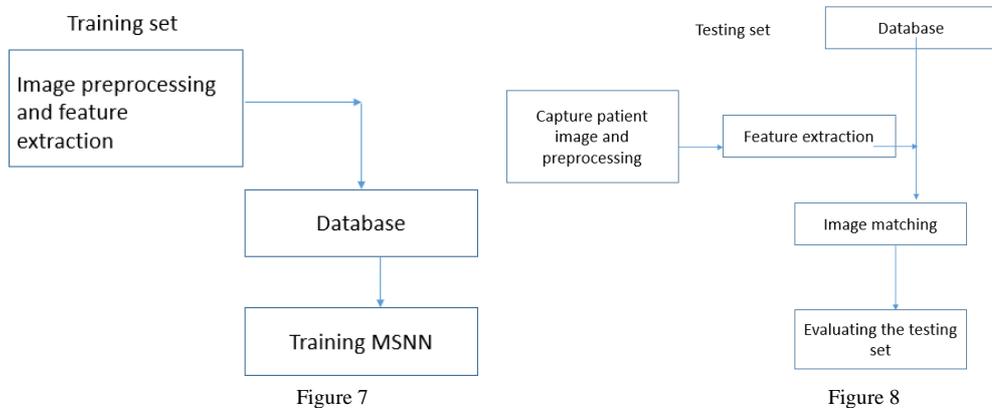
#### B. Neural Network Training

After pre-processing and feature extraction of the images present in the dataset, the MSNN algorithm is the trained using the training set of the dataset. After training the neural network using training set, it is then evaluated and validated by the testing dataset. It is done by matching the testing set with the original images and the accuracy of the MSNN algorithm is measured. The accuracy of the testing set tends to increase by increasing the number of neural network iterations. The efficiency and error test curves of the MSNN model in maximum aggregate sampling mode are shown.

#### C. Network Performance Comparison

The amount of training parameters of the MSNN model network is related to the depth of the network and the number of network filters in each layer. A deeper network layer and a wider network width can capture more network features and improve the network's ability to represent features. The network parameters of NIN and Google-Net are smaller than VGG. Network training time is shorter, resource overhead is less, and network execution efficiency is higher. At the same time, the MSNN model constructed in this article introduces a deeply separable convolutional layer, the calculation size of the model parameters is the smallest, and the network runs

the fastest not only in the network. A desktop computer with a graphics card can run fast and can run quickly on a portable mobile device. Combined with image multi-scale technology, it can still achieve high classification accuracy while reducing the parameters of the deep convolutional neural network model.



## V. RESULTS

The proposed system accuracy for 30 epochs or 150 iterations of MSNN model is shown in Fig.9 Also the model is used to predict test samples of the dataset and the confusion matrix of the predicted values is displayed in the Fig.10

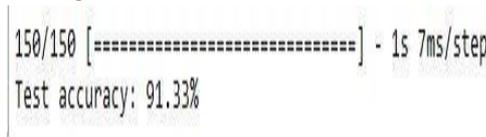


Figure 9

	Predicted NORMAL	Predicted VARICOSE
Actual NORMAL	20	7
Actual VARICOSE	6	17

Figure 10

## VI. CONCLUSION

There is a positive correlation between vascular endothelial cell inflammation and varicose veins of the lower extremities. Therefore, this paper uses vascular endothelial cells as a research object to construct a deep convolutional neural network for lower limb varicose veins to improve classification and recognition accuracy. The accuracy of the presented work with MSNN comes close to meeting the acceptable error levels that would be required for a system with some classification of a patient's leg image. Compared with the existing deep convolutional neural network model, the network can improve the feature extraction ability of the network, has the characteristics of fast running.

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# Email Automation and Database Management

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**Abstract**— Senders and recipients both put a lot of work into managing their email. Perhaps some of this job can be automated. In order to determine. (i) the kind of automated e-mail handled user's desire. (ii) the types of data and computation required to support that automation, we conducted a mixed-methods need-finding study. We organised the demands through a design workshop, ran a poll to further understand those categories, then categorised the email automation software already on the market to determine which criteria have been satisfied. Our findings point to the necessity of a richer data model for rules, additional attention-management options, using context of internal and external emails, complex processing like response aggregation, and sender-friendly features. We created a framework for producing short stories to better explore our findings. An efficient information system gives users accurate, timely, and pertinent information that they may use to make decisions. When making judgments for current operations as well as long-term strategic planning. To ensure that the decisions made are the right ones, the decision-making process must be supported by timely and pertinent data and information. Information is created as a result of data processing, which information systems perform using information technology.. Data management is required to ensure that information is the right information, at the right time, accurately, and pertinently. Data is the building block of information and is gathered in a database (database) to provide To collect the necessary information on the academic organization of the institution, for instance, a university must create an academic database that at the very least includes student, lecturer, course, room, and schedule data. Therefore, a basic understanding of databases and Database Management Systems is required in order to build a successful database. Database management solutions are used to organize the massive volumes of data that businesses use on a regular basis. Managers need to be able to swiftly and readily discover certain facts so that they can make decisions. The company divides the complete data collection into a series of linked data tables; by reducing data repetition, these linked tiny collections of data will ultimately improve data consistency and accuracy. Most businesses today employ databases with a relational structure. Automated email is any message that is automatically sent from your email service provider (ESP) in response to a particular user's actions (or inactions) on your website or web app. You may use automated mail to provide one-to-one communications to customers in real time, enhancing their engagement, loyalty, and retention.

**Index Terms**— SQL, SMTP, Python, Pandas, NumPy, E-mail, Automation etc.

## I. INTRODUCTION

In the 51 years since its creation, email has developed into not just a commonplace instrument for individual and

group communication but also a location for keeping track of assignments, activities, and personal information. Email is increasingly intimately associated with work as a result, and for many individuals, email takes up the majority of their workday. Since at least 1990, when the program allowed writers to Due to the burden it generates, there has always been a need to automate many aspects of email processing. To filter email into certain folders, regular-expression scripts may be created. Richer automation functionalities have developed over time. For instance, Boomerang enables users to postpone receiving emails so they can be received again at a later time. A user is forced to manage all of their requests manually, rely on a human assistant, or juggle a collection of 3rd party plugins since different apps provide various automation possibilities.

## II. MOTIVATION

Our Initial Promise to finding the best solution and overcoming current industry issues. It Will Improve Our Profile Being a Sponsored Project. Our approach will lessen manual labour. First exposure to industry to maximise effectiveness.

## III. PROBLEM DOMAIN

This project's primary method of operation is a database management system and sending automatic emails to the non-fillers after comparing and segment the data from the GST portal. The automated processes will take the place of the manual ones. By automating processes, we can cut back on expenses, time, and waste.

## IV. PROBLEM DEFINITION

The organization's immediate challenge was to separate the data by contrasting two databases based on specific criteria. We must automatically email alerts to the "non fillers" category after segregation. When an organisation receives a lot of data from the "GST-PORTAL," we must divide it into two groups, such as "Fillers" and "Non-fillers," based on the data already in the organisation. After segregation, we must automatically email the non-fillers with transaction data and a reminder to pay their debts as soon as feasible using the organization's letter format. This project tries to overcome the real time difficulty encountered by industry.

## V. STATEMENT

Automated emails are issued to non-fillers to pay their invoices as soon as is possible.

## VI. REVIEW OF LITERATURE

Database management systems (DBMSs) are pieces of software that make it simple for businesses to consolidate data, manage data effectively, and give application applications access to data. Several DBMSs, such as Microsoft Access, IBM DB2, Postgres, Oracle, Microsoft SQL Server, are highly popular. The primary purpose of a database management system (DBMS) is to store data. Users are not required to understand how data is stored or processed. Each piece of data entered must be transformed into a predetermined structure and format as part of the DBMS's function in data presentation and transformation.

Email users are both senders and recipients, and systems provide automation capabilities addressing both roles. For instance, email clients provide two types of reminders. Email users can set a reminder for messages to get back to it later (reminder as a recipient) and remind their recipients to solicit responses (reminder as a sender)

### *Implementation\Methodology*

Data will be compared under the parameters set forth by the company. After contrasting two types of Data Segregates:

The matched data from both datasets fall under the fillers category.

The unmatched data from both datasets fall into the non-fillers category.

Gathering of all transaction information for a single consumer that falls into the non-filler category.

Keeping track of this transaction in many Excel files using the GSTIN number. After that sending each non-filler an automated email by obtaining their email addresses from the organization's database.

## VII. PROBLEM SOLVING

The problem will be resolved in two steps.

*Phase 1:* Importing the organization's pre-existing dataset for the Non-Fillers Category.

By using manual filters on an excel sheet, the organisation has filtered out this dataset.

gathering of all transaction information for a single consumer that falls into the non-filler category.

Keeping track of this transaction in many Excel files using the GSTIN number.

sending each non-filler an automated email by obtaining their email addresses from the organization's database.

*Phase 2:* Importing the GSTR2-A Company register and Portal datasets.

Data comparison on the terms set forth by the business.

Data division into two categories:

The matched data from both datasets fall under the fillers category.

The unmatched data from both datasets fall into the non-fillers category.

Exporting the Non-filler dataset that has been filtered out onto a separate Excel sheet for usage in the following phase

## VIII. CONCLUSION

Users want their email management to be more automated, according to our research. The results of the three different need-finding probe we carried out consistently pointed to a few common categories of email needs: capturing richer data models and internal and (time-varying) external context, using them for recipients to manage attention and for senders to lessen recipient load, and automated content processing to, for example, aggregate replies to an invitation or extract attached photos into a relevant storage location.

hackers that abuse the characteristics of email today. We discovered people utilizing attention-management techniques that recycle existing email features. For instance, users have been seen marking emails as unread across numerous probes to act as a reminder to revisit and read them.

## VIII. FUTURE SCOPE

A graphical user interface that is interactive and simple to understand. saves time and money while increasing accuracies-useability (i.e., scripts can be used for any similar form of automation) (i.e., scripts can be used for any similar type of automation). Flexible (i.e., easy to adapt for any future updates) (i.e., easy to modify for any future updates). The organization's manual tasks will be replaced by automated ones. Business automation standards.

## ACKNOWLEDGEMENT

Perseverance, inspiration and motivation have always played a key role in the success of any venture. At this level of understanding it is difficult to understand the wide spectrum of knowledge without proper guidance and advice, hence we take this to express our sincere gratitude to our respected Project Guide who as a guide evolved an interest in us to work and select an entirely new idea for project work. He has been keenly co-operative and helpful to us in sorting out all the difficulties. I am also grateful to my classmates and cohort members, especially my office mates, for their editing help, late-night feedback sessions, and moral support. Thanks, should also go to the librarians, research assistants, and study participants from the university, who impacted and inspired me. We would also like to thank our HOD and Principal, for their continuous advice and support.

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# A Novel Approach with Deep Learning Method with Effective Storage Security in Hybrid Clouds

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**Abstract**— Platforms, data storage, and IT services are delivered over the Internet in cloud computing, a contemporary computing technology. Task management is crucial for effective scheduling and affects the overall effectiveness of cloud computing environments due to the full availability of resources and the significant number of tasks assigned to it. In cloud environments, security is a crucial concern in addition to timing. Since cloud computing services go beyond data archiving and backup, supporting data dynamics through the most popular types of data manipulation, like block modification, insertion, and deletion, is also crucial for practical use. A step, that is. Public auditability or dynamic data manipulation have not always been effective in prior attempts to ensure remote data integrity, but this document accomplishes both. We first recognized the challenges and potential security concerns of direct extension with fully dynamic data updates from prior work, and then we seamlessly incorporated these two crucial features into the protocol design. In particular, we enhance existing proof-of-storage models by modifying the conventional Merkle hash tree structure for block tag authentication to achieve effective data dynamics. This demonstrates how to construct an elegant validation scheme for dot. To secure cloud data storage, a variety of techniques have been put into practice [1]. The safety analysis method described in [1] is not a useful technique, though. The new idea of smart card authentication is used in this work to provide security for cloud data storage. Data storage in the cloud can be made more secure using an effective method called smart card authentication. We implemented this prototype in accordance with the CPDP scheme within the virtualization framework of a cloud-based storage service. Hadoop Distributed File System (HDFS) 6 is illustrated in Figure 5 as an example.

It is a distributed, scalable, and portable file system [14]. HDFS's architecture is made up of NameNodes and DataNodes, where NameNodes translate filenames to a collection of block indices and DataNodes hold actual data blocks. The NameNode's index hash table and metadata must be integrated in order to support the CPDP scheme and provide query services based on hash values ((3)i,k) or index hash records (i). implement a protocol for verification.

**Index Terms**— cloud computing, cloud security, hybrid clouds, public verifiability, and storage security.

## I. INTRODUCTION

Hybrid clouds effectively offer dynamic scaling of services and data transfers by integrating a variety of private and public cloud services. For instance, a customer can combine data from various private or public providers into one backup file or archive (see Figure 1). As an alternative, a service can take data from other services that are located in a private cloud and store it in its own storage, creating a hybrid cloud.

A Data-Proven (PDP) scheme based on public cloud offers a publicly accessible remote interface for exploring and managing vast amounts of data, but the benefit of the suggested PDP scheme is that performance is comparable to that of hybrid cloud. is capable of meeting the specific bandwidth requirements of, but the capacity cannot keep up with the time. Consider the hybrid cloud storage service depicted in Figure 1 as a solution to this problem. It consists of three distinct entities. an organization that manages and offers storage services through the use of large amounts of computing power and storage space. trusted third parties (TTPs) that keep track of and offer data retrieval services for customer review information.

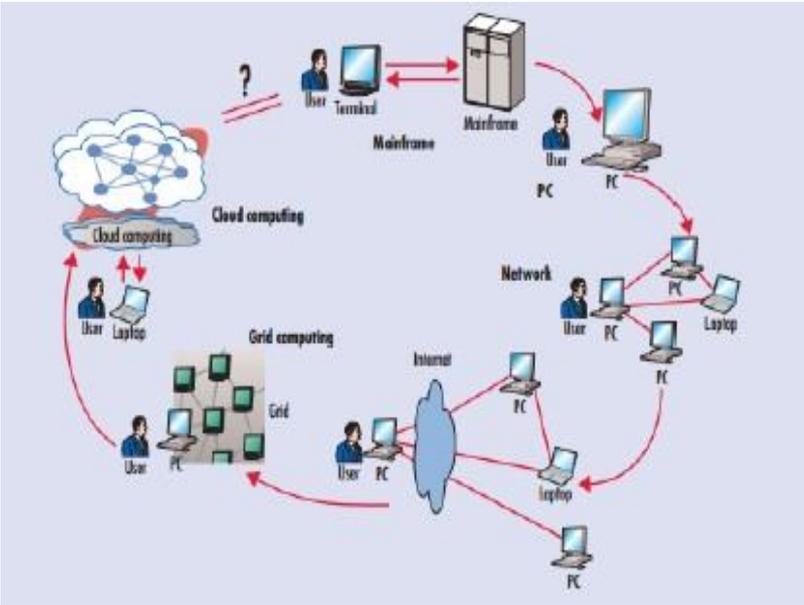
The new paradigm of data storage in the "cloud" is seen as a promising service platform for the Internet, but it raises a number of challenging design issues that have a big impact on the overall security and performance of an organization. The most significant issue with cloud data storage is data authentication on unreliable servers.

For example, a storage service provider may choose to conceal data failures from its clients in order to benefit from them. More importantly, by not keeping or consciously deleting data files that they routinely share with their customers, service providers can save money and disk space. The customer may find it practical to perform routine consistency checks without using a local copy of the data files to mitigate the issue when a significant amount of electronic data is offloaded and the customer has constrained resource capacity. must find a solution. There may be deep roots.

Several solutions have been put forth among various protection models and schemes to address this issue. A lot of time and effort is put into designing solutions in all of this work to satisfy various requirements. High system efficiency, stateless acknowledgments, limitless query use, and irretrievable data are a few of these.

All of the methods so far presented can be divided into two groups based on the role of the verifier in the model: private verifiability and public verifiability. Although a system with private verifiability can achieve higher system efficiency, public verifiability does not imply that only the customer (the data owner) can compete with cloud server.

Customers can do this without using their own computing resources to contract out service evaluations to independent external auditors (TPAs). In the cloud, the client itself cannot be relied upon to maintain integrity. The addition of public verifiability to validation protocols, which are anticipated to play a more significant role in achieving economies of scale in cloud computing, seems more balanced in real-world applications. be divided. The conversation seems to be similar to the performance conversation. When performing validation, validators shouldn't need external data.



II. RELATED WORK

In Yan Zhu, Huaixi, and others (2010). [1] Demand ownership of verifiable data to guarantee data integrity. The hybrid cloud's data ownership scheme is one that is helpful and auditable. It offers service scalability, data

migration, and collectively gathers and stores customer data. Because operating costs are lower, communication complexity can be reduced to minimum.

According to Qian Wang et al. Through dynamic data manipulation, [2] introduces a new scheme that enables remote data integrity and auditability. This step first pinpoints specific scaling issues and potential security concerns with fully dynamic data updates. Through manipulation of the conventional Merkle Hash Tree (MHT) structure, which is used to validate blocktags, we achieve efficient data dynamics and enhance retrievability models. This is a very effective and safe technique [2].

An allocation framework driven by models was put forth in 2012 by Tekin Bicer, David Chiu, and Gagan Agrawal [3]. Data-intensive applications running in hybrid cloud environments can benefit from this technique's support for time- and money-efficient execution. With a 3 point 6 percent error rate, you can meet implementation deadlines, stick to budgetary restrictions, and shorten application run times.

Using the currently in use cloud computing organisms, Haoming Liang, Wenbo Chen, and Kefu Shi [4] proposed a method for analyzing programming and task scheduling models. The programming process, its modification process, and the flow of replacing services and resources are all explained with the help of examples.

In 2010, Ravi Sandhu, Raj Boppana, and Ram Krishnan put forth a fresh idea for integrating mission-driven presentation, pliability, and security policies into the computing and communication infrastructure by integrating hooks and supporting protocols into the cloud. This methodology can effectively address the twin cloud security and accessibility issues [5].

A dynamic user-integrated cloud computing architecture was introduced in 2011 by Guannan HU and Wenhao ZHU [5]. This model expands the capabilities of cloud computing data centers by actively integrating clients with storage and computing capability. Services are offered to other users through client cooperation with the data center [5]. In order to better meet the practical learning needs of lifelong learners, Xiang Li, Jing Liu, Jun Han, and Qian Zhang proposed The article describes design of micro-learning platform architecture constructed through cloud computing expertise, details the layered structural design of micro-learning platform based cloud, and details the intention [6].

Xinwen Zhang, Anugeetha Kunjithapatham, Simon Gibbs, Joshua Schiffman, and Sangoh Jeong proposed A Solution for Authentication and Secure Session Management between Weblets Running on the Device Side and Weblets in the Cloud in 2009 [7]. allows cloud weblets to access sensitive user data through external web services and offers protected migration. In business environments, it enables application integration between private and public clouds [8].

Year: 2010, Yan Zhu, Huaixi, et al. [9] suggests a hybrid cloud data ownership plan that facilitates data migration and service scalability. This opens up possibilities in which several cloud service providers collaborate to store and manage customer data. Less overhead and simpler communication are the outcomes of this plan.

According to Qian Wang et al. [10] is a protocol that outlines the challenges and potential security concerns of direct extension with fully dynamic data updates before demonstrating how to create complex validation schemes for error-free integration. is recommending. This has an effect on block tag validation using the conventional Merkle Hash Tree (MHT) structure [10].

Arash Nourian and Muthucumaru Maheswaran proposed a new image coding scheme in 2012 that uses the Ima coding method, which transforms images using chaos maps, to enhance image privacy and enable the cloud to carry out some types of computation. introduced. chosen following random masking.

Jia Yu, Rajkumar Buyya, and Kotagiri Ramamohanarao presented a method in 2008 for allocating the proper resources to workflow tasks in order to complete their execution and enable each user to perform the desired function. It makes an effort to enhance the workflow scheduling algorithms currently in use that have been created and used by various grid projects [13].

Luis Mendonça and Henrique Santos published research findings and test results in 2012 that defined an efficient set of traffic parameters that could model both normal and abnormal behavior of networks and demonstrate abnormal and coordinated behavior. We focused on the detection of botnet movements in the instance of The detection framework model was also foreseen and tested with actual traffic gathered at the University of Minho campus edge [15].

A new security load balancing architecture based on multilateral security (LBMS) was proposed by Pengfei Sun Qingni Shen, Ying Chen Zhonghai, and Wu Cong Zhang in 2011. This architecture provides the ideal physical security device by automatically migrating tenant VMs during peak loads. CloudSim, a simulation of cloud computing, is the foundation of this method. When VMs move to physical machines for load balancing, this design tries to prevent potential attacks.

A new hybrid scheme that combines anomaly and signature detection with honeypots was put forth by Pragya Jain and Anjali Sardana in 2012. To enable real-time system capabilities, the first stage used signature-based

detection of known worm attacks. Anomaly detectors can quickly spot deviations from the norm at the second level. Honeypots are used to identify zero-day attacks at the top level. It provides the advantages of a resource-efficient honey farm by utilizing honeypots and both detectors. Regulators route data traffic to the proper honeypots [18].

### III. PROBLEM STATEMENT

The issue is that a variety of authentications have been used to protect dynamic data while numerous techniques have been used to store it. Although public verifiability and data dynamics are already implemented in cloud environments, it is still inefficient to provide both at the same time for remote data authentication. We also don't combine these technologies. Merkle hash tree storage of data failed. In order to provide a joint PDP scheme that supports dynamic scaling across multiple storage servers, a technique was put into place.

### IV. PROPOSED METHODOLOGY

Smart cards can support a wide range of applications used by many different communities, including electronic (digital) signatures, email and data encryption, virtual private network (VPN) authentication, and password management. Biometric authentication and secure wireless network access. There are several variations of smart card technology. connect Hadoop and unstructured data.

Plastic cards (contact or contactless communication), USB devices, or as protected components that can be embedded in mobile phones and other devices are all examples of these. The following diagram displays the proposed method's architectural overview.

The suggested approach here uses smart cards to provide security while implementing the hybrid cloud concept.

#### A. Authentication using a smart card.

Configuration:.

Generation of keys in Module 1.

Choose a number of data.

Saves information as a Merkle hash tree.

Make a count of the files.

To facilitate authentication, make a private key.

Key Assignments for Module 2.

Files should be given keys.

Put the right key in the file's encryption.

In a hash table, keep the key and the information.

since using an index to access data is a simple process.

You can only search the data index; you cannot search the entire database. So, it will move along quickly.

Module 3: Cloud Server Data Storage.

These encrypted files should be saved to a different location on your cloud server.

Requestor possesses only appropriate keys.

The requester sends these keys to an outside verifier.

TPA uses these keys to validate data later on.

But the original data is hidden from TPA. Only uses cryptographic signature schemes for verification checks.

Integrity Check is a module in 4.

Decrypt all of the cloud server's files.

Put all files together.

Verify the data size. The size is identical to the initial data.

Put the corresponding encrypted file in this location in case data loss occurs as a result of a file's technical difficulties.

Keeps the entire file encrypted so that your security is never compromised.

Data Dynamics, Module 5.

At runtime, this module executes a few operations on the cloud server.

Change in data.

Incorporating data.

Erasure of data.

Batch Audit is the sixth module.

On cloud servers, many users keep their files.

In a batch system, each user validates his own data.

To accomplish this, a number of scheduling and priority algorithms are employed. E.g. bottleneck, deadlock. therefore, the auditing time will be very less.

To determine if the evidence passes an integrity check, a verifier (TTPA) runs an algorithm. If the validation process worked, she returns TRUE; otherwise, she returns FALSE. Finally, the user receives a thorough test report. In the system description, we discussed the use of TTPA for hybrid cloud data integrity verification.

Her three main client-side phases make up our plan. The initialization stage, the key generation stage, and the tag generation stage are what they are called.

*Step 1:*

A certificate is first obtained by the user (or data owner) during his KeyGen stage.

CA (Certificate Authority) request and.

give his name and public key. tick The.

The format of certificates issued by CA is as follows:

$C(DO) = [ID(DO), sig_{CA}(ID(DO),)]$  -.

where  $[sig_{CA}(ID(DO),)]$  denotes the CA's digital signature. produced using a proprietary algorithm.

*Step 2:*

The data owner uses the verification algorithm  $ver_{CA}[C(DO)]$  to confirm permissions.

*Step 3:*

TTPA and the cloud server must receive this certificate in a secure manner. A perpetrator might pose as a trustworthy person.

user and acquire her valid.

public key and identity information are contained in a certificate. In order to prevent this, the consumer gives cloud servers and verifiers access to the certification authority  $ver_{CA}[C(DO)]$ 's verification algorithm. Online server.

additionally got a certificate.

$C(DO) = [ID(DO), ver_{DO}, sig_{CA}(ID(DO), ver_{DO},)]$  ---(9).

$C(CS) = [ID(CS), ver_{CS}, sig_{CA}(ID(DO)), ver_{CS},]$ ---- (10).

*Step 4:* During the exchange of communications.

the and the TTPA.

Using the cloud server, a safe, authenticated channel is created.

the session key. These two parties communicate using the same session key.

The generated proof (P), which Cloud Server signed with its private key.

creating a signature with (SK).

Next, send (P, C.

(DO) to TTPA.

*Step 5:*

After receiving the signature, TTPA first verifies the certificate using a verification algorithm. If.

is certified, the answer is checked using its public key.

(PK). Otherwise, the consistency check will stop.

*Step 6:*

Decrypt the proof reply once more in the following step.

utilizing the public key (PK). After making sure that, this is done.

Verification of the certificate of authenticity. Her.

The authenticity of the server is then established by verifying the signature.

*Step 7:*

Finally, TTPA checks the proof by running the.

verification algorithm. By doing this, you can prevent active attackers from altering your data in any way.

## V. RESULT ANALYSIS

TABLE I. PROPOSED WORK FROM VARIOUS ATTACKS

Recurring Attacks	Y
Attacks involving identity theft	Y
Insider dangers	Y
External assaults	Y
Listening in	Y
Identity Theft	Y
Attacks using passwords	Y

The various proposed attack preventions are being criticized, as shown in Table 1.

TABLE II. SUGGESTIONS FOR AUTHENTICATION FACTORS.

Number of bits in token	Number of bits in secrete value	Time taken
64	216	24.5 sec

An analysis of first factor authentication is presented in Table 2. Here, the number of bits used to generate the secret value is dependent on the number of bits used to create the token.

TABLE III. THE SUGGESTED METHOD'S MEMORY COMPARISON.

Storage/ scheme	Our scheme	R. song al et.
Smart card	640 bits	480 bits
Server	320 bits	640 bits

It shows that the proposed method reduces the load on the server because the server only stores the server's private key.

## VI. CONCLUSION

In any environment, security is crucial to the transmission of data from sender to receiver. When data is consistent, it is kept in a single place across many nodes. For data storage and data integrity, the cloud concept was introduced. The ability to check nodes from one cloud to another and back up dynamic data is typically possible if multiple clouds are implemented and data is stored dynamically. Add unstructured data to challenging Hadoop. By authenticating the node from one cloud to another, we use the hybrid cloud concept to dynamically store data exposed from any node in any cloud. Describe the idea. We're working to make it a reality. Data ownership is supposed to be dynamic, so whenever one of your node's clients wants to access data kept in another cloud, it has to first approve public access to the data. The suggested method used here improves authentication, lessens the chance of eavesdropping, and guards against a number of attacks like DOS, replay attacks, etc.

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# Video Surveillance Fire Detection System using CNN Algorithm

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**Abstract**— Fires in public places such as shopping malls, hospitals, train stations, and others can endanger both people and resources. This has been a big concern for the past few decades. Stopping these accidents should be a priority. So to achieve these, there are various techniques, but there are some loopholes in those techniques. So to overcome those loopholes, we have developed a model that detects fire in images and video frames, and as soon as it detects fire, it sends an alert message to the nearest fire station and related authorities. The main purpose of these models is to prevent accidents due to fire and minimize human work load. This paper uses the CNN algorithm to build these projects.

## I. INTRODUCTION

Fire accidents are one of the biggest threats to industries, social gathering places, hospitals, malls, and various densely populated areas across the world. These kinds of incidents may cause damage to property and the environment and pose a threat to human and animal life. According to the recent National Risk Survey Report [1], fire was ranked third in terms of its impact on various fields related to problems, among many others. There were some fire accidents in different countries that resulted in the impending ecological disaster, claiming millions of lives and resulting in billions of dollars in damage. Early detection of fire can save many lives, as well as various resources, and prevent damage caused by fire. This is one of the advantages of detecting fire at an early stage. In order to achieve high accuracy and robustness in dense urban areas, detection through local surveillance is both necessary and effective. There were numerous issues with traditional fire systems, such as false alarms, detecting fire when there was none, and ringing alarms when there was no fire. Maintenance was difficult. The use of sensors in hot, dusty industrial conditions is also not possible. Thus, detecting fires through surveillance video One of the most feasible and cost-effective solutions is streaming, which is suitable for the replacement of existing systems without the need for large infrastructure installations or investments. The existing domain knowledge is heavily used in video-based machine learning models.

As a result, they must be updated to meet new threats. So our model can detect fire in a video or image frame and send an alert message as soon as it detects fire. It can be used to detect fires in surveillance videos. Unlike existing systems, this neither requires special infrastructure for setup, like hardware-based solutions, nor does it need domain knowledge and prohibitive computation for development.

## II. PROPOSED FRAMEWORK

We investigate deep neural networks for potential fire detection in the early stages of the suggested system's surveillance. For the objective problem, we investigate various deep CNNs while accounting for accuracy, the embedded processing power of CCTV systems, and the frequency of false alarms. The computer vision problems

and applications where CNNs have shown promise include object detection and localization, image segmentation, super-resolution, classification, and indexing and retrieval. Their hierarchical method, which automatically learns very potent qualities from raw data, might be credited for this widespread success.

A typical CNN design is made up of three well-known processing layers. 1) Numerous feature maps are created as a convolution layer when various kernels are applied to the input data. 2) A pooling layer that, in order to achieve some translation invariance and dimensionality reduction, chooses the maximal activation from a small neighbourhood of feature maps acquired from the previous convolution layer. 3) A fully interconnected layer that builds a global representation of high-level data from input information. The high-level characteristics of the input data are produced by this layer after a sequence of convolutional and pooling layers. These layers are arranged in a hierarchy, with the output of one layer serving as the input for the following one.

In convolutional kernels and fully connected layers, the weights of every neuron are adjusted and learned throughout the training period. By simulating the characteristic features of the input training data, these weights can carry out the objective classification. Pre-processing refers to all the adjustments made to the raw data in our project before it is provided to the deep learning or machine learning algorithm. A CNN model, for instance, would almost likely produce subpar classification results if trained on raw images. A neural network called CNN extracts the features of the input images. The input image is used by a network for feature extraction. The feature extraction signals are used by the neural network for categorization.

### III. RELATED WORK

THE SDLC MODEL TO BE USED each software development life cycle model begins with an analysis, in which the technologies employed in the project and the team load are specified. Software Development Life Cycle models, or SDLC models, are one of the fundamental ideas in the software development process. The SDLC is a continuous process that begins when the choice to start the project is made and ends when it is completely removed from exploitation. No single SDLC model exists. Here, the waterfall model is used in the suggested system. The steps of the waterfall model that are necessary for creating the suggested system project are shown in Figure 3.1.

The phases of the proposed system's waterfall model are listed below. Requirement Analysis

#### *A. Waterfall Model:*

Figure 3.1 the most crucial and essential stage of the SDLC is the requirement analysis. With input from all Department of Computer Engineering, ACEM, 2021–22 18 Video Surveillance Fire Detection System stakeholders and subject matter experts (SMEs) in the sector, the senior members of the team carry it out. At this point, planning is also done for the requirements for quality assurance and for the identification of project-related risks. A meeting is scheduled with the client by the business analyst and project manager to obtain all the necessary information, such as what the customer wants to construct, who will be the end user, and what the product's goal is.

#### *B. System Design:*

System Design is the following phase that will compile all of the information on requirements, analysis, and software project design. This phase is the result of the previous two, such as requirement collection and client input.

#### *C. Implementation:*

The actual development process starts here, and the programming is created. Coding represents the start of design implementation. Programming tools including compilers, interpreters, debuggers, and other similar tools are used to generate and implement the code, and developers must adhere to the coding standards outlined by their management.

#### *D. Testing:*

After the code is created, it is tested in comparison to the requirements to ensure that the solutions are addressing and accumulating the demands throughout the requirements stage. Unit testing, integration testing, system testing, and acceptability testing are carried out at this level.

### E. Deployment:

After the software has been certified and no problems or errors have been reported, it is deployed. The software may then be delivered as is or with proposed improvements in the object portion depending on the assessment. The maintenance of the software starts once it has been deployed.

### F. Maintenance:

Once the client begins utilising the built systems, the real problems surface and periodic problem-solving is required. Maintenance is the process when the developed product is given attention.

## IV. PROPOSED WORK

When classifying images, convolutional neural networks have produced results with extremely high accuracy. Convolutional neural networks are the most widely used deep learning architecture and are quite powerful.

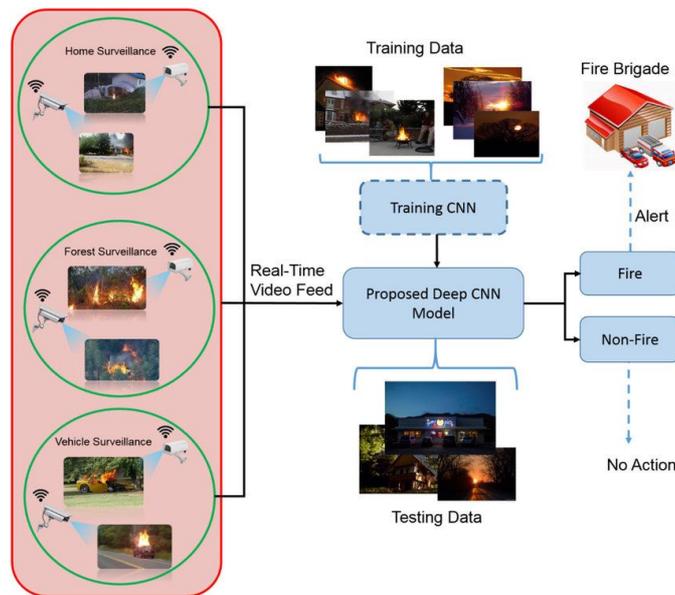


Figure 1. Using deep CNN Early flame detection in surveillance videos.

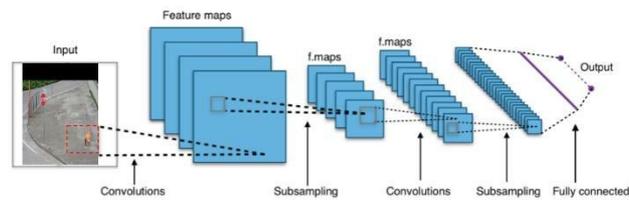


Figure 2: Operation of CNN architecture

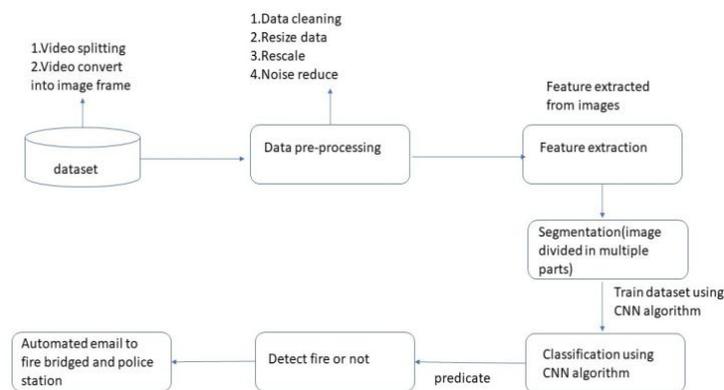
This built model will collect data from CCTV or surveillance footage and process it gradually in real time. Frame by frame, the video is processed, and then the processed frames are fed into the pretrained CNN model. This pre-trained CNN model will categorise frames into two groups in real time: one with fire and the other without fire. This pre-trained CNN model may be set up to operate on a distant server using data from various video surveillance systems. After processing these inputs, the pre-trained CNN model outputs a real-time prediction on the real-time streaming data. To ensure that no frames are lost, streaming frames will be kept in data storage. As the knowledge grows, the model will shortly

By doing this, a rich dataset is produced, and the model is trained using a large number of frames from the dataset. As a result, the model's frame prediction accuracy will grow. Since the architecture of the monitoring system won't need to be changed, this fire detection will be affordable. The model uses information from current CCTVs or surveillance systems to forecast the presence of fire. This architecture is shown in Fig. 1.

## V. CNN

An example of an eager learner algorithm is CNN. One of the Deep Learning models is CNN. The classification performance of CNN is excellent. The most effective algorithm for classifying images at the moment is CNN. Since LeNet, a Deep Learning algorithm, CNN has gained enormous popularity for classifying images. Huatan Watan Jishu Wutan AUG/2020, Volume XVI, Issue VIII, ISSN 1001-1749 Pages: 99 There were five concepts utilised, all of which had very good accuracy, to classify handwritten digits. The convolution layer, the Relu layer, the Pooling layer, and the fully connected layer are the four processing layers that make up a convolution neural network. One layer's output is used as the input for another layer.

1. The convolution layer, which forms the foundation of CNN, maps several kernels onto the input data before performing a dot product to produce a feature map. 2. The Relu layer replaces negative numbers with 0 while leaving other values alone. 3. To minimise and produce translation invariance, select the maximum value for the pooling layer in a limited area around these maps. The fourth layer of CNN is known as the fully connected layer. This layer receives as its input the output of the previous three levels. A fully connected layer will classify the photos using the training data it has collected using the provided weights.



Implementation

## VI. ADVANTAGES

- 1) Easy to detect Fire or NOT.
- 2) Improve Accuracy.
- 3) Time Saving.
- 4) Easy to use.
- 5) It is User Friendly Application.

## VII. APPLICATIONS

- 1) Fire Detection System.
- 2) Helps in Fire Fighting

## VIII. CONCLUSIONS

In conclusion, a sizable archive of recordings of forest fires in a range of scene conditions has been used to investigate an aerial-based forest fire detection approach. The chromatic and motion characteristics of a forest fire are first extracted, and then they are rectified using a rule to highlight the burning region, in order to increase the detection rate. Second, smoke is also extracted using our suggested algorithm to address the issue of dense smoke that almost completely engulfs the fire. In the actual application of aerial forest fire monitoring, the proposed System framework demonstrates its robustness with a high accuracy rate of detection and a low false alarm rate. Making difficult and specific scene comprehension data sets for fire detection methods and in-depth trials may be the main focus of future research.

Additionally, fire detection systems can be integrated with reasoning theories and information-hiding algorithms to intelligently observe and authenticate the video stream and start the necessary actions in an autonomous manner.

#### ACKNOWLEDGMENT

Sincere appreciation to Prof. U. L. Tupe and HOD Dr. Nihar Ranjan for their assistance in resolving project-related issues. A particular thanks to the computer wizards who created lovely libraries that are time-saving. Additionally, we appreciate the IEEE community's assistance with the use of libraries.

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# Smart Time Table Generation using Artificial Intelligence

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**Abstract**— For any educational institutions be it a small-scale school or a college or huge institutions like universities, time tabling is a very important and tedious task. It concerns all activities with regard to producing a schedule that must be subjective to different constraints. Being dependent on various constraints, it is a temporal arrangement of courses, faculty and students hence it requires changes every now and then. Creating such time tables manually especially with large scale institutions like universities, leaves scope for clashes and human errors. To overcome these problems automated time table generation using AI can save a lot of time of administrators and manpower. Such an automated system will require various inputs like course details, infrastructure, teachers available and strength of class, and will aim to make most optimized utilization of all these resources in a way to best suit any of constraints of college rules. A precise time table will then be chosen from generated solutions. Time table is scheduled for various purposes like organizing lectures, bus schedules, exam time tables and many more. In our proposed model we will make an approach to build a model that can automate time tables to serve various scheduling purposes using Evolutionary Algorithm (EA) and Genetic Algorithm (GA), and further can be integrated with ERP of institutes for ease of data fetching. This technique allows one to make an attempt to create time table with reduced errors and mistakes in the least time.

**Index Terms**— Timetable, Generation, Genetic, Optimization, Constraints, Scheduling, Fitness, Chromosome.

## I. INTRODUCTION

Timetable is basically a structure which shows the time at which some prescribed event occurs. For educational institutes timetable is for achieving its basic purpose of lecture delivery, and is used for scheduling of events throughout the day, week, term or year for each batch. It requires the combination of resources like batch of students, classes, instructors, time slots, and days arranged in a way such that no mentioned resources have an overlap. This practice of mapping events in general (classes/ exams) to timeslot subject to the constraints, is carried out manually in most of the institutes, requiring lot of manpower and time. Hence, time tabling gives rise to scheduling problem that is tedious and as well requires solution in every institute at least once or twice an academic year.

From above discussion, time tabling is a non-polynomial (NP) complete problem, i.e., a problem which has no defined way to draw an appropriate solution. This NP complete scheduling problem falls in the class of computational problems for which no efficient algorithm that can give accurate solution has yet been found.

Hence to provide an efficient solution to the stated problem, we will make an adaptive heuristic approach, which will generate a set of good solutions from which the most optimized solution will be provided as output. In the field of computer science, for precision or optimization problem, artificial intelligence is used to implement a model providing solution to it.

The main objective of this paper is to address the timetabling problem (which is NP complete, scheduling problem) by using AI which will result in an optimal solution with minimal or no redundancy errors. This model is developed using genetic algorithms falling in the class of evolutionary algorithm of AI. It works in adaptive heuristic searching way for solving constrained optimization problem. This approach is based on natural selection and then proceeding for evolution of selected individuals from population to reproduce generations i.e. pool of many timetables here, from all these generations on the basis of fitness the most optimal solution is given as output. The classical GA that we will be using in our model is based on Darwin's theory of evolution and the principle of survival of the fittest.

## II. RELATED WORK

The constant struggles in designing of time table have been observed widely associated with small to large scale educational institutions. While this area is vast covering scheduling of regular classes, examinations, bus schedules and many more; various efforts have been made globally to address this problem and lot of research has been carried out to propose and implement various methods for automated generation of time tables. As also mentioned in the previous section time tabling is a NP complete problem, so only the attempts to the best possible solutions have been made so far. Optimal solutions were achieved using both kind the traditional and artificially intelligent techniques. This chapter will examine all the variety of approaches carried out so far.

The stated timetabling problem was first studied by Gottlieb in 1963, who considered that each lecture consisted of one student group, and one teacher whose combination can be chosen freely. Since then, the problem is being addressed by proposing various models using variety of methodologies to develop a computational solution which can replace manual task of scheduling, as discussed in the following part of this section.

Authors Dipti Srinivasan Tian Hou Seow Jian Xin Xu (2002) [1] proposed a model for automated timetable generation using multiple context reasoning. They presented an EA based approach along with context-based reasoning for creating physical timetables in less computational time. But it is difficult to implement as compared to GA and has less accuracy and optimization.

Shengxiang Yang, Member, IEEE, and Sadaf Naseem Jat (2008) [2] defined university course timetabling problem (UCTP) as a combination of events and time slots. They addressed it using GA with Local Search (LS) technique. The GA guided search strategy create offspring based on individuals from previous generations and LS use its exploitive search to improve the efficiency and quality.

D. Nguyen, K. Nguyen, K. Trieu, and N. Tran (2010) [3], used Tabu search algorithm to develop the model for giving solution to timetabling problem. In this, the search space comprises of set of achievable solutions. A fundamental "taboo" element exists to move aside the non-improving moves and gradually it keep away from getting trapped at local maxima but this is expensive approach for evaluating the resources and formulating it.

N. M. Hussin and A. Azlan (2013) [4], implemented graph colouring heuristic method for scheduling problem. Here problem stated is represented using graphs for constructing stages of difficulty in the process of scheduling. Nodes of graph denote subjects and edges denote conflict. With each phase it keeps improvising the solutions and ultimately reach the best solution, but the prolonged time taken to reach this stage makes this method less reliable.

Authors W. F. Mahmudy and R. E. Febrita (2017) [5] used fuzzy logic method for providing computational solution to time tabling problem. This multivalent logic is based on fuzzy set theory and linguistic variables are used to solve optimization problem of timetable and provide a realistic solution. But this makes it difficult to evaluate membership function and ultimately it is hard to create and calibrate fuzzy model.

T. Elsaka (2017) [6], used Constraint satisfaction modelling which is based on constraints and variables and not on the object function. Two main components here are constraint and data. Constraint programming has statement of constraints that serve as part of program which is an advantage of this model. The main hindrance is the amount of time it consumes and the soft constraints are not considered.

Authors K. Y. Junn, J. H. Obit, and R. Alfred (2018) [7] proposed a solution based on GA which is based on theory of natural selection. It is an iterating process of creating population from individuals. Convergence can be a drawback if not taken care in the iteration.

D. Apostolou and E. Psarra (2019) [8] have proposed an approach on basis of Hybrid Particle Swarm optimization (PSO) with local search, which is an AI method. The stated problem is provided a solution by

integrating PSO with prototype methodology which creates particles that can upgrade themselves and have own memory. But unlike GA it does not have operators like crossover and mutation to avoid convergence.

This section explained how others through various approaches used intelligence to solve the problem by setting rules and how classical genetic algorithm can prioritize these rules dynamically to optimize the timetable generation by providing benefit of distributed solution and load balancing. It can serve as the best possible way to provide a solution provided constraints and proper convergence condition.

From above discussion, many studies have focused on making an approach to time table scheduling using AI by considering diverse techniques. However, rapidly evolving demands do not sustain with these attempts. The well-established relationship between constraints and scheduling is very crucial for our problem to provide an optimized solution. In light of this, we also studied the area of genetic algorithms in great depth, researchers have made latest and advanced studies that can be compatible with the evolving world.

Indeed, a brief analysis by Sourabh Katoch, Sumit Singh Chauhan, Vijay Kumar (2020) [9] on advances in genetic algorithm and their implementation, has made a clear differentiation between all above discussed attempts and motivated us for an approach using GA in our problem domain. Further for GA implementation and mathematical modelling, the analysis made by L V Stepanov, A S Koltsov, A V Parinov, A S Dubrovin (2018) [10] was studied and on its basis our proposed model was developed.

### III. METHODOLOGY

#### A. Proposed System

In our approach we have developed model for providing solution to Timetabling problem based on genetic algorithm in AI, it is based on natural selection and evolution method. Here we use basic terminology which can be referred as follows.

*Phenotype* refers to population in real world, whereas *Genotype* is used for reference to population in computational world.

*Population* is generally referred to set of human beings in phenotype but in genotype it is set of solutions (here it will be a set of generated time table, also sometimes population can be referred to as generation)

*Chromosome* is the individual solution to given problem and a gene specifies one element position in a chromosome.

To simply understand implementation of GA and the genetic operators that are responsible for the alteration in composition of offspring, the following part of this section can be referred.

Implementation of GA in our developed model is done as in below steps,

#### *Preprocessing*

The prerequisite to perform operations in GA is to convert potential solution into a simple value like a string of real or binary numbers. It helps in improvement of speed of algorithm. We have used conversion of data to binary string i.e., a string of combination of 0 or 1. These bits of string are responsible for characteristic presentation of solution as well as algorithm accuracy. Each chromosome string is a composition of sequential arrangement of gene string.

#### *Initial population*

After encoding, the first step of the algorithm is to generate initial population which is done by random creation of individuals on the basis of the constraints defined. The larger the population, the better will be the results. This process sometimes can also be described as selection process or in terms of GA it can be referred as reproduction operator.

#### *Evaluation of population*

The parameter used for evaluating an individual is known as fitness of an individual. The fitness of each chromosome is determined within a generation, which is an estimate of how well the solution satisfies the given constraints relative to other solutions.

As we have used binary encoding, our range for the fitness function will be between 0 (worst solution) and 1 (best solution). The fitness function defined in our approach is as follows,

$$F(a) = \frac{\sum_{i=1}^n a_i * h * d}{t}$$

where, a= timetable solution under evaluation,

h= hours per day,

d= days per week,  
t= total fitness of a generation

After determining the fitness of all chromosomes in a generation, i.e., complete evaluation of population, we need to select chromosomes for further mating so that new generations can be created. This is done using Roulette wheel selection method [9]. The basic principle on which this selection method works is

*Selection a.fitness*

The concept of this technique, is to dividing a wheel according to proportion based on fitness value. Then each chromosome is mapped in the suitable proportion. Eventually, the wheel is rotated and the pointer points at the chromosome is selected for further reproduction. Also, as the basis of proportion is fitness value, mostly the larger proportion will be composed of fitter chromosomes, increasing probability of pointer to stop at fitter individuals.

*Crossover*

Now for mating the selected chromosomes, the crossover operator is used, hence resulting in new chromosomes together making a new generation. We have used single point crossover in our model. The selected chromosomes using above selection method are used and single point crossover is performed [9]. In this operation, random point of a chromosome is selected, and for two parents, gene after this point is swapped resulting in new off springs with different gene composition.

*Mutation*

This genetic operator is very crucial as it is used to prevent converging at a very early stage of reproduction. It basically alters genes of chromosomes for generating diverse variety of population. We have implemented Displacement mutation (DM), as name suggests it operates by displacing genes within a chromosome. This results in production of diversity, hence reducing risk of premature convergence.

*B. Algorithm*

Based on the above described implementation of GA in our model, its algorithm can be depicted as in Fig. 1.

*C. Constraints*

In GA constraints can be classified into two categories, *Hard constraints*, these mandatorily needs to be followed. In our model the hard constraints that are,

- Same student must not have two lectures simultaneously.
- Same lecturer must not have two lectures simultaneously.
- One room must be allocated to only one lecture at a time.

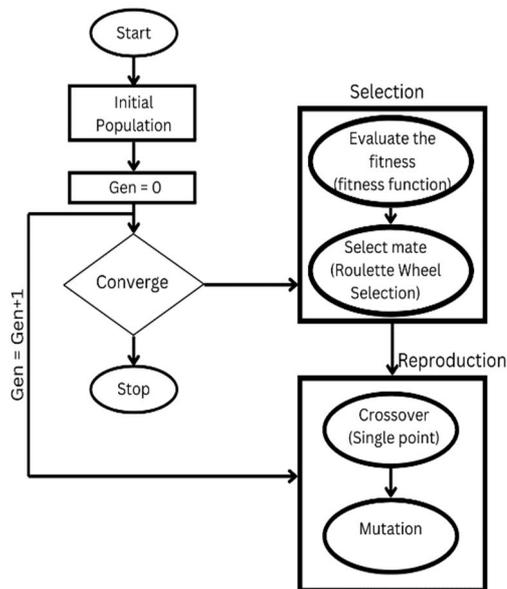


Figure 1. Algorithm

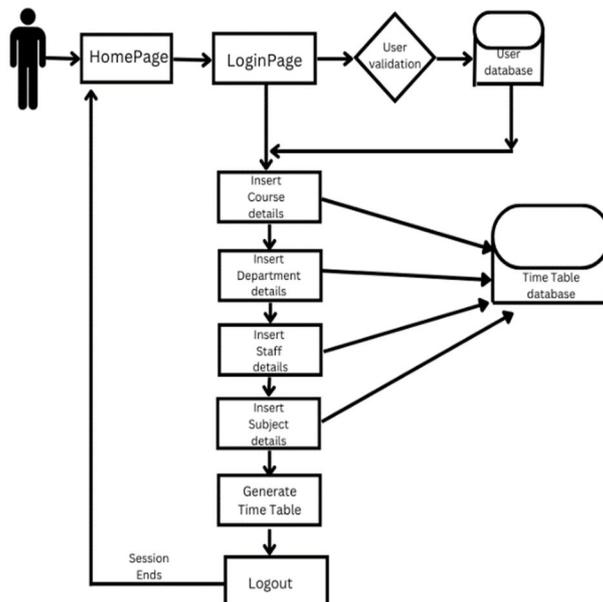


Figure 2. System architecture

*Soft constraints* are the constraints that are required to be satisfied, but it is not obvious that they will always be satisfied. In our model the soft constraints considered are,

- Same lecturer must not have two consecutive lectures.
- Fixed slot assignment for particular subject.

#### D. System Architecture

The system architecture of the developed model as shown in Fig. 2 uses GA to solve timetabling problem and generates optimal minimum or no error solution. It has capability to take various resources (class, subject, teacher details) as input in a very user-friendly manner and process them for the required output in low cost and less time.

#### E. Hardware and Software Requirements

The minimum *hardware requirements* for implementing the system are Processor of minimum configuration Pentium IV/Intel I3 core with speed of at least 1.1 GHz, RAM 512 MB (min) and Hard Disk of minimum 20GB. The output is displayed on standard monitor screen and for data input keyboard and mouse is required.

*Software requirements* for implementation is about the prerequisites to be installed on the system for proper functioning. In our model, such prerequisite software are Java 8 and above supporting compiler, Struts-2 framework, Apache tomcat server and MySQL database. Operating system supporting our model are Windows 7 and above versions.

For developing front end Html5, CSS, JavaScript, bootstrap and AJAX is used, whereas the backend code is in Java.

#### F. Modules and Interfaces

- *Registration and Login*: When the user visits the homepage, for the first time they need to register by providing basic details. These are then stored in the user detail database as seen in system architecture Fig. 2. Login is a submodule of this interface, where user can enter credentials for logging in.
- *Input Interface*: After login, user is asked for all input details required like number of slots, batches, days per week for which schedule is to be created. Then after the course details along with faculty details and submit button is clicked. This directs to the browser page where the optimized timetable is displayed.

### IV. RESULT ANALYSIS

Timetable is generated using genetic algorithm and this optimized solution satisfies all hard constraints defined and most of the soft constraints.

In Fig. 3, the snapshot of the console shows the fitness values reached in various generations by the chromosomes. All of the generations are presented on the console itself in the genotype and on the output screen, only the phenotype optimized solution is displayed. Also, by clicking on refresh we are able to get the lesser optimized solution on display, this is the facility for convenience of human to compare and contrast given solution with the other possible solutions if in any case human intervention is needed to alter the produced timetable. Results displayed are free from clashes and generated in a very less time as compared to manual creation and also saves lot of efforts.

### V. CONCLUSION

We have implemented GA in AI for smart time table generation, which produces optimal timetable subject to the constraints defined.

Though the solution cannot always be 100% optimal and suited, as the degrees of optimization depend upon the constraints defined. The improvement has been achieved using intelligence system by the appropriate use of genetic operators. Developed system works accurately initially for schools as they execute classes in a very classical model and gradually increases its scope to colleges and higher secondary classes which has more constraints hence making the problem more complex, but our model deals with it in a user-friendly way. There is future scope to enhance the developed system model for producing timetable and scheduling for various purposes like examinations, bus schedules, and many more.

```

eclipse-workspace - Time-table-scheduler/src/scheduler/inputdata.java - Eclipse
File Edit Source Refactor Navigate Search Project Run Window Help
Tomcat v8.0 Server at localhost [Apache Tomcat] C:\Program Files\Java\jre1.8.0_91\bin\java.exe (23-Aug-2022 12:22:01 PM)
111 139 107 138 129 130 134 106 135 112 121 136 126 124 116 105 125 115 117 132 122 127 108 119 113 123 133 114 110 120 118 137 131 109 128
160 174 140 141 167 166 143 169 145 155 142 154 171 157 163 153 149 150 159 165 162 156 144 170 151 146 164 173 172 147 168 152 158 161 148

Chromosome no. 101 :0.95
Chromosome no. 201 :0.9428571428571428
Most fit chromosome from this generation has fitness = 0.9785714285714285
***** Generation2 *****
Fetching details from this generation...
Chromosome no.0: 0.9928571428571429
4 9 29 16 30 19 32 25 5 33 1 18 6 10 13 24 12 27 31 21 0 23 2 28 14 7 20 11 17 3 15 34 22 26 8
60 53 45 55 43 68 35 57 46 67 36 66 69 42 59 64 58 61 54 63 50 39 49 40 37 65 48 56 51 44 52 41 47 62 38
72 89 91 103 99 92 85 96 79 73 71 84 93 90 100 76 70 78 77 83 98 101 102 104 97 74 81 75 88 87 82 94 86 95 80
124 139 114 138 116 128 123 117 131 120 122 107 105 133 112 137 108 125 130 110 109 132 134 113 115 136 127 106 119 135 118 129 126 121 111
149 150 160 142 153 145 151 148 162 163 168 158 147 171 156 174 143 164 155 173 154 141 170 140 146 167 172 144 157 165 169 152 159 161 166

Chromosome no.1: 0.9928571428571429
4 9 29 16 30 19 32 25 5 33 1 18 6 10 13 24 12 27 31 21 0 23 2 28 14 7 20 11 17 3 15 34 22 26 8
67 46 60 66 63 49 36 50 57 62 69 37 55 56 61 38 52 53 45 35 59 48 58 41 54 64 44 42 68 39 51 43 65 40 47
72 89 91 103 99 92 85 96 79 73 71 84 93 90 100 76 70 78 77 83 98 101 102 104 97 74 81 75 88 87 82 94 86 95 80
109 112 114 119 108 111 110 134 106 107 136 122 125 131 118 116 117 129 130 113 123 128 132 120 133 124 126 115 137 127 135 105 139 138 121
149 150 160 142 153 145 151 148 162 163 168 158 147 171 156 174 143 164 155 173 154 141 170 140 146 167 172 144 157 165 169 152 159 161 166

Chromosome no.2: 0.9928571428571429
4 9 29 16 30 19 32 25 5 33 1 18 6 10 13 24 12 27 31 21 0 23 2 28 14 7 20 11 17 3 15 34 22 26 8
53 67 38 39 68 41 48 45 68 36 35 65 63 42 43 54 61 49 37 50 56 52 48 46 59 51 66 64 57 47 62 69 44 58 55
72 89 91 103 99 92 85 96 79 73 71 84 93 90 100 76 70 78 77 83 98 101 102 104 97 74 81 75 88 87 82 94 86 95 80
124 139 114 138 116 128 123 117 131 120 122 107 105 133 112 137 108 125 130 110 109 132 134 113 115 136 127 106 119 135 118 129 126 121 111
149 150 160 142 153 145 151 148 162 163 168 158 147 171 156 174 143 164 155 173 154 141 170 140 146 167 172 144 157 165 169 152 159 161 166

Chromosome no.3: 0.9928571428571429
4 9 29 16 30 19 32 25 5 33 1 18 6 10 13 24 12 27 31 21 0 23 2 28 14 7 20 11 17 3 15 34 22 26 8
47 40 37 53 42 56 48 62 41 35 63 67 52 89 50 69 44 68 45 63 43 66 57 55 49 36 51 60 39 38 54 46 64 61 58
72 89 91 103 99 92 85 96 79 73 71 84 93 90 100 76 70 78 77 83 98 101 102 104 97 74 81 75 88 87 82 94 86 95 80
124 139 114 138 116 128 123 117 131 120 122 107 105 133 112 137 108 125 130 110 109 132 134 113 115 136 127 106 119 135 118 129 126 121 111
149 150 160 142 153 145 151 148 162 163 168 158 147 171 156 174 143 164 155 173 154 141 170 140 146 167 172 144 157 165 169 152 159 161 166

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Figure 3. Genotype output on console determining fitness

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# Review of AI/ML in Software Defined Network from Past to Present

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**Abstract**— Software-Defined Networks (SDN) technology disrupts the traditional network architecture's tight link between the data plane and the control plane, enabling network resource economy, security, and controllability. In this study, we carried out a systematic analysis with a specific focus on the application of AI/ML algorithms to enhance SDN functions. Artificial intelligence (AI) or Machine learning (ML) will have significant potential in fields such as route planning, network resource management, traffic scheduling, network security and fault detection, when paired with SDN architecture. Networks have become more complicated and challenging to configure, manage, and monitor as a result of these demands. Researchers and operators recommended using software tools that can monitor and configure networks on-demand to make networks more manageable and controllable. From the perspective of ML algorithms, this study focuses on the applications of traditional AI/ML algorithms in SDN-based networks. Finally, a discussion and analysis of the potential future development of SDN concepts in ML algorithms is addressed. We present a summary of the state-of-the-art after reviewing 1450 publications. Researchers from various domains will find this study useful and essential in fully understanding the fundamental concerns.

**Index Terms**— Artificial Intelligence, Machine Learning, Quality of Service, Software-Defined Networks, Systematic Literature Review.

## I. INTRODUCTION

The necessity for novel and effective network architectures is made clear by the rising service heterogeneity and consumption. To ensure quality of service (QoS) and to achieve Service-Level Agreements (SLAs), modern networks are configured with complicated static rules. The complexity of administration and configuration procedures tends to rise in multi-vendor setups. The problems with conventional network-centric architectures are intractable. Consequently, with SDN and network programmability and automation, network-centric paradigms give way to application-centric paradigms [1]. In order to grant access to and control over the network resources, the SDN controller hosts APIs. However, these APIs require the applications to effectively optimize network speed and security, and machine learning (ML) and artificial intelligence (AI) algorithms can support this effort. There have been numerous systematic reviews of SDN studies conducted by academics and business professionals. The authors of [2] describe different SDN load balancing methods, some of which use AI algorithms. Using SDN designs, Ray et al. proposed an examination of IoT devices in [3]. In addition, [4] discusses the difficulty of applying AI/ML in SDNs.

Network management is made easier with the advent of SDN, which also makes it possible to configure networks efficiently through programming [5]. Through streamlined hardware, software, and management, SDN can accommodate while having lower operational costs [6]. Hardware limits on the network design will be eliminated.

Applications for SDN enable centralized management of network policies and regulations. Additionally, they include a range of features that let administrators use ML techniques to successfully resolve network issues. In parallel, the SDN architecture implements network management and traffic control based on ML techniques. From a comprehensive network perspective, controlling network traffic is simple since the controller has access to all data regarding physical networks and their operational needs. According to our findings, network traffic categorization research has been a hot area for a while. This study is crucial for choosing the best route configurations, managing network resources, meeting QoS standards, etc. One of the crucial applications that cannot be underestimated is network security.

Although these studies offer some extremely intriguing viewpoints and a thorough examination of the subject, none of them discuss how AI/ML might be used to SDNs as a whole, instead concentrating primarily on particular features like load balancing and intrusion detection systems. Furthermore, no studies that used a rigid and open selection process in conjunction with a systematic literature review technique could be located. Therefore, the focus of the current work is on how AI/ML may enhance performance and address unique challenges in SDNs.

## II. METHODOLOGY

The objective of this study is to compile a collection of publications and analyze them in order to address different research issues. The following are the research questions:

RQ1. What kind of AI/ML mechanisms are applied to SDN?

RQ2. Can Performance of SDNs be improved by AI/ML?

RQ3. What are the main limitations of using AI/ML in SDNs with respect to Quality of Service (QoS)?

We gathered a number of publications for analysis. An initial batch of papers is assessed using inclusion/exclusion criteria at the beginning of the procedure. In a subsequent iteration, references and citing articles from the individuals listed are acquired and examined.

Our search was conducted using the terms "Software Defined Networks," "Artificial Intelligence," and "Machine Learning," as well as their respective acronyms: ("SDN" OR "Software Defined Network" AND ("Artificial Intelligence" OR "AI" OR "Machine Learning" OR "ML"))

### A. Start Set and Criteria

We submitted the search query into the IEEE Xplore, Google Scholar and Core, search engines in order to build the start set. The first five papers from each group were then chosen.

The following acceptance standards were established before the articles were examined:

- Publication date between 2011 and 2022 (OpenFlow's release date);
- Published in first- or second-quartile peer-reviewed articles (Scimago ranking);
- Written in English;
- Focus on the current themes, such as SDN and AI/ML applications;
- Articles with access that the authors have been given.

With the help of the approval criteria, we selected a collection of articles that directly examine AI/ML in SDNs from reputable sources. Only six of the prospective beginning set's fifteen articles ultimately complied with the requirements: [7–12]. A total of 344 were omitted based on the year of publication, 112 were excluded because they were not published in conferences or journals with high enough rankings, 14 were unavailable, 296 were duplicates, 4 were not articles, and 582 did not directly address the issues at hand. 98 articles were chosen from this process, which was conducted between August and September 2022.

## III. DISCUSSION

The primary objectives of this part are to present our findings, discuss them, and provide an overview of existing and emerging trends.

### A. Application of AI/ML algorithms

The application of AI/ML algorithms in the publications is displayed in Table 1. The ranking shows that supervised learning algorithms are second in prevalence to neural networks (NNs) methods. Other mechanisms,

such as self-organizing maps, have been discussed in a number of studies but have not received as much attention.

The popularity neural networks and of deep learning, as well as RF and DT algorithms, can be used to explain why supervised learning techniques are preferred over the others. Unsupervised learning discovers patterns from unlabeled data, whereas supervised learning uses labelled data to adjust model parameters.

TABLE I. SDN-CONCEPT NETWORK PERFORMANCE ANALYSIS AND APPLICATIONS OF AI/ML ALGORITHMS

References	AI/ML Algorithm	Application	Performance analysis
[13]	K-Nearest Neighbours (KNN)	Predis: detects various attacks in addition to DDoS attacks.	Easily accessible, highly accurate; incapable of recognizing extremes; Calculate features easily; Suitable for multiclass classifications; Time consuming for large datasets
[14]	Random Forest (RF)	using regression to model one VNF's latency distribution.	High accuracy
[15], [16]	Decision Tree (DT)	Packet classification; LCD: optimize the ASP; Flow classification; Inductive inference;	Simple to comprehend and implement; Data preparation is easy or not required; High-speed; Too many categories may lead to higher error growth.
[17]-[19]	Neural Network (NN)	Collaborative intrusion prevention; Predicting the performance of SDN; Load balancing	Due to its simple and parallel computational capabilities, it achieved a low overhead; Achieved low mean squared error (MSE); improved efficiency and a 19.3% reduction in network latency.
[20], [21]	Reinforcement Learning (RL)	Cognitive network management	Manage networks efficiently;
[22]	Deep RL	Adaptive multimedia traffic control mechanism leveraging	Dynamic coordination of computational, networking, and caching resources
[23],[24]	Deep Q-Learning	Q value-action function approximation	Promote resilience and scalability
[25] [26], [27]	SVM	Predict link failure; Detect DDoS attack;	Reduces the start-up time for identification and classification recognition; lowers the rate of false alarms
[28]	Laplacian SVM	Traffic classification on the real Internet data	Similar applicability to supervised learning; only tested in a lab environment; processes synthetic data

In this context, it appears that supervised learning can be used more readily to enhance network decision-making in areas like routing and QoS. RL and unsupervised learning algorithms are outperformed by supervised learning algorithms, which are distinguished by a peak in 2017 and an erratic drop in the years that followed. It's interesting to note that RL has been rising gradually. In IoT, 5G access networks and automotive networking—dynamic situations recognized by RL to perform unsupervised and supervised learning methods—this suggests a possible application for SDNs. Based on these findings, it is predicted that the usage of RL to train networks and SDN processors would have to adapt to variations in resource demand and traffic, especially with the introduction of SDNs in increasingly complicated networks.

### B. Artificial Intelligence in SDN

Numerous issues, resource allocation and admission control, [29], have been successfully solved using AI and ML methodologies. However, in the SDN era, AI's function was greatly expanded due to the significant efforts made by the business sectors. Many researchers have revealed a significant trend in the scientific community's application of AI methods in SDNs.

### C. ML Methods In SDN-Concept Networks

The reinforcement learning, the semi-supervised, the unsupervised, the supervised learning method are the four kinds of ML approaches. A mathematical model is created by supervised learning algorithms using a labelled training sample. Algorithms for unsupervised learning gain information derived from test results that were not labelled. Additionally, when some of the sample input lacks labels, semi-supervised learning approaches are used to build mathematical models using sparse training data. Numerous classification and prediction issues have been successfully solved by the application of ML methods [30]. In this section, we will continue our work from

an algorithmic perspective by providing many traditional ML techniques used in SDN also listed in Table I for greater understanding.

#### *1) Supervised Learning in SDN-Concept Networks*

Nowadays, Numerous various applications, including spam detection, object and speech recognition, commonly use supervised learning [31]. Predicting the value of results obtained from the values of a vectors of input variable is the objective. In the context of regression approaches, the SDN architecture uses a regression to predict [32]. The key performance indicator (KPI) for the application and the network metrics are additionally related using multiple linear regressions [33]. Regression algorithm usage in SDN is currently uncommon on the whole. We focus on introducing the categorization techniques in SDN. The Logistic Regression, SVM, Decision Trees, KNN, Naive Bayesian algorithms are some of the most frequently used classification methods.

##### *a) K-Nearest Neighbours (KNN) In SDN-Concept Networks*

KNN is categorized by calculating the distance between various feature values. The categorization outcomes actually depend on a relatively limited set of nearby samples. KNN is appropriate for multiclass classifications which has been extensively utilized as a classifier in many different fields.

Predis, a computationally straightforward and effective KNN method, was proposed by Zhu et al. [13] as its detection technique. Because of its better efficiency design, it can accurately identify a variety of other forms. The algorithm takes a long time when the training dataset is huge. KNN, one of the most straightforward ML algorithms, is simple to use, estimates features accurately, and works well for multiclass classifications. When used to huge datasets, the algorithm takes a long time.

##### *b) Support Vector Machine (SVM) in SDN-Concept Networks*

Generalized linear classifiers include SVM that uses supervised learning to carry out binary classification. Because both structural and empirical risk minimizations are taken into consideration in the optimization problem, SVM is stable. SVM only works for binary classification tasks, it should be mentioned. Multiple classification tasks will therefore be broken down into a number of binary questions. The technology uses SVM embedded in the controller to identify DDoS attacks in [26]&[27]. It can identify the distinction between flow entries created by DDoS attack traffic that are malicious and flow entries created by normal traffic that are benign. In terms of binary classification problems, SVM has a lower rate of false alarms. Effectively cutting down on the time needed to start classification recognition and assault detection is the detection strategy. Since SVM is established at the SDN controller stage, the effectiveness of the SDN system is not significantly impacted by its complexity.

##### *c) Neural Networks (NN) in SDN-Concept Networks*

According to the testing findings, CIPA is more effective than [35] at identifying DDoS flooding attacks. CIPA also has success finding outbreaks of the Witty, Slammer, and Conficker worms. Due to its parallel and straightforward processing capabilities, the system achieved little computational and communication overhead. A multi-label classification method was suggested by He et al. [36] to estimate global network allocations. The neural network approach outperformed decision trees and logistic regression and reduced algorithm runtime by up to two-thirds. In order to estimate traffic demands off-line for a mobile network operator, Alvizu et al. [34] employed a neural network technique, which reduced the optimality gap between 0.2% and 0.45%. Additionally, the next configuration time point was predicted off-line using a NN technique.

A system for intrusion detection for SDN built on NN technique was proposed by Abubakar et al. [37]; it made use of the NSL KDD dataset to obtain a high reliability of 97.3%.

##### *d) Decision Tree (DT) in SDN-Concept Networks*

DT is a prediction model that illustrates the relationship among both object values and characteristics. It is a tree data structure where leaf nodes signifies a category and branch route denotes a potential parameter value, and internal node in the tree indicates an object. DT is frequently used in data mining to examine data for prediction. Packet classification is its primary use in networks. These are well-known methods, such as Hyper Cuts [38], Hi Cuts [39], Cut Split [40] or Effi Cuts [41], Partition Sort [42], which incorporates the advantages of DTs and TSS (Tuple Space Search), is proposed in light of the significantly increased dimensionality and dynamism in SDN. A least cost disruptive (LCD) decision tree was developed to resolve trade-offs between good delivery of services, adaption costs, and users disruptive level variables [43]. The DTs were employed in the work in [44] as a technique of solving the Flow Table Congestion Problem (FTCP). The main advantage of DT over KNN and SVM is that it can be easily implemented, and that preparation of data is either trivial or not even necessary. However, when there are too many categories, errors could increase more frequently.

##### *e) Ensemble Learning in SDN-Concept Networks*

The objective of the supervised learning method is to develop a stable model that excels in all situations, although the facts aren't quite obvious. In order to create a stronger, more complete strong supervision model,

multiple weak supervised models are combined through ensemble learning. A particular approach is used to merge a group of individual learners after they have first been formed. Bagging and boosting are two of the main ensemble learning algorithms. Despite the fact that these methods are used less frequently than traditional methods. RF (Random Forest) creates bagging integration and uses it in numerous settings using DT as the foundation learner. The indoor localization generated by the model in [45] has a high efficiency of 98.3% and performs best when using SVM, NN and KNN. It trains itself using RF-based cross validation (Neural Networks). To effectively describe the latency distribution of a single VNF, Lei et al. [46] suggest using a random-forest regression prediction approach. Ensemble learning is more accurate than the conventional methods mentioned above, but comes with a high level of complexity.

#### *2) Unsupervised Learning in SDN-Concept Networks*

The training samples' labels are unknown in unsupervised learning techniques. Analyzing training samples without labels that adds another layer of support for data analysis, the objective is to discover the fundamental characteristics and laws governing the data. The most popular technique is "clustering," and K-means is the most basic and well-known algorithm[48]. In an SDN-based WAN design, a controller placement problem is solved using a hierarchical K-means algorithm [49]. There are also algorithms that contrast or combine supervised learning and unsupervised learning. Understanding each algorithm's benefits and drawbacks is the goal of the comparison. Different supervised and unsupervised learning methods, including Naive Bayes, KNN, K-medoids and K-means, are used by Barki et al. [47] to categorize the traffic as abnormal or normal. Compared to Bayes and KNN, K-means and K-medoids are faster but less accurate. For traffic categorization, the two ML techniques unsupervised K-means clustering and supervised SVM are investigated [50].

#### *3) Semi-Supervised Learning in SDN-Concept Networks*

Generally, unsupervised and supervised learning are the two main subcategories of machine learning technology. While unsupervised learning only utilizes unlabeled sample sets, supervised learning only employs labelled sample sets. However, because labelling data is so expensive, there are sometimes far more unlabeled data available in real issues than there are labelled data. As a result, semi-supervised learning methods that may be applied to both labelled and unlabeled samples quickly developed. A combination of unsupervised and supervised learning is used in this learning strategy. By employing a large amount of unlabeled samples and small amount of labelled data and it primarily focuses on how to build and categorize models. The same applications as supervised learning utilize semi-supervised learning [36]. Semi-supervised learning has only been evaluated in the lab and has historically been used to handle synthetic data, whereas [51] has done studies to achieve accurate traffic classification of real Internet data. To re route effectively and accomplish the objectives of resource, the QoS parameters may be used. The QoS classifier also uses semi-supervised machine learning to handle traffic from unidentified applications. Its practical importance has not been adequately represented, relative speaking. Additionally, more study is needed to determine the practical benefits of semi-supervised learning.

#### *4) Reinforcement Learning (RL) in SDN-Concept Networks*

Through trial and error and rewards from interactions, an agent learns the reward-guiding activity referred as RL. In SDN-concept networks [52], [53], RL delivers path selection or route optimization and is often used to support reliability and scalability [20]. When delay reduction and throughput maximization are employed as the primary operational and maintenance method for DROM [54], the resulting network performance, routing services, and convergence are all significantly improved. The Internet of Vehicles (IoV) environment can be sensed and learned from to give an optimal routing policy adaptively. SDCoR [55] is the first study to do this and outperforms numerous common IoV protocols. Reduce the number of distinct pathways used for contiguous data frames in order to address the primary challenge of high jitter [52]. It is suggested to mix certain innovative RL research with other technologies for improved performance. To discover the best overlay paths with the least amount of monitoring overhead, for instance, Random NN with RL are constructed [21]. For making auto-scaling policy decisions, SRSA [56], an RL-based auto-scaling decision mechanism, was investigated. Furthermore, due to the complex and dynamic network environment, RL with architecture changes are considered.

To effectively manage networks with SON (Self-Organizing Networks) capabilities, Daher et al. [57] presented a scalable strategy based on distributed RL. By combining DL with RL, Deep Reinforcement Learning (DRL) accelerates learning and enhances the effectiveness of RL algorithms. DRL has produced outstanding outcomes in both theory and practice. In particular, the Google Deep Mind team's DRL-based Alpha Go program is regarded as a significant development in the field of artificial intelligence. Our findings support DRL's claims of some development in SDN concept networks. DRL for leveraging adaptive multimedia traffic control mechanism was researched by Huang et al. Without using a mathematical model, it can directly govern

multimedia flow. Deep Q-Learning (DQL) is specifically employed for the majority of DRL-related activities [58]. And in various network circumstances, different DQL approaches can be employed to solve various challenges. He et al. [59] suggested an integrated DQL methodology with SDN that uses a deep Q network to approximate the Q value-action function. Overall, RL is a significant ML technique that is frequently applied to network-related problems. Keep in mind that it only describes the interaction processes as opposed to offering a different teaching strategy. Additionally, an RL can be created from any learning algorithm [60], and it will be frequently used for analysis and prediction. Figure 1 gives a brief description of machine learning methods [61].

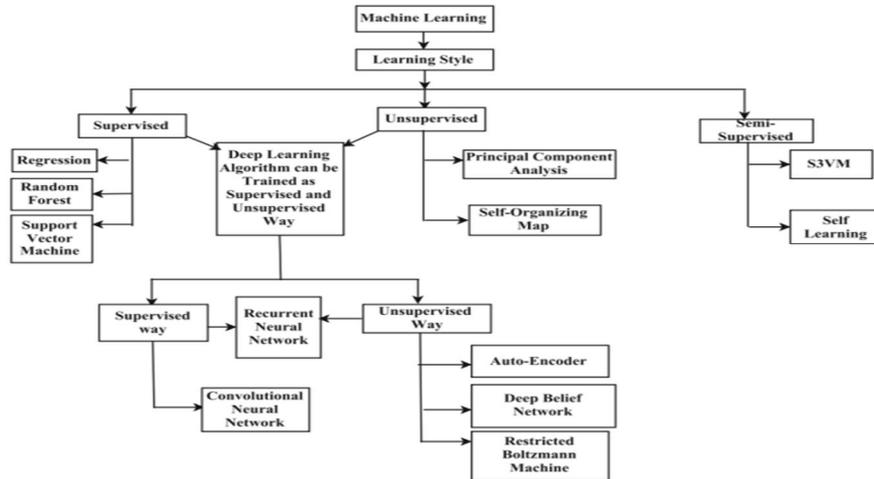


Fig 1. Overview of machine learning approaches

#### D. Quality of Service in SDN

The network will offer various levels of QoS depending on the offered traffic type, the volume of traffic at any given time, and the traffic's final destination[62]. Using Deep Air, a DRL-based adaptive intrusion detection Software-Defined Networks may successfully defend against cyber attacks (SDN). When compared to a Q-learning, Deep Air can significantly lower the ratio of QoS violating traffic flows [63]. To install SDN controller flow rules on the SDN-capable switches to decide the routing paths [64]. However, they are constrained in size due to their high cost and energy consumption. The installation in the SDN nodes' flow tables is impacted by this restriction, and ineffective rule administration can result in a reduction in the network's QoS. In [65] a DRL-based solution to the SDN flow tables' rule insertion issue is provided. The fundamental concept is to get rid of the rules that are meant to be used less. In this method, the objective of increasing the quantity of flows that the network can handle and subsequently enhancing network QoS is accomplished.

Due to the expansion of IoT applications, cloud services, mobility and video streaming made available to internet users, networking systems are becoming more sophisticated. The problem is that different QoS demands made by internet users are not satisfied. Artificial intelligence can be integrated into the system to manage complex networks thanks to machine learning. To get a comprehensive network view and installing the best routes in the routing/switch devices, the SDN platform is employed. The difficult part is computing the choice reward value and dynamically gathering the parameters in network. Real-time network topologies are used to carry out the emulation. Comparing the results to the conventional link-state algorithm, they are encouraging. The learning agent can gradually learn the way thanks to the RL algorithm for path determination (training time). For a destination pair and single source, the testing step takes  $n-1$  comparisons to find the path [66].

Network congestion and the end-to-end customer satisfaction exhibited by the QoE, the massive traffic utilization has adversely affected the network's QoS particularly during night time peak hours. A n intelligent multimedia framework in [67] is introduced to make use of the integration of SDN and RL, which allows for the exploration, learning, and exploitation of potential paths for video streaming flows, to optimize users' QoE and the network's QoS.

#### E. Impact of AI/ML on SDNs

The impact of AI/ML in SDNs is described in Table 2. AI facilitates intelligent resource optimization, promotes autonomous network management and controller, and increases security. Even though the majority of the techniques are proofs of ideas, they amply show how AI/ML may be used to manage QoS and QoE and

automate networks. These results imply that SDNs can successfully implement AI/ML algorithms, potentially accommodating both present and future specifications

TABLE II. IMPACT OF AI/ML ON SDNS

References	AI/ML algorithms	Use Cases
[68]-[70]	Deep RL	Optimise network resource usage
[71]	Supervised ML	Guarantee traffic based on its QoS requirements
[72]	Matheuristic with ML based	Enhance autonomous network management and configuration
[73], [74]	Decision Table (DT), Bayesian Network (BayesNet), and Naive-Bayes; Neural Network	Improve network security
[75]	Unsupervised ML for Networking	Monitor load balancing
[76], [77]	semi-supervised ML; RF, DT, KNN	Guarantee Quality of Service
[78]	ML and Deep Packet Inspection	High accuracy and applicability of classifier

#### F. Limitations of applying AI/ML in SDNs

AI/ML techniques are useful in many sectors, but they have major drawbacks. The same premise holds true for SDNs, as seen in Table 3. There is potential for improvement, as many studies (76 %) report having trouble putting the AI/ML techniques into practice. The three main issues are learning distortion, difficulty in processing large amounts of data without sampling and locating quality training sets

TABLE 3. LIMITATIONS OF AI/ML ALGORITHMS OF QOS IN SDN ENVIRONMENTS

References	Method	Advantages	AI/ML Limitations
[79]	SDN-Cloud - DDoS attack	<ul style="list-style-type: none"> <li>• Since a multi-controller SDN environment is emerging, attack mitigation at a single controller will result in increased computing overhead.</li> <li>• High scalability support</li> </ul>	<ul style="list-style-type: none"> <li>• Weak security between controllers and switches</li> <li>• Reduces flow timeout duration</li> <li>• Time-consuming operation</li> </ul>
[80]	AI-aided SD-IoT	<ul style="list-style-type: none"> <li>• High scalability</li> <li>• Less complexity.</li> <li>• High QoS</li> </ul>	Nil
[81]	FSM	<ul style="list-style-type: none"> <li>• Less overhead</li> <li>• Does not require frequent flow migrations</li> </ul>	<ul style="list-style-type: none"> <li>• Impossible to forecast an absolute transition.</li> <li>• Not suited for a large-scale environment</li> </ul>
[82]	Sway	<ul style="list-style-type: none"> <li>• K-paths are determined</li> <li>• The route is constructed for multimedia traffic</li> </ul>	<ul style="list-style-type: none"> <li>• Low throughput</li> <li>• Low Load balance rate</li> <li>• Low scalability</li> <li>• Not suited for heterogeneous devices</li> </ul>
[83]	DNN-SDR	<ul style="list-style-type: none"> <li>• Achieved load balance rate</li> <li>• Network dimensionality is reduced</li> </ul>	<ul style="list-style-type: none"> <li>• Time-consuming</li> <li>• Single point of failure</li> <li>• Poor scalability</li> </ul>
[84]	FRI	<ul style="list-style-type: none"> <li>• Low packet loss rate</li> <li>• Predicts the best path for traffic</li> </ul>	<ul style="list-style-type: none"> <li>• Large delay in best path selection</li> <li>• Low throughput</li> <li>• Traffic overhead is high</li> </ul>
[85]	Robust security (SDN-5G)	<ul style="list-style-type: none"> <li>• Able to reduce security threats</li> <li>• Increases flow time out period</li> </ul>	<ul style="list-style-type: none"> <li>• Authentication is time consuming</li> <li>• Searching time for packet assignment is extensive</li> <li>• Conventional ECC is utilized to generate keys, reducing robustness and dependability;</li> </ul>

#### IV. CONCLUSION

To investigate the application of AI/ML approaches in SDNs, we examined 98 publications (out of a total of 1450). The findings imply that algorithms for supervised learning considerably outperform those for unsupervised learning and reinforcement learning. According to the majority of studies, NNs are the most effective way to improve intelligence and optimize SDNs. However, in environments where numerous diverse devices compete for network resources, RL has noticed a minor rise in adherence and may begin to see a higher

rise in the number of SDN problems it is capable of resolving (e.g., 5G networks). Network management, automation, performance, and QoS are all enhanced through supervised and reinforcement learning. One of the most effective AI technologies is ML for managing and operating autonomous networks because to its capacity to extract information from data, which is fuelled by the availability of data and the theoretical advancement of ML frameworks. Although there have been some analyses of the problems and difficulties for ML in different SDN-based networks there hasn't been much proof that the applications haven't succeeded in providing workable management solutions for autonomous networks. We concentrate on SDN network applications using ML techniques for the other part. We also talk about the future directions for this field of study. The primary problems with ML approaches are noted. Although ML areas have made considerable progress, effective ML is challenging due to challenging patterns and a lack of training data availability. Because of this, many ML programs frequently perform below expectations. We anticipate that our discussions will serve as a straightforward manual for the advancement of SDN and the creation of a more intelligent network. Researchers with various goals can use this study to better understand the fundamental problems in the subject. Future network design and management will depend heavily on SDN-concept networks using ML techniques in all areas, including resource management, intelligent routing management, network security, flow control, etc. Future research will be done in-depth on the main issues mentioned in the study. The uses of AI/ML in SDN applications increases the potential and worth of these architectures in research and business. Future trends are expected to place an even greater emphasis on AI/ML techniques, as they offer substantial performance improvements.

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# Preprocessing and Segmentation of Retinal Blood Vessels in Fundus Images using U-Net

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**Abstract**— Deep Learning plays an important role today in disease detection and prediction. All deep learning models need to be trained to process the input; Extract features and return prediction results. Before classification and prediction, the given input must be preprocessed to perform segmentation using augmentation. Only with the help of preprocessed images each model can make accurate predictions at higher speeds. This proposed work aimed to detect Diabetic Eye Diseases by means of segmenting the augmented images using U-Net. U-Net is familiar with its Encoder-Decoder architecture for sampling. Retinal Blood Vessel is one of the most precise parts of an eye. Based on the nature of this blood vessel one can identify whether it is affected by diabetic retinopathy or not. So, segmenting the blood vessel helps to classify the disease category in early stage and of course U-Net is probably meant for segmenting medical images. In this paper, the discussions will be made on preprocessing eye images from the data set, segmenting those images using U-Net to extract the retinal blood vessel, classification based on segmentation..

**Index Terms**— Deep Learning, Prediction, Classification, Segmentation, Augmentation, U-Net, Diabetic Eye Diseases.

## I. INTRODUCTION

### A. Image Processing:

Image processing as the name suggests, means processing images, and many techniques are required to reach the goal. It is the core domain of computer vision that plays a key role in many real-world examples, such as robotics, self-driving cars, and object recognition. Image processing allows us to transform and manipulate thousands of images simultaneously and derive useful insights from them. It has a wide range of applications in almost every field. The final output may be in the form of either an image or an equivalent feature of that image. This can be used for further analysis and decision making. An image can be represented as a 2D function  $F(x, y)$  where  $x$  and  $y$  are the spatial coordinates. The amplitude of  $F$  at a particular value of  $x, y$  is known as the intensity of the image at that point. If the  $x, y$  and amplitude values are finite, it can be called as digital image. This is an array of pixels arranged in columns and rows. A pixel is an image element that contains information about intensity and color. Images can also be represented in 3D, where  $x, y,$  and  $z$  are spatial coordinates. Pixels are arranged in a matrix. This is called an RGB image. There are different types of images: i) RGB Image - Contains three layers of a 2D image, these layers being the red, green and blue channels, ii) Grayscale Images - These images contain shades of black and white and contain only one channel.

## B. Segmentation:

Image segmentation is a computer vision task that divides an image into regions by assigning a label to each pixel in the image. It provides more information about the image than object detection, which draws bounding boxes around detected objects, or image classification, which assigns labels to objects. Segmentation is useful and can be used in real-world applications such as medical imaging, clothing segmentation, flood maps, and self-driving cars. There are two types of image segmentation.

- Semantic Segmentation: Classify each pixel with a label.
- Instance Segmentation: Classifies each pixel to distinguish each object instance.

In Ref. [1], U-Net is a semantic segmentation method originally proposed for medical image segmentation. This was one of the early deep learning segmentation models, and the U-Net architecture (Figure 1) is also used in many of his GAN variants such as his Pix2Pix generator.

In Ref. [2], the U-Net is an elegant architecture that solves most of the occurring issues. It uses the concept of fully convolutional networks for this approach. The intent of the U-Net is to capture both the features of the context as well as the localization. This process is completed successfully by the type of architecture built. The main idea of the implementation is to utilize successive contracting layers, which are immediately followed by the up-sampling operators for achieving higher resolution outputs on the input images.

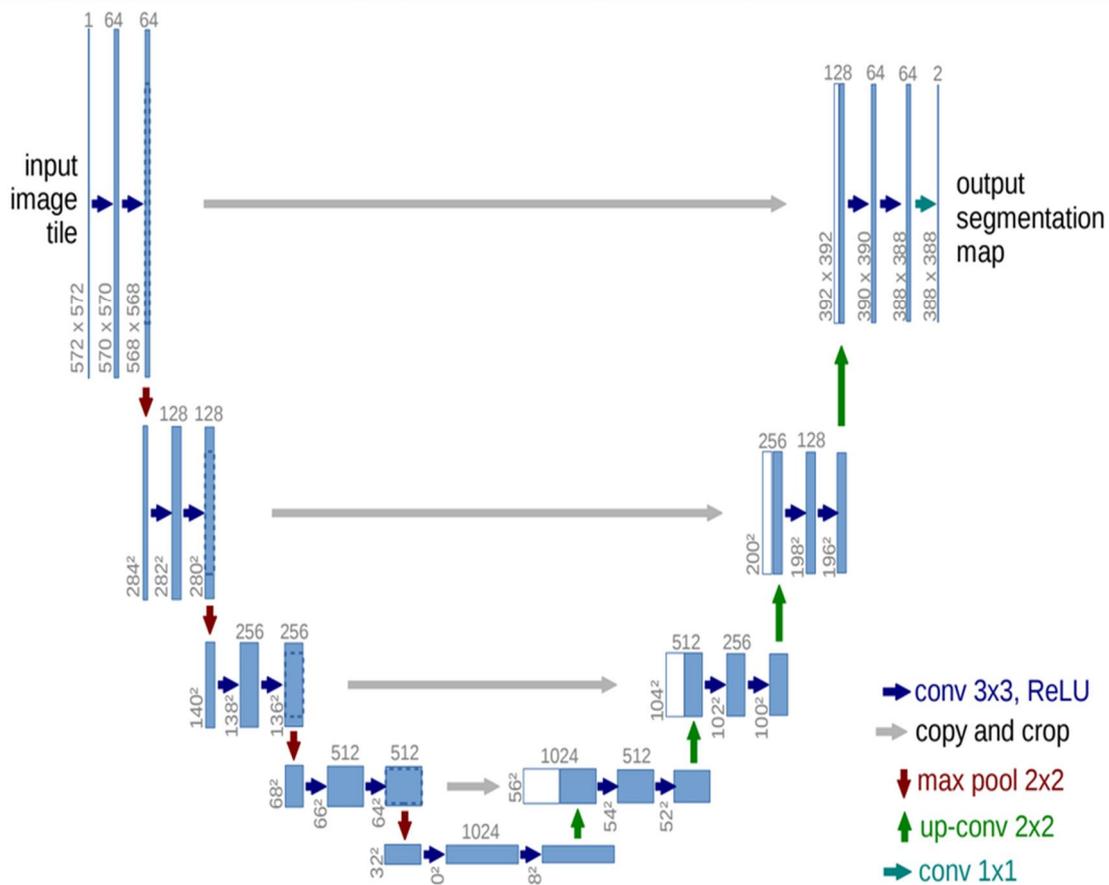


Figure 1. U-Net Architecture

This paper is arranged as chapters in the following manner, Chapter II contains Literature Survey, Chapter III contains Image Preprocessing, Chapter IV contains Segmentation, Chapter V contains Proposed Method, Chapter VI contains Segmentation result and discussions, and Chapter VII contains Conclusion.

## II. LITERATURE SURVEY

In Ref. [4], a typical CNN has a multi-layered structure such as feed forward networks. As different from feed forward networks, a CNN can include several Convolutional layers with a sub-sampling section. All the

parameters have been calculated for the CNN after three image processing stages as resizing the image, applying Histogram Equalization, and applying CLAHE. After the image processing-based enhancement, the classification was made using the CNN. The performance of the introduced method was evaluated by using 400 retinal fundus images in the MESSIDOR database. In Ref. [5], this work depicts the green channel of the RGB model exhibits the best contrast between the vessels and background while the red and blue ones tend to be noisier. The grey image from the green channel is processed and the retinal blood vessels appear darker in the grey image and then invert it to appear brighter than non-vessel background. Salt and pepper noise is added in order to represent the presence of noise. In order to remove the salt and pepper noise, order and median filters are used. The output of the order filter gives better contrast between the vessels and the background, thereby removing the noise more accurately than the other filters.

In Ref. [6], This study aimed to detect Optic Disc. Some of the features of Diabetic Retinopathy are exudates, hemorrhages and micro aneurysms. Detection and removal of optic disc plays a vital role in extraction of these features. This paper focuses on detection of optic disc using various image processing techniques, algorithms such as canny edge, Circular Hough (CHT). Retinal images from IDRiD, Diaret\_db0, Diaret\_db1, Chasedb and Messidor datasets were used.

In Ref. [7], the proposed model has been trained with three types, back propagation NN, Deep Neural Network (DNN) and Convolutional Neural Network (CNN) after testing models with CPU trained Neural network gives lowest accuracy because of one hidden layer whereas the deep learning models are outperforming NN. The Deep Learning models are capable of quantifying the features as blood vessels, fluid drip, exudates, hemorrhages and micro aneurysms into different classes. In Ref. [8], Glaucoma is a group of conditions, in which high pressure inside the eye damages the optic nerve of the eye. The vision lost due to glaucoma is irreversible and cannot be regained. Hence it is very important to detect this disease as early as possible and treat early to preserve vision. In this paper, the performance of five preprocessing techniques is compared namely Contrast Adjustment, Adaptive Histogram equalization, Median filtering, Average filtering and Homomorphic filtering. The performances of these techniques are evaluated using Mean Square Error (MSE) and Peak Signal to Noise Ratio (PSNR).

In Ref. [9], proposed automated methods consist of pre-processing, blood vessels extraction, optic disc segmentation and macula region segmentation. Initially, pre-processing is performed using shade correction and top-hat transformation for enhancement of dark anatomical structures such as blood vessels and macula/fovea region. A novel graph cut method is used to extract blood vessels. Then template based matching and morphological operations are used for detection and extraction of optic disc. Finally, post processing is used for detection of macula in retinal images. In Ref. [10], the work proposed was an OD segmentation model from fundus images based on Retina Net extension with DenseNet that addresses the vanishing gradient problem, enhances feature propagation, performs deep supervision, strengthens feature reuse and reduces the number of parameters. The model was developed based on promising results achieved by the Retina Net and the DenseNet in many object detection problems. Combining both models facilitates the reuse of computation through dense connections and improves gradient flow.

In Ref. [11], segmenting the optic disc (OD) is an important and essential step in creating a frame of reference for diagnosing optic nerve head pathologies such as glaucoma. The main contribution of this paper is in presenting a novel OD segmentation algorithm based on applying a level set method on a localized OD image. To prevent the blood vessels from interfering with the level set process, an in-painting technique was applied. The new automatic eye disease diagnosis system has to be robust, fast, and highly accurate, in order to support high workloads and near-real-time operation.

### III. IMAGE PREPROCESSING

The purpose of pre-processing is to raise the image's quality so that we can analyze it more effectively. Preprocessing allows us to eliminate unwanted distortions and improve specific qualities that are essential for the application we are working on. Those characteristics could change depending on the application. There are four different types of Image Pre-Processing techniques and they are as follows;

1. Pixel brightness transformations/ Brightness corrections
2. Geometric Transformations
3. Image Filtering and Segmentation
4. Fourier transform and Image re-saturation

The brightness of a pixel is altered by *Brightness transformations*, which are dependent on the characteristics of the individual pixel. In PBT, the value of the output pixel depends only on the value of the matching input pixel.

Enhancing contrast is a crucial component of image processing for both human and machine vision. It is commonly used in speech recognition, texture synthesis, medical image processing, and many other image/video processing applications as a pre-processing step.

The most common Pixel brightness transforms operations are

1. Gamma correction or Power Law Transform
2. Sigmoid stretching
3. Histogram equalization

Two commonly used point processes are multiplication and addition with a constant.

$$g(x)=\alpha f(x)+\beta \quad (1)$$

The parameters  $\alpha > 0$  and  $\beta$  are called the gain and bias parameters and sometimes these parameters are said to control contrast and brightness respectively.

#### A. Histogram Equalization

It is a well-known contrast enhancement technique due to its performance on almost all types of images. Histogram equalization provides a sophisticated method for modifying the dynamic range and contrast of an image by altering that image such that its intensity histogram has the desired shape. Unlike contrast stretching, histogram modeling operators may employ non-linear and non-monotonic transfer functions to map between pixel intensity values in the input and output images.

The normalized histogram can be represented as,

$$P(n) = (\text{number of pixels with intensity } n) / (\text{total number of pixels})$$

#### B. Image Filtering and Segmentation

The purpose of utilizing filters is to change or improve the qualities of the images and/or to extract important data from the images, such as edges, corners, and blobs. A kernel, which is a tiny array applied to each pixel and its neighbors inside a picture, defines a filter. Some of the basic filtering techniques are; i. Low Pass Filtering (Smoothing), ii. High pass filters (Edge Detection, Sharpening), iii. Directional Filtering, iv. Laplacian Filtering. Often based on the properties of the picture's pixels, *Image Segmentation* is a widely used method in digital image processing and analysis to divide an image into various parts or areas. Foreground and background can be distinguished in an image using segmentation, and pixels can be grouped together according to their similarity in color or shape. Image Segmentation is mainly used in Face detection, medical imaging, Machine vision, Autonomous Driving.

#### C. Fourier Transform

In Ref. [3] is an important image processing tool used to decompose an image into its sine and cosine components. The output of the transform represents an image in the Fourier or frequency domain, while the input image is equivalent in the spatial domain. In Fourier-domain images, each point represents a specific frequency in the spatial-domain image. Fourier transforms are used in a variety of applications such as image analysis, image filtering, image reconstruction, and image compression.

## IV. IMAGE SEGMENTATION

### A. What is Segmentation?

Segmentation is the separation of one or more regions or objects in an image based on a discontinuity or a similarity criterion. In Ref. [21], A region in an image can be defined by its border (edge) or its interior, and the two representations are equal.

*Segmentation approaches:*

- *Pixel-based segmentation:* each pixel is segmented based on gray-level values, no contextual information, only histogram. Example: Thresholding.
- *Region-based segmentation:* considers gray-levels from neighboring pixels by – including similar neighboring pixels (region growing), – split-and-merge, – or watershed segmentation.
- *Edge-based segmentation:* Detects and links edge pixels to form contours.

Following are the primary types of image segmentation techniques: (in Figure 2)

1. Edge-Based Segmentation
2. Thresholding Segmentation
3. Region-Based Segmentation
4. Clustering-Based Segmentation

## 5. Watershed Segmentation

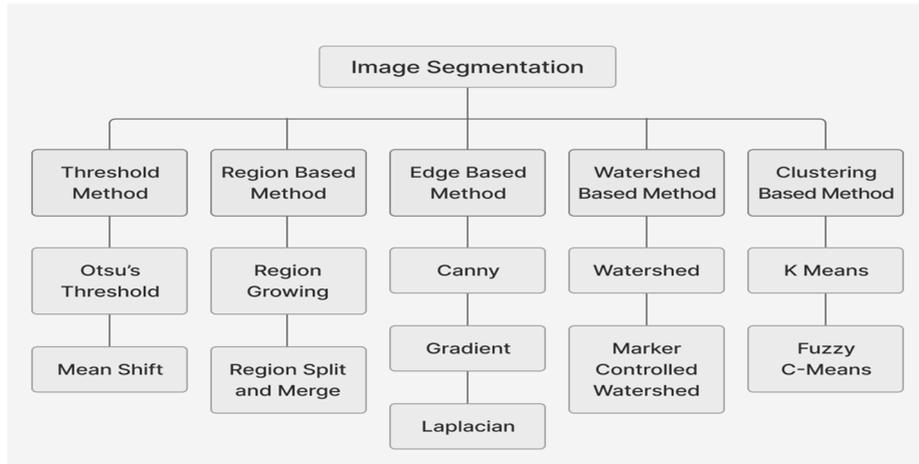


Figure 2. Segmentation approaches

1. **Edge-Based Segmentation:** Edge-based segmentation is a popular image processing technique that identifies the edges of various objects in a given image. It helps locate features of associated objects in the image using the information from the edges. Edge detection helps strip images of redundant information, reducing their size and facilitating analysis.

Edge-based segmentation algorithms identify edges based on contrast, texture, color, and saturation variations. They can accurately represent the borders of objects in an image using edge chains comprising the individual edges.

2. **Thresholding Segmentation:** Thresholding is the simplest image segmentation method, dividing pixels based on their intensity relative to a given value or threshold. It is suitable for segmenting objects with higher intensity than other objects or backgrounds.

The threshold value  $T$  can work as a constant in low-noise images. In some cases, it is possible to use dynamic thresholds. Thresholding divides a grayscale image into two segments based on their relationship to  $T$ , producing a binary image.

3. **Region-Based Segmentation:** Region-based segmentation involves dividing an image into regions with similar characteristics. Each region is a group of pixels, which the algorithm locates via a seed point. Once the algorithm finds the seed points, it can grow regions by adding more pixels or shrinking and merging them with other points.

4. **Clustering-Based Segmentation:** Clustering algorithms are unsupervised classification algorithms that help identify hidden information in images. They augment human vision by isolating clusters, shadings, and structures. The algorithm divides images into clusters of pixels with similar characteristics, separating data elements and grouping similar elements into clusters.

5. **Watershed Segmentation:** Watersheds are transformations in a grayscale image. Watershed segmentation algorithms treat images like topographic maps, with pixel brightness determining elevation (height). This technique detects lines forming ridges and basins, marking the areas between the watershed lines. It divides images into multiple regions based on pixel height, grouping pixels with the same gray value. The watershed technique has several important use cases, including medical image processing. For example, it can help identify differences between lighter and darker regions in an MRI scan, potentially assisting with diagnosis.

### *B. CNN for Image Segmentation:*

In Ref. [12], we applied Convolutional Neural Networks (CNN) on the semantic segmentation of remote sensing images. As well as, improving the Encoder- Decoder CNN structure SegNet with index pooling and U-Net to make them suitable for multi-targets semantic segmentation of remote sensing images.

Convolutional neural network is a hierarchical model whose input is raw data, such as RGB image and raw audio data. Convolutional neural networks extract high level semantic information layer by layer from the input layer of raw data by stacking a series of operations such as convolution operation, pooling operation and mapping of non-linear activation functions. This process is called “feed-forward operation”. Different types of operations in the convolutional neural networks are called “layers”. Convolution operations are convolutional layers and

pooling operations are pooling layers. The last layer of convolutional neural network transforms its target tasks (classification, regression, etc.) into the objective function. By calculating the error or loss between the predicted value and the real value, the error or loss back-forward layer by layer by the back-propagation algorithm to update the parameters of every layer and then back-forward again and again until the network model converges. In Ref. [13], during past days, a lot of research has been carried out for retinal blood vessel segmentation for identification of Diabetic Retinopathy using various machine learning and deep learning models. In this research work, Convolutional Neural Network (CNN) and CLAHE are applied together to tackle the problem of retinal blood vessel segmentation of images over the DRIVE dataset. The method undergoes pre-processing- grey scale conversion and CLAHE, feature extraction using morphological feature, segmentation, training and prediction using CNN. Experimental evaluation shows that the proposed method outperforms 98.06% accuracy.

In Ref. [14], a comprehensive review of the literature has been written, covering a broad spectrum of pioneering works for semantic and instance-level segmentation, including fully convolutional pixel-labeling networks, encoder-decoder architectures, multi-scale and pyramid-based approaches, recurrent networks, visual attention models, and generative models in adversarial settings. We investigate the similarity, strengths and challenges of these deep learning models, examine the most widely used datasets, report performances, and discuss promising future research directions in this area. In Ref. [15], with the advent of neural networks, deep convolutional neural networks (DCNNs) provide benchmarking results in the problems related to computer vision. Manifold DCNNs have been proposed for semantic segmentation such as U-Net, DeepU-Net, ResUNet, DenseNet, RefineNet, etc. The general procedure is common for all the models. It has three phases - pre-processing, processing and output generation. The outputs of the processing phase are the masked image and segmented image. In this paper, a systematic critique of the existing DCNNs for semantic segmentation has been manifested. The datasets and the architectures of the existing models have also been discussed in this paper with illustrations.

In Ref. [16], the proposed model has 13 layers and uses dilated convolution and max-pooling to extract small features. Ghost model deletes the duplicated features, makes the process easier, and reduces the complexity. The Convolution Neural Network (CNN) generates a feature vector map and improves the accuracy of area or bounding box proposals. Restructuring is required for healing. As a result, convolutional neural networks segment medical images. It is possible to acquire the beginning region of a segmented medical image. The proposed model gives better results as compared to the traditional models, it gives an accuracy of 96.05, Precision 98.2, and recall 95.78. In Ref. [17], they present a network and training strategy, that relies on the strong use of data augmentation to use the available annotated samples more efficiently. The architecture consists of a contracting path to capture context and a symmetric expanding path that enables precise localization. We show that such a network can be trained end-to-end from very few images and outperforms the prior best method (a sliding-window convolutional network) on the ISBI challenge for segmentation of neuronal structures in electron microscopic stacks.

In Ref. [18], after researching various techniques, they have found that, the CNN is one the most powerful tool in image segmentation technique. Detailed analysis of CNN is also done here explaining different layers and workings of each layer. As we know CNN technology is at a boost of implementation nowadays in making the human life more and more convenient and less manual. There have already been a lot of work done in various fields like commutation, medical tasks, crop monitoring, road transportation, activity detection, product quality monitoring. In Ref. [19], a novel attention Gabor network (AGNet) based on deep learning for medical image segmentation that is capable of automatically paying more attention to the edge and consistently for improvement to the segmentation performance is proposed. The proposed model consists of two components. The first one is to determine the approximate location of the organs of interest in the image using convolution filters, and the other one is to highlight salient edge features intended for a specific segmentation task using Gabor filters. In order to facilitate collaboration in between the two parts, a region attention mechanism based on Gabor maps is suggested. The mechanism improved performance by learning to focus on the salient regions of the image that are useful for the authors' tasks.

In Ref. [20], fully automatic segmentation of wound areas in natural images is an important part of the diagnosis and care protocol since it is crucial to measure the area of the wound and provide quantitative parameters in the treatment. Various deep learning models have gained success in image analysis including semantic segmentation. This manuscript proposes a novel convolutional framework based on MobileNetV2 and connected component labeling to segment wound regions from natural images. The advantage of this model is its lightweight and less compute-intensive architecture. The performance is not compromised and is comparable to deeper neural networks. We build an annotated wound image dataset consisting of 1109-foot ulcer images from 889 patients to train and test the deep learning models.

## V. PROPOSED METHOD

### A. Dataset:

In the proposed method, the UNET model is trained with DRIVE dataset. This dataset contains 20 training images with mask and manual ground truth images. The images were enhanced using some preprocessing techniques such as, Grayscale transformations, Brightness transformations, applying CLAHE (Contrast Limited Adaptive Histogram Equalization), Extracting edges by Canny Edge Detection etc., The aim of this method is to segment the blood vessel from retina for classification of disease severity.

### B. Flow Diagram:

The flow diagram (in Figure 3) depicts the work flow of process to extract blood vessel and segment them using UNET Model. In the proposed method, images are acquired from the dataset. The RGB image is then converted into a grayscale image. The Gray image is fed to the process of CLAHE (Contrast Limited Adaptive Histogram Equalization). The image is processed with Canny Edge Detection method. By this, Retinal Vessels are extracted from the image. The output is considered as ground truth image for segmentation process. The UNET model is trained to segment the retinal blood vessel from the given image. This model is implemented in Google Colab, NVIDIA Tesla K80 GPU. The model performance is measured using segmented image by comparing them with ground truth.

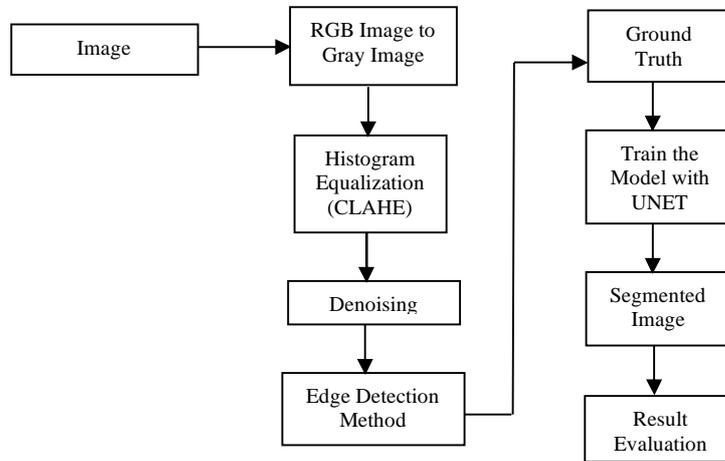


Figure 3. Flow Diagram of Proposed Method

### C. ALGORITHM:

Input:  $I_i$ , Read images from Dataset,

Process:

Step1: Convert RGB Image to Grayscale Image

Step2: Increase Brightness using CLAHE.

Step3: Denoise the image by Non-Local Mean Denoising function.

Step4: Detect the edges by Canny Edge Detector – Ground Truth Image,  $G_i$ .

Step5: Train the model,  $U_i = I_i + G_i$ .

Step6: Segmented Image,  $S_i$ .

Output: Retinal Blood Vessels Extraction.

### D. CLAHE (Contrast Limited Adaptive Histogram Equalization):

The CLAHE operates on small regions in the image, called tiles, rather than the entire image. The neighboring tiles are then combined using bilinear interpolation to remove the artificial boundaries. This algorithm can be applied to improve the contrast of images. There are two parameters to be considered. They are,

i. clip Limit – This parameter sets the threshold for contrast limiting. The default value is 40.

ii. tileGridSize – This sets the number of tiles in the row and column. By default, this is  $8 \times 8$ . It is used while the image is divided into tiles for applying CLAHE.

### E. De-noising Images:

In Ref. [22], its basic idea is to build a pointwise estimation of the image, where each pixel is obtained as a weighted average of pixels centered at regions that are similar to the region centered at the estimated pixel. For a given pixel  $x_i$  in an image  $x$ , NLM ( $x_i$ ) indicates the NLM-filtered value.

Let  $w_{i,j}$  be the weight of  $x_j$  to  $x_i$ , which is computed by,

$$W_{i,j} = 1/C_i \exp(-\|X_i - X_j\|_2^2) / h \quad (2)$$

where  $C_i$  denotes a normalization factor, and  $h$  indicates a filter parameter.

### F. Canny Edge Detection Method:

This method contains four major steps to process;

- Reduce Noise using Gaussian Smoothing.
- Compute image gradient using Sobel filter.
- Apply Non-Max Suppression or NMS to just keep the local maxima
- Finally, apply Hysteresis thresholding which that 2-threshold values  $T_{upper}$  and  $T_{lower}$  which is used in the Canny () function.

Figure 4. shows the original image, preprocessed, edge image, and segmented image.

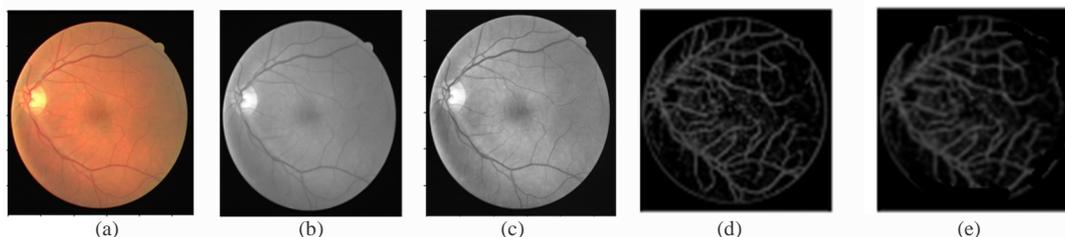


Figure 4. (a) Original image, (b) Grayscale image, (c) CLAHE image, (d) Canny Edge image and (e) Segmented image.

## VI. SEGMENTATION RESULTS

After preprocessing, the U-Net model is trained with images and masks. Original images and Ground truth images are given as training and validation inputs. Images are given to x coordinate and masks are given to y coordinate to perform 2D convolutions. The DRIVE dataset contains manually annotated masks considered as ground truth images. The model performs out well in all epochs. The number of epochs started from 5, and ends with 100. The following table (Table.1) and Figure 5. shows the accuracy achieved for each number of epochs.

TABLE.1. NO. OF EPOCHS VS ACCURACY

No. of Epochs	Accuracy (%)	No. of Epochs	Accuracy (%)
	88.73	50	91.23
10	88.74	70	94.71
20	89.31	100	98.92

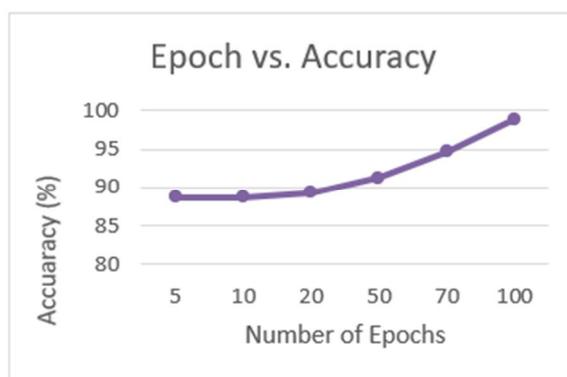


Fig.5 No. of Epochs and Accuracy

### A. Result Comparison:

In previous research works, the authors used Convolutional Neural Network models and H-minima for classification using the DRIVE dataset. But segmentation helps the classification task in better way. And also, U-Net models is specifically meant for bio-medical images. This model really predicts the segmented images as in

the ground truth image. The edge images were generated automatically. This method is implemented in Google Colab with GPU environment. From the results, the proposed model is compared with existing works of different datasets and different models. The proposed method outperforms well with U-Net Model. The following table (Table.2) shows the comparison about the dataset used and accuracy obtained by other authors.

TABLE II | COMPARISON OF PROPOSED METHOD WITH PREVIOUS WORK ON DRIVE DATASET

Author	Dataset	Model	Accuracy (%)
[13]	DRIVE	CNN	98.06
[23]	DRIVE	CNN+UNET	97.90
[24]	STARE & DRIVE	H-Minima	95.91 & 96.72
Proposed Method	DRIVE	CANNY Edge Detection + UNET	98.92

## VII. CONCLUSION

In the proposed method, DRIVE dataset is used and Canny Edge Detection with U-Net model was implemented. The model uniquely identifies all the edges present in the original eye image, also it represents the blood vessels of retina. From the identified edges, the U-Net model is trained with images and masks for various number of epochs. Finally, it achieves better accuracy compared to other previous works. This work can be enhanced furtherly as, by applying different datasets such as, IDRiD, Messidor-2, STARE etc., and the segmentation can also be done with other models like Attention U-Net, Res U-Net. Due to its easy-to-access and good performance, the proposed method accelerates the diagnosis of Diabetic Eye Diseases in early stages itself.

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# COVID-19 Tracker

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**Abstract**— Covid-19, which is also called as “The outbreak of Corona virus” as it is commonly known as in the process of getting terminated completely, but it is never known about the future of any virus or bacteria. The prevalence of Corona Virus in our society can be successfully monitored only through proper tracking and the subsequent analysis with those tracking. The process of analyzing the tasks is completely dependent on the society experts, but they can analyze only with the tracking provided to them. The application that is being built now eases the work of the analysis experts. It will keep a track of the day-to-day cases of corona, its surges and downfall. It will show the daily changes in the form of graphs and charts which, with a better User Interface that can help not only the experts, but also general people, visualize the readings clearly by minimizing the visible details and making it more abstract suitable for smaller screen sized applications. People can check the ups and downs of the covid cases in a pictorial format through bar charts, pie charts, line graphs and other graphical diagrams. The data for all the countries will be fetched via an API call which will be updated by the API service provider itself. The data fetched will then be processed and visualized in the form of bars and charts. Apart from the daily cases, users can also view the daily deaths and recoveries. They can additionally check the total number of Covid cases till date. The total number of Deaths and recoveries can also be viewed by the user with ease. Users will be given an option to sort the type of data they want to view i.e., death, recoveries, new cases and total cases. Based on their input, the pictorial representation will be shown to them. Mobile phone users always look for an application for their comfort, thus an application which visualizes less detailing and more abstract way targeting small screen users.

**Index Terms**— User Interface, Covid-19, Visualization, Tracking.

## I. INTRODUCTION

The title of this project "Covid-19 Tracker" in simple terms means a record of daily covid cases prevailing in the country. These records in turn helps the analyst and experts to properly understand the Covid scenario and make correct decisions for future. Furthermore, the tracking helps every individual using the app to remain up to date and aware of the future consequences. In the past, the cases turned less predictable when there was a second wave in the curve plotting the number of active cases and new cases. Though the curve of death cases did not find a clean wave second time in the graph. These incidents made the cases go unpredictable causing not only the analysts, but also the general people look into graphs everyday with less understanding of the high level graphs in mobile devices and great numbers which doesn't explain much.

Though there were many types of visualizations, more detailing and lower level graphical representations lost

views from mobile users. Mobile phone users always look for an application for their comfort, thus an application which visualizes less detailing and more abstract way targeting small screen users. The Data for all the countries will be fetched via an API call which will be updated by the API service provider itself. The data fetched from the API will then be processed and filtered. The filtered data will be used to visualize the covid cases and displayed to the users through pictorial representation in the form of bars and charts. Mobile phone users always look for an application for their comfort, thus an application which visualizes less detailing and more abstract way targeting small screen users. The main purpose of the project is to provide a better user interface to the users to view the covid changes happening daily and work accordingly. Both the common people and the covid analysts can make use of the app and keep them updated and aware.

## II. LITERATURE SURVEY

In [1], the author analysed how much time people spend over small displays compared to large displays over time. Small displays are considered mobile phones, the data taken from websites which encountered API calls from devices with smaller resolutions and screen size, data visualised over various time periods. The study proved that people with smaller devices are more likely to check data related to a specific trend or fashion but often give up due to complex data over a smaller screen.

Various visualization techniques have been shown in [2] which can be applied online and offline by using static data and how it helps various professions such as policy makers, scientists, healthcare providers and the general public understand the aspects of the pandemic. These techniques came to limelight due to the pandemic and most people learnt more new terms about visualization during the pandemic. In [3], the authors use the retrieved data for Susceptible Exposed Infectious Recovered (SEIR) predictive modelling. Sentimental Analysis is done with news data by segregating into negative and positive sentiments, to understand the influence of the news on people's behaviour both politically and economically.

Audio analysis methods have been discussed by the authors in [4] using audio data sets and symptoms of people to detect the presence of COVID-19 virus from sampling of data and applying SVM. The data was crowd sourced using their application. This audio data helped people identify symptoms as during the first phase of pandemic throat infection was a major symptom for the virus. In [5], the authors discussed about the Community-level surveillance with an unsupervised symptom-based online search model is being used here. In our analysis, we compare Correlation and regression where the relationship of search frequency time series and confirmed cases or deaths can uncover symptoms or behaviours related to COVID-19.

The authors in [6] discussed about the analyses of mobility data collected by GPS and Wi-Fi by analysing the data of devices connected through public Wi-Fis through tourism boards and tracing its mobility during the pandemic. The data helped in tracking people who were possibly in contact with a vector using the device footprint logged in public Wi-Fis which were connected same time when the disease carrier was using the Wi-Fi to easily sort out the contact tracing. This made possible to track down few cases and avoid spreading.

In [7], the authors suggested various phases of COVID-19 spread control by using automated ways with the help of IOT and Internet to conduct various process like screening, testing, contact tracing, prediction, sanitation with the help of robotics and IOT instead of manual ways to increase accuracy and safety. This further helped safety of people by using robots instead of front line workers using safety guards and masks which doesn't guarantee safety in all circumstances.

## III. PROPOSED SYSTEM

The architecture of the project is displayed in Figure 1. The system consists of front end and back end. The front end of this system consists of the User Interface which interacts with the user to get inputs by handling events from touch and keyboard. The user interface consists of views and view controllers which are arranged in particular layouts and order to show one over the other with specific overlays. The user interface has to filled with data, which is obtained from back end through the help of data managers which manage the data from network and database. The user interface also handles various screen sizes and resolution thereby computing the size and pixels of every frame for the specific device. Other than colour and layout, front end needs data to be filled out which is dynamic and cannot be hard coded. The data is handled by back end. The back end consists of a data manager which handles the data to be fetched from various APIs and decode the data to a specific format which the code can understand. It converts to classes and types defined earlier to the user interface and passes the data in those types to the front end. The front end utilizes this data and updates the User Interface. The data obtained from APIs after decoding is also stored in databases for further access as network calls take a lot of

time to get the response. This data is passed further to database and to the UI and received from network to the database and so on. Thus, back end manages the data and sends it to the front end through a single layer to interact to avoid multiple point of contacts between front and back end.

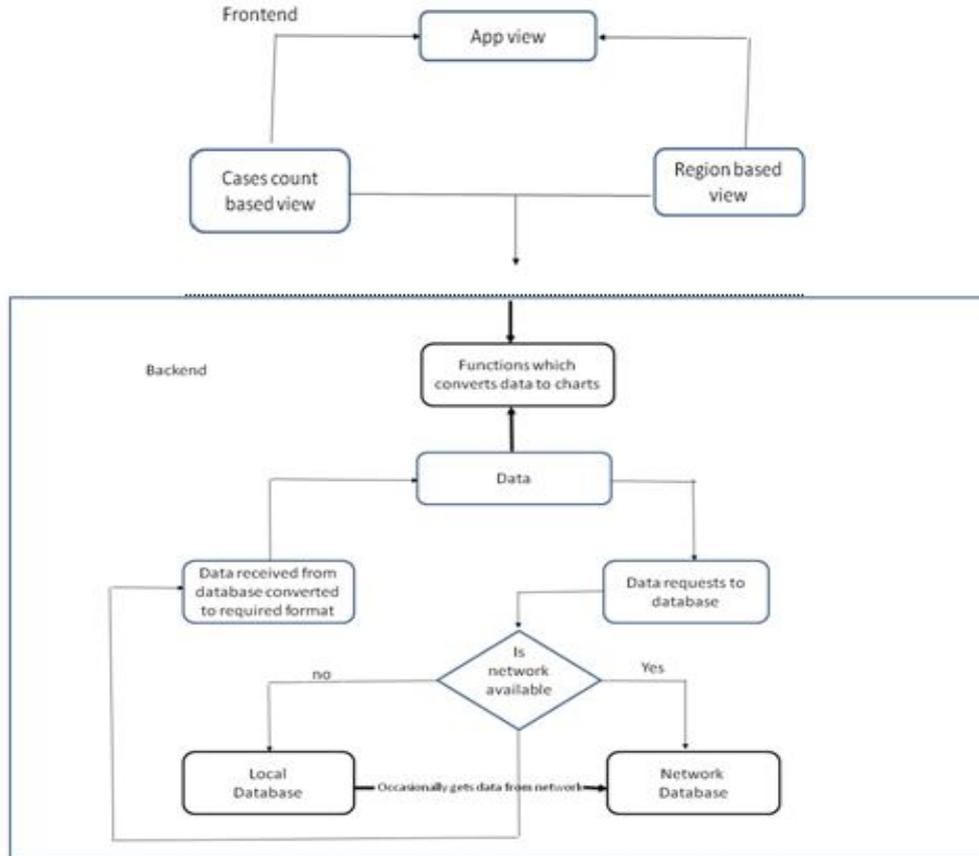


Figure 1. Architecture diagram

There are three modules in this application namely, , Domain module, Data module and Presentation module. The presentation module handles the input data received from user and converts it to function calls and passes it to the domain module. Also, this module handles all the views and visualizations presented to the user such as buttons, colours, layouts, frames and images. The domain module collects the function calls from the presentation module and passes it to the data module. The data module collects the data requests from the domain module and passes responses to the domain module the data fetched either from database or through some network calls. The final data is passed to the presentation module and displayed to the user..

#### A. Domain Module

The domain module consists of all types responsible for the application's back-end. It consists of the entities not limiting to the types present in the database model. These entities are used throughout the application in place of the set of data which is structured. Domain also has the implementations of the use cases which are required for the functionality of the application. It uses the help of Data module to fetch data for the specific use case and may or may not convert it to specified entities and pass back to UI. The UI gets help of these use cases to obtain the data without directly interacting with the database or API.

#### B. Data Module

The data module consists of all network calls such as API requests and responses, socket management and database management. The data is obtained from the network and entered to the database tables. These tables receive data from sockets also. The formatting of these data happens in this module. The formatted data is passed to the Domain module as a response.

### C. Presentation Module

The presentation module performs all input and output operations with the user. This module has all the views which displays buttons, text, images, etc. These views are flooded with data obtained from Domain module. There can be inner views which also can be used with the help of the Domain module for obtaining the data. The data used here should be easy to understand as it interacts directly with the user.

### D. Input Design

The input is collected through user interface items such as Buttons, selectors, touch events through the mobile's screen. The inputs are converted to use cases in the presentation module in the app and sent to domain module to collect data as a response to the input events. The inputs are logged using the default logger present in the development environment and are collected frequently while the application is used. These events are collected just in case the application crashes, the recent events are sent to the developers in the crash report to analyse the cause of the crash.

### E. Output Design



Figure 1. Screenshot of output

The output is displayed as an iOS application in iPhones. The output includes the graphical representations of the covid-19 data in bar graphs, pie-charts, half pie-charts. The data is also represented in maps showing the counts inside circular buttons, which on click displays the country's case details in a pull-over view, which can be dragged across the screen to view the details. Further, there are buttons to switch the type of data in the map visualization. A sample screenshot of output is displayed in Figure 2.

## IV. RESULTS AND DISCUSSIONS

The proposed system has many UI visualizations which are simpler and easy to understand for the general audience unlike the existing system which provided with complex data which was helpful only to experts and analysts. This further dominates the need of the application by displaying live data over the application by fetching from live crowd sourced data, whereas in web we need to refresh to look over the new data. Figure 3 and 4 depicts the global and daily Covid cases respectively. Figure 5 shows the advantage of performance of Swift programming language which is used for iOS development better than react native, a leading web development language. Swift leads in performance for displaying images, graphs, maps, etc. comparatively with react native. Although, maps consume more memory comparatively with react native, iPhones are capable of handling high memory load. Swift is designed in such a way to overcome the defects of other development languages by using a LLVM(Low Level Virtual Machine) compiler, which uses a concept of Automatic Reference Counting, which saves huge memory spaces in long running applications comparatively with languages like Java and JavaScript which use garbage collector, which is comparatively slower.

The proposed system has less detailed data in graphs, charts allowing users to easily understand and get convinced over the covid cases by looking at these visualizations over the mobile phone. This system has performance advantages as it processes less data which further reduces the time and space complexity over the data which is complex in existing systems. This efficiency produced in the existing system makes this application more eligible for needs over the existing system.



Figure 2. Global Covid Cases

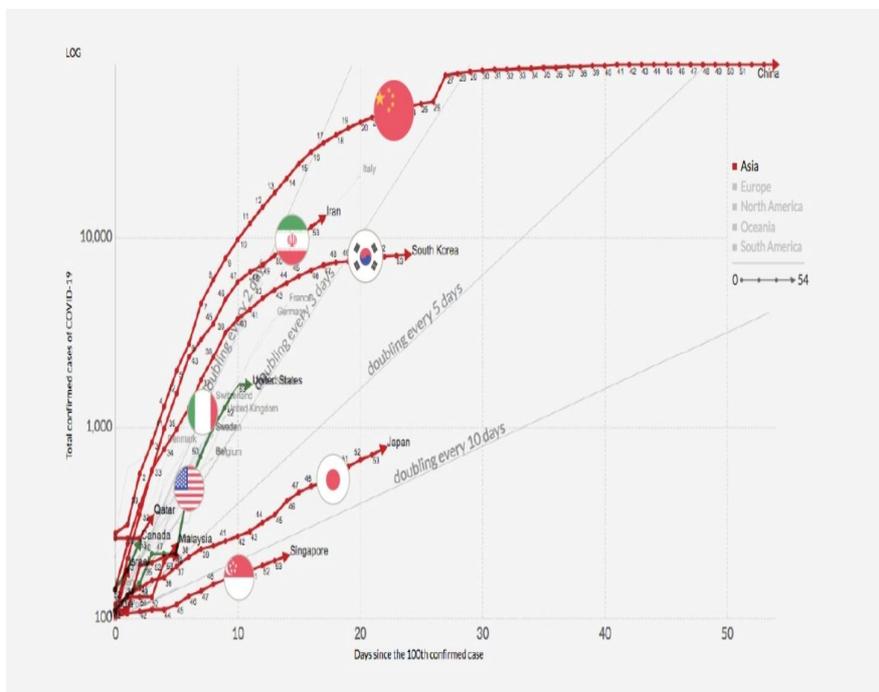


Figure 3. Daily Covid Cases

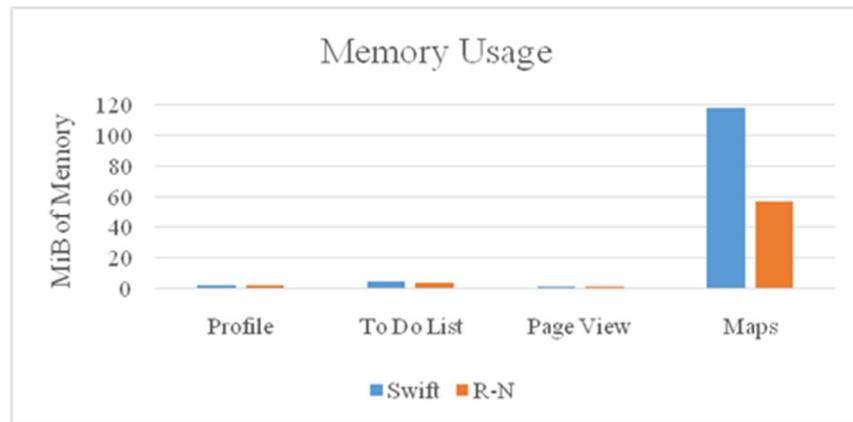


Figure 5. Memory usage comparison between react native and iOS

## V. CONCLUSION AND FUTURE ENHANCEMENTS

The proposed work is mainly be used to track the Covid-19 surges. Finding, testing, isolating and treating a Covid patient is an ongoing process that is undoubtedly helping a lot of people, but, it is also vital to trace and track the day to day Covid-19 cases to keep a record and analysis from the records. The analysis done will in turn help the experts and other individuals to create awareness and increase the mental satisfaction among people. This model can be adopted for further visualization concepts such as stocks, HR management, analytics, business management, project management and health services. All industries which use graphs and other visualizations to display in mobile applications can build iOS application using simple visualization and enhance the application to be comfortable for the user which looking at the data.

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# Smart Vision Goggles for Blind People

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**Abstract**— People who are visually impaired face various problems in their daily life. Their daily activities are greatly restricted by loss of eyesight. They usually travel using blind navigation systems or by their accumulated memories in their long-term exploration. This paper is about a new design of assistive smart vision goggles for visually impaired persons. The main objective of the proposed model is to make the user comfortable carrying the device that is designed in a wearable format. This device includes a pair of glasses and an obstacle-detection module fitted in it the center of goggles, an output device i.e., voice through a headset, a camera to find the obstacle, and text recognition i.e., it helps the blind to read out the text by scanning through the camera where the input is given through a switch. For image capturing, we use Raspberry pi and for obstacle detection, we use ultrasonic sensors which can scan at most 5-6 meters of 30 degrees range. Cloud technology is used to identify the object scanned by the camera. These Smart Vision Goggles for Blind People are portable devices, lightweight, easy to use, and user-friendly. These glasses could easily guide blind people and help them to avoid obstacles.

**Index Terms**— Smart goggles, Blind People, Raspberry pi, Ultrasonic Sensors, Text recognition.

## I. INTRODUCTION

People who are visually impaired have decreased ability of visual perception. Blind mobility is one of the major challenges encountered by visually impaired persons in their daily lives. Their life activities are greatly restricted by the loss of eyesight. Visually impaired people are who have lost their ability to see completely and who have partial loss of vision [1]. According to the world health organization (WHO), there are around 285 million visually impaired people in the world. Among the 285 million people, 39 million people are totally blind and 246 million people have a low vision. Because they don't require usage of hands or just minimal hand use, wearable gadgets are thought to be the most helpful of all assistive technologies. The head-mounted type is the most common. Their primary benefit is that, unlike other devices, they naturally point in the direction of the viewer, negating the need for extra direction signs. This paper highlights a brand-new style of smart glasses that can help with a variety of jobs while yet having a modest construction cost. To communicate information to the user, the design makes use of the latest Raspberry Pi 4 Model B, a camera, and earphones.

## II. LITERATURE SURVEY

### A. Previous Works and their Limitation

There are already many existing devices that help a blind person in walking. The most common one is a simple walking stick. With this simple walking stick, the blind man may identify the obstacle. A few authors came up with the smart cane for the blind which detects the obstacles in front of them [2]. Still, it has many disadvantages such as they can't detect the obstructions that are hidden but very dangerous for the blind such as stairs, holes, etc., Shoes that point you in the right way, which aid the blind, are another example of a smart device in use. The audible directions on your smart phone are no longer necessary to pay attention to while you're walking somewhere new. Bluetooth allows the shoe insoles to communicate with the associated app, which is accessible on iOS, Android, and Windows. Then, a vibration will notify you as you walk when you need to turn. As the turn draws closer, the buzz in your left shoe will tell you to turn left, and the vibration in your right shoe will tell you to turn that way. Both feet will vibrate at once if you need to turn around. The shoes can't yet assist you in avoiding obstacles, through their path. The Eye Stick, a walking stick with eyes, is another gadget. A lens is fixed to the bottom of the eye stick. The distinctive features, such as traffic lights, stairs, the subway, and so forth, can be recognized. After that, blind persons can receive each communication via vibration. These gadgets still have limitations in that they cannot detect obstacles such as poles or other objects that are directly in front of the user [3].

### B. Proposed Model to Overcome the Limitations

In this regard, to overcome the limitations, Smart Vision Goggles for the Blind by using raspberry pi is proposed in this paper. It is designed in the shape of eyeglasses for providing guidance efficiently, comfortably and safely. It uses ultrasonic sensors and a webcam which are placed on the goggles to detect an object and alert the user. The advantage is, it is easy to carry the goggles and it provides a lot of features like it identifies the obstacles in front of the person and alerts the person with a message through headphones. Also, it detects the image in front of the user by scanning through a webcam and gives the information to the user through headphones. The proposed model will also provide text reading by scanning the image through a webcam and converting the text using google text to speech converter. If the user feels unsafe, then a message will be sent to the user's caretaker mobile by pressing an input switch.

## III. IMPLEMENTATION

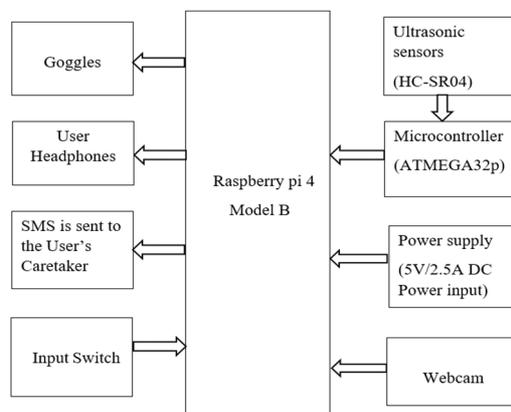


Figure 1. Functional diagram of the proposed prototype

The implementation of Smart vision Goggles for the Blind is achieved with the help of components such as Raspberry pi, ultrasonic sensors, a webcam, and earphones. All these components are placed in a compact and secure manner which helps the person to carry them easily. The person will be comfortable with the model, he can use it whenever he needs it and can remove it when it is not necessary. These goggles will help blind people to reach their destination independently. The reason these glasses are more reliable and easier to implement is that they are developed using ultrasonic sensors and raspberry pi which are commonly available almost everywhere. These ultrasonic sensors have a specified range (2cm-4m) for sensing the objects. These sensors detect the obstacles in front of a person, like they can sense objects, stairs and buildings and give a voice-over to

the person through headphones. We designed the goggles in such a way that they can identify the object in front of the person by taking pictures via camera. Conversion of captured image information into voice will be provided to the user through headphones that help the blind people to know who/what is in front of them. These goggles also help the blind to read text by scanning the book through the camera. Another feature we have added to this project is, if the blind person is feeling insecure then he can press an input switch upon which a message will be sent to the caretaker of that blind person immediately.

The Raspberry pi is a low-cost and small size computer that is used for running programs. Ultrasonic sensors are used to measure the distance by using ultrasonic waves. Here, the sensor head emits an ultrasonic wave and receives the wave reflected from the target. These sensors measure the distance from the target by measuring the time between the emission and reception. They have a limited range to detect the obstacle i.e., 2cm-4m. Ultrasonic sensors are placed on the top of the model, some with a certain angle to identify the obstacles, digs, holes, and stairs and alert the user with a message through the earphones. The functional diagram of the proposed model is shown in Figure 1. The features such as voice-out obstacles, detecting the image, reading the scanned image, and sending the current location are programmed on the raspberry pi. A specific button is provided to execute all these features. Pressing the button at different periods enables the features execution accordingly. The output of all the features is in speech format using the gTTS (google Text to Speech) library [4].

#### IV. PROPOSED SYSTEM DESIGN FLOW

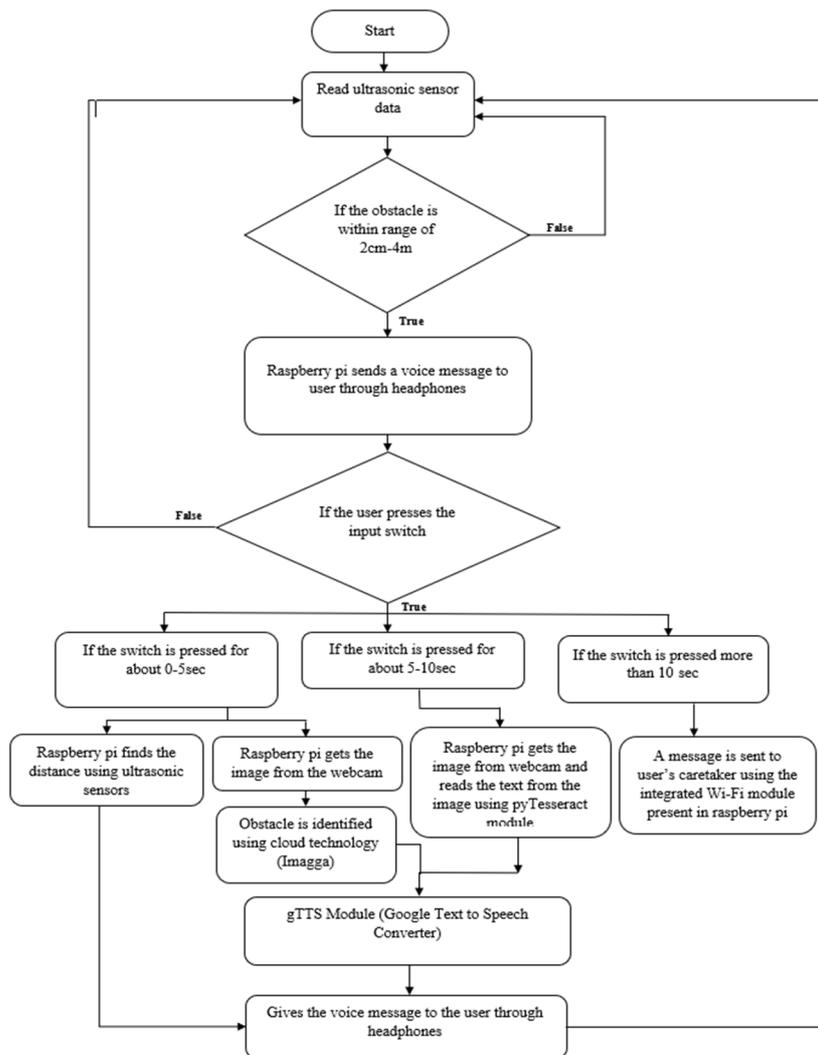


Figure 2. Flow diagram of the proposed system

Stepwise procedure to use this prototype model is as follows.

**Step 1:** First, make a connection of all the modules and other components to the raspberry pi, and microcontroller.

**Step 2:** Get the option from the user through the input switch.

**Step 3:** Ultrasonic sensors automatically sense the obstacles in front of the user and alert him by specifying the range of distance as shown in Figure 5.

**Step 4:** If the input switch is pressed for less than 5sec then the image is captured through camera and the obstacle is identified using cloud technology Imagga as shown in Figure 3.

**Step 5:** If the input switch is pressed for 5-10sec then the image is captured and the text present in that image is extracted using pyTesseract module and converted to speech using gTTS library as shown in Figure 4.

**Step 6:** If the input switch is pressed for more than 10sec then a notification is sent to the user's caretaker.

**Step 7:** All the actions are converted into a resultant text document and given to gTTS module which converts the text into speech that can be heard by the user through earphones.

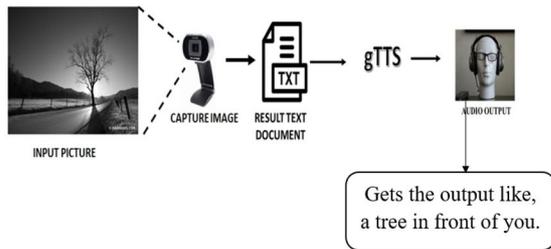


Figure 3. Capturing the image and identifying the object.

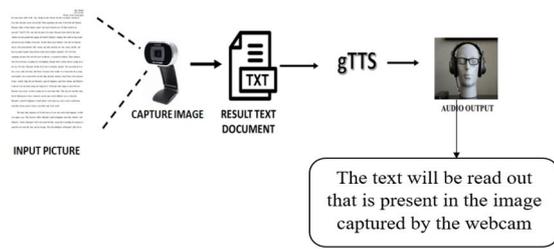


Figure 4. Capturing the image and reading the text

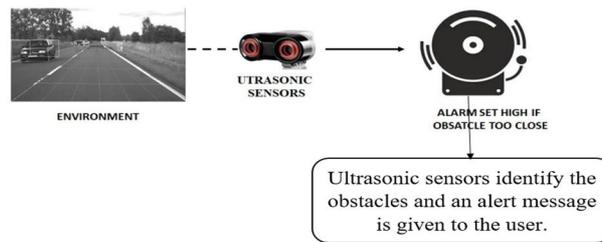


Figure 5. Reading the obstacle distance and warning the user

#### IV. HARDWARE DESCRIPTION

##### A. Raspberry pi processor:

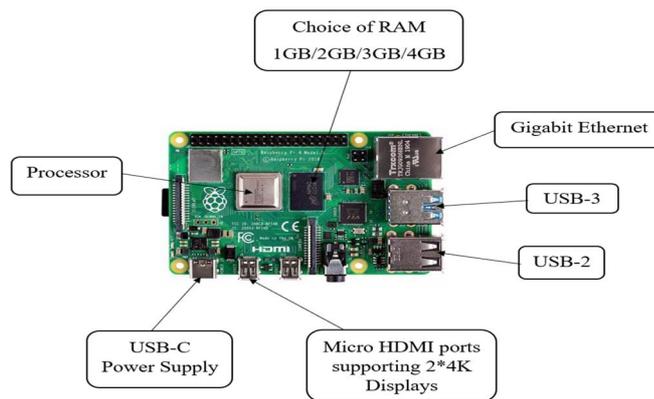


Figure 6. Raspberry pi 4 Model B

The raspberry pi used in our project is “Raspberry PI 4 Model B” (shown in figure 6) with a high-speed 64-bit quad-core processor, 4GB RAM and Dual-band 2.4/5.0 GHZ wireless LAN [9]. It is the heart of this project which is responsible for performing all control actions [8].

### B. External Webcam:



Figure 7. Webcam

An external webcam is attached to the goggles which are used for capturing the images for the optical character recognition (OCR) feature and the dominant feature [10]. The external webcam that is used in this prototype is shown in Figure 7.

### C. Ultrasonic Sensors:

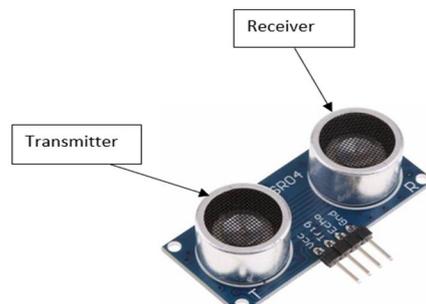


Figure 8. HC-SR04 Ultrasonic sensors

Ultrasonic sensors are used to detect obstacles, digs, and stairs in front of the user. These ultrasonic sensors work in a particular range of distances [11]. The ultrasonic sensors that are used in this project are shown in Figure 8 and their range is 2cm-4m.

### D. Input Switch:

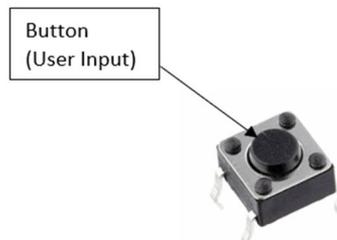


Figure 9. Input Switch

The input switch provided would act as a hand-held remote through which the user can select a particular feature to execute and hear the result. The switch will be operated based on the period the user holds it. If the time is less than 5sec then the obstacle is identified by scanning through a webcam. If the time is 5-10sec the text recognition will be enabled. If it is more than 10sec then a message is sent to the respective person who takes care of the user [12]. The switch used in this project is shown in Figure 9 and the power rating is MAX 50mA 24V DC and the operating temperature range lies between -20 to 70 °C.

### E. Microcontroller:

The microcontroller used in this project is ATmega328p. It is an 8-bit AVR RISC-based microcontroller chip. It consists of flash memory 32 KB ISP with read-while-write capabilities, EEPROM of 1KB, 23 general-purpose I/O pins, SRAM (Static Ram) of 2KB, 32 general-purpose working registers, etc [13]. Microcontroller is used to get the information from the ultrasonic sensors and gives it to the raspberry pi for processing the data.

## V. SOFTWARE USED

IDE— IDLE software is needed to be installed on the computer to give the optimal functioning of the application [14]. The specifications of the software used are:

- Operating System – Windows
- Programming Language – Python3 [15]
- IDE – IDLE

Libraries – requests, time, cv2, speake3, pytesseract, pyttsx3, json, telepot, RPi.GPIO, Imagga.

## VI. PYTHON MODULES

### A. Voice out results

gTTS (google search to speech library): It is used to convert the text format to speech format. It is vital in providing voice output for users [5].

### B. pyTesseract

Python-tesseract is an OCR tool for python. That is, it will recognize and “read” the text embedded in images [6].

### C. Geocoder

This module is used to find the current location of the user. Geocoding uses spatially explicit reference datasets (e.g., digital road networks) to identify the location to best match the input address, essential for comparing and interpolating the address to the range of addresses for each segment of the referenced dataset [7].

## VII. HARDWARE AND SOFTWARE INTERFACING



Figure 10. Hardware and Software Interfacing



Figure 11. Hardware connections

The hardware and software interfacing is shown in Figure 10 and hardware connections are depicted in Figure 11. The USB cable is connected to Raspberry pi for the power supply and earphones are plugged in. After interfacing, the program is compiled and run, then the respective features will get executed based on input from the switch and the output is heard through earphones.

## IX. RESULTS

The output of the smart vision goggles is observed as shown in figures 12 to 15. When the user is walking with these goggles on, if there is any obstacle then he is hearing a message “obstacle in front of you (if there is any object or stairs)” or “digs in front of you (if there is downward stairs or hole)” as shown in figure 12. If the user wants to know what the obstacle is then he can press the input switch. The features offered here are:

Case 1: If he presses it for about less than 5 sec, then it captures the image and gives the information about the objects that are captured in the image to the user through earphones. That information is shown in Figure 14.

Case 2: If he presses it for about 5-10 sec, then it captures the image and and it reads the text and gives that information to the user through earphones, which is shown in Figure 15.

Case 3: Another feature included in the project is, if the user felt insecure he can long press (>10sec) the input switch so that a message is sent to his caretaker as shown in Figure 13.

```
Type "help", "copyright", "cre
>>>
===== RESTART:
Telegram bot is ready
OBSTACLE INFRONT OF YOU
OBSTACLE INFRONT OF YOU
OBSTACLE INFRONT OF YOU
Digs INFRONT OF YOU
Digs INFRONT OF YOU
Digs INFRONT OF YOU
```

Figure 12. Obstacle message to the user through earphones

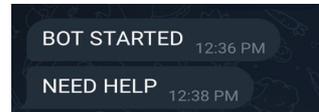


Figure 13. A message sent to the caretaker's mobile

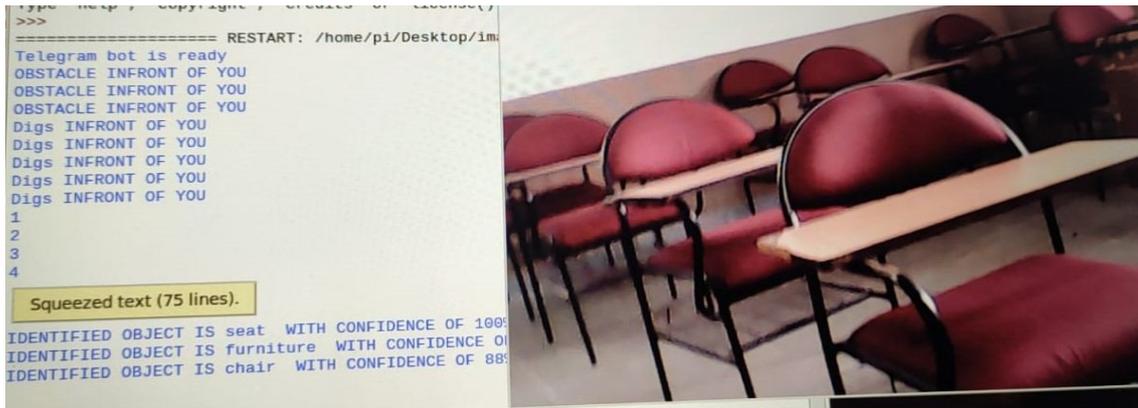


Figure 14. Captured image and Obstacle Information heard by the user

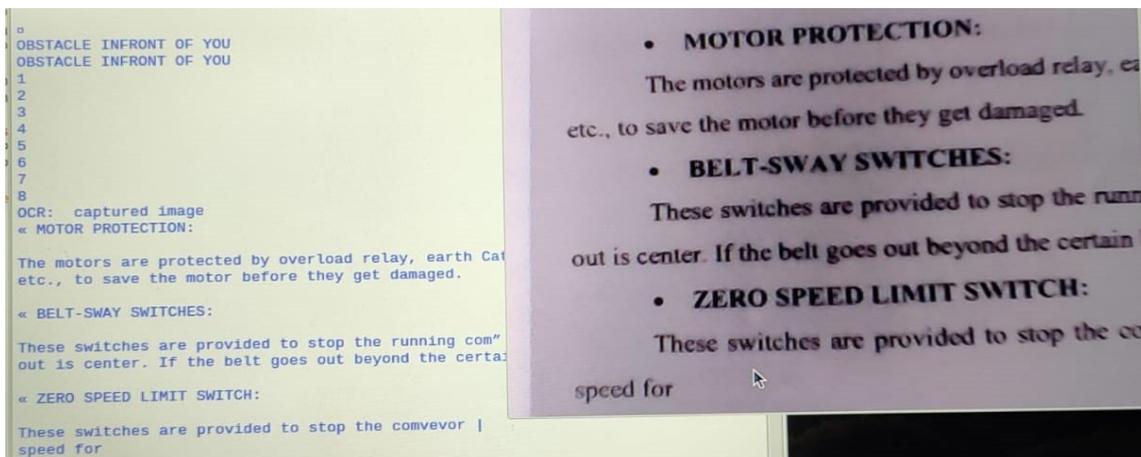


Figure 15. Text captured and text information heard by the user

## X. CONCLUSION

Smart vision goggles, is a project in which we have used raspberry pi model to provide assistive care for blind people. This product helps blind people to read newspapers, and books, it helps to identify the obstacles in front of the user, captures the images, and can send an alert message to the person who is taking care of the user. All these features have voice output to the user through headphones. These features are accessed by the user through the input switch provided. This proposed model is providing efficient results and it is easy to use. With this model the user is able to walk through roads, labs and hallways without any assistance.

## XI. FUTURE SCOPE

All the features that are developed in this product are processed by the raspberry pi processor. For further enhancement of the project, we can add directions to guide the person, help the user to know the current date and time, help him to know the exact location where he is, weather information, and can get the top 10 headlines of present-day news. All these features can be processed by using raspberry pi. This may help the person to know the things happening in society without any assistance.

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# Data Science based Recommendation System -An Application of Computer Science

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**Abstract**— Recommender system (RS) has emanated as the most popular application of e-commerce websites. In the e-commerce business, collaborative filtering based RS systems suggest products to the customers and find the interesting things for the users which they may wish to purchase. The success rate of any recommendation system depends upon, information reliability as well as expression of daily life behavior in the consolidated format. The main task is to produce the best ranked list of ‘n-number’ of items for the user’s need. Due to the natural structure, Z-Numbers are more consistent to producing a recommendation list. To solve real life problem, Z-Numbers should be incorporated into decision-making models. However, Online shopping involved multicriteria group decision-making (MCGDM). Z-information persisting some difficulties with MCGDM. Therefore, to enhancing the ability of Z-numbers Complex Fuzzy Sets (CFSs), are employed. Besides this entropy, distance measure, and aggregation operator are combined to produced MCGDM based ranking of customer preference.

**Index Terms**— Fuzzy Set, Linguistic Variables, Z-Numbers, Recommendation System.

## I. INTRODUCTION

Data Science is one of the fastest growing fields under the umbrella of Computer Science. Moreover, Recommendation System is a co-domain of Data Science that is used by various e-commerce websites like Amazon, Flipkart, Netflix, and so on. It helps in presenting relevant products in front of user to increase the sale and customer base. However, it is not so easy to plot precise mapping of products and priority or choice of customer. The main reasons include the limited knowledge of decision-makers, lack of evaluation time, and insufficient understanding of alternatives. The success rate of any recommendation system depends upon, information reliability as well as expression of daily life behavior in the consolidated format. Z-numbers have been proven to be advantageous in revealing uncertain information. In 2011 Zadeh [1] proposed the concept of Z-numbers. In this article improved Z-numbers are applied to harness the Recommendation System. Considering that various uncertain data are inevitable in the process of addressing actual problems, uncertain Z-numbers are to express information and measure information reliability.

Generally accepted, linguistic description is more consistent with the daily expression [1]. However, there are still some difficulties limiting the applications. Like the calculation process in Z-Numbers is a typical nonlinear programming problem, which will inevitably lead to the problem of complicated calculation. Therefore, to enhancing the ability of Z-numbers Complex Fuzzy Sets (CFSs), are employed. Besides this entropy, distance

measure, and aggregation operator are combined to produce MCGDM based ranking of customer preference. Collaborative filtering systems help in automatically locating relevant opinions and aggregating them to provide recommendations. The main task is to present the best ranked list of 'n' number of items for the user's need. Clustering the preferred item's set and recommend the prioritized list are two major tasks of Collaborative filtering based Recommendation System. A preference expressed by a user for an item can be represented by a triplet (User, Item, Rating). Due to the difficult-to-quantify nature of evaluation, experts intend to describe the evaluation information with natural language like slightly good, good, very good, extremely good. Z-Number is more suitable demonstrated more support to express mundane task [2], [3]. Besides this interval valued fuzzy sets and intuitionistic linguistic numbers are applied in [4], [5], [6] to express information with more reliability. Therefore "Z-Numbers" attract the attention of researchers in the domain of multifold group decisions [7], [8], control theory [9], [10], and cluster [11]. However, the calculation process is a typical nonlinear programming problem, which will inevitably lead to the problem of complicated calculation Aliev et al. [13], [14] defined the operations of discrete and continuous Z-numbers. Liu et al. [15] suggested the negation of discrete Z-numbers. To further enrich the related research, Z-numbers have also been tried to combine with other mature theories. In [16] and [17], Z-triplet is utilized to express the normal cloud model and the trapezium cloud model with linguistic terms. Z-numbers employed to update the Bayesian network, VIKOR model, and TOPSIS model in [12],[18] and [19] respectively. In previous study a gap is found to express decision making problem which are based on two or more criteria. Hence there is requirement of harnessing the improved version of existing Z-Numbers. The rest of this article is organized as follows. In Section II, some fundamental concepts are introduced along with transformation method between Z-numbers and CFSs. In Section III, IVZCFS method validated using proposed algorithm. Finally, Section VII concludes this paper.

## II. FUNDAMENTALS

### A. Z-numbers

Z-numbers are improved to uncertain Z-numbers. By utilizing an interval concept instead of a specific concept to characterize the fuzzy constraint and reliability. Typically, a Z-number is composed of A and B, recorded as Z = (A, B). The parameters A and B represent the fuzzy constraint and reliability, respectively. The two components are connected by the underlying possibility distribution (UPD). For example User e1 is very certain, that product a1 is good based on a criteria c1" can be transformed into Z = ("good," "very certain"). Usually, the determination of UPD is a problem. In 2002, the concept of complex fuzzy sets (CFSs) was defined by Ramot et al. [20]. It is an extension of type-1 fuzzy sets, in which the codomain of the membership function is the unit disc. A brief description of CFS is given in next subsection.

### B. Complex Fuzzy Sets

Assumed that S is CFS in an universe of discourse U, then  $S = \{(x, \mu_s(x)) | x \in U\}$   
 $\mu_s(x) = r_s(x) \cdot e^{j\omega_s(x)}$   
 where  $r_s(x) \in [0, 1]$ ,  $\omega_s(x) \in [0, 2\pi]$ ,  $j = \sqrt{-1}$ .

### C. Uncertain Z-Numbers

In [17] Z-numbers were combined with Atanassov's interval-valued intuitionistic linguistic fuzzy sets to formalized "uncertain Z-numbers".

$$IVZ = ((\text{very good}, [0.6, 0.8]), (\text{uncertain}, [0.7, 0.8])).$$

Expression can be represented by pair of bounded interval  $IVZ = ([Sa^-, Sa^+], [Hb^-, Hb^+])$ , where  $Sa^-$  and  $Sa^+$  represent the upper and lower bounds of linguistic constraint, respectively.  $Hb^-$  and  $Hb^+$  indicate the upper and lower bounds of reliability, respectively.

The aim of IVZ is to better represent the fuzzy constraint and reliability. IVCFSs

$J_s = [r_s^-(x), r_s^+(x)] * e^{j[\omega_s^-(x), \omega_s^+(x)]}$  can also achieve the aim.  $r_s^-(x)$  and  $r_s^+(x)$  represent the upper and lower bounds of amplitude term, respectively.  $\omega_s^-(x)$  and  $\omega_s^+(x)$  indicate the upper and lower bounds of phase term, respectively.

The theme of 'IVZ', state that "interval concept is more appropriate than a specific concept to characterize the fuzzy constraint and reliability, e.g. {anticipated budget deficit, between 1.8 and 2.2 million dollars, likely, very likely}

#### D. Transformation From Uncertain Z-Numbers to IVCFSs:

Z- numbers are expressed by triplet (Z,A,B) [1] to make information more expressive and reliable A and B are were projected into interval rather than specific in uncertain Z-numbers. To express IVZ in IVCFSs, the membership variables of  $[S_{a-}, S_{a+}]$  and the probabilistic variables of  $[H_{b-}, H_{b+}]$  are represented by  $r^-_s(x)$  and  $r^+_s(x)$  and  $\omega^-_s(x)$ , and  $\omega^+_s(x)$  respectively by using definition (1).

Definition 1: Given two Linguistic Term Set S and H, where  $S = \{S_0, S_1, \dots, S_E | E \in \mathbb{N}\}$  and  $H = \{H_0, H_1, \dots, H_F | F \in \mathbb{N}\}$ , for  $([S_{a-}, S_{a+}], [H_{b-}, H_{b+}])$ , and for  $J_s = [r^-_s(x), r^+_s(x)] * e^{j[\omega^-_s(x), \omega^+_s(x)]}$  using  $r^-_s(x), r^+_s(x) \in [0,1]$  and  $\omega^-_s(x), \omega^+_s(x) \in [0, 2\pi]$

#### E. Generalized Entropy

Entropy, an essential concept in thermodynamics and information theory, is usually adopted to measure the chaos of a system. Scholars have proposed many entropy calculation methods for classical fuzzy sets [21]. As far as we know, however, there is no approach to calculate the entropy of Z-numbers from the perspective of CFSs. generalized entropy  $E_g(J)$  is defined as equation (2).

$$E_g(J) = 1 - \left[ \frac{1}{2} (|r^-_s(x) + r^+_s(x) - 1|^p + \frac{1}{2\pi} |\omega^-_s(x) + \omega^+_s(x) - 2\pi|^p) \right]^{1/p} \quad (2)$$

In literature various ordered weighted operators are reported, among them the entropy weight method (EWM) preserved the objective. Moreover, EWM is high reliability and convenience [22]. Therefore a weight calculation method is employed based on generalized entropy based equation (2). Equation (1)  $J_s = [r^-_s(x), r^+_s(x)] * e^{j[\omega^-_s(x), \omega^+_s(x)]}$  is adopted to derive the weight of each criterion. The weight vector  $\{w_1, w_2, \dots, w_n\}$  is derived as ,

$$w_i = \frac{1 - E_g(J_i)}{\sum_{k=1}^n [1 - E_g(J_k)]} \quad (3)$$

where  $\{i = 1, 2, \dots, n\}$ ,

#### F. Aggregation Operator

Interval-valued complex fuzzy sets power weighted average (IVCFSsPWA) is used in the process of information fusion is proposed.

Definition 2: Assume that  $J_s = [r^-_i(x), r^+_i(x)] * e^{j[\omega^-_i(x), \omega^+_i(x)]}$   $\{i=1,2, 3, \dots, n\}$ .

The integrated J is given by equation (4).

$$J = IVCFSsPWA(J_1, J_2, \dots, J_n) = J_1 \oplus J_2 \oplus \dots \oplus J_n \quad (4)$$

Where Integration Operation is given by equation (5)

$$J_1 \oplus J_2 = \left[ 1 - \prod_{i=1}^n (1 - r_i^-)^{w_i}, 1 - \prod_{i=1}^n (1 - r_i^+)^{w_i} \right] \cdot e^{j[2\pi(1 - \prod_{i=1}^n (1 - (\omega_i^- / 2\pi))^{\omega_i}), 2\pi(1 - \prod_{i=1}^n (1 - (\omega_i^+ / 2\pi))^{\omega_i})]} \quad (5)$$

#### G. Distance Measure and Similarity Measure

The distance and similarity measure between  $J_1$  and  $J_2$  is calculated by equation (6) and (7) respectively.

$$D(J_1, J_2) = \frac{1}{4} \left( |r^-_2(x) - r^-_1(x)| + |r^+_2(x) - r^+_1(x)| + \left| \frac{\omega^-_2(x) - \omega^-_1(x)}{2\pi} \right| + \left| \frac{\omega^+_2(x) - \omega^+_1(x)}{2\pi} \right| \right) \quad (6)$$

$$S(J_1, J_2) = 1 - \frac{1}{\sqrt{2}} \left( \left( \frac{r^-_1(x) + r^+_1(x)}{2} - \frac{r^-_2(x) + r^+_2(x)}{2} \right)^2 + \left( \frac{\omega^-_1(x) + \omega^+_1(x)}{4\pi} - \frac{\omega^-_2(x) + \omega^+_2(x)}{2\pi} \right)^2 \right)^{1/2} \quad (7)$$

### III. PROPOSED SYSTEM

In the real-time online users may either drop the idea of shopping or divert to another e-shopping cart due to following reasons . Limited knowledge of decision-makers, lack of evaluation time, and insufficient understanding of other products. That triggered pop up best products in millisecond based on Z-information.

Therefore to satisfy multicriteria decision making in collaborative filtering based recommendation uncertain Z-numbers are with improved version in proposed algorithm.

Steps

- (i) : Attain the IVCFSs of evaluation information as shown in Table I.
- (ii) : Estimate weight vector.
- (iii) : Obtain collective evaluation information.
- (iv) Calculate the positive and negative distances (Dp) and (Dn) between alternatives and ideal solutions.
- (v) : Generate a non- decreasing order of list of products based on matching of customer query.

The evaluation information is displayed in Table I, II, and III for attributes  $c_1, c_2, c_3,$  and  $c_4$ .

TABLE I EVALUATION INFORMATION FOR E1

	c4(lips and chin)	c3(eyes)	c2(nose)	c1(forehead)
f1	{ slightly-large, large, certain, extremely certain }	{ small, slightly small, uncertain slightly uncertain }	{ extremely small, very large, slightly certain, certain }	{ slightly small, slightly large, extremely uncertain, certain }
f2	{ slightly-large, large, certain, extremely certain }	{ small, slightly small, uncertain slightly uncertain }	{ extremely small, very large, slightly certain, certain }	{ slightly small, very large, extremely uncertain, very certain }
f3	{ slightly-large, large, certain, extremely certain }	{ small, slightly small, uncertain slightly uncertain }	{ extremely small, very large, slightly certain, certain }	{ slightly small, slightly large, extremely uncertain, certain }
f4	{ slightly-large, large, certain, extremely certain }	{ small, slightly small, uncertain slightly uncertain }	{ extremely small, very large, slightly certain, certain }	{ slightly small, slightly large, extremely uncertain, certain }

TABLE II EVALUATION INFORMATION FOR E2

	c4(lips and chin)	c3(eyes)	c2(nose)	c1(forehead)
f1	{ slightly-large, large, certain, extremely certain }	{ small, slightly small, uncertain slightly uncertain }	{ extremely small, very large, slightly certain, certain }	{ slightly small, slightly large, extremely uncertain, certain }
f2	{ slightly-large, large, certain, extremely certain }	{ small, slightly small, uncertain slightly uncertain }	{ extremely small, very large, slightly certain, certain }	{ slightly small, very large, extremely uncertain, very certain }
f3	{ slightly-large, large, certain, extremely certain }	{ small, slightly small, uncertain slightly uncertain }	{ extremely small, very large, slightly certain, certain }	{ slightly small, slightly large, extremely uncertain, certain }
f4	{ slightly-large, large, certain, extremely certain }	{ small, slightly small, uncertain slightly uncertain }	{ extremely small, very large, slightly certain, certain }	{ slightly small, slightly large, extremely uncertain, certain }

TABLE III EVALUATION INFORMATION FOR E3

	c4(lips and chin)	c3(eyes)	c2(nose)	c1(forehead)
f1	{ slightly-large, large, certain, extremely certain }	{ small, slightly small, uncertain slightly uncertain }	{ extremely small, very large, slightly certain, certain }	{ slightly small, slightly large, extremely uncertain, certain }
f2	{ slightly-large, large, certain, extremely certain }	{ small, slightly small, uncertain slightly uncertain }	{ extremely small, very large, slightly certain, certain }	{ slightly small, very large, extremely uncertain, very certain }
f3	{ slightly-large, large, certain, extremely certain }	{ small, slightly small, uncertain slightly uncertain }	{ extremely small, very large, slightly certain, certain }	{ slightly small, slightly large, extremely uncertain, certain }
f4	{ slightly-large, large, certain, extremely certain }	{ small, slightly small, uncertain slightly uncertain }	{ extremely small, very large, slightly certain, certain }	{ slightly small, slightly large, extremely uncertain, certain }

## VI. EXPERIMENTS

During the online shopping displaying specific set of products in first few seconds play extremely important role to attract customer attention. Recommendation of best suited products are based on profile building features of Collaboration filtering. Besides this, produce a list of products with decreasing order of taste, may be helpful in printing good impression in customer memory. Customer, always want to choose the most suitable brand of the product based on their needs. Suppose that customer wants to select one from four brands  $a_1, a_2, a_3,$  and  $a_4$ . For the sake of prudence, a group of three online users  $e_1, e_2,$  and  $e_3$  evaluate the options from four aspects, including the physical appearance ( $c_1$ ), color combination ( $c_2$ ), performance ( $c_3$ ), and price ( $c_4$ ) among the brands  $a_1, a_2, a_3,$  and  $a_4$ . Assuming that the Linguistic Term Sets (LTSs) are  $H = \{h_0 = \text{extremely terrible}, h_1 = \text{very terrible}, h_2 = \text{terrible}, h_3 = \text{slightly terrible}, h_4 = \text{slightly good}, h_5 = \text{good}, h_6 = \text{very good}, h_7 = \text{extremely good}\}$  and  $S = \{s_0 = \text{extremely uncertain}, s_1 = \text{very uncertain}, s_2 = \text{uncertain}, s_3 = \text{slightly uncertain}, s_4 = \text{slightly certain}, s_5 = \text{certain}, s_6 = \text{very certain}, s_7 = \text{extremely certain}\}$ .

### A. Results

Table IV, V, and VI consist of evaluation information in the form of IVCFSs. After calculating the weight vector of criteria for user  $e_1, e_2,$  and  $e_3$ , estimated collective evaluation information with aggregation operator is shown in Table VI. Besides these distances between alternatives and ideal solutions distances  $D_p$  and  $D_n$  are estimated. Besides this Table VII is displaying ranking of all alternatives in decreasing order of preference. Hence the order of displaying of face sketch can follow the estimated sequence to achieve better impression.

TABLE IV INPUTS ARE IN IVCFS FOR E1

	c1	c2	c3	c4
a1	(0.43,0.57,0.90,4.49)	(0.14,0.86,3.59,4.49)	(0.29,0.43,1.79,2.69)	(1.79,2.24,4.49,6.28)
a2	(0.14,0.29,1.79,2.69)	(0.71,1,3.59,5.38)	(0.29,0.57,1.79,4.49)	(0.43,0.71,3.59,6.28)
a3	(0.29,0.43,0.90,1.79)	(0.71,0.86,0.90,4.49)	(0.71,1,2.69,3.59)	(0.57,0.71,0.90,1.79)
a4	(0.43,0.57,2.69,4.49)	(0.14,0.71,0.90,1.79)	(0.86,1,1.79,2.69)	(0.43,0.57,2.69,3.59)

TABLE V INPUTS ARE IN IVCFS FOR E2

	c1	c2	c3	c4
a1	(0.28,1,2.69,6.28)	(0.42,0.57,0.89,4.48)	(0.14,0.85,1.79,3.49)	(1.39,0.854,3.58,3.58)
a2	(0.14,0.28,1.79,3.58)	(0.14,0.28,1.79,2.69)	(0.71,1,1.79,2.69)	(0.73,1,1.79, 2.62)
a3	(0.14,1,0.89,3.58)	(0.28, 0.42, 0.89, 1.79)	(0.71,0.85,2.69,1.79)	(0.71,0.89,0.90,1.79)
a4	(0.14,0.28, 3.58, 6.28)	(0.42,0.57,2.69,4.49)	(0.14,0.71,1.79,4.49)	(0.14,0.71,2.69,4.48)

TABLE VI INPUTS ARE IN IVCFS FOR E3

	c1	c2	c3	c4
a1	(0.43,0.57,0.90,4.49)	(0.14,0.86,3.59,4.49)	(0.29,0.43,1.79,2.69)	(1.79,2.24,4.49,6.28)
a2	(0.14,0.29,1.79,2.69)	(0.71,1,3.59,5.38)	(0.29,0.57,1.79,4.49)	(0.43,0.71,3.59,6.28)
a3	(0.29,0.43,0.90,1.79)	(0.71,0.86,0.90,4.49)	(0.71,1,2.69,3.59)	(0.57,0.71,0.90,1.79)
a4	(0.43,0.57,2.69,4.49)	(0.14,0.71,0.90,1.79)	(0.86,1,1.79,2.69)	(0.43,0.57,2.69,3.59)

TABLE VII RANKING OF ALL BRANDS

	a1	a2	a3	a4
e1	0.54	0.66	0.61	0.62
e2	0.65	0.57	0.58	0.44
e3	0.62	0.56	0.61	0.53
$\emptyset$	0.62	0.58	0.59	0.55
Ranking	a1 > a3 > a2 > a4			

### III. CONCLUSIONS

Even though Z-Numbers is a naive concept just introduced in 2011, and it is in preliminary stage. Besides this it's an effective tool to develop MCGDM. E-Commerce website using recommendation system to help online customers in purchasing daily life commodities. Therefore, an improved version of Z-Numbers i.e. IVZ is applied along with CFS. In this paper IVCFS TECHNIQUE is adopted to handle uncertain Z-numbers. The support of CFS is unrestricted and may include real numbers, daily households, accessories, moreover provides feasibility of interpreting information expression uncertainty and reliability. Therefore, CFS base IVZ is used to ranked and recommend certain set of preferred items.

Generalized entropy, distance measure, and aggregation operator are applied proposed recommendation system., which is ultimately producing a ranking of favorite products from high to low. The limitation of presented work is high degree of dependency of evaluation information from different sects of users.

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# Mobile Malware Attacks, Classification, Propagation, Analysis, Detection, Challenges and Future Directions – A Survey

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**Abstract**— Number of Smartphone users are increasing day by day and mobiles have become an integral part of the society. This is because of the rich variety of mobile devices and essential applications provided by its manufacturers. The increasing number of mobile devices invite skilled developers and hackers to develop malware that invades personal and business information in a very efficient manner. Therefore, mobile devices are an ideal target for various security issues and data privacy threats in a mobile ecosystem. Threats posed by malwares include leaking of private information, financial loss to users, system damage. For better protection on computers, researchers and manufacturers making great efforts to produce anti-malware systems with effective detection methods why the most targeted platform for the malware developers is Android and why and how and when malwares propagate into the mobile system with how they are detected, and protection mechanism is discussed in this paper.

**Index Terms**— Detection algorithm, mechanism, malware, machine learning approach, threats, vulnerabilities.

## I. INTRODUCTION

In recent times, the use of mobile devices for both business and personal purposes has increased significantly. Modern tablets and Smartphone's provide many useful services such as internet browsing, maps, social network clients, internet banking in addition to standard mobile functionality including phone calls, SMS, and Bluetooth. The data used and stored in these services is often highly sensitive and therefore desired by the attackers. Mobile devices may have become the most popular gadgets, but their security is still a developing domain. this is a rising significance and a cumulative need, but it is comparatively weak area for the user's data privacy and protecting. Although mobile companies do think for the user's security and data privacy, the use of applications from the internet creates complex issues in relation to handling threats and vulnerabilities when securing a user's data privacy.

There are thousands of diverse applications accessible from application stores for each mobile device, and these applications have an extensive range of purposes, including web browsing, entertainment (movies, games, and music), social networking, communication (e-mail, internet messaging), banking, and location-based services.

The reasons for the motivations of existence of malware are

- User Information Stealing
- Publicity of User Data
- Spam SMS
- Optimization of search process
- Ransom

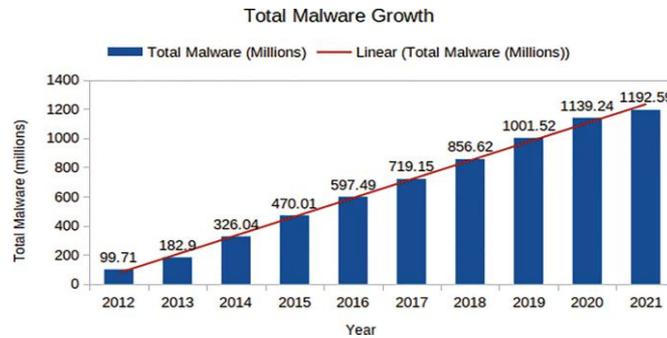


Figure 1: Malware growth in relation with time

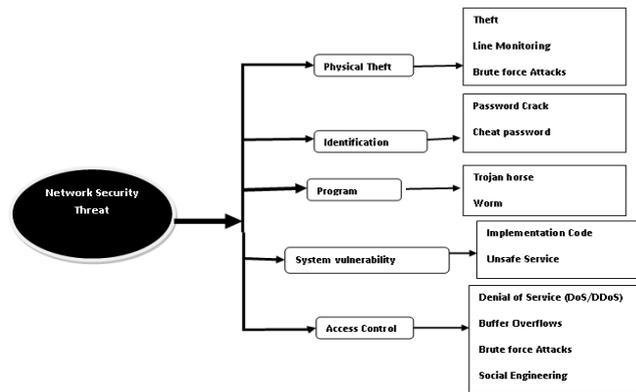


Figure 2: Threats and attacks on mobile OS

Security goal is the processes of achieving are confidentiality, integrity, and availability.

- Confidentiality is referred as the process of preserving the data from the unauthorized confinements and implies to the proprietary information and personal privacy security.
- Integrity refers to the process of safeguarding the information from the unauthorized attacker’s process of destruction or modification and further the guarantee for the authenticity and non-reputation of information.
- Availability is characterized as guaranteed access and utilization of data within the assured time. The term availability ensures that the information and data used are utilized in timely.



Figure 3: Data protected by CIA trait

The important aspects of mobile device security and data privacy issues is discussed. Sensitive security issues affecting on smart phones such as malware attacks, vulnerabilities, and Threats is addressed. Classification of malware, malware propagation and the types of malware analysis techniques is discussed. This survey presents

the trusted security countermeasures, various malware detection techniques to help the users to protect their devices. Research questions for future works are introduced in this review. This paper is organized as follows. In Section 2, the malware classification is discussed. In Section 3, this paper discussed the malware propagation. Section 4 presented the malware analysis and detection approaches taxonomy. In Section 5, discussed the malware detection mechanism. In section 6, we have presented the performance evaluation techniques. Future directions are described in Section 7. In section 8, conclusion is presented.

## II. MALWARE CLASSIFICATION

The term malicious software is the abbreviation of the term malware. Put simply, any piece of software that was written with the intent of doing harm to data, devices or to people is called a malware. Malware classification can be done in several ways to distinguish the unique their types from each other. for better understanding of how they can infect computers and devices, the threat level they pose and how to protect against them, Distinguishing and classifying them from each other becomes imperative. The depending on the type of damage malware infuses it can be helpful in categorizing what kind of malicious software you're dealing with. The common types of malwares, but are as follows

- **VIRUS:** like biological science, viruses glue themselves to clean files and it is contagious and may attack other clean files. They can spread hysterically, and cause damage to a system's core functionality and deleting or corrupting files. They usually appear as an executable file.
- **TROJANS:** malware which differentiate its own self as the legitimate software or is included in legitimate software that has been tampered with does belong to trojans family. It creates backdoors in your security to let other malware in and may also tend to act discretely.
- **SPYWARE:** No surprise here: spyware is malware designed to spy on you. It hides in the background and takes notes on what you do online, including your passwords, credit card numbers, surfing habits and more.
- **WORMS:** Worms infect entire networks of devices, either local or across the internet, by using network interfaces. It uses each consecutive infected machine to infect more.
- **RANSOMWARE:** Also called scareware, this kind of malware can lock down your computer and threaten to erase everything unless a ransom is paid to its owner.
- **ADWARE:** Though not always malicious in nature, particularly aggressive advertising software can undermine your security just to serve you ads which can give a lot of other malwares a way in. Plus, let's face it: pop-ups are annoying.
- **BOTNETS:** Botnets are networks of infected computers that are made to work together under the control of an attacker.

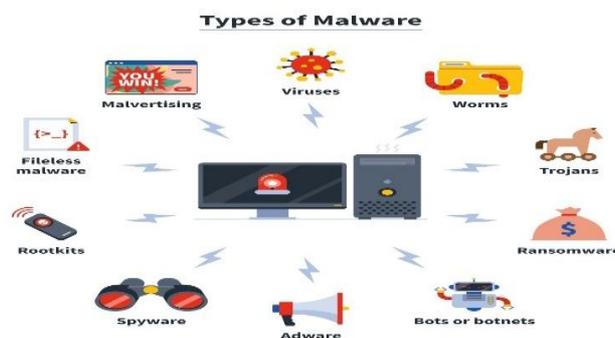


Figure 4: Malware types

## III. MALWARE PROPAGATION

There are different types of malware propagation, they are

- **REPACKAGING:** Malware developers first download any popular app, disassemble that app (i.e., generating the source code written in Java), insert their own code having malicious payload within the original code, reassemble the app and redistribute that app in official or third-party app markets.

- **UPDATE ATTACKS:** Repackaging technique includes malicious payload within the original app but that is easier to detect by analyzing the source code. To evade detection malware developers instead of including malicious payload within the app, they include only an update component which downloads the malicious payload at run time after the app is installed on the device. Hence scanning the source code will not be able to detect the malware as initially there is no malicious code within the app.
- **DRIVE BY DOWNLOADS:** This technique employs traditional drive-by-downloads to Android devices as well in which users are enticed to download interesting or attractive apps. For example, Tracker malware has in-app advertisement library. After clicking on that advertisement link user is redirected to a website which displays the message to download an app which can save battery of the device. However, that downloaded app is a malware which subscribes to premium rate services without user's knowledge.



Figure 5: Types of malware propagation

#### IV. MALWARE ANALYSIS TECHNIQUES

Malware can be analyzed with the help of detection techniques. Malware analysis is the method or a process of understanding the code, behavior, and functionality of malware so that critical act of attack can be measured. static analysis, dynamic analysis and permission-based analysis are the three broad categories of Detection techniques- parameters-static code analysis, taint tracing and control flow dependencies are the ways in which static analysis can be done with this is depicted in the figure given below. Dynamic analysis considers parameters including-network traffic, native code, and user interaction. Permission-based analysis can be done with the help of permissions specified in manifest file. As told in literature, various techniques exist for detection of mobile malware.

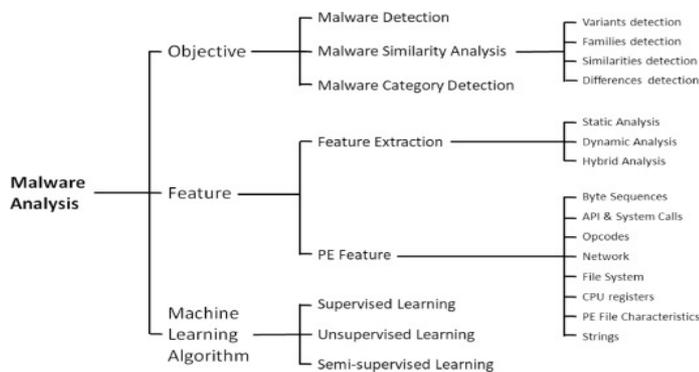


Figure 7: Malware analysis techniques

- **Static Analysis:** Static analysis can perform the investigation in the downloaded app by inspecting its own software properties and its source code. It is an inexpensive way to find malicious activities in code segments without executing application and notifying its behavior. Many techniques can be used for static analysis: decompilation, decryption, pattern matching and static system call analysis etc. The obfuscation and encryption techniques embedded in software makes static analysis hard. Static analysis is further divided into two categories-
  - misuse detection
  - anomaly detection traditionally used by anti-viruses.

- Misuse detection: signature-based approach for detection of malware based on security policies and rulesets by matching of signatures is where the Misuse detection is used. Data flow dependency and control flow dependencies in source code that would help to understand the behavior of apps, this is possible in case of static analysis.
- Anomaly detection: machine learning algorithms for learning of known malwares and predicting unknown malware is used in case of Anomaly detection. Identifying action of malware rather than pattern is the most common application of this approach. The procedure undergone here are first used to construct suspicious behavior of applications and then observed signatures are matched against database of normal behavior applications. By training network with classifier such as support vector machine (SVM) it can distinguish between malicious and normal behavior.
- Dynamic Analysis: Dynamic analysis performs the implementation of application in a secluded environment to keep in track of its execution behavior. Various heuristics are considered for monitoring dynamic behavior which includes monitoring network activity, file changes and system call traces. Android applications can run in an Android SDK, a mobile device emulator running on a desktop computer for emulation of software and hardware features except generating phone calls. For testing purposes emulator supports Android Virtual Device (AVD) configurations. When applications start running on the emulator, it can use all services like to invoke other applications, accessing network state, play audio and video, store and retrieve data.
- Permission Analysis: Permissions play a key role while analyzing android applications. They are listed in Manifest.xml file while each application is installed. Install time permissions limit application behavior with control over privacy and reduce bugs and vulnerabilities. Users have the right to allow or deny the installation of applications, but they cannot go for the selection of individual permissions. These permissions are required in android applications because the use of resources in android phones is based on this permission set. Some researchers can detect malicious behavior of android applications based on permissions specified in Manifest.xml.

## V. MALWARE DETECTION MECHANISM

Malware detection system is a method to examine if a program has malicious or non-malicious. Detection system includes two processes-

- Analysis
- Detection.

It takes two inputs one is the signature or behavioral parameters of a given code and second is the program under inspection, it can employ its own detection mechanism to decide if the program is malware or not. They can be divided into

- signature-based detection
- specification-based detection
- behavior-based detection
- Application Permission Analysis
- Cloud Based Malware Detection
- Data Mining Based Malware Detection.
- Signature-Based malware detection

A pattern-matching approach commercial antivirus is an example of signature-based malware detection where the scanner scans for a sequence of bytes within a program code to identify and report a malicious code. This approach to malware detection adopts a syntactic level of code instructions to detect malware by analyzing the code during program compilation. This technique usually covers complete program code and within a short period of time. However, this method has limitations by ignoring the semantics of instructions, which allows malware obfuscation during the program's run-time.

### A. Specification-Based Malware Detection

Specification based detection makes use of a certain rule set of what is considered as normal to decide the maliciousness of the program violating the predefined set of rules. The specification-based system there exists a training phase which attempts to learn all valid behavior of a program or system which needs to inspect.

The main limitation of specification-based system is that it is very difficult to accurately specify the behavior of the system or program.

### B. Behavioral-Based Detection

The behavior-based malware detection system is composed of several applications, which together provide the resources and mechanisms needed to detect malware on the Android platform. Each program has its own specific functionality and purpose in the system and the combination of all of them creates the Behavior-Based malware detection system. For collecting data from Android applications, the Android data mining scripts and applications mentioned in are the responsible, and the script running on the server will be the responsible for parsing and storing all collected data.

### C. Permission-based Detection

Applications run in a sandbox environment however they need permissions to access certain data. At the time of installation, Android platform asks the user to grant or deny permission for the application based on the activities the application can perform. This is to overcome a limitation in Android platform where the developers can intentionally hide permission label to a component. If no label is specified there is no restriction as it had default allow policy.

### D. Cloud Based Malware Detection

The Google Play apps are examined for the malware. Bouncer are the service used automatically to examine the apps on the Google Play Store for malware. As soon as an application is uploaded, the Bouncer checks it and then compares it to other known malware, Trojans, and spyware. Every application is run in a simulated environment to see if it will behave maliciously on an actual device.

### E. Data Mining Based Malware Detection

In data mining methods for detecting malicious executables, a malicious executable as a program that performs function, such as compromising a system's security, damaging a system, or obtaining sensitive information without the user's permission. Their data mining methods detect patterns in large amounts of data, such as byte code, and use these patterns to detect future instances in similar data. Their framework used classifiers to detect new malicious executables.

## VI. PERFORMANCE EVALUATION METRICS

Evaluation metric plays a critical role in achieving the optimal classifier during the classification training. Thus, a selection of suitable evaluation metric is an important key for discriminating and obtaining the optimal classifier. This paper systematically reviewed the related evaluation metrics that are specifically designed as a discriminator for optimizing generative classifier. Generally, many generative classifiers employ accuracy as a measure to discriminate the optimal solution during the classification training. However, the accuracy has several weaknesses which are less distinctiveness, less discriminability, less informativeness and bias to majority class data.

Metrics	Formula	Evaluation Focus
Accuracy (acc)	$\frac{tp + tn}{tp + fp + tn + fn}$	In general, the accuracy metric measures the ratio of correct predictions over the total number of instances evaluated.
Error Rate (err)	$\frac{fp + fn}{tp + fp + tn + fn}$	Misclassification error measures the ratio of incorrect predictions over the total number of instances evaluated.
Sensitivity (sn)	$\frac{tp}{tp + fn}$	This metric is used to measure the fraction of positive patterns that are correctly classified
Specificity (sp)	$\frac{tn}{tn + fp}$	This metric is used to measure the fraction of negative patterns that are correctly classified.
Precision (p)	$\frac{tp}{tp + fp}$	Precision is used to measure the positive patterns that are correctly predicted from the total predicted patterns in a positive class.
Recall (r)	$\frac{tp}{tp + tn}$	Recall is used to measure the fraction of positive patterns that are correctly classified
F-Measure (FM)	$\frac{2 * p * r}{p + r}$	This metric represents the harmonic mean between recall and precision values

Figure 8: Performance Evaluation Metrics

## VII. FUTURE DIRECTIONS

In case of security and privacy, the Smartphone users are not able to figure out the number of attacks on their devices and how much money malicious apps may steal from their accounts. In this survey, first, we have discussed different types of the mobile device vulnerabilities and threats, Secondly, we have classified malware and malicious applications focusing on how the attack is executed and what is the target of the attackers. Finally, discussed the possible malware detection defense mechanisms for mobile device security and then, suggested some future directions to improve the detection of malicious or abnormally behaving applications before its propagation. Using new machine learning techniques for providing real-time behavior analysis and identifying fake apps. Deep learning algorithms can be utilized for the features extraction with more accuracy during the malware testing. The Mobile OS companies, especially popular ones, should consider more security mechanisms for preventing against unpredictable attacks.

## VIII. CONCLUSION

Smart phones are becoming popular in terms of power, sensor, and communication. With the rapid proliferation of the Smartphone gadgets and developing apps with a lot of features, as several sensors and connections, the number of malware and attacks is raising. Modern, smart phones provide lots of services such as messaging, browsing internet, emailing, playing games in addition to traditional voice services. Increase in the number of smart phones on the market, the need for malware analysis is an urgent issue. Malware is a critical threat to user's computer system in terms of stealing

- confidential information
- corrupting or disabling security system.

This survey paper explains some occurred technologies used by security researchers to gear these threats. It says malware types, static, dynamic and hybrid malware analysis techniques, malware detection mechanisms. Among the various existing approaches Machine Learning methods have shown the results with high Accuracy in the detection of malicious activities. With this categorization, we want to provide an easy understanding for users and researchers to improve their knowledge about the security and privacy of smart phones.

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# A Survey on Hyperspectral Sensing Techniques for Identification of Fake Pharmaceuticals Medicines

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**Abstract**— Risky or subpar medications are indeed an issue for healthcare organizations, especially in middle-income countries with inadequate pharmaceutical care and pharmaceutical legal frameworks. Impoverished pharmaceuticals can lead to major adverse drug reactions, the emergence of bacterial resistance, as well as the possibility of therapeutic failure. They can also raise medical costs and erode the trust of the people in medical institutions. In the rapidly growing world, the study of fake pharmaceutical medicines is crucial. Hyperspectral imaging (HSI) is a developing imaging technique for use in medicine. The dataset, which has three dimensions, two spatial and one spectral is acquired via HSI. A summary of the research on hyperspectral sensing techniques for the identification of fake pharmaceutical medicines is provided in this research article. This study aims to evaluate the available various technology for identifying fake medicines.

**Index Terms**— Hyperspectral imaging (HSI), Raman hyperspectral imaging, spectroscopy, fake pharmaceuticals medicines, spectral signature, Visible to near-infrared region, Spectral data analysis.

## I. INTRODUCTION

The impact of fake medicines on society has a global reach. Due to massive distribution paths, unauthorized online pharmacies, and reused materials and packaging, they are difficult to identify. It is necessary to develop detection techniques for identifying fake medicines as well as various techniques for confirming counterfeiting to solve this problem. For the identification of fake medicines tablets, various challenges are rising day by day. Developing a new technique to identify fake pharmaceutical products with appearance inspection. Now the rapid development of identification techniques in that analytical, chromatography, and spectroscopy are available but these techniques are taking more time, more data, or maybe impacting the environment. So, to reduce this problem need the development of new techniques or methods. Selling in fake medicine (FM) the prevalence of fake or poor medications is increasing. Quite striking, particularly as the leading medical products or medications there is no need for a permit. A primary goal in rich nations, exercise is a costly medication of living (hormones, steroids, appetite suppressants, medications for premature ejaculation, Psychotropic drugs) whereas, in underdeveloped regions, daily existence pharmaceuticals (Tablets of antibiotics, antimalarial, antituberculosis, antiretroviral medicine) are the objective [1]. **Error! Reference source not found.** shows the categories of fake medicines with its definition. Substandard medicines are approved medical item that does not meet benchmarks,

regulations, or sometimes both, and is often referred to as hazardous and pharmaceutical ingredients which purposefully or falsely conceal their origin, name, or even content. Those standards were completely contradictory; therefore, a sampling may only be categorized as being either sub-standard or falsified by the world health organization (WHO) [5]. Medicines that lack active pharmaceutical ingredients (APIs), in addition to those that include incorrect substances that could or could not be dangerous, are counterfeit.

TABLE 1:FAKE MEDICINE CATEGORIES

Categories	Definitions
Substandard	Medications that fall short of quality standards and criteria are known as poor or substandard medications [2].
Falsified	Falsified medications seem to be imitations of legitimate medications made from bogus components [3].
Counterfeit	Medications that can violate copyrights or trademark infringement are considered counterfeit [3].
Diverted	The unauthorized transfer of authorized medications from credible sources to the black market is known as prescription medication diverting [4]

The world health organization (WHO) has noted that counterfeit medications have identification the illegally source information purposefully and misnamed. Several nations definitions of the word counterfeit medication have made it difficult to share information among them or truly comprehend the scope of the issue on a worldwide scale [6]. Various categories of counterfeit medications are distinguished, and that can be found using a variety of analytical techniques. Some of the most typical products include those having an inadequate amount of the active ingredient or products with no active ingredient at all. 15.6 % of items are packed wrongly, and 21.4 % of products are constructed using inappropriate material. 8.5 % of the precise product's genuine copies have significant contamination [7]. Fake medications with a wrong dosage of an active component. It can cause a variety of medical conditions. Minimal antibiotic treatment may not eradicate the germs but it could cause the growth of bacterial resistance. In Cambodia, fake malaria medicines killed 30 people in 2000 [8]. In 1993, more than 100 kids in Nigeria were killed as a result of a toxic chemical found in fake cough syrup. Due to the presence of ethylene glycol in cough syrup in place of glycerol, comparable cases occurred both China and India during the time period 1990 and 2007 as well as in Panama. Around 190,000 people died in 2002 as a result of polyethylene glycol poisoning in paracetamol syrup [9].

Fake medications with an undeclared active component. Recreation medications with potential botanical constituents are a typical target for this kind of fraud. Despite being healthy, cannabinoids could nonetheless have certain pharmaceutical consequences for the body. Therefore, it needs to be considered, and using such medications must be used with a prescriber. Four children cough syrups Promethazine oral solution, Kofexmalin baby cough syrup, Makeoff baby cough syrup, and Magrip N cold syrup have recently been labeled as substandard by the WHO after causing kidney problems and the deaths of about 66 kids in the Gambia [10]. According to the literature, fake medicines cover practically all pharmaceutical medicines types such as antimicrobials, antimalarials [11,12]. erectile dysfunctions, herbal, diabetes, and weight control [13].

#### A. Hyperspectral Remote Sensing

HRS (Hyperspectral Remote Sensing), also known as imaging spectroscopy, can give good image spectral information. Researchers and scientists have investigated and applied imaging spectroscopy techniques for the detection, identification, and mapping of minerals on land, in waters, and the atmosphere, based on the characteristics of HRS, which combine imaging with spectroscopy and possess individual absorption features of materials due to specific chemical bonds in a solid, liquid, or gas. As a result, HRS technology, as an enhanced remote sensing instrument, has been explored for a variety of applications, including geology, geomorphology, and environmental monitoring, etc. [65]. Hyperspectral Imaging (HSI) is a technique that examines the entire wavelengths of colors instead of identifying primary colors RGB (red, green, and blue) with each pixel. So, the light reaching every pixel is divided into numerous separate wavelength channels and provides additional details about what has been viewed. The unique color signature of an individual object may be recognized using HSI. Unlike other optical technologies that can only detect a single color but hyperspectral imaging can detect the whole color spectrum in each pixel [66].

Standard RGB photographs display a basic contour and color they can always distinguish between connected component sampling that shares the same contours and color that varied in their materials responses. Obtain the

same, particularly when it comes to pharmaceutical prejudice. A primary between hyperspectral images and standard RGB data is the higher Spectrum Resolution and larger Spectrum Range of hyperspectral data. Figures 1 and 2 demonstrate that the hyperspectral signal contains additional data than the standard RGB data. An earlier technique for image processing is much less suited for hyperspectral data since data is considered hyperspectral it has more than a hundred plus bands [67].

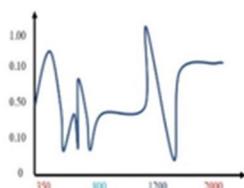


Figure 1: Hyperspectral data

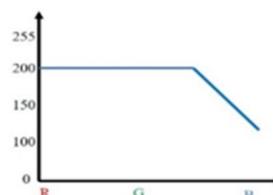


Figure 2: Standard RGB data

For the identification of active pharmaceutical ingredients in medicines use the hyperspectral data. In hyperspectral data, a target at a high number of distinct wavelengths is described as hyperspectral imaging. In its most basic form, hyperspectral data is a data cube in which the first two dimensions indicate spatial distances and the third represents the spectral wavelength or wavenumber. Hyperspectral imaging is used in various applications like remote sensing, agriculture, and food, also be used in pharmaceutical studies [68]. The advantage of the technique is it required little sample and do not make use of any chemical or solvent, which is increased safety, reduced negative environmental impacts, and save chemical laboratory analysis cost. When the data is captured by hyperspectral image sensors all the chemical information is in a given spectral range. Thus, with appropriate data analysis, it is simultaneously determining several quantitative properties with a single scan image.

## II. RELATED WORK

To start, we looked through the existing literature for academic journals, original research, conference papers, and case studies that are available on different platforms like Google Scholar, IEEE Xplore, and PubMed (Medline) repositories. The multidisciplinary character of the research objective, which required a review of the science/health research, has been the justification for selecting those resources. Hyperspectral imaging (HSI) is a developing imaging technique used in medicine, particularly in the identification of fake pharmaceuticals. A literature review has focused on the study of the identification of fake medicines using hyperspectral imaging, multispectral imaging, Raman hyperspectral imaging. *TABLE II* shows hyperspectral imaging's various applications in the medical field.

An infrared absorption band-based multimodal PLS-based quantitative study of produced tablet content was built. The study's aggregate result with 7 suspect paracetamol tablet tests, or 12%, is roughly in line with WHO assessments for such amount of inferior or counterfeit pharmaceuticals marketed internationally. The numerical study for this wavelength range (1524-1493  $\text{cm}^{-1}$ ) revealed no errors [33]. Near-infrared spectroscopy (NIR) is being to quantify the active components in semi-solid pharmaceutical preparations. This study assessed how well six distinct dermatological semi- solid pharmaceutical formulations could be quantitatively inspected using a NIR spectrometer with a restricted wavelength range (1000–1900 nm). The accuracy and variance are highly dependent on the active component and the range of its concentrations [34]. ASD FieldSpec4 Spectrometer was used in a study for the spectral database of pharmaceutical common excipients and active pharmaceutical ingredients. It has a broad spectral range (350-2500 nm) and its supporting software were need derivatives along with a derivative gap of 7 are employed as pre-processing approaches. ViewSpecPro software is used to display the output of the spectrum database as figures for each sample [31]. The strategy was applied to real or fake Viagra and Plavix materials. A margin of error of 15 to 24% was used to determine the amount of active medicinal component. The methodology may now be used to provide a first estimate before the application of further quantitative approaches [35]. Phosphodiesterase type 5 inhibitors have a murky online market that is booming. Because fake medical products could make the user feel sick, medical practitioners may get sceptical of them. The authentic drug and Cialis pills from dubious internet pharmacies were also examined in this investigation. Using infrared and Raman spectroscopy, it was possible to detect the bogus pills and establish

TABLE II: APPLICATIONS OF HYPERSPECTRAL IMAGING SYSTEMS IN MEDICAL

Spectral range (nm)	Methods	Application	Method of measuring
440 -640	Hyperspectral imaging	Skin cancer [14]	Fluorescence and Reflectance
500- 600	Medical hyperspectral imaging (MHS)	Diabetic foot [15]	Reflectance
450- 650	Hyperspectral imaging	Endoscope [16]	Reflectance
365- 800	Hyperspectral imaging microscopy	Melanoma [17]	Transmission
400 -720	Hyperspectral imaging	Tumor hypoxia Microvasculat-ue [18]	Fluorescence
450 - 700	Medical Hyperspectral Imaging	Breast cancer [19]	Reflectance
400 -1000; 900 - 1700	Hyperspectral imaging	Intestinal ischemia [20]	Reflectance
450 to 950	Hyperspectral imaging	Prostate cancer detection [21]	Reflectance
2500 - 11,111	Fourier transform infrared spectroscopy	Breast cancer [22]	-
500-3500	Raman hyperspectral imaging	Substandard Antimalarial Tablet [23]	-
1000-2500	Hyperspectral imaging	Classification of drug tablets [24]	Wavelength
1000-2500	Short wave infrared hyperspectral imaging	Detecting counterfeit drugs with identical API composition [25]	Wavelength
350 -1050	Hyperspectral imaging	Detection of Counterfeit Medicines [26]	Reflectance
1000 -2500	Near Infrared spectroscopy	counterfeit detection a large database of pharmaceutical tablets [27]	Reflection
4000–12,000 cm	Near infrared spectroscopy	Illegal synthetic adulterants in herbal anti-diabetic medicines [28]	Reflection
1730–174 cm <sup>-1</sup>	Raman spectroscopy	Identification of counterfeit drug [29]	Wavelength
4000–400cm <sup>-1</sup> , 1000–4000cm <sup>-1</sup>	Fourier transform infrared spectroscopy, Near-infrared spectroscopy and Raman spectroscopy	Detection of counterfeit medicines [30] Detection of falsified antimalarial drug [31]	Reflectance
1001-2500	Hyperspectral non-imaging	Pharmaceutical Common Excipients [32]	-

their API and excipients [36]. Aripiprazole in pharmaceutical formulation and bulk is detected quantitatively using high-performance liquid chromatography (RP-HPLC). According to the study, recovery experiments and the computation of the percent return were both used to assess the method's reliability [37]. Fake medications were examined using portable Raman spectroscopy with tailored localized plain views. Local Straight-Line Screening (LSLS) as well as fundamental problems severely (PCA). An algorithm was used to identify the fake drug mixed with herbal medications. To detect suspicious fake medicines, the LSLS technique was extended to Raman Spectroscopy by weighting developed false positive false negative ratios adjustments [38]. A total of 26 anabolic androgenic substances (ASA) tablets are found. Outraged, the developed technology has been applied to products intended to promote stronger and larger muscles. UHPLC-MS (ultra-high-performance liquid-tandem mass chromatography spectrometry) technology has been developed and approved for screening and quantifying AAS found in counterfeit medications and supplements [39]. Hyperspectral detection is a method are used have to detect fake medicines tablets. By adding different amounts of calcium carbonate, these medication powders have been modified to mimic fake medications. For this study, a hyperspectral sensor that operates in the visual range and near-infrared (350–1050 nm) range was utilized. The findings suggest that we would achieve a classification accuracy of greater than 90% [40]. To study to identify fake drugs, counterfeit drugs were detected using image analysis and processing, within range of visible near-infrared (400-1000 nm) and short-wave infrared (1000-2500 nm) hyperspectral imaging. Pfizer Viagra original product and imitation pills were compared. The Gray-Level Co-Occurrence Matrix (GLCM) analysis allows for the assessment of the homogeneity of pill component distribution [41].

53 formulations from 29 distinct medicinal product families have been measured, producing a massive library of spectra. The principal component analysis (PCA), the K-Nearest Neighbors (KNN), the support vector machine

(SVM) and the discriminant analysis (DA) were among the chemometric methods used to analyze the data. Near-infrared spectroscopy is used for the identification of pharmaceutical tablets by using a rapid investigative tool for counterfeit detection [42]. Near-infrared (NIR) spectroscopy was used as a quick and easy analytical approach to distinguish fake pharmaceuticals. Atorvastatin calcium sesquihydrate (AT) formulations were found in seven different types of brand-name and generic pills. The likelihood of classifying the AT tablet samples into the seven kinds was 100%. The major excipient combinations were what determined the PCA and SIMCA (Soft independent modeling of class analogy) classification of the AT tablets [43]. From the related work we studied and analyze the hyperspectral imaging technology that is used most to identify fake medicines and active pharmaceutical ingredients (API) with an average spectral range is 450nm to 1000nm. We also analyze the fake medicine tablets that are found in internet pharmacies and medicines stores those are Paracetamol, Pfizer Viagra, Plavix, and Cialis.

### III. DATA COLLECTION TECHNIQUES

The issue of medicines has evaluation has significantly across the globe. The importance and difficulty of maintaining medical performance are increasing. This creates demand for faster, smarter ways to meet demand. Any medicine, pharmaceutical ingredient, or material is considered an active pharmaceutical ingredient. It's all about testing, testing for similar as compounds and identifying contaminants. Preparations of pharmaceuticals medicines can be analyzed using various tools or methods.

#### A. Spectroscopic Method

The word spectroscopy describes a variety of techniques that make use of radiation to learn more about the composition and characteristics of substances. Spectroscopy refers to a wide range of technologies that employ radiation to collect information about the composition and features of a material, which one used to tackle a wide range of research problems [44]. A variety of analytical issues can be resolved by using the spectroscopy approach, which studies the chemical and physical characteristics of materials using radioactivity. In the spectroscopic technique, there are different types of the spectroscope. In that Infrared spectroscopy (IRS) and near-infrared spectroscopy (NIRS), Mass spectrometry (MS), Nuclear magnetic resonance (NMR) spectroscopy, Raman spectroscopy, Fourier transform infrared (FTIR) spectroscopy, etc. For example, NIRS has been widely used in the pharmaceutical sector, to identify crude ingredients or Active Pharmaceutical Ingredients (API), or to determine relative humidity. NIRS collects details about both chemical and physical factors. The biologically active component of a drug product (tablet, capsule, cream) that produces a better impact is referred to as the active pharmaceutical ingredient (API) [45]. Raman spectroscopy, which is simple, non-destructive, and information-rich, is an excellent method for the detection of the rapid categorization of drug substances. It provides a powerful tool for the analysis and determination of counterfeit medicines when coupled with chemometric techniques [46].

#### B. Chromatographic Method

The chromatography method can be utilized for and separate the components within a mixture. It is a process used in laboratories to separate mixtures. The mixture is dissolved in a fluid known as the mobile phase, which transports it through a structure that contains another substance known as the stationary phase. Chromatography can be used for both preparatory and analytical purposes. Preparative chromatography is a type of purification that is used to separate the components of a mixture for later use. Analytical chromatography is often employed for lesser amounts of material, although it may also be utilized for pharmaceutical analysis and formulation. Chromatography may be used for purification and classification, it is a method that use in laboratories to separate mixtures.<sup>31</sup> For the identification of fake medications and illicit pharmaceutical formulations, many chromatography methods have been used and are as following [47].

#### C. Thin-layer Chromatography

Thin-layer chromatography (TLC) is a method that has the benefits of being inexpensive and simple to use. The basic idea behind TLC in counterfeit analysis is straightforward: by comparison of the results with a test solution that was similarly applied to a TLC silicon plate, the existence or authenticity of the active ingredient in a fake or copycat sample is verified.

#### D. Liquid Chromatography

It is utilized in the evaluation and characterization of unlawful pharmaceutical formulations and fake medications. LC is utilized in this sector for a variety of reasons in conjunction with various detectors. It is used

as both a quantitative approach and a method for target analysis (the presence of one or more recognized substances).

#### E. Gas Chromatography

Gas chromatography (GC) have been employed to identify and find fake medications. Gas chromatography has been used to verify the authenticity of essential oils and the presence of residual solvents, volatile components, and unidentified chemicals or analogues (particularly in the quality assurance of herbal remedies) [48].

#### F. Hyperspectral Imaging Method

Hyperspectral imaging (HSI) is a developing imaging technique for use in medicine, particularly in the detection of illness with photograph treatment. The hypercube collection, which has three dimensions two geographical and one spectral is acquired via HSI. HSI's remotely sensed spectrum scanning yields sensor readings on the biology, and architecture, including the substance of the material. Hyperspectral imaging is a blended technique that integrates spectroscopic with image processing. The three-dimensional (3-D) dataset of spatial and spectral data is produced through Hyperspectral imaging besides gathering spectral information at each pixel of a two-dimensional (2-D) sensor emits. This set of information is referred to as a hypercube. Figure 1 Hypercube versus red, green, and blue picture comparisons. The two-dimensional picture on every wavelength is a part of the three-dimensional database known as Hypercube. The reflectance curve (spectral signature) of a pixel in the picture may be located in the lower left. Merely 3 picture bands on the red, green, and blue wavelengths are present in an RGB color picture. The RGB picture's image pixel gradient is shown in the bottom right. The source of each spectrum on samples may be identified with geographical information, allowing for a more thorough investigation of how light interacts with the disease. HSI can recognize several pathological disorders thanks to the spectral signature of each pixel in the photos. In comparison to multispectral imaging (like red, green, and blue color cameras), HSI often covers a continuous region of the visible spectrum with more spectral bands (more than hundred) and greater spectral resolution [49]. Over the past years, hyperspectral imaging methods have successfully demonstrated their value in a variety of pharmacological research domains. It involves taking pictures of an object at several distinct wavelengths.

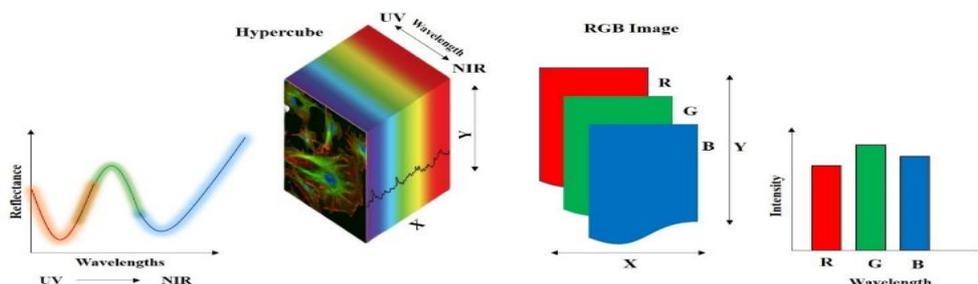


Figure 1:Hypercube 3D dataset and RGB 2D Images

A hyperspectral picture is essentially a datacube with 2 dimensions that reflect spectral wavelengths. Hyperspectral imaging is used in chemical imaging, which is the process of identifying and quantifying the chemical components of a sample or product, as well as their dispersal or uniformity. Compared to hyperspectral imaging, which covers any frequency band, spanning visual to lengthy infrared, chemical imaging generally uses the near-infrared (NIR) or short-wave (SWIR) infrared ranges, which carry on the bases of the chemical relationships. The NIR and SWIR spectra of the organic compounds which make up the majority of pharmaceuticals are distinctive. Chemical compositions inside a material can be identified and quantified using spectral features. Combining, tracking tablets manufacture, and spotting fake goods are just a few of the medical research and quality assurance applications that make utilization of chemical imaging.

#### IV. HYPERSPECTRAL DATA ANALYSIS

For the hyperspectral data collection and analysis below steps as in Figure 2 can be followed

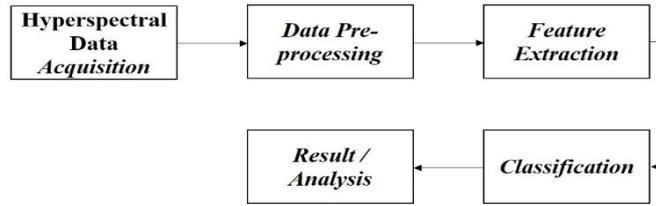


Figure 2: Workflow steps for proposed system

### A. Data Pre-processing

Images recognition and data standardization are the fundamental components of the hyperspectral imaging pre-processing stage. The literature additionally makes use of the Gaussian function to flatten spectral signatures and reduce the noise impact [50]. Data normalization modifies or normalizes hyperspectral illumination data to values that indicate the inherent characteristics of biomaterials, such as absorbance or reflectance. A superior way of preparing data for the analysis is by normalization, which also minimizes systems distortion and image artifacts caused by uneven surface illumination or a lot of unnecessary data in the hyperspectral imagery's sub-bands. Absorbance and reflectance [51,52] are the most popular pre-processing techniques used in hyperspectral data. By covering the sensor lens, taking a dark picture, and subtracting the hyperspectral data for the dark image. From the hyperspectral data taken from the area of interest, the camera's dark current impact was eliminated. To create a white reference image, a white diffuse reflectance target was employed. The hyperspectral data relative reflectance (R) is determined by equation 1. From the collected data it needs to select a spatial region of interest (ROI) and then apply further pre-processing [53].

$$R = \frac{I_s - I_d}{I_w - I_d} \times 100 \quad (1)$$

whereas  $I_d$  is the dark image,  $I_w$  is the white reference image, and  $I_s$  is the raw hyperspectral data.

### B. Feature Selection and Feature Extraction

Finding the most pertinent information within the original dataset and representing it in a lower-dimensional space are the aims of feature selection and feature extraction. A greater variety of spectral bands may make it feasible to distinguish between more particular classes in hyperspectral databases. However, using too many spectral bands may reduce the accuracy of classification because of the effect of dimensionality. Every pixel in hyperspectral data may be expressed as an N-dimensional vector, where N is the total number of spectral bands. For hyperspectral image processing applications, such pixel-based format has been extensively employed [54].

### C. Classification

Primary pixel and subpixel hyperspectral data categorization techniques utilized within the medical field depend on the type of pixel information present. Structured and unstructured categorization could be done at the pixel level. Sampling distribution for the data is typically assumed by parameterized classifications, however, this assumption is frequently ignored in applications [55].

*Principal component analysis (PCA)*: PCA is the commonly utilized dimensionality reduction technique for analyzing medical hyperspectral datasets. While retaining the majority of the variation in the high-dimensional region as is practicable, PCA minimizes redundant information in the bands of hyperspectral imaging [56]. It is new platforms of remotely sensed have made utilization of the principle component analysis. A historical backdrop of PCA and its mathematical justification are detailed in Gonzalez and Woods in 1993. The overall majority of the research focuses on methods for achieving efficient multispectral data categorization, with little attention paid to PCA efficiency and also its enhancement. The principal component analysis is based on the observation that adjacent bands in hyperspectral imaging frequently include data about the object that is nearly identical and strongly correlated. The analysis is used to modify the original information to eliminate band correlations. The procedure results in the identification of the ideal linear function of a set of the original bands that accounts for the variance of pixel values in a picture [57]. Simply data dimensionality is reduced using the mathematical equation that is Principal Components Analysis (PCA). As a result, the PCA approach enables the recognition of standards in data and their representation in a way that highlights both their similarities and contrasts. Finding patterns, compressing them, and reducing their size without losing any information [58].

*K-Nearest Neighbour (KNN)*: One of the simplest machine learning algorithms, depending on the supervised method, is K-Nearest Neighbour. A new data point is classified using the K-NN method groups with similar after all the existing data has been stored. As a result, fresh data may be quickly and accurately categorized into

appropriate categories that use the K-NN algorithm, emphasizing both their distinctions and similarities. Finding patterns, compressing them, and reducing their size without losing information [59]. A popular non-parametric technique for classification in pattern recognition is the KNN algorithm. The core element of KNN is that a data point's categorization is decided by the classifications of its closest K neighbours [60].

*Partial Least Square Regression (PLSR)*: It is frequently used for quantitative spectrum analysis as well as reflectance spectroscopic data processing. It breaks down both variables and discovers additional components. When there are several highly line segments key predictors, it is utilized to build forecasting analytics. Based on the spectrum, it may be utilized to create a linear prediction model for the sample size. Distinct frequency readings make up each spectrum. The answers are forecasted linearly using the PLS Factors, which are generated as a specific linear combination of the spectral range. Compared to the previous multiple regression approach method, it produces richer findings [61].

*Support Vector Machine (SVM)*: The aims of SVM is to identify an ideal higher-dimensional space as a decision boundary in high-dimensional space, is founded on a statistical learning concept. The SVM chooses from an unlimited number of linear decision boundaries the one that minimizes the classification error in the instance of a two-class pattern-recognition problem when the categories are discrete. The decision boundaries chosen will therefore be the one that leaves the largest class label, where the margin is defined as the sum of the distances from the nearest instances of the two classes to the higher dimensional space [62,63]. Support vector machines' benefits include efficiency in high-dimensional environments. It is useful in situations where the quantity of dimensions exceeds the number of samples. It is also memory efficient since it only uses a portion of the training points (known as support vectors) in the decision function. There are standard processors available, but we can also define our processors. SVM has some drawbacks, including avoiding over-fitting when selecting processor functions and regularisation terms if the number of features is much more than the sample size [64].

## V. CHALLENGES

Currently, the areas of active pharmaceutical ingredient detecting (API), pharmaceutical validity authentication, medication cluster analysis, or medication covering layer recognition are used hyperspectral technologies in pharmaceuticals. The majority of pharmaceutical identification techniques like analytical methods, spectroscopy methods, and the basic principal component analysis (PCA), with partial minimal, when it comes to statistical techniques like polynomial regression (PLSR), data evaluation in the experiment is often the implementation situation; commercial pharmaceutical production processes, as well as other locations, are not excluded from this. As a result, there are many potential applications for hyperspectral technology in the context of pharmaceutical research, yet there are numerous obstacles to overcome. The main problem at the moment is how to employ hyperspectral technologies in medication identification in the commercial pharmacy setting using extreme accuracy and cheap cost. So continued development of that kind of technique is being constrained by a shortage of pharmaceutical hyperspectral data sources or a lack of scientific fervor. Hence, should ensure the continued development of hyperspectral technologies inside this sector, academics have to not only extend beyond identification techniques to generally utilized computer vision techniques, yet also need to regularly incorporate popular pharmacological detecting data.

## VI. CONCLUSION

Based on the study, the issue of fake medications has indeed been extensively acknowledged, although it is not yet properly described and adequately handled. According to a study, we found the most fake pharmaceuticals medicines are antimicrobials, antimalarials, erectile dysfunctions, herbal, diabetes, and weight control. In this study, we have tried to provide an overview of several approaches for the identification of fake pharmaceutical medicines, particularly we are focusing on hyperspectral imaging technology because the is non-invasive, actual hyperspectral imaging technologies are three-dimensional picture cubes having 2-dimensional aspects, and one spectral aspect can be acquired. Every hypercube pixel may well be described by a spectral curve that really can reach from the Ultraviolet towards the Infrared spectrum. This hyperspectral imaging acquired remotely sensed spectrum offers analytical details on the material biology, architecture, including substance. As it gives spectrum data that could be utilized to differentiate between authentic and fraudulent medications, hyperspectral sensors easier processes thus accelerating the identification of falsified medicines as found 350 nm to 1000nm visible range to near-infrared range.

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# Electrical Design of Off-Road Electric Vehicle

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**Abstract**—The study, design, and construction of every electrical system required to create a fully functional off-road EV are presented in this report. Three main electrical categories were required, namely critical vehicle systems, e.g. engine control unit integration with engine sensors and a motor-controlled shifting system, safety systems and the additional designs that added value to the vehicle, e.g. an electronic driver interface, digitally controlled shifting etc.

**Index Terms**— Accumulator, BLDC motor, Simulink, Efficiency.

## I. INTRODUCTION

The benefits of EVs include increased energy efficiency due to regenerative braking and newer packaging options, along with a reduction in CO<sub>2</sub> emissions. The goal of this thesis is to increase understanding of the benefits of electric power trains and how they might be used[1]-[2]. The objective of the paper is to highlight that how different choices affect the vehicle dynamics, how the motors and gears might be configured and the way the accumulator pack and motor controller might be designed to maximize the performance of the car.

Many experts are looking for alternate energy sources because of the problem of air pollution caused by automobiles. A promising approach is to use an electric car, known as a combustion motor replacement. In order to determine its characteristics, the first step in this research is to model the power flow inside the energy system for electric vehicles[3]-[4]. Because electric vehicles are highly dependent on the finite amount of electrical energy provided by the battery, power flow efficiency is a crucial topic to discuss. Therefore, it needs to be handled effectively. In order to ensure that the amount of electrical energy meets the needs of electric vehicles, the study will track the power flow calculation[5]-[8]. The electrical layout of an off-road electric vehicle model using MATLAB/Simulink software is to get the best power flow response to the electric vehicle energy system.

## II. SIMULATION DESIGN PARAMETERS

The simulation approach was entirely based on existing Simulink and MATLAB Models, which was configured according to the requirements. The main reason behind this approach was to avoid “Reinventing the wheel” which saved us a lot of time and extra energy. We had to do a lot of exploratory research to finalize a step-by step problem solving approach to acquire the required data. Using various graphs and problem solving strategies we have fulfilled this topic in detail and the power train model of formula and off road EV is hence made.

Aiming toward resolving the issues with the previous year’s vehicle, so more emphasis was given on Simulating

and calculating new values of the Power train department (speed,torque,power) and Electrical Department (Battery Calculations) for reaching the heights of efficiency for the power train. Our team also intended to create a correct Cooling system design simulation and analyze the dynamic response. In order to try to to so, several simulations were conducted to realize the right calculations.

### III. ELECTRICAL SPECIFICATION

#### A. Tractive System

Tractive system consist of Accumulator pack,Accumulator management system,Brake light,Led indicators,Fuse, Kill switch,Master switch,Relays, Motor control unit,DC-DC converter,HVD and wires with their connectors.

##### i)Shutdown Circuit

This Circuit is responsible for shutting down the Tractive System upon failure of any component. It consists of many sensor-driven automatic as well as manual switches which assists the purpose.

##### ii)High Voltage System

The HV System consists of the following equipment-

- Li-FePo4(Formula)
- Li-NMC(E-Baja) Accumulator Pack
- BLDC Electric motor
- Kelly Motor Controller

##### iii)Accumulator Pack

**Purpose:** Supply power to the entire Tractive System

**Status:**Research for improving the efficiency of existing battery pack by modifying the Accumulator Management and Charging techniques.

For research purposes I am referring to the design strategy of University of Wisconsin-Madison.

**Next Steps:** modifying the existing pack by adding cell temperature monitoring module and adding some extra safety measures to the cell configuration

##### iv)Accumulator specification

- Accumulator voltage:48V,
- Accumulator capacity:110Ah
- Li-ion cell Nominal voltage-3.2V
- Charge cut-off Voltage-3.6V
- Cut-off Voltage-2V
- Accumulator pack consist of combination of 22 in parallel and 16 in series.
- The cells contain within an en-closer constructed of fibre reinforced plastic. The cell is mounted in a non permanent arrangement as it will be easy for servicing and access. Accumulator container is equipped with at least 2 AIR & 1 Fuse . It also include AMS with embedded Master and Slave modules to monitor cell voltages. MCU also embedded Thyristor module to regulate the voltage supply to the Motor.

#### B. Safety Device

##### i)Accumulator Isolation Relay

TWO KILOVAC EV200 AIRs are used in the system.

each one is connected to the battery positive and negative terminals respectively.Its rated at 500A at 12v.The AIRs are connected in parallel with each other.It is of normally open type relay.Operating temperature -40 degree to 85 degree.

##### ii)Brake System Plausibility Device (BSPD)

Non programmable.Disconnects AIRS when throttle>10%, and brakes are activated.Opens AIRS circuit.AIRS remain open until power cycle.

##### iii)Brake light:

Must be red and Visible in sunlight.Must be rectangular/triangular/round.Located between wheel center line/shoulder of driver.

#### D. Kelly DC to DC converter Specifications

- Nominal input voltage: DC 48V, 60V, 72V
- Output voltage: DC 13.5V under 70°C or DC 12.2V above 70°C
- Operating voltage range: 40V-100V
- Output current: 30A
- Output power: 400W
- Operating Temperature Range: -20°C to 90°C (case temperature)
- Full - load efficiency: ≥93%
- Ripple coefficient: ≤1%
- Weight: 2.25lbs

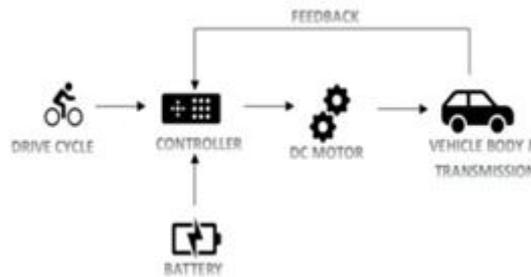


Fig. 1 Block diagram of the overall system

The basic simulink will be derived with respect to the following block diagram.

In the configuration the main blocks are battery, drive cycle, controller, DC motor, vehicle body and transmission and feedback. The driver cycle is the driver input who will ride the vehicle. Here FTP75 drive cycle is used to give the output on how it reacts to the drive cycle. The main purpose to design the EV is to understand the speed of vehicle, calculate SOC discharge rate, distance travelled by vehicle. The SOC block in MATLAB simulink will calculate the SOC, distance is measured by distance and time parameter.

#### IV. PROBLEM FORMULATION

For the battery charging current I B, the battery management system monitors the battery voltage, SOC, and battery temperature voltage,

$$S = \frac{Ch}{Ch_{nom}}$$

where, S : state of charge; Ch : actual stored “Ah” capacity in the battery; Chnom : the nominal “Ah” capacity of the battery. The battery terminal voltage VB is determined by battery SOC and its impedance.

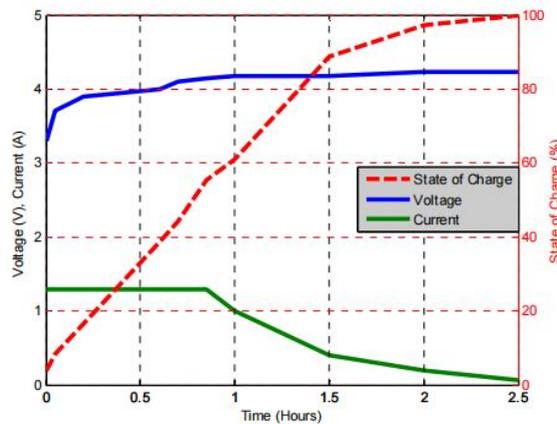


Fig 1: charging characteristic of lithium battery

$$\text{Battery Size(Ah)} = \frac{\text{watt} * \text{hour}}{\text{voltage}}$$

- Battery size calculation :  
= (3000x8)/48= 500Ah
- Current required to run load:  $I_1 = \text{load(watt)}/\text{voltage} = 3000/50 = 60\text{A}$
- Battery Charging current:  $I_2 = \text{battery size(Ah)}/\text{Hr} = 500/10 = 50\text{A}$

Total current to run load:  $I_1 + I_2$   
50+60=110A

- Output power  
 $W = 2\pi(n)/60 = (2 \times 3.14 \times 2400)/60$   
= 251 W

$P_{\text{out}} = T \times W = 251 \times 12 = 3000 \text{ W approx.}$

$P_{\text{in}} = V \times I = 48 \times 110 = 5280 \text{ W}$

- Efficiency=  $P_{\text{out}}/P_{\text{in}} = 55\%$

#### V. SIMULINK RESULT ANALYSIS

The current flows to the dc motor through the battery through the dc power converter to drive the motor. The controller will control the voltage . the controller will run by the instruction given by the driver input and will run the motor at required rpm.

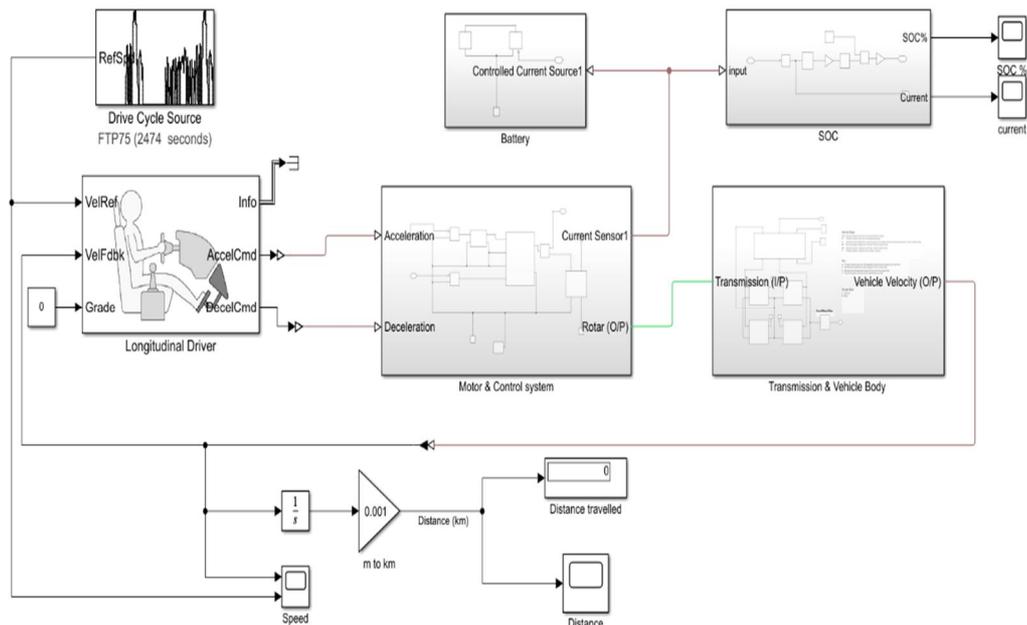


Fig. 2 Simplified configuration of Electric vehicle

All these components are available in the Simscape electrical components library so they need a connection to the solver configuration block which helps solve the simulation. The majority of blocks are Simscape blocks. It converts the physical signal from Simscape block to Simulink signal.

Initially it was set to 90% charge and after running for 1000s the final charge is around 55%.

The distance obtained for a given FTP75 drive cycle with 80Ah battery capacity is able to cover say 10km distance for 80Ah battery capacity.

**Distance Travelled** The distance obtained for a given FTP75 drive cycle with 80Ah battery capacity is able to cover 11.14km distance

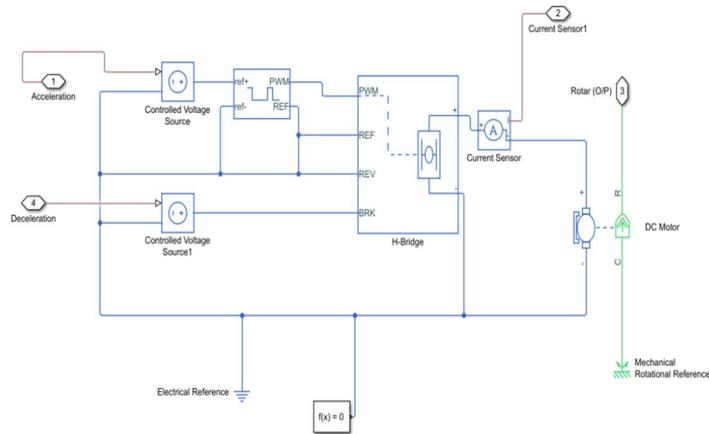


Fig 3: Motor controller design

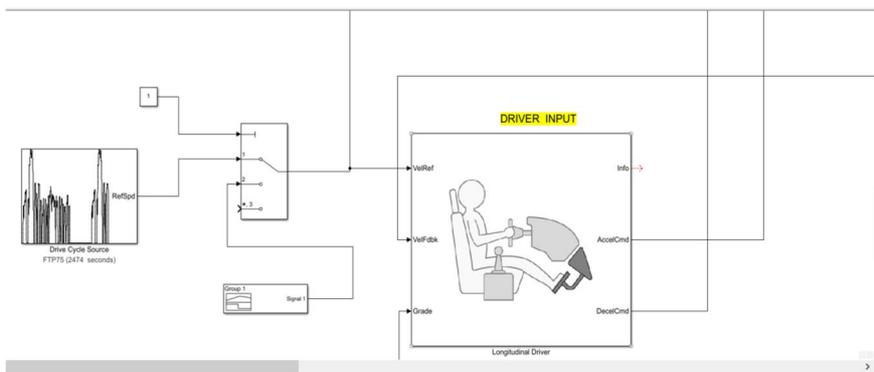


Fig 4: Driver input

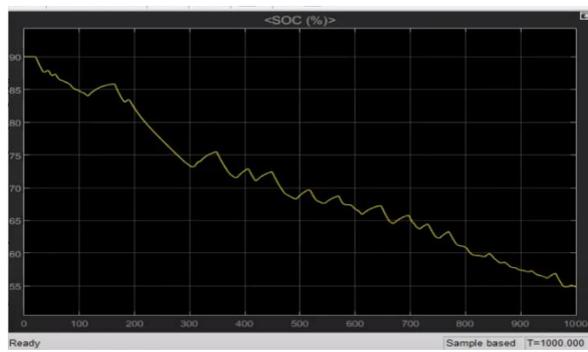


Fig.4 State of charge vs time

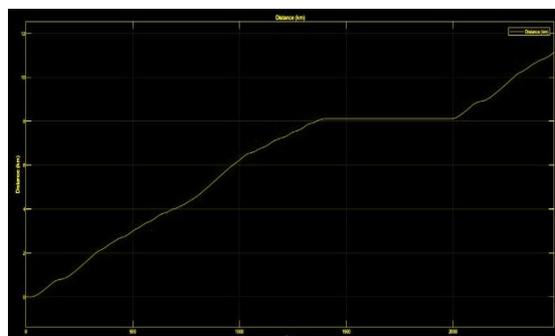
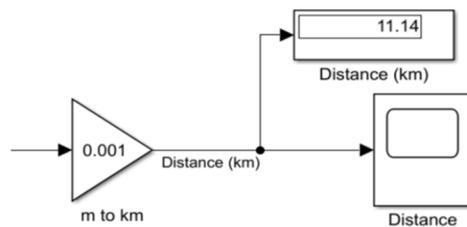


Fig. 5 Distance travelled vs time



## VI. CONCLUSION

The EV is created by MATLAB simulink and it is obtained for a drive cycle by FTP75 driver. It can be tested for any drive cycle by selecting the drive cycle block. It can travel 11.14 km by the presence of 80Ah battery capacity. It will travel further more distance if the battery capacity has been enhanced. However, it should be taken into account considering space and cost in the real time.

Making the actual model is made simpler by modelling the EV prototype system. The battery life of an EV can be estimated using this prototype. The model can be used to assess the efficiency of an EV during startup or constant-speed operation.

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# PM based Eddy Current Braking for Automobile Applications

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**Abstract**—Of late, there is overwhelming growth of the e-mobility sector and hence, growing interest in integrating automotive electronics. In this context, the present paper discusses Eddy Current Braking (ECB) Systems. Electrification of the braking systems would aid in gaining electronic control and total integration of electrical and electronic components in an automobile. Electrical eddy-current braking is a prominent type of braking systems used in textile, oil rigs and locomotive sectors. Potential of incorporating ECB with existing frictional braking to form Integrated braking systems for automotive braking applications is explored. ECB provide retardation, while frictional components are required to halt the brake disc. Development of analytical model and a preliminary hardware model are carried out in the present paper.

**Index Terms**— Eddy Current Braking, electrical braking systems, permanent magnets.

## I. INTRODUCTION

Brakes have changed considerably from traditional wooden log blocks to present day Automatic braking systems. For more than 100 years, braking systems have evolved to adapt with improving automotive capabilities and road conditions. Throughout history, the mechanical friction type of braking mechanism has been favored, with little to no advocation towards Electrical or electromagnetic braking. With the exponential growth of e-mobility sector and interest of electrifying automotive components, the focus on electric braking is gaining prominence.

In the present paper, Eddy Current Braking (ECB) Systems are looked into as a prospect for application in automotive braking. Integrated ECB systems which incorporate existing frictional braking components and employ Permanent Magnets (PMs) are explored to fulfil the needs of automotive braking.

A brief review on evolution of braking systems and current status of ECB is done in Section II. In section III, ECB is designed using Permanent Magnets incorporating brake disc. Section III covers a simple analytical model is developed to validate the expressions and plot characteristic graphs of an ECB. In section V, a preliminary hardware model is designed to validate the fundamental working principles of an ECB employing PMs. Subsequent results obtained and inferences observed are elaborated in section VI, followed by concluding remarks in section VII.

## II. LITERATURE SURVEY

### A. Evolution Of Braking Systems

The earliest brakes were wooden log blocks used on steel rimmed cart wheels. They were primarily used in

steam powered vehicles and horse drawn carriages. However, Rubber tyres were introduced by Michelin brothers in late 1890s [1], which made wooden braking obsolete. The drum braking systems were a huge upgrade from wooden braking in terms of usability and braking force. Mechanical drum braking consists of a cam, brake linkage, brake shoes and a drum anchored to the vehicle's chassis. They were designed to be used in early rubber wheeled automobiles. Louis Renault, a French automobile pioneer, developed this model around 1902 [2].

A 4-wheel brake system using hydraulics was first used in Model A Duesenberg car in 1921 [3]. In Hydraulic braking, when a pedal is pressed, fluids are used to transfer the pressure to the brake shoe. Cylinders and tubes are used to achieve the desired pressure.

The first vehicle to commercially adapt to disc braking was Chrysler Imperial in 1949 [4]. This method employs calipers with brake pads, which pinches a rotor or disc, mounted on the wheel shaft.

Anti-lock Braking Systems (ABS) was first installed in FF sports sedan, produced by Great Britain Jensen. ABS was meant to be used in airplanes [5]. It prevents vehicles' brakes from locking up. This technology particularly senses when the brake is about to lock up and then responds by stimulating the valves to reduce brake pressure.

A production car by Pierce-Arrow's was the first to integrate power braking in 1928 [6]. In this method, the intake-manifold vacuum is used to reduce the magnitude of effort required to apply brakes.

Automatic braking technology has been on the rise since 2006 with Mercedes leading and implementing the technology in their higher-end models. Automatic Emergency Braking Systems (AEBS) employ short-range radar and long-range radar that can bring a car to a stop even if the driver does not touch the brake pedal. Electrical dynamic braking is the use of an electric traction motor as a generator for slowing down a rotor. It is termed "rheostatic" if the generated electrical power is dissipated as heat in brake grid resistors, and "regenerative" if the power is returned to the supply line. Other spectrum of Electrical braking is Electromagnetic brakes, which slow or stop motion using electromagnetic force to apply mechanical resistance (friction).

#### *B. Eddy Current Braking Systems: Advancements and Current Status*

Currently, eddy current brakes are used in various domains like oil rigs, textile industry, trains and selected automobiles. With respect to the automotive domain, they are employed in some of the commercial trucks and buses and are referred to as "electric retarder" or "electromagnetic retarder". It is an auxiliary braking system to the basic friction brake system, aiding in scenarios like downhill driving and overheating. It is usually mounted on the drive-shaft.

Several architectures [7-12] are developed to vary the magnetic field in case of permanent magnets and several architectures are developed to control excitation in terms of electromagnets. However, architectures which vary the magnetic field by mechanical movement of the magnet itself have not been studied extensively.

An auxiliary braking system which uses electromagnets (EM) is proposed in [13, 14]. PMs are used as a source of magnetic field as opposed to EMs used in the previous configurations [15]. The magnetic circuits are designed to vary magnetic fields. In recent years, permanent magnet technology has evolved, with magnets having increased energy density and reduced costs. Extensive study using new permanent magnets to use in Eddy current braking is to be carried out. Stand-alone type of braking systems or retarder type of braking systems are predominantly designed [16,17]. Integrated braking configurations [18] i.e., eddy-current braking which incorporates the already existing components of a traditional frictional brake is not efficiently realized. However, including magnets in the existing caliper of the brake is not explored extensively. Simple Analytical models [17, 18] and comparatively more complex FEA analysis models [19,20,21] are among the common simulation models used. The difference between the models in terms of performance and the parameters affected is explored. However, subsequent ways to reduce the gap between the models in terms of results by improving the simpler analytical model is to be attempted. An experimental test set-up is employed to validate the Finite-Element Analysis (FEA) results and numerical results in [22]. Models not necessarily designed to be implemented on the vehicle, but to verify the results and equations are to be developed. An effective experimental model to fill the gap between prototype model and mathematical results is to be realized.

#### *Gaps in Research:*

At present, ECB is not commercially implemented in passenger vehicles. Towards this end, prominent research and development of prototype models for Integrated braking systems which make use of existing mechanical frictional braking components are not realized.

Keeping these in minds, the scope for further research work is inferred to be:

- Development of an end-to-end model which uses a simple analytical method taking into consideration the new PMs.
- This analytical model's equations and results are to be validated by a simple working hardware model. The architecture of mechanically moved magnets to control the braking can be explored and the setup is to be realized incorporating already present components of traditional frictional braking.

### III. DESIGN OF ECB

The Eddy Current Braking model employed consists aluminum brake disc rotating with velocity  $v_m$ , through an inhomogeneous magnetic field created by magnet placed facing the disc. Fig. 1 represents the arrangement of the Brake disc and the Magnet.

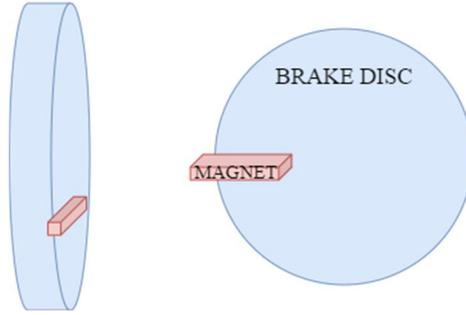


Fig. 1. Basic ECB Model with brake disc and magnet

In the model, we can either employ Permanent Magnet (PM) or Electro-magnets (EMs) to generate the magnetic field. In case of PMs, air-gap distance is varied to gain control over braking force, whereas excitation current is varied in case of EMs.

#### Permanent Magnets

During the rotation of brake disc with velocity  $v_m$ , the induced voltage  $u_i$  in the disc can be calculated using Faraday's law of induction,

$$\oint_S \vec{v} \times \vec{B} dS = (B^+ - B^-)0.5lv_m \quad (1)$$

where  $l$  is the width of the disc [23]. The resistances along axis of eddy current path, namely  $R_1$  and  $R_2$  is calculated. Disc physical and material properties are taken into consideration.

$$R_1 = C_r \frac{2l}{\sigma t_{ec} \tau} \quad (2)$$

$$R_2 = C_r \frac{\tau}{\sigma 2lt_{ec}} \quad (3)$$

The total resistance of one eddy current path is,

$$R = 2C_r(R_1 + R_2) \quad (4)$$

The correction factor  $C_r$  is used, as the eddy currents are considered of only one eddy current streams.

To take into consideration the field repression, the resistances are calculated across the thickness of the brake disc. But, due to presence of fictive current in eddy current paths, effective thickness,  $t_{ece}$  for eddy current paths is calculated as,

$$t_{ece} = \delta \left(1 - e^{-\frac{t_{ec}}{\delta_p}}\right) \quad (5)$$

$$\delta_p = \sqrt{\frac{\tau}{\pi \sigma \mu_0 \mu_{co} v_m}} \quad (6)$$

Where,  $\sigma$  is the conductivity of eddy current material,  $\delta_p$  is the penetration depth and  $\mu_{co}$  is the relative permeability.

As eddy currents of only one stream are taken into consideration, an inductance  $L$  is applied to eddy current path. Inductance is the result of magnetic resistance present in the air gap. It is calculated by,

$$L = \frac{\mu_0 C_L \tau l}{8 t_{ece}} \quad (7)$$

where,  $C_L$  is the inductance fitting parameter and  $\tau$  is the length of the magnet. The respective reactance can be calculated by,

$$X = \frac{L2\pi v_m}{\tau} \quad (8)$$

Due to the impedance  $Z$  and voltage induced in the disc, the eddy current can be estimated as,

$$I = \frac{u_i}{\sqrt{R^2 + X^2}} \quad (9)$$

The drag force produced in an eddy current brake can be approximated by,

$$F = RN_{ec} \frac{\Delta B^2 l^2 v_m}{4(R^2 + X^2)} \quad (10)$$

Where,  $N_{ec}$  is the number of eddy current paths. All parameters used for the calculations are presented in Table 1 including brake disc and magnet parameter values.

The Effective flux density at an air gap distance  $l_g$  is calculated by,

$$B_T = \frac{B}{2} \left( \frac{l+lg}{\sqrt{\left(\frac{d}{2}\right)^2 + (l+lg)^2}} - \frac{lg}{\sqrt{\left(\frac{d}{2}\right)^2 + lg^2}} \right) \quad (11)$$

where,  $d$  is the Disc diameter.

The aim of the design is to find the physical parameters of the ECB which ensure maximum braking torque. Fig. 2 shows the Torque-speed curve of an ECB with its characteristic values.

TABLE I. PARAMETERS USED FOR PM DISC BRAKING

Parameter	Value
Disc thickness ( $t_{ec}$ )	4 mm
Disc diameter ( $d$ )	20 mm
Disc material	Aluminium
Length of magnet ( $l$ )	80mm
Magnetic Inductance of PM ( $B_x$ )	1.2 T
Number of eddy current paths ( $N_{ec}$ )	8
Resistance Correction Factor ( $C_r$ )	2.02
Inductance Correction Factor ( $C_L$ )	0.21
Permeability Correction Factor ( $\mu_{co}$ )	8.2

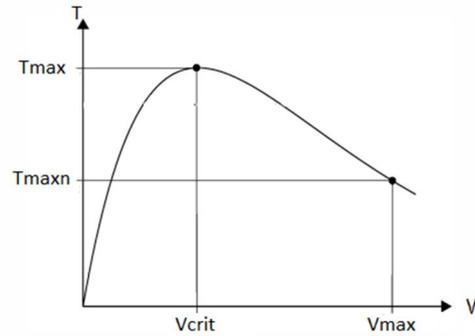


Fig. 2. Characteristic torque curve of an ECB

Torque axis and Speed axis correspond to Braking Torque of the ECB and Speed of the Brake disc respectively. It can be observed that the Torque of an ECB increases up to its critical speed  $V_{crit}$ , where it reaches Maximum torque  $T_{max}$ . As the speed increases past Critical value, the torque decreases.

#### IV. DESIGN OF ANALYTICAL MODEL

A simple analytical model to assess the equations of ECB using permanent magnets is developed. The analytical model takes disc parameters, magnet parameters and other physical parameters like air gap as input. It calculates the Braking force and torque generated, with respect to brake disc speed. The results of the analytical derivations are implemented and computed using MATLAB®. The braking torque is computed for a broad speed range. Fig. 3 shows the algorithm used for calculations.

After the calculations, the characteristics 'Braking Force-Speed' and 'Torque-speed graph' are plotted.

Fig. 4 shows the Braking Force vs Speed plot of Eddy-Current Braking system. The Brake disc speed  $V_m$  is plotted against the produced Braking Force. In our application of Eddy Current Braking system to automobiles, the region of characteristic plot where, braking force is increasing with increase in speed is taken into account.

Fig. 5 corresponds with the Braking Torque-Speed characteristics of the Eddy Current Braking system. Brake disc speed is plotted against corresponding Braking Torque. It can be observed that Braking torque is increasing in magnitude with increase in speed.

Fig. 6 shows the Braking force as a function of different air gaps  $l_g$ . It can be seen that increasing air gap between the permanent magnet and disc decreases the magnitude of braking force.

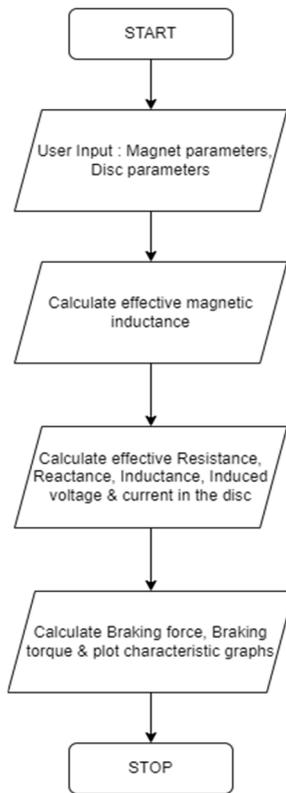


Fig. 3. Algorithm implemented in MATLAB to solve for Braking parameters of ECB

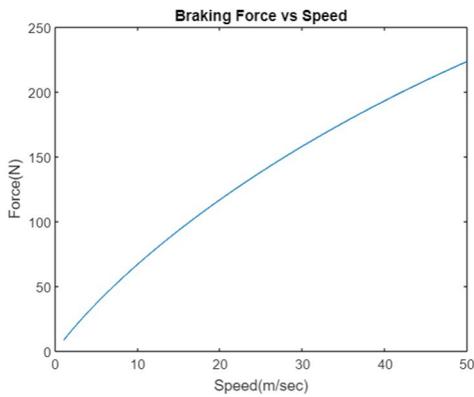


Fig. 4. Braking Force – Speed curve of Eddy Current Brake

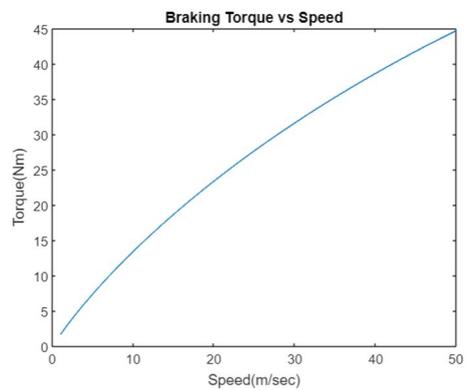


Fig. 5. Braking Torque – Speed curve of Eddy Current Brake

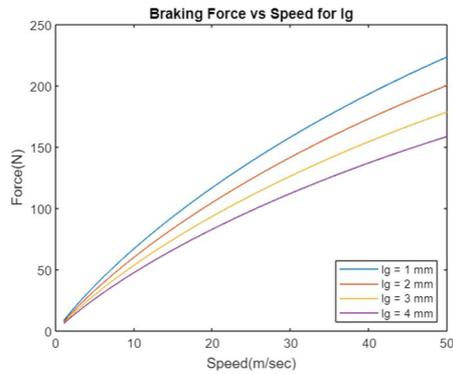


Fig. 6. Braking force – speed curve for different air-gap distance  $I_g$

## V. HARDWARE DESIGN AND PRELIMINARY REALIZATION

A preliminary hardware model is designed to test our hypothesis on fundamental physics and working of an Eddy Current Braking model employing Permanent Magnets. Neodymium Circular disc magnets, which possess high magnetic flux density are chosen to decelerate an Aluminium disc of a similar dimensions to that of an automotive brake disc. Suitable drive type to actuate the disc is designed and motor sizing is carried out. Fig 7.shows the CAD model of the designed system.

TABLE II. HARDWARE MODEL SPECIFICATIONS

<b>Disc</b>	
Material	Aluminum
Dimensions	20 cm OD
<b>Magnet</b>	
Type	Neodymium disc magnets
Magnetic Induction (B)	1.2 T
Dimensions	50*20*20 mm
<b>Motor</b>	
Motor type	PMSM Motor
Torque	5-8Nm
Speed	1500 RPM
Type	Variable speed type
<b>Drive</b>	
Type	Direct coupling with shaft
Shaft	8mm aluminum
Bearings	Ball bearings
Mountings	Weld mountings
Body	Cast Iron

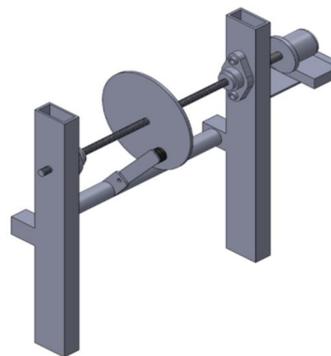


Fig. 7. Model of preliminary Braking test system using PM

A preliminary hardware working model is realized to test out the theoretical assumptions and to ensure the fundamental understanding of working of an ECB using PM are validated.

Due to restrictions not limiting to financial, availability and time restrictions, some variation has been made from the designed model.

A mild steel disc of 20mm outer diameter was procured instead, and appropriate light-weight shaft has been used to enable rotation of the disc. The shaft is directly coupled with a PMSM motor to eliminate any drive losses. Neodymium circular disc magnets are mounted on a retractable flat member which oscillates the magnet in and away from the disc. Ball bearings are installed at both ends of the shaft to ensure there is no other load other than the disc itself. The whole frame for the model has been constructed with Iron square members to ensure strength and rigidity.

Fig. 8 and Fig. 9 contains the images of realized ECB model using PMs.

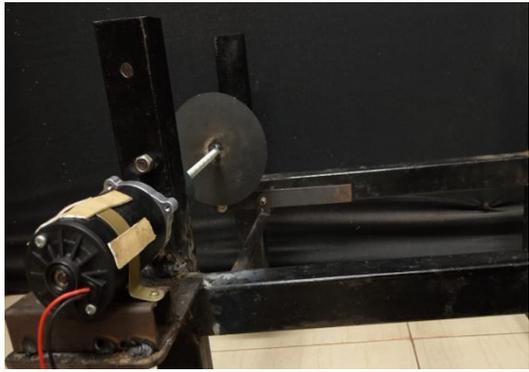


Fig. 8 Realized working model of preliminary Braking system using PMs

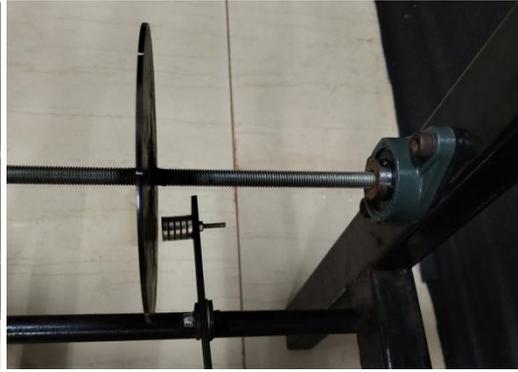


Fig. 9. View of PMs in vicinity of the Brake disc

## VI. RESULTS AND DISCUSSIONS

Several test cases have been performed on the set-up to aid the understanding of basic principles related to ECB. Disc speed has been measured in RPM.

In the first set of experiments, PM is brought in the vicinity of the disc without cutting off the motor power supply. The readings are taken for two cases, 330 RPM and 860 RPM as initial speeds. In the next set of experiments, motor power is cut off when the magnets are brought in. Same two cases of speed are measured. Air gap  $l_g$  of 2 mm has been fixed throughout the entirety of the experiments undertaken.

Fig. 10 shows case 1, when the disc is initially rotating freely at 330 RPM. When the permanent magnet is brought in the vicinity of the disc, the speed of the brake disc drops to 280 RPM. Speed of the disc is reduced by 50 RPM and remains constant as the motor is powered throughout the time period.

Fig. 11 shows case 2, where the disc is rotating freely at 860 RPM. When the permanent magnets are brought closer to the disc, the speed of the brake disc drops to 780 RPM and remains constant as motor is still live.

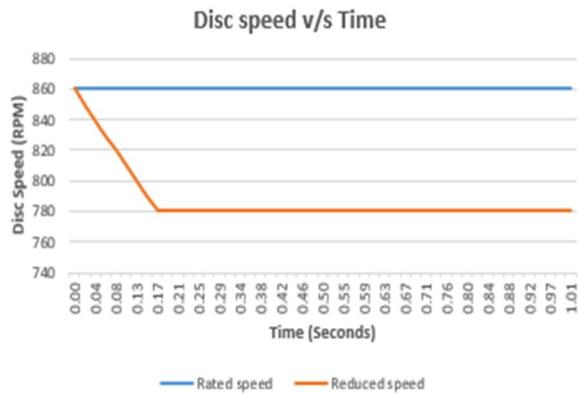


Fig. 10 Disc speed – Time graphs of initial speed 330 RPM

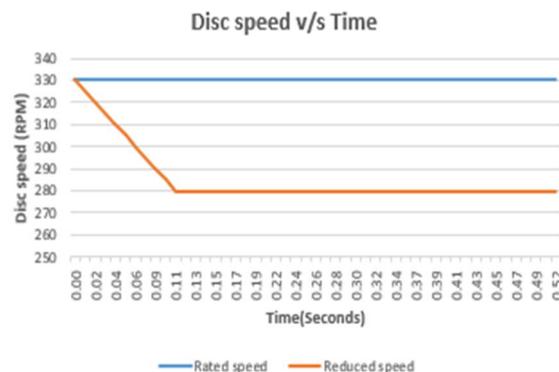


Fig. 11 Disc speed – Time graphs of initial speed 860 RPM

In the next set of experiments, the motor power is taken off to simulate accelerator pedal being taken off in case of an automobile. Subsequently, readings of time taken by the disc coming to halt, with magnet in its vicinity and magnet without in its vicinity are taken. This corresponds to braking effect and the deceleration rate of the brake disc.

Fig. 12 shows the graph of Brake disc speed versus time, with magnet in discs vicinity and without magnet in discs vicinity. It can be observed that the disc naturally decelerates at the rate of 11 RPM/s from 330 RPM to 0 RPM in 0.5 seconds. When the permanent magnet is brought in to produce brake torque, the disc now decelerates at increased magnitude of 18.33 RPM/s and takes only 0.3 seconds to stop.

In another case when the initial speed of the disc is 860 RPM, the disc naturally decelerates at 8.9 RPM/s to come to a halt at 1.60 seconds. When the braking as a form of bringing in the permanent magnets is applied, the disc decelerates at increased magnitude of 23.8 RPM/s and takes 0.6 seconds to stop. It is illustrated in Fig. 13.

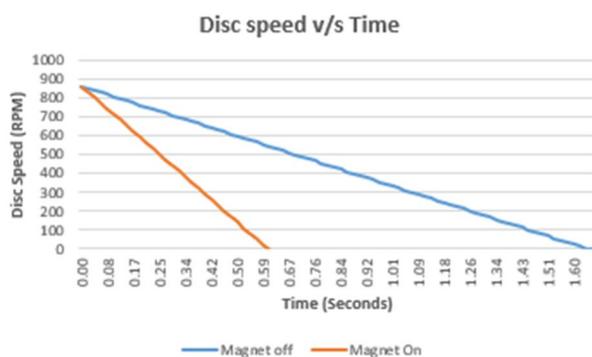


Fig. 12 Deceleration graph of initial speed 330 RPM

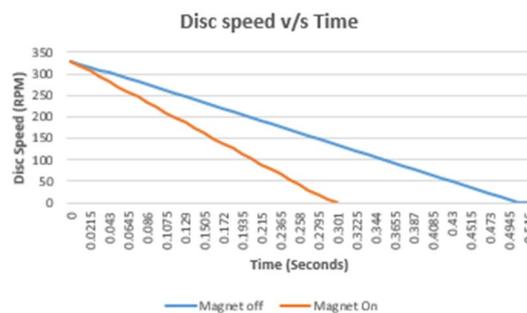


Fig. 13 Deceleration graph of initial speed 860 RPM

## VII. CONCLUSION

With the exponential growth of e-mobility sector and the increasing interest in automotive electronics, focus on electric braking is gaining prominence. In this context, the present work was taken up to explore the realization of Eddy current braking using Permanent Magnets for automobile braking application.

Evolution of braking system was studied, leading to exploration of current state Eddy Current Braking Mechanisms. Eddy Current Brake is designed with Permanent Magnets incorporating already present frictional braking component of brake disc. Simple analytical model is developed to validate the equations and plot the characteristic graphs of an Eddy Current Braking System. Preliminary hardware system to validate the understanding of fundamental working of ECB was designed and realized.

Usage of ECBs in passenger vehicles has advantages like gaining electronic control over the braking mechanism and complete Electrical-Electronic integration of all the components in an automobile. It can be concluded that the presented work aims to aid the transition from traditional frictional braking to Integrated ECB systems.

## ACKNOWLEDGMENT

Authors would like to thank the authorities of KLE Technological University, Hubli - 580031 (INDIA) for the support in carrying out this research work under Research Experience for Under-graduate (REU) scheme.

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# Skin Disease Identification using online and Offline Data Prediction using CNN Classification

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**Abstract**—In this study, a convolution neural network (CNN) is used to classify images for the detection of skin illness. We collected in a database from the government medical hospital in Aurangabad and the HAM10000 online data. The seven classes are in the skin diseases dataset such as Basal Cell Carcinoma, Psoriasis, Ringworm, Impetigo, Leprosy, and Eczema. The seven additional categories of skin disease are in the database. We have used pre-processing techniques to improve the model accuracy such as resizing images, and normalization of a dataset. We have used a deep learning algorithm for the classification of skin diseases in the database. We have used a deep learning algorithm for the classification of skin disease. It is given an 80.2% percent accuracy rate and its overall accuracy is 78%. Acne disease identification is got 100 accuracies while testing for it is 97.6% accurate. For the classification of skin diseases, we used a deep learning system. Its total accuracy is 78% and it has an accuracy rate of 82.2%. Identification of the acne disease has a 100 accuracy rating, while testing for it has a 97.6% accuracy rating.

**Index Terms**— CNN, Skin Disease Dataset, Deep Learning, Convolution Neural Network, Image Processing.

## I. INTRODUCTION

The most common disease nowadays that affects people of all ages is skin disease and lesions, however young children and the elderly are immunity powerless compared to other. The investigation of patient's medical history and symptoms, skin scrapping, dermoscopic examination, and skin biopsy is a common method for skin disease diagnosis. But these methods of diagnosis are exhausting, time-consuming, and prone to error. Most of them request an expert dermatologist with superb vision. Medical imaging technologies are sophisticated and trustworthy in diagnosing skin diseases. However, people in low-resource contexts are healthcare institutions. In the healthcare sector, digital imaging cameras and sensing platforms have recently emerged as an alternate method of disease diagnosis. The most recent generation of the camera allows for high-resolution digital image capture images in high resolution to its high-definition camera, enormous storage capacity, and high-resolution digital image capture to its high-definition camera, enormous to its probability, affordability, and connectivity [1].

Computer-aided diagnosis is important and required because it may analysis of different types of skin diseases. The bulk of regularly used algorithms for forecasting skin diseases involve deep learning. This approach will

enable finding the inspected bits in the discovered data pattern, which will considerably improve the performance of even the simplest computational models [2]. The majority of chronic skin conditions, such as impetigo, ringworm, eczema, basal cell carcinoma, and psoriasis, are categorized as serious fitness problems that have an adverse impact on one's physical, mental, and financial health. This dataset contains 2000 dermatoscopic images. A digital camera is employed in many different settings due to its likelihood, affordability, and connectivity [3]. The majority of the initiatives, which focused on skin disease images and aimed to identify specific body parts, were dependent on the availability of an online public dataset. The rest of this article is structured as follows: More information on related studies work for the diagnosis of skin conditions is provided in sections 3 and 4. Section 3 describes the finding and the discussion of the result followed by Section 5's conclusion.

## II. LITERATURE REVIEW

Since the past ten years, several studies have been published on Skin disease. Andre Esteva and Brett Kuprel investigated clinical screening and histological testing to categorise skin cancers at the dermatologist level that have substantial neurological systems. They initially showed how to classify a skin illness using a single CNN, and then they became ready to classify images utilising two essential binary inputs, where the disease is only represented by a single pixel [4].

Convolution and Artificial Neural Networks (ANN) Neural networks are commonly used techniques in radiological imaging and diagnosis. The ANN-based model for early detection of breast cancer through image processing or either neural network approach method requires enormous training and testing models considering performance, which requires a lot of computational effort. Furthermore, in ANN, as image resolution increases, so does the number of trainable parameters, resulting in massive training efforts. Furthermore, for the validation set, the classifier achieved an accuracy of 89.90%. The K-Nearest Neighbours (KNN) classification model is widely used for casting and prediction models. This model is also divided into training and testing phases. Furthermore, the accuracy of the KNN model is quite high [5]. KNN models are not suitable for use with large-scale data models because performing prediction models can take a long time. Poor performance when working with high-dimensional datasets with inappropriate feature information may impact the model's accuracy and prediction performance.

## III. DATASET DESCRIPTION

TABLE I. LOCAL DATABASE FOR SKIN DISEASE

Sr. No.	Name of Institute/Organization	Database Size	Name of Disease	Resolution	Year
1	Govt. Hospital (GHATI), Aurangabad	612	Acne, psoriasis, Eczema, Wart, Ringworm, Vitiligo, Skin Cold.	6016*3384	2020-2021
2.	<a href="https://www.kaggle.com/datasets">https://www.kaggle.com/datasets</a>	10015	Melanocytic –Nevi, BCC, Benign Keratosis-lesions, Melanoma, Dermatofibroma, Vascular-lesson, Akira	478 x 600	2014 A dataset ingested by data. The world may have a maximum size of 1GB and up to 250 individual files

We have captured images from Government Medical Hospital Aurangabad, under the observation of the dermatology lab. We used a direct-current light source to avoid the flickering effect of alternating current (AC). Additionally, information is withheld unless physicians completely and honestly disclose the objectives behind the collection of their data. Both dermatologists and patients are aware that we are only gathering this information for the study. This data was gathered from every patient, and our study was authorized by the institute's ethics committee.

In Source \_1 (Sony HD Camera) we have data from seven different skin datasets such as Acne, psoriasis, Eczema, Wart, Ringworm, Vitiligo, and Skin Cold., which are mentioned in table 2. The data indicates a 6016\*3384 resolution.

Another is the Source 2 we have taken the pictures from Kaggle [6]. We have considered skin infection pictures with the natural parts. It has been seen that the proposed framework yield exactness differs as for skin illnesses.

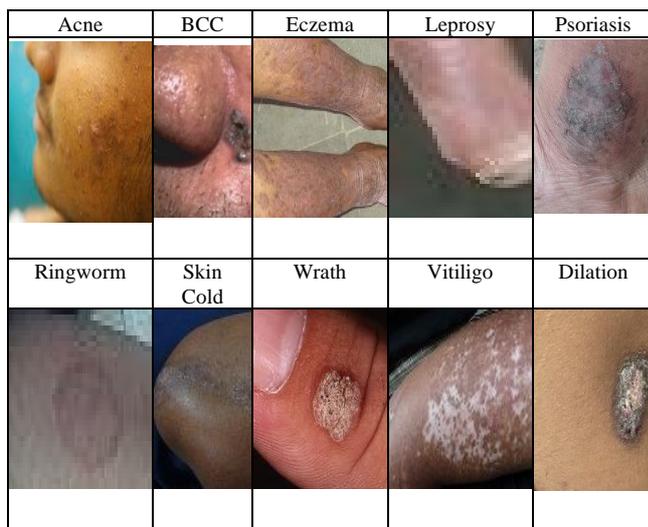


Figure 1. Skin Disease Images Dataset

TABLE II. LOCAL DATABASE FOR SKIN DISEASE

Skin Disease	Train Data (80%)	Test Data (20%)
Acne	180	25
Basal Cell Carcinoma- BCC	45	10
Psoriasis	275	120
Ringworm	50	21
Impetigo	45	35
Leprosy	122	79
Eczema	118	23
Total	825	313

We have additionally gathered pictures from the web. More than 1012 images with a resolution of 678\*600 have been downloaded on seven different infections: melanocytic, bcc, benign keratosis lesion, melanoma, dermatofibroma, vascular lesion, and Akira. In the underlying preparation stage, trademark properties of ordinary picture highlights are confined, and, in light of these, a one-of-a-kind portrayal of every characterization classification is made for seven distinct classes.

The classes are skin inflammation, acne infection, leg infection, hand infection, dermatitis subcutaneous, lichen simplex, stasis dermatitis, and ulcers [7]. In the testing stage, these component space allotments are utilised to create group picture highlights.

#### IV. METHOD AND TECHNIQUES

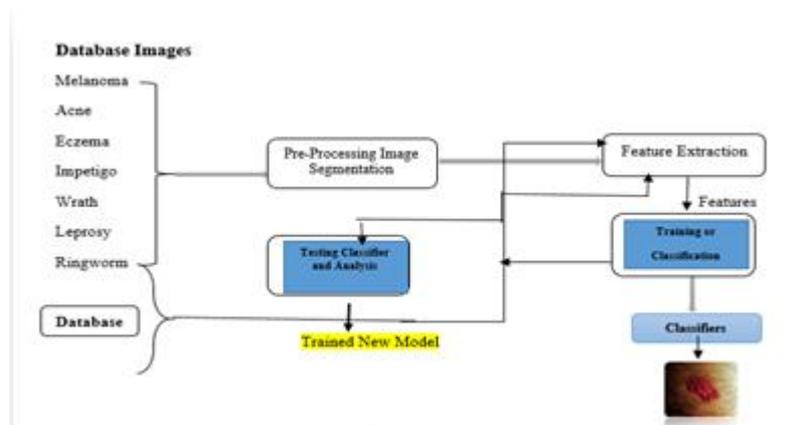


Figure 2. Proposed Methodology

##### A. Image Acquisition

With the use of two sources, including dermatologist photographs from a digital camera and the Kaggle website as well as online and offline disease images.

##### Data Preparation

At the point when we gathered our pictures, all the pictures were in an alternate measurement. Our informational index is diverse in its height, width, and size. In any case, the profound neural classifier needs a comparable informational index for preparing and testing the informational index. So we set the pixels to 100 x 100. At that

point, we'll prepare our model. Our all-out picture number post-growth is 3000. We used 2400 images for preparation and 600 for testing [8].

### B. Convolution neural Network

We developed our algorithm based on pre-trained 825 images we adjust the final layer and used on, Our dataset as inputs, CNN have similar functions, where the calculated feature are combined with each other. The simplified framework of the entire process is shown in figure 2. CNN is often used in real life for image recognition and natural language processing. Each pixel in the input images was transformed into element in a matrix. If there are 100 images input images, the input matrix would be 825 images. 256\*100 dimensional images this also called input layers.

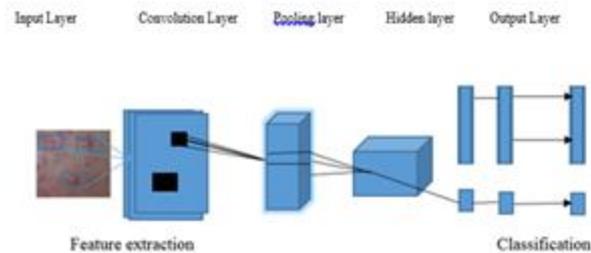


Figure 3. Convolutio Model

Figure 3. Convolutio Model

Image data generator generates argumentation of images in real time while the model is still training. One can apply random transformation on each training images as it is passed to model.

Data are distributed in following layers.

1. Convolutional
2. Pooling
3. Dropout
4. Flatten
5. Dense

Our idea is to build up a new CNN model, in our model, we have 13 layers. We also have 5 convolutional layers:

- The first layer has  $32-3 \times 3$  filters and 'linear' as an activation function.
- The second layer has  $64-3 \times 3$  filters and 'linear' as an activation function.
- The third layer has  $128-3 \times 3$  filters and 'linear' as an activation function.
- The fourth layer has  $256-3 \times 3$  filters and 'linear' as an activation function.

Additionally, we may state that the average size of the five max-pooling layers is  $2 \times 2$ . The parameters of our two dropout layers are 0.3 and 0.4, respectively. In our model, a level layer exists. Finally, there are two thick layer capabilities known as "softmax" and "straight". Both skills are used in the beginning process. But to determine the likelihood of our five classes, "softmax" is used [9].

### Training Model

Adam optimizer is used for the compilation of our model. For training purposes, we use 80% of our training dataset, and then the rest of the 20% dataset is used for testing purposes. our training dataset consists of 2400 images. So we can say that the number of training sets consists of 1920 images and validating set consist of 670 images. Our classifier's batch size 78. 50 epochs were used by us to train the model.

## V. PERFORMANCE EVALUATION

Preparing precision is regarded as the model's accuracy when applied to the data we prepare. The model's accuracy when applied to a small sample of data from any class is referred to as the approval precision. The diagram in the illustration depicts the creation and acceptance of exactness. to evaluate the performance of the proposed model, we conduct a set of experiments by comparing the proposed model to several state-of-art in diagnosis models. A convolutional neural network (CNN) system is used for Deep Learning [10]. In image processing, such a method is commonly used to classify the object as well as to perform the ROI detection and segmentation process. There are a number of layers in CNN to detect various features of the input layer learning.

At different resolutions, filters are applied to every trained image and the outcome of the convolution layer. The CNN algorithm used for disease detection is based on layer. Our aim behind using CNN for skin disease detection is to improve the recognition results compared to other classifiers.

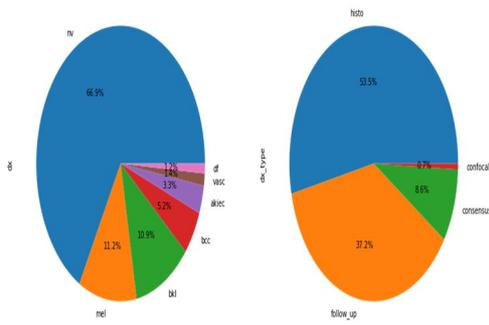


Figure 4. Compare Skin disease Ratio

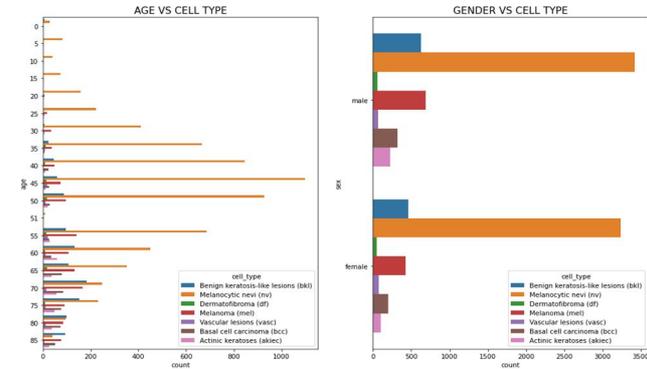


Figure 5. The Ratio of DiseasePrediction

we have shown in figure 6. The ratio of disease prediction result. In the graph is affected among people and more prominent in men and infection on the lower extremity of the body is more visible in women. and some unknown regions also show infection and its visible in men and women, that acral surface show at least cases that too in men. only gender groups don't show this kind of infection.

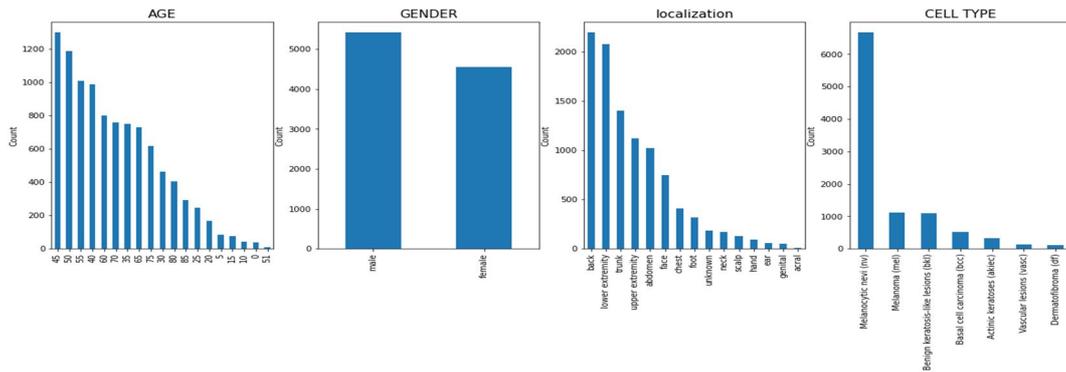


Figure 6. Gender Wise Disease Prediction Ratio

In the online dataset, skin diseases were found maximum 45 year old patient and below 10 year old. Maximum of 10 below. We observed that the probability of having a disease ratio is increased compared to men and women who are facing skin cancerous disease; we have found most of the melanocytic lesions in dermatofibroma disease. The age group between 0-75 years is infected the most by melanocytic nevi. On the other hand, people aged 80-90 are affected more by benign keratosis-like lesions. All the gender groups are affected the most by melanocytic nevi.

### A. Performance Measures

Experiments have been carried out to validate the efficiency of the proposed model. The experiment was carried out with a core i5, 2.3 GHz processor with 8 GB RAM using python. Comparisons with other models conducted to measure the performance of the classification are evaluated in terms of classification sensitivity, specificity, and accuracy from the confusion matrix. The measures are computed by using the equations described below with the following convolutions. In this study, the confusion matrix was used to calculate several metrics. This matrix forms four indices which are true positive (TP), false positive (FP), false negative (FN), and true negative (TN). TP and TN match the number of correctly predicted hypoxic and normal samples, whereas the FP and FN match the number of incorrectly predicted hypoxic and normal samples, respectively.

Accuracy, Recall, and F1-score have been determined from our test dataset which contains 600 pictures. So we can say that our Precision normal is 0.76, Recall normal is .78 and F1-score normally us 0.78. Finally, we can say that our classifier is quite acceptable. Characterization table is given underneath. The total accuracy we got 78 %.

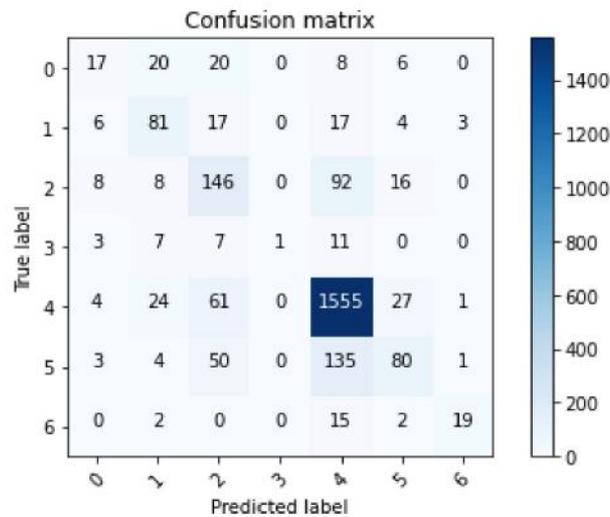


Figure 7 Confusion Matrix

TABLE IV. CNN MODEL-1, PERFORMANCE MEASURES DETECTION OF OFFLINE SKIN DISEASE

Diagnosis class in the dataset	Precision	Recall	F-score
Acne	100%	100%	100%
Basal Cell Carcinoma-BCC	96.01%	98.6%	98%
Psoriasis	95%	97.9%	97.5%
Ringworm	92.6%	96%	96%
Impetigo	92.4%	97.3%	96%
Leprosy	74.4%	94.23%	91%
Eczema	68.6%	85.5%	80.2%

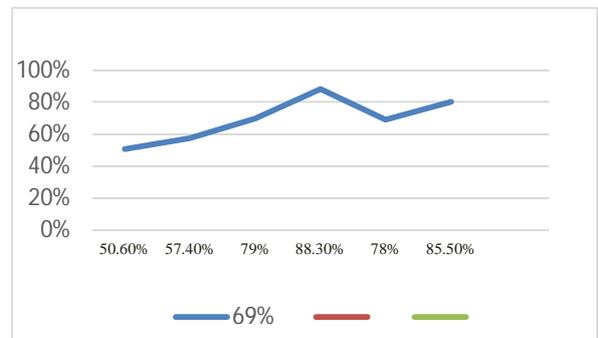


Figure 8. Disease Prediction

Table V. Show that the proposed system can produce high accuracy when we apply it to multiclass skin disease. The result shows that the proposed system correct identifiers all Acne, BCC (Basel cell carcinoma), and psoriasis patients with a diagnosis. Finally, Acne skin diagnosis has the highest accuracy compared with other diseases.

TABLE V. CNN MODEL-1, PERFORMANCE MEASURES OF DETECTION OF ONLINE SKIN DISEASE

Diagnosis class in the dataset	Precision	Recall	F-score
Melanocytic – Nevi	69%	69%	69%
BCC	50.01%	50.6%	51%
Benign Keratosis-lesions (BKL)	55%	57.4%	57.6%
Melanoma –MEL	79.6%	79%	70%
Dermatofibroma – DF	88.4%	88.3%	88.3%
Vascular Lesions –VASC	74.4%	78%	69%
Akira	68.6%	85.5%	80.2%

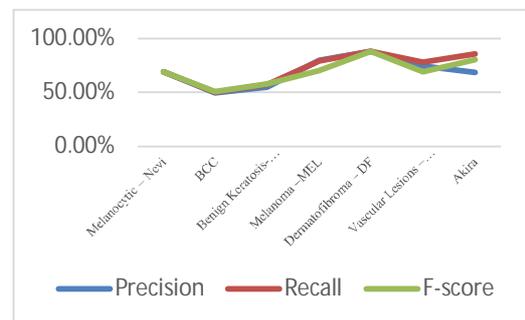


Figure 9. Performance Accuracy with Offline Dataset

Table VI. Show that the proposed system has higher performance in terms of accuracy specification and sensitivity and f-score than the system proposed system by using higher accuracy compared with other diseases using online data using skin disease. The result shows that the proposed system nearby correctly identifies all patients with DF, MEL, and AKIRA disease. Finally, dermatofibroma skin disease has also can be diagnosed with the nearby accuracy state with other state of art skin diagnosis systems.

## VI. CONCLUSION

In this study, we have presented a CNN method for the diagnosis of dermatological disease in brief. We gather information from internet and original datasets with various photos, including those of skin conditions including vitiligo, psoriasis, warts, eczema, and skin cold. Another source is online, where 1012 pictures of seven distinct infections melanocytic, bcc, benign keratosis lesion, melanoma, dermatofibroma, vascular lesion, and Akira have been obtained. In terms of identifying skin lesions, we have seen some quite encouraging findings. We identified seven different skin conditions in certain hairy photos. Finally, we ran a statistical analysis to compare performance with the results of our objective investigation. The results of the statistical tests conducted on both datasets' photos to assess performance led to the conclusion that our technique is the statistically best algorithm. As a consequence, when each class was examined independently, our accuracy rate values in multiple classifications rose, and using CNN classification resulted in findings with varied degrees of accuracy. In terms of identifying skin lesions, we have seen some quite encouraging findings. As a consequence, when each class was examined independently, our accuracy rate values in multiple classifications rose and using CNN classification resulted in findings with varied degrees of accuracy. The method displays disease skin detection accuracy in an online database. It has an accuracy rating of 82.2% and a 78% total accuracy. Acne disease detection accuracy is 100 percent, and test results are 97.6 percent accurate.

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# Automatic Rail Track Inspection System

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**Abstract**— The need for safety components in the contemporary rail systems is increasing as a result of the need to prevent accidents. Among the presence of impediments on the tracks, whether they are stationary or mobile, is one of the major factors that might cause significant accidents. This study focuses on one of the most effective techniques for preventing railway accidents caused by track cracks and obstacle identification. The primary goal of this project is to create a method for identifying railway track cracks and notifying nearby stations. The location of track defects is being pinpointed by a GPS system. The project provides a solution by providing an advanced tracking and management system for trains to improve the current railway track inspection and hence transportation service. The approach is based on a potent blend of mobile computing, an infrared sensor, an Arduino Uno and the Global System for Mobile Communication (GSM).

**Index Terms**— Arduino, GPS module, GSM module, IR sensor, Motor driver.

## I. INTRODUCTION

Although it has been determined that rail cracks are the main reason for derailments in the past, there are currently no accessible low-cost automated testing methods available. Because of this problem's significant effects, a practical and affordable solution that can be used on a large scale is needed. Crack is often assessed manually by the experts called keyman. This is accomplished with a track checker, a miniature railroad car designed to inspect the integrity of railroad lines. The early track checkers, also known as track walkers, were only individuals who walked on the tracks to ensure that they were undamaged Fig. 1. However, a contemporary track checker is a compact carriage with wheels that may either be controlled by an engineer known as a "Track Checker" or it can be automated. This vehicle travels on railroad rails. One of the best nondestructive testing (NDT) methods now available for surface and near-surface fault detection is eddy current testing (ECT) for crack detection Fig. 2. The most effective ECT devices are powerful enough to measure thin materials precisely and easily identify minute variances.

In order to enhance the inspections, new detection techniques must be created. Even if the government has taken the required precautions to ensure a safe voyage, accidents will still occur owing to these cracks, thus this study focuses on an effective technique to prevent these mishaps. This study describes an approach for inspecting and to find breaks and cracks in railway tracks. Tracking has advanced significantly with the development of communication technology, making it easier to monitor items like automobiles. The prior approaches were replaced with renewed options. These options rely on the integration of technology using the Global Positioning System (GPS) and other technologies [1].



Figure 1. Manual inspection



Figure 2. Eddy current testing

## II. LITERATURE SURVEY

There are several conventional methods for inspecting railroad track cracks. Advancements technologies such as GSM and GPS are playing major role in wireless inspection of tracks with simple components viz. GSM modem, an IR transmitter, and a receiver etc. An IoT based railway track crack detection by using IR sensor is developed and the information of crack is sent to the host server [1]. A Bluetooth technology based [2] system for detecting railway cracks using IR sensor is proposed. But Bluetooth technology fails for the long range communication. [3-5] proposed the crack monitoring technique by using GPS,GSM and GPRS communications with low accuracy which can be enhanced by using IR sensors. An ultrasonic sound based technology was proposed which can be made with a special embedded system but they feature of geo location is not provided [6]. An image processing based technique was proposed to detect the crack. Image processing is one of the advanced techniques used for vision based detection. Even though it is a advanced method it has the disadvantage of having limited information about software requirements [7]. Proposed an IR transmitter and receiver based technique to monitor the rail track crack, but the location of the crack detected to be sent to the nearby station [8-9]. Various methods of track inspection techniques are being developed by many researchers. They are broadly classified as nondestructive testing, condition monitoring systems, track recording systems etc. [10]. Among different sensors that come under nondestructive testing such as cameras and accelerometers, IR sensors are economic, simple and low wait comparatively.

After reviewing different techniques used for crack detection using IR in particular it is identified that identification of location along with the detection of crack is the need of hour. The proposed model can detect the rail crack using IR sensor accurately and sends the geo location where the crack is detected by using GPS communication system. And it sends the message to the registered mobile number by using GSM module.

## III. METHODOLOGY

The key components of crack detection system are given in block diagram Fig. 3. The concept includes several technologies,including previously discussed IR, GPS and GSM, in the proposed system.

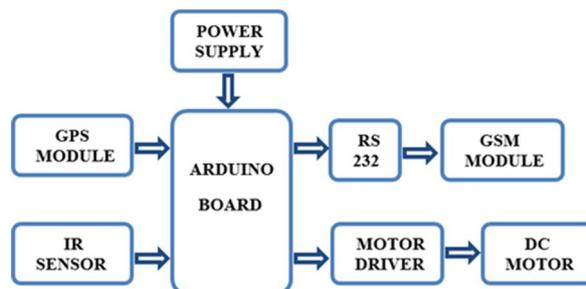


Figure 3. Block diagram of crack detection system

The microprocessor is the heart of the system which coordinates crack detection and communication. The GSM module is driven by the microcontroller to transmit text messages containing the current coordinates of the crack consisting its latitude and longitude received by the GPS receiver to the appropriate authority.

## IV. HARDWARE COMPONENTS

The hardware elements used in the suggested system are discussed in the following sections.

### A. Arduino UNO

It uses a type Uno Arduino board (R3) as seen in Figure. With a wide range of shields, it is one of the most popular and frequently utilized. The Italian word "Uno," which means "One," was chosen to symbolize the imminent introduction of Arduino 1.0. The Arduino Uno version 1.0 board with the crack detecting mechanism will serve as the standard going forward. The most well-liked construction boards for electronics and robotics is the Arduino UNO. The flexibility of the board and it has become extremely popular because it can connect numerous robotic components, including sensors, actuators, etc. One of the advantages of UNO is a USB port that can be programmed using the Arduino software and communicates with software such as Windows or Mac OS without the need for drivers. The Arduino Uno's ATmega328 has a boot loader built in that enables users to upload new code to it without the need for an external hardware programmer. A microcontroller board called the UNO R3 Starter Kit is based on the ATmega328. It includes a 16 MHz crystal oscillator, a USB port, 6 analogue inputs, a reset button, a power jack, and 14 digital input/output pins. You only need to connect it to a computer with a USB wire and power it with an AC to DC adapter or battery to get things going. It comes with everything you need to support the microcontroller. The Uno R3 is compatible with all currently available shields and is adaptable to new shields that utilize these extra pins. Shields for Arduino are simple to use boards that may be used to complete a variety of activities quickly.



Figure 4. Arduino UNO R3 board

### B. IR Sensor

IR LED and Photodiode are the primary electronic components required to make an infrared detector circuit. One kind of diode is an IR photodiode that can detect light, serve as a source of illumination, and on rare occasions have a black or dark blue layer on the outside that makes it appear like an LED. As a source of infrared rays, IR LEDs are the kind of LED that emit light in the infrared range. When no light is shining on it, it has an extremely high resistance. This set of infrared transmitters and receivers, also known as an IR TX- RX pair, may be purchased for not very much money from any respectable electronics parts store. Additional components needed for this sensor include a transistor type 2N2222 and resistances of 330 and 10 ohms.

### C. GPS Module

The major three connections required to use the module as presented in Figure 5. A microwave horn antenna to detect problems with rail tracks the computer terminal via which the module transmits GPS satellite data.

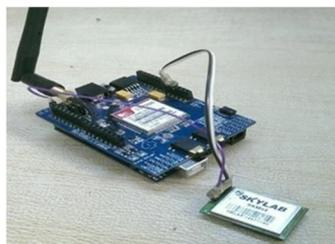


Figure 5. GPS module with Arduino board



Figure 6. GSM module with Arduino

### D. GSM Module

The GSM module requires a predetermined number, GPRS shield, and SIM card to send SMS messages with the GPS coordinates notification to a cell phone.

The general procedure used to deliver SMS is as follows:

- Place the SIM card in the slot provided as indicated in Figure 6, installed atop the GSM shield.
- Connect the module to the Arduino board.

- Connecting external power to the shield source using USB-to-Arduino cable. Gently push the power button to check the power On/Off indication.
- Observe how frequently the network LED blinks; it begins blinking rapidly for a few seconds looking for the network.

### E. Motor Driver

It uses a DC motor driver of type L293D Figure 7. Two DC motors are connected to and run by a dual H- bridge motor driver integrated circuit. Both in a clockwise and anticlockwise direction. It operates on the principle of an H-bridge, a type of circuit that allows voltage to flow in either way, allowing the motor to revolve either clockwise or anticlockwise. Two H-bridge circuits that may independently spin two dc motors are present in a single L293D chip.

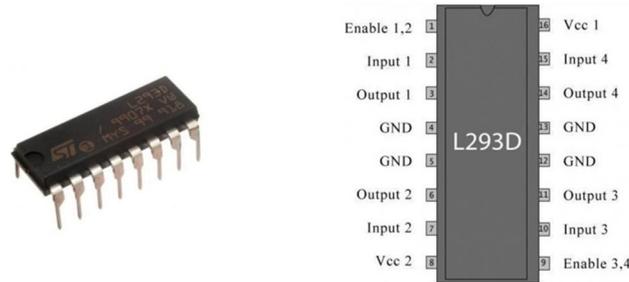


Figure 7. L293D pin diagram

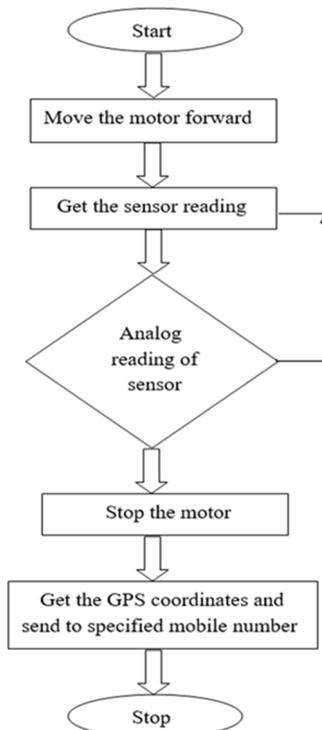


Figure 8. System flow chart



Figure 9. Proposed model

The input pins on the left (pin 2) and right (pin 15 and 10) will control how the motors on the left and right side rotate accordingly. The L293D is intended in positive-supply applications to drive inductive loads such as relays, solenoids, DC and bipolar stepping motors, as well as other high current/high voltage loads. The motors are spun according to the inputs given across the inputs as logic 0 or logic 1. A single L293D chip has two h-bridge circuits that may independently operate two dc motors. Due to its compactness it is very much employed in robotic applications for controlling DC motors. The pin layout of an is provided below L293D motor controller.

## V. SYSTEM SOFTWARE

The Arduino's code for proposed system is created in the C programming language. The program's strategy can be separated into four sections: The first section on the Arduino UNO's input output addressing, the second on moving the engine forward and getting sensor data, and the third on figuring out if there is a fracture by analyzing the sensor reading. The crack's latitude and longitude, as determined by the GPS module, are shown in the third section. The fourth section involves sending coordinates to a predetermined cell phone using a GSM module. Figure 8 illustrates the flow chart of the proposed system. Programs built using Arduino Software (IDE) are referred to as drawings. These drawings are created in a text editor and stored alongside the file UNO extension.

## VI. SYSTEM IMPLEMENTATION AND RESULTS

A pair of infrared sensor transmitter and receiver assembly makes up the proposed fracture detecting system crack finder. Up on the detection of a crack, signal is sent to the controller. A GPS receiver is enabled whose purpose is to receive satellite signals to determine the present location of the device. It uses the most recent latitude and longitude information. A GSM modem has been used to transmit the information that has been received. First stage in execution is to construct the suggested model, which is given in Figure 9 and secondly loading the code. The system is a conventional robot that resembles a basic toy. A single IR sensor that can detect cracks in the railway has been mounted in front of the robot. The motherboard that encloses the motor driver, GPS, and GSM modules, as well as the Arduino UNO board is principally responsible for the actual detection. The GPS & GSM modules will send information to a defined number along with geolocation Figure 10 and Figure 11.

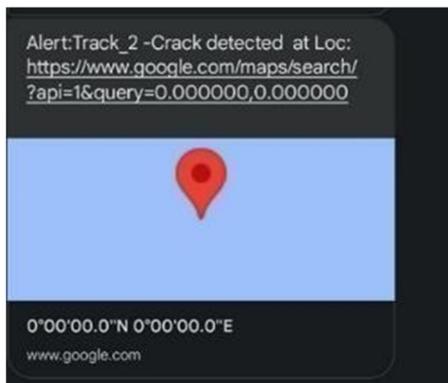


Figure 10. Geolocation images

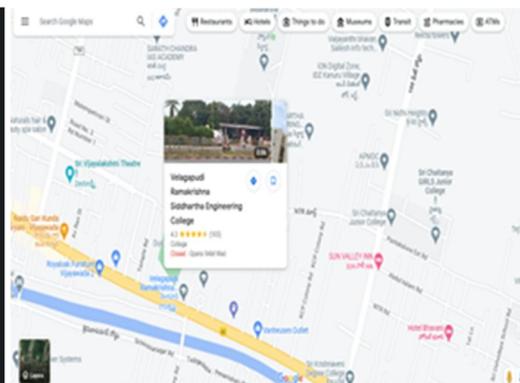


Figure 11. Geolocation images

## VII. CONCLUSION

The primary goal of this work is to use a robotic crack tracing system to replace the manual approach of railroad fracture identification. The proposed automatic rail track inspection system comprising Simple parts include a board for Arduino connected to IR sensors, motors, GSM and GPS modules was developed and tested on a prototype rail track. The system successfully detected the crack (which was intentionally put in the track) and sent the SMS with geo location of the crack to the predefined mobile number. Checking the SMS is far convenient compared to web based alert system as it just gives information of crack in single touch. The developed system is found reliable and economical, and it is useful in places where manual inspection is difficult and expensive, such as in mountainous, forested, and remote areas. The system is tested on both its software and hardware sides, and is working well. Hence the proposed system can be implemented on railroads. The presented system not only economical but it will save a significant amount of time in contrast to the modern techniques. Given that everything is automated, tracking how well the tracks are maintained may be the end less chance of error than conventional detection methods. Consequently, it will greatly reduce the likelihood of train accidents.

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# Automatic Industrial Gas Leakage Detection and Control System

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**Abstract**—This project's primary goal is to develop a successful functioning prototype that can detect the existence of gas leakage, which in this case is liquefied petroleum gas (LPG) and control the gas to prevent leaks in great amounts. The prototype should perform immediate data transfer and warning in addition to detection and control. This can be done by implementing an alerting system, such as an alarm via a buzzer, an application via a Wi-Fi module, and SMS via a GSM module. Here, the alerting system is in place to inform nearby residents and industry workers about the leakage. Once a leak has been discovered, the first step is to pinpoint its precise location. This can be done in two different ways. The first way is to check the pressure using a barometric pressure sensor in each region, if there is a difference between the pressure in one region and the previous which means a leak of gas has occurred; the higher the pressure drop, the bigger the leak. The second approach involves using an appropriate gas sensor, in this case MQ-6, to directly detect the gas concentration that is leaking. This is accomplished by comparing the error between the actual value and the predetermined value of the sensors. Here, we are combining both the approaches to increase redundancy. When this condition is met, an alert is triggered, and valves at the location of the gas leak are controlled using an Arduino Mega Controller. Further repair action will be performed at the damaged pipe line. This results in a shorter response time for damage restoration. As a conclusion, this project has offered students the chance to incorporate theories into solving issues relevant to the engineering scope of work.

**Index Terms**— Arduino Mega Rev 3, GSM module, ESP8266 Wi-Fi module, Sensor, HX710B Atmospheric Pressure Sensor Module.

## I. INTRODUCTION

Today's industrial accidents and worker fatalities are primarily caused by dangerous gas leakages. Consider the recent "VIZAG GAS LEAK" event that happened in LG Polymers on May 7, 2020, for a clearer understanding. This issue involved uncontrolled Styrene vapours coming from the boiler tanks. In the immediate aftermath of the tragedy, 12 individuals lost their lives, 585 people required hospital care, and cattle and vegetation were destroyed. This is one of the recent incidents to occur in our nation. In this decade, there have been a lot of other accidents.

Gas usage causes serious issues in both domestic and commercial settings. The gas that is used could be pricey

or hazardous. Therefore, if the gas that leaked is toxic, it may have negative effects on the worker's and the surrounding community's health. And if gas is expensive, the industrial management suffers a loss. So, to avoid these in most of the industries, one of the key parts of any safety plan for reducing risks to personnel and plant is the use of early-warning and controlling devices with the help of gas detectors. These can assist in giving you additional time to take corrective or preventative action. They can also be utilised as a component of an industrial plant's comprehensive, integrated monitoring and safety system. Gas leakage accidents, which are extremely significant and deadly, are caused by the oil and gas industry's rapid expansion. Since gas leaks also result in a large financial loss, solutions must be found at least to reduce the effects of these accidents. The difficulties lie in creating a prototype of a gadget that can not only detect leaks but also react to them automatically when they happen.

## II. LITERATURE SURVEY

### A. Previous Works and their Limitations

In the past, many authors came up with ideas to prevent and detect gas leakage. One such idea is presented in "IoT Based Industrial Plant Safety Gas Leakage Detection System," done by R. K. Kodali, R. N. V. Greeshma, K. P. Nimmanapalli and Y. K. Y. Borra [1], and the detection is also can be done through robotics, the authors Meer Shadman Saeed and Nusrat Alim done the work on "Design and Implementation of a Dual Mode Autonomous Gas Leakage Detecting Robot" in which they implemented a robot that detect the gas leakage in small tunnels, vents, pipelines where human can hardly make access to detect the leakage of gas [12]. Most of these studies deals with only detection and not on control action i.e., it cannot prevent the leakage of gas. After a time, some authors proposed some ideas which deals with detection as well as control. Here, the control action is primarily focused on shutting off the system if there is any leakage, which may be accomplished by installing a control valve at the inlet or by turning off the system's power [2,4]. Due this the gas accumulated in the pipes are released into the atmosphere creating damage and loss to the industry. Also, the whole process in the industry will be shut down until the damage is rectified. Some authors came with other ideas of having additional control system such as neutralizing gas system that will decrease the effect of toxic gas by releasing a neutralizing gas in fixed proportion based on amount of toxic gas detected that neutralizes the toxic gas leaked. Here also the gas is wasted until the damage is cured and the cost of installation of extra or additional system (neutralizing gas system) is not that much beneficial for any small and medium scale industry.

### B. Proposed Model to Overcome the Limitations

In order to get over these limitations, this study proposes an IoT-based automatic industrial gas leakage monitoring and control system. It can detect gas leakage from a variety of remote locations with continuous monitoring of leakage and is able to control gas leakage via control valves placed in the necessary positions in the pipe lines. It generates real-time leakage information that is accessible through the internet and SMS by working with a gas sensor, pressure sensors, microcontroller through Wi-Fi module and GSM module. This idea of prevention of gas can be also implemented in LPG gas cylinders to prevent gas leaks in households[11].

## III. PROPOSED SYSTEM

The primary functions of the proposed system are to detect gas leaks, monitor leakage data and control toxic gas leaks with ON/OFF switching of control valves. In this proposed system, a microcontroller Arduino Mega has been used, that is mainly connected with hardware components like gas sensors (MQ6), Pressure Sensors (Barometric pressure sensor), Wi-Fi and GSM modules and solenoid valves.

### A. Methodology

Figure 1 shows the block diagram of the proposed model, which is divided into three main sections, labelled (i) Inputs, (ii) Alert system, and (iii) Control system, presents the proposed prototype's overall system information. The Input section is composed of the sensor data which are pressure and Gas concentration that are given to the Micro Controller. The Alert system consists of some modules such as Wi-Fi module, GSM module and an LCD. Finally in Control section there will be an IC i.e., L293D which delivers the desired control signal to the desired control valves.

The system's fundamental concept is to employ solenoid valves to partition the pipe lines into segments or compartments. A pressure and gas sensor are placed at every segment. Having two sensors is intended to boost redundancy. Since any sensor could undergo damage, the others would continue to function. Various components of our suggested system are depicted in Figure 2. As shown in Figure 2, we have taken 3 segments

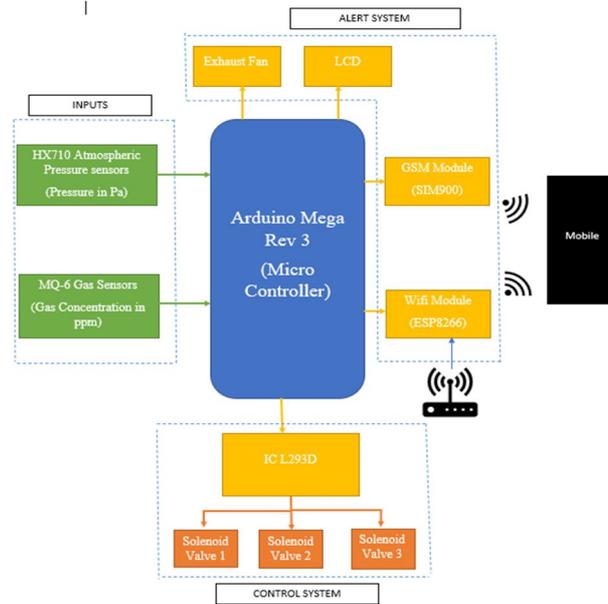


Figure 1. Block Diagram of the Proposed model

for our prototype. The primary objective of the system is to determine the location of the gas leak, or the precise segment where the gas leak occurred, by utilizing gas sensors (G1, G2, G3) and pressure sensors (P1, P2, P3). Opening any one of the hand valves (HV1, HV2, or HV3) in this prototype causes a leak at different positions. The attention shifts to controlling action once the damaged component has been located. Closing the control valves (Solenoid valves or air valves) at the beginning and end of the segment where the gas leak is occurring is the primary objective of the control action.

For a better understanding, if a gas leak occurred at segment 2, i.e., by opening of HV2, then there will be a change in pressure from segment 2, i.e., at P2, P3 respectively. We can also observe an exponential rise in the readings of the gas concentration in parts per million (ppm) with respect to the gas that is leaking at the gas sensor G2 only. The controller determines when to close the valves in relation to the intended set point by using these measurements of pressure change and gas concentration. Since we were using the MQ 6 sensor, whose range is 200 to 10,000 ppm, we had set the set point at 300 ppm. Whenever the concentration exceeds the predetermined level or whenever there is a significant shift in the pressure values from the previous segment, i.e., if the gas leak satisfied the aforementioned requirements, a signal from the Arduino controller is delivered to the solenoid valves, S2 and S3 which are located at the inlet and outlet of the segment 2 respectively. Additionally, a triggered signal is sent to the alarm system, which comprises of a GSM module that sends an SMS to factory workers informing them of the location of the gas leak and a Wi-Fi module that transmits continuous monitoring data from sensors to the ThingView application or ThingSpeak website over the internet [3]. In addition to these, we also have the most widely used equipment, such as an alarm (buzzer) to alert the industry that there is a leak and an exhaust fan to remove the gas leak into the atmosphere. Due to this segmentation and closing of control valves there will be a minor gas leak which will be released and breathed into the atmosphere where it does not significantly impact the health of the people in and around the industry premises. Therefore, since the desired position of the leakage at a specific section is known, less time is needed for damage restoration.

### B. Hardware and software

The hardware setup is shown in Figure 3. A brief description about the hardware used is given below.

#### Arduino Mega 2560 Rev 3

The ATmega2560 serves as the basis for a microcontroller board known as the Arduino Mega 2560. (datasheet). It includes 16 analogue inputs, 4 hardware serial ports (UARTs), a 16 MHz crystal oscillator, 54 digital input/output pins (14 of which can be utilized as PWM outputs), a USB connector, a power jack, an ICSP header, and a reset button. It is used to obtain sensor data and produces activation signals that operates the solenoid valves and sends alert signals.

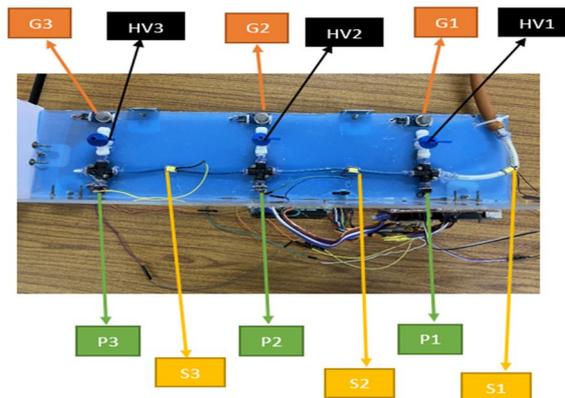


Figure 2. Top view of the proposed prototype

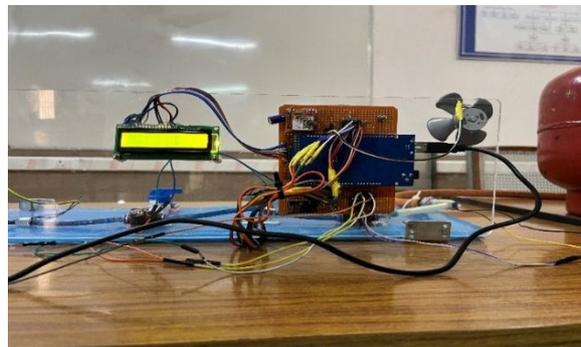


Figure 3. The hardware setup

#### *MQ-6 Sensor*

The MQ6 Gas Sensor is a Metal Oxide Semiconductor (MOS) type Gas Sensor that is primarily used to identify the presence of Butane and LPG in the air. The MQ 6 sensor has a range of 200 to 10,000 ppm [5].

#### *GSM Module*

SMS notifications are sent using a SIM900 GSM module when gas is detected. GSM is intended to be a tool for exchanging information [6].

#### *Piezo buzzer*

The buzzer's primary function is to transform the input signal, which is current (less than 15 mA), into sound.

#### *HX710B Atmospheric Pressure Sensor Module*

Atmospheric Pressure Sensor Module, HX710B, with an altitude resolution of 10 cm is used. This barometric pressure sensor is best used with altimeters and variometers. The sensor module can sense 0-40KPa air pressure. This sensor can be used to monitor water level and other air pressure [7].

#### *LCD*

LCD is employed for displaying the message indicating that “gas detected at zone” into the display, which is initially coded in program to display the danger.

#### *Wi-Fi Module*

A self-contained SOC with an integrated TCP/IP protocol stack, the ESP8266 Wi-Fi Module allows any microcontroller to access your Wi-Fi network. The ESP8266 is capable of offloading all Wi-Fi networking tasks from another application processor or hosting an application [8].

#### *Exhaust fan*

Exhaust fans are used for exhaling of toxic gases in industries.

#### *Solenoid Valves*

It is an electromechanical valve that is often used to control the flow of liquid or gas. There are many different kinds of solenoid valves, but the two most common varieties are direct acting and pilot driven [9].

### IC L293D

L293D IC is a typical Motor Driver IC which allows the DC motor to drive on any direction. Here in this prototype, it is used for opening and closing of solenoid valves [10].

### C. Proposed system design flow

The flowchart diagram in Fig. 4 depicts the entire hardware connection process of the suggested system design. Following are some quick discussions of the process flow's steps:

- **Step 1:** Firstly, connect all the Modules and other components to the Arduino Mega Micro controller.
- **Step 2:** Get the sensor data from the respective sensors that are placed at respective locations.
- **Step 3:** Check whether the predetermined condition is satisfied or not, that is if the Gas concentration from the MQ-6 Gas sensor is greater than or equal to 300 ppm or if there is an exponential change in the Pressure values from Pressure sensor.
- **Step 4:** If the condition is not satisfied then go back to the second step.
- **Step 5:** If the condition met then Arduino finds the location where the leakage is occurred with the help of sensor data.
- **Step 6:** Now it sends a triggered signal to all the alert systems such as GSM module and Wi-Fi module and also share the sensor data with them.
- **Step 7:** It also sends the control signal (CO) to IC L293D to apply the desired control action at desired control valve.

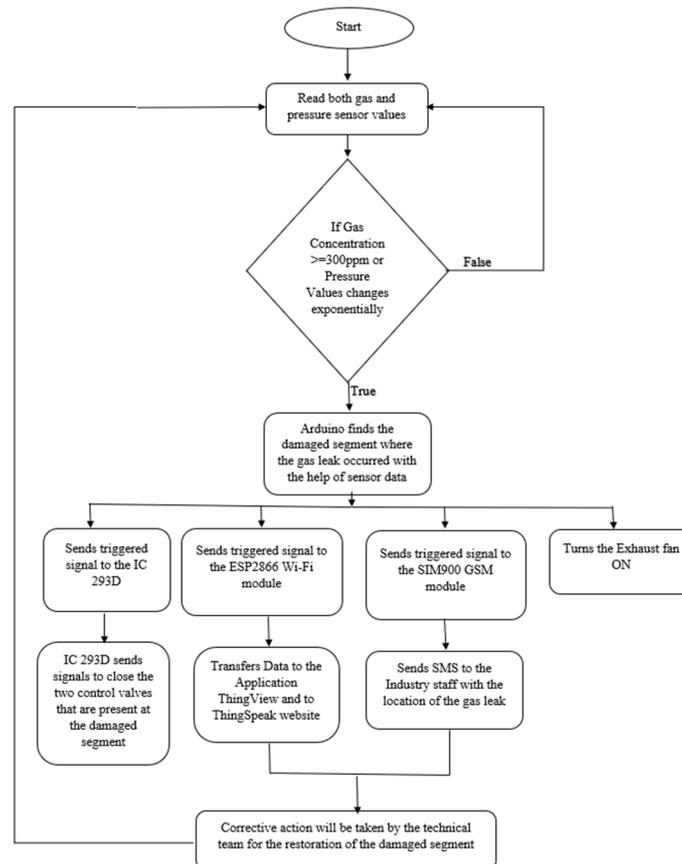


Figure 4. Flow chart of the proposed system

## IV. EXPERIMENTAL RESULTS

Figure 5 shows both the hardware and software setup circuit with Arduino Mega, pressure and MQ-6 sensors, control valves and a PC for detection, indication of position of gas leakage in the pipelines on LCD display and the control action taken.

As mentioned earlier in Methodology section, let us study the same example practically. That is if leakage is occurred at second segment which is done by opening second hand valve, then the sensor parameter changes are shown in Table 1.

Figure 6 shows the LCD display which displays the pressure and MQ-6 sensor readings. Here in the display the first line shows the Pressure values and second line gives the gas concentration values. Here A, B, C indicates the segments 1, 2, 3 respectively. When the gas leakage occurs, then the LCD displays the location of gas leakage(Location 2) with respect to the pressure and MQ-6 sensor as shown in Figure 7.

TABLE I: OBSERVATIONS

Parameters	Before opening the 2 <sup>nd</sup> hand valve	After opening the 2 <sup>nd</sup> hand valve
Pressure at position 1 (A)	320 Pa	215 Pa
Pressure at position 2 (B)	315 Pa	215 Pa
Pressure at position 3 (C)	310 Pa	220 Pa
Gas concentration at Position 1 (A)	0 ppm	0 ppm
Gas concentration at Position 2 (B)	0 ppm	431 ppm
Gas concentration at Position 3 (C)	0 ppm	0 ppm

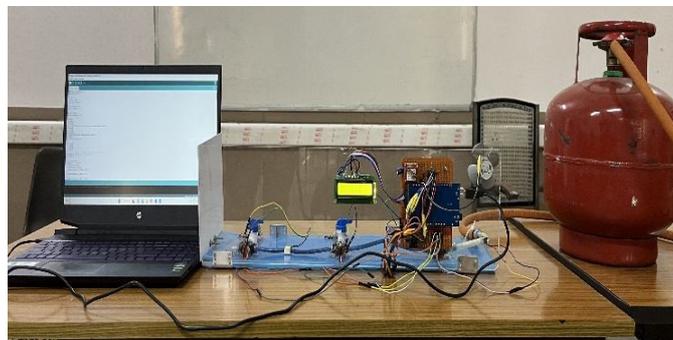


Figure 5. Proposed prototype model



Figure 6. LCD display showing the gas and pressure sensors readings



Figure 7. LCD display showing the position of leakage

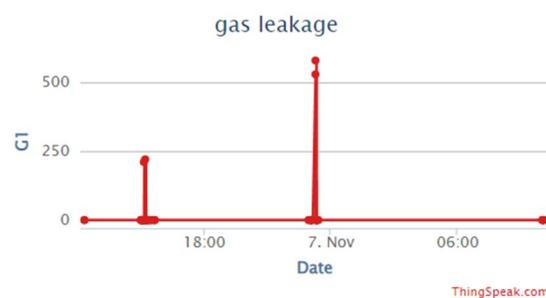
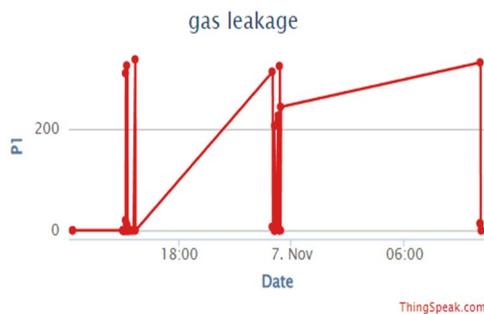


Figure 8. (a) Graphical Representation of pressure (Pa) values in ThingSpeak at segment 1, (b) Graphical Representation of Gas concentration (ppm) values in ThingSpeak at segment 1

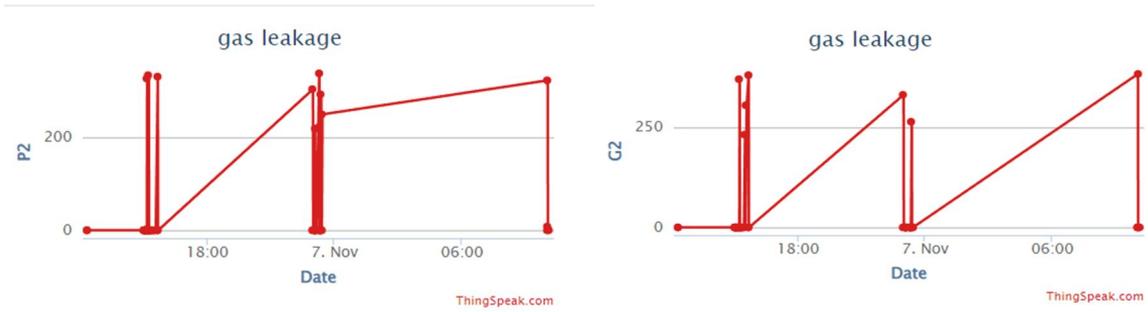


Figure 9. (a) Graphical Representation of pressure (Pa) values in ThingSpeak at segment 2, (b) Graphical Representation of Gas concentration (ppm) values in ThingSpeak at segment 2

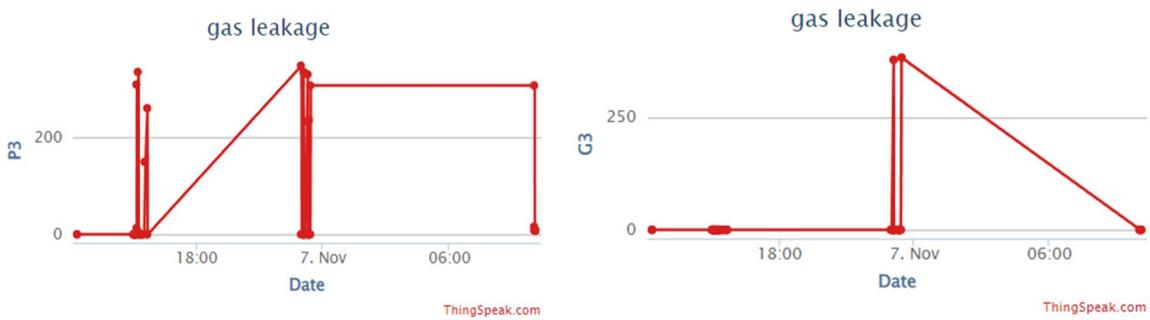


Figure 10. (a) Graphical Representation of pressure (Pa) values in ThingSpeak at segment 3, (b) Graphical Representation of Gas concentration (ppm) values in ThingSpeak at segment 3

Coming to the alerting system, the SMS and Graphical analysis data will be sent to the application or website. The Figures 8,9,10 gives the individual sensor data with respect to time which is sent to the ThingSpeak website through Wi-Fi module to get aware of the data in the form of graphs and a warning is sent when the gas leakage exceeds the limit. The same data can also be seen in mobile through ThingView application. For better understanding, visit the website through the link <https://thingspeak.com/channels/243722>.

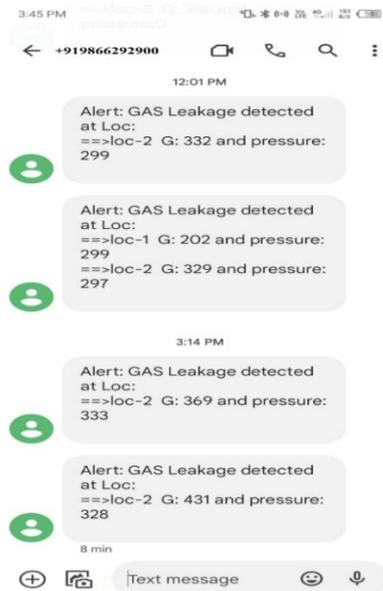


Figure 11. SMS sent to the registered mobile with sensor values

The Data is also sent to the mobile as SMS as shown in Figure 11 by using SIM900A Quad Band GSM/GPRS Module.

## V. CONCLUSION

In terms of the project's goals, the prototype has given adequate answers for preventing the toxic gas leaks in industries at low cost. The detection, alerting, and control systems make up the prototype's three core parts. The detection part is designed with a MQ-6 sensor and a HX710B atmospheric pressure sensor. The control system is constructed using solenoid valves, an Arduino Mega controller, an exhaust fan, and an IC L293D. The alert system is created using an LCD, an ESP8266 Wi-Fi Module, and a SIM900 GSM Module. This alert system is incorporated to increase public awareness of toxic gas leaks, which in turn lowers accidents brought on by toxic gas leaks. The integration of these three systems gives us accurate results. The prototype's design eliminates all the limitations of previous works and makes it simple for both small and large-scale companies to deploy without making significant changes to the existing system.

## FUTURE SCOPE

Other types of sensors, as well as other actuators, can be employed that may perform better than the traditional paradigm. It also enables flexibility because other modules may be introduced without affecting the existing modules for taking control actions and alerting system.

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# Polymer Conducting Nanocomposite Film to Improve Electromagnetic Compatibility of Electronic Devices

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**Abstract**—This article presents the analysis of polymer conducting nanocomposites (PCNC) to improve the electromagnetic compatibility of various electronic equipment. PCNC has been fabricated using the reduced graphene oxide (rGO) as a filler, and poly (vinylidene fluoride-co-trifluoroethylene) [P(VDF-TrFE)] polymer as insulating polymer matrix. Simplest and efficient method of solution casting was used for fabrication purpose. The obtained nanocomposite films were characterized for surface structure using Scanning Electron Microscopy (SEM) technique. The dielectric parameters were obtained in the frequency region of 10KHz to 1MHz accordingly the shielding effectiveness was calculated using the dielectric parameters. The developed sheets are cost effective, flexible and showing excellent EMI shielding properties around 30dB for shielding of various electronic equipment to enhance their electromagnetic compatibility.

**Index Terms**— Nanocomposite, Electromagnetic Interference, Solution casting, Shielding effectiveness, flexibility.

## I. INTRODUCTION

Nowadays various electronic devices are used in close vicinity to each other. The electromagnetic interference (EMI) which occurs due to interference in electrical and magnetic fields of electronic devices could disturb the functioning of any device as well as can interrupt the working of other devices in same confined space, which can be dangerous [1,2,3]. Various studies shown that there has been rise in number of calamity due to EMI. These calamities are mostly found in an environment where so many electronic devices are working at the same time [4] as noted by rathi et al. To tackle with this problem, the manufacturing companies of electronic devices putting their constant efforts. They want to fortify the safety features of electronic devices to the effects of electromagnetic radiations (EM). The solution of this problem is to offer a shielding for EM radiations. By shielding a device, electromagnetic compatibility of the device can be improved. To guard any electronic device, we need to stop the transmission of EM radiation through a shield called EMI shield.

Electrical conductivity is most significant requirement of EMI shield. We know that all metals are very good conductor of electricity. So they are assumed to be perfect source of protection against EMI waves. But they have some limitations also, like heavy weight, rigid and rusting nature. In today scenario, an alternative is used,

which is a polymer based conducting composites. They are considering to be best substitute for EMI shielding over metals [5,6]. Polymer composites are light in weight, flexible, non-corrosive and very cost effective which make them good choice for creating an EMI shield. Conducting polymer composites are fabricated by adding conducting fillers within the insulating polymer matrix. Fillers are added to insulating polymer matrix using techniques like blending, casting, in sites, polymerization etc. These conducting fillers then form conducting channels in polymer matrix to allow the electrons movement. The conducting polymer composite enhance the ability of material to shield EM waves known as EMI Shielding Effectiveness (SE). SE is expressed in dB (SE dB). It is expressed as sum given from reflection, absorption & multiple reflection [7,8]. So, it can be concluded that

$$SE = A + R + CF. \quad (1)$$

This relation helps in understanding the shielding effect. Here, A is absorption loss, R is reflection loss CF is loss to multiple reflection in the shield.

Nowadays, to resolve the problems of thickness & flexibility we need to fabricate flexible polymer conducting nanocomposite (PCNC) film. For present work poly (vinylidene fluoride-co-trifluoroethylene) [P(VDF-TrFE)] has been used for matrix material & reduced graphene oxide (rGo) has been used as a conducting filler. P(VDF-TrFE) have many features, like its flexibility, easily process able, and of light weight in comparison to other materials [9,10]. It is a ferroelectric copolymer that have a large dipole moment and dielectric constant. rGo is used as a filler due to its property of easy soluble and cost effectiveness, Other main advantages of rGo is that they are efficient in making EMI shield films & they have capability to form thin nano-composites. Different compositions of P(VDF-TrFE)/rGo composite were fabricated with different concentration of rGO as 5wt%, 10wt% and 15wt% so we obtained the films with composition as 95/05 , 90/10 and 85/15 respectively. using solvent casting method. The dielectric properties of the fabricated films were measured as the function of frequency (10KHz to 1MHz) by network analyzer accordingly the SE of the films was calculated. Scanning Electron Microscopy (SEM) was used to get the idea of fabricated film's surface morphology. Mechanical strength of the films was measured to get the idea of flexibility of the films.

## II. EXPERIMENTAL

### A. Materials

The PCNC films were developed using the polymer P(VDF-TrFE) (99.9 % pure) powder purchased from Piezotec Arkema group. The polymer molecular weight was 200,000 g/mol. rGo was used as the conducting filler having product ID-777684, in powdered form as solutes and for dissolving the solutes and N,N-Dimethylformamide (DMF) was used as solvent to form a heterogeneous solution. The items were purchased from Sigma Aldrich, India.

### B. Fabrication of Nanocomposite Film

The simple and effective technique of solution casting was used to develop P(VDF-TrFE)/rGo PCNC. Fig. 1 describe the process of solution casting method. Firstly the P(VDF-TrFE) is dissolved with DMF in a glass tumbler. The combination of P(VDF-TrFE) and DMF was heated at a temperature of around 80°C for approx 2 h with a stirring speed at 400 rpm so that we get a homogenous solution. After this rGo with different ratio is added in that solution, the obtained solution was again heated at 50°C for around 5 h. Acquired uniform solution is transferred into a glass petri dish and allowed to heat slowly so that solvent can be removed from the petri dish. Once the films are completely dried, the films can be unwrapped from the petri dish. The same process of fabrication was repeated for the different concentration of rGO as 5wt%, 10wt% and 15wt% so we obtained the films with composition P(VDF-TrFE)/rGo as 95/05 , 90/10 and 85/15 respectively.

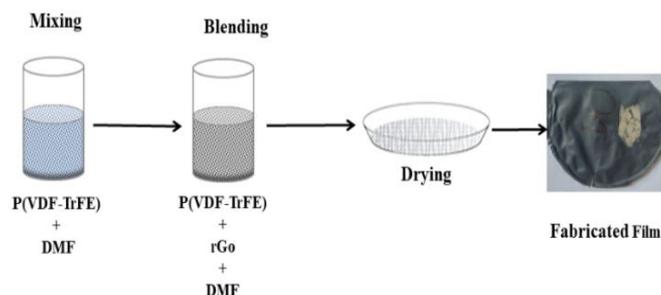


Figure 1. Fabrication process of Composite Film

### III. RESULTS AND DISCUSSION

#### A. Surface morphology of composite films

With the help of SEM images we get the idea of surface morphology of the fabricated CPNC. Fig. 2 shows the SEM images of fabricated films. Fig. 2(a) shows the morphology of pure P(VDF-TrFE) we can see the spotted grain structure like surface of the film as reported earlier [11,12]. Fig. 2(b) and 2(c) shows the SEM image of 90/10 and 85/15 respectively. We can see the effect of rGO on the surface, clearly the conducting channels can be seen on the surface of P(VDF-TrFE) as concentration of rGo increases the conducting channel increases.

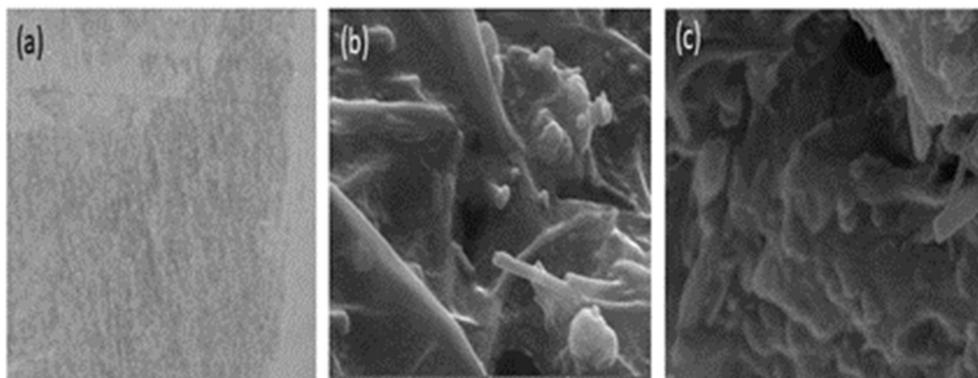


Figure 2. SEM images of (a) pure P(VDF-TrFE); (b-c) SEM images of composition 90/10, 85/15 of P(VDF-TrFE)/rGo respectively

#### B. Dielectric analysis

SE of fabricated CPNC samples was calculated with help of dielectric parameters in the frequency range of 10 KHz to 1 MHz. Conductivity ( $\sigma$ ) and Dielectric constant ( $\epsilon'$ ) of the fabricated CPNCs are shown in Fig. 3(a) and (b) with respect to the frequency. SE of the films mainly depends on conductivity, it is clear from the graph that conductivity of film with 85/15 P(VDF-TrFE)/rGo ratio is maximum and the film with composition 95/05 P(VDF-TrFE)/rGo has smallest value of conductivity. The main cause for this is the formation of various conducting channels between the interfacial area of polymer matrix, which increases the dipole moment. Dielectric constant of the films also calculated and it is maximum for film with 15% of rGo.

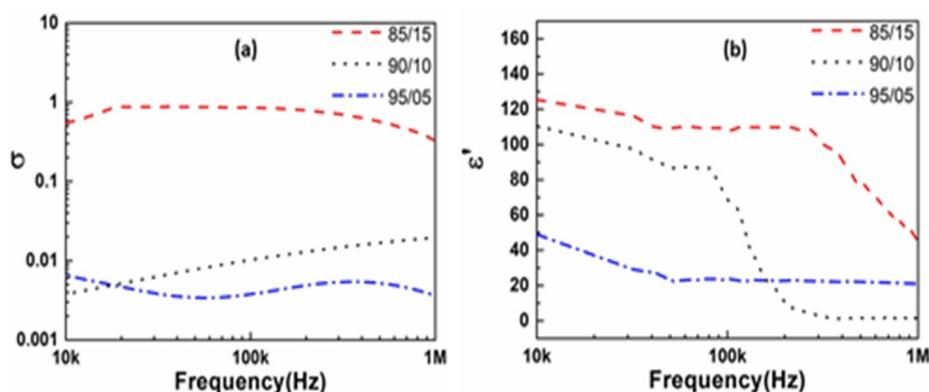


Figure 3. (a) Conductivity; (b) Dielectric constant of fabricated films

#### C. Mechanical Properties

The mechanical properties analysis gives the idea about the performance of the fabricated films when the films are lay open to stretching or pulling force before it fails [13]. The mechanical properties of films with combination labels 85/15,90/10,95/05 are depicted in the stress – strain diagram shown in Fig. 4. From the graph we can observe that 85/15 is the most brittle among these films and 95/05 is the most ductile material. The toughness of the films will depend on area under the curve in stress – strain diagram which is different for all hence, the toughness for them will also be different. The film with composition of 90/10 is the most satisfactory material according to the graph but still we can see the composition 85/15 have flexibility of 0.7mm and can bear

a load of around 1.5 MPa however as the concentration of conducting filler decreases the flexibility and mechanical strength of the films increases.

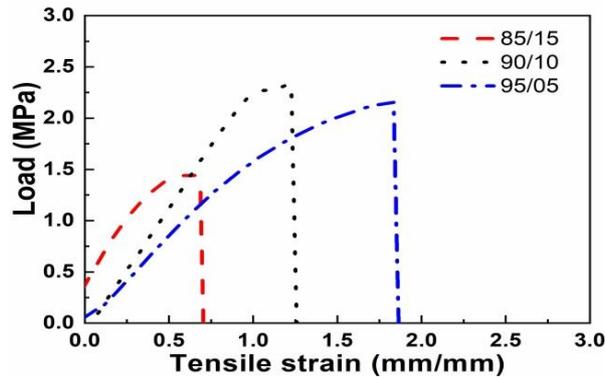


Figure 4. Shielding Effectiveness of obtained films

#### D. EMI Shielding Analysis

We have already described that SE can be measured with the help of A, R and CF. Total value of SE of P(VDF-TrFE)/rGo is presented in Fig. 5. We can see from the figure that the SE value increased with increase in rGo content and decreased with frequency generally. The CPNC having 15 wt% of rGo filler content showed maximum value of SE. The maximum value of 36 dB at 10KHz was attained for 15 wt% of rGo in P(VDF-TrFE)/rGo conducting polymer composite. The film with 5wt% of rGo the SE is low it is around 10dB for examined frequency region. After the concentration of 15wt% of rGO there is no significant increase in SE, so that should be its percolation threshold level.

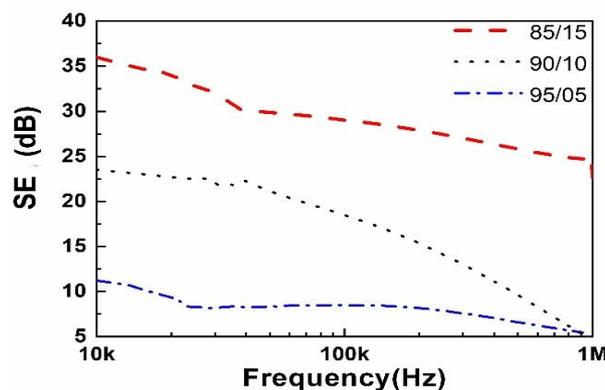


Figure 5. SE of obtained films

#### IV. CONCLUSION

In the presented work thin, cost effective and flexible composite sheets have been developed for EMI shielding application. As we increase the content of filler in the composition of film the SE of films get increases as well. With the study of dielectric and SE analysis, we can say that the CPNC with 15wt% of rGo is giving most suitable result as, it's SE is highest and it is in between 36dB to 25dB for examined frequency range of 10kHz to 1Mhz. Its conductivity is also highest among other fabricated CPNC. Also the mechanical properties of CPNC with 15wt% of rGo is satisfactory. This is also clear from SEM images that the rGo filler distributed evenly through P(VDF-TrFE) polymer matrix. The fabricated P(VDF-TrFE)/rGo composite film has a very good prospect to be used as a flexible EMI shielding film to increase the electromagnetic compatibility of various electronic equipment.

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# Floating Sun Tracking Solar Panel

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**Abstract**—The future of renewable power generation is Solar power. The main problem with solar power generation is solar panels occupy more area on roof tops, open areas and they are not easy to mount. The concern with solar panels is that they are difficult to install, maintain, and clean on a regular basis. They also take up a lot of room on roofs or other open spaces. Additionally, shifting the solar panels in accordance with the position of the sun may produce up to 40% more solar electricity. Here, we suggest a of solar panel that may be placed on bodies of water, like lake pools, freeing up space on the ground. We also provide a novel technique that is sun tracking floating solar for moving solar panels in accordance with the position of the sun using LDR sensors, which would increase power production and the floating system in the water resists the solar panel from overheating. Additionally, the water is also conserved due to reduction in evaporation of water from the water body. In the upcoming 10 years, India proposes the generation 1GW and 1.75 GW of solar Photo Voltaic power from renewable energy sources. As on date around 5000MW has been commissioned in different parts of country, as per the Jawaharlal Nehru Solar Mission. To meet the target, there is a need to produce more solar energy in short span of 10 years. Floating solar Photo Voltaic plants are an emerging form of PV systems, that floats on the water bodies like canals, water reservoirs, lakes, and ponds. This paper proposes a prototype of floating sun tracking solar panel to increase the production of solar energy using floating solar panels, Raspberry Pi Pico microcontroller board, Thonny IDE software.

**Index Terms**— Raspberry Pi Pico microcontroller board, Thonny IDE, Current Sensor module, DHT11 temperature and Humidity Sensor.

## I. INTRODUCTION

The standard solar panel does not have much efficiency and the production of energy is very little. To overcome this problem, we have proposed a floating sun tracking solar panel. The floating Photo Voltaic system exploits many functions such as cooling, concentrating, and tracking. The outcomes of the system have designated an important influence on cooling and tracking on the system competence. The main advantage is large amount of solar energy production when compared to roof top solar panels and the solar panel is introduced in the water therefore due to cooling effect of water the panel will not get heated continuously[1]. This increases the efficiency of solar panel which also leads to production of large amount of energy. More electricity will be generated due to cooling effect of water in floating solar than the terrace roofing systems. The geometry of the given system has been determined with two major aspects [2]. Firstly, the module should protect as much water

as possible to avoid water evaporation. Secondly, the size of the module is adapted to the commercially available PV modules in the market.

## II. IMPLEMENTATION

Fig.1 represents the floating sun tracking solar panel flow diagram. The heart of the system is the controller, i.e., Raspberry Pi Pico RP2040. Single axis solar panel is used, which rotates in  $180^{\circ}$  according to this position maximum amount of energy is absorbed by the LDR. The panel rotation is done with the help of servo motor. Micro Python is used in Raspberry Pi Pico for rotating the servo motor. The floating of the panel is done with the help of vacuum filled tubes [3]. The solar panel continuously rotate in the direction of sun with the help of servo motor. Thus, the Photo Voltaic cells absorb the maximum amount of energy from the sun. Chargeable batteries are used to store energy for future needs. The floating solar panels can be installed at the existing power plants. These floating solar panels keep water bodies fresh and clean while generating the renewable energy.  $16 \times 2$  LCD is used to display the generated voltage. Due to continuous rotation of panel in the sun direction there is continuous heating this reduces efficiency in solar panel. In order to overcome this, we use floating solar panel as it continuously dissipates the heat. When compared to roof top solar panels, efficiency of the floating solar panel is increased by 35%. A solar panel of 100 watts when received 10 hours of direct sun-hours per day will generate 2kWh of energy. Then the maximum energy annually produced is 730kWh [4].

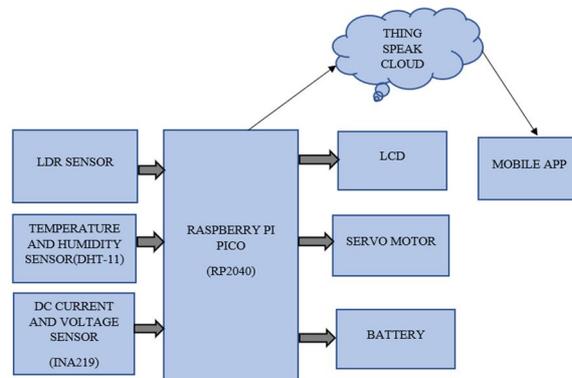


Fig.1 Functional process flow diagram

## III. PROPOSED SYSTEM WORKING FLOW

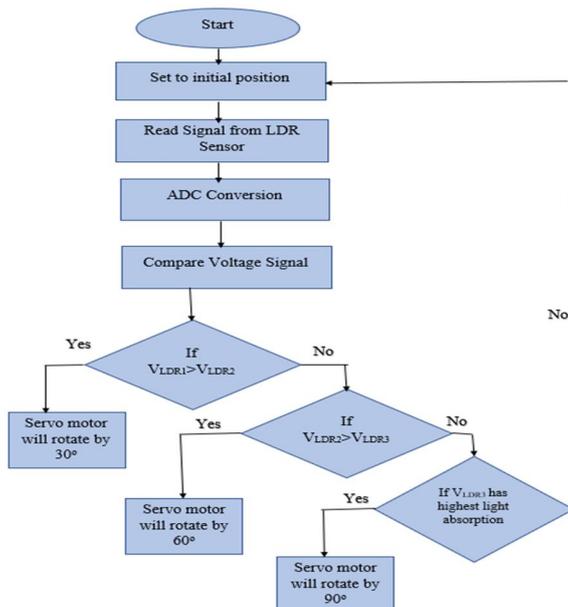


Fig.2 Flow Chart for the Working of Proposed System

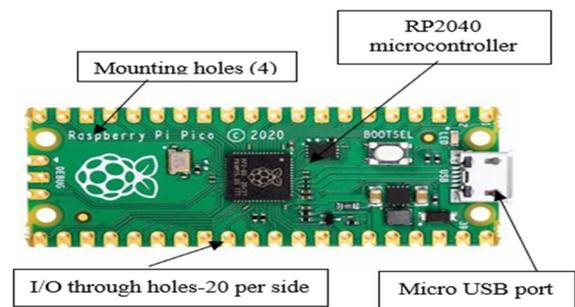


Fig.3 RP2040Raspberry Pi Pico

The flowchart diagram in Fig.2 depicts the working process of the suggested system design. Following are some quick discussions of the process flow steps:

- **Step1:** Place the Solar Panel on a roof top or in an open area.
- **Step2:** Connect the model to an external power supply for rotating the servo motor.
- **Step3:** If the LDR1 has absorbed more voltage than LDR2, the servo motor rotates in 30° Clockwise direction.
- **Step4:** If the LDR2 has absorbed more voltage than LDR3, the servo motor rotates in 60° Clockwise direction.
- **Step5:** If LDR3 absorbs the maximum voltage, then the servo motor rotates in 90° clockwise direction.

#### IV. HARDWARE AND SOFTWARE

##### A. RP2040 Raspberry Pi Pico

The RP2040 Raspberry Pi Pico shown in fig.3 is a dual-core Arm Cortex-M0+ processor with 264KB internal RAM and it supports up to 16MB of off-chip Flash [5].It has 40 I/O pins. Among 40 pins, 26 are multipurpose GPIOs and it has 8 ground pins. It has 3 pins for debugging.

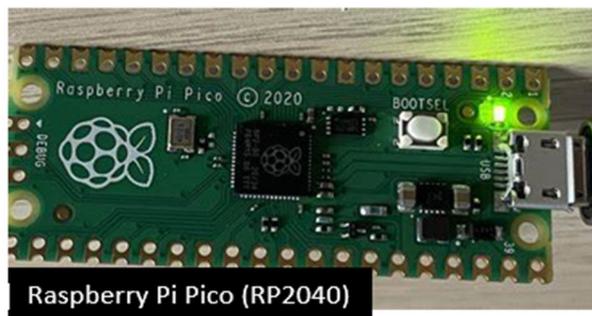


Fig.4 Pin configuration of RP2040

Fig.4 shows the pin configuration of Raspberry Pi Pico. The Raspberry Pi Pico consists of an integrated temperature sensor and low power sleep and dormant modes. Table.1 shows the specifications of Raspberry Pi Pico (RP2040).

TABLE I. RP2040 SPECIFICATIONS

S. No	Parameters	Specification
1	Microcontroller	RP2040
2	Operational voltage range	1.8Volts-5.5 Volts
3	Processor	Dual-Core and Arm Cortex-M0+
4	SRAM	264KB
5	Flash Memory	2MB

##### B. INA219 Dc voltage and current Sensor Module

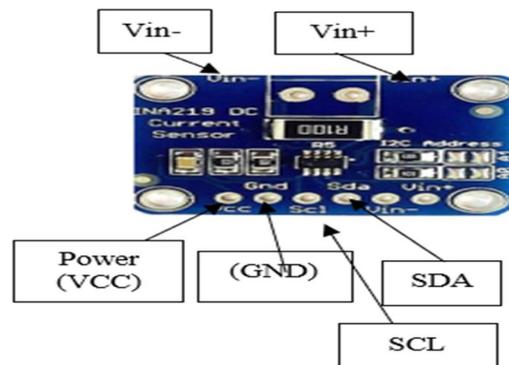


Fig.5 INA219 based Dc voltage and current Sensor Module

Fig.5 shows a INA219 based DC voltage and Current sensor module. CJMCU-219 is a zero drift I2C interface based. It is a bidirectional current/power monitoring module. It is an essential component of power monitoring system. It is capable of sensing current, voltage, power. It transmits data to host microcontroller using I2C bus protocol. The specifications of CJMCU-219 current sensor module is given in Table.2 [6].

TABLE II. CJMCU-219 SPECIFICATIONS

S. No	Parameter	Specification
1	Power Input	3 Volts to 5.5Volts
2	Target Voltage	+26V max
3	Current sense resistor	0.1 ohm 1% 2W
4	Bus Voltages	0 to 26 V
5	Compatible interface	2C- or SM Bus

### C. LDR Sensor

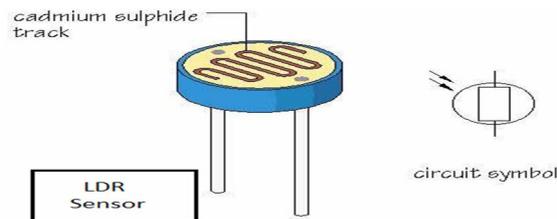


Fig.6 LDR Sensor

LDR or light dependent resistor is shown in Fig.6. It is a kind of resistor whose resistance changes depending on the amount of the light falling on its surface and it is made of a high resistance semiconductor. These resistors are used in circuits where it is required to sense the presence of light. It's operation is based on semi conductivity. LDR has a variety of functions and resistance. The electrons in the semiconductor material's valence band are stimulated to the conduction band when light strikes the object, or when photons strike it. To cause the electrons to move from the valence band to the conduction band, the incident photons must have an energy larger than the bandgap of the semiconductor material. As a result, when sufficiently energetic light impacts the device, a huge number of charge carriers are produced as more and more electrons are driven to the conduction band[7].

### D. DHT-11 Temperature and Humidity Sensor

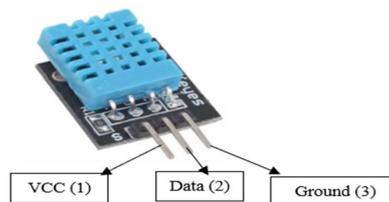


Fig.7 DHT-11 Temperature and Humidity Sensor

Fig.7 shows a digital sensor DHT11 for measurement of Humidity and temperature. The sensor is interfaced with the Raspberry Pi Pico. This DHT11 is available as both sensor and module. In this prototype we are using DHT11 sensor. DHT11 measures the surrounding air using thermistor and capacitive humidity sensor [8]. Table.3 shows the specifications of DHT11 Temperature and Humidity Sensor.

TABLE III. DHT11 SPECIFICATIONS

S. No	Parameter	Specification
1	Operational Voltage	3.5V - 5.5V
2	Operational Current	0.3mA(measuring) 60uA (standby)
3	Output data	Serial data
4	Temp Range	+0°C - +50°C
5	Humidity Range	20% - 90%
6	Accuracy	±1°C & ±1%

### E. LCD

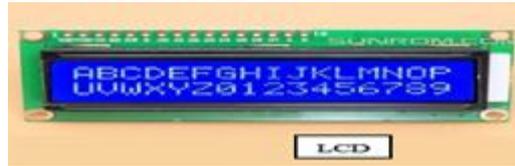


Fig.8 16X2 LCD

LCD mean liquid crystal display is shown in fig.8. This 16x2 LCD working principle is, it blocks the light rather than dissipate. It is an electronic display module used in many applications like mobile phones, calculators, and computers. The LCD used here has 16x2 display with 40 pins [9]. The main advantages of using this kind of LCD are they are inexpensive, simply programmable also there are no limitations for displaying custom characteristics.

### F. MG995 Servo Motor



Fig.9 MG995 Servo Motor

Fig.9 shows a MG995 which is a heavy-duty reliable servo motor. It is a high-speed actuator with dual bearings. It is a low power, and cost effective which is feasible for Industrial production. A maximum torque of 208 oz-in is delivered at 6 volts. It has a maximum rotational speed of 0.13 seconds per 60°. If the voltage is dropped to a smallest of 4.8 volts, it maintains a torque of 180 oz-in and rotates with a speed of 0.17 seconds per 60° [10].

### G. Thing Speak IOT Platform

Thing Speak is an IOT platform used for gathering the real-time data like location, climatic changes information and other device data. In our proposed floating sun tracking solar panel model this IOT platform is used to collect the voltage of both the floating solar panel and the static solar panel.

### H. Thonny IDE

Fig.10 shows the interface of the Thonny IDE. It is the platform used for coding. We use Micro python for programming the servo motor to rotate in the direction of the sun.

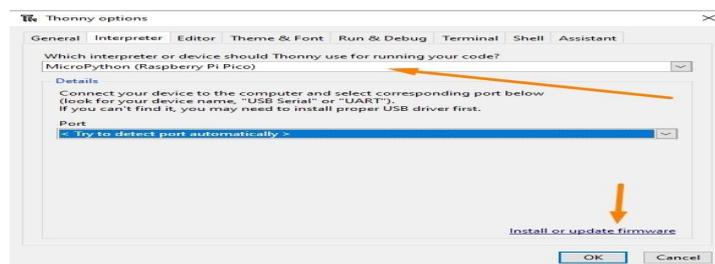


Fig.10 Interface of the Thonny IDE

### I. Micro Python

Micro Python is a Python 3 programming language. It contains a small subset of Python library and is enhanced to run on microcontrollers and in obliged environments.

## V. HARDWARE AND SOFTWARE INTERFACING

The software and hardware interfacing connections are depicted in Fig.11 and Fig.12 shows hardware connections. The solar panel is exposed to light after interfacing [11]. Then the panel will rotate in the direction

of the sun with the help of servo motor. The amount of voltage generated is shown in the LCD display and the current, voltage and Temperature readings are taken from the thing speak cloud using the Wi-Fi module ESP8266. This is specifically for use in Internet of Things (IoT) systems. With a 32-bit processor, some RAM, and, depending on the supplier, between 512KB and 4MB of memory, the ESP8266 is a complete Wi-Fi system on a chip. This enables the chip to work as a standalone device that can run simple programmes or as a wireless adaptor that can add Wi-Fi functionality to other systems.

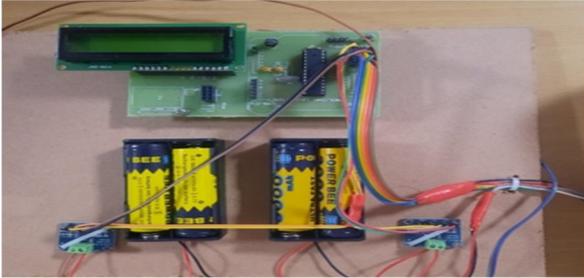


Fig.11 Hardware and Software Interfacing

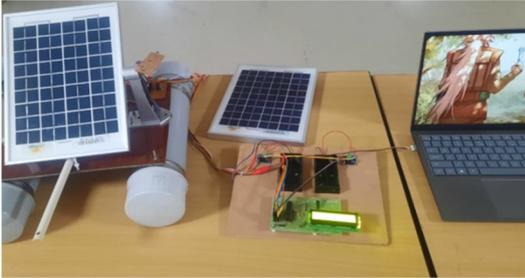


Fig.12 Hardware connectional diagram

VI. RESULT

There were two solar panels tested. The other is a floating sun tracking solar panel, while the first is a static rooftop solar panel. The static solar panel is positioned at a 33-degree angle since this will ensure that its power production is maximised. From 8 AM to 6 PM, the test was conducted continuously across three days, with measurements being made continuously. In this test, a load was used to compute the solar panel's current and voltage (battery of capacity 15V-17V). Figures 13,14,15 shows the voltage, current and temperature readings of the static solar panel and Figures 16,17,18 shows the voltage, current and temperature readings of Sun Tracking Floating solar panel in Thing Speak IOT platform and the readings were taken for every 15 minutes from 8:00 AM to 5:00 PM. The following results shows that the floating sun tracking solar panel is more efficient than static solar panel.

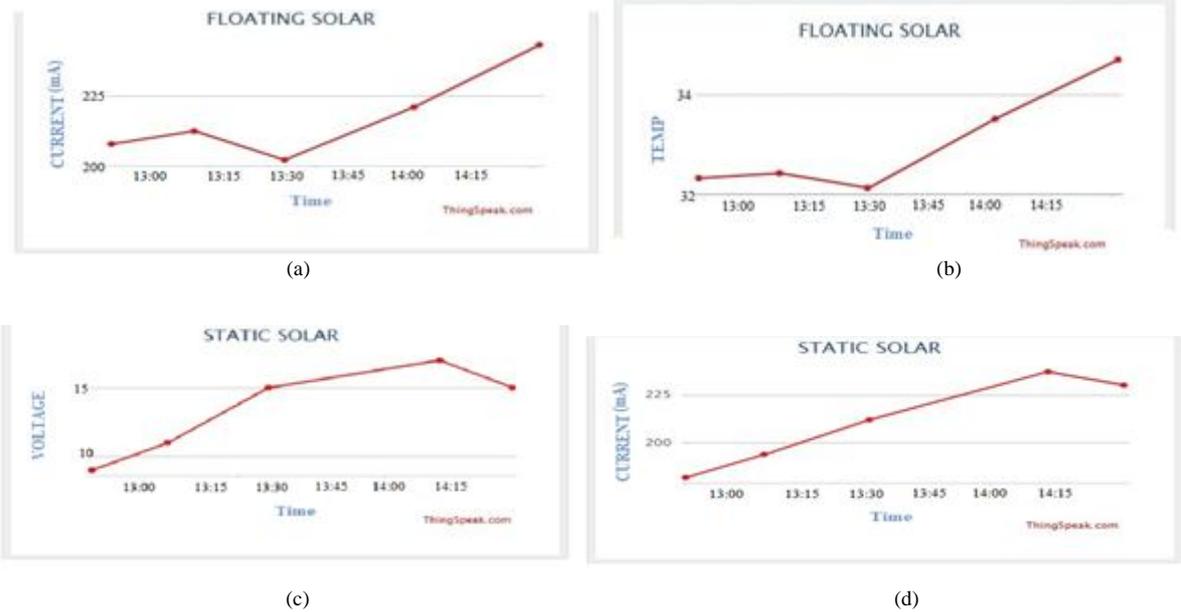


Fig.19 shows the final output voltage displayed on the LCD. The power rating of the solar panel used in the prototype is 5W,12V which is useful for charging small electronic devices. 25-35% energy is generated in floating solar panel when compared with roof top solar panel. The solar panel used in the prototype is of area 27 X 19 sq.cm ,which generates a maximum energy of 11 volts. The standard roof top solar panel with the same power rating generates a maximum of 9 volts.

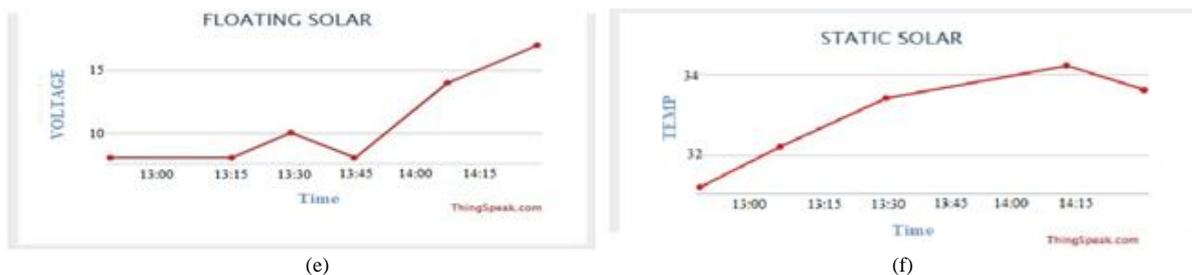


Fig.13(a) Graphical representation of Voltage for Static Solar Panel in Thing Speak (b)Graphical representation of Current for Static Solar Panel in Thing Speak (c)Graphical representation of Temperature for Static Solar Panel in Thing Speak (d) Graphical representation of Voltage for Floating Sun Tracking Solar Panel in Thing Speak (e) Graphical representation of Current for Floating Sun Tracking Solar Panel in Thing Speak (f) Graphical representation of Temperature for Floating Sun Tracking Solar Panel in Thing Speak



Fig.19 Final output voltage displayed on the LCD

Table.6 shows the real time statistical data of the prototype floating Sun Tracking Solar Panel. The current, voltage, and temperature readings are taken from 8:00 AM to 5:00 PM continuously. The sun tracking panel rotates in the direction, when the maximum light falls on the panel, due to absorbance of the light by LDR sensor the servo motor runs, this causes change in the position of the solar panel which leads to absorption of maximum energy.

TABLE VI. REAL TIME STATISTICAL DATA OF FLOATING SUN TRACKING SOLAR PANEL AFTER TESTING

Solar panel position with respect to Sun Tracking	Time	Temperature(°C)	Current (mA)	Voltage (V)
30°	8:00 AM	27	193	9
30°	9:00 AM	28	199	10
60°	11:00 AM	32	203	11
60°	12:00 PM	35	260	18
60°	1:00 PM	34	221	13
60°	2:00 PM	33	234	15
90°	4:00 PM	31	203	11
90°	5:00 PM	30	198	10

## VII. CONCLUSION

The concept of floating sun tracking solar panel is neoteric. In this study, we provide an easy-to-understand explanation of the solar tracking mechanism used to increase solar gain energy. We also discuss how inexpensive it is to operate and maintain a solar tracker. The tracking system is used to locate the solar panel in sun direction to produce the maximum amount of energy. The floating system is used to cool the solar panel which is heated continuously due to sun tracking. The cooling system dissipates the heat absorbed by the solar panel so that it works efficiently and produces more amount of energy when compared to standard roof based solar panels. The floating solar panel generates a maximum voltage of 11 volts while a roof top solar panel generates a maximum voltage of 9 volts for a standard 5W solar panel.

## FUTURE SCOPE

As the renewable energy resources are free, proper management is needed and we need to discover more technologies for energy production through these free resources. Other types of sensors as well as solar panels can be employed in water reservoirs, lakes that may perform better than the traditional paradigm. For maximum

absorption of light from the sun we can use anti reflective coatings on the solar panel. By using them the destructive interference will be eliminated from incident light waves from the sun. Thus, the maximum amount of light is transmitted to the solar panel which increases the amount of energy production.

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# Application of Grey Wolf Optimization Algorithm for Improving Inertia Constant Selection in Wind Farm Deployments

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**Abstract**—This paper presents a Grey Wolf Optimization (GWO) algorithm for doubly fed induction generator (DFIG)-based wind turbine generators. In order to address the system operability challenges that have arisen as a result of the continuous reduction of system inertia caused by the increasing penetration of renewable power generation. The GWO algorithm that has been makes it possible for individual DFIG generators to contribute an efficient inertial response. This response helps to stabilize the rate at which the frequency is changing and minimizes the large frequency deviations, when disturbance occurs. The DC voltage of the DFIG runs at different levels in accordance with the changes in the inertia constant to facilitate energy exchange with the associated ac grid. Additionally, the standard control system for the DFIG has been updated to accommodate the implementation of the GWO algorithm. The proposed model utilized GWO in order to evaluate optimum values of inertia constant, that assists in improving output power efficiency levels. Concerning the DFIG, practical challenges such as maximizing active power while minimizing reactive power are examined, and pertinent solutions are offered for a variety of different cases.

**Index Terms**— Grey Wolf Optimization, Power System, DFIG, Wind, Inertia, Load Frequency Control.

## I. INTRODUCTION

In contrast to fixed-speed machines where active and reactive power control is not independent, DFIG-based wind turbines are the preferred option for network operators [1]. The turning speeds of conventional wind turbines are fixed; on the other hand, DFIG technology enables wind turbines to function at a broad range of speeds. Traditional wind turbines have fixed turning speeds. The back-to-back converter is affixed to the rotor of the DFIG, and its function is to provide the rotor with currents of varying frequencies in order to obtain the required rotational speeds of the rotor. This application note provides a demonstration of how a back-to-back converter controller may be used in combination with a DFIG wind turbine to generate electricity levels [2]. The dynamic response of DFIG to fluctuations in wind speed as well as the process of turbine braking. The amount of power that the wind has in the form of kinetic energy [3, 4], which is represented by the symbol  $P_v$ , by utilizing (1).

$$P_v = \frac{1}{2} \rho \pi R^2 V_v^3 \quad (1)$$

where  $V_v$  represents average speed of wind in the area,  $A = \pi R^2$ , where  $R$  represents rotor blade diameter, and  $\rho$  represents density of air in the current area sets. The power recovered by wind turbine can be represented via (2),

$$P_t = \frac{1}{2} \rho \pi R^2 V_v^3 C_p \quad (2)$$

The power coefficient  $C_p$  is a number that does not have a specific unit of measurement, and it is used to express how well a wind turbine is able to transform the kinetic energy of the wind into the mechanical energy that may be used. The power output of the wind turbine is what is used to measure the efficiency of the wind turbine. This coefficient shifts as a function of the wind speed, the speed of the rotor blades, and the angle at which the pitch is set [5, 6]. The length of the rotor blades in proposed model of a Wind Turbine with DFIG is set to  $R = 50$  meters, and the air density is set to  $= 1.225$  kilograms per cubic meter. Both of these settings are in meters per second squared. Automatic adjustment in pitch angle ( $\beta$ ) is done in such a way as to guarantee that the change in  $C_p$  as shown in the "Fig. 1". The value of  $C_p$  will be maximum when  $\beta$  is taken to be zero. Apart from this, the output power of the turbine will be less if the value of  $\beta$  is different [16].

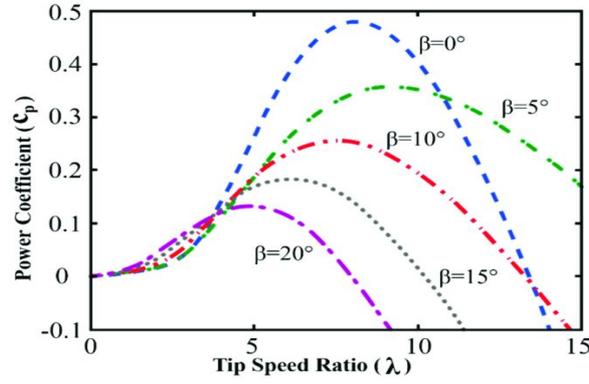


Figure 1. Power coefficient ( $C_p$ ) as a function of wind speed [16]

One of many DFIG controls may be activated at any one time, and the one that is used is determined by the zone in which the machine is now running. After investigating performance of different models [7, 8, 9] it can be observed that existing models showcase high efficiency for control of DFIG operations. In this regard, it is feasible to observe that the models [10, 11, 12] that are now in use are either very sophisticated or do not incorporate a significant amount of control with the intention of maintaining constant output levels. In order to address these problems, one possible solution is described in Section 3, and it is titled "Design of a Machine Learning technique for increasing Inertia constant Selection in Wind Farm installations." The proposed model was put through an examination in section 4, during which its results were compared with those of previously executed DFIG-based deployments. This paper comes to a conclusion with a number of in-depth observations on the model that has been provided, as well as suggestions for optimization models that may enhance the performance of the model in a variety of use scenarios.

## II. PROPOSED GWO ALGORITHM FOR IMPROVING INERTIA CONSTANT SELECTION IN WIND FARM DEPLOYMENT

After referring existing DFIG based control models [13, 14, 15], it was observed that existing models do not use stochastic optimizations, which limits their applicability under real-time use cases. To overcome this limitation, proposed Grey Wolf Optimization (GWO) algorithm for estimation of inertia constant for DFIG based wind turbines is discussed in this text. The algorithm works via the following process,

- Initialize the following parameters,
  - Total wolves existing in the model ( $N_w$ )
  - Total iterations for which the model will be evaluated ( $N_i$ )
  - Learning rate for the model ( $L_r$ )
- Initialize all wolves to be 'Delta', and evaluate them for each iteration via the following process,
  - If the Wolf is currently marked as 'Delta', then process it, else go to the next wolf in sequence
  - To process a Wolf, generate its internal configuration via the following process,
- Stochastically generate an inertial constant via (3),

$$Hs = STOCH(0, 1) \quad (3)$$

Where, Hs represents the inertial constant, and STOCH indicates a stochastic process to generate numbers between given ranges.

- Based on this value of Hs, simulate the model, and estimate its fitness via (4)

$$f = \frac{P_{active}}{P_{reactive}} \quad (4)$$

Where, Pactive represents active power at the output of model, while Preactive represents output reactive power levels.

- Evaluate fitness for all Wolves, and then estimate fitness threshold via (5)

$$f_{th} = \sum_{i=1}^{N_w} f_i * \frac{L_r}{N_w} \quad (5)$$

- At the end of each iteration, re-evaluate all Wolves via the following process shown in “Fig. 2”,

- Mark Wolf as ‘Alpha’, if  $f > 2 * f_{th}$  (6)

- Mark Wolf as ‘Beta’, if  $f > f_{th}$  (7)

- Mark Wolf as ‘Gamma’, if  $f > L_W * f_{th}$  (8)

- Else, Mark Wolf as ‘Delta’, if for this configuration,  $f < f_{th}$  (9)

Repeat this process for all iterations, and then select the ‘Alpha’ Wolf with maximum fitness levels. Due to selection of Wolf with maximum fitness, active power is increased, while reactive power levels are reduced at the output, which assists in improving circuit efficiency levels. This is advantageous, because it's possible that an excessive quantity of reactive power may cause the components to overheat, which would significantly cut down on the equipment's lifetime.

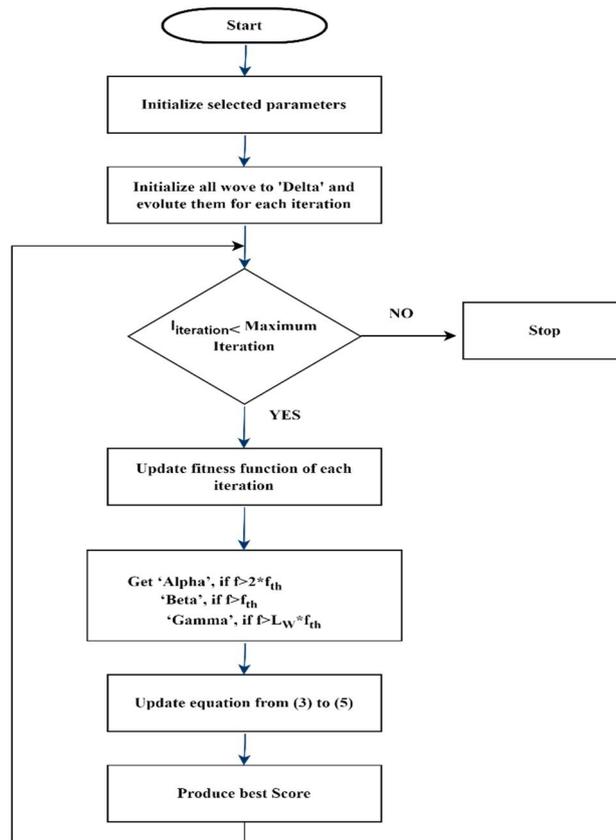


Figure 2. Flowchart of grey wolf

If power quality standards and regulations are not followed to, it may result in unanticipated shutdowns, power losses, and even fines. This is in addition to the fact that it may cause blackouts. Thus, the efficiency of DFIG based wind systems is improved due to selection of proper inertia constants. This efficiency is evaluated for different models in the next section of this text.

### III. RESULT ANALYSIS & COMPARISON

The proposed model uses GWO algorithm in order to evaluate optimum values of inertia constant, that assists in improving output power efficiency levels. To validate this performance, the model was evaluated on a standard DFIG model that can be observed from “Fig.3”, where a 120 kV source with 2500 MVA 3 Phase coupling device is connected to a 30 km line which is capable of feeding a 25 kV load via grounding transformer sets. The model uses 150 Ohms input source resistances with 50 Ohms load resistors. It also uses a combination of Wind Turbine with Drive Train in order to produce power base for generators, that drives an asynchronous machine for on load conditions. The circuit is capable of being driven by a 9 MW Wind farm that consists of 6 generator units, each having a capacity of 1.5 MW under real time loads. The model is validated via modifying the inertia constants under different loads, and power efficiency was evaluated through (10).

$$\eta_{eff} = \frac{1}{N} \sum_{i=1}^N \frac{P(Out)}{R(Out)} \quad (10)$$

Where, P(Out) & R(Out) represents active and reactive power outputs for N different circuit reading iterations designations.

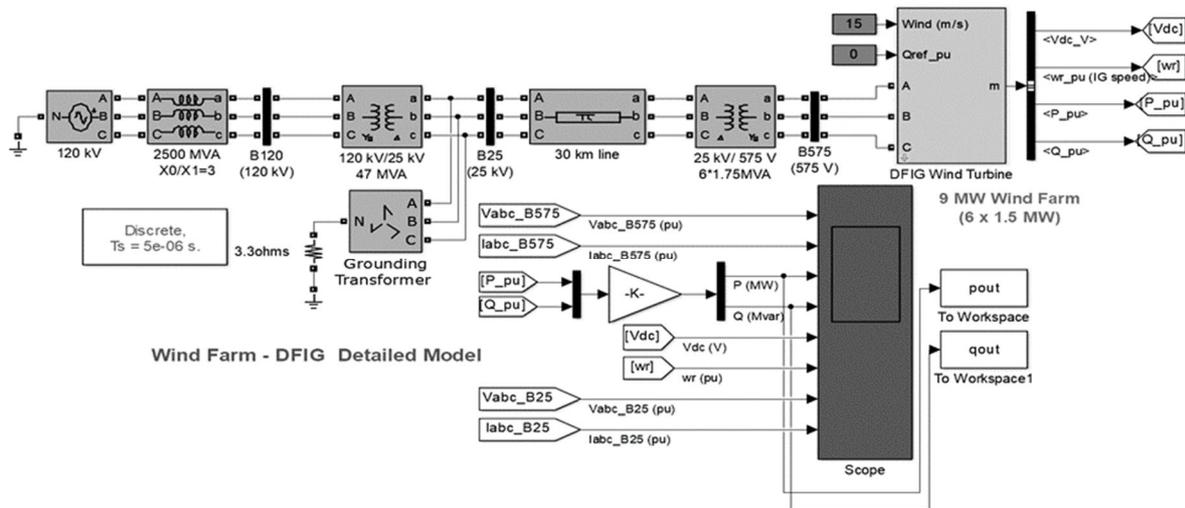


Figure 3. Simulink model of the DFIG model under different condition

The outputs were obtained for 3 Phase Voltage across 575V grid (Vabc\_575), 3 Phase Current across 575V grid (Iabc\_575), Active Power (P), Reactive Power (Q), 3 Phase Voltage across 25kV grid (Vabc\_25), and 3 Phase Current across 25kV grid (Iabc\_25). These waveforms can be observed from “Fig. 4” as follows, based on these readings, the power efficiency (P) levels were evaluated via (10), for the circuit with GWO and without GWO were tabulated in table 1 as follows, which represents circuit performance under different simulation instances. Based on these results and “Fig. 5”, it can be observed that the proposed model can improve the power efficiency levels by 8.5% after application of GWO, which makes it useful for a wide variety of real-time simulation use cases. Due to these advantages, the proposed model is useful for improving power efficiency for different DFIG based wind farms.

### IV. CONCLUSION

In this paper, optimal value of inertia constant for DFIG wind farm has been obtained for different loading condition, GWO optimization has been utilized. Because of this, the proposed model is able to enhance the power efficiency levels after the application of GWO by 8.5%, which allows it to be useful for a wide variety of various real-time simulation use cases. This is because of the fact that: It is possible that the model that has been

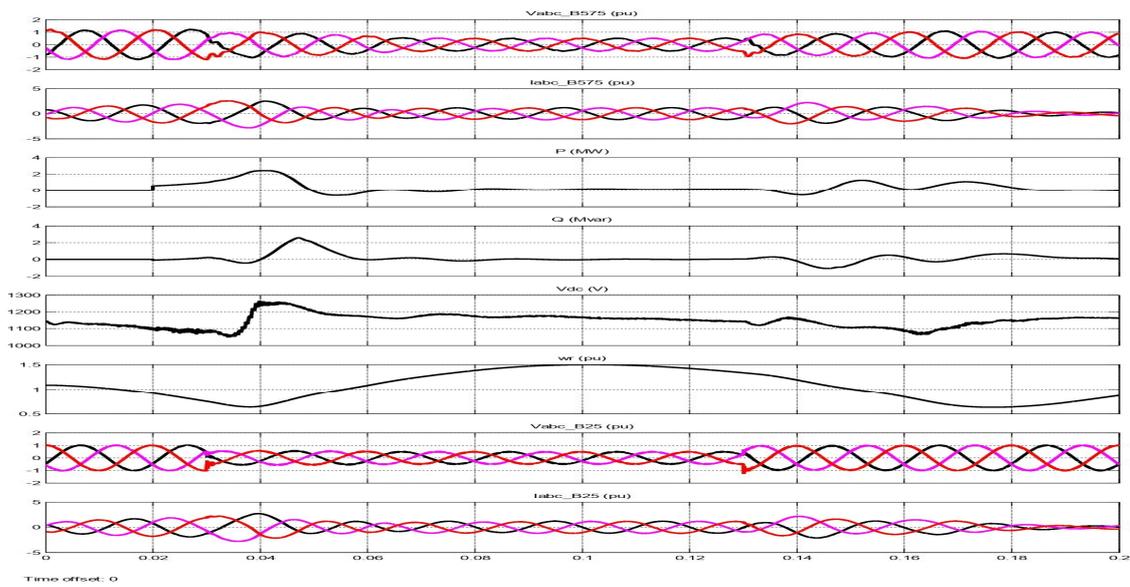


Figure 4. Output voltage & current levels for different component

TABLE I. RESULTS FOR DIFFERENT SIMULATION INSTANCES

S. No.	Simulation Time (s)	Efficiency (%) Without GWO	Efficiency (%) With GWO	INERTIA CONSTANT WITH GWO
1	1	75.50	86.50	0.0931
2	2	76.80	88.30	0.9723
3	3	77.40	89.40	0.5302
4	4	78.30	90.50	0.7062
5	5	79.25	90.80	0.4057
6	6	80.15	91.20	0.1843
7	7	81.05	91.20	0.8000
8	8	81.95	92.80	0.9557
9	9	82.85	93.57	0.8968
10	10	83.75	94.34	0.5852
11	12	84.65	95.11	0.7640
12	15	85.55	95.89	0.4771
13	18	86.45	96.66	0.4658
14	20	87.35	97.43	0.0976
15	25	88.25	98.20	0.4858



Figure 5. Power efficiency levels for different simulation instances

created may be successful in boosting the power efficiency of a variety of DFIG-based wind farms as a result of these advantages.

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# Negative Emotion Detection using ECG and HRV Features

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**Abstract**—Emotions cause different physical, behavioural and cognitive changes in the human body. Emotions can be positive and negative. Negative emotion is the experience of negative feelings such as anger, frustration, panic, stress and fear. These negative emotions can cause severe health problems. So there is a need for detection of negative emotions. It will help in improving the health of the human body. As these emotions result in a change of various physiological parameters like heart rate, skin temperature, blood pressure, skin conductance, etc., these signals can be used to detect the emotions of a person. These signals are generated by the body during the functioning of various physiological systems, so they cannot be regulated artificially. Due to this reason, it is a reliable source for the detection of such information. So physiological signal is one of the most important factor in the field of emotion detection. The change in signals represents certain characteristics which are used to estimate the emotions. This work mainly focuses to build a better model of negative emotion detection for Typically Developed group using Machine learning approach with the help of Electrocardiogram (ECG) signal. This study was conducted on DECAF database for typically developed group. The study focused to extract the relevant features from both ECG and HRV signals. Then to identify which is more contributing towards negative emotion detection. A machine learning model was developed for typically developed group db4 as mother wavelets for feature extraction. The significant features of ECG and HRV were then classified separately using the logistic regression, ensemble and support vector machine. Logistic regression classifier achieved maximum accuracy using HRV data for typically developed (TD) group.

**Index Terms**— ECG, negative emotion detection, DWT, machine learning.

## I. INTRODUCTION

Emotion is a state of thought that arises spontaneously and is accompanied by physiological changes. Emotion is made up of three parts: a subjective component that defines how we feel emotions, a physiological component that describes how our bodies react to emotions, and an expressive component that reflects the human reaction to each emotion. External motivations, thoughts, and changes in interior feelings are all referred to as emotion. Emotion recognition has become a vast field of study in cognitive science, engineering, and psychology. Emotion detection was used in psychology to comprehend the feelings of persons who were being counselled. It

is also employed in the medical field to help crippled and elderly persons. Emotions can be positive and negative. The sensation of negative feelings such as anger, frustration, panic, stress and fear is known as negative emotion. Negative emotions might lead to serious health issues. As a result, there is a requirement for negative emotion detection. It will aid in the improvement of human health. The early methods employed were facial expression and voice processing, but the primary difficulty with these approaches is that they may be readily hidden because a person can mimic himself and mask the true feelings. The physiological signals can be utilised to determine a person's emotions since they cause changes in physiological characteristics such as heart rate, skin temperature, blood pressure, and skin conductance. Because these signals are produced by the body during the operation of numerous physiological systems, which cannot be intentionally managed. As a result, it is a trustworthy source for detecting and forecasting such information. As a result, one of the most essential factors in the field of emotion detection is physiological signal. Physiological detection of emotions can have better performance compared to other techniques since physiological signals are not under the voluntary control of the human. Emotion can be modeled as two dimensional emotion model consisting of valence and arousal, where valence denotes pleasantness or polarity of emotion stimuli whereas arousal represents the strength of emotion.

Since brain and emotions are not mapped for autistic people EEG cannot be used for emotion recognition for such people. Here in this work ECG is employed for detecting the emotions. DWT is used for the feature extraction purpose. These extracted features after selection are used as training data for the classifiers. The significant features of ECG and HRV were then classified separately using the logistic regression, ensemble and support vector machine. This paper consists of 5 sections. Section II describes about the previous works done in the field. It gives a detailed review of works carried out in this field. Section III describes about the proposed system and section IV gives the results and discussion and section V gives the conclusion of the work.

## II. RELATED WORK

Zi Cheng et al. [2] used various combination of features extracted from ECG signal and its derived HRV to detect negative emotion. Emotions were evoked by using 15 standardized film clips. HRV was derived using an automatic R peak detection algorithm. They extracted a total of 28 features, including seven linear-derived features, ten nonlinear-derived features, four time-domain features (TD) and six time-frequency domain features (T-FD). 5 classifiers including SVM, Random Forest (RF), k-Nearest Neighbor (kNN), Decision Tree (DT) and Gradient Boost Decision Tree (GBDT) were also compared. Among all these combinations, the best result was achieved by using only 6 time-frequency domain features coming from wavelet with SVM, which showed the highest accuracy of 79.51% and the lowest time cost of 0.13 ms. Han-Wen Guo et al. [3] used 3-10 minute video excerpts for eliciting emotions such as wrath, fear, sadness, happiness, and relaxation. They used time-domain, frequency-domain, Poincare, and statistic analysis to extract heart rate variability (HRV) components from an ECG signal. Time-domain analysis extracts characteristics such as mean, coefficient of variation, standard deviation of RR interval, a standard deviation of successive differences of RR interval FFT extracted parameters such as low frequency, high frequency, and LH ratio were used to perform spectral analysis of HRV data. Statistics analysis elements include kurtosis coefficient, skewness, and entropy. The length SD2 along t line of identity and the breadth across this line are Poincaré properties of point clouds (SD2). PCA was the data reduction technique used which selected 5 features as relevant features. Then these relevant features were used to classify different emotion states by support vectors machine (SVM). Using 13 HRV features the classification accuracy for 2 emotions (negative and positive) was 70.3% and that for 5 emotions was 52%. After feature selection accuracy for 2 emotions was 71.4% and that for 5 emotions was 56.9%.

M. S. Goodwin et al. [4] investigated whether previous physiological and motion data collected by a wrist-worn biosensor can predict hostility toward others in children with ASD. They recorded peripheral physiological and motion signals from a biosensor worn by 20 youth with ASD and developed prediction models based on ridge-regularized logistic regression. Time series feature extraction and logistic regression classifier was used. B. Anandhi et al. [5] analyzed the QRS complex derived ECG signal for emotion recognition. A personalized emotion elicitation protocol was developed for children with ASD. Emotion evocation was with the help of audio-visual stimuli. They conducted the study for 10 children with ASD. Various digital filters were used for the removal of noise and quality improvement. Different linear and nonlinear features were extracted from this complex and one-way ANOVA was used for the analysis of these features. Finally, the authors used k-nearest neighbor and ensemble classifier for the classification of emotions. They were able to achieve an accuracy of 70.5% for children with ASD.

DECAF[1] is a database containing the physiological response to different emotions elicited in 30 subjects using 36 movie clips and 40 one minute music video segment. They had collected different signals such as MEG, horizontal electrooculogram hEOG, ECG, trapezium electromyogram.,(tEMG) and near-infrared facial videos which were recorded synchronously.

### III. METHODOLOGY

The work focuses to extract the relevant features from both ECG and HRV signals. Then to identify which is more contributing towards negative emotion detection. A machine learning model was developed for typically developed group db4 as mother wavelets for feature extraction. The significant features of ECG and HRV were then classified separately using the logistic regression, ensemble, support vector machine and k-nearest neighbor. ECG data for various emotions are collected from DECAF [1]. In this work ECG signal corresponding to two different emotions happy and sad are considered. The block diagram is shown in Fig. 1.

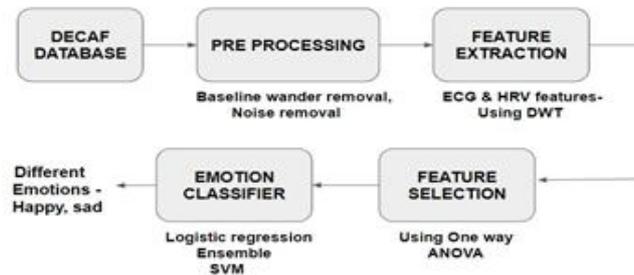


Fig. 1. Block Diagram of Negative Emotion Detection System

#### A. ECG Data

ECG data was taken from DECAF database[1]. It is a multi-modal database containing physiological response to various emotions. The emotions are elicited using 24 one minute movie segments and 40 one minute music segments. The experiment was carried out for 30 healthy subjects. In this work only ECG signal response to the one minute movie segment for emotions happy and sad was analysed.

#### B. Pre-Processing

Pre-processing is done to improve the quality of signals by removing noises. These noises include power line interference, baseline wandering and high-frequency noises [6]. This helps to improve the quality of the negative emotion detection method. Baseline wander is a low-frequency noise that arises from breathing, electrodes attached to the body, or subject movement. It occurs in the frequency range of 0.5 to 0.6Hz. Baseline wander can cause the amplitude of the QRS complex to increase significantly. The wavelet-based approach is best for removing ECG signals. The DWT-based method makes use of high-level decomposition to eliminate low-frequency components corresponding to the baseline variation. DWT was performed using Daubechies (db8) as the mother wavelet because of the similarity of wavelet function with the shape of ECG signal[7]. Then high-frequency noises occurring due to power line noises were removed using 6th order low pass Butterworth filter with a cut of frequency of 50 Hz since in India the power line frequency is at 50 Hz. After noise removal heart rate variability (HRV) was derived. It refers to the variation of the time interval between successive heartbeat. Fig. 2 and Fig. 3 represents raw and corresponding pre-processed signals of happy emotion. Fig. 4 and Fig. 5 represents raw and corresponding pre-processed signals of sad emotion.

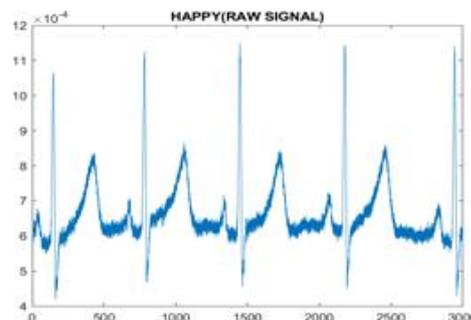


Fig. 2. Raw ECG signal containing happiness of TD group

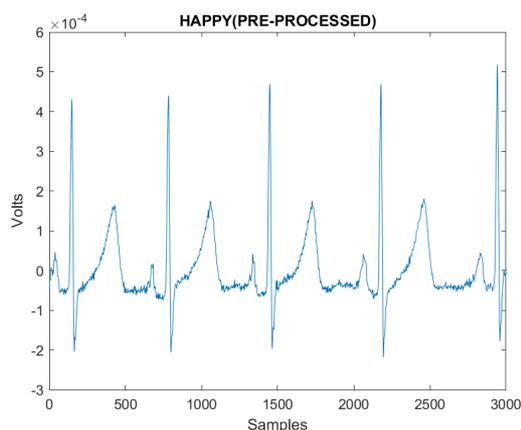


Fig. 3. Pre-processed ECG signal containing happiness of TD group

### C. Feature extraction

Here features are extracted from ECG and HRV. Different features are extracted to get the emotional content in the signal. Feature extraction helps to reduce the redundant data present in the signal. Thereby it helps to get useful information from the signals. Different feature extraction techniques are used in the literature [8]. DWT (Discrete Wavelet Transform) was used to extract the features here.

DWT makes use of the mother wavelet which is a single prototype function used to decompose the input signal. Decomposition depends on the scaling and shifting derive frequency sub-bands of the input signal.

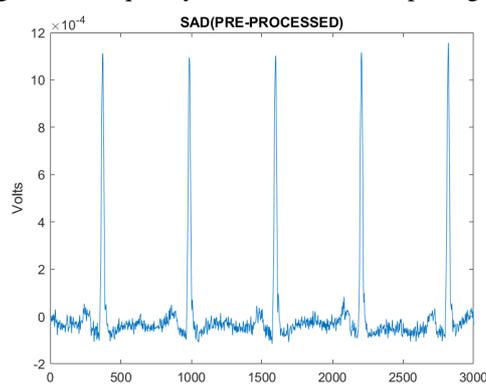
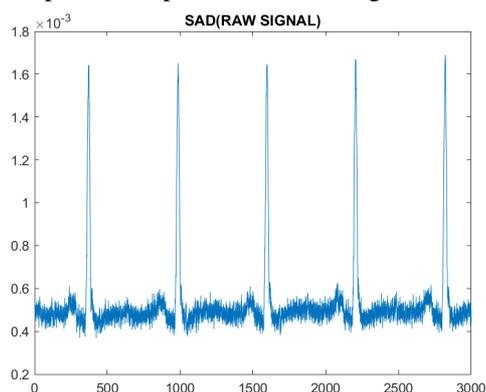


Fig. 4. Raw ECG signal containing sadness of TD group Fig. 5. Pre-processed ECG signal containing sadness of TD group

DWT decomposes the original signal to approximation and detail coefficients with the help of a low pass filter and high pass filter. The output of the low pass filter (LPF) is known as approximation coefficients and the output of the high pass filter (HPF) is known as detailed coefficients. The output of this LPF is again applied to HPF and LPF which forms the second decomposition level. In this study 14 level decomposition is done. This is because the emotional content is present in the low-frequency band and high-frequency band [10]. Detail coefficient from 11th to 14th is used for extracting various features.

Wavelet transform make use of mother wavelets. Different wavelets includes Daubechies (db) wavelet, Haar wavelet, Symlet wavelet, Coiflet wavelet etc. Daubechies are orthogonal wavelets which is characterized by maximum number of vanishing moments for some predefined support length. The name of these wavelets are represented as dbN. Here N represents the order of these wavelets. Usually N varies from 1 to 8. In this work, analyses were carried out using db4 mother wavelet. ECG and HRV features were extracted for negative emotion detection using two emotions. All the features extracted from ECG and HRV data is listed in Table I.

In addition, time domain features of HRV is also considered which includes mean R-R interval difference(meanRR), Root Mean Square Distance of Successive R-R interval(RMSSD), Number of R peaks in ECG that differ more than 50 milliseconds(NN50), percentage of successive RR intervals that differ more than 50 ms (pNN50), standard deviation of RR intervals(SD RR), and Standard Deviation of Heart Rate(SD HR).

TABLE I. FEATURES EXTRACTED FROM ECG AND HRV

Serial no.	Features	Description
1	max	Maximum value of signal in each level
2	min	Minimum value of signal in each level
3	mean	Mean value of signal in each level
4	median	Median value of signal in each level
5	std	Standard deviation of signal in each level
6	mad	Mean absolute deviation of signal in each level
7	range	Range of signal in each level
8	power	Power of signal in each level
9	L1 norm	L1 norm of signal in each level
10	L2 norm	L2 norm of signal in each level
11	Kurtosis	Kurtosis value of signal in each level
12	entropy	Entropy value of signal in each level
13	skewness	Skewness value of signal in each level
14	HF power	Sum of power of levels 11 and 12
15	LF power	Sum of power of levels 13 and 14
16	LF power norm	HF power/(LF power + HF power)
17	HF power norm	LF power/(LF power + HF power)
18	power	HF power + LF power
19	ratio	Ratio of HF power and LF power

#### D. Feature extraction

Here features are extracted from ECG and HRV. Different features are extracted to get the emotional content in the signal. Feature extraction helps to reduce the redundant data present in the signal. Thereby it helps to get useful information from the signals. Different feature extractions techniques are used in the literature [8]. DWT (Discrete Wavelet Transform) was used to extract the features here.

DWT makes use of the mother wavelet which is a single prototype function used to decompose the input signal. Decomposition depends on the scaling and shifting

#### E. Feature extraction

Here features are extracted from ECG and HRV. Different features are extracted to get the emotional content in the signal. Feature extraction helps to reduce the redundant data present in the signal. Thereby it helps to get useful information from the signals. Different feature extractions techniques are used in the literature [8]. DWT (Discrete Wavelet Transform) was used to extract the features here.

DWT makes use of the mother wavelet which is a single prototype function used to decompose the input signal. Decomposition depends on the scaling and shifting.

TABLE II . SIGNIFICANT FEATURES WITH P AND MEAN VALUES FOR ECG

Sl no.	Features	Sig. Value	Mean Value (happy)	Mean Value (sad)
1	mediand11	0.044	$-2.3 \times 10^{-6}$	$9.86 \times 10^{-7}$
2	kurtosisd11	0.034	12.933	14.235
3	ratio	0.01	0.3573	0.4241

TABLE III SIGNIFICANT FEATURES WITH P AND MEAN VALUES FOR HRV

Sl no.	Features	Sig. Value	Mean Value (happy)	Mean Value (sad)
1	meand11	0.028	618.372	692.67
2	L1d14	0.012	$-3.5 \times 10^7$	$-5.4 \times 10^7$
3	NN50	0.000	70.504	70.90
4	SD HR	0.000	26.808	28.004

#### F. Classification

The significant features obtained after feature selection is classified using various machine learning algorithms. Every machine learning classifier have two phases. First phase is training phase and followed by a testing phase. 70% of total available data is used for training and model is tested using remaining 30%. Classifiers are used to classify the significant features into emotions happiness and sadness of typically developed group. Here three different machine learning models such as logistic regression, ensemble and SVM are used for negative emotion detection.

#### IV. RESULTS AND DISCUSSION

The features extracted from ECG signal includes time- frequency domain features and frequency domain features. Time-frequency domain features include maximum value, minimum value, mean value, median value, standard deviation, mean absolute deviation, range, power, L1 norm, L2 norm, entropy, kurtosis, skewness of 11th to 14th decomposition level detail coefficient. Frequency domain features include high frequency power, low frequency power, total power, low frequency power norm, high frequency power norm

The features extracted from HRV data include time- frequency domain features, time domain features and frequency domain features. Time-domain features include mean R-R interval difference (meanRR), Root Mean Square Distance of Successive R-R interval (RMSSD), Number of R peaks in ECG that differ more than 50 millisecond (NN50), percent- age of successive RR intervals that differ more than 50 ms (pNN50), standard deviation of RR intervals (SD RR), and Standard Deviation of Heart Rate (SD HR). Frequency domain features include high frequency power, low frequency power, total power, low frequency power norm, high frequency power norm and ratio of low frequency power and high frequency power.

Significant features of ECG for typically developed group using db4 analysis includes mediand11, kurtosisd11 and ratio of low frequency power and high frequency power. Significant features of HRV for typically developed group using db4 analysis includes meand11, L1d14, NN50 and SD HR.

Logistic regression, ensemble and SVM classifiers were used for classifying signals to emotion happiness and emotion sadness. The training phase is carried out on 70% percent of the feature data set while the testing phase is the remaining feature set. Confusion matrix of logistic regression classifier obtained for db4 analysis using HRV features for typically developed group is shown in Fig 6. Accuracy gives a measure of correctly classified signals with respect to total number of signals.

The classification results obtained for typically developed group is given in the Table IV and Table V. This analysis indicates that HRV data, indicating the variability in heart rate is an effective indicator for detecting negative emotions. Logistic regression and ensemble classifier was found to have better performance than other classifiers.

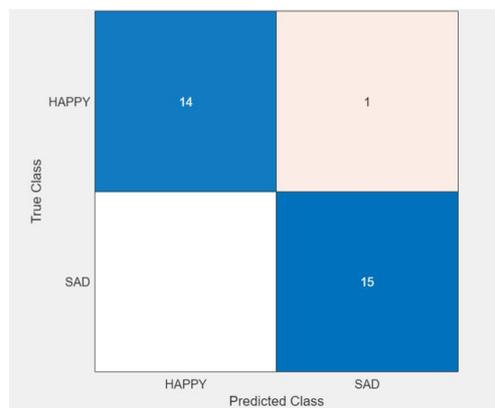


Fig. 6. Confusion matrix obtained for Logistic regression using HRV features

TABLE IV. SUMMARY OF RESULTS OBTAINED BY USING ECG FEATURES

Model	Accuracy	Precision	Recall	F-1 score
Logistic Regression	63.3%	60%	64.2%	62%
Ensemble	66.7%	66.7%	66.7%	66.7%
SVM	66.7%	66.7%	66.7%	66.7%

TABLE V. SUMMARY OF RESULTS OBTAINED BY USING HRV FEATURES

Model	Accuracy	Precision	Recall	F-1 score
Logistic Regression	96.7%	93.3%	100%	96.5%
Ensemble	90%	86.7%	92%	87.5%
SVM	86.7%	86.7%	86.7%	86.7%

## V. CONCLUSION

Electrocardiogram signals are an effective way for analyzing human emotions. In this work, negative emotion detection for typically developed group using different classification models was done. The study included a comparison between ECG and HRV features. It was found that HRV features are more contributing towards the emotion detection. Logistic regression and Ensemble classifier showed better performance compared to other machine learning algorithms for typically developed group.

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## Author Index

<b>A</b>		<b>H</b>	
Aarya Pawar	7	Halkarnikar P P	116
Abdul Rahman	231	Harish Kumar	93
Abhishek Kajal	155	Harshavardhan J	295
Abinanda P	110	Hemant Singh Pokhariya	290
Aditya Tripathi	178	Himanshu Pal	290
Ajay U Surwade	61		
Ali Albkhrani	269	<b>J</b>	
Amol Dhakne	116	Jayadeep K	223
Anjani Pujitha PSVL	295	Jerritta S	309
Anusha N	282		
Arjyadhara Pradhan	254	<b>K</b>	
Arshad Ali	178	Kalaiselvi K	140
Arun Kumar Dash	217	Kanchan Shelke	174
Aswini J	217	Karthick Myilvahanan J	33
Ayushi Agarwal	14, 23	Karthik A	295
		Kavya K	276
<b>B</b>		Khandagale H P	116
Babita Panda	254	Kirti Thakur	93
Bachu Munideepika	50	Krishnaveni A	33
Bharti W Gawali	244, 269		
Biplab Bag	130	<b>L</b>	
Brijesh Prasad	290	Lakhan Jadhav	185
Brunda U	140	Lipika Nanda	254
<b>C</b>		<b>M</b>	
Chandrasekhar D	276	Madhukumar Patnala	50
Chitralekha Jena	254	Malarvizhi N	217
		Mani Barathi S P S	237
<b>D</b>		Manikanta V	217
Danish Tamboli	72	Manne Sowmya	223
Deepak Nandal	77	Mansi Patil	102
Deepesh Bhati	303	Mayur Gaikwad	185
Deepti Jagyasi	148	Minakshi M Sonawane	269
Dhyaneshwaran J	29	Mohana Sundaram N	33
		Mohit Patil	67
<b>F</b>		Mrityunjaya Kappali	260
Farrel Deva Asir J	29		
		<b>N</b>	
<b>G</b>		Nachiket Joshi	55
Gayathri G	110	Nallapothula Sreenivasulu	50
Gopi Sivanadh D V S	295	Neelam Chandolika	102

Neeraj Manikanta Sai G	276	Senthilkumar B	237
Nikhil Patil	67	Shantanu Sharma	23
Nikita Lahon	254	Sharon Christa	122
Nilesh Gopale	55	Shashank Saxena	178
Ninad Deogaonkart	55	Shivanand Koli	185
Nishant Kulkarni	7	Shiyam R	168
Nivetha K	33	Shreeyanshi Gautam	23
<b>P</b>		Shubham Ghalme	174
Palakuru Akhilesh	140	Sindhu N	309
Pankaj	77	Snehmani	93
Paramjit	43	Sourav Kumar Satpathy	254
ParthaPratim Sarkar	130	Srividya R	168
Poojitha K	276	Sudha Abirami R	207
Pranav Kurle	72	Sudhir Mendhekar	269
Prasad Kulkarni	185	Sujithra M	85, 110, 237
Pratap Patil	67	Sukhwant Kour Siledar	190
Pratham Khinvsara	7	Sulaiman Awadh Ali Obaid Maeli	61
Pratham Patil	67	Sulochana D Shejul	244
Pravin V Dhole	244	Sumalatha A	276
Preethi N	1	Sunny Kumar	1
Priya Shelke	55	Suresh Kumar G	207
Priyadharshini R	85	Suruchi Dedgaonkar	55
Priyanshi Patil	67	Sushanta Sarkar	130
Pushan Deb	1	Susmita Bala	130
		Swathi N	223, 282
		Swati Shilaskar	102
<b>R</b>		<b>T</b>	
Radha T Deoghare	136	Tanusha Mittal	122
Raghavendra Kulkarni	196	Teja Sai Ethesh	282
Raja Sri A	223	Totthuku Sunil	50
Ramchandra Adware	148	Trushant Jadhav	72
Ramesh R Manza	269	Tupe U L	185
Rathika J	110	Tushar Raikar	7
Rekha V S	110	<b>U</b>	
Revant Pund	7	Umakant Tupe	174
Rishikesh Dayma	7	Umamaheswari K	295
Ritika Rastogi	14	<b>V</b>	
Riya Gupta	14	Vaibhav Rana	155
Rohit Desai	55	Vaishali Khupase	102
Rupali Umbare	72	Varun Mishra	290
Rutuja Kadam	174	Vedant Bhamre	72
<b>S</b>		Velvativu P	85, 110
Sai Prakash M	223	Vetti Pavithra	50
Sai Vamsi Reddy	282	Vijay D Dhangar	244
Sandeep Bhongade	303	Vijay Prakash	178
Santosh R	33	Vijaya B Musande	190
Sapana A Kolambe	136	Vikas Rathi	290
Saranya S	29, 163, 168		
Saurabh Charya	43		

Vinayak C Magadal	260	Yoga Verma V	163
<b>Y</b>		<b>Z</b>	
Yashwanth Krishna A	282	Zeba Khan	231
Yashwanth M	163		

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