SESMIC 2022

CONFERENCE PROCEEDINGS

International Conference on Recent and Future Trends in Smart Electronics System and Manufacturing

Edited By

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1st to 3rd December, 2022

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Message

It gives me immense pleasure that Department of Electronics & Telecommunication Engineering, Symbiosis Institute of Technology (SIT), Pune, is organizing "International Conference on Recent and Future Trends in Smart Electronics System and Manufacturing and its Applications" with the support of Department of Science and Industrial Research (DSIR), New Delhi and in collaboration with University Kebangsaan Malaysia (UKM), Malaysia from 1st to 3rd Dec. 2022 at SIT, Pune.

Investigating the practical aspects of Smarts Electronics Manufacturing is essential for the advancement of Industry 5.0 focusing on "Atmanirbhar Bharat" and "Make in India".

I am sure that the conference will provide a platform for exploring and exchanging the ideas on "Electronic System Design and Manufacturing, Artificial Intelligence and Machine Learning, Robotics and Automation, Communication and Information Systems" among the participants from academics, industry, research organizations etc.

I hope that this Conference would provide useful ideas on Smart Electronics System Manufacturing.

I wish the event all success.

N.Kalaiselvi
(N.Kalaiselvi)

November 21, 2022
New Delhi

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MESSAGE

I am extremely happy to learn that Symbiosis Institute of Technology is Organising International Conference on Recent and Future Trends in Smart Electronics System and Manufacturing (SESMIC 2022), which is an extremely relevant issue with significant implications for the future of the economy of our nation. Therefore its imp to students, faculty, researchers, businesses and industry is paramount.

Today, the Govt of India has the utmost priority of promoting growth and increasing the contribution of the manufacturing sector. For this, the centre has taken initiatives to increase the share of the manufacturing sector through campaigns like Make in India, Aatmanirbhar Bharat and Samarth Udyog Bharat 4.0. Smart manufacturing can make manufacturers more efficient and allow them to stay ahead of the competitive curve, and explore new business models and practices. Businesses can adopt it to help streamline processes, increase productivity, stay competitive, and prepare for the future including unprecedented events, such as a pandemic. Electronics Manufacturing is an important component for future of our country.

The conference on '**Recent and Future Trends in Smart Electronics Systems and Manufacturing'** has been organised to discuss all these issues by well-known experts, researchers and managers from the industries and society who will present their views and discuss the opportunities, threats, strengths and weaknesses of the subject.

I wish the conference all the very best and hope it will be productive and fruitful for you all.

Jai Hind

23 November 2022
Pune

(Harmandeep Singh)
Major General

ABOUT CONFERENCE

An international conference on recent and future Trends in Smart Electronics System and Manufacturing is being organized with the support of the Department of Science and Industrial Research (DSIR), New Delhi by the Electronics & Telecommunication Department, Symbiosis Institute of Technology (SIT). This conference is in collaboration with University Kebangsaan Malaysia (UKM), Malaysia. SIT is a constituent of Symbiosis International (Deemed University) which is ranked amongst India's topmost international universities. SIT endeavors to provide quality education in lines with the requirements of today's competitive industry and rapid developments in technology.

The theme of the proposed conference revolves around advances in the area of smart electronics systems design, manufacturing recent and future trends and will bring together researchers, engineers, industry professionals and practitioners. It encompasses wide and diverse topics of application in almost every field of Business and Services. The conference will also feature pre-conference tutorials/panel discussion and industry invited talks on multi-disciplinary and cross-disciplinary areas in smart electronics systems design and manufacturing using hands-on/workshops delivered by industry professionals.

The proposed conference is objected to for promotion, development and utilization of smart electronics manufacturing Technology, R&D and innovation activities relating for and by large no. of researchers, academicians, PG scholars and practitioners from all over the world.

The main objectives are:

- To provide a platform for exchange of views, useful insight and learning for the benefit of industry, academia, consultant and research organizations, etc.
- To create an access to knowledge and research collaboration under one umbrella for the advancement of smart electronic system designs and manufacturing.
- To conduct activity to support indigenous technology promotion, development, utilization and transfer of knowledge of smart electronics system designs and manufacturing.
- To promote innovations by students and entrepreneurs by conducting Hackathons, and Panel discussion.
- To support and promote the policy of "Make in India" and "Atma Nirbhar Bharat".

TRACKS:

The scope of the conference covers the following 4 tracks.

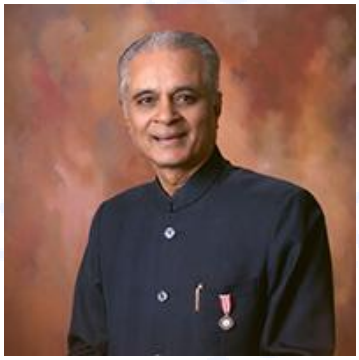
Track1: Electronics System Design & Manufacturing
Track2: Artificial Intelligence and Machine Learning
Track3: Robotics and Automation
Track4: Communication and Information Technology

HACKATHON:

The scope of the Hackathon covers in the following application themes:

Theme1: Agri-tech
Theme2: Health-tech
Theme3: Ed-tech
Theme4: Socio-tech

OUR LEADERSHIP



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2. Prof. Mohd Helmy Abd Wahab, University Tun Hussein Onn Malaysia.
3. Prof (Dr.) Sawal Hamid Md Ali, University Kebangsaan Malaysia.
4. Dr. Bhanu Sood, Deputy Chief Technologist for NASA's Goddard Space Flight Center, USA.

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Sentiment Analysis using Naïve Bayes Classifiers and Logistic Regression

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Abstract.

In the current digital world, people are using online shopping for purchasing goods extensively with first preference. Reviews and ratings on the sites will play a vital role in improving global communications among the customers and it has the potential to influence consumer buying patterns as well. Many E-commerce giants like Amazon, Flipkart are providing a platform that empowers users to share their real-time experiences and provide real-time insights about the performance of the product to future buyers. Sentimental Analysis and classification of the reviews as positive and negative will help us in understanding the voice of the consumers. So current study works on the reviews whose ratings are not provided by the customers. Machine learning models like Naïve Bayes, Multinomial NB, Bernoulli NB and Logistic Regression are used during the study. The result predicted the sentiments of those reviews.

Keywords. Machine Learning; Sentiment Analysis; Naïve Bayes classifiers; Feature extraction; Predictions.

1. INTRODUCTION

Current study focuses on Sentimental Analysis of the reviews that customers give for the products they purchase and have classified them as "Positive" or "Negative". Along with the reviews, customers also give ratings for the products and it is one of the filter criteria as well on the e-commerce websites to allow customers to view only those products which have ratings more than the chosen number. Thus, in today's world, it has become important to classify the products accordingly and display correct information to the user. Machine Learning provides different classification models which further helps in predicting the outcome. In this study Naïve Bayes Algorithm and Logistic Regression are used to classify the reviews as positive and negative. Naïve Bayes is a kind of classifier that use Bayes Theorem. It is used to predict membership probabilities for each class. In this work, the membership classes are, if a Positive Review or a Negative review so, the Naïve Bayes classifier is used to predict whether the given review belongs to the Positive or Negative class. Logistic Regression is a supervised machine learning algorithm that is used for classification problems. It is an algorithm used for predictive analysis and is uses the concept of probability. It works best on binary classification problems and since in current study, there are only two classes such as Positive or Negative reviews, so Logistic Regression is also used for comparison purpose.

2. PREVIOUS STUDY

Users today finds it difficult to process all of the data unless an automated summary is available. With fragmented messages as inputs, social media summarization creates a summary of content generated by user. Sentiment analysis and classification, in particular area aim to summarize online customer reviews. These reviews allow consumers to compare consumer feedback or review from different items by highlighting the benefits and drawbacks of their product features. Since web users give their opinions on a product, they have both positive and negative review about various aspects of the product. The ratio of positive and negative review about each product feature across multiple products needs to be compared to offer a quantitative overview and comparison between multiple products. Sentiment classification establishes the alignment of a review opinion irrespective of product features, while sentiment analysis excerpts individual product feature groups from review opinions [1]. Sentimental analysis is the procedure of determining the sentiment of reviews based on the positive and negative implications. Sentiment analysis can be done at three levels: document level, sentence level, and phrase-level [2]. There has been a lot of previous work completed in this area where terms and phrases have been categorized as positive or negative oppositeness [3]. In certain cases, this prior definition is useful, but when contextual oppositeness is involved, the sense obtained from positive or negative oppositeness may be completely different [4]. In addition, a refined method for establishing contextual oppositeness of phrases has been developed, which uses subjective detection to compress reviews while preserving the intended oppositeness [5] [6]. There are different approaches used for sentimental analysis. Also there are many machine learning algorithms that have been used to do sentimental analysis like Decision tree, Support Vector Machine and Rule based Approach. These techniques have its own set of advantages and the limitations as well [14]. Lexicons were regularly used for polarity and intensity classification [7]. Authors have presented SentiSense as an affective lexicon. Its job is to attach emotional categories to WordNet synsets. This lexicon could be useful for opinion mining and analyzing the sentiments. One of its major benefit is the accessibility of diverse set of algorithms and tools. Thus, the lexicon may be extended collaboratively, so that user's extensions may be used to enrich the core of the lexicon. Authors have [8] proposed a technique depend on improvement of bag-of-words method for testing sentiment of positive, negative and neutral and to score repeatedly using the words weight method rather than term frequency. [14] Few of them are Negation handling, language generalization, synonyms gathering, detection of fake and spam reviews and comparative sentences [13]. To do this, use of SVM, KNN models and identify the fake reviews and fake false reviews and do comparative study [15] is an option. A system has been built to take in the sentiment embedding's and does sentimental analysis on feedback made by the customer. To obtain overall score for the product, the polarity scores are added obtained from the feedbacks of a particular product. It is then presented in the form of a graph to the administrator depending upon which administrator can manage the inventory so as to improve the overall quality of the website [9]. Rating, Reviews and Emoticons are the parameters, to measure the quality, quantity or some combination of both. To find out fake reviews MAC based filtering approach was proposed. The method is verified on real time data from online website [10] [11]. CommTrust is proposed to define sellers profile. It shows reputation scores and trust score of seller. [12]. Sentimental analysis has been done using various techniques for example, Information gain, Chi-Square, Mutual information and TF-IDF in order to choose

features from feature set with high dimensionality. The classification of sentiments was performed using Support Vector Machine [16]. Authors have presented methods to normalize the tweets which have noise and classified them based on their polarity [17]. A novel method with a multi-domain active learning framework has been proposed. Term frequency is implemented for weightlifting features and LIBLINEAR SVM is used to generate a better classification model [18]. Authors have proposed a new technique which is based on clustering to oppress the problems of the prevailing methods. The clustering process was implemented multiple times to acquire the final result [19]. Sentimental analysis has been performed using various Machine Learning Techniques in the past such as Decision Tree Classifier, K-Nearest Neighbour Classifier, Support Vector Machine, Bayesian Network, Neural Network etc. Result shows 85% of accuracy was achieved by using supervised learning technique [20-22].

3. PROBLEM FORMULATION

Whenever user intends to buy something from e-commerce, they will tend to buy the products whose ratings are more than 4, and they read reviews of the products whose ratings are good most of the times. Users generally see the reviews as a sorting filter in many e-commerce sites but sadly, sites are being sorted only by the number of reviews irrespective of them being a positive or a negative one. This will impact the sales of the e-commerce site. So, in current study focus given on targeting the reviews for which ratings are not available and try to predict the emotions of those reviews using Naïve Bayes Classifier. This approaches helps in understanding and predicting the sentiments of the users. This approach helps to enhance the products that are having more positive reviews so that the user will feel more secure about the product that is being purchased.

4. PROPOSED METHODOLOGY

Data used for the study is gathered from Kaggle website i.e. Customer reviews of Amazon products. During data cleaning the punctuations and stewards have been removed from the reviews which are having ratings and the reviews with rating Nan. Dataset consists of 21 columns such as Id of the product, Name of the product, brand, categories, keys, manufacturer, and date of the review, review Id, and review rating, review text, review title, username and so on. The data is split into training and test sets. Features have been extracted from the data and then accuracy of the model have been observed. Different classifiers are used during the experiment i.e. NLTK Naïve Bayes, Multinomial NB, Bernoulli NB and Logistic Regression. This helped in predicting and segregating the sentiments into positive and negative. Figure 1 shows the proposed architecture model of the sentiment analysis using different classifiers.

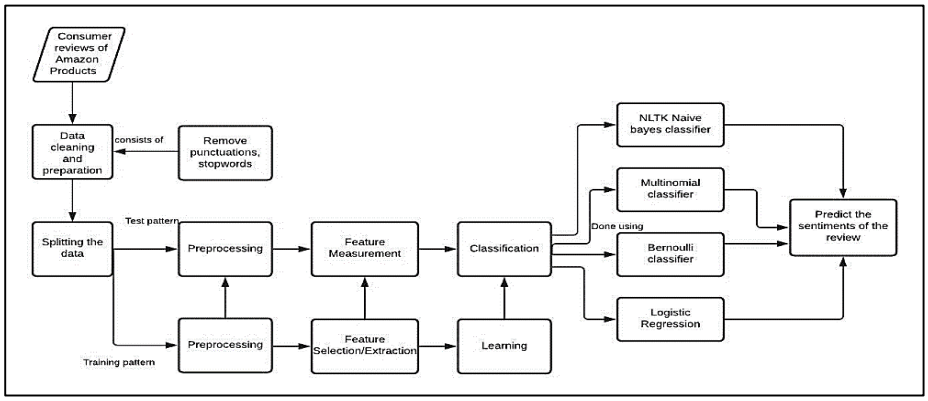

Figure 1. Proposed Sentiment analysis model.

5. DATASET AND EXPERIMENT DISCUSSION

Dataset of Consumer Reviews of Amazon Products is considered during the experiment. The main focus lied only on the columns named "reviews. rating, reviews. Text, reviews. title and reviews. username" from the dataset.

1. Initially Null values in these columns are observed. Then reviews in which there was no rating given are then filtered out. The reviews which possessed some rating also filtered and stored in some variable.
2. Reviews with the rating greater than 4 are classified into positive else classify as negative. It has been observed that there were 32316 reviews as positive and 2311 as negative. Figure 2 shows the bar chart of the same.
3. Next data cleaning was performed in order to feed the data to proposed sentiment analysis model and the sentiment of each review was shown against the reviews given by customers.
4. Naïve Bayes classifier was applied on the training data and the accuracy of the model was observed along with 5 most informative features. However, the accuracy was just 58.9%.
5. Count vector and TF-IDF vector was then constructed and for training, testing and check data.
6. Then predicted the sentiments for check vector which was not having any rating initially using Multinomial NB and found the accuracy to be 93.29%. Bernoulli NB method also checked for accuracy which was approximately 92.04%. The model is also trained using Logistic Regression and predicted the sentiments for check data and accuracy came out to be 93.70%.

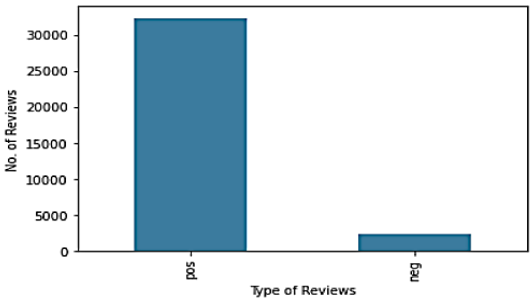

Figure 2. Positive and negative reviews

6. RESULT ANALYSIS

This section discusses about the results obtained from the experiment. It presents the analysis and visualization of the reviews for which ratings are present

6.1. Word Cloud Visualization of the sentiments

Python is used to show the feelings retrieved as features in a WordCloud. Figure 3 describes all of the sentiment words that were retrieved as opinion characteristics.

Fig 3. Word Cloud of all sentiment

Fig4. Word Cloud of positive sentiments

Fig 5. Word Cloud of negative sentiments

Figure 4 and 5 shows the words used for predicting positive and negative sentiments respectively

6.2. Performance of classifier using AUC-ROC curve

Measuring performance is a necessary activity. So authors have used AUC - ROC Curve which helps to validate a classification experiment. The Area Under the Curve (AUC) and Receiver Operating Characteristics (ROC) curve is used to confirm the outcome of a multi-class classification problem The ROC algorithm determines a classifier's threshold. The curve aims to maximize genuine positives while reducing false positives. The area under the curve calculation was utilized (AUC). Fig. 6 shows the performance for different classifier i.e Multinomial, Bernoulli and Logistic Regression. When compared to other methods, Logistic Regression has a high score of 0.86.

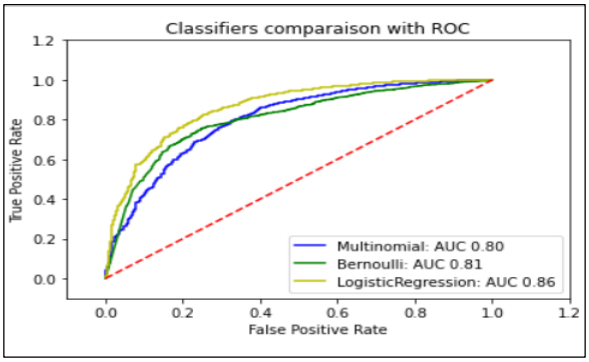

Figure 6. Performance of Classifiers

The ROC algorithm determines a classifier's threshold. The curve aims to maximize genuine positives while reducing false positives. The area under the curve calculation was utilized (AUC). Figure 6 shows the performance for different classifier i.e Multinomial, Bernoulli and Logistic Regression. When compared to other methods, Logistic Regression has a high score of 0.86.

6.3. Performance Metrics of different classifiers

Table 1 shows Performance metrics for the model i.e. precision, recall and accuracy for the Multinomial, Bernoulli and Logistic Regression classifiers.

TABLE I. PERFORMANCE METRICS

Performance Parameter / Types of Machine Learning Models	Precision	Recall	Accuracy
Multinomial	0.87	0.93	0.93
Bernoulli	0.90	0.92	0.92
Logistic Regression	0.93	0.94	**0.94**

Observation for Sentiment model proposed during the study is; Multinomial Precision would be 0.87, or 87 %, Bernoulli Precision would be 0.90, or 90 % and Logistic Regression Precision would be 0.93, or 93%. As a result, when it is predicted that the reviews will be positive, there will be an 87%, 90% or 93% possibility that all of the reviews will be positive. Recall for Multinomial would be 0.93, or 93 %, Recall for Bernoulli would be 0.92, or 92 %, and Recall for Logistic Regression would be 0.94, or 94 % for proposed model. As a result, there would be a 93%, 92%, or 94% chance of getting real positive review from the positive reviews proposed model have identified.

7. CONCLUSION

Sentiment mining is incredibly significant in business since it allows companies to better understand its consumers' opinions and enhance their offerings. Customers also rely on the

opinions of others who have already purchased the item. Reviews or feedback become a deciding factor in whether or not to purchase or sell a product. Current study forecasted the sentiment of reviews with Nan ratings by feeding the reviews with proper ratings into proposed model and that helped to identify the customer's opinion. Current study helps to forecasts the opinion based on unrated reviews. In comparison to multinomial and Bernoulli regression, the logistic regression prediction has received a positive review. The accuracy of the forecast from Logistic regression is higher i.e. 94% than multinomial and Bernoulli.

8. FUTURE SCOPE

Different dataset would be tested on proposed model in future with different feature selection methods. Also the same model can be used for sentiment classification for detecting fake reviews. User can see more positive reviews which will help in building better customer relationships.

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Smart Car Parking System Using Arduino UNO & Mobile Application

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Abstract.

In this paper, we have implemented an Android-based car parking application. We have used the application for multistory parking. We have used Arduino UNO, Infrared (IR) Sensors, NodeMCU, and Servo motors. Also, we have placed one LCD at the entrance for displaying the ongoing status like Vacant/Full. Hence, this paper intends to design and develop a smart car parking system using mobile app technology. This system can control entry, exit, and slot booking for vehicles.

Keyword. Car Parking, Arduino UNO, Infrared (IR) Sensors, Mobile Applications, LCDs

1. INTRODUCTION

In the survey of metropolitan areas, it's seen that population increment causes a high density of vehicles on road resulting in poor parking facilities and traffic issues. Due to the increase in urbanization vehicle parking is a major challenge in various cities [1], [2]. Finding suitable parking spaces is a major problem for many drivers, especially visiting crowded public places like malls, cinema halls, 5-star hotels, etc. Parking slots provided in multi-stores, malls, multi-complex buildings, etc. usually operate manually i.e. a person is allocated to supervise empty slots which consume time and fuel and are hence not effective. Nowadays when people are in rush and in such inflation where fuel prices are very high, drivers tend to waste their time and fuel in search of empty slots and end up parking in non-parking areas causing jams on the road which can lead to accidents. Some studies so far have drawn attention to smart parking systems for up-gradation as per modern requirements [3]. A fully automated parking system not only solves parking issues but saves time, energy, and fuel and does its work easily without causing any trouble to other drivers. This also enhances the security system by monitoring and controlling the access of vehicles in parking areas of the government and private sector. This project eliminates unnecessary time consumption in the search for a vacant parking slot and saves fuel, also solving the majority of the above problems. In the last few years, various smart car parking methods have been proposed. The impact of IoT, sensors, and microcontrollers can be seen in smart city development [4], smart homes [5], home automation systems [6], and many more.
Parking methods are generally based on Arduino UNO, IoT, Clouds, and RFIDs. Among a

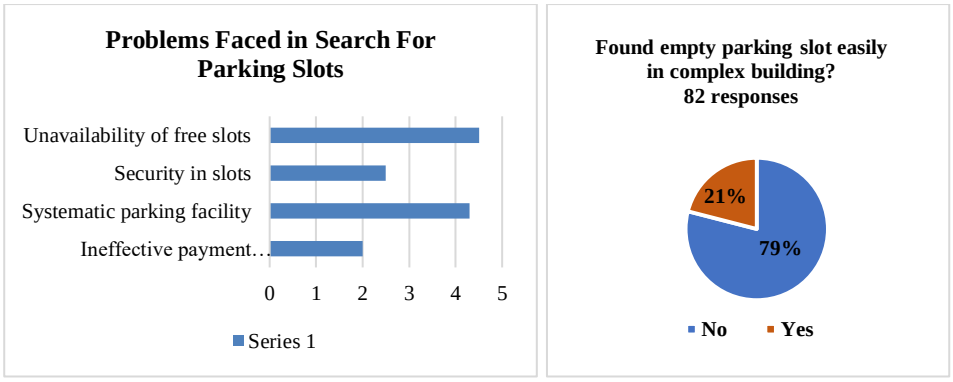
large number of proposed techniques, few techniques are reviewed in the literature survey. In [7], the system is based on the integration of web applications and electronic devices such as ultrasonic sensors, Arduino UNO, NodeMCU, Wi-Fi microchips and TCP / IP stack, and a camera. The web application contains three available components that are *Control panel*: the control panel where the controller creates spaces and configuration space, *the API*: Web-based APIs are developed for communication between other applications and web applications, *check-in point page*: used to sign in and click images to create spaces. In this system, the sensor will detect the car in space, transmit signals to NodeMCU to detect the vehicle, and dial the API to change the slot status in the web application. When the vehicle leaves the area, the sensor will detect the space again, transmit the signal to NodeMCU, and will also call the API URL to update the slot status in the web application. Barcode scanner and camera connected to a computer/laptop system in checkpoint IN there is an input field where the generated code will be added after the card is scanned. The request will then be sent to the server for a verification card. Once the card is verified, the system will prompt the user to enter the number only if the system cannot read the image number of the captured image. If the system successfully reads the number from the plate, the system will allocate space against that user and will display location information and map URL in the code.
In [8], the proposed system works on basic sensor-enabled functionality using Arduino. IR sensors detect a vehicle approaching the front gate. The gate opens when the car is found again, and the IR sensors of each space detect empty spaces and display them on the LCD. Thus, the driver is aware of the empty spaces on the door itself and can easily park in the space. There are infrared sensors in the parking lots that track the available space. The front gates do not open when there is no space. In [9], the designed method uses a cloud server / mobile application to pre-book available spaces and the internet of items in the RFID module. After accessing the premises, the Wi-Fi module helps inform the user about real-time parking. The RFID reader is connected to the Arduino UNO which receives the entry time stamp. The IR sensors in the spaces update the position as the vehicle stops. The app has a new user registration page and an existing user login page. The app gives users a set time when cars need to be parked in the desired location. The mobile app also has an e-wallet with which the user makes a payment while logging out. The IR sensor starts the timer when the user parks in the area and the charge is calculated when the user stops the timer and the value is deducted from the e-wallet only after which the exit bar opens. In [10], the system is designed based on hardware such as Arduino UNO system control, IR sensors that detect the presence of an object using infrared light, a servo motor for direct or angular motion, acceleration, and speed or input and output gates, an LCD used to display the number of spaces if available. All hardware connections are made to the breadboard. There are IR sensors at the entry and exit gates, the car approaching the gate will hear the IR sensor and send a signal to the Arduino to check for blank spaces, when the spaces are found it automatically adjusts spaces and slows down the count as soon as the car reaches the entrance gate sensor again, the bar opens for the car to enter. If there are no spaces, there is a message from the LCD saying “sorry no space” and the gate does not open. In [11], the system works on the IR sensors and the Wi-Fi module. The sensors are connected to an Arduino that sends signals when any vehicles are approaching the entrance gate. There are connected LEDs that glow red when the IR sensors receive a signal of the occupied spaces and glow green while the IR sensors do not receive any signal indicating that there are no vehicles parked in the area. The signal received by the IR sensor is compared with the boundary value and if it is greater than the limit the red light flashes in the same way when the received signal is below the limit the green light flashes. The process remains the same in all spaces and whenever any vehicle enters or exits a parking space the website is

constantly updated. All results are displayed on the LCD and in a text message on your cell phone. In [12], the proposed system is based on Arduino, GSM module, SMS, and payment method. In this app the driver needs to book and based on this the driver gets a unique android app. This application allows users to enter or exit a car park. The user entering the parking lot receives an SMS with information about available spaces and reservations. Ultrasonic sensors are located in the parking lots to send signals about the availability of spaces. At the door, the driver had to connect via Bluetooth and press the enter button. Arduino detects the signal and checks that the driver has only made a payment and sends one signal to the servo motor to open the gate and another to the GSM sending module SMS to the driver about the booked slot and immediately The slot is booked and Arduino starts the calculator time until the car leaves the parking spaces. Payment is based on a time frame until the vehicle leaves space. When you exit, there are ultrasonic sensors to detect the exit vehicle, then send a signal to Arduino and another user receives an SMS related to the exit route. Exit gates only open when the user presses the exit button. In [13], the system is designed based on Arduino, RFID, and LCDs. As the user approaches the parking lot the user is asked to choose two parking spaces or pull out the car, in selecting the parking option the user needs to select the empty spaces available. The vehicle is then positioned in a rotating position i.e. a forklift that receives a signal from Arduino to move the vehicle to a fixed position, this is achieved by sending continuous movement instructions to make a smooth movement. To retrieve the car, the driver needs to select the "restore" option and the system tells the user to swipe the RFID card. RFID information is checked on the website and a signal is sent to Arduino for retrieval. The forklift is designed in such a way that the vehicle cannot access the forklift until the user makes the required payment using RFID. In this paper, we have introduced a smart parking system using Arduino UNO, IR sensors, LCD, NodeMCU, and mobile applications. This system works on real-time data and sends the information on the mobile app and also displays it on LCD. It also helps drivers to pre-book the slots and park effortlessly. To overcome all these issues, this proposed model includes:

1. Excludes all the long signing-up process
2. Have a very easy slot booking mechanism
3. All drivers do not need to signup for the app to see availability, they can see it on the LCD and save time.

2. DESIGN & IMPLEMENTATION

The car Parking system is developed using various electronic components. From [9], we took the idea for a survey, the summary of which is listed below. From this survey, we can conclude the best way to a smart parking system.To understand the problem better we surveyed the problems related to parking in India, the responses are shown below in Figure 1. The majority of the issue is the unavailability of an empty parking slot in a suitable area followed by systematic parking facility and security of vehicles in slots as the problems identified by the surveyed users on a scale of 5. We then surveyed the empty parking slots problems with complex buildings, malls, offices, shopping stores, and cinema halls as depicted in Figure 2 which shows that 79% found it difficult to find an easy parking slot.



(a) (b)

Figure 1. (a) Problems with the manual parking system (b) Complex Parking issue

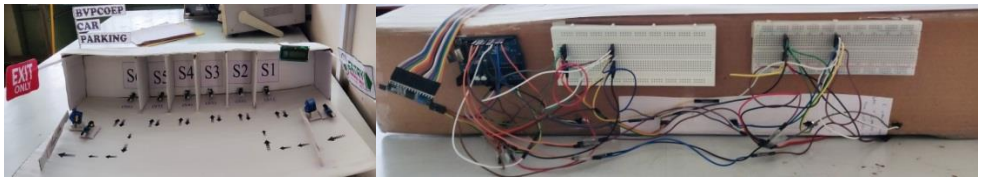
2.1. COMPONENTS USED

The list of components used in our models are:

1) **Servo motor:-** It is used for controlling the gates of the parking. In total two servo motors are used out of which one is used for opening the gate and the other for closing. The servo motor is initialized with angles like 90^0 when closed and 0^0 when open. The servo gets instruction from Arduino UNO when the IR sensor senses any obstruction to open the gate and we have set a delay for closing. We have given a 5V supply to the motor.
2) **IR Sensor**:- These are used to detect obstruction if any. We can set the range of the IR manually. We have used 8 IR sensors, one of the six IR sensors at the respective slots, and one of the two IR sensors at the entry and exit of the gate. When any car arrives or leaves, the IR sensor senses the car and updates the Arduino UNO followed by the opening of the gates. The 6 slots have a respective sensor to sense the car and these sensors update the vacancy of the parking and also help in analyzing which slot is empty or which slot is filled. We have given a 5V supply to all the IR sensors.
3) **LCD:-** It is used to show the no of vacancies the parking has and it also shows the respective slot which is empty or filled. We have given a 5V supply to the LCD and we have used I2C as a communication protocol between LCD and Arduino UNO.
4) **Arduino UNO:-** We have used an Arduino UNO board and ATmega 328p microcontroller to control the various components. Arduino UNO has 14 digital and 6 analog inputs. All the sensors are connected to the digital pin of the Arduino and the Arduino is given a supply of 5V which it gets from the laptop. We have written the codes of Arduino in Arduino IDE and have burnt it in the microcontroller. It has a flash memory of 32KB.
5) **NodeMCU:-** NodeMCU is based on ESP8266 and can be used to connect objects and transfer data through the Wi-Fi protocol. In addition, NodeMCU provides some of the most important features of microcontrollers such as GPIO, PWM, ADC, etc. Features
    - *a)* Onboard ESP32-S module
    - *b)* Onboard CH340, USB to UART converter
    - *c)* USB port for power input, firmware programming, or UART debugging
    - *d)* 2×19 pin extension headers, break out all the I/O pins of the module
    - *e)* 2× keys, used as reset or user-defined

3. METHODOLOGY

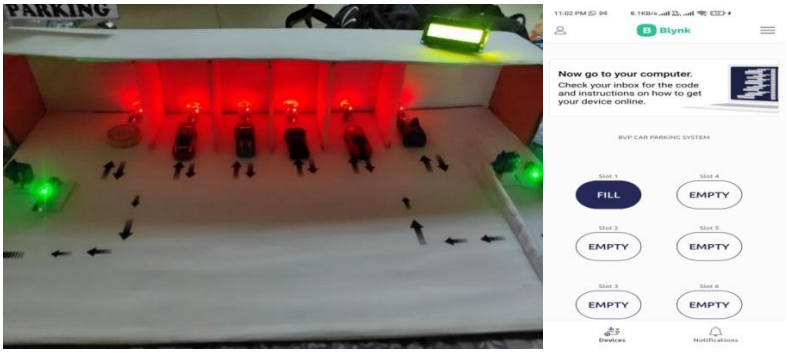
The project revolves around the parking problem that we face in malls, hospitals, and public places where proper guidance and knowledge of availability lacks which leads to time loss as well as fuel loss. In this project with the help of a microcontroller and several sensors, we have designed a smart car parking as shown in Figure 2 (a) & (b) in which the availability and the available spot can be known in advance. The commuter can either use the LCD that is placed on the entrance gate or the mobile app to see the available slots to park the vehicle.



(a) (b)

Figure 2. (a) Front portion (b) Back portion of our proposed Model

The model has a total of 6 slots in which the car can be parked and 2 gates, 1 at the entrance and 1 at the exit. Both the gates automatically open as they are integrated with the IR sensor which detects the motion of the approaching cars. The components used include 1 LCD, 2 servo motors, 8 IR sensors Arduino UNO, and Node-MCU Esp32 as shown in Figures 2 & 3 (a). LCD is used to display the total available slots and also the individual slot that is empty as shown in Figure 4 (a-d).



(a) (b)

Figure 3. (a) Figure showing LCD model(b) Mobile application Showing Slot Status

The servo motor is used to control the gates of the parking. The IR sensors are used to detect the presence of the cars on either of the gates or the slots. 6 IR sensors are used for the 6 slots while 2 are at the gates 1 at the entrance and the other at the exit. Arduino UNO is used to receive the data from the sensors and direct it to the gates to open or close them and also to the LCD to display the required information. NodeMCU is used as a Bluetooth module to connect to the app and send the data over the mobile app. The code for the Arduino is done in the Arduino IDE which is embedded in C. The availability of the slots gets updated every 5 seconds. The LCD first displays the name of the parking i.e. 'BVP CAR PARKING SYSTEM' then the no. of available slots as shown in Figure 4 (a) and then the specific slot

if it is full or empty and as depicted in Figure 4 (b) if the IR sensor at the slot senses a car the LCD shows the slot status as 'fill' and ‘Empty’ when no car is detected. The same information is shown in the Mobile app illustrated in Figure 3 (b). The complete parking model block diagram is illustrated in Figure 5.

(a) (b) (c) (d)

Figure 4. (a-d) Showing Slot Status in LCD

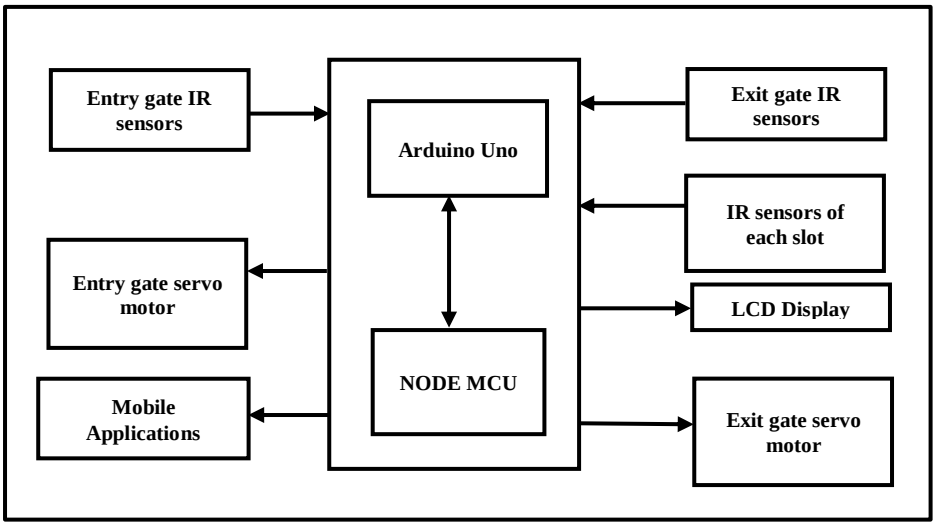


Figure 5. Model Block Diagram

3.1. WORKFLOW

The design and development of this model are divided into two parts entry and exit part, the explanation is depicted in the flowcharts given in Figure 6. The flowchart shown in Figure 6 depicts the methodology that has to follow by any user who enters the parking area. When the user reaches the area he can see the total vacancy of slots on the LCD screen and can check the slot number for parking on the mobile application and can continue booking for the slot. As soon as the user parks the car the IR sensor senses the car and sends information to Arduino and the Arduino update the information on both, LCD as well as a mobile application as shown in Figure 3. Figure 7 depicts the exit flow process of this model which starts as the user removes the vehicle from the slot. As soon as the car gets removed, the IR sensors detect the space and send the information to the Arduino which increases the empty slot number on the LCD as well as the mobile app. This helps other users access the application and find empty slots.

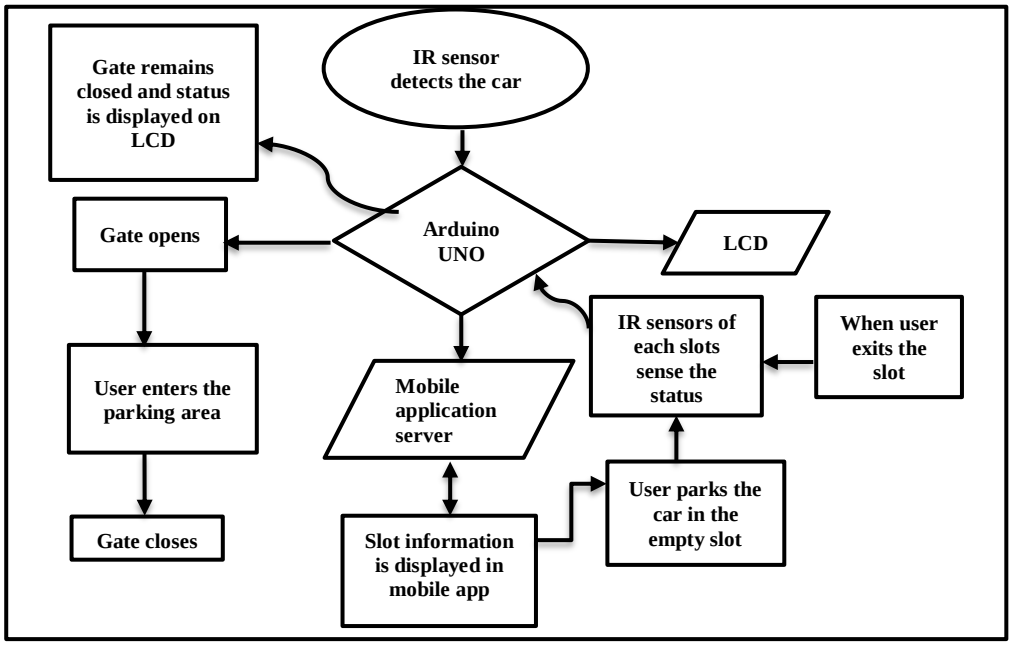


Figure 6. Entry Process Flowchart

3.2. EXIT WORKFLOW

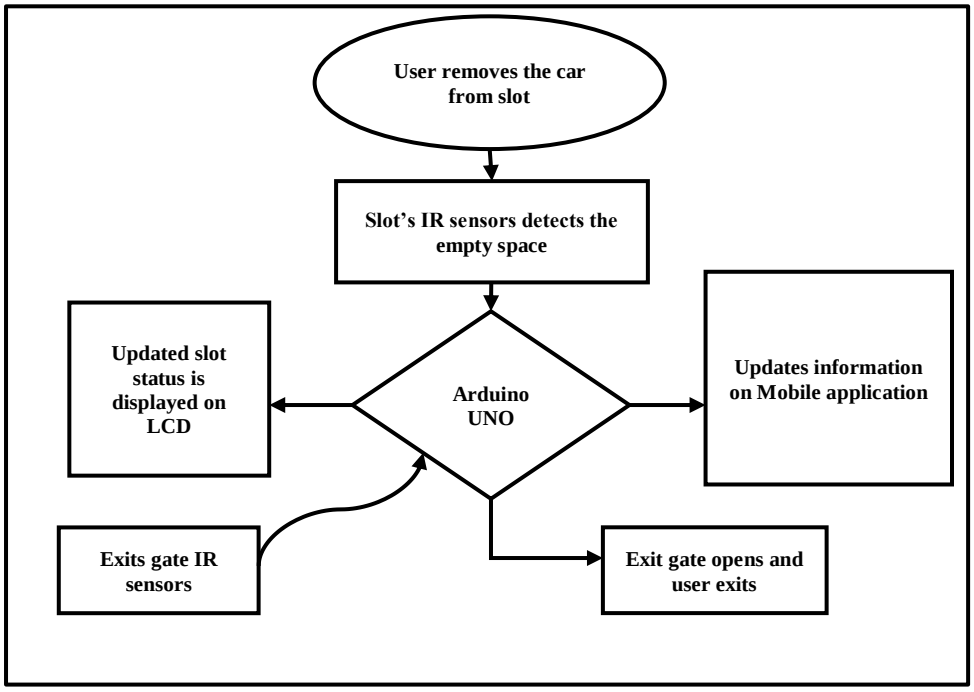


Figure 7. Exit flow chart

4. CONCLUSION

This paper showcases a smart Car parking system using Arduino UNO, NodeMCU, and Mobile Applications. This system makes parking allocation easier since there is no registration required and directly guides people to the exact location of the empty slot. In case there is no empty slot remaining the entry gate does not open which saves lots of time. This system has both an LCD as well as a Mobile application where through LCD users can get to know the status of slots without downloading the application and users can book the slot if available. The slot will be allotted in order of numbers and if any slot in between gets empty that empty slot will be allotted first to any user, and if any user does not park the car after booking the slot, after 2 minutes the booked slot will be updated as empty. This feature makes our model more efficient than others.

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Biographies

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Sentiment Analysis Using SageMaker And Pytorch

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Abstract.

Machine learning engineers have a lot of data from many online and offline sources. IMDB which stands for internet movie database is one of the available online databases that contain various sets of movie reviews from millions of reviewers. The IMDB dataset comes with labelled and unlabelled reviews; the labels are either positive or negative, and a positive label means that the review is positive and a negative label means that the review is negative. Learning patterns from these millions of online reviews is a challenge as data comes with a lot of incomplete and unstructured texts, and is sometimes meaningless as the reviewers use some unfamiliar abbreviations. This paper focused on building a machine learning model based on Long-Short Term Memory (LSTM) and Recurrent Neural Networks. Accuracy is the performance metric used to measure the robustness of the model. This paper explains the most suitable technique for detecting if sentiment is positive or negative, it also explains a new technique to train, test and deploy a sentiment analyser using Amazon SageMaker. The words in the reviews are converted into an array of vectors, then fed to the model. After training the model, accuracy is 85%.

Keywords. Sentiment Analysis, SageMaker, Pytorch.

1. INTRODUCTION

The need to make a computer understand what text means is more and more needed in today's society, the increasing number of online shopping applications, where the users will review product and a machine algorithm has to rate if it is a positive comment or not. The increasing amount of data available online gives the opportunity to machine learning enthusiasts to learn patterns from the data and come up with a model that can understand at machine level what a text means or if text has a positive or negative sentiment. The need to make computer understand text is needed in various fields such as classifying an email if it is spam or not, getting information from web, text summarization, text translation, and many more. In email classification and sentiment classification, there are some predefined classes but in text translation and summarization there is no predefined class making it more difficult to the approach to finding a good model that could translate well a text. This paper aims to develop a sentiment analyser using Amazon SageMaker, and develop as machine learning algorithm on IMDB dataset to predict the sentiment of a text. The paper also covers the processing of data, the way the data is uploaded on Amazon Web service (AWS) on the S3

bucket, the model building using SageMaker, training, testing, and deploying the model using AWS, and building a website to interfere with the model, the website will take reviews from the users and feed it to the model on the cloud, the model returns the sentiment of the reviews and that sentiment will be displayed on the web application.

2. RELATED WORK

Artificial intelligence (AI) is one of the most active research areas, researchers got their interest in artificial intelligence due to the fact that it has a lot of undiscovered potentials. Both deep learning and machine learning coming under AI have seen an increasing number of researchers trying to understand and discover the underlying potential of these fields. Many researchers worked on developing and deploying models using Amazon Web services (AWS), in this direction Singh Himanshu wrote a book where he explained three useful cases where AWS is used to develop and deploy machine learning models with few numbers of code reducing the work for developers. Zakari et al. wrote a paper where they classified toxic comments, they presented a new method to analyse social media comments using AWS and S3 bucket, they found that LSTM perform better on sentiment analysis with AWS, the accuracy of their model is 70%. Hudgeon et al. wrote a book where they explained how AWS can be used efficiently to develop a machine learning model that can help businesses [3]. Kumar et al. worked on the IMDB dataset; they used a hybrid feature classification using a concatenation of machine learning features with lexicon features [4], their model performed well over many other models, this model is complex and difficult for new researchers to understand. Qaisar and Saeed Mian published an article in 2020 where they used the LSTM model to classify the IMDB dataset, the found an accuracy of 89.9% [8], their model is based on a recurrent neural network (RNN) model, they measured the performance of their model on the basis of accuracy. Md. Rakibul Haque, Salma Akter Lima, and Sadia Zaman Mishu published a paper in 2019 where they used CNN, LSTM, and a combination of CNN and LSTM (LSTM-CNN) to classify IMDB data, they used F-Score as an evaluation metric, their experimental work showed that CNN performed well over LSTM, LSTM-CNN, the CNN model gave an F-Score of 91% [2]. Mathapati et al. developed a classifier for sentiment analysis, they used the IMBD dataset, they also used deep learning techniques to gain higher accuracy and reduce loss and computational time [6]. Rehman et al. developed a model based on the word to vector applied to CNN and LSTM [10], the word to vector translates word into an array of integers, their model outperformed conventional classifier in term of accuracy, precision, recall, and F-Score; they applied their method on Amazon movie review and they got satisfying results.

3. DATA

This paper used IMDB for training and testing. IMDB is a large dataset obtained from various internet movie reviewers. It is for binary classification [1], the dataset has two classes either positive or negative, it has 50,000 records of very popular movie reviews split into two sets such as 35,000 for training and the other 15000 for testing making a ration of 70% of data is used for training and 30% for testing, the data has been randomly shuffled before splitting into training and testing. The dataset comes with other records with no class, these unlabelled records can be used for reinforcement learning. They can be downloaded from the Standford University website, each movie has a huge number of reviews, the

dataset has taken only 30 reviews from any movie, this is because some movies have more reviews than others, so it is convenient to take the same number of reviews so that we have a same dimensional data for computing.

4. PROPOSED WORK

4.1. Processing the Data

The data comes in a raw file and contains a lot of things that should be cleaned such as punctuation, to have train and test data, this paper divided the data into two sets, one for training and another for testing. The downloaded data contains 25000 training records, 12,500 of which are positive reviews and the remaining 12,500 are negative reviews. The paper combined and randomly shuffled the positive and negative reviews after reading the positive and negative reviews. After shuffling the data, it is the right time to separate it into training and testing. Four variables are created: train X, test X, train y, test y represent respectively the training reviews, test reviews, training labels and test labels. Each variable has a length of 25,000. The data is downloaded from the internet so some HTML tags come with the data and these tags should be removed. The input should be tokenized in a way that words such as exited and exiting are considered as same in the sentiment analysis. To do so this paper used the stopwords from nltk (natural language Toolkit) corpus and stemmer porter and BeautifulSoup A method review to words is then created that uses BeautifulSoup to remove any HTML tag that appears in the data, to tokenize the reviews, the nltk is used. This operation is expensive in time so the method review to words caches the results, removes all punctuation, and convert all word to lower case. While running this method for the second time, it will not take time, it will just load the data save in the cache.

4.2. Upload Data to S3

The training will be done using Amazon SageMaker, so the data should be uploaded to Amazon S3 so that the training code can access it. To begin, the data is saved locally then it is uploaded to S3.

4.2.1. Amazon SageMaker:

SageMaker is a service provided by Amazon which helps every data scientist or any developer to build, train and deploy machine learning models in a rapid way. Amazon SageMaker is a cloud-based service that covers the entire machine learning lifecycle, from data labelling and preparation to selecting an algorithm, training the model, tuning and optimising it for deployment, and making predictions.

4.2.2. AWS- IAM account:

AWS stands for Amazon Web services, IAM stands for Identity and Access Management, IAM is a service that help to access with security AWS services, in the case, a web application has to access the SageMaker endpoints, an IAM role will be assigned to authorize this access.

4.2.3. S3:

The training data is saved locally into a comma separated value file called ‘train.csv’, this format is very important as it will be used while writing training code. It has a label, length, and an array of length 500 containing an array of integers obtained from the words in the review. The data is then uploaded into the SageMaker default S3 bucket, saving the data in this bucket help to access it in the training phase of the model.

4.3. Introduction to SageMaker

4.3.1. Building the Model:

The model is composed of three things such as the artifacts of the model, training code, and testing code, they interact with each other, Amazon provides containers and gives the option to add a new code. In the training folder, there is the model file model.py. In the building process of the model, the torch.nn is imported then a python class is created and inherits the module of the torch.nn, the class init of the class takes parameters such as self ‘embedding dim’, ‘hidden dim’ and ‘vocab size’. The ‘self.embedding’ is assigned to be an instance of the Pytorch neural network embedding module having the vocab size, embedding dimension and padding set to zero as parameters. The LSTM is inherited from the torch neural network module and takes parameters such as embedding dim and hidden dim. As it is a long short-term classifier, dense and sigmoid layers are important so a dense layer is created from the linear model of torch neural network. A sigmoid activation function is then added, a forward function is very important, it takes the self and x as parameters and returns the sigmoid output, it has an output range of 0 to 1. Before it returns a value, it transposes the variable x to get the lengths of the reviews, it embeds the reviews and feeds them into the LSTM defined in the initialization part of the class, the LSTM output is then passed to the dense layer and the function finally returns the sigmoid activation of the output of the dense layer. To improve the performance of the model, the embedding dimension, hidden dimension, and vocab size should be tuned well, these parameters will be modifiable in the code without modifying the training script. A small portion of the training set is taken to see if the training script is running well, error-free, and produces the desired output.

4.3.2. Training the Model:

The model is a PyTorch model builtin Amazon SageMaker, there is a need to specify an entry point, it is the python file that will be run when in the training phase of the model, it contains all necessary code to train a model, SageMaker passes hyperparameters to a training script, these hyperparameters are then passed to and used by the training code. Some steps of the training in SageMaker are explained in the following: Starting the training job, launching requested ML instances, Downloading the input data, Downloading the training image, uploading generated training model, completing the training. BCELoss (Binary Cross Entropy Loss) is used to measure the loss. BCELoss measures the Binary Cross Entropy between the target and the output.

4.4. Test the model

Testing is an important part of any project, a machine learning model can perform well on training data and give worse results on live data that is why testing is an important step in building and deploying a machine learning model. This model will be tested by deploying

and sending the test data on the endpoint that is already deployed, this is also a way to check if the deployed endpoint is working well.

4.4.1. Deploy the Model for Testing*:*

The model is trained and it should be tested to see how it performs on unseen reviews, the model takes two variables as input: the review length and an array containing a sequence of integers of length, the array has a size of 500, these integers represent the word in the review, reviews are encoded to integers using the word dict method. There should be a function that loads the saved model, this function is called model fn(), and it takes one parameter: the directory of the saved model, this function is in the python script that is used for the entry point.

4.4.2. Test the Deployed Model:

Once the model is deployed, it can be used for testing, test data is then set and the model gives the output and accuracy of 85%, a precision of 83% and recall of 81%. After deploying the model for testing and doing the testing, it is good to delete the endpoint otherwise it will keep running.

4.5. Deploy the Trained Model for Web App

Now that the model is deployed and tested, it is time to write some inference code so it can receive a review, process it, and give tell if the review is positive or negative. The estimator need to use the entry script and the directory of the saved script, the input of the model will be a string so the words in the string should be processed and converted into integers of length 500 by the method review to word and convert and pad functions. the following function: model fn, input fn, output fn, and predict fn should be deployed into the SageMaker as the container need to use them, the model function loads the model, the input function takes the input and has the role of sending the input to the model endpoint, The output function returns the output to the caller of the model endpoint, the predict function is where the prediction is done. To deploy the model, a new PyTorchModel object is needed and it points to the model artifacts created during the training and to the inference code that will be used, after this a deploy function is provided by Amazon SageMaker, it should be called so it can launch the deployment container.

4.6. Use the Deployed Model for Web App

Now that is model is saved and is working well on Sage-Maker, it is time to develop a website where a user can type a review and receive the sentiment of that review, to achieve this, the web application should access the SageMaker endpoint, to access the endpoint it needs to be authenticated with AWS using an IAM role that contains the access to the endpoint of the SageMaker, this can be done in an easier way using more AWS services. The next diagram shows the interaction between different services from the left, the web application sends and receives data from the API. It collects a user review of a movie, sends it to the API, and expects a positive or negative sentiment from the API. On the right side, there is the model, the trained and deployed model. The API and the lambda function are in the middle. The lambda function [7] is a Python function that executes whenever a given event occurs; this function has permission to send and receive data from the SageMaker endpoint to execute the Lambda function, an API Gateway is needed to create a new

endpoint, the new endpoint is the URL used to listen to the data that will be sent. Once the API Gateway has the data, it forwards it to the Lambda function, the Lambda function passes the data to the model, the model returns the sentiment to the Lambda function which returns it to the API, and finally, the API sends the sentiment to the web application and the web application will display the sentiment to the reviewer.

4.6.1. Setting Up a Lambda Function*:*

The Lambda function executes every time the public API sent data, it processes the data and sends it to the SageMaker endpoint.

Creation of an IAM Role for the Lambda function: The Lambda function is set up to call the API so it should have the necessary permissions to do so; to achieve this a role shou ld be created and later given this role to the Lambda function. The role will be created using AWS Console, in the IAM page there is an option for Roles, then Create role, this should be under the type of trusted entity and then choose the service as Lambda, this will be used in the role then click next, it will navigate to the permissions. A search box appears, type SageMaker and check the box which is next to AmazonSageMakerFullAccess policy, click next, and review. A name is assigned to the role, and that name will be necessary in the next processes, in this example the name of the role is LambdaSageMakerRole, then click Create role, and the role is then successfully created.

Creation of a Lambda function: In the AWS console, there is an option in the navigation called AWS Lambda, create a function in this section and name the function, this project used the Python 3.6 version, Choose the role created by the previous part, click on Create Function, the Lambda function is then successfully created; In the next page, all the information about the Lambda function is available and an editor is available to write the code that will be executed when the Lambda function is called. The editor will contain custom code and save the endpoint.

4.6.2. Setting Up API Gateway*:*

On the AWS console, there is an option to create an API gateway, once clicked on that option it will be easily created, a method is also created from the same console to trigger the lambda function created previously. From the AWS console, the API gateway can be deployed and can access the SageMaker model.

5. DEPLOYING THE WEB APP AND RESULTS

Now that the model is deployed on AWS, it is time to build a simple website that will take user review and returns the sentiment of that particular review. The SageMaker endpoint must be launched and running for the web app to connect with it. This implies that every time the endpoint runs, AWS will charge. The endpoint is left running when the web app is in use but turned off when the web application is not used, else it will end up with a relatively huge AWS bill. A website is then built, it has a question asking if a review is positive or negative, then a paragraph saying to “Enter your review below and click submit to find out...” then there is a text box where a review can be typed, after submitting the review, the sentiment will display. If the sentiment is positive it will display “Your sentiment is positive” otherwise it will display “your sentiment is negative” The web app that interferes

with the model on the cloud, the website work well and gives the review but an error occurs when the endpoint is deleted because the web app will not be able to access the model if there is no endpoint. Using SageMaker saves a lot of time for developers as it is easy to setup, train test and deploy a model.

6. CONCLUSION

This paper presented how to build, train, test, and deploy a sentiment analyser using a cloud service, it uses AWS, and, Using AWS saves a lot of time for the programmer and reduces code, SageMaker is a robust machine learning model builder and having the model on the AWS cloud reduce the risks of the model being hacked , model on local servers may suffer from unresponsiveness, the model will not be able to give output due to the server being too busy, locals servers may crash or be down several times due to technical problem, using AWS has resolved all these issues. In future work, this paper will be built using another cloud provided and compare the billing, the effectiveness and the robustness of each cloud to find which one is better.

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A Survey Paper on CPU Process Scheduling

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Abstract— This paper provides an extensive study related to CPU Process Scheduling by using Shortest Job First algorithm and Shortest Job Next algorithm. An operating system must employ process scheduling to ensure that processes run effectively and with fewer wait periods. The goals of process scheduling strategies are to make efficient use of CPU resources, boost throughput, shorten wait times, and quicken reaction and turnaround times. Processes and tasks are scheduled in order to complete the task on time. Scheduling the CPU is a procedure. One process may utilize the CPU, thanks to CPU scheduling. As a result of the lack of any resources, such as I/O, etc., another process is delayed (put on standby), fully utilizing the CPU. The primary goals of CPU scheduling is to increase the system's effectiveness, speed, and fairness. To get around the shortfalls of the Shortest Job Next (SJN) algorithm, SRTF (Shortest Remaining Time First) was created. The work that is closest to completion is given the processor in the SRTF (Shortest Remaining Time First) algorithm. In this paper we have discussed about CPU process Scheduling using different Scheduling Algorithms.

Keywords— CPU, scheduling, Shortest Job Next (SJN), and Shortest Remaining Time First (SRTF) (SJN)

1. INTRODUCTION

The activity of method, the method manager, which deals with the withdrawal of the active process from the mainframe as well as the selection of another process based on a particular strategy is an essential component of a concurrent execution. Such operational systems allow for the loading of just one method at a time into the working memory, and the loaded method also shares the mainframe by using temporal multiplexing.

Different Types of Scheduling

Scheduling falls into one of two categories:

Non-preemptive: In this case, a resource cannot be removed from a method until the method has finished running. Once the running method completes and transitions to a waiting state, the swap of resources takes place. Preemptive: In this case, the OS gives a method a specific amount of time to use the resources. The technique shifts between running state and prepared state during resource allocation, or from watching for the state to prepared state.

1. FCFS (First Come First Serve)

This is the only software system planning algorithm currently in use. The mainframe initial is assigned to the method that demands it. The Convoy effect and the much longer average waiting time as compared to the other scheduling algorithms are FCFS's key drawbacks.

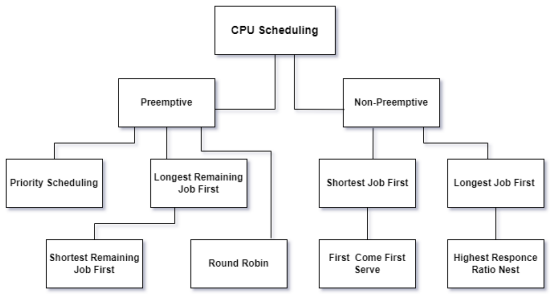

Figure 1 Types of CPU Scheduling

2. Shortest Job First (SJF):

This programming technique may choose the waiting procedure with the shortest execution time to run next. This programming method significantly shortens the usual waiting time for various processes that are waiting to die, whether or not it is preventative. The Shortest Job First is the SJF's overall kind. This strategy's drawback is that, SJF suffers from hunger. Additionally, it is frequently difficult to forecast the length of an impending CPU request in SJF.

3.Longest Job First (LJF):

As the name implies, this algorithmic rule is dependent on the real fact that the method with the longest burst time is processed initially. Longest Job First (LJF) is just the reverse of shortest job initial (SJF). Initial Longest Job is not preventive in nature. The LJF algorithm's high average waiting and turn-around times for a given collection of processes, which might cause a convoy effect, is a drawback of this technique.

4. Round Robin:

It is a CPU scheduling mechanism that cycles around assigning each task a specific time slot. It is the First come, First served CPU Scheduling technique with preemptive mode. The Round Robin CPU algorithm frequently emphasizes the Time-Sharing method.

5. Shortest Remaining Time First:

The preventive SJF programming algorithm is called SRTF (Shortest Remaining Time First). When using SRTF, a method's execution is halted after a specific amount of time. The brief computer hardware schedules the operating process with the least amount of remaining burst time from the list of available processes upon the arrival of each method. No preemption is performed once all processes have been unit tested in the prepared queue, allowing the

algorithmic rule to function as SJF programming. When a method is stopped from being executed and a regular process follows, the method's context is kept in the method management block. On a subsequent execution of this procedure, the PCB is accessible. Given that its overhead costs are not taken into account, the SRTF algorithm processes tasks more quickly than the SJF method. In SRTF, the context transition occurs far more frequently than in SJF, taking up significant CPU processing time. This increases the processing time and lessens the benefit of quick processing. One of SRTF's benefits is that brief procedures are performed quickly.

1. Also, the system uses minimal overhead because decisions are only made when a process is finished or a new one is added.

2. SRTF has a few drawbacks, including the potential for process hunger like shortest job first.

If short processes are consistently introduced, large processes may be postponed forever.

2. RELATED WORK

A Shortest Job First Scheduling Algorithm for CPU Scheduling[1] The authors of this study contrasted Round Robin, Shortest Job Remaining First, and the suggested method. In comparison to Shortest Job First search, the suggested approach made a little adjustment to the average waiting time, which resulted in a respectable reduction in context switching.Preemptive Shortest Job First (SJF) Analysis in CPU Scheduling[2] The Preemptive Shortest Job First method is the subject of the author's case study in this essay, which is described with the aid of statistics, Gantt charts, and average waiting times."Shortest-Job-First (SJF) Scheduling Algorithm for Multiprocessor and Real-Time Scheduling"[3] The execution of the processors from less execution time to high execution time and determining the duration for each processor. In addition to this work, the author used SJF to 4 alternative CPU values and implemented them in a specific amount of time.A preemptive scheduling algorith for soft real-time systems called "Equitable Shortest Job First"[4] In this research, the authors suggested an algorithm that protects a process by prioritizing, addressing the issues associated with the lengthy process starvation in SJF. They also came to the conclusion that the suggested approach might be used to guarantee quality of service in soft real-time systems by integrating it into more complex scheduling algorithms.Round Robin, SJF, and FCFS CPU Scheduling Comparison and Analysis[5] In order to determine which algorithm is best for a certain process, the author of this research analysed three algorithms: Round Robin, SJF, and FCFS. Following all the comparisons, it was determined that FCFS performs best when used in short bursts of time. SJF performs better, however, when the process is run simultaneously on many processors. Last but not least, Round Robin can be used to change the standard waiting time."A Case of Backpack Production Scheduling Systems: Comparison of First In First Out with Shortest Job First in a Production Schedule Development"[6] The study found that, with an AWT difference of 68% and an ATT difference of 62%, SJF scheduling is preferred to FIFO scheduling. SJF is appropriate for situations when there is a build-up of processes concurrently or nearby. Whereas FIFO is used when the process arrival period is lengthy enough.

An innovative Round Robin and Dynamic Variable Quantum Time Task Scheduling method combination.[7] In this paper, the authors focused on separating the ready queue into sub-queues for lengthy and short jobs while also developing a hybrid algorithm based on dynamic quantum RR and SJF. The findings showed that the suggested algorithm was effective in minimizing turnaround and waiting time relative to reaction time, hence lowering the starvation of lengthy jobs.

3. COMPARISON TABLE

Table 1 Comparison Table

Sr no	Authors	Year	Title	Algorithm used	Remarks / Conclusions
1	Inayat ur-Rehman, Mamoona Humayun, Maryam, Hira Khurshid, Muhammad Akhtar, Bushra Hamid	2015	An Optimized CPU Scheduling Shortest Job First Scheduling Algorithm[1]	FIFO, Shortest Job Remaining First, Round Robin	The authors of this study contrasted , Shortest Job Remaining First, Round Robin and the suggested method. In comparison to Shortest Job First search, the suggested approach made a little adjustment to the average waiting time, which resulted in a respectable reduction in context switching.
2	Tri Dharma Putra	2020	CPU Scheduling Analysis of Preemptive Shortest Job First (SJF)[2]	Pre-emptive Shortest Job First	The Pre-emptive Shortest Job First, this method is the subject of the author's case study in this paper, which is described with the aid of statistics, Gantt charts, and average waiting times.
3	Adel Abdullah Abbas	2015	Real-time, Multiprocessor , and Shortest-Job-First (SJF) Scheduling Algorithm[3]	Non-Preemptive Shortest Job First and Preemptive Shortest Job First	The execution of the processors from less execution time to high execution time and determining the duration for each processor.

4	Mario Jean Rene, Dimitri Kagaris	2014	A preemptive scheduling algorithm for soft real-time systems called equitable shortest job first[4]	Enhanced Shortest Job First, Shortest Remaining Time, Highest Response Ratio Next,	In this research, the authors suggested an algorithm that protects a process by prioritizing, addressing the issues associated with the lengthy process starvation in SJF.
5	Andysah Putera Utama Siahaan	2016	FCFS, SJF, and Round Robin CPU Scheduling Comparison Analysis[5]	Round Robin,SJF,FCFS	In order to determine which algorithm is best for a certain process, the author of this research analysed three algorithms: Round Robin, SJF, and FCFS.

4. GRAPHS AND TABLES OF COMPARISON

Figure 2 Shortest Job First

Table 2 Processes and their own burst and arrival time

Process	Burst Time	Arrival Time
J1	7	0
J2	3	1
J3	4	3

Gantt Chart for SRJF:

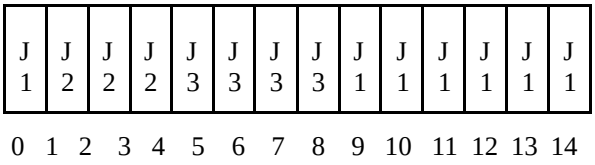

Figure 3 Gantt Chart

As the three processes P1, P2, and P3 arrive and burst at their respective times. Let's compute the waiting time, turnaround time, and completion time. Here, we may use: to determine Turn Around and Waiting Time:

1. Turnaround time equals arrival time minus completion time
2. Waiting Time = Turnaround Time-Burst Time

Table 3 Shortest Remaining Time First (Preemptive)

Process	**Arrival Time**	**Burst Time**	**Completion time**	**Turn Around Time**	**Waiting Time**
J1	0	7	14	14-0=14	14-7=7
J2	1	3	4	4-1=3	3-3=0
J3	3	4	8	8-3=5	5-4=1

Table 4 Average Waiting and Turnaround Time in MIPS

Amount Of tasks & VM					
Existing System/Algorithm	5	10	15	20	25
Policy (Default) Scheduling	4.1	8.2	10.6	13.8	17
SRJF	4.3	6.2	8.2	9.6	8.7

5. SCOPE OF IMPLEMENTATION

This review contributes to discuss various CPU-scheduling algorithms considering the various aspects like Waiting time, Turnaround time, Burst time and other field of scheduling. The analysis shows that no one technique is perfect. Each scheduling algorithm has different use cases and is useful in different domains based on its advantages. Thus, reviewing the limitations of each of the scheduling algorithm and also the main focus being the best and efficient usages of CPU we should use that scheduling algorithm, which best suits a particular operating system.

In this work, we explored several strategies for improving the accuracy and efficiency of the Shortest Job First Algorithm. Its two varieties are Non-Preemptive Shortest Job First and Preemptive Shortest Job First. The algorithm's major goal is to cut down on waiting times on average.

6. CONCLUSION

Scheduling algorithms' primary goals are to decrease resource depletion and ensure fairness among the parties using the resources. Determining which of the open requests will receive resources is the subject of scheduling. The system's behaviour shouldn't be impacted by the scheduling methods. The effectiveness and reaction time of the system are, however, affected by the scheduling algorithms. Adaptive systems are the finest. To perform at the highest level, we need to be able to foresee what would be the most appropriate method for next execution. The Greedy Algorithm is The Shortest Remaining Time First. The main problem with this approach is that if shorter processes keep appearing, it can lead to starvation. The idea of ageing can be used to overcome this issue. It is basically impossible since the operating system might not be aware of the burst time and would not be able to sort them.

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[12] https://www.researchgate.net/publication/234556241_OPTIMIZED_SOLUTION_TO_SHORTEST_JOB_FIRST_BY_ELIMINATING_THESTARVATION

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Indian vehicle number plate detection and recognition using morphological operations and state extraction

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Abstract

Over the past two decades, there has been a significant growth in the use of vehicles. Vehicle technology has advanced quickly as a result of the luxurious lifestyle. Due to this constant increase, it is exceedingly taxing to monitor every vehicle for safety, traffic control, or law enforcement reasons. The necessity of a vehicle number plate recognition system is highlighted by the phenomenon of continually increasing vehicle numbers. The automatic toll collection, traffic control, parking systems, enforcement of traffic laws, automatic gate openers, etc. are some of the applications for number plate recognition systems. This study proposes a single algorithmic method based on the idea of mathematical morphology for detecting and recognizing a car plate number. The suggested algorithm is straightforward, effective, and adaptable. The popular and effective image processing analysis tools OpenCV and Python were used in the development of this user-friendly software solution. The system also determines which Indian state the vehicle is from.

Keywords. Character segmentation, character recognition, license plate detection, state extraction.

1. INTRODUCTION

Vehicle Number Plate Recognition (VNPR) systems have several uses in intelligent transportation systems, which is increasing interest from many nations in developing such systems that can perform duties like traffic monitoring and law enforcement, among others. In addition, VNPR systems are employed for toll payment collection, security purposes in restricted areas like military bases, and the observation of vehicles entering and exiting parking lots. These VNPR systems are typically used to prevent fraud and to bolster security in specific zones. These systems, for instance, might be useful when looking for lost, stolen, or cars involved in crimes. These duties demand a large amount of time, effort, and resources, excepting the VNPR systems. A moving vehicle's license plate is almost impossible for a human to read and retain, therefore manual intervention may result in incorrect analysis.In essence, a VNPR system receives an input image and, if the image contains a vehicle, outputs the content of the license plate (often as text). These systems include a camera that records photos of the vehicle. These scanned images may be infrared, colorful, or black and white depending on the needs of the system. The car number plate can be found and understood using a variety of methods, including object detection [1], [2], [3],

[4], image processing, and pattern recognition.India's states and automobile codes are covered in Section 2, and a brief overview of related tasks is covered in Section 3. The proposed model is presented in Section 4, the experiment results are shown in Section 5, and the conclusion and future work are presented in Section 6.

2. INDIAN STATES VEHICLE CODES

Government statistics from 2016 show that there are more than 23 crore vehicles registered in India. The district level RTO (Regional Transport Office) of the relevant states is responsible for issuing all of the state codes for Indian vehicles.The 28 states and 8 Union territories' vehicle codes, including any recent modifications, are included in the following tables according to ISO 3166-2.

Table 1. Indian States Vehicle Codes (28)

State	Vehicle Code	State	Vehicle Code
Andhra Pradesh	AP	Manipur	MN
ArunachalPradesh	AR	Meghalaya	ML
Assam	AS	Mizoram	MZ
Bihar	BR	Nagaland	NL
Chhattisgarh	CG	Odisha	OD
Goa	GA	Punjab	PB
Gujarat	GJ	Rajasthan	RJ
Haryana	HR	Sikkim	SK
Himachal Pradesh	HP	Tamil Nadu	TN
Jharkhand	JH	Telangana	TS
Karnataka	KA	Tripura	TR
Kerala	KL	Uttar Pradesh	UP
Madhya Pradesh	MP	Uttarakhand	UK
Maharashtra	MH	West Bengal	WB

Table 2. Union Territories (8)

Union Territory	Vehicle Code	Union Territory	Vehicle Code
Andaman and Nicobar Islands	AN	Jammu and Kashmir	JK
Chandigarh	CH	Ladakh	LA
Dadra and Nagar Haveli & Daman and Diu	DD	Lakshadweep	LD
Delhi	DL	Puducherry	PY

Table 3. Bharat Series

All over India (Bharat)	Vehicle Code
Bharat Series	BH

Table 4. Review on License Plate Detection

Reference number & Year	Author	Technique
[12] 2019	Khamdamov, R.K.,Rakhmanov, H. E	Contour analysis
[13] 2020	Yaoyao Li, Liu, Chen Zia	YOLO v2 & CNN
[14] 2020	Ascar Davix Jadson D. et al.	Segnet & CNN
[15] 2021	Qiuying Huang,Zhanchuan Cai	One-stage convolutional network
[16] 2021	Farheen Ali and Himanshu Rathor/ Wasim Akram	Radial Basis Function Neural Network: RBFNN
[17] 2022	C. L. P. Chen and B. Wang	CNN Adaboost
[18] 2022	Tian, L. Wang and R. Zhang	CNN

3. RELATED WORK

Due to regional variances in license plate sizes, fonts, colors, and standards, it is difficult to offer a universal solution for the detection and recognition of a license plate from anywhere in the globe. Additionally, other elements like rotations (tilted plates) and other obstacles of the license plates restrict the use of the current systems in practical contexts. Given the current limits, the procedures are therefore more computationally complex and demanding [5], [6], and [7].The identification or extraction of the license plate from the vehicle's photograph constitutes the first stage. Various computer vision approaches with object detection are utilized to determine the license plate area from an image. The key building blocks of these computer vision approaches are the characteristics of the license plate, including its shape [2], [8], color, texture, symmetry, etc.In the second stage, the license plate is segmented, and the characters are extracted using some widely used methods, including mathematical morphology [9], relaxation labelling, connected components, and vertical and horizontal projection. However, not all multi-stage VLPR systems necessarily perform the character segmentation stage.In the last stage, characters are recognized using classifiers like neural networks, SVM, and fuzzy classifiers that match patterns. The one-stage processes have recently seen multiple successful tries. In each of these tries, the license plate is localized and recognized in a single pass using a single neural network that has been trained for end-to-end detection. Recognition of license plates is a particular instance of object detection. These models can take use of the fact that license plate detection and recognition are highly linked, just like single-stage object detectors [10]. Instead of the usual two-stage approach, this allows the models to have fewer parameters and share them. They can therefore be quicker and more effective than the two-stage technique [10], [11].

Methodology

Image acquisition – The image should be delivered in such a way that it shows the car's number plate of either the front or rear of the vehicle. System noise, blur, distortion, and other elements can all have an impact on how successful this stage is.

Image pre-processing – This process involves changing the image from RGB to grayscale. A 2-dimensional grayscale version of the three-dimensional RGB image is created.

Number plate detection – Number plate recognition looks for the precise features in the image that contain the license plate.

Character Segmentation – In this stage, the necessary section of the license plate is cropped out. To correctly recognize each text, it requires separating the image from its background.

Character recognition – This is where OCR and OpenCV are used to their best potential. It entails locating and recognizing image frames and transforming them into pertinent text.

State Extraction – The state to which the vehicle belongs is determined from the recognized alphanumeric characters.

The proposed VNPDRSD (Vehicle number plate detection, recognition and state detection) system has four stages: state detection, character segmentation, optical character recognition (OCR), and license plate localization (LPL). In the LPL stage, every pixel of the image is scanned to identify and pinpoint the location of the license plate. Character segmentation is the stage where each character on a license plate is identified and separated. OCR receives, verifies, and encodes the character's data. The level of state detection determines the state to which the vehicle belongs. A flowchart of the various phases is shown in Figure 1 for your reference.

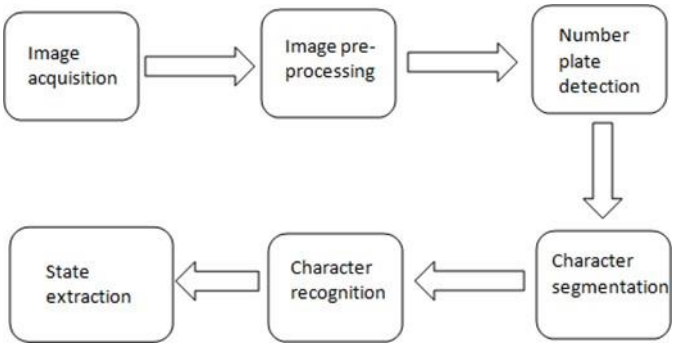


Figure. 1. The stages of a VNPDRSD system.

Various components inside the image are sorted out using mathematical morphology, given the right size and shape of the structural elements. Because undesired portions of the image can be found, improved, or removed, the size and shape are crucial. In order to extract the pertinent structures from a given collection, morphological operators are essential. The interaction between that particular set and the structural component is what causes this process to happen. The morphological operator's dilatation and erosion make up a basic pair in theory. Initially, preparation for the License Plate Localization (LPL) involves turning the colored original image into a grayscale image. The image is then scaled using morphological transformation, binary thresholding is applied, noise is eliminated by closing and opening

morphological features, and finally the license plate is extracted. Following the license plate extraction, the characters are recognized using the Python OCR tool pytesseract, and then the condition of the vehicle to which it belongs is deduced from the extracted characters. We made use of the Kaggle and Google Image datasets.

4. OpenCV, Python Implementation Results

After the system receives the image, it recognizes the license plate and displays the number as well as the state or union territory that it belongs to. Otherwise, "License plate not recognized" is shown if it cannot read the license plate (for example, because of image noise, a tilted license plate, excessive brightness, etc.).We have tested 25 samples where the extraction of the plate region and it's segmentation was successful with 100% accuracy, whereas the accuracy obtained from alphanumeric character recognition was 96% which in turn resulted in 96% of accuracy in identifying the state or union territory.

Table 5. Result Images

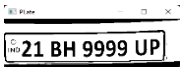
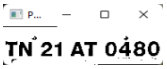
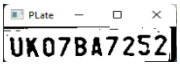
Sr. No.	Source image	Result image- License plate localization and detection	Result image- detection, recognition andstate or union territory identification of Indian car license plates
1			
2			
3			
4			
5			

Table 5. Result Analysis

Applied stages	Sample Number	No. of correct detection	Accuracy (%)
Extraction of plate region	25	25	100%
Segmentation	25	25	100%
Recognition of alphanumeric characters	25	24	96%
State or union territory identification	25	24	96%

5. CONCLUSION AND FUTURE SCOPE

There are currently several license plate locating algorithms available. Each technique has a certain range of applications and constraints. This work adopts an edge detection-based method for the placing of license plates using mathematical morphology. For the rapid positioning of the license plate region, a combination of mathematical morphology and the edge detection filtering function is employed to lessen the interference of noises from the photos. The algorithm is easy to use, quick, and reliable.Future research should focus on methods for extracting intrinsic images (such as lighting, reflectance, and depth images) and real-time license plate recognition from videos. Although the license plates are focused on a single nation (India), they can be extended to use with license plates of other countries.

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Machine Learning Based Novel Framework for Malware Detection

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Abstract

Recent technology developments in computer systems change human life from real to virtual worlds. Cyber criminals' attention has transferred from a real to a virtual realm as well. This is because it is easier to conduct crimes on the computer than in real life. Malicious software (malware) is unwanted software that is often used by hackers to launch cyber-attacks. Malware versions continue to grow by using advanced obfuscation as well as packaging approaches. Novel approaches which are entirely distinct from traditional ways must be applied to effectively tackle emerging-malware strains. Traditional AI (Artificial Intelligence) approaches, notably ML (Machine Learning), are unsuccessful in recognizing all new & complicated malware variants. DL (Deep Learning) approach which is considered separate from normal ML techniques may be a potential solution to the difficulty of recognizing all sorts of malware. In this research, the fusion model proposed depends upon deep learning and machine learning technique that must classify malware variants. The main influence of this work is to propose new fusion architecture which has integrated a custom DNN model and machine learning-based random forest classifier in an optimized way It is planned to test the proposed method using the Microsoft BIG 2015 dataset. Based on the experimental findings, it has been predicted that the proposed technique has useful in classifying malware with high accuracy and that it has surpassed the existing method

Keywords. Malware; Malware Classification; Malware Detection; Malware Variants; Deep Neural Networks; Deep Learning; Machine Learning.

1. INTRODUCTION

Today, it is feasible to conduct all of one's social interactions, financial transactions, and physical measurements over the Internet. All of these advancements entice cybercriminals to conduct crimes online rather than in the real world, and they've been effective. Cyberattacks cost the global economy billions of dollars, according to current academic and commercial studies. [1][2]. Malware [3][4]is often used by cybercriminals to initiate cyberattacks. Presently, no. of illegitimate and criminal applications is rapidly increasing. Many of these apps are malicious software designed to aid in the expansion of the organization. Criminals make use of malware to gain control of computers, steal personal and secret information, and utilize this information in some other way to make a profit. Malware forensics has become an integral aspect of computer forensics in today's world [5][6]. An example of malware would be a piece of software that causes harm to a victim's computer. Viruses, worms, trojans, ransomware, & rootkits are just a few examples of malicious software. Distributed Denial of Service (DDoS) assaults may be initiated by malware types, as well as the resulting disruption to computer systems can be devastating.

To stay undetected in the victim's system, malware sample types use tactics such as encrypting as well as packaging [7]. Research spread by leveraging human trust as an infectious vector. There are several ways in which malware may propagate, such as opening email attachments, installing fraudulent apps, and viewing and downloading files from false websites[8]. Proposed work is focused in identifying malicious software as soon as it is downloaded on the computer systems to keep system safe. When a suspicious file is examined, malware detection is used to determine if it is malicious or not. Once the file has been determined to be malicious, the classification of the malware may be determined. However, even though both static & dynamic methodologies may be employed for analysis, various ML also have been developed to automate classification phases & malware analysis to limit the number of samples needing close human study. The difficulty of determining if a file is malicious or not is classified as a problem of classification. The virus is classified using a variety of ML methods [10][11], including SVM (Support Vector Machine), DTs (Decision Trees), and NB (Naive Bayes), [12] among others. In this ML method, the dataset is often comprised of files, with the label indicating if a file is malicious or not malicious. This dataset has been classified into two parts i.e., training & testing, respectively. The training dataset is utilized for constructing a specific model for a given task based on the information in the dataset. It is required to use a cross-validation approach to enhance the evaluation of the model. The model is used to test the dataset once it has been trained on the training dataset. In this case, the model is completely oblivious to the labels. To determine the label for each file, it makes informed estimates about the label. The accuracy of the classification is then determined by counting the number of files that were correctly categorized.

2. LITERATURE REVIEW

According to [12], a new deep-learning-based architecture may be developed to identify malware variants using a hybrid model. Researchers have proposed a novel hybrid architecture in which 2 wide-ranging pre-trained network systems are seamlessly integrated. Four phases are involved in the construction & training of the suggested DNN architecture, as well as testing and evaluating a trained Deep Neural Network. The suggested approach was evaluated on datasets from Malimg, Malevich, as well as Microsoft BIG 2015.DL methods [13] based on RNNs are examined in this study for the ability to detect malware in cloud VMs. Research focuses on LSTMs and Bidirectional RNNs, two significant RNN designs (BIDIs). For this study, the authors used a pool of 40,680 harmful & benign samples to test a hypothesis. Malware operating in an open online cloud environment with no constraints was used to gather the process-level characteristics. This mimics realistic cloud provider conditions & captures the genuine behavior of stealth and sophisticated malware. Different assessment measures provide detection rates of more than 98% for LSTM & BIDI models. To fully grasp the significance of input data representations, an analysis study is also conducted. In some cases, the order of the inputs does have an impact on the efficiency of the trained RNN models, according to research findings. A novel [14,15] methodology for detecting malware in real time and adapting to new characteristics was suggested in this paper. API-Pair was accepted as a new dataset & trained using the Maximum Entropy model, which was able to achieve both weighting & adaptive learning goals at once. After that, a clustering technique was used to eliminate characteristics that were unconnected or ambiguous. An LSTM -based detector was also developed to provide real-time detection.
[16] provides an ML framework for finding & detecting DGA domains to lessen the danger. For a year, they gathered real-time threat data from traffic. A 2-level model & prediction model is part of the suggested ML framework. As part of a two-tiered paradigm, the author first identifies the algorithms responsible for generating DGA domains, & then utilizes the clustering technique to identify them. The hidden Markov model is used to build a time-

series model that predicts incoming domain information (HMM). As a result, created a DNN model to help the suggested ML framework deal with the massive dataset steadily gathered over time. Outcomes from rigorous testing show that the suggested system & DNN model are accurate.

3. PROPOSED METHODOLOGY

Proposed method has offered a fusion model of DL & ML-based architecture for malware classification illustrated in fig.1 that have used in conjunction with other studies. Malware data will be acquired from the Microsoft BIG 2015 dataset for use in the proposed methodology. To process malware samples further, research has first been transformed into grayscale images also then transmitted to a deep learning system for processing. Once the image acquisition phase is done the proposed approach would extract high-level malware features from malware pictures via convolution layers of the proprietary architecture of DNN, as well as the system trained in a supervised manner after the image acquisition section is accomplished. At the end of the process, a classification using machine learning-based random forest classifiers have employed to categorize malware variants. In figure 1 all processes of research first data collection, that is Microsoft BIG 2015 dataset, after this data preprocessing which is called data acquisition, converts the collected data grayscale image. This collected dataset is split into train, test, and validate. For the feature extraction purpose CNN model is used and classification used machine learning approaches. after the trained model calculate the performance of the proposed model. Finally, get predicated results.

- Data Preprocessing: Data preprocessing is the procedure of digitizing information from the world around so it may be processed, presented, & stored in a computer. This project aims to create a grayscale picture of binary files. It has read in a vector of eight-bit unsigned numbers from the beginning of the malware binary file. This has been followed by the conversion of the binary value of each component into its decimal counterpart. After being transformed into a 2D matrix, the resultant decimal vector is translated into an image in grayscale. The size of the malware binary file has a significant impact on the width & height of the 2D matrix.
- Feature Extraction by DNN [17]: Extracting as much information as possible from the available data sets is crucial to creating an effective solution. The task of deconstructing the features learned by a custom DNN.
- Custom Deep neural network: Deep neural networks (DNN) were used for a variety of tasks, and the substantial gains in performance gained using DNN for those tasks led to the use of DNN for the picture classification task. To extract features, we made use of a DNN variation called a Deep Convolutional Neural Network (DCNN)[18][19].

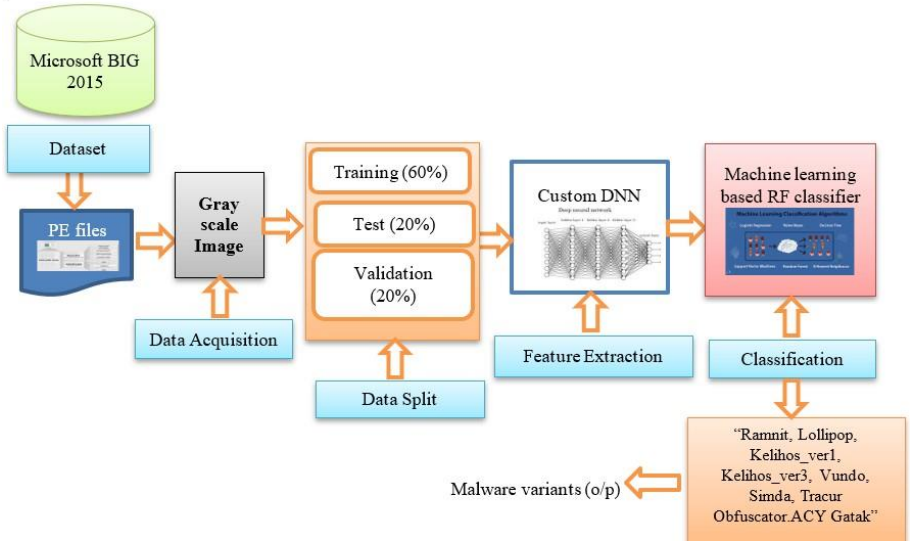


Figure 1. Block architecture of proposed methodology

- Oversampling using SMOTE: The dataset must be balanced to improve the minority class's forecast accuracy. The class imbalance issue is addressed using SMOTE (Synthetic Minority Oversampling Technique)[20]. SMOTE uses feature space to generate synthetic samples of the minority class. Synthetic instances are generated by first multiplying the difference in feature vectors between the minority class instance and its closest neighbor by a random value between 0 and 1. To create a synthetic instance of the minority class, the outcome of multiplying the feature vector is added to it.. Consider the fact that the feature vector of the under-investigation minority class sample is denoted by fi, and that $fnear$ is K-nearest neighbors of fi. Newly created synthetic sample, denoted by f_{new}, may be symbolized by the equation. (1).

$$f_{new} = f_i + (f_i - f_{near}) \times R \qquad (1)$$

Here, R is a random no. among 0 & 1.

- Random Forest Classifier (RFC): Random forests are a kind of machine learning regression approach for classification. This method is driven by assembling web data into a multitude of decision trees (DTs) during the training phase, also then outputting class i.e., mode of classes that are produced by individual trees. It is the most accurate algorithm currently in use.

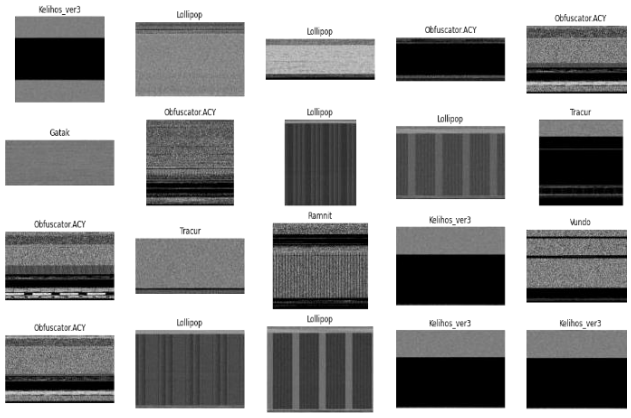
4. RESULTS AND DISCUSSION

This section describes the dataset in use for malware detection, and its visualization, and highlights the present research work's analysis of trials. This study used the Microsoft BIG 2015 dataset to apply the methods suggested in this study in python 3.0. Multiple performance metrics are used to assess the outcome.

Dataset Description

Microsoft BIG 2015 is being used to acquire malware data in the beginning. This year's Microsoft BIG 2015 dataset[1] involves 10868 malware samples divided into nine separate

classes, which are called Gatak, Kelihos_ver1, Kelihos_ver3, Lollipop, and Obfuscator.ACY, Ramnit, Simda, Traceur, and Vundo. The many kinds of malware are represented by respective grayscale graphics in Figure 2 (a). (The dataset known as Microsoft BIG 2015 is where these photographs originated). Figure 2 (b) shows the count of images of the malware dataset with each category. The dataset contains nine categories of data. The gatka count is 1013, lollipop count is 2878 similarly other labels contain count values of data.



(a)

labels	count
Gatak	1013
Kelihos_ver1	398
Kelihos_ver3	2942
Lollipop	2478
Obfuscator.ACY	1228
Ramnit	1541
Simda	42
Tracur	751
Vundo	475

(b)

Figure 2. (a) Sample dataset images (b) Count of images in each malware category

Studies were done in a Windows 10 environment with an Intel Core i7 CPU operating at 4.8 GHz and 32 GB of RAM. Python programming language was used to implement the proposed design. Assessment procedures are carried out sequentially to ensure the random selection of training, validation, and test datasets. The selection rates of the data available for the training, validation, or testing phases are set at 60%, 20%, and 20%, respectively. Figure 3 illustrates the confusion matrix for the proposed RFL. A confusion matrix is a visual demonstration of ground-truth labels compared to model predictions. Using the confusion matrix, you can see how many different classes of cases are represented in each row and column. On the x-axis, the predicted label for Metrix is shown, while on the y-axis, the actual label is shown. Using the confusion matrices, the accuracy rates of each malware version are shown below. No doubt about it offered approach works.

```
Training Accuracy : 1.000
Validation Accuracy : 0.950
Testing Accuracy : 0.956
F1 Score: 0.955
Recall: 0.956
Precision: 0.956
```

Figure 3. Evaluation Metric

- Evaluation metric of the proposed model: Figure 3 shows the proposed model performance with multiple parameters. The results show the proposed DNN+RFC model achieved training accuracy is 100% which is very good and much better than existing work. The validation accuracy of the proposed model is 95%, the training accuracy is 95.6% and the f1 score, recall, and precision are 95% approx. All three last

parameters achieved similar results. These outcomes clearly show proposed model is much better in comparison to the base work.

Figure 4 and Table 1 show comparison outcomes of the base and proposed model. Furthermore, the results were compared to the most recent findings in the field.

Figure 5 shows the distribution graph of the malware dataset with each category. All potential data values (or intervals) are shown in a data distribution as a function or a listing. It also informs you how often each value is used. In the above figure, the x-axis shows the malware variant that is shown in the graph very clearly, and the y-axis shows the number of counted images.

Table 1. Comparison between Base (DNN) and proposed model

Parameters	**Proposed (DNN+RFC)**	**Base (DNN)**
Accuracy	100	94.47
F1 Score	95.5	71.06
Recall	95.6	70.28
Precision	95.6	83.06

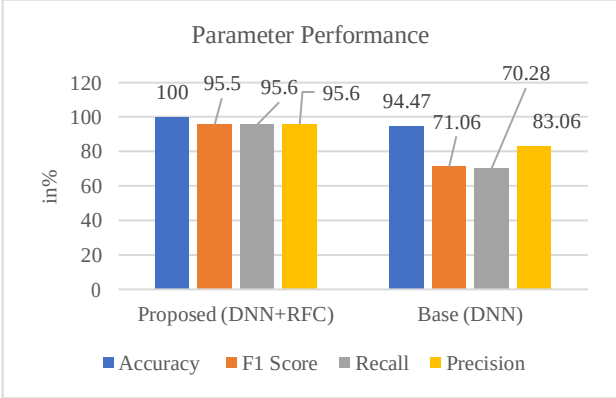


Figure 4. Graphical Comparison between base & proposed model

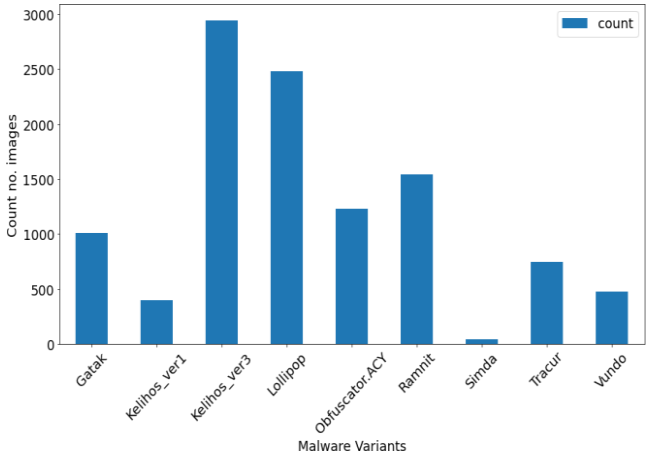


Figure 5. Dataset Distribution graph of each category

5. CONCLUSION AND FUTURE WORK

Even though a substantial amount of research has been conducted on the detection & classification of malware, determining the best effective approach for detecting malware variants remains a serious problem in the world of information security. Malware identification is made more difficult by obfuscation and packing methods that hide the source code. This paper proposed novel machine learning (Random forest classifier) and DL-based (Custom Deep neural network) architecture to efficiently detect malware variants. The fusion Model is used in the suggested design. Numerous datasets were used in the beginning to gather malware data. After that, pre-trained networks are used to extract the features. Lastly, a supervised learning approach is utilized to train DNN design. Fusion models may be created by optimally joining two pre-trained network models, which is the primary contribution of the proposed technique Microsoft's Big 2015 dataset is used to test the suggested machine learning & deep learning techniques. The proposed Fusion model is then compared to each model.

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A Binary Audio Fingerprint Based Music File Retrieval System

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Abstract.

The music industry around the globe has been witnessing huge, consistent growth over the past couple of decades after the internet boom. Music is a popular source of entertainment and has made a very large contribution to the growth of the global cinema industry. Each music record stored in the database of music companies has an ID or a combination of metadata that acts as a primary key for retrieving the user-specified music file. The music file retrieved from the database using metadata can get compromised due to the eavesdropping of hackers attacking the enterprise system. To prevent the sensitive metadata of music files from getting compromised, many music file retrieval systems make use of audio fingerprints (AFP) in place of metadata to identify the audio file being requested by the customer. The prime objective is to ensure that sensitive metadata is not compromised and even if AFPs get compromised due to hacker's eavesdropping, the feature values created from the read sample of audio are not sufficient information to get the complete audio file compromised. The proposed system uses a numeric pattern matching recognition system with decision boundaries for querying the database to find the train sample having an AFP match to the query sample. The AFPs of the train samples are stored in the MongoDB ATLAS database. The experiment results show that the proposed AFP system has more accurate recognition compared to two existing systems.

Keywords. Audio Fingerprint, eavesdropping, metadata, database, enterprise, MongoDB ATLAS, decision boundaries.

1. INTRODUCTION

The music files are audio recordings with specific patterns of beats that do not possess phonemes or words [1]. Hence, they do not possess any lexical or linguistic features that are conducive to identifying music files efficiently [1]. The majority of music produced is registered for copyright protection, then organized and subsequently categorized into numerous hierarchical levels, starting from groups of notes, bars, and phrases to sections and then movements [2].The Music Data Storage Process (MDSP) is a three-step process [3]. The initial step of the procedure is generating the feature vectors to create an AFP using

audio data of the music file whose metadata is to be stored in a database such that the size of the AFP is smaller than the audio data [3]. The AFP has to be converted to a database (DB) compatible AFP format [2]. The AFP will act as unique index for the set of metadata of that music file [2]. The metadata will be stored along with AFP separately in a DB table. The AFP will be used as primary key for accessing the set of metadata of that music file [2]. The third step of the process is storing AFP with the audio content of music file in a DB-compatible format in a separate DB table with the AFP set as the primary key [2, 3]. The Music Data Fetch Process (MDFP) is also a three-step process [3]. The initial step is the creation of the AFP of the query sample. The second step is the AFP search algorithm execution to find the file with an AFP match [3]. The third step is fetching of specified metadata associated with that file. The AFP search technique may be audio content-dependent. A very general example is that of the music recommendation algorithms in music streaming services that use AFPs for querying the DBs when the user selects an option from the recommendation list [3]. The proposed music file retrieval (MFR) system comprises of both MDSP and MDFP intended for retrieving the data related to the music file.

1.1. Audio Fingerprint

AFP storage is a method that uses the entire audio content under observation to make a smaller-sized vector which is mapped one-to-one to the actual filename in the database [4, 5]. The AFPs can serve the purpose of checking the number of broadcasts of specific music made in a day or for a quick search of the metadata of the music composed and stored in a very large database [4, 6]. They can also be used to identify plagiarized content in a music or a song to protect digital rights [6]. The purpose of generating fingerprints is to decrease the amount of data needed for representing complete audio in a way that it can be mapped in the audio database [7]. The prerequisites for any AFP based system are efficient distinction of each AFP over a large set of AFPs searched in the DB [5]. The generated AFP should remain significantly robust to acoustic distortions [6]. An AFP generating algorithm is considered time-efficient if the algorithm has a very low computation time [5]. Such AFP algorithms are well-suited to process very large-sized databases [5].As the percentage of accurate detection of the actual music file in the audio DB has the highest priority for every AFP based audio system, the importance of true positives precedes that of true negatives [5, 8, 9].The organization of the paper is summarized here. Section I gives a brief introduction to the characteristics of music files and music information retrieval challenges, along with a brief explanation of processes in AFP based system. Section II gives a literature survey of a few of the existing AFP based music systems that are robust to environmental disturbances. The complete functioning of our proposed system is provided in Section III. The Section IV has all the details of the test results of our proposed system, followed by conclusions drawn from the observations in Section V.

2. LITERATURE SURVEY

The majority of the research works proposed shortly after the first proposed AFP based Music systems focused deeply on making the symbolic representations of the music segments with help of instrument digital interface [3]. There was much signal processing research in the very early years of the 2000s aimed at applying domain transformation directly to the read music data without audio pre-processing [3].Cha Guang-Ho analyzed

Miller et al. proposed system [10]. Miller et al. has used a 256-ary tree to guide the AFP search in an AFP database [10]. As each node has 32-bit, the tree has an overall 256 X 32 = 8192 bits in the AFP frame [10]. Each 8192-bit AFP frame is represented as 1KB of data. Every successive byte in the AFP is a factor that decides the path to descend to which node of the tree out of the 256 child nodes [10]. When the bits are traced from the root node to a specific child node, a unique fingerprint of an audio file will be obtained for their proposed system [10].George and Ashok proposed an AFP algorithm robust to many distortions like the time-stretching effects on audio [11]. Their AFP based system operates by finding the three largest frequencies. The bins are chosen for every overlapping time frame within the spectra of the signal. The authors have encoded the bins to get 30-bit binary codes. Every bin within the 30 bits of binary code gets 10 encoded bits. Hence, the data can be displayed as a binary sequence of Ci codes. The 'i' suffix used in Ci is to indicate the instantaneous bit in the sequence. The AFP search algorithm deployed in their system extracts every feature code of the train sample which found a match with the test sample codes codes [11]. Chang et al., 2021 has used an AFP which converts segmented features to the L2 normalize vector. The inner-product is used to identify matching segment. Their system has a pre-processor followed by neural networks [5].

3. PROPOSED METHODOLOGY

The proposed AFP based MFR system has two processes which have the block diagram as shown in figure 1 and figure 2. The MFR system execution flow has two processes, namely, the Batch Creation process and the Query Fetch process.

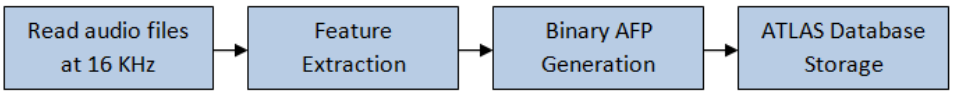

Fig. 1. Batch Entry creation process

3.1. Batch Creation process

The directory path containing the audio files of the training dataset is passed as input to the algorithm of the process. Each audio file in that directory is processed serially in the batch creation process. The AFPs of each train sample are generated in a serial manner and stored with metadata in a collection of MongoDB database. A file-Id value is one-to-one mapped to the AFP stored in ATLAS collection. The audio of the music file from which the AFP is generated and gets stored in a separate collection present in the same database with the file-Id mapped to that corresponding music file.

3.2. Query Fetch process

The directory path of a specific test sample is passed as a query input to the process algorithm. The audio files of training set and test set are referred to as ‘train audio files’ and ‘test audio files’ respectively in the explanation ahead. The test audio files have a length ranging from 1 to 6 seconds. The algorithm of the process reads the audio content at a fixed sampling rate of 16 kHz and extracts the features which are used to create AFP corresponding to that query music file.

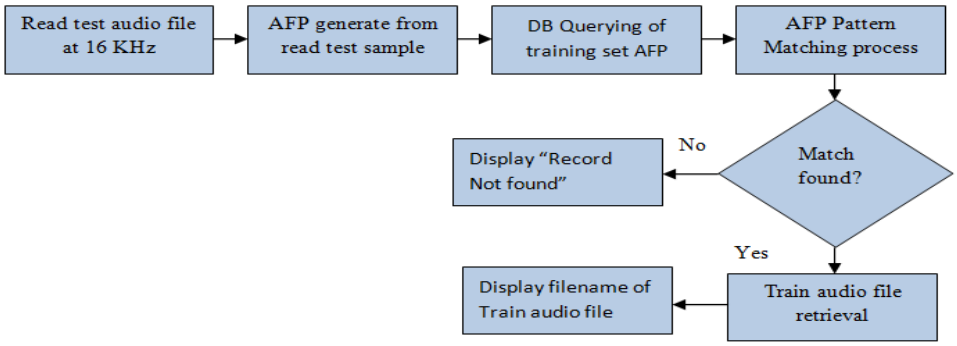

Fig. 2. Query Fetch process

All the binary data of AFPs within the collection of the database is fetched by the algorithm which is converted to their numeric equivalent using binary-to-ASCII conversion. The process algorithm transforms the binary data of trained sample AFP serially to their numeric equivalent values. The numeric equivalents of entire binary data are stored in a two-dimension array with each frame of the array containing 16 samples which we will refer to as the "rms samples". Every frame of the train rms sample AFP gets searched for an absolute match of the test sample being iterated.If the algorithm finds a matching rms sample between test and train samples of the AFP being compared, then the counter is incremented by one. When every rms sample of the test AFP has been matched with the train sample AFP under observation, then the Query Fetch process calculates the percentage of rms samples with matches. If the percentage of matching samples is greater than 90%, the test sample is classified as a match for the training sample in the current iteration. The hop size of the sliding window is set to 100 rms samples. The iteration count with AFP pattern match is multiplied by eight to find the second of the train sample for which match was found. The algorithm will fetch the file-Id value of the corresponding music file from the ATLAS database. The music file audio data will be fetched from the ATLAS collection using the file-Id and will be stored in the project folder.

3.3. Audio Fingerprint Extraction

The entire sequence of steps for extracting the feature based on audio content is provided in the figure 3. The audio files used in the training and testing dataset are in ".wav" format. The audio content of the music file is read into an array using a 16 kHz sampling rate [12]. The audio array is trimmed from the start such that the count of audio samples is an integral multiple of 16000. The root mean square(rms) of 20 successive samples is taken to reduce the storage cost of AFP by a factor of 20 and to normalize the disturbances, if present. The audio data sampled at a frequency of 8 kHz is sufficient to make an audio fingerprint as specified by Sonnleitner and Widmer in their Quad based AFP system. It would reduce the storage requirement of the proposed system with a minor decrease in the accuracy [12]. Hence, there will be a trade-off between storage requirements and the accuracy of the system.

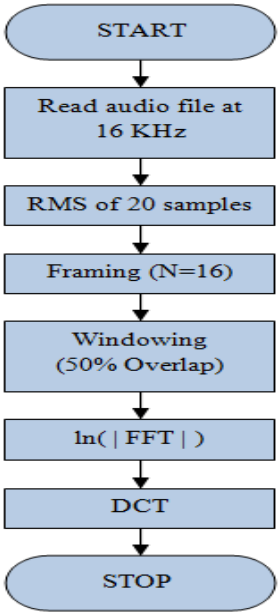

Fig. 3. Feature Extraction Flowchart

As we are taking the rms of 20 consecutive samples in our proposed system, the size of the AFP of the proposed system would be smaller than many existing systems and so, the sampling rate is set at 16 kHz. The rms audio array has 'N' no. of rms samples which is fragmented into 'M' rms frames of size '16'. Each rms frame corresponds to a 20 ms time period.

$$N\ X\ 20\ =\ T \tag{1}$$

$$M\ X\ 16\ =\ N \tag{2}$$

Here,
M - count of rms frames corresponding to 20ms,
N - Overall count of RMS sample,
T - Total samples stored in the array from the read audio file.

The frame size is 16 rms samples for a sampling rate of 16 kHz. Hence, the Hanning window used in the proposed system has a size (M) of 16 with 50% overlap. The equation of Hanning window for M=16 as per Podder et al.(2014) would be,

$$H(n)\ =\ 0.5\ -\ 0.5\cos\left(\frac{2n\pi}{15}\right) \tag{3}$$

The zeroth sample of the Hanning window is replaced by 0.01 to prevent data loss of each zeroth sample of the output frame of the windowing operation.

$$H(0)\ =\ 0.01 \tag{4}$$

Each rms sample of the windowing operation output A(m) will undergo a 1-D FFT magnitude transformation [13, 14]. The resultant array will contain only real parts of the

A(m) in the frequency domain. The FFT magnitude of RMS sample $F_r(k)$ in close relation to (7) of [13] can be expressed as,

$$F_r(k) = \Delta(t) \left| \sum_{m=0}^{15} A(m) e^{\frac{-j(2mk\pi)}{16}} \right| \quad \ldots \quad (k = 0,1\ldots,15) \tag{5}$$

As the sampling rate is a fixed value, the value of 'T' and 'N' will remain constant. Hence, Δ(t) is a ratio of constant given in accordance with [13] as $\Delta(t) = \frac{20\ X\ 10^{-3}}{16}$ which gives the value $\Delta(t) = 1.25\ X\ 10^{-3}$. The frequency magnitude of the rms sample is then subjected to compression through natural logarithmic transformation followed by Discrete Cosine transform (DCT). Let, $L_f(k)$ be the natural log transformation values of each Frequency sample written as,

$$L_f(k) = ln(F_p(k) \tag{6}$$

In Let, $C_f(\bar{k})$ be the output array of the DCT signals. The FLCC co-efficient at the output using DCT of [15] is calculated as,

$$C_f(\bar{k}) = \frac{2}{16} \sum_{k=0}^{15} L_f(k) \cos \frac{(2k+1)\bar{k}\pi}{32} \quad \ldots \quad (\bar{k} = 1,2,\ldots,15) \tag{7}$$

The equation (8) gives the value of zeroth sample of DCT [15].

$$C_f(0) = \frac{\sqrt{2}}{16} \sum_{k=0}^{15} L_f(k) \tag{8}$$

The zeroth sample of DCT output is replaced with a unit value. The output of the DCT operation is an array of numbers, which can't be stored in the ATLAS database. The compatible data formats for storing data chunks in ATLAS are binary or string formats. Hence, the DCT output array is initially subjected to ASCII-to-binary conversion to convert the numeric array to binary data.The binary data is then transmitted to the ATLAS server over an SSL secured channel during the batch creation process. The binary data of AFP when received from a database is subjected to binary-to-ASCII conversion to get the original numeric FLCC array during the query fetch process. The AFP pattern matching algorithm takes the AFP numeric array of test and train sample as the input. The list of recognized audio files with the exact seconds of the train sample where the AFP pattern match has been found is passed at the output.

4. RESULTS AND DISCUSSION

The experimental plots of initial frame for each step of the FLCC feature extraction procedure are shown from figure 4 to figure 7. From the comparison of the samples of FFT magnitude in figure 6 and the FLCC samples magnitude in figure 7, it is evident that the FLCC samples are compressed significantly which reduces the AFP storage cost of the proposed system and gives the cepstral co-efficient.

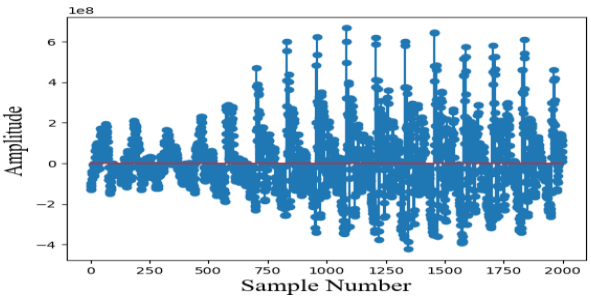

Fig.4. Stem plot of test audio file

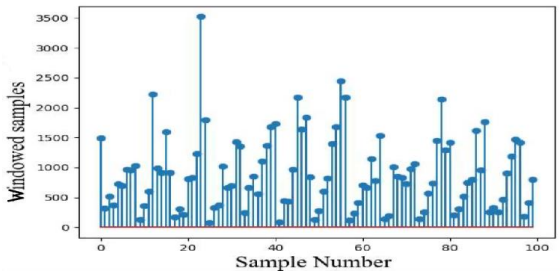

Fig. 5. Stem plot for Windowing operation output

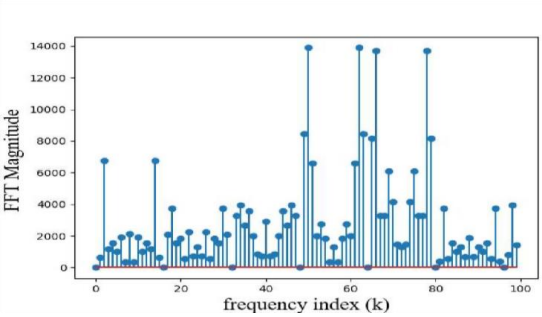

Fig.6. FFT magnitude output stem plot

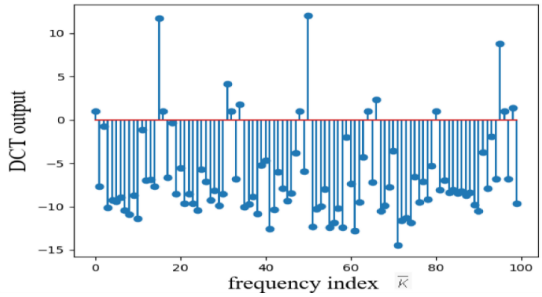

Fig.7. FLCC Feature stem plot

4.1. Test Result Analysis

The accuracy of our proposed system was compared with the Panako and RAFS AFP system on the subset of Voxceleb1 dataset [16]. The dataset was further separated into three sub-sets in the proportion of 60:20:20 for training, validation and testing of Voxceleb1 dataset samples [9]. The training dataset possesses 2,799 clean noise-free audio files while the validation and test sets each have 1,812 and 1,184 clean audio clips with length ranging from 1 to 6 second [9].Panako AFP system uses a constellation algorithm in which a sample is initially pre-processed before generating a constant-Q spectrogram which is robust to time-frequency domain disturbance [9]. The local maximas are combined to form the AFP of their system [9]. A hash value is calculated using AFP for a single frame. Panako uses a hash matching algorithm which queries the database for matching hashes and returns the train samples with exact matches [9, 16].The RAFS AFP system uses 32-bit frames equivalent to 11.6 ms for a frame. The AFP has a consecutive 256 frames, which equals to three second in time domain [17]. The algorithm initially segments the entire audio data into overlapping frames [17]. The overlapping frames of 37 ms are windowed with a Hanning window with overlapping of 31/32. This overlap strategy causes one sub-AFP to be extracted for every 11.6ms and uses bit error rate pattern matching [9, 17].The name of each test audio file along with exact second value was noted in advance before the start of the testing process. If the recognized test file during the testing process has the same name as the actual file and the predicted second same as the actual second, then that test sample is classified as a ”true positive”. If the list of the recognized file does not have the name of the actual file, then it is classified as a ”false negative” sample. If the proposed system recognizes the name of the actual file but the predicted second is not same as the exact second of the actual file, then it is marked as a ”false positive” sample. If the test audio file does not occur in any train audio file sample and there is no file recognized from the fetched data due to AFP mismatches then the sample is noted as ”True negative” else as a ”False positive” sample.Table I shows the comparison of the granular identification accuracy of our proposed system with that of the Panako and RAFS AFP system using Suarez recorded readings [9]. The Panako and RAFS system were tested for accuracy using test audio files ranging from 1-6 seconds.

TABLE I. ACCURACY COMPARISON FOR DIFFERENT AUDIO LENGTH

Test sample length	**Proposed**	**Panako [9]**	**RAFS [9]**
1 second	64.5%	0%	0%
2 second	85.35%	15.29%	23.07%
3 second	89.75%	60.70%	67.02%
4 second	94.3%	91.22%	79.49%
5 second	99.6%	97.61%	85.24%
6 second	99.8%	98.03%	82.74%

Test sample length	Proposed	Panako [9]	RAFS [9]
Average	88.883%	60.475%	56.26%

The testing process is carried out to identify granular identification accuracy of proposed system compared to the Panako and RAFS systems. The proposed system was able to recognize test samples with length of 1 second.

5. CONCLUSION

A frequency-domain feature named as Frequency Log Cepstral Coefficient (FLCC) has been proposed in this paper to make a binary AFP of our proposed system. The test results of the proposed system gave better granular identification accuracy than the Panako and RAFS AFP systems on the subset of Voxceleb1 dataset.

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Survival Prediction of Malignant Brain Tumor Patients

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Abstract.

Glioblastoma (GBM) is a fatal form of malignant tumor, and patients have a very low survival tenure. The patient's survival is very much dependent on the physiology of the tumor. However, predicting survival days based on manual inspection of MRI images is exceedingly difficult and pertain to qualitative error. Alternatively, an automated method may help the medical professional to diagnose GBM and to predict the overall survival (OS) days, which can further help expects planning treatments. In this regard, segmentation of the tumor cells from the whole brain MRI and OS prediction is very crucial. Researchers can use an end-to-end method, which can automatic segments tumor using radiological images and further extracts features to predict survival days accurately. The proposed work predicts comparable OS days with current top performing methods. Furthermore, we observed the role and impact of dataset on the performance of model. Also, we examined and reason out the performance impact when targeting survival days prediction as classification problem. The accuracy, MSE, Spearman ranking coefficient on the BraTS-2020 training set were 53.8%, 60668.61, 0.754, and on the validation set they were 55.2%, 79826.24, 0.711 respectively. This is consistent with the top performing approaches in the BraTS-2020 competition on the validation dataset.

Keywords. AI, Glioblastoma, brain tumor segmentation, features selection, permutation importance, Random forest regression, survival prediction

1. INTRODUCTION

An automatically generated brain-tumor segmentation and OS prediction of Glioblastoma or Glioblastoma-Multiforme (GBM) patients have recently received widespread attention from the research fraternity due to their critical nature (1). These tasks are regarded as among the most difficult in the medical domains (2). Accurate delineation of malignant tumor cells and survival days prediction are crucial and directly impact the cycle of treatment and post-treatment planning. GBM is an exceptionally invasive type of brain tumour found in adults with a highly infiltrative and diffusive nature. MRI has traditionally been the most basic

imaging technology used to examine these types of cancers due to its non-invasive, high resolution and contrast nature. Deep learning-based segmentation methods have consistently outperformed traditional methods in recent years. Specifically, 3D UNet (3) based approaches have been proposed to generate robust segmentation results. The Brain Tumor Segmentation (BTS) comprises of dissecting tumor into following regions of interest (ROI): Enhancing-tumor (ET), Tumor-core (TC) and Whole-tumor (WT). A Dice score (DS) is used to evaluate segmentation result. DS measures overlapping pixels of predicted and ground truth maps, whereas Hausdorff-Distance - 95% (HD) determines the 95% percentile of the distance from the set of points from the predicted map, which is the closest point from the ground truth. In general, various 3D Unet based single, cascaded (4) and/or ensemble (2) (5) (4) of multiple models are used for BTS. In the recent BraTS-2020 (Brain-Tumor segmentation) challenge, Isensee et al. (2) implemented an ensemble of multiple 3D Unet based model for segmenting brain-tumor. They incorporated region-based training, post-processing, and a wide range of data augmentation techniques. Further, In BraTS-2021 Luu et al. (5) and Futrega et al. (6) further enhanced the performance of the model with minimal modifications (2). The above segmentation techniques suggest that automatic tumor segmentation is not only highly computation expensive but also extremely challenging problem due to high variance in shape, structure, location, texture of tumorous tissues, lack of sufficient standard dataset and an imbalance between tumorous/lesion and healthy/background areas. After brain tumor segmentation, survival prediction is another pivot sub-task which has gained wide attention (7). In comparison to BTS task, it is equally challenging yet crucial in medical domain. The survival rates of GBM patients are poor, most of them succumb to death within two years of diagnosis (8). Finally, the reduced set of features was used as input to train random-forest regressor (RFR) model. Ali et al. (9) implemented an ensemble of both 3D and 2D models for segmentation, while image-based features and radiomics based features were extracted from the input images and segmentation result for OS prediction. Further to reduce dimensions of features and overfitting, recursive feature elimination (RFE) was performed. At the end, these reduced features set were fed as input to train a RFR model for predict OS in numbers of days. Literature review suggests that for OS prediction, geometrical, statistical, location, and texture features were extracted from each tumor regions. Further, feature selection was performed on the datasets. They were trained on different regressor – RFR, Support-Vector Machine (SVM), and Decision-Trees (DT) to predict survival days of GBM patients'. As discussed priorly that OS prediction is also a difficult task due various reasons such as: incomplete data of patients, small dataset, less clinical information on gender, health condition, treatment, capturing biological characteristics, and qualitative image properties from radiographic images. Also, when targeting survival prediction as a classification problem, minor changes in prediction can misclassify the sample, which will hugely impact the classification accuracy. The proposed paper used permutation importance (PI) (10) based feature selection techniques and RFR model for prediction. The OS prediction of the BraTS competition (11; 12; 13) focuses on predicting survival days and classifying the survival days into Long-Term, Mid-Term, and Short-Term categories. Here, accuracy and and Spearman ranking coefficient (Spearman Ranking) are mainly used to rank and access the model performance. In the suggested approach, the selected features performance is comparable to the current state-of-art methods. The following are the paper's primary contributions:

• Accurate and comparable OS prediction with current top performing methods, on validation BraTS-2020 dataset.

• In-depth analysis of the impact of dataset on model performance.

• In-depth analysis of model performance in-terms of OS prediction.

• In-depth performance impact analysis, when mapping survival days prediction into different categories.

2. BraTS-2020 Dataset

The BraTS2020 (11; 12; 13) training dataset comprises of 369 samples images and meta-data (Age, resection status and survival days) of 236 patients for OS prediction. Whereas validation dataset contains 125 isamples images for segmentation and meta-data information of 29 sample for OS prediction. All the sample cases have GTR resection status. There are four MRI modalities in each sample: T1-weighted, contrast enhancing (T1-ce), T2-weighted, and (T2-FLAIR), and manually-labelled result. The class labels of segmentation results are: Label-1 represents Non-enhancing tumor (NET-ROI) and necrotic tumor (NCR-ROI), label-2 represents edema (ROI), label-4 represents enhancing-tumor (ET-ROI), and label 0 represents background pixels. The dimensions of each image are: 240 × 240 × 155 (width, height, and channels).

3. O. S Prediction Methodology

The proposed O.S prediction methodology can be seen in Figure 1. Since, tumor segmentation is pre-requisite for O.S prediction, we have implemented a 3D network for segmenting brain tumor, which had U-Net-like architecture (14). It has the most straightforward architecture and was one of the best-performing segmentation models of the BraTS-2017 challenge. The details about the structure of model can be found here (14). The dice-scores obtained on the BraTS 2020 training-set are 0.819 for WT, 0.766 for TC, and 0.702 for ET. For validation-set DS are: 0.880(WT), 0.858(TC) and 0.759(ET). Further, for predicting OS days, we extracted : image, radiomic-based features and trained Random forest regressor (RFR) model.

3.1. Feature-Extraction and Feature-Selection

3.1.1. Feature-Extraction

(15; 16; 17) Feature-extraction is a method to derive new features space from the original feature set. We extracted 1265 features which can be categorized into : 1) image-based features - 39, 2) radiomics-based features using LoG and wavelet filters (18) - 1226. Numbers beside feature categories show total numbers of features extracted.

Table 1.: Features extraction set

Image-based features	Shape based features (such as surface area, volume, proportion of tumor regions..), location based features (centroid of tumor regions..)
Radiomics features	Shape features 3D (such as flatness, elongation..), firstorder statistical features (such as entropy, energy..), gray-level features (such as gray-level size-zone(GLSZ), gray-level cooccurrence matrix(GLCM)..)

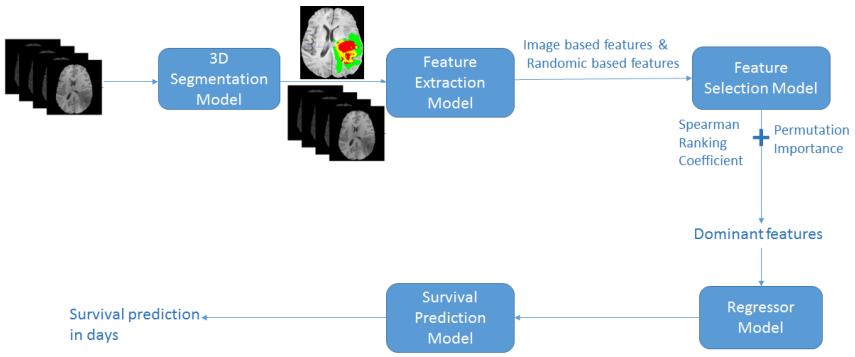


Figure 1.: The diagrammatic representation of the proposed framework for OS prediction.

3.1.2. Feature Selection

The fundamental purpose of feature-selection methods is to identify a subset of input features that have unique information to distinguish the target feature. We used permutation importance (PI) as feature selection techniques (19) to obtain 29 dominant features.

3.2. Regression and Classification Framework

We have trained RF regressor model to predict OS days and RF classifier to classifying into these three categories (long-term, mid-term and small-term survivor). RFR has proved to be more successful because of the following reasons: 1. The output prediction is the mean of the prediction of all the individual trees, and 2. The introduction of randomness in the growth of the trees and the splitting of the trees (20) reduces generalized errors and overcomes overfitting. Also, in the studies mentioned in (21), where the authors assessed 179 different classifiers on 121 different datasets, they found that RF outperforms all the other classifiers. The datasets also include survival prediction of breast cancer patients. We have used only those samples whose resection status is GTR and five cross validations to train the model in the training phase. Furthermore, we have used grid search to find set of optimal hyper-parameters.

4. Results and Discussion

All the results were obtained through BraTS online evaluation platform (22).

4.1. Quantifying Performance of the model

In the dominant feature set obtained through PI (feature selection method), it has been observed that significant features are based on wavelet filter and the Laplacian of Gaussian filter. The wavelet transform can capture spatial and global informations (23). Whereas, LoG filter which is widely used in biomedical image analysis, can enhance structural or edge information (24). The accuracy of the RFR model on training are 53.5% and on validation sets are 55.2%, respectively. Table 2 presents the outcomes.

Table 2.: Performance metrics on training and validation BraTS-2020 dataset for OS prediction.

Dataset-2020	Accuracy	MSE	Spearman ranking
Training	53.8%	60668.60	0.75
Validation	55.2%	79826.20	0.71

4.2. Evaluation of RFR model for OS prediction

Since the BraTS OS prediction is a classification task, we classified the survival days from the training dataset into small-term (class 0), mid-term (class 1), long-term (class 2) categories. For short-term survival, the survival days are less than 300 days; for mid-term survival, the survival days are in between 300 to 450 days; and for long-term survival, the survival days are more than 450 days. The BraTS dataset don't include these categories but only survival days. Figure 2 shows a classification of survival days into categories and the distribution for the training dataset. The box plots for these categories are shown in Figure 3.

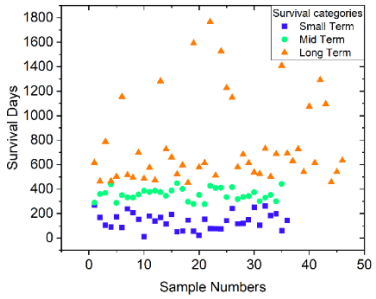


Figure 2.: Distribution of survival days categories i.e., Small-Term, Mid-Term and Long-Term from the training dataset. Samples with GTR resection status are plotted. $N = N_0 + N_1 + N_2 = 36 + 35 + 46 = 117$, where N_0, N_1, N_2 are the number of samples in class 0, 1, 2 respectively and the overall number of samples is N.

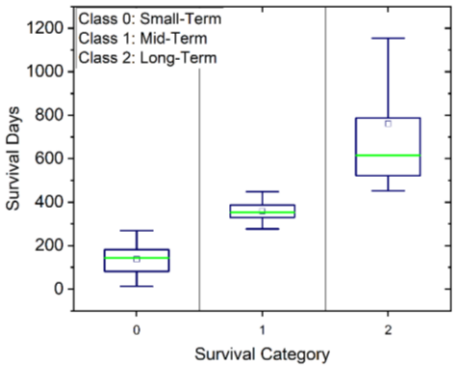


Figure 3.: (a) Box-plot depicts survival days into different categories

A box-plot showing the distribution of long-term, mid-term and short-term survival categories. Green line of the whisker shows the median value of the respective classes. Box in the whisker shows the mean value of the respective classes. The median value of long-term, mid-term and short-term are 615.5, 353 and 143.5 respectively.

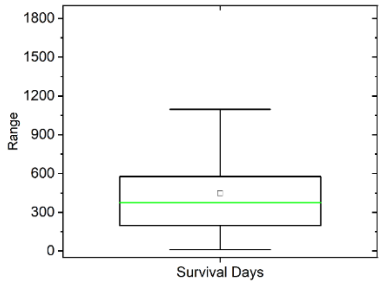


Figure 3(b) Box-plot for Survival days,

A box-plot showing the overall distribution of survival days from training data.We can observe from Figure 2, that for small-term category the distribution of samples are very sparse for e.g. under 50 survival days, there are only two samples with vast difference in survival days. These can also be justify through the Figure 3 (a), where median survival days for small-term category is 143.5 days. Whereas for mid-range samples have even distribution and range value of classification is also less compare to other two categories. Whereas, sample distribution and range of survival days without categorisation can be seen in Figure 3 (b). Similarly, observing mean value of each categories validate the distribution of samples. Hence for the same reason, the prediction of our model is more accurate for the mid-term category, followed by small-term and long-term categories. A comparison of the predicted and ground-truth survival days for the 30 test samples from the training samples is shown in Figure 4. We recognise that the suggested model exhibits a good degree of generalisation for survival days ranging from 180 to 950 days. The reason is that 1. The maximum number of data points of survival days falls in this range (cf. Figure 3(b)). 2. There are not enough samples to train the model for better approximation in any other range.

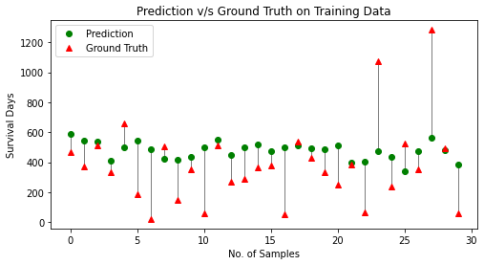
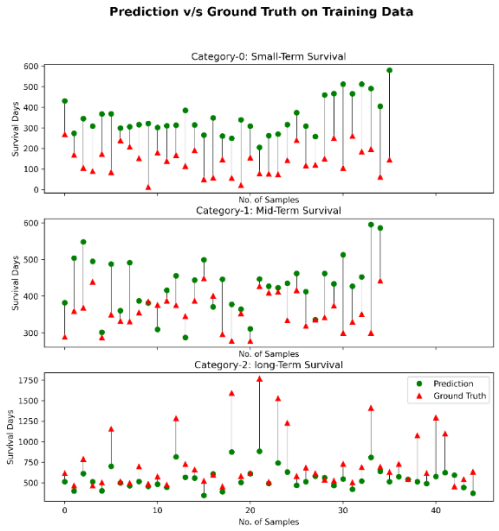


Figure 4.: RFR prediction on test samples taken randomly from the training dataset

The overall accuracy of the OS prediction depends on how accurately the model predicts survival days for each of the three categories. Figure 5 depicts comparison plots between predicted and ground-truth survival days for each category to demonstrate the proposed model's classification performance. The quantitative evaluation of the proposed model on all the three categories on the training dataset is shown in Table 4. The MSE for the prediction of survival days in the small-term, mid-term, long-term categories are: 52762.20, 10850.27, and 101711.33, respectively. We observe that MSE is maximum for the long-term survival category compared to other survival categories. The reason is that for misclassified training samples, the difference between the predicted and ground-truth survival days is more for the long-term survival category compared to the other two categories. Whereas,

the obtained accuracy is more for long-term survival category, followed by mid-term and least for the small-term survival category. The reasons for that are: 1. Since the sample distribution i.e., range is more for long term and so is the error margin, it results in the possibility of the large variation between the predicted and ground-truth falling in the same category. 2. The number of samples is more for long-term category compared to the other two categories. Further, to validate the results, we have used receiver operating characteristic (ROC) curve which is shown in Figure 6. It displays both true-positive rate (TPR) and false-positive rate (FPR). From the figure, we can observe that the predictability of the model for the mid-term and long-term survival category is better than short term survival, which supports the results we are getting from the RFR regressor. The area underneath the curve is 0.57 for mid-term and long-term whereas the area for the small-term is 0.48 which shows our model has a reasonable discriminatory ability for the mid-term and long-term categories and very little discriminatory capability for the small-term category. The reason for the lower discriminatory capability is: 1. The discontinuity in the spread of samples is least for this category. 2. A smaller number of training samples.



Finally, a performance comparison of the RFR model with top-ranking models of BraTS-2020 competition on the training and validation datasets has been noted in Table 5. The performance metrics of the top-ranking models was obtained through the BraTS validation leaderboard (25). Our model has shown a robust performance since it has performed significantly better in all the mentioned evaluation metrics. Also, the training and validation per formance of our model is close to each other, signifying that the model is robust and generalizing well.

Table 4.: Category-wise performance evaluation on training dataset BraTS-2020 challenge.

Dataset-2020	Accuracy	MSE	Spearman ranking
Small-Term	25.00%	052762.20	0.31
Mid-Term	45.70%	010850.30	0.28
Long-Term	82.20%	101711.00	0.75

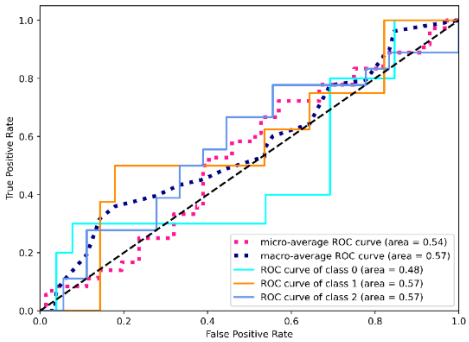


Figure 6.: ROC curve to multi-class using RFR classifier model (class-0 Small-Term survival, class-1 Long-Term survival and class-2 represents Mid-Term survival).

Table 5.: On the training and validation BraTS-2020 dataset, performance was compared to top-ranking models.

Dataset 2020	Team-name	Accuracy	Mean squared error (MSE)	Spearman Ranking
Training	SCAN (26)	NA	NA	NA
	Redneucon (27)	82.20%	55499.71	0.833
	COMSATS-MIDL (9)	64.10%	62305.61	0.632
	Proposed	53.80%	60668.61	0.754
Validation	SCAN (26)	41.40%	098704.65	0.253
	Redneucon (27)	52.00%	122515.80	0.130
	COMSATS-MIDL (9)	48.30%	105079.40	0.134
	Proposed	55.20%	079826.24	0.711

Note: Team names and ranking were taken from BraTS challenge leaderboard (25) and ranking platform (28).

5. Conclusion and Future work

In this work, we proposed an in-depth analysis of the impact of dataset distribution on the performance of the model. Further, we inspect the performance of model on each instance and analysed it to reason its impact on instances in-terms of error margins. Also, we examine the performance of model when targeting O.S prediction as category problem. We explained the reason for the true-positive and false-positive classifications of the model. For regression and classification, we have trained random forest model with the dominant feature set obtained through PI feature selection method. This feature selection methods quantified the role of each feature selected and hence unravelled the reason for performance of the model. This RF regressor model performed well for mid-term O.S prediction followed by small-term and long-term whereas RF classifier performed well for long-term and mid-term. The performance of the model can be increased by: 1. including more location-based features 2. larger dataset 3. improved segmentation results, which are used for feature extraction.Acknowledgments M. Roy acknowledges the seed grant No. ORSP/R&D/P DP U/2019/MR/RO051 of PDEU (for the computing facility), the core research grant No. CRG/2020/000869 of the Science and Engineering Research Board (SERB), Govt. of India and the project grant no GUJCOST /ST I/2021−22/3873ofGUJCOST, Govt. of Gujarat,

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Voice Controlled Radio Mobile Application with Speech Recognition Using Alan Studio

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Abstract

In this paper, a very captivating proposal is offered, a mobile-based service that is a union of the ground-breaking Alan Studio, Flutter & Dart. The projected idea of the Voice Controlled Mobile Application offers a naive method and comfort to the user. This application delivers all the mechanisms mandatory for a user to be able to use speech & voice as an intermediate to shuffle between radio stations of his/her choice and also the option to have a conversation with the application. A voice-controlled structure implanted in a mobile application. Music has many health benefits – improves mood, reduces stress, improves memory, improves cognition and many more. By the participation and establishment of technology, it is detected novel behaviours of listening to music are substituting longstanding methods. Thus, new ways of listening to music, such as radio are in demand now and this application gives the user the experience of hands-free radio, along with voice commands such as a conversation, weather and news too. Alan AI's responses are compared to Siri and Google Assistant and they showed staggering results.

Keywords. Alan Studio, Flutter; Radio, Voice Controlled Mobile App.

1. INTRODUCTION

Advancements in technology are being developed to make life easier, and voice control is one of the main machineries that is slowly used on more and more gadgets. One of the most in-demand skills is voice control. Voice control is becoming more common in apps and services. Voice control capabilities give the customer a very simple and hands-free experience, allowing them to access the facility without using the device by hand. Current routines do not let us remove time out of our hectic schedules to type/select every song, artist, or genre that we desire. We want things done quickly and without having to use our hands. Music has many health benefits – improves mood, reduces stress, improves memory, improves cognition and many more. By the participation and establishment of technology, it is detected novel behaviours of listening to music are substituting longstanding methods. There are no linguistic borders when it comes to a good melody, thus music is popular all around the world. When people are exercising, driving, doing domestic chores, or doing anything else that requires their hands to be active, they prefer to listen to music to make their activity more enjoyable. We created Bharat Play, an AI radio with an in-app voice assistant named Alan that makes listening to music much easier. With only one voice command, you can listen to your favourite radio station. The system's hands-free method goes a long way toward encouraging the user to cooperate frequently, as the user wishes to

practice speech facility than inputting instructions. One of the most significant rewards of the suggested application is that speech recognition is not restricted to mobiles, laptops, or desktops, but is also implemented in all types of devices with which handlers cooperate, such as smart tv's and smart watches.

2. LITERATURE SURVEY

As speech communications are much prevalent, a rising amount of research has aided to clarify many questions regarding whose voice is maximum effective, as well as the key obstacles and confines of voice assistants. Numerous researches have looked at popular assistants like Google Assistant Alexa, Siri have become interwoven into users' daily lives, as well as how their associations with these assistants have evolved as time passes. Voice interactions are particularly beneficial in situations where the user's visual and ligaments are busy, for example while driving/cooking/working out. Users regularly request their voice assistants to 'answer search or type queries, control music, set timers, and manage associated smart home devices', according to usage records and self-report statistics [2]. Fig 1. Shows how Google Home and Amazon Alexa compare in terms of command criteria. In both the charts, music has a very high ratio, 26.1% and 28.5% respectively. This shows that across all voice assistants regardless of the brand, people do trust their voice assistant to play songs.

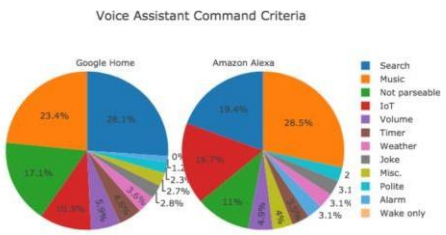


Fig 1. Voice assistant criteria Google Home vs Alexa

Similarly, project principles and finest practises for designing for speech are yet in their early phases, and voice assistants face many unanswered technical challenges. Voice interfaces, especially those deprived of a screen, frequently suffer from a lack: unlike graphical user interfaces, where the potentials for communication are noticeable to the user. Furthermore, speech recognition mistakes plague voice assistants, leading in erroneous transcriptions of what the user said. Liable on the customer's pronunciation or usage of specialised language and proper nouns, theseerrors can be particularly common.

3. METHODOLOGY

3.1 Alan Studio

3.2 Unique terminology and workflow

The Alan Platform enables application developers to define dialog scripts for their in-app voice assistant. These dialog scripts enable the Alan Platform to build a Domain Language Model for the application and later use the non-verbal context to understand user language very accurately.[1]

ii. Voice conversations are dynamic

Today, most conversational solutions require you to design a static, template-driven dialog flow. This type of design expects users to stick to the step-by-step structure, which can result unnatural, frustrating, and unsuccessful interactions. Most such conversations are rigid and robotic, and far from the dynamic flow of human interactions. Fig 8 gives a representation of these types of voice conversations.

Alan provides a means to load entities dynamically and customize them during the dialog session. The conversational flow, therefore, can be updated during runtime, on the fly, without the need to rebuild the AI conversational model. All this is feasible because the Alan Platform uses a hybrid model for dialog management. The hybrid approach builds voice dialogs through a combination of machine learning models tuned on your application data and procedural programming in JavaScript that has access to the Dynamic Intent and Entities. shows the different approaches taken for dialog management.

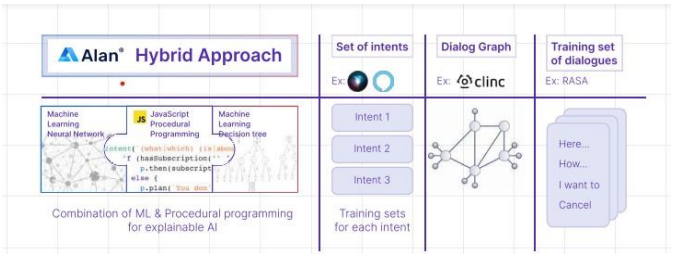


Fig 3 Hybrid Approach for Dialog Management to enable human-like conversations.

Source : Alan Whitepaper

iii. Quickly iterate

When the in-app voice assistant goes live, Alan collects conversational data and provides you with advanced voice analytics tools to gain real-time insights into users' interactions in each context. This will help you better understand your users' needs and deliver a more accurate experience. With all the key metrics and conversational data at their disposal, app developers will augment the voice conversation scripts to improve the user experience and expand the cohort that is exposed to the voice assistant.

3.2 Flutter and Dart

Flutter is a cross-platform UI toolkit that permits for code reclaim across operating systems for example iOS and Android while also consenting applications to interact straight with fundamental platform services [5]. The goal is for developers to be able to produce high-recital programmes that feel normal across platforms, embracing changes where they are while allotting as much code as feasible.

We have used Flutter and Dart to create the front end- the audio player and integrate the Alan Package from Alan Studio. This was all coded in Android Studio.

4. DESIGN IMPLEMENTATION

The aforementioned technologies come together to provide the user with a flawless software that allows him to listen to his favourite genre of music while browsing through various radio stations. The app is quite accurate in its operation, providing the user with songs coming from the maximum dependable and reliable radio stations.

Fig 4 shows the flowchart of the application when the user says the 'Hey Alan!' wake word.

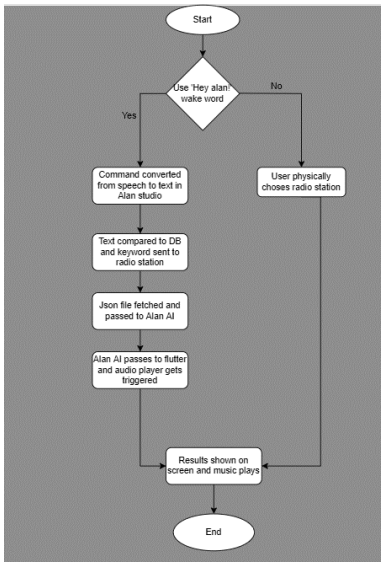


Fig 4 Flowchart of the App

5. EXPERIMENTAL RESULTS

Here we can see how Alan compares to Siri and Google Assistant. The first parameter we tested was the response time shown in Table 1. Here we can see we have tested 8 instances between the three voice assistants and by no surprise Siri has topped the ratings with the lowest average response time, Google Assistant coming second and Alan Voice coming last. But a thing to note is that in the system we have developed, music is the main motive and we can see that in Siri and Google Assistant the 'Stop Music' function does not work but in Alan voice it does. Moreover, there is no way for Siri and Google Assistant to play a particular radio station but Alan can, as we see in the Accuracy Table Shown in Table 2.

Figure 5 shows Table 1's response time comparison in the form of a bar chart visualised by colour coding the different assistants.

In playing a specific genre we can clearly see that Alan took far less time than Siri, which is a great insight to the working of our system and the wake word 'Hey Alan' performed really well when compared to the popular voice assistants.

	Response time (ms)		
Parameters	Alan	Siri	Google Assistant
Wake word	2160	1720	**1092**
Play a song	6530	**6020**	6150
Stop music	**3000**	--	--
Play next	4450	**2650**	2920
Conversation(name)	3420	3210	**1530**
calculator	4160	3530	**2960**
Play genre	6860	9000	**6330**
Play radio city FM	**6700**	--	--

Table 1. Response time comparisons

	Accuracy (1 or 0)		
Parameters	Alan	Siri	Google Assistant
Wake word	1	1	1
Play a song	1	1	1
Stop music	1	0	0
Play next	1	1	1
conversation	1	1	1
calculator	1	1	1
Play genre	1	1	1
Play radio city FM	1	0	0
Total	**8/8**	6/8	6/8

Table 2. Accuracy Score Comparison

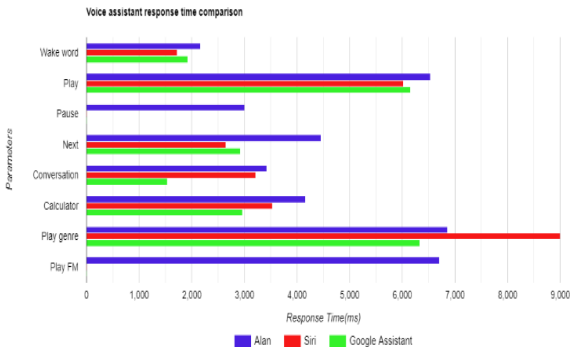


Fig 5 Voice assistants' response time comparison

We can see that Siri and Google both had 1 false positive and 1 true negative each, False positive because it played a random song when asked to play a paritcular FM and True negative because it did not even respond to the 'Stop' function when asked to pause the song.

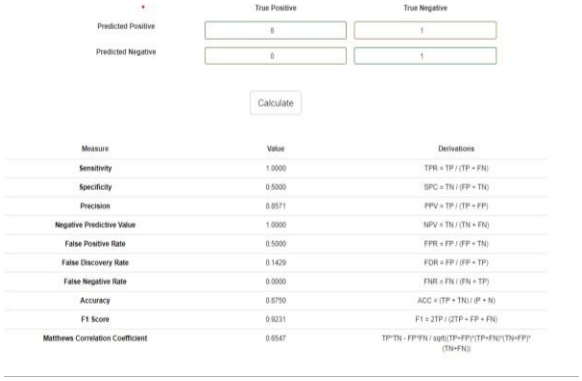
However Alan didn't have any faults and succesfully executed with and accuracy score of 1.00 in these tests.

	True Positive	True Negative
Predicted Positive	8	0
Predicted Negative	0	0

Calculate

Measure	Value	Derivations
Sensitivity	1.0000	TPR = TP / (TP + FN)
Specificity		SPC = TN / (FP + TN)
Precision	1.0000	PPV = TP / (TP + FP)
Negative Predictive Value		NPV = TN / (TN + FN)
False Positive Rate		FPR = FP / (FP + TN)
False Discovery Rate	0.0000	FDR = FP / (FP + TP)
False Negative Rate	0.0000	FNR = FN / (FN + TP)
Accuracy	1.0000	ACC = (TP + TN) / (P + N)
F1 Score	1.0000	F1 = 2TP / (2TP + FP + FN)
Matthews Correlation Coefficient		TP*TN - FP*FN / sqrt((TP+FP)*(TP+FN)*(TN+FP)*(TN+FN))

Fig 6 Confusion Matrix for Alan Voice



	True Positive	True Negative
Predicted Positive	8	1
Predicted Negative	0	1

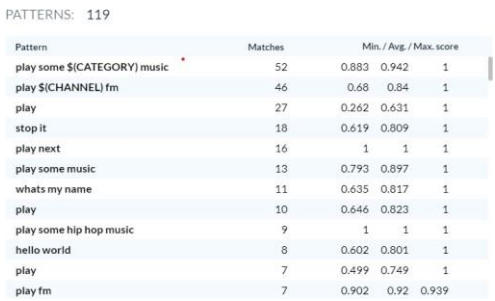
Calculate

Measure	Value	Derivations
Sensitivity	1.0000	TPR = TP / (TP + FN)
Specificity	0.5000	SPC = TN / (FP + TN)
Precision	0.8571	PPV = TP / (TP + FP)
Negative Predictive Value	1.0000	NPV = TN / (TN + FN)
False Positive Rate	0.5000	FPR = FP / (FP + TN)
False Discovery Rate	0.1429	FDR = FP / (FP + TP)
False Negative Rate	0.0000	FNR = FN / (FN + TP)
Accuracy	0.8750	ACC = (TP + TN) / (P + N)
F1 Score	0.9231	F1 = 2TP / (2TP + FP + FN)
Matthews Correlation Coefficient	0.6547	TP*TN - FP*FN / sqrt((TP+FP)*(TP+FN)*(TN+FP)*(TN+FN))

Fig 7 Confusion Matrix for Google Assistant and Siri

Alan studio analytics

As a user interacts with a voice assistant in the app, Alan AI captures voice data and analyses key conversational metrics.



PATTERNS: 119

Pattern	Matches	Min. / Avg. / Max. score		
play some $(CATEGORY) music	52	0.883	0.942	1
play $(CHANNEL) fm	46	0.68	0.84	1
play	27	0.262	0.631	1
stop it	18	0.619	0.809	1
play next	16	1	1	1
play some music	13	0.793	0.897	1
whats my name	11	0.635	0.817	1
play	10	0.646	0.823	1
play some hip hop music	9	1	1	1
hello world	8	0.602	0.801	1
play	7	0.499	0.749	1
play fm	7	0.902	0.92	0.939

Fig 8 Patterns

6. FUTURE WORK

No one expected speech recognition to become such a heavy power for forthcoming technological breakthroughs when it first emerged in the early 2010s with the debut of what is now one of the furthermost well-known devices, Siri. 'One-sixth of the population in the United States now possesses a smart speaker, according to estimates. This is just a small sample of the technology's potential and the huge expanse of possibility it offers.'

Predictions for future: Personalized Experiences, Voice Push Notifications, Search Behavior Will Shift, Inbuilt Security Features for Users, Voice Cloning and SmartDisplays.

7. CONCLUSION & DISCUSSION

The suggested technology allows a diverse group of users to listen to their favourite radio station no matter where they are. Because music is such an important part of everyone's lives, it allows users to enjoy their time whether travelling, exercising, or even with their hands busy. It also enables physically challenged persons to benefit from the most recent technological advances while also allowing them to relax by listening to their favourite type of music.

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Analysis of properties leading to cytotoxicity of silver nanoparticles using Machine Learning

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Abstract

The last decade has observed an exponential increase in the application of silver nanoparticles (Ag-NPs) synthesized by various routes. The extensive use of Ag-NPs has raised concerns about their potential impact on human health, which is debatable in terms of toxicity whenit comes to direct contact with the human body. The present study comprehends the relationship between the physical parameters of Ag-NPsand theircytotoxicity on normal and carcinoma cell lines. This study deals with a meta-analysis of the cytotoxicity data of Ag-NPs by collecting the heterogeneous input features from the literature using machine learning tools, decision tree (DT), and random forest (RF). Significance of the selected input features was ranked using the permutation-based measure known as mean decrease Gini (MDG). Performances of the models wereevaluated through regression metrics, root mean square error (RMSE) and square of standard deviation (R^2). Decision tree and random forest assisted in classifying the input parameters by asserting certain threshold values.The obtained high value of R^2 (DT-0.98, RF-0.88) and low value of RMSE (DT-3.9, RF-8.9) confirmed the accurate predictionand classification of toxicity and non-toxicity on normal and carcinoma cell lines. An attempt has been made to understand the toxicity of Ag-NPs to normal and carcinoma cell lines.

Keywords. Ag-NPs, Cytotoxicity, HEK-293, PC 12 cell line, Machine learning, Decision tree, Random Forest, K-means clustering, Regression metrics

1. INTRODUCTION

Ag-NPs are widely employed in consumer goods, including cosmetics and ointments, and are in great demand [1]. Ag-NPs have a wide range of applications in medicine, pharmaceuticals, pharmacology, biotechnology, electronics, engineering, energy, magnetic fields, and environmental cleanup [2]. In addition to these uses, Ag-NPs have become more significant in the industrial field of textiles, food, consumer goods, etc., due to their inborn and powerful antibacterial capabilities [3]. Ag-NPs are currently being investigated for medical devices, feminine hygiene products, paints, sunscreen, biosensors, textiles, and electronics [1-3]. Despite these advantages, Ag-NPs have also been found to be toxic.

Because of their potent oxidative properties, silver ions (Ag+) are released, which have detrimental effects on biological systems in the form of cytotoxicity, genotoxicity, immunological reactions, and even cell death (apoptosis) [4-7].The precise methods by which NPs interact with biological entities are yet unknown, and the mechanism of Ag-NPs cytotoxicity is not fully understood [8-11]. Recent studies have shown that the physical properties of Ag-NPs, such as their particle size, NPs dosage, and agglomeration, are crucial in determining their cytotoxicity. Investigations revealed that the kinetic development of NPs at each stage of synthesis greatly influences their physical properties [12,13]. To fine-tune the cytotoxicity behaviour of Ag-NPs, it is essential to determine the predictive correlation between cytotoxicity and the physical characteristics that arises due to the synthesis techniques. Hence, we report a comprehensive analysis for predicting and classifying cytotoxicity associated with Ag-NPs. This has been achieved by two machine learning algorithms, (i) decision tree (DT) and (ii) random forest (RF), run by datamining found in the literature. The findings are expected to reveal the key parameters that affect the cytotoxicity of Ag-NPs. Several nanoparticles are considered in the data mining and may affect the predictive results of machine learning as different nanoparticle exhibits various physical properties. The present work is inspired by our previous work on Ag-NPs synthesized using turmeric extract [14]. The input parameters are chosen based on Ag-NPs on normal cell lines and carcinoma cell lines using supervised learning, i.e. Decision Tree (DT) and the Radom Forest (RF).

2. METHODOLOGY

The preferred keywords for collecting data were "silver nanoparticles for cytotoxicity". To avoid duplication, we limited our search to only two databases, ScienceDirect and MDPI. Additionally, we focused on the most recent cytotoxicity study and collected the data from October 2019 to April 2022. We were only concerned with current research articles. From ScienceDirect, we located about 38 research articles, and from MDPI, about 21. Around 40 of the 59 articles could be accessed, and we acquired 2000 datasets (cell viability) and their corresponding concentrations of NPs. Out of them, 485 datasets were excluded due to cytotoxicity assays other than the MTT assay. In the end, 200 data were eliminated since the concentrations were not measured in µg/mL but in other units. The result of data mining is a final yield of 1315 data points from 40 articles with 11 different input features, including reducing agents, particle size, zeta potential, cell line type (normal/carcinoma), hydrodynamic diameter, wavelength, morphology, exposure time and concentration of silver based NPs for assessing cytotoxicity using MTT assay. The plant and non-plant mediated extracts are utilized as biosynthesizing agents in producing green AgNPs that might affect toxicity. The phytochemicals present in such synthesis agents may interact with other factors to affect the toxic effects of AgNPs. This could be a possible input feature for further negotiating the different machine learning algorithms to enhance their performance metrics.

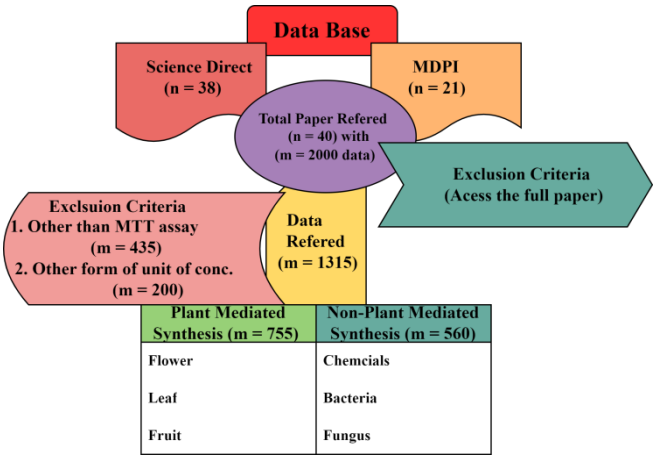


Figure 1. Block diagram representing the selection procedure of the research articles

3. RESULTS AND DISCUSSION

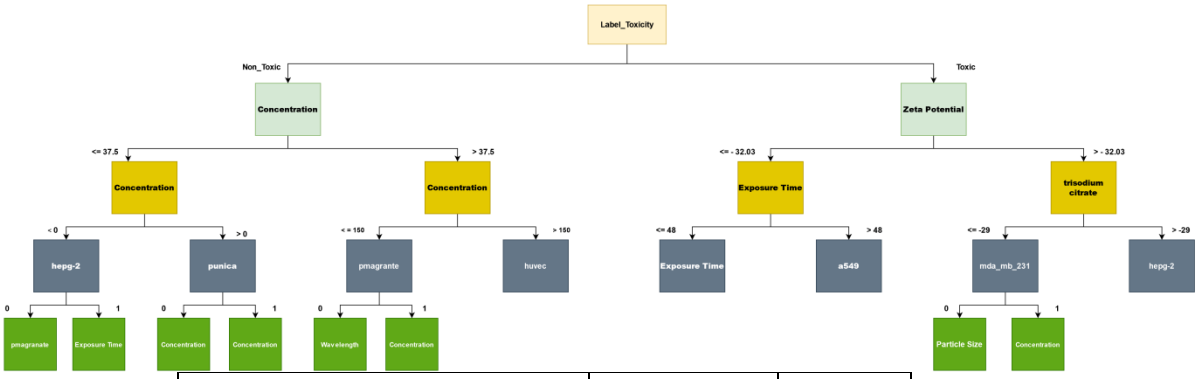
The information is gathered and shaped into an m×n matrix, where m stands for 1135 datasets and n for the 11 characteristics.The work was divided into two sets based on cell lines, such as normal and cancer. Every time identical input features were applied to build both datasets using DT and RF models. The input features were a reducing agent, carcinoma and normal cell lines, exposure period, particle size, hydrodynamic diameter, zeta potential, wavelength, concentration, and cell viability.The input features must have the best possible correlation. As a result, while completing the regression and classification analysis through DT, RF, and clustering, the projected outcome must comply with the conditions involved. Before making a prediction, supervised learning techniques follow a set process. Datasets are divided into training and test datasets when using supervised machine learning. To match the result, algorithms are first trained on the labelled dataset (in terms of cytotoxicity). Second, a subset of the training dataset called the test dataset is used to validate the model. For the best possible anticipated outcome, the input features are chosen. The Orange open-source toolkit's Decision Tree (DT) and Random Forest (RF) were zutilized [56]. Certain restrictions applied to the normal cell line, including the following: (i) cell viability of less than or equal to 50% suggests that nanoparticles are harmful to cells(ii) Cell viability of more than 50% indicates that nanoparticles are not toxic to cells.

The optimal cart segmentation procedure is chosen after repeatedly sampling the original data. At each sampling, a collection of features from each node pool is randomly selected. Finally, a forest is built by aggregating the random features (classifiers) and letting each tree decide which classification is more likely. RF models are often more accurate and resilient than DT classifiers regarding noise and outliers.The conditions imposed on the dataset during the CART algorithm are if the cell viability is greater than or equal to 50%, the nanoparticles are toxic to the cell lines irrespective of whether it is normal or carcinoma, and

if the cell viability is greater than 50%, the nanoparticles are non-toxic to the cell lines irrespective of whether they belong to normal or carcinoma. The root mean square error (RMSE) and R^2 metrics were used to evaluate the performance of the model in regression analysis. RMSE measures the standard deviation of the residuals. R^2 quantifies how well a regression model fits a dataset and measures how well the model reproduces the observed results based on the proportion of the overall variation in the outcomes the model is accountable for explaining.When the regression analysis was performed on the decision tree and random forest model, the R^2 (0.9761) of the DT model was higher than R^2 (0.8776) of the RF model, and the RMSE (3.9322) value of DT was lower than the RMSE (8.8889) value of RF. The high value of R^2 and low value of RMSE indicates that the prediction is accurate, suggesting that the decision tree performed better than the random forest in predicting the toxicity parameter.

Figure 2. Prediction of cell viability using a DT using toxicity as an important parameter for normal cell lines

Table 1.Summary of the selected input features and machine learning results



Model	RMSE	R^2
Decision Tree (DT)	3.9	0.98
Random Forest (RF)	8.9	0.88

The Gini impurity in the decision tree algorithm represents a function that determines how successfully the decision tree was split, and its value ranges between 0 and 0.5. The significance of the chosen input features was ranked using the permutation-based measure called mean decrease Gini (MDG), where the inclusive parameter toxicity was selected since the conditions on which the DT and RF are to be run depends upon the cell viability, which is derived from the cell type. Cell viability was found to be a vital predictor for studying the toxic nature of nanoparticles. Hence, the input feature silver seems to be another potential predictor and the most important determinant of cytotoxicity.

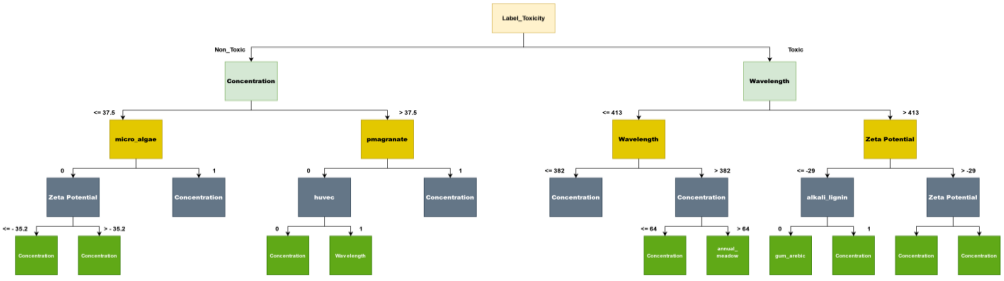


Figure 3. DT confirms that while calculating cytotoxicity and cellviability for carcinoma cell lines, zeta potential, exposure time, reducing agent, and concentration are important factors

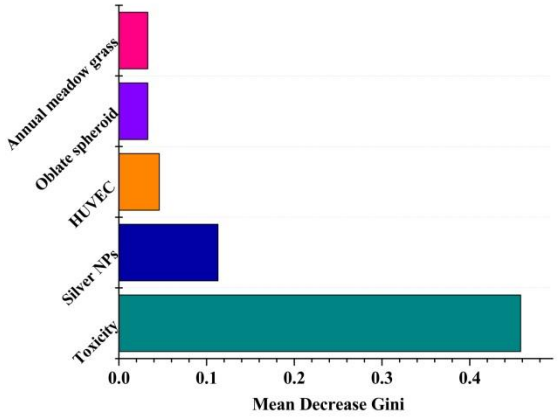


Figure 4. Ranking of the variables using mean decrease Gini for normal cell lines

Table 2. Ranking of the variables using mean decrease Gini for normal cell lines

Parameters	**Gini coefficient**
Toxicity	0.458
Silver NPs	0.113
HUVEC	0.046
Oblate spheroid	0.033
Annual meadow grass	0.032

Table II shows that toxicity is important in combination with Ag-NPs, exposure time, oblate spheroid shape and extract of annual meadow grass (since 162 data points have annual meadow grass as the reducing agent). Thus by these parameters, it can be predicted whether particular materials are toxic or non-toxic to normal cell lines.

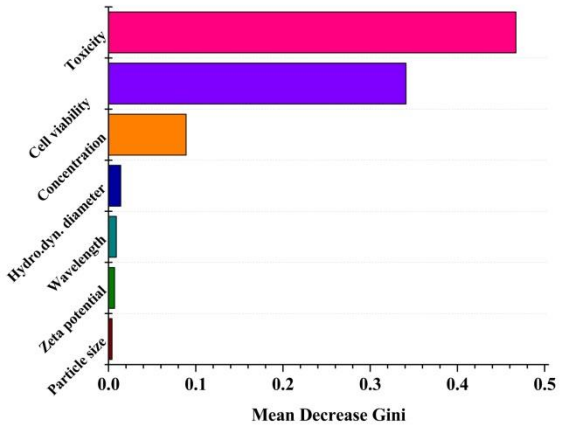


Figure 5. Ranking of the variables using mean decrease Gini for carcinoma cell lines

Table 3. Ranking of the variables using mean decrease Gini for carcinoma cell lines

Parameters	**Gini coefficient**
Toxicity	0.467
Cell viability	0.341
Concentration	0.089
Hydrodynamic diameter	0.014
Wavelength	0.009
Particle size	0.007
Zeta potential	0.004

Table III shows that concentration is an important factor than particle size and zeta potential that affect cell viability in the case of carcinoma cell lines.

4. CONCLUSION

From thecurrentmeta-analysis study, it has been revealedthat the cytotoxicity of Ag-NPs depends upon the physical input features like reducing agents, particle size, zeta potential, cell type (cancer/normal cell lines), hydrodynamic diameter, wavelength, morphology, exposure time and exposure dosage through two well-known supervised machine learning algorithms for regression analysis such as decision tree (DT) and random forest (RF) and the obtained test scores were compared with the DT showing an optimum accuracy in

comparison to RF. The obtained high value of R^2 and low value of RMSE indicated that the prediction is accurate, suggesting that DT has performed better than RF in predicting the toxicity parameter.The forecastis more precise and accurate, and best fits the dataset.The plant-mediated and non-plant mediated cytotoxicity on Ag-NPs with the inclusion of other major variables like cell assays, biological extracts and reaction parameters utilized in synthesis and the performance of models can be further advanced in terms of different machine learning algorithms like unsupervised k-means clustering that can be built to classify so that it will provide a basis for future work.

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Biography

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Dr. Neeru Bhagat is an Associate Professor in the Department of Applied Sciences. She has completed her BSc. and MSc. from Devi Ahilya Vishva Vidyalaya (DAVV) Indore and Ph.D. in Physics from Inter University Consortium, UGC-DAE under DAVV Indore. She is currently working on synthesis and characterization of metal nanoparticles and exploring their biological applicability. She is also working in Heusler alloys as half-metallic ferromagnets for shape memory alloys. She has published more than 25 papers in reputed journals.

DYNAMIC DASHBOARD FOR REAL TIME INSIGHTS ON COVID-19

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Abstract

The dashboard approach derives insights into dynamic data from Worldometer and derives various insights for the specific country and of the dynamic covid data which changes over time. The proposed system gives a dashboard which is an interactive and user-friendly visual tool for worldwide covid cases. The proposed system computes and derives insights as plots on Population Immunity, Recovery, and Risk with the population for the data by computing the probability on a statistical basis. The infection rates among the population based on countries are being compared by using plots and by statistics metrics. The countries and their level of risk of infection are being computed and visualized geographically. The level of recovery based on population and covid cases is analyzed and visualized in the dashboard. To visualize the behavior and trend nature of Covid-19, the proposed system follows a dashboard approach. The proposed system helps to identify the pattern, and trend of covid cases, and the nature of the spreading of the coronavirus geographically by the dashboard which could help WHO and health department officials in decision-making.

Keywords. COVID-19 dashboard, data visualization, Business Intelligence, recovery and risk with population, population Immunity.

1. INTRODUCTION

Covid 19 or Coronavirus is a pandemic and a communicable disease spreading globally and it is caused by the Severe Acute Respiratory Syndrome known as the SARS-CoV-2 virus. The first case was recorded in China, in a city named Wuhan, in November 2019. There was an exponential increase in the growth and spreading of the disease covid-19 worldwide. Several global countries had made statements of lockdown in the initial stages and drove vaccination to overcome this disease. This study shows the total active cases of covid 19, total deaths due to covid 19, and insights about immunity, and recovery in various countries and worldwide in a dashboard approach.

Dashboards help in decision-making and support behavior change. The user could derive insights about the virus and the growth and spreading nature of the virus globally in PowerBI. Based on the live covid data, the pattern, nature, and trend of the virus should be visualized as a dashboard approach and the insights should be analyzed for decision-making

by taking preventive measures in order with controlling the cases and reducing the deaths. Therefore, the proposed system gives the design and development of an online dashboard that visualizes the actual and live information about the COVID-19 and pattern of coronavirus in various countries using different methods. The dashboard updates dynamically based on real-time web data.

The use of the dashboard approach during the pandemic period was wide. The dashboards are used for interactive visualization in different geospatial regions. Dashboard analysis of covid 19 was the effective visual stimulation of trends and patterns of covid 19 worldwide and country-wise. The dashboard approach helps in aggregating various data from different countries and thereby helps in decision-making.

This paper focuses on visualizing the trend and nature of coronavirus globally through dashboards. The organization of the paper goes with the problem definition, briefing the existing problem in society and the need for the system for effective decision-making through visual tools, and a dashboard and it gives the objectives of the proposed system. The technology stack explains the process flow and describes statistical concepts used to derive insights from dynamic data. The module description picturizes the tools used for analysis and their overview. The results and discussion describe the dashboard approach and various charts used for real-time insights into global covid data. The future scope describes the possible future works that might be undertaken to benefit society and mankind. The conclusion part describes the decision-making in the healthcare domain through the dynamic dashboard.

2. LITERATURE REVIEW

A trend analysis of Google shows that the term “Covid-19 Dashboard” had been at its peak during March 2020. [1]

Kranthi Kumar Leela and Alphonse P.J.A analyzed the spreading and in-depth analysis of the diagnosis of COVID-19 disease which helps the clinical experts and research scientists to take necessary preventive measures for the pandemic.

Zhijun Ren [3] proposed the delivery of a standard Business Intelligence solution with the help of Microsoft Business Intelligence tool and he concluded that blending several technologies which include databases, connectors, business intelligence tools, and SharePoint servers leads to business intelligence solutions in an organization.

The author Guangzhi Zheng [4], in his work, had performed an exhaustive study of practical applications of business intelligence and realized the need for business intelligence to aid in decision-making in the healthcare domain.

Abel Brodeur, David Gray, Anik Islam, and Suraiya Bhuiyan’s studies show the economic and financial effects and disturbances of COVID-19.

Hector Florez and Sweta Singh [11] developed a dashboard and developed a mathematical model to project the cases and deaths evolved by country.

The existing research aims to derive useful clinical and health-related information in social media platforms like Twitter data using topic clustering and sentiment analysis to understand the public nature of covid-19.

The Covid-19 dashboard approach of the World Health Organization derives insights into the trends and patterns of the coronavirus and their peak during the covid waves but does not have information regarding the countries which were prone to the risk of coronavirus and their mode of recovery. The proposed system derives interactive and valuable insights based on the risk and recovery rates of various countries worldwide.

3. TECHNOLOGY STACK

3.1. ETL Operations

The live covid data is being extracted from the sources from the worldometer website. The data is extracted as a live table. The columns in the dataset have the live data as of the date (15.07.2022) of various attributes. The missing values and null values are being replaced with 0 in Power Query Editor. The extracted data is transformed based on their column values. The data type of the columns is transformed based on the data points in Power Query Editor. The transformed data is loaded in the PowerBI for dashboard generation.

3.2. Statistical Analysis

The statistical metrics such as population immunity, recovery rate, and risk with population measures are calculated from the data. The new parameters from the dataset are derived for visualizing the insights in the dashboard. Population immunity tells the extent to which the particular country is exposed and immune to the covid-19 disease. The parameter population immunity for various countries is derived by computing the probability of total deaths over total cases.

Population Immunity = 1 - (Total deaths / Total cases)

The recovery rate of the country shows the overall chances of surviving or recovering from the covid-19 of the overall country's population. The recovery rate of various countries is calculated by comparing the population immunity. The countries with population immunity greater than 0.95 are categorized as Strong Recovery countries. The rest of the countries with population immunity less than 0.95 are classified as Weak Recovery countries. These countries will be of less immunity in nature and will be in danger in the next wave of Covid hits a particular country.

if (Population Immunity (Countries) > 0.95), Strong Recovery

else, Weak Recovery

The parameter risk with population analyses the risk of rising cases to their peak in the population of the country. It is derived by comparing the total cases per 1 million population. If the overall corona cases per million population are greater than 5000 then the countries are categorized as High-Risk countries and the values between 1000 to 5000 are classified as Medium risk countries and the rest as low-risk countries.

if (Total Cases / 1M Population >= 5000), High Risk
Elif (Total Cases / 1M Population > 1000 && <5000), Medium Risk
else, Low Risk

4. MODULE DESCRIPTION

4.1. Data

The live covid-19 dataset from the web has daily information on the coronavirus containing the data fields of the globally affected cases, overall deaths, and active cases by a novel coronavirus. This is a time series value of real-time data, hence the data of the cases on a specific day is the cumulative value of the previous cases to date. The real-time data in the table from the webpage is updated daily after midnight GMT+0 (Greenwich Mean Time). The update in the live data is being reflected in the dashboard. The dashboard updates dynamically when the web data refreshes. The dashboard updates dynamically based on the live data. The real-time dynamic covid data about the cases of coronavirus infections were obtained from the Worldometer website (https://www.worldometers.info/coronavirus/). The worldometer website has the same live dataset size as on date in the web. The live data from the web is ingested into PowerBI as tables with the attributes.

4.2. Power Query Editor

Power Query Editor is used for performing ETL operations for loading the dynamic covid data in PowerBI through the on-premises gateway. Power Query Editor helps in transforming the data from the web, based on the attributes needed for ingesting or loading the data for dashboard generation.

4.3. On Premises Gateway

Power BI Gateways and Power BI Connectors help in creating interactive dashboards for the dynamic data and generating reports. Power BI Gateway is the component that helps in web scraping the data from various data sources with the help of connectors and protocols. [2] The different data sources may be data from cloud platforms, data from other databases, and data from the web. The real-time data from the worldometer website is ingested in the PowerBI by the on-premises gateway.

4.4. Power BI

Microsoft Power BI is a tool for business intelligence and data analytics, for decision making by the insights obtained from the interactive dashboards. Power BI supports publishing reports and dashboards and sharing with peers within the organization. The interactive and dynamic visualization charts for the live data such as area charts, stacked charts, treemap, bubble plot, cards, gauge charts, slicers, matrix, histogram, line chars, pie chart, doughnut chart, and geospatial map helps in better visualization and decision making through reports and dashboards. Map creation for visualizing countries is done by the choropleth option or by adding a vector layer in GIS maps.

5. RESULTS AND DISCUSSION

The goal of the dashboards in COVID-19 is to visualize the cases globally and to create awareness among individuals by analyzing the trend of coronavirus. Dashboards act as intelligent decision tools and guide in monitoring and guiding proper decisions promptly. The usage of intelligent dashboards ranges from monitoring the coronavirus and its infection and initiating preventive measures like social distancing and wearing masks and enforcing strict regulations in geographical areas or regions with high risk and low recovery from

covid-19. This dashboard was created on 15.07.2022. The results discussed were specific to the particular date. However, the dashboard updates daily, and the everyday results could be tracked and inferred for decision-making.

5.1. Risk level and Recovery level of countries towards Covid-19

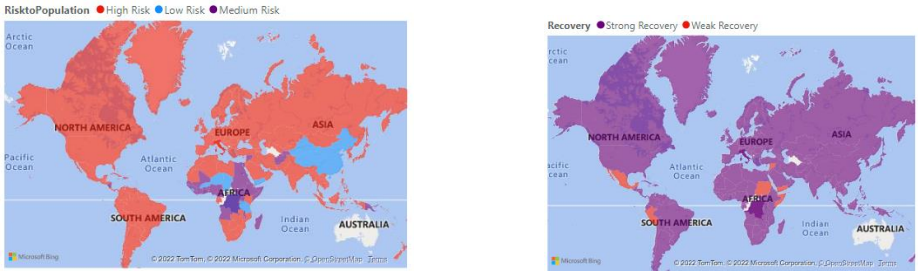

Figure 5.1 Filled map (Chloropleth) – (a) Risk to population (b) Recovery

Figure 5.1 (a) categorizes the countries based on risk with population. All the American, European and Asian countries were highly at risk with population. African countries such as Egypt, Ethiopia, Mali, Nigeria, Sudan, and Madagascar were at medium risk with population. The countries such as China, Tanzania, and Chad were at low risk of Covid-19. China being the first largest populated country, is at Low risk of infection at present. The decline in cases in China over days due to various reasons such as vaccination and following government protocols such as social distancing is the major reason for China being in low-risk countries.

Figure 5.1 (b) shows the recovery of countries. The lightly shaded regions show weak recovery from covid-19. Globally, many countries except a few show strong recovery from covid-19. This study says that even if another wave hits up due to mutations of coronavirus, the maximum number of countries have a high level of recovery even if they were at high risk to the population. The countries such as Mexico and Peru show low recovery and high risk with the population. These two countries should be targeted and necessary preventive measures should be initiated by the WHO to reduce the future impact due to covid-19.

5.2. Real-time Cumulative Active Covid-19 cases

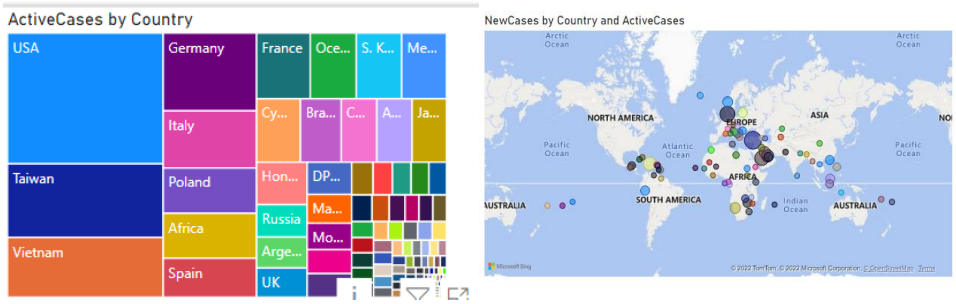

Figure 5.2 (a) Treemap - Active Cases by Country (b) New cases by Country

Figure 5.2 (a) shows the active cases of covid-19 on a particular day in all countries as a tree map. The larger rectangles show the countries with a greater number of covid-19 active

cases. The space inside each rectangle is allocated based on the value of the active covid-19 cases. Treemaps can be used to find the largest values of hierarchical data, and to show the pattern of distribution of data in the hierarchy. The USA, Taiwan, and Vietnam rank the top most active cases recorded. However, Taiwan records the second maximum daily covid cases, China is at a low level of risk of coronavirus.

Figure 5.2 (b) shows the daily new cases of covid-19. Each bubble in the geographic map represents a data point of a country. The size of the bubble represents the number of new cases and active cases in a country. The horizontal position on the x-axis in a bubble chart represents the new cases recorded in a country. The vertical position y-axis in a bubble chart represents the cumulative sum of active cases in the country.

5.3. Real-time rise of covid-19 cases

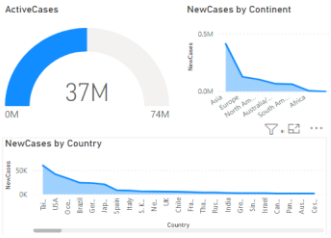

Figure 5.3 Gauge Chart - Active Cases

Area Chart - New cases by continent, New cases by country

Figure 5.3 shows the gauge chart which is an indicator for detecting the rise in cases globally and it acts as a decision tool to suggest preventive measures like imposing lockdown if the indicator level crosses the limit. The area chart shows the rise in new cases in countries by continent. It gives the magnitude of change of covid-19 cases across different regions. The Asian and European countries register the maximum number of new covid cases daily. The Asian and European countries such as China, Italy, Germany, Spain, Nepal, and France record the maximum number of new cases. Though they have an increased number of new cases, their level of risk to coronavirus and their mode of recovery rate is optimum. Hence, even if there were a rise in new cases the immune nature of the population helps to overcome the situation without any emergency in those countries.

5.4. Dashboard for decision making

Figure 5.4 (a) Slicer - Risk and Recovery (b) Dashboard - Active Cases

Figure 5.4 (a) shows the dashboard with a slicer containing the values of Risk and Recovery features calculated based on probability and statistical measures. The countries of Mexico and Peru were at high risk of covid-19 with a weak recovery rate from the disease. The World Health Organization should identify such countries periodically and suggest measures to improve the recovery and risk rate. The suggested measures may be of following and regulating the protocols like social distancing and increasing vaccinations. Figure 5.4 (b) shows the dashboard containing the slicer showing the range of cumulative active cases of Covid-19 globally. The slider value could be adjusted to see the varying number of active cases given the input range, which displays the countries of that particular range of active covid cases in various countries in the dashboard.

6. CONCLUSION

The COVID-19 dashboard enables analysis of COVID-19's behavior and pattern. With the use of a dashboard, it is possible to see which nations have been most negatively affected by the coronavirus. Decision-making in the healthcare sector is aided by knowledge of the nations with a high risk of coronavirus infection based on their population and rate of recovery. By analyzing and identifying the countries that are at risk and the countries based on recovery rate, the dashboards assist in decision-making. The produced dashboards can be accessible over the web, for as through a website or shared link inside the organization, or via mobile applications like Power Apps and Mobile Power BI. Government leaders and healthcare domain specialists worldwide could make decisions based on the Covid-19 dashboard.

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Text Extraction and Categorization of Videos using Image Processing Techniques and Naïve Bayes Classifier

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Abstract

Internet has become a very important part of our lives today. We can search information regarding anything which will be presented to us in various formats like texts, images and videos. There are many different categories of videos present on the internet today such as news, sports and music. But searching for a particular category of video out of all the videos present in a particular dataset becomes a tough and time consuming job. Hence our objective is to categorize the videos into different groups so that it becomes easier for searching or analyzing a certain category of videos. Among the various categories of videos news and cricket videos are searched by almost everyone. So it would be very useful if we are able to categorize them. In this paper, we have proposed a method for categorization of videos by making use of the textual content that is present in the video frames. The dataset involves videos of cricket and news and the average length of the videos is 20 seconds. To categorize the videos according to the text present in them, we need to first extract and store the text from the video frames into a machine readable format. After that we use a machine learning algorithm to categorize the text into their respective groups.

Keywords. Text detection, edge detection, thresholding, dilation, contours, optical character recognition, text classification.

1. INTRODUCTION

After the discovery of internet, we are surrounded by an extensive amount of multimedia content. Information is present on the internet in various forms like texts, images and especially videos. With the rapid growth of internet and a lot of studies performed in compression technology, massive amounts of information in video format are present over the internet today. With every passing day, thousands and thousands of videos are getting uploaded over the internet through various websites. For this reason it has become essential to put videos into their respective categories for easy browsing, indexing, searching and analyzing so that important information can be extracted or computed from those video data [1].

There are two particular categories of videos every Indian loves to watch - one being news and the other cricket. Categorizing news and cricket videos into two classes of videos will

be very useful. To index videos we need information about the content present in them. In the case of news and cricket, this content can be obtained from the textual information appearing in the video frames. We have proposed a model where video classification has been done based on textual content present in the video frames. The dataset used in this model consists of videos of news and cricket. We can gain a lot of knowledge by studying the textual content in the video frames [2]. Usually text present in a video about news is different than the content present in cricket videos. The entire process of video categorization consists of two major steps – first being the text detection and extraction phase and the second being the text categorization phase.

2. LITERATURE SURVEY

Over the past few years, multiple techniques have been designed to detect text in images and videos but they all have certain limitations. In the color-edge combined algorithm for text extraction, first the background is removed which leaves only the text and then the text is extracted using OCR [2]. However this method cannot extract multilingual texts. In another experiment for detecting and localizing text from videos, two edge maps were first created for the edge detection stage [4]. For this Sobel operator was applied to the entire frame. Sobel edge detection can be used to detect the discontinuities in image as well as to apply a smoothing effect to the image. From the results, it was found that a vast majority of the falsely detected text regions were filtered out. Text detection can also be performed using the USTB_TexStar algorithm [5]. Even though this approach was found to be practical and effective in automatic text detection and tracking, the main problem was the motion of the objects or the camera, which makes it hard for the feature extraction process. In the MSER (Maximally Stable Extremal Regions) technique for real time asynchronous text detection, two separate modules were used for real time text detection, one consists of a Multi-Script scene text extraction algorithm related text detection and the other is an MSER based tracking module [6]. The main limitation of this method is the degradation of tracking in the presence of severe motion blur or strong illumination changes. To recognize text regions we need to first localize and isolate the text regions so that OCR can be performed on it. Motion blurs and illuminations can make text tracking difficult as well.

For classification of text many supervised machine learning algorithms exist such as K-NN clustering and Naive Bayes classifier. However the problem with K-NN is that it takes a lot of computational time since we need to iterate the process for multiple values of n to find which gives the best result[1]. Another experiment was performed to recognize song performers based on the lyrics of the song using the Naive Bayes classifier [7]. The accuracy range obtained in the prediction chart for the experiment was in between 0.8 to 0.9.

Naïve Bayes efficiency in prediction and modeling is a major advantage over other classification algorithms and it can handle large datasets and attributes with ease.

3. PROPOSED METHODOLOGY

Most of the videos in news and cricket category contain valuable information in them and they can be used to determine the category in which the videos belong.

The entire process of video categorization is divided into two phases. First is the text detection and extraction phase where the video will be taken as input and the text present in

the video frames will get extracted into a machine readable format. The second phase consists of the text classification where we will use the Naive Bayes algorithm for classifying the text into their respective categories. We use a series of image processing techniques to detect the text regions in each input video frame. After identifying the regions we isolate them from the rest of the background after which we can apply Optical Character Recognition, or OCR, to recognize and extract the text. The processes to be performed for the text detection and extraction phase are listed in the flow diagram.

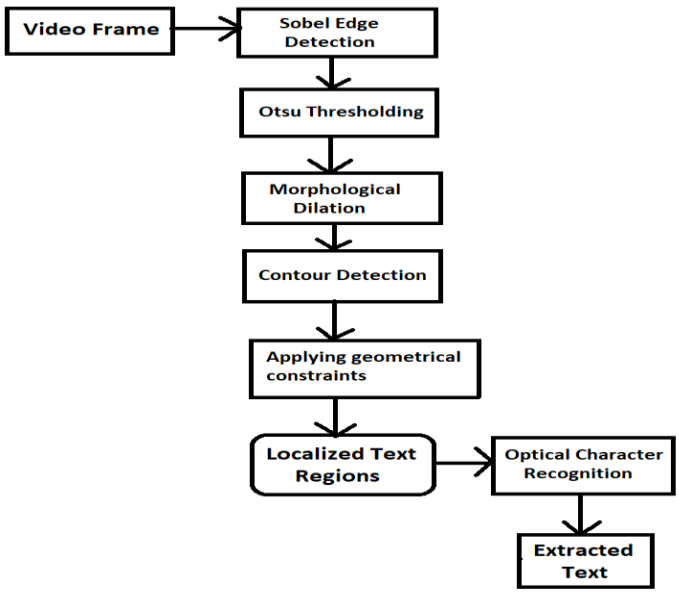

Fig. 3.1. Flow diagram for text detection and extraction.

3.1. Text Detection and Extraction

First we need to detect the locations of text in a frame and extract it. We would first try to identify the regions containing text in each frame and isolate it from the rest of the background. The Videos can be treated as a sequence of video frames. After processing a video frame, we will skip the next hundred frames since most of the consecutive frames will contain the same text content. The text region has sharp differences in intensity between its borders and background. Hence, edges are present in between the boundary of a text region and the background. For this reason edge detection needs to be done. Also a lot of information such as corners and curves can be obtained from the edges which make it easy to identify shapes of objects.

We have used the Sobel edge detector to find the edges of the video frames. Basically it calculates the absolute gradient value at each pixel of the input image.

Fig. 3.2. Sample input video frame

This operator makes use of two kernels. Each has a size of 3x3 and each is used for computing the approximations of the derivatives in horizontal and vertical directions. The final output is a 2 dimensional map which displays the gradient calculated at each pixel of the image.

Fig. 3.3. Result after Sobel edge detection in x direction

After Sobel Edge Detection, the next step is to separate the regions of interest from the regions where no edges were detected. It is important to segment the two parts to have a proper division between regions or segments of the video frame on the basis, that they have textual content in them or not. To solve this problem we use Otsu Thresholding.

In Otsu Thresholding, the threshold value that maximizes the inter-class variance is calculated mathematically. It basically minimizes the sum of intra-class variances present in the background as well as foreground pixels and the result is an optimum threshold value. The final threshold value is the average of the means computed for the two classes.

Fig. 3.4. Result after Otsu thresholding

After the edges have been detected and the text and non text regions have been segmented, connection of the edges needs to be done to create individual blocks. For this morphological dilation is used. Morphological dilation can be defined mathematically with an example. If X = {all Euclidean coordinates of binary image}, E = {coordinates of structuring element}, Kx =translation of K by which origin remains at x then X's dilation by K will be a set of points such that:

$$K_x \cap X \neq \emptyset \tag{3.3}$$

Fig. 3.5. Result after applying Dilation operation

After the Dilation process, the contour extraction process needs to be done. Contours are the boundaries of the text region with same intensity. The contours can be used for detecting and recognizing objects and also for analyzing object shapes. After dilation operation, the detected edges of text characters are combined to form blocks which are basically white in color. Hence the overall procedure involves separating the white color blocks which contain text in them form the background that is black in color. Each contour is a rectangular box which contains text. They give us information about the locations where the textual content is present in a video frame. The second is the retrieval mode of contour and the third is the approximation method. Every contour is basically a set of coordinates that indicate the boundary of the text regions.

Fig. 3.6. Contour Extraction

After the completion of the dilation process and detection of contours, the bounding boxes need to be extracted. Among the contours detected, some contours will contain regions that are wrongly detected as text. Also for our project we assume that all the text that appear the video frames are in horizontal direction hence we only focus on the horizontal bounding boxes and ignore the vertical ones. To make the results more accurate, we make use of certain constraints, or conditions, which specify the properties of the extracted rectangles. These are called geometrical constraints. Extraction of the text is done by applying Optical Character Recognition (OCR) on it. OCR helps to convert the text which is form of a video frame segment and an image format to a machine readable format such as at text file in txt format

3.2. Text Categorization

After Text extraction we collect a dataset of text files corresponding to the Videos containing the text that was present in videos. Before the categorization process takes place we need to divide our text dataset into two divisions – Train and Test. The train dataset will be used to train our model and the test dataset will be used to check how well our model performs.

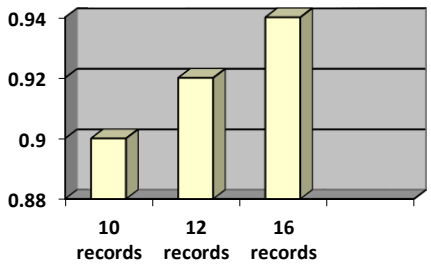

Fig. 3.7. Accuracy of classification for 10, 12 and 16 records in training dataset

4. CONCLUSION

A model for video categorization based on textual content present in video frames has been presented on this project. Using various image processing techniques we were able to extract a lot of text from the frames which helped us gather information on the videos and categorize

them. The results obtained after preprocessing had a better outcome over the efficiency of classification. We were able to achieve an accuracy of 0.94 using this classification process.

This project can be expanded to include various other categories of videos. A lot of videos are available over the internet and if the video frames contain text, then video categorization can be performed for each and every one of those videos.

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6. BIOGRAPHIES

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Code Text-based Virus and Non-virus Classification and Comparative Analysis of Machine Learning Algorithms

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Abstract

In today's world, The Antivirus is capable of handling all the threats and vulnerabilities that are fed into the software after getting that knowing vulnerability, but every time the attack. To counter new threat features, Processing for making a new technology, where the data set is analysed the type of Viruses, Malware, Trojan Horses, Backdoors, Ransomware, and Rootkits used for attacking the victim. The purpose of this project is to make a new type of software (Anti-Virus) that will be capable of tracing all the threats where the aim is to analyse every code that is previously available or available in the market, or that is not in the software. In this research, a novel dataset of virus and non-virus has been created i.e., 97 codes of applications. The text of the codes is used to extract the features text pre-processing techniques and 26 different algorithms are utilized for the extensive analysis of classification over four parameters i.e., accuracy, balance accuracy, AUC-ROC, and F1-Score. The highest classification accuracy has been achieved by the four classifiers equally (i.e., 78.95%) which are AdaBoost, Decision tree, GaussianNB and Bagging.

Keywords: Cybersecurity, Virus, Malware, Trojan horse, Malicious, Backdoor, Ransomware, Threat, Text-Mining, Classification, Machine Learning.

1. INTRODUCTION

As the world is moving towards Digital called Cyberspace. Cyberspace is where work done digitally, like using Social Media Apps, Em@ils, Net Banking, Work from Home, etc., is done. Everything done in cyberspace is stored and has the vulnerability threat of being exploited by the Attackers (Bad Hackers). To secure digital devices, there is much software like Antivirus. Still, not every technology is efficient for all threats as every minute in the world; there are Approximately 2 lakhs to 3 lakhs or more attacks practiced by hackers. You can check this on the online threat map where attacking types and numbers are shown which are updated every second. Therefore, to cope with new technologies of attack, new security technologies are developed its counter. However, it is not the only method to counter that type of attack in industries of the world.

There are several types of security available in cyberspace like cybersecurity, information security, network security, malware, etc. The goal of cybersecurity is to protect from the risks or to save from unauthorized access or alteration. The main source & channel is the internet where people do business. The attack is aimed at assessing, altering, and removing sensitive data, extracting money, or interfering with normal business operations [1]. The aim of information security is to protect the privacy of

information and hardware that manages saves and transmits that information [2]. The user got attached by malware i.e., Breach of the network through vulnerability, clicking on a suspicious email connection, or installing risky software. Once entering the network, it receives sensitive data; due to flaws in the framework, more harmful software can be made. Blocking access to strong business networks [3]. Network security is to protect users on the network, when the network achieves this, the potential threat gets blocked from the introduction. It contains a firewall that blocks unauthorized access to a network for secure remote access. Snort is one of the Network Security which includes IP tracking, Tracing, and Intrusion Detection mechanisms [4].

The code of virus and non-virus are very important content to understanding the type of application. Therefore, this research focuses to classify the virus and non-virus applications based on their codes. The author has collected a novel dataset of virus and non-virus code and extracted the features using text preprocessing techniques. The twenty-six (26) machine learning algorithms are used to do the extensive analysis for the classification task, where accuracy, balance accuracy, AUC-ROC, and F1-Score are measured for the comparison of distinct classifiers. It has been observed that four classifiers (i.e., Adaboost, Decision Tree, GaussianNB, and Bagging).

The novelty of the research work is as follows:

- The author has collected a novel dataset of the 97 codes in the form of the text of virus (50) and non-virus (47) applications;
- The features from the text related to virus and non-virus have been identified manually after pre-processing of instructions of code because pre-processing of the code is different from the normal text pre-processing. Then the total number of features got extracted from the codes is 637 including virus and non-virus applications;
- Extensive comparative analysis of machine learning algorithms (26 algorithms) has been done with three performance measures i.e., AUC, ROC, and F1-Score;
- The various future research scope has been identified based on text classification of virus and non-virus application;

In this research paper: Section I has the introduction of cybersecurity, applications, short description of proposed methodology and novelty of the work. In next section II has the brief description of machine leaning and their related application in cybersecurity along with brief description of various machine-learning algorithms. Section III describe the literature review related the work. Methodology of proposed word with flowchart has been discussed in the Section IV and Section V has the results and their analysis over various parameter of the performances. Lastly, Section VI has the conclusion of research work.

2. LITERATURE REVIEW

Attackers are skilled, circumvent security measures and allow them to go undetected for extended periods. Worse, attack mechanisms are becoming commoditized, making them easier to distribute without requiring a deep understanding of how to create. The project on which work is going on is "Cybersecurity-Text Mining Using Lazy Predict (Classification): Machine Learner", where I must take a Dataset of text files that contain Viruses and Non-Viruses [16, 17]. Dataset will be used for analyzing either Virus or Non-virus text files by applying Machine Learning Python Code for feature extraction, Classifier, F1 Score, Recall, Precision, Accuracy, Confusion Metric, Heat Map of each Classifier (KNN—Nearest Neighbours Classifiers [18], SVM-Support Vector Machine [19], DT-Decision Tree

[20], MLP-Multilayer-Perceptron Classifier [21], Gaussian NB-Gaussian Naive Bias) [22]. Creating the new dataset is not easy. When I was creating a dataset for my Machine Learning Model, I got some difficulties searching the virus and Non-Virus Code [23]. The main problem is saving it in windows as Now in these days Windows does not allow to save of virus files. If you forcefully save it in windows defender will detect and delete that file forcefully. Therefore, to solve that problem, I have saved in zipped on Google Drive and GitHub. The main thing here is to make a dataset.

3. METHODOLOGY

Figure 1 shows the flowchart of the proposed work for virus and non-virus classification tasks.

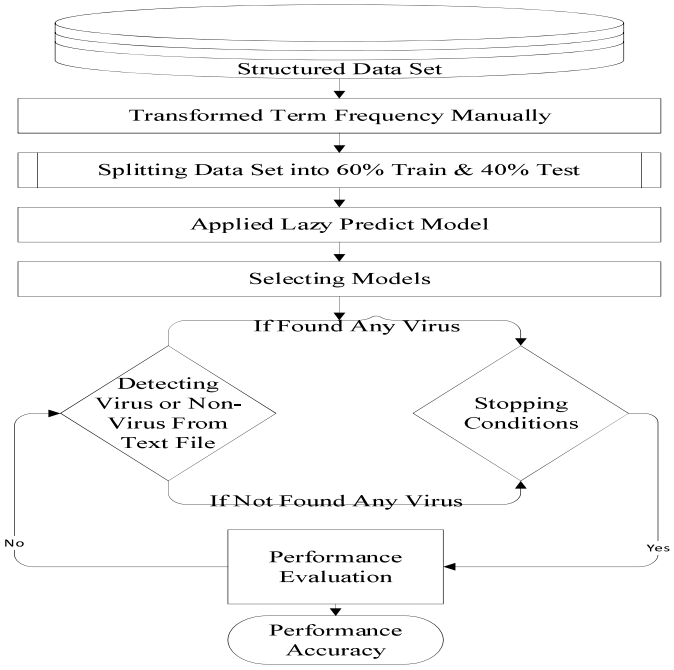

Fig. 1: Flowchart of proposed work for virus and non-virus classification.

The virus and non-virus text classification task contain the following subtasks the collection of data, preprocessing of the text of code, data set sampling for the training and testing, deployment of different machine learning algorithms along with hyperparameter tuning using validation process, and final evaluation of performance using distinct measures.

4. EXPERIMENTS

4.1. Collection of datasets:

Dataset collection is novel & obtained from different sources using Tor Browser (A particular browser for ethical hackers to gain any information about hacking and new Virus, Malware, Ransomware, Trojan, etc. The list of the virus and non-virus are shown in Table 1. Here is the list of categories that

have been used to obtain the different virus and non-virus: demands without considering the data volume. Taking into consideration this ratio, Green IT Technologies have important benefits in terms of:

- ***Virus:*** *A software that causes damage to data and software [24];*

No.	Virus	Non-Virus	No.	Virus	Non-Virus
1.	Adaptor Info	AccessinArrays1	26.	Matrix	ListDirectoriesUsingCmd
2.	Application Bomber	AccessinArrays2	27.	MIS17Port445	LocalNGlobalVariables
3.	Attempt PWN	Arithmetic Operators	28.	Non-WorkingTXTFiles	LoggingErrorMessagesToAnotherFile
4.	Bugs& Ransomware	Block_usb	29.	PC_Virus.C	LoopCMDLineArguments
5.	Computer Crash	CommandLinePrinter Control	30.	PCCrashes	MAS_1.4_AIO_CRC32_9A7B5B05{CrackHAsh}
6.	ComputerShutsDownWhenTurnedOn	CreatingAlias	31.	PcCrashForever	ModifyingArray
7.	CryptAcquireContent	CreatingAlias1	32.	PcShutDown	ModifyingExistingArray
8.	DriveContent Delete	Creating Array	33.	PoppingCD	NoFormComments
9.	Endless Enter	CreatingArrayStructure	34.	ProcessCreator	NumericValuesSet ASwitch
10.	Endless Notepad	CurrentDirectoryWithPrompts &Warnings	35.	RegistryDeleter	Office
11.	Eternal Blue MIS17 Ransomware	Date	36.	SEO	Patch
12.	Eternal Blue Worm	DateFormatYearMonthDay	37.	ShellSH	Pause
13.	Fake Windows Error With Notepad	Debbuging	38.	ShutDownComputer EveryTimeStart	PrinterCMD
14.	FolderFoolder	Deleting Alias	39.	ShutInternet Permanently	RemCMD
15.	EternalBlueMS17Ransomware	EchoCMD	40.	System32Delete	ReplacingAlias
16.	EternalBlue Worm	ErrorLevel	41.	SimpleHarmlessVirus	RunningProcessLists
17.	FormatDrives	ErrorLevelToDetectErrorNLog	42.	TextToAudio Convertion	SetupComplete
18.	Goliate Hidden Tear Ransomware	FindComputers&Logged Users	43.	ToggleButton	StartingNewprocess
19.	Green001-Something Ransomware	FunctionDefination	44.	UserAccountFlooder	TestPrinterExistence
20.	HarmlessCDRom Virus	FunctionDefination1	45.	VIRUS-VBS CODE	Unblock_usb
21.	ILoveYou	HelloCMD	46.	VirusBasicFormat	UsingTheStatement
22.	InternetDisabler	IteratingArray	47.	VirusToTestAntivirus	ViewrunningProcessList
23.	InternetOpenTypes Direct	JavaEnvironment Variables	48.	WindowsCrash	
24.	IP	KillingParticularProcess	49.	WindowsHacker	

25.	IPScanLoop	LengthofArray	50.	WindowsLogOff	

Table 1:List of Virus & Non-Virus Dataset

4.2. Pre-processing of text data of the code:

Dataset set is transformed into the numerical form using the tf-idf formula [28]. The first dataset is converted into term frequency for the further conversion of term frequency-inverse document frequency, where 637 number of features are extracted for the 97 samples for the binary classification task. The tokens have identified manually because for the coding there are no tokenization tools are available to the best of my knowledge. After pre-processing, a structure labelled dataset has been prepared with 97 rows and 637 columns before deploying the machine learning algorithms.

4.3. Sampling of the dataset before deploying the machine learning algorithms:

The labelled structured dataset has been splitted into 60% and 40% samples for training and testing purposes. It has been resampled while all iterations of the experiments.

4.4. Deployment of machine learning algorithms:

These steps of the framework, deploy the machine learning algorithms and tune hyperparameter while training the algorithms, then predict the test data to get the performances of the classifiers corresponding to the given measure(s). In this research 26 machine learning algorithms are utilized to analyse the performance i.e., AdaBoost, Decision Tree, Naïve bayes, Gaussian NB, Bagging, BernoulliNB, XGB, SVC, NuSVC, SGD, Ridge CV, Ridge, Random Forest, Quadratic Discriminant analysis, perceptron, Passive aggressive, Linear SVC, Nearest Centroid, Logistic Regression, LDA, Label Spreading, Label Propagation, KNN, Extra Tree, and Calibrated CV.

4.5. Evolution of machine learning algorithms:

The performance of the algorithms may evaluate with different parameters like overall accuracy, balance accuracy, precision, recall, F1-Score, etc. This may utilize a combination of measures to evaluate the obtained classifiers that has obtain while training. The analysis of the classifiers for the classification task is performed based on Accuracy, balance accuracy, AUC-ROC, and F1-Score.

5. RESULT AND ANALYSIS

5.1. Description of Results:

Fig. 2 show the accuracies and balance accuracies comparison of various machine learning algorithms and the ROC-AUC and F1-Score based performances of the classifiers, the x- axis and y-axis are denoted as list of classifiers and performance measures, respectively.

5.2. Analysis of Results:

5.2.1 Accuracy:

There are four classifiers of Lazy Predict, which have the highest equal accuracy of 78.95% on both virus and non-virus datasets AdaBoost Classifier, Decision Tree Classifier, Gaussian NB, and Bagging Classifier. While the second highest best-performing classifiers are SGD Classifier, Perceptron, Nearest Centroid, Label Spreading, and Label Propagation, with an accuracy of 68.42%. The third

highest performing classifier is BernoulliNB, with an accuracy of 43.36%. While the remaining classifiers are performing the same with the lowest classification accuracy of 31.57%.

5.2.2 Balanced Accuracy:

There are four classifiers of Lazy Predict, which have the highest equal Balanced Accuracy of 66.67% on both virus and non-virus datasets AdaBoost Classifier, Decision Tree Classifier, Gaussian NB, and Bagging Classifier. While the second highest best performing classifier is BernoulliNB, with an accuracy of 57.05%. While the remaining classifiers are performing the same, with the lowest classification Balanced Accuracy of 50%.

5.2.3 ROC-AUC:

The result of ROC is the same as the Balanced Accuracy, i.e., there are four classifiers of Lazy Predict, which have the highest equal Balanced Accuracy of 66.67% on both virus, and non-virus datasets are AdaBoost Classifier, Decision Tree Classifier, Gaussian NB, and Bagging Classifier. While the second highest best performing classifier is BernoulliNB, with an accuracy of 57.05%. While the remaining classifiers are performing the same, with the lowest classification Balanced Accuracy of 50%.

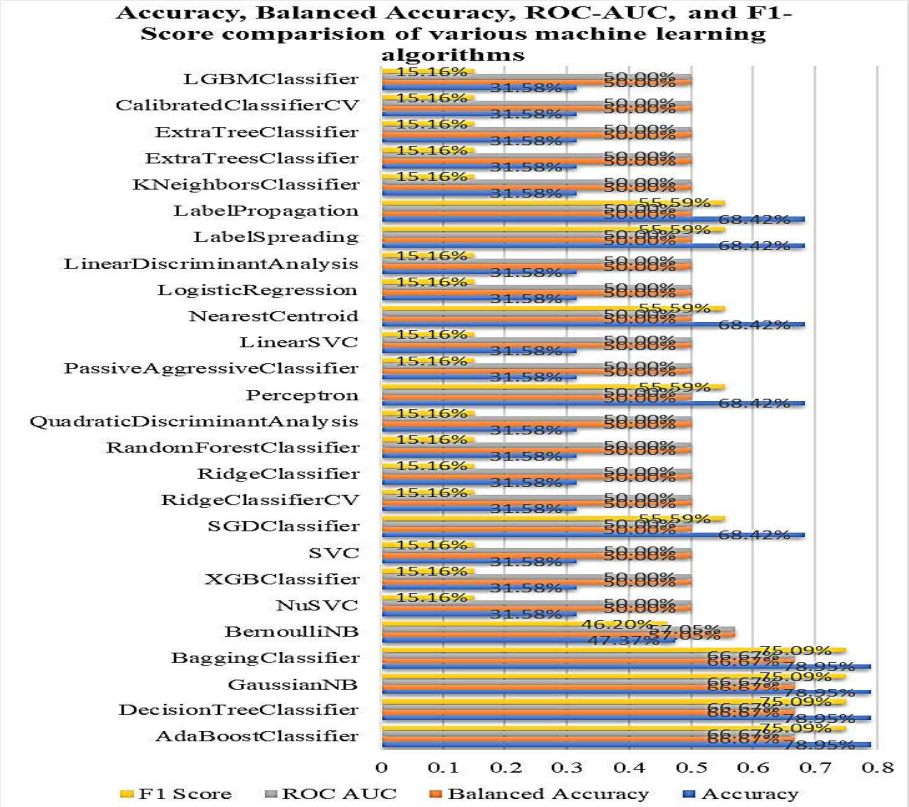

Fig. 2: *Comparison of Various Machine Learning Algorithms*

5.2.4 F1-Score:

Here, AdaBoost Classifier, Decision Tree Classifier, Gaussian NB, and Bagging Classifier are the best performers, with an F1-Score of 75.09%. While the second highest best-performing classifiers are SGD Classifier, Perceptron, Nearest Centroid, Label Spreading, and Label Propagation, with an accuracy of 55.60%. The third highest performing classifier is BernoulliNB, with an accuracy of 46.20%. While the remaining classifiers are performing the same with the lowest classification accuracy of 15.15%.

Conclusion of the above analysis show that AdaBoost, Decision Tree, Gaussian NB, and Bagging Classifier are the best performer among all four measures accuracy, balance accuracy, ROC-AUC, and F1-Score. These classifiers may be utilised for the text classification of virus and non-virus code directly.

6. CONCLUSION

There are four classifiers which have the highest Accuracy of 78.95%, Balanced Accuracy of 66.67%, ROC of 66.67, and F1-Score of 75.09% on both virus and non-virus datasets. According to the result of Lazypredict Classifiers, which have the highest equal accuracy of 78.95% on both virus and non-virus datasets are AdaBoost Classifier, Decision Tree Classifier, GaussianNB, and Bagging Classifier, indicates that these classifiers are efficient in detecting the virus from the trained & test dataset. While the second highest best-performing classifiers are SGD Classifier, Perceptron, Nearest Centroid, Label Spreading, and Label Propagation with an accuracy of 68.42% . The third highest performing classifier is BernoulliNB, with an accuracy of 43.36%, indicating that it has an efficiency of detection chance of 43.36%, in contrast with the above two highest & second highest accuracy. While the remaining classifiers are performing the same with the lowest classification accuracy of 31.57%, indicating that they can detect. Still, viruses may be detectable or not according to a given accuracy.

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BUSINESS INTELLIGENCE ON RETAIL DATA – A DECISION-MAKING TOOL THROUGH A DASHBOARD

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Abstract.

Transactions made in superstore data are extremely useful for the turn of events and can likewise be utilized to forecast future sales and to study past business challenges. The utilization of Business Intelligence apparatuses can assist with breaking down a lot of information including quality investigation and company examination. This undertaking was planned to utilize BI way to deal with examining the information. The research focuses on reporting the data regarding the sales and profits acquired. This project also uses OLAP operations to describe data visualization with help of Bivariate Analysis such that it provides better benefits and competitive advantage. Business Intelligence is supposed by organization pioneers to have the option to comprehend the information that will have been handled in figuring out visual structures and can undoubtedly retain the data expected to pursue choices for the organization.

Keywords: Business Intelligence, Retail Analysis, Bivariate Analysis, OLAP, Kibana, Dashboard, Decision Tool.

1. INTRODUCTION

SuperStore is a retail business area in the United States. It includes organizations that work by having enormous size spaces which store and supply a lot of merchandise. To support this, Superstore needs a dashboard that it helps in making decisions and managing data so that they can add valuable advantages to support the existing business processes. Also, this system analyzes the data to recognize feeble regions and chances to help business development. The analysis also gives insights into the sales and profit of various products. The organization of the paper goes with the problem definition, briefing the existing problem in the society and the need for the system for effective decision making through visual tools, dashboard and continued by the objectives of the proposed system. The pre-processing and Exploratory Data Analysis depicts the process implemented and concepts used to derive insights from dynamic data; accompanied by the process flow which picturizes about the module and tools used for analysis and their overview. The results and discussion describe the dashboard approach and various charts used for real time insights on data. The future scope describes the possible future works that might be undertaken to benefit the society and mankind. The conclusion part describes the decision making in the management domain by dynamic dashboard.

2. LITERATURE REVIEW

In existing systems [1] the basic analysis is done about the data and exploratory data analysis is done based on various approaches. Performing further analysis using the difference between the order date and shipment date. Also, some customer-level analyses are made

such as the first and last purchase of each customer, calculating retention of each customer, the number of orders by each customer, and average revenue from each customer which are based on company and management purposes. Some include basic EDA operations in python including the factors of State, category, year, etc. with sales as the target variable. Can be also known as a univariate analysis of the data [1]. The proposed system consists of Exploratory Data Analysis upon two factors such as sales and profit and forecasting the sales for a further few periods. This Bivariate Analysis is done based on building effective Dashboards using Kibana (ELK stack) where live data can be taken into account for evaluation & processing the data for a better decision-making process. Also considering sales attributes since data contains time series factors in it, ARIMA (Autoregressive Integrated Moving Average) is used to forecast the generation of sales for a few upcoming periods. With this analysis, the store can recognize different patterns of purchasing products and take measures respectively. The outcome of the analysis is to give the store management a comprehensive, but easy-to-understand analysis using some key visualization tools for easy understanding and also forecast future sales.

3. OBJECTIVES

The purpose of the project is to analyse sales and profit and to perform various superstore statistics, thus providing a perspective on the way business is trending. With developing requests and merciless rivalry on the lookout, it would be smarter to comprehend which items, areas, classifications, and client fragments they ought to target or avoid. Every store be it online or offline needs evaluation and analysis to predict daily sales and know what goods customers want at a particular time and what the trend would be every day, month, and year. The Store tends to understand certain features of its business and obtain vital information from its data, that would be helpful to plan or focus on what is ongoing sales, with a full understanding of sales trends and forecasting for the future all things being equal. This kind of analysis will help in the proper stocking of needed goods, to reduce understocking and overstocking, which helps in supply chain management to process beneficiaries; also focus extremely on the selling of products by taking into consideration demand and supply and increase the sales and profit geographically wise; also forecasted the Sales for further upcoming few years.

4. ANALYSIS

Descriptive Statistics of the data have been done. NULL values and any other missing values are checked. Splitting of the order date to their entities such as day, month, and the year has been made. Ship Date has been dropped since there was no relevance for the visualization. The final data consists of dimensions on basis of 10000 * 23 instances. Python & Excel are used for performing Exploratory Data Analysis on the Data. Sweetviz: A package in python used for web-based visualization in which it gives the relation between the Dependent Variable (target variable) to each & every Independent Variable, including some of the descriptive statistics along with some corresponding plots such as graphs and charts. An Interactive EDA is built with help of this technique as shown in fig.1 below.

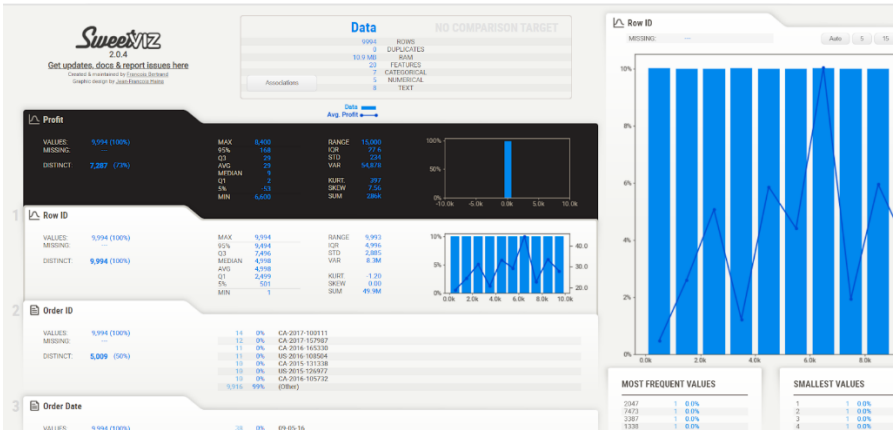

Fig. 1. Represents the EDA done using Sweetviz.

Also, Box Plots and histograms were utilized for visualizing and analyzing the distribution of continuous variables

5. MODULE AND PROCESS FLOW

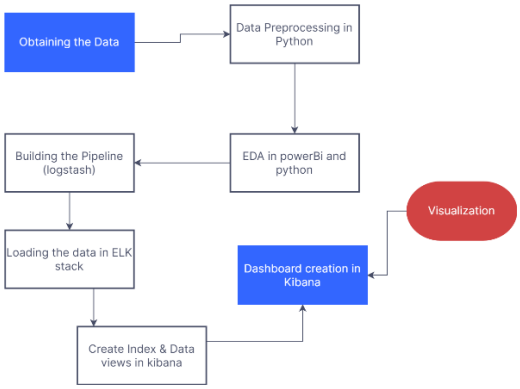

Fig: 2. Process Flow of the proposed system

Figure 2. Represents the flow of the proposed system where the process is made with help of the above-mentioned tools. The data is extracted from the Kaggle website and pre-processing steps have been processed in python and some of the basic visualizations obtained from EDA operations(included in results) are done in PowerBi. For interactive visualizations and real-time processing systems, Kibana comes into play with help of ELK Stack architecture. With help of a pipeline(Logstash), the final pre-processed data has been pushed/loaded into the distributed search and analytics engine known as elastic search, where Kibana is used for visualization purposes by navigation on your data present in elastic search[7].

6. RESULTS AND DISCUSSION

This proposed system consists of two dashboards, one for the company view & other for the customers' view. An image of the dashboard along with some constraints(controls) to Year,

Month, State, City, and Region; Category, Sub-Category which are linked to the whole dashboard, is shown below in figure 3.

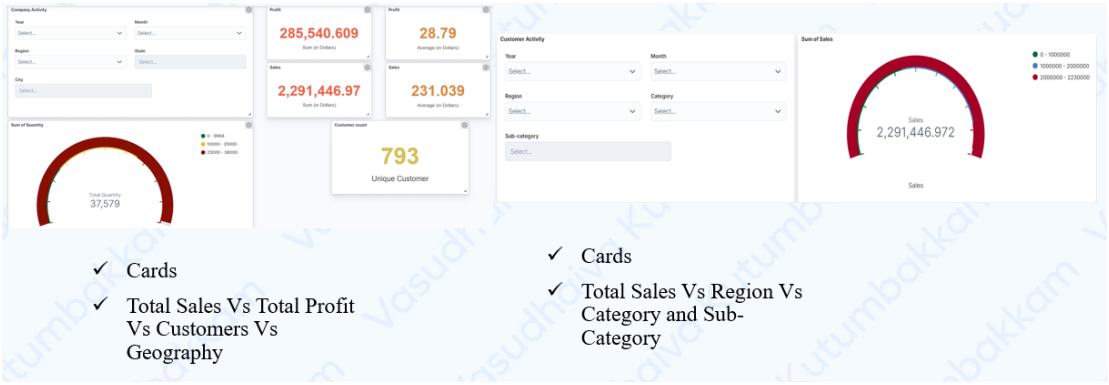

Fig: 3. Dashboard for Decision Making and Evaluation

Figure 3. The Metric plot is used to show the Overall Sum and Average of Sales, Profit according to given constraints in form of cards. The Gauge plot shows the Total Quantity sold in each period respectively

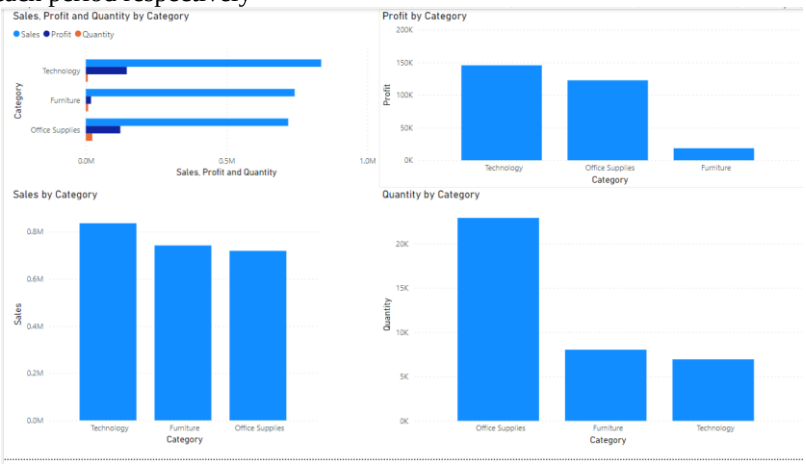

Fig: 4. Category vs Sum of sales

Figure 4 shows that all 3 categories make similar amounts of sales. Although Furniture makes comparable deals as Technology, it is the most un-beneficial likewise amount sold is at least. Office Supplies sell the most, as far as amount as it is a somewhat modest item.

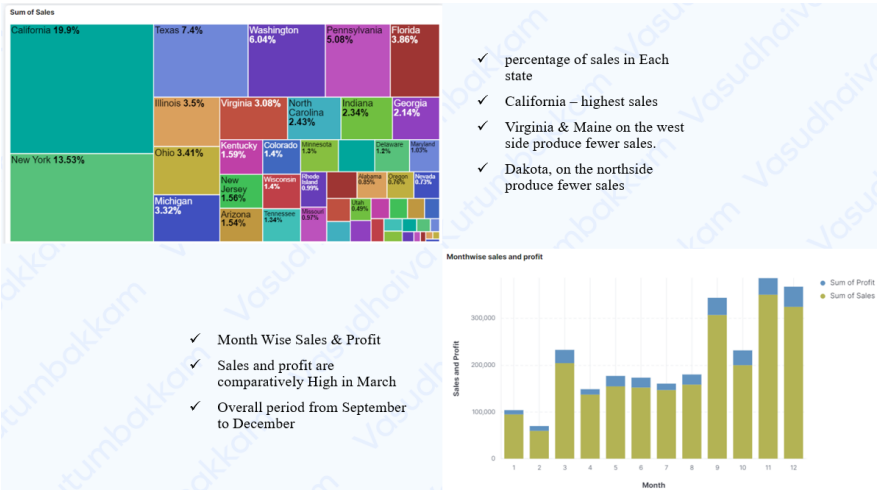

Fig: 5. State vs Percentage and Sum of sales

Figure 5 depicts the percentage of Sales in Each state which are displayed according to the given constraints. Some states such as Virginia, and Maine on the west side and Dakota on the northside produce fewer sales due to reasons of population, product pricing, no. of stores in respective locations is less. Using a vertical bar plot in descending order, the plot of profit generated by the top 15 states in respective years and regions can be generated accordingly; We can observe the sales and profit for the overall period in March and from September to December which can be due to seasonal purchases & festival reasons by family members.

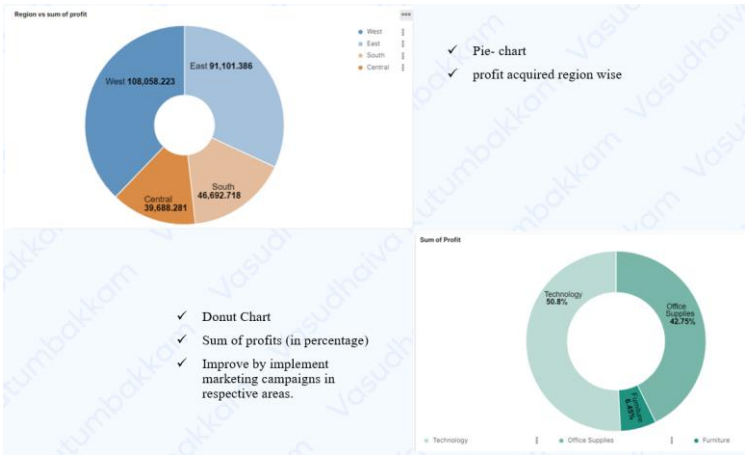

Fig: 6. Profit vs Region-wise and Category

Figure 6 shows the profit acquired region wise which can be viewed based on constraints. Profitable regions from the overall period are East > West > South > North. Overall report shows, Furniture with less percentage so the store can improve or implement marketing campaigns in respective areas.

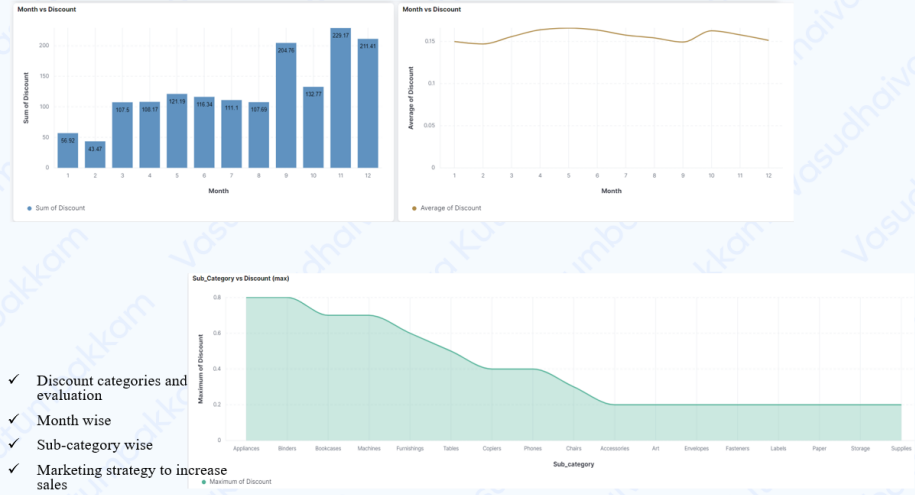

Fig: 7. Profit vs Region-wise and Category

From Figure 7, customers can view the maximum of discounts provided to top 15 subcategories which can motivate them to view about the categories and investigate the product, which indirectly helps company in marketing them.

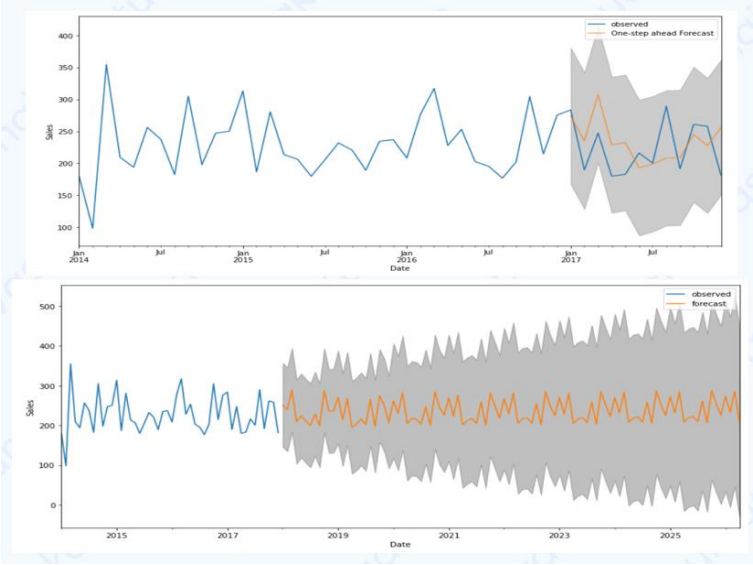

Fig: 8. Forecast for a Year and Further Years

Figure 8, the above plot provides a view of observed sales versus predicted one which provides a piece of information that in march the observed sales is less than forecasted which may be due to various reasons such as the economic crisis and from July to upgrowing months the revenue is generated more or less equally to the observed and forecasting; Below plot, denote the sales under some specific range in form of upper limit and lower limit, where the lower limit addresses the worst situation imaginable and the furthest cut-off addresses the most ideal situation throughout 5 years. It can be also observed that the forecasted sales tend to remain the same throughout and this may vary in the future due to enormous situations or conditions that are unpredictable, but lies under the provided range of values or plotted area.

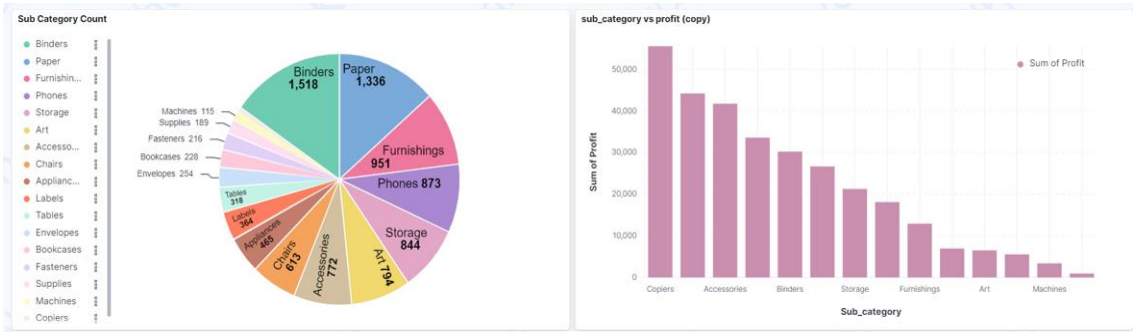

Fig: 9. Profit vs Region-wise and Category

Figure 9 represents the count of subcategories concerning their profit. Eg: Blinder's count is high but produces less profit compared to Copiers, where the stock count of copiers is Low; so, they can increase the count of copiers according to suitable decision making. Art produces Less profit but the count is high so the store can reduce the stock to prevent overstocking and help in supply chain management.

7. FUTURE WORKS

The implemented work is based on existing information (secondary data), but this will work in a better manner and more efficiently for sources like primary data. Having access to primary data will help to gain real-time information and updates so that predictions will be made more accurately so a person responsible for these activities can make decisions based on acquired results such as maintaining stock in accordance with supply chain management and deciding which areas to concentrate based on geological factors to improve the sales and revenue.

8. CONCLUSION

The analysis and forecast ensure that the problem statement is followed with necessary questions answered with the analysis. For misfortune-making items like Supplies, Bookcases, and Tables, consider either dropping these from the list or bargaining for a cheaper price from another supplier. Consumer and Corporate Segments make up more than 70% of the customer base. Target them, especially customers from the East and West regions in the Top 10 urban communities with Highest Sales by presenting extraordinary advancements and packs for mass Consumers and Home Offices and sending limited-time messages or flyers. Sales of the store have increased every year resulting in high profit by a margin by the end of 2017. With this analysis, the store can recognize different patterns of product purchases and take measures respectively. Also, try to reduce the Expense of Supply Chain Management wise and increase the sales and profit geographically wise; also forecasted the Sales for further upcoming few years.

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Irregular Occurrence Detection of Video SurveillanceUsing DeepConvolutionalGAN

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Abstract.

In modern intelligent surveillance systems, detecting video anomalies has received considerable attention. Regardless of the technical characteristics of current technology, extraordinary event detection in surveillance video structures is difficult and necessitates extensive human efforts. Because of the difficulties associated with anomaly detection, we focused on its evolution and then investigated various methodologies. We propose (DeepConvolution GAN) to detect anomalies and build DCGAN by using Deep Learningwith PyTorch : Generative Adversarial Network. The proposed DCGAN uses frames to increase the image quality produced by the GAN and identify anomaly accurtely. We compute the logists loss function, optimize the load of images and ROC Curve. The proposedwork has extensively evaluated on the CUHK Avenue, UPSC Ped1 dataset at the frame leveland compared with state art methods.

Keywords. DeepConvoltuion GAN, Real image, Fake image, Adam optimizer.

1. INTRODUCTION

Finding anomalous, unexpected, unpredictable, uncommon events or things that don't fitthemould of typical or frequently happening events is known as Anomaly Detection. Nowadayspersonal and private property are increasingly protected important. Real-time video surveillance plays a useful role. Due to these requirements, camera placement occurs at everynook and cranny; When an unexpected action is spotted, a video surveillance system may beused to capture the moment. The primary factor comprehends the action and then reports theimmediately notify the operator or users when an unforeseen incident happens. The effectiveness of video surveillance has improved, and the use of security and safety measuresfor managing Private and public sectors. Real-time video surveillance systems must be developed due to the growing requirement to ensure public safety in congested regions. It continuously scans the crowd to quickly spot any unusual motions, helping to avert accidents, violent crime, and terrorist strikes [1][2]. A video is a collection of frames with changing image times. Both spatially and temporally are digitized for the image data. Quantization is done on the resulting pixel intensities. The great majority of modern, state- of-the-art techniques for detecting video anomalies rely on intricate neural network designs[21]. Although deep neural networks perform better on a variety of computer visionand machine learning tasks, such as object detection, picture classification, and video surveillance. There are flaws, such as handling losses and the quality of the created images [22, 23].

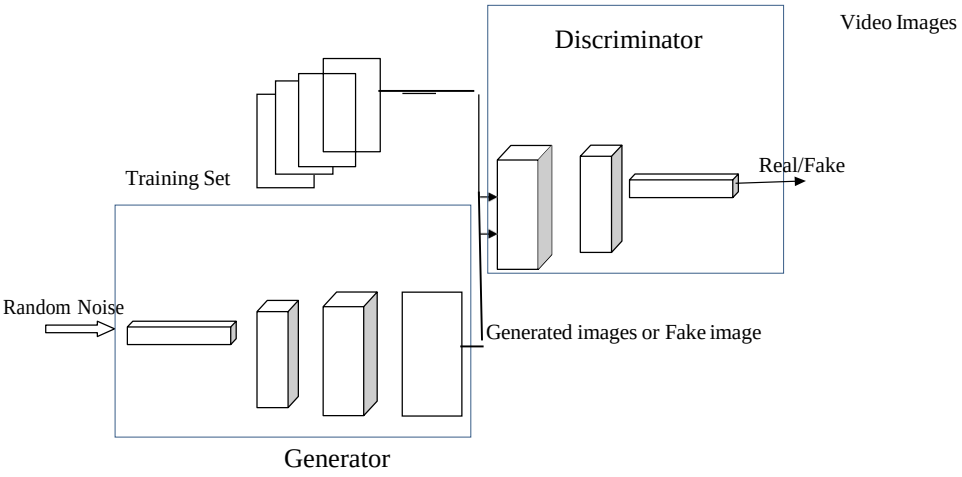
We suggest a DCGAN Methodology in response to the aforementioned domain problems and research gaps and to improve performance. The main objective is to detect anomalies effectively through well-trained Generator and Discriminators.

2. RELATED WORK

Deep learning researchers are becoming increasingly interested in generative adversarialnetworks (GANs) [3][4]. GAN's have been used GANs have been used in a variety of domains, including "computer vision" [5], "Natural language processing" [6], time series applications [7][8], and semantic-based segmentation [8]. GANs are a type of generativeanddiscriminative model in machine learning. GANs are superior to other generative models like autoencoders and density functions in that they create required samples quickly, do awaywith deterministic bias, and are internally well-compatible with neural architecture [9]. GANs have shown considerable success, especially in the area of "computer vision", such as image translation [10], image creation [11] [12], high resolution of images [12][13], image reconstruction [14] and video processing.

2.1. Basic GAN Architecture

Figure 2.1 shows how to teach a DL model to use GAN to develop new data from the same dissemination as the training data. Ian Goodfellow created GAN's in2014, and he initially wrote about them in the paper "Generative Adversarial Nets". A Generator and a Discriminator, two separate models, make them up. The generator's job is to create "fake" pictures that look like the practice pictures. The Discriminator's task is to examinea frame and determine whether it is a genuine training frame or a phoney frame produced by the generator. Throughout the training, the Discriminator strives to improve while the generatoris continuously trying to outwit them by producing increasingly convincing fakes.



Figuree 1. Basic GAN Architecture

3. PROPOSED METHODOLOGY

For Generator, DCGAN was the first to use a Deepconvolutional neural network model [15].Deepconvolution is put forward as a method for observing the features of a CNN [16]. WithDCGAN, we get more stable training and high-resolution. At the beginning, DCGAN substitutes a strided convolutional layer for the discriminator and a partial strided convolutional layer for the generator. Next, to locate generated and real images centred at zero, batch normalisation is used for both Generator and Discriminator. Then,in the Discriminator for all layers, LeakyReLU activation is used to prevent the model from beingstruck. All layers in the Generator use ReLU activation except output, which uses Tanh. In this case, while the Generator gets gradients from the Discriminator, the LeakyReLU activation will stop the network from stacking in a "death state" scenario. ImageNet and Large-scale Scene Understanding (LSUN) are used to train DCGANs [17][18]. Using “stochastic gradient descent (SGD)” and a mini-batch, all models were trained. Initializationof all weights used a normal distribution with a centre at zero and a standarddeviation of 1.It uses the Adam optimizer for optimization here. A crucial turning point in the development of the GAN is DCGAN in Figure 3.1.

3.1 Proposed Framework

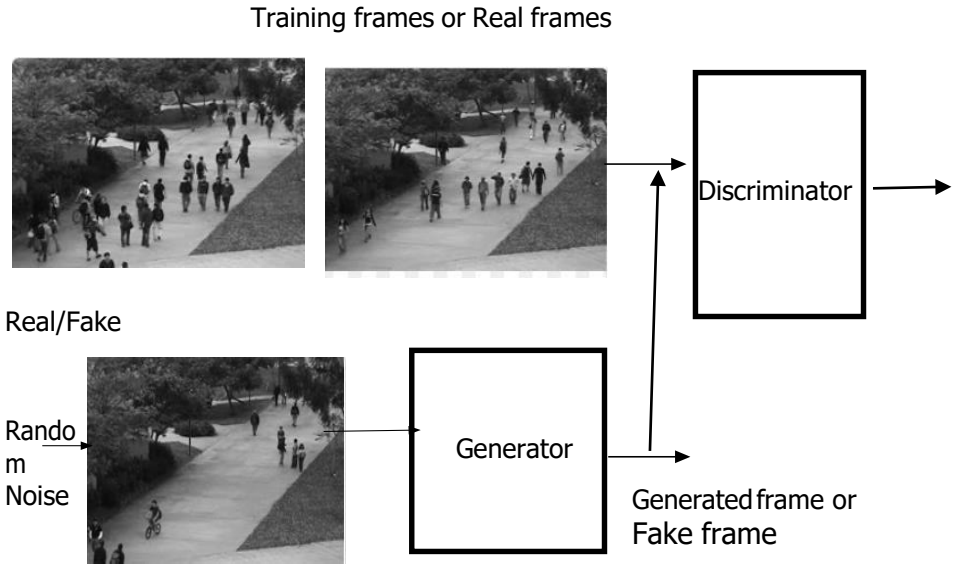


Figure 2. DCGAN Architecture

3.2 Datasets:

CHUK AVENUE DataSet:

21 test videos and 16 training videos with a frame size of 360 x 640 pixels each are includedin the CUHK Avenue dataset. The videos have a total of 30652 frames (15328 for training and 15324 for testing). There are many bizarre scenes, like people tossing objects, fleeing, and jumping on roadways. The total Dataset is divided into 240 batches. The size of a batchis 128.Sample video Frame shown in Figure 3.2.

Figure 3.2. Sample CHUK Avenue Video Frame and Sample UCSD Ped1 Test Video Frame

UCSD Ped1:

A stationary camera installed at a height and looking down on pedestrian pathways was used to collect the UCSD Anomaly Detection Dataset. The walkways had varying densities of people, from very few to many. Bikers, skateboarders, tiny carts, and pedestrians crossing awalkway or in its surrounding grass are examples of often occurring anomalies. A few incidents involving wheelchair-bound individuals were also noted. Allabnormalities are real; they weren't produced to create the dataset. They all occur spontaneously. Two separatesubsets of the data were created, one for each scene. Each scene's video recording was divided into a number of clips, each with about 200 frames.

Peds1: footage showing crowds of people moving in both directions from and toward thecamera, with some perspective distortion. Contains 34 examples of training videos and 36 examples of testing videos. Sample Video Frame Shown in Figure 3.2.

3.3 Implementation Of Discriminator Model

We use the Discriminator D classifies two classes as real and a fake. Discriminator D trainedto do classification between both real and fake classes as shown in Fig1. D computes a binarycross-entropy loss with logits loss. Here network divided into 3 blocks has layersas Conv2d,BatchNorm2d, LeakyReLU after this its flatters the results and next given to fully connectedlayer to get results and forwards from 1 block to next last send to linear layer which covers binary cross entropy with logitsloss which takes raw output.

3.4 Implementation Of Generator Model

With a random noise as an input, the Generator G learns to create an output fake frame. TheGenerator network's goal is to create realistic fake frame. We are using a random noise vector size of 64, which is used to create random noise to feed this to the Generator while training as shown in Fig1. Input is reshaped and given to the Generator as batch size, channels, height, and width. Every block contains layers as ConvTranspose2d, BatchNorm2d, ReLu given to the ConvTranspose2d, Tanh activation function to generateimages. Finally, replace random initialised weights with normal weights to make the network strong for Discriminator and Generator.

3.5 Training Gan Model

While training, it calculates Generator Loss and Discriminator Loss starting from 0. TheGenerator uses a real frame and noise to create a fake frame. The Discriminator is given a fake frame and a real frame to predict whether it is real or fake. It calculates fake loss by passing Discriminator prediction with a fake frame. To improve the accuracy here it calculates real loss by using Discriminator prediction with real frame. Discriminator loss byaveraging these 2 losses. The generator follows the same procedures by passing these backward and updating weights for optimization.

3.6 Optimizing

Real loss and fake loss are to be calculated. passing logitsloss (a linear function which takesraw input) to compute real loss while considering discriminator prediction and 1 ground truth. To compute a fake loss, consider the discriminator prediction and 0 groundtruth. TheAdam optimizer is used to optimise the discriminator and generator. Atlast computes Total DLoss and Gloss by averaging DLoss and Gloss with batch sizes. To increase the accuracy, we need to increase the epochs shown in Figure 3.6.

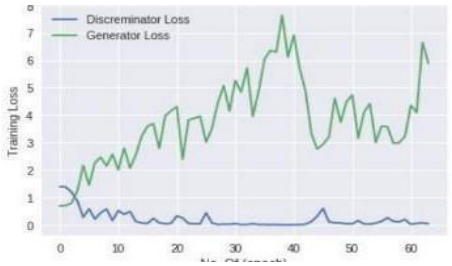


Figure 3. Generator and Discriminator Training Losses in no.of epochs

3.7 Evaluation of DCGAN

Frame-level evaluation and pixel-level evaluation are the two different ways that for evaluation. Without localising the anomaly, the model's accuracy is assessed at the frame-level by identifying abnormal frames. On the other hand, pixel-level analysis pinpoints anomalies and compares model output to actual image pixels. A model's detection is deemedto be accurate if it can identify at least 40% of aberrant pixels. The "True positiverate" (TPR) and "False positive rate" (FPR)-based area under the ROC curve (AUC) is acommonly used metric to assess and compare the efficacy of various models. TPR is determined as

$$\text{TPR} = \frac{TP}{P} = \frac{TP}{TP + FN}, \tag{3.1}$$

where TP represents how many frames are accurately identified as abnormal frames and FNrepresents how many frames are mistakenly classified as normal frames. Equation (3.1) canalso be used in pixel-level mode, but the number of pixels should be counted instead of frames. The FPR is calculated as follows:

$$\text{FPR} = \frac{FP}{N} = \frac{FP}{FP + TN}, \tag{3.2}$$

There is no difference between FPR and FNR at EER. FPR calculation shown in Equation(3.2). An algorithm with a lower EER is more accurate and less error-prone. The temporal complexity requirement is another crucial factor. Employing an algorithm in numerous applications is more enticing if its total execution time is swift enough.

3.8 Results using UCSD Peds1 and Chuk Avenue

Models are trained with training data, and then tested with testing data, and finally evaluatedusing ground-truth data by evaluating the system based on the criteria listed above. Figure3.8shows ROC curve.

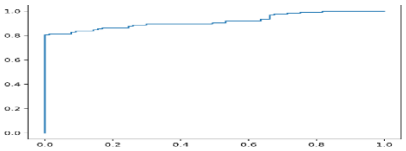


Figure 3.8. The sample ROC curve shows the "True Positive Rate" (TPR) vs the "FalsePositive Rate" (FPR).

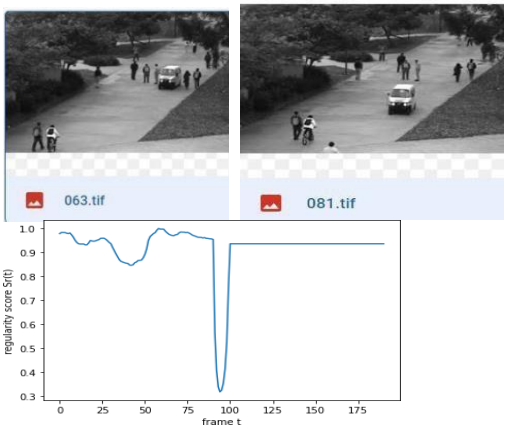


Figure 4. Anomaly frames identified by regularity scores

3.9 Results using UCSD Peds1 and Chuk Avenue

Models are trained with training data, and then tested with testing data, and finally evaluatedusing ground-truth data by evaluating the system based on the criteria listed above. Figure3.8shows ROC curve.

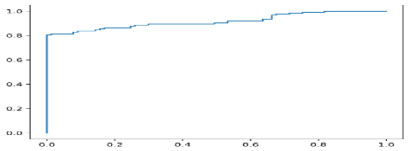


Figure 3.8. The sample ROC curve shows the "True Positive Rate" (TPR) vs the "FalsePositive Rate" (FPR).

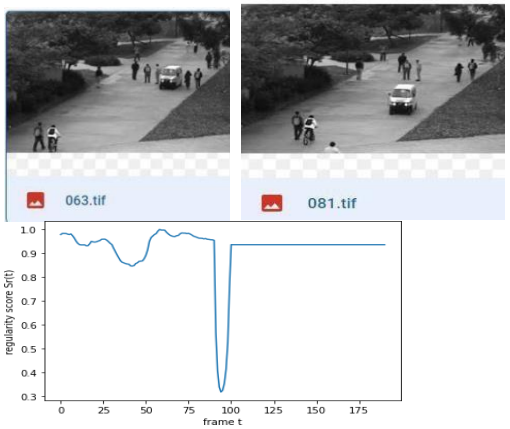


Figure 5. Anomaly frames identified by regularity scores

The model is trained with normal videos of datasets. While testing, we used both normalvideos and anomaly videos with ground truth. Regularity scores were evaluated using threshold-identified anomaly frames. The regularity score for normal frames is high; the regularity score for abnormal frames is low. .To compute ROC, EER, and AUC, find true positives,false positives, true negatives, and false negatives. A sample regularity score of the test videowith anomalous frames from the UPSC Ped1 dataset is shown in Figure 3.9.In Table 3.8, performance metrics are presented as a comparison between the proposed method and the current state of the art Methods(Unsupervised Learning Methods).

Table3.8. Compared to state-of-the-art methods

	CHUK Avenue		UCSD Ped1	
Method	EER	AUC	EER	AUC
Conv-AE[24]	25.1	70.2	27.9	81.1
MLAD[25]	38.82	52.82	23.50	82.34
Our Method	24.6	89.9	36	93

4. FUTURE DIRECTIONS

GANs were initially created to generate realistic fake frames, and they have demonstratedto function very well in the field of computer vision. Despite the fact that there are no reliableevaluation measures for the performance of GANs in these sectors, the use of GANs for time-series data and on morphing photos has not been thoroughly studied. It is recommendedthat more study be done in these areas. We required attention to creating a forgery detector to rapidly and precisely recognize images produced by AI (including usingGANs). Image classification also can be improved by using GAN's[21][22][23].

5. CONCLUSION

Due to various factors influencing outcomes, such as video noise, outliers, and resolution, finding anomalies in video surveillance is difficult. In this research, we present a methodtogenerate images by training on already existing similar images. In the dynamic systemknown as GAN, the optimization process looks for an equilibrium between two forces ratherthan a minimum. In this paper our proposed DCGAN gave more accurate generated framesthan other methods. The input data is represented both as appearance-motion and motion- only. Consequently, it detects abnormalities in the body's shape, the skeleton, speed, and thedirection as a result. The proposed method is compared with state-of-the- art through experimental case studies. UCSD Peds1 and CHUCK Avenue datasets were used for the experiments. As compared to other methods, the proposed method has a lower EER and higher AUC. Additionally, a study of the time complexity of the proposed method is conducted, demonstrating that it is sufficient time efficient. An abnormality ofa frame can be detected and located within a short period of time by utilizing a personal computer. A LSTM can improve the accuracy of the system in the future.

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Mrs. Swapna. C has completed her M.Tech in Computer Science and Engineering and presently she is on the verge of completing her Doctoral degree in the area of Machine Learning at Jawaharlal Nehru Technological University Hyderabad. She is having 10+ years of teaching experience, and her research area of interest are MachineLearning, Video Surveillance, Anomaly Detection, cand rime prediction.

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A Smart Surgery Guide (SSG): An innovative deep learning-based surgery approach for Healthcare Informatics

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Abstract:

A smart surgery guide is presented in this study (SSG). The goal is to assist and train the surgeon in stabilizing the patient during surgery and to improve the surgical process by utilizing cutting-edge technology (e.g., IoT, ML). The smart surgery guide is a system that collects, process, and analyses real-time sensor data (e.g., Oximeter, Optical Heart Rate Sensor, Thermometer, Blood Pressure Sensor, etc.) and then apply the deep learning model to build a surgery model using past surgery data to help you learn from previous surgery errors or life-saving methods and provide you with the best surgery solution. SSG will play an important part in training purposes. It aids the aspiring student in comprehending the procedure and scope of surgery. It can help to train for surgery by providing critical situations during practice to help develop decision-making abilities during operations. In this paper working of smart surgery has been discussed in detail.

Keywords.. Smart Surgery, Patient monitoring, Internet of things, Deep learning

1. INTRODUCTION

The purpose of the Smart Surgical Guide is to eliminate human error and improve surgical skills during surgery. According to the report, doctors' errors injure more than 12 million patients each year, according to the World Health Organization. The Smart Surgical Guide is particularly helpful in reducing surgery errors because it suggests the ideal surgery model based on real-time sensor data analysis. That allows doctors to learn from previous mistakes made during these types of surgeries, as well as life-saving techniques that help save the patient's life [1-5].

Apprenticeship and shadowing are the traditional methods of surgical training. Technical competence evaluation is subjective and heavily reliant on mentors, only reflecting the trainee's expertise. Certain characteristics of this system obstruct students' technical training. **SSG** can, on the other hand, assist us in revolutionizing surgical education and training. **SSG** is described as a computer's ability to conduct behaviour that is like those performed by the human brain. It can be used to objectively assess a trainee surgeon's surgical abilities. Machine learning techniques can be used by artificial intelligence to analyze large data sets to analyze operator performance [6, 12].

The SSG plays a critical function in the tenth stage of surgery to train doctors to save the patient's life. It allows doctors to make many complex processes with accuracy, flexibility and control as

possible with common techniques. Surgeons that use the SSG claim that it enhances precision, flexibility, and control during surgery while also enabling them to visualise the site better as compared to conventional methods.

Using the SSG system during surgery, surgeons can carry out delicate and complicated therapies that would be challenging or impossible using conventional techniques [13]. Massive amounts of data can now be used for educational purposes thanks to advances in artificial intelligence and machine learning [14, 15]. Artificial intelligence's use in education has come under fire for its algorithms' lack of openness in its decision-making processes..

The purpose of this study is to 1) explain artificial intelligence and 2) validate the framework by creating a platform for automated instructional feedback called the Virtual Operative Assistant. Additionally, robotic surgery and surgery automation both depend on it. The importance of surgical systems is increasing in the field of automatic handling operation theatre as a result of the expansion of the Internet of things (IoT) [16] in the medical industry. For a city to become smart, its healthcare system must be advanced. Every action has a greater benefit when taken in an atomized fashion than when taken traditionally [17].

2. METHODOLOGY

2.1. System Requirements:

Patient monitoring is an important component of surgery, and we need a guide who can tell us what different techniques have been employed by doctors in the past to rescue patients during surgery. The machine learning model used previous cases to assist you in stabilizing the patient's state during operation. We think that SSG enhances the surgeon's control, precision, and flexibility during surgery while also enhancing their ability to visualise the area. Using the SSG system during surgery, surgeons can carry out delicate and complicated therapies that would be challenging or impossible using conventional techniques. [18].

2.2. System working

We used a variety of sensors to keep track of the patient (e.g., Oximeter, Optical Heart Rate Sensor, Thermometer, Blood Pressure Sensor, etc.). The Node MCU is essential to the success of Operation Theatre. Using the integrated Wi-Fi module, it gathers data from all sensors and sends it to the cloud service layer. Using real-time sensor data and the ML model, it will assist us in keeping an eye on the patient. Using real-time sensor data, a trained With the aid of a prior instance, machine learning models on the cloud can forecast the optimal course of action during surgery. Data is obtained from a Google Firebase cloud computing platform and sent to applications by the processing layer. The smart display displays sensor data at various phases of the process along with the best available guidance and solution in the form of animation [19]. Wi-Fi modules support the use of web-based mobile interference to monitor the real-time data (fig1.). the elements listed below make up Fig. ESP8266, 2. An optical heart rate sensor. Oximeter Thermometer 3. 4. A blood pressure monitor

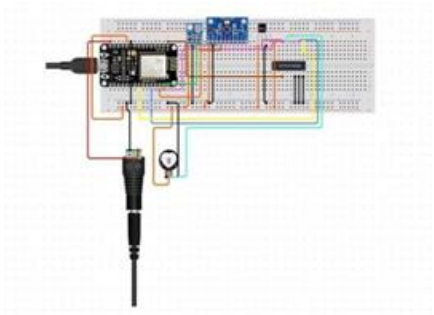

Figure1. Circuit Diagram

Figure 2: - Layer of working

2.3. Detailed of Layered Design

• Sensor Layer: The detecting layer is composed of several sensing modules, such as an infrared sensor module, an infrared temperature detection sensor, an anode microcontroller, and extra patient monitoring sensors...

• Networking Layer: The Web and mobile interfaces, Google Firebase, the MQTT broker architecture, and the networking and communication layer are all connected to the sensing layer by this layer. • Cloud Layer: Data from sensors are tracked by the cloud layer. assist in using data. A Google Firebase database is an open-source cloud platform used by the system being presented. live information. After processing, the data is transferred to the application layer for additional review.

Processing Layer: This layer regulates how data is received from the Google Firebase cloud computing platform using the MQTT broker architecture.

3. DEEP LEARNING MODEL LAYER DESIGN

CNN, a subclass of feed-forward neural networks, serve as one example. The two main CNN layers—convolutional and pooling—are the focus of this work. Convolutional layers are one type of layer. The foundation of CNN is convolution. The filter can be likened to the layer's neuron because it provides an output value and has a weighted input..

Since filters may only travel along the x- and y-axes to extract features, convolution is effectively a two-dimensional spatial filtering technique. In order to build feature maps, it is necessary to precisely determine the number of filters and their kernel sizes. In swimming Layer the number of

parameters in feature maps is still too high after the convolutional layer. As a result, the pooling layer is used for subsampling.

Pooling extracts important characteristics while also decreasing the complexity of feature maps by reducing their size. The main objective of pooling, also known as maximum pooling and average pooling, is to select the maximum or average value to produce a new feature map. In order to build better models, we can utilise CNN to extract traits from input data. Long Short-Term Memory Network (LSTMN)

The LSTM Network, an upgraded RNN (sequential network), enables data retention indefinitely. It can fix the vanishing gradient problem with RNN. For persistent memory, one uses a recurrent neural network, or RNN. The nodes in each layer of a standard neural network model are fully unconnected, while the layers themselves are completely coupled. As a result, it is ineffective at resolving sequence problems. Time sequences for sensor data, as previously mentioned. In order to do this, recurrent neural networks. In contrast to conventional neural networks, RNN's hidden layer nodes are connected. The input of the hidden layer also contains the output of the hidden layer from the time slot prior, in addition to the output of the input layer. Recurrent connections within the network may eventually facilitate feedback and memory.. The gradient of the neural network may become unstable when back-propagation is used in a very deep RNN, leading to the growing gradient problem or even the vanishing gradient problem, which makes the produced model untrustworthy. LSTM,which use long short-term memory, can address these problems. In fact, the LSTM is an RNN variant with many of gates and memory units.

3.1. Convolutional Neural Network -LSTM Method

As noted earlier, we employ a hybrid model that combines CNN and LSTM to forecast values based on sensor data. After entering the sensor data, CNN first extracts the features. The characteristics are then sent into an LSTM for more training. Figure 3 depicts the suggested model's topology.

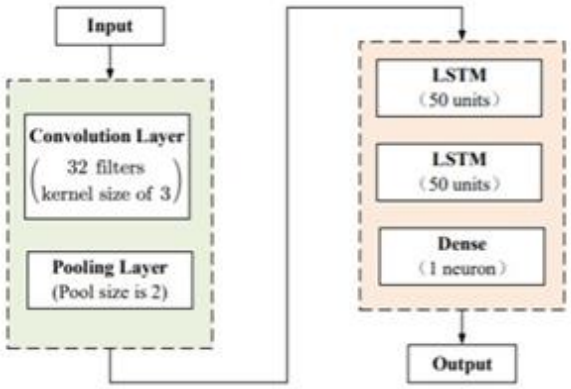

Figure 3. Model Layer

The windows prediction methodology increases forecast accuracy by estimating the values of the forthcoming time slot using sensor data from several recent time slots. We must link the input and output data in order to create a training and validation data set. Next, zero-mean (z-score) normalisation is used to transform the sensor data. Data are represented by $X = \{x^1, x^2, \ldots, x^t \ldots\ldots\ldots, x^T\}$, for each entry in the data x^t equation is an example of z-score normalisation showing in equation1..

$$z^t = \frac{x^t - x^t_{mean}}{x^t_{std}}, \qquad \ldots\ldots\ldots\ldots\ldots\ldots(1)$$

It's worth noting that the model's input contains n_W data, which adds to the model's complexity. In addition, as n_W increases, the input characteristics become scarce and harder to extract. As a result, we employ CNN to extract characteristics from sensor data. For greater subsampling and maximum pooling, a pooling layer with a pool size of 2 is added after inserting a convolutional layer with 32 filters and a kernel size of 3. The input features have now been successfully recovered and are simpler than the initial input data. After that, two 50-unit LSTM hidden layers receive the features for extra training. Because the prediction problem is truly a regression problem, we utilise the dense layer (i.e., fully connected layer with one neuron) to receive the tensor from the LSTM hidden layer and The output has been completed with the desired values. Because of the advantages of LSTM's time sequence advantage and CNN's feature extraction skills, the suggested method predicts outcomes better

4. CONCLUSIONS AND FUTURE ENHANCEMENTS

In urgent situations, this smart display directs medical professionals and aids in patient lifesaving.

The machine learning model helps us to offer the best answer in urgent situations, enabling us to give impeccable advise to prevent making the same mistakes twice. As noted earlier, we employ a hybrid model that combines CNN and LSTM to forecast values based on sensor data..

The major finding from this study:

- Smart Surgical Guide is to eliminate human error and improve surgical skills during surgery.
- SSG can, on the other hand, assist us in revolutionizing surgical education and training. SSG is described as a computer's ability to conduct behaviour that is like those performed by the human brain.
- In the tenth stage of surgery, the SSG plays a crucial role in educating surgeons on how to preserve the patient's life. Surgeons that use the SSG claim that it enhances precision, flexibility, and control during surgery while also enabling them to visualise the site better as compared to conventional methods.

Technologies like artificial intelligence and machine learning have created new ways to use massive amounts of data for educational purposes SSG can be a vital part of any medical organization's training programme for future surgeons and can also aid to increase accuracy. It is used to maintain the stability of patients and with the help of the deep learning model, it helps to make crucial decisions in major operations. It can improve our medical system and guide us with more effective ways to save a life. We used an IoT-based robotic arm to operate on the patient with the help of machine learning guidance. This is completely automated robotic equipment, and its features enable doctors to control the arm during surgery. It operates on humans and will be directed by a doctor, reducing human error and ensuring accurate surgery

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The Role of Chatbots in the higher education sector

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Abstract.

Technology advancement has provided various tools to the users of AI. The use of chatbots has gained popularity and acceptance over time. The different sectors like banking, healthcare, and E-commerce are already using it to provide services to their customers. Chatbots have the potential and the reach to deliver personalized services to many clients. However, the potential of chatbots in education "remains to be investigated."
With the advent of AI, chatbot systems can now be integrated into several forms of teaching. This mechanization is now frequently being used in teaching. Everyone in the industry, including students and staff at institutions, has the potential to benefit from chatbot technology in terms of providing quick and personalized services. This paper provides various applications of Chatbots in the education arena. This E-chatbot model is all about how it is beneficial to the students in the higher education sector regarding the query being handled, counselling, assignment help, and faculty help. This paper is based on a proposed conceptual model based on the review literature.

Keywords. Artificial intelligence, Chatbot, counseling, higher education sector

1. INTRODUCTION

A chatbot is a software program that is used for online chat using text or text-to-speech. [1][2] Higher education is considered to be a relatively new business by several emerging technologies. Conversational AI (Artificial Intelligence), commonly referred to as AI-powered chatbots, is a good example of this. Many schools and institutions are taking advantage of the immense potential that conversational AI has to enhance the student experience by implementing artificial intelligent chatbots. A chatbot is an (AI) interactive interface that can have a full conversation with a person. Data is fed to chatbots, which are configured to process information that has already been given to them.AI chatbots can help higher education institutions accelerate their future by chatting with their students and future students in a similar way they communicate with Alexa or Siri at home. [3] Indeed, Chatbots can be used for education in a variety of ways beyond marketing. The first point of contact, however, has the most impact on how prospective students and parents view and evaluate your institution. The world-changing events of 2020 hold the key to finding the solution. The old forms of inquiry are obsolete, as evidenced by the failure of both public and commercial institutions to respond quickly to a wave of inquiries. [4] The pandemic compelled schooling to take place online. As a result, even conventional institutions and colleges, which rely on a range of in-person activities, were compelled to focus solely on being digital. You cannot afford to subject your potential customers to a search across countless pages in a field were gaining or losing even one customer can affect the thousands

of dollars available to the. Additionally, you cannot afford to always have a large staff on hand to respond to inquiries. [5] One of a person's and their family's biggest financial and life investments is attending college or a university. Stressful application procedures are not beneficial, particularly during a pandemic outbreak. Educational institutions must be able to connect and communicate with students and their parents in real-time to react to the decision's importance and the stress it may cause them. [6] The top manufacturer of chatbots, Landbot, emphasizes the significance of chatbots in the customer journey, which is customer-centric both in theory and in practice and ranges from lead generation to customer care.

a. Making it simple for potential students to contact you instantaneously through a website campaign landing page, social media, or messaging app.

b. Although the phrase "qualification" is very marketing-oriented, it refers to knowing your application pool as a whole and on an individual basis. It involves discovering who they are, what interests them, and what they require at a specific stage of their path.

c. The recommendation focuses on using the information you gained during the qualification process to persuade prospects to schedule an interview or submit an application.

d. Although it is accessible at all times throughout the procedure, support is listed last on this list. Conversational marketing enables you to quickly address reservations and issues. [7] Education marketing tactics involve accelerating and enhancing the process from a prospect knowing about your school/program to applying. Going digital is important, but doing so in a way that seems human is even more important.

2. LITERATURE REVIEW

Higher education institutions (HEIs) must constantly implement innovative business strategies to maintain a market position in the face of intense competition from government funding, internationalization, and new trends toward a thriving online education market. Current research on the competitiveness of HEIs reveals the market's uniqueness in comparison to other businesses In which these institutions fulfill a traditional societal function and provide a professional working class while treating students as consumers with high-quality goods and services for which they pay [8]

Text messaging is preferred over phone calls by millennials because it is more convenient and straightforward. Chatbots, where texting is the primary mode of communication, could provide self-service options, handle simple tasks, and be available to customers 24 hours a day, seven days a week. Chatbots have been used in the education sector for a variety of purposes. Many colleges are using chatbots to answer common enrolment questions. This paper employs a single example of a program of study Facebook Page to demonstrate the benefits of chatbot implementation. From beginning to end. This Chatbot was created using Google Dialog flow as an NLU platform, and Facebook Messenger, as well as the platform interface, is discussed. The database contained 807 sentences submitted by 125 users. [9]

The popularity of chatbots is increasing as it is used for chatting in various fields due to the internet and the exponentially growing smartphone market. This study examined how university students used chatbots for educational/learning purposes. Although extensive research has been conducted into the use of chatbots in the service industry, there is still a

gap in the use of chatbots in education for effective learning. The study validates two newly added constructs to use path analysis. The Technology Adoption Model attempts to understand the reasons for the intention to adopt chatbots. This study is critical for researchers, policymakers, e-learning platforms, teachers, and students to ensure effective learning. [10] The curriculum of pre-service teacher training in educational sciences, like most curricula in the humanities and social sciences, frequently includes time-consuming reading and writing tasks that promptly require high-quality support and prompt feedback. One well-known One-on-one mentoring is one method of providing this assistance to students. This contribution investigates how, using an interdisciplinary approach, Personal mentoring can be made available to as many students as possible with the help of technology. taking into consideration the didactic, organizational, and technical frameworks at universities [11]

Today, every organization relies on information and communication technology (ICT) for efficient service delivery and cost-effective application of technology and technological assets, with a growing preference for Artificial Intelligence acceptance in global business operations in India and abroad. The global Chatbot market will proliferate in the coming years. The Chatbot market is booming in the AI era with extraordinary expansion due to increased demand for Smartphones and the increased use of messaging apps. In recent years, Chatbot technology has been adopted by the food delivery industry, finance, and the eCommerce industry. One of the industries that can significantly benefit from the educational sector is utilizing this technology. Education can be advantageous from the development of chatbots as it can boost productivity [12] Chatbots are becoming increasingly common in various fields, including medicine, the product and service industry, and education. Chatbots are computer programs that can hold audio or text-based conversations. A growing body of evidence suggests that these programs can effectively alter students' learning and information-gathering methods, particularly in large-scale learning. Chatbots can solve the problem of overcrowding in scenarios with more than 100 students per lecturer. Individual student assistance, However, there has been no systematic, structured overview until now because of their educational value; as a result, the purpose of this paper is to conduct a systematic literature review. based on a multi-perspective framework from which we derived preliminary search questions [13] There are existing studies related to Chatbot usage in HEI for academic and non-academic purposes. Specifically for academic purposes, studies are more related to language-related challenges[14] and academic implementation challenges. Studies are focusing on using Chatbots as a language learning medium to overcome the challenges students face across the courses [15]. Further, there are attempts to assist teachers in classroom research, using Google dialog flow evaluated by teachers' performance[16][17]. The non-academic purpose studies also discuss the use of chatbots for student services [18] and chatbot usage for digital library services using Node.js and AngularJS, evaluated with K fold cross-validation [19]. This paper aims to talk about intelligent learning environments and present the FIT-EBot, a chatbot that automatically responds to students' questions about the subject. The educational system provides services for the benefit of the academic personnel. The Chatbot can function as an intelligent assistant who offers solutions to higher-education institutions to improve their current services, cut labor costs, and create new ones [20] The current study encompasses the usage of chatbots for academic as well as non-academic purposes, including learners' challenges as well as the teacher's assistance

2.1 METHODOLOGY

The process and the content for developing Chatbot for Higher education is discussed in this section.

Conversational Marketing: Adoption of Full-Cycle Chatbots

Five lessons to help higher education use chatbots

1. **Get to know your audience better:** With a website, you can easily keep tabs on things like: • how many prospects visited it?

• How did they arrive?

• For how long did they linger?

• The number of pages they view.

• Where do they come from?

Although this information doesn't reveal much about their requirements and preferences, you definitely have a basic sense of who your target audience is. A higher education chatbot, also known as a conversational assistant, can initiate and carry out thousands of conversations while gathering qualitative data, including:
How much a potential student is drawn to your school or course?
What is it they are looking to do or accomplish? (e.g., browse courses, talk to someone, check references, learn more about the environment or professors)
What are the pain points they are experiencing at that instant or see in your proposal?

Asking them instantly when it's fresh and most relevant is the easiest and most accurate way to go about it. You could believe that a straightforward form would suffice. You neglect the fact that most people don't really like recordings, though. They are less likely to be finished the longer they are. Chatbots are effective because they take action without waiting for prospective students or their parents' initial initiative. [22]

2. **Connect with your audience on the appropriate channel:** It's time to explore beyond those pages now that you have a better grasp of who is interested in your organization and what concerns they have when they first visit your website. The most effective communication techniques go to their audiences rather than waiting for opportunities to find them. Put another way; you must begin speaking with your prospects on their terms. Analyze your traffic metrics first. While a lot of leads can find you through Google searches, you'll see that social media and direct entries also play a big part. Word-of-mouth marketing is the greatest and most effective kind of advertising for education, other than demographics and course selection. That word of mouth still exists today. These days, word-of-mouth spreads via social media and messaging services like WhatsApp and Messenger. But for most educational institutions, email continues to be the most popular form of communication. Asking for the email address is OK, but don't end there. Demonstrate to them that you are able and willing to meet them where they are most at ease. You may approach potential students on Facebook, Instagram, WhatsApp, and other messaging platforms with higher education chatbots. [23]

3. **Boost Engagement in the Most Human Way Possible:** Today, messaging apps and social media sites are used to spread word of mouth. How to Increase Engagement in the

Most Human Way. Websites for universities and colleges are renowned for having pages and pages of content. Content is frequently either too hazy, too wordy, or too disjointed. These websites have drawbacks that make them challenging to use. In higher education, chatbots can streamline your content marketing efforts and increase interaction, which will help you convince and convert more readers. In point number one, we discussed how you could use conversational assistants to discover more about your audience. The next stage is to use this knowledge to enhance the experience of potential students by redesigning the website to take into account the needs and preferences you identified or by simply developing total conversational proficiency. Alternately, after determining the important pages, be sure to replace the online forms with chatbots. Instead of asking people to fill out a form and wait for a response, this method of clicking on a CTA will start a conversation with immediate consequences. Last but not least, you can intelligently link students and parents with your personnel by using chatbots. [24]

4. **Make your application process frictionless:** The busiest time of year is during application season because everything happens at once. You can streamline and control that process with the aid of conversational technologies. For instance, you may use unofficial channels to your advantage by employing rule-based or AI bots to automatically follow up with prospects who have shown interest in the application process. By addressing their concerns and offering advice on the channels they regularly access, they may assist them in the beginning and concluding of the process. Additionally, chatbots for higher education are constantly accessible to speak with potential students. Even tell which candidates have a higher chance of succeeding, thriving, and becoming ambassadors. [25]

5. **Bring Life to Your School's Spirit (Brand):** Whatever the size or makeup of your educational institutions, your marketing plan must be distinctive from those of rivals. Together, marketing initiatives can get dull. However, conversational marketing offers you a special chance to show your brand identity in ways other than through the school's emblem and colors. Conversational assistants have the ability to express feelings and personalities that best reflect your company and the educational experience that they are about to embrace. [25]

3. RESULT

How Can Land Bot Support Your Chatbot Marketing for Higher Education Implementation?

Land Bot is a potent no-code platform for building chatbots and automating conversation. The "no-code" features are its key benefit because they let university marketers build chatbots themselves. By removing the code barrier, Land Bot makes conversational marketing accessible to those with the most expertise in it, enabling them to create compelling conversations and experiences without waiting for the IT department. Because modifications, updates, and tweaks to campaigns and bots can be made immediately and while in use, agility offers a significant benefit. By empowering your marketing team, your institution or university may be visible everywhere, including on the web, social media platforms, and messaging apps.[26]

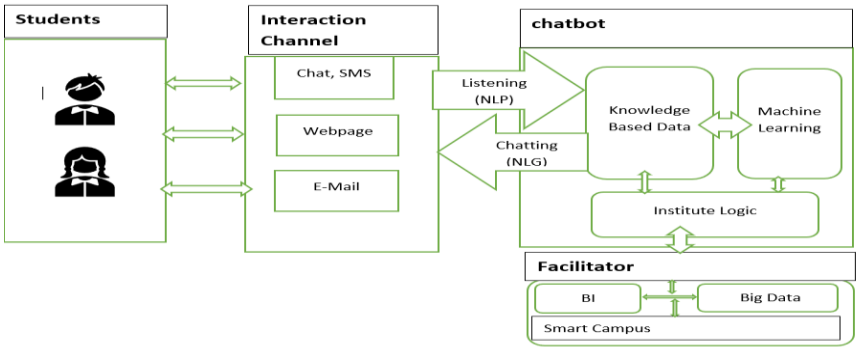

Figure 1: Schematic representation of Chatbot

The above model is an answer to higher education's current and future needs. This model has been conceptualized and presented after reviewing the literature of 20 papers. The model is a schematics representation that explains that students having a query regarding the institute can interact with the Chatbot through Chat, SMS, Webpage, and Email. The question goes to the Chatbot and then searches the knowledge-based data and, with the help of Machine learning, uses a database already fed with logical answers from the institute and responds either through listening (NLP)-Natural Language Processing or chatting (NLG)-Natural language generation. The facilitator for all these answers is the vast database. The BI (Business Intelligence) converts the Bigdata and makes the responses ready logically and transports them through Machine learning to Chatbots to answer. This system makes the campus intelligent, leading to a better higher education system. A chatbot can provide immediate responses to library requests and sign students up for new classes or direct them to the admissions department, making self-service more streamlined and appealing to impatient students. Chatbots can respond to questions via messenger, allowing students and university staff to stay on the same page. Because chatbots never sleep, international students can contact the university office any day or night, regardless of the university's local time. Chatbots can act as agents and sift through thousands of enrolment documents in seconds, delivering the right information when needed. They are ideal for answering basic questions from prospective students about enrolment, financial aid, residency availability, and various other institute-level queries. Adapting chatbots in higher education can make the process much more streamlined, faster and efficient resulting in more student satisfaction and business. Along with students, faculty and staff can also be integrated to interact on different aspects related to teaching and learning, evaluations, admission process, research, etc. The feasibility of this model is yet to be tested.

Process of Voice/Text in Machine learning In general, speech-to-text software listens to spoken audio, records it, then converts it into text. The result is a transcript that is as close to verbatim as feasible. The deep learning model or underlying computer program makes use of linguistic algorithms that run on Unicode, a global software standard for managing text. The primary role of linguistic algorithms is to classify spoken auditory data and encode them as Unicode. [27]

1) Analog to digital conversion: When people speak or generate other noises, different vibrational sequences are produced. These vibrations would be especially detected by a

speech-to-text algorithm because they are analog signals in theory. These vibrations are then fed into an analog-to-digital converter, which transforms them into a digital language.[27]

2) Filtering: The audio files created by the analog-to-digital converter are in a format that can be read by machines. The converter does a thorough analysis of the audio file and accurately measures the waves.[27]

3)Segmentation: Phonemes, linguistic elements that distinguish one word from another, are used to segment speech. The segmented words in the input audio are then compared to this unit of sound to match and anticipate potential transcriptions. In the English language, there are about 40 phonemes, and there are thousands of different phonemes in all languages.[28]

4) Character Integration: The speech-to-text program uses a mathematical model made up of several words, phrases, and sentence permutations and combinations. The phonemes move via a network made up of mathematical model components so that the most prevalent components can be compared to these phonemes. At this stage, the likelihood of the likely textual output is calculated by combining the parts into cohesive sentences.[12]

5) Final Transcript: Based on deep learning predictive modeling, the most likely transcript of the audio is displayed as text at the end of this procedure. The built-in dictation features of the device being used for transcribing are then employed to create a computer-based demand from the probability mentioned above.[28]

AI-driven digitization has always improved industries, and it may now improve education as well, mostly through conversation. AI. The various ways AI-driven chatbots can help are as follows:

Streamlining Student Admission: A normal student enrolment process can be cumbersome even in the best of times. The excessively long admission lines in schools and colleges, a deluge of documentation needs, and credential verification requirements make the process tedious for everyone involved in it, specifically for education can make some of the challenging aspects of the industry simpler. Even in the best of circumstances, the enrolment process for students can be challenging. Everyone participating in the process finds it frustrating because of the unnecessarily long admissions lines at schools and colleges, the mountain of data needed, and the stringent credential verification procedures. Introducing chatbots for use in education can help to overcome some of these issues. Educational chatbots are configured to respond to certain cues to facilitate communication between institutions and applicants. Automating communication between institutions and applicants greatly helps admission logistics. For instance, a chatbot could request that students present their identification and educational credentials before a machine learning-based system verifies their legitimacy. Student admission can be facilitated by a chatbot's ease of processing information and delivering it to users, which can speed up the process. More significantly, it gives the people working on the process more time to work on other, potentially trickier admission-related duties.[29]

Individualizing the Learning Process: Too frequently, instruction in schools and colleges is delivered broadly for students, each of whom may comprehend a particular idea at a different rate and in a variety of ways. The delivery of personalized educational content to each student by sophisticated future educational chatbots can increase the degree of customization in the teaching process. Such systems can also address each student's

questions and doubts on an individual basis, adapting to their rate of learning and assisting them in getting more from their curriculum. Chatbots though utilized extensively still has some drawbacks that need to be fixed. However, as we've seen above, they can eventually result in genuinely major changes in the field of education.[29]

4. CONCLUSION

Higher education Institutes face the challenge of student connectivity and interaction and thus realize the need for an interactive digital-first strategy for competitive advantage. Advanced technology using Artificial intelligence and Virtual Reality like chatbots will be the standard practice for faculty, staff, and students to be on the same platform in their academic progression. [28] Depending on the institution and its capacity to capitalize in the latest technology for its students would ensure equal access to the technology and resources. [28]The HEI facing the digital divide is a known fact, and the type of school having technology and AI integration usage also poses a huge disparity in the opportunities for the Institutes. Its consequences for students can lead to higher discrimination leading to profound socio-economic division.[28]Their other challenges are there as well, which are at the individual level. The anticipation of sharing huge amounts of data with the AIand the security and accessibility of the data to everyone is also one of the limitations for the institutions seeking privacy and confidentiality of these information banks.

Earlier studies highlighted that Chatbots have been for educational purposes, classifying those with educational intentionality and those without. The one with educational intentionality would be more inclined towards student-teacher interaction whereas Chatbots without education intentionality can be assigned the student guidance and assistance-related administrative tasks.[28] The paper suggested the integration of Chatbot over the Facebook page to have better reach and connectivity with the stakeholders, especially students. The article proposed a solution wherein the operation efficiency of Facebook chatbot assistants would be higher and the response time would be paltry as chatbot assistance would be available 24/7.[12]. Similarly, we have an example of the AI Teaching Assistant at the Georgia Institute of Technology, showcasing futuristic classrooms where the technology could run without human intervention.[28] This is the future that is not far away, and the only option we have is to embrace and apply .Compared to earlier generations, today's youth are exposed to technology considerably more frequently. Recent developments in artificial intelligence (AI), particularly in natural language processing (NLP) and understanding (NLU), have made it possible to expand the use of AI chatbots in education. These tools can now support students not only with administrative tasks or academic advising but also by assisting them and keeping track of how they are doing while they are learning. With a focus on their application and difficulties in the subject of education, this paper offers a survey of the various techniques and tools used in chatbot design. [30]

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COORDINATE TRACING AND OBSTACLE AVOIDING ROBOTIC CAR

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Abstract

This project demonstrates a robotic unit which is programmed to find an optimal path to its destination and simultaneously avoid obstacles on the way. The project is based on Arduino MEGA where the code is written in Arduino IDE Software. Optimal path finding and obstacle avoidance are the key factors for developing mobile robots. The robot uses a path finding algorithm to determine the quickest way to its goal, and an ultrasonic distance sensor mounted on a micro-servo motor for precise obstacle detection in the bot's vicinity.

Keywords: Arduino, Pathfinder, Odometry, Servo Motor, Ultrasonic Sensor, Speed Sensor, Encoders, Robotic Car, Coordinate Tracing, Obstacle Detection

1. INTRODUCTION

It can be difficult to determine the fastest route between two sites in real time. Robots that can accomplish this can be deployed in hazardous areas where human penetration could be fatal. The fundamental components of these robots can help those who are blind or deaf to sound locate nearby objects. To identify the shortest route between two sites, complex algorithms have been developed. Odometry uses motion sensor data to assess how the robot's position has changed over time in relation to a known position. It helps the robot know its present coordinates by keeping track of the coordinates that it is tracing, as stated in [1]. The bot's orientation may be determined using IMU sensors. As shown in [5], the data from these sensors can be used with the Kalman filter to reduce errors. The sliding mode method can help further reduce this orientation inaccuracy [6]. When the wheel is set in motion, an infrared speed detector is used to retrieve the encoder disc's number of ticks in order to obtain the RPM, which can then be utilised to determine the distance travelled using 2D kinematics as demonstrated in [4][7]. A fundamental component of a robotic automobile unit is obstacle avoidance, which is further broken down into static obstacle avoidance [2] and dynamic obstacle avoidance [3]. This is done with the aid of a highly sensitive ultrasonic

sensor that uses SONAR technology. The information from the ultrasonic sensor is sent to a microcontroller, which determines how close the barrier is and allows the robot to avoid it [8].

In this paper, we describe a robotic unit that can trace its journey and arrive at the destination coordinates by combining coordinate tracing and obstacle avoidance technique [2][3][8]. We have employed wheel encoders and 2D kinematics in place of IMU sensors [5] to track the exact orientation of the bot. We have modelled the bot in a way that makes it capable of determining the shortest path from its present position to the final coordinates, in addition to coordinate tracing [1]. We have used interrupt pins since the entire process is taking place in real time, allowing the bot to respond quickly to any changes that the sensors pick up on and minimise any waiting time between activities. The microcontroller receives the destination coordinates through a Bluetooth module, and the user receives the processed sensor data that can be used to track the progress of the robot car.

This paper is divided as follows: The System design and the robotic unit's schematics are described in Section II. The technique, kinematics, and flowchart of the robotic unit are covered in Section III. The results are presented in Section IV. In Section V, the paper comes to a close.

2. SYSTEM DESIGN

The key components used in this robotic unit are Wheel Encoder, Ultrasonic Sensor, Motor Driver Module, Micro-servo Motor and Bluetooth Module along with circuit diagram which are shown in figure 1.

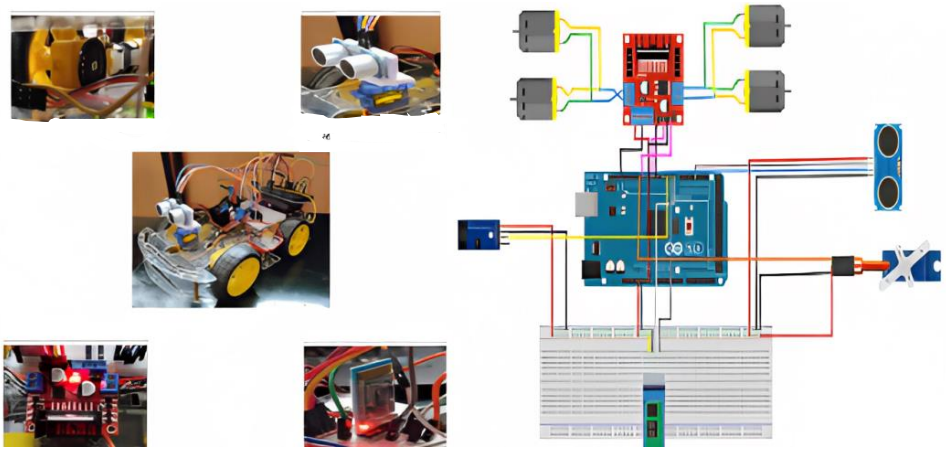

Figure 1: System Architecture

3. METHODOLOGY

Bluetooth is used to send the destination's 2D coordinates to the mobile bot. The Bluetooth module HC05 transmits data from compatible Bluetooth-enabled devices. The bot utilises these coordinates to draw a straight line to the end coordinates, which is the quickest route to the destination. This is accomplished by employing integrated 2D geometrical formulas in the code. Before beginning translation, the robot spins to position itself in a straight line

leading there. Wheel encoders are used to achieve the right orientation and odometric measurements. The micro-servo motor's ultrasonic sensor, which is placed at the top, continuously scans for impediments. For real-time detection, ultrasonic and speed sensors transmit data through interrupt pins. The robot keeps moving forward until it encounters an obstruction, at which point it scans the path to its left and right by spinning an ultrasonic sensor with a micro-servo motor. The loop repeats until the goal is accomplished, choosing the obstacle-free route each time. Figure 2 provides an illustration of this technique.

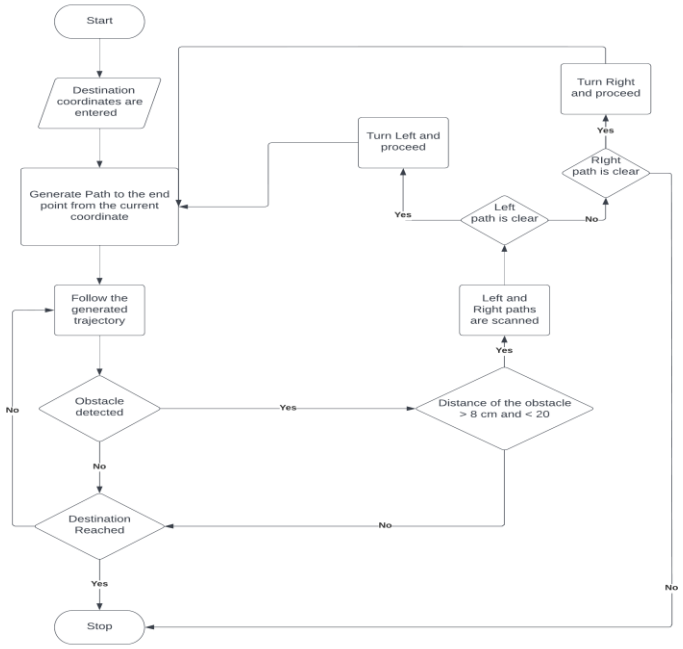

Figure 2: Flowchart of the pathfinding algorithm

3.1. Kinematic Formulae

(1) provides the formula for calculating the number of wheel rotations, and (2) provides the odometric data [9]. The tick count, or the number of voids in the encoder disc, is obtained using the wheel encoder LM393.

$$Rotations = Ticks / 20 \quad (1)$$

$$Distance\ travelled = 2 * 3.14 * radius * RPS \quad (2)$$

where *RPS* stands for rotation per second and radius is the radius of wheel.

(3) provides the formula for calculating the distance of obstruction from the chassis of the bot [10].

$$Distance\ of\ obstacle = 343 * (Time/2) \quad (3)$$

where *Time* represents the total amount of time taken by an ultrasonic pulse to leave and return back to the sensor port.

The velocity of right and left wheels is given by (4) and (5).

$$V_R = R*\omega \quad (4)$$

$$V_L = R*\omega \quad (5)$$

where ω is the angular velocity of the wheel and R is the radius of wheel. The robot moves forward when V_R and V_L are equal. It takes a left and right turn when $V_R > V_L$ and $V_R < V_L$ respectively.

Co-ordinate tracing is carried out by 2D geometrical formulae (6) and (7).

$$X' = X + r * cos(\theta) \quad (6)$$

$$Y' = Y + r * sin(\theta) \quad (7)$$

X, Y = old coordinates of the robot

X', Y' = current coordinates of the robot

r = distance between (X', Y') and (X, Y)

θ = the angle robot makes with respect to X_1 axis

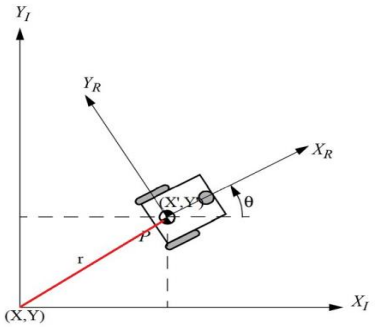

Figure 3: Global and Robot Local reference frame [11]

4. RESULTS AND DISCUSSION

The destination coordinates for the robot are (1,1). The first step is to rotate 45 degrees counter clockwise because (1,1) from (0,0) has a 1 slope (figure 4). As it advances, the robot spots an obstruction at (0.5,0.5) and turns left to get around it as illustrated in figure 5. The robot's most recent coordinates are used to construct a new, ideal course, and it stops once it arrives at its goal (figure 6).

Figure 4: Reception of Destination Co-ordinates (1,1) and Counter-clockwise turn by 45 degrees

Figure 5: Obstacle detection and avoidance

Figure 6: Optimal path generation and termination at destination

5. CONCLUSION AND FUTURE SCOPE

In this paper optimal shortest path is generated and the bot reaches its destination by avoiding obstacle(s). This is achieved by fusing coordinate tracing with obstacle detection and avoidance. We have primarily used wheel encoder to carry out this operation and the ultrasonic sensor functioning on interrupt pin provides us with real time feedback. Implementation of gyroscope to the robotic unit will enable it to move in uneven terrains. For greater precision a radar unit can be installed along with GPS communication system. Such robotic units are capable of reaching the exact final location. Implementation of the algorithm can be used to make a go to destination omni or mecanum wheel bots. Further, proportional controllers can be used to reduce the speed gradually as the bot reaches the desired coordinates and smoothen the entire process. When employed in a confined space, ArUco markers can be used on the bot to obtain feedback from the camera sensor, which can then be used to determine the exact location and orientation of the bot with relation to the camera frame.

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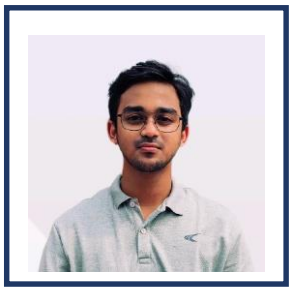
Biographies



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A Novel SMS-Based Crack Detection System

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Abstract.

The study aims to design a simpler system that automates the detection of cracks in railway tracks using an Ultrasonic or IR sensor and Arduino. In this study, use of HC-SR04, an Ultrasonic sensor module is made. The purpose of the module is to emit pulses of ultrasonic sound waves (greater than 20kHz [1]) that reflect as echo after striking the surface and are detected by the receiver. By calculating the time difference between the emission of the waves and the detection of the echo, the distance of the surface from the sensor can be calculated. In the case of an IR setup, the infrared pulses emitted from the IR blaster on striking the surface comes back as reflected electro-magnetic waves to the IR receiver. Also, the GPS and the GSM service are used to send these location coordinates to the user's mobile, desktop, or web interface. Lately, with the advancement of railways, the capabilities of the trains have been continuously increasing. Hence, an inspection of a rail track is a necessary task, which should be inspected periodically. To make it time-efficient, an automatic crack detection system is proposed which detects the abnormality on the surface of the rail track. It uses simple statistical analysis to detect the cracks on edge.

Keywords. Crack detection system, HC-SR04, Arduino, rail industry, sensor.

1. INTRODUCTION

There are many problems around us which we face in our daily life. We want to create a project that can help and benefit the people of our country, so we look into various public

sector domains that are used widely that require some changes in the system. And one such domain that requires attention is transportation. Today, transportation is of great importance for its sustainability and safety due to its primary usage. There are many changes or updates that one can make in this sector for the betterment of our nation. Also, IoT is dynamic in the field of technology and its advancement. When we talk about transport, Railways occupies a leading position in India in reducing a fast-growing economy's growing needs, but there are still many problems which can be corrected to make this system more efficient. The main issue that is faced here is that there is no reliable and affordable equipment to diagnose train track issues and the lack of proper maintenance. The railway infrastructure dates back to the colonial history of India. These tracks were laid by the British back then for transporting goods from different parts of India. After the independence, this whole system that was once used to transport Indian goods to the major ports for export was converted as a medium of transportation and in very few years became the most used mode of traveling as well as transportation. After these many years, a lot of things were upgraded but the system used for the maintenance of these decades-old tracks remains the same. With the increasing number of trains and usage of the railway system, the current methods of maintenance are not very productive and take a lot of time and labour.

Thereby, authors thought of making the current proposed model that speaks of a proposed test train design for detecting obstacles and cracks in the tracks, similar to the line following the test train. This project will help improve the rail industry and many people will be benefited from this. It is the most economical and efficient solution provided to achieve good results of railways of our country to minimize the stats of accidents caused. Besides this, it also saves time and money when this project is applied in real life.

2. RELATED WORK

According to current research-based study, authors came across multiple research papers that discuss similar ideas. Most of the methods discussed in those research papers are about detecting a crack and sending an SMS to a particular mobile number. However, it is believed that there are many other ways to use and deliver this data. In this study, authors have proposed some of these ideas with their benefits. Also discussed some of the important aspects mentioned in most of these research papers, points to improve them, and a small demo project we built with the limited resources we had. In [2] the authors propose a system where they use Raspberry Pi with a camera module on a mounted platform. The camera took images of the tracks and they used computer vision and image processing to detect cracks on the tracks. The idea is quite fascinating and useful but many other ways are quite simple and less sophisticated than using computational intelligence and image processing. This requires a lot of extra resources and the maintenance of this system itself won't be very easy. As the parts used are comparatively expensive and repair is a bit difficult. This system could however be a real add-on as a surveillance module. Another excellent application is seen in [3] where the authors discuss the use of neural networks for precise classification of cracks or damage and present an implication where a motorized cart is mounted with an Arduino board, IR sensors, and GPS/GSM modules which sends a notification into a mobile device when a crack is detected. This system is quite effective and less expensive to maintain.

With the technology stack discussed above, it's quite clear that almost all the solutions are collecting huge bundles of data that could be useful in training more sophisticated systems. Current study on the other hand uses simple, less sophisticated and less resource consuming statistical analysis to detect the cracks.

3. METHODOLOGY

This section focuses on the system design. The components used during the experiment design are:
Ultrasonic sensor: This is an electronic sensor that measures the distance of objects by emitting ultrasonic (high-frequency) sound waves and converting the reflected sound waves (echo) into electrical signals. These sensors are one of the best tools to measure distance as they are fast and can be 97% precise for long distance. [4]
GPS: The Global Positioning System is used to receive the position data of an individual or vehicle and display it on a digital map. It will also have an interface to the communication link. Authors [5] interfaced neo-6m GPS module with Arduino to get the location co-ordinates which could be using with Google Maps API to improve the presentation.

3.1. Interface Model

Figure 1 describe about the interface used to connect HC-SR04 with Arduino board. The ultrasonic module HC-SR04 is a 4-pin system. One is VCC which is the 5V live pin connected to the 5V pin of Arduino. The 'GND' pin is the Ground pin connected to the Ground pin of the Arduino. The next is the TIRG pin that stands for 'Trigger pin' which is an output pin. It is connected to the digital I/O pin-number 2. It provides the pulse with respect to which the sensor module emits high-frequency sound waves of 40kHz. The last pin is the 'Echo pin' which acts as the input pin. This pin is used to take distance measurement as this pin goes HIGH after a burst of waves is send and goes LOW only after it receives an echo. [6]

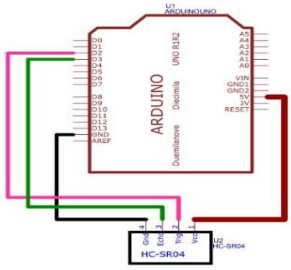

Figure 1. Arduino and HC-SR04 circuit diagram

3.2. Mathematical relation:

Velocity of sound wave in air ($\boldsymbol{v}$) ≈ 343m/s. [7] [8] [9] (one can ignore some errors on the precise measurement in the velocity as the detection of surface abnormality is purely relative and it should work till, consider the same value of v throughout the procedure.)

$$v = \frac{S}{\Delta t} \quad (1)$$

Where **S** = distance travelled by the wave and Δt = time taken.

Distance of the object from the source of wave (**S**) is:

$$S_{actual} = \frac{\Delta t \times v}{2} \Rightarrow \frac{343\ (\Delta t)}{2} m \approx 170(\Delta t)\text{m} \quad (2)$$

3.3. Proposed model for crack detection system

Figure 2 describes the organization of different element of the whole system. The 'track surface' data is collected by the HC-SR04 sensor which sends the data to the Arduino. Arduino then formats the data and send to the 'crack detection interface' (a software service) running on the Raspberry Pi (or any computer) which is responsible to process the data and detect the cracks. The 'crack detection interface' saves the data collected in a separate log file that could be used for real-time visitation or reference later. The software service has to be calibrated in a control environment which will calculate the error generated by the sensor. This information will be provided to the detection block which will compare the data in real-time to detect a crack in the surface. If a crack is detected, an SMS is sent by the user with the location coordinates by the software service.

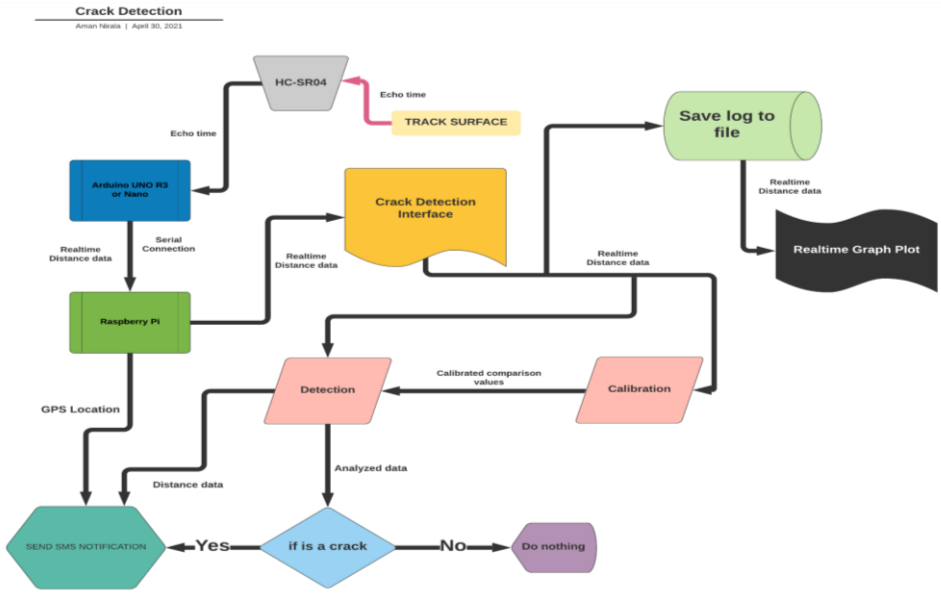

Figure1. Block diagram of crack detection system

3.4. Arduino module

Figure 3 (a) represents the HC-SR04 module on the Arduino board. Figure 3 (b) represents the connections of the HC-SR04 with the Arduino board.

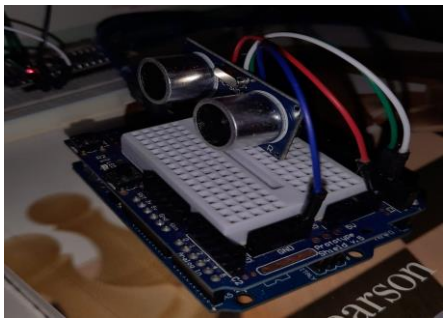

Figure 3(a) Front view Arduino UNO with Prototyping shield and HC-SR04)

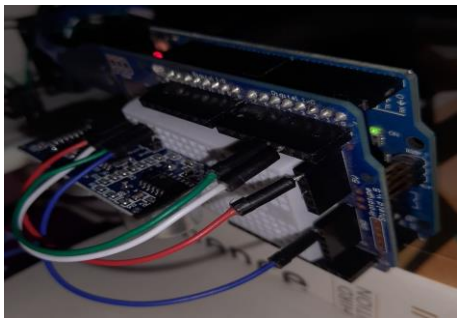

Figure 3(b) Arduino UNO with Prototyping shield and HC-SR04) Pin connection

4. RESULT ANALYSIS

The client application (built in Python) can be deployed in a platform independent way. The service is responsible for processing the data collected by the sensor. The application requires three parameters, 'depth sensitivity', 'max distance allowed' and 'calibration time'. 'Depth sensitivity' tells the program the tolerance level of a structural abnormality. If the deviation is larger than the threshold, it is marked as a potential candidate. 'Max distance allowed' is the maximum possible value of reading, this eliminates some noisy reading that might be caused due to environmental factors or defect in the instrument. 'Calibration time' parameter is the value that tells the program how long it should collect the data in a controlled environment to calculate the mean absolute error generated by the instrument $\left(\boldsymbol{MAE} = \frac{\mathbf{1}}{\boldsymbol{n}}\sum_{\boldsymbol{i}=\mathbf{1}}^{\boldsymbol{n}}\left|\boldsymbol{d_i} - \overline{\boldsymbol{d}}\right|\right)$ [10] which can be used to evaluate errors in the real reading value. The mean of the data collected by the sensor is considered the normal surface level ('surface normal'). The threshold for detecting a crack is the sum of the depth sensitivity/tolerance and the surface normal. When a crack is detected on the track, an SMS is sent to the preferred number/portal by using a remote SMS client (will be using GSM modules in the future) and GPS service. The message contains a Google Maps link with the latitude and longitude of the place where the crack is detected. Figure 4 shows a diagrammatic representation of the applied system which different elements calculated during the calibration period. Figure 5(a) represents the raw surface data collected during the calibration period in a controlled environment. Figure 5(b) represents different features calculated from the data. Table 1 represents different information collected during a calibration period which will be used by the detection system to classify a data point as a significant crack.

TABLE I. CALIBRATION INFORMATION

Measures	Values
Surface normal	74.82452512
Surface minimum	73.71
Surface maximum	75.77
Max error	0.945474876
Min error	-1.11452512
Mean absolute error	0.279969167

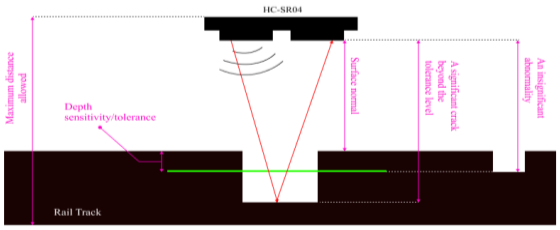

Figure. 4 Applied system

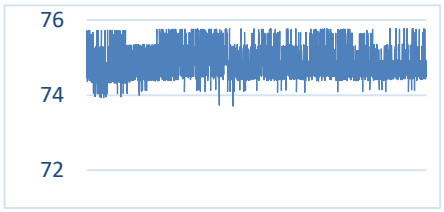

Figure 5(a) Calibration result

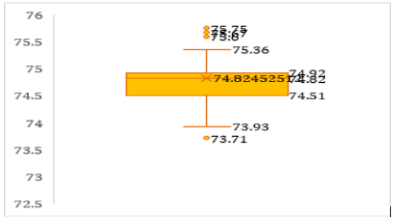

Figure 5(b) Box plot of features

Figure 6 (a) represents the reading from the sensor with a significant crack. Figure 6 (b) represents the SMS notification sent to the user mobile with the information of the crack and the location coordinates.

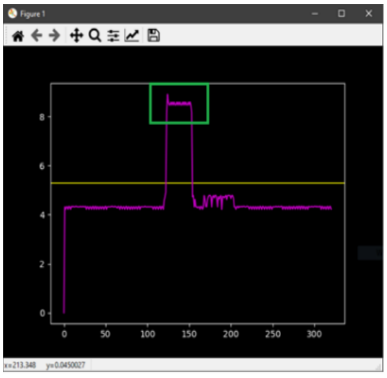

Figure 6 (a) Crack detected

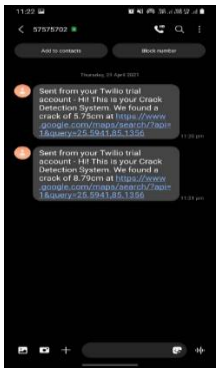

Figure 6 (b) SMS is sent on test number

4.1 Advantages of Proposed System

- Easy and automatic data collection that can be used for analysis and management.
- Low resource consumption.
- Easy to maintain and low-cost hardware.
- Less sophisticated mechanism.
- Versatile and easily scalable.
- Ability to send alerts/warnings to particular train drivers if a potential crack is detected.

4.2 Limitations of Proposed System [11]

- This method can't detect very fine fractures because to detect an abnormality the feature should be larger than the wavelength of the sound waves so that it can reflect the sound waves. This can be handled by using other technologies like LIDAR.
- Long distance of the sensor from the tracks can make the echo weak and lead to noisy readings.

The angles of reflection of the echo are governed by the Snell's law ($\frac{\sin\theta_i}{\sin\theta_r} = \frac{V_i}{V_r}$). **[1]** For the sensor to receive the echo, the emitter has to be nearly perpendicular to the surface or else the echo won't be captured by the receiver. This makes the alignment an important variable in achieving error free result. Table II shows the comparison of the existing crack detection system with the proposed system.

TABLE II. COMPARISION WITH STATE-OF-THE-ART CDS SYSTEM

Sr.No	Mean Absolute error of existing system	Mean Absolute error of proposed system	References
1	56.407	0.279969167	[12]
2	0.97		[13]
3	11.04		[14]
4	10.6		[15]

5. CONCLUSION

In this paper, a method to distinguish cracks in rail route tracks has been introduced utilizing ultrasonic waves and simple statistical analysis. The strategy replaces manual assessment of the track area, via programmed review and use of sophisticated hardware and computational intelligence. This will assist with cracks promptly and lessen the possibility of any mishappening. There will be less need for physical power, i.e., to manually detect every crack. This system can pinpoint the exact locations and send an immediate message in an economically accurate manner. The simple design of the proposed system makes the efficiency directly proportional to the capabilities of the sensors used. With the current system the mean absolute percentage error generated by the sensor is less than 0.4% making it very efficient for surface and sub-surface crack detection. In the following time, if applied at a larger scale, it will be time-saving and provide railways with a better safety system and effective testing infrastructure.

6. FUTURE WORK

Currently, authors are using the SMS-based system to deliver text messages regarding the cracks detected on the track. Moving further a smart device, web portal, and a cloud system will be added to make the applied method and algorithm more efficient and user friendly.

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A Study of User Perception and Adoption of Telemedicine

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Abstract

The purpose of the study is to inspect the variables influencing the level of acceptance and adoption of telemedicine among users in India. Data was collected from the Gen X and Gen Y. SmartPLS was used to ascertain the dominant constructs by employing extended TAM influencing the user's intent to use telemedicine. The results show that telemedicine is influenced by perceived ease of use, perceived risk, technology and social influence.

***Keywords*— Telemedicine, perception, trust, perceived ease of use, perceived usefulness, user acceptance, social influence**

1. INTRODUCTION

Telemedicine has transformed the healthcare sector and is rapidly growing with technological advancement. Telemedicine refers to the use of various information and communication tools (ICT) in providing healthcare and allied services by creating a virtual space for patients and healthcare professionals. According to American Telemedicine Association, Telemedicine is defined as the use of ICT such as the Internet, wireless networks, intranets, and worldwide webs in the delivery of healthcare services. Healthcare sector has been facing challenges in India with rising costs, out of pocket expenses, demands of patients and universal access [1]. Telehealth is considered to be the suitable alternative solution to deal the problems of access to healthcare in emerging nations to provide health care support where the availability of health care professionals is a challenge [2]. This study aims to help understand factors such as user's behavior in adopting telemedicine, inclination to use it as an alternative medium and the perceived risk in the adoption of telemedicine. The available research in the past few years highlight that, the market size of telemedicine in 20 countries (Italy, Poland, Netherlands, U.S., Canada, Germany, UK, France, Spain, Belgium, Switzerland, Sweden, China, Japan, India, Australia, Brazil, Mexico, South Africa and Saudi Arabia) for the year 2019 was estimated to be $45.5 billion [3] [4]. According to Statista report, by August 2022 the level of usage of telemedicine by Indian consumers has upsurge by 22% for physical health and 33% for mental health [5]. In view of this, Ministry of Health and Family Welfare (MoHFW) in association with Department of Information Technology (DIT) introduced the Telemedicine Practice Guidelines (TPG) in March 2020 [6] [7]. But its wide spread adoption has impeded due to several challenges like administrative and legal policy, lack of adequate regulatory framework to implement telemedicine modalities to healthcare service delivery, resulting in underprivileged and heterogeneous acceptance and integration of telemedicine services across India [8]. The Indian telemedicine market is forecasted to exhibit a CAGR of 30.20% by 2027, impelled by rapid digitization of health care industry. The telemedicine industry is projected to create a $5.4 billion market with a CAGR of 31 per cent. India attained the World Health Organization (WHO) requirement of doctor to population ratio of 1:1000, despite this fact several issues persist in India concerning the unmet urban rural divide w.r.t ICT infrastructure, unmet rural health are inequalities [9] [10]. Telemedicine can help reduce the time of consultation and shall also help in improving healthcare services by extending the

reach to rural areas. The study aims to identify the dominant constructs that promote the use of telemedicine among the population. Also, it entails in identifying the relationship amongst the selected constructs. This study intent to assess the perception level of acceptance of telemedicine services in India using TAM and tries to fill the existing gap found in the previous literature. The study would help the policy makers, health care service providers and Information Technology (IT) vendors to understand the significant factors that influence the user in adopting telemedicine.

2. LITERATURE REVIEW

Telemedicine services include health examinations, hospital procedures, and location-based services. This can all be availed by technology-based platforms. A study by Nancy E and Brown-Connolly [11] [12] demonstrated that telemedicine service using mHealth is highly cost-effective. Telehealth has helped in the early detection of health hazards and facilitated in bringing productive modifications to users' health habits. Due to their benefits like effortless agility, portability, and omnipresence, health associated technologies have received worldwide attention [13]. However, empirical studies about users' adoption behaviours of Telemedicine services remain circumscribed as a newly emerging phenomenon. Technology acceptance Model (TAM) proposed by [14] [15] is considered as the initial model in assessing and measuring the user acceptance in adopting new technology. The acceptance by the users has been a major concern in the process of using and adopting the advanced technologies in consumer research [16]. Extended TAM has been used in the study to understand the impact of new technologies. TAM is extensively used model to gauge the adoption, impact of technology and related factors in various fields, including healthcare [17]. The original TAM model uses perceived ease of usefulness (PEOU) and perceived ease of use (PEO) as the primary constructs. However, the usage intention by a specific user cannot only be explained by the mentioned constructs. Mohd.Alam et al, in their study[18] confirmed the acceptability of Unified Theory of Acceptance and Use of Technology (UTAUT) model in the context of mhealth services among generation Y in the developing nations. Rahi 2022 [19] emphasised on the factors influencing the individual behaviour towards the adoption of telemedicine by incorporating UTAUT model. Bhataacharjee [20] studied the phenomenon of telemedicine and explored the various aspects of healthcare technology awareness adoption and practice in India. To develop the model, factors of basic TAM and other noted constructs, social and behavioral factors, risk-associated factors, and resistance towards technology etc., have been used to assess the association of users' perception level of acceptance and adoption behavior. Based on previous research conducted in this field where the popular two variables of TAM such as PEOU, PU, have been identified as major factors influencing the user’s bias towards using telemedicine services[21] and other significant factors like privacy & trust, social influence, perceived utility, technology acceptance and resistance and intention to use were considered as response variables in extended TAM. [22]

3. RESEARCH METHODOLOGY

The purpose of the study is to assess the variables that influence the telemedicine user`s perception level of adoption. To achieve the objective, a questionnaire as a primary survey tool was designed which was organized into two sections; the first section is about the demographic factors of the respondent and the second part of the questionnaire is about users' perception of their comfort using telemedicine and the risk associated with it. The purposive sampling technique was used to identify the sample population. Generation X and Generation Y having minimum educational qualifications as graduation and knowing technology usage, was selected as a sample population. The questionnaire was administered

to the people falling between the age group 20-60. The questionnaire was circulated online to approximately 272 respondents out of which 196 responses were received, 188 were considered after removing duplicates and inappropriate responses for data analysis. The data was analyzed using SmartPLS method. PLS model in this research facilitated in determining the user's acceptance of telemedicine by considering Privacy & Trust (PAT), Perceived Ease of Use (PEOU), Perceived Usefulness (PU), Perceived Risk (PR), Social Influence (SI), Technology (T) as the latent variables. The PLS model calculated t- value and path values based on the responses to validate the hypothesis. The parameters were measured on a 5-point Likert scale, with one measuring as "Strongly Disagree" and 5 "Strongly Agree". The following hypotheses are developed to assess the users' perception of the determining factor of behavioral intent and usage that influences the adoption of telemedicine.

3.1 Perceived ease of use

Perceived ease of use (PEOU) is the most common significant determinant of technology acceptance in the TAM model [23]. If a user believes that telemedicine would help reduce the cost of healthcare expenditure, the users will swiftly adopt this method. Former literature reveals that a person would find adopting telemedicine services useful only if they receive speedy delivery of health care services with affordable health inspection and reduced service time of health care. Davis. F [24] defined PEOU as a person's belief that employing technology will require the least effort on his/her part. As a result, it is anticipated that people will only receive and employ telemedicine services if they believe doing so would result in improved outcomes [25].

3.2 Perceived usefulness

Perceived usefulness (PU) is also the most common significant determinant of technology acceptance [26]. PU is defined as the extent to which a person believes that using a structure would benefit in enhancing his/her performance [27]. In the context of present study, the definition of PU is referred to the use and the acceptance of telemedicine would help faster delivery of healthcare services without unnecessary health examination and with reduced time of healthcare service. According to Badea et al, [28] it was observed that home care (52.86 % of the total group) followed by emergency care (42.14 % of the total group) were the most directed area for the application of telemedicine [2].

3.3 Perceived risk

This hypothesis suggests that the user may be reluctant to use telemedicine, perceiving that the same may not be useful in addressing their concern and may lead to mental dissatisfaction. This may lead to the disinclination of users to adopt telemedicine services. Perceived risk is a person's assessment of the risk involved in taking a specific action or activity [29]. The consequences of risk and uncertainty associated with healthcare and ICT, cannot be curtailed. However, the sources of risk and uncertainty about ICT usage vary considerably across the users [30]. Risk perception about the security and reliability are considered to be the important antecedents of the behavioral intention to use telemedicine and its acceptance [31]. Previous research has identified six different categories of risk: performance, financial, social, psychological, safety, social, and opportunity/time [32]. Considering these as foundation, we define perceived user risk as psychological, financial, and performance in this study.

3.4 Social influence

Social influence represents the magnitude at which a person believes that her/his acquaintances and friends have faith that he/she would use the system/new technology confidently [33]. The opinion of people plays an important factor in user acceptance of

telemedicine. Existing literature highlights that social influence significantly impacts people's willingness to embrace new technologies [34]. Word of mouth in a society with access to telemedicine technology gives people the confidence to move towards the same. Rahi.S [19] projected that, social influence as a major influencing factor in determining the user behavior towards adoption of telemedicine application. Nevertheless, their thoughts and experiences would also encourage them to practice telehealth facilities.

3.5 Technology based services

People's resistance to adapting to new technology can result in technology failure in telemedicine applications. Though technology has endless potential, if it is entirely rejected by the users or remains unutilized, then technology resistance by the user may limit the use of telemedicine. In an interview-based study by Jarosławski & Saberwal, technology was not the only limiting factor for the use of telemedicine; factors like unavailability of health personnel, financial stability and absence of business model also played a significant role [35].

3.6 Privacy and trust

The user may believe that the data being captured in the process may not be secure and may have a possibility of being disclosed publicly. This would build avoidance inclination in the minds of the user towards the telemedicine services. Several researches have supported the inclusion of risk and trust in TAM models to explain the adoption and integration of ICT-based healthcare technologies over time [36]. Trust has been considered as a significant determining factor in the assessment of acceptance of innovative ehealth services [37]. Trust is perceived as faith in embracing novel technology that end-user`s place in the services it offers [38].

4. DATA ANALYSIS & DISCUSSION

The details of the demographic characteristics of the respondents are as follows. Out of the 188 observations, 46.81 per cent represents Generation X, born after 1960. Of the participants, males constituted 69.15% and the rest 30.85% are females. About the education qualification, majority of the respondents i.e., 50.79% are post graduates and 46.37% are graduates and only 5.29% are undergraduates. The proposed model presented a variance of 61.3% demonstrating the fact that 61.3% of usage intention could be explained using this research model. To validate and ensure reliability of the responses received from the survey items, Cronbach's alpha was applied using SPSS software, and it was found to be 0.742 for the 26 items. Average Variance Extracted (AVR) & Composite Reliability (CR) was calculated to find the convergent validity of the items loading. The CR for all the constructs was calculated and found to be above 0.7 for all constructs suggesting that the criteria for convergent validity are fulfilled. The following graph No. 1 is representing as measurement model depicting the loadings of individual items and how each variable is contributing to the constructs. From the following graph no.1 presented below, we observe a value of 0.822 PU1, 0.814 PU2 as factor loadings contributing from Perceived Usefulness (PU) and similarly, factor loadings of other variables are observed. In the technology(T), we find T1 with 0.855 and T3 with 0.877 factor loading. In perceived risk (PR) PR5 carries the maximum factor loading of 0.819, in social influence (SI) SI1 & SI3 carry factor loading of 0.844 & 0.894. similarly, in perceived ease of use (PEOU), PEOU 2 has a factor loading of 0.851. And finally, in privacy and trust (PAT), PAT2 with 0.864 represents the highest factor loading effect. Factor loadings entails, how much a factor explains a variable. The value between various constructs and Intention to Use is the standardized regression value or the effect of each construct towards acceptance and intention to use.

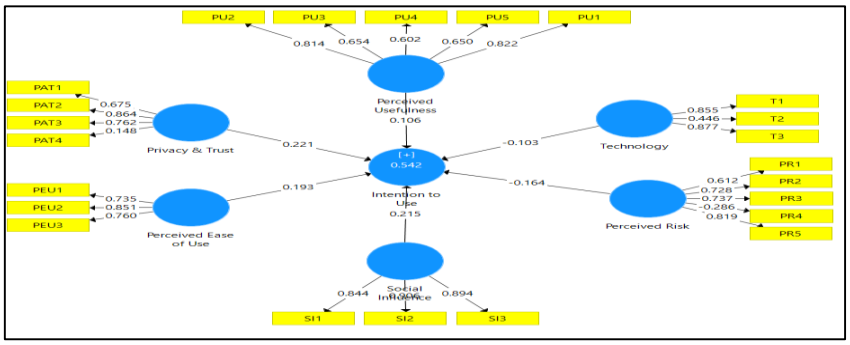

Figure no. 1 T-statistics value calculated using SmartPLS

To determine whether the regression values are significant or not, bootstrapping is performed. Bootstrapping is a statistical process for resampling a single dataset to create multiple simulated samples. The results after performing bootstrapping are observed in table no.1.

Variables	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics	P Values
Privacy & Trust-> Intention to use	0.221	0.220	0.064	3.44	0.001
Social Influence -> Intention to Use	0.215	0.210	0.071	3.03	0.002
Perceived Ease of Use -> Intention to Use	0.193	0.198	0.063	3.057	0.002
Perceived Usefulness -> Intention to Use	0.106	0.122	0.102	1.039	0.299
Technology -> Intention to Use	-0.103	-0.095	0.077	1.33	0.184
Perceived Risk -> Intention to Use	-0.164	-0.162	0.081	2.023	0.043

Table no.1: T-value of various constructs calculated using SmartPLS

From the T statistics value, it can be observed that Perceived Ease of Use (t=3.057, β=0.193), Privacy and Trust (t=3.440, β=0.221), Social Influence (t=3.030, β=0.215), and Perceived Usefulness (t=1.039, β=0.106) have a positive relationship with the intention to use. A T-value above 1.96 suggest that the hypothesis is supported. Lower t-value are observed for Perceived Usefulness and Technology, suggesting that people are not confident about the benefits of telemedicine and are not sure whether adopting telemedicine would help them reduce healthcare expenses or improve health care quality. A lower t-value in the case of technology suggests that the hypothesis related to technology remains unsupported; this could be possible as most respondents are under the age of 40. This age group are more familiar with technology and hence may not find difficulty in adopting new tools. At the same time, a negative β suggests that if some threat due to technology is observed, it may hinder telemedicine's usage as a service.

5. CONCLUSION

The study presents majorly four dominant constructs' comprising, PEOU, PR, SI and PAT that are evidently demonstrating to be influential in adapting the telemedicine services. In India, telemedicine would be essential in overcoming the healthcare problems. Moreover, to utilize it to its full potential, it is required that the population needs to be educated about the practices of telemedicine. From the responses, it is evident that people are willing to use and accept telemedicine in their life but are not quite sure whether its application would help them reduce their healthcare expenses or even save time. Perceived Risk and Technology are crucial in setting the example for telemedicine applications. Awareness of the use of telemedicine is to be developed among the people through education support programs. Privacy and Trust played the highest role in user acceptance of telemedicine, suggesting that there should not be any area of confusion in the mind of users related to data security. Telemedicine service providers and policymakers can use the research findings to design campaigns for expanding telemedicine services. The factors identified can help detect the barriers and drivers of promoting telemedicine. Lastly, the scope of the study can be increased by including several other independent constructs and examine the impact on the adoption of telemedicine. Also, a cross reference study using demographic factors would be more beneficial to understand the perception level of the users and adoption of telemedicine.

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Biographies

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Blockchain Supported Charity System to Track the Utilization of Funds

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Abstract

NGOs face a difficult fundraising situation, due to their lack of transparency. With each passing day, it grew increasingly difficult to determine if donations were being delivered to the right address or if they were misused to commit fraud. As a result, donors lose their trust in these NGOs. This study proposed a solution to the problem by utilizing Blockchain technology, a decentralized system that offers security, transparency, and lower financing costs by removing the need for third parties between donors and NGOs. In the blockchain, all donations can be recorded, allowing donors to see where and how their money is being used. Polygon-Mumbai Blockchain was used to achieve the proposed solution. Smart contracts are used to make all payments, allowing donors to know exactly when and how their money will be received. For ease of use of the proposed system, a website was developed for users. Our objective is to support the growth of philanthropy and enhance public trust in NGOs by implementing a blockchain-based charity system.

Keywords. Polygon, Smart contract, Blockchain, Charity, Fundraising, Transparency.

1. INTRODUCTION

Charity is an essential component of a democratic society. Every year, numerous situations occur in this world that result in painful loss. People are growing increasingly eager to contribute to society[1]. Many individuals have recently been interested in donation activities. In order to collect donations from people all over the world, charities work to reach as many people as they can. Satoshi Nakamoto introduced the concept of decentralized blockchain[2]. Blockchain is a technology that can be used to store data that needs to be tamperproof as the data written to the blocks cannot be changed without changing the data in the following ones. Data that is public, transparent, and permanent can be stored on the blockchain. A blockchain-based decentralized solution [3] is being provided in this paper that works as a charity platform for donors to donate money in crypto currency. Blockchain has the potential to have a significant influence on the charity sector, allowing for the safe and transparent allocation and management of donations. Donors can donate money in cryptocurrency to non-government organizations who need the donation taking advantage of the high security and transparency characteristics of blockchain.

2. LITERATURE SURVEY

Considering recent development of Blockchain in various fields, many researchers are focusing on use of blockchains in various domains. Table 1 shows few of them studied during proposed work.

Table1. Literature review of related papers

Title, Author(s), Year of Publication	Purpose of study	Research type/aspect
"Blockchain-Based One-Off Address System to Guarantee Transparency and Privacy for a Sustainable Donation Environment" *Jaekyu Lee, Aria Seo, Yeichang Kim, and Junho Jeong (2018)*	The current system for charity has numerous issues like transparency with donors and privacy. To try to solve the problem of transparency, this paper proposes a donation mechanism based on smart contracts on the blockchain and to preserve privacy, the authors suggest a one-time address system using the same smart contract concept. Here, donations are sent through the donor account address created once to ensure anonymity. [4]	Case study/learner experiences
"Managing charity 4.0 with Blockchain: a case study at the time of Covid-19" *Rangone, A., Busolli, L. (2021)*	This paper goes in depth about the current status of blockchain and how this technology can be used in the charity sector. The paper then studies the idea of Charity wall, a system that uses the combination of a social network for NGOs and an automated audit system. Not only transactions but all documents are traced in this system. It discusses how Charity wall helps restore relationships with small and medium-sized donors, lower operating costs, refine the whole supply chain, and speed up contribution procedures in the interests of the eventual recipients. [5]	Survey/institutional and administrative factors
"Research on Charity System Based on Blockchain" *Baokun Hu1, He Li(2020)*	This paper investigates the intersection of blockchain technology and philanthropy and presents a blockchain-based charity model. Donors complete donations and use funds with the help of smart contracts. All transactions are recorded on blocks to ensure fund traceability and boost transparency. A DApp that the paper developed claims to have validated certain fundamental components and realizes the next step to create a complete blockchain-based charity system. [6]	Case Study/learning environment; learner perceptions
"Platform for Tracking Donations of Charitable Foundations based on Blockchain Technology" *Hadi Saleh, Sergey*	Donors are suspicious of how their money is handled. Blockchain technology is now being used in a variety of industries. Incorporating blockchain technology helps make money giving and receiving a	Causal comparative/ learners' outcomes

Avdoshin, Azamat Dzhonov (2019)	transparent process. It is necessary to build a single platform for monitoring donations that would track all information regarding gifts, transactions, and donors. The aim of the paper is to explain the development of a blockchain based system for tracking donations. Based on blockchain technology, the system provides transparent accounting of operations for donors, charitable foundations, and recipients. A charity platform should provide a way to show complete transparency which allows donors to monitor or track where and how the charity funds were used.[7]	
"Investigating the Charity Funding System using Blockchain Technology" *Ajendra Saxena; Dileep Kumar; Bhanu Pratap Singh; Bhairu Lal Jatt; J. Sathish Kumar (2022)*	In this article, the author suggests a blockchain-based solution for the online philanthropy system. Any donor's contributions may be tracked and kept up to date using the blockchain technology. The system turns actual money into digital tokens, and all transactions on the platforms are carried out using tokens. These tokens are given out by donors, and other algorithms are used to distribute them when they are given to receivers. Based on execution time and execution cost, the comparability of proposed algorithms is assessed and examined[8].	Case study/learner experiences
"Charity Donation System Based On Blockchain Technology – 2022" *Prof. Dhanashri Patil; Abhishek Kadam; Gargi Shetye; Tanmay Budage; Ashutosh Sonar (2022)*	For transparency in this study, the authors created a blockchain-based contribution mechanism. This procedure makes donations transparent. By encrypting the contribution from a specific donor to a specific NGO, it protects the privacy of the system's users [9].	Causal comparative/ learners' outcomes
"Developing a Reliable Service System of Charity Donation During the Covid-19 Outbreak" *Hanyang Wu; Xianchen Zh (2020)*	This paper investigates how charity service providers may employ blockchain technology as a quick and secure solution during the COVID-19 pandemic, which led to a spike in information asymmetry and the demand for contributions. The researchers were able to ensure the veracity and quality of information during the pandemic because to this application of blockchain technology. They explain the design and implementation of the service system [10].	Case study/learner experiences; design and implementation

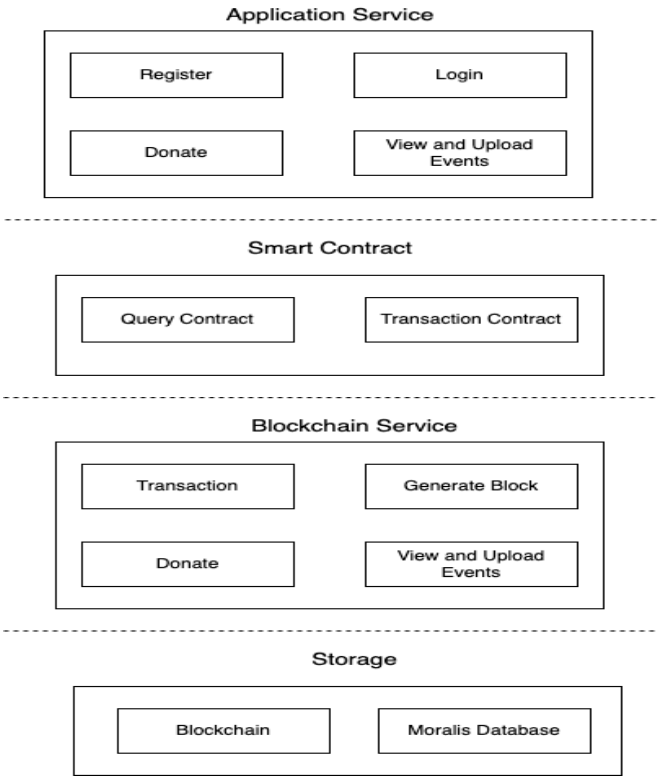

Figure 1. Architecture Diagram

3. PROPOSED SYSTEMS AND SOLUTIONS

Currently majority of web-based software is centralize. In this project, a decentralized process for charity funding is developed with two basic categories: NGOs and contributors (DONORs). By using Polygon-Mumbai Test Chain, every transaction information is stored on a blockchain network. This system uses the Meta Mask Browser Extension as cryptocurrency wallet. Smart contracts were developed using Solidity. Dapps were used to verify the project formation, and fund transfer processes.

4. FUNCTIONALITIES

4.1 Functionalities for NGO as a user.

- Connect to meta mask wallet and login into the NGO dashboard
- Click on create campaign to host a new event for which the NGO wants to raise funds and fill in the name, description and the amount to be raised in crypto (MATIC)
- View all donations received by donors on poly scan for all events
- View all events created by other NGOs

4.2 Functionalities for Donor as a user

- Connect to meta mask wallet and login into the donor dashboard
- View all active events to make donations

- Make donations to an event of their choice in crypto (MATIC)
- View all donations received by donors on poly scan for all events

4.3.1 WORKFLOW

The proposed system's entire workflow pattern is depicted in Figure 2. The following are some key details to note:

- There are two dashboards available (DONOR & NGO). If a user links their Meta Mask wallet to the Donor Dashboard for the first time, they will be logged in as a DONOR and will not be able to connect the same wallet to the NGO Dashboard. The same is true if an NGO account is created through the NGO Dashboard and subsequently can't log in from Donor Dashboard.
- If the user is an NGO, the user can request funding by submitting a proposal (NGO Campaign/Event).
- If the user is a DONOR, the user can donate crypto (MATIC in this case) to the newly created NGO Proposal. On Polyscan, the user can examine all of the donations that NGOs have received.
- The account balance and prior transactions are visible to both the NGO and the DONOR.

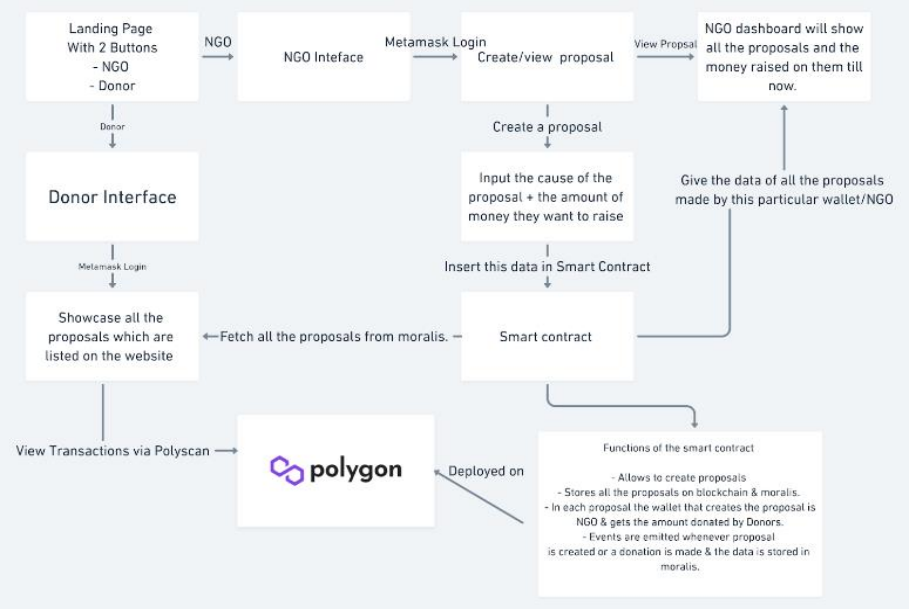

Figure 2. Workflow Flowchart

4.3.2 USERS Involved

- **NGO:** These are NGOs or charities in need of assistance.
- **Donors:** These are the entities that will review the needs stated by various NGOs, and will choose whether to donate to the NGO's cause or not.

The proposed website's landing page includes a detailed description of the system's purpose. Two dashboards are available, into which users may log in and link their crypto wallets for future usage.

To create a Charity Event, a user must first link their Meta Mask wallet to the NGO dashboard, following which a campaign can be created by filling out a form. The NGO would fill in the event's title, the amount of money intended to raise, and a description of the event. The Meta Mask wallet extension requests the user to sign/approve this transaction; if approved, the Event created will be permanently recorded on the Blockchain.
After creating an NGO Event, the NGO Dashboard will display the details of the events that the NGO organized as well as the total funds received thus far by that campaign.
Donors who have successfully integrated Meta Mask wallets can donate money. The donor is given two buttons: one to verify all the donations in detail and the other to donate to the charity as shown in Figure 3. If the donor clicks on the donate button, then a donation amount and a message to be sent can be entered into the campaign of their choice. Assets will be sent immediately to the NGOs wallet address after approval.

All donations are made using smart contracts, allowing donors to track the flow of their benefactions. Polyscan is a block explorer and a search engine for the Polygon network, allowing users to look up, confirm, and authenticate transactions. Figure 3 shows a list of an NGO's incoming and outgoing transactions, which may be viewed by any Donor who has previously clicked on the "View Donations" button.

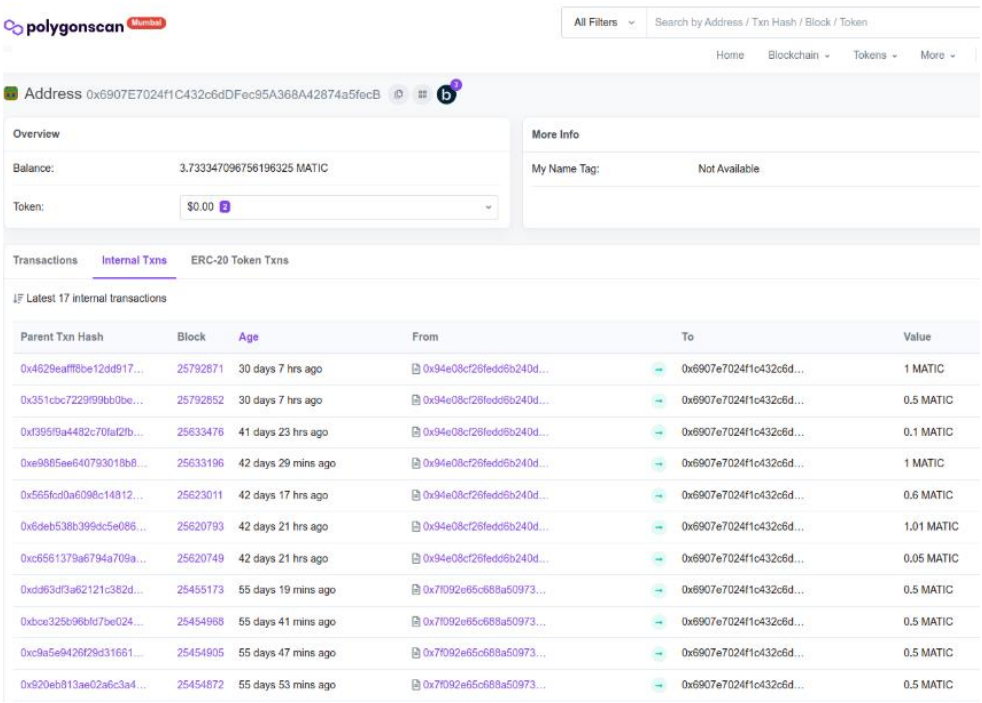

Figure 3. Polyscan results displaying all incoming and outgoing transactions to an NGO

5 RESULTS

The basis of our approach for charity, tracking its utilization, is blockchain. In the blockchain, all donations are recorded. Once recorded, they cannot be tampered with, allowing donors to see where and how their money is being spent allowing for the safe and transparent allocation and management of donations. blockchain technology does not require any third-party involvement. Because blockchain renders data open/transparent in ways that have not previously existed in financial institutions, many say that it might be utilised as the set of standards for transparency. Most consumer goods and service

companies are currently using this technology to safeguard their customers' data. In our case, the donor will be able to see the flow of his donation from the start point, to where it heads, and how successfully it goes into the charity's wallets without any tampering. The ultimate see-through option for all the donations ranks this platform's superiority against other online working camps.

6 CONCLUSION AND FUTURE SCOPE

Inadequate transparency, data security, concerns about individual trust are few issues with India's charity system that has to be resolved soon[11]. This study proposed a ground-breaking method to change the Charity framework by utilizing blockchain technology. The entire procedure will be more transparent as a result of this application. Users can donate to an NGO, and donors can view the donations that have been made, thus making them more transparent & secure.

Decentralized autonomous organization, or DAO, is a group of people that agree to follow certain norms to accomplish a common objective. Every DAO has a built-in treasury to keep its crypto assets, which members may only access with the group's approval, and group decisions are decided collaboratively over a specified period. Charity DAO's members will all have access to a single treasury. As a result, all funds/donations received by all NGOs will be deposited in the shared treasury. An NGO would have to create a "withdrawal proposal," which would have a voting period. If the proposal obtains more than 51% of the vote, the desired funds will be sent into the NGO's personal wallet from the common treasury. This feature increases security and is a better method to verify the authenticity of the NGOs.

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REDEFINING ENDPOINT SECURITY THROUGH NEXT-GEN MONITORING TOOLS

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Abstract.

Over the years, both attacks and attack patterns got significantly changed. There is an inclusion of a massive number of unknown threats exposed for the first time, zero-day attacks being one of the best examples of that. Endpoints are most vulnerable to attacks, and are the primary target of attackers. To give Endpoint more security, various new tools and techniques evolved, like Next-gen antivirus solutions (EDR, XDR, etc.), which have artificial intelligence-enabled and will observe behavior rather than just signature. This, in a way, has redefined the way we approach Endpoint security. One of the significant aspects of endpoint security is the monitoring tools that analyze all the endpoints and other security assessment points available inside the organization. They provide various attack indicators, including the attack pattern, tactics and techniques used, source and target of the attack, impact and risk mitigation steps. Multiple sensors and other detectors provide alerts of different severity, and the monitoring team takes steps based on that. Artificial intelligence becomes crucial here as it studies the history of the attack source and the target system or network. This paper analyses and enumerates these new techniques which enables the next generation end point security. We also describe the way in which these technologies can be plugged together to provide better detection results.

Keywords. Endpoint security, Monitoring tools, Endpoint Detection and Response, Artificial intelligence.

1. INTRODUCTION

Cyber-attacks are constantly evolving in sophistication and scale, reaching such an extent that the World Economic Forum considers it the second most threatening risk for global commerce over the next decade.[1] Endpoint security is the process of guarding against dangerous threats and online attacks on gadgets like desktops, laptops, mobile phones, and tablets. Businesses may defend against cyber-attacks using endpoint security software to secure employee work devices on a network or in the cloud. A company network connects endpoints with each other, such as a computer to a printer, and with internal structures, such as servers, databases, intranets, and extranets [2]

The state-of-the-art protection provided by security staff is typically using multiple tools to monitor different parts of networked systems for security. While each of these tools may provide unique information, they suffer from drawbacks: (a) they provide information limited to a specific view of a network, (b) operators must develop expertise in multiple cryptic tools that change frequently, and (c) multiple tools do not currently provide cross-cues or fusion for events in complex environment. [3]

When we talk about AI-enabled monitoring tools, logs are at the center of research. They analyse the logs more quickly and provide an in-depth analysis of the attacks. Some widely used tools like Security information and event management (SIEM) and Endpoint detection and response (EDR) have already enabled AI in most engines. That has provided a positive response from their client, and soon it is going to be a practice in the industry.

2. LITERATURE REVIEW

Successful endpoint security demands a proactive information security system rather than a reactive one to create and run the management tools for endpoint security of different OS-based devices and mobile devices. Improvements are also be made to the information security lifecycle for "Policy" to configure an endpoint, "Real-time protection" technology to detect and filter malware, "Detection" to confirm the occurrence of abnormal symptoms or threats, and "Remediation" to deal with and recover from the actual damage.[4] Endpoint security attacks are becoming more frequent and deadly. Thus, businesses need to be ready for the shifting tides of vulnerabilities and exploits as well as potential crises and emerging threats. Endpoint security requires ongoing attention, resources, and planning; developing and executing endpoint security strategies are just the beginning.[5]

The research states that by detecting or even stopping many cyberattacks in their early stages, advanced pattern recognition and correlation algorithms are making their way into security systems, this in particular. This reduces the potential impact of these attacks. Adopting frameworks that are both explainable and comprehensible must go hand in hand with the tighter integration of artificial intelligence and machine learning into present EDRs.[6] The open-source EDR is a low-cost security solution with high predicted value in terms of flexibility, use, and scalability. It can be utilized in next-generation digital platforms that develop hyper-connectivity, hyper-intelligence, and global scale. For the first time, according to MITRE attack, attack detection, and coverage analysis were made possible in this investigation by open-source EDR. A few stages displayed a low detection rate due to insufficient query settings to identify each stage's specific threats.[7]

Many aspects were taken into account when analysing the actual effectiveness of EPP and EDR. The EDR success rate is a crucial factor to consider when deciding whether or not to use this product. EDR is preferable when there is a high likelihood of success and a low likelihood that the risk will result in paralysis. EPP is preferable, though, if anything is different and either of the two requirements is incorrect. The majority of EDR providers can promise high success rates in both detection and defence, and the business must fend off the attack. To ensure the safety and security of a corporation, we firmly advise taking into account both goods.[8]

The primary objective is to determine how the monitoring tools have redefined endpoint security. How the endpoint security is more secure now and how it can tackle some of the most critical threats. This will also focus on the reactive and proactive models of threats and their mitigation steps. Zero-day attacks, Top trending attack patterns will be a crucial area of

research. During cyber-attacks, the decision-making process and mitigation plan are the most critical steps, as quicker identification will result in lesser damage.

3. ENDPOINT SECURITY

3.1. What has changed in Endpoint Security?

Endpoint security is a technique to secure the organization's entry points of end-user devices against ever-evolving cyber threat attacks. Mobile phones, Desktops, laptops, tablets, and other network-capable devices are the primary endpoints being secured.

In the past, a server on the company's internal network was used to implement traditional endpoint protection. The endpoint server updates every network endpoint's installed endpoint software. The endpoint server not only sends endpoint updates but also serves as an authentication server, confirming connections outside and inside the network. How is endpoint security changing to tackle these threats, given the ongoing changes in the threat landscape and attack vectors?

The evolution of endpoint security over time and various trends that can be foreseen for the future will be examined in this paper. We will also examine certain endpoint security technologies and solutions and how they're affecting the way endpoint defensive mechanisms operate.

3.2. Moving from traditional antivirus to next-gen antivirus

Endpoint security has redefined itself throughout time, moving from conventional signature-based antivirus software to more sophisticated next-generation antivirus solutions that leverage sophisticated and automated technology, better endpoint detection and response, and the Operating System oriented Positive Security strategy.

Earlier, most endpoint security protection was provided by installing antivirus software, which was only as effective as its antivirus signatures. This had been the situation for as long as antivirus software had been used to defend endpoints. However, recently most things have changed, and malware is now capable of considerably more nuanced antivirus evasion. The endpoints need to be secured more effectively.

Traditional AVs had the significant drawback of requiring frequent virus signature updates, making them only as effective as their available updates. However, next-generation antivirus software introduced a method that made it possible to identify malware based on machine learning and artificial intelligence rather than signatures. This has become more prevalent in the last decade, and since then, it has grown significantly. Table 1 explains some of the major upgradation happened in NGAVs.

Even after the emergence of the Next-Gen Antivirus solution, there are still some concerns around endpoint security listed *below.*

1. Since NGAVs are only being educated on current malware, their inability to detect zero days and brand-new malware.
2. Inability to detect file-less malware since NGAVs can only perform static file analysis and are not signature-based.
3. The drawback of artificial intelligence is that attackers use it for bad purposes. Hackers using artificial intelligence, thereby rendering them ineffective, can create Malware that cleverly avoids NGAVs.

Table 1. DIFFERENCE BETWEEN TRADITIONAL AND NEXT-GEN ANTIVIRUS SOLUTION

Traditional Antivirus Solution	**Next-Gen Antivirus Solution**
Using Signature to identify the attacks.	Using behavior to identify the attacks.
Usually it relies on the hardware and that needs to be installed at the physical premises.	In this cloud-based solution is available where there is no need for hardware or software specifically.
Its focus is on detecting malicious activities at the endpoint alone.	It generally uses a larger variety of threats, which includes modern-day attack vectors.
Operational costs are high	Less operational costs
Unable to detect unknown threat as it uses only signature database to identify the attack.	Using the latest technology, it detects the anomaly of the file and thus able to cater unknown attacks too.

3.3. Emergence of Next-Gen Monitoring Tool

Monitoring tools play a vital role in detecting and responding to cyber incidents as they are the first line of defence for any organization. Endpoint detection and response(EDR) provides visibility into most of the problems left across by the antivirus solutions. Security departments can now use EDR solutions to perform console alerting and reporting, advanced response to security issues, expand geographic support over vast regions, manage detection and response, and one of the most crucial capabilities to date: third-party integration.

Security teams now have the insight they need to find problems that might otherwise go undetected due to EDR security solutions, which keep track of all endpoint, workload activity, and events. Continuous and thorough visibility into what is occurring on endpoints in real time must be offered by an EDR system. An EDR tool provides sophisticated threat detection, investigation, and response capabilities, such as alert triage, threat hunting, suspicious activity validation, incident data search, and suspicious activity validation.

Alongside EDR, there are multiple other technological advancements like XDR and MDR, which talks about the broader coverage of endpoint security. Not only do they provide

additional security features, but also they cover more attack surfaces too. An enterprise may proactively defend itself against cyber threats due to the next-generation cybersecurity technology XDR (Extended detection and response). It achieves this by giving unified visibility across the various attack channels that a cyber-threat actor might use to target an enterprise's network. A security-as-a-service option called MDR (Managed Detection and Response) was created as a replacement for an internal Security Operations Center (SOC). An MDR solution gives business access to the tools and security knowledge it needs to defend themselves against online attacks.

Security information and event management (SIEM) is yet another crucial monitoring tool that most organizations adopt. It provides visibility into entire systems and networks from a centralized dashboard which helps to detect and respond in a faster WAY. MACHINE learning and other AI-based approaches are used by next-generation SIEMs to speed up the identification of dangerous activities. This methodology of using advanced technology is known as User and Entity BEHAVIOUR Analytics (UEBA). This monitors every system activity to determine what constitutes "acceptable BEHAVIOUR." Alarms are raised when these criteria are violated. The tactic is a triage method to concentrate on potential hazards for further investigation. ON-BOARD advancements accelerate the initial detection of a zero-day attack in detection techniques. The threat information is promptly submitted to the intelligence pool and downloaded for immediate action by other Next Generation SIEMs worldwide.

4. ARCHITECTURE OF A NEXT-GEN MONITORING TOOL

With the rise in cyber threats, monitoring tools are coming with more advanced and customized features for their clients. These include the integration of all the devices and technologies across the network into a single consolidated tool, such as next-gen SIEM or EDR. With the help of this, clients can see all the alerts and incidents in a centralized console which is easier to monitor.

Figure 1 demonstrates a typical architecture of how a Next-Gen security monitoring tool and the components that it possesses. These tools dive deep into the prevention and detection of malicious alerts.

4.1 Activities involved inside prevention

Prevention of threat actors is the initial yet critical element of any next-gen monitoring tool. This possesses various techniques like mobile device management, Host intrusion prevention system (HIPS), Patch management, firewall and proxy policies, Encryption of data, Vulnerability Management, Device Application, web application control, etc. Mobile device management includes policies that revolve around the removal of media, storage media, and all other devices which carry information outside the organization. Security of these devices and proper reporting of unauthorized activities should be alerted appropriately inside the tool. A host-based intrusion detection system is not only capable of monitoring the alert but also provides in-depth analysis of their response through the host and network segmentation. Another key component of these tools is the management of firewall and proxy policies. They help in the prevention of network-based attacks by fine-tuning alerts. This tool also offers Vulnerability management services in order to protect the infrastructure beforehand. Overall, the Prevention component within any next-gen monitoring tool aims at protecting the infrastructure before the attack by removing the vulnerability, securing it from the threat actors, and mitigating the risk.

4.2 Activities involved inside detection:

Detection is the backbone of any monitoring tool as they provide the information to the first line of defense. It helps the team to analyze the threat actors and their sources in order to find the root cause. The initial phase of detection starts with incident management, where the incidents are managed and segregated based on the priority of the alerts. Another aspect of detection is the handling of false positives, as they are one of the key concerns for any security monitoring team. These tools help in reducing false positives through the use of behavior-based technologies like AI and ML. Real-time monitoring is another key feature and constitutes threat hunting and modelling to a greater extent. These tools also do the detection of malicious scripts and source code reviews. In the end, it provides a centralized console where we can analyze and monitor all the alerts and key information related to those..

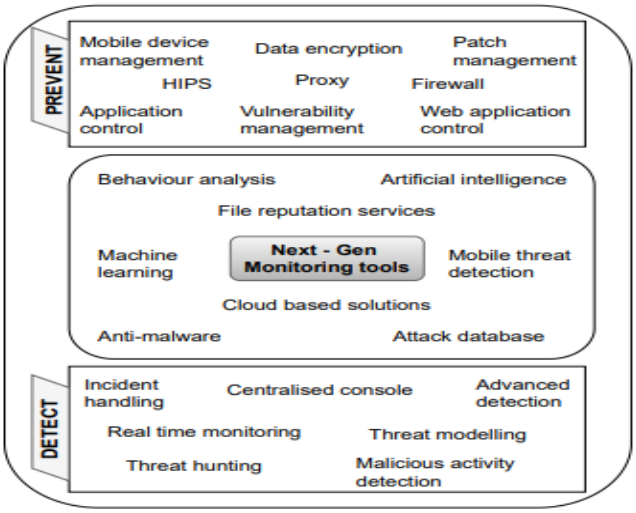

Figure 1 : Architecture of next-gen security monitoring tools

The above-mentioned architecture is just a visualization of the key components inside any next-gen monitoring tool. This may vary from vendor to vendor and technology to technology based on the need of the client environment. However, most of the elements will remain in the tool in some or the other way. The threat database will also change based on the vendor as indicators of attack (IOC) will not be the same for each tool.

5. HOW EFFECTIVE ARE THESE MONITORING TOOLS AGAINST THE CYBER-ATTACKS?

Every day, new attack tactics and vulnerabilities are found. The company probably has firewalls, IDS/IPS, and antivirus programs that scan the IT infrastructure from the perimeter to the endpoints for indicators of Suspicious activity. Many of these solutions, meanwhile, lack the ability to recognize advanced persistent threats and zero-day attacks. The organizations may already have monitoring technologies like SIEM, which combine data from all security measures into a single correlation engine, but which also have the potential to generate a significant number of false alerts, i.e., false positives. As a result, it's crucial to

fine-tune the monitoring tools and offer meaningful information for incident response and real-time threat detection.

These monitoring tools provide a higher level of protection by ensuring more endpoint visibility, fetching details from threat databases, and using behavioural protection. Using only signature-based techniques or indications of compromise (IOCs) results in "silent failure," which paves the way for data breaches. Behavioural techniques that look for indications of attack (IOAs) are essential for effective endpoint detection and response because they let us know about a suspicious activity before a breach takes place. All these features are inculcated in next-generation endpoint security monitoring tools. As we know, nothing is fully secured in cyber security, yet these tools provide a significant amount of security against threats.

6. CONCLUSION

Throughout the research, we have tried to analyze endpoint security according to the current trends and also studied the evolution of endpoint security in phase wise manner. In the initial phase, traditional antivirus was more vigilant for securing endpoints, but with the more advanced threats, these search engines got many loopholes. Furthermore, we described the next-generation antivirus tools like EDR, XDR, MDR, SIEM, etc. Also, we highlighted their effectiveness against advanced cyber-attacks.

Although there are some concerns regarding the effectiveness of these monitoring tools, they still provide mainly real-time analysis and detection, which has made the jab of the defence team relatively smooth. The evolution of tools and their associated search engines protect huge umbrellas of threats. The usage of advanced technologies like Artificial intelligence, Machine learning, Internet of things has made a significant contribution to accuracy as well. No matter their size or industry, firms in the twenty-first century operate in a dangerous environment. Threats to cyber security that existed 20 years ago are now a reality. Whether we like it or not, cyber-attacks will stay prevalent and are probably going to get more frequent and more intense in the future. Despite the fact that there are a number of defences against these threats, we might argue that monitoring and identifying cyber security threats is one of the best ones. It entails taking a proactive approach to problem-solving by seeing problems early on before they become much worse.

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Biographies

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Nisha T N is an Assistant Professor at Symbiosis Centre for Information Technology (SCIT), a constituent of the Symbiosis International University (SIU), Pune. She is a Graduate in computer science from Calicut University and Post Graduate in Computer Management from Pune University, India. She completed PhD in Computer Science from Symbiosis International University, her research in the area of Information security, specialized in network intrusion detection and has a teaching experience of ten years in the areas such as information security, programming, Algorithm analysis and data structures.

Survey Paper on Banker's Algorithm to Remove Deadlock

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Abstract- It is common knowledge in the computing field that computers can accomplish multiple tasks at once. In breaking deadlocks, the operating system is crucial. You must remove deadlocks correctly in order to accomplish your multitasking objectives. Bankers' Algorithm is used for allocating resources and removing the deadlock, that evaluates all resource requests made by processes, checks to see if the system corresponds to a safe condition after granting the request, and then approves the request if the system corresponds in a safe state otherwise, checks to see whether any potential pending processes exist before putting the system into a S state. . The paper is on different surveys to remove the deadlock in Banker's Algorithm and also to know which process needs what instant of resources and also increasing the number of processes.

Keywords- Banker's Algorithm, Safe State, Request Response Algorithm, Dynamic Approach, Max.

1. INTRODUCTION

1.1 Deadlock

When all of the processes in a set are awaiting an event that can only be triggered by one other process in the set, a stalemate occurs. A deadlock happens when two programmes that are using the identical resources block each other from using it, which causes both programmes to abort working. One programme could only run at a time on the first computer operating systems. When a number of processes is in a wait state, a deadlock happens because every process is expecting a resource that is being managed by another process which is in still condition. As a consequence, all deadlocks involve competing demands for resources from more than processes.

Deadlock Occurrence Conditions

Deadlock occurs when four conditions are met simultaneously.

i. Mutual Exclusion: As there is only sufficient area for one person in the landings, it

is not possible for two individuals to pass each other. The first requirement for the progress of the deadlock is that just one person (or process) is able to get access (or resource) between them.

ii. Hold and Wait: Holding is when two people waiting for their ground and deny to back down.

iii. No Pre-emption: To remove the deadlock, one need to only abandon one process, in order for the other to proceed to execute. The Operating System, however, does not. The processors are provided with the resources for as long as is required till the task is finished. The resources are not provisionally reallocated as a result.

iv. Circular Wait: This is what happens when two persons deny to to give back and wait for the other to do so that they can complete their duty.

1.2 Deadlock Handling Methods

To prevent a system from deadlock, the two techniques are applied.

i. Deadlock Avoidance

This is attained by preventive the approaches via which a request may be done. We work to evade any one of the four conditions listed above since a draw only happens when all four are true.

ii. Avoiding Deadlock

The deadlock avoidance process looks at the resource-allocation state whenever a process ask for a resource. The request is processed unless allocating that resource leaves the system in an unsafe state.

As an output, it requires more particulars, such how many resources of each type a process needs. To prevent a deadlock, the system must return if it reaches an unsafe state.

1.3Banker's Algorithm

This algorithm simulates resource allocation for present maximum feasible amounts of all viabilities before doing a "s-state" check to search for prospective activities and deciding whether allocation should be continued or not further.The banker's algorithm gets its name from the fact that it is used in the banking industry to decide whether or not to approve a loan to an individual. Assume a bank has n account holders with a total of S in their individual accounts. When someone applies for a credit, the bank first minimizes the requested credit value from the total amount of money it has, and only the requested loan value is granted if the left sum is more than S.

Assume that there are n processes in the system and m different resource kinds.

Available:

It is an array of 1 dimensional of size 'm' that lists the total amount of resources of each type that are accessible.

Available [j] = k indicates that the resource type exists in k instances.

Algorithm for Safety

The following is a description of the algorithm for determining whether a system corresponds to safe state:

1) Assume x and y are two vectors, m and n, respectively.

Start with W = A. (W-x, A- Available.)

x[i] = false; where I = 1 through n

2) Locate an I such that x[i] = false in both cases.

Need(i) = W; in the absence of such, proceed to step (4)

3) A[i] = W+ W

Move to the next, if finish[i] is true (2)

Algorithm for Resource Requests

1) Start with the procedure.

2) If Request(i) >= Need(i)

otherwise, give a wrong condition because the process has made more claims than it can handle.

2) If Available > Request(i)

If you skip step (2), P(i) will have to wait since the resources are not available.

3) Change the state in such a way that the process appears to have given P(i) the requested resources:

Banker Algorithm Improvements

When certain processes move into the wait state, the banker algorithm does not have a viable method for providing a secure sequence. A safe sequence is offered by the wait state process
algorithm.
As to how it operates: Following the resource request procedure, the process must carry out the following steps if it enters the wait state:

Step 1: Demand(m) and Demand are compared in (m+1 to rearmost). increase.
Step 2: Execute the procedure with the greatest allocation and the least amount of necessity.
Step 3. Put the process into action. Set state if it's possible.
Step 4: Obtainable=Obtainable + Assignment in step four.
Step.5: Continue performing steps 1 through 4 until the Process as a whole enters the Running condition.

2. LITERATURE REVIEW

[1] In this paper a new O(n) (PBA) with an ideal running time of O is proposed in this study. The strategy was implemented in hardware, named the PBA unit (PBAU), using Verilog HDL, and its complexity of runtime was confirmed. It is an intelligent property (IP) block that gives multiprocessor system-on-chips (MPSoC), which are anticipated to rule future high-performance computing environments, a very quick automatic deadlock avoidance technique.

[2] The technical aspects of allocating or redistributing resources are crucial. By doing this, processes are prevented from using and reserving resources that are required by other processes. Without effective management of the allocation and deallocation of these two jobs, many processes would starve themselves of resources while they wait for the system to allot resources and are held up by processes waiting for more resources. When a process runs into a deadlock situation and runs out of resources, it can find itself in a perilous state where it cannot finish its execution.

[3] According to the author, private higher education includes private universities as a significant component. Undergraduate electives come in a variety of forms. Classes are filled to capacity with interdisciplinary students. At the end of the semester, those with few resources face enormous difficulties. A dynamic deadlock algorithm removal technique is the Banker algorithm.

[4] According to the author, private higher education includes private universities as a significant component. Undergraduate electives come in a variety of forms. Classes are filled to capacity with interdisciplinary students. At the end of the semester, those with few resources face enormous difficulties. A dynamic deadlock algorithm removal technique is the Banker algorithm.

[5] In this paper, two fresh approaches to preventing deadlocks in concurrent systems are presented. Use of the suggested method to describe a flexible manufacturing system with Petri nets. Both approaches are based on an understanding of the process structure and are upgrades to the conventional Banker algorithm. The Petri net model's size polynomial comes first. The second may involve non-polynomial costs and is highly reliant on the number of alternative processing methods for the portion.

[6] In paper [6], author tells to breakdown trees in regions and determine the related overall resource demands earlier to process execution, they presented a quadratic-time approach. With the original banking algorithm, this data is utilized during runtime to assess the system's security. However, this method was not practical and could not identify resource-related calling patterns.

[7] A deadlock avoidance technique for wait state systems is presented. This approach improves on Banker's algorithm. There is no effective strategy for sorting waiting processes in the algorithm of the banker after a process enters a wait state (FCFS is not good enough). This study offered a methodology that selects waiting processes to run while taking into account the no. of allotted resources or the number of possibilities and the resource's demand.

3. COMPARISON TABLE

TABLE. 1 COMPARISON TABLE

Sr No	Authors	Year	Title	Conclusion
1.	Jaehwan John Lee and Vincent John Mooney III	2005	A Novel O(n) Parallel Banker's Algorithm for System-on-a-Chip[7]	The study presents a revolutionary Parallel Bankers Algorithm for multi-situation, multi-resource systems together with the hardware implementation of the PBA
2.	Dushyant Singh Mrinal Gaur	2009	Implementation of Banker's Algorithm Using Dynamic Modified Approach[1]	The algorithm specific activity requires and tells weather it is in safe order or not., making it very simple to add the required resources to the process and address the issue.
3.	Lambert Kekebou Erefaghe	2021	Illustration of Safe and Unsafe State Using Transition Table and Java Simulation [2]	The concept of deadlocks is very important in advanced stages of technology development, especially software development, and a clear understanding of them
4.	LI Jiang	2019	Application Research of Banker Algorithm in Teaching Arrangement in Independent College[3]	The banking algorithm is introduced and its implementation in the university course planning system is performed, A dynamic method of avoiding deadlock is the Banker algorithm.
5.	Xu Gang Wu Zhiming	2021	Deadlock Avoidance Based on Banker's Algorithm for FMS[4]	In this paper, a deadlock avoidance technique for FMS is suggested. The standard Banker algorithm is the foundation of this approach

6.	F. Tricas J.M. Colom J. Ezpeleta	2000	Some Improvements to the Banker's Algorithm Based on the Process Structure[5]	The traditional Banker technique for concurrent systems deadlock avoidance received two upgrades from authors. The fact that authors are aware of the system's process structure inside the FMS application

4. GRAPHS OF COMPARIOSN

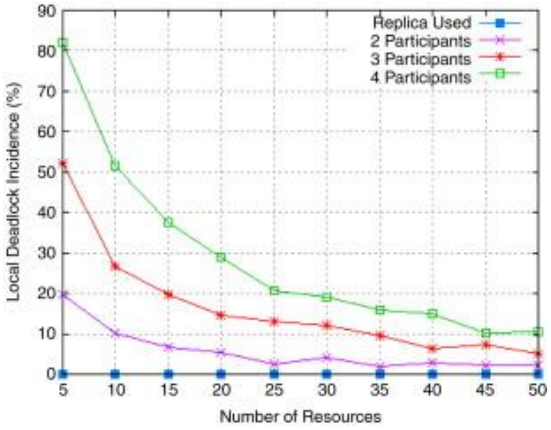

Figure 1 Deadlock Incidence based on no. of resources.

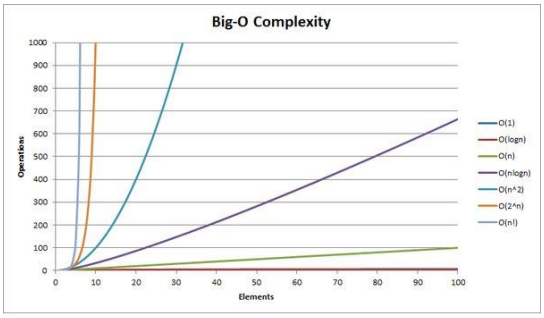

Figure 2 Comparison with time complexity(O)n.

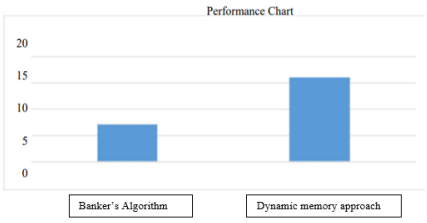

Figure 3 – Comparison Graph for Bankers Algorithm and Dynamic modified Approach

5. SCOPE OF IMPLEMENTATION

In this research, we discussed the importance of banking algorithms for breaking operating system deadlocks. The concept of deadlocks is very important at these advanced stages of technological development, especially software development, and a clear understanding of them provides principles for dealing with deadlocks in various areas of computing, networking, and computer science. It is an important asset to understand. Computer technology applied in industry.

6. CONCLUSION

The Banker algorithm is demonstrated to work in this study. This is done in order to pinpoint the issue with the original algorithm that led to the process execution failure. Therefore, the Dynamic Approach has resolved the Banker's algorithm's existing issues. The outcomes demonstrate that the modified banker algorithm identifies the kind of additional resources that are required for this specific activity. With this method, it is pretty simple to add the required resources to the process in order to remedy the issue because it also indicates whether everything is in safe order or not.

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Biographies

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A Review on Modified Residual Energy Aware for Electing Optimal Cluster Head Selection in Wireless Sensor Network

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Abstract

WSNs are a collection of specialized transducers that provide sensing services to IOT objects that have limited power and storage. Because it is practically impossible to replicate or recharge batteries in sensor nodes, energy consumption is one of the most significant design concerns in WSN. The clustering technique is crucial for power conservation inside an energy-constrained network. Picking the right cluster head can assist in network load balancing, saving energy usage and boosting longevity. The study is focused on a cluster head election mechanism that can be used in IoT fields such as environmental surveillance, smart cities, and systems. WSN apps have dramatically advanced in recent years. Clustering is a technique used in WSNs to extend the network's lifecycle and improve operational processes. Every cluster elects a leader, referred to as the Cluster Head. Optimized grouping has the potential to save a lot of energy in the system. The authors of this paper discussed a variety of clustering protocols for WSN.

Key Words— Wireless Sensor Networks, Internet of Things, Cluster Head selection, Residual energy, Network Lifetime, Energy efficiency.

I. INTRODUCTION

Internet of Things (IoT) is a collection of networked devices and objects that can send and receive data over the internet. It's an impenetrable but smart network that detects, manages, and can be configured to connect with one another via embedded system. IoT offers great efficiency and productivity by providing immediate access to data about any object. Approximately 5 billion smart gadgets have been connected to date. The number of persons who are actively communicating may outnumber the number of devices/machines with whom they are virtually connected. This will result in massive traffic, with humans becoming the minority of traffic creators and recipients. Because of the challenges and potential that IoT presents, it is being investigated for numerous study topics [1].

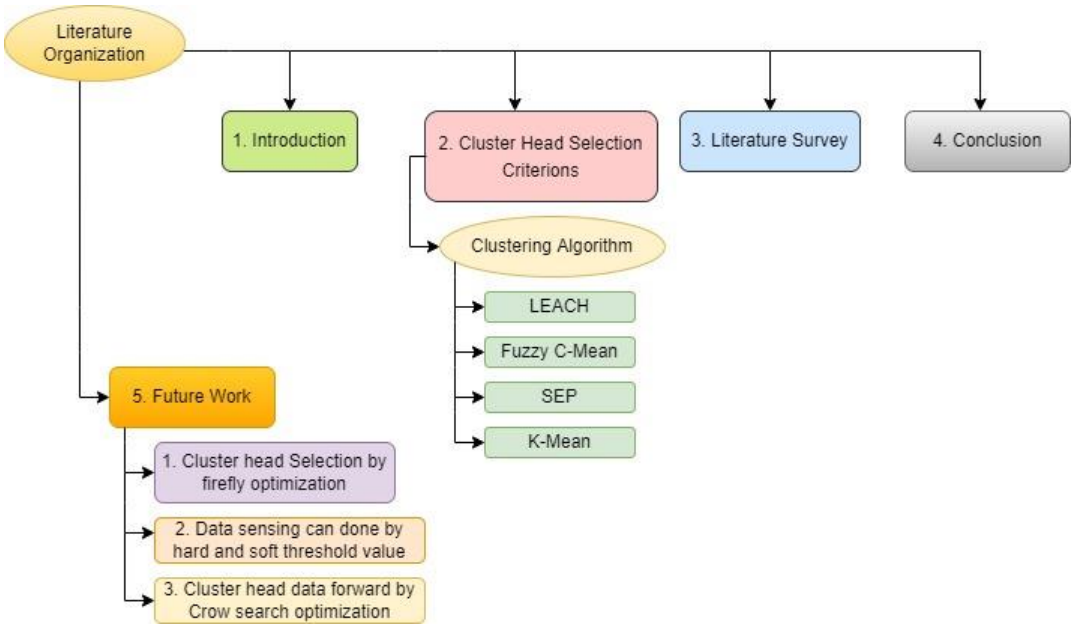

Figure. 1. Workflow of Paper

Wireless sensor networks (WSNs) have developed as a rapidly expanding topic in wireless transmission. Narrow, limited, and smart sensors are placed in immediate environments and interconnected through wireless channels, providing new potentials for detecting physical traits such as motion, stress, temperature, and attacks, among others, thanks to new advancements in Micro-Electronic-Mechanical Structures and interaction devices. It can be used in a wide range of applications, including army, commercial, farming, traffic enforcement, atmospheric or ecosystem monitoring, and other essential domains. WSN design concerns differ depending on the applications since WSNs are application-specific. A wireless sensor network is a self-organizing ad hoc system composed of multiple sensor networks. A device's ability to self-organize allows it to join new nodes without the need for user intervention [1]. These networks are composed of a variety of small, low-cost sensors called nodes, and also one or even more base stations called sinks. The BS receives data from these nodes.

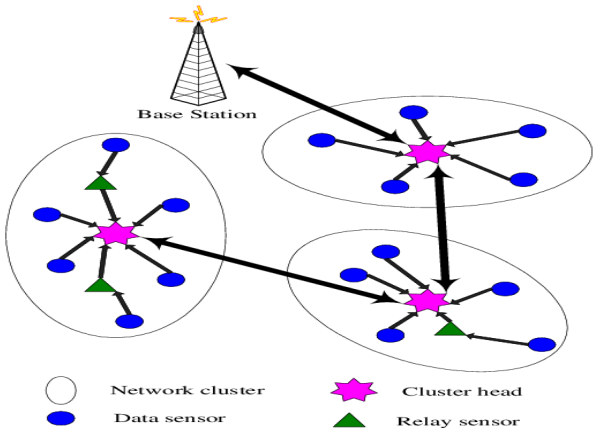

Figure. 2. Architecture of WSN

These sensor nodes are used in a wide range of settings, including commercial, civil, climate, and intelligence data collection [2]. A Sensor Node is an implementation for a pair of different low-power self-sufficient machines that can sense, calculate, and broadcast signals in order to acquire local knowledge and make global judgments about their physical environment.

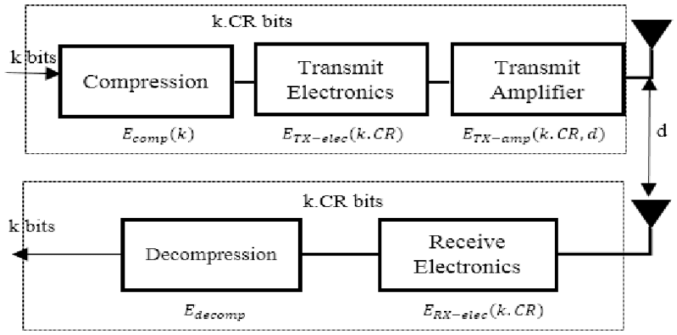

Figure. 3. Radio Energy model

Characteristics of Wireless Sensor Networks

1. All wireless sensor network use data transfer or multi-hop transfer to communicate with the BS.
2. SN detects conditions at predetermined intervals in different locations and always has data to send to the BS.
3. Sensor Nodes are grouped together in what is known as a cluster. The Cluster Head gathers information, and the BS retrieves information that has been stored.
4. The WSN lifespan is the amount of time it takes for the initial SN to lose energy.

The practice of grouping several sensor nodes is known as clustering. The CH is the administrator for each cluster. Cluster members decide who gets a CH. This CH collects and sends data from cluster nodes to the destination (BS) [3]. To boost longevity and extensibility aims, clustering algorithms are commonly used. A hierarchy that reduces the load of communicating with the BS could be built using a variety of clustering algorithms [4].

In IoT-based Wsn applications, significant source content, redundant data, changing network size, less trustworthy medium, heterogeneous network, and multiple BS or sink units often provide significant challenges to Qos parameters [6]. Security challenges in WSN [7] include data authenticity and encryption, integrity of data, and information crispness. When designing WSNs, lowering power consumption always has been a top priority. Recent research has yielded a variety of approaches for reducing energy use and extending network longevity in order to maximize resource utilization.

Selecting a CH is tough since numerous variables must be considered while determining the best node inside the cluster [9]. There are several factors to consider, including the range among nodes, remaining energy, agility, and capacity of each node. Clustering is the process of forming a hierarchical system of set of groups of sensing devices which receive and process data to CH. After that, the CH aggregates the data and sends it to a mobile sink, also called as a base station (BS), which serves as a link between both the end user and the network. As a result, this work is organized so that Clustering Algorithms & Protocols for WSN are included in part II. The literature review is explained in Section III, and paper is concluded in Section IV.

II. CLUSTER HEAD SELECTION CRITERIONS

Clustering in sensor nodes is widely proposed by research community to address sensory network scalability, energy, and life challenges [11]. A community of cluster nodes is made up of the cluster's head (selected leader) and local interactions between members. Cluster members frequently interact with the cluster's leader, who collects data and mixes it with energy efficiency [13].

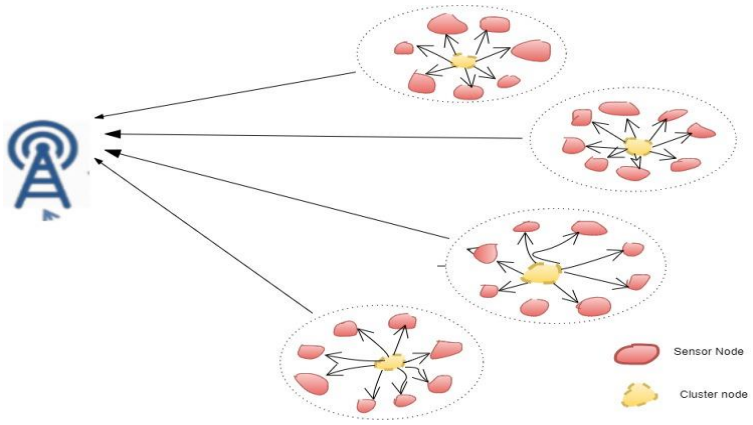

Fig. 4. Cluster head Selection

Clustering is most often used energy consumption methods. groups are formed by sensor's nodes [6]. Each group has cluster leader as well as some node members. Member nodes forward their detected information to the heads of their clusters. Cluster head gathers all of the data, aggregates it, and then sends it to the BS [7]. When compared to regular sensor nodes, each CH [8] depreciates at a rapid rate. This condition is made possible by making Cluster Heads (CHs) dynamic. Clustering is the grouping of entities that are linked [9], and clustering procedures include searching for similarity and pattern grading using unsupervised learning techniques [10].

CLUSTERING ALGORITHMS

a) **Fuzzy c-Means:** The FCM [14] methodology divides a sample into n-clusters, with each data point in its own cluster. The FCM clustering technique is implemented in FORTRAN IV [15]. The FCM program covers a broad spectrum of geostatistical research issues. This method generates varying parts and prototypes for each numbered data set. These divisions are used to confirm or imply a previously unknown data structure. The clustering criterion for aggregating subsets is a generalized function. Based on these findings [3] implemented a fuzzy value index based on furious compactness, segregation, and a penalty feature to ensure that the value of the clustering index never monotonously decreased and that the number of groups was nearly zero when items bordered, resulting in the loss of robustness and decision-making functionality.

b) ***LEACH:*** It's a TDMA-based MAC technology that combines grouping with a network routing algorithm. Sensors are installed in LEACH, and the CH is performed by a single node. A hierarchy protocol is used to extend a wireless network sensor. The lead cluster collects and compresses data from each node to the BS. Authors [18] provided a clustering strategy for constructing a routing tree that is both efficient and energy efficient.

c) ***Stable Election Protocol (SEP):*** The SEP protocol is an enhancement to LEACH protocol. It is a heterogeneous protocol that extends the period before the first node dies, which is useful in a variety of situations. To make the most of the system's energy, several clustering strategies are described. These two hierarchical clustering-based routing protocols [3] are clustering techniques that primarily broaden system lifetime. SEP is one of the suggested energy efficiency algorithms.

d) ***K-means Clustering****:* K-means clustering [14] finds groups in data, with group numbers shown as variable K. depending on supplied variables, procedure allocates every point of data to a group of K repeatedly. The data instances are clustered together on basis of how competitive their qualities are. K-means algorithm calculates k centroids and assigns each instance to the closest group, keeping the centroids as small as possible [10]. The 'means' in K-means relate to the data's mean; that is, to determine the centroid. The suggested algorithm's efficiency is calculated using a variety of performance metrics. For optimal cluster evaluation, a cluster strategy based on K-means and ant lion optimization (ALO) was invented.

III. LITERATURE SURVEY

Table 1: List of Literature Survey Table in WSN [1-15]

Literature Table			
Sr.no.	**Author**	**Methodology**	**Limitation**
1.	**Trupti Mayee Behera et al.,[10]**	Modified LEACH protocol.	Choosing an energy-efficient routing algorithm, restricted to limited CH parameters network lifetime ,throughput , energy utilized and dispatched
2.	**Ali Abdul et al.,[12]**	CH selection with rotation mechanism (CHSRA), modified FCM algorithm(M-FCM)	To improve protocol by upgrading FCM algorithm and CH selection goal function by using a weighted energy-based distance.
3.	**S. M. Mahdi et al.,[13]**	Grey wolf optimizer (GWO), fitness function.	There is no energy waste prevention, no fault tolerance mechanism, and no other quality of service (QoS) metric than lifetime.
4.	**Mishra et al.,[15]**	Optimal Cluster Size Selection-based Clustering Protocol, FIS (fuzzy inference system)	Limited computation complexity, network performance suffers the consequences of the death of lesser amount of nodes, and network performance suffers consequences.
5.	**Rajnish Kansal.,[4]**	ACS algorithm, K-means clustering, Fuzzy-leach	It withstands failures, has no route computation overhead, and provides steady and optimal clustered structure performance.
6.	**T. Sharma.,[7]**	LEACH-Fuzzy Clustering (LEACH-FC) protocol	When compared to LEACH, EEDCF the energy efficiency has improved, resulting in lower energy usage
7.	**V. Loscrì.,[9]**	ECHSSDA protocol	On basis of energy consumed, it was better than the LEACH and LEACH-C protocols.
8.	**G. Smaragdakis.,[8]**	Particle Swarm Optimization (PSO) technique for energy-aware clusters generation	Due to the limited ability to deploy sensor mobility in larger dimensional regions, the distributed PSO-application will be the focus.
9.	**K. Pawar., [7]**	Energy-LEACH and multihop-LEACH protocols	The Energy-LEACH protocol takes into account residual energy heads and employs multi-hop communication among the cluster and sink.

10.	**W. Heinzelman.,[2]**	ANP (Analytical Network Process) assessment tool used for CH choice	The approach can be employed for various scenarios in IoT based processes, such as ZH selection for further variables for which nodes are portable and change their stance.

IV. CONCLUSION

The choice of cluster head has major effect on network performance, service, and dependability. This necessitates large no. of clustering protocols in wireless sensor networks. Clustering methods are critical for maintaining uninterrupted connectivity between network nodes. Clustering protocols for WSNs are classified in a variety of ways. Several clustering algorithms for WSNs are presented in this research. As a result, in order to extend the network's lifespan, building a residual-based energy-conscious technique is critical. This study presents a comparison of several well-known WSN protocols. Its ongoing evolution has resulted in a large body of knowledge in this field. The cluster-dependent protocol is a low-power method of selecting and transmitting information to the CH. This study looks at a number of energy-efficient clustering algorithms used in the wireless sensor industry. The paper also looks at LEACH, K-means, and SEP, which are all energy-saving cluster algorithms. These algorithms' main purpose is to reduce energy usage while increasing network longevity.

V. FUTURE WORK

In this paper future work can be expanded by First modification will be done based on way cluster head is elected. While current protocol uses no. of optimum cluster heads as well as energy of nodes as parameters for CH selection, proposed protocol would use Firefly optimization to do so. The residual energy of node and its closeness to cluster members would be taken into account in this. Second modification will come in the form of data sensing where we will be used the concept of hard and soft threshold values of the data sensed by the nodes.

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Comparative Analysis of Different Text Summarization Models

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Abstract

Text summarization has long been a subject of conversation in academics. Despite the fact that various strategies for automatic text summarization have been developed in recent years, efficiency remains a challenge. The ever-increasing bulk of textual content needs the development of a method to retain the information in a condensed manner with little information loss. Given the increase in the size and number of papers available online, an efficient automatic news summarizer is an absolute necessity. This study proposes a pipeline of procedures for generating lossless summaries. There are 2 types of summaries: extractive & abstractive summaries. The extraction method identifies and extracts only relevant sentences from the original document. Abstractive summarization techniques, on the other hand, create the summary after knowing the source text, which makes it more complex. This study compares some transformers architecture based pre-trained models for summarization of text.

Keywords - Abstractive Text Summarization, BART, PEGASUS, ROUGE, Transformers, T5.

1. INTRODUCTION

If no one reads your work, it makes no difference how much information you include. Any summary can help a reader decide whether or not the subject is worth learning more about. Text summarization is a time-saving approach that may be combined with data extraction and filtering software. It is necessary to condense textual data into shorter, focused summaries containing crucial features to travel through it more effectively. Despite the fact that numerous methodologies for news summarization have been developed over this time, absolute efficiency has yet to be achieved. The amount of today's information repository is significantly bigger than one can readily and efficiently handle. Business transactions, news stories, satellite data, digital media, written reports and memoranda, and biological data are all examples of this. Furthermore, in current times, everyone wants to get more and more in a shorter amount of time. Therefore, reading large texts and then trying to understand them is not a smart idea. It is more worthwhile to read the synopsis of a large text while retaining the topic or key information provided within it. As a result, greater and greater data can be acquired in less time. The need for efficient data mining methods is increasing by the day. Hence, devising a technique for automatic text summarising that is not just time-saving for the reader, but also efficient, accurate, and feasible.

2. LITERATURE SURVEY

The research by Tadashi Nomoto provides a Bayesian model for text summarizing that explicitly encodes and uses information about how human judgements are dispersed across the text. Using test data from Japanese news texts, a comparison to non-Bayesian summarizers is done [1]. Amir

Jalilifard et. al propose STF-IDF, a unique connotation technique build using TF-IDF, is suggested for rating word weightage in a corpus of natural writings [2]. Mike Lewis et. al propose BART, a de - noising autoencoder used for the pre defined training of sequence-to-sequence models, is presented. BART is learned as first distorting the textual data with a random noising algorithm and later generating the model so as to retrieve the actual text. BART makes use of standard neural network translation architecture, which is based on transformers that, although being straightforward, may be thought of as generalizing BERT, GPT and then a variety of alternative recent pretraining approaches [3] Colin Raffel et. al in their paper delves into the area of transfer learning methodologies, by presenting single scheme which converts all text-based linguistic challenges in a text-to-text form. On hundreds of language understanding tasks, our structured research examines pretraining goals, model architectures, transfer methodologies, and many more other parameters [4]. Jingqing Zhang et. al introduce pre-training huge encoder-decoder models based on transformers, on "vast text corpora with a novel self-supervised aim. PEGASUS extracts/masked essential sentences deriving out of an input file & generates them like a single output series deriving out of the other phrases, comparable with an extractive type of summary. They put PEGASUS through its paces on 12 subsequent summarization exercises. Experiments show it delivers cutting-edge results on all the 12 datasets. The conclusion was formed on the basis of obtained ROUGE scores [5-8]. The final model developed by Lucy Vanderwende and Aria Haghighi, called HIERSUM, displays the contents particularly as a ranking of subject vocabulary arrangement. It was also suggested that HIERSUM may provide several "topical summaries" to facilitate content browsing and discovery [9-12].

Objectives

To identify and convey the most significant information from a particular text to end users.

To focus on data relevance, maximum information completeness, minimum information redundancy, and summary coherence.

To analyse a model generated summary against a set of reference materials using ROUGE Score.

To propose utilizing the Transformer paradigm to reevaluate NLP jobs The inputs & outputs will be strings of text in sus paradigm.

3. MATERIALS AND METHODOLOGY

Dataset

The dataset utilized in this study for comparing the transformer models is the CNN-DailyMail dataset. A little over 3,000,000 unique news stories in English, published by CNN and Daily Mail writers, make up this dataset. The data fields contain 3 columns:

- ID - It includes a string that contains the SHA1 hash of the URL where the article was retrieved, formatted in hexadecimal.
- Articles - The article's body is contained in the article column.
- Highlights - The highlight of the piece, as written by the author, is contained in the Highlights column.

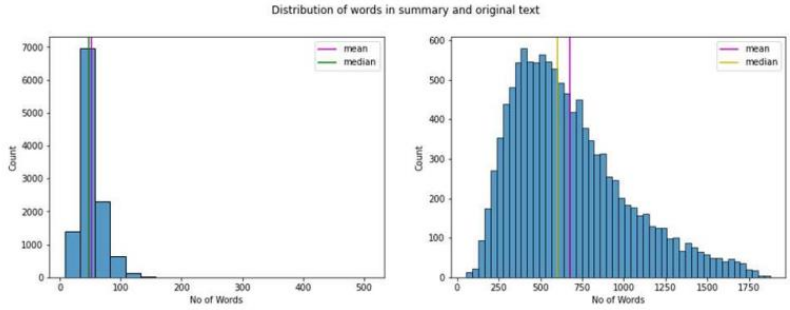

Figure 1: Distribution of the Words in the original article and the summary

The Basic Transformer Model

The various attention levels that comprise a transformer system for text summarization represent its fundamental foundation. It is based on attention layers & directional encoding to recall the sentences in an input pattern. The overall global reliance generated by using several attention layers help and assist in the concurrent computation of input pre-processing [13].

Encoder Block:

Computers do not understand words. Computers, on the other hand, deal with matrices, vectors, or integers. As a result, one must turn the words into vectors. By utilizing the embedding space for this, which is similar to an open area or a dictionary in that words with similar meanings are clustered together [14]. Each word in this system is mapped and assigned a value depending on its meaning. As a result, the encoder block convert our words into vectors. Positional encoders in this block provide context based on where a word is in a phrase. This concludes our input, which is subsequently forwarded to the encoder block.

Multi-headed Attention Layer:

It is up to the reader to determine how essential a word is in relation to the other words in a sequence of words. Relative position of words is much important in linguistic models so as to make sense out of the sentence. It is exhibited as an attention vector. Regardless of the fact that each word in the phrase has significantly more weight, this research work is interested in how each word in that sentence interacts with the other phrases. As a result, this layer compute numerous attention vectors for each word before utilizing a weighted average to calculate the final attention vector for each word. This strategy is also known as the multi-head attention block since the layer is employing many attention vectors. In decoder & encoder layers, layer having multi-head attention employs a process known as self-attention. Value, key & query vectors are generated from the inputs by routing it into 3 internally connected layers. Then ‘n vectors’ are formed by the division of these 3 vectors.

$$Attention = \text{softmax}\left(\frac{\mathrm{QK}^t}{\sqrt{d_k}}\right)V$$

Feed forward Layer:

Each attention vector is subjected to a basic feed-forward network. The network of digital neurons turns information into format which is suitable for the next encoder or decoder layer.

Multi-headed Masked Attention Layer:

Attention in the Masked Multi-Head Attention Layer is focused on tokens up to the current position (index till which the transformer forecasts) rather than future tokens (which have not yet been predicted).

Linear Layer:

A Logits vector is a large vector formed from decoder stack. A fully connected neural network forms a linear layer which does this job of converting the vectors.

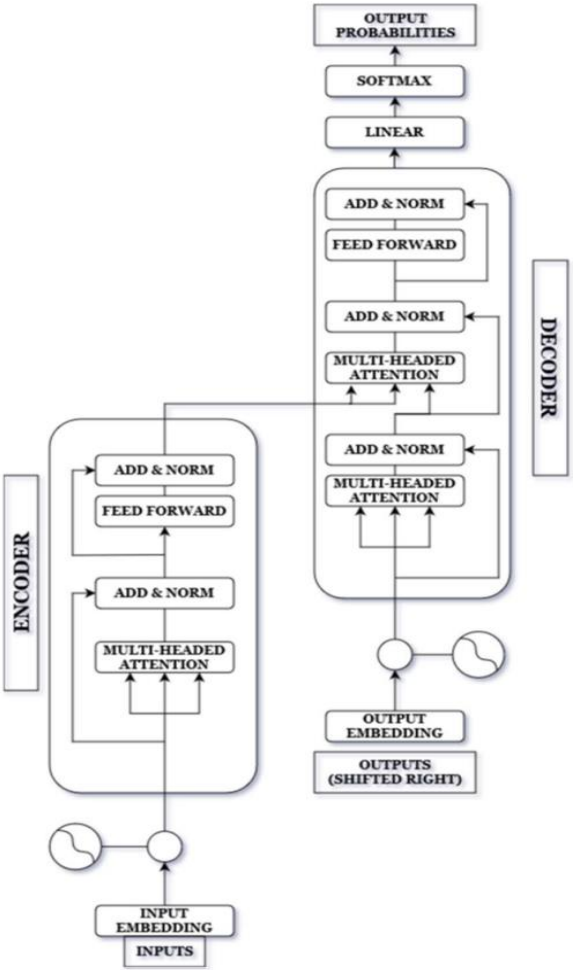

Figure 2: Transformer Architecture

SoftMax Layer:

The SoftMax layer transforms the input to a probability distribution that can be interpreted by humans. The three transformers T5, BART and PEGASUS are used for finetuning on our dataset.

A. T5:

The Text-to-Text Transfer Transformer is abbreviated as T5. T5 paradigm is based on a concept known as Transfer learning. After being trained in Transfer Learning on a task with a significant amount of text, this T5 model was finetuned on a downstream task to obtain broad day-to-day language abilities and knowledge that could be used for tasks like text summarization [15]. This transformer model utilizes a sequence-to-sequence generation method, where encoded input is delivered to the decoder layer via the model's cross-attention layers [16]. The decoder's output is autoregressive, which means that it will report the next future words, values on where encoder receives tokens in sequential manner as inputs & translates those to a collection of embeddings.

B. BART:

BART is a model based on sequence-to-sequence denoising autoencoder. It makes use of a standard seq2seq/NMT structure alongside bidirectional encoder & left-to-right decoder [3]. It implies that a BART model which is finely-tuned on a dataset may have an input text series & create new text sequence from it. BART combines both the concepts from GPT and BERT, being bidirectional like BERT, and the auto regressive one like GPT. The argument or the thinking behind it is that BERT's bidirectional nature, which is the auto encoder paradigm is beneficial for some NLP works like classification, which require details and data about complete sentence [17]. Therefore if one have classification tasks, it's not necessarily an advantage to predict one word at a time, it's more about understanding the whole the whole sentence at once in a sense. The

downside of something like BERT is it's is poor at handling generation NLP work, where the generated word should only hnag on to the formerly prediscted word [18].

PEGASUS:

Pre-training with Extracted Gap-sentences for Abstractive Summarization Sequence-to-Sequence Models is abbreviates as PEGASUS [5]. PEGASUS by Google improves the state-of-the-art (SOTA) outputs for the abstractive mode of summarization, particularly with limited supply of computational power, by utilizing prior researched and finding in NLP [19]. To be more specific, PEGASUS, unlike previous models, allows us to get results that are almost equivalent to SOTA utilizing 1,000 samples rather than hundreds of thousands of training sets [21]. To teach sequences from sequences, PEGASUS employs an encoder-decoder framework.

Table 1: Models along with their parameters and checkpoints used

Models	Parameters	Checkpoints
T5	11 Billion	T5 – Base
BART	140 Million	BART – large-cnn
PEGASUS	568 Million	PEGASUS – cnn_dailymail

4. EVALUATION AND RESULTS

ROUGE is an abbreviation that means Recall-Oriented Understudy for Gisting Evaluation. It provides ways to evaluate the excellence of a synopsis mechanically by matching it to the rest of the (ideal) summaries generated from individuals. This metrics counts amount of overlying subsequence, like n-grams, text patterns, & pairs of words, that exist in computer generated summaries & the optimal summary by humans [21].

ROUGE metrics are classified into various segments, like the ROUGE-1, ROUGE-2, ROUGE-L & others.

ROUGE-1 distinguishes uni-grams in the computer-generated & manual referential summaries.

ROUGE-2 relates to bigram overlapping between the system and referential synopsis.

ROUGE-L calculates the sequence of words with longest matching subsequence with the help of Longest Common Subsequence (LCS). LCS seems to provide the ease of just needing in-sequence comparisons that capture sentence level grammatical structure, rather than consecutive matches. Since it mechanically includes the greatest in-sequence related n-grams, no specified n-gram length is required.

Table 2: ROUGE Scores for Transformer Models

Models	ROUGE - 1	ROUGE - 2	ROUGE - L
PEGASUS	0.013042	0.000968	0.000968
BART	0.376068	0.069565	0.290598
T5	0.487804	0.247933	0.406504

5. DISCUSSION

This research work used transformers fruitfully and examined them by making use of a standard evaluation criterion ROUGE. Our research led us to the outcome that finely calibrated transformers layered on top of previously trained language models generated tremendous success and a logical and flowing summary of a specified text's material. For comparative purposes, this research derived ROUGE scores for every model's forecasting and deduced that the T5 model outperformed every other model, notably BART and PEGASUS. Based just on the ROUGE score,

the study may infer that T5 comes out on top, accompanied by BART and then PEGASUS. In the future, attention should be focused on constructing higher trustworthy models. The Transformer model could be employed to build more efficient models that provide accurate and clear summaries and appear more genuine, and human-generated. A combination of the aforementioned models, as well as hybrids, could be employed to enhance the precision, readability, and clarity of the summaries

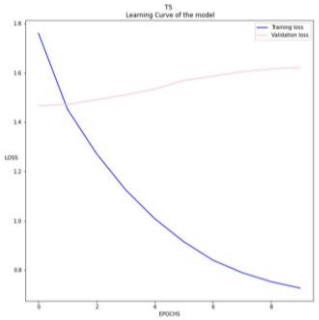

Figure 3: Training Loss vs Validation Loss curve for T5

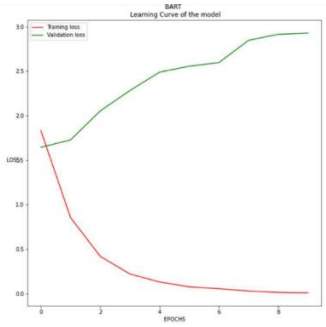

Figure 4: Training Loss vs Validation Loss curve for BART

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MIMO antenna for mm-wave 5G application

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Abstract

Paper introduces a MIMO (multiple inputs multiple outputs) antenna for the 5G (Fifth generation) application. This antenna is a low-profile antenna and has a low cost. This antenna has a compact size of 24 x 12 x 1.5. Simulated results of the antenna introduce a 10dB impedance bandwidth of 2.75 GHz (24.38 GHz to 27.13 GHz). This antenna provides a total gain of more than 2.79 dBi for the entire bandwidth. This antenna structure provides minimum isolation of less than -20db for operating bandwidth. Radiation efficiency received is 99%. ECC for proposed antenna is 0.0005. Diversity gain for proposed work is 9.99. These important features make it appropriate for 5G applications.

Keywords. MIMO, mm-wave (Millimeter wave), 5G (Fifth Generation).

1. INTRODUCTION

In recent years there is a demand for maximum throughput, high data rate and, a wide spectrum, and smart home life. As a result, 5G technology come up which is the most promising technology. Big challenge for 5G device is to provide high gain, minimum radiation losses, and enhance bandwidth. The 5G technology required an antenna with minimum path loss, good radiation pattern, and low latency [1]-[6]. Millimeter wave frequency band was provided for different 5G application.Now a days the mm-Wave (Millimeter-wave) technology has attracted the industry and academia for its various advantages. It's a promising technology for applications like the Internet of Things (IoT) used for smart cities, Machine to Machine (M2M) communication, and 5G wi-fi routers and repeaters. 26 GHz spectrum used in 5G technology cover band from 24.25 GHz and 27.5 GHz is used for different application like mobile communication, fixed Links, and Satellite Receiver Earth stations. Further 5G antenna design requires an antenna with improved performance. That can be achieved by using MIMO antenna structure. The use of multiple antennas at the transmitting and multiple antennas at the receiving end further improves link reliability, data rate, and channel capacity [7]. MIMO utilizes more than one transmits and receive antennas which multiplies the capacity of the link. This is the technique that simultaneously transmits and receives multiple channels over the radio link. One key feature of the MIMO antennas is without enhancing signal power it increases transmission range. As compared to an array antenna system Multiple antennas are preferred because it makes the system simpler. MIMO antennas are applied in 5G communication to gain maximum throughput, high efficiency, high data rate, and minimum latency. One of the factors of the 5G antenna design is compact size. But if the spacing between the antennas is reduced then it leads to enhance in mutual coupling. This mutual coupling linking multiple antenna structure gets increased because of the huge flow of current from the exciting port to the non-excited port or because of space radiation. The main question in the 5G antenna design

is to lessen mutual coupling between multiple antennas by maintaining the compact size. Different mutual coupling reduction techniques are used like Frequency selective surface [8], meta surface shields [9], defected ground planes [10][11], and EBG structure [12] to improve isolation between two antenna elements. Ansys HFSS software is used to simulate a Single patch and MIMO antenna structure. In proposed work wide bandwidth is achieved. The paper is arranged like this: In section II single patch antenna geometry is presented. This section provides Simulation results for the evolution steps of antenna design, return loss, gain, and radiation pattern. In section III MIMO antenna geometry and simulated results of return loss, and isolation is presented. Finally, in section IV work is concluded.

2. SINGLE PATCH ANTENNA DESIGN IN TEXT

The mm-wave 5G antenna is designed using Roger RT duroid 5880 substrates with tan δ = 0.0009 and ε_r = 2.2. The single patch antenna is designed with a substrate dimension of 12 x 12 mm2. Fig. 2.1 (a) demonstrate the evolutionary stage of the suggested mm-wave single-patch antenna.

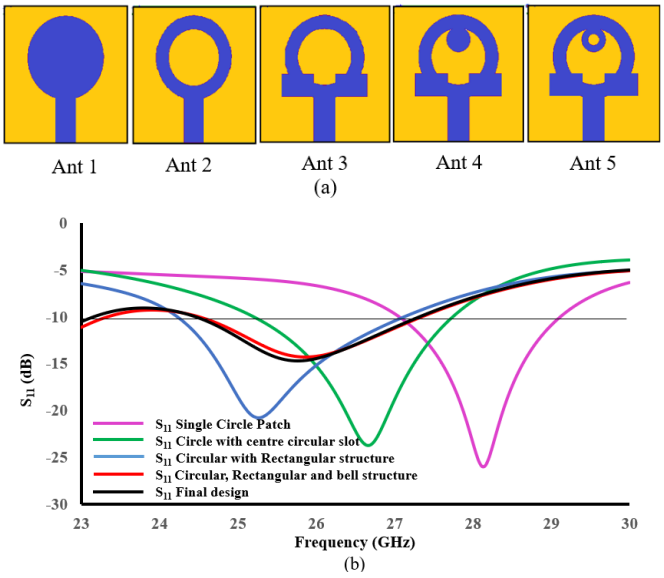

Figure 2.1 (a) Sigle patch antenna evolution stages. (b) S_{11} for each stage of antenna design.

Fig. 2.1 (b) represents the S_{11} of each evolutionary stage of the antenna design. In the first stage of antenna design Ant 1 which is resonating at 28GHz. Further to resonate at a lower frequency circular slot is inserted in the circular patch. Now antenna resonates at 26. 5GHz. Further to improve the bandwidth and to resonate at a lower frequency rectangular structure is inserted in the bottom corner of the circular patch as represented by Ant 3 and Ant 4. In the final stage of the antenna design Ant 5 one more circular slot is inserted to further improve bandwidth which covers lower mm-wave 5G frequency band. Fig 2.2 (a) and (b) represents the mm-wave single patch antenna. The optimized value of the designed structure is presented in table I. The scattering parameter result is shown in fig. 2.2 (c). From the simulated result presented in Fig. 2.2 (c), bandwidth achieved for the antenna is 2.75 GHz

(24.38 GHz to 27.13 GHz). Figure 2.3 depicts the total gain. The total antenna gain is more than 2.79 dBi and the maximum gain achieved is up to 4.44 dBi. Fig. 2.4 (a) and (b) represents E-plane cross-polarization and co-polarization for single patch antenna. The simulated result of the antenna radiation pattern is presented in fig. 2.4 (c).

Table 1. ANTENNA DESIGN

Parameter	Dimension (mm)	Parameter	Dimension (mm)	Parameter	Dimension (mm)
A	12	d	5	i	2
B	12	c	1	j	3
h	1.5	e	2.2	l	3.9
c	7.4	g	1	m	2

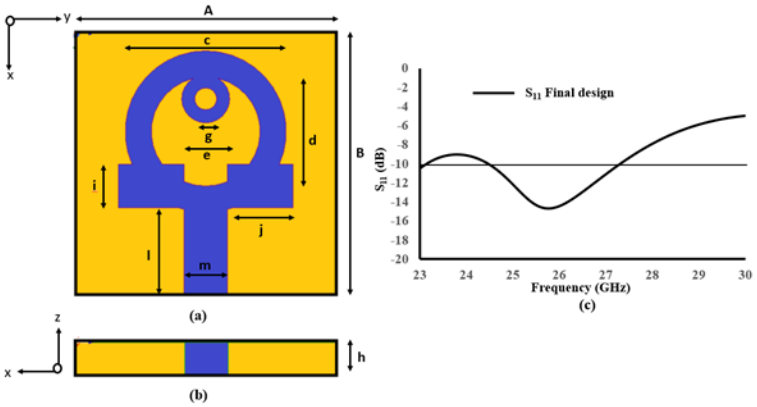

Figure 2.2 (a) Mm-wave 5G antenna structure. (a) Top view. (b) Side view. (c) S_{11} for single patch antenna.

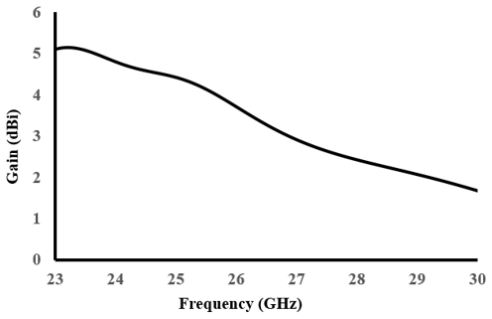

Figure 2.3 Gain for the single antenna structure.

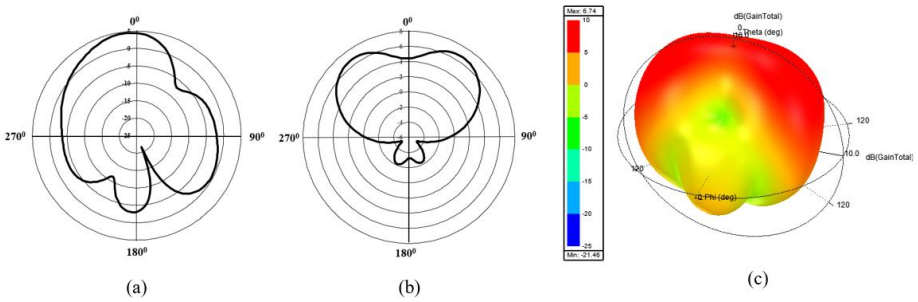

Fig. 2.4. Single patch antenna structure E-Plane (a) Co-polarization. (b) Cross Polarization (c) Radiation pattern.

3. MIMO ANTENNA DESIGN AND RESULT

As now a days because of the increase in demand for IoT devices and smart devices 5G devices are recommended to provide link reliability, much faster data

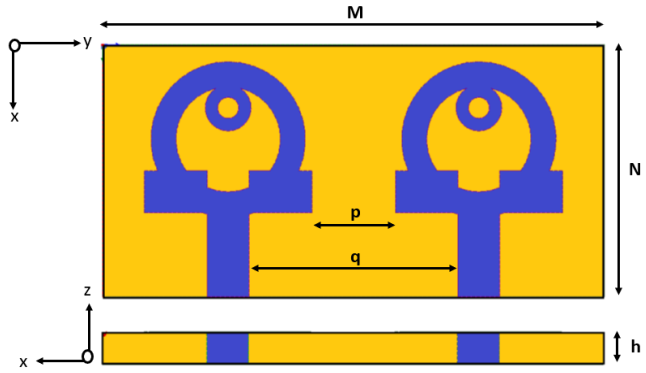

Figure 3.1 MIMO antenna geometry M = 24 mm, N = 12 mm, h = 1.5 mm, p = 4 mm, q = 10 mm.

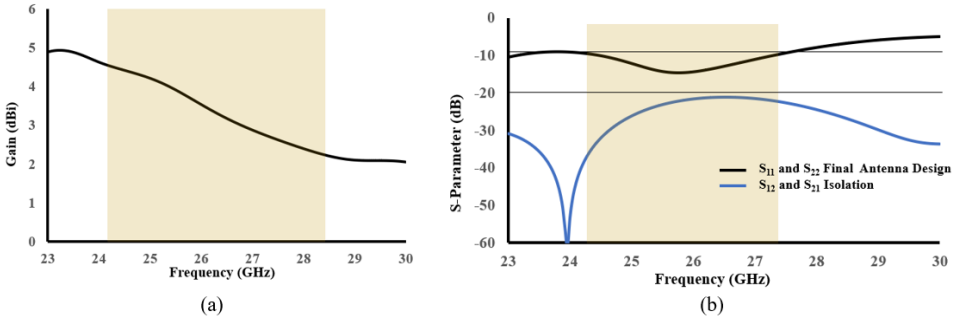

Figure 3.2 (a) Gain of MIMO antenna geometry. (b) S-parameter for MIMO antenna (S11, S22, S12 and S21).

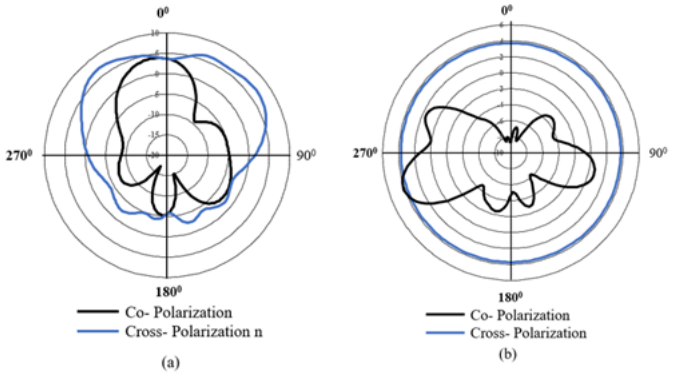

Figure 3.3 (a) Cross - Polarization and Co – Polarization for E-Plane (b) Cross - Polarization and Co – Polarization for H-Plane.

rate, and improved capacity. The main requirement of a 5G antenna is a MIMO antenna. A Two-port MIMO structure is designed as presented in fig. 3.1. Two antennas are sharing the same substrate. With substrate size of 24 mm x 12 mm. Fig. 3.2 (a) shows the gain of the MIMO antenna. As the geometry of all two antennas is kept similar so there is no change in bandwidth received for antennas. This bandwidth received is remaining the same as bandwidth received for a single patch antenna in between 24.38 GHz to 27.13 GHz.

Table 2. ANTENNA DESIGN COMPARISON OF VARIOUS PARAMETERS

Ref	Size (mm2)	Substrate	Center freq. (GHz)	No. Of ports	Radiation Efficiency (%)	BW (GHz)
[13]	20 × 27.7	Rogers RO4003C	28.45	2	91	3.8
[14]	60 x 60	PET	26	4	61	-
[15]	20 x 20	Rogers 5880	28	2	-	0.85
[16]	157 x 70	Rogers 5880	28	8	60	1.62
[17]	31.77 × 39	Rogers 6010	26	2	-	1.9
[18]	35 x 35	Rogers 6003	26	4	96	3
[19]	50 x 50	Rogers 4350	28	2	86	1
This work	24 x 12	Rogers 5880	25.7	2	99	2.74

One of the factors of the 5G antenna design is compact size. But if the spacing between the antennas is reduced then it leads to increase in the mutual coupling. Mutual coupling must

be less than -20dB. In the proposed design isolation achieved is less than -20 dB for entire bandwidth. Fig. 3.2 (b) shows the reflection coefficient and mutual coupling between antenna. Fig. 3.3 presents E-Plan and H-plane radiation pattern. Simulated radiation efficiency received is 99%. Envelope correlation coefficient (ECC) for proposed antenna is 0.0005. Diversity gain achieved is 9.99 for antenna presented.

4. CONCLUSION

This mm-wave antenna is a low profile, low-cost antenna, and which can be used for the 5G application. The size of the MIMO antenna is 24 mm x 12 mm x 1.5 mm. Simulated results show that the maximum impedance bandwidth provided by a single patch as well as a MIMO antenna is 2.74 GHz (24.38 GHz to 27.31 GHz). Antenna provide maximum gain of 4.4 dBi. Simulated results provide minimum isolation between antenna is less than -20dB. ECC value received for proposed antenna is 0.0005. Radiation efficiency received is 99%. Diversity gain for proposed work is 9.99. Because of all these features, this antenna design is useful for 5G applications.

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An Efficient MPPT Strategy to Mitigate the Effects of Varying Irradiance on Solar Photovoltaic System

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Abstract

Solar irradiation and ambient temperature are two environmental factors that significantly impact the production of Photovoltaic (PV) power. The initial step response of the converter duty cycle of the conventional Maximum Power Point Tracking (MPPT) Incremental Conductance (IC) method is not precise, leading to misjudgement because of the single control condition and any change in the external environment. A modified IC algorithm is designed to track the Maximum Power Point (MPP) for Solar Photovoltaic (SPV) systems under varying solar irradiance levels. The proposed method outperforms in terms of complexity, stability, and efficiency. It tracks the MPP with an efficiency of more than 98% with a response time of less than 0.1 ms.

Keywords. Incremental Conductance, MPPT, Solar Energy, Solar Photovoltaic.

1. INTRODUCTION

The exponential growth of the global population and humans' use of electronic devices and electrical appliances to raise their living standards are the primary drivers of the day-to-day increase in energy consumption. In this scenario, fossil fuels are playing a significant role. However, the threats of carbon emission, air pollution, residual waste, and global warming will also increase simultaneously generated from power plants employing non-renewable energy sources [1]. The primary source of all energies can be thought of as the sun. The most abundant, limitless, and cleanest source of renewable energy available today is solar energy. It can be used in a variety of ways, including utilizing all of the sunlight to produce electricity directly or harnessing the heat from the sun as thermal energy. A very recent and exciting technological advancement that opens up a wide range of new prospects for producing" green" electricity is the capacity to produce electricity from sunlight [2] Global investment in SPV energy is rising quickly. A SPV modules generates electricity from sunlight and power converters for energy extraction and grid interface control help compensate a grid-connected SPV system [3]. A single SPV unit is referred to as a cell. It is typically tiny and produces around 1 or 2 watts of electricity [4]. It's a zero carbon emission source of energy, unlimited nature, and indigenous origin. However, during the last several decades, the high cost of photovoltaic (PV) energy has limited economically feasible utilisation to a small range of off-grid, low-energy consumption applications. A SPV module's output power and its lifespan depend on a variety of factors, some of which includes: The type of material used by SPV module manufacturing, solar radiation received intensity, temperature of the cell, parasitic resistance, cloud and other weather conditions, shading effects, efficiency of the inverter, orientations of modules, thickness of cable, geographical locations, etc [5, 6]. The non-linear relation between the Current and Voltage or Power and Voltage of the SPV cell,

generated output power fluctuates with solar irradiation (G) and ambient temperature (T) [7]. Therefore, the Maximum Power Point (MPP) changes as the fluctuation in G and T [8]. An in-depth understanding of the *I-V* and *P-V* characteristics curves of SPV modules is necessary for the efficient analysis of SPV systems. The atmospheric factors affect the PV cell's output characteristics [9]. To modify the peak power output and raise the producing effectiveness of the PV system, several MPPT control strategies have been put forth. According to their control theoretic and optimization principles, the three primary MPPT approaches for PV systems are reviewed, summarised, and grouped into three groups in this work. In particular, the benefits and drawbacks of MPPT approaches for PV systems with PSCs are contrasted and examined.

2. LITERATURE REVIEW

The MPP from SPV energy systems under varying climatic circumstances has been tracked using several different ways. The most difficult problem for researchers in this domain is to extract electrical power from SPV systems in non-uniform irradiation, such as Partial Shade Condition (PSC) or Fast Transient Circumstances (FTC). To remove the losses and maximize the power from SPV systems, a power electronic architecture with a MPPT algorithm is required. MPP may be tracked using traditional MPPT methods with constant solar irradiation [10]. A Multiple Perturbation and Observation (MP&O) based MPPT method is suggested to quickly attain the global MPP using a reversed boost-buck converter architecture with a parallel power processing idea [11]. The effectiveness of algorithms for MPPT is impacted by inaccurate PSC or FTC detection. As there are several peaks in the *P-V* curve, an MPPT algorithm's typical role during PSC or FTC is to search among the local peaks for the global peak and stabilize the output voltage. The output system voltage stability is more of a concern during PSC for small isolated SPV systems than power efficiency [12]. Along with current publications on diverse hardware design processes, MPPT techniques are used for PV systems as documented in the literature. Depends on the tracking method used to track the MPP under PSCs, they are divided into four classes i.e.- Classical, Intelligent, Optimization, and last is Hybrid. Since there is just one peak in the *P-V* curve under uniform insolation, classical approaches are heavily favoured [13]. The oscillation, random fluctuation, and sluggish power tracking of PV systems might reduce their power. A unique optimization of grasshopper (GHO) approach is added to the MPPT controller under rapidly changing irradiates and PS circumstances to address these problems. Under 5 different weather scenarios, a difference between is done with known approaches i.e. - P&O, PSOGS, DFO, ABC, CS, and PSO optimization strategies. Complex partial shading reveals flaws in current methods (CPS) [14]. Based on research examining the output characteristics of SPV systems under partial shadowing situations, a unique MPPT is developed. Multiple peaks appear on PV curves when circumstances are partially shaded, which reduces the effectiveness of traditional methods. As a result, the suggested approach, which is based on the Modified Particle-Swarm Optimization (MPSO) methodology, boosts the output power of SPV systems under such abnormal situations and performs better than existing techniques [15]. For quick, precise, and effective tracking, a hybrid MPPT approach based on T-S Fuzzy-integral back-stepping is presented. The suggested method allows for dependable and steady functioning in the face of quick dynamic environmental changes. Additionally, it is easy because it doesn't need additional atmospheric sensors. Through simulations using Matlab/Simulink and practical outside testing, the theoretical model addressed confirmed. The effectiveness of the created MPPT approach is highlighted through a comparison with several alternative MPPT strategies [16]. In this regard, a novel framework for the MPPT

algorithm built on a sliding mode controller (SMC) is created in this research and applied to PV panels under partial shade circumstances (PSC) and uniform conditions [17].
According to published research, bio-inspired MPPT control systems have certain significant flaws, including long tracking and settling times, oscillations at global maxima (GM), and local maxima (LM) trapping under PS circumstances [18]. Based on a recent meta heuristic method for Manta Ray Foraging Optimization (MRFO), author have suggested a novel GMMPT algorithm. In the literature, a multi-port DC converter-based PV sub-module Distributed MPPT technique is proposed. The SPV model and its unmatched properties, the module Voltage Equalisation (VE) strategy, and its implementation with the multiple port buck-boost converter are all investigated and researched thoroughly. The trade-off between the real Distributed MPPT and VE in terms of to control the complexity and tracking precision, and a thorough derivation is made to show how they vary from one another. Experiments were used to confirm the suggested scheme's viability and development [19].

3. PROPOSED MPPT METHOD FOR SPV SYSTEM

To mitigate the effects of partial shading on a SPV system is employed with MPPT as shown in Figure 3.1a. The Pulse Width Modulated (PWM) signal is generated by MPPT under variation in Vpv and Ipv. PWM signal drives the DC–DC converter's gate driver circuit and maintains the output at MPP. This type of implementation required addition gate driver circuitry to adjust the duty cycle of DC-DC converter output. Using an inverter circuit, output AC powered load appliances are connected to the SPV system. Incremental Conductance (IC) is one of the popular techniques to track the MPP accurately. The algorithm searches the *P-V* curve's peak value by detecting the *P-V* curve's slope. It compares the instantaneous Conductance (I/V) and the PV array's incremental conductance (dI/dV) to track the MPP. Slope Detection for IC algorithm is shown in Figure 3.1b.
The operating point on the P–V curve is located by checking the relationship between these two values as expressed in Equations 3.1, 3.2, and 3.3. Equation 3.1 indicates the operation at MPP, and Equations 3.2 and 3.3 represent the PV system operation on the MPP's left and right sides.

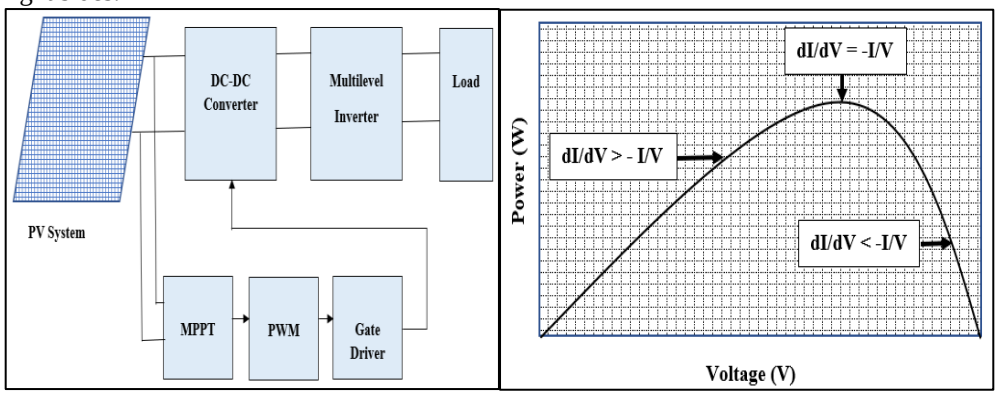


Figure 3.1 a) SPV System Block diagram with implementation of MPPT b) Slope Detection for IC algorithm

$$\frac{dI}{dV} > -\frac{I}{V} \qquad (3.1)$$

$$\frac{dI}{dV} = -\frac{I}{V} \qquad (3.2)$$

$$\frac{dI}{dV} < -\frac{I}{V} \qquad (3.3)$$

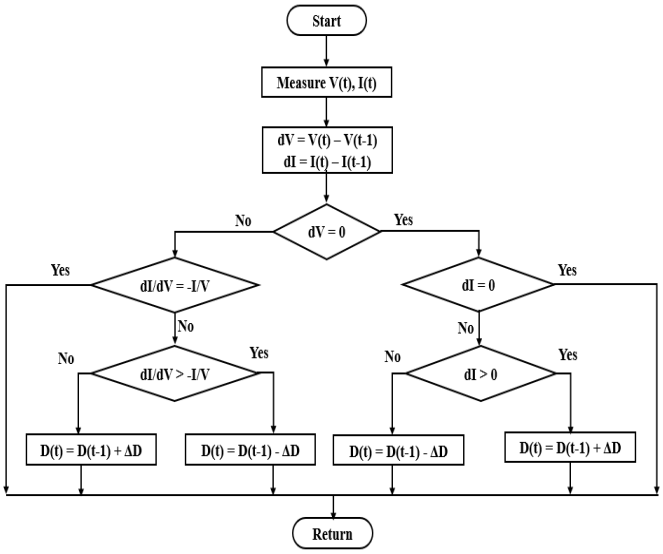
The slope of the *P-V* curve at MPP is 0.

$$\frac{dP}{dV} = 0 \qquad (3.4)$$

Re[w]riting equation 4,

$$I + V\frac{dI}{dV} = 0 \qquad (3.5)$$

PV voltage and current are measured, and Equation 3.5 is used to detect MPP. If equation 1 is satisfied, the duty cycle of the DC-DC converter is decreased. If Equation 3.3 is satisfied, the duty cycle of the DC-DC converter is increased. According to these modifications in the



duty cycle, the required MPP is tracked by the algorithm, as shown in Figure 3.2.

Figure 3.2 Flowchart for IC-based MPPT Algorithm

4. RESULTS AND DISCUSSION

In a proposed methodology using the MPPT approach, four-panel were considered to experiment with four different cases (C1, C2, C3, and C4). In each instance, a separate irradiation was set, and the instantaneous voltage, current and power were recorded concurrently. These logged data are utilised to generate *I-V* and *P-V* graphs. Consequently, the output value of M_p and FF is noticed and recorded. Table 4.1 summarizes the influence of Variations in Solar Intensity on the Performance of SPV Systems.

Table 4.1 Impact of Variations in Solar Intensity on PV Systems

Case No.	Panel 1 (W/m^2)	Panel 2 (W/m^2)	Panel 3 (W/m^2)	Panel 4 (W/m^2)	M_p (W_p)	FF (%)
C1	1000	1000	1000	1000	30.562	0.8546
C2	1000	1000	1000	804	24.338	0.6852
C3	1000	1000	804	701	21.064	0.5956
C4	1000	809	701	609	18.067	0.5159

The combined graphs for the *I-V* plot and *P-V* plots for various situations are illustrated in Figures 4.1, and 4.2.

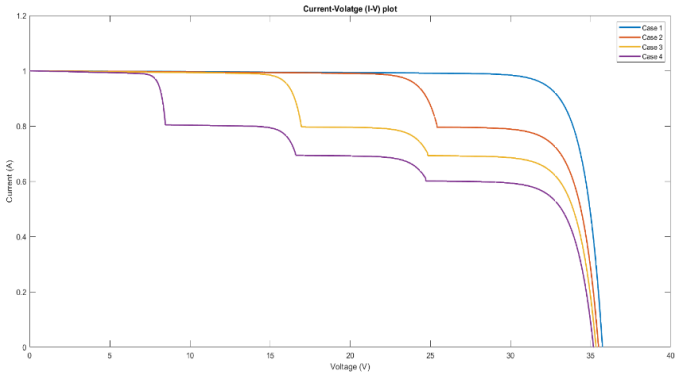


Figure 4.1. *I-V* Plot of data captured from emulator for four different cases

The IC algorithm-based MPPT is implemented in MATLAB-Simulink. The system is tested for five different levels of solar irradiance i.e., 350 W/m^2, 500 W/m^2, 650 W/m^2, 800 W/m^2, and 950 W/m^2. According to the changes in the duty cycle (D), the DC bus voltage is varied, and MPP is tracked. The available SPV power and load power are noted in all the cases. Table 4.2, summarizes the results logged for different cases using MATLAB-Simulink.

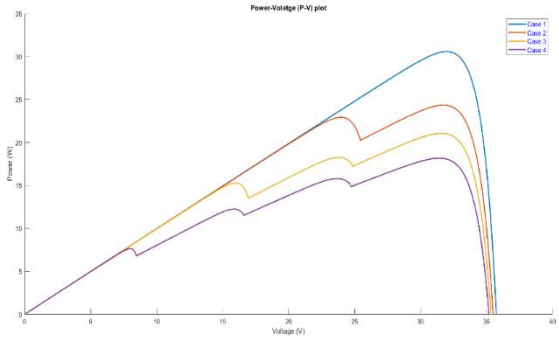


Figure 4.2. *P-V* Plot of data captured from emulator for four different cases

Table 4.2. Load Power for IC-based MPPT

Case	**Irradiance (W/m^2)**	**DC Bus Voltage (V)**	**Solar PV Power (kW)**	**Load Power (kW)**
1	350	265.8823	0.7709	0.7541
2	500	302.0581	0.9940	0.9732
3	650	345.0433	1.2735	1.2699
4	800	380.6385	1.5786	1.5455
5	950	419.6706	1.9009	1.8787

The results show that the DC bus voltage varies in response to solar irradiation variations to maintain the operating point at MPP. The findings indicate the variances in solar panel voltage and solar power. The IC-based MPPT reliably tracks the MPP as shown in Figure 4.3.

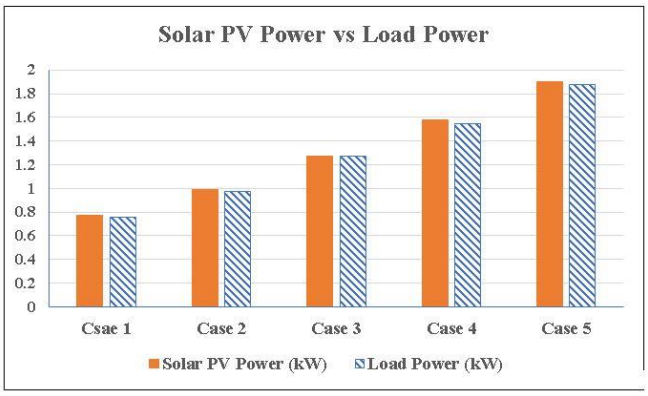


Figure 4.3 Solar PV Power vs. Load Power

5. CONCLUSION

This paper proposes an Incremental Conductance (IC) algorithm-based MPPT for PSV systems under varying solar irradiance levels. Compared to other MPPT methods, the proposed method is more straightforward and stable. The said technique can accurately track the MPP with an efficiency of more than 98 %. The MATLAB simulation results validate the stability and accuracy of the proposed algorithm. The algorithm also outperforms the convergence speed to track the MPP with a response time of less than 0.1 ms. Due to the more straightforward structure of the algorithm, it can be implemented with less complex hardware, which increases the possibility of utilising the proposed method in actual SPV power generation.

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E-commerce Sales Prediction using Machine Learning Techniques

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Abstract.

In the current digital world, people are using online shopping for purchasing goods extensively with first preference. Reviews and ratings on the sites will play a vital role in improving global communications among the customers and it has the potential to influence consumer buying patterns as well. Many E-commerce giants like Amazon, Flipkart are providing a platform that empowers users to share their real-time experiences and provide real-time insights about the performance of the product to future buyers. Sentimental Analysis and classification of the reviews as positive and negative will help us in understanding the voice of the consumers. So current study works on the reviews whose ratings are not provided by the customers. Machine learning models like Naïve Bayes, Multinomial NB, Bernoulli NB and Logistic Regression are used during the study. The result predicted the sentiments of those reviews.

Keywords. Machine Learning; Sentiment Analysis; Naïve Bayes classifiers; Feature extraction; Predictions.

1. INTRODUCTION

Everyone have arrived on the e-commerce globe. Users frequently come across a plethora of different retailers on the internet. Inventors made it possible to trade with anyone and from anywhere. User can purchase items without leaving the house, compare prices in other stores in seconds, and see what user want rather than settling for the first or least appropriate supply. It would be highly eye-catching to appear in this environment through the data it generates. Prediction or forecasting of the sales of E-commerce Company is very crucial now days. The prediction gives directions to especially smaller companies to increase their sales and reach the desired target. Amazon, for example, will continue to aggressively grab market share and outperform many small e-commerce firms. Smaller e-commerce firms are

among the losers, partially because they lack more sophisticated ways of reaching out to potential customers. Larger companies have recently begun to use advanced data analytics, machine learning, and artificial intelligence to predict the sales [1]. Also the sales prediction is helpful in inventory management. The prediction of product sales is an important component in inventory optimization. Because, as each one know, some e-commerce businesses have its own exclusive products that they sell online. As a result, that type of E-commerce platform must usually maintain a close eye on their inventory [2]. Sales prediction has some benefits like allocation of budget, setting the goals, targeting audience, assessing sales performance and many more. Similarly, in any E-commerce Company, the forecasting or prediction of sales plays a major role, as it shows the performance of the sales department; it will help in handling the budget and taking decisions according to it; to cornerstone the target audience etc. So, this paper focus on experiment with e-commerce figures and checks out to gain a better understanding of it.

2. PREVIOUS STUDY

The global e-commerce market is expected to reach $66,932.1 billion by 2030, growing at a rate of 13.5 percent per year from 2020 to 2030, owing to increased online buying and digital transactions in the wake of the COVID-19 epidemic. Value e-commerce in India, which is currently valued at $4 billion, is predicted to rise significantly, reaching $20 billion by 2026 and $40 billion by 2030, a 10x increase in ten years, according to the report. In E-commerce, sales prediction is a necessary process that has a significant influence in creating educated business decisions. It can assist us in managing our personnel, cash flow, and resources, as well as optimizing manufacturer supply chains, among other things. Sales prediction is a difficult subject because sales are influenced by a variety of factors such as promotional activities, pricing adjustments, and user preferences, among others [3]. In addition to linear regression, random forest, and decision tree, a study was conducted on sales prediction utilizing diverse models such as artificial neural networks and long short-term memory approaches [4]. The K-means algorithm, the Market Basket model, and the Vector Distance model is used in another study to establish a collection of important variables that would reflect group qualities. The silhouette index was calculated to assess whether or not these clusters are compact [5, 11, 12]. A study demonstrates the flaws and problems of standard online purchasing behaviour prediction approaches and offers a network shopping behaviour analysis and prediction system [6]. The authors of a research looked at the problem of demand forecasting on an e-commerce website and concluded that their method will predict significantly better when more data is used. Because the difference between the suggested model and random forest is not statistically significant, the proposed method can be utilized to forecast demand due to its accuracy with fewer data [7]. The ability to predict real-time, hourly order arrivals has been inadequate [8]. Prediction is more of a regression problem than a time series problem. It has been predicted that the regression methodology trends in historical data would repeat themselves in the future. Lasso regression may be employed in the future [9]. The researchers came to the conclusion that in order for businesses to handle massive amounts of data, they need an intelligent sales predictive model [10].

3. METHODOLOGY

The purpose of this study is to discover that surprises and gifts sell diversely depending on the season: peak sales, then a sharp dip the next year, then a steady increase until the next peak. Here authors have use Grid Search and Cross-Validation to test Linear Regression, Decision Tree and Random Forest Regression as shown in the Figure 1. Authors had calculated the mean square error and mean absolute error, then compare its results to see which one best fits the regression.

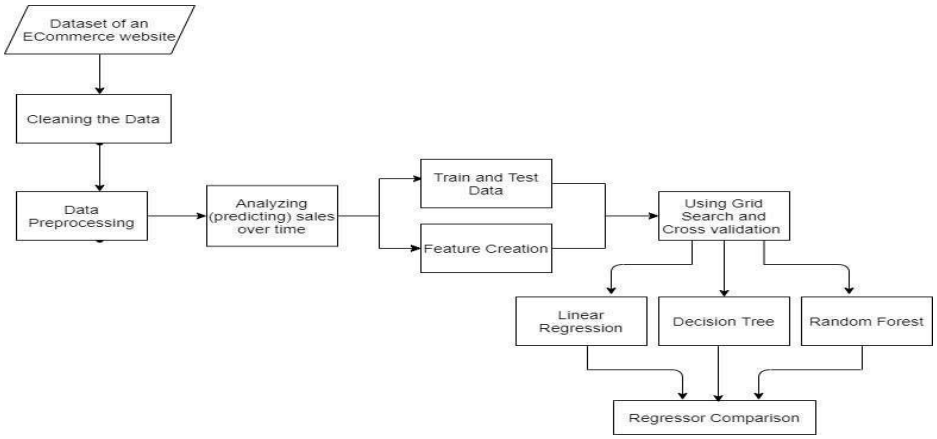

Figure 1.E-commerce Sales Prediction Model

4. DATASET AND EXPERIMENT DISCUSSION

The dataset which has been taken for this study has 8 columns InvoiceNo, StockCode, description, Quantity, Invoice Date, UnitPrice, CustomerID, Country. Pandas, numpy, matplotlib, scikit-learn and seaborn python libraries are used in this study. Using pandas dataframe, the records were read and added to the dataframe. After that the data was visualized using seaborn.

4.1 Experiment Steps

To generate fascinating visual findings, authors begin by setting up our environment and loading relevant libraries such as numpy and pandas. We also require data visualisation tools matplotlib and seaborn.

1. Read *csv()* method used to read our data. Then, for visuals and numerical, author conducted exploratory data analysis. A quick statistical overview is done to see negative quantities and unit prices.
2. Dealing with the data types and null values. Examining the columns one by one to determine the buying patterns.
3. Using plots and calculations, it was discovered that the vast majority of sales were made in the United Kingdom, with only 8.49 percent going abroad.
4. Detecting the outliers by plotting scatter plot and removing it.
5. After cleaning, removing invalid records and removing outliers visually check the distribution of numeric features.
6. Analysing the sales over time by resampling time data, and observing the patterns.

7. Creating features like quantity per invoice, quantity range, price range and month to improve the data for modelling.
8. Scaling 'QuantityInv' that is quantity per invoice feature to bring it in the range 0-1 like others. Splitting the data into train and test data.
9. Testing and validating three types of regressors: Linear, DecisionTree and RandomForest by using GridSearch and CrossValidation.
10. Create a bar plot for comparing the three types of regressors.

5. RESULT ANALYSIS

In Figure 2 a graph can be seen. The graph shows the items that were bought more often. Here White Hanging T-Light Holder is bought more often. Regency Cake stand 3 Tier and Jumbo Bag Red Retro spot are also bought often. The count for these three of the things is more than 2000. Also, Jam Making Set with Jars is the item which has not bought more often as compare to the others. Same is the case with Natural Slate Heart Chalkboard, Postage, Jumbo Bag Pink Polka dot and Heart of Wicker Small, that these are also not bought often.

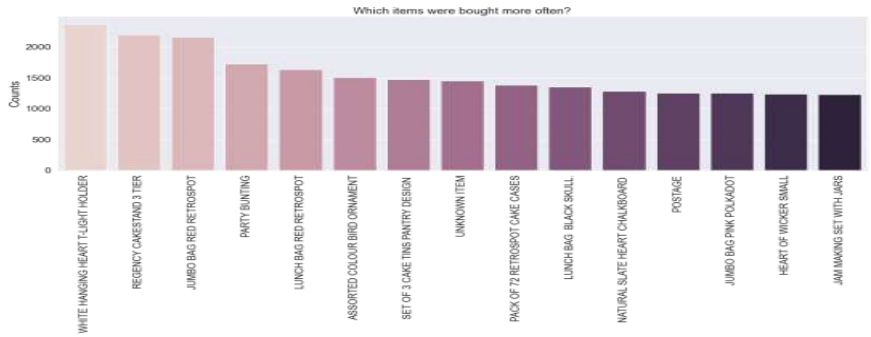

Figure 2. Items bought more often

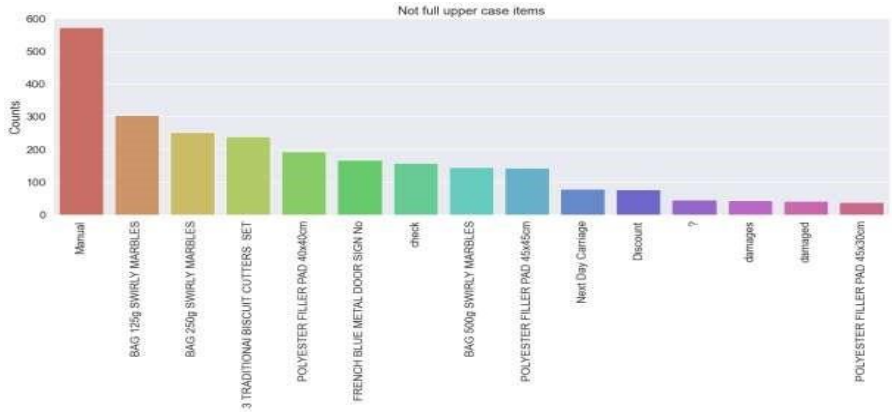

Figure 3. Not full upper case items

Figure 3 indicates the items which are not full upper case. Checking the case of letters in a sentence is a good idea. According to the description, certain units have lower case letters

in its names, and lower case records are for cancelled products. Authors can see that data management in the store can be enhanced in this case.

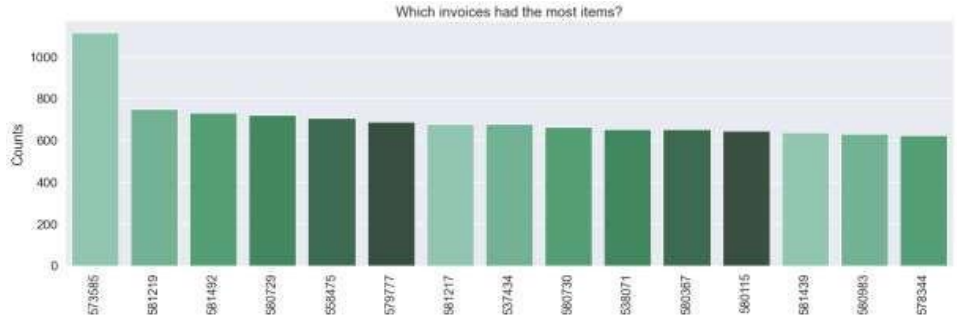

Figure 4. Invoice having four items

The figure 4 shows which invoices had the most items. Here authors can see that Invoice no. 573585 has most items. The items for Invoice no. 573585 have exceeded 1000 counts as shown in the graph. While looking at Figure 5 we can look at stock codes. Authors can see that 85123A has exceeded the 2000 counts. It appears that they are strongly linked to descriptions, that is Figure 1, which makes sense.

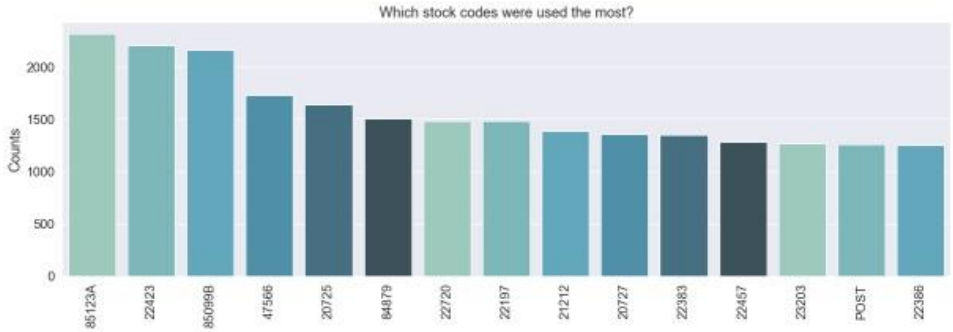

Figure 5. Most used stock codes

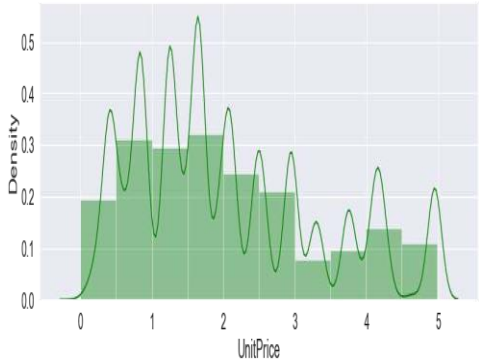

Figure 6. UnitPrice plot

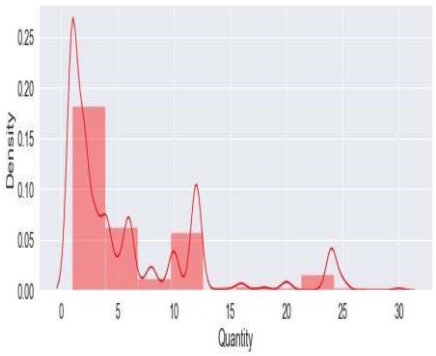

Figure 7. Quantity plot

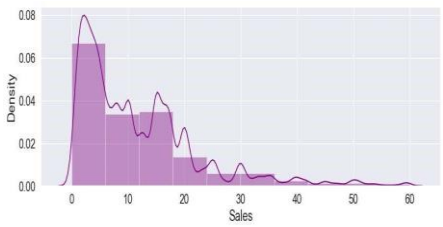

Figure 8. Sales plot

Figure 9. Sales over time

Authors are visually checking the numeric features distribution in the Figure 6, 7 and 8. Figure 6 shows unit price dist plot where authors can see that the majority of the things sold at this store are inexpensive, ranging from 0 to 3 pounds. Figure 7 shows that customers typically purchase 1-5 products. In the case of a sale, perhaps 10-12 items. Although, figure 8 shows that the majority of sales per order were between 1 and 15 pounds each.

Table 1. Sales as per Invoice Date

Invoice Date	Sales
12/5/2010	185427.8
12/12/2010	329936.8
12/19/2010	216012.2
12/26/2010	92369.3
1/2/2011	0
1/9/2011	133658.2
1/16/2011	193362
1/23/2011	138349.6
1/30/2011	125170.8

Table 2. Statistical Measures

	Linear Regression	Decision Tree	Random Forest
Best Score	0.1742	0.3727	0.4400
Mean Absolute Error	15.1135	6.7723	6.7276
Mean Squared Error	3918.8825	2101.3317	1951.5702
R2 score	0.15630	0.5476	**0.5798**

Figure 9 shows the analysis of sales over time. Authors can see here that in particular week of month January the sales look 0. The sales in first week of December have increasing rapidly from 200,000 to around 340,000 pounds. However, suddenly after that it reaching towards the month of January the sales decreased and became 0. After that it again started increasing and went on increasing till December next year. Well, Table 1 confirms the fact that there are 0 sales in January.

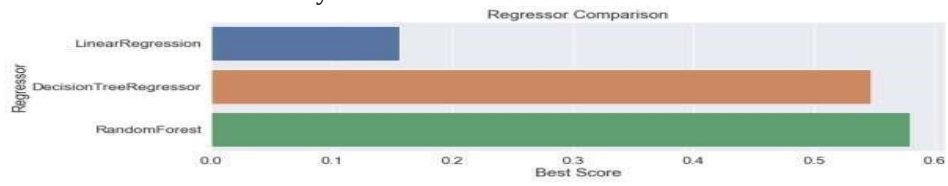

Figure 10. Comparing the Regressor

As shown in Figure 10 and Table 2 authors can observe that the Best score for Random Forest is high compare to Decision Tree Regressor and Linear Regression.

6. CONCLUSION

The sales were predicted using linear regression, decision trees, and random forests. With linear regression, the mean squared error was 0.15, and the coefficient of determination was 1. Linear Regression's fundamental flaw is that it only considers the dependent variable's mean. This is a simple analysis of a transaction dataset using a sales prediction model. It is observed that a sales high, followed by a sharp drop the next year in January, and then a steady increase until the next year's end. Authors were able to successfully estimate E-commerce sales using machine-learning algorithms, and observed that Random is the greatest fit for prediction. The best score obtained with Random Forest is 0.6. As a result, for future analysis, random forest must be applied rather than linear regression or decision tree.

7. FUTURE SCOPE

In future work, it would be good to focus on the variable choices rather than the algorithm. Many aspects can still be improved, such as cluster analysis and feature creation.

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Survey Paper on Memory Allocation Systems

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Abstract.

In the world of computation, we expect computers to perform various tasks at the same time, to achieve this goal multitasking and memory allocation must be done properly. Operating system performs a vital role in allocating memory to the processes. Memory Allocation techniques are primarily used for effective memory management. Moving processes between both the main memory and disc during process execution is another duty of the operating system. This paper discusses various techniques for memory allocation systems which helps users in allocating and deallocating memory as per their requirements.

Keywords. Memory, Allocation, Deallocation, Static, Dynamic, Contiguous

1. INTRODUCTION

A computer system's primary objective is to run applications. Both instruction and data are included in the programme. We can say that memory is a collection of instructions and data. A program that we are going to execute must be stored in the main memory. Memory is divided into large arrays. Each location has its address. Various memory allocation techniques are used for this purpose and the choice of technique depends upon the situation. Memory Allocation in an operating system is a method used to move in or move out of processes from the main memory to the disk at the time of process execution to achieve the aim of multiprogramming. The task of loading the process into the main memory is done by the loader. There are two types of loaders which are as follows:

- Static loading: In this type of loading, a complete program is loaded into the main memory before execution.
- Dynamic loading: In this type of loading, program load into the main memory as per demand.

Memory allocation can be done by using following methods:

- Contiguous Memory Allocation: Contiguous memory allocation is one of the oldest memory techniques used for the allocation of memory to the processes. In this type of allocation, memory is divided into consecutive memory blocks. Before execution, all the processes are in the waiting queue; these processes must be brought into the main memory for execution. Before this, size of the process is compared to the amount of contiguous memory available. If enough memory is found, then memory gets allocated to the process and the process starts executing. Multiple Partition Allocating: When a process needs memory in this sort of partitioning, the process is loaded into the free partition after being brought from the input queue.

- Manual Memory Allocation: This type of allocation is done by the programmer manually. A programming language such as C, C++, C# etc. still supports this type of memory allocation
- Fixed Partition Allocating: In this type of partitioning, the operating system maintains a table that shows the used memory and available memory by the processes. This available memory is known as a "Hole". When the process arrives in the waiting queue and requests memory we search for free available space. If enough space is found then the process gets memory and the execution of the process starts. While allocating memory to the process problem may arrive from the available free hole which free hole is used to fulfil the need of the process of size 'n'.

This problem is known as the dynamic storage allocation problem. The following are solutions to this problem:

- First Fit: In the first fit, the first free available hole which satisfies the memory request of the process is allocated to the process.
- Best Fit: In the best fit, the smallest available hole which is big as per the requirement of the process is allocated.
- Worst Fit: In the worst fit the biggest available hole is allocated to the process. This causes a waste of memory.

When a process terminates, the partition gets deallocated and now it is available for other processes. Another important terminology related to memory allocation is fragmentation. Fragmentation: After the execution of the process, it is removed from memory which creates a small hole in memory which is known as fragmentation. This causes a waste of memory. So, to achieve the goal of multiprogramming we must reduce memory wastage. There are two types of fragmentation:

- Internal Fragmentation: This fragmentation causes when memory is allocated to the processes more than their requirement.
- External Fragmentation: This fragmentation is caused when we have free memory blocks but we don't assign processes to that block.

2. LITERATURE REVIEW

In this paper [1], the author discusses operating system's memory management, along with the fundamentals of operating system segmentation and memory allocation. Additionally, the fundamentals of dynamic memory and virtual memory management are discussed in this work. The paper [2] is based on an examination of first-fit and dynamic equi-dimensional memory allocation arithmetic; this work offers a novel method of managing dynamic memory for embedded systems. The addition of dynamic equi-dimension memory tables in the first-fit arithmetic eliminates the effect of the length of the allocated linked table on the time to release memory blocks. The aim of the study [3] was to identify the contiguous memory allocation mechanism with the lowest fragmentation. According to the authors in paper [4], from a security standpoint, it is preferable to prevent code pointers (such as return addresses and function pointers) from being leaked. To protect code pointers, isolation methods have always been the preferred option. These methods incur significant

performance overhead because additional instructions must be instrumented for frequent authority switching or bound checking. The study in paper [5] offers three allocating strategies for dealing with external fragmentation. First-fit, Best-fit, and Worst-fit are these algorithms. On produced virtual traces, the author compared the performance of three methods and gave their implementations. This research study [6] discusses various memory allocation strategies and compares them in terms of the internal fragmentation they produce reaction time, memory footprint, and allocation and deallocation durations. Memory allocation has a significant impact on many computer systems, including multi-user systems, virtual machines, cloud-based services and many other systems. This paper [7] introduces a novel memory allocation strategy for on-demand (online) web applications, based on sequential fits and zoning. The study in paper [8] is to explore the magnitude and efficiency of artificial models of behaviour in programme allocation. If these models are sufficiently precise, offer a compelling substitute for algorithm assessment based on trace-driven simulation by real tracks. Memory access latency is significantly influenced by memory management and array binding methods. This study [9] presents a method for memory allocation and array binding that is efficient. The authors have also implemented buffer allocation for such arrays that have been used most frequently in an effort to reduce the number of requests to off-chip DRAMs. To manage memory layouts, several memory management systems use buddy memory allocation techniques. Using the interactive theorem prover Isabelle/HOL, the authors of this study [10] construct and formally validate a memory allocation model that preserves functional efficiency and security features.

TABLE 1 COMPARISON TABLE

Sr. No.	Authors	Title	Approach	Remark	Conclusion
1.	Durgesh Raguvanshi, 2018	Memory Management in the Operating System[1]	In this paper, the operating system's memory management is discussed, along with the fundamentals of operating system segmentation and memory allocation.	1.Space loss is caused by static memory allocation. 2.Longer execution time is necessary.	The fundamental idea of how an operating system works, how its memory is segmented, and what memory management is all about.

2.	Fuqing vu, Max Q-H, 2009	The study and improvement of memory management based on OS[2]	This paper presents a unique approach to managing dynamic memory for embedded systems.	The length of the allocated linked table is no longer a factor in how long it takes to release memory blocks	In this work, the memory allocation of the SOS OS is described briefly,
3.	A. K Mandal. Dilip Kumar Baruah, Jogamoh Medak, Neelutpol Gogoi, ParthaPratim Gogoi	Critical Scrutiny of Memory Allocation Algorithm[3]	This study's primary objective is to determine the contiguous memory allocation mechanism with the lowest fragmentation.	Internal fragmentation may or may not happen in fixed-sized partitions, but external fragmentation never happens since leftover space from a partition cannot be given to another process.	The worst performer in a variable-sized partition might not be the worst fit. The next fit algorithm, which looks for the first unoccupied division.
4.	Jiameng, YingRui, HouLutan, ZhaoFengkai, Yuan Pengh, ZhaoDan, Meng, 2022	A lightweight memory page management extension to prevent code pointer leakage[4]	According to the authors, from a security standpoint, it is preferable to prevent code pointers (such as return addresses and function pointers) from being leaked.	The solution does not require extending the cache and memory architecture as compared to typical tag architecture.	This investigation that employs conventional isolation solutions to stop code pointer leakage causes large performance overheads.

3. GRAPH OF COMPARISON

Table no. 2 discusses how each algorithm performs while allocating to different processes. Here three algorithms are listed. Which are first, best and worst fit memory algorithms. According to the total size of memory and total size of process in kb, amount of internal fragmentation is shown in table. Also, percentage of process allocation and internal

fragmentation are shown. Internal fragmentation value represents the difference between allocated memory and demanded memory. If we compare first and worst fit cases then it is seen that there is more percentile of internal fragmentation in case of worst fit memory algorithm. Whereas it is seen that best fit memory algorithms perform best as it shows less percentage of internal fragmentation as compared to other algorithms.

TABLE 2 MEMORY UTILISATION IN FIXED SIZED PARTITIONS AND INTERNAL FRAGMENTATION.

Algorithm	Total memory allocate (In KB)	Total size of process allocation (In KB)	% of process allocation	Internal fragmentation (In KB)	% of internal fragmentation
First Fit	1300	760	69.72	540	31.76
Best Fit	1600	1090	100	510	30.00
Worst Fit	1300	760	69.72	640	37.65

Fig. 1. Represents comparison graphs for first, best and worst fit memory algorithms. Here the x-axis represents the size of the process and the y-axis represents the number of blocks allocated to the process for different memory algorithms. By observing the graph, it is found that first fit technique sometimes performs as good as best fit technique whereas sometimes it allocates memory which is too small to hold the process. Worst fit algorithms give very less performance as compared to first fit and best fit. Best fit memory algorithm gives better performance as compared to both algorithms.

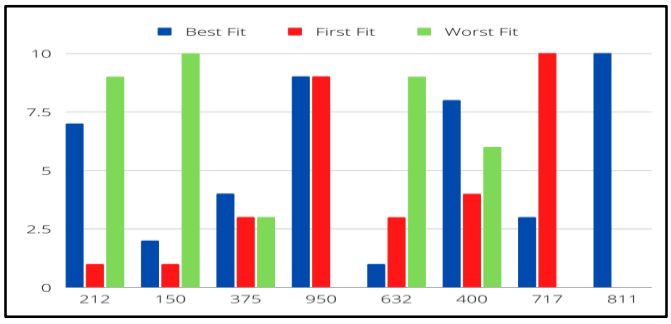

Figure 1 Analysis of Three Allocation Algorithms for Performance.

Table 3. Shows the comparison amongst other memory allocation algorithms based on three parameters which are fragmentation, response and memory footprint. Fragmentation is of type either external or internal in both conditions causing memory wastage. Memory footprint is the amount of main memory occupied by a process that uses any one of the algorithms in the table. So basically, good performing is the one who has smaller

fragmentation, faster response time and min value for memory footprint. It is found that TLSF is a good performer amongst all of the algorithms.

TABLE 3 FRAGMENTATION IT CREATES AND REACTION TIME.

Algorithm	Fragmentation	Response	Memory Footprint
Buddy System	Large	Fast	Max
Sequential Fit	Large	Slow	Max
Segregated Fit	Large	Fast	Max
Index Fit	Large	Fast	Max
Bit mapped Fit	Large	Fast	Max
TLSF	Smaller	Faster	Min
Hoard	Small	Faster	Min
Tertiary Buddy	Small	Fast	Min

4. SCOPE OF IMPLEMENTATION

In this survey paper, we have discussed the importance of memory allocation techniques in the operating system. Also, we have discussed how the processes get memory for execution. Process of swapping which is used for swapping lower priority processes with higher ones. Problems such as fragmentation and dynamic memory allocation occur while the execution and allocation of memory processes can be solved using multiple partition allocation. Algorithms such as first fit, best fit, and worst fit can be used to tackle the problem of dynamic memory allocation.

5. CONCLUSION

The main aim of this review is to discuss the various Memory allocation techniques. From loading the process into memory to the execution of the process there are many techniques used by operating systems. This paper also gives the brief information about various terminologies related to memory allocation such as static and dynamic loaders that load the process into main memory. After analysing various papers some problems get highlighted such as dynamic memory allocation. This paper also discusses solutions to these problems. Algorithms such as first fit algorithm, best fit algorithm, and worst fit algorithm can be used effectively to solve the problem of dynamic memory allocation. In the above discussion, the problem of fragmentation is also discussed. This causes wastage of resources. This problem

occurs when small holes are created in memory after the execution of the process. Methods such as multiple partition allocation can be used to tackle such problems. Our study also encourages that various algorithms and methods related to memory allocation are used but nobody's perfect one can use according to requirements.

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Biographies

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Achieving Business Excellence through Big Data: Evidence from Tourism Sector

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Abstract

The study aims to examine the role of business analytics in tourism sector. It provides an in-depth review of various applications of big data used by tourism companies, and challenges associated with the usage of big data by tourism companies. Using case studies of top tourism companies; namely; Make My Trip, Booking.com, Yatra.com, Thomas Cook and Trip Advisor; the implementation process of big data in tourism sector have been explained, along with its strategic importance for making companies' decisions. The study aims to highlight the dark side of using big data for tourism sector as well. Data was purely secondary, and qualitative in nature, hence qualitative analysis was conducted for the research. The major finding of the study is that big data has power to build the corporate image of the travel companies, through customer engagement, brand positioning, customized solutions and through market segmentation. Dark side of the big data usage, helps in framing strategies which can eliminate the inconvenience caused to tourism customers along with reaping maximum benefits from big data applications.

Keywords Big Data, Business Analytics, Business excellence, Business strategy, Tourism analytics, and technology.

1. INTRODUCTION

Data leveraged astutely has the power to improve the overall performance of the companies, Travel companies are no exceptions to this; in fact, travel companies are more likely to use data analytics as after e-tourism concept, most operations of the travel companies depend on the data analytics. Data analytics also helps the marketing department of tourism companies to get insights about the purchasing and travelling patterns of customers. It gives insights like customer's country of origin, the number of days he is willing to stay, which areas the customer is interested to visit or stay, how much the customer is willing to spend[1]. According to this data, companies can come up with good offers which will be more customers centric. Suppose a customer searches for any tourist place on Makemytrip.com, all data searched for and entered will be analysed to come up with a series of suggested tours. According to this data, customized and affordable tour packages will be provided to the customer. The current trends that are ongoing in the tourism industries are – Mobility, sustainability, Lifestyle and experiential travelling, an increase in booking windows[2]. Many international hotels, airlines, and railway are also using data analytics for dynamically managing prices and enhancing their revenue. This validates them to increase their revenue and develop the best travel experiences for customers. This data can be obtained from many sources like online feedbacks or word of mouth. This data

can be used to get SWOT (Strengths, Weakness, Opportunities, Threats) analysis of our competitors. This data can be more valuable, as it gives a clear picture of the gaps in the market. The study examines different applications/tools of big data in the tourism sector. These tools help companies to gain a competitive advantage over other companies if used effectively. The study also gives insights about the challenges faced by companies while implementing big data. It also explains the implementation process of business analytics and strategic decisions with the help of analytics. The flow charts used gives us a clear view of the process of implementation. Further, the study explains the dark side of using business analytics in the tourism industry. Keeping in view the importance of business analytics for the tourism sector, the current study is an in-depth exposition to examine how tourism companies can achieve excellence through business analytics.

2. APPLICATIONS/TOOLS OF BIG DATA IN TOURISM SECTOR

Spatio-temporal pattern technique: Big data is used to find the spatiotemporal pattern for the demand and supply in the tourism sector. Here, spatial pattern is the impact of tourism of one region on the demand of neighboring regions, while temporal pattern is the pattern created due to the seasonal effects over the demand factors. Making use of the big data related to the customers' preferences for a tourist's destination in a particular season can help in estimating the spatiotemporal pattern for the demand in tourism sector. User generated contents, visitation rates, hotspots data of tourists and the search engine queries can help in generating big data for this technique [1] [2].

Mobile network operator technique: Mobile network operator is a tool used for tourism analytics, where the analytics completely based in the big data generated by the mobile network operators, whenever a customer make use of mapping, hotspots or the search for a restaurant, or other places at some tourists' destination. Even the data related to the search for a particular place, from origin place, compared places can also be generated using MNO tool. This application makes the big data a competitive edge for designing tourist friendly policies and tourist plans for the potential tourists for a specific location [3].

Predictive analysis technique: This technique is one of the very important and widely used application of big data in almost all the sectors. Several companies are working on vector autoregressive models to estimate the demand of the tourism sector, using big data generated through web search queries and general database, and then using predictive analysis tools to estimate the demand. Several indicators which cause demand for tourism sectors, are taken together and then these are analyzed using the vector autoregressive models, to fit a trend line and knowing the cause and effects relationship between the vectors. Focusing on the causing factors, one can plan strategies for handling the excessive and less demand periods which are usually taken as the period for attention by the marketers [4] [5].

Text mining: Text mining is one of widely used tool of analytics, in travel sector, where the reviews, and feedbacks of the customers are available in the form of text and the text mining is used for analyzing the trends, similar patterns in the text data. It is one of the unique tools after evolution of the big data, as earlier the software available for the analysis did not have this feature and the qualitative data was tough to analyze. It was all affected by the subjectivity of the readers, or the analyst but now text mining application of the business analytics have made this easy and

more meaningful information to the decision makers. In travel companies it helps in taking strategic decisions based on the results of text mining tools [6].

Deep learning: Machine learning or deep learning helps in generating raw data by the system itself, which can be used for the analysis and several of the travel companies' strategies are planned using the deep learning technique. Pricing strategies, which adjust the prices as per the demands, and seasonal conditions, without comprising the profits of the suppliers, estimation of the demands, and the recommended products or services to the customers are some of the effective usage of the deep learning by travel companies. This can enhance the customer experience in both long run and short run which leads to word-of-mouth marketing and brand loyalty too [7].

Shrinking tools for big data: There are software such as Hadoop and EDB which compresses big data and extracts meaningful information out of it. Big data requires lot of storage; this has been managed easily by the companies. They use applications which handles big data efficiently without losing the essence of the information. Data per click saved efficiently on the backend yields itself to any kind of analysis required to assist in economic benefits for the firm. In travel sector, this tool plays specific important because it is a two-way information flow, which provides the information from buyer to suppliers and supplier to buyer, and every search history of both buyer and supplier results into big data inventory and requires some tool to manage such data [8]

Word frequency analysis: Under this method, the frequently used words in the blogs, websites, customers' forum are converted into different themes and the critical incident method is applied over different themes to analyze the behavior of the customers who have availed the services of the travel companies, or have stayed at some property. Based on the results, the different attributes are identified to work upon for improving the customer satisfaction and their overall experience [9].

Virtual reality technology: In tourism sector, augmented and virtual reality tool is used to provide memorable experiences to the tourists. Here, big data serves as a base, which is used to create a virtual environment of the desired tourist location by the customers. Customers before visiting a tourist's place, can decide in advance whether that place is worthy to visit or not based on the virtual reality technology. Both the video and audio stimuli are used to make the Customers feel in completely different environment, where they can have a feel of real environment. This technology actually immerses the customers, and helps in the promotion of the tourist's destination using big data. This technology helps in saving time and cost of the tourists [10] [11].

Web analytics: Web analytics as the name suggest is a tool used to analyze the contents of a website, which provides a deep insight about the business performance to the travel companies. The web analytics of makemytrip.com, or yatra.com, provides a clear picture about the number of customers visited their websites, products searched for, filtering process used by the customers gives insights about the customer preferences for specific products or offers, and type of promotional offers checked by the customers. Apart from all this, web analytics gives the information about real business generated by the customers such as; number of bookings, payment made by customers, mode of payment, actual travel history through a particular travel company, and cancelled deals or booking against cancellation etc. [12].

Performance Dash boards: Performance dashboard is a tool which is used by the travel

companies for both the buyer and supplier. Buyer is provided with the latest search options, similar products, products with discounted offers and facilities etc., while the dashboard for the sellers provide them an insight about the number of page search, rate of properties booked, and cancelled, comparison stats of customers, and the future predictions about the demand for their specific properties [13].

3. CHALLENGES IN IMPLEMENTATION OF BIG DATA IN TOURISM SECTOR

Cost factor: Business analytics companies use very good amount of software's, also there hire a lot of data scientist and business analytics to run these operations and also monitor the changes required accordingly. Hence, many new companies and those who have low expenditure cost or are new in this business, find it very difficult challenging to compete with existing players. Tourism sector uses a lot of Business Analytics, Apps such as Airbnb, Oyo is entire based on technology and uses business analytics, data science and is entirely software based. Lot of new firms with great idea finds difficult to implement at initial stage as the cost is very high and it requires lots of ads/publicity/offers to make it a success.

Real time data: Business analytics work on the principle of real time data, the older the data less effective it will be for any kind of analysis. Hence, company require the real time data to be processed, which not only requires the huge resources to be deployed by the company to access such data but also make it difficult. While for travel companies it is important to have the real time data, to predict the demand for the tourism services and products accurately.

Authenticity of data: “At the point when great data goes in the model, a great model delivers great outcomes.” The inverse is known as GIGO (Garbage In, Garbage Out). In the period of Big Data, “it is altogether increasingly hard for the information examiner to mine in the mountains of data and locate the applicable pieces.” All the time, legitimate models produce poor outcomes, which lead to inappropriate choices. In the era of Big Data, this happens all the time. An on-going story 20 reports how ten volunteers checked the exactness of their data on AboutTheData.com and they each discovered mistakes. In one explicit case, a volunteer found that "she had two youngsters, at 26." Interestingly, a CNN group found that Acxiom, the organization that runs the database, was increasingly precise determining the interests and less exact in segment information (marriage status, number of kids). Wrong suppositions can prompt wrong choices [14].

Structure of data: Structure of the data is another important hurdle while applying business analytics in an organization. Technological era has made the data availability easy and in abandon but the problem is the data is not found to be structured except for the database management system. Hence, it makes the adoption of the business analytics again challenging as data available need to be screened, sorted and filtered out as per the needs of the business. Most of the data is available in the form of semi-structured like emails, blogs and unstructured data such as; reviews or feedbacks.

Business analytics culture: Business associations are definitely entering the new worldview of Big Data. They have been making use of preferred databases for over three decades and have gathered understanding and information. Having said that, Big Data calls for the adoption of newer ways of thinking and practices; an enormous quantity of them are nonetheless in the

formative stages. Securing the new devices requires an excessive trade in hidden convictions or hypothesis—they require any other perspective. It requires, for instance, that a better variety of folks think 'probabilistically' as an alternative of 'narratively'. It moreover necessitates that administrators determine how to pay attention to various overt signals and symptoms and do not turn out to be lost in the commotion [15].

Resistance by employees: The purpose of using "analytics is to bring business esteem through better vital and operational choices, at the vital level, the individuals who settle on choices about what models to execute and what should be estimated will collect more power. At the operational level, the usage of such models brings a force move in the dynamic procedure." Data based changes and its training and implantation of new software's and latest techniques can lead to a strong resistance by the employees [16] [17].

Management attitude: Adoption of business analytics in a company, affected by the management attitude towards it. Managers who believe in taking rational decision usually, believe in taking decisions or framing strategies which are backed by the analysis, proper data collection and facts and supportive statistics behind it. This kind of decision not only make the strategies and planning process effective but helpful in resolving the traditional issues faced by the companies. Management of Travel companies should understand the significance of the business analytics for the company's growth and future prospects and should support analytics for each and every decision of the firm [18].

Cost benefit trade off: Cost benefits trade off shows the cost involved in adoption of the business analytics and the benefits derived using analytical tools. The cost is not only related to the installation cost or the cost of the intellects hired for this purpose, but it also involves the cost to upgrade the software as per the changing need of the macro environment, which makes it questionable whether the company will be able to reap the enough benefits out of business analytics or it is the cost that will eat up its benefits derived using the analytics. Updation and maintenance are the important steps of the implementation process and that requires huge resources. Hence, it is difficult to decide regarding the cost benefit in context of business analytics by the companies, especially in case of travel companies where the margin of the profits is too less [19].

4. AREAS FOR USING BUSINESS ANALYTICS

Customer engagement: Business analytics is one of the important strategic tools which can be used to improve the customer engagement. Customers get engaged when company keep a track about the likes, dislikes, preferences and the changing attitude of them with the advancement in technology. In tourism sector, travel companies keep a watch on the travel history of the clients, travel stories shared by the travelers, their feedbacks after visiting or staying at a particular place, and then based on this information keep on emailing about the similar options which can be preferred by the customers, or opted for in near future. Gamification engages customers via some game points, or sharing some GIFs or getting likes by others for a theme and getting travel offers in return etc. this all helps the company in generation of data, reaching to vast markets and engaging the customers [20].

Customized solution: Travel companies can make use of the business analytics for providing customized solution and enhancing their market share along with profits by increasing the

customer satisfaction. Customized solutions to the customers based on their related data, such as; tourism products or offers as per the salary range of the individuals, past travel history, promotional deals on specific occasions such as birthdays, or anniversaries. All the customized solution provided by the company are based on some kind of analysis, such as; details of birthdays and anniversaries related details of the customers can be taken while providing services to the customers and taking feedbacks which can help in providing customized solution later on [21].

Brand positioning: Brand positioning and business analytics go hand in hand especially in the technological era, where everything works on digital resources, decision making, consumer behavior gets influenced by the data freely available to customers. Makemytrip.com make use of the business analytics to position its brands, after analyzing the customers behavior and choices. Based on the loyalty of customers towards their brand, which is again measured using the analytical tools on big data available to them related to their loyal customers, company frame its strategies for the brand positioning and keep its customers updated about the brands activities and future plans.

Corporate image: Corporate image is the outcome of all the above-mentioned activities, such as; brand positioning, customer engagement and the customized solution. Travel companies like booking.com mainly focus on engaging their customers by accessing their data, and using analytical tools on such data, provide them customized solution, which helps in improving the corporate image of the companies. Hence, corporate image can be improved using big data and analytical decisions of the company.

5. BUSINESS ANALYTICS AND STRATEGY FORMULATION

Data used by the travel company is mainly semi-structured data, where the search history of the people related to the tour plan inquires, inquires related to the hotels booking, cab booking or the flight booking can be used, even from the mobile network operator's data the data related to the hotspot, google maps used and other information can be accessed. These need to fit into the strategic decision-making approaches for the company as well. At last stage of the implementation, tools applied and information generated for the problem, maintained and updated on regular basis by the company. Even the regularity in add up of information is required to reap the benefits of the analytics. For this, the authentic and large amount of data is the necessity for ensuring the success of implementation process.

Business analytics should be a part of the strategic decision of a company, which makes the decisions more successful and impactful as well. In the technological era, everything is based on the analysis. Hence, the whole process of the travel companies backed by the data and its analysis, without this travel companies can't work**.** Even a brick-and-mortar kind of travel agency also work on same basis, but the mode of data it makes use of is different. Such as; the receipts of the customers along with their names, contact numbers who have taken services of the travel agency can be used for demand prediction in future, or demand during a particular season or place, or by a particular community even. Hence, travel companies have to backed their decisions by some kind of analytics to make them impactful and fruitful.

5. DARK SIDE OF USING BUSINESS ANALYTICS IN TOURISM SECTOR

Business analytics has been considered as a tool to improve the performance of the businesses, to reach to the height of business excellence but it has its limitations Some of these drawbacks or the negative side of the business analytics or big data related to tourism sector and specially the companies like makemytrip.com or booking.com has been mentioned in this section.

1. **Manipulative reviews or feedbacks**: Manipulative or fake data used for any kind of analytics will automatically lead to wrong insights and failure of business strategies. People on tourism related websites sometimes give fake reviews or feedbacks, or feedbacks under some influence or through knowns or fake email ids, to get the reputation or highlighted in search process by the tourists, which makes it difficult for the tourism companies to use such data. Any kind of reviews analysis can lead to wrong information in such cases.
2. **Breach of privacy**: openly accessible data and using it for the business purpose cause no harm to anyone, but using the personal data of people by breaching the privacy of individuals make the exercise of big data analytics unethical. In case of travel companies, information feed by the customers, are supplied to the credit cards agents, banking and insurance products agents, or online booking sites which make use of customer's data who travels to national or international tourists places frequently, which is unethical. This type of practices by travel companies is another dark side of business analytics.
3. **Right tools for right data**: Data analytics can't prove to be helpful or worthy until and unless, it is being analyzed using correct tool or technique, like testimonials or blogs related data can be analyzed using text mining tool, while the number of booking in the hotels, cancellation rate can be analyzed using predictive analysis. Hence, only accessing and storing the big data is not at all sufficient, until it is worked upon by a team of expert data analysts.
4. **Loss of data or the server failures**: Use of data gives an ease to the tourism companies for developing dashboard for sellers, and the visitors, deriving cancellation rates, number of visitors to a particular security and the comparative stats. A very few requests of the customers are handled by the company offline, which makes it difficult for the companies in case of any data leakage, or the servers' failures due to any technical reasons, which leads to huge losses and even converted into lost customers and customer dissatisfaction.

6. CONCLUSION

Overall, it can be said that big data has power to build the corporate image of the travel companies, through customer engagement, brand positioning, customized solutions and through market segmentation. Data is powerful, the more you torture the data, the more it will confess to you, meaning here is that if data is used correctly, wisely then it has the power to improve the overall performance of the companies, by making its business excellent in all aspects. Travel companies are no exceptions to this, in fact, travel companies are more prone to data analytics as after e-tourism concept, whole of the operations of the travel companies depends on the data analytics. Hence, travel companies can make use of the business analytics by making it a part of the strategic decision making and can improve their business excellence.

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An Approach to Select Efficient Data Optimization Techniques in Connected Cars

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Abstract

To make data storage more successful, even using much storage, data can be compressed. By compressing data, information can be shared much more quickly. There are multiple techniques available for data optimization. Each approach also provides a different set of outcomes. This paper will discuss the optimization techniques using four different algorithms: Huffman encoding, Lempel Ziv Welch, Run Length Encoding, and Shannon Fano methods. This essay shows how a method performs compression and which method is more appropriate and effective when utilized to perform real-based data compression. The result of a technique can be determined by the compression file size, which is less than the original file.

Keywords: *Data compression, connected cars, compression techniques, Lossless compression, Real data-based compression*.

1. Introduction

The connected car, which is a vehicle with Internet connectivity, communication capabilities with other vehicles and road infrastructure, and the ability to gather real-time data from multiple sources, is predicted to be a key player in the future Internet of Things [1]. With the support of hardware and software that facilitate widespread knowledge transfer rapidly via the internet, around the world, technology is developing quickly. Information technology [2] professionals can effortlessly by sending information over the internet. Not all data can be sent easily, though. To decrease the quantity of data that needs to be kept and transferred while easing data transmission, a data set is converted into a code through the process of compression. Compression can help cut down on time and memory [3] requirements (storage). The Huffman, Lempel Ziv Welch, Run Length Encoding, and Shannon Fano methods are only a few examples of efficient compression algorithm techniques. The optimization method is shown in Figure 1.

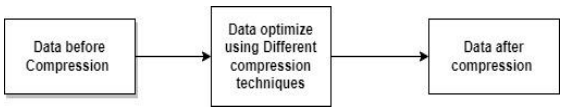

Figure 1: Block diagram of Data compression process

Figure 1 describes the general data compression process [4]. When data is not compressed, lossless compression is used to process the uncompressed tour to compress its size. The file will be smaller than it was before compression once the content has been reduced. A file's size is decreased through compression from a huge size to a smaller size.

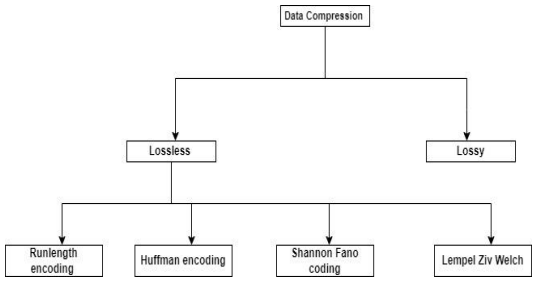

Figure 2: Types of data compression

Figure 2, there are two compression techniques named lossless and lossy compression techniques [5]. In the lossy compression technique, the data in a file is takeout and brought bring back to its original form after decompression. Lossy compression is generally used to compress multimedia data (audio, video, and images). In lossless compression techniques, it belongs to a kind of data compression that makes it possible to recover the main data exactly from the optimized data lack of losing any details. Since most real-world data exhibits statistical redundancy, lossless compression is practical. It maintains quality. In lossless compression, it uses different algorithms for compressed data like as, Huffman encoding, Shannon Fano coding, Run-length encoding, and the LZW method [6]. Here is an explanation of how data compression can be executed.

- Compression for audio
- Compression for text
- Compression for video
- Compression for image

There are different explanations for how data compression can be executed. As we are working on Real-based data so, it required text data for compression [7]. When text is optimized, the decompression procedure resets the compressed file to the beginning of the text. The results of decompression depend on whether Lossless Compression or Lossy Compression was applied. If a text has completed lossless compression, the main details

can be precisely retrieved from the uncompressed file. Lossy compression causes some information to be lost, and the text generated after decompression cannot fully equal the text from the original data. It is explicitly evaluated and compared to how well various approaches compress text data.

2. Literature Review

In this paper [8], A novel multilevel Huffman coding-based test database optimization method was proposed. The suggested method works with IP cores whose structural details are unknown. The technique encrypts three of the primary data kinds. The same Huffman codewords produce better compression outcomes. According to most of the relevant procedures from the literature, the efficiency of the space above the intended Decompressor is relatively low.

In this paper [9], It can be concluded that the Shannon-Fano algorithm for data compression has been very well achieved using Modalism SE 6.4 simulator and VHDL coding and that data is compressed using these techniques. The Shannon-Fano algorithm equation creates a very effective compression strategy for determining how much data is compressed.

In this paper [10], Arithmetic coding provides the best compression, but its slow execution can be a drawback. Arithmetic coding's efficiency and built-in separation of coding and modelling are its key benefit for statistical data compression. The drawbacks of arithmetic coding are its slow performance, implementation complexity, and shortage of prefix codes.

In this paper [11], For most of the text files, the combination of the RLE and LZW compressors will result in somewhat better compression than either RLE or LZW alone. Since both the RLE and the LZW algorithms take benefit of common redundancy in text-based files (i.e., repetitiveness or multiple examples of phrases), combining this beneficial Aspect of the two algorithms into one algorithm can lead to better results than the individual performance, but in the end, they find that individual performance gives more compression ratio.

3. Data Optimization

3.1 Different algorithms

Run length encoding

RLE, also known as run-length encoding, is the most straightforward data compression approach. This algorithm distinguishes between runs and non-runs by identifying successive symbol sequences as runs. This algorithm handles a certain amount of redundancy. Based on their redundancies and their lengths, it evaluates whether there are any repetitive symbols. All other sequences are regarded as non-runs, while consecutive recurrent symbols are labelled as runs. For instance, if the file "XYXZZZZX" is chosen to optimize, the first three letters are regarded as a non-run with a length of 3, while the following four characters are regarded as a run with a length of 4 because the symbol Z is repeated. This algorithm's primary priority is to locate the runs in the source file and to mark each run's symbol and length. While storing all the non-runs and not using any of

those runs for the compression process, the RLE algorithm [12] uses those runs to optimize the main research file.

Huffman Encoding

ASCII character data compression is the focus of Huffman coding. Numerous types of data, including text, audio, video, and images, are compressed using it. This method is based on developing a complete binary tree for each symbol in the original file after figuring out the probability of each symbol and sorting the symbols by reducing probability**.** Lossless compression techniques are included in the Huffman compression algorithm. A compression technique known as lossless compression does not alter the underlying data information to make it smaller**.** Huffman's approach is that each ASCII character is typically represented by 8 bits. As an illustration, if a file has the character "UUVWX" in a row, it has 40 bits, 5 bytes, or 5 bits. We only require a file that is 10 bits in size (0010111110) if each character is assigned a code, such as U = 0, V = 10, W = 111, or X = 110. that specifies that codes must be identical, or that a code cannot be generated from some other code [13].

Shannon Fano Encoding

Shannon methods, which replace each symbol with a binary code whose length is calculated based on the likelihood of the symbol, were at the time the best method, but after the Huffman encoding, they were hardly ever utilized. Shannon Fano is a method for generating a prefix code [14] based on a combination of symbols and probabilities in the area of data optimization. Huffman encoding, on the other hand, is more capable of producing the code.

Lempel Zev Welch Algorithm

In general, the LZW method uses a dictionary and is a lossless compression algorithm. Dictionary-based techniques do this instead of having a statistical model as their core. A dictionary is a collection of all words that can be used in a language. Larger and more frequent dictionary words are represented by the entries' indexes, which are preserved in a table-like format. The most popular method is known as the LZW algorithm [15]. This methodology stores and indexes the previously observed string patterns in a dictionary. Instead of repeating string patterns, these index values are used during compression. Instead of using repetitive string patterns, these index values are used during compression. The dictionary is generated dynamically during the compression process; thus, it is not necessary to send it along with the encoded message for decompression. During decompression, the same dictionary is dynamically created.

3.2 Measuring compression performance

Depending on the application, a compression algorithm's performance can be evaluated using a variety of factors. When assessing performance, space efficiency would be the main factor to take into consideration. The efficiency of using time is another factor. Because the behaviour of the compression is based on the symbol repetition in the main file, evaluating a compression technique's overall performance may be difficult. As a result,

calculating effectiveness is challenging, and many measurements should be used to analyze the performance of those compression categories. The measurements used to evaluate how well lossless algorithms work are listed below.

Compression Ratio: It describes the proportion of the source file's size to the compressed file's size.

$$CR = \frac{Size\ after\ compression}{size\ before\ compression}$$

Saving percentage:

$$Saving\ \% = \frac{size\ before\ compression - size\ after\ compression}{size\ before\ compression}\%$$

Compression factor: It is the absolute opposite of compression ratio.

$$CF = \frac{Size\ before\ compression}{size\ after\ compression}$$

4. Methodology

The Run Length Encoding Algorithm, Huffman Encoding Algorithm, Shannon Fano Algorithm, and Lempel Zev Welch Method are implemented and analysed in a set of data files to evaluate the performance of lossless compression methods. The mentioned factors are evaluated to measure results.

LZW Algorithm Performance Analysis

Entropy and code efficiency are not planned for this technique because it is not based on a statistical model. Calculations are performed regarding the compression and decompression processes, file sizes, compression ratios, and saving percentages [16].

Run length encoding Algorithm Performance Analysis

The Run Length Encoding Algorithm produces the File Sizes, Compression Ratio, and Saving Percentage since it does not use any statistical techniques to perform compression. For calculating, a variety of files with multiple source patterns and file sizes are used.

Huffman and Shannon Fano encoding Algorithm Performance Analysis

Implemented and carried out separately are Shannon Fano and Huffman's Encoding methods. Calculations are performed regarding the File sizes, compression ratio, and saving percentage [17].

Comparing the performance

The selected methods function differently depending on the calculations; while one approach offers a maximum saving percentage, it can take a longer processing time. Therefore, to pick the best option, all these aspects are examined. The best algorithm is one that produces a respectable saving percentage in a reasonable period.

5. Results and Comparison

Two text files retrieved from GitHub Real-word file [18] (open source) with various file sizes and distinct contents, i.e., actual-base data, are tested using four lossless compression algorithms. The original text files are 4096 bytes and 16384 bytes in size.

Evaluate the performance of the different Algorithms:

Table 1: shows the compression Ratio

File size		**Run-length encoding**	**Shannon Fano coding**	**Huffman encoding**	**LZW method**
4096	Compressed file	1919	1877	1650	1450
	Compression ratio	0.531	0.541	0.591	0.645
16384	Compressed file	7707	7100	6707	5707
	Compression ratio	52.96%	56.66%	59.06%	65.16%

Table 2: shows the comparison between saving%, compression factor, and ratio

Parameter	**Run-length encoding**	**Shannon Fano encoding**	**Huffman encoding**	**LZW method**
Compression Ratio	0.531	0.541	0.591	0.645
Compression factor	1.88	1.84	1.69	1.55
Saving percentage	53.14%	54.17%	59.71%	64.59%

As can be observed in tables 1, and 2, the relative compression ratios, compression factor, and saving percentage are displayed in each compression strategy. The run length encoding has the moderate compression ratio of all data sets. Nowadays, lossless data compression rarely uses RLE [19]. Based on the information that is currently known regarding compression ratio, the Huffman encoding strategy is determined to be the best alternative because it focuses only on reducing input data redundancy [20]. Although Huffman encoding, which has a moderate compression factor and compression percentage, seems to produce the outcomes that Shannon Fano encoding most nearly fits.

Dictionary size is an important factor in Lempel-Ziv-Welch encoding's success in achieving greater compression ratios. Therefore, when compared to other compression techniques, the results of lower dictionary sizes are reduced.

6. Conclusion and Future Scope

Our text bed had a limited amount of text data, thus we compared four lossless data compression algorithms in this research. In the future, a larger test bed including audio, video, and image data may be used to create more compression methods (both lossless and lossy). After that, a system that can find out the file and then choose the best compression methodology for that file can be put into place. It was performed as an experimental comparison of various lossless text data compression algorithms. The effectiveness of various known lossless compression techniques is evaluated. Although they are evaluated on various file types, the focus is primarily on multiple test patterns. The Lempel Zev Welch algorithm can be regarded as an effective technique among the shortlisted ones by considering the compression ratio, file size, compression factor, and saving percentages of all the algorithms. These algorithmic parameters are within a reasonable variety, and it produces effective outcome for big data.

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Development of user interface using Robotic Process Automation in Healthcare

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Abstract.

Today's healthcare facility leverages modern technologies to extend digital operations, provide e-services, and AI (artificial intelligence) for many processes. However, they are still being used marginally, and there exists abundant scope for healthcare organizations to evolve. India is one of the countries where disease control is still lacking and there exist fields where technology can be leveraged. This study examines the prospects and implementation of robotic process automation (RPA) in the healthcare industry and illustrates how RPA can work in sync with traditional websites and further build scalable systems that aim to reduce and eliminate repetitive operations and processes.

Keywords. Healthcare automation, robotics process automation, Ui Path.

1. INTRODUCTION

The healthcare infrastructure is one of the major sectors of revenue as well as employment in any country. Managing and processing data from various internal and external sources, such as clinical applications, insurance sites, and radiology information, is difficult in any healthcare system. Integration between these systems is often difficult and redundant, moreover, healthcare organizations rely on people to perform complex manual labor to process information. RPA in healthcare assists in the automation of processes and the improvement of healthcare operations[1]. In this paper, we will look at how RPA may be used to scan and analyze blood test results, the present focus is on applying RPA to blood reports and creating health status based on that blood report

2. LITERATURE REVIEW

Damian Kedziora and Kari Smolander highlighted the use of RPA in the City of Turku Healthcare Division's response to theCOVID-19 emergency. A generic RPA/ML-based framework was presented by Nitu Bhatnagar to assure the uniformity and quality of Bhasma - an end product acquired after various actions in the ancient Indian System of

Medicine - Ayurveda.

RPA was used to improve operational efficiency in the healthcare sector by Dr. N. Sumathi, Dr. A. Jeyalakshmi. Dr.Shahid Ud Din Wani et al. highlighted that AI can assist healthcare staff in expanding their knowledge, allowing them to spend more time providing direct patientcare and reducing weariness. Santiago Aguirre & Alejandro Rodriguez carried out a case study for demonstrating the applications of RPA in adifferent sector. Their results showed that productivity improvement is the main benefit of RPA

3. METHODOLOGY

3.1. Conventional

Doctors assess the blood reports of an individual to assess blood counts and cholesterol levels and to assist in the diagnosis of vitamin shortages or medical disorders.

Review of the conventional healthcare workflow and the RPA based workflow in the following subsections.The steps of a conventional healthcare workflow include:

- An individual first sees a doctor to learn about his health. The doctor might then advise doing a blood test.
- The actual blood draw often takes less than 3 minutes, and it can take several minutes to several hours for the results tobe available.
- The individual then makes another appointment with the doctor on receiving a blood report.
- When the patient visits the clinic, the doctor views his blood report and gives him a report on his health status[2].The disadvantages of using a conventional healthcare system:
- Because three separate parties the patient, the blood testing laboratory, and the doctor are involved in the traditional system, a lot of time is spent on each step.

3.2. RPA – Based Healthcare workflow

The first step is to train the RPA platform to execute the same tasks that the process engineer performs. After the workflow has been imagined as an RPA-based workflow[4], steps 3 to 5 of the conventional workflow are, in principle, automated. The RPA- driven workflow steps are:

- This is similar to the initial step of the conventional workflow where the doctor advises doing a blood test.
- The RPA bot scans submitted blood test reports for blood vitals. After scanning it processes the blood vitals values and stores them in an excel file, retrieving and converting them into JSON format for the health status algorithms to process and generate health statu.

3.3. RPA – Methodology

In this age of the modern world, where computers are getting smarter and humans are getting lazier, there's a need ofRPA.

There are a number of jobs and procedures in the traditional workflow of healthcare that can be automated using an RPA tool like UiPath. One among them is the manual review of blood reports, which is typically done by the attending physician and is also the first prospective task for automation[30]. Automation of the process would enable the medical professionals to focus more on the diagnosis and treatment; moreover, utilizing RPA[1,2].

- The patient can determine whether or not he has cardiovascular issues by viewing his health status immediately.
- The person's blood sample is collected.
- When the person receives his blood report, he can upload it to RPA based tool.

Tools to automate the review of blood reports make it possible for concurrent observations[37] and allow the doctor/physicians to consider several diagnoses and treatment options that are most appropriate for the patient[2].

3.4. Robotic Process Automation

The future and significance of Robotic Process Automation is bright as companies worldwide have already started to deploy RPA bots[2] to take stable rule-based processes from human workers and hand them to software, increasing efficiency and decreasing cost significantly.

Software Needed - UiPath, Node.js, Postman.

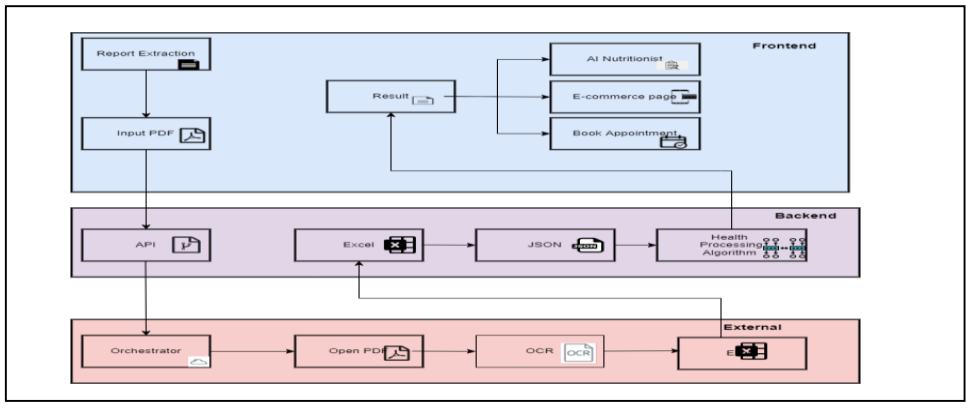

Fig 1: RPA Methodology

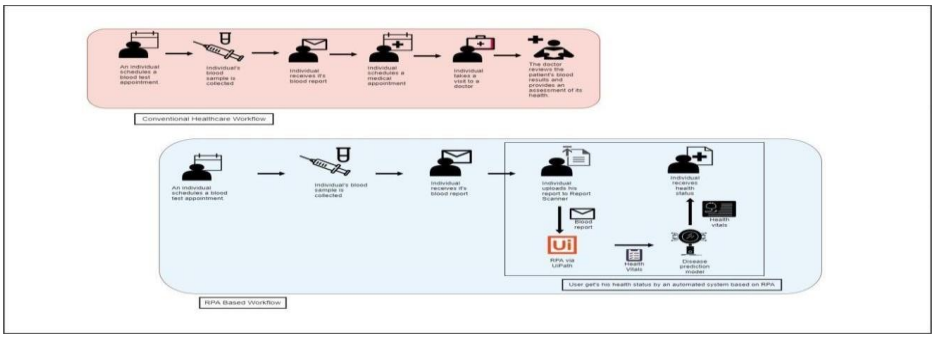

Fig 2: Comparison – Conventional and RPA Driven workflow

3.5. UI Path Methodology

The very initial step is to open the pdf in order to extract blood vital values, the same can be done by the Start process which isa part of UiPath core activities in the UiPath Studio. Once the report is fetched, the screen scraping of the blood vitals can be done via Optical character recognition. created, monitored, scheduled, deployed, and controlled by the orchestrator.

It acts as a mediator between third-party solutions and once the report is fetched the screen scraping of blood vitals can be done using Optical Character Recognition

3.6. Optical Character Recognition

OCR is process of converting a text from images into machine readable format.

Utilizing OCR allows the user to build automation based on what is displayed on the screen thus assisting in locating all of the characters displayed on the PDF. Once the blood report PDF has been scanned, relevant values can be extracted and exported to excel or any other storage.

3.7. Exporting Data to Excel

The write cell method in UiPath Studio can be used to export data to Excel and subsequently be used for various use cases.

3.8. Orchestrator overview

The UiPath Orchestrator is a web application that enables you to schedule how UiPath Robots[2] carry out repeated business tasks.

It may be understood as a location where the address of an RPA bot is maintained after deployment so that when we call the orchestrator using the API with a robot id and security settings, the address associated with that robot id is fetched and run.

Automation provided by UI path are categorized into two types -

- Attended Automation - These are the robots that require human supervision to complete their tasks[1,3]. Some of these tasks are automated, whileothers require human intervention. In attended automation, Orchestrator makes sure that package versions are correctly delivered to robots for execution andare managed centrally.

- Unattended Automation - Unattended Automations are designed for more complex and highly repetitive tasks that must be performed in batches andcan be determined by a predefined rule

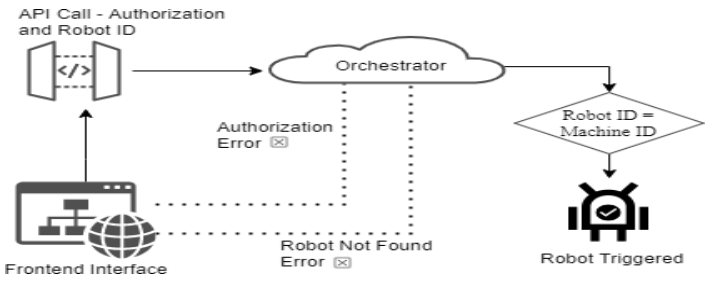

Fig 3: Orchestration overview for UiPath Bot

3.9. Robot Deployment

The previous section, we discussed the RPA bot creation process, now in this section we will be talking about how to publish your RPA bot on an orchestrator as an unattended automation.

- After creation of the robot, we need to first publish it on orchestrator[23].
  - On the right of the Studio ribbon, click Publish.
  - Enter the name of the package in the Publish properties tab.
  - Select Orchestrator Tenant Processes Feed in the Publish options tab, that's the location from where unattended robots can access the automation.
- Configuring UI Path Assistant
  - Open UI Path assistant. Login/Sign Up in UI
  - Path Assistant, from the same ID where you have published it.
- Orchestrator Setup
  - Open UI path orchestrator in your browser, from homepage click Tenants. Creating a new Folder - In tenants go inside Folders, create a new folder with desired name and descriptionand under process package source, click on Tenant Package Feed.
  - Managing Access –
    - Click on Manage Access, then from the users table select the user with registered emailID, and then click on edit. In the roles section select “Allow to be automated user”. In the next page, enable Unattended robot.
    - In the Domain/Username section you need to enter the designated domain of your machine, for that, Open command prompt on your machine and enter whoami, you will get your domain as Output. Enter your windows password in the password field and select credentials type as windows credentials. Click on Update.

- Machine Setup
  - From the tab, select machines Select your machine from the list and click on edit. In the Production (Unattended), update the field from 0 to 1.
- Click on machines then manage machines, find machine listed Now go back to the folder created by you and click on Users. Select your machine and then click on Update. Click om automation, then add process, then find your process name there and click next and then create.

4. RESULTS

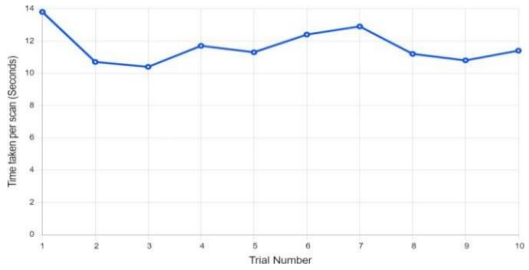

Fig 4: Trial Number vs Time Taken per Scan

With reference to the above graph, when automated processes are compared to the traditional way, this is incredibly cost- effective. Both the doctor and the patient who has taken the test might save a great deal of time this way. As a result of the substantial time savings, the healthcare system will benefit[2].

5. COMPARISON WITH EXISTING RESULTS

Jerry et al. (2021) [46] used RPA to relieve the IPC team of the load of repetitive duties related to the daily processing of test findings. According to the report, RPA cut administrative time by 3 hours per day, which corresponds to 18 hours per week or 936 hours per year. Furthermore, RPA saved a significant amount of time necessary for processing COVID-19 results and surveillance.

Considering this as base reference the process automation proposed under this paper optimizes the task more, depending upon the length of report, usually the process of scanning through the entire report takes around 120 – 180 seconds, which can be reduced to 10 – 12 seconds via RPA thus saving approximately 140 seconds per report. With an estimated 100 reports scanned per day, the deployment of RPA can save approximately 3.8 hours per day, which corresponds to 23.3 hours per week or 1260 hours per year.

6. CONCLUSION

In this study, we examined the prospects and implementation of RPA in the healthcare industry. We also illustrated how RPA[5-7]can be synced with traditional websites and be used to build scalable systems. We discussed conventional methodologies, and in contrast,

RPA methodology and RPA-based healthcare workflow. Wedemonstrate that the adoption of RPA into healthcare can reduce and eliminate repetitive processes and operations. Future work includes testing various RPA-based methodologies against each other to observe which one can be bestimplemented for different kinds of backgrounds.

7. REFERENCES

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Naman Nihal will receive his bachelor's degree in Information Technology from Symbiosis Institute of Technology (SIT) in 2023. He was former summer intern at Microsoft, Hyderabad and currently working at a firm based in Indore.

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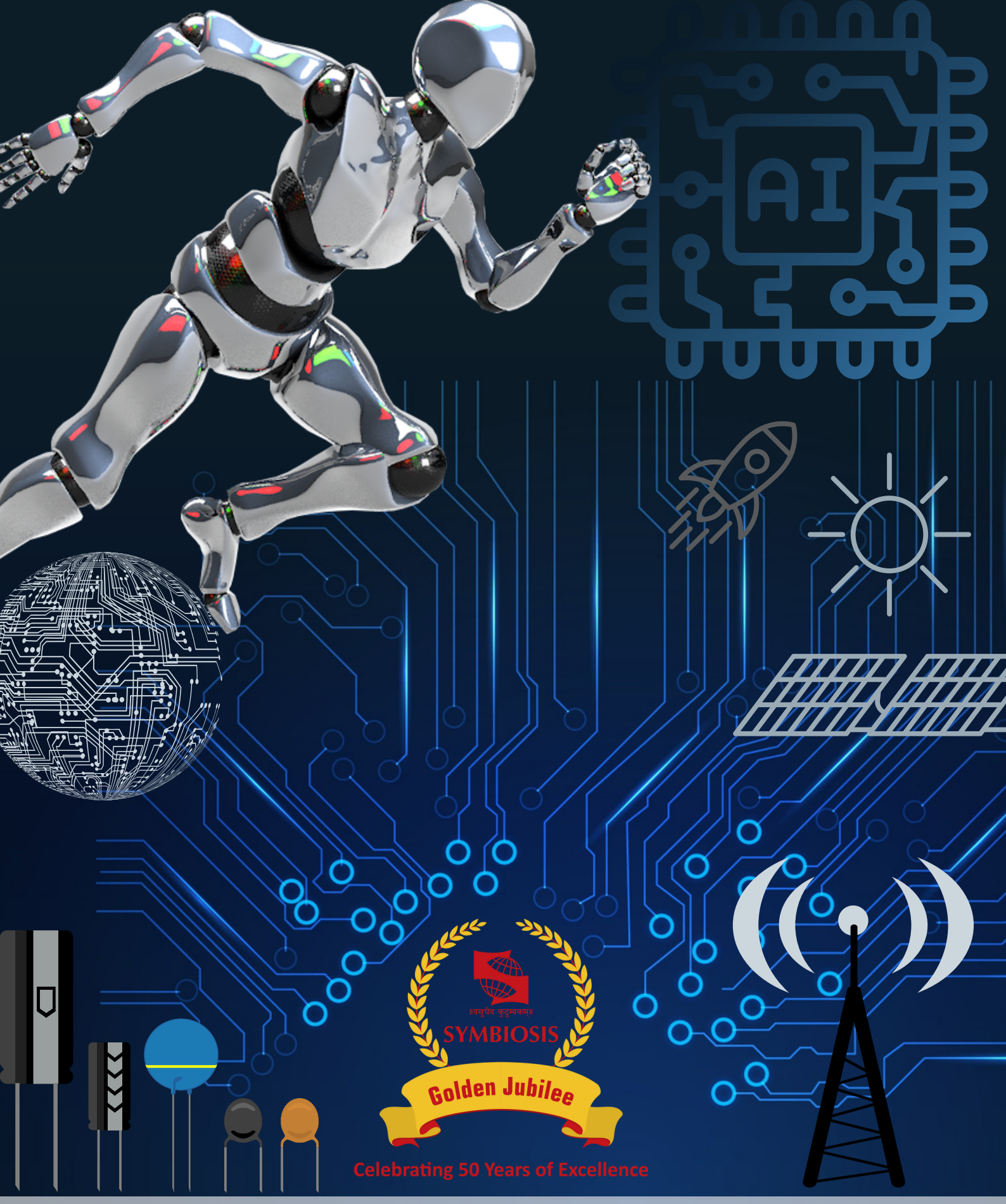
Ms. Priya Jadhav is Assistant Professor in the Department of robotics and automation Engineering department at SIT, Symbiosis International (Deemed University), Pune, India. She has around 15 research publications published in various journals. She has 10 years of expertise in the educational area. Manufacturing, surface engineering, and corrosion analysis are among her research interests. She earned her master's degree in Mechanical Automotive Engineering in 2013 and is now pursuing her PhD at SIU Pune. She is now working on a project to improve surface properties for high temperature applications.

Dr. Satish Kumar is an Associate Professor in the Department of Robotics and automation Engineering and in-charge of Advanced Manufacturing Technology Lab at SIT, SIU. He is Program In-charge, Faculty of Engineering, SIU. He has completed his Master's degree in 2013 and Doctoral degree (PhD.) in year 2020 from Visvesvaraya Technological University, Belgaum, Karnataka. His area of research interests includes Smart Manufacturing, Digital Twin, Condition Monitoring, Composites, Cryogenic Treatment, Additive manufacturing, and Hard materials machining. He has authored more than 32 + international/national journal and conferences publications. He has filed Indian patent based on his current research projects and he is also a corporate member of Institution of Engineers. He is a research supervisor to PhD. Research scholars and M. Tech students working in the domain of Predictive Maintenance, Manufacturing and Industry 4.0.



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