

YAKADA YAKA - Crowdsourcing Solution To Railway Accidents

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Abstract— There are many train accidents in Sri Lanka every year. As a result, human and animal lives, as well as property, get severely damaged. During last year, a total of 273 people lost their lives due to railway accidents. The main purpose of our research was to find a solution to the increasing number of train accidents. The main objective of our research is to acquire data from the passengers or the public through a mobile app, analyze this data and come up with a solution for these accidents and prevent situations such as elephant collisions, rockfalls, and landslides. We also hope to give train drivers who ride in those particular areas some insight about the railway track.

Keywords: *Crowdsourcing, User-Interface, Gamification, Accelerometer, google map, machine learning, Naive bayes classifier, Extra tree classifier, Support vector machine algorithm*

I. INTRODUCTION

Annually, there are several train accidents in Sri Lanka. Animals and human lives, as well as properties, were badly harmed as a result. A total of 273 persons died because of railway accidents on the year 2021[1]. Many train accidents occur today as a result of a lack of communication with the railway administration. Many of these incidents may have been avoided if trees had fallen on the tracks or landslides had delayed train operation. Damage caused by wild elephants crossing railways on a regular basis. These issues have no proper remedy, resulting in damage to railway property and life. Our survey's main goal was to discover a solution to the growing amount of train accidents. The major goal of this study is to collect data from passengers or the public via a mobile app, compare it and come up with a way to avoid events like elephant crashes, rock falls, and landslides. Another problem is determining the reliability of the information provided by people, as many train accidents nowadays are caused by a lack of good connection with the railway department, which is particularly important. The proposed approach will allow us to easily obtain information via a mobile application and strengthen our contact with train

passengers. While standing on the train, it is tough to use the phone. As a result, we must improve the user experience in our mobile app. Common mishaps can also be reported directly, which will be verified and added to our database to identify potential hazards. We also focus on streamlining the app to log in quickly because there is no standard signal everywhere. Also, through this application we can double-check the information we've just received. This may cause inaccurate data to be added to our database. A land slide is not possible in the Colombo area is an example. After that, we record the validated data in our database and evaluate it. A dashboard is used to display the data to railway officials. Also we indicate accident sites by pinning those locations on a digital map of Sri Lanka. This map can be accessed through the dashboard. The other train to these places is then identified by our system, and an SMS is sent to them telling them of the danger and what they may do to mitigate it. As drivers change from day to day, our goal here is to reflect that timetable in the system. It is our hope to provide that information to the appropriate driver. We also using gamification technology to motivate people use the app. We give points to those who give the right information and when those points are completed, we make it possible to post it as an achievement in social media. We use the accelerometer of the user's phone to check whether the user is on the train. We develop our application to read and record the accelerometer readings of the user's phone and analyzing the data recorded by the application and verifying the data by comparing it to data recorded by an accelerometer while traveling on a train. Once the data sets match up to a certain percentage the application then shows a pop-up notification asking whether the user is on a train. Also using our mobile application user can Take a photo of elephant dung and send it to our server. after that we identify how long ago the elephant was in those places by using digital image processing and Convolutional neural networks. Even if such an elephant comes and goes at night, people are less likely to see it. Then it will not be updated to our database in that real time, so we will detect the location of the elephant dung and submit it to our database. This allows us to identify the places and times they visit each day after assembling the information we receive.

II. BACKGROUND AND LITERATURE SURVEY

Many train accidents occur today as a result of a lack of communication with the railway administration. Many of these incidents may have been avoided if trees had fallen on the tracks or landslides had delayed train operation. Damage caused by wild elephants crossing railways on a regular basis. These issues have no proper remedy, resulting in damage to railway property and life. We hope to establish a railway accident prevention system with the cooperation of train passengers as a solution to this.

A. Creating a mobile application Using crowdsource technology for reduce train accidents

There are several types of systems according to this component. They have many problems when compared among this system. Those previous research final outcome is not classified into more details or does not meet the exact purposes of the passengers and Department of Railway. One of the existing system relevant in this system is "calling method". One of the researchers has introduced telephone numbers by getting the support from the two main mobile network companies (Mobitel & Dialog). What we must do is if there is barrier in the railway, we can call to those numbers and give the information. Then they are calling to nearest railway stations and give the information to those stations. The main problem of this system is that this system is only for avoiding the Elephant Crashes. If there are elephants in the railway people can call to this number and inform that. And there is no way to inform landslides, rock falls etc. Another difficulty is determining the reliability of information offered by travelers. From this calling system we cannot check the correctness of the information given by the passengers. Sometimes given information might be incorrect, but our system is checking the validity of the information given by the people. Difficulty in handling is the other problem of the existing system. This calling system is not possible because the signal strength is not constant for everywhere in the country. Some areas are not having signals for even making a call. But through our system User can easily login to the system and upload the information. According to Hector Garcia-Molina, Manas Joglekar, Adam Marcus, Aditya Parameswaran, and Vasilis Verroios Crowdsourcing is a method of resolving major problems by enlisting the help of human workers to solve individual sub-problems or jobs. According to them, the difficulty with data crowdsourcing is data capture, management, and analysis. They give an overview of data crowdsourcing in this work, as well as examples of problems that the authors have solved, and the major design stages required in implementing a crowdsourced solution from their research. And they also go over some of the open issues that have yet to be resolved.[2] Adam Azzougand Sakdirat Kaewunruen tell that not all the millions of train travels that take place every day are measured or monitored for ride comfort. Allowing passengers to use their smartphones to evaluate riding comfort helps railway firms to gather immediate feedback from passengers about the quality of their trains' rides. And, according to them this can be performed by creating a smartphone application, analyzing the data collected by the app, and comparing the data to data from a track inspection car or an accelerometer.[3] According to

Valery Lazarev, public transportation that works well is an important aspect of every city or region. According to him, People still prefer to utilize personal transportation, mainly because of the difficulties that accompany public

transportation delays, overloaded buses, non-functioning ticket machines, and so on. And researcher says that one option for Object Placement addressing these issues is to collect data from travelers themselves and technological advancements have made it easier than ever to establish a connection between a business and its customers, and so obtain critical information that can help enhance service quality. Passengers, on the other hand, must be encouraged to submit reports [4].

B. Detect and ensure that gathered information accuracy

Checking Obtained information whether it's true or false is one of the important parts in railway system. It helps to railway department get correct information about incidents. In this collected data verified and stored correct data in database and removed false information. Analyzed data sent through the server to display in dashboard. mostly intent to do this with using algorithms with help of machine learning. Since this analyzing information became a most important part to many fields, it will help to identify information whether it's true or false. Using this part railway department can get correct data and warn the engine drivers through sending a text message. William Yang Wang [5] as shown a New Benchmark Dataset for Fake News Detection, dataset can be used for fact-checking research as well. Notably, this new dataset is an order of magnitude larger than previously largest public fake news datasets of similar type. Empirically, they investigate automatic fake news detection based on surface-level linguistic patterns. they have designed a novel, hybrid convolutional neural network to integrate metadata with text. They have shown that this hybrid approach can improve a text-only deep learning model. Rohit Kumar Kaliyah, Anurag Goswami and Pratik Narang[6] Research is done based on a system that was design in India, in this paper machine learning used for Multiclass fake news detection. The loss function is a measurement function indicating how smart the model's coefficients are at fitting the hidden data or information. Gradient boosting machines are a group of high-performing Machine Learning algorithms

C. Create dashboard and Monitor train passengers using the mobile phone's accelerometer sensor

Dashboard is one of the major tasks in railway system. It helps to analyzed data to mostly designate certain incident locations for railway authorities to monitor. in this the verified data is then stored in our database and analyze the data in a way that kind of is convenient for the railway officials display is done through using this dashboard, for all intents and purposes contrary to popular belief. mostly intend to do this with using a digital map of Sri Lanka and highlighting those particularly specific locations with a generally unique color in a subtle way. This paper discusses the methodologies regarding the Dashboard to identify the accident location using google map API. Since this dashboard became a most important part to many fields, it will help to display stored data and identify the true and false information. Using this dashboard can categories information. And this information pin to google map API. This will vastly affect the managing of the overall process. Smartphone accelerometer sensor another major task in railway system. It helps to monitor whether passenger in a train or not. in this monitor accelerometer sensor then the collected data match with the data base, after that message send through the mobile app asking whether passenger in a train or not. Since this accelerometer became a another most important part to many fields, it will help to identify the objects movements and places by monitoring real time data. Rashmi Jangale, Sujata Khedkar [7] research is done based on a system that was designed in Mumbai, India. In this paper, dashboard design for happy hours and their deals recommendation system for mobile advertising is

presented. their system provides platform to retailers for publishing Happy Hours Deals. It also provides users to specify and edit the distance limit for recommendation and recommends happy hour deals in application notification.

D. Send message to train drivers traveling dangerous areas and say time in the elephant dung using image processing

W. Gong and G. Fu, "Research on SMS filtering algorithm based on user personality," [8] The existing improvements to the SMS filtering algorithm are aimed at the traditional sense of spam messages. In the process of improvement, it does not take into account the user's definition of spam messages and does not construct the SMS filter from the user's needs and the SMS filter lacks of personalize. Aiming at this problem, this paper proposes a SMS filtering model based on the user characteristic model. The model analyzes the information of App category and user's existing SMS in the user's mobile phone and obtains the user characteristic model. And uses the model to optimize the SMS filtering algorithm and obtains the SMS filtering model based on the user features G. Dharmale, V. Thakare, and D. D. Patil, "Intelligent hands-free speech-based SMS system on Android," [9] Over the year's speech recognition has taken the market. The speech input can be used in varying domains such as automatic reader and for inputting date to the system. Speech recognition can minimize the use of text and other types of inputs, at the same time minimizing the calculation needed for the process. A decade back speech recognition was difficult to use in any system, but with elevation in technology leading to new algorithms, techniques, and advanced tools. Now it is possible to generate the desired speech recognition output. One such method is the hidden Markov models which is used in this paper. Voice or signaled input is inserted through any research device such as microphone, then speech can be processed and convert it to text hence able to send SMS, also phone number can be entering either by voice or you may select it from contact list. Voice has opened date input for a variety of users such as illiterate, handicapped, as if the person cannot write then the speech input is a boon and other's too which can lead to better usage of the application.

III. RESEARCH OBJECTIVES

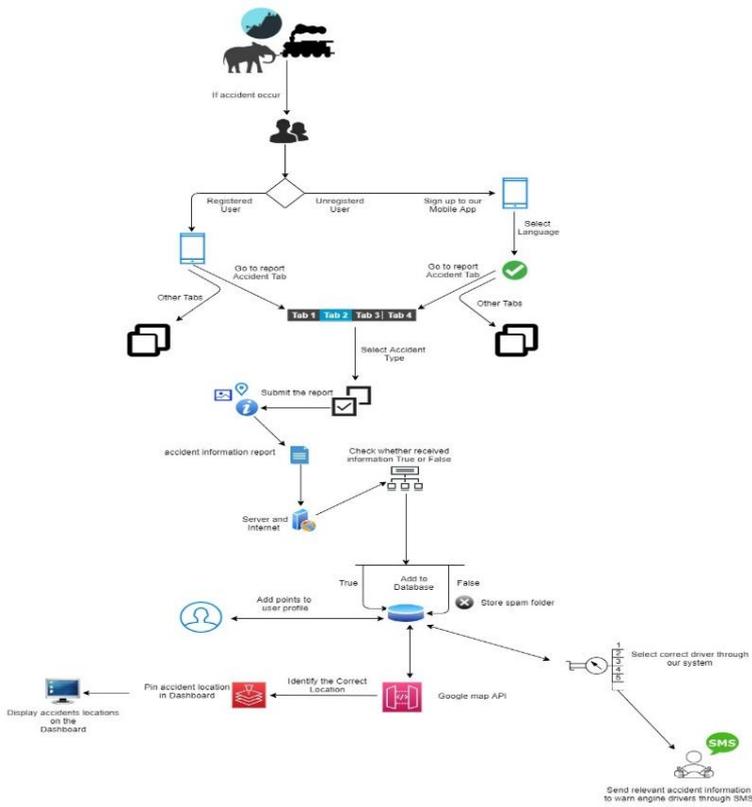
One of the goals of this study, which is mostly significant, is to prevent these accidents from happening again. The proposed solution will allow us to acquire information rapidly via a mobile application and, for all intents and purposes, strengthen our relationship with train passengers, or so they believe. They reasoned that using the phone while standing on the train would be tough. So, they reasoned, we obviously need to improve user experience in our mobile app. Also, relatively common accidents can be reported immediately, and it will be thoroughly verified before being included to our database to discreetly identify potential threats. We also focus on streamlining the app to log in quickly in a major way because there is no standard signal everywhere. The next step, we decided, was to analyze the information we had received. This may inadvertently add erroneous information to our database. A landslide, for example, is not conceivable in

the Colombo area, which is noteworthy. We plan to use classification models to filter this data in a variety of ways. After that, we record the validated data in our database and evaluate it. This data is presented to railway officials via a dashboard, which is a key feature. We plan to accomplish so by highlighting such very precise areas with a distinct hue on a digital map of Sri Lanka. Our technology then locates other trains traveling through these places and sends them an SMS alerting them to the danger and, contrary to popular opinion, what they should do to mitigate it. Our goal here is to put that timetable in the system because drivers vary from day to day in minor ways. We aim to deliver that information to the relevant driver, which is crucial. We also using gamification technology to motivate people use the app. We give points to those who give the right information and when those points are completed, we make it possible to post it as an achievement in social media. When considering objectives, one of the first objectives which comes into the light is to find out whether the user is on the train. To do this we use the accelerometer of the user's phone to check whether the user is on the train. The train's movement is unique, and the accelerometer readings are occurring at a certain pattern when the accelerometer is on a moving train. Therefore, we develop our application to read and record the accelerometer readings of the user's phone and analyzing the data recorded by the application against several data sets (accelerometer readings) recorded while the accelerometer is on a moving train. Once the data sets match up to a certain percentage the application then shows a pop-up notification asking whether the user is on a train. Hence, we can verify whether the user is actually on the train. And the photo of elephants dungs we can identify the time when elephant arrive at near the railway track. Because of that we can minimize elephant accidents.

IV. METHODOLOGY

With this Yakada Yaka project, we hope to find out the current problems in the Railway Department and the causes of accidents and work with the train passengers to minimize them through the system shown in our chart below.

Fig 1: Overall System Diagram



A. Crowdsourcing

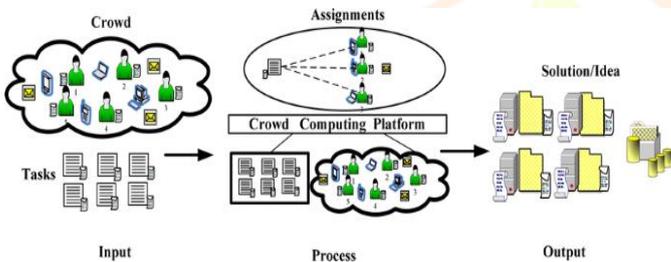


Fig 2: How Crowdsourcing works

In most businesses throughout the world, crowdsourcing is causing a stir. When used in the appropriate place at the right time, it can be incredibly effective. Crowdsourcing is the process of gathering work, information, or opinions from a big number of individuals using the Internet, social media, or smartphone apps. Crowdsourcing is the process of enlisting the help of a large number of people to achieve a common goal.[10] It's best used while trying to come up with new ways to address complex problems or reduce time-consuming operations. GitHub is used by many software engineers for this purpose. If a company needs to collect customer data, it may turn to social media or another consumer-facing platform to crowdsource information. Here we are using the crowdsourcing method to gather information quickly through railway passengers. This way is very effective than other methods.

The UI/UX Design Specialization takes a design-centric approach to user interface and user experience design, providing practical, skill-based training that is concentrated on visual communications rather than marketing or programming alone. From user research to establishing a project's strategy, scope, and information architecture, to generating sitemaps and wireframes, this four-course sequence will outline and demonstrate all steps of the UI/UX development process[11]. We are using Adobe XD for design user interfaces. we involved in all elements of product creation, such as design, usability, functionality, branding, and marketing. According to our research we use light colors in our application because this application mainly uses in outdoors.

Best UI design & Color ? *



Option 1

Option 2

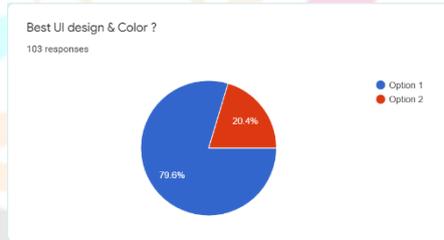
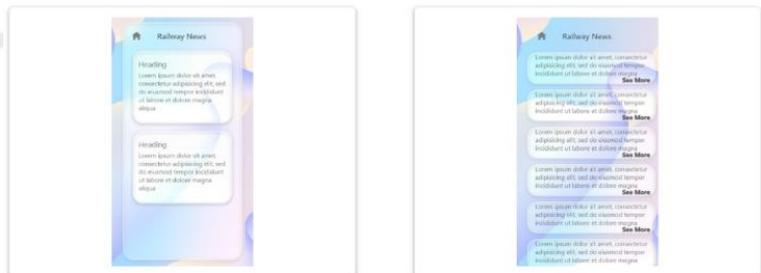


Fig 3: User Feedback results

Furthermore, we did a survey to track down the most straightforward method for perusing the data in the application while on the train. We had the option to get a few entirely important public remarks. The vast majority of their thought is that when they have "See more" it makes it harder so that them might see more subtleties. This is on the grounds that it is hard to see the train in any event, when it is blocked. So the most favored is that the point of interaction should be exceptionally clear, straightforward, with every one of the subtleties.

Easiest way to Read information *



Option 1

Option 2

Easiest way to Read information
103 responses

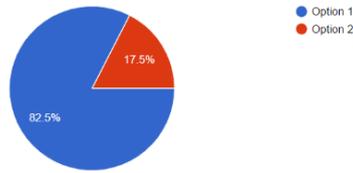


Fig 4: User Feedback results

While developing this mobile application we are using Xml UI, Google Material Designs, Xml layouts and third-party libraries. We use firebase for develop application back-end.

C. Gamification

To boost engagement, gamification involves incorporating game concepts into nongame environments such as a website, online community, learning management system[12], or a company's intranet. Gamification aims to engage customers, employees, and partners to encourage them to collaborate, share, and interact. Gamification works by using game mechanics and game dynamics to provide proactive directives and feedback to audiences, resulting in the achievement of business goals and objectives. Engaging gamification experience taps into a participant's emotions and simply illustrates the best actions that an audience may do to contribute to mutually shared goals. Employees and customers that interact with a gamification software receive immediate feedback on their performance and are guided toward new goals. So, in here we are using Gamification techniques to promote our application among train passengers.

D. Create a classification Detect and ensure that gathered information accuracy

We used below classification models for choosing highest accurate model

highlights being classified is autonomous of one another.

"Support Vector Machine" (SVM) is a managed machine learning algorithm that can be utilized for both classification or relapse difficulties.

Model	Accuracy	AUC	Recall	Prec.	F1	Kappa	MCC	TT (Sec)
nb Naive Bayes	0.9429	0.0000	0.9079	0.9271	0.9322	0.9391	0.9409	0.0050
svm SVM - Linear Kernel	0.9429	0.0000	0.8978	0.9314	0.9352	0.9391	0.9405	0.0120
et Extra Trees Classifier	0.8913	0.0000	0.8158	0.8694	0.8769	0.8842	0.8873	0.0680
rf Random Forest Classifier	0.8884	0.0000	0.8236	0.8569	0.8672	0.8809	0.8840	0.0870
dt Decision Tree Classifier	0.8883	0.0000	0.8009	0.8855	0.8732	0.8809	0.8838	0.0040
lr Logistic Regression	0.8855	0.0000	0.8349	0.8439	0.8574	0.8777	0.8809	0.0230
gbc Gradient Boosting Classifier	0.8798	0.0000	0.8161	0.8393	0.8528	0.8718	0.8753	1.1690
ridge Ridge Classifier	0.8052	0.0000	0.7133	0.7350	0.7587	0.7919	0.7965	0.0130
lda Linear Discriminant Analysis	0.7792	0.0000	0.7560	0.8461	0.7842	0.7697	0.7792	0.0090
lightgbm Light Gradient Boosting Machine	0.7335	0.0000	0.5995	0.6949	0.7048	0.7165	0.7238	0.1390
knn K Neighbors Classifier	0.6934	0.0000	0.5737	0.6178	0.6413	0.6727	0.6814	0.0100
ada Ada Boost Classifier	0.2895	0.0000	0.1156	0.2257	0.2328	0.2240	0.3326	0.0310
dummy Dummy Classifier	0.1949	0.0000	0.0367	0.0381	0.0637	0.0000	0.0000	0.0030

Fig 6: Compare models

Naive Bayes is the model that highest accuracy in data set.

E. Smartphone Accelerometer sensor

The accelerometer is an in-built component of a smartphone to measure its acceleration. It tracks the different motion like shaking, tilting, swinging, and rotating and accordingly change the orientation of the app[13]. Monitor accelerometer reading in the direction of the movement of the train then the collected match with the database. After that, a message is sent to the passenger asking whether he/she is on the train or not. if more than 5 passengers respond to this pop-up message sent through the app. this will help to identify the location of that train and the distance between the train and the accident location. First, I should collect a few data samples of accelerometer reading by travel in the train number of time (15) due to the movement of train compartment to monitor the movements. To apply this, I must understand the x, y, and z-axis of the phone accelerometer

Random Forest Classifier

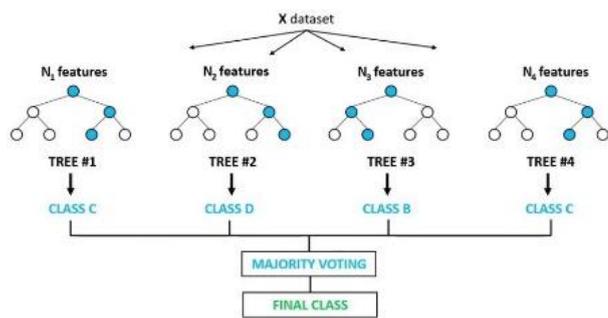


Fig 5: How Random Forest works

Random decision forest is a gathering learning method for classification, regression and different errands that works by developing a huge number of decision trees at training time

Extremely Randomized Trees Classifier(Extra Trees Classifier) is a kind of group learning strategy which totals the consequences of different de-associated choice trees gathered in a "forest" to yield it's classification result.

Naive Bayes classifiers are an assortment of classification algorithms in based on Bayes' Theorem. It's anything but a solitary algorithm however a group of algorithms where every one of them share a typical standard, for example each pair of

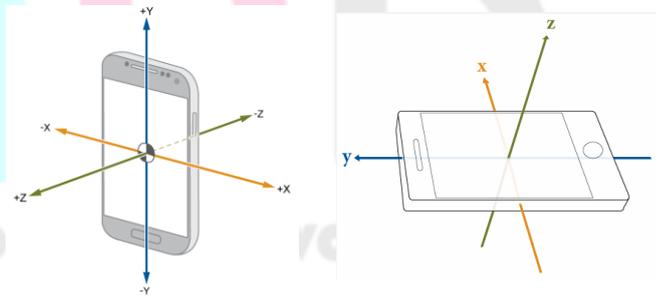


Fig 7: Data samples vertically and horizontally

Once we collected the vertically and data horizontally store them in our database. Then we will add passenger's real-time accelerometer data to our database and match passenger's phone real-time accelerometer readings with the monitored data that we have stored in our database, then the app should monitor its real-time accelerometer reading over the period.

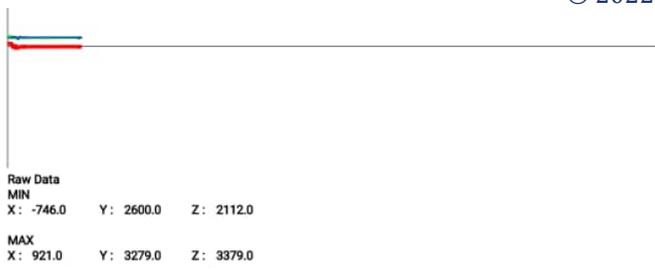


Fig 8: Normally Accelerometer readings

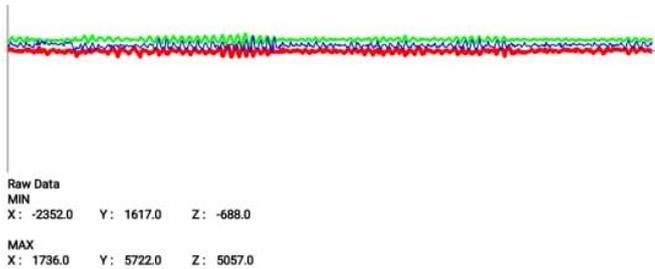


Fig 9: Several accelerometer readings recording while traveling on the train

As seen above the x y z coordinates varies in certain pattern. Above data were recorded while taking several train journeys. In the application the user's accelerometer readings will be recorded and compared against these data sets and if the data sets overlaps or matches up to a certain percentage the application will show a pop up notification asking whether the user is on a train or not.

F. Google Maps APIs

Google Maps is a free Google service that is quite popular. Developers can add Google Maps features to an Android application with the Google Maps application programming interfaces (APIs). By using the Google Maps APIs, developers can save time and costs in building a reliable digital map application and can focus more on the data. To use Google Maps APIs, we first log into the Google Console, as seen in Fig. The API library has documentation, links and a smart search experience. Included on cards category are maps SDK for Android, maps[14] SDK for iOS, map JavaScript API, Places API, Directions API. we using Google Cloud Platform for create map. we involved is all elements of based in this part such as design and functionality. And also, to facilitate developer in developing of location-based service application. The Google Maps Platform is built with Application Programming Interfaces (APIs) and SDKs that allow designers and developers to insert Google Maps into mobile applications and web pages or retrieve information from Google Maps. The Maps SDK for Android can add maps in accordance with Google Maps data to the mobile application. Also, the API keeps access to Google Maps servers that improve data download with response to card retrieval in various gestures. In here we are using Google Map

G. Handling database and Create SMS system to provide notifications to drivers

We send an SMS alert to the train driver using SMS gateway. This is useful to check whether the information coming from the people are right or wrong and send it to the train controller of the relevant train. we hope to process the information obtained from the public in the shortest possible time and give the results in the shortest possible time. It is done using data optimization. And also, I hope to use My SQL to handle our database.

H. Create CNN algorithm to ensure that the gathered image information is accurate

We can simply transform data between elephant dung images using the CNN method[15]. Convolutional neural networks, or CNNs, are a subset of deep learning neural networks.

We involved 3 libraries for this. They are TensorFlow, keras and Open CV. The fundamental library here is TensorFlow. It is utilized as a stage on which we can prepare a model. The TensorFlow platform is used to train the model made utilizing keras. The other library is the library utilized for open cv image processing. The root dir in this partition is the place where the informational collection is. I have separated it into three sections as indicated by the time

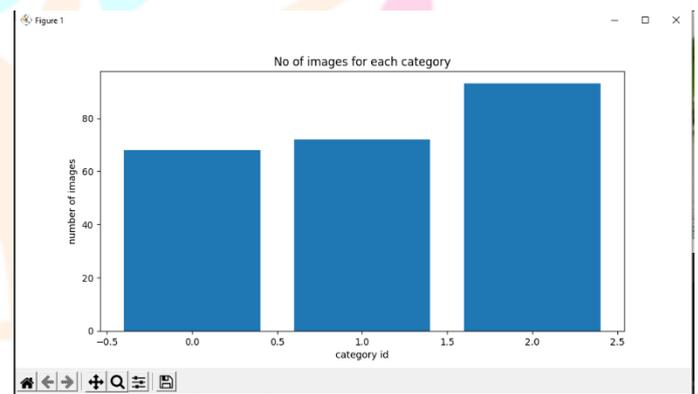


Fig 10: image categories according to the time

In test ratio and validation ratio, if we take 100 images in a data set, 80 images have to be training and for 20 has to be test. Similarly, in the validation ratio 20 images has to be validated and 80 has to be trained.

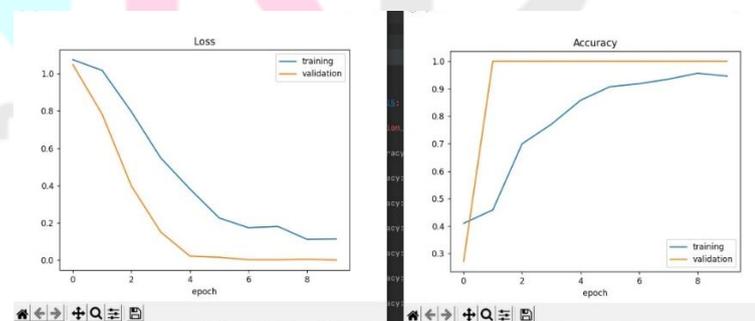


Fig 11: Diagram of Testing and Validation ratio

After convert the image to an array that the machine can recognize it. We transfer the converted array to the CNN network. Then the converted images are added to the test and validation ratio created earlier and divided into testing and training

V. RESULTS AND DISCUSSION

Before starting the research implementation, the information gathering process was carried out thoroughly. By contacting the current professionals of the Railway field experts, we were able to gather much information regarding, When the accident happens, the damage caused to the Railway Department? The time does it take to recover? We previously reached out to Mr. Maweekubura He is an Engine driver by profession. From him, we were able to discover a lot of information about locomotives, railroads, potential accidents, how to react, and the methods currently in use to warn them of impending danger. After that, we reached Mr. Irosh Perera. He is an Aircraft engineer. He additionally functions as a volunteer in a task called forestall rail line elephant mishap. He had a few rounds of conversations, particularly on the risks of train-elephant impacts and the actions at present being taken to relieve them and the strategy we can take from now on. In addition, with the help of a Google form, we received feedback from railway passengers on current issues as well as the system we intend to create. We got 300+ responses to it. We also created a mobile application using a similar google form and created various user interfaces to get their feedback. Also, our team went on the train with them and gained experience in making our mobile application very user friendly.

VI. CONCLUSION

Introduced by our research, the Yakada Yaka mobile application creates a way for railway passengers to immediately provide information to those working in the railways. Also, this application is made in a user-friendly way so that you can use it on your phone while standing, which makes it more efficient. Also, with the Navi Bayes classification model, we check whether the information given by people is true or false so that the false information is not passed on to the railway department. We also have a dashboard that shows the railway crew all the information and dangers we have on a map with those locations so that anyone can easily understand them and act. Also, elephant dung can find out the whereabouts of the elephant and inform the Railway Department that an elephant is roaming in the area at that time to prevent a lot of damage to my life and property. We also look forward to answering many of the Department's questions by texting train drivers to those areas as soon as an accident occurs, and by locating accelerometer sensor passengers on board a train. But we get a lot of data from this because it costs a lot of money to buy servers that die. We look forward to receiving feedback from people who use it in the future, as well as updating all of this with the latest technologies and optimizing it to work on every device.

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