TRAIN TRACKING AND DETECTION SYSTEM
TMP-23-302

Project Proposal Report
Jayanga B.M.C

B.Sc. (Hons) Degree in Information Technology
(Specializing in Data Science)

Department of Information Technology

Sri Lanka Institute of Information Technology
Sri Lanka

2023

TRAIN TRACKING AND DETECTION SYSTEM
TMP-23-302

Project Proposal Report

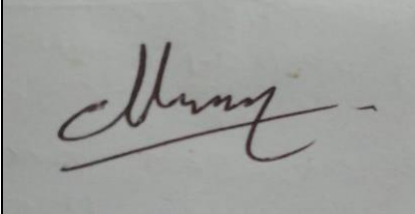B.Sc. (Hons) Degree in Information Technology
(Specializing in Data Science)

Department of Information Technology

Sri Lanka Institute of Information Technology
Sri Lanka

2023

DECLARATION

I Jayanga B.M.C, declare that the research project report is my original work, and it has not been submitted in whole or in part for any other degree or qualification. Any ideas, data, or information obtained from other sources have been fully acknowledged by means of a citation or reference. I have followed the guidelines for academic writing and referencing provided by my university, and the project conforms to the required standard.

Name	Student ID	Signature
Jayanga B.M.C	IT20188672	

The above candidates are carrying out research for the undergraduate Dissertation under my supervision.

Signature of the supervisor: Date:
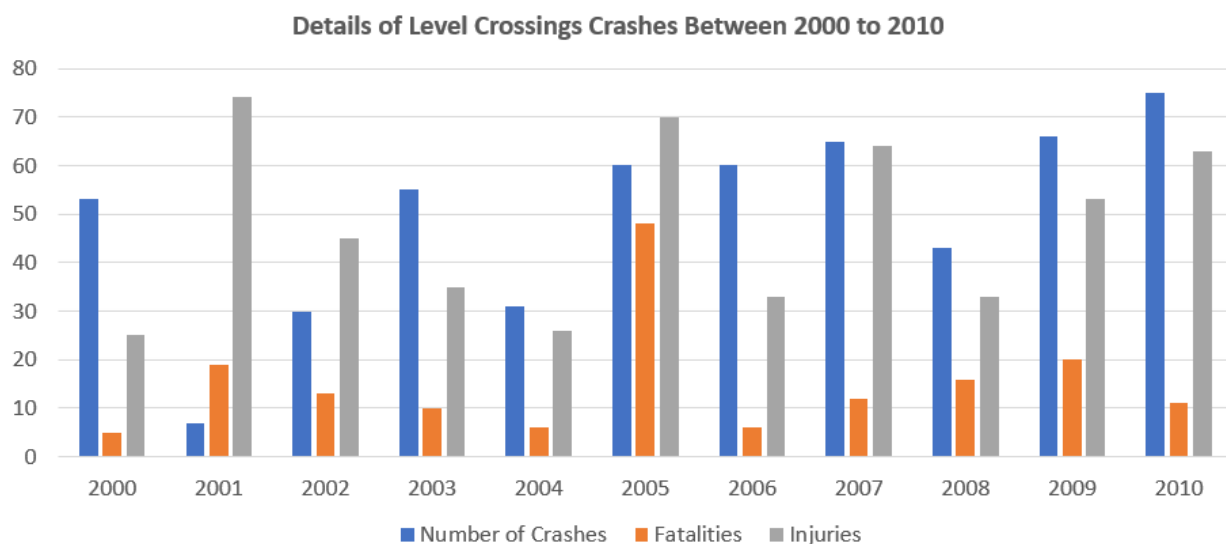
ABSTRACT

Railway Crossing accidents have been a significant safety concern not only worldwide, but also in Sri Lanka, resulting in significant loss of life and property annually. The biggest railway crossing collision that happen in Sri Lanka was on 27th April 2005, near Polgahawela, resulted the death of 41 citizens.
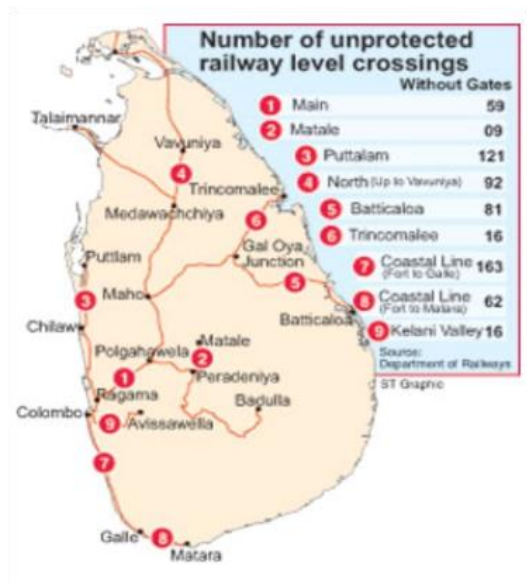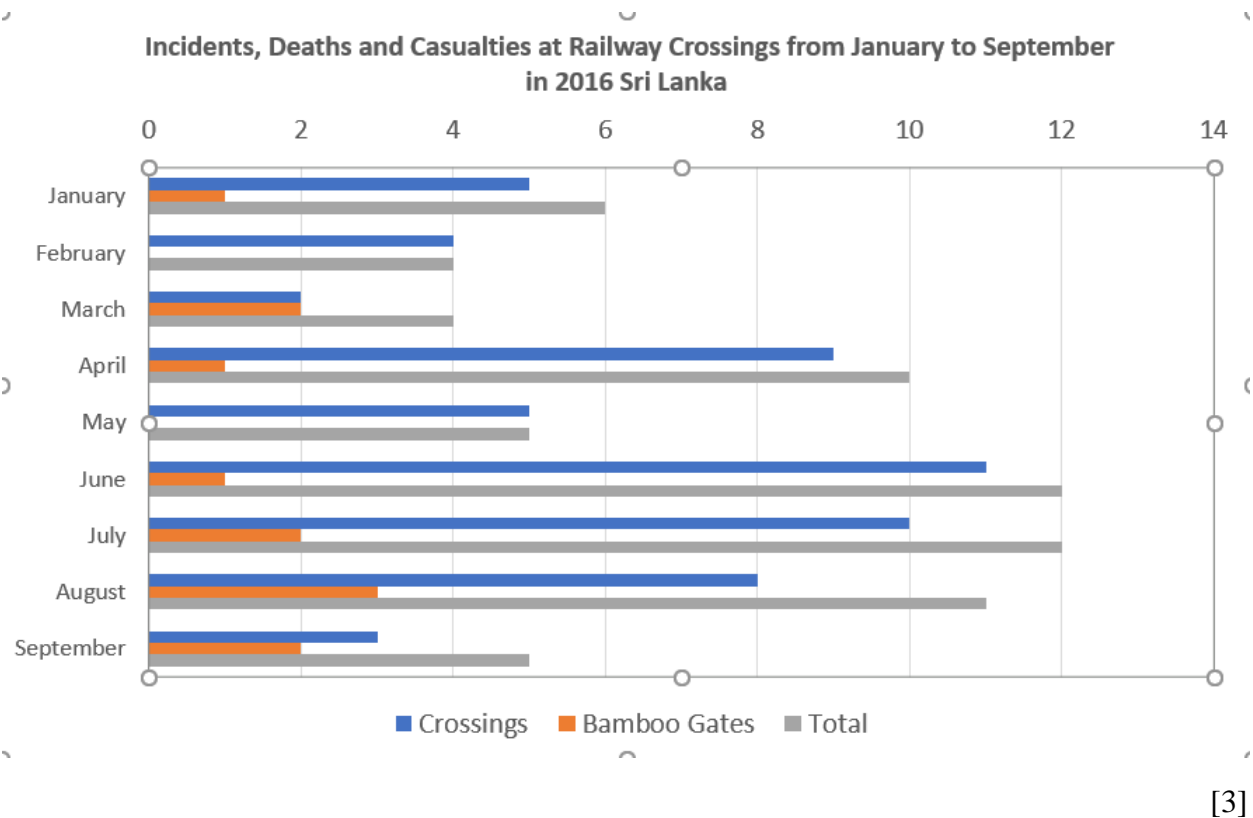
[1]

Polgahawela level crossing accident was a collision between a bus travelling from Galkiriyagama to Colombo and a train at a level crossing in Yangalmodara, near Polgahawela in Kurunegala district on 27 April 2005 at 8.30 local time, which resulted in the death of 41 people [2]

These are some detailed facts that proves how much damage is done annually from railway collision in Sri Lanka.

Details of Level Crossings Crashes Between 2000 to 2010

[3]

Incidents, Deaths and Casualties at Railway Crossings from January to September in 2016 Sri Lanka

Legend: Crossings · Bamboo Gates · Total

[3]

Number of unprotected railway level crossings

		Without Gates
1	Main	59
2	Matale	09
3	Puttalam	121
4	North (Up to Vavuniya)	92
5	Batticaloa	81
6	Trincomalee	16
7	Coastal Line (Fort to Galle)	163
8	Coastal Line (Fort to Matara)	62
9	Kelani Valley	16

Source: Department of Railways
ST Graphic

[4]

And also statistics proves that, 1 person dies due to a road accident in every 3 hours averagely in Sri Lanka.[5] and Every 3 days, a Child dies in Road Accident. [5]

We identified some major reasons for these collisions. Major reason for so much collisions in Sri Lanka is there are so much unsafety unprotected railway crossings all around the Island. Above image [4] shows how many unprotected railway crossings in all around the Island. Due to some heavy rains or fog conditions, people cannot see the upcoming railway crossings when they are driving the vehicle. Human Errors is also another fact for railway collisions in Sri Lanka. That means citizens may misjudge the speed or distance of an approaching train, leading to accidents or near-misses. And also, Citizens may not be aware of the dangers posed by railway crossings or the proper safety procedures to follow when crossing tracks. Therefore, providing solutions to reduce these collisions happening in railway crossings became a major need specially in Sri Lanka because many human and animal lives and properties lost to the country annually. But from the government side, we cannot see they are considering this as a big problem. They didn't even take necessary steps to reduce these railway crossing collisions like providing gates near railway crossings, signal and alarms likewise. As citizens who feel this as a major problem in Sri Lanka, we need to find some solution to reduce these annual railway crossings collisions since the government is not involving on this matter much.

As undergraduate students doing the degree on IT field, we felt that we need to address this problem from IT based solution.

Contents

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

Abbreviation	Description
IT	Information Technology
IOT	Internet Of Things
App	Application
GPS	Global Positioning System
SMS	Short Message Service
UI	User Interface

1. INTRODUCTION

Currently, there is no proper solution to address the railway crossing collisions in Sri Lanka. So as undergraduate students who are specializing in IT field, we propose a IT-based solution to address these railway crossing collisions in Sri Lanka. Even though there are apps to alert train schedules and train routes, time tables, there is no app to address the safety of citizens who are crossing the railway crossings in Sri Lanka. The "Train Detection & Alert System" for citizens ins Sri Lanka project aims to address the challenges faced by citizens who cross the railway crossings through the use of advanced technology and infrastructure improvements. To address this problem, our research project proposes a system that utilizes various technologies, including IoT devices, GPS tracking, machine learning algorithms, security technologies and real-time databases.

Our Train Detection & Alert System includes multiple components, such as real-time tracking of trains and vehicles near the railway crossing, alert system to vehicles which are moving towards to the railway crossing, alert system to all the users who are near to the railway crossing, sending real-time train location details to relevant IOT devices, security system for the system and predictive maintenance system. These all components work together to detect potential safety hazards and prevent accidents from occurring. The project aims to create a user-friendly interface for the system, making it accessible to a wide range of users and enhancing the overall passenger experience. Additionally, the system will be used by train authorities to monitor the railway crossings collisions, helping to improve the overall efficiency and safety of citizens and taking relevant actions to reduce the collisions happening in railway crossings.

My component of the research project aims to predict whether a vehicle is likely to cross a railway crossing on a particular time and particular day when a train is also approaching, and if he/she is likely to cross the railway crossing, send alert warning messages. And then Analyse the past patterns of vehicles and predict if they are likely to cross the railway crossing on a given day.

Since we are developing an app for our users, we ask the location permission from the user when they download, install and login to the app. From the location permission we asked, we can track the app and the user. So we are creating a range circle about 1.5km rounded by the IoT device near the railway crossing. And if we detect a vehicle user who use our app, entered that range circle from tracking, we start continuing tracking that app user. So if only that app user is approaching towards the way of railway crossing, warning message alerts are sent to that user that railway crossing is nearby and train is approaching on that way via the app. Otherwise, warning message alerts are not sent to the app user. That means if we detect there is no movement of the app, or the app is going away from the railway crossing, or the app is not in a road near a railway crossing, that alert messages are not sent to that particular user of the app. Then we store the vehicle patterns of that particular app user, vehicle patterns mean the roads which he or she used to drive near that particular railway crossing. And also, we store the data of date, time as well. And then store these data in some real-time database. We are planning to "Firebase-Real time database" to store these data at the moment. So after collecting these kind of vehicle patterns of the same app user more times, we pre-process that data to analyse. Then analyse that particular data to make predictions. Then we do predictions that whether this app user is likely to cross the railway crossing on a particular day and particular time when a train is approaching towards the railway crossing. If it is, we send alert messages to that user not only through the app, but also through the SIM card as well. The reason for that is, for some reason that user's mobile data might be off for some reason, or that particular user might closed the app. So even though on such scenarios, the user will be notified via SMS alert notifications.

The proposed Train detection and Alert System is expected to improve safety of the citizen who cross the railway crossings significantly. It will help to reduce the number of accidents and fatalities near railway crossings. Overall, this research project has the potential to make a significant contribution to the citizens of Sri Lanka who are crossing the railway crossings, safety and development of them. And ultimately, improving the quality of life for citizens in Sri Lanka.

2. LITERATURE REVIEW

2.1 BACKGROUND

The concept of providing solutions for the safety of people who are crossing railway crossings has been around for a long time, but the development of modern technology has made it possible to implement more effective solutions. The first research on providing solutions for the safety of people who are crossing railway crossings may date back to the late 19th century. At that time, many accidents occurred due to the lack of proper signalling systems, and there was a growing need to improve safety measures. The first documented effort to address this issue dates back to the 1870s when the first automatic signal system was installed in England. Since then, many countries have made significant progress in developing and implementing safety measures for railway crossings. However, with the increasing number of vehicles and railway crossings, new and innovative solutions are still being researched and developed to improve safety for pedestrians and drivers alike.

I mainly focused on some points when I am studying about the literature review background for my relevant component.

1. **App Based safety solutions** – I explored literature on app–based safety solutions for the users who are crossing the railway crossings regularly.

2. **Vehicle Tracking** – I explored literature on vehicle tracking near a railway crossing.

3. **Alerts Sending** - I explored literature on alerts sending to the users when they are approaching towards a railway crossing and a train is coming on that way as well.

4. **Predictive Analysis** - I explored literature on previous researches that do some predictive analysis and predicting whether some vehicle is likely to cross the railway crossing.

5. **Real-time Databases** - Research literature on real-time databases and their use in applications. This could include information on different types of real-time databases,

The use of real-time data analysis and prediction has been increasingly popular in the transportation industry, with the aim of improving the overall efficiency and safety of the transport systems. In the context of train tracking, various methods such as GPS, RFID, and GSM have been used to monitor train movement and location. However, the use of these technologies has its limitations, and real-time prediction of train location remains a challenge.

In recent years, machine learning and artificial intelligence techniques have been used to improve train tracking and prediction but not to analyse vehicle near the railway crossings. These techniques have the potential to analyse and process large amounts of real-time data, leading to more accurate predictions of train location and arrival times. One promising approach is the use of recurrent neural networks (RNNs), which have shown success in predicting the future trajectory of trains.

2.2 LITERATURE SURVEY

"Evaluation of Safety Degree at Railway Crossings in Order to Achieve Sustainable Traffic Management: A Novel Integrated Fuzzy MCDM Model" is a research done in 2021 by Aleksandar Blagojević, Sandra Kasalica, Željko Stević, Goran Tričković and Vesna Pavelkić. [6] They have done a research to address railway crossings collisions by measuring the analysis of safety degree on some railway crossings. They have used some mathematical formulas to count this analysis of safety degree.

"Traffic Signal Operations Near Highway-Rail Grade Crossings" is a another research done in USA by Transportation Research Board and National Research Council in 1999. [7] . They mainly focused on the alarm and alert systems in the railway crossings. It's an automatic railway crossing safety system that means, when a train is approaching, automatically safety options near the railway crossings like alarms, red lights are activated.

.

"An Automatic Railway Level Crossing System with Crack Detection" is another research done to minimize the collisions in the railway crossings. [8] This researched have used IoT devices like microcontrollers, Ultra Sonic Sensors, GSM Modules to detect cracks and barrier control when a train is approaching. GSM module is used to send alert messages to relevant authorities when a crack is detected. It is said that this system have a high accuracy of 93% reliability of crack detection. And also they send alerts of railway crossings gates and alarm status like whether they are on or off when a train is approaching to the relevant authorities.

"RDMNS.LK" is a Sri Lankan-developed mobile application to alert railway alerts in Sri Lanka. [9]. This application shows the users the live locations of the trains when a train is approaching. And also, this app alerts the user whether trains are delayed or not and if the train is delayed, how much time the train is delayed. This app also shows us train station contact numbers, ticket prices from Colombo Fort and so many more details related to trains in Sri Lanka. This application is available for both Android and IOS currently.

"Smart Railway Crossing Surveillance System" is another research project done to address railway crossings collisions. [10] This system addressed railway collisions by displaying whether the railway gate is opened or closed based on the train passing, the most recent gate closure timestamp, and each time when the gate is closed, a centralized platform for knowing the condition of the gate, traffic density, and intrusion detection near the railway gate. Based on the experimental results, this automated railway crossing assistance outperformed human-assisted railway crossings, resulting in an efficient and cost-effective solution for traffic regulation and avoidance of accidents at railway gates. They have used an Arduino IoT system for this system as well.

The literature survey highlights several research studies related to the safety of railway crossings. Researchers have proposed various solutions, including mathematical models to evaluate the safety degree of railway crossings, automatic safety systems activated by approaching trains, IoT-based systems for crack detection and barrier control, mobile applications to alert users about train locations and delays, and smart surveillance systems to monitor railway gates and traffic density. These studies provide valuable insights into addressing railway crossing collisions and can help inform the development of effective safety measures.

3. RESEARCH GAP

Research Features	Proposed Component	Automatic Railway Crossing System with Crack Detection[8]	RDMNS.LK: LIVE Train Alerts[9]	Smart Railway Crossing Surveillance System[10]
Mobile App	✓	✗	✓	✓
Vehicle Tracking	✓	✓	✗	✗
Alerts Sending to the Users	✓	✗	✓	✓
Analyzing the Past Vehicle Patterns	✓	✗	✗	✗
Predict the likely to Cross the Railway Crossing on particular Day	✓	✗	✗	✗
Send Alerts to Relevant Authorities	✗	✓	✗	✗
Train Tracking	✗	✓	✓	✓

Table 1: Table of Research Gap

This research project aims to bridge this gap by developing a Train Detection System for citizens via the sim or the app, which can be accessed by a wider range of users. The proposed system utilizes GSM trackers, prediction patterns, flooded message systems and other real-time data sources to provide up-to-date information of trains and provide alerts about trains, which can be used by the app users and people near the railway crossings to avoid accidents with trains in the railway crossings via the app, sim or IoT devices near the railway crossing.

My component is "Sending alert messages only to the app users who are approaching a railway crossing". The main objective of this is to analyse the past patterns of vehicles and predict if they are likely to cross the railway crossing on a given day. And sub objectives are to identify the vehicles that are moving towards the railway crossing, and send alerts only to them through the app, To track the location of the user's vehicle when they enter the range circle near the railway crossing, Store the tracked patterns of the user's vehicle and send a notification to the user's SIM card if they are predicted to cross the railway crossing on a particular day, even if they are not using the app or have mobile data turned off.

According to the literature survey above conducted, it is evident that Train detection system for citizens who cross the railway crossing is a much-needed implementation since it is really rare to find researches that targets the safety of citizen who cross the railway crossings. Up to now in the researches that were conducted under this scope, we can see that they have covered the following areas.

- Train Detection and live location showing
- Railway crossings crack detection
- Railway crossings Alarms and alert systems Improvements
- Measuring the analysis of safety degree on railway crossings
- Railway Crossing Surveillance System
- Train alerts and delay time showing
- Train detection using IoT devices

4. RESEARCH PROBLEM

According to Sri Lanka Tweet (2019), Every 3 hours, a person dies from a road accident in Sri Lanka. [5] And also, Every 3 days, a child dies from a road accident in Sri Lanka. According to a study on railway-roadway level crossing safety, which is done by Kulasingham Ragulan and Niranga Amarasingha, there are so many railway crossing collisions happen annually in Sri Lanka. [3]. And also, WorldData.info website shows that Population : Mobile Phone ratio is 1.4 per person in Sri Lanka. [11] That means the total number of phones are greater than the population of Sri Lanka. Even though the count of phones are higher than the population of Sri Lanka, there is no proper ways to use these phones to address the safety of people in Sri Lanka.

These railway crossing collisions has taken so many human lives as well as lot's of property damage. Today, there are several web applications and mobile applications about trains in Sri Lanka. But there are no proper IT based solutions to address the safety of people who cross the railway crossings, specially in Sri Lanka.

- How to enhance the safety of passengers and drivers near railway crossings?

One of the major research problems addressed by my component is the need to enhance the safety of passengers and drivers near railway crossings. Railway crossings can be dangerous places, and accidents involving vehicles and trains can result in severe injury or even death. My component seeks to address this issue by providing real-time message alerts about the approaching trains when a user is coming towards a railway crossing via the app and SMS messages.

- How to provide the predictions with highest accuracy rate?

Another research problem to be addressed in my component is the accuracy of vehicle likelihood of crossing the railway crossing when a train is approaching prediction. Inaccurate predictions could lead to mis timely alerts, which could cause passengers and drivers to become desensitized to the warnings provided by the app, resulting in a decreased level of safety. Additionally, the accuracy of vehicle prediction of crossing the railway is critical to the overall effectiveness of the this research project, and any improvements to the accuracy of the system could have a significant impact on the overall safety of railway crossings. Predictions should be made in higher accuracy for better safety of people.

- How to sort the vehicles which are approaching toward the railway crossing?

Since we are developing an app to alert the users, it is important to sort the users who are moving toward the railway crossing only. Otherwise, if the alerts are sent every time to the user when a train is approaching, it can be like a headache for the user. That will be a major User experience issue.

- How to develop the mobile application with a better user experience?

The app should be a optimized and should be in a simple and attractive UI for a better User Experience. Since we are targeting to commercialize this, the app will play a major rule since it will directly be connected with the user.

- How to integrate with real-time databases?

Since the most parts of the whole system connected with a database, it is important to connect them with a real-time database because outputs should be delivered so faster since this address the

safety of people. So connecting the component parts with a better real-time database is so much important.

- How to send alert messages not only via the app but also to the SIM card as well?

The app user might not use the mobile app due to various reasons. Like whether he/ she may turned off the mobile data or his/her 3G or 4G connection's signal strength is not enough to connect to the internet at the moment. When this kind of scenario happens, it's important to send alerts to the user somehow.

5. OBJECTIVES

5.1 MAIN OBJECTIVE

- Analyse the past patterns of vehicles and predict if they are likely to cross the railway crossing on a given day.

The ultimate main objective of my component is to analyse the past patterns of drive patterns near a particular railway crossing of the vehicles of the app users and predict if that particular user is likely to cross the railway crossing when a train is approaching. To analyse the vehicle moving patterns, we need to track them. For that, the mobile application come to play. We ask the permission of location when the user is registering to the app. Then we store the vehicle movement patterns in the particular database. After storing vehicle movement patterns of same user more times, we can analyse that patterns and make a prediction of whether this user is likely to cross the railway crossing on the train approaching time or not. More and more vehicle patterns, increases the accuracy of the prediction as well.

5.2 SPECIFIC OBJECTIVES

Sub Objective 1: Identify the vehicles that are moving towards the railway crossing, and send alerts only to them through the app –

Vehicles which are moving toward the railway crossings are identified by the location permission of the particular user's app. When it is identified that particular user is moving towards the railway crossing way only from the tracked location, alert messages are sent. Otherwise, that user is not moving, the user is going away from the railway crossing, like that kind of scenarios, alert

messages are not sent to that particular user. This makes the User Experience of the user about app better.

Sub Objective 2: Send notification alerts to the user's SIM card if they are predicted to cross the railway crossing on a particular day, even if they are not using the app or have mobile data turned off –

This is a sub-objective should be accomplished after accomplishing the main objective. The app user might not use the mobile app due to various reasons. Like whether he/ she may turned off the mobile data or his/her 3G or 4G connection's signal strength is not enough to connect to the internet at the moment. When this kind of scenario happens, it's important to send alerts to the user to the SIM card as well.

In accomplishing the main objective, below sub-objectives need to be satisfied.

Sub Objective 3: Track the location of the user's vehicle when they enter the range circle near the railway crossing.

Sub Objective 4: Store the tracked patterns of the user's vehicle – Tracked patterns of vehicles should be stored in a real-time database.

Sub Objective 5: Analyse the vehicle movement patterns and do predictions with high accuracy – To make better predictions, Machine Learning algorithm should be chosen with the highest accuracy rate and it should be trained well.

6. METHODOLOGY

After having some discussions with our supervisor, co-supervisor and research panel members, requirements were identified, some were changed and finally finalized them. Background and literature survey was done for my component in the area of alerting the people who cross the railway crossings. And then found some implementations has been done before which are looks like bit similar world-wide. As it is evident in the literature survey, that there has not been done a specific IT based system to address the safety of people on the road, when they are moving towards a railway crossing and when a train is approaching as well.

The methodology for creating the proposed train detection and alert system includes the following steps:

1. Literature Survey
2. Data Collecting
3. Model Building
4. Model Testing
5. UI Designing
6. Security Designing
7. Security Testing
8. Integrating
9. Testing
10. Deployment of the Prototype

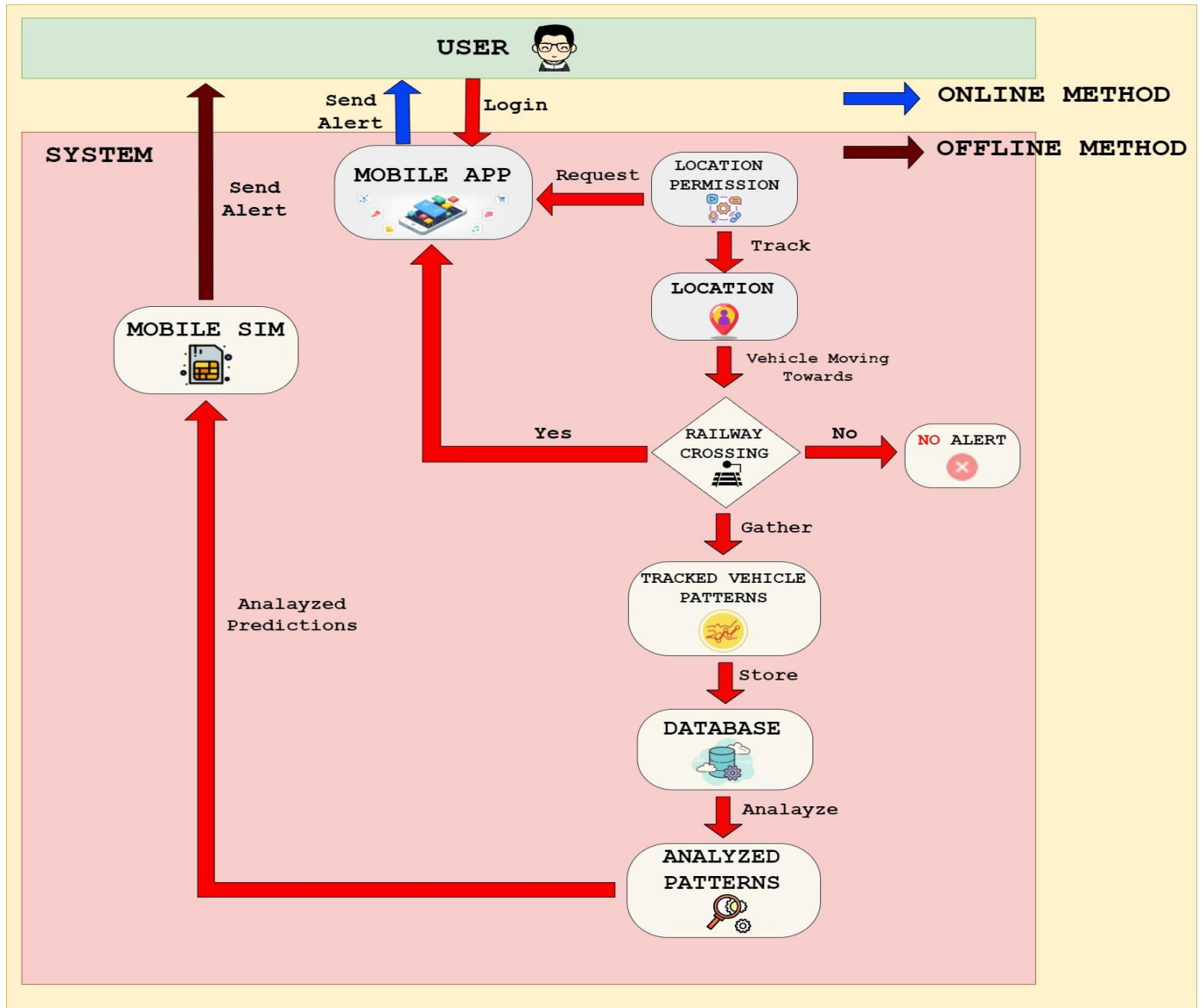## 6.1 SYSTEM ARCHITECTURE DIAGRAM

Figure 6.1: Overall System Architecture Diagram

The location permission is asked from the user when he/she logs to the app to track him/her. If that particular user is moving towards the railway crossing when a train is approaching, alerts messages are sent to him/her. Otherwise alert messages are not sent to that particular user. That is measured

using the location tracking. Then the vehicle movement patterns are collected of that particular user and they are stored in the real-time database. Then the patterns which are in the database are analysed and give alerts to the particular user form the analysed patterns via the app (Online Method) and the SIM card (Offline Method) as well.

6.2 TOOLS AND TECHNOLOGIES

Model Building – Python will be used for model building as the back-end of the system.

Mobile App Development - Flutter is used to create the front-end thus facilitating a cross-platform mobile application.

Data Storage – Firebase real-time database

Version Control System – GitHub

IDE - Visual Studio Code 1 (VS Code) and Android Studio

Machine Learning Techniques

7. SYSTEM REQUIREMENTS

User Requirements:

- User should have a smart phone.
- Mobile Application should be installed to the smart phone.
- Mobile phone should be switched on.
- Capability of understanding simple English.
- Guidance if a user is unable to use the application alone.
- Message alerts should be viewed regularly.

Functional Requirements:

- **Providing accurate predictions** – The component should be able to provide accurate prediction about the vehicles likelihood of crossing the railway crossing with higher accuracy.

- **Vehicles (Users) identification** - The component should be able to identify the vehicles that are moving towards the railway crossing.

- **User Location Tracking** - The component should be able to track the location of the user's vehicle when they enter the range circle near the railway crossing.

- **Vehicle movement pattern storage** - The component should be able to store the tracked patterns of the user's vehicle.

- **Integration with the App** - The component should be integrated with the existing mobile application for the railway crossing safety system.

- **Real-time updates** - The component should be able to provide real-time updates about the location of incoming train and the railway crossings ahead in the road to the user.

- **Notification Delivery -** The component should be able to send a notification to the user's SIM card if they are predicted to cross the railway crossing on a particular day, even if they are not using the app or have mobile data turned off.

- **Alert Delivery** - The component should be able to send alerts only to the app users who are approaching the railway crossing.

Non- Functional Requirements:

- Ease of usability
- Simple UI / UX designs
- High performance
- Availability
- Reliability
- Security

8. COMMERCIALIZATION

Identifying the target Audience: Since our ultimate goal of this project is to reduce the number of collisions happen in the railway crossings in Sri Lanka, we are targeting this system to whole people in Sri Lanka, there is no limitation.

Social media marketing: Social media platforms such as Facebook, Twitter, Instagram, YouTube and LinkedIn offer a cost-effective way to promote our product. By creating and sharing engaging content on social media, researchers can reach a wider audience and increase the visibility of their research. Social media can also be used to engage with potential collaborators and industry partners.

Partnership with a reputed company: Partnerships and collaborations with industry partners and other research institutions can help to commercialize research findings. By partnering with organizations that can provide resources, funding, or expertise, researchers can accelerate the commercialization process and increase the impact of the research. As the research project team, we expect to commercialize our final output product by building some partnership with well reputed company.

Attending Award Competitions: Attending conferences and events related to the research topic can provide opportunities to network with potential collaborators and industry partners. Researchers can also use these events to present their research findings and gain valuable feedback from peers and experts in the field.

9. REFERENCES

[1]   N. News, "NBC News," 27 April 2005. [Online]. Available:
https://www.nbcnews.com/id/wbna7647780.

[2]   Wikipedia, "Wikipedia," [Online]. Available:
https://en.wikipedia.org/wiki/Polgahawela_level_crossing_accident#:~:text=Polgahawela%20lev
el%20crossing%20accident%20was,the%20death%20of%2041%20people..

[3]   N. A. Kulasingham Ragulan, "SLSTL," 2021. [Online]. Available: https://slstl.lk/wp-
content/uploads/2021/10/A1.3.docx.

[4]   IEEE, "IEEE Explore," 2017. [Online]. Available: https://ieeexplore.ieee.org/document/8361529.

[5]   S. L. Tweet, "Twitter," 25 May 2019. [Online]. Available:
https://twitter.com/SriLankaTweet/status/1132093011997863936.

[6]   MDPI, "MDPI," January 2021. [Online]. Available: https://www.mdpi.com/2071-1050/13/2/832.

[7]   T. R. Board, "TRB org," 1999. [Online]. Available:
https://trb.org/publications/nchrp/nchrp_syn_271.pdf.

[8]   IEEE, "IEEE Xplore," 01-03 November 2022. [Online]. Available:
https://ieeexplore.ieee.org/document/10051357.

[9]   RDMNS, "RDMNS," 2023. [Online]. Available: https://rdmns.lk/.

[10]   IEEE, "IEEE Xplore," 23-25 June 2022. [Online]. Available:
https://ieeexplore.ieee.org/document/9885699.

[11]   W. D. Info, "WorldDataInfo," 2020. [Online]. Available: https://www.worlddata.info/asia/sri-
lanka/telecommunication.php#:~:text=Under%20the%20country%20code%20%2B94,the%
20world's%20average%20by%20population..

APPENDICES

Appendix A: Gannt Chart

No	Task List	December	January	February	March	April	May	June	July	August	September	October	November
1	Initial Stage												
	Research Topic Selection												
	Requirement Gathering												
	Study on Research Area												
	Topic Evaluation form submission												
	Topic Evaluation (Project pre-assessments) resubmission												
	Topic Approved												
	Project Charter												
2	Proposal Stage												
	Proposal Draft Submission												
	proposal Presentation												
3	Implementation Stage 1												
	System Design and Planning												
	Implementation of functions												
	Integration and testing Level 1												
	Progress presentation -50%												
	Prepare Research Paper												
4	Implementation Stage 2												
	Implementation of functions												
	Integration and testing Level 2												
	Progress presenation -100%												
5	Final Stage												
	Final Thesis												
	Final Presentation												

Figure 1 - Gannt Chart

Appendix B: Work Break Down Chart
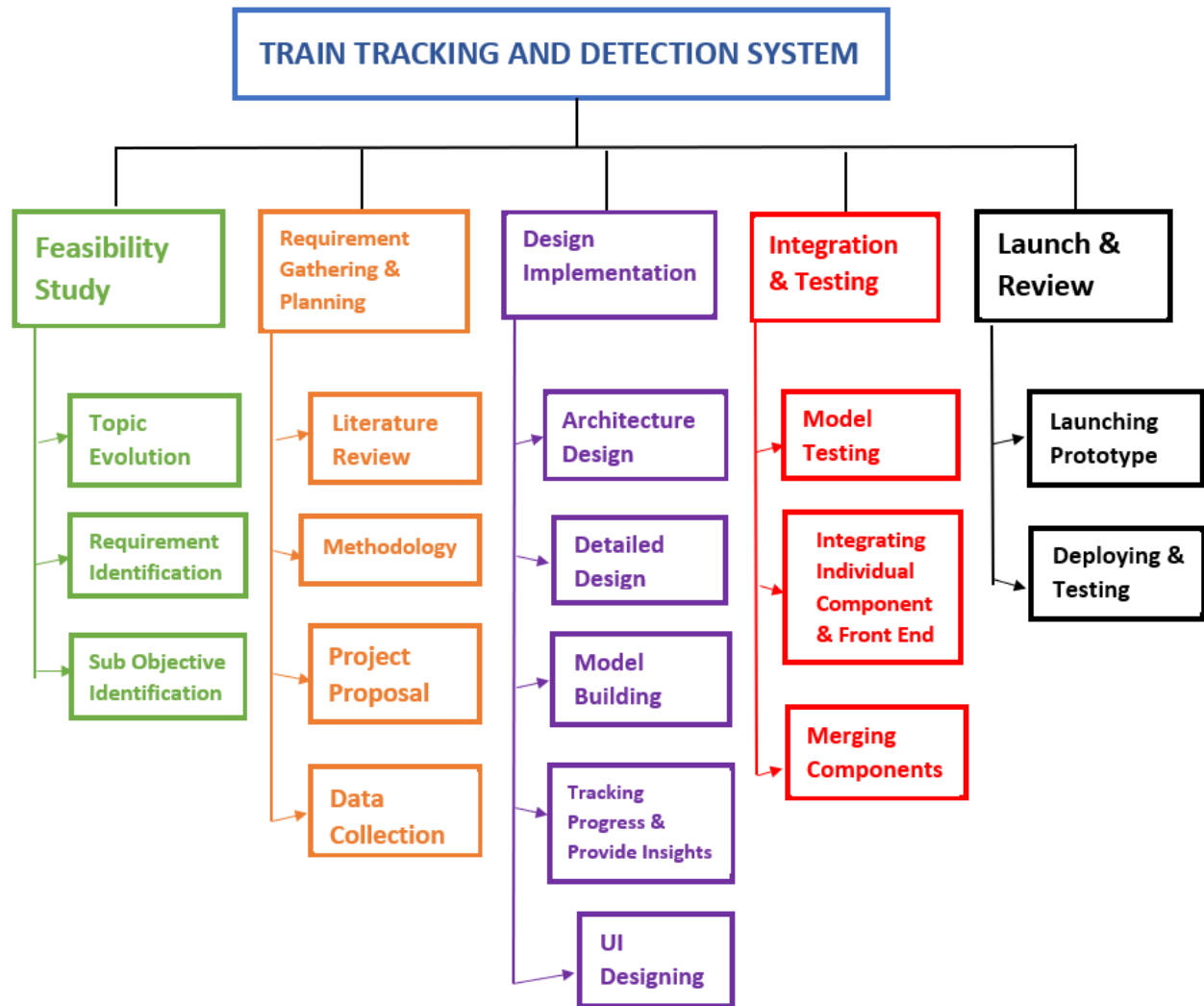
Figure 2: Work Break Down chart

Turnitin Report Screenshot