

TRAIN DETECTION & ALERT SYSTEM

TMP-23-302



TEAM MEMBERS



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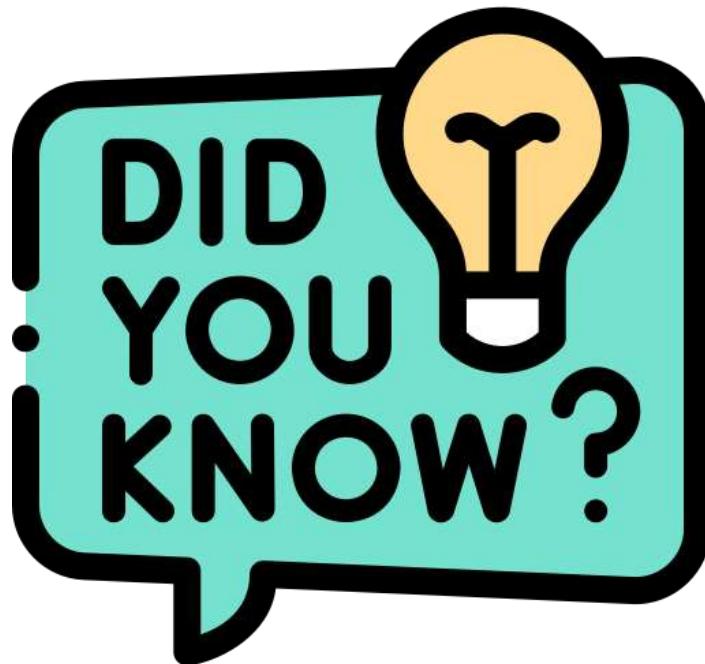


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INTRODUCTION



- In Sri Lanka ,  [3]
- Every 3 hours, A person dies in Road Accident.
- Every 3 days, a Child dies in Road Accident.
- Population : Mobile Phone ratio is 1.4 per person [4]

INTRODUCTION

WHY WE CHOOSE THIS TOPIC

?

- So many railway-crossing collisions happen in Sri Lanka annually.
- These railway-crossing collisions cost many loss of lives and property damages annually.



[1]

Polaahawela level crossing accident was a collision between a bus travelling from Galkiriyadda 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]

INTRODUCTION

- Citizens have to face collisions at the railway-crossings due to many reasons, unfortunately.
 1. **Unsafety Railway Crossings** – Many unsafety railway crossings all around Sri Lanka.
 2. **Poor Visibility** – This can happen due to heavy rain, and fog conditions.
 3. **Human Errors** – Citizens may misjudge the speed or distance of an approaching train, leading to accidents or near-misses.
 4. **Lack of Awareness** – Citizens may not be aware of the dangers posed by railway crossings or the proper safety procedures to follow when crossing tracks.

INTRODUCTION

A technology-based solution called the Train Tracking and Detection System for Citizens via the Sim or a Tracker enables people to follow the movement and location of trains in real time. Both a separate tracker device and a mobile phone with a sim card can be used to access this system. For the most recent information on the whereabouts and status of trains, the system makes use of GPS and other real-time data sources. Passengers can make better travel plans with this information, decreasing the likelihood of missing trains or having a long wait. In order to increase the general effectiveness and safety of railway operations, train operators can also utilize this technology to monitor the performance of their trains.

OBJECTIVE

MAIN OBJECTIVE

PROVIDE AN IT-BASED SOLUTION (MOBILE APPLICATION) TO ADDRESS THE SAFETY OF THE CITIZEN IN SRI LANKA FROM THE RAILWAY – CROSSINGS COLLISIONS

SUB OBJECTIVE

- Develop an User-friendly application that provide real-time data of trains and send alerts to the user properly.
- Gather and analyze data to train models.
- Provide the security and the privacy to the application as appropriate.
- To evaluate the effectiveness and reliability of the developed system through testing and validation.

METHODOLOGY

1. Data Collecting

02. Model Building

03. Model Testing

04. UI Designing

05. Security Designing

06. Security Testing

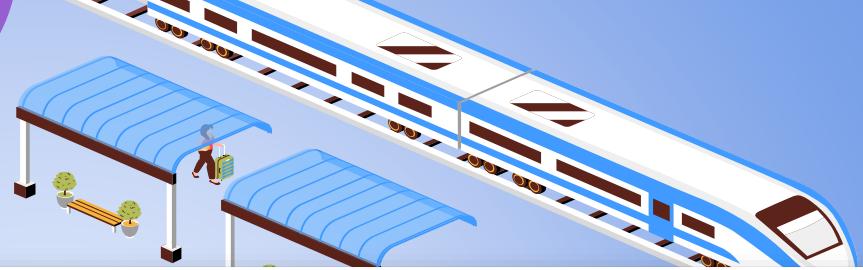
07. Integrating

08. Testing

09. Deployment of the Prototype

GANNT CHART

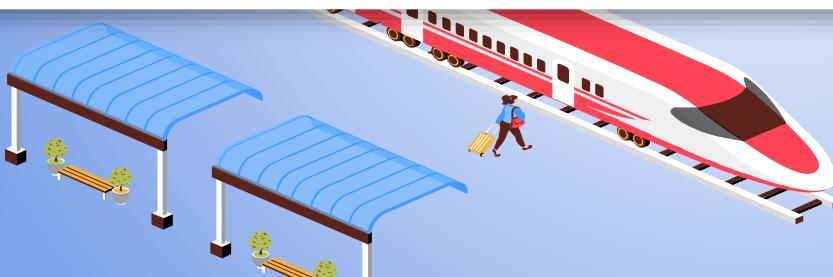
No	Task List	December	January	February	March	April	May	June	July	August	September	October	November
1	Initial Stage												
	Research Topic Selection												
	Requirement Gathering												
	Study on Research Area												
	Topic Evaluation form submission												
	Topic Evaluation (Project 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 presentation -100%												
5	Final Stage												
	Final Thesis												
	Final Presentation												



Development of an IoT Device and GSM Tracker System for Enhancing Safety Measures at Railway Crossings and Predicting the Location of a Lost Signal.



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LITERATURE SURVEY

Features Research	IOT Device	Train Tracking	Message sending To IOT device	Analyzing the Trains Past Patterns	Predict the duration for the non signal railway crossing	Alert the IOT device	Train Tracking
Proposed Component							
Automatic Railway Crossing System with Crack Detection [1]							
RDMNS.LK: LIVE Train Alerts [2]							
Smart Railway Crossing Surveillance System [3]							

RESEARCH GAP

Predict when to send the alert to the IOT device

- Lack of existing studies on the implementation of an IoT device on railway crossings and GSM trackers on trains to improve safety measures.
- Absence of prior research on the linking of the IoT device and GSM tracker to send an alert when a train approaches the crossing.
- Limited studies on the use of manual training of datasets to predict the location of a lost GSM tracker signal in the railway industry.

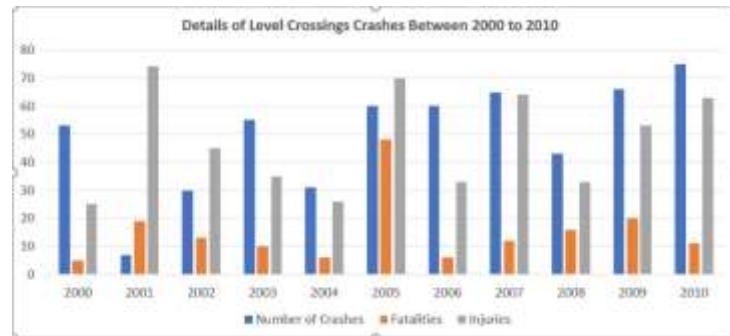
RESEARCH PROBLEM

Predict when to send the alert to the IOT device

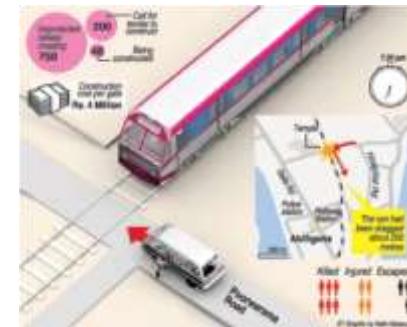
- So many railway-crossing collisions annually happen in Sri Lanka.
- Lack of accurate and efficient to determine the impact of real-time alerts on passenger safety and satisfaction



[1]



[2]



[3]

OBJECTIVE

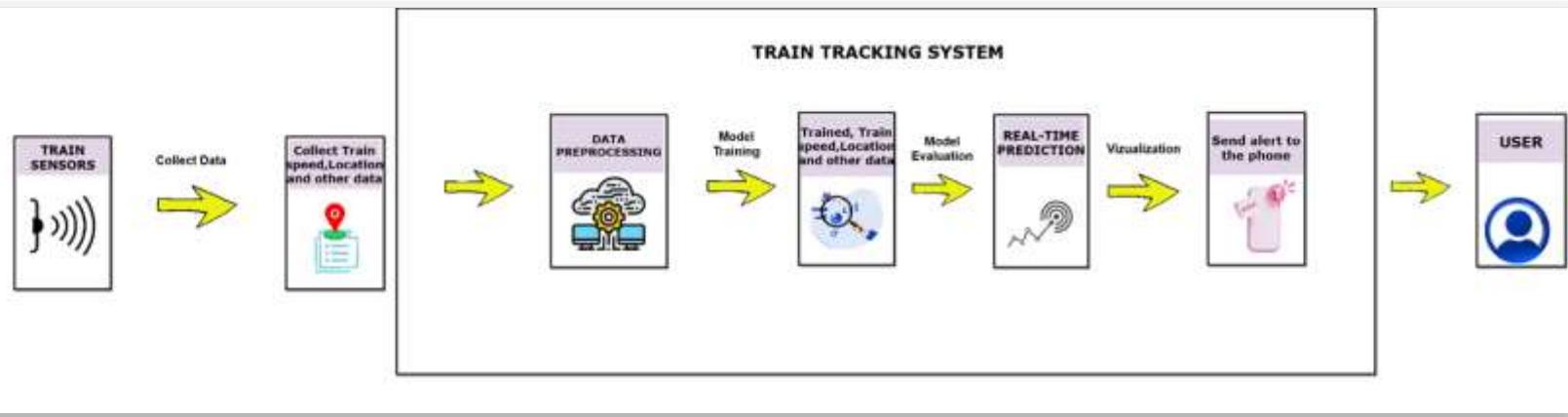
MAIN OBJECTIVE

- To develop a GSM tracker that can transmit its location to the IoT device on the railway crossing

SUB OBJECTIVE

- To enhance the safety measures at railway crossings by developing an IoT device that can detect approaching trains and send an alert to the nearby devices.
- To integrate the IoT device and GSM tracker to establish a communication link to send an alert when a train approaches the crossing. To investigate the feasibility and effectiveness of using manual training of datasets to predict the location of a lost GSM tracker signal in the railway industry.
- To evaluate the performance of the integrated system and its impact on improving the safety measures at railway crossings.

SYSTEM OVERVIEW



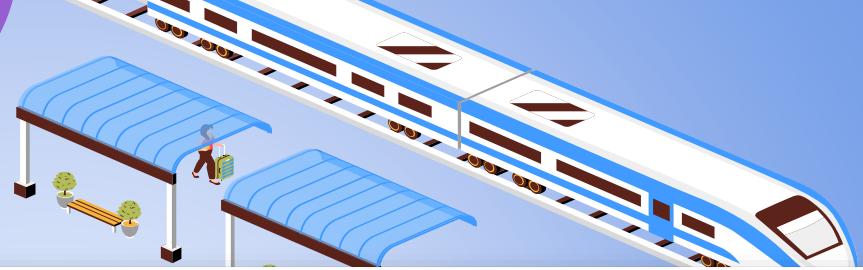
TOOLS AND TECHNOLOGIES

Microcontroller	Ardino
Communication module	ZigBee
DATABASE	FIREBASE



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- [1] S. TIimes, "sunday times," [Online]. Available: https://www.sundaytimes.lk/110612/News/nws_23.html.
- [2] N. A. Kulasingham Ragulan, "SLSTL," 2021. [Online]. Available: <https://slstl.lk/wp-content/uploads/2021/10/A1.3.docx>.
- [3] S. Times, "Sunday Times," 2013. [Online]. Available: <https://www.sundaytimes.lk/130630/news/railways-750-blood-gates-48-crossings-to-get-gates-by-years-end-50946.html>.



Sending alert messages only to the app users who are approaching a railway crossing



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LITERATURE SURVEY

Features Research	Mobile App	Vehicle Tracking	Alerts sending To Users	Analyzing the Vehicle Past Patterns	Predict the likely to Cross the Railway Crossing on particular Day	Send Alerts to Relevant Authorities	Train Tracking
Proposed Component	✓	✓	✓	✓	✓	✗	✗
Automatic Railway Crossing System with Crack Detection [1]	✗	✓	✗	✗	✗	✓	✓
RDMNS.LK: LIVE Train Alerts [2]	✓	✗	✓	✗	✗	✗	✓
Smart Railway Crossing Surveillance System [3]	✓	✗	✓	✗	✗	✗	✓

RESEARCH GAP

Sending alert messages only to the app users who are approaching a railway crossing

- There is no application to track vehicles near a railway crossing in Sri Lanka.
- No sorting. Sending alerts to every vehicle near the railway crossing.
- There is no system to analyze past drive patterns on roads of the particular vehicle near a railway crossing.
- And no system to give an analyzed output of likely cross the railway crossing on a particular day from that past drive patterns on roads.

RESEARCH PROBLEM

So many collisions because lack of applications to alert citizens who cross railway crossings

No Proper Application to address reducing railway collisions

Develop a Mobile Application with a better User Experience?

Prediction Accuracy of the trained Model

OBJECTIVE

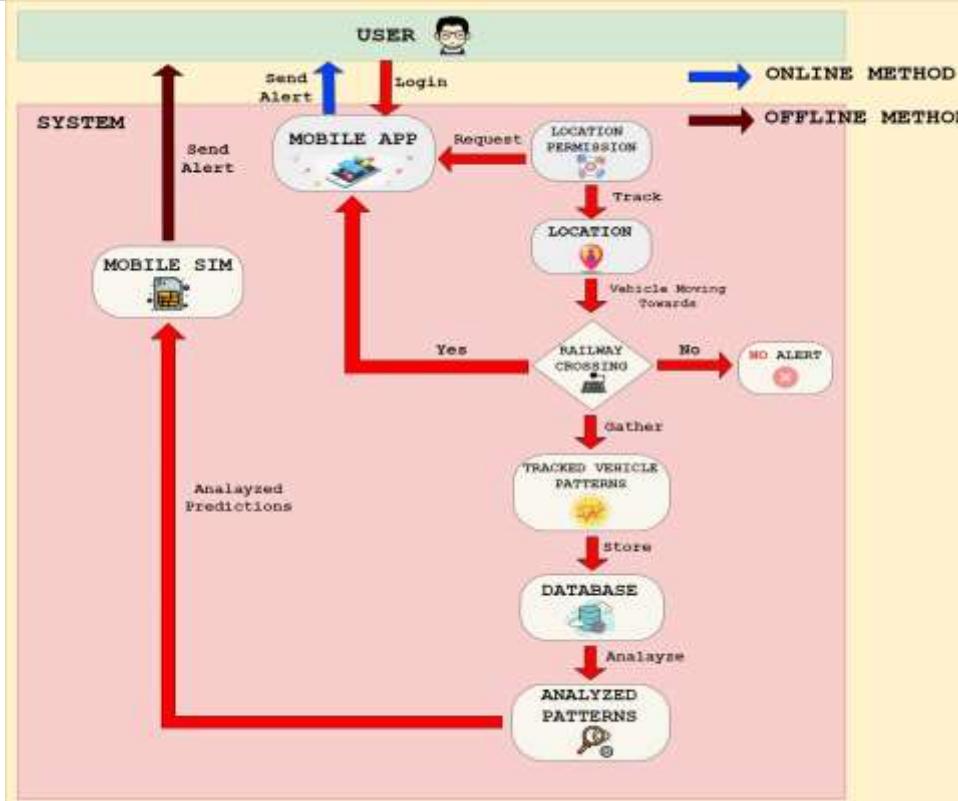
MAIN OBJECTIVE

- Identify the vehicles that are moving towards the railway crossing, and send alerts only to them through the app.
- Analyze the past patterns of vehicles and predict if they are likely to cross the railway crossing on a given day.

SUB-OBJECTIVE

- 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.
- 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.

SYSTEM OVERVIEW



TOOLS AND TECHNOLOGIES

FRONTEND	FLUTTER
BACKEND	PYTHON
DATABASE	FIREBASE



REFERENCES

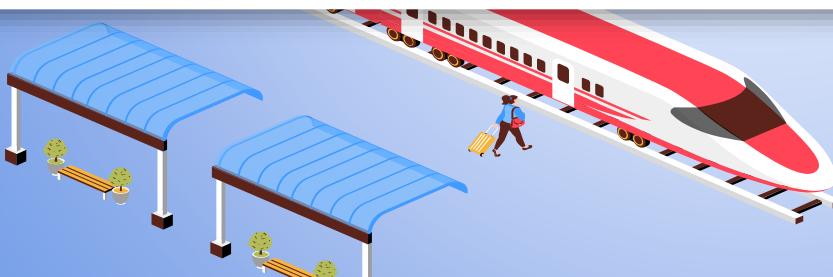
- [1] IEEE, "IEEE Xplore," 01-03 November 2022. [Online]. Available: <https://ieeexplore.ieee.org/document/10051357>.
- [2] RDMNS, "RDMNS," 2023. [Online]. Available: <https://rdmns.lk/>.
- [3] IEEE, "IEEE Xplore," 23-25 June 2022. [Online]. Available: <https://ieeexplore.ieee.org/document/9885699>.



Security analysis for Train Tracking System.



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RESEARCH GAP

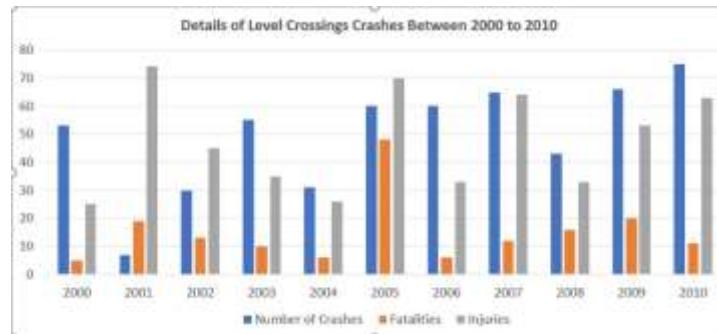
Security analysis for Train Tracking System

- Wireless Communication Security: Train tracking systems rely heavily on wireless communication to transmit data between trains and control centers. However, wireless communication is vulnerable to interception and interference. Research could focus on identifying the security risks associated with wireless communication in train tracking systems and developing effective security measures to address these risks.
- Privacy and security: Mobile applications for railway detection and tracking may gather private data regarding train routes, stops, and freight. To create safe and private applications that safeguard user information and guarantee the security and safety of railway operations, research is required.

RESEARCH PROBLEM

Security analysis for Train Tracking System

- There are many problems which occur in railways as there are no proper system implemented for the railways in Sri Lanka.
- Above statistics show the no of crashes are increasing year by year in railway crossings.
- There's no proper solution for these crashes, so implementation of a mobile application which have a connection with the railway crossing is the proposed solution for this problem.



OBJECTIVE

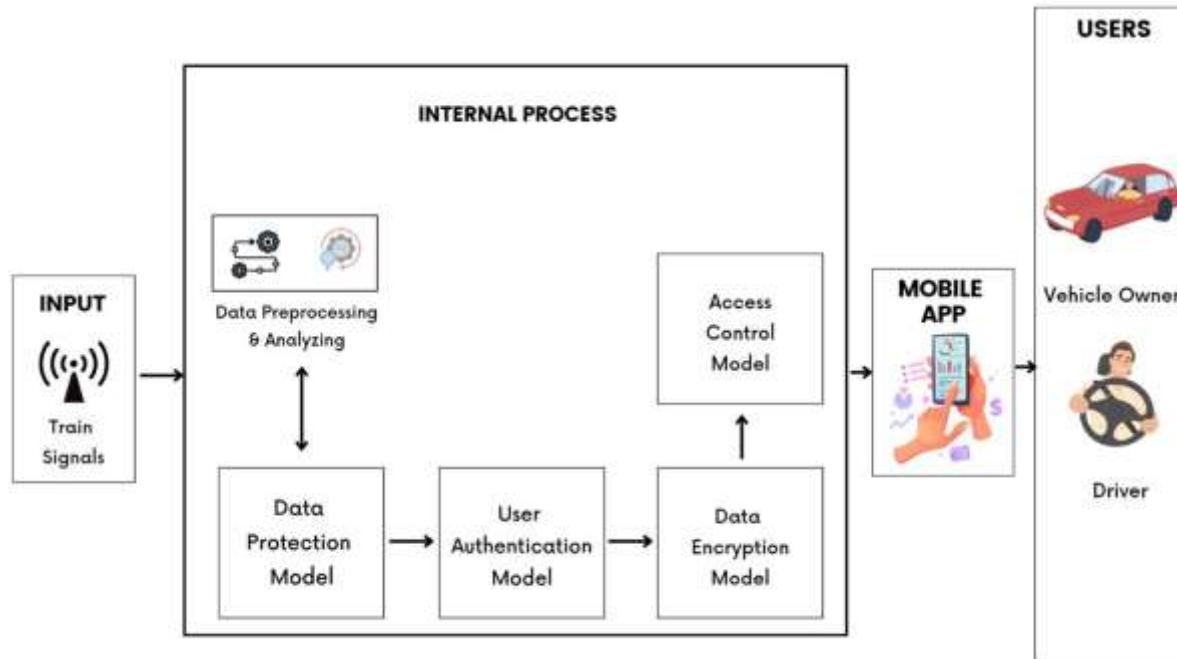
MAIN OBJECTIVE

- To develop a system to provide the security for the mobile application.

SUB OBJECTIVE

- Gathering data required for the implementation of the mobile security. This component need dataset such as general mobile threats and problems occur due to lack of security in mobile applications..
- Using of tools for ensure the safety of the mobile application such as penetration testing tools.
- The mobile application is using personal information as the user needs to be a registered user. An encryption is used to secure the password and the safety of the user data safety should be ensured within the mobile application.

SYSTEM OVERVIEW



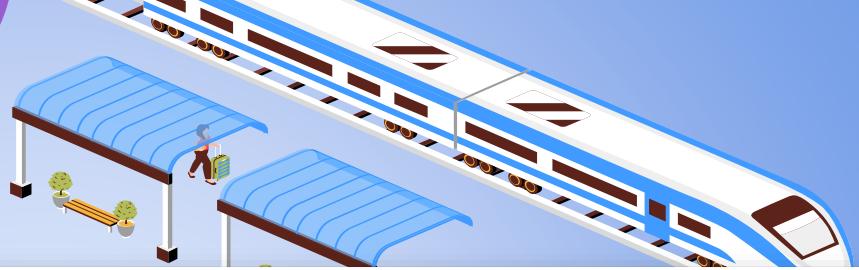
TOOLS AND TECHNOLOGIES

FRONTEND	FLUTTER
BACKEND	PYTHON
DATABASE	FIREBASE



REFERENCES

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- <https://www.getstra.com/blog/app-security/mobile-application-security-testing/>
- <https://cyberlegion.io/mobile-application-penetration-testing/>
- <https://techbeacon.com/security/5-essential-steps-securi>



Alerting system from IOT Device to SIM



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LITERATURE SURVEY

Features Research	SIM Alerts	Alerts sending To Users	Real-Time Alert System Connected with IOT Device	Send Alerts to Relevant Authorities	Fast Moving Flooded Message System
Proposed Component	✓	✓	✓	✓	✓
Automatic Railway Crossing System with Crack Detection [1]	✗	✓	✗	✗	✗
RDMNS.LK: LIVE Train Alerts [2]	✗	✗	✗	✗	✗
Smart Railway Crossing Surveillance System [3]	✗	✗	✗	✗	✗

RESEARCH GAP

Sending the flooded messages from the IOT device for the SIM users who are within a 1.5km radius

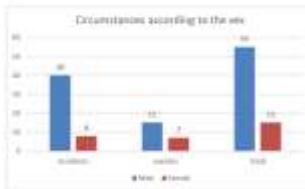
- Lack of developed systems to accurately detect and prevent collisions at railway crossings, which can have catastrophic consequences.
- Lack of a flooded alerting system to prevent collisions.
- Lack of accurate, real-time and fast moving flooded alerting system.

RESEARCH PROBLEM

Sending the flooded messages from the IOT device for the SIM users who are within a 1.5km radius

- So many collisions because of lack of real-time flooding alerting systems near railway crossings.

The following figure illustrates the different circumstances of death.



Sixty nine percent ($n=48$) were accidental while the rest were suicidal. Homicidal deaths or post mortem disposal was not observed. Accident was the foremost apparent manner of death among males 73% ($n=48$) (Figure 1).

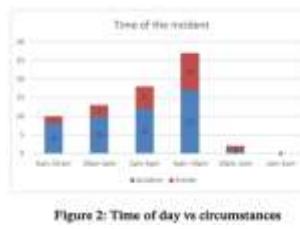
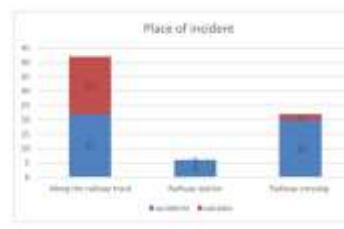


Figure 2: Time of day vs circumstances

The highest number of fatalities 64% ($n=45$) were observed between 2 pm to 10 pm. Sixty three percent ($n=30$) of accidents occurred during day light (6 am to 6 pm) whilst suicides showed a higher frequency 77% ($n=17$) in the evening and night. This was statistically significant (Figure 2).



The place of incident included railway station (and surrounding), rail track away from station, protected/ unprotected level crossings or close to the level crossing. (Figure 3) Rail track, railway station or the rail crossings are not safe for the users showing 22 (45.8%), 6 (12.5%) and 20 (41.7%) accidental fatalities respectively in these locations.

Figure 1: Circumstances of death

Of the 230 deaths and 477 cases of injury from 1,456 train accidents in 2018, 212 fatalities were classified as suicides or due to trespass on tracks. The vast majority of victims (167) were male. In 2018, level crossing accidents have caused 13 deaths and 69 cases of injury. Five people lost their lives falling off trains. In 2019, there were 215 deaths and 369 injuries coming from 1,385 train accidents. All but 15 of the deaths were classified as suicides/trespass on tracks. A further 10 deaths came from level crossing accidents, and five more from 76 cases of people falling off trains.

OBJECTIVE

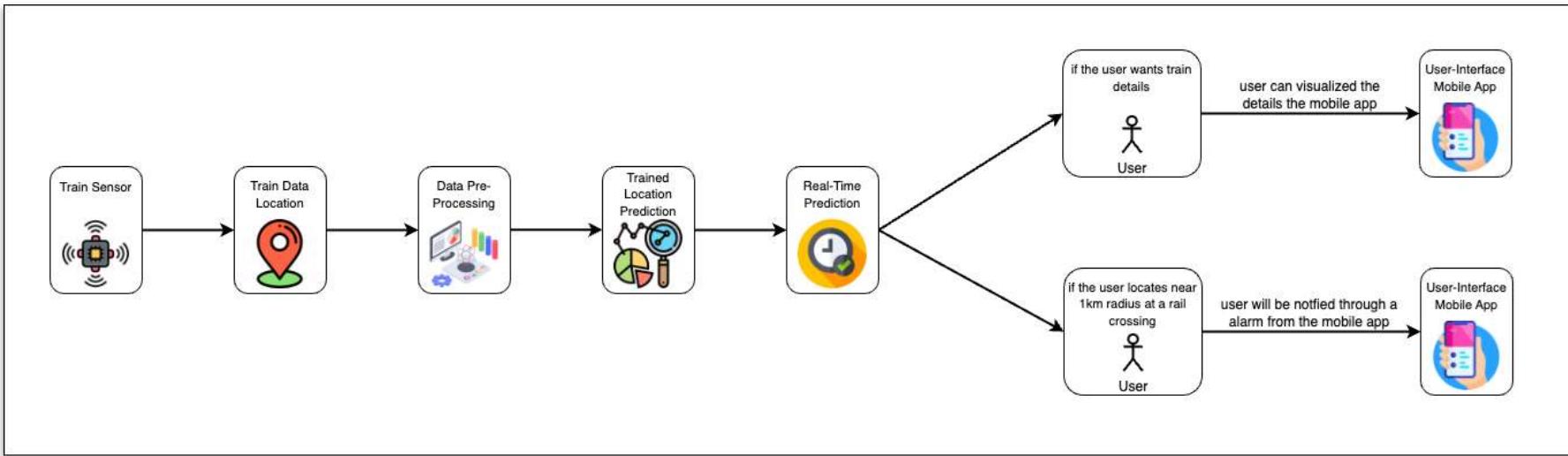
MAIN OBJECTIVE

- Sending the flooded messages from the IOT device for the SIM users who are within a 1.5km radius

SUB OBJECTIVE

- Provide the accurate real-time alert for the user within the specific radius.
- Flooding the alert among the users through the SIM.
- Make the flooding alert fast as possible among all the user's within the radius.

SYSTEM OVERVIEW



TOOLS AND TECHNOLOGIES

FRONTEND	FLUTTER
BACKEND	PYTHON
DATABASE	FIREBASE



REFERENCES

- [1] IEEE, "IEEE Xplore," 01-03 November 2022. [Online]. Available: <https://ieeexplore.ieee.org/document/10051357>.
- [2] RDMNS, "RDMNS," 2023. [Online]. Available: <https://rdmns.lk/>.
- [3] IEEE, "IEEE Xplore," 23-25 June 2022. [Online]. Available: <https://ieeexplore.ieee.org/document/9885699>.

COMMERCIALIZE

- Social Media Marketing
- Identifying the Target Audience
- Partnership with a reputed company
- Attending Award Competitions

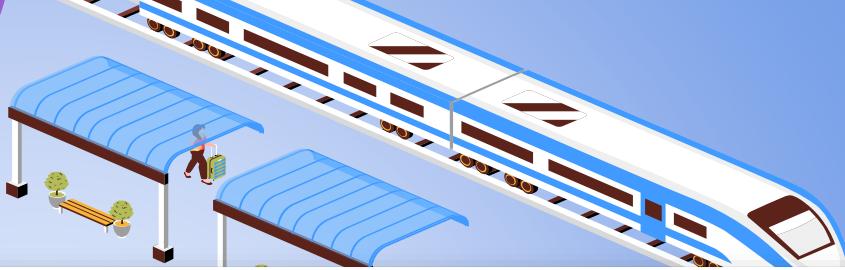


CONCLUSION

For the purpose of ensuring the security and effectiveness of train travel, train tracking and detecting technologies are crucial. These systems enable both train operators and passengers to make well-informed travel decisions by offering real-time information regarding train whereabouts, delays, and safety incidents. To improve the capabilities and efficacy of these systems, however, a number of research gaps must be filled. These flaws include insufficient user participation in system development, limited coverage and accuracy, and a lack of interaction with other transportation systems. By filling in these gaps and utilizing cutting-edge technology like artificial intelligence and the Internet of Things, we can create train monitoring and detection systems that give passengers and train operators more precise, thorough, and user-friendly information.

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- [3] S. L. Tweet, "Twitter," 25 May 2019. [Online]. Available: <https://twitter.com/SriLankaTweet/status/1132093011997863936/photo/1>.
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THANK YOU!

TMP-23-302

