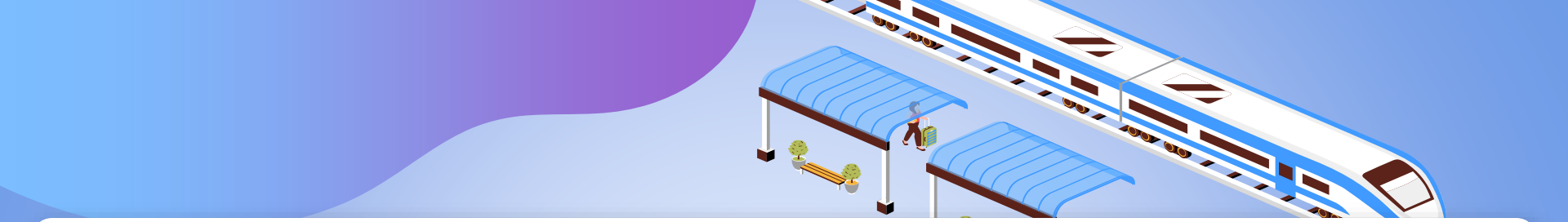

TRAIN DETECTION & ALERT SYSTEM

TMP-23-302

TEAM MEMBERS

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Data Science

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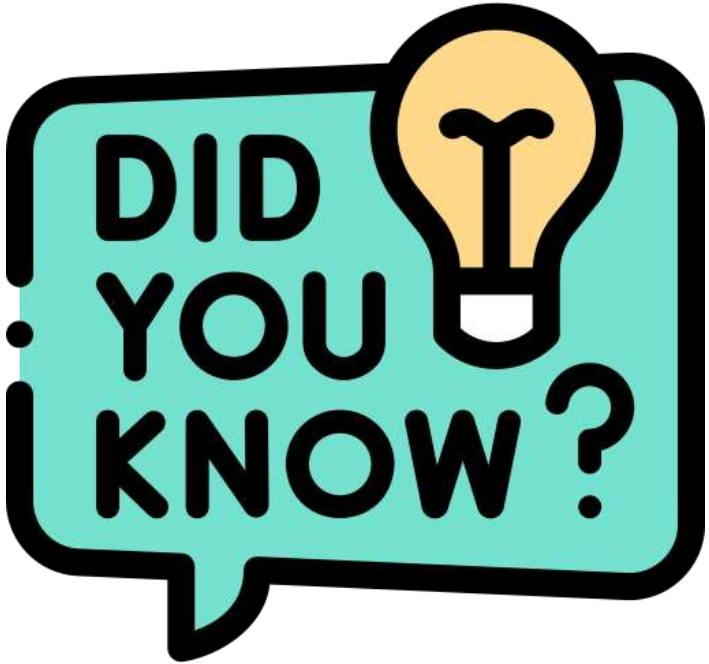
INTRODUCTION



- In Sri Lanka ,

- Every 3 hours, A person dies in Road Accident.
- Every 3 days, a Child dies in Road Accident. [3]

- 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]

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]

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 TO ADDRESS THE SAFETY OF THE CITIZEN IN SRI LANKA FROM THE RAILWAY – CROSSINGS COLLISIONS

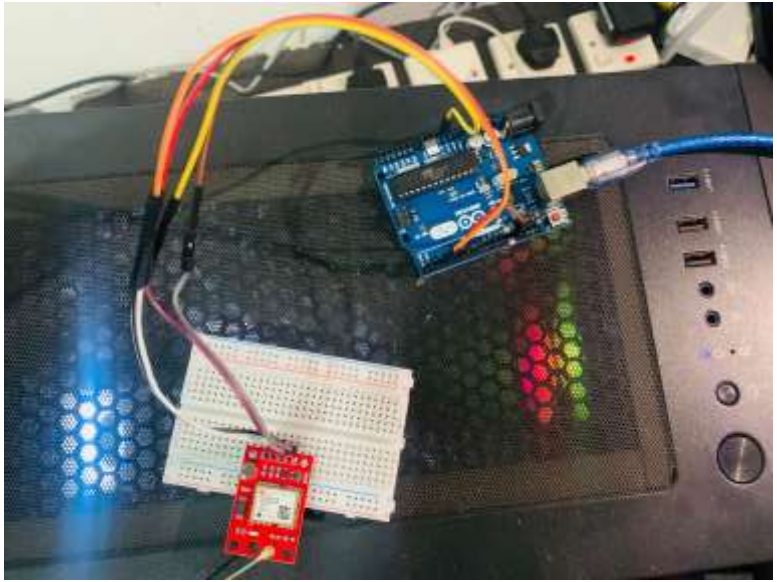
SUB OBJECTIVE

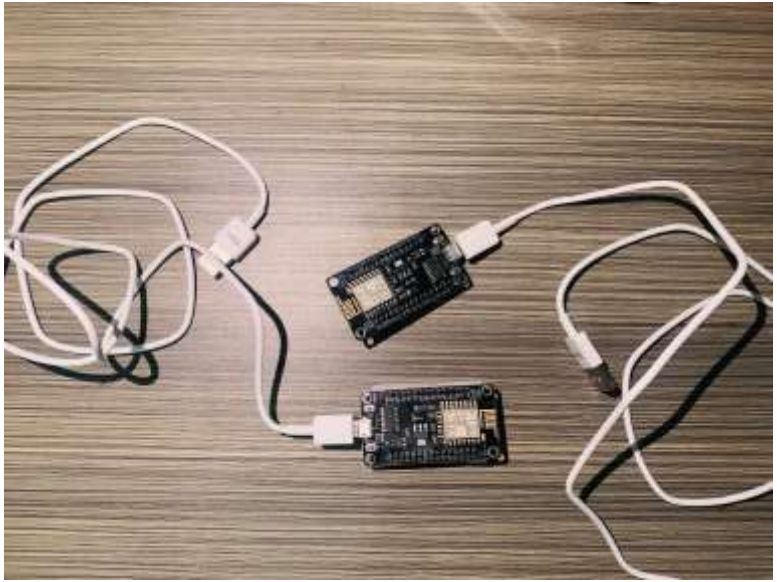
- Develop an User–friendly application that provide real-time data of trains and send alerts to the user properly.
- Gather and analyze data to train models.
- Provide the security and the privacy to the application as appropriate.
- To evaluate the effectiveness and reliability of the developed system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

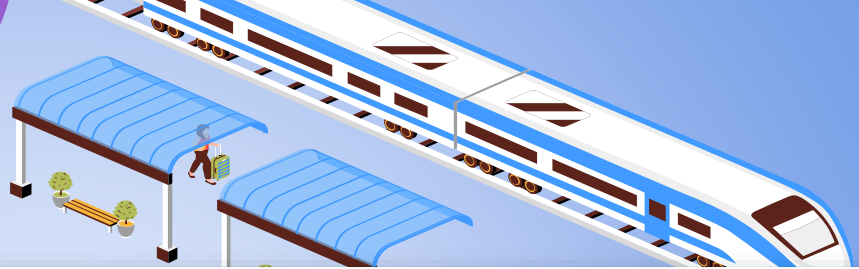
METHODOLOGY

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

USED DEVICES







To develop a system that utilizes GSM trackers on trains and IoT devices at railway crossings to predict and alert potential blind spots on the train.

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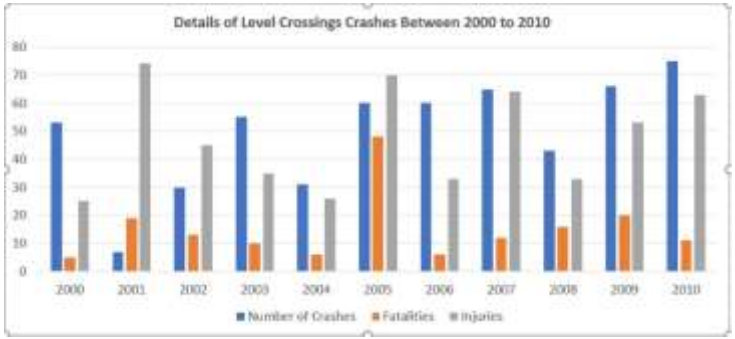
IT20212490
Data Science

RESEARCH PROBLEM

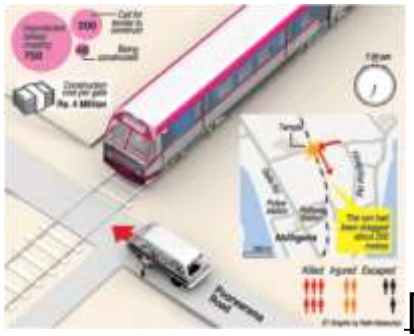
Predict when to send the alert to the IOT device

- 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

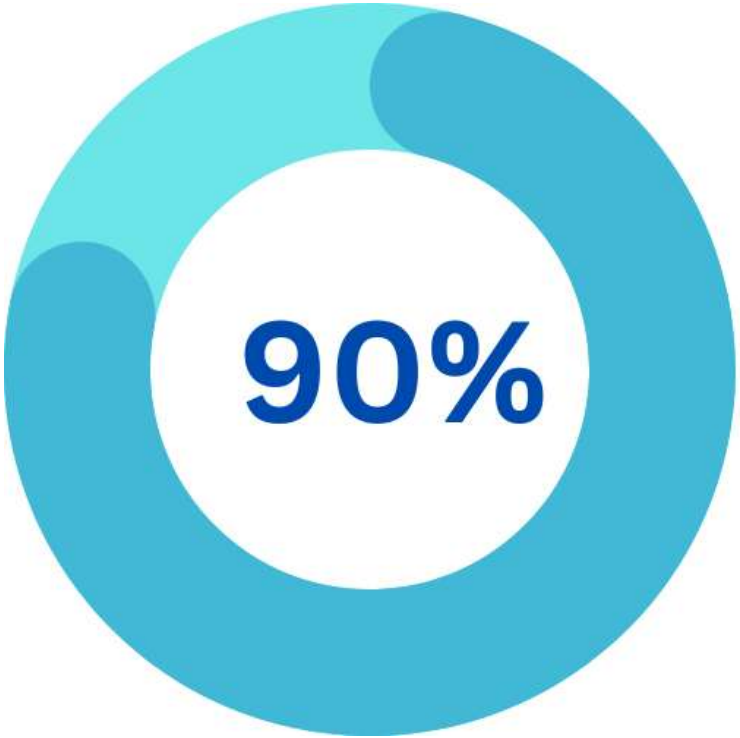
MAIN OBJECTIVE

- To develop a system that utilizes GSM trackers on trains and IoT devices at railway crossings to predict and alert potential blind spots on the train.

SUB OBJECTIVE

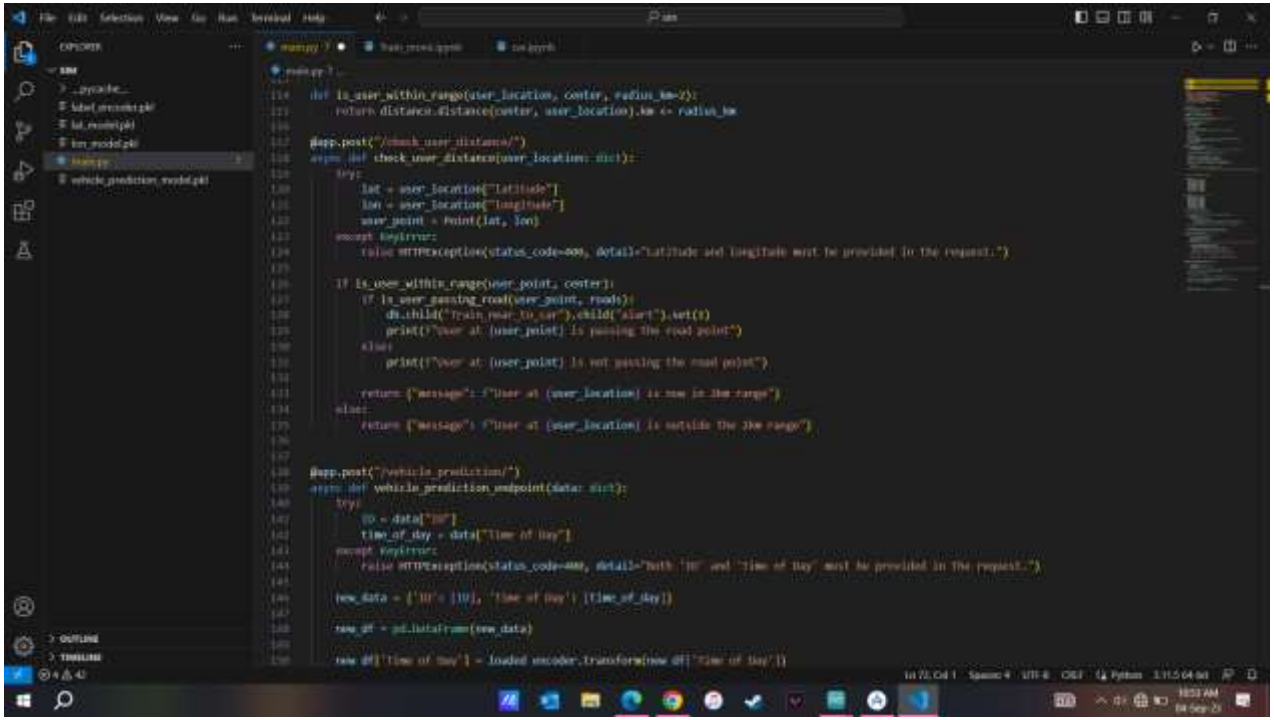
- To develop a GSM tracker that can transmit its location to the IoT device on the railway crossing.
- To enhance the safety measures at railway crossings by developing an IoT device that can detect approaching trains and send an alert to the nearby devices.
- To integrate the IoT device and GSM tracker 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.

CURRENT PROCESS

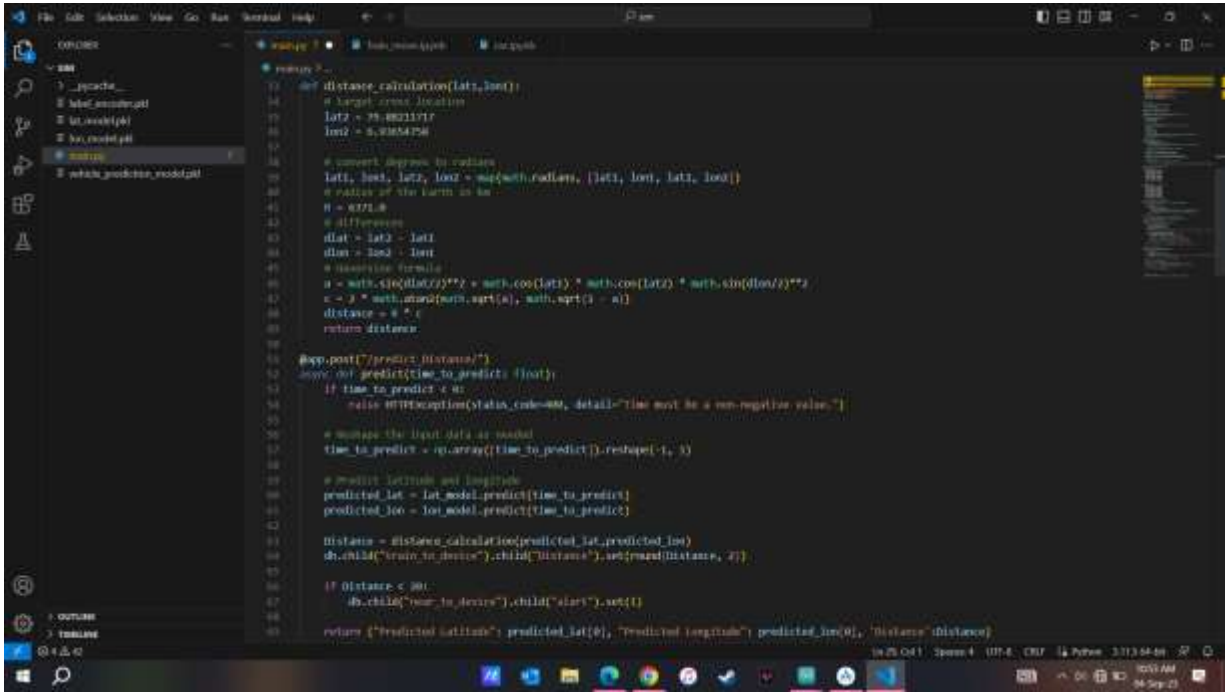


- When train comes to the blind spot, when signal is lost get the past data and predict when to send the alert to the IOT device located on the crossing.

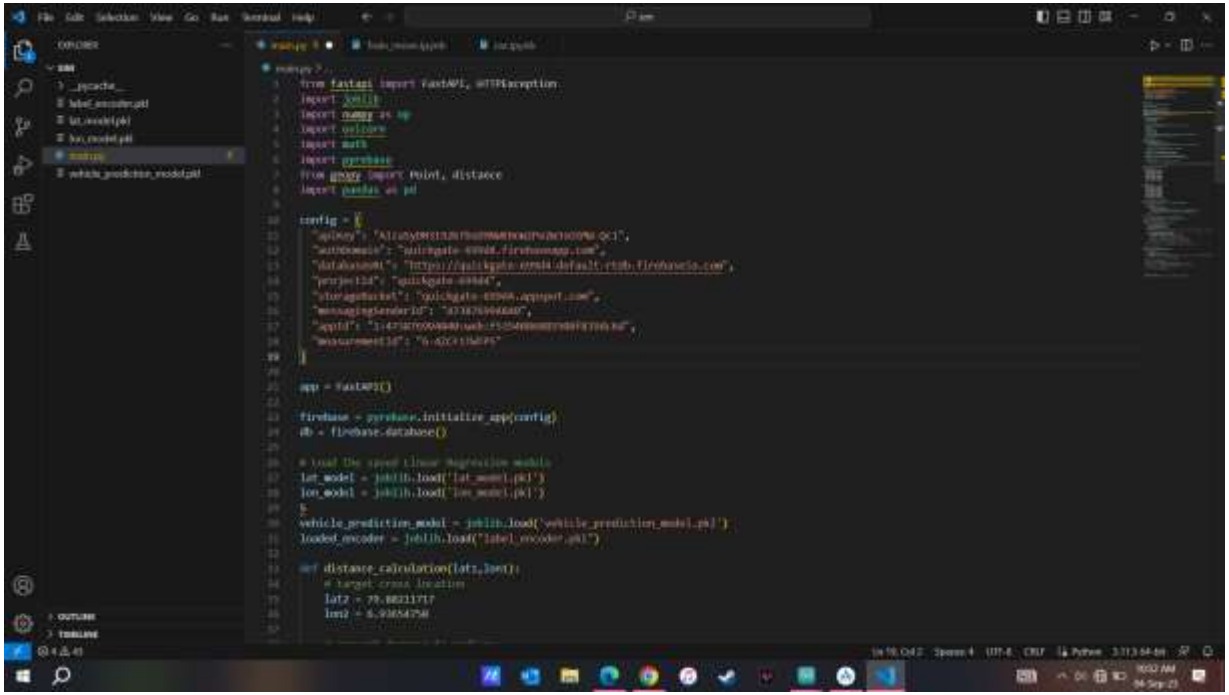
EVIDENCE



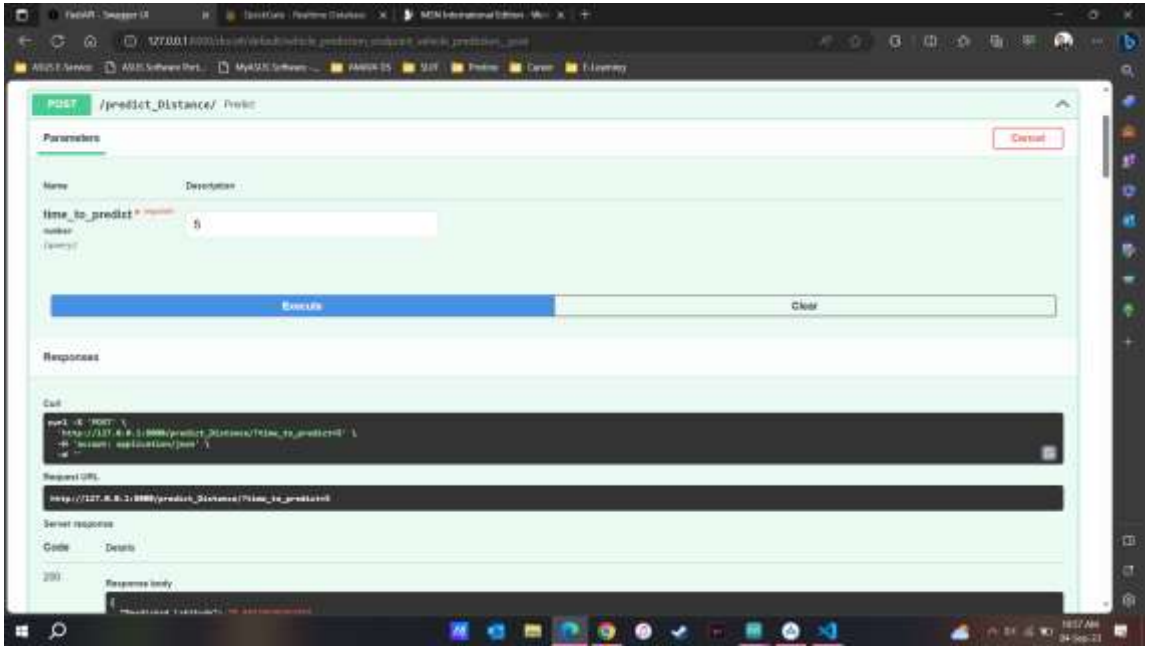
EVIDENCES



EVIDENCE


from fastapi import FastAPI, HTTPException
import joblib
import numpy as np
import uvicorn
import math
import pyrebase
from geopy import Point, distance
import pandas as pd
app = FastAPI()
lat_model = joblib.load('lat_model.pkl')
lon_model = joblib.load('lon_model.pkl')
vehicle_prediction_model = joblib.load('vehicle_prediction_model.pkl')
loaded_encoder = joblib.load('label_encoder.pkl')
def distance_calculation(lat1,lon1):
lat2 = 79.88211717
lon2 = 6.93654758

EVIDENCE

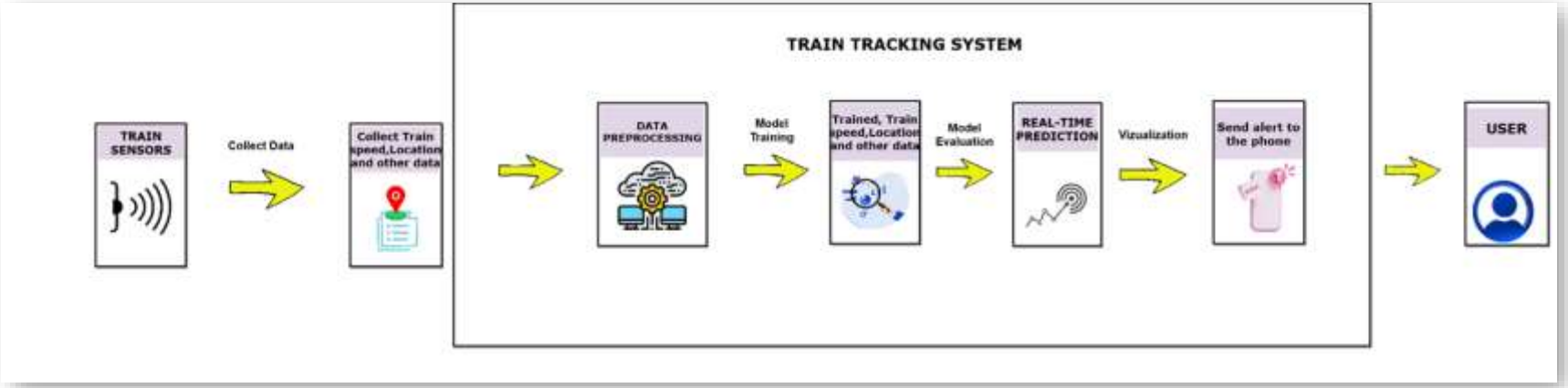

POST
/predict_Distance/
Parameters
Cancel
time_to_predict
5
Execute
Clear
Responses
Curl
Request URL
Server response
Code
Details
200
Response body

TASKS TO BE COMPLETED

Need to add a ESP 32 / UNO r34 for the IOT device

Need to add a speaker for IOT device get the alert on surrounding environment

SYSTEM OVERVIEW



TOOLS AND TECHNOLOGIES

Microcontrollers	Arduino uno, NodeMCU
DATABASE	FIREBASE
Trcaking Device	Tracker module (TCRT 5000IR), Sim800 GPS Tracker

Libraries :

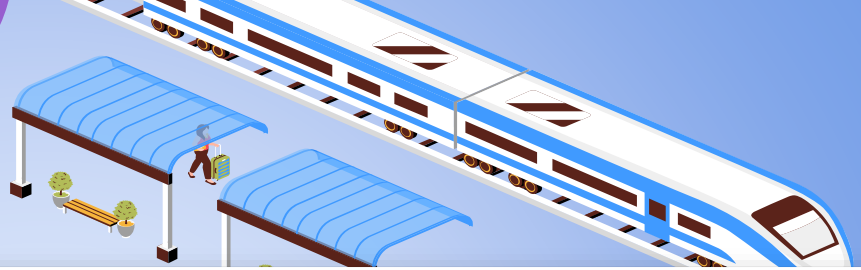
IDE s :

TCRT5000 IR Infrared Reflective Switch Sensor

SIM800L GSM/GPRS Module

REFERENCES

- [1] S. TImes, "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 alerts to the users via the app & Predicting the likelihood of crossing the railway-crossing

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Data Science

BACKGROUND

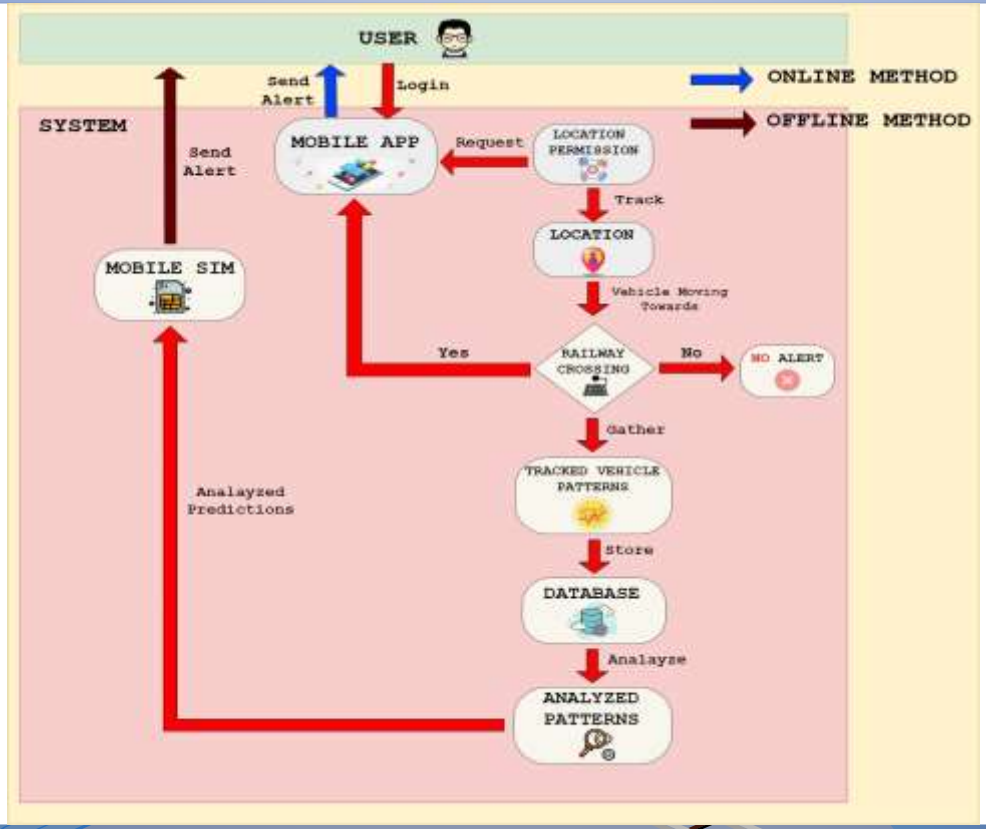
ANALYZE THE PAST PATTERNS OF VEHICLES AND PREDICT IF THEY ARE LIKELY TO CROSS THE RAILWAY CROSSING ON A GIVEN DAY

- Main Objective.
- Below objective should be completed first.
- If the app user crosses the railway crossing, the data will be collected to do the predictions.
- Data will be sent to the cloud-based database.

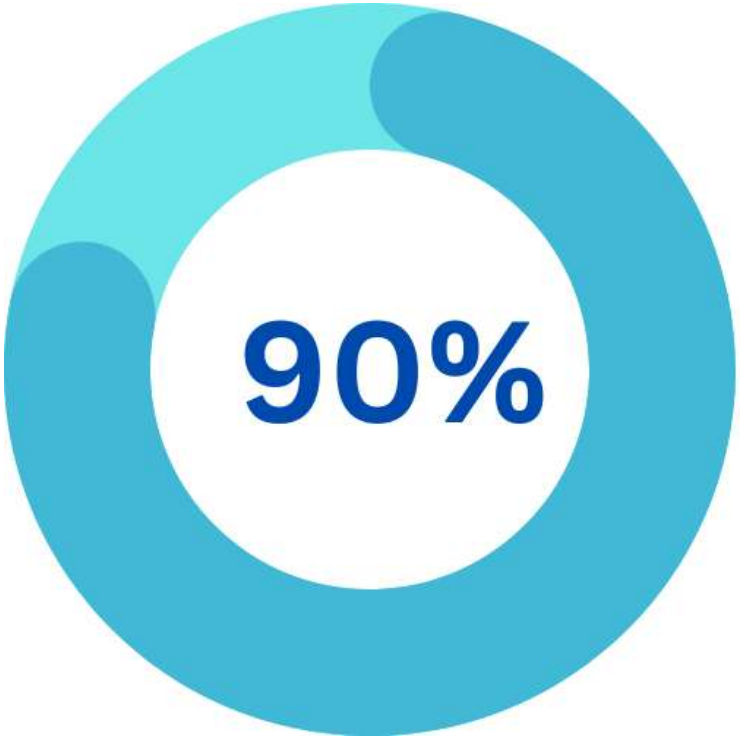
IDENTIFY THE VEHICLES THAT ARE MOVING TOWARDS THE RAILWAY CROSSING, AND SEND ALERTS ONLY TO THEM THROUGH THE APP.

- Secondary Objective.
- Ask the location permission from the user through the app.
- If only the user is moving towards the railway crossing, alert messages are sent.
- Otherwise, alert messages are not sent.

INDIVIDUAL COMPONENT DIAGRAM

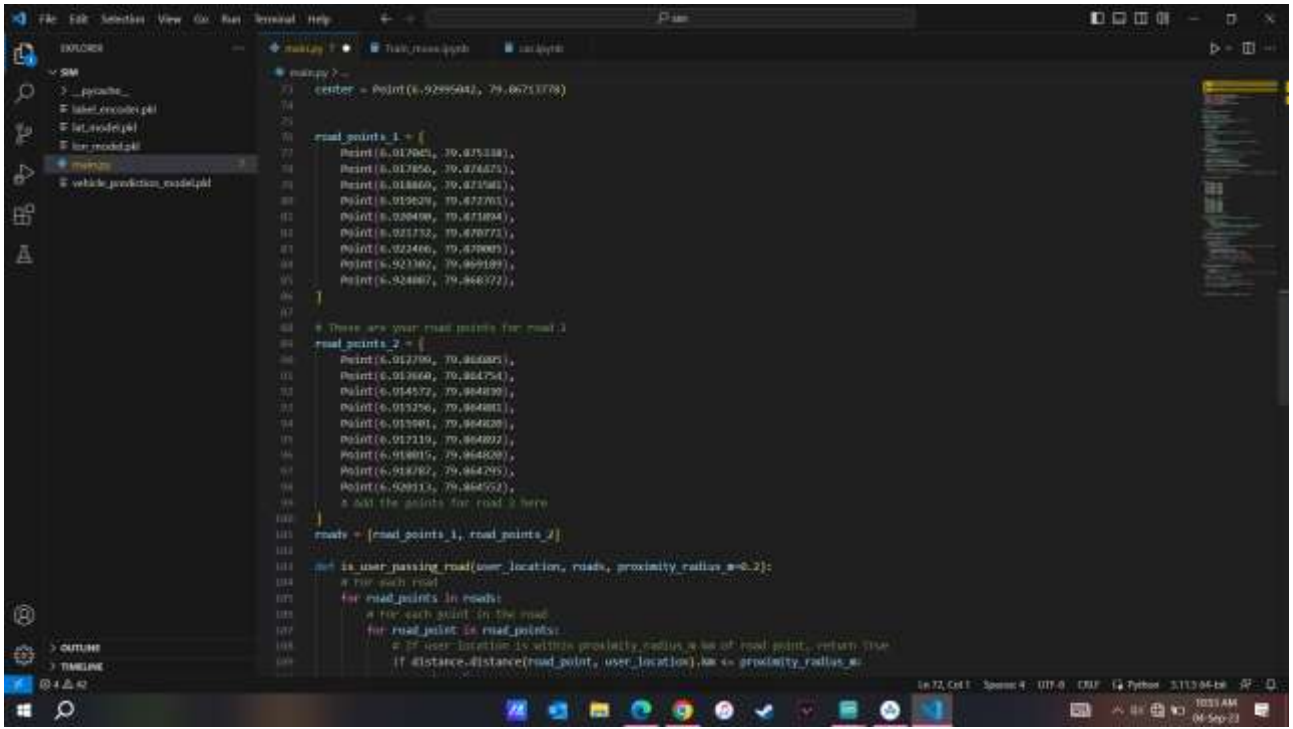


CURRENT PROGRESS

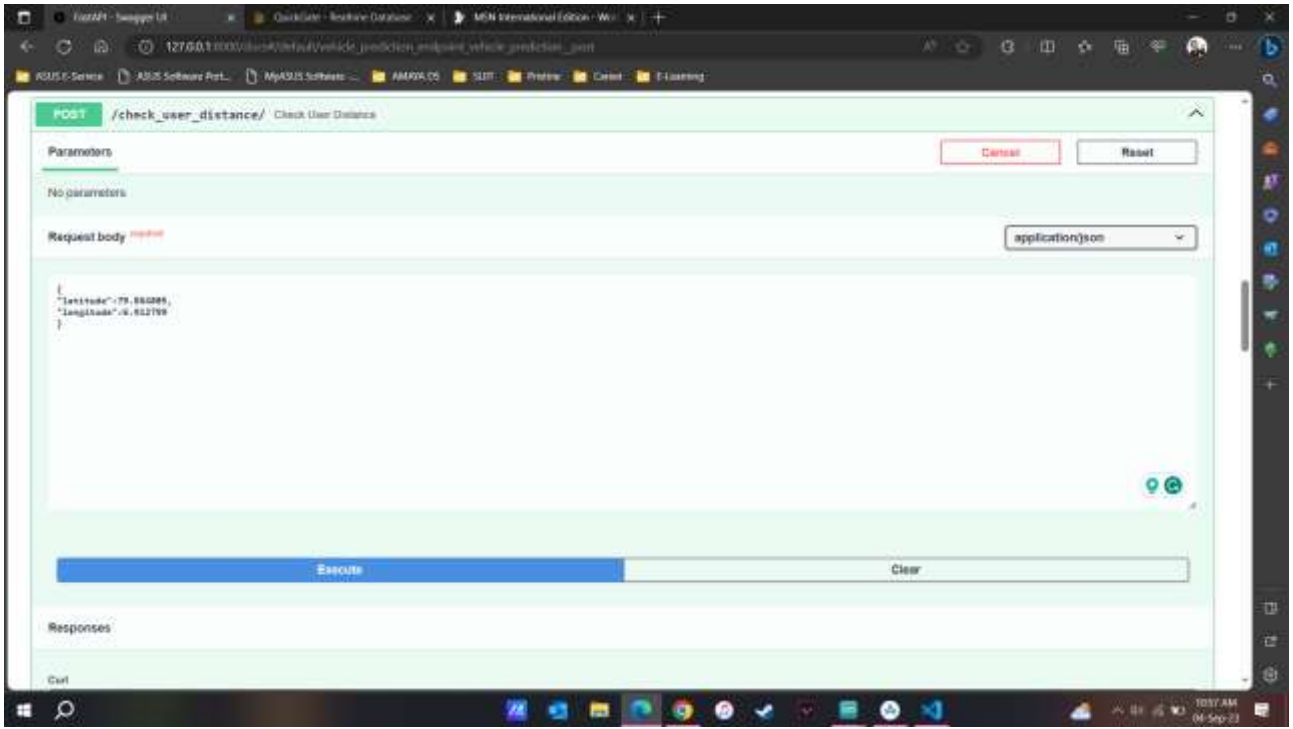


- Capture the Vehicle ID, Time and location and predict the likelihood of the vehicle crossing the railway crossing at a particular time.

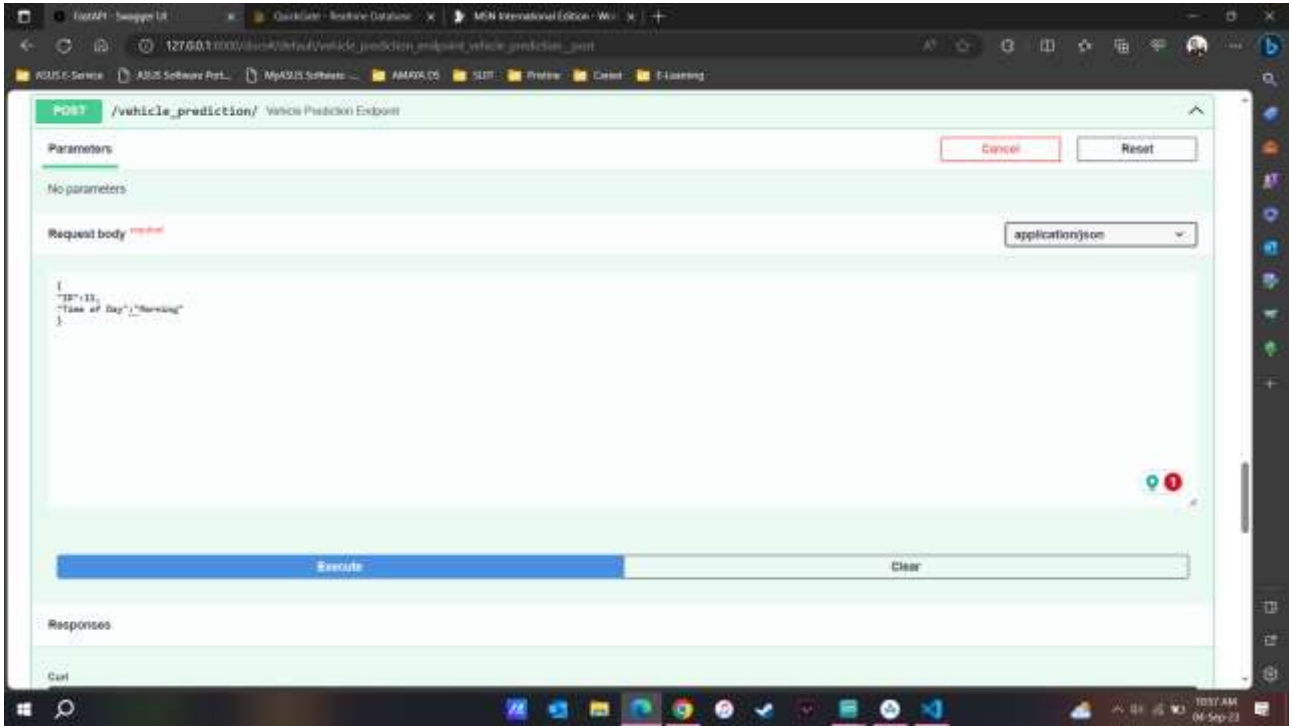
EVIDENCE


center = Point(6.92995482, 79.86713778)
road_points_1 = [
Point(6.917685, 79.875338),
Point(6.917856, 79.874675),
Point(6.918869, 79.873501),
Point(6.919629, 79.872703),
Point(6.920498, 79.871894),
Point(6.921732, 79.870771),
Point(6.922466, 79.870085),
Point(6.923302, 79.869189),
Point(6.924807, 79.868372),
]
# These are your road points for road 1
road_points_2 = [
Point(6.912709, 79.866085),
Point(6.913668, 79.864754),
Point(6.914577, 79.864030),
Point(6.915256, 79.864081),
Point(6.915981, 79.864020),
Point(6.917119, 79.864092),
Point(6.918015, 79.864020),
Point(6.918782, 79.864295),
Point(6.920113, 79.864552),
Add the points for road 2 here
]
roads = [road_points_1, road_points_2]
def is_user_passing_road(user_location, roads, proximity_radius_m=0.2):
# For each road
for road_points in roads:
# For each point in the road
for road_point in road_points:
# If user location is within proximity_radius_m km of road point, return True
if distance.distance(road_point, user_location).km <= proximity_radius_m:

EVIDENCE


POST
/check_user_distance/
Parameters
Cancel
Reset
No parameters
Request body
application/json
Execute
Clear
Responses
Curl

EVIDENCE


POST
/vehicle_prediction/
Parameters
Cancel
Reset
No parameters
Request body
application/json
Execute
Clear
Responses
Curl

TOOLS AND TECHNOLOGIES

Flutter python™ Firebase

FRONTEND	FLUTTER
BACKEND	PYTHON
DATABASE	FIREBASE

Libraries :

Flask NumPy Folium matplotlib

- Flask
- Numpy
- Folium
- Matplotlib

IDE s :

Android Studio

TASKS TO BE COMPLETED

Completing the Mobile Application Development

Integrating the whole components

Security analysis for Train Tracking System.

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IT20187064
Cyber Security

RESEARCH GAP

Security analysis for Train Tracking System

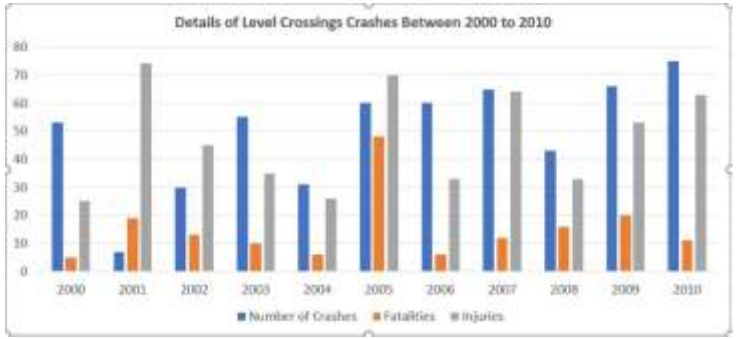
- Wireless Communication Security: Train tracking systems rely heavily on wireless communication to transmit data between trains and control centers. However, wireless communication is vulnerable to interception and interference. Research could focus on identifying the security risks associated with 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.

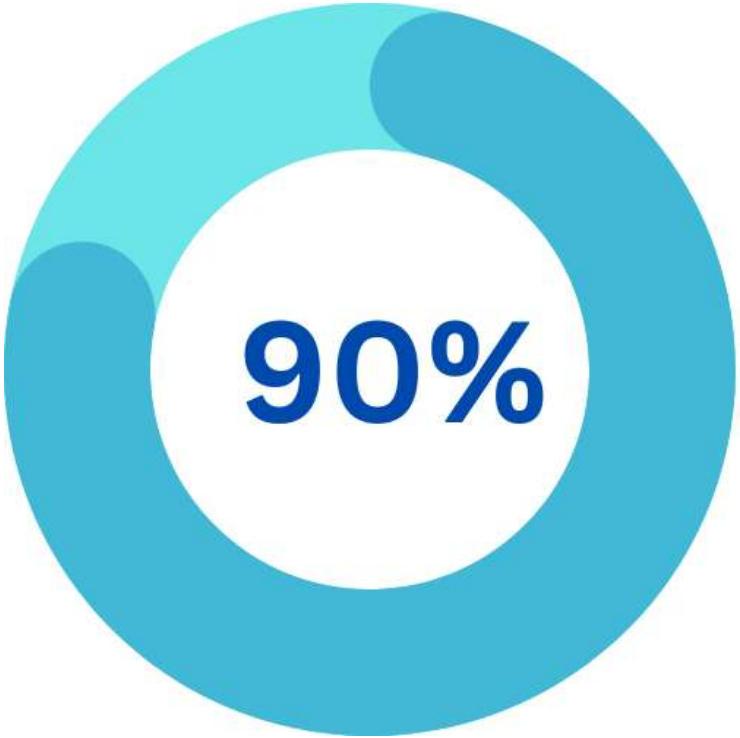
RESEARCH PROBLEM

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.

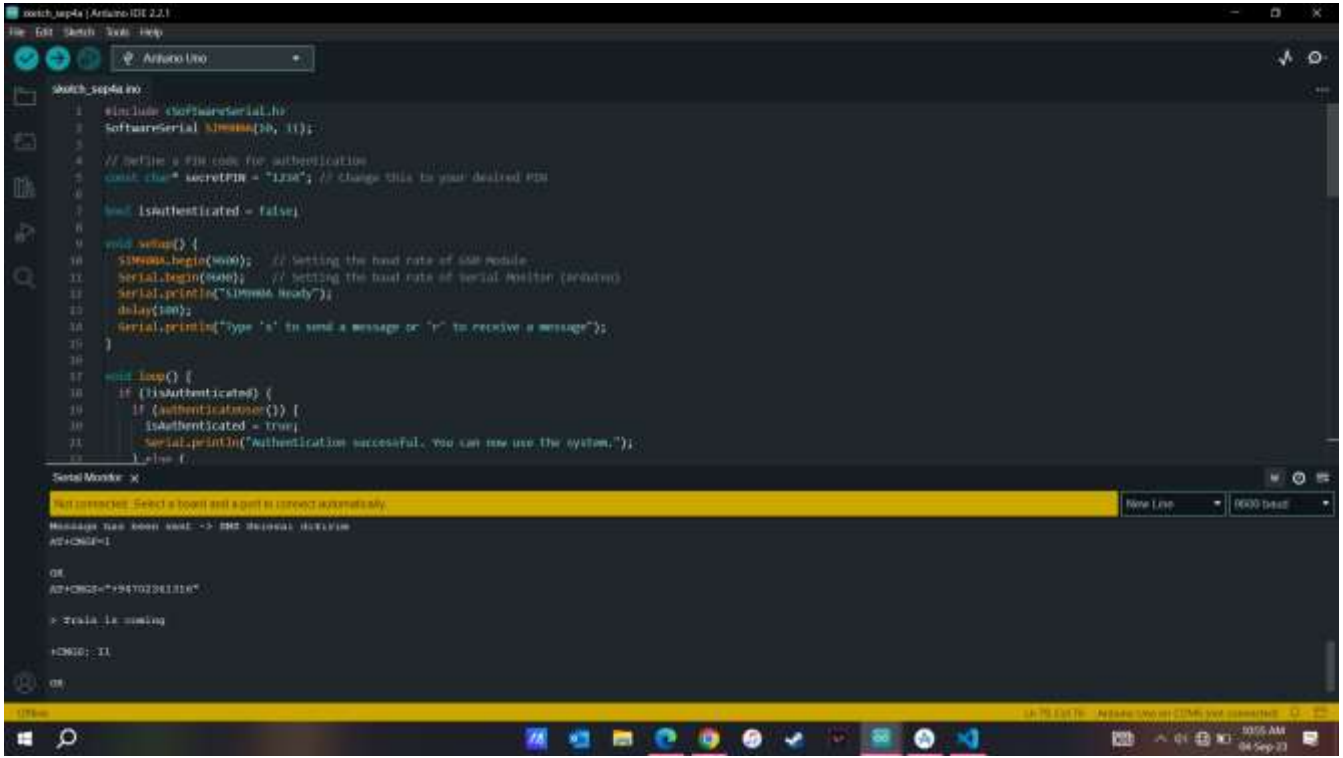


CURRENT PROCESS



- Setup the Authentications. (Firebase and SIM to Message)
- Setup the encryption.

EVIDENCE


sketch_sep4a | Arduino IDE 2.2.1
File Edit Sketch Tools Help
Arduino Uno
sketch_sep4a.ino
#include <SoftwareSerial.h>
SoftwareSerial SIM900A(10, 11);
// Define a PIN code for authentication
const char* secretPIN = "1234"; // Change this to your desired PIN
bool isAuthenticated = false;
void setup() {
SIM900A.begin(9600); // Setting the baud rate of GSM Module
Serial.begin(9600); // Setting the baud rate of Serial Monitor (Arduino)
Serial.println("SIM900A Ready");
delay(100);
Serial.println("Type 's' to send a message or 'r' to receive a message");
}
void loop() {
if (!isAuthenticated) {
if (authenticateUser()) {
isAuthenticated = true;
Serial.println("Authentication successful. You can now use the system.");
} else {
Serial Monitor
Not connected. Select a board and a port to connect automatically.
New Line
9600 baud
Message has been sent -> SMS Received Activity
AT+CMGF=1
OK
AT+CMGS="+94702361316"
> Irala is coming
+CMGS: 11
OK

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.

TASK TO BE COMPLETED

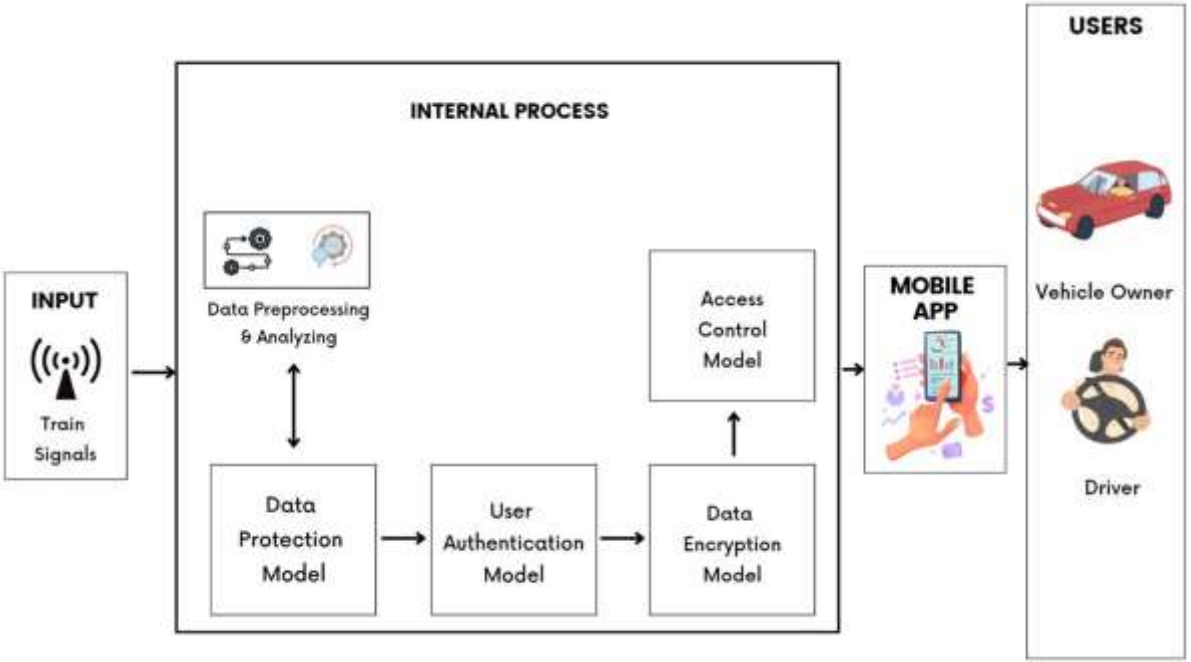
All Device Security

User Management and Data Base Management

User Authentication

Credentials Permission

SYSTEM OVERVIEW



TOOLS AND TECHNOLOGIES

FRONTEND	FLUTTER
BACKEND	PYTHON
DATABASE	FIREBASE

SIM800L GSM/GPRS Module

IDE s :

REFERENCES

- https://www.synopsys.com/glossary/what-is-penetration-testing.html#:~:text=A%20p
- https://www.getastra.com/blog/app-security/mobile-application-security-testing/
- https://cyberlegion.io/mobile-application-penetration-testing/
- https://techbeacon.com/security/5-essential-steps-securing-enterprise-mobile-apps

Alerting system from IOT Device to SIM

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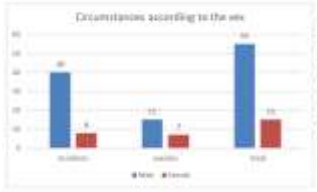
IT20101824
Information Technology

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 1: Circumstances of death

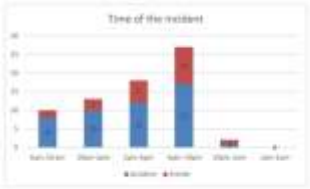
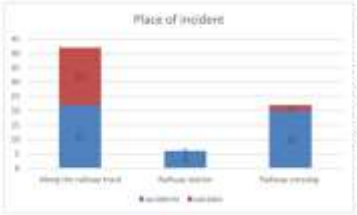


Figure 2: Time of day vs circumstances

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.

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

- Gathering the data from the IOT Device
- 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.

EVIDENCE


sketch_sept4a.ino
#include <SoftwareSerial.h>
SoftwareSerial SIM900A(10, 11);
// Define a PIN code for authentication
const char* secretPIN = "1234"; // Change this to your desired PIN
bool isAuthenticated = false;
void setup() {
SIM900A.begin(9600); // Setting the baud rate of GSM Module
Serial.begin(9600); // Setting the baud rate of Serial Monitor (Arduino)
Serial.println("SIM900A Ready");
delay(100);
Serial.println("Type 's' to send a message or 'r' to receive a message");
}
void loop() {
if (!isAuthenticated) {
if (authenticateUser()) {
isAuthenticated = true;
Serial.println("Authentication successful. You can now use the system.");
} else {
Serial Monitor
Not connected. Select a board and a port to connect automatically.
New Line
9600 baud
Message has been sent -> ONE Release Asiriya
AT+CMGF=1
OK
AT+CMGS="+94702343316"
> Train is coming
+CMGS: 11
OK

CURRENT PROCESS

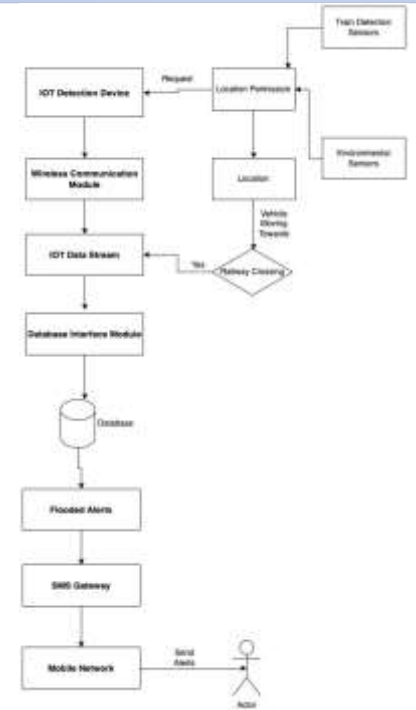
- Setup the Arduino Board with UNO board and SIM 900L.
- Setup the Alerting Message with a static number.
- User receiving a message “Train Is Coming”.

TASK TO BE COMPLETED

Need to add a ESP 32 / UNO r34 for the IOT device

User registration via the message with collaborate with a mobile service provider

SYSTEM OVERVIEW



TOOLS AND TECHNOLOGIES

IDE	ADRUINO
Library	RTC_DS3231
DATABASE	FIREBASE

GANTT 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												

COMMERCIALIZE

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

BUDGET (Up to Now)

ITEM	BUDGET
Node MCU Board (x2)	4000.00 LKR
Micro USB Cable(x2)	700.00 LKR
GSM Tracker	1000.00 LKR
Jumper Wires	150.00 LKR
Bread Board	200.00 LKR
Travelling Costs	1000.00 LKR
Electricity & Internet Costs	1000.00 LKR
Total	8050.00 LKR

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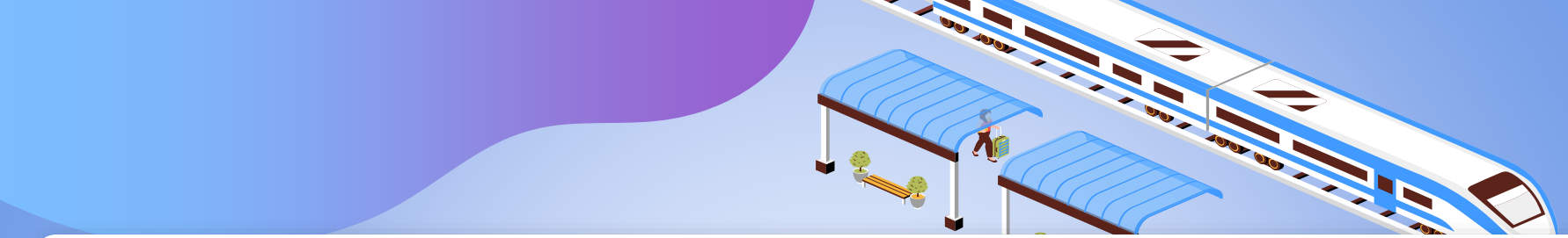

THANK YOU!

TMP-23-302