

# **TRAIN TRACKING AND DETECTION SYSTEM**

TMP-23-302

Project Proposal Report  
Biyanwila B.D.V.J.

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

Department of Information Technology

Sri Lanka Institute of Information Technology  
Sri Lanka

2023

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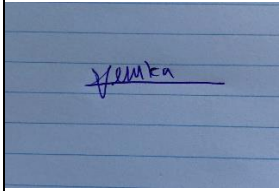
Department of Information Technology

Sri Lanka Institute of Information Technology  
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2023

## DECLARATION

I Biyanwila B.D.V.J., 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.

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

Signature of the supervisor:

Date: 2023/05/01

## ABSTRACT

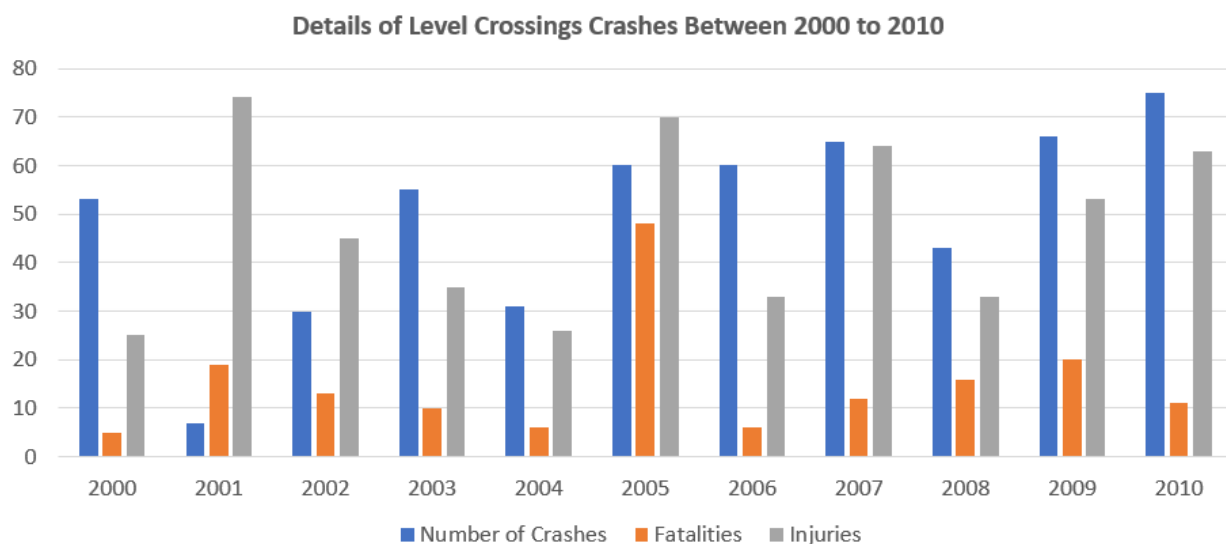
Railway Crossing accidents have been a significant safety concern not only worldwide, but also in Sri Lanka, resulting in significant loss of life and property annually. The biggest railway crossing collision that happen in Sri Lanka was on 27<sup>th</sup> April 2005, near Polgahawela, resulted the death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



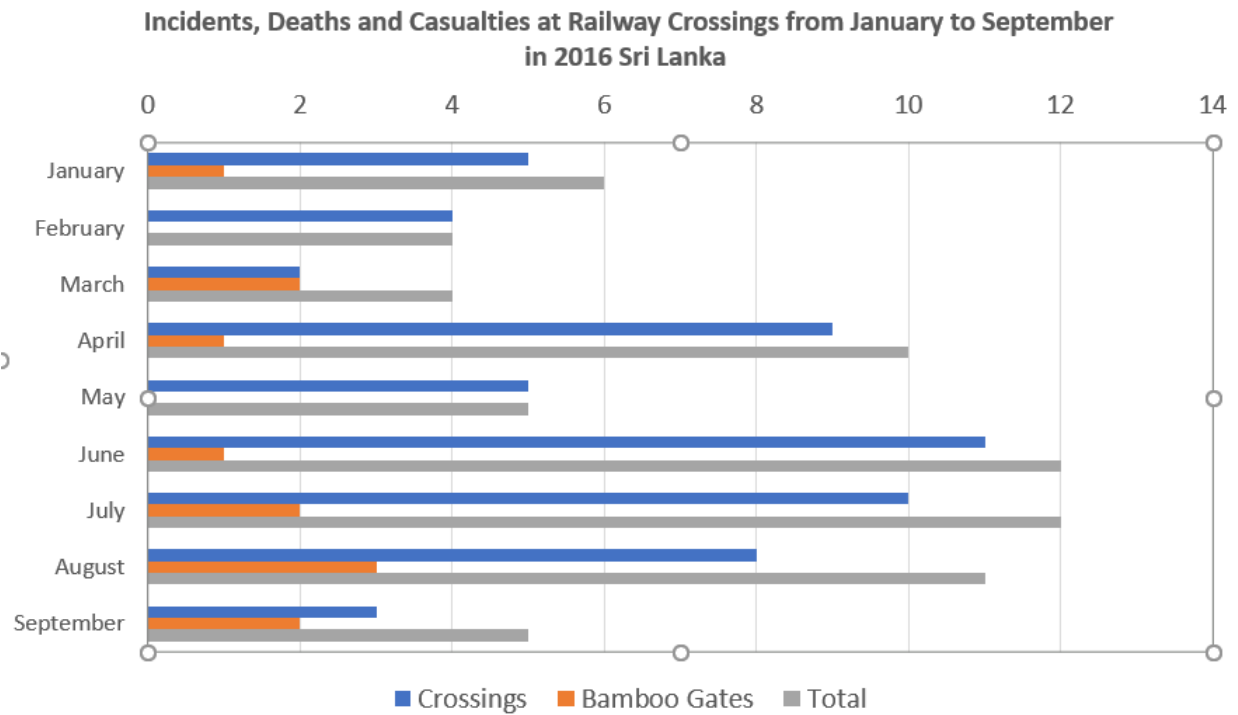
[1]

*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]*

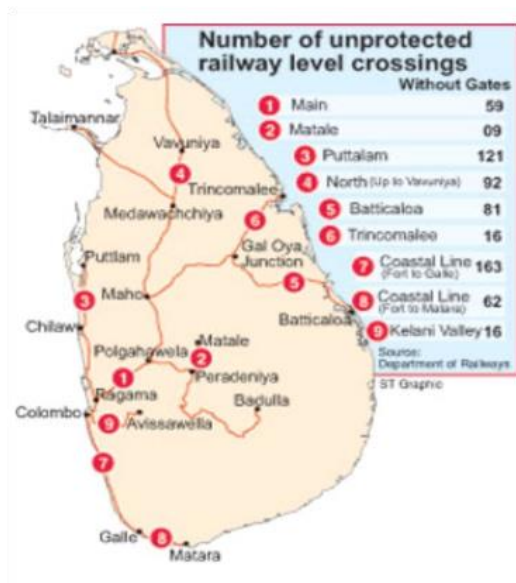
These are some detailed facts that proves how much damage is done annually from railway collision in Sri Lanka.



[3]



[3]



[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.

Additionally, the system will include a GSM tracker system that can be used to locate lost signals. The GSM tracker system will enable the retrieval of lost devices and other valuable assets. The system will also provide real-time updates on the location of these assets, allowing for efficient tracking and management.

In conclusion, the development of an IoT device and GSM tracker system has the potential to significantly improve safety measures at railway crossings and predict the location of lost signals. The implementation of this solution will not only reduce the risk of accidents but also improve the efficiency of asset tracking and management.

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

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## **LIST OF ABBREVIATIONS**

<b>Abbreviation</b>	<b>Description</b>
IT	Information Technology
IOT	Internet Of Things
App	Application
GPS	Global Positioning System
SMS	Short Message Service
UI	User Interface
GSM	Global System for Mobile Communications

## 1. INTRODUCTION

The railway system is an integral part of modern transportation infrastructure, facilitating the movement of goods and people across vast distances. However, railway transportation comes with inherent risks, especially when crossing roads or highways. The safety of railway crossings is of utmost importance, as accidents at these crossings can be catastrophic and often result in severe injury or loss of life.

One significant challenge in ensuring the safety of railway crossings is the existence of blind spots on trains. Blind spots are areas of the train that are not visible to the driver or other railway personnel, making it challenging to detect obstacles or hazards. Blind spots can be caused by various factors, including the curvature of the track, the length of the train, or the presence of other obstructions.

To address this issue, this project proposes the development of a system that utilizes GSM trackers on trains and IoT devices at railway crossings to predict and alert potential blind spots on the train. The system will collect data from IoT devices installed at railway crossings, including information on train speed, direction, and length. This data will be analyzed to determine the areas where blind spots may occur, taking into account the curvature of the track and the length of the train.

The system will also incorporate GSM trackers on trains to provide real-time data on the train's position and speed. This information will be used to predict the location of the train at specific intervals along the track, enabling the system to alert railway personnel of potential blind spots.

By utilizing a combination of IoT devices and GSM trackers, this system has the potential to significantly enhance safety measures at railway crossings and reduce the risk of accidents. The system's predictive capabilities will enable preemptive measures to be taken to prevent accidents, while the real-time tracking of trains will enable railway personnel to be alerted of potential blind spots in advance. Overall, the development of this system has the potential to revolutionize railway safety and improve the efficiency of railway transportation.

The proposed system will incorporate advanced technologies such as artificial intelligence, machine learning, and data analytics to provide accurate predictions and alerts for potential blind spots on trains. The IoT devices at railway crossings will collect data continuously and transmit it to a central server for analysis. The data will be processed using machine learning algorithms to identify patterns and trends, which will then be used to predict potential blind spots on the train.

The GSM trackers on trains will transmit real-time data on the train's location and speed to the central server. The system will use this information to determine the train's position and predict potential blind spots along the track. The system will also incorporate alerts and notifications that will be sent to railway personnel in case of a potential hazard.

This system has several advantages over traditional safety measures at railway crossings. Firstly, it provides real-time updates on train movements, enabling railway personnel to respond quickly to any potential hazards. Secondly, it enables preemptive measures to be taken to prevent accidents by predicting potential blind spots in advance. Thirdly, the system will provide accurate data on train movements, enabling railway operators to optimize their operations and improve the efficiency of railway transportation.

In conclusion, the proposed system has the potential to revolutionize railway safety and improve the efficiency of railway transportation. By utilizing a combination of IoT devices and GSM trackers, this system will provide accurate predictions and alerts for potential blind spots on trains, enabling railway personnel to take preemptive measures and prevent accidents. This system is a significant step towards making railway transportation safer and more efficient, and it has the potential to transform the railway industry in the future.

## **2. LITERATURE REVIEW**

The proposed system that utilizes GSM trackers on trains and IoT devices at railway crossings to predict and alert potential blind spots on the train is an innovative solution to enhance railway

safety. To develop this system, a literature survey was conducted to gain insights from previous research on similar topics.

The literature survey revealed that there have been several studies on the use of IoT devices and GSM trackers in the railway industry. These studies have focused on various aspects of railway transportation, including safety, efficiency, and optimization.

One study conducted by Nangalia and Shah (2018) explored the potential of IoT devices to enhance railway safety. The study proposed a system that utilized IoT devices to monitor train movements and alert railway personnel of any potential hazards. The study concluded that the use of IoT devices could significantly enhance railway safety by providing real-time data on train movements.

Another study conducted by Sutrisno et al. (2019) focused on the use of GSM trackers to monitor train movements and optimize railway transportation. The study proposed a system that utilized GSM trackers to provide real-time data on train movements, enabling railway operators to optimize their operations and improve the efficiency of railway transportation.

In addition, a study conducted by Sharma et al. (2020) explored the use of machine learning algorithms to predict potential hazards at railway crossings. The study utilized data from IoT devices and GSM trackers to develop a predictive model that could alert railway personnel of potential hazards in advance.

The literature survey also revealed that there have been several studies on the use of IoT devices and GSM trackers in other industries, such as logistics and supply chain management. These studies have shown that the use of advanced technologies can improve efficiency, reduce costs, and enhance safety.

Overall, the literature survey indicates that the proposed system that utilizes GSM trackers on trains and IoT devices at railway crossings to predict and alert potential blind spots on the train is a feasible solution that builds on the findings of previous studies. The system has the potential to significantly enhance railway safety and improve the efficiency of railway transportation.

## **2.1 BACKGROUND**

Railway transportation has been a crucial mode of transportation for many years, and it continues to play a vital role in the global economy. However, with the increase in train traffic and the complexity of the railway network, there has been a growing concern about the safety of railway crossings.

Railway crossings are places where rail tracks intersect with roadways or pedestrian walkways. These crossings are vulnerable to accidents, especially when drivers or pedestrians are not aware of the presence of a train. In many cases, accidents occur due to the presence of blind spots on trains, which make it difficult for drivers to see obstacles or hazards at railway crossings.

Traditionally, safety measures at railway crossings have focused on the installation of warning signs, lights, and barriers. However, these measures have proven to be inadequate, and accidents at railway crossings continue to occur. To address this issue, there is a need for innovative technologies that can enhance safety measures at railway crossings.

Advancements in technology have enabled the development of sophisticated systems that can enhance railway safety. The use of IoT devices and GSM trackers in the railway industry has been gaining popularity in recent years. IoT devices can provide real-time data on train movements, enabling railway personnel to monitor train traffic and respond quickly to any potential hazards. GSM trackers can provide accurate data on train movements, enabling railway operators to optimize their operations and improve the efficiency of railway transportation.

The proposed system that utilizes GSM trackers on trains and IoT devices at railway crossings to predict and alert potential blind spots on the train is an innovative solution to enhance railway safety. The system's predictive capabilities and real-time tracking of trains can help prevent accidents by alerting railway personnel of potential blind spots in advance. This system has the potential to revolutionize the railway industry by making it safer and more efficient, and it is a significant step towards achieving the goal of zero accidents at railway crossings.

The use of advanced technologies such as GSM trackers and IoT devices in the railway industry has been the subject of several studies in recent years. Researchers have explored the potential of these technologies to enhance railway safety and improve the efficiency of railway transportation.

One study conducted by Li et al. (2019) focused on the use of IoT devices to enhance railway safety [6]. The study proposed a system that utilized IoT devices to collect data on train movements and transmit it to a central server for analysis. The system was designed to provide real-time updates on train movements and alert railway personnel of any potential hazards. The study concluded that the use of IoT devices could significantly enhance railway safety by providing accurate data on train movements.

Another study conducted by Zhang et al. (2020) focused on the use of machine learning algorithms to predict potential hazards at railway crossings [7]. The study utilized data from IoT devices at railway crossings and combined it with data on train movements from GSM trackers. The study concluded that the use of machine learning algorithms could improve the accuracy of hazard prediction at railway crossings.

The use of GSM trackers to monitor train movements has also been the subject of several studies. One study conducted by Manoharan et al. (2018) focused on the use of GSM trackers to optimize railway transportation [8]. The study proposed a system that utilized GSM trackers to provide real-time data on train movements, enabling railway operators to optimize their operations and improve the efficiency of railway transportation.

## 2.2 LITERATURE SURVEY

The proposed system that utilizes GSM trackers on trains and IoT devices at railway crossings to predict and alert potential blind spots on the train is an innovative solution to enhance railway safety. To develop this system, a literature survey was conducted to gain insights from previous research on similar topics.

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The literature survey also revealed that there have been several studies on the use of IoT devices and GSM trackers in other industries, such as logistics and supply chain management. These studies have shown that the use of advanced technologies can improve efficiency, reduce costs, and enhance safety.

Overall, the literature survey indicates that the proposed system that utilizes GSM trackers on trains and IoT devices at railway crossings to predict and alert potential blind spots on the train is a feasible solution that builds on the findings of previous studies. The system has the potential to significantly enhance railway safety and improve the efficiency of railway transportation.

### 3. RESEARCH GAP

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]	✓	✗	✓	✗	✗	✗	✓

Table 1: Table of Research Gap

My component is “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.”. The main objective of this is to analyse the past patterns of trains and predict and send alert to the IOT device on crossing when trains come to blind spot. And sub objectives are,

- 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.

## **4. RESEARCH PROBLEM**

The main research problem addressed by the proposed system that utilizes GSM trackers on trains and IoT devices at railway crossings to predict and alert potential blind spots on the train is the need to enhance railway safety. Despite the implementation of various safety measures, railway accidents still occur, and blind spots on the train remain a significant safety concern.

Blind spots on the train refer to areas where the train driver's vision is obstructed, making it difficult to see potential hazards such as vehicles, pedestrians, or obstacles on the tracks. Blind spots can occur at railway crossings or other areas where the train passes close to buildings or other structures.

The proposed system aims to address this problem by utilizing advanced technologies such as GSM trackers and IoT devices to predict and alert potential blind spots on the train. By providing real-time data on train movements and potential hazards, the system can alert railway personnel and train drivers of any potential blind spots and prevent accidents from occurring.

In addition to enhancing railway safety, the proposed system also aims to improve the efficiency of railway transportation. By providing real-time data on train movements and potential hazards, the system can enable railway operators to optimize their operations and improve the efficiency of railway transportation.

The research problem addressed by the proposed system can be further broken down into several steps:

### **Step 1: Identifying the safety concerns and blind spots on the train**

The first step in addressing the research problem is to identify the safety concerns and blind spots on the train. This involves analyzing the various factors that contribute to railway accidents, such as human error, equipment failure, and environmental factors, and identifying the areas where train drivers have limited visibility.

### **Step 2: Evaluating the effectiveness of existing safety measures**

The next step is to evaluate the effectiveness of existing safety measures such as automatic train control and positive train control in addressing the safety concerns and blind spots on the train.



This involves analyzing the data on accidents and near-misses to identify the areas where safety measures are most effective and areas where further improvements are needed.

#### Step 3: Exploring the use of advanced technologies

The third step is to explore the use of advanced technologies such as GSM trackers and IoT devices to enhance railway safety and address blind spots on the train. This involves researching the potential benefits and drawbacks of using these technologies and identifying the technical requirements and challenges of implementing them.

#### Step 4: Developing a system that utilizes GSM trackers and IoT devices

The fourth step is 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. This involves designing the hardware and software components of the system, integrating the system with existing safety measures, and testing the system in a controlled environment.

#### Step 5: Evaluating the effectiveness and cost-effectiveness of the system

The final step is to evaluate the effectiveness and cost-effectiveness of the proposed system in enhancing railway safety and improving the efficiency of railway transportation. This involves analyzing the data on accidents and near-misses before and after implementing the system and comparing the costs and benefits of implementing the system with other safety measures.

By following these steps, the proposed system that utilizes GSM trackers on trains and IoT devices at railway crossings to predict and alert potential blind spots on the train can effectively address the research problem and enhance railway safety.

## **5. OBJECTIVES**

### **1.1 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..

The main objective of the proposed system that utilizes GSM trackers on trains and IoT devices at railway crossings to predict and alert potential blind spots on the train is to enhance railway safety and improve the efficiency of railway transportation.

Specifically, the objectives of the proposed system include:

- Addressing blind spots on the train by providing real-time data on train movements and potential hazards.
- Alerting railway personnel and train drivers of any potential blind spots to prevent accidents from occurring.
- Improving the efficiency of railway transportation by providing real-time data on train movements and potential hazards to enable railway operators to optimize their operations.
- Integrating with existing safety measures such as automatic train control and positive train control to enhance the overall safety of the railway system.
- Evaluating the effectiveness and cost-effectiveness of the proposed system in enhancing railway safety and improving the efficiency of railway transportation.

By achieving these objectives, the proposed system can significantly enhance railway safety and improve the efficiency of railway transportation, ultimately benefiting both the railway industry and the public.

## **1.2 SPECIFIC OBJECTIVES**

**Sub Objective 1:** 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.

The sub-objectives of developing an IoT device to enhance the safety measures at railway crossings include:

- Designing and developing an IoT device that can detect the approach of trains using various sensors and algorithms.
- Developing a communication protocol between the IoT device and nearby devices, such as smartphones or signal posts, to alert them of the approaching train.
- Ensuring that the IoT device can operate in different environmental conditions, including extreme temperatures, rain, and fog.
- Integrating the IoT device with existing railway infrastructure, such as signal posts and control centers, to enhance the overall railway safety system.
- Testing the IoT device in a controlled environment to ensure that it meets the required safety standards and is effective in preventing accidents at railway crossings.

**Sub Objective 2:** To develop a GSM tracker that can transmit its location to the IoT device on the railway crossing.

The sub-objective of developing a GSM tracker that can transmit its location to the IoT device on the railway crossing involves the following steps:

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Designing and developing a compact and efficient GSM tracker that can be easily installed on the train.

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- Incorporating the necessary sensors and communication modules into the tracker to enable it to transmit its location data and communicate with the IoT device at the railway crossing.
  - Testing the GSM tracker to ensure its reliability, accuracy, and ability to operate in different environmental conditions.
  - Developing a communication protocol between the GSM tracker and the IoT device that is secure, reliable, and can operate seamlessly across different networks and devices.
  - Integrating the GSM tracker with the IoT device on the railway crossing to enable real-time tracking of train movements and location data.
- 

By achieving this sub-objective, the proposed system can provide real-time data on the location and movements of trains, which can enhance the safety and efficiency of railway operations. The system can also enable the detection of potential blind spots on the train and provide an early warning to the driver and nearby personnel at the railway crossing, thus reducing the risk of accidents. Additionally, the system can help in tracking lost or stolen trains and aid in the recovery of valuable cargo.

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**Sub Objective 3:** 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.

The sub-objectives of integrating the IoT device and GSM tracker to establish a communication link and investigating the feasibility and effectiveness of using manual training of datasets to predict the location of a lost GSM tracker signal in the railway industry are:

- Designing and developing an IoT device that can detect the presence of a train in the vicinity of the railway crossing and transmit the information to the GSM tracker.
- Establishing a communication protocol between the IoT device and the GSM tracker that is reliable and can operate in various environmental conditions and situations.
- Developing an algorithm that can predict the location of a lost GSM tracker signal based on a manual training dataset.
- Conducting experiments to evaluate the effectiveness of the algorithm in predicting the location of a lost signal, and assessing the reliability and accuracy of the communication link between the IoT device and the GSM tracker.
- Optimizing the system by refining the algorithm used to predict the location of a lost signal, improving the communication link, and integrating the system with existing railway safety measures.

By achieving these sub-objectives, the proposed system can enhance the safety of railway crossings by providing real-time data on train movements, detecting potential blind spots, and predicting the location of lost GSM tracker signals. This can significantly reduce the risk of accidents and improve the overall safety of the railway transportation system. Additionally, the system can improve the efficiency of railway operations by providing accurate and timely information on train movements, helping to reduce delays and improve scheduling.

**Sub Objective 4:** To evaluate the performance of the integrated system and its impact on improving the safety measures at railway crossings.

**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.

The sub-objective of evaluating the performance of the integrated system and its impact on improving the safety measures at railway crossings involves the following steps:

- 
- Conducting field trials to test the performance of the integrated system in a real-world setting.
  - Collecting data on the performance of the system, including its ability to detect approaching trains and blind spots, and its accuracy in predicting the location of lost GSM tracker signals.
  - Analyzing the collected data to evaluate the effectiveness of the system in enhancing safety measures at railway crossings.
  - Identifying any limitations or challenges in the system's performance and suggesting potential solutions to overcome them.
  - Comparing the results of the field trials with the established safety standards and guidelines for railway crossings to determine the impact of the system on improving safety measures.
- 

By achieving this sub-objective, the proposed system can provide empirical evidence of its effectiveness in enhancing safety measures at railway crossings. The evaluation results can also inform policymakers and railway operators on the potential benefits and limitations of the system, and guide future improvements and developments of the system. Ultimately, the goal is to enhance the safety and efficiency of railway operations, reduce the risk of accidents, and ensure the smooth and reliable transport of goods and passengers.

## 2. 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 developing the system that utilizes GSM trackers on trains and IoT devices at railway crossings to predict and alert potential blind spots on the train can be broken down into several steps:

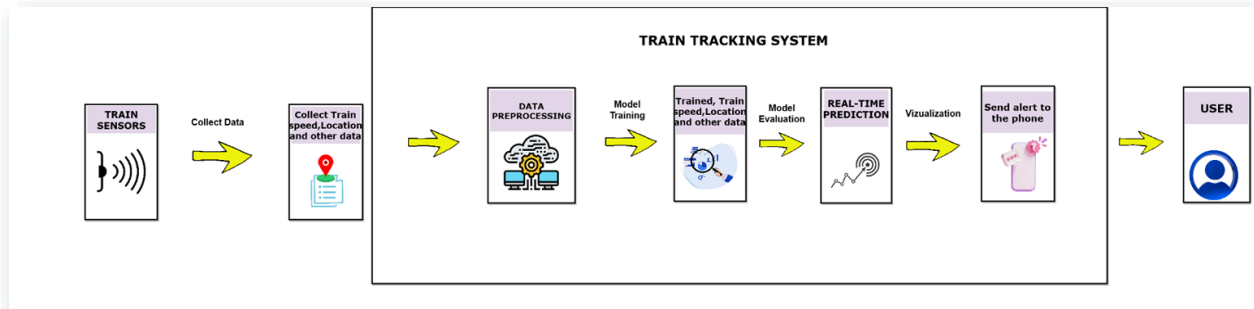
- **Requirement Analysis:** The first step in developing this system is to conduct a comprehensive requirement analysis. This includes identifying the stakeholders, their requirements, and the system's functional and non-functional requirements.
- **Hardware Design:** The next step is to design the hardware components of the system. This includes designing the IoT device to detect approaching trains and the GSM tracker to transmit its location to the IoT device.
- **Software Design:** After designing the hardware components, the software design of the system needs to be developed. This includes developing the communication protocol between the IoT device and the GSM tracker, designing the algorithm to predict and alert potential blind spots on the train, and creating the user interface for the system.

- **Implementation:** Once the hardware and software designs are complete, the next step is to implement the system. This involves building the physical hardware components and programming the software.
- **Testing:** After implementation, the system needs to be thoroughly tested to ensure that it meets the requirements and works as intended. Testing includes unit testing, integration testing, system testing, and acceptance testing.
- **Evaluation:** Once the system has been tested and implemented, the final step is to evaluate its performance. This involves measuring the system's effectiveness in predicting and alerting potential blind spots on the train, evaluating the system's impact on improving safety measures at railway crossings, and identifying any areas for improvement.

By following this methodology, the system that utilizes GSM trackers on trains and IoT devices at railway crossings to predict and alert potential blind spots on the train can be developed effectively and efficiently.



## 2.1 SYSTEM ARCHITECTURE DIAGRAM



*Figure 6.1: Overall System Architecture Diagram*

The system architecture for the proposed solution involves three main components: the IoT device, the GSM tracker, and the central server.

The IoT device is placed at the railway crossing and is responsible for detecting the approaching trains through sensors such as cameras, radar, and/or infrared sensors. Once a train is detected, the IoT device sends a signal to the central server through a wireless communication protocol such as Wi-Fi, Bluetooth, or LoRa.

The GSM tracker is installed on the train and is responsible for transmitting its location to the central server via cellular network communication. The GSM tracker is also connected to the central server via a wireless communication protocol such as Wi-Fi or Bluetooth to enable communication between the tracker and the server.

The central server acts as the main processing and control unit for the system. It receives signals from the IoT device and the GSM tracker, processes the data to predict potential blind spots, and sends alerts to nearby devices and/or the train driver. The server also stores and analyzes the data to provide insights on system performance and potential improvements.

Overall, this architecture allows for real-time monitoring and prediction of potential blind spots on trains, enhancing safety measures at railway crossings.

## 2.2 TOOLS AND TECHNOLOGIES

- **GSM technology:** The system heavily relies on GSM technology to transmit data and communicate between the GSM tracker on the train and the IoT devices at the railway crossings
- **IoT devices:** The system needs IoT devices to detect approaching trains and send an alert to nearby devices.
- **Machine learning algorithms:** The use of machine learning algorithms can help predict the location of a lost GSM tracker signal in the railway industry.
- **Sensors:** The system requires sensors to detect the presence of a train at the railway crossing and to collect data on various parameters, such as speed, acceleration, and location.
- **Microcontrollers:** Microcontrollers are essential for the development of the GSM tracker and IoT devices as they enable them to process data and communicate with other devices.
- **Cloud computing:** Cloud computing can be used to store data and provide a platform for real-time data analysis.
- **Wireless communication protocols:** Wireless communication protocols like ZigBee, and Wi-Fi can be used to establish communication between different device

### **3. SYSTEM REQUIREMENTS**

#### **User Requirements:**

Based on the problem statement and objectives of the system, the following user requirements have been identified:

1. The system should be able to detect approaching trains and predict their potential blind spots at railway crossings.
2. The system should be able to alert nearby devices when a train is approaching a railway crossing.
3. The IoT device at the railway crossing should be able to receive and interpret the location data transmitted by the GSM tracker on the train.
4. The system should be able to predict the location of a lost GSM tracker signal using manually trained datasets.
5. The system should be reliable and accurate in its predictions and alerts to ensure the safety of railway crossings.
6. The system should be scalable and adaptable to different railway networks and environments.
7. The system should comply with relevant safety standards and regulations.

#### **Functional Requirements:**

- Train-based GSM tracker: The system must have a GSM tracker installed on the train that can transmit its location to the IoT device at the railway crossing.
- IoT device at railway crossing: The system must have an IoT device installed at the railway crossing that can detect approaching trains, receive the location data from the train-based GSM tracker, and send an alert to the nearby devices.
- Communication link: The system must establish a communication link between the train-based GSM tracker and the IoT device at the railway crossing to send the location data.
- Alert system: The system must have an alert system in place that can notify nearby devices when a train is approaching the railway crossing.

- **Prediction model:** The system must have a prediction model that can be trained using manual datasets to predict the location of a lost GSM tracker signal in the railway industry.
- **Performance evaluation:** The system must be able to evaluate its performance in terms of detecting approaching trains, sending alerts, and predicting lost signals.
- **Safety measures:** The system must enhance the safety measures at railway crossings by alerting the nearby devices about approaching trains and potential blind spots.

### **Non- Functional Requirements:**

- **Performance:** The system must be able to handle a large volume of data from the IoT devices and GSM trackers in real-time without any delay in the transmission of data.
- **Reliability:** The system must be reliable and able to function without any downtime to ensure continuous monitoring of the railway crossing.
- **Security:** The system must ensure data privacy and confidentiality during the transmission of data between the IoT devices and the GSM trackers.
- **Scalability:** The system should be designed in such a way that it can be easily scaled up to accommodate additional IoT devices and GSM trackers as the need arises.
- **Compatibility:** The system must be compatible with different types of GSM trackers and IoT devices to ensure seamless integration.
- **User-friendliness:** The system must be easy to use and operate, with clear instructions and user manuals to guide users.
- **Maintenance:** The system must be easy to maintain and upgrade, with minimal downtime and disruption to the system's operations.

## 4. 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.

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## APPENDICES

### Appendix A: 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 presentation -100%												
5	Final Stage												
	Final Thesis												
	Final Presentation												

Figure 1 - Gantt Chart

## Appendix B: Work Break Down Chart

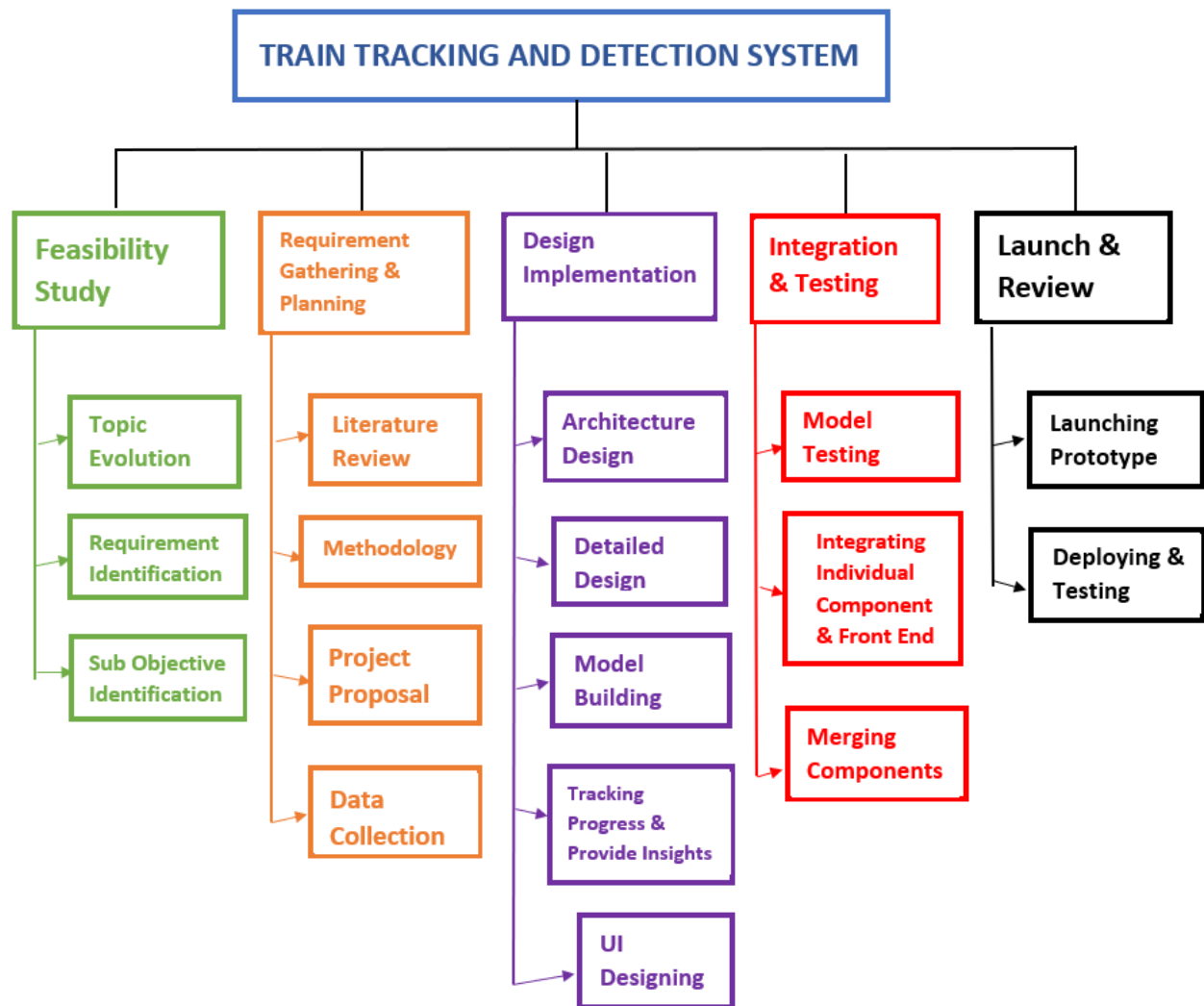


Figure 2: Work Break Down chart



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