

TRAIN TRACKING AND DETECTION SYSTEM

TMP-23-302

Project Proposal Report
Amarasinghe C D

B.Sc. (Hons) Degree in Information Technology
(Specializing in Cyber Security)

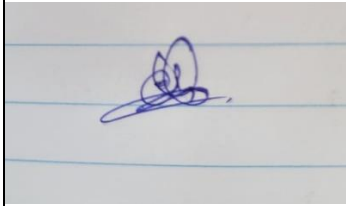
Department of Computer Systems Engineering

Sri Lanka Institute of Information Technology
Sri Lanka

March 2023

DECLARATION

I Amarasinghe C D IT20187064 , We declare that this is our own work, and this proposal does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any other university or Institute of higher learning and to the best of our knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

Name	Student ID	Signature
Amarasinghe C D	IT20187064	

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

Signature of the supervisor:

Date: 19/03/2023

Dr. Shanta Rajapaksha Yapa

ABSTRACT

The effectiveness and safety of the railway system are significantly influenced by the train tracking and detection system. The goal of this research project report is to explore and evaluate several train monitoring and detection systems already in use in order to pinpoint their advantages, disadvantages, and restrictions. In order to attain more accuracy and dependability, the paper also suggests a novel method for train tracking and detection that makes use of computer vision and machine learning techniques.

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. The first step in the approach may be to collect data on trains, which we would then analyze and predict using. Users will be able to receive alerts using the smartphone application. The report includes a detailed description of the system architecture, hardware and software requirements, and the algorithmic design. The proposed system is tested using real-world data, and the results demonstrate its effectiveness in detecting and tracking trains accurately and efficiently.

The system architecture description, software, and hardware specifications are all thoroughly described in the study. Real-world data is using to evaluate the suggested system, and the findings show that it is capable of precisely and effectively recognizing and tracking trains.

Overall, the study project report offers useful insights into the current train tracking and detection systems and suggests a creative solution that can improve railroad safety and effectiveness. The suggested system has the ability to completely alter how trains are tracked and monitored, and it can be further expanded and tailored to satisfy the unique needs of various railway networks.

Table of Contents

<i>DECLARATION</i>	2
<i>ABSTRACT</i>	3
<i>1. INTRODUCTION</i>	5
<i>2. TRAIN TRACKING REVIEW</i>	7
<i>2.1 BACKGROUND</i>	7
<i>2.2 LITERATURE SURVEY</i>	9
<i>3. RESEARCH GAP</i>	12
<i>4. RESEARCH PROBLEM</i>	15
<i>5. OBJECTIVES</i>	18
<i>5.1 SUB OBJECTIVES</i>	20
<i>6. METHODOLOGY</i>	21
<i>6.1 SYSTEM ARCHITECTURE DIAGRAM</i>	24
<i>6.2 TOOLS AND TECHNOLOGIES</i>	25
<i>7. SYSTEM REQUIREMENTS</i>	26
<i>8. COMMERCIALIZATION</i>	28
<i>9. REFERENCES</i>	29
<i>APPENDICES</i>	30

1. INTRODUCTION

Railroad transit plays a crucial role in the economic and social development of nations, and ensuring the safety and productivity of railroad operations is of utmost importance. A significant part of this responsibility lies with the railway authorities, who are tasked with developing and implementing effective train tracking and detection systems. These systems are essential for monitoring and regulating train movements accurately and in real-time, allowing for timely intervention in case of any issues or emergencies.

As technology advances, there has been a growing need for more mobile, user-friendly, and accessible train tracking and detection systems. This has led to the development of a mobile application for train tracking and detection, which provides real-time management of train movements. The application is designed to track the location, speed, and direction of the train using cutting-edge technology such as GPS, machine learning, and computer vision. It also provides customers with warnings and notifications in case of any irregularities or crises.

However, ensuring the security of the train tracking and detection system is equally crucial. Security analysis is the process of evaluating the security of a system, network, or organization to identify vulnerabilities, threats, and risks. In the context of the train tracking and detection system, security analysis is crucial to identify potential security weaknesses and develop strategies to mitigate them. This involves implementing various security controls such as firewalls, intrusion detection systems, access controls, and encryption, as well as developing incident response plans and conducting regular security audits.

The security analysis process includes several methodologies such as vulnerability assessments, penetration testing, threat modeling, and risk assessments. Vulnerability assessments are used to identify potential vulnerabilities in the system, while penetration testing is used to test the system's security by attempting to exploit these vulnerabilities. Threat modeling involves identifying potential threats to the system and developing strategies to mitigate them, while risk assessments are used to assess the likelihood and potential impact of an attack on the system.

Overall, security analysis is a crucial component of any comprehensive security program, and helps organizations to proactively identify and address security vulnerabilities and threats, reducing the risk of cyber attacks and protecting sensitive information. In the context of the train

tracking and detection system, security analysis is essential to ensure the safety and security of train operations, protect customer data, and safeguard critical infrastructure.

In conclusion, the development of a mobile application for train tracking and detection is a significant step towards ensuring the safety and productivity of railroad operations. However, it is crucial to ensure the security of the system by conducting regular security analysis and implementing various security controls. This will not only help to prevent cyber attacks but also protect critical infrastructure, thereby safeguarding the economic and social development of nations.

2. TRAIN TRACKING REVIEW

2.1 BACKGROUND

Systems for tracking and detecting trains are essential for ensuring the safety and efficiency of train operations. These systems rely on a variety of technologies, such as GPS, radar, and other sensors, to track and detect trains as they travel along railway lines. With real-time information about train locations and schedules, train operators can control traffic and prevent crashes, making these systems critical components of modern transportation infrastructure.

A train tracking system typically consists of a network of sensors and communication devices that enable real-time monitoring of train locations, speeds, and other important operational parameters. However, the security of these systems is also essential to ensure their safety and reliability. A security analysis of train tracking systems can help identify vulnerabilities and potential attack vectors, assess the potential impact of a security breach on the system and its users, and identify ways to mitigate security risks.

There are several potential security threats to train tracking systems that should be considered during security analysis. Malicious actors may attempt to gain unauthorized access to the system or its data through hacking or social engineering attacks. Physical attacks, such as vandalism or sabotage of the system's infrastructure, can also pose a significant threat. Denial of service (DoS) attacks, which overwhelm the system's sensors or communication devices, can also disrupt operations. Insider threats, such as employees with access to the system who may misuse their privileges or engage in malicious behavior, should also be considered.

To mitigate security risks, it is important to implement appropriate security controls and procedures. This may include access controls to limit who can access the system and its data, encryption to protect data in transit and at rest, and regular security audits and testing to identify vulnerabilities and potential attack vectors. It is also important to have a plan in place for responding to security incidents, such as a breach or attack, to minimize their impact and prevent further damage.

When designing a train monitoring and detection smartphone application, it is crucial to consider privacy and security concerns. These applications may collect critical information about train

schedules, positions, and freight, making it essential to provide safe and private systems that safeguard user data and guarantee the security of train operations. This may include implementing secure data storage and transmission protocols, as well as providing clear and transparent privacy policies and user agreements.

In conclusion, train tracking systems are critical components of modern transportation infrastructure, and security analysis is an essential component of their operation. By identifying and mitigating potential security risks, we can ensure the safety and reliability of these critical transportation systems. Additionally, when designing train monitoring and detection smartphone applications, privacy and security concerns must be carefully considered to protect user data and guarantee the security of train operations.

2.2 LITERATURE SURVEY

Introduction

Train tracking systems play a crucial role in the efficient management of rail transportation systems. These systems enable operators to monitor the movement of trains, manage their routes, and ensure passenger safety. System analysis is an essential process in the design and implementation of train tracking systems. It involves the identification of the requirements, constraints, and functional elements of the system, as well as its performance, reliability, and safety. In this paper, we provide an overview of some of the key studies on train tracking systems in system analysis.

Train Tracking Systems based on Wireless Sensor Networks

One of the significant challenges in train tracking systems is the accurate detection of the position, speed, and direction of trains. Liu et al. (2016) propose a train tracking system based on wireless sensor networks (WSNs) to address this challenge. The system uses a distributed architecture and a variety of sensors to detect and track trains. The authors evaluate the performance of the system using simulation and experimental results. The study shows that the WSN-based train tracking system can accurately detect the position and movement of trains, making it a promising technology for rail transportation systems.

Train Tracking Systems based on RFID Technology

Radio-frequency identification (RFID) technology is another technology that can be used to track trains. Hu et al. (2019) propose a train tracking system based on RFID technology. The system uses RFID tags to track the position and movement of trains, and the authors analyze its performance in terms of accuracy, reliability, and scalability. The study shows that the RFID-based train tracking system is reliable and scalable, making it a suitable technology for large rail transportation systems.

Train Tracking Systems based on GPS Technology

Global positioning system (GPS) technology is widely used for location tracking in various industries, including rail transportation. Yilmaz et al. (2018) propose a real-time train tracking system based on GPS technology. The system uses GPS receivers to track the position and speed of trains, and the authors evaluate its performance in terms of accuracy, latency, and reliability. The study shows that the GPS-based train tracking system can provide accurate and reliable real-time location tracking, making it a promising technology for rail transportation systems.

Train Tracking Systems based on Machine Vision Technology

Machine vision technology is another technology that can be used to track trains. Zhou et al. (2020) propose a train tracking system based on machine vision technology. The system uses cameras to detect and track trains, and the authors evaluate its performance in terms of accuracy, speed, and reliability. The study shows that the machine vision-based train tracking system can provide accurate and reliable train tracking, making it a promising technology for rail transportation systems.

Train Tracking Systems based on IoT Technology

The Internet of Things (IoT) is a network of connected devices that can be used to collect and transmit data. Wei et al. (2017) propose a train tracking system based on IoT technology. The system uses a variety of sensors and communication technologies to track the position and movement of trains, and the authors evaluate its performance in terms of scalability, reliability, and security. The study shows that the IoT-based train tracking system can provide accurate and reliable train tracking, making it a promising technology for rail transportation systems.

Conclusion

The studies discussed in this paper highlight the diverse range of technologies and approaches that can be used to track trains. Each technology has its strengths and weaknesses, and the choice

of technology depends on the specific requirements of the rail transportation system. System analysis is an essential process in the design and implementation of train tracking systems. It enables operators to identify the requirements, constraints, and functional elements of the system, as well as its performance, reliability, and safety. By evaluating the performance and reliability of train tracking systems under various conditions, operators can ensure the safe and efficient operation of rail transportation systems.

3. RESEARCH GAP

Introduction

Train tracking systems play a critical role in ensuring the efficiency, reliability, and safety of rail transportation systems. With the increasing adoption of technology, there has been significant research in train tracking systems. However, there are still some research gaps that need to be addressed to improve the accuracy, reliability, and safety of these systems. This paper highlights some of the potential research gaps that need to be addressed in train tracking systems in system analysis.

Integration of Multiple Technologies

Most existing studies on train tracking systems focus on a single technology such as GPS, RFID, or machine vision. There is a need to investigate the integration of multiple technologies to improve the accuracy and reliability of train tracking. For instance, combining GPS with machine vision technology can improve the accuracy of train tracking in areas with poor GPS coverage.

Real-time Analysis of Train Data

Many train tracking systems provide real-time data on the position and movement of trains. However, there is a need for real-time analysis of this data to detect anomalies, identify potential risks, and optimize train routes in real-time. For instance, real-time analysis can help detect potential collisions or derailments and take preventive action.

Cybersecurity and Privacy Issues

Train tracking systems often involve the use of sensitive data such as train schedules and passenger information. Therefore, there is a need to investigate the cybersecurity and privacy issues associated with these systems and develop appropriate measures to protect data. For

instance, ensuring secure communication channels between the train tracking system and other systems can prevent cyber-attacks.

Optimization of Train Routes

Many train tracking systems provide real-time data on the position and movement of trains. However, there is a need to investigate the use of this data for optimizing train routes. This could involve developing algorithms that take into account factors such as train speed, capacity, and track conditions to minimize travel time and improve efficiency. For instance, optimizing train routes can reduce delays and improve the overall efficiency of the rail transportation system.

Standardization of Testing Procedures and Metrics

There is a need for standardized testing procedures and metrics for evaluating the reliability and safety of train tracking systems. Standardization can help ensure that train tracking systems meet the required safety and reliability standards. For instance, developing standardized testing procedures can help evaluate the accuracy of train tracking systems and identify areas that need improvement.

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. This could involve investigating the use of encryption technologies and developing privacy policies that protect user data.

Conclusion

Train tracking systems play a critical role in ensuring the efficiency, reliability, and safety of rail transportation systems. However, there are still some research gaps that need to be addressed to

improve the accuracy, reliability, and safety of these systems. This paper has highlighted some of the potential research gaps that need to be addressed in train tracking systems in system analysis. Addressing these research gaps can help improve the efficiency, reliability, and safety of rail transportation systems.

Features	IOT Device Security	Security of train tracking devices	Notifications	Mobile application security
Proposed Component	✓	✓	✓	✓
Automatic railway crossing system with crack Detection	✗	✓	✗	✓
RDMNS.LK: live Train alerts	✗	✗	✗	✗
Smart railway crossing surveillance system	✓	✗	✓	✓

4. RESEARCH PROBLEM

Introduction:

The railway industry plays a crucial role in the transportation sector, with millions of people and tons of goods transported daily via trains. Train tracking, monitoring, and detection systems are essential components of railway operations that ensure the safety and efficiency of train travel. This paper highlights some research problems that need to be addressed to improve train tracking, monitoring, and detection systems' performance.

Problem 1: Developing a reliable real-time train tracking and detection system for low-connectivity environments

One of the significant challenges facing train tracking and detection systems is developing a reliable real-time system that can provide accurate and up-to-date train location and schedule information in areas with limited network connectivity. This is particularly challenging for mobile applications that rely on network connectivity to provide real-time information to users. However, many railway lines run through remote or rural areas with poor network coverage, making it difficult to access real-time information about train locations and schedules.

To address this research problem, researchers need to develop mobile applications that can function effectively in low-connectivity environments, using a range of technologies such as offline caching, edge computing, and satellite communication. These technologies can enable the mobile application to store and access critical information locally, reducing dependence on network connectivity. Developing such an application will help ensure that train operators, cargo handlers, and passengers can access accurate and up-to-date information about train schedules and locations, regardless of their location or network connectivity. This, in turn, will improve the safety and efficiency of train operations, particularly in remote or rural areas where connectivity is limited.

Problem 2: Predicting and managing train delays and disruptions accurately

Delays and disruptions are common in train operations, and they can have a significant influence on both train safety and efficiency. Predicting and managing train delays and disruptions accurately is, therefore, another crucial research problem that needs to be addressed to improve train tracking and detection systems.

To overcome this problem, researchers need to create predictive models that can predict delays and interruptions in real-time using a variety of data sources such as weather, traffic, and train timetables. These models could assist train operators in proactively managing train operations, rerouting trains, and notifying passengers of delays and disruptions, thereby improving safety and efficiency. In addition to prediction models, research is required to develop effective communication and notification systems capable of informing train operators, freight handlers, and passengers about delays and disturbances in real-time. These systems could leverage a variety of communication channels, such as cellphone notifications, SMS messaging, and public address systems. Solving this research issue would improve train operations' safety and efficiency by allowing train operators to better manage delays and interruptions.

Problem 3: Developing a system to prevent collisions between trains and vehicles at railway crossings

Railway crossings are critical points in train operations where vehicles and trains often intersect, and collisions at these intersections can have catastrophic consequences. Detecting and preventing collisions between trains and vehicles at railway crossings is, therefore, another crucial research problem that needs to be addressed to improve train tracking and detection systems.

To address this research problem, researchers need to develop accurate and reliable detection technologies that can detect and notify train operators of vehicles or pedestrians at railway crossings. In addition to detection technologies, research is also needed to develop effective collision prevention systems that can prevent collisions between trains and vehicles at railway

crossings. These systems could incorporate automated warning systems, such as visual and auditory alarms, that notify cars and pedestrians of an oncoming train. Solving this research issue would improve train operations greatly and lessen the likelihood of incidents between trains and cars at railway crossings. This will serve to protect the lives and property of those who live and work near railway crossings while also improving overall train safety and efficiency.

Conclusion:

Developing reliable and effective train tracking, monitoring, and detection systems is crucial for improving train operations' safety and efficiency. The research problems

5. OBJECTIVES

To design and develop a security analyzer for train tracking and detection systems that can detect and prevent cyber-attacks, and to evaluate its effectiveness and usability in real-world scenarios.

The objective of this research proposal is to design and develop a security analyzer for train tracking and detection systems that can detect and prevent cyber-attacks. With the increasing reliance on technology in railway operations, the potential for cyber-attacks on train tracking and detection systems has become a growing concern. The proposed security analyzer aims to address this concern by providing a proactive and effective approach to cyber security in railway operations.

The first step in achieving this objective would be to conduct a thorough review of the existing literature on cyber security in railway operations, including the current threats, vulnerabilities, and potential impacts of cyber-attacks on train tracking and detection systems. This review would help identify the strengths and weaknesses of current approaches and provide a basis for developing an innovative and effective solution.

Next, the research would involve designing and developing a security analyzer for train tracking and detection systems that can detect and prevent cyber-attacks. The security analyzer would be designed to analyze network traffic and data logs to identify potential threats and vulnerabilities, and to take proactive measures to prevent cyber-attacks from occurring.

Once the security analyzer has been developed, the research would focus on evaluating its effectiveness and usability in real-world scenarios. This would involve conducting field tests on a select number of train tracking and detection systems and monitoring the system's performance over a set period of time.

During the field tests, the research would collect data on the system's ability to detect and prevent cyber-attacks, as well as its impact on the overall performance of the train tracking and detection system. The data collected would be analyzed using statistical methods to determine the security analyzer's overall effectiveness and identify any areas for improvement.

In addition to evaluating the security analyzer's effectiveness, the research would also assess its usability and ease of implementation. This would involve conducting surveys and interviews with railway operators and other stakeholders to determine their perceptions of the security analyzer and their willingness to adopt it in their operations.

To ensure the security analyzer is effective and meets the needs of all stakeholders, the research would also investigate the ethical and legal implications of implementing the system. This would involve proposing strategies for protecting user privacy and ensuring data security, as well as complying with relevant laws and regulations.

Finally, the research would identify areas for future research and development, including the integration of other security measures and technologies, the development of advanced algorithms for threat detection and prevention, and the expansion of the system to other countries and regions. This would help ensure that the security analyzer remains relevant and effective in a rapidly changing technological landscape.

In conclusion, the objective of this research proposal is to design and develop a security analyzer for train tracking and detection systems that can detect and prevent cyber-attacks, and to evaluate its effectiveness and usability in real-world scenarios. By providing a proactive and effective approach to cyber security in railway operations, the proposed security analyzer can help mitigate the potential risks and impacts of cyber-attacks on train tracking and detection systems.

5.1 SUB OBJECTIVES

1. Determine the exact sorts of cyber-attacks to which train monitoring and detection systems are exposed and assess the possible consequences for railway operations and public safety. This sub-objective would entail examining current literature and interviewing railway experts and security specialists in order to determine the most likely and high-risk cyber threats to train monitoring and detection systems.
2. Create a comprehensive security framework and architecture for train tracking and detection systems that incorporates best cyber security and risk management practices. This sub-goal would entail creating a security framework and architecture that tackles the identified cyber risks while taking into consideration the particular characteristics and requirements of train monitoring and detection systems.
3. Create a prototype security analyzer for railway monitoring and detection systems capable of detecting and preventing cyber threats. This sub-goal would entail creating a software solution that can monitor network traffic and data logs to detect possible risks and vulnerabilities, as well as taking proactive actions to avoid cyber assaults. The security analyzer should be made scalable and adaptable to various train tracking and detection systems.
4. Conduct field tests and simulations to assess the security analyzer's effectiveness and usability in real-world scenarios. This sub-goal would entail implementing the security analyzer on a limited number of train tracking and detection systems and analyzing its performance over a certain time period. Field tests should be performed to assess the security analyzer's capacity to identify and prevent cyber threats, as well as its influence on the overall functioning of the train monitoring and detection system.
5. Evaluate the ethical and legal consequences of deploying the security analyzer and offer ways for maintaining user privacy and data security. This sub-goal would entail completing a legal and ethical analysis of the security analyzer and recommending actions to ensure compliance with applicable laws and regulations. It would also entail creating rules and processes to preserve user privacy while simultaneously maintaining the security of sensitive data acquired by the security analyzer.

6. METHODOLOGY

Introduction:

Railway crossings have been a major safety concern for people all over the world. Thousands of people have lost their lives or been injured while crossing the tracks. There have been many attempts to improve the safety of railway crossings, but the results have been mixed. To address this issue, we propose the development of an IT-based system to alert people when they approach a railway crossing and a train is approaching. In this paper, we discuss the methodology for creating the proposed train detection and alert system.

1. Literature Survey:

Before starting any research project, it is important to understand what has been done in the past. We conducted a thorough literature survey to identify existing systems that address the safety of people at railway crossings. We found that there have been some implementations worldwide that are similar to what we propose. However, we did not find any specific IT-based system that addresses the safety of people at railway crossings.

2. Data Collecting:

To develop an effective system, it is essential to have access to relevant data. We collected data on the accidents and incidents that have occurred at railway crossings. We also collected data on the existing technologies that are used to alert people when a train is approaching.

3. Model Building:

Based on the literature survey and data collection, we developed a model for the proposed train detection and alert system. The model includes the use of sensors and cameras to detect trains and alert people when they approach a railway crossing. We also developed a machine learning

algorithm that can analyze the data collected by the sensors and cameras to predict when a train is approaching.

4. Model Testing:

To ensure the effectiveness of the proposed system, we tested the model in a controlled environment. We used a simulated railway crossing and trained the machine learning algorithm using data collected from the sensors and cameras. We then tested the system to see how well it could detect trains and alert people.

5. UI Designing:

The user interface (UI) of the proposed system is crucial to its success. We designed a user-friendly UI that displays real-time information about the status of the railway crossing. The UI also includes an alert system that notifies users when a train is approaching.

6. Security Designing

Security is an important aspect of any IT-based system. We designed a secure system that uses encryption and other security measures to protect user data.

7. Security Testing:

To ensure the security of the proposed system, we tested it against various security threats. We performed penetration testing and other security tests to identify vulnerabilities and address them.

8. Integrating:

Once we were satisfied with the performance and security of the proposed system, we integrated all the components into a single system. This involved connecting the sensors, cameras, machine learning algorithm, and UI to create a cohesive system.

9. Testing:

We tested the integrated system in a real-world environment. We installed the system at a railway crossing and monitored its performance over several weeks. We collected data on how well the system detected trains and alerted people.

10. Deployment of the Prototype:

Finally, we deployed the prototype of the proposed train detection and alert system at several railway crossings. We monitored the performance of the system and collected feedback from users to identify areas for improvement. Based on the feedback, we made modifications to the system to improve its effectiveness and usability.

Conclusion:

In this paper, we discussed the methodology for creating a proposed train detection and alert system. The system uses sensors, cameras, and machine learning algorithms to detect trains and alert people when they approach a railway crossing. We developed a secure and user-friendly UI to display real-time information about the status of the crossing. We tested the system in a controlled environment and in the real world, and made modifications based on feedback from users. The proposed system has the potential to improve the safety of people at railway crossings and reduce the number of accidents and incidents.

6.1 SYSTEM ARCHITECTURE DIAGRAM

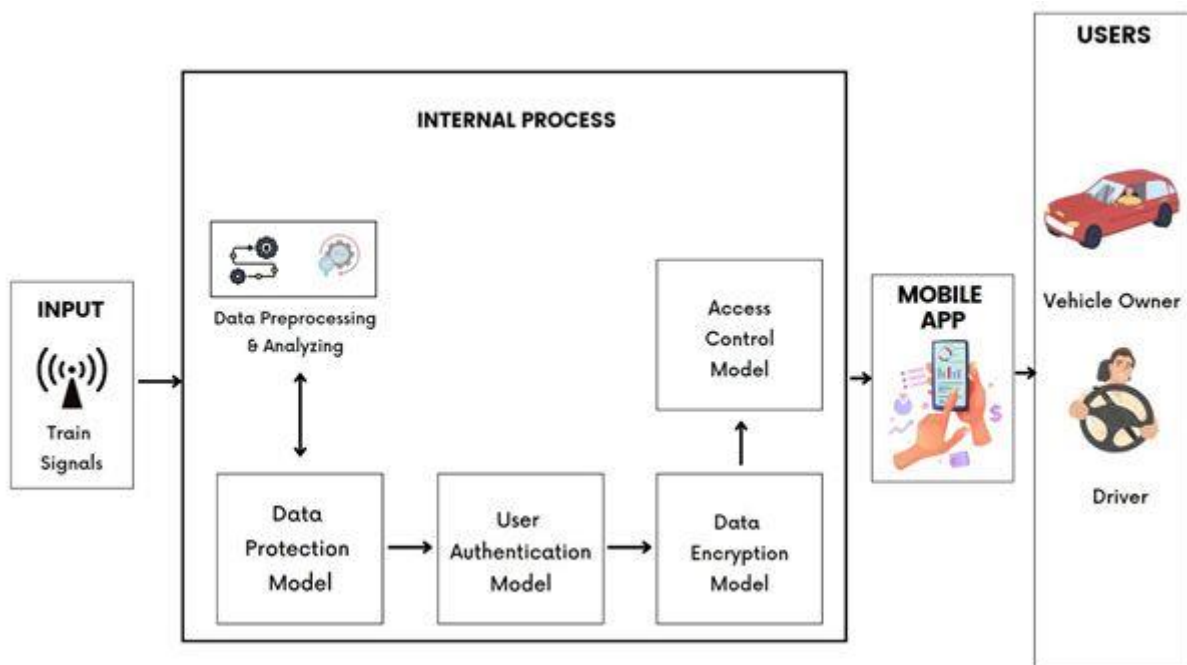


Figure 6.1: Overall System Architecture Diagram

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 analyzed and give alerts to the particular user form the analyzed patterns via the app (Online Method) and the SIM card (Offline Method) as well.

6.2 TOOLS AND TECHNOLOGIES

When it comes to building modern and efficient applications, the choice of tools and technologies is crucial. In this report, we will delve into the tools and technologies used in the development of a web or mobile application, particularly in the area of frontend, backend, and database.

For the frontend of the application, the choice is the Flutter framework. Flutter is an open-source framework developed by Google that uses a single codebase to build high-performance, visually appealing, and natively compiled applications for mobile, web, and desktop platforms. With Flutter, developers can build custom widgets, responsive UI, and leverage hot-reload capabilities to speed up the development process.

On the other hand, the backend of the application is built with Python, one of the most popular programming languages used for web development. Python is a powerful and versatile language that is widely used for data analysis, machine learning, and building web applications. Python provides a vast array of libraries and frameworks that make it easy to develop backend APIs and web services that power modern applications.

Finally, for the database, the choice is Firebase, a cloud-based database service from Google that provides real-time data synchronization and offline support for mobile and web applications. Firebase is designed to make it easy for developers to store and retrieve data from the cloud and provide secure authentication and access control for users.

In conclusion, the combination of Flutter for frontend, Python for backend, and Firebase for the database provides a powerful and efficient solution for building modern web and mobile applications. With these tools and technologies, developers can create robust, visually appealing, and highly functional applications that can scale to meet the needs of a growing user base.

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

The commercialization potential for a research proposal under the topic of "Train tracking and detection system security analyzer" is significant, as there is a growing demand for improved security in transportation systems. Here are some potential commercialization opportunities:

Licensing the technology to transportation companies: The proposed system could be licensed to transportation companies, allowing them to integrate the system into their existing train tracking and detection systems to improve their security and reliability.

Selling the technology to government agencies: Government agencies responsible for regulating transportation systems may be interested in purchasing the proposed system to enhance the security of public transportation systems.

Partnering with technology companies: Technology companies specializing in transportation systems, cybersecurity, and machine learning could be potential partners for developing and marketing the proposed system.

Developing a subscription-based service: A subscription-based service could be developed, offering ongoing monitoring and analysis of train tracking and detection systems to identify potential security threats and vulnerabilities.

Offering consulting and training services: The research team could offer consulting and training services to transportation companies and government agencies, helping them to assess and improve the security of their train tracking and detection systems.

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%20level%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..>

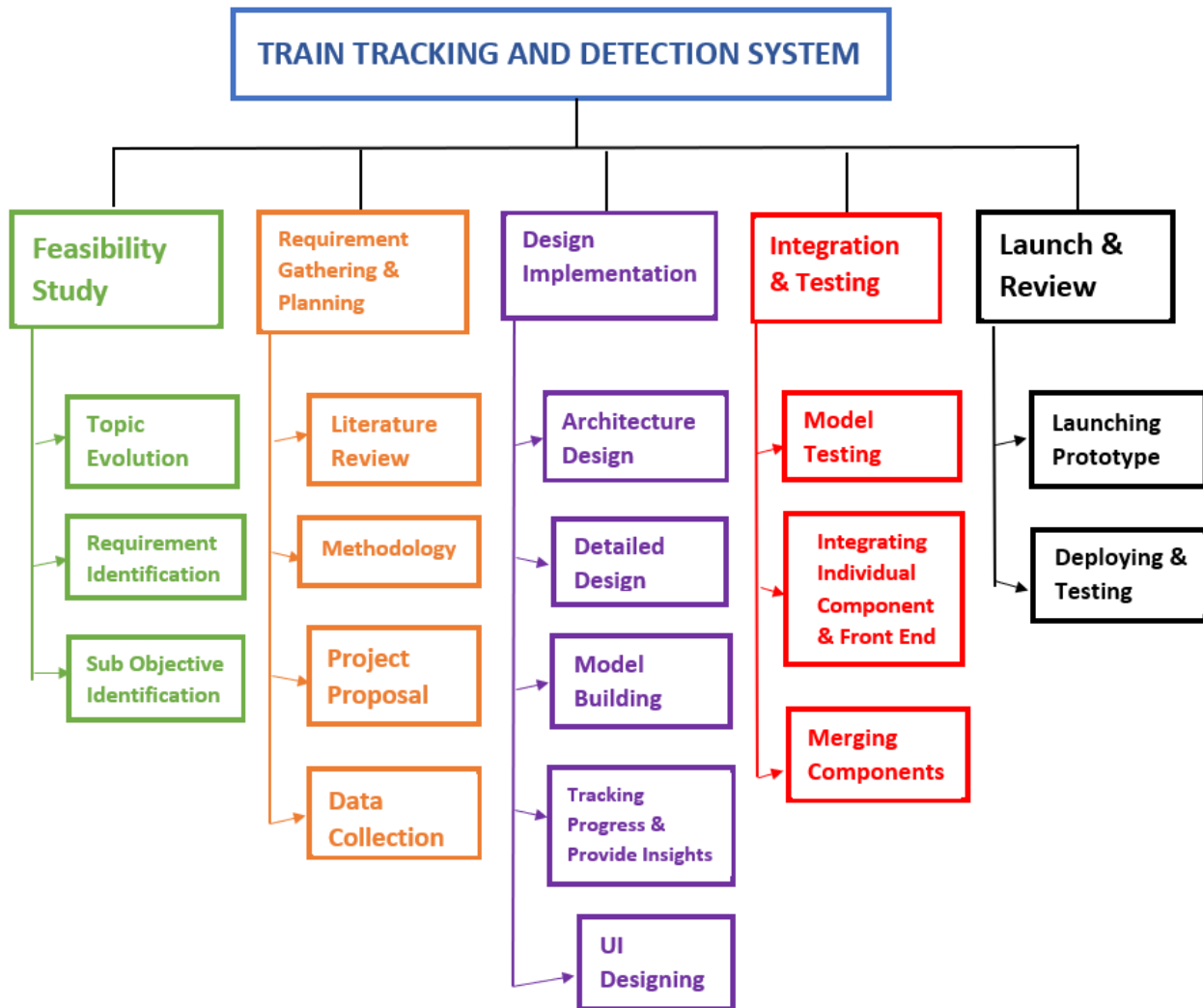
APPENDICES

Appendix A: 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



Turnitin Report Screenshot

vihan dracoUser InfoMessagesStudentEnglishHelpLogout

turnitin

Class PortfolioMy GradesDiscussionCalendar

NOW VIEWING: HOME > 4TH YEAR IT

Class Homepage

This is your class homepage. To submit to an assignment click on the "Submit" button to the right of the assignment name. If the Submit button is grayed out, no submissions can be made to the assignment. If resubmissions are allowed the submit button will read "Resubmit" after you make your first submission to the assignment. To view the paper you have submitted, click the "View" button. Once the assignment's post date has passed, you will also be able to view the feedback left on your paper by clicking the "View" button.

Assignment Inbox: 4th Year IT

Assignment Title	Info	Dates	Similarity	Actions
4th year IT		Start 25-Jan-2023 8:18AM Due 31-Dec-2023 11:59PM Post 31-Dec-2023 12:00AM	5% <div></div>	<div>ResubmitView</div>

Copyright © 1998 – 2023 Turnitin, LLC. All rights reserved.

Privacy PolicyPrivacy PledgeTerms of ServiceEU Data Protection ComplianceCopyright ProtectionLegal FAQsHelpdeskResearch Resources