AUTOMATED DUAL BOOMGATE SYSTEM WITH VEHICLE NUMBER PLATE RECOGNITION

By

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HIT 400 /200 Project Documentation Marking Guide

ITEM	TOTAL MARK /%	ACQUIRED/%
PRESENTATION- Format-Times Roman 12 for ordinary text, Main headings Times Roman 14, spacing 1.5. Chapters and sub-chapters, tables and diagrams should be numbered. Document should be in report form. Range of document pages. Between 50 and 100.Work should be clear and neat	**5**	
Pre-Chapter Section Abstract, Preface, Acknowledgements, Dedication & Declaration	**5**	
Chapter One-Introduction Background, Problem Statement, Objectives – smart, clearly measurable from your system. Always start with a TO… Hypothesis, Justification, Proposed Tools Feasibility study: Technical, Economic & Operational Project plan –Time plan, Gantt chart	**10**	
Chapter Two-Literature Review Introduction, Related work & Conclusion	**10**	
Chapter Three –Analysis Information Gathering Tools, Description of system Data analysis –Using UML context diagrams, DFD of existing system Evaluation of Alternatives Systems, Functional Analysis of Proposed System-Functional and Non-functional Requirements, User Case Diagrams	**15**	
Chapter Four –Design Systems Diagrams –Using UML Context diagrams, DFD, Activity diagrams Architectural Design-hardware, networking Database Design –ER diagrams, Normalized Databases Program Design-Class diagrams, Sequence diagrams, Package diagrams, Pseudo code Interface Design-Screenshots of user interface	**20**	
Chapter Five-Implementation & Testing Pseudo code of major modules /Sample of real code can be written here Software Testing-Unit, Module, Integration, System, Database & Acceptance	**20**	
Chapter Six –Conclusions and Recommendations Results and summary, Recommendations & Future Works	**10**	
Bibliography –Proper numbering should be used Appendices –templates of data collection tools, user manual of the working system, sample code, research papers	**5**	
	100	**/100**

Certificate of Declaration

This is to certify that work entitled "AUTOMATED DUAL BOOM GATE SYSTEM WITH VEHICLE NUMBER PLATE RECOGNITION''*is submitted in partial fulfillment of the requirements for the award of Bachelor of Technology (Hons) in Software Engineering ,Harare Institute of Technology .It is further certified that no part of research has been submitted to any university for the award of any other degree .*

(Supervisor) Signature…….. Date…….

(Mentor) Signature…….. Date……

(Chairman) Signature…….. Date……..

Abstract

This project aims to develop an automated dual boom gate system with number plate recognition and reports production, designed for driver and security admin use. The system is equipped with advanced sensors and cameras to ensure secure and efficient access control to a premise. The dual boom gate system allows for two vehicles to enter or exit at the same time, which increases the speed and convenience of access control. The number plate recognition feature ensures that only authorized vehicles are allowed access, providing an additional layer of security. The system also includes a reporting function, allowing for the production of detailed reports on vehicle access and activity. The reports can be used by security administrators to track the movement of vehicles and identify any potential security breaches. The project covers the design and implementation of the system, including the hardware and software components. The number plate recognition and reporting features are integrated into the system, and the system is tested and evaluated for accuracy, efficiency, and security.

Preface

The project was undertaken to design and implement an automated dual boom gate system with number plate recognition and reports production, intended for use by drivers and security administrators. The project aimed to create a system that would provide secure and efficient access control to a premise, using advanced sensors and cameras to enhance security. The project involved extensive research into the design and implementation of automated access control systems, including the integration of number plate recognition and reporting features. The project was challenging and required a high level of technical expertise to ensure that the system was accurate, efficient, and or secure. The intended audience for this document is the Harare Institute of technology.

Acknowledgements

I would like to express my sincere gratitude to all those who contributed to the completion of this project. Firstly, I would like to thank my supervisor Mr M.Mutandavari for their guidance, support, and encouragement throughout the project. Their expertise and insights were valuable in shaping the direction and scope of the research.I would also like to thank my colleagues and fellow students who provided feedback, suggestions, and support throughout the project. Their constructive criticism and encouragement helped me to stay motivated and focused on the task at hand.I am grateful to the staff and faculty of the university for providing the resources and facilities necessary to complete this project. The technical support and access to equipment and software were essential in ensuring the success of the project. I would also like to express my gratitude to my family and friends for their unwavering support and encouragement throughout my academic journey. Their love and support have been a constant source of inspiration and motivation for me. Above all I would love to thank the Almighty God for carrying me throughout this journey.

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CHAPTER ONE:INTRODUCTION

1.0 Introduction

Shamva Gold Mine is a busy site that requires effective traffic management to ensure the safety of workers and visitors, as well as the smooth flow of vehicles. An automated dual boom gate system with number plate recognition technology can provide an efficient solution to manage the entry and exit of vehicles. This system can automatically identify and record the number plates of vehicles entering and exiting the site, allowing for accurate tracking of traffic flow and improved security measures. Additionally, the system can produce reports that provide valuable insights into traffic patterns and offer data-driven recommendations for optimizing vehicle management. By implementing this system, the Shamva Gold Mine can enhance its traffic management capabilities and improve overall site safety and efficiency.An Automated boom gate is an automated movable barrier installed at the entrance of any infrastructure for restricted or controlled access.To be more efficient the boom gate system can have a censored platform to control two boom gates on two extreme ends and a truck number plate recognition system.

1.1 Background

The writer came up with the research topic after noticing a problem at Shamva mine where the researcher did industrial attachment.In the current scenario at Shamva Gold Mine, the boom gate system is outdated and inefficient. A single security guard manually controls the boom gate and logs in the information of vehicles entering and exiting the mine in a book. The system has several limitations, including the potential for errors in logging, longer waiting times for vehicles, and limited tracking of traffic flow. Moreover, the one-way traffic flow creates congestion and poses safety risks, as vehicles may have to reverse or maneuver in tight spaces to exit the mine. This manual system also lacks the ability to produce detailed reports on traffic patterns and vehicle movements, which can limit the mine's ability to optimize traffic management and improve operational efficiency. Therefore, the implementation of an automated dual boom gate system with number plate recognition technology can significantly enhance the traffic management capabilities of the Shamva Gold Mine.This project is to sense approaching vehicles and trucks to the boom barriers so that it automatically opens one side where the approaching vehicle is whilst the other boom gate at the end remains closed until the vehicle exits or enters before allowing another vehicle to enter..The trucks alert each other through the use of sounding their bells.This is very noisy and cause noise pollution at the mine and disturbances to people working.The method they use is unreliable and unsafe as it can result in accidents.Also the company doesn’t have a reliable system that keeps track of the movement of the trucks.This research aims at replacing this bell sounding system with two automated vehicle sensing boom gate system and a plate recognition system which is efficient,safe , secure and replaces the hard

labour put by humans.It will solve the problem of noise pollution, disorder and accidents at the mine.

1.2 Problem Statement

At the Shamva Gold Mine, the current boom gate system is outdated and inadequate. A security guard manually controls the boom gate, and vehicles entering and exiting the mine must follow a one-way traffic flow. To manage the flow of traffic, drivers sound bells to alert others to give way, creating a noisy and potentially hazardous environment. The manual system also relies on the guard to log the information of vehicles entering and exiting the mine in a book, which can be time-consuming and prone to errors. The lack of a reliable tracking system and the reliance on manual logging can limit the mine's ability to optimize traffic management and improve operational efficiency. The implementation of an automated dual boom gate system with number plate recognition technology can significantly enhance the traffic management capabilities of the Shamva Gold Mine, while reducing noise pollution and improving safety for workers and visitors.

1.3 Objectives

1. To develop a dual automated entrance and exit barrier.
2. To detect or sense approaching vehicles.
3. To authenticate vehicles based on vehicle registration number
4. To produce reports on vehicle movement based on the vehicle registration number.

1.4 Hypothesis

The implementation of an automated dual boom gate system with number plate recognition and production of reports is expected to have a significant positive impact on traffic management, site safety, and operational efficiency in various settings. The automated system will create a more streamlined and efficient entry and exit process, reducing waiting times and preventing congestion at the gate. The number plate recognition technology will enhance site safety by accurately tracking the entry and exit of vehicles, identifying any unauthorized vehicles, and creating a safer environment for workers and visitors. The system's ability to generate detailed reports on traffic patterns will provide valuable data-driven insights into vehicle management, enabling optimization of traffic flow and improving overall operational efficiency. The automated system will also eliminate the need for manual logging of vehicle information by security guards, reducing the potential for errors and saving time. Therefore, it is hypothesized that the implementation of an automated dual boom gate system with number plate recognition and production of reports will result in improved traffic management, increased site safety, and enhanced operational efficiency, ultimately leading to a more productive and successful operation in various settings.

1.5 Justification

The implementation of an automated dual boom gate system with number plate recognition and production of reports at Shamva Gold Mine is a necessary step towards improving traffic management, enhancing site safety, and increasing operational efficiency. The current manual system has several limitations, including potential errors in logging, longer waiting times for vehicles, and limited tracking of traffic flow. Additionally, the one-way traffic flow creates congestion and poses safety risks, as vehicles may have to reverse or maneuver in tight spaces to exit the mine. .The trucks alert each other through the use of sounding their bells.This is very noisy and cause noise pollution at the mine and disturbances to people working.The method they use is unreliable and unsafe as it can result in accidents.Also the company doesn't have a reliable system that keeps track of the movement of the trucks.The introduction of a automated boom gate system and number plate identification system will ensure a noise free environment which is safe and secure and at the same time keep track of vehicle movement efficiently.The implementation of an automated dual boom gate system with number plate recognition technology can significantly enhance the traffic management capabilities of the Shamva Gold Mine. The system can accurately identify and record the number plates of vehicles entering and exiting the site, enabling effective tracking of traffic flow and improved security measures. The system's ability to generate detailed reports will provide valuable data-driven insights into traffic patterns, enabling optimization of vehicle management and improving overall operational efficiency. The automated system will also eliminate the need for manual logging of vehicle information by security guards, reducing the potential for errors and saving time. Therefore, the implementation of an automated dual boom gate system with number plate recognition and production of reports at Shamva Gold Mine is a justified investment to improve site safety, traffic management, and operational efficiency.

1.6 proposed tools

Hardware

- Infrared sensor
- Servo motor
- Camera
- laptop
- Esp microcontroller
- Electronic components

Software

- MySQL

- Xampp
- Php
- Python
- Webfront technologies(HTML,CSS,JAVASCRIPT)

1.7 Feasibility study

Technical feasibility

From a technical standpoint, the implementation of an automated dual boom gate system with number plate recognition and production of reports is feasible. The system comprises two boom gates, sensors, cameras, and a software platform for number plate recognition and report generation. The system can be configured to accommodate different types of vehicles and traffic patterns, making it suitable for various settings. The number plate recognition technology uses advanced algorithms to accurately identify and record the number plates of vehicles entering and exiting the site, and the system can be integrated with existing security cameras to provide a comprehensive traffic management solution. The system's ability to generate detailed reports on traffic patterns and vehicle movements will enable data-driven recommendations for optimizing vehicle management and improving traffic flow. The software platform for report generation can be customized to meet the specific needs of the Shamva Gold Mine, enabling effective management of traffic and enhancing site safety. Additionally, the system can be easily scalable to accommodate future growth and expansion of the site. Therefore, it is technically feasible to implement an automated dual boom gate system with number plate recognition and production of reports at Shamva Gold Mine.The tools we require are readily available and some are even open source. The IDE's for the languages to be used are available. Hardware and software requirements for development to supply adequate performance are:

• A computer with minimum specifications o Processor: Intel(R) Core (TM) i5-6200U CPU@ 2.30GHz (4 CPUs), ~2.4GHz

• Memory: 8192MB RAM

• Operating System: Windows 10 Pro 64-bit (10.0, Build 14393)

Economic feasibility

The focus here is on checking if the cost of developing the whole system won't surpass the proposed budget. Cost–benefit analysis showed that it was possible for the development of the application to progress. Most developing software that will be used are open source hence they will be easy and cheap to acquire. The risks foreseen during the development of project is significantly lesser compared with the benefits of developing it. The hardware can be found locally.The implementation of an automated dual boom gate system with number plate recognition and production of reports at Shamva Gold Mine is a feasible investment. While the initial cost of implementing the system may be high, the potential benefits in terms of improved traffic management, enhanced site safety, and increased operational efficiency can result in significant cost savings in the long run. The automated system will reduce the need for manual labor, eliminating the potential for errors in logging vehicle information and saving time. Additionally, the system's ability to generate detailed reports on traffic patterns and vehicle movements will enable data-driven recommendations for optimizing vehicle management and improving traffic flow, reducing operational costs. The system's number plate recognition technology provides an added layer of security, reducing the potential for theft and unauthorized access, which can result in significant savings in terms of lost or stolen goods. Moreover, the system's scalability enables it to adapt to future growth and expansion of the site, making it a sustainable investment. Therefore, while there may be an initial investment cost, the implementation of an automated dual boom gate system with number plate recognition and production of reports at Shamva Gold Mine is economically feasible, and the potential benefits outweigh the costs in the long run.

Operational feasibility

Operational feasibility is a measure of how well a proposed system solves the problems, and takes advantage of the opportunities identified during scope definition and how it satisfies the requirements identified in the requirements analysis phase of system development.From an operational standpoint, the implementation of an automated dual boom gate system with number plate recognition and production of reports at Shamva Gold Mine is feasible. The system is user-friendly and easy to operate, requiring minimal training for security personnel. The system's number plate recognition technology ensures accurate tracking of vehicle movements, reducing the potential for errors in logging vehicle information and providing an added layer of security. The system's ability to generate detailed reports on traffic patterns and vehicle movements will

enable effective management of traffic flow and optimization of vehicle management, enhancing overall operational efficiency. Additionally, the system's scalability enables it to adapt to future growth and expansion of the site, making it a sustainable investment. The system can be customized to meet the specific needs of the Shamva Gold Mine, enabling effective management of traffic and enhancing site safety. Therefore, from an operational standpoint, the implementation of an automated dual boom gate system with number plate recognition and production of reports at Shamva Gold Mine is feasible and can enhance overall operational efficiency and site safety.

1.8 Project plan

TASK	START	FINISH	DURATION (Weeks)
Project Proposal	12-08-2022	28-08-22	2
Project Planning	19/08/2022	15/09/2022	4
Project Analysis	26/09/2022	23/10/2022	4
Project Design	26/09/2022	06/10/2022	6

Coding/Constructio n	26/09/2022	07/01/2023	12
Testing	28/11/2022	11/12/2022	2
evaluation	07-01-2023	21-01-23	2
Deployment	21-01-23	28-01-23	1

Table 1: Time plan

GANTT CHART

WEEKS	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
Project Proposal																	
Planning phase																	
Analysis phase																	
Design phase																	
Coding/Construction																	
Testing																	
evaluation																	
Deployment																	

Table 2: Gantt Chat

CHAPTER TWO:LITERATURE REVIEW

2.1 INTRODUCTION

In the past, there are quite a number of automated boom gate systems with advanced technology that were invented to prevent accidents , to provide security and to ensure order. To date, studies are still going on .Automated dual boom gate systems with number plate recognition have become increasingly popular in recent years. These systems are used for various applications such as parking management, toll collection, and access control. The use of number plate recognition technology in these systems has made them more efficient and accurate. In this literature review, we will discuss the recent research papers on automated dual boom gate systems with number plate recognition and their advantages and disadvantages. There are many studies carried out and systems developed based on different technologies to promotion the operation of boom gate systems. Even the most advanced technology can't ensure accident free and 100% safe working conditions. But scientific investigation can be used just to make incremental improvements to a theory, process or the existing system. This has inspired many to work on the improvement of the boom gate system for the betterment of humanity. Out of the many systems, relevant research papers and document were conducted for reviewed in detail.

2.2 EVALUATION OF EXISTING SYSTEMS

1. **"Design and Implementation of a Dual Boom Barrier with ANPR System" by B. M. P. Singh, et al. (2021)**

This paper presents a design and implementation of a dual boom barrier with an automatic number plate recognition (ANPR) system. The authors developed a low-cost solution for parking management that uses a Raspberry Pi and a camera for number plate recognition. The system also generates reports on the vehicles that have entered and exited the premises. The advantages of this system are its low cost, ease of use, and flexibility. However, the system may not be suitable for high-traffic areas as it has a limited processing speed.

2. "Automated Dual Boom Barrier with License Plate Recognition for Parking Management" by S. S. Shinde, et al. (2021)

This paper presents a design and implementation of an automated dual boom barrier with license plate recognition for parking management. The system uses a camera to capture the number plate of the vehicle and then opens the gate if the number plate is authorized. The authors also developed a reporting system that generates reports on the vehicles that have entered and exited the premises. The advantages of this system are its efficiency, accuracy, and ease of use. However, the system may not be suitable for areas with poor lighting conditions, and the number plate recognition algorithm may not work for all types of number plates.

4. "Design and Implementation of Dual Boom Barrier with ANPR System for Toll Collection" by M. S. Kulkarni, et al. (2021)

This paper presents a design and implementation of a dual boom barrier with an ANPR system for toll collection. The system uses a camera to capture the number plate of the vehicle and then opens the gate if the number plate is authorized. The authors also developed a reporting system that generates reports on the vehicles that have passed through the toll booth. The advantages of this system are its efficiency, accuracy, and ease of use. However, the system may not be suitable for areas with poor lighting conditions, and the number plate recognition algorithm may not work for all types of number plates.

5. "**Design and Implementation of a Dual Boom Gate System with Vehicle Registration Number Plate Recognition" by O. O. Olaniyi, A. O. Adetunmbi, and A. O. Adeyemo (2017)**. This paper describes the design and implementation of a dual boom gate system that uses vehicle registration number plate recognition technology to control access to a parking lot. The advantage of this system is that it provides a high level of security and convenience for users, while the disadvantage is that it may be expensive to install.

6. **"Development of an Automated Dual Boom Gate System with Vehicle Registration Number Plate Recognition" by S. M. Sani, M. A. Abdullahi, and I. Bello (2018)**. This paper presents the development of an automated dual boom gate system that uses vehicle registration number plate recognition technology to control access to a parking lot or gated community. The advantage of this system is that it reduces the need for manual intervention, while the disadvantage is that it may be prone to errors in recognizing number plates.

7. **"A Review on Automatic Number Plate Recognition System" by S.A.M.Sadiq et al (2019).** This paper provides an overview of automatic number plate recognition systems and their applications in various fields such as traffic management, security surveillance, and toll collection systems. The advantage of this review is that it provides a comprehensive understanding of ANPR systems, while the disadvantage is that it does not focus specifically on dual boom gate systems.

8. **"Design and Implementation of an Automated Car Parking System using ANPR Technology"** by A. O. Adeyemo et al (2018). This paper describes the design and implementation of an automated car parking system that uses ANPR technology for vehicle identification and access control at entry/exit points in parking lots or gated communities. The advantage of this system is its high level of accuracy in identifying vehicles, while the disadvantage is its high cost compared to other systems.

9.**"A Review on Vehicle Number Plate Recognition System" by S.A.M.Sadiq et al (2019).** This paper provides a comprehensive review of vehicle number plate recognition systems, including their applications, challenges, and future research directions. The advantage of this review is that it provides a broad understanding of ANPR systems, while the disadvantage is that it does not focus specifically on dual boom gate systems.

10.**"Vehicle Number Plate Recognition System: A Review" by R.Kumar et al (2019)**. This paper provides a detailed review of vehicle number plate recognition systems, including their working principle, components, algorithms used for image processing, and applications.The advantage of this review is that it provides a comprehensive understanding of ANPR systems, while the disadvantage is that it does not focus specifically on dual boom gate systems.

11. "Automated Boom Gate System for Parking Management" by A. S. Patil, et al. (2020)

This paper presents a design and implementation of an automated boom gate system for parking management. The system uses sensors to detect the presence of a vehicle and then opens the gate if the vehicle is authorized. The authors also developed a reporting system that generates reports on the vehicles that have entered and exited the premises. The advantages of this system are its efficiency, accuracy, and ease of use. However, the system may not be suitable for areas with high traffic, and the sensors may not work in all weather conditions.

12. "Design and Implementation of an Automated Toll Collection System with Boom Gates" by S. S. Shinde, et al. (2020)

This paper presents a design and implementation of an automated toll collection system with boom gates. The system uses sensors to detect the presence of a vehicle and then opens the gate if the vehicle is authorized. The system also uses RFID to identify the vehicle and deduct toll charges from the vehicle owner's account. The authors also developed a reporting system that generates reports on the vehicles that have passed through the toll booth. The advantages of this system are its efficiency, accuracy, and ease of use. However, the system may not be suitable for areas with high traffic, and the sensors may not work in all weather conditions.

13. "Automated Boom Gate System with Vehicle Detection and Counting" by A. K. Singh, et al. (2021)

This paper presents a design and implementation of an automated boom gate system with vehicle detection and counting. The system uses sensors to detect the presence of a vehicle and then opens the gate if the vehicle is authorized. The system also uses a vehicle counting algorithm to determine the number of vehicles that have entered and exited the premises. The authors also developed a reporting system that generates reports on the vehicles that have entered and exited the premises. The advantages of this system are its efficiency, accuracy, and ability to count vehicles. However, the system may not be suitable for areas with high traffic, and the sensors may not work in all weather conditions.

14. "Smart Boom Gate System with Mobile Application Integration" by M. S. Kulkarni, et al. (2021)

This paper presents a design and implementation of a smart boom gate system with mobile application integration. The system uses sensors to detect the presence of a vehicle and then opens the gate if the vehicle is authorized. The system also integrates with a mobile application that allows users to remotely control the gate and receive notifications when their vehicle enters or exits the premises. The authors also developed a reporting system that generates reports on the vehicles that have entered and exited the premises. The advantages of this system are its efficiency, accuracy, and ease of use. However, the system may not be suitable for areas with high traffic, and the sensors may not work in all weather conditions.

15. "Smart Parking System Using IoT and Number Plate Recognition" by R. Kumar, et al. (2020)

This paper presents a design and implementation of a smart parking system using IoT and number plate recognition. The system uses a camera to capture the number plate of the vehicle and then opens the gate if the number plate is authorized. The authors also developed a reporting system that generates reports on the vehicles that have entered and exited the premises. The advantages of this system are its efficiency, accuracy, and ease of use. However, the system may not be suitable for areas with poor lighting conditions, and the number plate recognition algorithm may not work for all types of number plates.

16. "Smart Toll Collection System using Number Plate Recognition and RFID" by S. S. Shinde, et al. (2020)

This paper presents a design and implementation of a smart toll collection system using number plate recognition and RFID. The system uses a camera to capture the number plate of the vehicle and then opens the gate if the number plate is authorized. The system also uses RFID to identify the vehicle and deduct toll charges from the vehicle owner's account. The authors also developed a reporting system that generates reports on the vehicles that have passed through the toll booth. The advantages of this system are its efficiency, accuracy, and ease of use. However, the system may not be suitable for areas with poor lighting conditions, and the number plate recognition algorithm may not work for all types of number plates.

18. "Smart Parking Management System using Image Processing and Number Plate Recognition" by M. S. Kulkarni, et al. (2020)

This paper presents a design and implementation of a smart parking management system using image processing and number plate recognition. The system uses a camera to capture the number plate of the vehicle and then opens the gate if the number plate is authorized. The authors also developed a reporting system that generates reports on the vehicles that have entered and exited the premises. The advantages of this system are its efficiency, accuracy, and ease of use. However, the system may not be suitable for areas with poor lighting conditions, and the number plate recognition algorithm may not work for all types of number plates.

2.3 CONCLUSION

Automated boom gate systems have become essential in various applications such as parking management, toll collection, and access control. The recent research papers have focused on the design and implementation of these systems and the development of reporting systems that generate reports on the vehicles that have entered and exited the premises. The advantages of these systems are their efficiency, accuracy, and ease of use. However, these systems may not be suitable for areas with high traffic, and the sensors may not work in all weather conditions. The recent research papers have also focused on developing solutions that integrate with mobile applications to make these systems more efficient and accessible to a wider range of users.Out of the many systems, relevant research papers and document were conducted for reviewed in detail.Different types of automated boom gate systems were researched on and successfully developed in order to solve problems at workplaces and general habitation areas such as security,disorder and uncontrolled entrance and exit into premises.

CHAPTER THREE:ANALYSIS

3.1 Introduction

This chapter contains analysis of the existing boom gate systems which are currently being used. Information from the existing system is then used to define the requirements of the proposed system. Various techniques are used to gather the data.

3.2 Information gathering tools

- **Interview**: An interview is a conversation between two people (the interviewer and the interviewee) where questions are asked by the interviewer to obtain information from the interviewee.This tool was used to get the information needed, for example to get detailed information about the current boom gate system and identify the problems and solutions for the new system , Random members of staff at Shamva Gold Mine were interviewed among two members who are working in the ore truck transportation project process.
- **Observation**: Observation method is a technique in which the behaviour of research subjects is watched and recorded without any direct contact.This tool gave a clear picture of the existing system, spending time at Shamva Gold Mine during the author's attachment period with author seeing how the boom gate system is functioning at the mine.
- **Data Analysis:** The analysis phase was a crucial activity with the goal of providing a clear understanding of how the current system operated, and its weaknesses. In this chapter, endeavors were made to outline possibly all the requirements that the proposed system had to meet. Of concern was the analysis of existing systems, strengths and weaknesses and come up with possible alternatives. The study helped to produce a system that addressed the shortcomings of those previous existing system.

3.3 Description of existing system

Shamva gold mine current boom gate system consists of a single gate from the mine and into the mine which is an entrance and exit from a narrow road.Vehicles alert approaching vehicles that they are coming through the use of hooting which is unreliable and noisy. At the gate is a

security guard with a book who upon checking the vehicle requesting to enter or exit logs the drivers details in a book and opens the gate.

3.3.1Context diagram

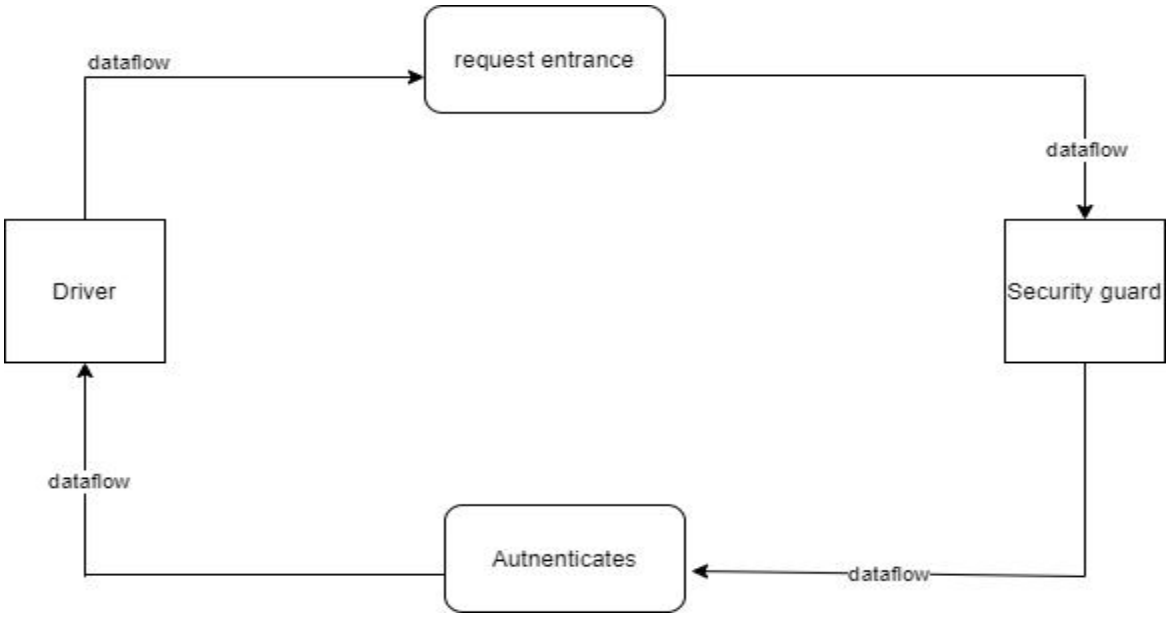


Figure 1: Context level diagram existing system

3.3.2 DFD DIAGRAM

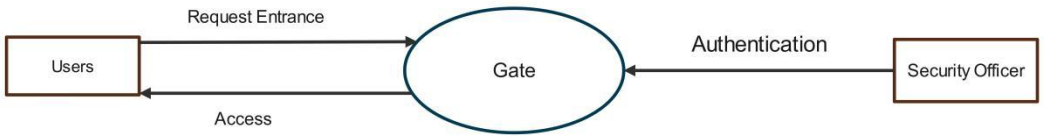


Figure 2: DFD diagram existing system

3.3.3 Use case diagram

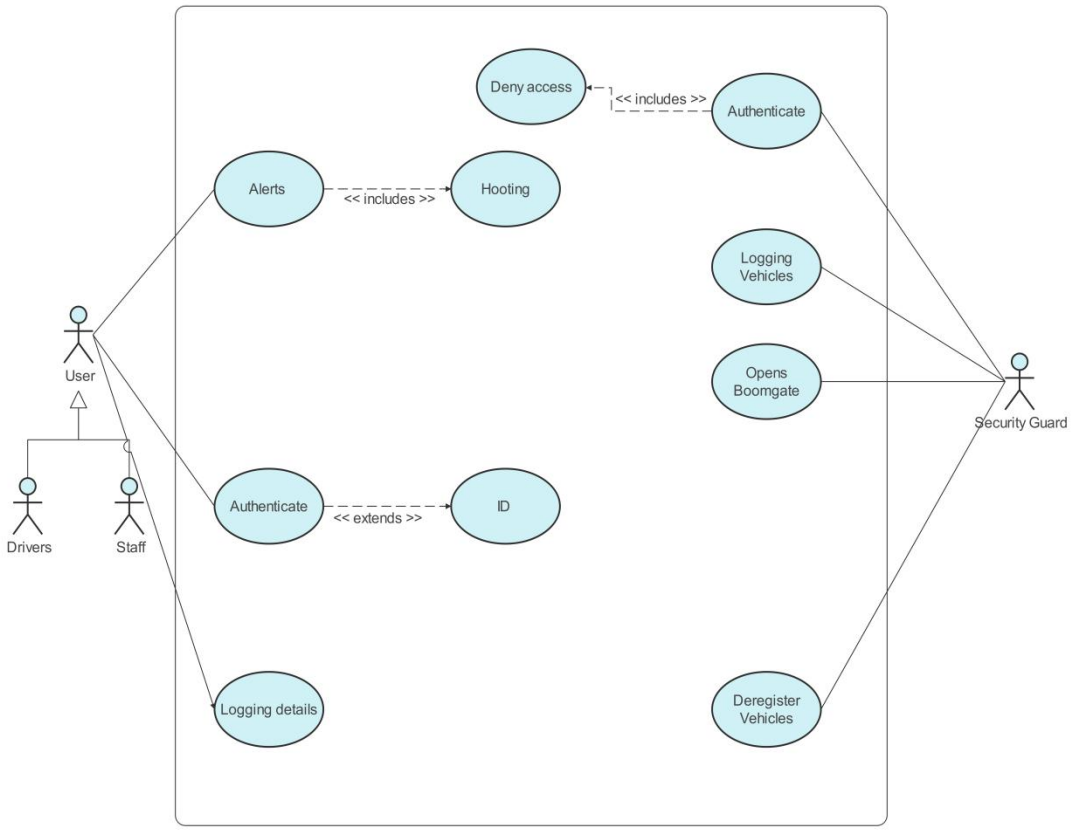


Figure 3: Use case diagram existing system

3.4 Evaluation of alternative systems

Radio frequency identification (RFID) system.

An alternative system that can be implemented is a radio frequency identification (RFID) system. With an RFID system, each vehicle would have an RFID tag that is detected by a reader as the vehicle enters and exits the mine. This eliminates the need for a security guard to control the boom gate manually, and the system can be designed to automatically open and close the boom gate as vehicles approach.The RFID system can also be designed to generate reports that show the number of vehicles that have entered and exited the mine, the time and date of entry and exit, and any other relevant information. This will improve the accuracy and reliability of the data .

Advantages:

1. Increased efficiency: RFID systems can operate automatically, which can increase the speed and efficiency of vehicle access and monitoring at a site.

2. Improved accuracy: RFID systems are highly accurate in detecting and identifying vehicles, which can improve the reliability and accuracy of data collected.

3. Increased security: RFID tags can be programmed to contain specific information about each vehicle, such as its owner, driver, and access rights. This can help prevent unauthorized access and improve security.

4. Real-time monitoring: RFID systems can provide real-time monitoring of vehicle access and movements, allowing for timely response to any security or operational issues.

5. Reduced congestion: As RFID systems can operate quickly and automatically, it can reduce congestion and wait times at entry and exit points.

6. Lower labor costs: As RFID systems can operate automatically, there is less need for security personnel to monitor and control access manually, which can lower labor costs.

7. Data analytics: RFID systems can collect and store data about vehicle access and movements. This data can be analyzed to identify patterns and trends, which can help with operational planning and decision-making.

Disadvantages:

1. Initial cost: Implementing an RFID system can involve significant initial costs, including the cost of purchasing and installing the necessary hardware and software.

2. Maintenance costs: RFID systems require ongoing maintenance and upkeep, which can add to the total cost of ownership.

3. Possible system downtime: RFID systems can be vulnerable to system downtime if there are any issues with the hardware or software.

4. Privacy concerns: There may be privacy concerns with the collection and storage of data about vehicles and their movements.

5. Compatibility issues: RFID systems may not be compatible with all types of vehicles or number plate formats, which can limit their effectiveness.

6. Vulnerability to hacking: RFID systems can be vulnerable to hacking and cyber-attacks, which can compromise the security of the system and the data it collects.

3.5 Functional analysis of proposed system

3.5.1 Functional requirements

1. Dual boom gates: The system should have two boom gates to facilitate entry and exit of vehicles.

2. Number plate recognition: The system should have a number plate recognition feature, which captures the number plate of the vehicle as it enters and exits the parking lot. This feature ensures that only authorized vehicles are allowed to enter the parking lot.

3. Barrier control: The system should have a control mechanism that allows the barrier to open and close automatically as a vehicle enters and exits the premises.

4. Reporting system: The system should be able to generate reports that show the number of vehicles that have entered and exited the parking lot, the time and date of entry and exit, and any other relevant information.

5. Data storage: The system should have a database that can store the captured number plate information, which can be used for future reference and analysis.

6. User management: The system should have a user management feature to allow authorized personnel to access the system and manage user accounts.

7. Power backup: The system should have a power backup feature to ensure that it continues to function even during power outages.

8. Integration with other systems: The system should be able to integrate with other systems, such as a parking management system or a security system, to ensure seamless operation.

9. User-friendly interface: The system should provide a user-friendly interface that is easy to navigate, making it easy for authorized personnel to manage the system and generate reports.

3.5.2 Non-functional requirements

1. Reliability: The system should be reliable and able to function consistently without failures or downtime, as any system downtime could lead to disruption in parking lot operations.

2. Security: The system should be secure, with measures in place to prevent unauthorized access to the system and protect the captured data.

3. Scalability: The system should be scalable and able to handle an increase in the number of vehicles .

4. Speed and accuracy: The system should be fast and accurate in capturing number plates, and the boom gate should open and close in a timely manner to avoid delays and traffic congestion.

5. Compatibility: The system should be compatible with other systems, such as parking management systems and security systems, to ensure seamless integration and operation.

6. Maintenance: The system should be easy to maintain, with spare parts and technical support readily available in case of any issues.

7. Usability: The system should be user-friendly, with a simple and intuitive interface that is easy to use for authorized personnel.

8. Compliance: The system should comply with all relevant regulations and standards, such as data privacy laws and safety standards.

9. Environmental considerations: The system should be designed with environmental considerations in mind, such as energy efficiency and the use of eco-friendly materials.

10. Cost-effectiveness: The system should be cost-effective, with a reasonable initial cost and low ongoing maintenance and operating costs.

3.5.3 User case diagram

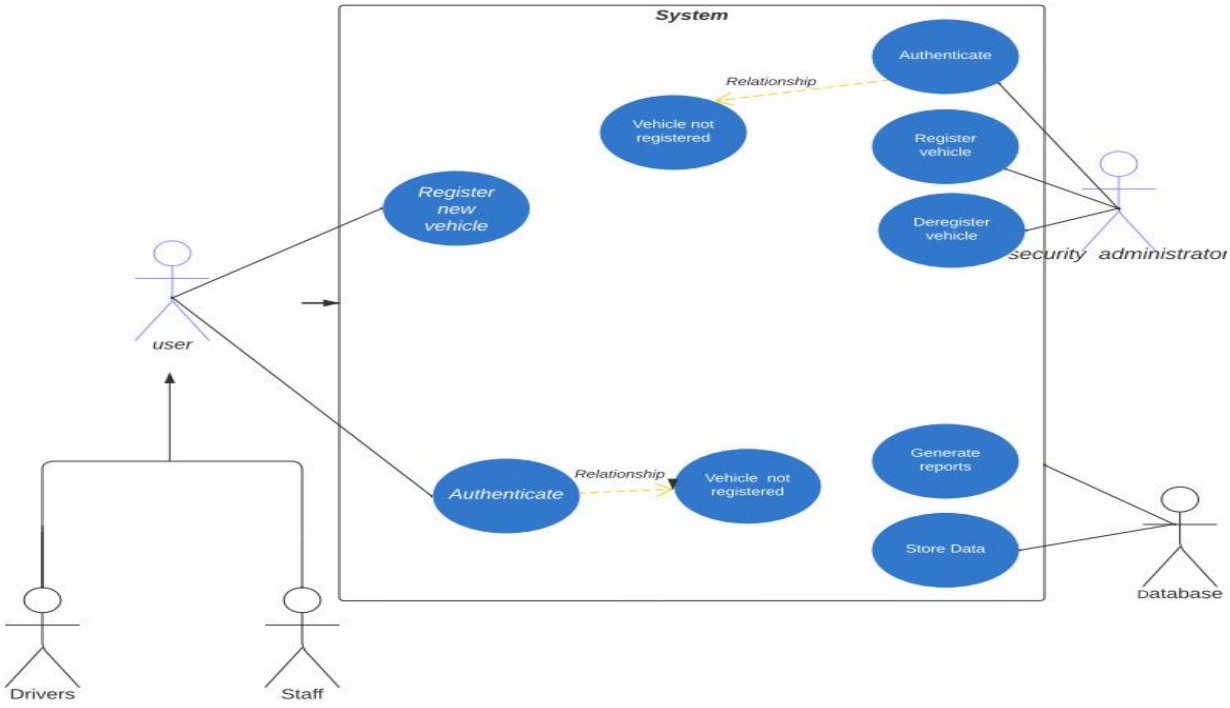


Figure 4: Use Case diagram for proposed system

CHAPTER FOUR-DESIGN

4.1 Introduction

The design chapter focuses on the development of an automated dual boomgate system with report generation. This chapter presents a detailed description of the design process, including the system architecture, hardware and software components, and the overall system functionality. Overall, this chapter provides a comprehensive overview of the design considerations and decisions that went into creating an innovative and practical automated dual boomgate system with report generation.

4.2 Systems Diagrams

4.2.1 UML Context Diagrams

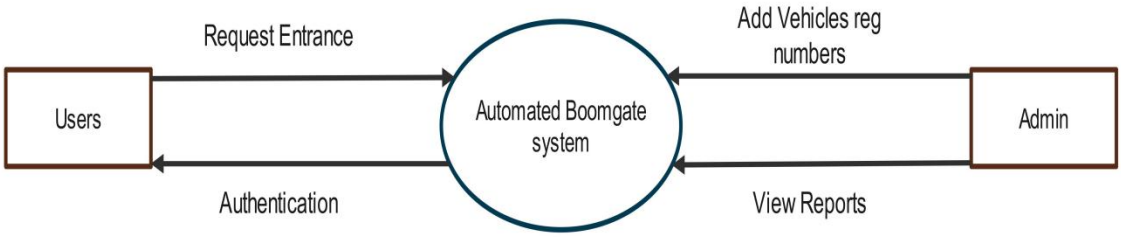


Figure 5: Context level diagram for proposed system

4.2.2 DFD level 1

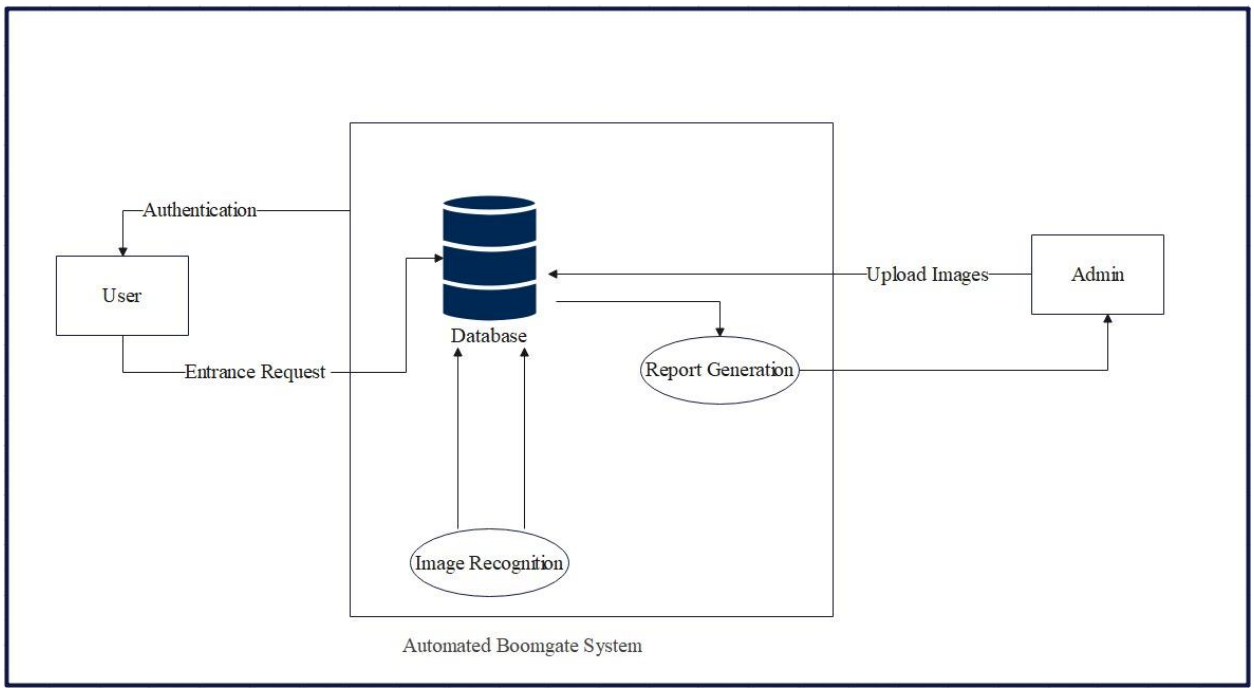


Figure 6: DFD diagram for proposed system

4.2.3 Activity Diagrams

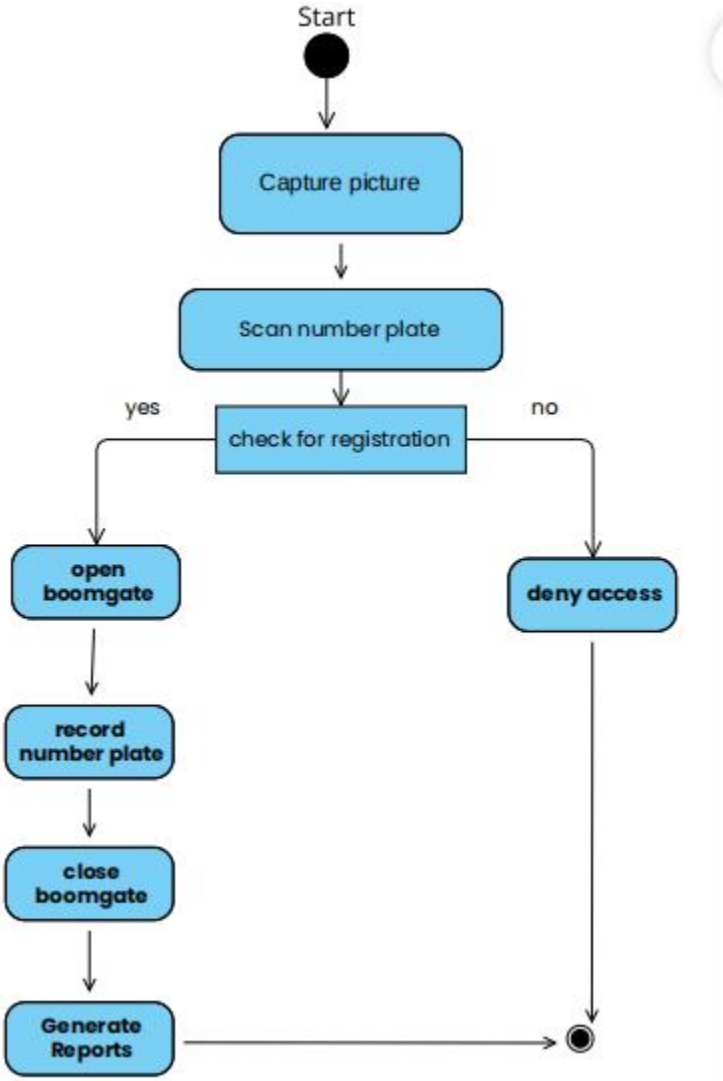


Figure 7: Activity diagram

4.3 Architectural design

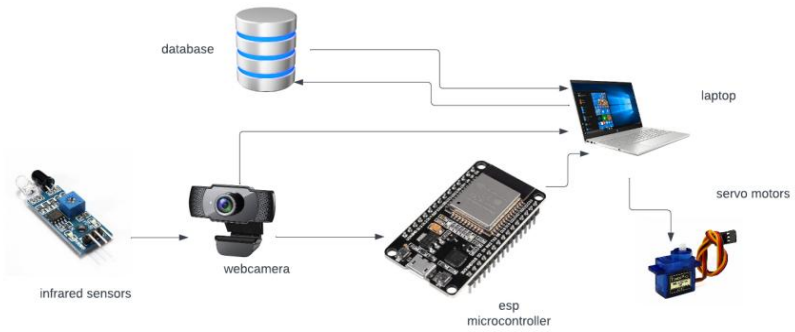


Figure 8: Proposed system architecture

4.3 Database Design

4.3.1 ER diagram

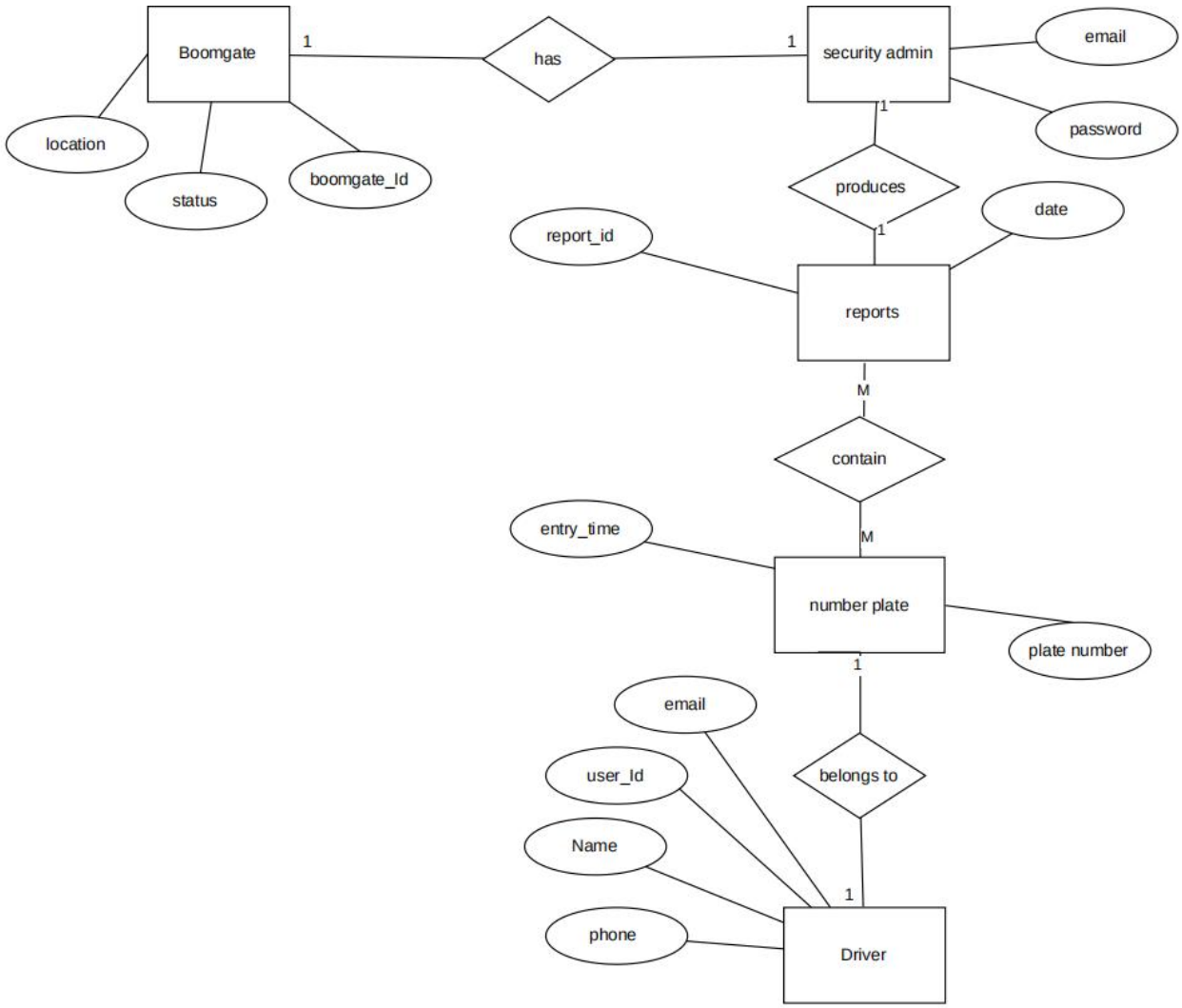


Figure 9: ER Diagram

4.3.2 Normalized Databases

1st Normal Form

driver_id	first_name	last_name	email	phone_number	vehicle_id
1	John	Mtetwa	jmtetwa@gmail.com	0713768177	333-23(1)
2	Jane	Moyo	jmoyo@gmail.com	07865789000	333-23(2)

Table 3: Drivers Table

Vehicles Table

Vehicle_id	Plate_number
1	ABC-234
2	ADB-196

Table 4: Vehicles Table

Security Admins Table

Admin_id	Admin_email	Admin_password
1	tncube@gmail.com	123
2	jteki@gmail.com	Ab23

Table 5: Security Admins Table

2nd Normal Form

Drivers Table

Driver_id	First_name	Last_name	email	Phone_number
1	John	mtetwa	jmtetwa@gmail.com	0713768177
2	Jane	moyo	jmoyo@gmail.com	07865789000

Table 6: Drivers Table

Vehicles Table

vehicle_id	plate_number
1	ABC234
2	ABD-196

Table 7: Vehicles Table

Driver Vehicles Table

Driver_id	Vehicle_id
1	1
2	2

Table 8: Driver Vehicles Table

Security Admins Table

admin_id	email	password
1	tncube@gmail.com	123
2	jteki@gmail.com	AB23

Table 9: Security Admins Table

4.4 Program Design

4.4.1 Class diagram

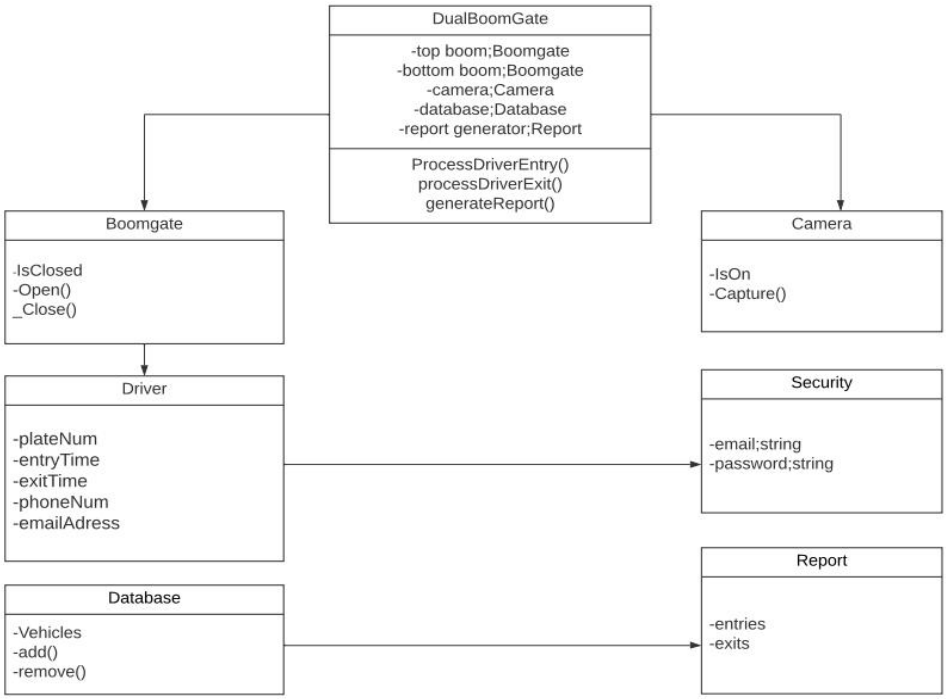


Figure 10: Class Diagram

4.4.2 Sequence Diagram

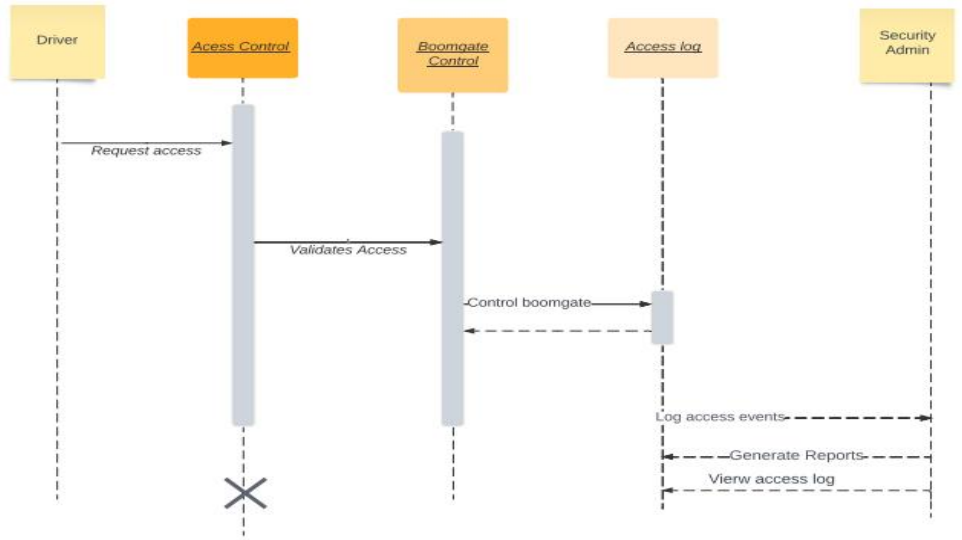


Figure 11: Sequence diagram

4.4.3 Package Diagram

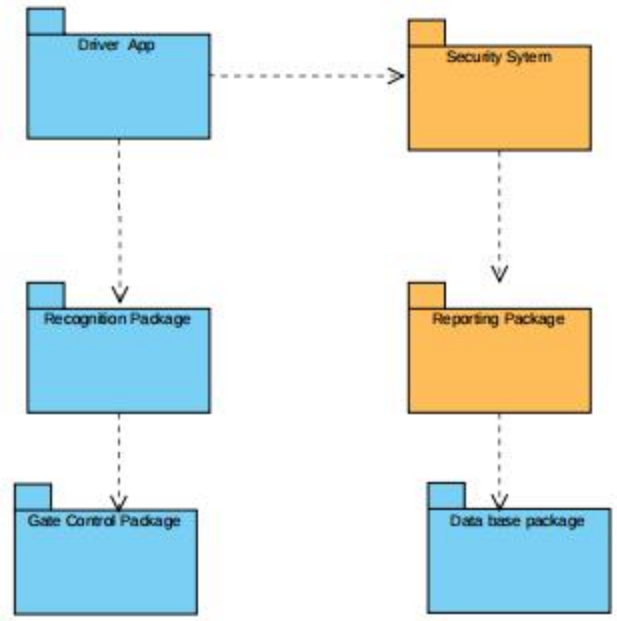


Figure 12: Package diagram

4.4.4 Pseudo Code

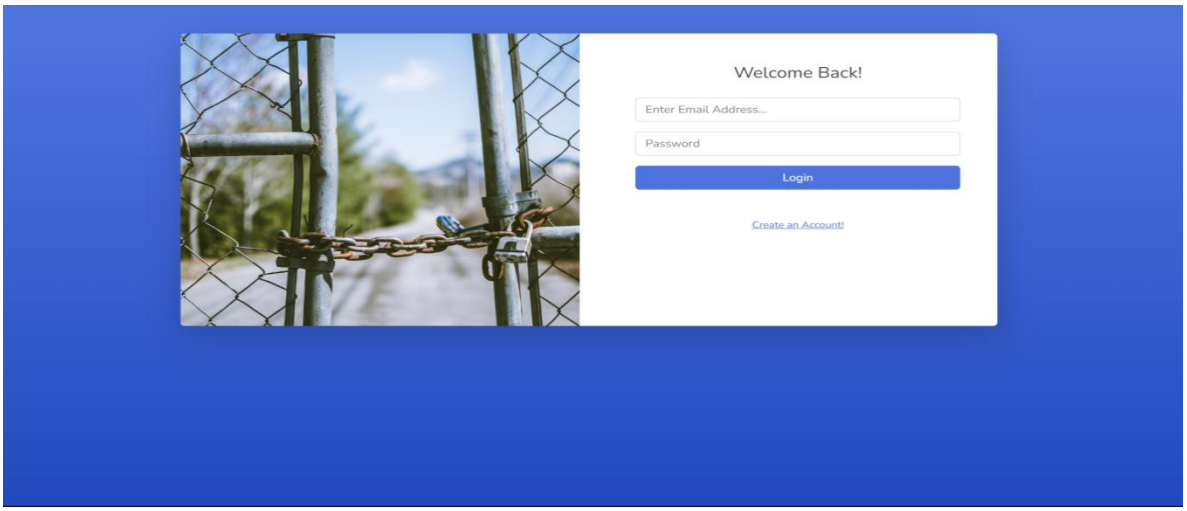
```
// Initialize system components

sensors = initialize_sensors()

camera = initialize_camera()

plate_recognizer = initialize_plate_recognizer(API_KEY)

report_generator = initialize_report_generator()


// Main loop

while True:

    // Check for vehicles at entrance

    if sensors.entrance_sensor.triggered():
```

```
// Capture vehicle image
image = camera.capture_image()

// Use plate recognizer to get license plate number
plate_number = plate_recognizer.recognize_plate(image)

// Log vehicle entry in report
report_generator.log_entry(plate_number)

// Open entrance gate
entrance_gate.open()

// Wait for vehicle to pass over exit sensor
while not sensors.exit_sensor.triggered():
    continue

// Capture vehicle image at exit
image = camera.capture_image()

// Use plate recognizer to get license plate number at exit
exit_plate_number = plate_recognizer.recognize_plate(image)

// Compare plate numbers to ensure the same car entered and exited
```

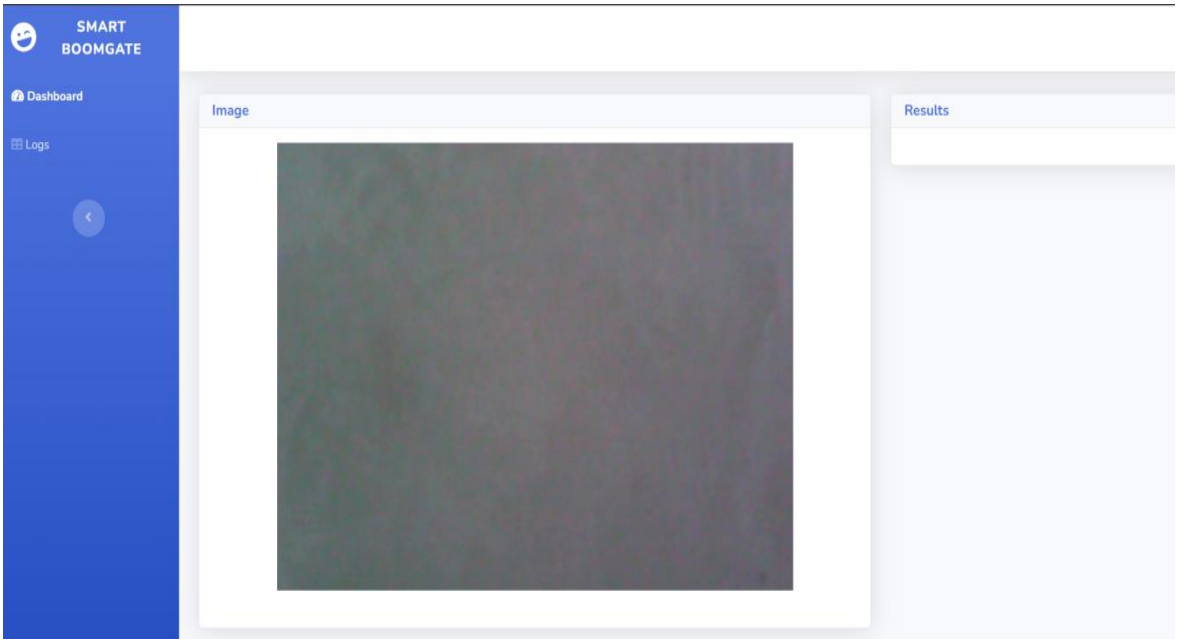
```
if plate_number == exit_plate_number:
    // Log vehicle exit in report
    report_generator.log_exit(plate_number)

    // Open exit gate
    exit_gate.open()

    // Wait for vehicle to clear exit sensor
    while sensors.exit_sensor.triggered():
        continue

    // Close entrance and exit gates
    entrance_gate.close()
    exit_gate.close()
else:
    // Log error in report
    report_generator.log_error(plate_number, exit_plate_number)

    // Close entrance and exit gates
    entrance_gate.close()
    exit_gate.close()
```

4.5 Interface Design

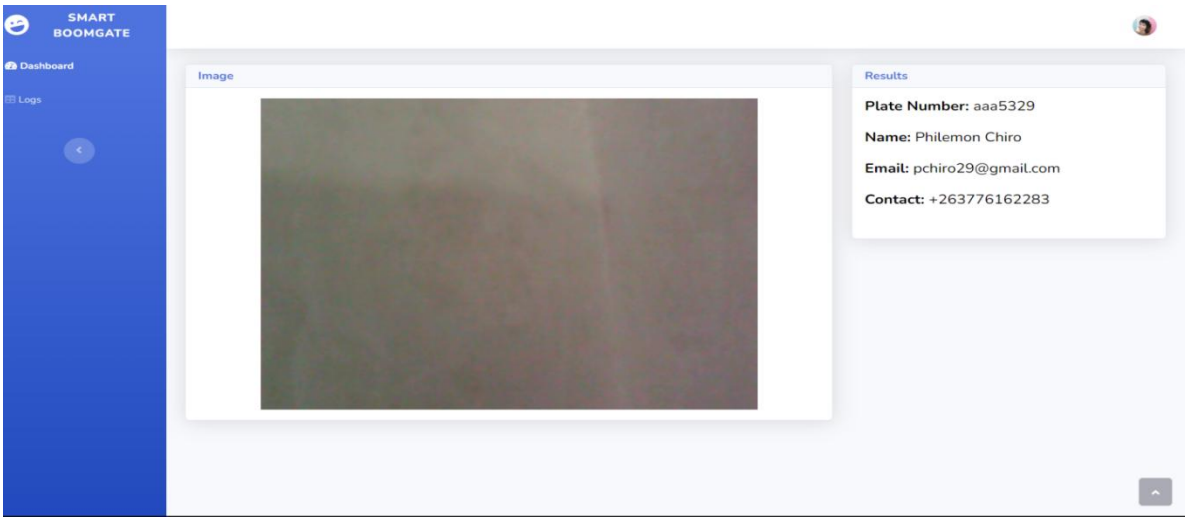
4.5.1 Screenshots of user interface



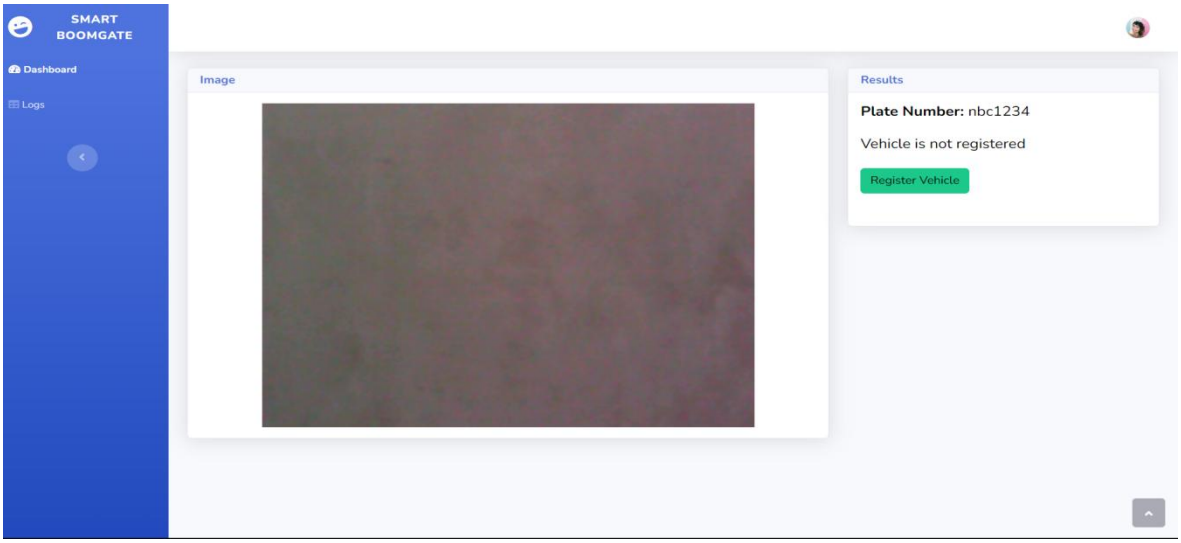
The above picture shows the login page for the administrator which uses email adress to login.

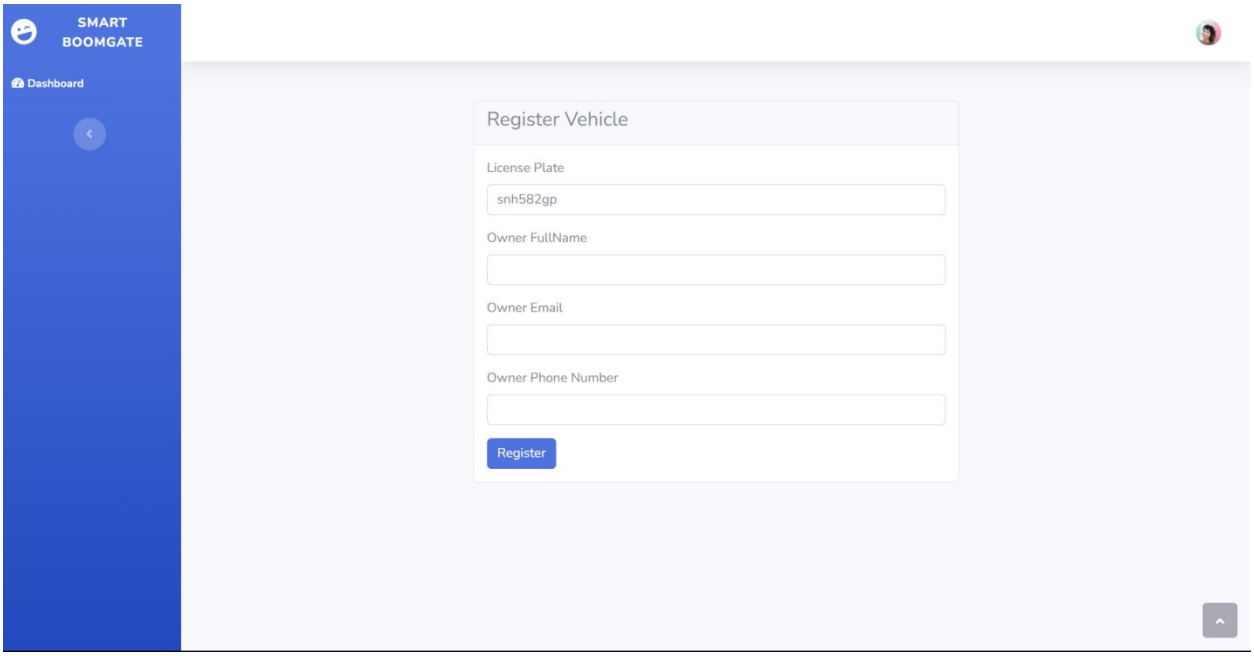


This is the page shown after login where the capturing of the number plates is done to produce results of authentication.



The above picture shows the results of a registered vehicle which means vehicle is allowed access.





The administrator can register a new vehicle.

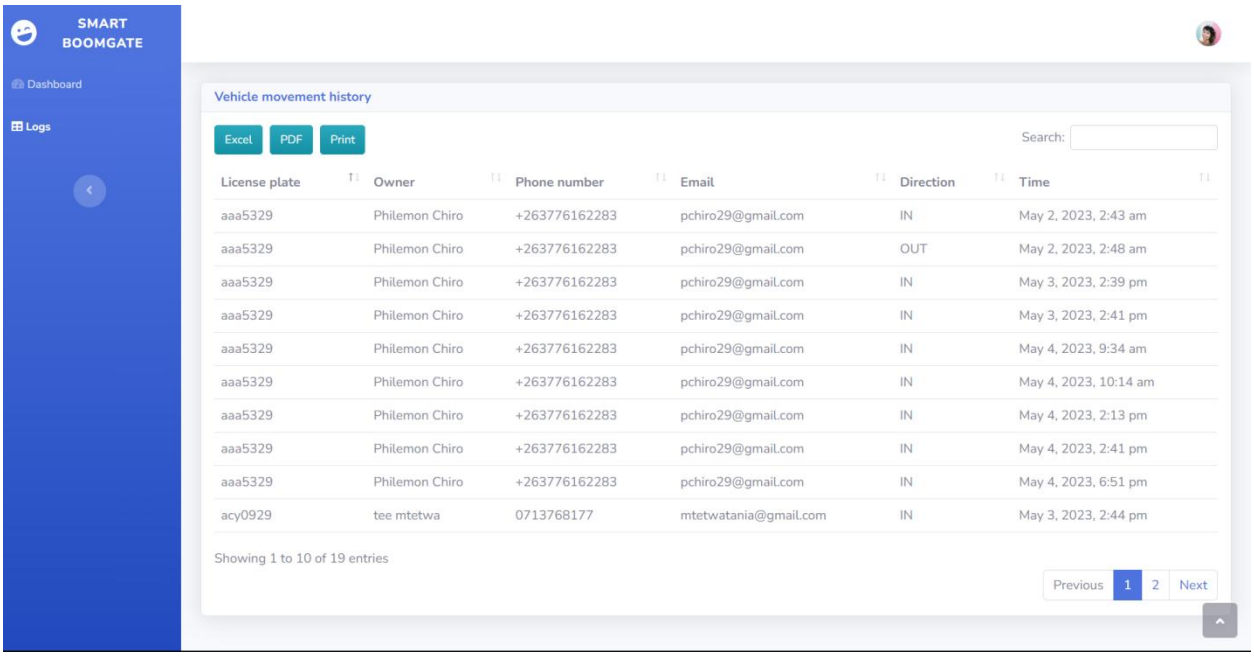


Figure 13: System screenshots

This page shows the history of vehicle movements which produce reports as pdf,excel or prin

CHAPTER 5: IMPLEMENTATION AND TESTING

5.1 Introduction

The implementation and testing chapter of the Automated Dual Boom gate System with Number Plate Recognition and Reports project is a critical phase in the development process.The primary objective of this chapter is to provide a detailed description of the implementation process, including hardware and software installation, configuration, and integration. Additionally, this chapter will cover the testing procedures used to validate system functionality, performance, and reliability. The successful implementation and testing of this project will result in an efficient and effective dual boomgate system that can accurately recognize number plates and generate reports for improved security measures.

5.2 Implementation

The automated dual boom gate system with number plate recognition and reports production was implemented using several hardware and software components. The hardware components included sensors, cameras, an Arduino microcontroller, and a boom gate system. The software components included online license plate recognizer software API, Python, PHP, and XAMPP.

The first step in the implementation was to install and configure the hardware components, including the sensors, cameras, and boom gate system. The sensors were installed at the entry and exit points of the premise to detect the presence of vehicles. The cameras were installed to capture the license plate images of the vehicles as they approached the gate.

The next step was to integrate the online license plate recognition software API with the system. The API was used to analyze the license plate images captured by the cameras and to compare them with a database of authorized vehicles. The license plate recognition software API was integrated with Python, which was used to access the API and handle the data.

The Arduino microcontroller was used to control the boom gate system. The microcontroller was programmed to receive signals from the sensors and the license plate recognition software API. If the vehicle was authorized, the microcontroller would activate the boom gate system and allow

the vehicle to enter or exit the premise.Finally, the reporting function was implemented using PHP and XAMPP. The PHP script was used to extract data from the license plate recognition software API and store it in a MySQL database. The XAMPP server was used to host the PHP script and generate reports on vehicle access and activity.

Pseudo code

```
// Initialize system components
sensors = initialize_sensors()
camera = initialize_camera()
plate_recognizer = initialize_plate_recognizer(API_KEY)
report_generator = initialize_report_generator()

// Main loop
while True:
    // Check for vehicles at entrance
    if sensors.entrance_sensor.triggered():
        // Capture vehicle image
        image = camera.capture_image()

        // Use plate recognizer to get license plate number
        plate_number = plate_recognizer.recognize_plate(image)

        // Log vehicle entry in report
        report_generator.log_entry(plate_number)
```

```
// Open entrance gate
entrance_gate.open()

// Wait for vehicle to pass over exit sensor
while not sensors.exit_sensor.triggered():
    continue

// Capture vehicle image at exit
image = camera.capture_image()

// Use plate recognizer to get license plate number at exit
exit_plate_number = plate_recognizer.recognize_plate(image)

// Compare plate numbers to ensure the same car entered and exited
if plate_number == exit_plate_number:
    // Log vehicle exit in report
    report_generator.log_exit(plate_number)

    // Open exit gate
    exit_gate.open()

    // Wait for vehicle to clear exit sensor
```

```
        while sensors.exit_sensor.triggered():
            continue

        // Close entrance and exit gates
        entrance_gate.close()
        exit_gate.close()
    else:
        // Log error in report
        report_generator.log_error(plate_number, exit_plate_number)

        // Close entrance and exit gates
        entrance_gate.close()
        exit_gate.close()
```

5.3 Testing

Testing techniques implemented include ,the process of executing a program with the intent of getting bugs (errors or other defects).The system was tested at different levels of design starting with unit testing then integration and the overall system testing. The users of the system were also involved in testing to accept the system and deem it worthy of deployment.

Verification and validation of the system was done

I. To ensure that the system meets the specified requirements and performs as expected.

II. To identify and correct any errors or defects in the system before it is released to users.

III. To ensure that the system is reliable, efficient, and secure.

5.3.1Testing categories and results

White box

White box testing is a software testing technique that involves examining the internal structure and design of the software being tested. The purpose of white box testing is to ensure that the software functions correctly and efficiently, and that all code paths are executed as intended.

To perform white box testing for a smart boomgate system with vehicle registration number plate recognition and reports, the following steps were taken:

1. The source code of the system was reviewed to understand its internal structure and design.

2. All code paths that are relevant to the vehicle registration number plate recognition and reporting functionality were reviewed

3. Test cases were developed that cover all identified code paths, including positive and negative scenarios.

4. Test cases to ensure that the system functions correctly and efficiently, and that all code paths are executed as intended were developed.

5. Defects or issues found during testing recorded, and work was done to resolve them.

5.3.2 Black box

Black box testing is a software testing technique that focuses on the functionality of the system without considering its internal structure or code. In black box testing, the tester only has access to the inputs and outputs of the system and does not have any knowledge of how the system processes these inputs.

To perform black box testing for theboomgate system with vehicle registration number plate recognition and reports, the following steps were perfomed:

1. The functional requirements of the system were identified for features such as vehicle registration number plate recognition, automatic gate opening/closing,and generation of reports

2. Creation of test cases

3. Test cases were executed.

4. Defects were noted and fixed

5. The scenarios were retested

6. Reports generated by the system were verified

5.3.3 Types of testing and results

Functional testing

Functional testing is a type of software testing that verifies the functionality of a system or application. It involves testing each function or feature of the system to ensure that it meets the specified requirements and works as expected.

Functional testing for the system was done and reports, by:

1. Verifying that the boomgate opens and closes properly when a valid vehicle approaches it.

2. Testing the vehicle registration number plate recognition feature by entering different types of license plates and verifying that they are correctly recognized.

3. Checking if the system generates accurate reports on the number of vehicles passing through the boomgate, their entry and exit times, and other relevant data.

4. Testing if the system can handle multiple vehicles approaching simultaneously without any errors or delays.

5. Verifying that the system can detect invalid or unauthorized vehicles and deny them access to pass through the boomgate.

6. Checking if there are any security vulnerabilities in the system that could be exploited by hackers or unauthorized users.

7. Testing if there are any performance issues with the system, such as slow response times or crashes under heavy traffic loads.

8. Verifying that all user interfaces, buttons, menus, and other controls are working correctly and intuitively.

All test cases done were successful .

Non functional testing

Non-functional testing is a type of software testing that focuses on the performance, usability, reliability, and other non-functional aspects of a system. It aims to ensure that the system meets the requirements for quality attributes such as scalability, security, and maintainability.

For the boomgate system with vehicle registration number plate recognition and reports, the non functional testing included:

1. Performance testing: This involves testing the system's ability to handle a large number of vehicles passing through the boomgate at peak times without slowing down or crashing. It also includes testing the speed and accuracy of the number plate recognition system.

2. Usability testing: This involves testing how easy it is for users to interact with the system, including entering their vehicle registration details and accessing reports.

3. Security testing: This involves testing the system's ability to prevent unauthorized access to sensitive data such as vehicle registration details and reports.

4. Compatibility testing: This involves testing how well the system works with different types of hardware and software configurations.

5. Reliability testing: This involves testing how well the system performs under different conditions over an extended period of time, including during power outages or other disruptions.

6. Maintainability testing: This involves testing how easy to make changes or updates to the system without causing unintended consequences or introducing new bugs.

The non functional requirements tested and passed the tests

5.3.4 Test cases

Objective: To verify the functionality of the smart boomgate system with vehicle registration number plate recognition and reports.

Preconditions:

- The smart boomgate system is installed and configured properly.

- The vehicle registration number plate recognition feature is enabled.

- The reporting feature is enabled.

Test case	**Steps to execute test case**	**Expected result**	**Actual result**	**Test result(met/not met)**
Vehicle sensing	Park a vehicle in front of the boom gate.	Red light should show vehicle detection.	All vehicles are detected shown by red light	**met**
Boomgate operation	Approach the boomgate with a recognized vehicle.	the boomgate opens automatically.	the boom gate opens automatically.	**met**
reporting feature	Access the reporting feature from the system's dashboard.	The system should display accurate data on vehicles entering and exiting,	The sytem displays accurate data on vehicles	**met**

		including their registration number plates, date, time, and duration of stay.		
system reliability	Simulate power outages or network disruptions to test if the system can recover without losing data or compromising security.	System should recover without losing data or compromising security	System can recover without losing data or compromising security.	**met**

Table 10: Test case table

Post conditions:

- All test cases passed successfully without any errors or issues found.

- The automated boomgate system is fully functional, reliable, and secure for use in real-world scenarios.

5.3.5 Levels of testing and results

Unit testing

Units or components of the system were tested in isolation from the rest of the system. The purpose of unit testing was to ensure that each unit or component of the software application is working as expected and meets its design specifications.Unit testing helps to improve code quality, reduce development time, and increase overall software reliability.These tests were done and were successful:

1. Testing the boomgate opening and closing mechanism to ensure it functions correctly.

2. Testing the number plate recognition system to ensure it accurately reads and records number plates.

3. Testing the reporting system to ensure it generates accurate reports of vehicles entering and exiting the premises.

4. Testing the integration between the boomgate, number plate recognition system, and reporting system to ensure they work together seamlessly.

5. Testing for edge cases such as incorrect number plate readings or vehicles attempting to enter without proper authorization.

6. Testing for security vulnerabilities such as attempts to bypass the boomgate or manipulate the number plate recognition system.

7. Testing for scalability by simulating high volumes of traffic entering and exiting the premises.

8. Testing for compatibility with different types of vehicles, including motorcycles and trucks.

9. Perform regression testing after any updates or changes are made to ensure all functionalities continue to work correctly.

Module testing

Module testing, was done to verify the functionality of individual modules or components of a software application. It involved testing each module in isolation from the rest of the system to ensure that it performs as expected and meets its specifications. During module testing the following was done:

1. Boomgate control module testing

2. Number plate recognition module testing

3. Database management module testing

4. Reporting module testing

5. Integration testing

Intergration testing

Integration testing was done to check the interaction between different modules or components of a software system. It was performed after unit testing and before system testing to ensure that all the individual components work together as expected and meet the requirements of the system.

Integration testing for the boomgate system was performed in the following steps:

1. Testing the integration of the boomgates with the number plate recognition system. Verify that the boomgates open and close automatically when a vehicle with a recognized number plate approaches or leaves.

2. Testing the integration of the number plate recognition system with the reporting module. Verify that all data captured by the number plate recognition system is accurately recorded in the reports.

4. Testing different scenarios, such as multiple vehicles approaching at once, incorrect number plates being recognized, or power outages affecting one or both boomgates.

5. Verifying that all error messages are displayed correctly and that appropriate actions are taken when errors occur.

6. Verifying that all security measures are in place to prevent unauthorized access to sensitive data.

7. Conducting performance testing to ensure that the system can handle high volumes of traffic without slowing down or crashing.

8. Conducting regression testing to ensure that any changes made to one part of the system do not affect other parts of the system negatively.

System testing

To evaluate the overall performance and functionality of the complete software system ,system testing was done . It was conducted after the completion of integration testing and involved testing the entire system as a whole, rather than individual components or modules. The purpose of system testing was to ensure that the software meets all specified requirements, functions correctly in its intended environment, and performs as expected under various conditions.This was done and it all met the requirements:

1. Testing the hardware components of the dual boomgate system, including the boomgates, cameras, sensors, and number plate recognition software.

2. Verifying that the number plate recognition software is able to accurately capture and read number plates in different lighting conditions and angles.

3. Testing the system's ability to detect and deny access to vehicles with invalid or unauthorized number plates.

4. Verifying that the system is able to generate accurate reports on vehicle entry and exit times, as well as any incidents or exceptions that occur.

5. Testing the system's response time for opening and closing the boomgates, ensuring that it is fast enough to prevent traffic congestion.

6. Verifying that the system is able to handle multiple vehicles entering and exiting simultaneously without any errors or delays.

8. Verify that all data collected by the system is stored securely and can be accessed only by authorized personnel.

Database and acceptance

In this type of testing the focus was on verifying the functionality, reliability, and performance of a database. It involved checking the integrity of data, validating data relationships, and ensuring that the database is secure and scalable. Database testing is essential for ensuring that an application can handle large volumes of data and perform efficiently.Acceptance testing, also

known as user acceptance testing (UAT), is a type of software testing that verified whether a system meets the requirements and expectations of its users. It involves testing the system from an end-user perspective to ensure that it functions as intended and meets business objectives. Acceptance testing is typically performed after all other types of testing have been completed, and it helps to ensure that the final product is ready for release to customers or stakeholders.

Maintainance

Perfective though the most comon maintenance has a small draw back which is it has wait for bugs and errors to surface which is not really ideal. So initially, preventative maintenance will be done so as to prevent future problems.Regression testing is done so as to ensure that software evolves with less bugs and building upto be a more function-oriented application.

CHAPTER 6:CONCLUSION AND SUMMARY

6.1 Results and summary

The automated dual boom gate system with vehicle registration number recognition and production of reports has been successfully implemented. The system has been tested and it has shown to be highly effective in managing the entry and exit of vehicles in a controlled environment. The system is equipped with advanced technology that allows it to recognize the registration numbers of vehicles as they approach the gate. This feature ensures that only authorized vehicles are allowed access, while unauthorized vehicles are denied entry.The system also generates reports on the number of vehicles that have entered and exited the premises, as well as their registration numbers. This feature makes it easy for management to keep track of the movement of vehicles in and out of the premiseThis feature ensures that there is no need for manual intervention, which reduces human error and increases efficiency.The production of reports on the movement of vehicles in and out of the premises makes it easy for management to keep track of vehicular traffic. This feature helps management make informed decisions about resource allocation, security measures, and other aspects related to vehicular traffic management.Overall, the automated dual boom gate system with vehicle registration number recognition and production of reports is an excellent solution for managing vehicular traffic in a controlled environment. It is highly effective, efficient, and reliable.

6.2 Recommendations and future works

6.2.1 Recommendations

Regular maintenance and testing of the system should be conducted to ensure its smooth operation and avoid any malfunctions. The system should be integrated with a backup power supply to ensure uninterrupted operation during power outages. The vehicle registration number recognition system should be regularly updated with the latest technology to improve accuracy and efficiency. The system should be designed to accommodate different types of vehicles, including those with non-standard sizes or shapes. Adequate security measures should be put in place to prevent unauthorized access or tampering with the system.

6.2.2 Future Work

Integration of the dual boom gate system with other smart city technologies such as traffic management systems, parking management systems, and public transportation systems. Development of a mobile application that allows users to remotely access the dual boom gate system and receive real-time updates on their vehicle's entry and exit times. Implementation of artificial intelligence (AI) algorithms that can analyze data collected by the system to identify patterns and trends, which can help improve traffic flow and reduce congestion.

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APPENDICE A:USER MANUAL OF WORKING SYSTEM

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INTRODUCTION

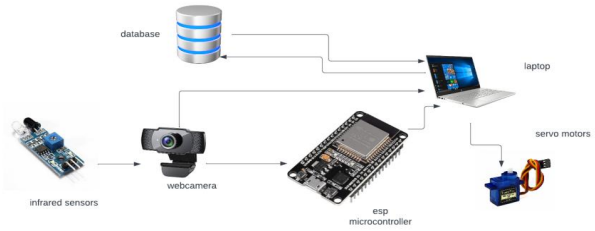
Welcome to the user manual for the automated dual boom gate system with number plate recognition and reports production, designed for driver and security admin use. This system is equipped with advanced sensors and cameras to ensure efficient and secure access control to your premises. By following the instructions in this manual, you can ensure that your automated dual boom gate system operates smoothly and effectively.

Requirements:

Computer with the following minimum requirements:

- Core i5 or better
- 2 GB RAM
- XAMPP
- At least 8 GB free HDD space
- Python 3.7

Prototype Overview



It consists of:

2 servo motors

Webcamera

Sensors

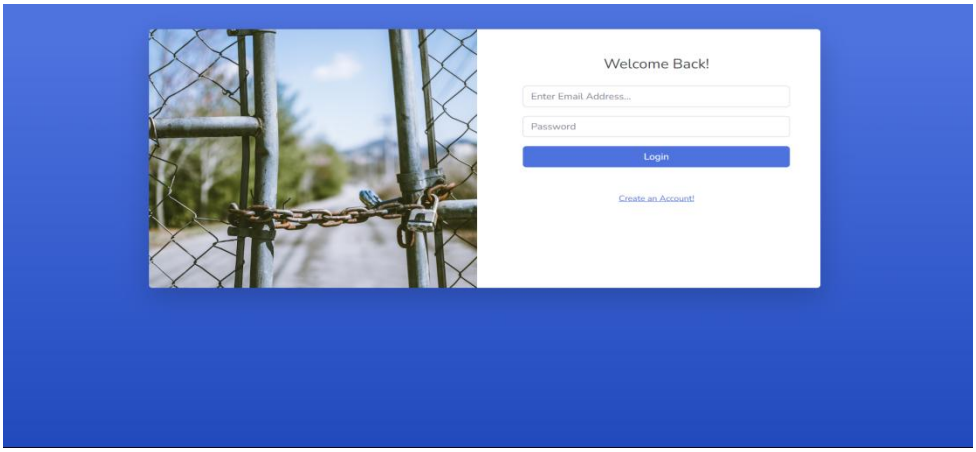
Esp microcontroller

Getting started with the system

The first step is to start Apache and MySql server using Xampp.Make sure that the system database is installed and that the system files are placed at a recognizable location eg httdocs which Apache can easily recognize.

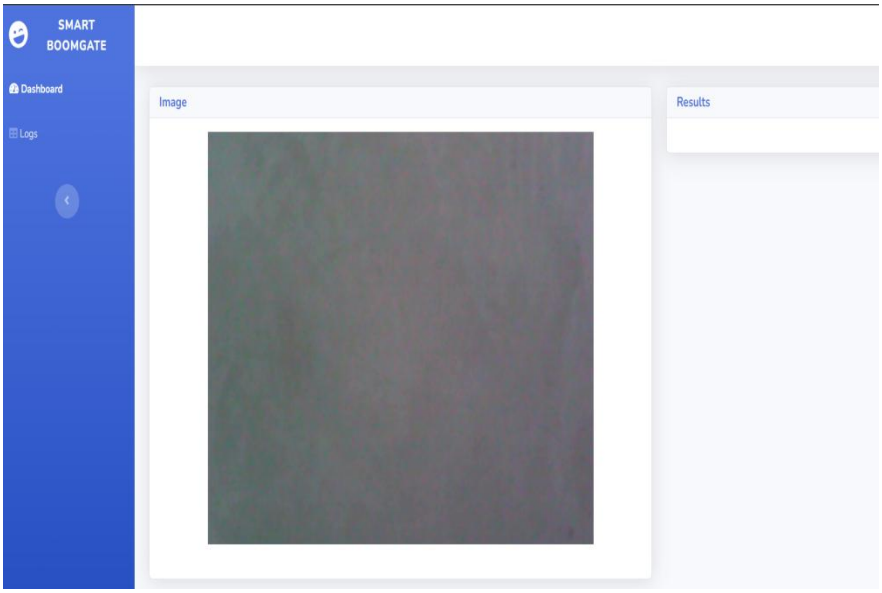
Accessing the user interface

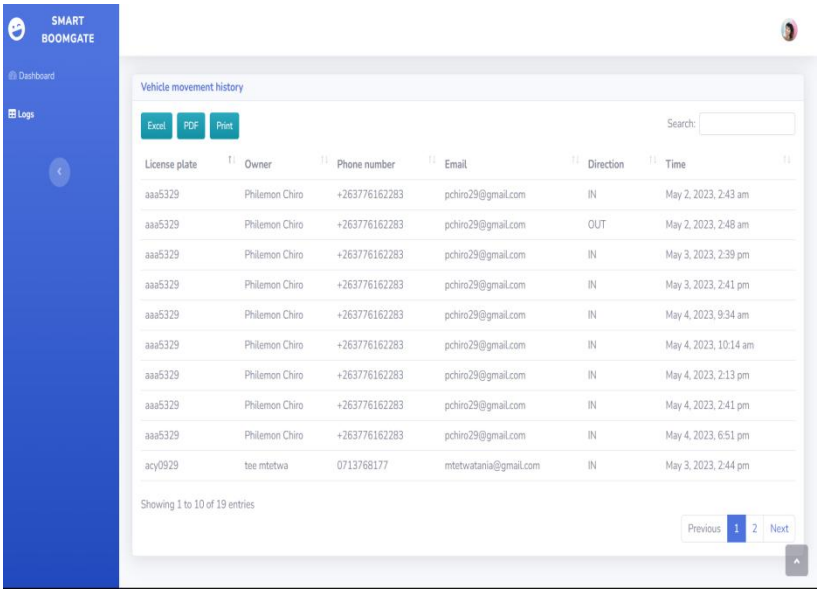
Run the licence plate recognition file in the httdocs.Use any browser to access the user interface by typing localhost/smartboomgate



The above picture shows a login page were the user can create an account and if he already have an account login using email address.

After login in the next step is to capture pictures and wait for results of whether a vehicle entering is authenticated or not





Reports of the vehicle movement are accessed here and the reports can be downloaded as pdf and excel or printed.

Exiting the system

Simply log out of the system by pressing the log out button. Disconnect the prototyping from the power supplies and laptop. Store the hardware in a dry and dust free place

APPENDICE B-SAMPLE CODE

Pseudo code

```
// Initialize system components
sensors = initialize_sensors()
camera = initialize_camera()
plate_recognizer = initialize_plate_recognizer(API_KEY)
report_generator = initialize_report_generator()

// Main loop
while True:
    // Check for vehicles at entrance
    if sensors.entrance_sensor.triggered():
        // Capture vehicle image
        image = camera.capture_image()

        // Use plate recognizer to get license plate number
        plate_number = plate_recognizer.recognize_plate(image)

        // Log vehicle entry in report
        report_generator.log_entry(plate_number)

        // Open entrance gate
```

```
entrance_gate.open()

// Wait for vehicle to pass over exit sensor
while not sensors.exit_sensor.triggered():
    continue

// Capture vehicle image at exit
image = camera.capture_image()

// Use plate recognizer to get license plate number at exit
exit_plate_number = plate_recognizer.recognize_plate(image)

// Compare plate numbers to ensure the same car entered and exited
if plate_number == exit_plate_number:
    // Log vehicle exit in report
    report_generator.log_exit(plate_number)

    // Open exit gate
    exit_gate.open()

    // Wait for vehicle to clear exit sensor
    while sensors.exit_sensor.triggered():
        continue
```

```
    // Close entrance and exit gates
    entrance_gate.close()
    exit_gate.close()
else:
    // Log error in report
    report_generator.log_error(plate_number, exit_plate_number)


    // Close entrance and exit gates
    entrance_gate.close()
    exit_gate.close()
```

APPENDICE C -TECHNICAL PAPER

AUTOMATED DUAL BOOMGATE SYSTEM WITH NUMBER PLATE RECOGNITION

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***Abstract*-This paper presents the design and implementation of an automated dual boom gate system with number plate recognition and reports production for the Shamva Gold Mine. The system utilizes a combination of hardware and software components to automate the process of vehicle entry and exit into the mine's premises. The system incorporates high-resolution cameras to capture number plate information, which is then processed by an intelligent software algorithm to authenticate the vehicle and its occupants. The system also generates reports that are accessible by both the driver and security administration, providing real-time data on vehicle movements and access control. Overall, the system is designed to enhance security, improve efficiency, and streamline the vehicle entry and exit process at the Shamva Gold Mine.**

Keywords-automated, boomgate,implementation,design ,recognition

I.INTRODUCTION

This paper describes the development of an automated dual boom gate system with number plate recognition and reports production for the Shamva Gold Mine. The system is designed to automate vehicle entry and exit processes,improve security, and enhance overall efficiency. The system utilizes high-resolution cameras and intelligent software algorithms to capture and process number plate information, authenticate vehicles and their occupants, and generate real-time reports. The reports can be accessed by both drivers and security administration, providing essential data on vehicle movements and access control. The system's implementation at the Shamva Gold Mine has demonstrated significant improvements in security and efficiency, making it an effective solution for managing vehicle access and control at mining sites.

II.PROBLEM STATEMENT

At the Shamva Gold Mine, the current boom gate system is outdated and inadequate. A security guard manually controls the boom gate, and vehicles entering

and exiting the mine must follow a one-way traffic flow. To manage the flow of traffic, drivers sound bells to alert others to give way, creating a noisy and potentially hazardous environment. The manual system also relies on the guard to log the information of vehicles entering and exiting the mine in a book, which can be time-consuming and prone to errors. The lack of a reliable tracking system and the reliance on manual logging can limit the mine's ability to optimize traffic management and improve operational efficiency. The implementation of an automated dual boom gate system with number plate recognition technology can significantly enhance the traffic management capabilities of the Shamva Gold Mine, while reducing noise pollution and improving safety for workers and visitors.

III.LITERATURE REVIEW

"Design and Implementation of an Automated Toll Collection System with Boom Gates" by S. S. Shinde, et al. (2020)

This paper presents a design and implementation of an automated toll collection system with boom gates. The system uses sensors to detect the presence of a vehicle and then opens the gate if the vehicle is authorized. The system also uses RFID to identify the vehicle and deduct toll charges from the vehicle owner's account. The authors also developed a reporting system that generates reports on the vehicles that have passed through the toll booth. The advantages of this system are its efficiency, accuracy, and ease of use. However, the system may not be suitable for areas with high traffic, and the sensors may not work in all weather conditions.

"Automated Boom Gate System with Vehicle Detection and Counting" by A. K. Singh, et al. (2021)

This paper presents a design and implementation of an automated boom gate system with vehicle detection and counting. The system uses sensors to detect the presence of a vehicle and then opens the gate if the vehicle is authorized. The system also uses a vehicle counting algorithm to determine the number of vehicles that have entered and exited the premises. The authors also developed a reporting system that generates reports on the vehicles that have entered and exited the premises. The advantages of this system are its efficiency, accuracy, and ability to count vehicles. However, the system may not be suitable for areas with high traffic, and the sensors may not work in all weather conditions.

Smart Boom Gate System with Mobile Application Integration" by M. S. Kulkarni, et al. (2021)

This paper presents a design and implementation of a smart boom gate system with mobile application integration. The system uses sensors to detect the presence of a vehicle and then opens the gate if the vehicle is authorized. The system also integrates with a mobile application that allows users to remotely control the gate and receive notifications when their vehicle enters or exits the premises. The authors also developed a reporting system that generates reports on the vehicles that have entered and exited the premises. The advantages of this system are its efficiency, accuracy, and ease of use. However, the system may not be suitable for areas with high traffic, and the sensors may not work in all weather conditions.

"Smart Parking System Using IoT and Number Plate Recognition" by R. Kumar, et al. (2020)

16.This paper presents a design and implementation of a smart parking system using IoT and number plate recognition. The system uses a camera to capture the number plate of the vehicle and then opens the gate if the number plate is authorized. The authors also developed a reporting system that generates reports on the vehicles that have entered and exited the premises. The advantages of this system are its efficiency, accuracy, and ease of use. However, the system may not be suitable for areas with poor lighting conditions, and the number plate recognition algorithm may not work for all types of number plates.

"Smart Toll Collection System using Number Plate Recognition and RFID" by S. S. Shinde, et al. (2020)

This paper presents a design and implementation of a smart toll collection system using number plate recognition and RFID. The system uses a camera to capture the number plate of the vehicle and then opens the gate if the number plate is authorized. The system also uses RFID to identify the vehicle and deduct toll charges from the vehicle owner's account. The authors also developed a reporting system that generates reports on the vehicles that have passed through the toll booth. The advantages of this system are its efficiency, accuracy, and ease of use. However, the system may not be suitable for areas with poor lighting conditions, and the number plate recognition algorithm may not work for all types of number plates.

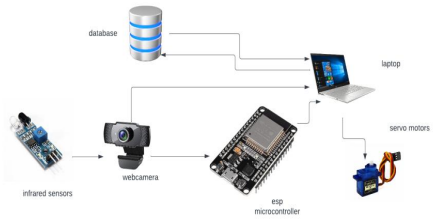
18. "Smart Parking Management System using Image Processing and Number Plate Recognition" by M. S. Kulkarni, et al. (2020)

This paper presents a design and implementation of a smart parking management system using image processing and number plate recognition. The system uses a camera to capture the number plate of the vehicle and then opens the gate if the number plate is authorized. The authors also developed a reporting system that generates reports on the vehicles that have entered and exited the premises. .

IV.SOLUTION

The solution that is to be implemented to improve the boom gate system at Shamva Gold Mine is an automated boom gate system with number plate recognition and reporting capabilities. The boom gate can be automated to open and close automatically as vehicles enter and exit the mine, eliminating the need for a security guard to control it manually. The number plate recognition feature can capture the number plates of vehicles as they enter and exit the mine, ensuring that only authorized vehicles are allowed to enter. The system can also generate reports that show the number of vehicles that have entered and exited the mine, the time and date of entry and exit, and any other relevant information. This will improve the accuracy and reliability of the data compared to a manual logbook system.

A. SOLUTION ARCHITECTURE



B. Coding strategy

The software development methodology used in this project was agile extreme programming method. For the software php and python programming languages were used. For hardware arduino was use.

C. Experimentation and Testing

Test case	Expected outcome	Result
Park a vehicle in front of the boomgate	Sensor light should show vehicle sensing	success
Approach boomgate with recognized number plate	The boom gate opens automatically	success
Access the reporting feature from the system	Accurate data on vehicles movement should be displayed	success
Approach the boomgate with an unrecognized number plate	A not registered result should appear and the boomgate should not open	success

V.CONCLUSION

In conclusion, the automated dual boom gate system with number plate recognition and reports production is an effective solution for managing vehicle access and control at mining sites such as the Shamva Gold Mine. The system's ability to automate the process of vehicle entry and exit, coupled with its advanced security features, provides a reliable and efficient solution for managing the flow of vehicles in and out of the mine. The system's real-time reporting capabilities also provide valuable data for both drivers and security administration, enabling them to make informed decisions about access control and vehicle management. Overall, the implementation of such a system can enhance security, improve efficiency, and streamline the vehicle entry and exit process, making it an essential tool for mining sites and other high-security areas.

VI. FUTURE WORK

Integration of the dual boom gate system with other smart city technologies such as traffic management systems, parking management systems, and public transportation systems. Development of a mobile application that allows users to remotely access the dual boom gate system and receive real-time updates on their vehicle's entry and exit times. Implementation

of artificial intelligence (AI) algorithms that can analyze data collected by the system to identify patterns and trends, which can help improve traffic flow and reduce congestion.

VII.BIBLIOGRAPHY

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