Traffic Offense Management System for Police Divisions in Central Province

Chamara Sameera Jayarathna

IT2020142

Faculty of information Technology

Horizon Campus

Supervisor: Mr. Daminda Herath

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This project proposal is submitted in partial fulfilment of the requirement of the Degree of Bachelor of Science (Hons) in Information Technology of the Horizon Campus

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Acknowledgements

Finally, it is my pleasure to acknowledge my benefactors who made it possible to realize this project. I would like to express my sincere gratitude to my project advisor Lecture Mr. Daminda Herath for his helpful recommendation, and constructive criticism that really helped me in the process of development. Many thanks go also to my instructors and the Department of Information Technology Department at Horizon Campus for offering the tools and information required completing this effort.

I would also like to thank my friends and families because they have supported and endured me throughout the project. Last but by no means the least, I express my gratitude to all people who contributed the technical and moral support to complete this work.

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1 Abstract

proposed research tackles the prevalent issues surrounding traffic violations and fine payment inefficiencies in Sri Lanka. Despite the common occurrence of traffic accidents and violations, the current process for paying fines is outdated and unfair. Manual payment procedures at police stations and post offices lead to time-consuming processes for both drivers and officers, fostering opportunities for disputes and fraud. To address these challenges, your study proposes the development of a mobile-based application. Leveraging the widespread use of smartphones and advancements in technology, the app aims to streamline fine payment processes, enhance data accuracy, and facilitate efficient communication between officers and drivers. Through the implementation of such a solution, your research endeavors to mitigate existing inefficiencies and promote a more transparent and convenient method for managing traffic violations in Sri Lanka.

- Incidents of conflict between police and drivers are on the rise.
- Widespread accidents and violations lead to constant traffic jams.
- Despite technology, there is no efficient way to pay fines.
- Lack of proper system allows potential fraud by some traffic police officers.
- A mobile app /web can be used on smartphones for easy fine payment.
- Implementing a mobile app/web can revolutionize the fine payment process.

The entire project is develop using PHP and React as the main language and MySQL as a database. The system. Android Studio/Flutter is the development environment I'm utilizing. The development process is called Modified (Iterative) Waterfall Methodology.

2 Introduction

2.1 Background of the Study

Accidents and violations have become commonplace in most parts of the island. Due to the occurrence of these traffic accidents, traffic congestion is a constant occurrence.

Based on all these issues, we can see daily newspapers and TV channels. One thing that is not discussed and paid attention to by many people is about the difficulty and injustices of paying fines to the traffic police for traffic violations [1].

In many cases, there is no proper system in paying the fines and for that the drivers have to go to the police station and the post office and spend a lot of time to pay the fines. No matter how advanced the technology is, there is still no proper method for this process. Therefore, the traffic police have to pay the fine by paying the bills as usual.

Here, some traffic police officers can easily commit frauds and crime. Nowadays, due to these reasons, many controversial incidents between police officers and drivers are reported more and more from every region [2].

I also have a lot of experience in such events. Mobile based as a solution to all these problems I think it is appropriate to create a suitable process for this through an App.

I think that this solution is more suitable because the technology is at a very high level nowadays and every person has a smart phone. This way drivers can easily pay the fines for the rules they have broken without having to spend time with the traffic police officers. In addition, this method can create a reliable system to store more accurate information and retrieve information when needed.

2.2 Problem Statement

The Traffic Police is a major unit of the Sri Lankan Police Department. No matter how much the traffic police try to make the conditions of the drivers and traffic peaceful, nowadays the increase in vehicles and unruly drivers. There are a lot of disputes between the traffic police and the drivers.

In addition, due to fraudulent officials, some erring drivers go free and other drivers suffer injustices. Drivers still have to pay fines manually for traffic violations. Here also to the police officer This process is a difficult task for the driver as well. Furthermore, the officer has to hand write the receipt. This increases the chances of injustices and frauds.

When drivers are issued a spot fine, the driver must then go to the police. There you will get a fine payment form from the traffic department and take it back to pay the fine You have to go to the post office. After paying the fine, you have to go again to find the officials who imposed the fine. Drivers have to spend a lot of time and effort in this process because the traffic in the city is high and the designated places are not known properly. If unable to do so No matter where they are for another 14 days, they must come back to the relevant police station and pay the fine and get the driver's license. Otherwise, the fine will be increased again.

This process is an inefficient process and with the development of technology, various alternative methods are being implemented in many countries, but still not implemented in Sri Lanka. To avoid loopholes in the process and misunderstandings between officials and drivers and to deal with issues of officials and drivers efficiently and quickly One mobile based app/web is suggested.

2.3 Motivation and Significant of the Project

The concept was inspired by the continuing problems with Sri Lanka's current system of collecting fines for traffic violations. The current manual system is not just difficult but also vulnerable to fraud and unfairness, creating disputes between traffic police and drivers. Given the growing number of cars on the road and the complexity of the current system, a more efficient and transparent solution is desperately needed.

The project's significance depends on how well it can use a mobile application to address these problems. With the growing popularity of smartphones and advances in technology, the suggested software hopes to simplify the process of paying fines, eliminating the need for drivers to physically visit post offices and police stations. By creating a more reliable and safe payment method, this eliminates the chance of fraudulent operations and saves time and effort for both drivers and officials.

The objective of the project is to employ technology to create an improved and easy to use information storage system that will allow for efficient retrieval when needed. Through a reduction of confrontations and the assurance of a fair and timely resolution of infractions, the introduction of this type of smartphone application/web application in Sri Lanka has the potential to enhance relations between drivers and traffic police. Enhancing the current traffic fee payment system and bringing it into compliance with recent advances in technology is the project's ultimate goal.

2.4 Scope and Objectives of the Project

2.4.1 Aim of the Project

- To develop Mobile based traffics offence and fine Charging reporting system for central province.

The main goal of the proposed project is to establish a mobile-based system that would efficiently report traffic violations and impose fines on violators in Central Province. This will improve traffic management and safety by enabling quick and accurate fine processing.

2.4.2 Objectives of the Project

- Traffic Rule Awareness:

Promote awareness of traffic rules and regulations through the mobile platform to reduce offenses.

- Automated Notification System:

Implement an automated notification system to inform offenders about fines and deadlines through mobile alerts.

- Digital Recordkeeping:

Establish a digital recordkeeping system to maintain a comprehensive database of traffic offenses and fines.

- Enhanced Accountability:

Improve accountability by tracking and recording fine payments through the mobile platform.

- Cost-Efficient System:

Develop a cost-efficient mobile-based system for managing traffic offenses, reducing paperwork and manual processes.

2.5 Expected Deliverables

- Mobile App: Develop an easy-to-use app for reporting and charging traffic offenses.
- User System: Create secure user registration and login.
- Offense Database: Set up a central database for storing reported offenses.
- Fine Calculation: Implement an algorithm to calculate fines based on offense severity.
- Payment Integration: Integrate payment gateways for users to pay fines within the app.
- Notification System: Establish automated notifications for payment confirmations and reminders.
- Real-time Dashboard: Develop a web-based dashboard for real-time offense monitoring.
- Admin Panel: Create a secure admin panel for managing offenses, fines, and user accounts.

2.6 Limitation of the project

- Challenges in coordinating stakeholders such as law enforcement, government departments, and technology providers.
- Dependency on stable internet access and robust technological infrastructure, which may vary across different areas.
- Legal considerations regarding data privacy and security necessitate compliance with relevant laws to safeguard user information.

2.7 Chapter outline

- Development of a mobile app/web to address traffic fine inefficiencies in Sri Lanka, focusing on payment streamlining, data accuracy enhancement, and communication improvement.
- Key challenges include stakeholder coordination, internet stability, and legal compliance.
- Despite hurdles, the project is essential for modernizing fine payments and improving relations between drivers and traffic police through technological innovation.

3 Literature Review.

- In order to address the increasing problem of traffic violations, S.T. Wickramasinghe launches an online motor traffic violation management system in Sri Lanka, focusing on faster fee payments and record-keeping. The PHP-implemented web-based solution easily combines multiple technologies to improve accuracy and efficiency. For more details, click this link.: http://dl.ucsc.cmb.ac.lk/jspui/handle/123456789/4516 [3].

- In the article "Taxation by Citation? Min Su explores the revenue motive for traffic fines at the county level in California using data spanning a period of 12 years. Results show that counties, especially those with a significant number of Hispanic residents and low incomes, have a tendency to increase per capita traffic fines after a loss of tax revenue. Interestingly, counties that rely on hotel taxes have a greater tendency to raise traffic fines, implying that there may be a policy of tax-exporting to drivers who are not from the area. The research explains the complex link between traffic penalties and local government revenue goals. You can view the paper by selecting the following DOI link for further information: https://doi.org/10.1111/puar.13125 [4].

- Sri Endah Wahyuningsih and Muchamad Iksan investigate the benefits of Indonesia's E-Traffic Ticketing (E-Tilang) System in dealing with traffic infractions. The impact of the system is assessed by the research, which highlights its efficacy and efficiency in the administrative handling of traffic infraction cases. Notwithstanding its advantages, certain problems have been identified, such as public indifference, limited availability, and false beliefs about the intricacy of the system. The study offers useful details about the benefits and difficulties related to the E-Tilang system's implementation. The research paper can be accessed at for more details. (http://creativecommons.org/licenses/by-nc/4.0/) [5].

- The Web-Based Motor Traffic Fine and Driver Point Management System, created by A. Ismathdeen, offers drivers in Sri Lanka an improved approach for issuing fines, paying them, and receiving demerit points. The Laravel 8 Framework is efficiently employed by the system to automate the fine process, hence augmenting road safety and improving traffic management. To get an accurate grasp, all the details can be reviewed. through the provided link: https://dl.ucsc.cmb.ac.lk/jspui/handle/123456789/4667 [6].

- In the study by Yerzhan Maratovich KHAKIMOV, the focus is on administrative actions addressing road safety violators in both Kazakhstan and foreign jurisdictions. The article underscores the importance of implementing effective measures and drawing insights from international legal practices. It highlights the need for improvements in addressing traffic violations, offering valuable recommendations for enhancing the existing systems. For a more in-depth exploration of the findings and recommendations, the article can be accessed at https://www.ceeol.com/search/article-detail?id=695028 [7].

- In a study conducted by Olivia Renny Irmayasari and Muhajir R. Hakim, the effectiveness of the Online Non-Tax State Revenue Information System (SIMPONI) is assessed in conjunction with the e-tilang application for the management of traffic fines in the Jambi State Prosecutor's Office, Indonesia. The research explores the integration of SIMPONI and the e-tilang app to enhance efficiency in handling traffic fines. By evaluating the system's performance, the study provides insights into the streamlined processes and improved management of non-tax state revenue. For further details and findings, the complete article can be accessed at https://ejournal.iainkerinci.ac.id/index.php/cspj/article/view/2798 [8].

- Conducted by the Department of Sociology at the University of Nevada, Las Vegas, this paper delves into the costs and consequences of traffic fines and fees in Nevada, focusing on a case study of open warrants in Las Vegas. The research exposes the disproportionate impact on impoverished and Black communities, accentuating the perpetuation of racial and economic disparities within the realm of traffic violations. By analyzing the implications of fines and fees, the study sheds light on the broader social and economic consequences of such practices. For those interested in a comprehensive exploration, the complete paper is available at https://doi.org/10.3390/socsci10110440 [9]

Table 1: Literature Review

Title	Authors	Key Findings	
implementation of online motor traffic violation management system	Wickramasinghe, S.T.	This web-based system in Sri Lanka streamlines traffic fine payments and recordkeeping, addressing the growing issue of traffic violations. Developed in PHP, it successfully integrates various technologies for efficiency and accuracy.	http://dl.ucsc.cmb.ac.lk/jspui/handle/123456789/4516
E-challan: Online traffic rules violation penalty and management system	Jain Aaditya	The E-Challan System streamlines traffic penalty management, minimizing paperwork, and fostering compliance, creating an efficient online platform for police-driver interaction.	https://www.indianjournals. com/ijor.aspx?target=ijor:sajmmr&volume=11&issue=12&article=004
Web Based Motor Traffic Fine And Driver Point Management System	Ismathdeen, A.	The Web-Based Motor Traffic Fine and Driver Point Management System streamlines fine issuance, payment, and demerit points, promoting discipline among Sri Lankan motorists for enhanced road safety. Developed with Laravel 8 Framework, it efficiently automates the fine process and improves overall traffic management.	https://dl.ucsc.cmb.ac.lk/jspui/handle/123456789/4667

3.1 Critical evaluation of the existing solution

3.1.1 Manual Fine Payment Process

Current Issues: At present the process to pay the traffic fines in Sri Lanka is mostly conventional where the drivers have to go to the police station or post office. This can be a very tiresome and an unproductive exercise particularly for people driving in busy cities. Some of these may involve drivers having to take sick leaves or even extravagant distances on some errands.

Impact: Such a manual method poses a lot of inconvenience to the drivers and can play a role in discouraging timely fine repayments. Due to the high time involved, people are discouraged from observing them even the fines which in turn will be paid late and attract other penalties.

Opportunity for Improvement: A digital solution to this could be that drivers pay their fines via their mobile phones thereby not requiring transport. This would in all likelihood enhance compliance astronomy and hence decrease administrative costs.

3.1.2 Risk of Fraud and Disputes

Current Issues: Lack of a secure and standardized method of handling fines increases the likelihood of the fines being handled inappropriately. There are examples when such kind of fraud may occur, for example, when traffic fines are processed or when drivers are forced to pay bribes instead of fines.

Impact: Such risks are capable of demoralizing the citizens and creating a lot of tension between the police and the car owners. This also leads to the obscure clarification of the traffic management system and results in unwanted controversy.

Opportunity for Improvement: The design of a safe payment solution would eliminate these problems if they were to develop an online platform for the company. This means that the rate of fraud in the transaction would reduce and this would ensure that many drivers gain confidence of the fairness of the system.

3.1.3 Inconsistent Record-Keeping

Current Issues: However, the use of the manual record system has a high possibility of human intervention. Concerning offenses fines and payments may drop, be misplaced or mis recorded thus making it difficult to organize the right information at the right time.

Impact: One is unable to keep a clear record of a driver's offenses or guarantee that all the fines levied have been recorded. Documentation mistakes result in inaccurate penalties so that drivers can be frustrate for the wrong penalties they receive due to missing or wrong documents.

Opportunity for Improvement: A digital system with indexed files at the center, would mean maintaining records would be efficient, and proper. It also provided ways data could be made easily accessible and retrievable to both traffic officers and drivers and in the process minimize disputes arising from erroneous data.

3.1.4 Absence of Real-Time Data

Current Issues: In the current system, there are no means by which the authorities and the drivers can share real-time data. Therefore, records of traffic offenses, fines and payments can be a problem or missing from the system. This makes the system slightly less efficient, while the lack of real-time performance also blurs accountability to some degree.

Impact: A driver may be arrested for violations and fines, only to ask for records, to discover that the issues are still pending, and the records are in a lapsed state. This may result to missed payments, higher penalties, and even more, disputes.

Opportunity for Improvement: A real-time that is on a mobile platform would help update the fine payment information automatically for anyone who desires it. This would reduce misunderstandings, when the drivers take appropriate action hence prevent increased penalties because of delayed information.

3.1.5 Less Accessible to Drivers

Current Issues: Drivers are usually unable to retrieve information including the offenses and the respective fines at their own convenience. Without the digital system, they are limited to notification from the authorities, which may not even get to them on time. Also, there is no a clear, open record of fines and viewpoints to which one may easily turn to in order to confirm whether one has a fine or not.

Impact: This limited accessibility can therefore result in violation of the rules due to ignorance on the part of drivers about the fines that await them. It also puts a lot of pressure on drivers who have to physically cross check their records at police stations or post office.

Opportunity for Improvement: The idea of having a mobile-based application would enable the drivers to access information on their offences and fines per—tap on their mobile phones. This would enable them protect themselves by being in a position to prevent compliance from occurring when it was not desired

4 Analysis

4.1 Introduction

In the Software Development Life Cycle (SDLC), the analysis phase scrutinizes collected data to offer insightful conclusions. It turns varied data into usable insight for decision-making by correlating and explaining it. This procedure is necessary to transform inconsistent data into results that make sense. For example, policy changes in traffic violation management systems are informed by analysis of fee payments and patterns of violations. In order to effectively guide system upgrades, it is imperative that meaningful conclusions be drawn from raw data during the analysis phase.

4.2 Feasibility Study

- Technical feasibility

The project's technical viability dictates whether it can be completed using the tools, processes, and software already in use.

- Hardware Component

Table 2:Hardware Components

Hardware Component	Description
Smartphones	Compatible with Android and iOS.
Server	Hosting database and handling transactions.
Internet Connection	Reliable connectivity for users.

- Smartphones: These devices are used by users to get the mobile application and pay their fines online.
- Server infrastructure is required for storing and handling the mobile application's database and backend activities.
- Network infrastructure is responsible for maintaining a steady and safe connection between the server and the mobile application.

- Police departments require computers and other devices at police stations in order to access and control the system.

- Example For Software Component and Hardware Component

Table 3:Example Software and Hardware Component

Hardware	Software
AWS, Azure Server	MySQL/MongoDB/SQLite
Smart Mobile	Android/iOS
Internet Connection	API/Google Map
8GB Ram	Java/js/php/XML/React
SSD - 512	Android Studio

- Software Component

Table 4:Software Components

Software Component	Description
Mobile App Platform	Android or iOS for user-friendly app.
Database Management System	Secure system for storing user data.
Payment Gateway Integration	Integration for secure online payments.
Geolocation Services	Identifying fine locations efficiently.
Security Protocols	Encryption and secure authentication.

- Operational feasibility

Entails a comprehensive assessment of whether the proposed system seamlessly integrates with the operational processes of traffic management authorities. This evaluation involves analyzing the workflow and procedures currently in place and determining how the new system will fit within these frameworks. Additionally, it involves assessing the ease of use for both traffic officers and drivers, ensuring that the system enhances efficiency rather than introducing complexities. Moreover, identifying and addressing any potential resistance to change among

stakeholders is crucial for successful implementation. The feasibility study aims to ensure that the proposed system aligns with operational requirements and facilitates smooth adoption by all involved parties.

- Technical feasibility

Technical feasibility involves a detailed assessment of whether the proposed mobile application can be effectively developed given the available technology and resources. This assessment includes evaluating the compatibility of the application with existing systems and infrastructure. Additionally, it entails analyzing factors such as the required expertise, software and hardware requirements, development tools, and potential challenges or limitations in implementation. The feasibility study aims to ensure that the project is technically viable and can be successfully executed within the constraints of available resources and technology infrastructure.

- Economic feasibility

Delves into a comprehensive examination of the costs associated with both the development and maintenance phases of the mobile application. This analysis includes not only the direct expenses related to software development and upkeep but also the indirect costs such as training, support, and infrastructure upgrades. Furthermore, it assesses potential benefits such as increased fine collection efficiency and reduced disputes to ascertain if the project offers a favorable return on investment (ROI). By thoroughly evaluating these aspects, the feasibility study aims to provide stakeholders with a clear understanding of the economic viability and potential profitability of the project.

- Legal and regulatory feasibility

Involves a thorough examination of the proposed system's compliance with data privacy laws and regulations related to payment processing. This assessment includes ensuring that the system adheres to standards such as GDPR, HIPAA, or other relevant regulations depending on the jurisdiction. Additionally, it entails verifying that the system maintains accuracy and fairness in fine collection and enforcement, avoiding any biases or discriminatory practices. By conducting a detailed analysis of legal requirements and ensuring adherence to them, the feasibility study aims to mitigate potential legal risks and ensure the system's compliance with applicable laws and regulations.

4.3 Fact Finding Techniques

- Interviews with Traffic Management Authorities:

Talk with traffic authorities to learn about the procedures that are currently in place, such as the issuing and collecting of fines, and to identify any operational difficulties.

- Drivers' Survey Results:

Get driver input to learn about their experiences with the present payment system and to obtain ideas for enhancements.

- Observation of Traffic Enforcement Procedures:

Learn about the practical aspects of handling infractions and processing fines by keeping an eye on enforcement activities.

- Analyzing Documents:

Examine rules and policies to make sure they adhere to the law and prevent any problems.

- Stakeholder Idea Generation:

Work together with stakeholders to fulfill diverse requirements and expectations while coming up with creative approaches.

4.4 Requirement Gathering Methodology.

- Check if it's Possible:
  - See if making a mobile app for fine payments is realistic and if it would actually help.
- Check Technology:
  - Look at how many people have smartphones and if the tech can support a new app.
- Learn from Others:
  - Find out how other countries use mobile apps for traffic fines.
- Identify People Involved:
  - Figure out who is affected, like drivers and traffic police.
- Ask Questions:
  - Talk to drivers about their struggles with the current fine payment system. Chat with traffic police to understand their challenges and concern

4.5 Functional requirement

Functional requirements for this project detail the necessary tasks and capabilities the mobile application must possess to manage traffic violations and fine payments effectively. These include functionalities such as user registration, login, and authentication, fine payment processing, violation reporting, automated notifications, and digital recordkeeping. Additionally, the application should promote traffic rule awareness, facilitate demerit point management, and ensure data accuracy. It should also enable seamless communication between users and authorities while being compatible with existing systems and infrastructure.

- **Vehicle Driver:**
  - Sign up and access the mobile application.
  - View the fine print and the transgressions they committed.
  - Able to examine information on the registration date, insurance data, emission test details, license expiration details, and applicant's personal information.
  - Include information about traffic rule violations
  - Use the smartphone app to get alerts about penalties.
  - Obtain comprehensive details regarding the transgression and the associated offence.
  - Within the app, select from a number of integrated payment methods.
  - Obtain payment confirmation and the offense's settlement.

- **Traffic Police Officer:**
  - Reviewing Offense Reports.
  - Receive Alerts.
  - Receive alerts for new offense reports in the system.
  - Verify the reported offense based on the provided evidence.
  - Decide whether the offense is valid and warrants a fine.
  - If the offense is valid, generate a fine with detailed information.
  - Send a notification to the driver informing them of the fine.
  - Update the status of the offense in the system (resolved, pending, etc.).
  - Receive real-time alerts for new offense reports in the system.
  - Evaluate the validity of the offense and determine if it warrants a fine.
  - Ensure transparency in the fine generation process to provide clear information to drivers.

- **System Administrator:**
  - Manage user accounts for drivers and traffic police officers.
  - Ensure data security for user information and offense details.
  - Implement updates and improvements to the mobile app and reporting system.
  - Integrate and maintain payment gateways for transactions.

  Reporting and Analytics:

  - Generate reports on offense trends, fines, and system performance.
  - Analyze data for improvement areas and policy adjustments.

  System Support:

  - Provide user support for app and reporting system issues.
  - Conduct regular maintenance to keep the system running smoothly.

  Compliance and Regulation:

  - Stay updated on traffic regulations.
  - Update the system to comply with legal requirements

4.6 Non-Functional Requirement

- Performance: The system needs to operate swiftly, efficiently handling user requests without delays.
- Reliability: Users must trust that the system will consistently function as expected without unexpected downtime.
- Security: Protection of user data and financial transactions should be paramount, employing strong security measures.
- Scalability: The system should effortlessly adapt to accommodate growing user numbers and data volumes.
- Usability: Interfaces should be user-friendly, ensuring that users can navigate the system easily with minimal assistance.

4.7 Methodology for the System.

4.7.1 System Overview

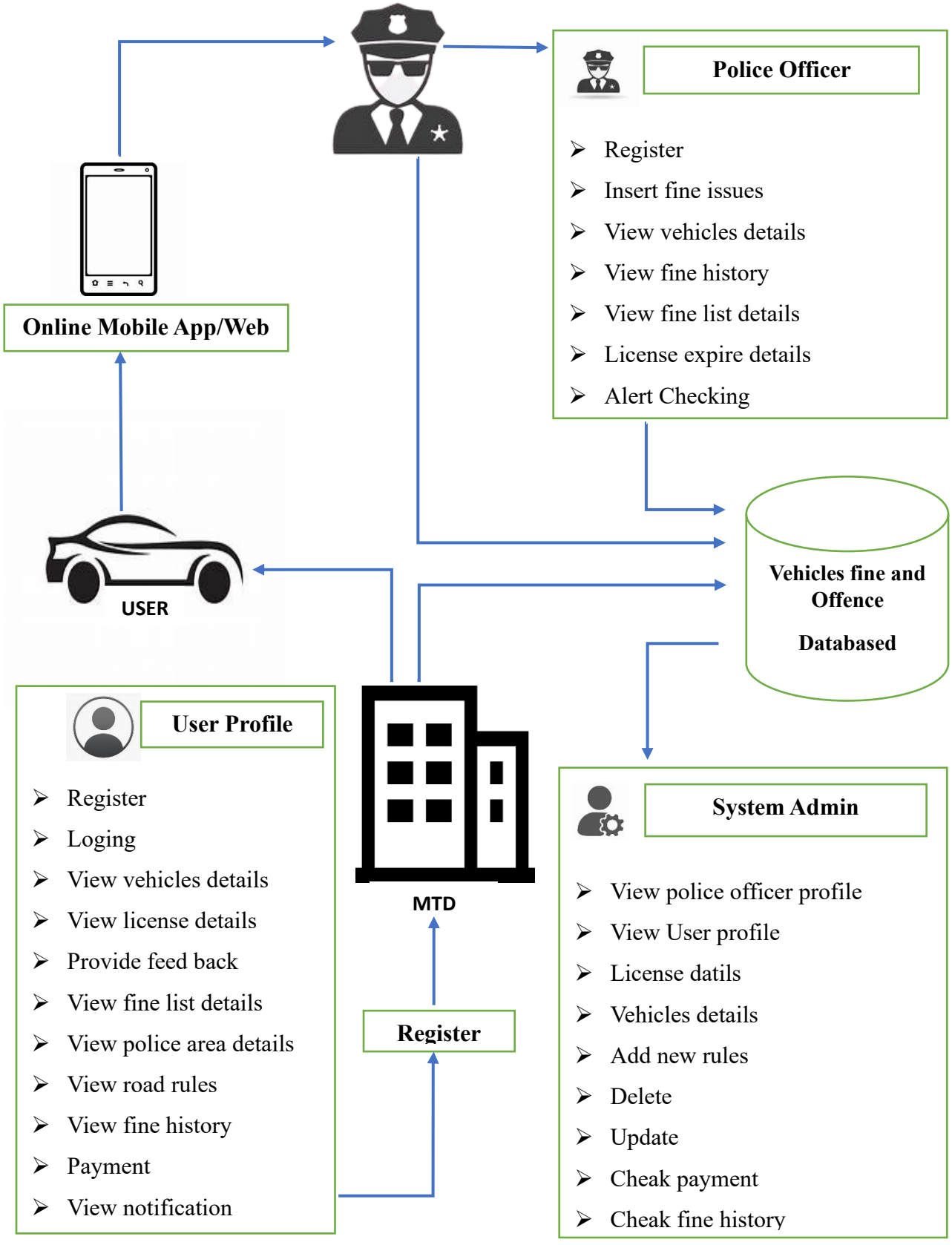


Figure 1:System Overview

4.7.2 Software Development Methodology

Waterfall Methodology:

Sequential and linear development process. Progresses through defined phases (requirements, design, implementation, testing, deployment) without revisiting previous stages. Well-suited for projects with stable and clear requirements.

- Adopt the Waterfall methodology for its structured, sequential approach, aligning with the well-defined nature of traffic regulations.
- Emphasize detailed documentation at each phase, ensuring accountability and traceability for compliance purposes.
- Facilitate client involvement primarily at the project's initiation and conclusion.
- Ideal for projects with stable and clear requirements, making it suitable for a traffic offense reporting system.
- Progress through defined stages, moving from requirements to deployment without revisiting previous phases.
- Mitigate risks by addressing issues at each phase before moving to the next.
- Provide a predictable timeline for planning and management purposes.
- Conduct thorough testing after the implementation phase to ensure a reliable and fully developed system.

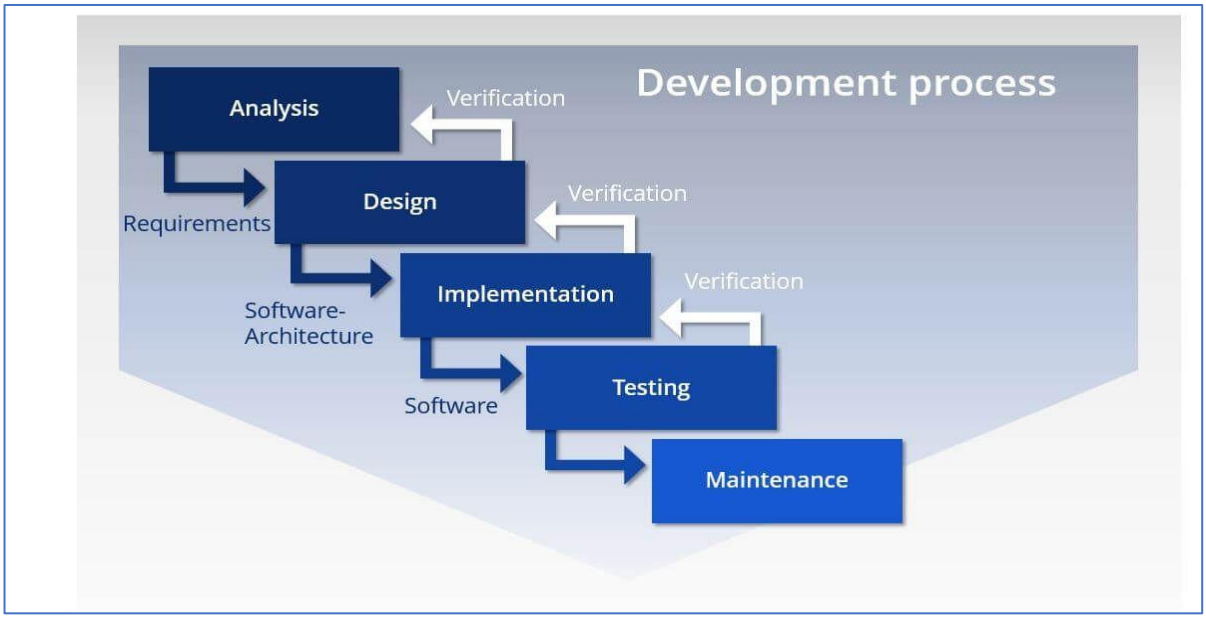


Figure 2:Waterfall Methodology

5 Design

5.1 Introduction

The proposed mobile app design prioritizes simplicity, accessibility, and reliability to streamline the fine payment process in Sri Lanka. It aims to create a seamless system for both drivers and traffic police, featuring user-friendly interfaces for fine payment directly from smartphones. The app will facilitate real-time communication between drivers and traffic police to resolve disputes and clarify violations. Additionally, it will integrate security measures like digital receipts and transaction tracking to enhance transparency. Overall, the design emphasizes efficiency and ease of use to revolutionize fine payment in Sri Lanka.

5.2 System Design Process

A creative activity that identifies the applications and creativity required in the web application design process. Components and their relationships based on customer requirements. is created. About how to solve a problem, so there is always a creative process. Often used.UML diagram or other design description language to describe the design

5.3 System Design Process (Mobile View)

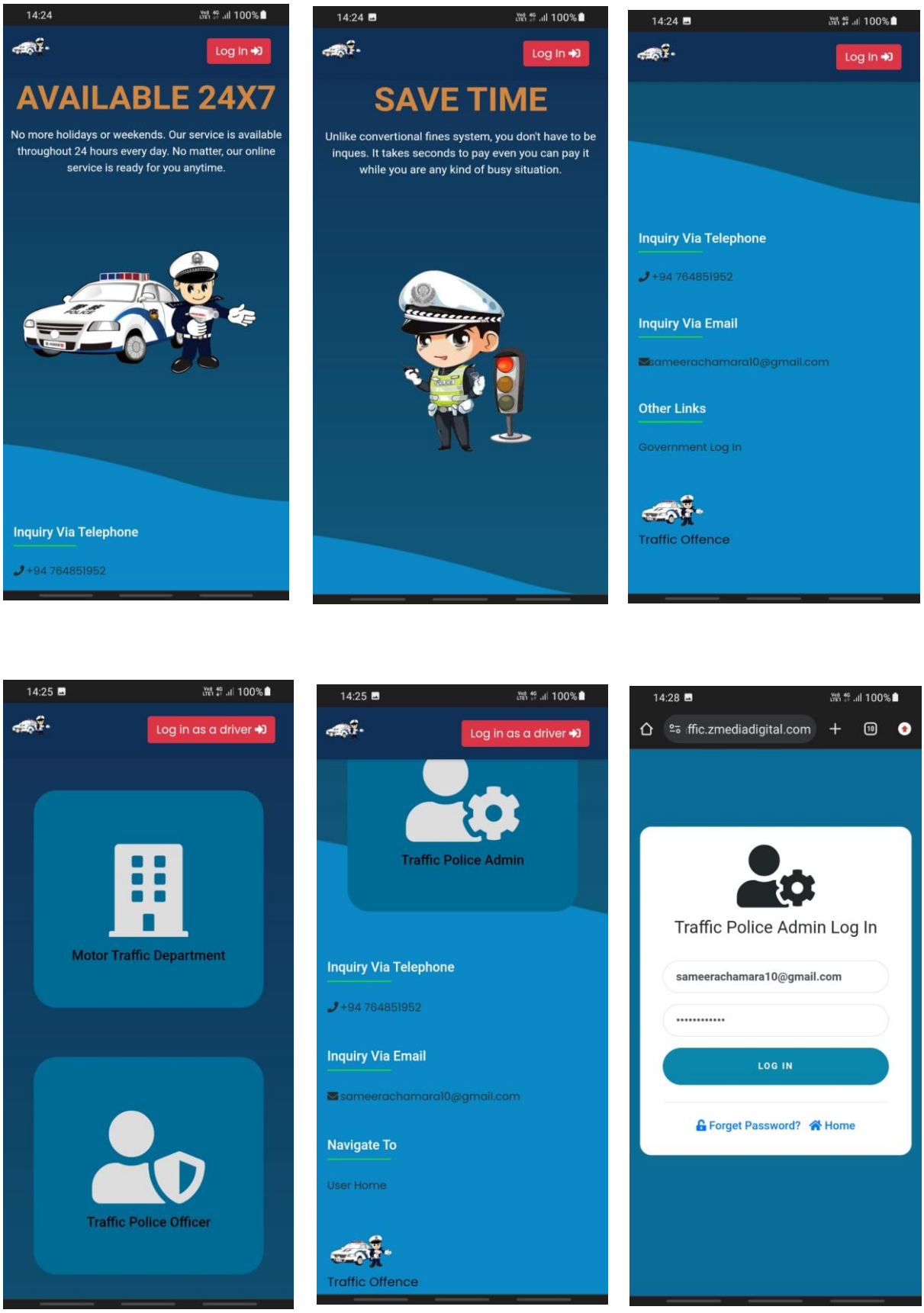


Figure 3:Web Application Mobile Interfaces

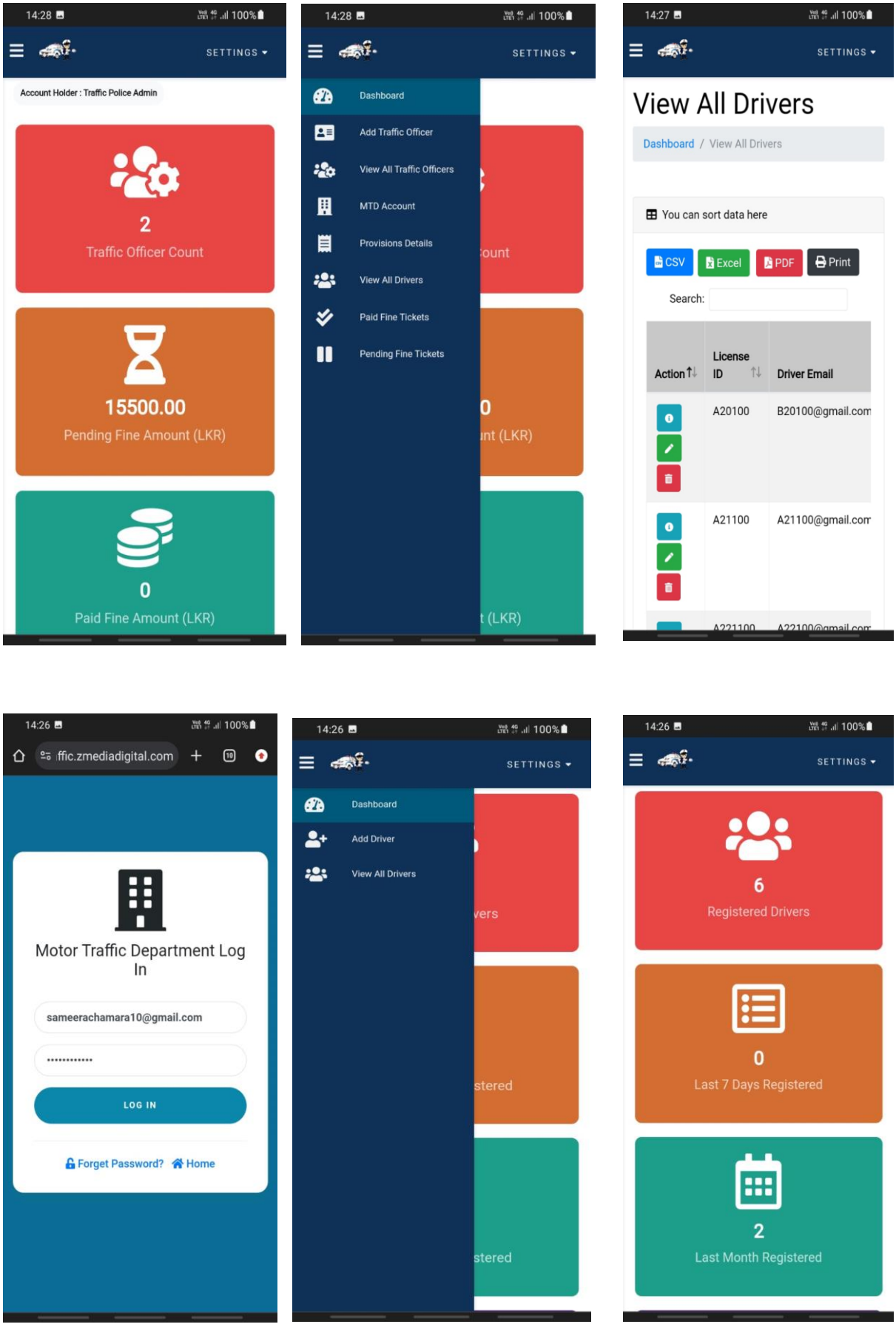


Figure 4:Web Application Mobile Interfaces

5.3.1 Use case Diagram

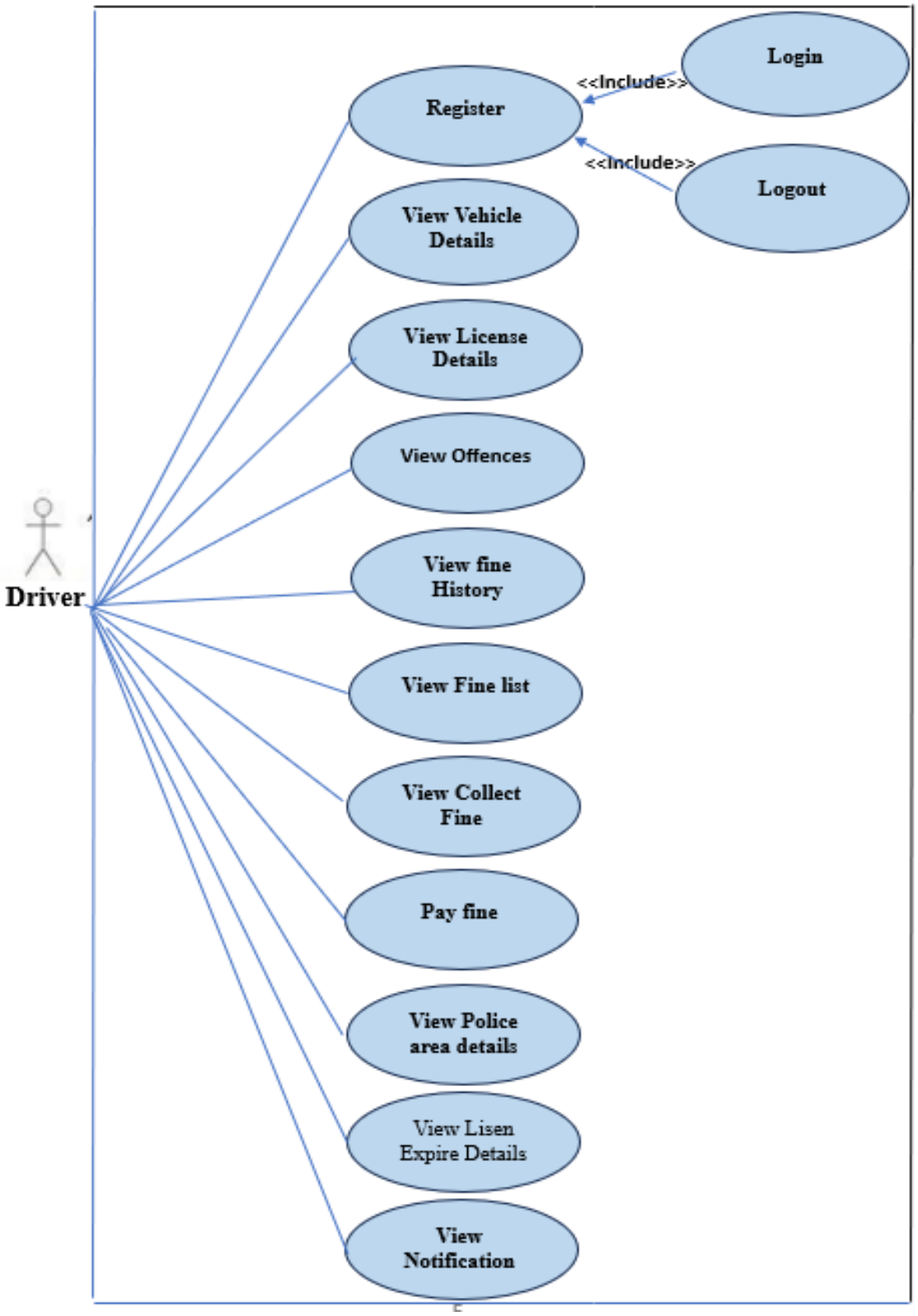


Figure 5:Driver Use Case Diagram

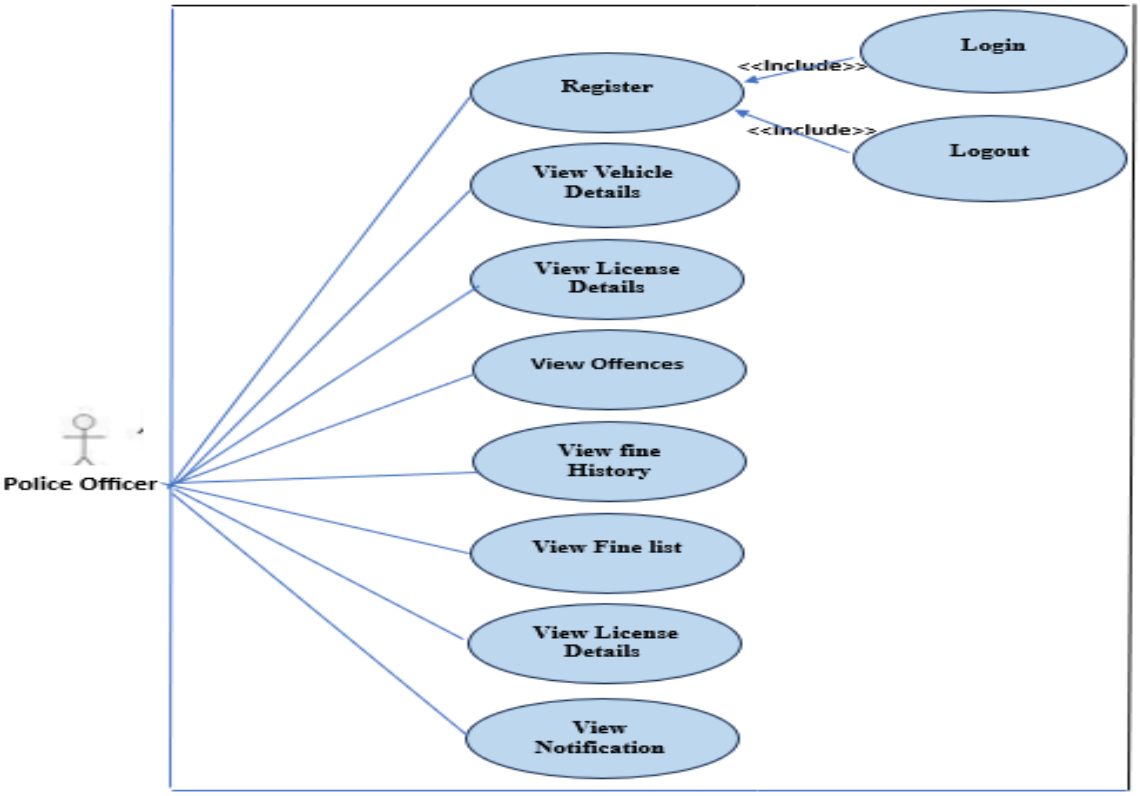


Figure 6:Police Officer Use Case Diagram

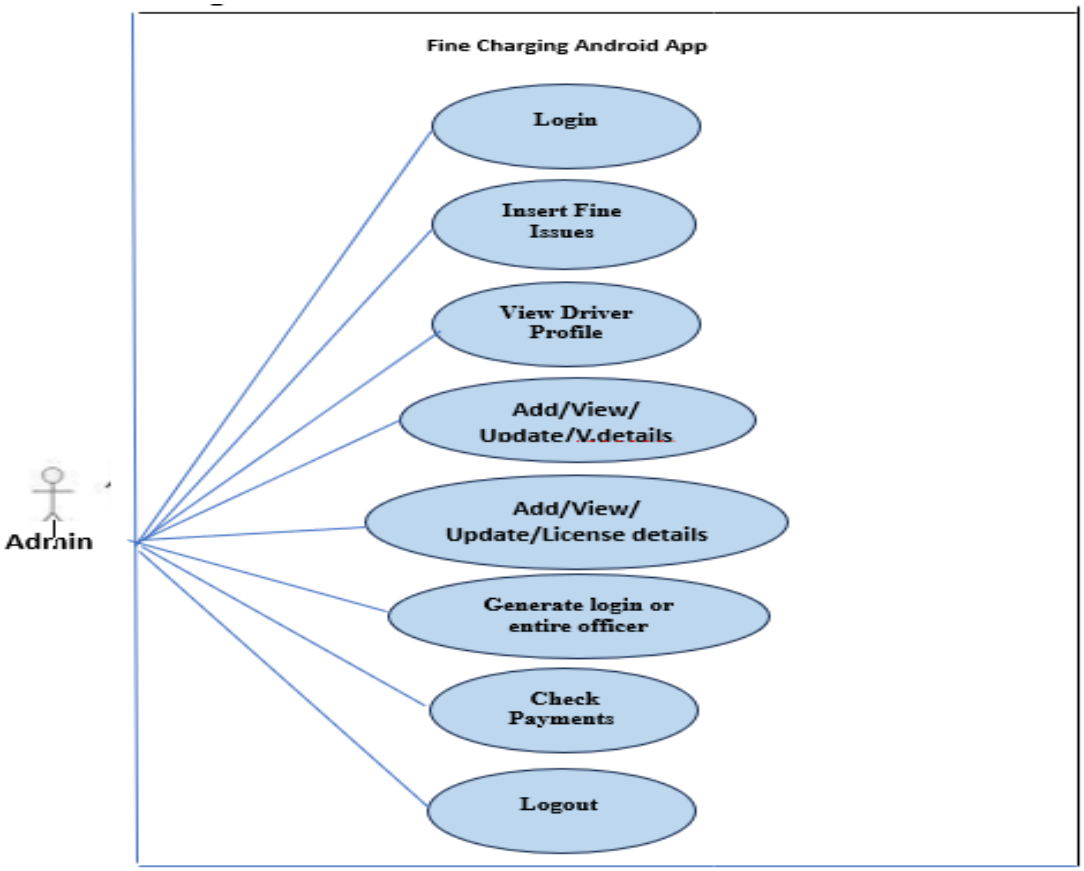


Figure 7:Admin Use Case Diagram

5.3.2 Class Diagram

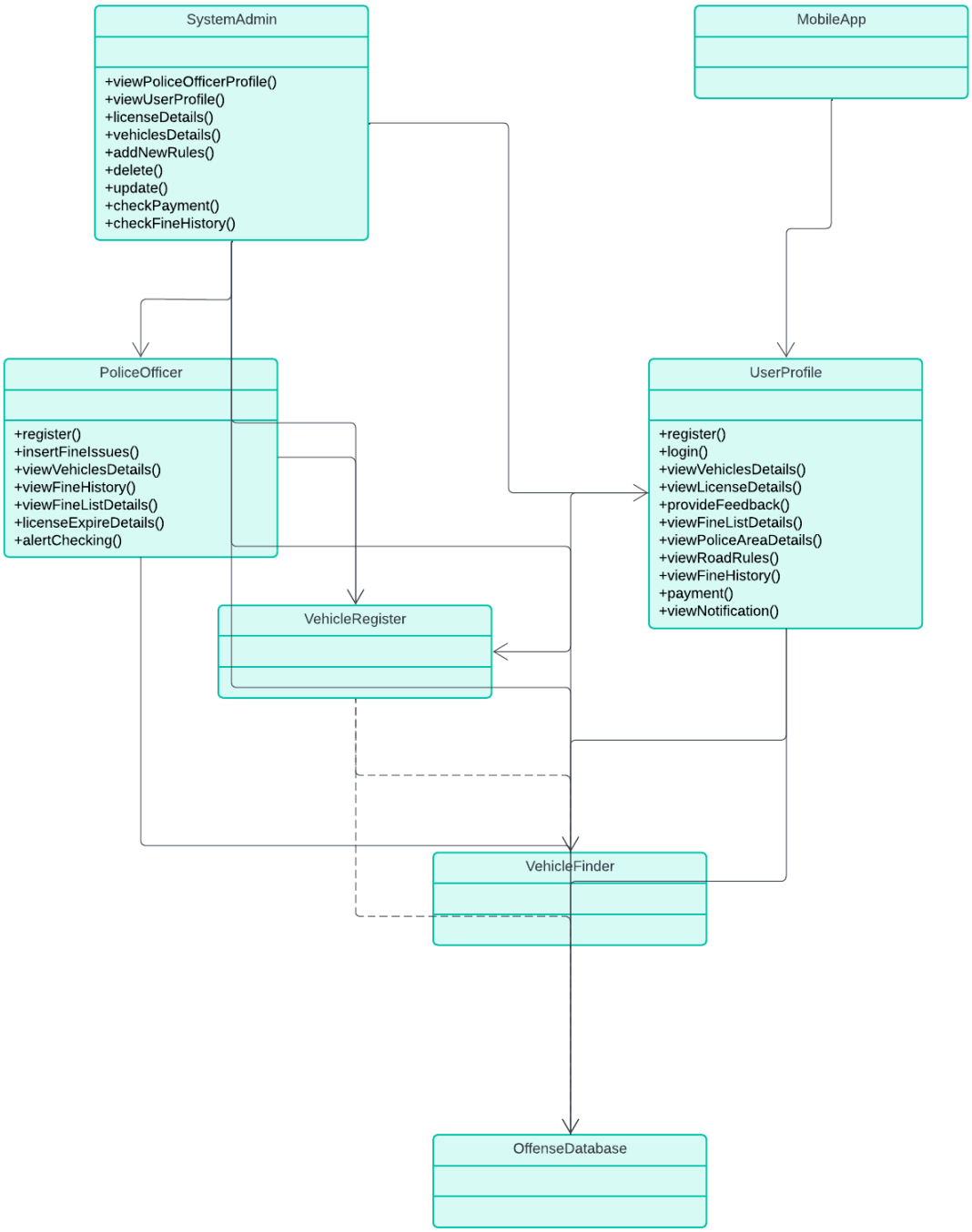


Figure 8:Class Diagram

5.3.3 Sequence Diagram

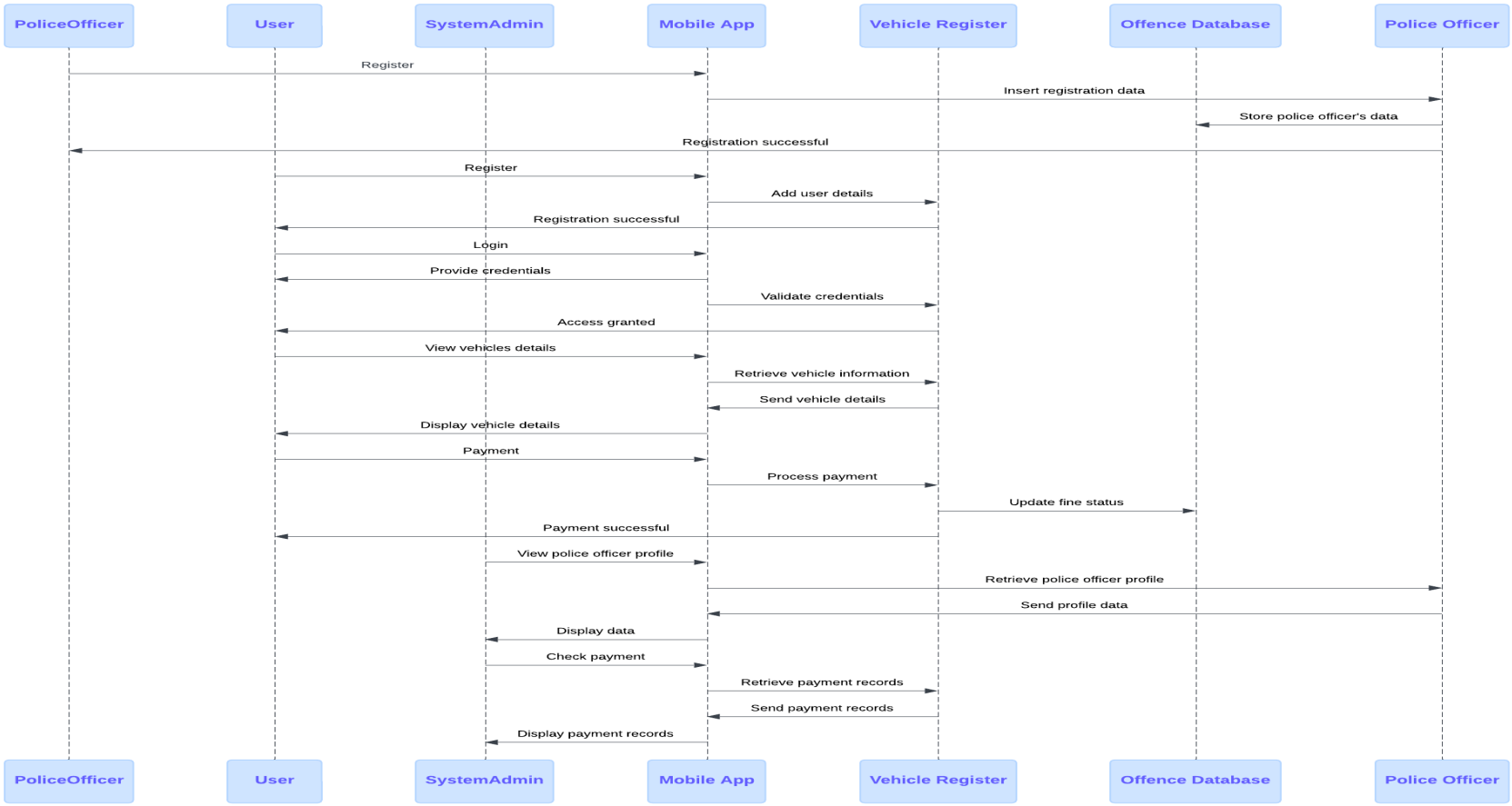


Figure 9:Sequence Diagram

5.3.4 Activity Diagram

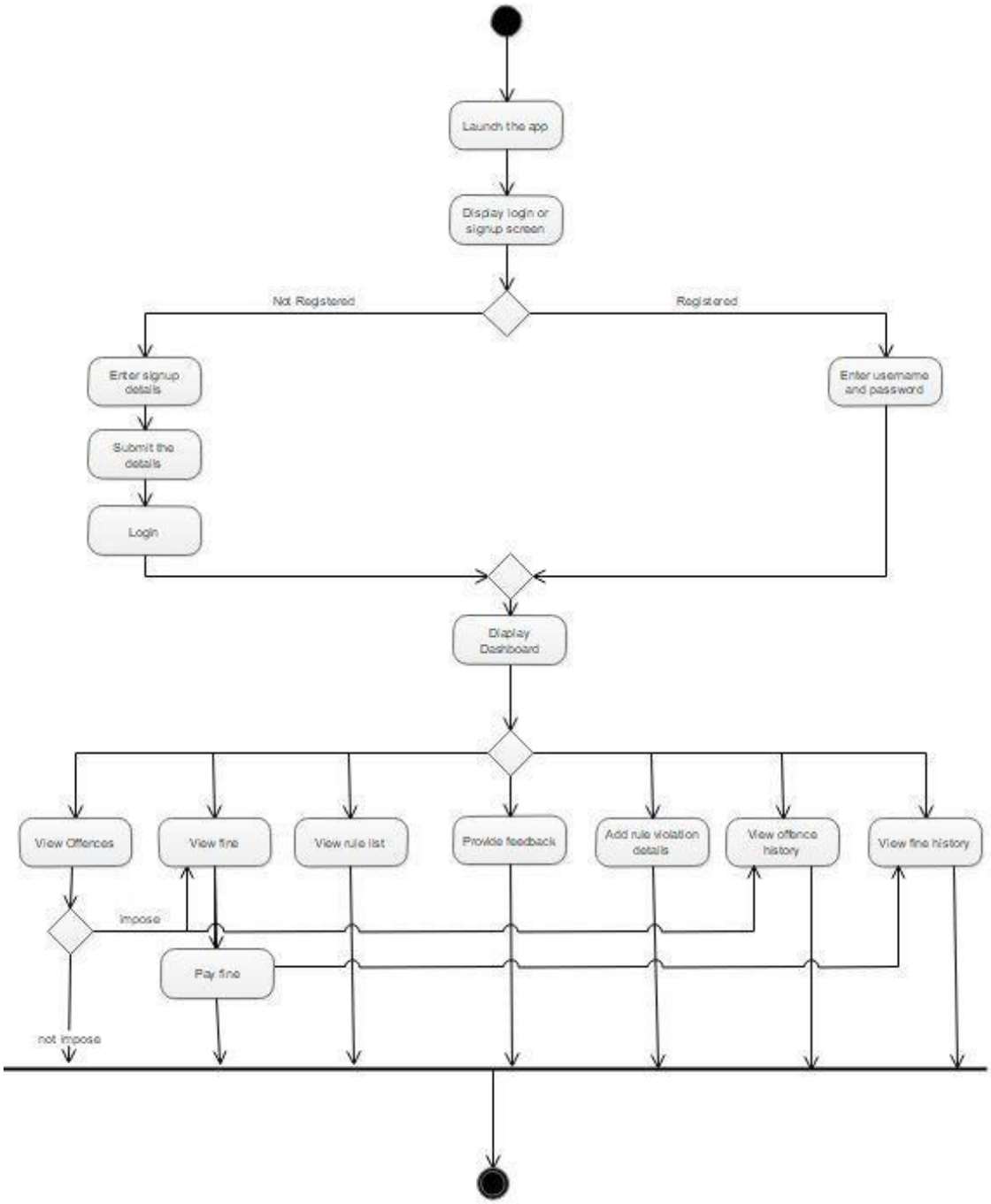


Figure 10:Activity Diagram

5.4 Interface Design

5.4.1 Design Principles

- Match Between System and Real World

  Use familiar language and terminology, such as "Fines," "Payments," and "Traffic Violations," to align with users' expectations.

  Include icons that represent actions naturally understood by drivers, such as a money symbol for payments or a police badge icon for reports.

- User Control and Freedom

  Provide options to go back, cancel, or undo actions, particularly during critical tasks like payment processing or data entry.

- Recognition Rather Than Recall

  Present options and actions visibly on each screen rather than requiring users to remember commands or navigate deeply to access information.

- Flexibility and Efficiency of Use

  Allow experienced users to quickly perform actions through shortcuts, such as a "Quick Pay" option for repeat offenses.

  Consider incorporating predictive text for frequently entered data, such as license plate numbers, to speed up input.

- Error Recovery

  Offer clear, actionable error messages that guide users on how to correct issues, such as a failed payment.

  Include options to retry actions after errors, such as “Try Again” after a network error during payment submission.

- The simplicity principle.

  According to the simplicity principle the design should make simple, common tasks simple to do, communicating clearly and simply in the user’s own language, and providing good shortcuts that are meaningfully related to longer procedures.

- The visibility principle.

  According to the visibility principal design should keep all needed options and materials for a given task visible without distracting the user with extraneous or redundant information.

- The feedback principle.

  According to the feedback principal design should keep users informed of actions or interpretations, changes of state or condition, and errors or exceptions that are relevant and of interest to the user through clear, concise, and unambiguous language familiar to users

- UCD, or user-centered design

  Make sure the app has clear instructions for every stage of the fine payment procedure, making it simple for both drivers and cops to use.

  To constantly enhance usability based on user experiences, provide feedback methods.

- Clarity and Simplicity

  Reduce cognitive burden by using a simple, clean design, especially for drivers who might need to utilize the app rapidly and effectively.

  Stay away from overflowing screens with information and speak in plain, succinct terms.

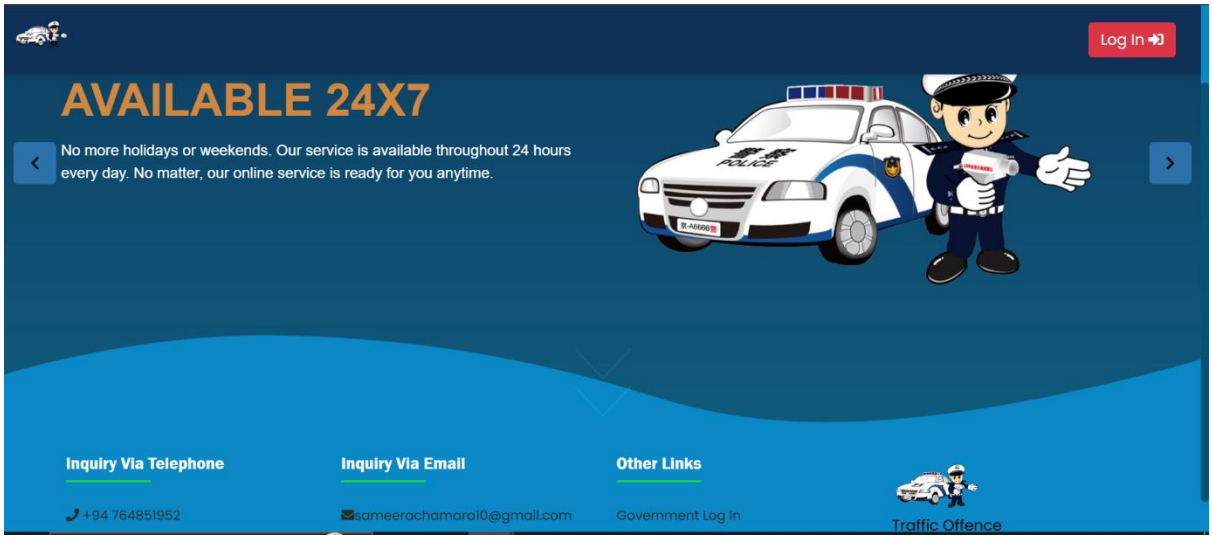
- Accessibility

  Use accessibility guidelines while designing the software to make it usable by everyone, including people with motor or vision impairments (e.g., color contrast, bigger letters, and touch targets).

  Since some customers in Sri Lanka may find language to be a problem, provide multilingual help.

5.4.2 Actual Screens of the System (Desktop View)

5.4.3 System Home Page



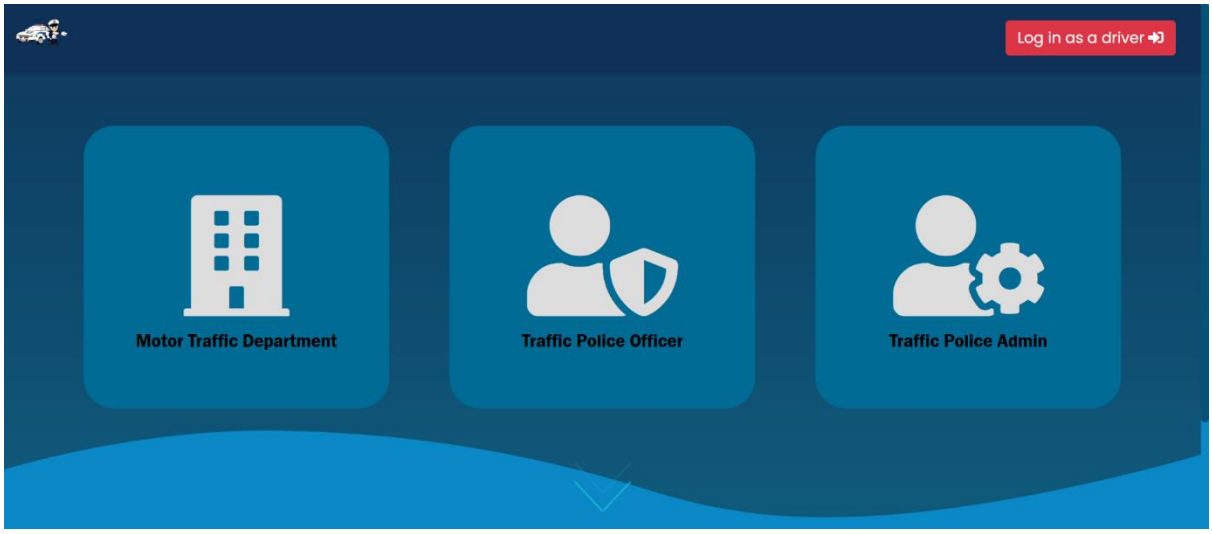
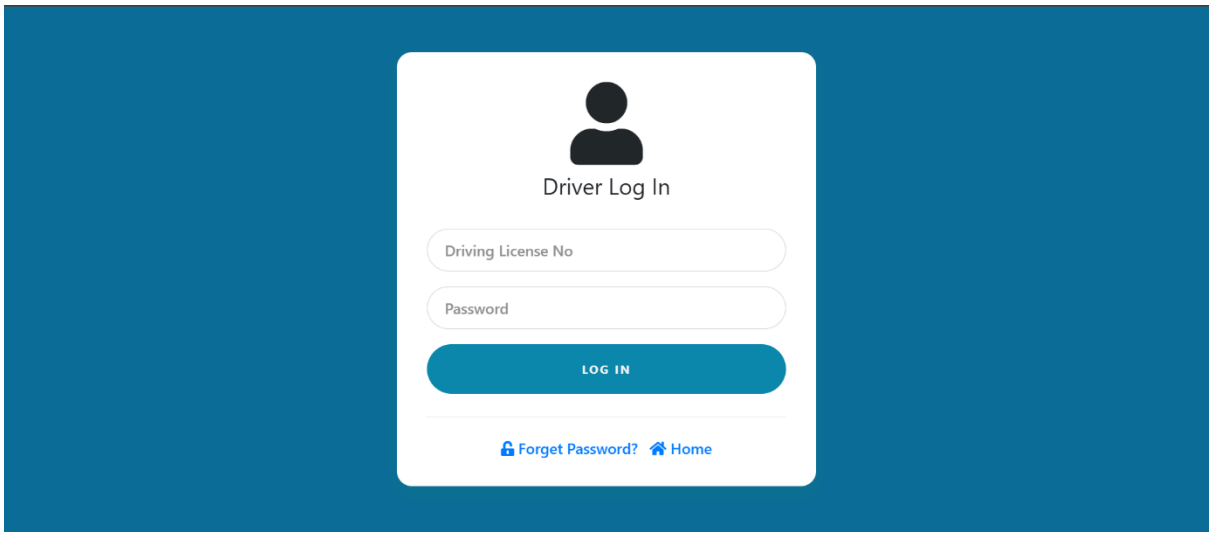
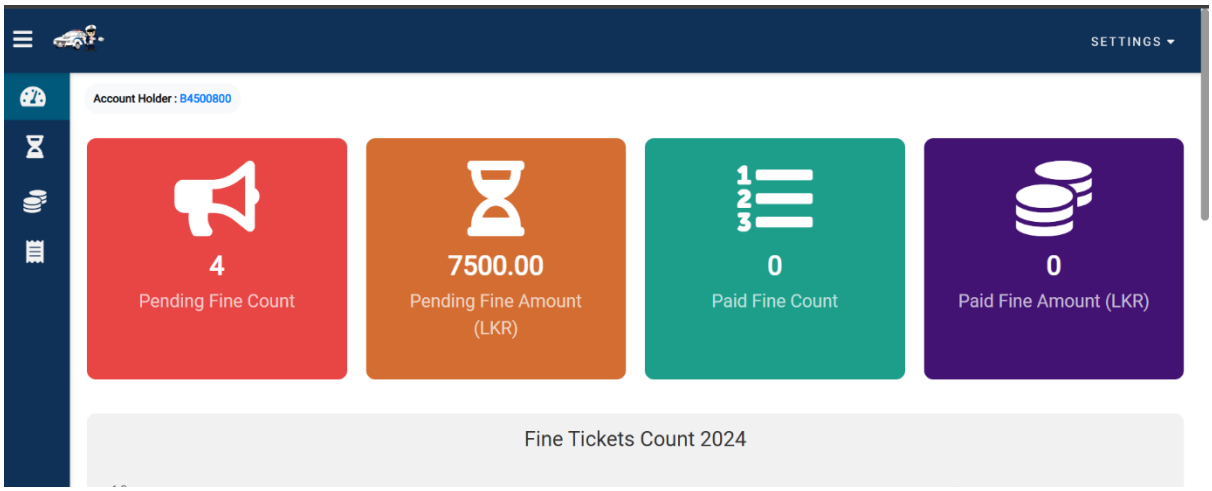
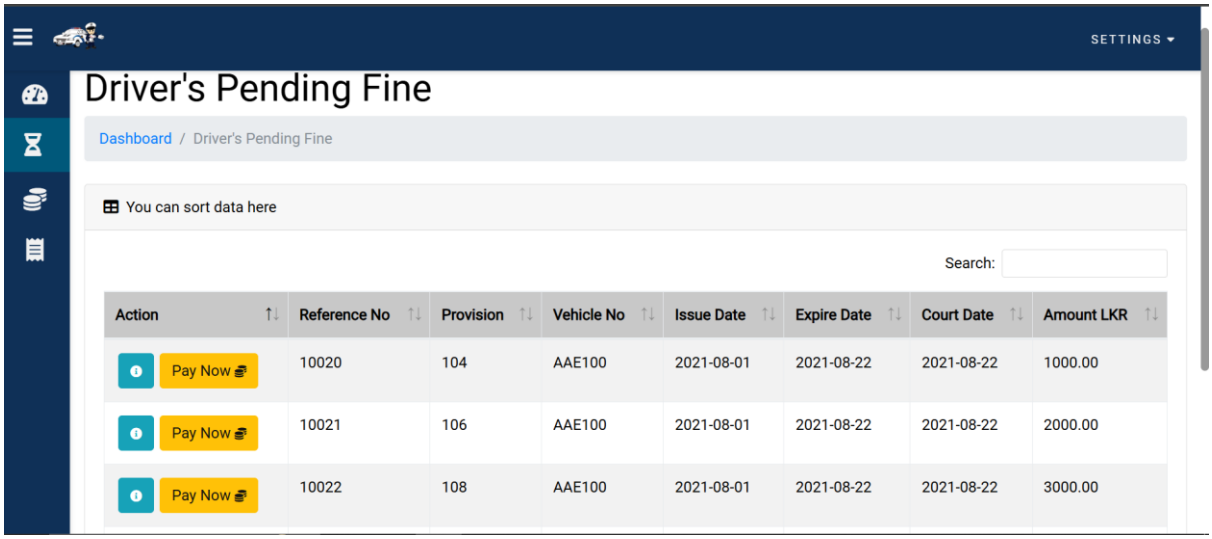


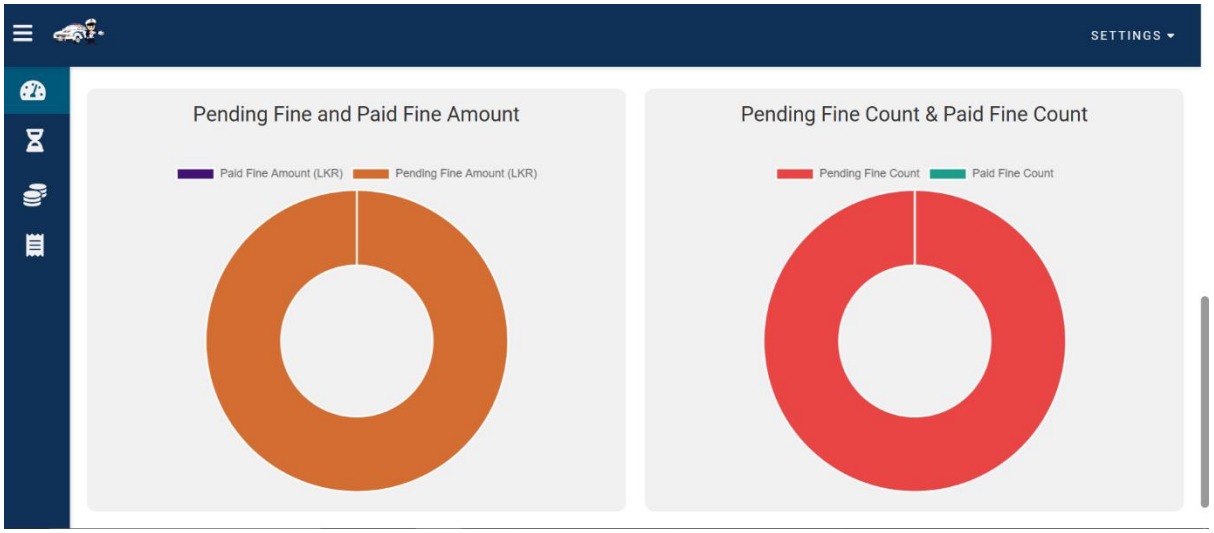
Figure 11:System Home Page

5.4.4 Driver Interface









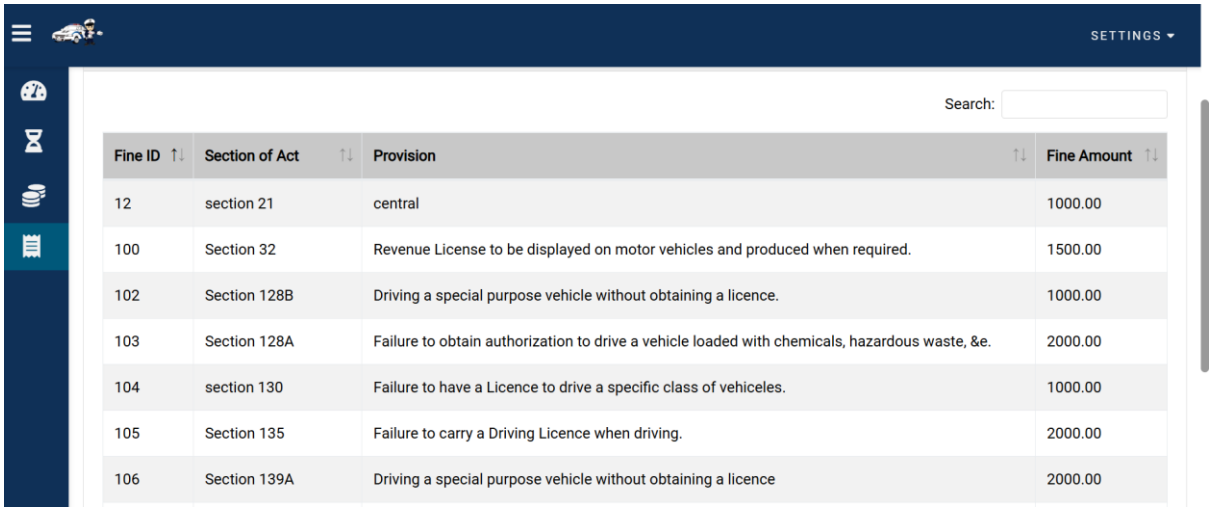
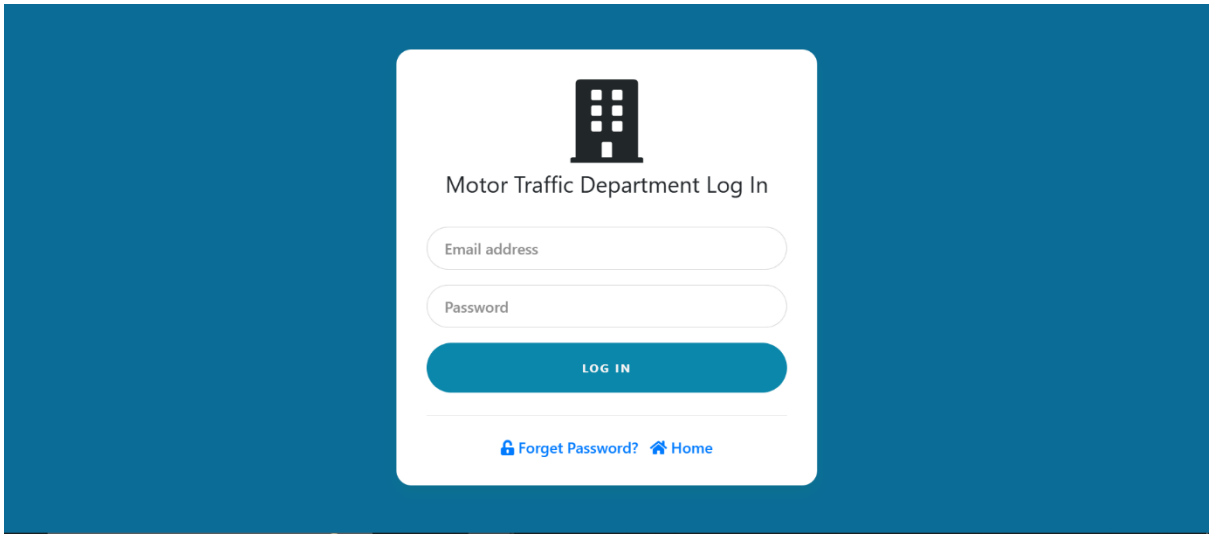
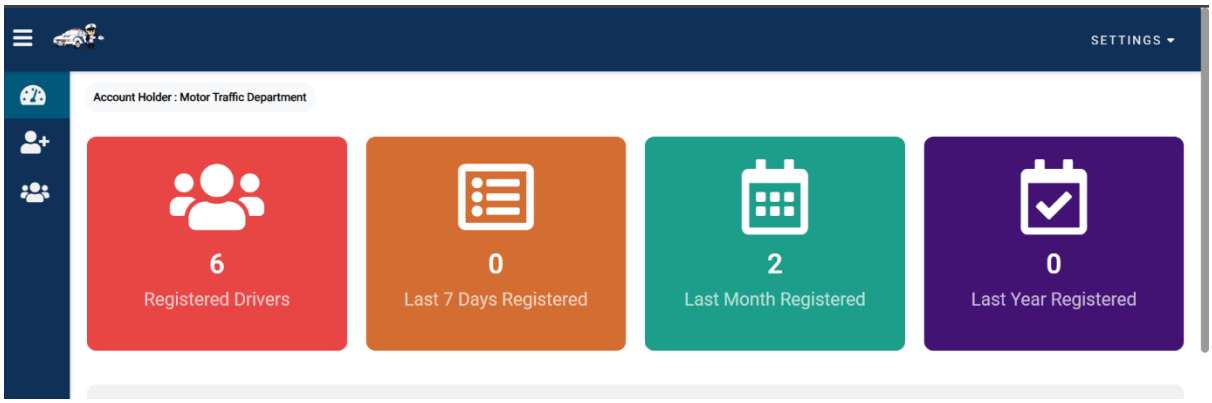
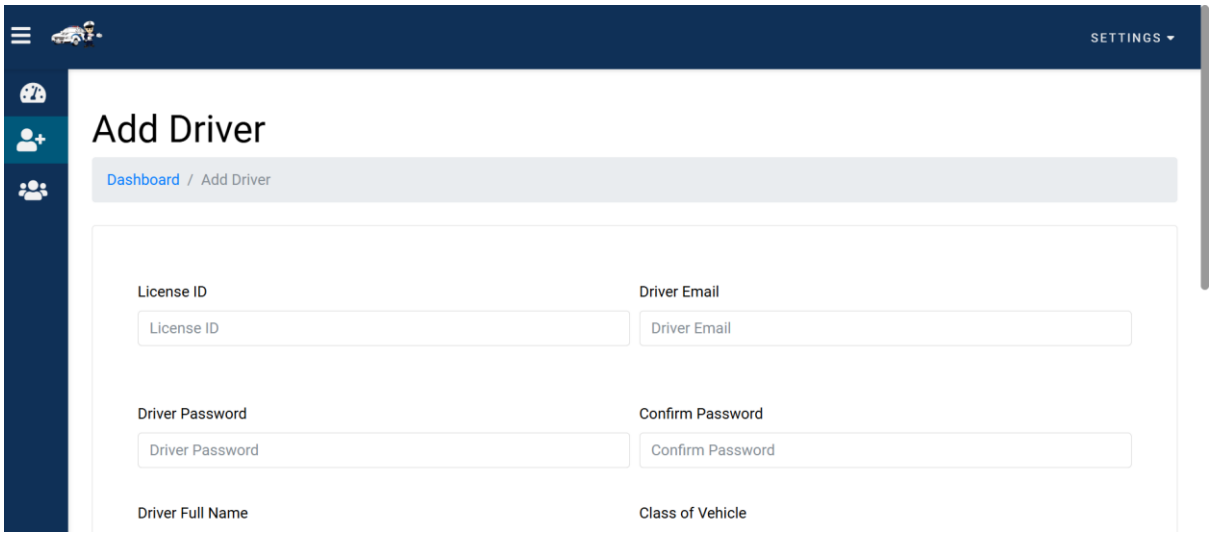


Figure 12:Driver Interface

5.4.5 Motor Traffic Department







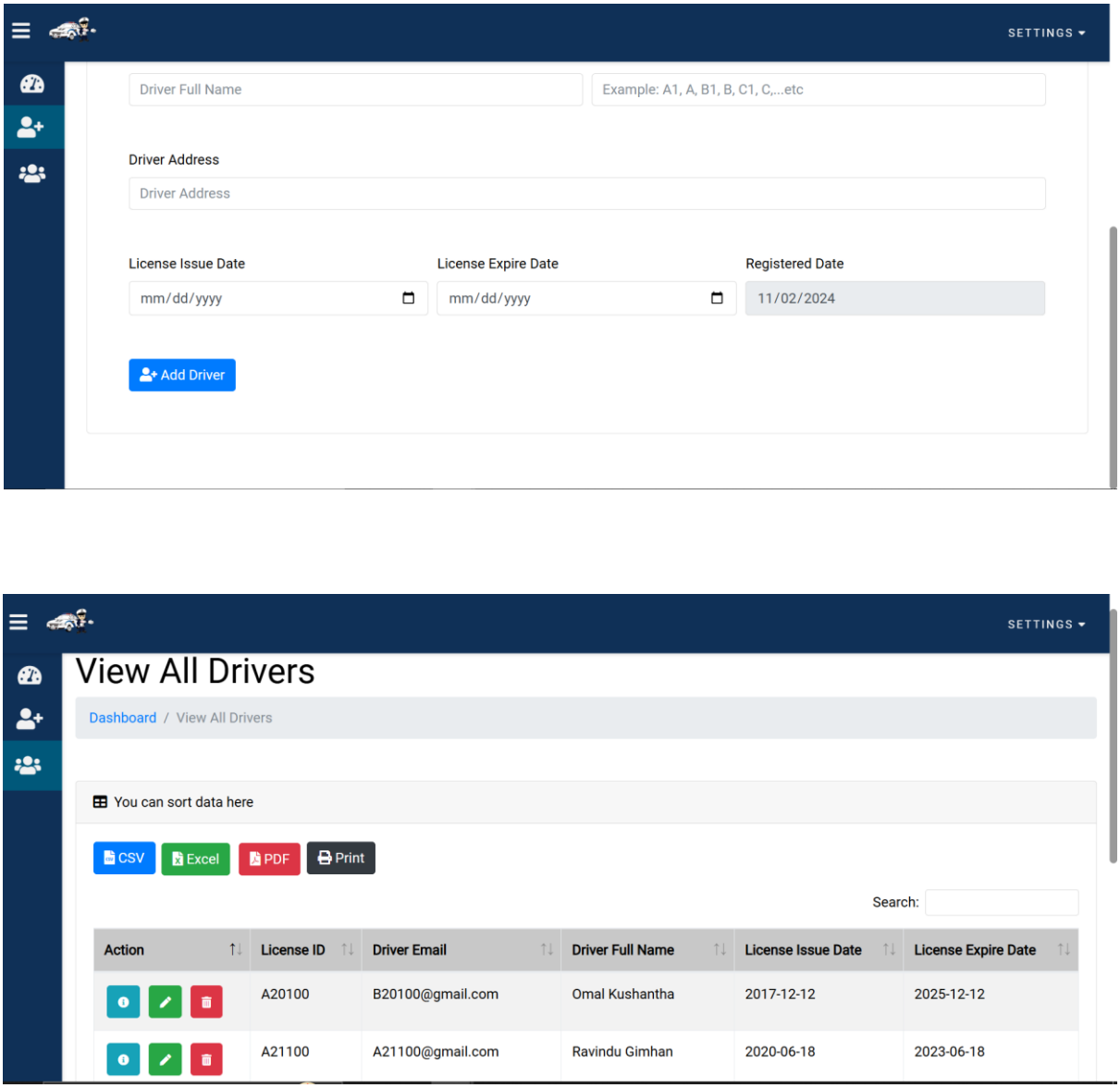
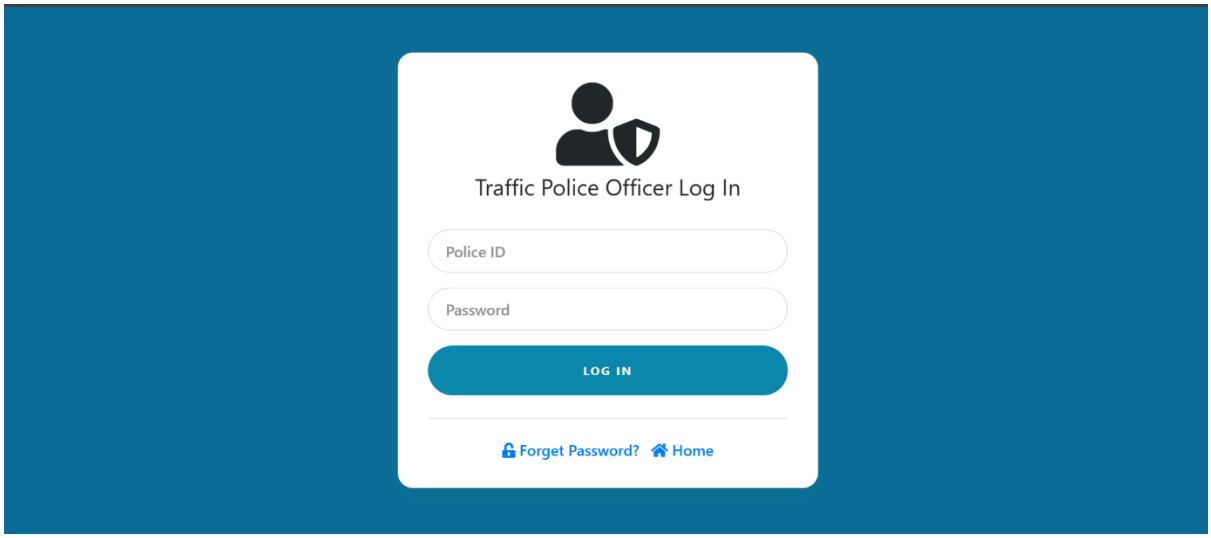
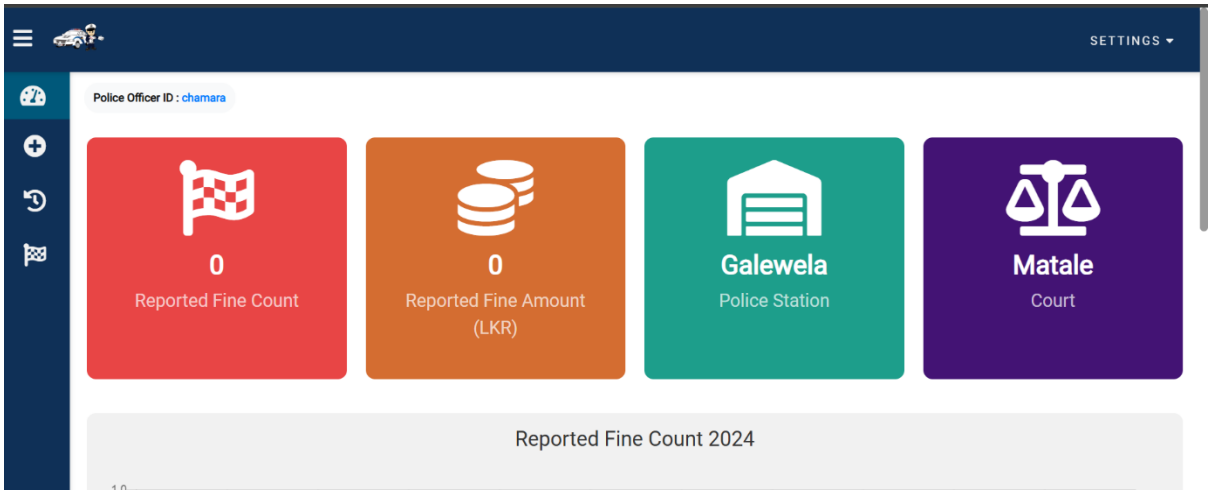
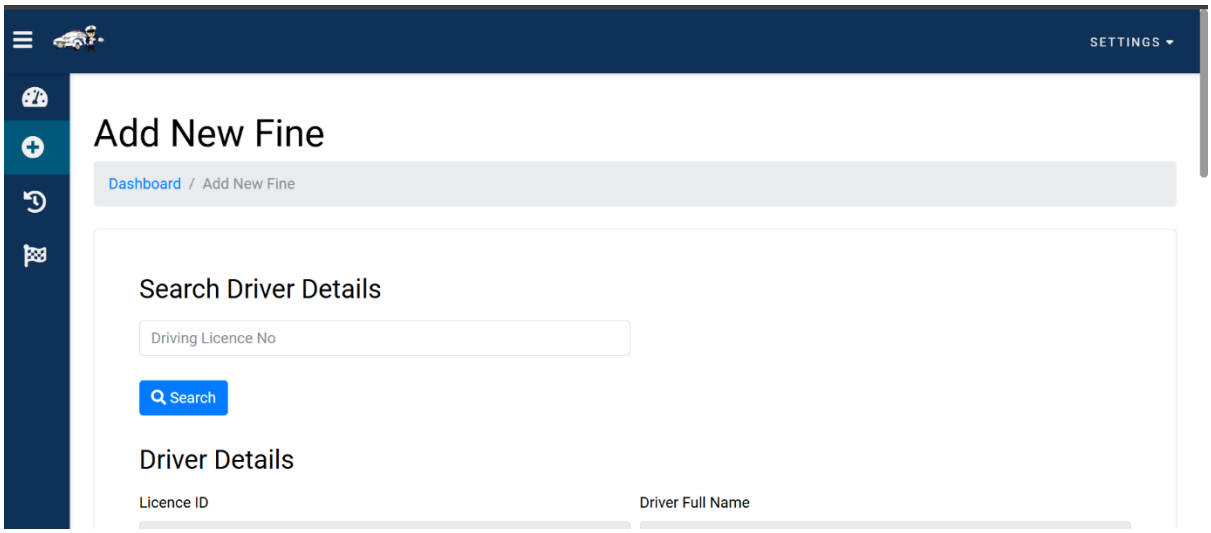


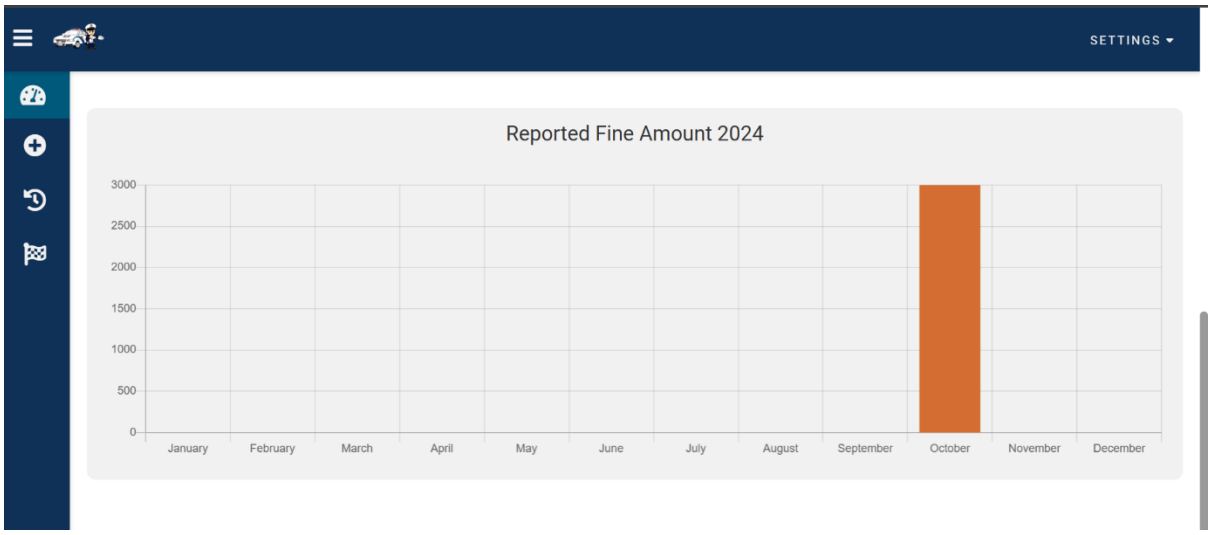
Figure 13:Motor Traffic Department

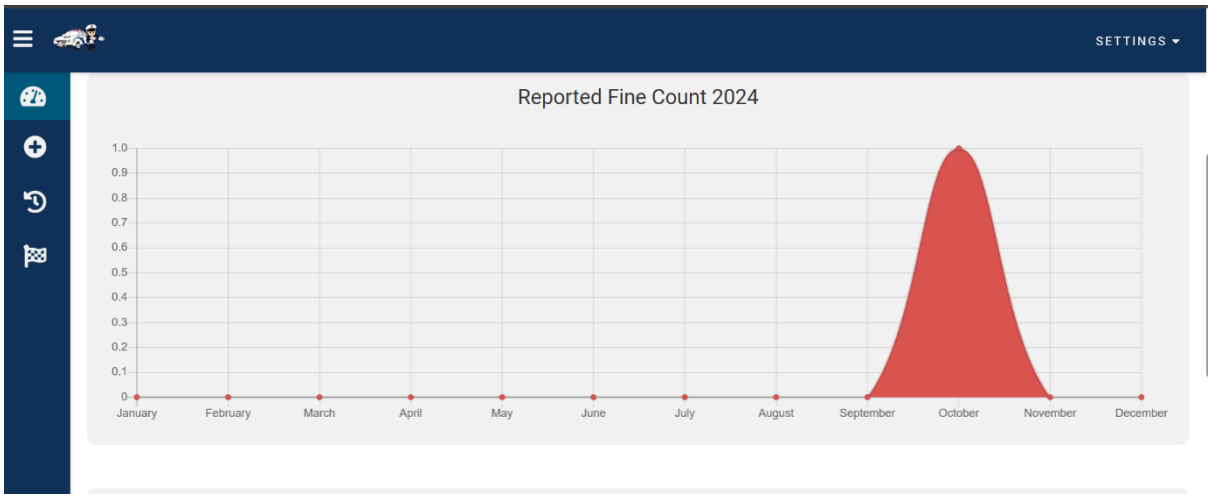
5.4.6 Police Officer Interface

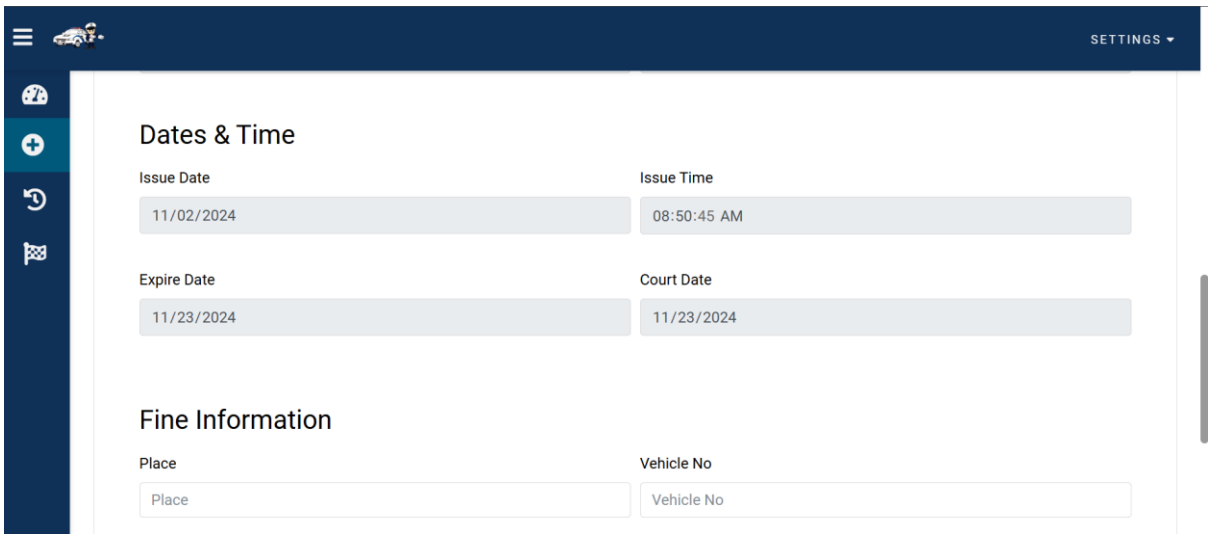







SETTINGS
Reported Fine Amount 2024
3000
2500
2000
1500
1000
500
0
January
February
March
April
May
June
July
August
September
October
November
December


SETTINGS
Reported Fine Count 2024
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
January
February
March
April
May
June
July
August
September
October
November
December


SETTINGS
Dates & Time
Issue Date
11/02/2024
Issue Time
08:50:45 AM
Expire Date
11/23/2024
Court Date
11/23/2024
Fine Information
Place
Place
Vehicle No
Vehicle No

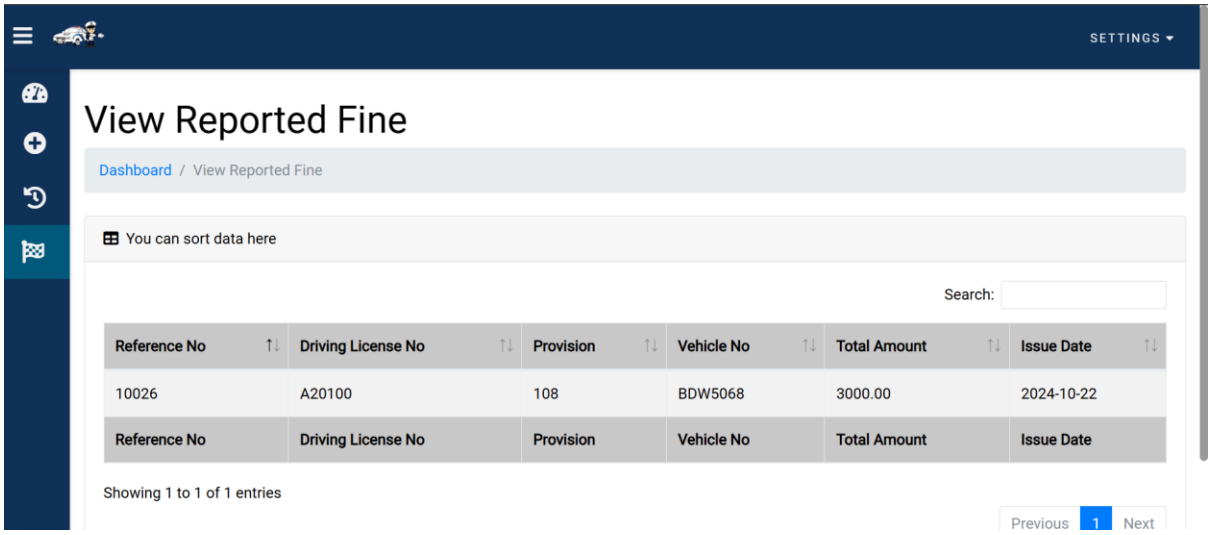
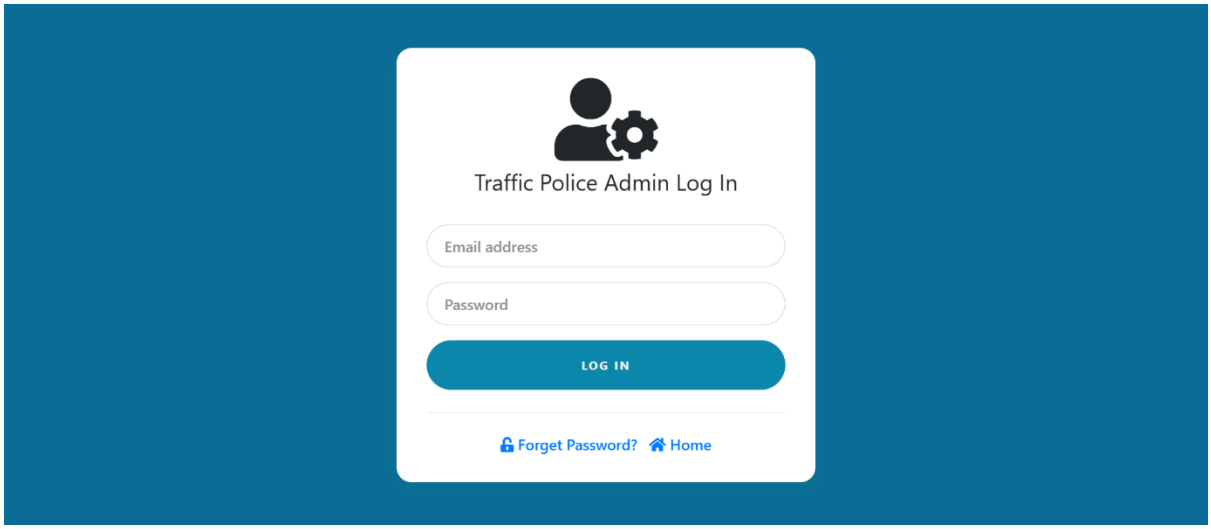
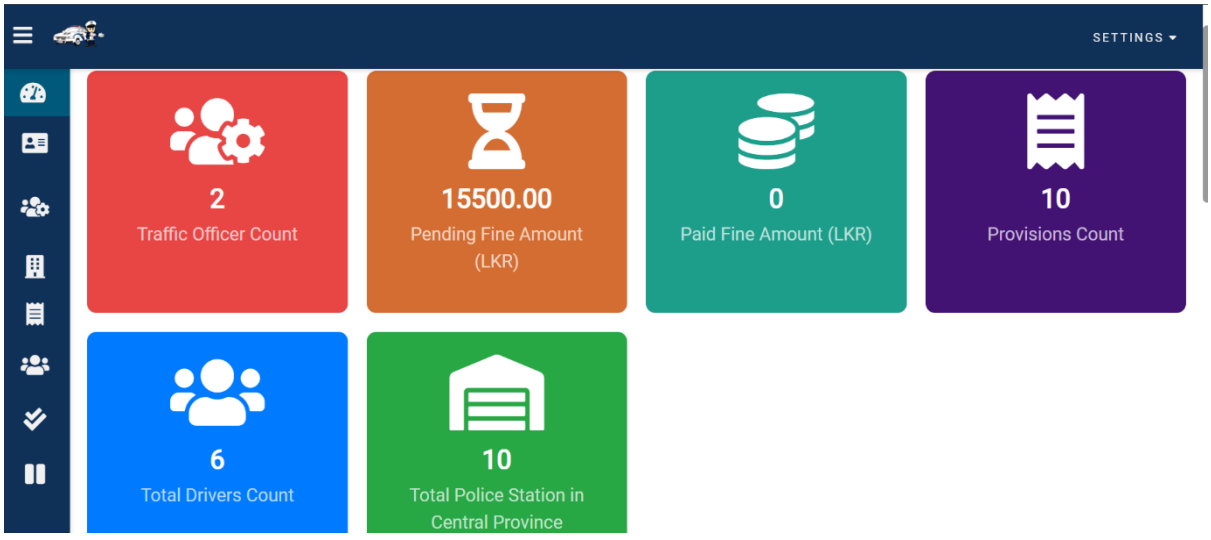


Figure 14:Police Officer Interface

5.4.7 Admin Interface





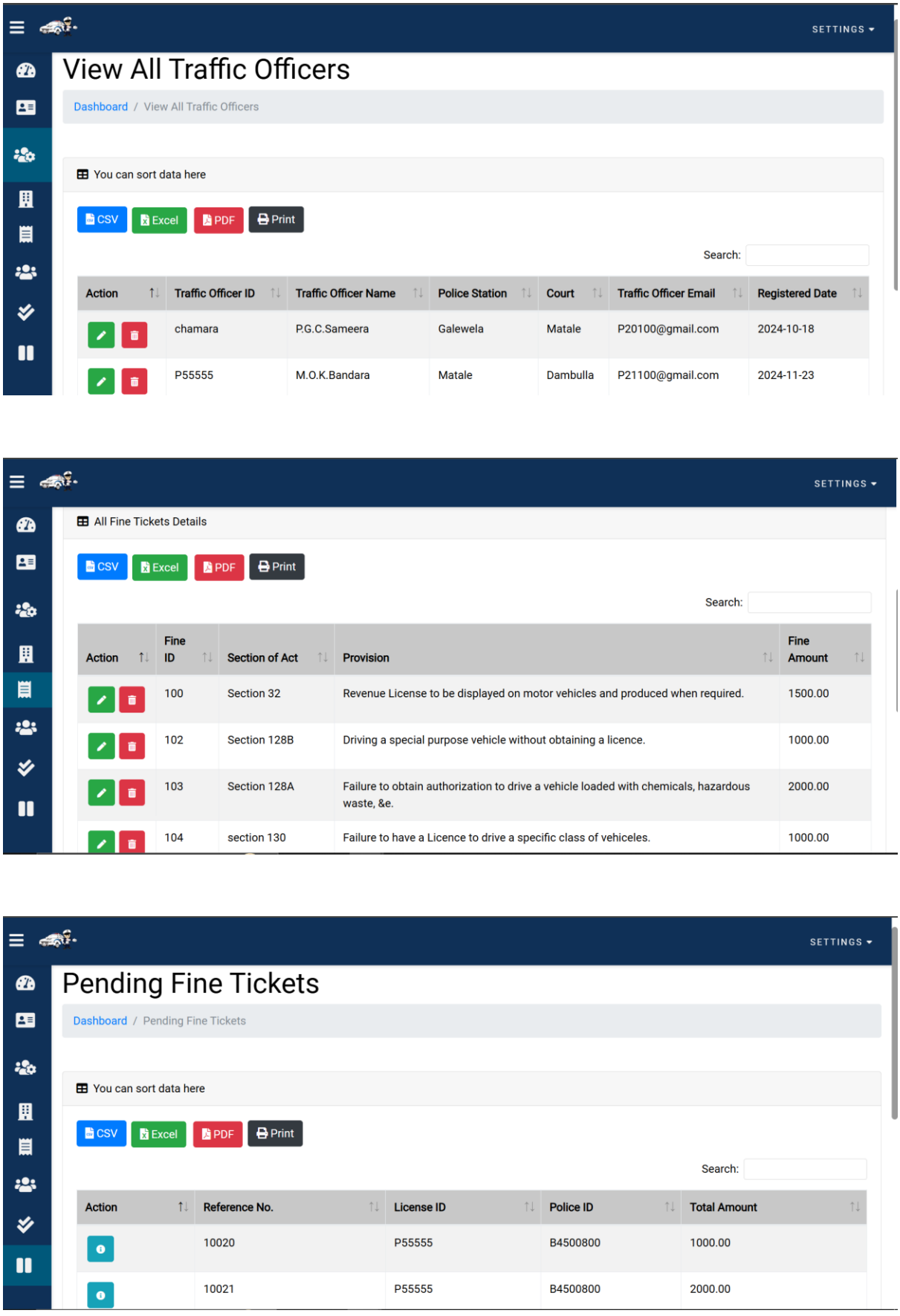


Figure 15:Admin Interface

5.5 Database Design

Database design, in essence, involves an endeavor of defining the creation and use of a Database Management System. This process encompasses a set of activities that can help to choose an appropriate data structure, which in the end would fit and serve an organization with the required performances with data. Key aspects of database design include the following:

Requirement Analysis:

It is the process of learning about the organization's data needs, that is, determining what specific information has to be recorded and how such information will be applied. This step involves the identification of stakeholder requirements and therefore, definition of their use cases.

Logical Design:

Realizing the conceptual model into the logical model, that is, defining tables and columns and their relationships which are clear for specific database system, but do not depend on the specific physical storage format. At the end of this level, normalization is done to avoid the occurrences of data redundancy and for the integrity of data.

Physical Design:

Explanation of how the data is stored, how the index is created and how the partitioning of data is done under different capabilities of DBMS. This stage contemplates performance enhancement for controlling performance and data integrity and capacity utilization for a strong database configuration.

Implementation:

Populating the actual database in the selected DBMS, define the tables, relations, constraints and indexes. At this stage data are populated into the database for the purpose of testing the database's performance and consistency.

Maintenance:

Other operational activities, after putting the databases are; tracking of performance, undertaking of update processes, data backup, and changes resulting from evolving need of the data. Maintenance also includes tuning of queries, fine-tuning of the index strategies and how this database would grow in line with the ever-expanding organization.

5.5.1 Normalization

Normalization is a key aspect of database design that focuses on organizing data within a database to minimize redundancy and improve data integrity. It involves dividing large tables into smaller, related tables and defining relationships between them, which reduces duplication and inconsistencies. Here's an in-depth look at normalization, its goals, and its implementation steps:

- **Goals of Normalization**

  Enhance Data Integrity: Through normalization, data consistency is maintained across the database, ensuring that updates, deletions, and insertions are accurate and reliable.

  Improve Database Flexibility: A normalized database design allows for efficient querying and scaling, making it easier to retrieve information without excessive joins or dependencies.

  Optimize Performance: Reducing redundancy and ensuring each table has a single purpose minimizes complex data retrieval processes, which can improve database performance, especially as it scales.

- Levels of Normalization (Normal Forms)

  1 **First Normal Form (1NF)**

  Objective: Eliminate repeating groups and ensure each table column contains atomic (indivisible) values.

  Implementation: Each column must contain only one value, and each row must have a unique identifier or primary key.

  Example: In a table storing contact information, instead of storing multiple phone numbers in a single cell, each number should be stored in separate rows or columns.

  2 **Second Normal Form (2NF)**

  Objective: Eliminate partial dependencies, meaning that each non-key attribute must depend on the entire primary key.

Implementation: 2NF requires a table to be in 1NF and that each non-primary key attribute is fully dependent on the primary key.

3 Third Normal Form (3NF)

Objective: Remove transitive dependencies, where non-key attributes depend on other non-key attributes rather than directly on the primary key.

Implementation: A table must be in 2NF, and all non-key attributes should depend only on the primary key.

5.5.2 Relational Schema

- Vehicle Driver Entity

Table 5:Vehicle Driver Entity

#	Name	Type	Collation	Attributes	Null	Default	Extra
1	Driver_ID	varchar(10)		Primary Key	No	None	
2	Driver_Name	String(255)			No	None	
4	NIC_No	varchar(12)			No	None	
3	Address	varchar(255)			No	None	
4	Contact_No	int(10)			No	None	
5	Vehicle_No	varchar(50)			No	None	
6	Licence_No	varchar(50)			No	None	
7	Password	varchar(20)			No	None	

- Traffic Police Officer Entity

Table 6:Traffic Police Officer Entity

#	Name	Type	Collation	Attributes	Null	Default	Extra
1	Police_ID	varchar(10)		Primary Key	No	None	
2	Officer_Name	String(255)			No	None	
4	NIC_No	varchar(12)			No	None	
3	Address	varchar(255)			No	None	
4	Contact_No	int(10)			No	None	
5	Working_Area	varchar(100)			No	None	
6	Username	varchar(50)			No	None	
7	Password	varchar(15)			No	None	

- Vehicle Entity

Table 7:Vehicle Entity

#	Name	Type	Collation	Attributes	Null	Default	Extra
1	Vehicle_No	varchar(10)		Primary Key	No	None	
2	Color	varchar(25)			No	None	
3	Type	varchar(25)			No	None	
4	Model	varchar(50)			No	None	
5	Engine_Capacity	varchar(50)			No	None	
6	Registered_Date	date			No	None	

- License Entity

Table 8:License Entity

#	Name	Type	Collation	Attributes	Null	Default	Extra
1	License_No	varchar(10)		Primary Key	No	None	
2	Driver_Name	String(255)			No	None	
3	Registered_Date	date			No	None	
4	Expire_Date	date			No	None	

- Offence Entity

Table 9:Offence Entity

#	Name	Type	Collation	Attributes	Null	Default	Extra
1	Offence_ID	varchar(10)		Primary Key	No	None	
2	Type	varchar(50)			No	None	
3	Vehicle_No	varchar(50)			No	None	
4	License_No	varchar(50)			No	None	
5	Imposed_Date	date			No	None	
6	Due_Date	date			No	None	
7	Amount	int(10)			No	None	

- Rule Entity

Table 10:Rule Entity

#	Name	Type	Collation	Attributes	Null	Default	Extra
1	Rule_ID	varchar(10)		Primary Key	No	None	
2	Type	varchar(50)			No	None	
2	Amount	String(50)			No	None	

6 System development

Thus, the development of the system for this traffic offence management project employs the Modified (Iterative) Waterfall method. These are; conceptualization, analysis, design, implementation, testing and deployment. PHP MySQL HTML CSS APIs: back end and database management Android Studio Figma: mobile application and designing. Designing of each phase is iteratively carried out to reach functional, performance and usability level to provide an optimal and efficient solution for traffic fines in Sri Lanka.

6.1 Navigation/Module Structure

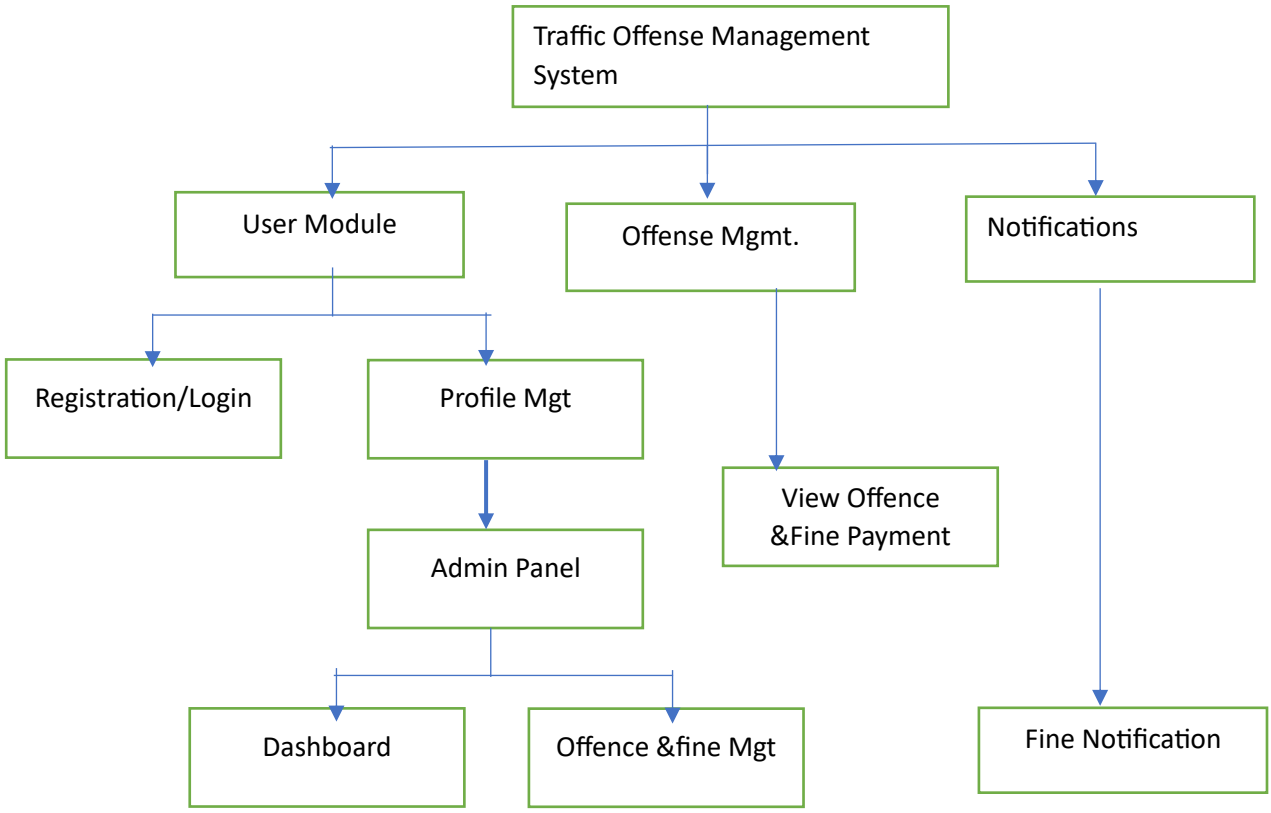


Figure 16:Navigation/Module Structure

6.2 Development Environment

Table 11:Development Environment

Category	Tool/Software	Purpose
IDEs	Android Studio	For developing the mobile application interface and functionality on Android devices.
	Visual Studio Code	For coding the web-based admin panel, managing HTML, CSS, JavaScript, and PHP code.
Backend and Database	XAMPP	Local server environment for running and testing the PHP backend and MySQL database locally.
	MySQL	Relational database to store data related to users, traffic offenses, and payment transactions.
Server and Hosting	GoDaddy	For hosting the web-based admin panel and backend, enabling remote access to the application.
Version Control	Git	For tracking code changes and facilitating team collaboration on codebase updates.
Design Tools	Figma	For designing the UI/UX layout and wireframes of the mobile app and admin panel.
	Photoshop	For editing images, icons, and other visual elements used in the application.
Documentation	MS Word	Used for project documentation, including requirements, test cases, and user manuals.

6.3 Technologies and Tools

6.3.1 Technologies

- **PHP** is the main development language used to develop the app's backend functionalities.

- **React.js, Tailwind HTML, CSS** (including SCSS), and JavaScript are the primary languages used to develop the admin panel for managing the system.

- **MySQL Datab**ase technology is used to handle the app's database management, ensuring data persistence and handling all relational data needs.

- **RESTful APIs** are utilized to facilitate secure communication between the mobile app and the server, handling data transfers and interactions in real-time.

- **XML** is employed for data representation and exchange, especially for structured data interchange between different parts of the application.

- **GoDaddy Server Hosting** is used to deploy and host the application, ensuring accessibility and server management.

6.3.2 Tools

- **Figma** – used for designing and prototyping the app's and admin panel's UI/UX.

- **Visual Studio Code** – for coding both the app and the admin panel in the Easy Fine project.

- **MySQL with XAMPP** – used to manage and host the database locally during development, ensuring smooth data handling.

- **GoDaddy Server** – used to deploy and host the application, providing accessible and reliable server management.

- **API Integration** – for backend development and connecting external services, such as payment gateways, within the app.

- **MS Word** – used for documentation and reporting throughout the project.

6.4 Major Code Segments

6.4.1 Home Page Code Segment

```
<!DOCTYPE html>
<html>

<head>
    <title>Traffic Offense Management System </title>

    <!--Meta tags start-->
    <meta charset="UTF-8">
    <meta name="description" content="Traffic Offense Management System ">
    <meta name="keywords" content="Traffic, Fine, System, Sri Lanka">
    <meta name="author" content="Horizon Campus">
    <meta name="viewport" content="width=device-width, height=device-height,
initial-scale=1.0, user-scalable=0, minimum-scale=1.0, maximum-scale=1.0">
    <!--Meta tags end-->

    <!--Favicon start-->
    <link rel="icon" type="image/png" href="assets/img/Hero.png">
    <!--Favicon end-->


    <!-- Import lib -->
    <link rel="stylesheet" type="text/css"
href="assets/vendors/animatecss/animate.css">
    <link rel="stylesheet" type="text/css"
href="assets/vendors/bootstrap/bootstrap.min.css">
    <!-- End import lib -->
    <!-- Import fonts -->
    <script src='https://kit.fontawesome.com/a076d05399.js'></script>
    <link
href="https://fonts.googleapis.com/css?family=Baloo+Chettan|Dosis:400,600,700|
Poppins:400,600,700&display=swap" rel="stylesheet" />
    <!-- End fonts -->
    <!-- Import styles -->
    <link rel="stylesheet" type="text/css" href="assets/css/main.css">
    <link rel="stylesheet" type="text/css" href="assets/css/home.css">
    <!-- End styles -->
    <!-- Import fontawesome from CDN -->
    <link rel="stylesheet"
href="https://use.fontawesome.com/releases/v5.7.2/css/all.css"
integrity="sha384-
fnmOCqbTlWIlj8LyTjo7mOUStjsKC4pOpQbqyi7RrhN7udi9RwhKkMHpvLbHG9Sr"
crossorigin="anonymous">
    <!-- End fontawesome from CDN -->

</head>
```

```
<body onload="loadingIcon()" class="overlay-scrollbar">

    <div id="loading">
        <table align="center">
            <tr>
                <td>
                    <div class="loadingio-spinner-dual-ball-ezjdz35ph7h">
                        <div class="ldio-1l6lp7zdq37">
                            <div></div>
                            <div></div>
                            <div></div>
                        </div>
                    </div>
                </td>
            </tr>
        </table>
    </div>

<div id="content">
    <!-- Topbar navigation start here
========================================================-->
    <div class="topnavbar animated fadeIn">
        <!-- topnav left -->
        <ul class="topnavbar-nav">
            <li class="topnav-item">
                <a href="index.php"><img src="assets/img/Hero.png" alt="TOMS
logo" class="logo logo-light"></a>
            </li>
        </ul>
        <!-- end topnav left -->
        <!-- topnav right -->
        <ul class="topnavbar-nav topnav-right">
            <li class="topnav-item">
                <div class="mydropdown">
                    <p class="mt-3 mr-4">
                        <a href="user/login.php"><span class="btn btn-md btn-
danger" data-toggle="modal" data-target="#userLogdin">Log In <i class="fas fa-
sign-in-alt" style="font-size: 1rem;"></i></span></a>
                    </p>
                </div>
            </li>
        </ul>
        <!-- end topnav right -->
    </div>
    <!-- Topbar navigation end here
========================================================-->
```

```
    <!-- Main slide show start here
================================================-->
    <div class="hero_area">
        <!-- slider section -->
        <section class="slider_section position-relative">
            <div id="Customcarousel1" class="carousel slide" data-
ride="carousel">
                <div class="carousel-inner">
                    <div class="carousel-item active">
                        <div class="container">
                            <div class="row mt-4">
                                <div class="col-md-6 ">
                                    <div class="detail-box animated
bounceInLeft custom-slide-animi">
                                        <h1>
                                            Available 24x7
                                        </h1>
                                        <p>
                                            No more holidays or weekends. Our
service is available throughout 24 hours every day. No matter, our online
service is ready for you anytime.
                                        </p>
                                    </div>
                                </div>
                                <div class="col-md-6 animated bounceInUp
custom-slide-animi">
                                    <div class="img-box">
                                        <img src="assets/img/Hero.png" alt="">
                                    </div>
                                </div>
                            </div>
                        </div>
                    </div>
                    <div class="carousel-item">
                        <div class="container">
                            <div class="row mt-4">
                                <div class="col-md-6 animated bounceInLeft
custom-slide-animi">
                                    <div class="detail-box">
                                        <h1>
                                            Save Time
                                        </h1>
                                        <p>
                                            Unlike convertional fines system,
you don't have to be inques. It takes seconds to pay even you can pay it while
you are any kind of busy situation.
                                        </p>
                                    </div>
```

```
                                </div>
                                <div class="col-md-6 animated bounceInDown
custom-slide-animi">
                                    <div class="img-box">
                                        <img src="assets/img/Hero_6.png"
alt="">
                                    </div>
                                </div>
                            </div>
                        </div>
                    </div>
                    <div class="carousel-item ">
                        <div class="container">
                            <div class="row mt-4">
                                <div class="col-md-6 ">
                                    <div class="detail-box animated
bounceInLeft custom-slide-animi">
                                        <h1>
                                            Analyze Fines
                                        </h1>
                                        <p>
                                            We keep tracks of your every
single payment from the beginning. Furthermore,  we are going to analyze your
data for you. You will see all of your records with many analysed way at a
glance.
                                        </p>
                                    </div>
                                </div>
                                <div class="col-md-6 animated bounceInUp
custom-slide-animi">
                                    <div class="img-box">
                                        <img src="assets/img/Hero_5.png"
alt="">
                                    </div>
                                </div>
                            </div>
                        </div>
                    </div>
                    <div class="carousel-item ">
                        <div class="container">
                            <div class="row mt-4">
                                <div class="col-md-6 ">
                                    <div class="detail-box animated
bounceInLeft custom-slide-animi">
                                        <h1>
                                            Check Past Fines
                                        </h1>
                                        <p>
```

```
                                        Every driver has a driving record,
which is a record of their driving story show traffic violation. Because your
driving record can affect everything from your driving privileges. It's
important to check your driving record for accuracy after handling a traffic
ticket.
                                    </p>
                                </div>
                            </div>
                            <div class="col-md-6 animated bounceInDown
custom-slide-animi">
                                <div class="img-box">
                                    <img src="assets/img/slide_03.svg"
alt="">
                                </div>
                            </div>
                        </div>
                    </div>
                </div>
            </div>
            <a class="carousel-control-prev" href="#Customcarousel1"
role="button" data-slide="prev">
                <span class="sr-only">Previous</span>
            </a>
            <a class="carousel-control-next" href="#Customcarousel1"
role="button" data-slide="next">
                <span class="sr-only">Next</span>
            </a>
        </section>
        <!-- end slider section -->
        <a href="#footer">
            <svg class="arrows">
                <path class="a1" d="M0 0 L30 32 L60 0"></path>
                <path class="a2" d="M0 20 L30 52 L60 20"></path>
                <path class="a3" d="M0 40 L30 72 L60 40"></path>
            </svg>
        </a>
    </div>
    <!-- Main slide show end here ========================================-->


        <!-- Footer start from here-->
        <footer class="footer" id="footer">
            <div class="container animated fadeIn">
                <div class="row">
                    <div class="footer-col">
                        <h4>Inquiry via telephone</h4>
                        <ul>
```

```
                        <li><a href="tel:+94714590249"><i class="fas fa-
phone"></i> +94 764851952</a></li>
                    </ul>
                </div>
                <div class="footer-col">
                    <h4>Inquiry via email</h4>
                    <ul>
                        <li><a style="text-transform: lowercase;"
href="mailto:sameerachamara10@gmail.com" target="_blank"> <i class="fas fa-
envelope"></i>sameerachamara10@gmail.com</a></li>
                    </ul>
                </div>
                <div class="footer-col">
                    <h4>Other Links</h4>

                    <ul>
                        <li><a href="gov.php">Government Log in</a></li>
                    </ul>
                </div>
                <div class="footer-col">
                    <img class="footer-logo" src="assets/img/Hero.png">
                    <p><Bold>Traffic Offence</Bold></p>
                </div>
            </div>
        </div>
    </footer>
    <!-- Footer End from here-->

</div>
    <script src="//code.jquery.com/jquery-3.2.1.slim.min.js"
integrity="sha384-
KJ3o2DKtIkvYIK3UENzmM7KCkRr/rE9/Qpg6aAZGJwFDMVNA/GpGFF93hXpG5KkN"
crossorigin="anonymous"></script>
    <script type="text/javascript" language="javascript"
src="assets/vendors/bootstrap/popper.min.js"></script>
    <script type="text/javascript" language="javascript"
src="assets/vendors/jquery/jquery-3.5.1.js"></script>
    <script type="text/javascript" language="javascript"
src="assets/vendors/bootstrap/bootstrap.min.js"></script>

    <script>
        window.onload = function loadingIcon() {
            setTimeout(function() {
                document.getElementById("content").style.display = "block";
                document.getElementById("loading").style.display = "none";
            }, 2000);
        };
    </script>
```

6.4.2 Driver Dashboard Code

```
<?php
session_start();
if (isset($_SESSION['license_id']) && isset($_SESSION['driver_email']) &&
isset($_SESSION['driver_name']) && isset($_SESSION['home_address'])) {
?>



<!DOCTYPE html>
<html>

<head>
    <title>Dashboard | Driver</title>

    <!--Elements inside the head tag includes goes here-->
    <?php
        include_once '../includes/header.php';
    ?>

</head>


<body class="overlay-scrollbar">

    <!--Top navigation bar includes goes here-->
    <?php
        include 'includes/topNav.php';
    ?>


    <!-- Left sidebar navigation start here
=============================================-->
    <div class="leftsidebar overlay-scrollbar scrollbar-hover">
        <ul class="leftsidebar-nav overlay-scrollbar scrollbar-hover">
            <!--Left sidebar navigation items-->
            <li class="leftsidebar-nav-item">
                <a href="dashboard.php" class="leftsidebar-nav-link active">
                    <div>
                        <i class="fas fa-tachometer-alt"></i>
                    </div>
                    <span>Dashboard</span>
                </a>
            </li>
            <li class="leftsidebar-nav-item">
                <a href="pending_fine.php" class="leftsidebar-nav-link">
                    <div>
```

```
                        <i class="fas fa-hourglass-half"></i>
                    </div>
                    <span>Driver's Pending Fine</span>
                </a>
            </li>
            <li class="leftsidebar-nav-item">
                <a href="paid_fine.php" class="leftsidebar-nav-link">
                    <div>
                        <i class="fas fa-coins"></i>
                    </div>
                    <span>Driver's Paid Fine</span>
                </a>
            </li>
            <li class="leftsidebar-nav-item">
                <a href="fine_tickets.php" class="leftsidebar-nav-link">
                    <div>
                        <i class="fas fa-receipt"></i>
                    </div>
                    <span>Provision Details</span>
                </a>
            </li>
            <!--Left sidebar navigation items-->
        </ul>
    </div>
    <!-- Left sidebar navigation end here
=============================================-->

    <!-- Dashboard main content start here
================================================-->
    <div class="dashwrapper animated fadeIn">
        <div class="container-fluid">
            <h6 class="mt-1 badge badge-pill badge-light tag-hover"
style="padding: 10px; font-size: 0.75rem;">Account Holder : <a
href="profile_details.php"><?php echo $_SESSION['license_id']; ?></a></h6>
            <!--Main four count boxes start here-->
            <div class="row p-2">
                <!--First count box start-->
                <div class="col-xl-3 col-lg-6 col-md-6 col-sm-12 col-xs-12
animated fadeIn">
                    <div data-toggle="tooltip" data-placement="bottom" data-
title="Number of fines you have to pay" class="dashcounter color-one p-4 box-
hover">
                        <p>
                            <i class="fas fa-bullhorn"></i>
                        </p>
                        <?php
                            include "../connection.php";
                            $license_id = $_SESSION['license_id'];
```

```
                            $query = "SELECT ref_no FROM issued_fines WHERE
license_id='$license_id' AND status='pending' ";
                            $query_run = mysqli_query($conn, $query);

                            $row = mysqli_num_rows($query_run);
                            echo '<h3 class="counter">'.$row.'</h3>';
                        ?>
                        <p class="dashcount-name">Pending Fine Count</p>
                    </div>
                </div>
                <!--First count box end-->
                <!--Second count box start-->
                <div class="col-xl-3 col-lg-6 col-md-6 col-sm-12 col-xs-12
animated fadeIn">
                    <div data-toggle="tooltip" data-placement="bottom" data-
title="Total fine amount you have to pay" class="dashcounter color-two p-4
box-hover">
                        <p>
                            <i class="fas fa-hourglass-half"></i>
                        </p>
                        <?php
                        include ("../connection.php");
                        $license_id = $_SESSION['license_id'];
                        $query = "SELECT SUM(total_amount) From issued_fines
WHERE license_id='$license_id' AND status='pending'";
                        $result = mysqli_query($conn,$query);
                        $row = mysqli_fetch_array($result);
                        $total = $row[0];
                        echo '<h3 class="counter">'.$total.'</h3>';
                        ?>
                        <p class="dashcount-name">Pending Fine Amount
(LKR)</p>
                    </div>
                </div>
                <!--Second count box end-->
                <!--Third count box start-->
                <div class="col-xl-3 col-lg-6 col-md-6 col-sm-12 col-xs-12
animated fadeIn">
                    <div data-toggle="tooltip" data-placement="bottom" data-
title="Number of fines you paid" class="dashcounter color-four p-4 box-hover">
                        <p>
                            <i class="fas fa-list-ol"></i>
                        </p>
                        <?php
                            include "../connection.php";
                            $license_id = $_SESSION['license_id'];
                            $query = "SELECT ref_no FROM issued_fines WHERE
license_id='$license_id' AND status='paid' ";
```

```
                        $query_run = mysqli_query($conn, $query);

                        $row = mysqli_num_rows($query_run);
                        echo '<h3 class="counter">'.$row.'</h3>';
                    ?>
                    <p class="dashcount-name">Paid Fine Count</p>
                </div>
            </div>
            <!--Third count box end-->
            <!--Fourth count box start-->
            <div class="col-xl-3 col-lg-6 col-md-6 col-sm-12 col-xs-12
animated fadeIn">
                <div data-toggle="tooltip" data-placement="bottom" data-
title="Total fine amount you paid" class="dashcounter color-three p-4 box-
hover">
                    <p>
                        <i class="fas fa-coins"></i>
                    </p>
                    <?php
                    include ("../connection.php");
                    $license_id = $_SESSION['license_id'];
                    $query = "SELECT SUM(total_amount) From issued_fines
WHERE license_id='$license_id' AND status='paid'";
                    $result = mysqli_query($conn,$query);
                    $row = mysqli_fetch_array($result);
                    $total = $row[0];
                    echo '<h3 class="counter">'.$total.'</h3>';
                    ?>
                    <p class="dashcount-name">Paid Fine Amount (LKR)</p>
                </div>
            </div>
            <!--Fourth count box end-->
        </div>
        <!--Main four count boxes end here-->

        <!--Charts start here-->
        <div class="row p-2">
            <div class="col-md-12">
                <div class="mycard">
                    <div class="mycard-header">
                        <h3 class="mycard-heading-charts">
                            Fine Tickets Count <?php echo date("Y");  ?>
                        </h3>
                    </div>
                    <div class="mycard-content">
                        <canvas id="issuedFineCount"
height="300"></canvas>
                    </div>
```

```
                    </div>
                </div>
            </div>
            <div class="row p-2">
                <div class="col-md-6">
                    <div class="mycard">
                        <div class="mycard-header">
                            <h3 class="mycard-heading-charts">
                                Pending Fine and Paid Fine Amount
                            </h3>
                        </div>
                        <div class="mycard-content">
                            <canvas id="PendingPaidfines"
height="200"></canvas>
                        </div>
                    </div>
                </div>
                <div class="col-md-6">
                    <div class="mycard">
                        <div class="mycard-header">
                            <h3 class="mycard-heading-charts">
                                Pending Fine Count & Paid Fine Count
                            </h3>
                        </div>
                        <div class="mycard-content">
                            <canvas id="DriverAndTpoCount"
height="200"></canvas>
                        </div>
                    </div>
                </div>
            </div>
            <!--Charts end here-->

        </div>
    </div>
    <!-- Dashboard main content end here
========================================-->


    <!--Javascripts includes goes here-->
    <?php
        include '../includes/footer.php';
    ?>

    <script type="text/javascript" language="javascript"
src="../assets/vendors/bootstrap/bootstrap.min.js"></script>

    <!--Dashboard number counter settings goes here-->
        <script>
```

```
        $('.counter').counterUp({
            delay: 10,
            time: 500
        });
    </script>

</body>

</html>

<?php
}else{
    header("Location: login.php");
    exit();
}
?>


<!-- 01.Chart => Pending fines and Paid fines
amount================================== -->
<!-- PHP Code goes here -->
<?php
    include ("../connection.php");
    $license_id = $_SESSION['license_id'];
    $result = mysqli_query($conn,"SELECT SUM(total_amount) From issued_fines
WHERE license_id='$license_id' AND status='pending'");
    $row = mysqli_fetch_array($result);
    $totalPending = $row[0];
?>
<?php
    include ("../connection.php");
    $license_id = $_SESSION['license_id'];
    $result = mysqli_query($conn,"SELECT SUM(total_amount) From issued_fines
WHERE license_id='$license_id' AND status='paid'");
    $row = mysqli_fetch_array($result);
    $totalPaid = $row[0];
?>
<!-- PHP Code end here -->
<!-- doughnut-chart -->
<script>
    pending = '<?php echo $totalPending ?>'
    paid = '<?php echo $totalPaid ?>'
    new Chart(document.getElementById("PendingPaidfines"), {
    type: 'doughnut',
    data: {
      labels: ["Paid Fine Amount (LKR)", "Pending Fine Amount (LKR)"],
      datasets: [
        {
```

```
          backgroundColor: ["#431374", "#d46d31"],
          data: [paid, pending]
        }
      ]
    },
    options: {
        responsive: true,
        title: {
            display: false,
        },
        animation: {
            duration: 2000,
        },
        legend: {
            onClick: (e) => e.stopPropagation(),
            position: 'top',
        }
    }
});
</script>
<!-- 01.Chart => Pending fines and Paid fines
amount================================== -->


<!-- 02.Chart => Pending fines and Paid fines
Count================================== -->
<!-- PHP Code goes here -->
<?php
    include ("../connection.php");
    $license_id = $_SESSION['license_id'];
    $pendingcountQuery = mysqli_query($conn, "SELECT ref_no FROM issued_fines
WHERE license_id='$license_id' AND status='pending'");
    $pendingCount = mysqli_num_rows($pendingcountQuery);

    $paidcountQuery = mysqli_query($conn, "SELECT ref_no FROM issued_fines
WHERE license_id='$license_id' AND status='paid'");
    $paidCount = mysqli_num_rows($paidcountQuery);
?>
<!-- PHP Code end here -->
<!-- doughnut-chart -->
<script>
    pending = '<?php echo $pendingCount ?>'
    paid = '<?php echo $paidCount ?>'
    new Chart(document.getElementById("DriverAndTpoCount"), {
    type: 'doughnut',
    data: {
      labels: ["Pending Fine Count", "Paid Fine Count"],
      datasets: [
        {
```

```
          backgroundColor: ["#e84545", "#1d9e8b"],
          data: [pending, paid]
        }
      ]
    },
    options: {
        responsive: true,
        title: {
            display: false,
        },
        animation: {
            duration: 2000,
        },
        legend: {
            onClick: (e) => e.stopPropagation(),
            position: 'top',
        }
    }
});
</script>
<!-- 02.Chart => Pending fines and Paid fines
amount================================== -->


<!-- 03.Chart => Pending fines and Paid fines
amount================================== -->
<!-- PHP Code goes here -->
<?php
    include "../connection.php";
    $license_id = $_SESSION['license_id'];
    $year = date("Y");
    $jan = mysqli_query($conn, "SELECT ref_no FROM issued_fines WHERE
license_id='$license_id' AND MONTH(issued_date) = 01 AND YEAR(issued_date) =
'$year'");
    $janVal = mysqli_num_rows($jan);

    $feb = mysqli_query($conn, "SELECT ref_no FROM issued_fines WHERE
license_id='$license_id' AND MONTH(issued_date) = 02 AND YEAR(issued_date) =
'$year'");
    $febVal = mysqli_num_rows($feb);

    $march = mysqli_query($conn, "SELECT ref_no FROM issued_fines WHERE
license_id='$license_id' AND MONTH(issued_date) = 03 AND YEAR(issued_date) =
'$year'");
    $marchVal = mysqli_num_rows($march);

    $april = mysqli_query($conn, "SELECT ref_no FROM issued_fines WHERE
license_id='$license_id' AND MONTH(issued_date) = 04 AND YEAR(issued_date) =
'$year'");
```

```
    $aprilVal = mysqli_num_rows($april);

    $may = mysqli_query($conn, "SELECT ref_no FROM issued_fines WHERE
license_id='$license_id' AND MONTH(issued_date) = 05 AND YEAR(issued_date) =
'$year'");
    $mayVal = mysqli_num_rows($may);

    $june = mysqli_query($conn, "SELECT ref_no FROM issued_fines WHERE
license_id='$license_id' AND MONTH(issued_date) = 06 AND YEAR(issued_date) =
'$year'");
    $juneVal = mysqli_num_rows($june);

    $july = mysqli_query($conn, "SELECT ref_no FROM issued_fines WHERE
license_id='$license_id' AND MONTH(issued_date) = 07 AND YEAR(issued_date) =
'$year'");
    $julyVal = mysqli_num_rows($july);

    $august = mysqli_query($conn, "SELECT ref_no FROM issued_fines WHERE
license_id='$license_id' AND MONTH(issued_date) = 08 AND YEAR(issued_date) =
'$year'");
    $augustVal = mysqli_num_rows($august);

    $september = mysqli_query($conn, "SELECT ref_no FROM issued_fines WHERE
license_id='$license_id' AND MONTH(issued_date) = 09 AND YEAR(issued_date) =
'$year'");
    $sepVal = mysqli_num_rows($september);

    $october = mysqli_query($conn, "SELECT ref_no FROM issued_fines WHERE
license_id='$license_id' AND MONTH(issued_date) = 10 AND YEAR(issued_date) =
'$year'");
    $octVal = mysqli_num_rows($october);

    $november = mysqli_query($conn, "SELECT ref_no FROM issued_fines WHERE
license_id='$license_id' AND MONTH(issued_date) = 11 AND YEAR(issued_date) =
'$year'");
    $novVal = mysqli_num_rows($november);

    $december = mysqli_query($conn, "SELECT ref_no FROM issued_fines WHERE
license_id='$license_id' AND MONTH(issued_date) = 12 AND YEAR(issued_date) =
'$year'");
    $decVal = mysqli_num_rows($december);
?>

<!-- PHP Code end here -->
<!-- bar chart -->
<Script>
    jan = '<?php echo $janVal; ?>';
    feb = '<?php echo $febVal; ?>';
```

```
    march = '<?php echo $marchVal; ?>';
    april = '<?php echo $aprilVal; ?>';
    may = '<?php echo $mayVal; ?>';
    june = '<?php echo $juneVal; ?>';
    july = '<?php echo $julyVal; ?>';
    aug = '<?php echo $augustVal; ?>';
    sep = '<?php echo $sepVal; ?>';
    oct = '<?php echo $octVal; ?>';
    nov = '<?php echo $novVal; ?>';
    dec = '<?php echo $decVal; ?>';

    new Chart(document.getElementById("issuedFineCount"), {
    type: 'line',
    data: {
      labels: ["January", "February", "March", "April", "May", "June", "July",
"August", "September", "October", "November", "December"],
      datasets: [
        {
          label: "Issued fine count",
          backgroundColor: "#5cb85c",
          data: [jan,feb,march,april,may,june,july,aug,sep,oct,nov,dec]
        }
      ]
    },
    options: {
        legend: { display: false },
        responsive: true,
        title: {
            display: false,
        },
        animation: {
            duration: 2000,
        },
        maintainAspectRatio: false,
        bezierCurve: false
    }
});
</script>
<!-- 03.Chart => Pending fines and Paid fines
amount================================== -->
```

7 Testing and evaluation

7.1 Introduction

Testing is a crucial step in traffic offence management project, because it is necessary to check the fine payment function, the data correctness and the real-time notifications, and many other ones. These are the following types of tests: unit testing of functions, integration testing between the mobile app, the server, the admin panel, and user acceptance testing.

The main development with regard to the project's nature can be viewed from two perspectives: the progressive enhancement of the system's reliable operation and the augmentation of the performance offered. future developments include data analytical capabilities for traffic pattern detection, capability for utilizing big data machine learning approaches and broader connectivity with the national databases. Such an iterative approach will keep the project sound, flexible, and valuable for all that are engaged in it.

7.2 Testing Procedure

- Unit Testing: Some testing conducted checks that each and every single component and/or function within the context of the application under development is functional optimally.
- Integration Testing: Communication between more than one module like, the mobile app with the admin panel, and the database is checked to ensure they are all integrated correctly.
- Functional Testing: The system is 'checked against' known criteria that can verify the functionality of elements like fine payment and notifications.
- User Acceptance Testing (UAT): Users (drivers and traffic officers) use the application in live simulation to verify if it will meet their demands and requirements.
- Performance Testing: The efficiency and stability of the system is evaluated in relation to its usage by different quantity and quality of users.
- Security Testing: The application is checked for any potential and actual threats for safe guarding such information that is considered sensitive.

7.3 Test Plan and Test Cases

7.3.1 Test Plan

A test plan for traffic offense management project describes how, why, what, when and who is involved in testing phase. They also help to make sure that each of the part like fine payment, user registration, and mutual data transfer, both meets the functional and performance specification and complies with the security standards set. The type of testing involves in the test plan includes the unit testing, integration testing, functional testing, user acceptance testing and the security testing. According to the plan, potential problems should be ascertained and solved ahead of time, the efficiency of the system should be increased, and finally, it is possible to make sure that the application meets the expectations of users and objectives set during the project.

7.3.2 Test Cases

In this traffic offence management project, a test case describes the specific conditions that will allow for testing of the different functions such as fine payment, registration, and notification among others. These test states include test purpose, procedure, predicted outcomes, and results attained in each test case. For instance; a fine payment test case would test the ability of the client to view, select and make payment for the fine without a glitch. These are they: The purpose of defining these test cases is to guarantee that all components work properly, satisfies the user's requirements, and covers possible dodgy areas.

7.3.3 Driver Login Test Case

Table 12:driver Loging Test Case

Test Case ID	**1**
Tested Component	Login as driver
Module Name	User Module
Tested Area	Login to the app as driver
Description	Testing the driver's login functionality

No	**Steps to Test**	**Expected Result**	**Actual Result**	**Status**
1	User (driver) enters valid email and password. Click sign in button.	Driver should be able to sign in and be redirected to the dashboard.		

No	Steps to Test	Expected Result	Actual Result	Status
2	User (driver) enters invalid email and password. Click sign in button.	Driver should not be able to sign in.		
3	User (driver) enters valid email and invalid password. Click sign in button.	Driver should not be able to sign in.		
4	User (driver) enters invalid email and valid password. Click sign in button.	Driver should not be able to sign in.		
5	User (driver) leaves email and password empty. Click sign in button.	Driver should not be able to sign in.		

7.3.4 Police Officer Login Test Case

Table 13:Police Officer Loging Test Case

Test Case ID	3
Tested Component	Login as police officer
Module Name	User Module
Tested Area	Login to the app as police officer
Description	Testing the police officer's login functionality

No	Steps to Test	Expected Result	Actual Result	Status
1	User (police officer) enters valid email and password. Click sign in button.	Police officer should be able to sign in and be redirected to dashboard.		
2	User (police officer) enters invalid email and password. Click sign in button.	Police officer should not be able to sign in.		
3	User (police officer) enters valid email and invalid password. Click sign in button.	Police officer should not be able to sign in.		
4	User (police officer) enters invalid email and valid password. Click sign in button.	Police officer should not be able to sign in.		
5	User (police officer) leaves email and password empty. Click sign in button.	Police officer should not be able to sign in.		

7.3.5 Admin Login Test Case

Table 14:Admin Loging Test Case

Test Case ID	**5**
Tested Component	Login as admin
Module Name	Admin Module
Tested Area	Login to the app as admin
Description	Testing the admin login functionality

No	**Steps to Test**	**Expected Result**	**Actual Result**	**Status**
1	Admin enters valid email and password. Click sign in button.	Admin should be able to sign in and be redirected to admin dashboard.		
2	Admin enters invalid email and password. Click sign in button.	Admin should not be able to sign in.		
3	Admin enters valid email and invalid password. Click sign in button.	Admin should not be able to sign in.		
4	Admin enters invalid email and valid password. Click sign in button.	Admin should not be able to sign in.		
5	Admin leaves email and password empty. Click sign in button.	Admin should not be able to sign in.		

7.4 Test Data and Test Results

In this project, Test Data is the sample information which is created as input, such as user's profile, traffic fines, payment detail, etc. to interacting the system. This data is crucial for confirming that everything from user registration, fine display, to payment processing functions as it should.

A Test Results represents the results of these tests to identify how each function works initially and whether it is suitable to operate within the system. Therefore, tests give precise results that particularize system reliability, issues, and solve them to facilitate a desirable user experience.

Table 15:Test Data and Test Result

Test Case	Description	Expected Result
User Registration	Test new user registration.	User successfully registers.
User Login	Verify user login with correct credentials.	User logs in to dashboard.
Profile Update	Check profile information update.	Profile updates are saved.
View Offenses	Display traffic offenses to user.	Offenses load correctly.
Fine Payment	Test fine payment functionality.	Payment completes with receipt.
Notifications	Display notifications to user.	Notifications appear on dashboard.
Admin Login	Verify admin login.	Admin accesses admin dashboard.
Add Offense	Admin adds a new offense record.	Offense is added to user dashboard.
Google Maps	Show offense locations on map.	Map displays correct locations.

Test Case	Description	Expected Result
User Logout	Ensure user logout works.	User logs out successfully.
Data Storage	Test data save and retrieval.	Data stores and displays correctly.
Access Control	Restrict admin features to authorized users.	Only authorized access allowed.

7.5 Acceptance Testing

Acceptance Testing in this traffic offense management project checks whether the system is ready to be deployed without fulfilling other user or business needs. It also employs real users such as the car owners or the traffic officers which to ensure that primary functionalities like paying fines, user registration, and notifications are ease to use and functional. The most important reason behind acceptance testing is to be able to verify if an application can perform its function in a live environment and meet end-user requirements in order to be released for production use.

8 Conclusion and future work

8.1 Conclusion

Realized in this traffic offense management project, these identified gaps in Sri Lanka's current Traffic Fine repayment mechanism are ameliorated effectively. The system is ready, digital, and based on mobile services that help control fine payments, decrease the possibility of errors, less disputes, and increase transparency between drivers and authorities. The project shows that technology can enhance public services, and propose a faster, revenue and reasonable approach to dealing with traffic offenses.

8.2 Future Work

Some improvements which are expected to be incorporated in the subsequent phases of this traffic offense management project include the establishment of the system in all the regions of Sri Lanka to make it comprehensible in every part of the country. Other areas of the planned features include linking GPS of the phone to Google map so that the user can easily identify traffic violation zones and areas where he/she can easily pay the fines. Further refinements of the mobile application will be oriented towards growth in usability, interactivity, and efficiency of the system, which will contribute to the growth of its relevance for users and officials. These updates will all serve to build a solid, a spanning solution meeting traffic management needs nationwide.

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Appendix A: System Development

This section descries the development environment and tools that has been applied over the course of the project and programming languages used. It also provides details of the requisite hardware and software, coding practices, and the selected Development Methodology, Modified Iterative Waterfall Methodology. Key development tools include:

- Development Tools: ph, mysql, html, xtml, API, XML
- IDE: Android Studio for the mobile application, Visual Studio for an admin panel.
- Hosting: GoDaddy Server
- Database: XAMPP for the local development, MySQL is a database management system.
- Other Tools: For UI, I use Figma since it is easier to design; for documentation, I use MS Word, as it helps in typed writing.

Category	**Details**
Languages	PHP (for backend), MySQL (database), HTML/CSS (frontend), XML
Development Tools	Visual Studio Code (for admin panel), Android Studio (for mobile app)
Database	MySQL, managed locally with XAMPP
Hosting Server	GoDaddy Server (for deployment)
Design Tools	Figma (for interface design), Photoshop (for vector editing)
Documentation	MS Word (for project documentation)
Methodology	Modified Iterative Waterfall Methodology

Appendix B: Design Document

To add some context to what was said earlier, the following section will cover the general concept of how the project is set up, in addition to both the general layout of the system interface and specific layouts for key components. The document includes:

- System Architecture: Explain how it is implemented in layers and describes the flow between the modules.
- Database Design: Introduction to the structure of the database with special reference to the tables and methods of normalization.
- User Interface Design: SMock up for the user interfaces of the application for driver, police officers as well as the administrative panel. Each of the screens described to Cattelan focus on its principal purpose while exhibited, as well as the navigation.
- Data Flow Diagrams: Several diagrams depicting the data input and output interfaces of the various modules.

Design Element	**Description**
System Architecture	A three-tier architecture: presentation (mobile app/admin panel), application logic (PHP), and database (MySQL).
Database Design	Normalized database schema with tables for drivers, police officers, offenses, and payments.
User Interface	Figma designs for screens like Login, Fine Payment, and Violation History, with a focus on accessibility.
Data Flow Diagrams (DFD)	DFDs for key processes, such as user login, offense recording by police, and fine payments by drivers.

Appendix C: User Document

The user document describes in details how different people such as drivers, police officers, and administrators can use the system. This includes:

- Driver Guide: Information on how to view fines, previous offenses, and how to pay for them as well as where to get receipts.
- Police Officer Guide: Directions on where to report additional violations, modify the records and handle users' requests.
- Admin Guide: A guide containing information on system usage control, user data handling, and reports.
- FAQs: Helpful tips for user experience to assist them in trouble shooting common problems

er Role	**Instructions Provided**
Driver	Instructions on how to view violations, pay fines, and access transaction history in the app.
Police Officer	Guidelines on recording offenses, updating data, and managing inquiries within the system.
Administrator	Steps for monitoring system activities, generating reports, and managing user accounts in the admin panel.
FAQs	Troubleshooting information for common issues such as login problems or payment errors.

Appendix D: Test Results

This section gathers all testing related information, actions, findings and records that were realized through different phases of testing for ascertaining system's reliability, functionality and usabilit. It includes:

- Test Cases: The key modalities and test cases include login, fine payment, and data updates, and their summaries.
- Testing Process: An explanation of the testing processes such as unit testing, integration testing and acceptation testing.
- Results Summary: A log of results from testing, what was anticipated against reality, and difficulties faced.
- Error Log: Possible error is as follows and correction for the above is as follows:

est Case ID	**Component**	**Module**	**Expected Result**	**Actual Result**	**Status**
TC-01	Login	User Module	Successful login for valid credentials	Success	Pass
TC-02	Fine Payment	Payment Module	Fine successfully paid and transaction recorded	Success	Pass
TC-03	Offense Recording	Officer Module	Offense details saved to database	Success	Pass
TC-04	Access History	Driver Module	Driver able to view violation history	Success	Pass
TC-05	Generate Report	Admin Module	Report generated without errors	Success	Pass

Appendix E: Glossary

Glossary presents the necessary list of technical terms and abbreviations to be used within the framework of the given project. This is the case since the general public may not understand certain terminologies that are utilized in the documentation process. Examples:

- API: Application Programming Interface, a collection of routines that directs an application to interact with other software and or systems.
- CRUD: CRUD, the term that stands for operations with data in a database, which include create, read, update and delete.
- UI: User Interface, or GUI, the interface of the system that is in immediate contact with the users.
- XAMPP: Web development studio that is software solution acting as a local server for web creation.

Term	Definition
API	Application Programming Interface; allows the system to interact with external applications.
CRUD	Create, Read, Update, and Delete; fundamental database operations applied to offense records.
UI	User Interface; visual elements of the mobile app and admin panel that users interact with.
XAMPP	Cross-platform local server software for developing PHP and MySQL applications offline.
Real-Time Data	Data updated instantly within the app, allowing immediate access for drivers, officers, and admins.

ANNEXURES

Annex 1 - Typesetting Recommendations

Description	Dissertation
Dissertation text Times New Roman	12pt
Text in tables and code listing	11pt
Line spacing (preface and main text)	1.5
Line spacing appendices	1.0
Left margin	37mm
Top/bottom/right margins	25mm
Chapter heading	24pt bold
Section heading	16pt
Subsection heading	14pt
Other headings	12pt bold
Tables heading	11pt bold
Printing	Double side of the paper