CopSco

Empowering Citizens for Safer Roads

SCS 3214 / IS 3113

Group project II

Group 55

PROJECT PROPOSAL

SCS 3214 / IS 3113
Group Project II

Proposed Project Title: CopSco

Group Number: 55

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Signature of the supervisor:

Date: 18.06.2021

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Signature of the co-supervisor:

Date:18.06.2021

The client of the Project (If applicable, otherwise supervisor will be considered as the client)

Name of the client:

Address of the client:

Contact person at client:

Contact number of the contact person:

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1. Goal and Objectives

1.1 Project Goals

The primary expectation of this project is to enhance the safety of roads. The system contributes to improving road safety by encouraging responsible driving behavior and discouraging traffic violations. Drivers will be able to act as traffic officers and help identify traffic violations and press charges against them by using their dash cameras (dash cam) and uploading footage of traffic violations. Since any driver will be able to act as a police officer and utilize the video footage as a valuable tool it will hold drivers accountable for their actions.

The system will also be used to pay fines online. The existing offline payment methods for traffic fines often require individuals to visit physical locations, such as the Postal Department or banks, to make payments. This process is inconvenient, time-consuming, and can lead to long queues and delays in fine settlement. Introducing an online fine payment system would streamline the fine payment process, enhance convenience, promote compliance, and improve overall efficiency in managing traffic violations.

1.2 Project Objectives

- Design and develop a user-friendly interface for the dash cam reporting system that accommodates drivers with varying technical backgrounds.
- Implement robust data management practices to protect the security and confidentiality of uploaded footage and personal information.
- Build a scalable and robust infrastructure to handle increasing user volumes and accommodate future growth.
- Ensure compliance with relevant legal and regulatory requirements concerning privacy, data protection, and the use of video footage or images as evidence.
- Enable individuals to pay fines online from the comfort of their homes or any location with internet access.
- Implement robust security measures, encryption protocols, and secure payment gateways to safeguard individuals' sensitive financial information during online transactions.
- Eliminate the need for individuals to physically visit various places to pay fines, saving them time and transportation costs.

2. Problem Definition

The police force consists of 43 Territorial Divisions, 67 Functional Divisions, and 432 Police Stations with more than 84,000 people. When it comes to total road length it estimates as 114,093km but the problem arises when we consider police officers per km of road length is approximately less than 1. which means there is a visible shortage of police officers that we can allocate for rush hours. [1]

The rapid increase in the number of vehicles on the roads has resulted in a significant rise in neglected traffic violations. With more vehicles competing for limited road space, drivers often disregard traffic rules, leading to an increase in accidents and a decline in road safety.

As the number of vehicles and traffic violations continues to rise, there is a significant shortage of traffic police officers to handle the growing demand for enforcement and monitoring. The limited manpower of the traffic police force makes it challenging to effectively patrol and regulate traffic violations, leading to an increased number of offenders going unnoticed and escaping penalties.

Currently, normal drivers have no effective means to report traffic violations they witness on the roads. They lack a platform or mechanism to report these incidents and provide crucial evidence to hold violators accountable. Additionally, there is no provision for rewarding drivers who actively participate in reporting traffic violations, which could potentially incentivize more individuals to engage in improving road safety.

The absence of an online payment system for fines poses a significant inconvenience for both law enforcement agencies and offenders. Presently, individuals who receive traffic violation fines must undergo a cumbersome process of physically visiting designated locations or offices to make the payment. This manual procedure not only consumes valuable time and effort but also adds administrative burdens to the concerned authorities.

The absence of a centralized system to record and manage fine details and driver information creates several challenges in maintaining accurate and accessible records. Currently, different regions and authorities adopt disparate methods for recording and managing traffic violation data, leading to inconsistencies, inefficiencies, and potential data loss. A unified and centralized system is necessary to consolidate all fine-related information and driver details, enabling seamless access, tracking, and management of fines.

3. Introduction

The increasing number of vehicles on the roads has brought about a surge in neglected traffic violations, posing significant threats to public safety and necessitating immediate action. Furthermore, the shortage of traffic police officers to handle the mounting demand for enforcement exacerbates the challenges faced in maintaining road discipline. To address these pressing issues, we present a comprehensive solution that harnesses the power of technology and public (crowd) participation. Our proposal aims to develop an innovative system that enables normal drivers to actively report traffic violations, while also providing a means for them to be rewarded for their contributions, called CopSco. Additionally, the proposal emphasizes the importance of creating a centralized platform that seamlessly integrates reporting, fine management, and an online payment system for offenders. By implementing these solutions, we can enhance road safety, optimize resources, and establish a robust framework for monitoring and regulating traffic violations.

By leveraging the ubiquity of dash cameras in vehicles, drivers can capture incidents of traffic violations and upload them to the system effortlessly. In addition to providing a means for reporting violations, our proposed solution focuses on integrating a single platform that combines reporting mechanisms with a reward system for drivers. This innovative approach incentivizes drivers to actively participate in identifying and reporting traffic violations. Drivers who contribute to the system by reporting violations will be eligible for rewards based on the quality and relevance of their submissions. To streamline the entire process, our proposal encompasses the development of a comprehensive centralized system that manages all fine details and driver information.

By implementing these solutions, we aim to revolutionize the way traffic violations are reported, managed, and penalized. Through the integration of technology, public participation, and streamlined processes, our proposal strives to create a safer and more responsible road environment for all stakeholders involved.

4. Scope

The project mainly focuses on developing a system that allows users to upload videos of traffic violations for verification and monitoring by traffic police. The system includes features such as user registration and authentication, video upload and verification, violation monitoring, and management, facilitation for license suspension and reinstatement, violation history recording, penalty management, reporting and analytics, communication and notifications, user support, and system administration. The proposed system offers a comprehensive solution to address the challenges of managing traffic violations effectively and promotes a safer driving environment.

4.1 Actors

1. General user
   - General Users are the primary users of the system who witness traffic violations via their dash cams and use the system to report them.
   - They upload videos of the violations, providing crucial evidence for enforcement.
   - General users contribute to improving road safety by actively participating in reporting and monitoring violations.

2. Evidence verifier
   - Evidence verifiers are responsible for verifying the authenticity and validity of the videos and details uploaded by users.
   - They review the videos according to the system's guidelines and verify their accuracy.

3. Traffic police
   - They can view past reported violations, and issue fines or penalties when caught during a violation.
   - Traffic Police play a crucial role in enforcing traffic laws and ensuring road safety.

4. Admin
   - The admin is responsible for managing the overall system and its configuration.
   - They have access to administrative tools and settings, allowing them to customize penalty structures, manage user accounts, and ensure data privacy and security.

4.2 In-Scope

1. User Registration and Authentication
   - In order to use the system, general users must first register. The user must submit documents through the system, such as photos of their NIC, in order to be authenticated.

2. Upload violation videos
   - General users are able to upload videos of traffic violations.

3. Video verification
   - Evidence verifiers review and verify the uploaded videos for validity and adherence to system guidelines.

4. Violation reporting and issuing fines
   - Traffic police are able to report traffic violations and issue fines to drivers when caught on the spot.

5. Tiered Reward System
   - As users progress through the tiers, the rewards and benefits they receive increase for uploading videos.

6. Violation History Recording:
   - The system maintains a comprehensive database of past violations, including details such as date, time, location, and type of violation.
   - Users, such as traffic police and administrators, are able to access and review the violation history of individual drivers.

7. License Suspension and Reinstatement:
   - The system automatically tracks and calculates the number of violations for each driver using a demerit point system.
   - When the violation threshold is reached, the system triggers the suspension of the driver's license for a specified duration via Police and Court orders.
   - After serving the suspension period, drivers are able to request the reinstatement of their license through the system.

8. Penalty Management:
   - The system enforces penalties for violations based on predefined rules based on the Act and penalty structures.

- Graduated penalties will be implemented to increase in severity with repeated violations.

9. Communication and Notifications:
   - The system facilitates communication between traffic police, evidence verifiers, and users.
   - Drivers receive notifications regarding license suspension, violation outcomes, and reinstatement instructions.

10. Profile management
    - Users are able to update personal details, reset passwords and edit their close contacts, etc.

11. Complaint Handling
    - Users can make complaints regarding the services that they are getting through the application.

4.3 Out-Scope

- Mobile application – Allow users to easily upload videos of traffic violations directly from their mobile devices.
- Traffic Incident Reporting - Providing a comprehensive system for reporting general traffic incidents, such as accidents, road hazards, or congestion, is beyond the scope of the system, which primarily focuses on traffic violation reporting.

4.4 Assumptions

- There are a sufficient number of users having dashcams or similar devices.
- The government allows payment of fines using online payment gateways.
- All system users are well-equipped with the requisite expertise to proficiently handle the migration of their video files to targeted devices.

5. Technologies

The deliverable of the project is a web application which is mobile responsive, therefore we intend to use the bootstrap framework to create UI components because it reduces design time.

React will be used to code the front-end logic of the system since it's widely supported and has improved performance, scalability, and maintainability. [2]

Express will be used to code the backend logic of the system since it's lightweight and has extensive support for microservices architecture. [3]

GitHub will be used for version control and collaboration. GitHub will be used to maintain our repository and GitHub Projects will be used as a project management tool.

For the System Design stage and the development of UML diagrams, we will be using Draw.io. Figma will be used for UI Design and Prototyping.

We intend to use PostgreSQL Since we require a relational database feature to manage relationships and constraints and it provides more customizability and maintainability. [4]

The TEXTIT.BIZ SMS API gateway will be utilized to send SMS notifications to drivers regarding the imposition of fines for their traffic violations.

Amazon AWS EC2 cloud service will be used to deploy our web application due to its high availability and scalability. [5]

6. Feasibility Study

6.1 Operational Feasibility

The system will provide real-time incident capture, commission calculating, and recorded footage uploading functionalities via its web application that provides an overview of the complete platform. With its user-friendly and simple interface, the website will ensure a positive experience for its users. Users will be able to upload recorded videos from their dash camera or other footage and the web application provides a trim tool to ease the user experience.

Registered users will be able to set up their profiles. Users of the application would not require any special training as the application will be designed so that any type of user can familiarize themselves with it in no time. All activities of the users could be monitored via the administration portal and if needed, necessary action could be taken against users who exploit the application or its functionalities to harm others.

6.2 Schedule Feasibility

The project entails developing a web application within a four-month timeframe, with a team of six members allocating 10 hours per week. This amounts to a total of approximately 960 man-hours dedicated to completing the project. The time available will be carefully distributed across various stages, including requirement analysis, documentation, interface design, system design, implementation, and continuous testing. Following an iterative approach, each stage will be revisited and refined as necessary during the development lifecycle. To ensure timely delivery, technologies will be selected that allow for the inclusion of all specified functionalities in the web application.

Additionally, an administrator portal, crucial to the project, will be developed concurrently with the web application, with completion expected within the first three months. The scheduling feasibility of the project appears to be well organized and accounted for.

6.3 Technical Feasibility

Based on the feasibility assessment, the development of the proposed web application appears to be technically viable. The system architecture includes a scalable and secure client-side and server-side component that can handle the anticipated user base and video queue.

Section 5 contains the technologies that will be used for the project.

The team is confident to handle the project's complexity within the defined timeframe. Scalability considerations have been considered, with provisions for load balancing, caching, and database optimization. Security measures, such as secure user authentication and encryption, align with industry standards and regulatory compliance. The application's integration with other police systems and third-party services is feasible through well-documented APIs and interoperability mechanisms. Ongoing maintenance, support, and monitoring processes have been defined, and the necessary infrastructure resources are available or can be procured reliably.

6.4 Economic Feasibility

Based on the feasibility assessment, the following were selected as the crucial points.

1. Development cost -
   Given that this project will be developed utilizing free and open-source software, there will be no associated expenses concerning the software. Furthermore, the labour cost will be zero as this is a voluntary project undertaken for academic purposes.

2. Operational cost -
● The system will be built using free and open-source software. therefore, no accompanying cost will be incurred.

● The system will be initially hosted using the AWS free tier available for backend hosting but following the initial deployment, there will be an annual fee involved for the hosting of the application. The free tier provides 750h per month free for the first year. Following the first year, the instance will be subjected to a charge of \$0.0124 per hour. Additionally, a cost of 0.0025\$ per GB will be incurred for storing video files in the AWS S3 bucket. [2]

The above costs are affordable and can be covered through the income generated from the application making the project economically feasible.

6.5 Legal and Ethical Feasibility -

Free and open-source software will be used in the development phase to ensure that there will be no risks or issues related to a software license. In addition, the system will be developed from scratch, therefore there will be no copyright issues associated with the project.

Tentative policies will be as follows:

- The video evidence is verified by an authorized police officer, and fines are imposed according to their decisions. Therefore, CopSco does not take responsibility for any legal issues that may arise.

- Points are deducted according to the circulations provided by the demerit point system of the government under the Act.

- Users understand and acknowledge that CopSco is not responsible for the transactions taking place between banks and users.

- Any users who are getting registered to the system will have to verify their citizenship and residential status by uploading proof documents and verified by the local Police Station.

- Users acknowledge that CopSco collects personal data provided by users such as during account creation and application usage. This may include their name, email, phone number, login name and password, address, profile picture, driver's license, and other government identification documents.

- Users acknowledge that CopSco may share personal data with other relevant authorities if required. Authorities will require users' data such as bank account details for conducting payments through the platform.

7. Main Deliverables

1. A mobile responsive web Application
2. Software Requirement Specification
3. The web application will be under a creative canvas

GROUP PROJECT - TIMELINE

GROUP PROJECT II - TIMELINE

PROJECT	FineFlix
GROUP NUMBER	55

			JUNE				JULY				AUGUST				SEPTEMBER				OCTOBER			
		PROJECT WEEK:	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
1	REQUIERMENT ENGINEERING	- Requirement Gathering	▓																			
		- Requirement Analysis		▓																		
		- Scope Identification		▓																		
		- Feasibility Study		▓																		
2	SYSTEM ANALYSIS	- Use case modeling			▓																	
		- Activity modeling				▓	▓															
		- Component modeling					▓															
		- SRS						▓														
3	SYSTEM DESIGN	- UI Design							▓													
		- Database Design							▓													
4	SYSTEM DEPLOYMENT	- Development of essentials								▓	▓	▓	▓	▓								
		- Platform Integration													▓	▓						
5	SYSTEM TESTING	- Unit testing																	▓			
		- Integrated testing																	▓			
		- System testing																	▓			
6	SYSTEM MAINTAINANCE	- Final product																		▓		

Need to show Documentation as well

9. References

[1] W. Contributors, "Sri Lanka Police," Wikipedia, [Online]. Available: https://en.wikipedia.org/wiki/Sri_Lanka_Police.

[2] React, "React – a JavaScript Library for Building User Interfaces," Reactjs.org, 2022. [Online]. Available: https://reactjs.org/.

[3] O. Foundation, "Express - Node.js web application framework," Expressjs.com, 2017. [Online]. Available: https://expressjs.com/ .

[4] T. P. G. D. Group, "PostgreSQL: The world's most advanced open source database," Postgresql.org, 2019. [Online]. Available: https://www.postgresql.org/ .

[5] AWS, "Cloud Object Storage | Store & Retrieve Data Anywhere | Amazon Simple Storage Service," Amazon Web Services, Inc, 2018. [Online]. Available: https://aws.amazon.com/s3/.

10. Appendix: Technological Justification

Frontend technologies

The front-end of the web application will be built using react which is a javascript-based frontend framework. React allows the development of interactive user interfaces easily and efficiently. It also encourages the creation of modular and reusable UI components. Components encapsulate both the structure and behavior of a specific part of the UI, making it easier to manage and maintain complex applications.

The major focus of this system should be to ease the process of uploading and entering violation information, therefore, building user-friendly user interfaces is a big concern of the development process, using react will make it easier to build these UI components easily because it is widely supported and updated by the community.

React also uses a virtual DOM which increases performance. This advantage is especially valuable in applications rendering large amounts of dynamic data, such as dashcam video uploads and real-time violation reporting.

Backend technologies

The backend logic of the system will be developed using Express.js which is a minimal and flexible web application framework built on top of Node.js. It provides a range of features and benefits that make it a suitable choice for developing the backend of our web-based software project.

Express.js is well-suited for developing microservices due to its modular nature. Each microservice can be built as an independent Express.js application, handling a specific functionality or domain of your software. This modularity allows for better scalability, as you can scale individual microservices based on their specific needs, without impacting the entire system. Express.js provides a flexible and intuitive approach to build RESTful APIs, which are crucial for your software's functionalities. It allows us to define routes, handle different HTTP methods, and process data sent in the request bodies. With Express.js, we can easily create API endpoints for uploading dashcam videos, reporting violations, and handling fine payments. Using a framework based on the same language (JavaScript) is an added advantage for development since it reduces the learning curve and eases compatibility.

Databases

PostgreSQL is used as our database for its relational database features, essential for maintaining data relationships and ensuring well-organized data. Data consistency is crucial for the government organization we're developing the system for. PostgreSQL's robust capabilities, including relationship management, data organization, and ACID compliance, align perfectly with our needs. Additionally, its flexibility and strong open-source community support make it an ideal choice.

PostgreSQL is designed to handle high volumes of data and concurrent users effectively. It offers various optimization techniques, including indexing, query optimization, and parallel execution, which enable efficient data retrieval and processing. PostgreSQL's ability to handle large datasets and complex queries makes it suitable for your software, where dashcam videos and violation records might accumulate over time.

PostgreSQL also supports user-defined data types as well as data in the JSON format which could come in handy when we're dealing with the metadata of videos as well as driver's license information. PostgreSQL offers advanced security features such as user authentication, data encryption, and fine-grained access controls. Its support for transactions and constraints helps maintain data consistency and prevent data corruption.

Data security is also a huge concern of our system since we store sensitive information related to the driving license as well as payment information of the users.
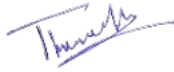
Deployment

Deployment of the system will be done in an AWS EC2 instance. Because the system provides payment options as well as real-time violation management the availability and scalability of our deployment service are important.

EC2 instances can be automatically scaled up or down to handle increased or decreased traffic load, ensuring optimal performance and cost-efficiency.

We also intend to use an AWS S3 bucket to store our video files since it's easily scalable and cost-effective which is an important concern when storing large data files such as dashcam videos.

11. Declaration

We as members of the project titled 'CopSco', certify that we will carry out this project according to guidelines provided by the coordinators and supervisors of the course as well as we will not incorporate, without acknowledgement, any material previously submitted for a degree or diploma in any university. To the best of our knowledge and belief, the project work will not contain any material previously published or written by another person or ourselves except where due reference is made in the text of appropriate places.

Name	Signature
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O.V. De Silva	
T.D. Attygalle	
M.A.V. Lochana	
A.J.U. Dakshika	
U.K.D.K. Nethmini	