VEHICLE REPORT AND INFORMATION SYSTEM

A Minor Project Report

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For

The partial fulfilment of Degree

Of

Bachelor of Technology

In

Computer Science & Engineering

By

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Session: 2021- 2022

DECLARATION BY THE CANDIDATE

I undersigned solemnly declare that the Minor project report entitled **"*VEHICLE REPORT AND INFORMATION SYSTEM*"** is based on my own work carried out during the course of my study under the supervision of Asst. Prof. ***Kaveri Kar.***

I assert that the statements made, and conclusions drawn are an outcome of the project work. I further declare that to the best of my knowledge and belief that the report does not contain any part of any work which has been submitted for the award of any other degree/diploma/certificate in this University/Deemed university of India or any other country.

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CERTIFICATE BY THE EXAMINERS

The project report entitled **"*VECHICLE REPORT AND INFORMATION SYSTEM*** "has been examined by the undersigned as a part of the examination of Bachelor of Technology in the faculty of Computer Science & Engineering of Chhattisgarh Swami Vivekanand Technical University, Bhilai.

_____ _____

Internal Examiner **External Examiner**

Date: **Date:**

ACKNOWLEDGEMENT

Working for this project has been a great experience for me. There were moments of anxiety when I could not solve a problem for the several days. But I have enjoyed every bit of process and am thankful to all people associated with me during this period I convey my sincere thanks to my project guide **Ms. Kaveri Kar** for providing me all sorts of facilities. Her support and guidance helped me to carry out the project. I owe a great dept. of her gratitude for her constant advice, support, cooperation & encouragement throughout the project I would also like to express our deep gratitude to respected **Ms. Kaveri Kar** (Assistant Professor) for her ever helping and support. I also pay special thanks for her helpful solution and comments enriched by her experience, which improved my ideas for betterment of the project. I would also like to express my deep gratitude to respected **Dr. Alok Kumar Jain** (Principal) and college management for providing an educational ambience. It will be my pleasure to acknowledge, utmost cooperation and valuable suggestions from time to time given by our staff members of my department, to whom I owe my entire computer knowledge and also I would like to thank all those people who have directly or indirectly helped me by providing books and computer peripherals and other necessary amenities which helped me in the development of this project which would otherwise have not been possible.

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LIST OF ABBREVIATIONS

UI	USER INTERFACE
ROI	REGION OF INTEREST
OCR	OPTICAL CHARACTER RECOGNITION
API	APPLICATION PROGRAMMING INTERFACE
DB	DATABABSE
RVD	REPORTED VEHICLE DATABASE
OS	OPERATING SYSTEM
XML	XTENSIBLE MARKUP LANGUAGE
HTML	HYPTER TEXT MARKUP LANGUAGE
SQL	STRUCTURED QUERY LANGUAGE
PHP	HYPTERTEXT PREPROCESSOR
PC	PERSONAL COMPUTER
RAM	RANDOM ACCESS MEMORY
ROM	READ ONLY MEMORY
CDMA	CODE DIVISION MULTIPLE ACCESS
NFC	NEAR FIELD COMMUNICATION
VOLTE	VOICE OVER LONG-TERM EVOLUTION
VPN	VIRTUAL PRIVATE NETWORK
GSM	GLOBAL SYSTEM FOR MOBILE COMMUNICATION
IO	INVESTIGATING OFFICER

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ABSTRACT

Since vehicles have become an important indispensable part of our everyday life, we need to make provisions to reduce vehicle crimes such as hit-and-run, illegal parking, abandoned vehicles, and more. One must be able to report a crime without the long procedures and only with few steps of verifications and minimal physical contact along with the sensitive information regarding the case being available in a secure environment to the investigating authorities without the need to go through tedious paperwork and documentation.

The project titled "VEHICLE REPORT AND INFORMATION SYSTEM" is an android application which aims to make the process of reporting vehicle related crimes and viewing the case related relevant information to the appropriate authorities, easier and much more transparent. It makes used of tools such as android studio and XAMPP to provide a full stack implementation of all its features.

CHAPTER 1
INTRODUCTION

1.1 OVERVIEW

The term 'vehicle crime' refers to the theft and trafficking of vehicles and the illicit trade in spare parts. These activities affect personal property, businesses, the economy and public safety in all regions of the world.

The organized theft of motor vehicles, while of immediate concern to the individual owner, also has a financial implication for insurance companies, is damaging to the reputation of car manufacturers and – in most cases – is linked to other organized crime operations.

For organized criminal groups, the acquisition, shipment and trade of stolen vehicles is a low-risk way to make profits. Stolen vehicles are frequently trafficked in order to finance and carry out other criminal activities, ranging from drug trafficking, arms dealing, people smuggling and international terrorism.

Additionally, the illicit market in spare parts is a lucrative source of income for criminal organizations and offers them many practical uses. Not only does this phenomenon have a financial impact on the industry, but it also puts drivers in danger as illicit spare parts are likely to fall below recognized safety standards.

In recent years, the use of the Internet has contributed to a dramatic increase in the resale of illicit vehicle components, making this an issue of major concern for law enforcement, car manufacturers, regulatory bodies and public health organizations across the world.

With the number of Internet enabled devices (e.g., a smartphone, a tablet, a wear-able or a laptop) highly increasing, so does their role in every person's daily life. Through the use of a call, an instant message, a post on social media or even real-time video communication, users can easily use their smartphone to report an event, ask for assistance or provide information about their status, allowing the provision of faster and more efficient safety services. To this end, community policing has come to be considered as a new and improved mode of policing by many countries in the past years.

In general, this new approach includes an increasingly active role of civilians in community policing which firstly includes to assist the police in creating improved relations with the communities they serve; and secondly, yet not unrelated, to make policing the responsibility of all members of a community which in turn should serve to decrease the level of crime in their society. In order to achieve this, the police service and communities need to have close working relationships with one another based on trust, transparency and a shared concern for safety, peace and stability. To facilitate the communication, the use of smart apps in Crime Reporting appears to be a fast and effective way of getting citizens engaged.

It goes without saying that police departments routinely collect information, while police reports include intimate details about victimization and other personal events. At the same time, the use of mobile applications in crime reporting will definitely lead to an increase of personal data collection and processing. These applications demand access to the user's personal data and information (e.g., location at the time of reporting via the embedded GPS sensor in the smartphone) for their efficient performance. By providing this access to his/her personal data, the user consents on the collection, storage and process of their data, hoping that this will be done in the frame to which he/she provided his/her consent.

1.2 INTRODUCTION TO PROJECT

In this project VEHICLE REPORT AND INFORMATIONS SYSTEM by making use of the android application development tools and packages along with the full stack application development methodology, we have implemented a user centric common interface targeting both the parties namely the assigned officer and the reporter of the crime, and have tried to make the process of reporting the crime easy as well as increased the accessibility to preliminary information regarding the report and ownership available at the very beginning of the reporting process.

1.3 FEATURES OF THE APPLICATION:

1 The deals with the public security domain. The main aim of the project is to provide ease in reporting vehicle related crime directly from android mobile phones and provide vehicle information directly to the investigating authorities.

2 The application has 2 variations in the UI design to make the accessibility of parts of the application on the basis of relevance to the type of user using it.

3 The application has a user interface for the citizens where the Citizen can report the vehicle by clicking a photo on the app and click on report, the server detects the number plate as ROI and after performing OCR gets the vehicle number to search in the database and places report to nearest police station in the database,

4 Also, in another variation of the user interface designed to deal with the investigating authorities the investigating authorities working in the station can access complete information of the vehicle for ease in investigation.

5 The application is developed using Java/Kotlin, android studio, for hosting the app the APIs are build using PHP and uses MySQL as database, TensorFlow object detection and EasyOCR.

1.4 WHY ANDROID APPLICATION?

As the data from Statista.com the estimated number of android users in world is about 748 million with 129.1 million android users from India, and the amount of smartphone users worldwide is forecasted to exceed 1.5 billion users by the year 2040.

Not only that the devices are equipped with Internet connectivity, camera access, are very easily accessible, portable, and quite easy to use compared to other available devices having similar functionalities.

Also making use of server and database most of the data required to run the application or the sensitive information is directly fetched when needed and doesn't create overhead on the storage of the user.

1.5 NEED FOR COMBINED INTERFACE?

The application is made to be able to provide one composite solution to many of the problems and overheads related to reporting vehicle related crimes. And targets both the customer segments that is reporter and the investigating authorities. If both can use the same application as per there requirements one would not need to go for 2-3 different apps for getting access to different functionalities.

Not only that the combined interface also makes it easier to train people to use the application if required as we need to train both the customer segments to be able to use only one application.

1.6 PRACTICAL APPLICATION SCENARIOS?

1 This project combines the Native full stack android application development with Artificial intelligence to provide an easier approach of reporting vehicle related crime to the authorities, and assist the authorities in investigating these reports by providing the vehicle information directly from the app.
2 The key area of the project is in public security domain. And it will facilitate information access control to the authorities, and as a result helping them to investigate as soon as possible.
3 This application will provide different interfaces for the citizen and investigating authorities, as the constitute major portion of the end users of this project.

1.7 ABOUT APPLICATION DEVELOPMENT:

Application development is the process of designing, building, and implementing software applications. It can be done by massive organizations with large teams working on projects, or by a single freelance developer. Application development defines the process of how the application is made, and generally follows a standard methodology.

There are lots of factors that go into how application development is done. You must consider the size of the project, how specific the requirements are, how much the customer will want to change things, how large the development team is, how experienced the development team is, and the deadline for the project.

1.7.1 SOFTWARE DEVELOPMENT LIFECYCLE:

- Planning
- Analysis

- Design
- Construction
- Testing
- Implementation
- Support

The way that application development teams have accomplished these seven tasks has changed a lot in the last few decades, and numerous types of application development methods have emerged. Each methodology must provide a solution for the seven stages of the SDLC.

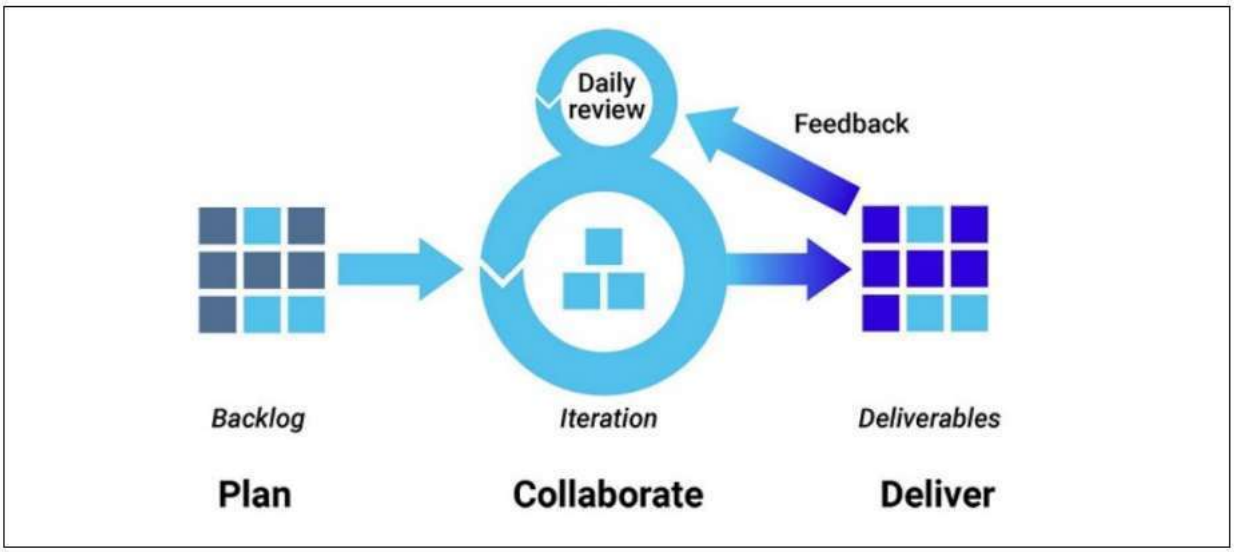

FIG 1.1 DEVELOPMENT CYCLE

CHAPTER 2
LITERATURE OVERVIEW

2.1 ANDROID APPLICATION: -

An android app is a software application running on the Android platform. Because the Android platform is built for mobile devices, a typical Android app is designed for a smartphone or a tablet PC running on the android OS.
Android apps are written in the Java programming language and use java core libraries. They are first compiled to Dalvik executables to run on the Dalvik virtual machine, which is a virtual machine specially designed for mobile devices.

Android initially came into existence with the sure-fire idea that developments are given the power and freedom to create enthralling Mobile applications while taking advantage of everything that the mobile handset has to offer.

2.2 CHARACTERISTICS OF ANDROID APPLICATIONS: -

- User Interface: the user interface of the android operating system is straight forward, and these features make it very user friendly.
- Multi-tasking: Android provides support to run apps and services in the background with ease which allows the users to use multiple apps at the same time.
- Connectivity: Android has extensive support to the connectivity, and it supports connectivity such as Wi-Fi, Bluetooth, Hotspot, CDMA, GSM, NFC, VOLTE, VPN, 3G, 4G.
- Extensible application support: android have play store which is used as the major tool to download and update applications on the operating system, however, one can download the installer, and install it manually, but it is not much recommended as third-party applications could be prone to some security breach in the smartphones.
- Multiple Language Support: Android supports multiple languages in its operating system and one can change the language very easily based on one's requirement, the international languages supported as English, Germany, Chinese and many more.

2.3 ANDROID STUDIO

Android studio is an android application development environment used for the testing, debugging, and making of android based apps. Android studio deals with apps for a wide range of electronic device category, such as, Android Wear, Android TV, Android Auto, Android phone, tablets, etc. It provides a unified environment consisting of mostly everything thing that might be of help or will be needed by the developer. For an instance it supports both installation of apps under development into physical devices as well as an inbuilt virtual android support environment where one can select from a wide range of different devices and OSs to test the application functionalities.

Structure code modules allow the developers to divide the project into units of functionality that can be independently build, test and debug as at the end the android studio takes care of connecting and indexing all the modules while creating the app. Not only that it provides

support for graphical user interface with extended support for features like drag and drop of various components as well as layout preview on side. Due to its interface being very interactive it is easier for new developers to adjust to the environment quite well and as this IDE is the one and only official IDE for android application development than at later stages of project one might have to migrate the apps and projects from other IDEs to android studio.

Android studio uses JAVA as the base programming language for the development purposes and XML for layout design. But one can also use Kotlin along with the feature to code in both the languages at the same as android studio has automated mechanism to convert the code from JAVA to KOTLIN.

Even the integration of various modules available online to make the development process smooth and less time consuming is also good in Android studio as the community for android development using JAVA has been around for quite a long time one may find many variations of implementation of a feature or find solution to a wide range of problems and errors, along with all the code being supported by the android studio.

2.4 XAMPP APP:

XAMPP is a completely free, easy to install Apache distribution containing MariaDB, PHP, and Perl. The XAMPP open-source package has been set up to be incredibly easy to install and to use. XAMPP is one of the widely used cross-platform web servers, which help developers to create and test their programs on a local webserver. It was developed by the Apache friends, and its native source code can be revised or modified by the audience. It consists of Apache HTTP server, MariaDB, and interpreter for the different programming languages like PHP and Perl. It is also available in 11 languages and supported by different platforms such as the IA-32 package of Windows & x64 package of macOS and Linux.

XAMPP is an abbreviation where X stands for Cross-Platform, A stands for Apache, M stands for MYSQL, and the Ps stand for PHP and Perl, respectively.

Components of XAMPP:

- Cross-Platform
- Apache
- MariaDB
- PHP
- Perl
- phpMyAdmin
- OpenSSL
- XAMPP Control Panel
- Webalizer
- Mercury
- Tomcat
- Filezilla

2.5 SOME COMPONENTS OF OUR ANDROID APPS:

2.5.1 VIEWS

Views are used to create input and output fields in an Android App. It can be input text field, radio field, image field etc. They are same as, input text field, image tag to show images, radio field in HTML.

View-Group is the base class for layouts, which holds other Views and define their properties. Actually, an application comprises combination and nesting of Views-Group and Views Classes.

Most used android view classes:

- Text View
- EditText
- Button
- ImageView
- ImageButton
- CheckBox
- Radio Button
- Radio Group
- ListView
- Spinner
- AutoCompleteTextView

2.5.2 RECYCLER VIEW

RecyclerView makes it easy to efficiently display large sets of data. We supply the data and define how each item looks, and the RecyclerView library dynamically creates the elements when they're needed. As the name implies, RecyclerView recycles those individual elements. When on item scrolls off the screen, RecyclerView doesn't destroy its view. Instead, RecyclerView reuses the view for new items that have scrolled onscreen. This reuse vastly improves performance, improving your app's responsiveness and reducing power consumption.

2.5.3 LAYOUTS

A layout defines the structure for a user interface in your app, such as in an activity. All elements in the layout are built using a hierarchy of View and ViewGroup objects. A View usually draws something the user can see and interact with. Whereas a ViewGroup is and inviable container that defines the layout structure for View and other ViewGroup objects.

Layout basically refers to the arrangement of elements on a page these elements are likely to be images, texts, or styles.

Commonly used layouts:

- Linear Layout
- Relative Layout
- Frame Layout
- Grid Layout
- List View

2.5.4 VOLLEY LIBRARY

Volley is an HTTP library that makes networking for android apps easier and most importantly, faster. Volley is available on GitHub.

Volley offers the following benefits:

- Automatic scheduling of network requests.
- Multiple concurrent network connections.
- Transparent disk and memory response caching with standard HTTP cache coherence.
- Support for request prioritization
- Debugging and tracing tools.
- Ease of customization, for example, for retry and backoff.
- Strong ordering that makes it easy to correctly populate the UI with data fetched asynchronously from the network.

2.6 JUPYTER NOTEBOOK

JupyterLab is a web-based interactive development environment for Jupyter notebooks, code, and data for Jupyter notebooks, code, and data. JupyterLab is adaptable: you may customize and organize the user interface to accommodate a variety of data science, scientific computing, and machine learning workflows. JupyterLab is modular and expandable, allowing you to create plugins that add new features and connect with current ones.

2.7 APACHE NETBEANS IDE

Apache NetBeans is free and open source and is governed by the Apache Software Foundation.

Fast & Smart Editing

- Apache NetBeans is much more than a text editor. It highlights source code syntactically and semantically, lets you easily refactor code, with a range of handy and powerful tools.

Java, JavaScript, PHP, HTML5, CSS, and More

- Apache NetBeans provides editors, wizards, and templates to help you create applications in Java, PHP and many other languages.

Cross Platform

- Apache NetBeans can be installed on all operating systems that support Java, i.e, Windows, Linux, Mac OSX and BSD. Write Once, Run Anywhere, applies to NetBeans too

CHAPTER 3
PROBLEMS & CHALLENGES

3.1 Background

Our main goal in this project is to make the reporting system easier, problem free and smooth, along with taking measures to deal with the time taking manual procedures and limiting unnecessary physical involvement on any party as much as possible. Using this app citizens will be able to report the vehicle crimes from on-site, anytime, withing the reach of their hands. The app is also equipped with Image OCR technology to reduce the error window for number plate detection, as well as the feature to extract the location information of the site of report and attaching it to the report to provided direct navigation features to the investigative authorities to make on-site visits.

3.2 Problems:

- Long and hectic procedures involving station visits may make a reporter hesitant to go make a report.
- The long-time take documentation procedures to get the relevant information regarding to the case for the authorities to design a broad picture of the case to be able to draw conclusions from.
- Authentication problems regarding the reporter's identity, reported vehicle identity, etc.
- Lack of centralised system to facilitate all the things regarding the case.
- Lack of permanent reliable organised and secure storage space for the case related information
- Lack of transparency at various levels.

3.3 Proposed Solutions

According to the above stated problems, our application tends to deal with some if not all the problems and provide an effective solution to them.
For an instance:

- The application provides a centralised environment to make reports, view reports, track progress, getting information regarding the in charges, and many more.
- For the identification of the reporter the application makes use of the Aadhar number and contact information which the reporter needs to fill in before being able to make any reports.
- For the identification of the vehicles the app makes use of the RVD which stores the information regarding the vehicle like its specifications, owner information, and vendor information.
- It eases the process by eliminating visit to a station to make a report and provided on-site reporting feature so to even eliminate the time gap which might be there if the reporter waits until the reaching the information to provide all the observed information.
- Eliminated the need for applications regarding accessing the vehicle owner and vendor information as the authorities assigned to handle the case can view them directly from the app and others can track the progress.

- All the information regarding the case progress such as status, report information, conclusion of the case, information related to the in charge of the case are store in a structure manner in the database.

CHAPTER 4
SOFTWARE REQUIREMENTS

SOFTWARE REQUIREMENTS:

In order to create our project in and effective manner, we employed a variety of applications. We utilised the Android Studio, XAMPP, Jupyter Library, Apache NetBeans IDE, and other applications in this system. Any system's development is incomplete without software. Regardless of the language in which the application was created. Software is an essential component of any application that aids in the growth of any system. Software is a collection of programs or codes designed to improve and simplify the computer's functioning.

4.1 SOFTWARE REQUIREMENTS FOR USER:

- Android Lollipop or higher (SDK 21 or higher).

4.2 SOFTWARE REQUIREMENTS FOR DEVELOPERS:

- Android studio version 4.1.2 with Kotlin and java support
- Windows 7/8/10.
- Any browser.
- XAMPP
- Jupyter notebook along necessary object detection libraries
- Apache NetBeans IDE 12.4

CHAPTER 5
HARDWARE REQUIREMENTS

HARDWARE REQUIREMENTS:

Hardware plays just as vital a role as software. If the programme necessitates suitable and precise software, it will likewise want appropriate hardware. Hardware settings should be based on the requirements of the software being created. Incorrect hardware configurations may result in an unfavourable outcome for the system being created. The RAM, ROM, and processor of the system that is being utilized for the project are the basic hardware requirements. The following are the requirements' explanations:

- The processor is a logical circuit that responds to fundamental instructions and processes them in order to run a computer system. It is a prerequisite since a computer cannot function without it. Every time, an updated processor should be utilized to ensure that there is no misbehaviour on the part of the processor.

- Another major element of a computer system is RAM. It is a computer's storage device. The RAM holds the data and machine codes that the software is now processing. While creating or executing the software, there should be enough RAM available. The lack of RAM space may result in the designed system's failure to perform properly.

- Another significant component of a computer system is the read-only memory (ROM). The ROM holds the computer's memory that can only be read and not updated to. The ROM enables us to boot the computer system whenever we turn it on. It does so by exposing some functionality.

So, with the support of the above-mentioned hardware explanation, we can readily comprehend the significance of hardware in the creation of any computer system project. A system cannot function correctly without ideal hardware, hence appropriate and precise hardware is required while building or running any system

5.1 HARDWARE REQUIREMENT FOR USERS:

- Snapdragon 300 series or higher
- 2GB RAM or higher
- Storage or higher
- Internet connection

5.2 HARDWARE REQUIREMENTS FOR DEVELOPERS:

- 3GB RAM minimum, 8 GB RAM recommended (plus 1 for Android Emulator.)
- 4GB storage space, 10 series NVIDIA GPU.
- Minimum resolution 1280 x 800, and Webcam.
- Processor i3 8^{th} gen minimum,
- Internet connection.

CHAPTER 6
DESCRIPTION AND IMPLEMENTATION

6.1 FRONT END DETAILS: -

6.1.1 Detailed overview: -

The front end consists of 2 variations of UI targeting the 2 different customer segments this application is made to serve. Proving only segment specific access to the various parts of the applications.

- The Start Up screen (Fig 6.1) of the application consists of a in app camera view made similar to the implementation of google lens to make it easy of the user to understand its working.
  Consists of
  - Log Out Button
  - Capture Button
  - View profile
  - View reports

- The feature to be able to report crime (Fig 6.2) is only accessible for the citizen customer segment, so on capturing the image of the car the reporter is directed towards the screen providing reporter with options to: -
  - Image preview
  - Crop option which directs the user to crop activity
  - Retake option
  - Number plate detection button to get the number using OCR on captured image
  - Submit button followed by number and information verification in case the user is yet to fill their profile details and then to proceed with further report process.

- Log In (Fig 6.3) and Sign-Up screen (Fig 6.4): -
  - Both are made to serve the 2 customer segments of the app with requiring the authorities to put extra details such as their government id number.
  - The Log in and Sign-Up interfaces are also implemented as Pop Up in case user needs to user specific functionalities as one needs to login do so.

- Report List View: -
  This Interface is made to be only accessible by the authorities with constraint of only being able to view the reports made to the police station to which the investigation officer is affiliated to.
  The interface contains a recycler view which is populated using a custom view,
  - The items of the recycler view are made to provide the overview information about the report to allow the officers to choose the case after getting to view some information but without compromising sensitive information regarding the report.
  - On selecting any of the items the officers are directed to verification alert box to choose if they want to accept the report or not, if they do so than they are directed to the Descriptive view of the report else they are directed back to the previous activity.

- Descriptive View of the report (Fig 6.5, Fig 6.6)
  This View is to provide a detailed view of the information regarding the information. The view is divided into 2 sections: -
  One is to display the details: -
  1. Original photo of the vehicle as per RVD
  2. Owner Name as per RVD
  3. Number Plate as per RVD

  The other section is further divided into 3 sections: -
  1. First section to provided report related information such as: -
     a. Report subject
     b. Reported image
     c. Reported information
  2. Second section is to provided information regarding the vehicle: -
     a. Complete information of the Owner as per RVD
     b. Complete information of the Car vendor as per RVD
  3. Third section is to provide the Officer to write change the status of the report and to put in the conclusion of the information before closing a case report.

- Profile View (Fig 6.7)
  Consists of 2 different UIs as per the type of user, and is divided into 2 sections: -
  a. First one to provide the profile information of the user in the database
  b. The other part if for the user to be able to insert/edit some details about them.

6.1.2 IMPLEMENTATION IMAGES: -

1. Start Up and crop image activities are illustrated below

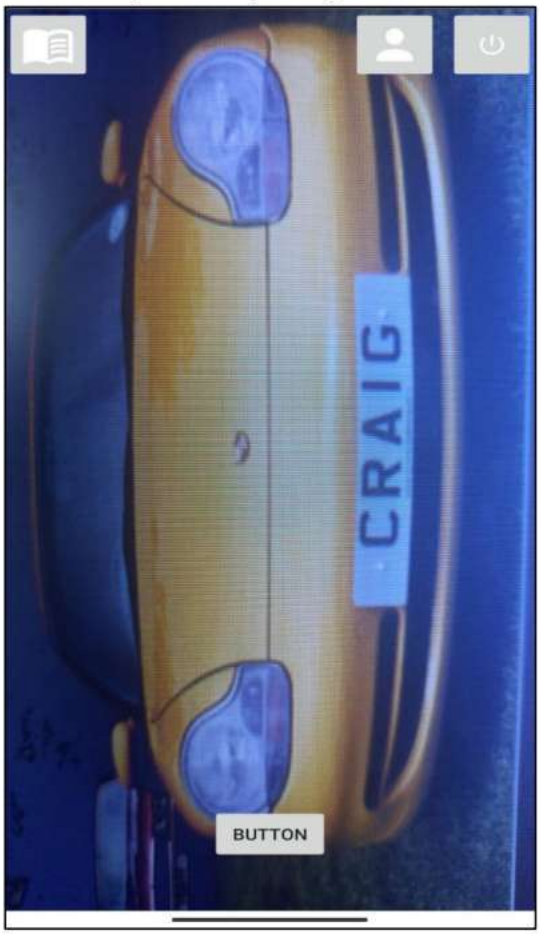

Figure 6.1 The Start Up UI

Figure 6.2 Image crop Activity UI

The Fig 6.1 Illustrates the start up activity which contains an in-app camera view using the camera2 framework API in backend and Texture View as a parent view to render it. Aside from Texture View the Views used are Button, Image Buttons.

The Fig 6.2 Illustrates the activity to allow user to crop/retake the captured image and detect the Plate number using the OCR model. The Activity Uses the constraint view as the parent view and contains text views, buttons, image views, and edit text view.

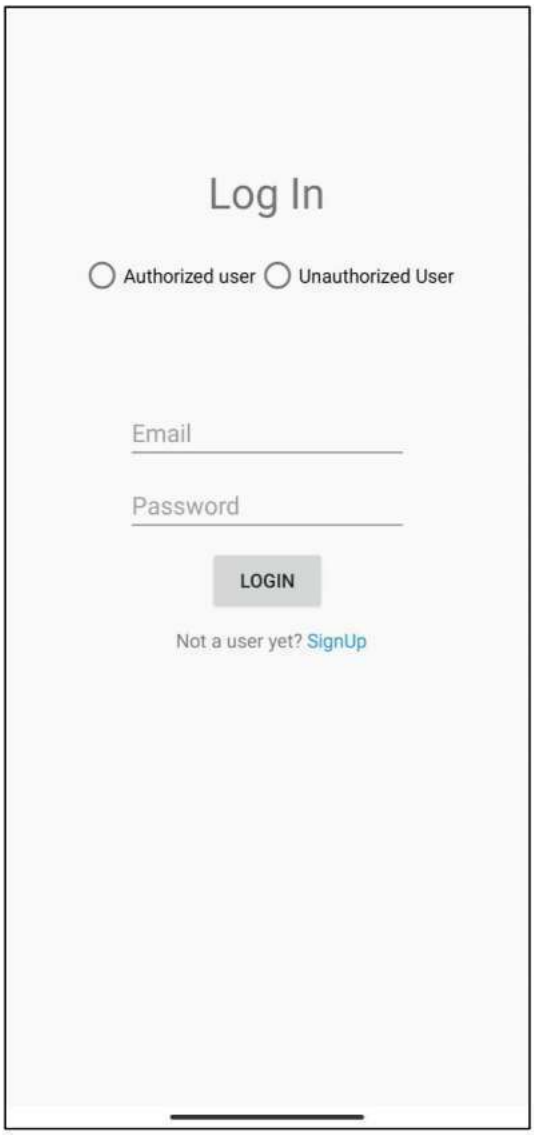

Fig 6.3 Login Activity UI

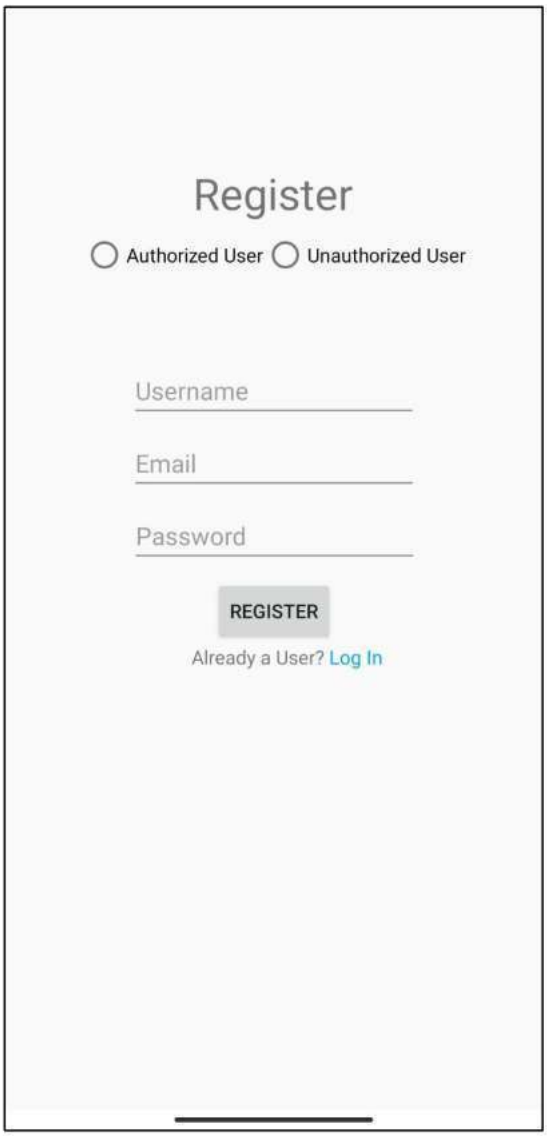

Fig 6.4 Registration Activity UI

Here the Radio button is used to provide option to choice which type of user is trying to make an accout or is trying to register for the first time. Both the UIs are also used as pop ups in different portions of the application to implement the auth whenever user specific functionalities are to be displayed. Parent view used in this activity Constraint Layout.

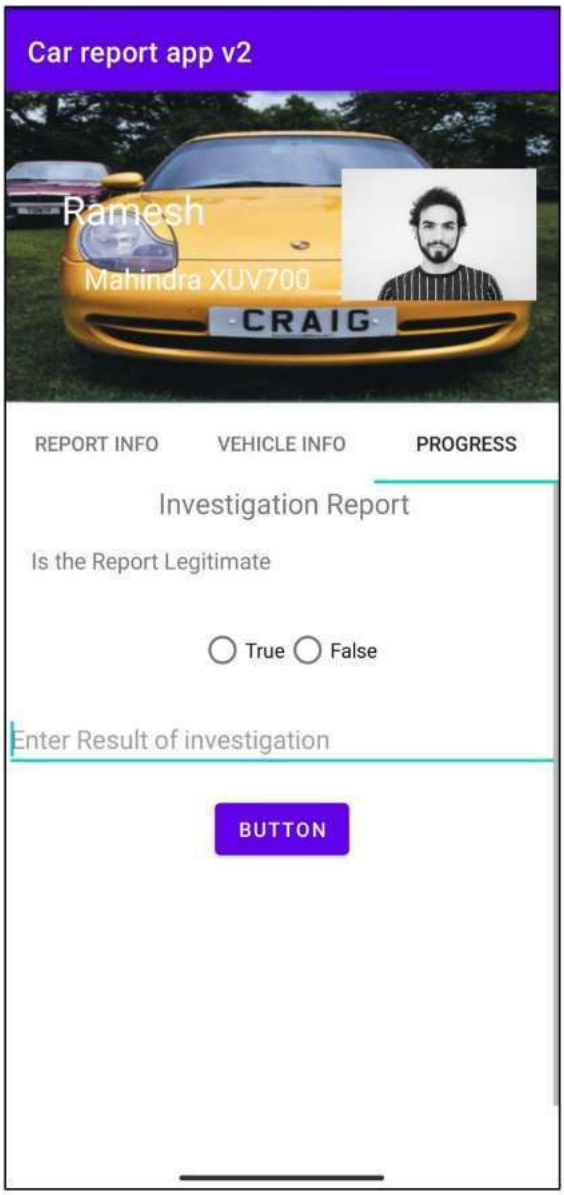

Fig 6.5 Report conclusion and report UI

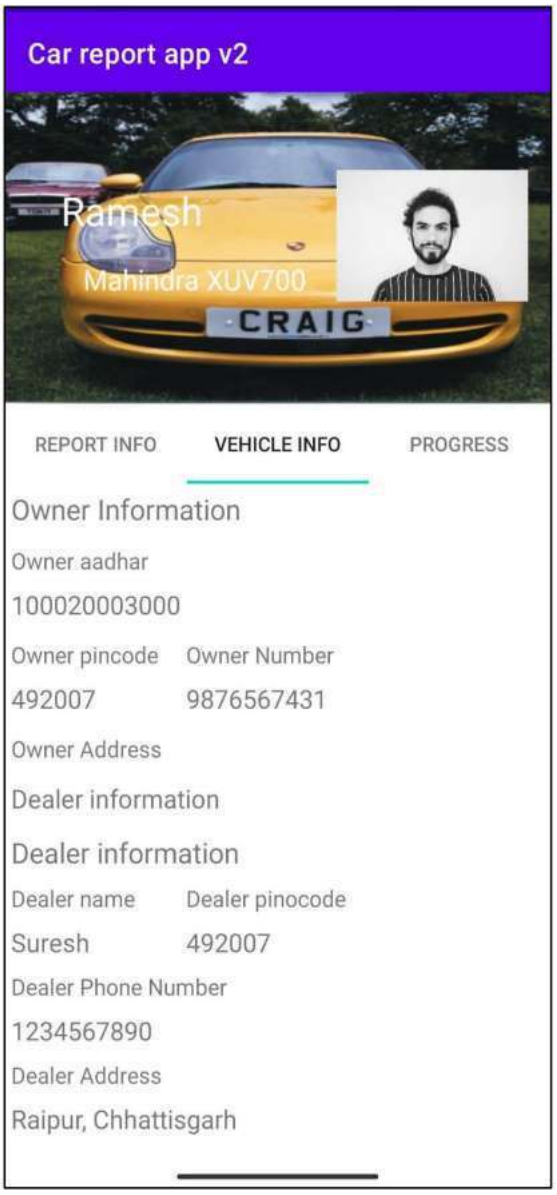

Fig 6.6 Vehicle information UI

These Activities are only available for the investigating officer to be able to view the reported vehicle information along with the vehicle vendor information.
Activities illustrated in Fig 6.5 and Fig 6.6 are build using:

1. TabHost for implementing Report info, vehicle info, and Progress
2. Linear Layout
3. TabWidget
4. FrameLayout
5. Constraint Layout
6. Scroll View
7. Grid Layout

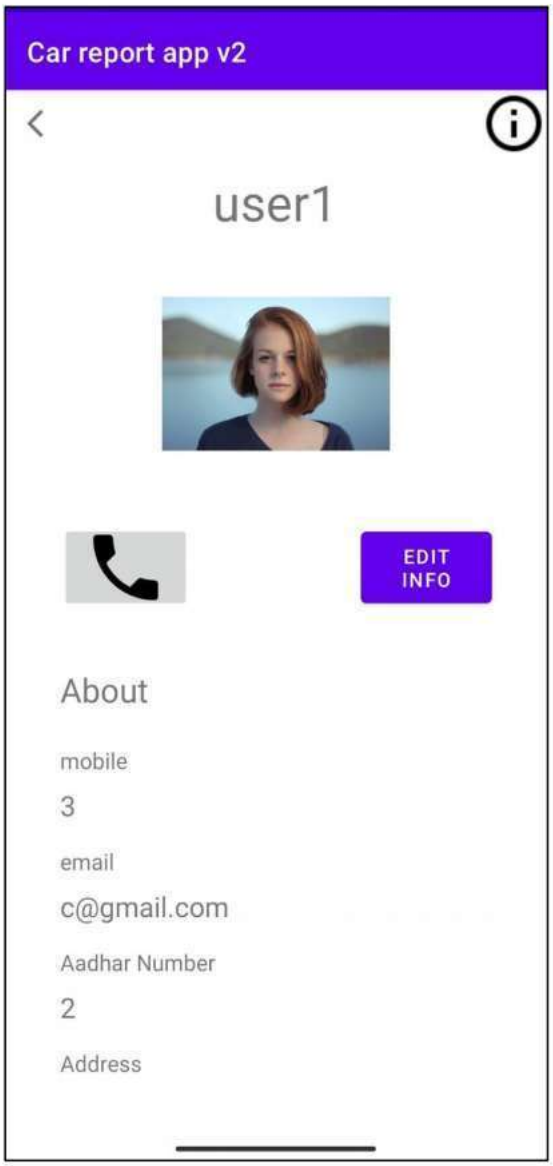

Fig 6.7 Profile UI

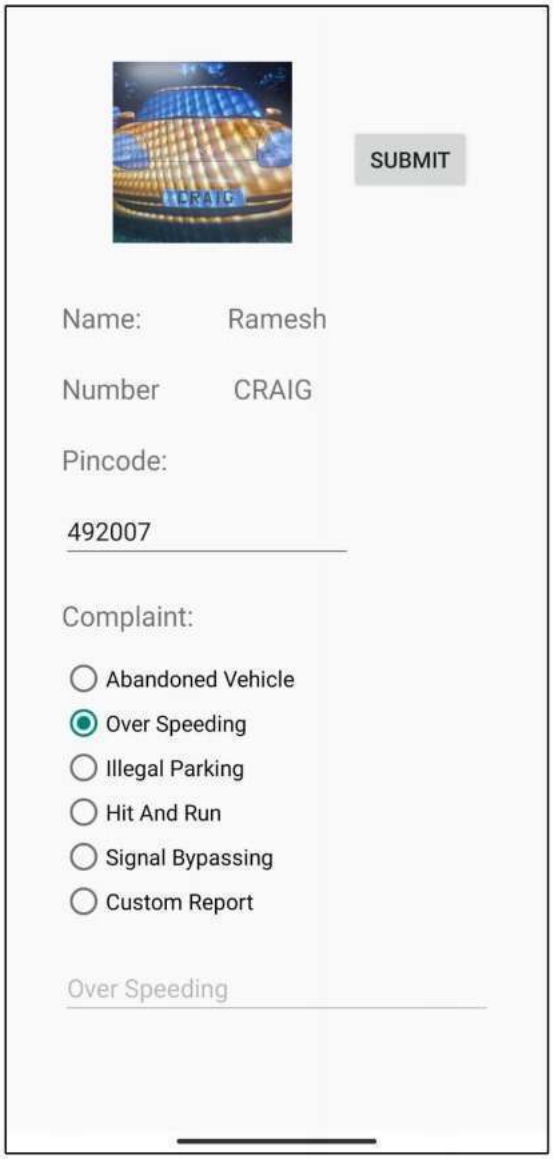

Fig 6.8 Report interface

The Fig 6.7 illustrates the Profile view provided to the user with a call button for calling 112 from the app, Edit Info button is for adding the facility of changing the profile information such as mobile number, email, Aadhar number, Address, etc.
Made using Constraint Layout, Scroll View as parent components.

The Fig 6.8 illustrates the make report activity, this activity provides a facility for the user to see the name of owner of the reported vehicle. Views used for this activity are Scroll View, Constraint Layout.

6.2 BACK-END DETAILS: -

6.2.1 OVERVIEW:

For the Back end the application makes use of: -

1. Programming languages:
   a. Kotlin
   b. JAVA
2. For API:
   a. PHP
3. For Database:
   a. MYSQL DB
4. For hosting the app locally, we have used XAMPP
5. The app also makes use of libraries such as
   a. Volley to make request (POST/GET)
   b. Picasso for loading images into the image view using the URL

6.2.2 Implementation details:

1. The app uses a centralised DB named “numauth” which uses the MYSQL DB hosted using XAMPP software.
2. The DB consists of a total of 9 tables: -
   a. Login_user and Login_admin: - these tables consist of the information required for authentication of the 2 customer segments.
   b. User_info and police_info: - these tables consist of the detailed user information of the customer such as profile image, name, AADHAR number, contact information, etc.
   c. Station_info: - this table stores the information of all the police stations along with there associated Pincode, number of active & solved cases.
   d. Vehicle_info: - this table stores the RVD information of the vehicle regarding the vehicle, its owner, and vendor information.
   e. Imageupload: - it is a cache table to make the image available before report process is complete so that in case the reporter fails to complete the report at least the image can be used for reference.
   f. Reports_user: - this table contains the information related to the report from the reporter centric point of view.
   g. Handle_cases: - this contains the information related to the report from the officer point of view

	Table	Action	Rows	Type	Collation	Size	Overhead
☐	handle_cases	Browse Structure Search Insert Empty Drop	3	InnoDB	utf8mb4_general_ci	16.0 KiB	-
☐	imageupload	Browse Structure Search Insert Empty Drop	0	InnoDB	utf8mb4_general_ci	16.0 KiB	-
☐	login_admin	Browse Structure Search Insert Empty Drop	2	InnoDB	utf8mb4_general_ci	16.0 KiB	-
☐	login_user	Browse Structure Search Insert Empty Drop	2	InnoDB	utf8mb4_general_ci	16.0 KiB	-
☐	police_info	Browse Structure Search Insert Empty Drop	2	InnoDB	utf8mb4_general_ci	16.0 KiB	-
☐	reports_user	Browse Structure Search Insert Empty Drop	6	InnoDB	utf8mb4_general_ci	16.0 KiB	-
☐	station_info	Browse Structure Search Insert Empty Drop	2	InnoDB	utf8mb4_general_ci	16.0 KiB	-
☐	user_info	Browse Structure Search Insert Empty Drop	2	InnoDB	utf8mb4_general_ci	32.0 KiB	-
☐	vehicle_info	Browse Structure Search Insert Empty Drop	4	InnoDB	utf8mb4_general_ci	16.0 KiB	-
	9 tables	Sum	23	InnoDB	utf8mb4_general_ci	160.0 KiB	0 B

Table 6.1 Database Implementation

6.3 APPLICATION WORKING METHODOLOGY

6.3.1 REGISTERING THE USER:

1. Both the type of users shares a similar space for the login and registration.
2. The user needs to open the application and locate the login button which is 2nd button to the left of the top right corner.
3. The user than needs to select the type of user they need to register as for using the application.
4. Available modes User and authority
5. A normal user needs to than fill in the email id and password they want to register with
6. Someone with the authority to investigate needs to also fill in the id number they have been assigned from the government for authenticity, along with email id and password
7. Then click on the sign-up button.

6.3.2 MAKING A REPORT

1. After opening the application, the user needs to take a photo of the vehicle with the plate number in the view
2. After this the user will be directed to the next page for cropping and adjusting the image.
3. The User than needs to make sure that the image is horizontal not vertical, and the image only includes the vehicle to be reported.
4. The user than needs to click on detection button to extract the plate number from the image.
5. The user than will have to click on report button after this the application will ask for number and details confirmation.

6. In case the user profile is insufficient for making the report the applications prompt the user with a page to fill those details directly without losing any progress.
7. After this the user will be providing with the name of the owner of the vehicle and a view to select the reason for reporting the vehicle
8. In case the application cannot detect the location of the user they will be asked to fill the Pincode of the nearest police station.
9. Then the user needs to confirm the details of the reports then the report is placed once again.
10. After successfully placing the report, an acknowledgement is given to the user.

6.3.2 ACCEPTING THE CASE AND VIEWING THE DETIALS:

1. The investigating officer (IO) will have to open the application and select the view report icon on the top left corner of the screen.
2. The IO can only view the reports registered to the police stations they are affiliated to.
3. The IO is given a list of reports consisting of abstract information about each of the reports
4. The IO can see the status of the report and click on the accepted one's to find the id of the in charge of the case.
5. To accept an unaccepted case the IO needs to click on the report.
6. The IO is then prompted to accept or reject the case.
7. On accepting the case the IO now has the authority to view all the information regarding the report namely the reported information, location information, reported vehicle owner and vender information along with more details of about the vehicle.
8. To go to navigation view from the application the IO will have to click on the open location button providing in the interface.
9. The IO will be forwarded to google maps with the navigation details.
10. The IO can also change the status of the report and write a conclusion report from the same interface.
11. The IO must navigate to the Progress tab of the interface.
12. The IO will have option to change the status of the report and then fill the conclusion of the report.
13. After filling in the details the IO needs to click the submit button and the values will be updated.

6.4 OHTER FUNCTIONALITIES IN THE BACKEND:

1. The application also keeps a record of the number of cases registered in the police station.
2. The details regarding the number of current solved cases and unsolved cases are also stored in the database.
3. The information regarding the conclusion is stored in the database in a separate table along with information regarding the in charge of the case, the police stations, and values to be able to access the reporter information and other report related information.
4. The application provides a buffer table in case the report is not completed the, but the image is uploaded which is cleared in some days and can be viewed by administrator.

CHAPTER 7
DIAGRAMS

7.1 PROJECT FLOW DIAGRAM: -

a. A project flow diagram represents the project process flow of the whole application.
b. It illustrates the relationship between major components of the application.
c. It is a picture of the separate steps of a process in sequential order.
d. It is a generic tool that can be adapted for a wide variety of purposes, and can be used to describe various processes, such as and administrative or serve process, project plan.
e. Uses: -
    a. To develop understanding of how a process is done
    b. To study a process for improvement
    c. To communicate to others how a process is done
    d. When planning a project

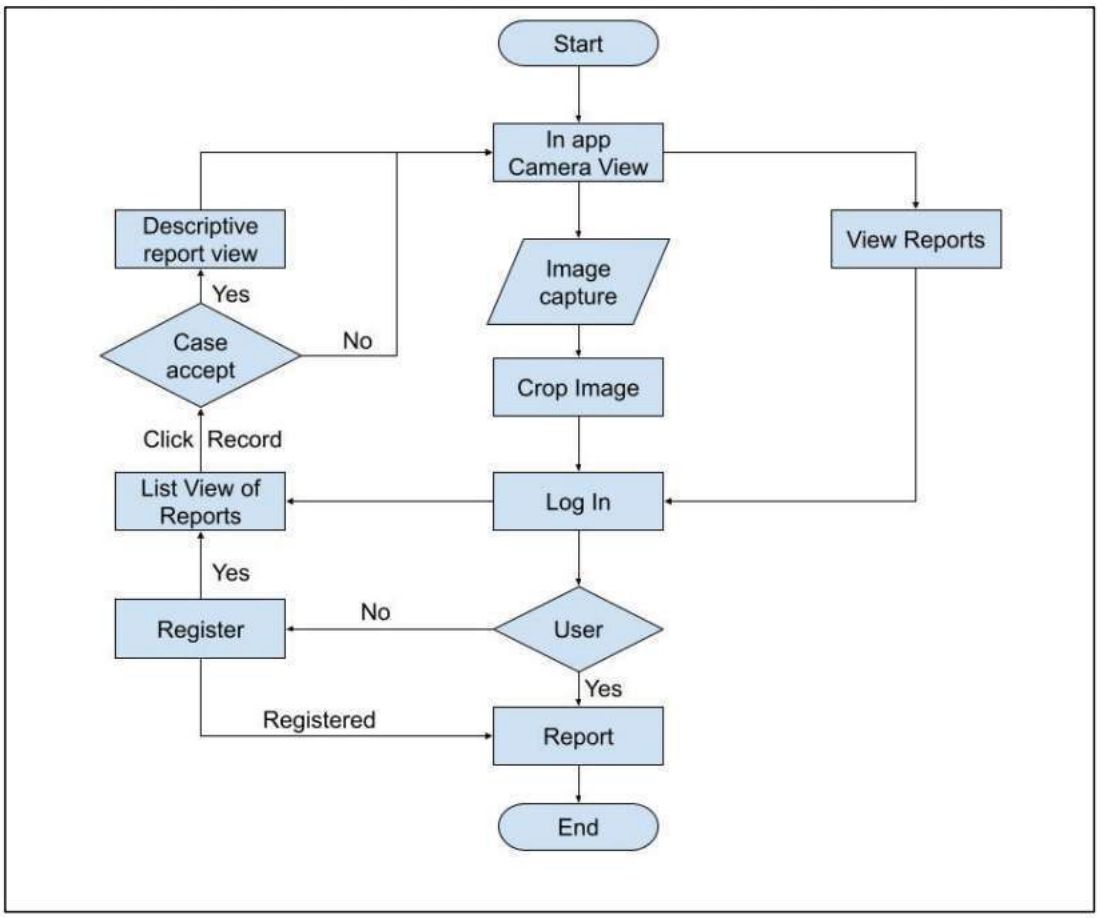

Fig 7.1 Project flow diagram

7.2 DATA FLOW DIAGRAM

I. Data flow diagrams are used to graphically represent the flow of data in a business information system.
II. DFD describes the processes that are involved in a system to transfer data from the input to the file storage and reports generation. Data flow diagrams can be divided into logical and physical.
III. Data flowcharts can range from simple, even hand-drawn process overviews, to in depth, multi-level DFDs that dig progressively deeper into how the data is handled. They can be used to analyse an existing system or model a new one.
IV. Here there is shown Level 0 and Level 1 in DFD

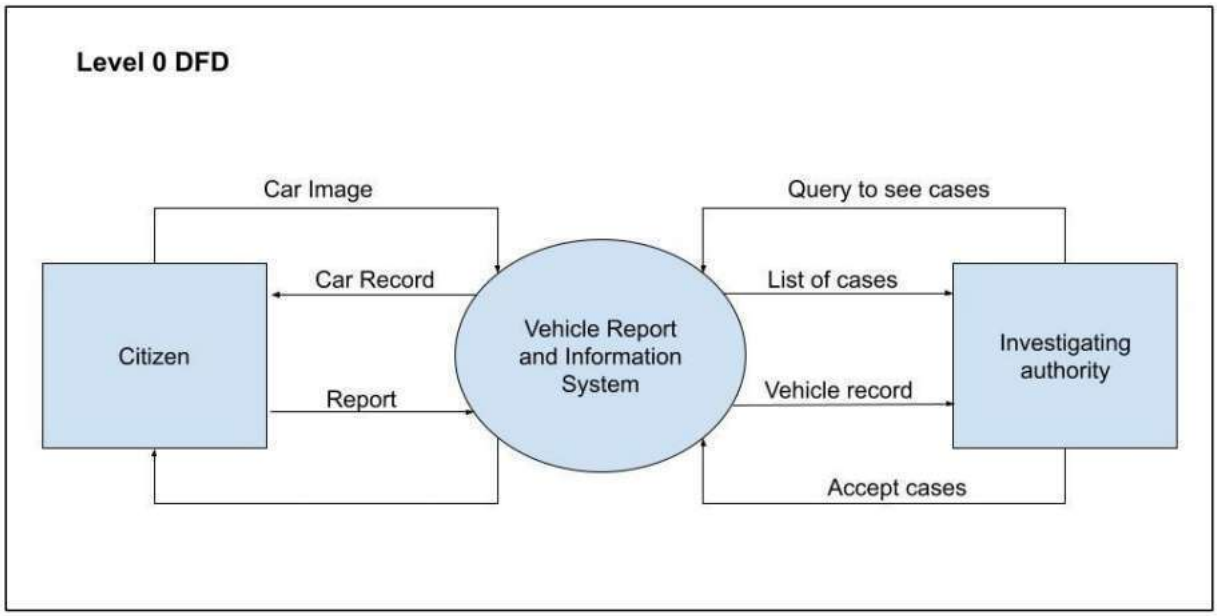

Fig 7.2 DFD Level Zero

V. After this we have Level 1 DFD for the citizen: -

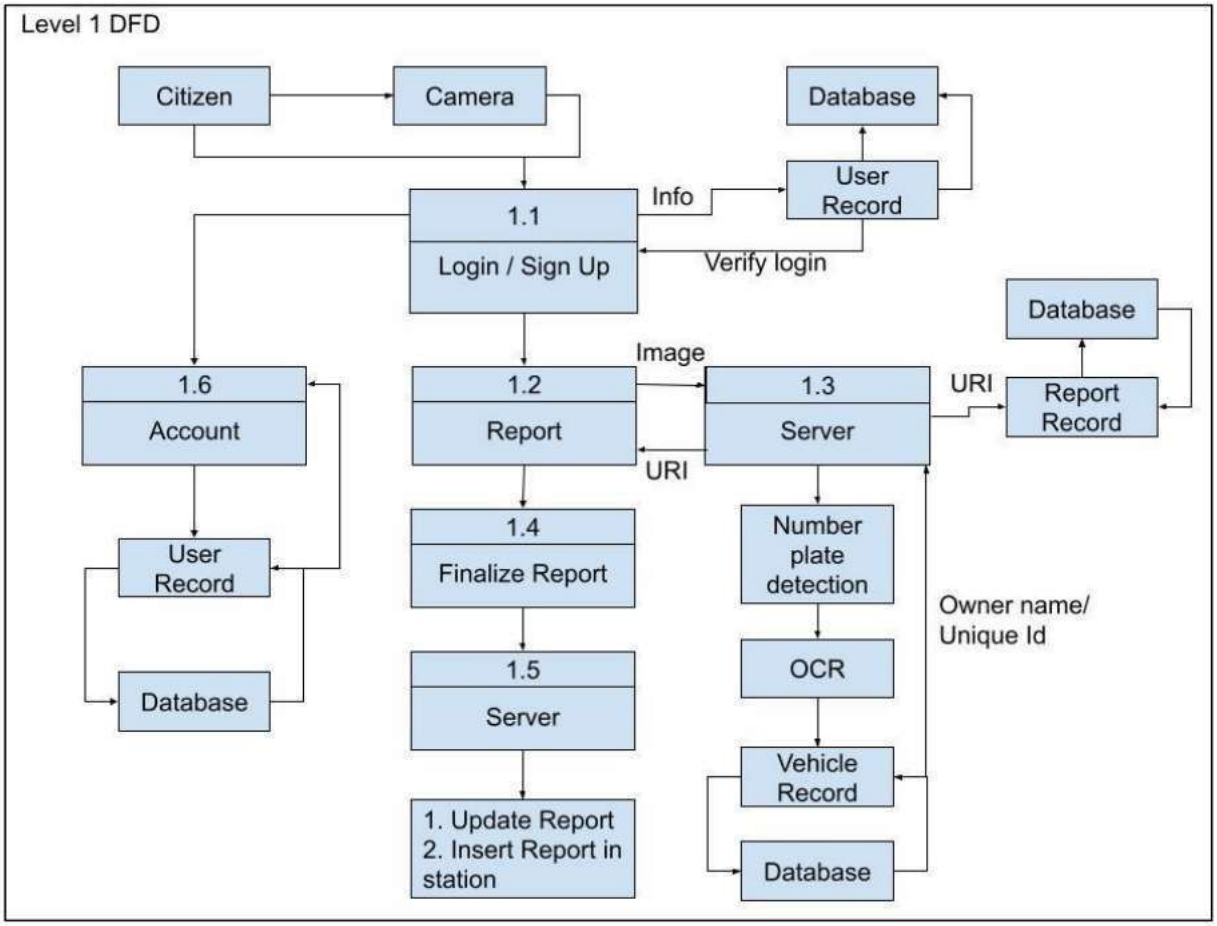

Fig 7.3 DFD Level One Citizen

VI. And the Level 1 DFD for the Authority

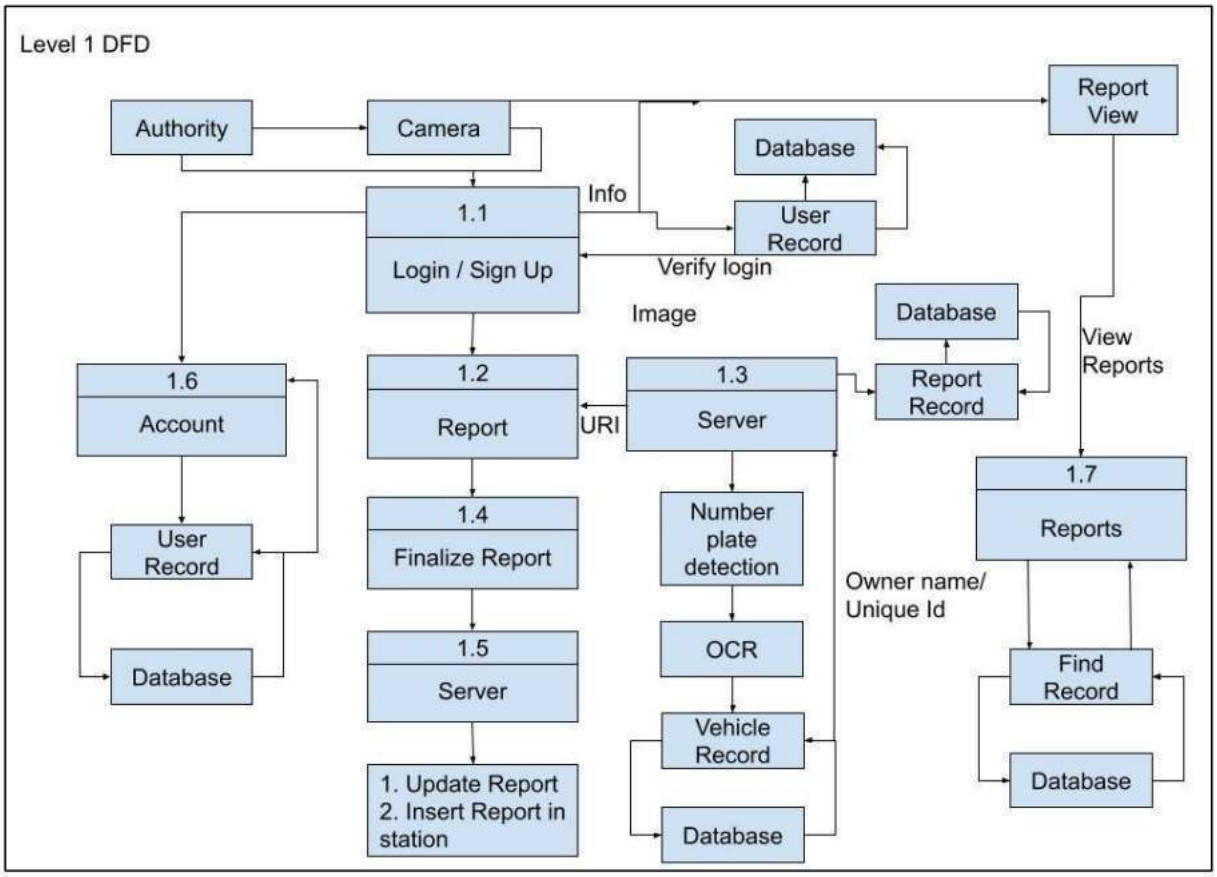

Fig 7.4 DFD Level One Authority

7.4 USER CASE DIAGRAM: -

I. A use case is a methodology used in system analysis to identify, clarify, and organize system requirements.
II. The use case is made up of a set of possible sequences of interactions between systems and users in a particular environment and related to a particular goal.
III. The method creates a document that describes all the steps taken by a user to complete an activity.

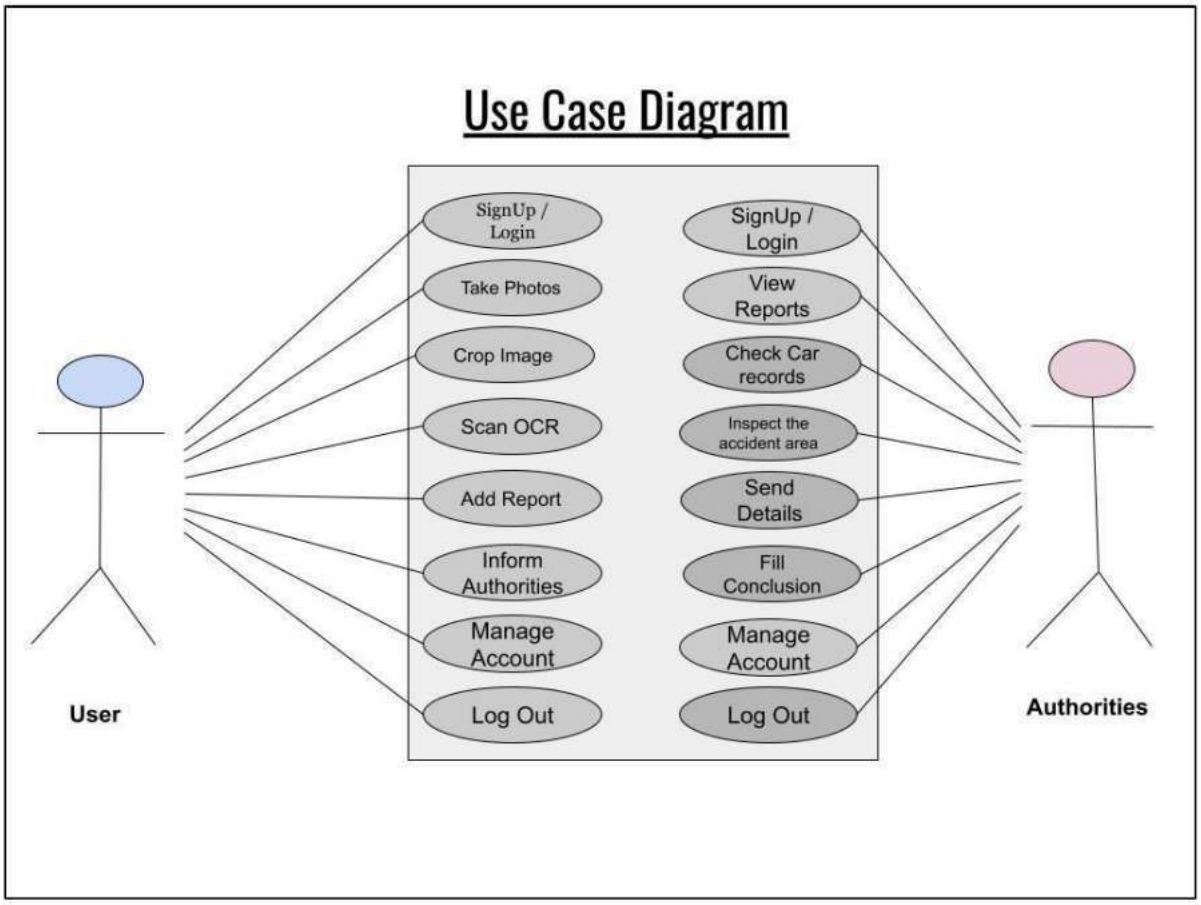

Fig 7.5 Use Case Diagram

Use case 1: Login/Signup
Primary Actor: User, Authority
Precondition: Must have to complete registration
Main Success Scenario:

1. User puts email id in the email section
2. User puts password in the password section
3. User presses the login/signup button

Exception Scenario:

1. Password is wrong
2. Password is empty

Use case 2: Report initiation
Primary Actor: User
Precondition:

1. Must be a registered user
2. Must have filled basic profile details
3. Must have registered as a user not authority

Main Success Scenario:

1. Photo of the vehicle is clear
2. The detected Plate number is same as original number
3. The User presses the report button after cropping and number detection
4. The User selects a valid reason for report and permits application to send location information with it.
5. User presses the confirm report button

Exception scenario:

1. The User is a registered authority
2. The User hasn't filled their profile details
3. The reported vehicle is an unregistered vehicle
4. The user doesn't allow application for the location information access.

Use case 3: Accessing the report information, and viewing assigned officer
Primary Actor: Authority
Precondition:

1. Must be a registered User
2. Must be registered as authority not as user
3. Must be affiliated with one of the police stations

Main Success Scenario:

1. The authority click on the view reports button
2. The authority belongs to a police station

Exception scenarios:

1. The authority isn't currently with a police station
2. The case is assigned to the authority trying to view the assigned officer

Use case 4: Accepting a case
Primary actor: Authority
Precondition:

1. Must be a registered User
2. Must be registered as authority not as user
3. Must be affiliated with one of the police stations

Main Success Scenario:

1. The Authority clicks on one of the reports with status as not accepted
2. The authority agrees to accept the case when prompt to do so.

Exception Scenarios:

1. The case is already accepted by someone else
2. The authority rejects when prompted to accept or reject the case

Use case 5: Changing report status and writing conclusion of investigation
Primary actor: Authority
Precondition:

1. Must be a registered User
2. Must be registered as authority not as user
3. Must be affiliated with one of the police stations
4. Must have accepted the case and now has access to all the information

Main Success Scenario:

1. The authority selects the new status from the radio button
2. The authority fills the report conclusion in the conclusion textbox
3. The authority clicks on the Submit button

Exception scenario:

1. The case is assigned to someone else
2. The authority doesn't select new status
3. The authority doesn't fill the conclusion

CHAPTER 8
DISCUSSION AND CONCLUSION

8.1 DISCUSSION:

The VEHICLE REPORT AND INFROMATION SYSTEM is a project dealing with a set of problems while not becoming very complex for normal users to use. This app is developed while keeping in mind a number of requirements people might have while making a report. While trying to find out a better solution the team has reached out to many people regarding their opinions on what they see in an interface or platform like this, which eventually lead our team to develop this centralised information system.

The project was a challenge as it has several complex functionalities, and we need to abstract them as much as possible to keep the UI easier. In today's world many more apps like this are required as the frequency of crime is not going down, and the authorities require not only some but all the citizen to cooperate to be able to resolve a case with outmost accuracy.

But one must not forget that the system even if it is easy approach to make a report must not be misused in any form by anyone. One must keep in mind the law and order and follow the ethics of society as a person who misuses their rights is no different than a criminal. If possible this app will change the perception of people a little bit and make them report crime more often than possible if it is observed somewhere.

Applications can be updated very easily to adapt to the market changes allowing for improvement in the Interface, speed, efficient utilization of storage and database space. This app could also serve as an basic architecture or structure for future development on similar applications.

As the technology grows day by day so at the application environment for better performance, the development of the app to a more abstract, easier, and better version will keep happing in the future. The application can be attached with a cloud storage too as to increase the ease of accessibility to the database and increase its reliability.

8.2 Conclusion

The Crimes related to vehicles are a major concern for today's society, to give better accessibility and transparency to the process of reporting and investigating the crime will surely help to open up a new room for possibilities affecting not only one or two sectors but the whole system. And with the increasing use of android smartphone day by day accessibility to portable resources has increased and reached to most of the people. The VECHILE REPORT AND INFORMATION SYSTEM application tries to exploit that very platform in hope to provide the necessary facilities.

The use of an application interface to provide accessibility will help in reporting and investigating crime anywhere, anytime with the only constraint being the Internet. Smartphone applications help people feel at ease due to their familiarity with the usage and in turn provides

the will to report crime with less worry over what might go wrong, this might help in reduce the chances of the crime not being reported at all.

For the authorities to have access to the relevant information is also an important issue as the misuse of information can be catastrophic, providing an centralised interface will also help keep in check who can access the information and who cannot, along with keeping a record of activities as well as the credentials of the person authorised to handle the case.

The availability of information and easy access to it may help in increasing the pace of the ongoing investigation and give better insight about the case to draw conclusions. As only the person assigned to the case can view the information helps in imposing security over it and remove some time taking procedures which might hinder the momentum of the investigation.

The application tries to provide most of the discussed functionalities with flexibility to extension of features and capacity in the future. The application also tends to provide a basis for development of further such public security domain targeted applications. With the development of such applications the unreported or unverified cases can be reduced in future.

CHAPTER 9
RESULT AND FUTURE SCOPE

9.1 Result

- Easy way to report vehicle related anywhere, anytime.
- Save time by eliminating many factors such as tedious paperwork, and frequent visits.
- Better way to keep records of the cases and ensure the consistency of the information.
- Eliminates the time required to get access to the insight details related to the vehicle crime, enabling the access to it through internet which makes it easy to carry around.
- Due to feature of storing the location of the report, it saves time by making use of google map services to find the location of the report easily by navigation.
- Easy way to authenticate the reporter as the information regarding the report as more detailed.

9.2 Future scope

- One of the main advantages of this application is that as it keeps the detailed records of things at various levels can be extended with some adjustments to code to perform data analysis over various parameter of the data available in the DB.
- Can be integrated with an application with broader range of feature which handles more than one category of crime, as this application deals only with vehicle crime it would be better if it can be integrated with an application providing all kinds of crime reports.
- The app can be modified to provide more transparency to both the customer segments of the apps like in future one can see the real time status of their report along with functionality like chatting with the authorities eliminating the need to make physical visits unless necessary.
- Can be integrated with a more optimized OCR model to make better predictions at lower hardware overhead.

Applications can be updated very easily to adapt to the market changes allowing for improvement in the Interface, speed, efficient utilization of storage and database space. This app could also serve as an basic architecture or structure for future development on similar applications.

As the technology grows day by day so at the application environment for better performance, the development of the app to a more abstract, easier, and better version will keep happing in the future. The application can be attached with a cloud storage too as to increase the ease of accessibility to the database and increase its reliability.

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