Break-Down Help Assistance: A Helping Assistance App for Vehicles on the Road

BY

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FINAL YEAR DESIGN PROJECT REPORT

This Report Presented in Partial Fulfillment of the Requirements for the Degree of Bachelor of Science in Computer Science and Engineering

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APPROVAL

This Project titled **"Breakdown Help Assistance: A Helping Assistance App for Vehicles that Break Down on the Road"**, submitted by Md. Habibur Rahman, ID No: **201-15-13718** to the Department of Computer Science and Engineering, Daffodil International University has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of B.Sc. in Computer Science and Engineering and approved as to its style and contents. The presentation has been held on 12/13 January, 2025.

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DECLARATION

I hereby declare that, this project has been done by me under the supervision of **Mohammad Jahanagir Alam, Assistant Professor, Department of CSE** Daffodil International University. I also declare that neither this project nor any part of this project has been submitted elsewhere for award of any degree or diploma.

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Finally, I must acknowledge with due respect the constant support and patients of my parents.

ABSTRACT

The primary objective of the app is to facilitate immediate roadside assistance for drivers experiencing vehicle breakdowns by connecting them with the nearest available garages and mechanics. It aims to ensure quick, efficient, and reliable support, reducing driver stress and minimizing delays caused by mechanical issues. The app leverages location-based services to match drivers with nearby service providers, enhancing safety and convenience. The Android based application named Breakdown Help Assistance to provide immediate service for the drivers when they fall in danger. This Android app is designed to provide immediate roadside assistance for vehicle drivers experiencing breakdowns. The app connects drivers in distress with nearby garages and mechanics, ensuring rapid response and support. When a breakdown occurs, the driver can use the app to request emergency help by sending a service request to the nearest available garage. The request includes the driver's location and vehicle details, allowing mechanics to assess the situation and respond efficiently. Mechanics can view incoming requests, accept jobs, and navigate to the driver's location for on-site assistance or towing services. The app aims to enhance safety, minimize downtime, and provide a seamless experience for both drivers and service providers by leveraging real-time GPS tracking and a user-friendly interface.

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CHAPTER 1
INTRODUCTION

1.1 Overview

The Breakdown Assistance Android App is a user-centric platform designed to provide fast and reliable help to drivers facing vehicle breakdowns on the road. By utilizing GPS technology the app connects drivers with nearby garages and mechanics, ensuring timely support. Drivers can initiate a service request by specifying the nature of the problem. By using this app the drivers share their location with vehicle details to the nearby garages. The nearest available mechanics receive the request and can accept the job, enabling faster service dispatch. After the service is completed, users can rate and review their experience to ensure quality control. This app aims to create a seamless and reliable roadside assistance experience, ensuring peace of mind for drivers in challenging situations.

1.2 Motivation

Roadside assistance services have been a critical part of vehicle ownership since the early 20th century, starting with automotive clubs like the American Automobile Association (AAA). These services initially focused on providing mechanical help, towing, and emergency fuel delivery. Over time, roadside assistance evolved to include insurance-based models and manufacturer-specific programs, offering a wider range of support tailored to customer needs.

Today, roadside assistance has become more sophisticated, incorporating advanced technologies such as artificial intelligence (AI), the Internet of Things (IoT), and telematics. Apps use GPS to track the exact location of breakdowns, enabling service providers to dispatch the nearest available mechanics efficiently.

The app provides several advantages:

- **Quick and Convenient Access to Help:** The app allows drivers to request assistance instantly by connecting them with the nearest available mechanics or garages, reducing wait times and enhancing convenience.

- **Enhanced Safety:** Drivers stranded on the road, especially in remote areas or dangerous conditions, can quickly get help, improving overall safety. The app provides peace of mind by ensuring that help is just a few clicks away.

- **Comprehensive Service Network:** By partnering with multiple garages and service providers, the app ensures broad coverage, even in less urban areas, improving service availability across regions.

- **Service Customization and Transparency:** Users can specify the type of problem (e.g., flat tire, battery issues) and receive tailored services. Additionally, real-time updates and cost estimates offer transparency, reducing uncertainty about the service process.

- **User Feedback and Quality Assurance:** Drivers can rate and review their experience, helping maintain service quality and encouraging accountability among service providers.

This app not only enhances the roadside assistance experience but also builds trust and reliability by leveraging modern technology to ensure fast, efficient, and safe service delivery.

1.3 Problem Statement

Vehicle breakdowns can occur unexpectedly, often leaving drivers stranded in unfamiliar or unsafe locations. The traditional methods of obtaining roadside assistance, such as contacting towing companies or insurance providers through phone calls, are often time-consuming, inefficient, and prone to delays due to miscommunication and lack of precise location information. Here write down a list of problem of the drivers who are fall in danger on the roadside:

- **Unexpected Vehicle Breakdowns:** Drivers often face sudden vehicle issues that leave them stranded in unfamiliar or potentially unsafe locations. These situations create significant stress and safety concerns, especially in remote areas or during adverse weather conditions.

- **Lack of Nearby Service Information:** Drivers frequently struggle to find available mechanics or garages nearby, especially in rural or less-served regions. Without a centralized platform, identifying service providers and assessing their availability becomes challenging.

- **Limited Transparency in Costs and Services:** Traditional roadside assistance often lacks clarity regarding service costs and arrival times. Drivers may encounter unexpected charges or uncertainty about when help will arrive, leading to dissatisfaction.

- **Inefficient Traditional Solutions:** Current methods of obtaining roadside assistance—such as calling towing companies or insurance providers—are slow and cumbersome. These approaches rely heavily on phone-based communication, which can lead to delays due to miscommunication or difficulty in describing the exact location.

Therefore, there is a need for a digital solution that leverages real-time GPS tracking, instant communication, and efficient service matching to provide quick and reliable breakdown assistance. This solution should enhance driver safety, minimize response times, and offer a seamless user experience for both drivers and service providers.

1.4 Objectives

The primary objectives Break-down Help Assistance follows:

- **Provide Immediate Roadside Assistance:** The primary objective is to connect drivers with nearby garages and mechanics in real-time, ensuring swift help in the event of a vehicle breakdown.

- **Enhance Driver Safety:** By enabling quick access to assistance, the app aims to reduce the risks associated with being stranded, particularly in remote or hazardous locations.

- **Leverage GPS Technology for Precise Location Tracking:** The app will utilize GPS to automatically detect and share the driver's exact location, facilitating accurate service dispatch and minimizing delays.

- **Ensure Service Transparency:** The app will provide clear information about service costs, estimated arrival times, and the nature of assistance, improving user trust and satisfaction.

- **Support a Wide Network of Garages and Mechanics:** By partnering with multiple service providers, the app aims to expand coverage and ensure help is available in both urban and rural areas.

- **Improve Service Quality Through Feedback:** Users will be able to rate and review their experience, promoting accountability and continuous improvement among service providers.

Enhancing the overall effectiveness, security, and user happiness of university transportation is the goal of these goals.

1.5 Project Outcome

The Breakdown Help Assistance Application aims to streamline the process of service requests, complaints, account management, and service tracking for users, mechanics, and admins. Below is a detailed project outcome for this app:

- **Improved User Experience:** The incorporation of GPS tracking enables users to monitor their location, locate nearby garages, and share their position with service providers, ensuring speedier and more precise service delivery.
- **Efficient Mechanic Operations:** Technicians can monitor service requests, approve or decline them according to their availability, and enhance service quality by managing requests effectively. This enhances task oversight and guarantees that the appropriate service is delivered at the correct time.
- **Streamlined Admin Management:** Admins can manage user accounts by promoting users to mechanics or admins and overseeing account updates or deletions. This facilitates appropriate role-based access control and guarantees that the correct individuals possess the necessary permissions.
- **Better Service Delivery and Management:** By incorporating GPS tracking and recommendations for nearby garages, response times for services are minimized, allowing users to obtain quicker help while mechanics can identify optimal service locations.

1.6 Organization of the Report

- **Chapter 1: Introduction** provides an overview of the project, including its objectives, background, problem statement, scope, limitations, and the overall organization of the report.
- **Chapter 2: Literature Review** discusses relevant previous works and studies related to how to find nearby garage and mechanics. In a **literature review**, key themes, theories, and findings from previous research and studies related to a specific topic are summarized and analyzed.

- **Chapter 3: Requirement Analysis and Design Specification** describes the application's unique requirements in depth and provides the design specifications that served as a roadmap for the development phase, guaranteeing that the project successfully satisfies user needs.
- **Chapter 4: Implementation and Testing** explains the Breakdown Help Assistance app's technical implementation, including the coding procedures, technology integration, and testing techniques used to guarantee dependability and functionality.
- **Chapter 5: Result and Analysis** presents the results obtained from testing the application and analyzes user feedback, assessing how well the app meets its objectives and identifying areas for improvement.
- **Chapter 6: Impact on Society, Environment, and Sustainability** examines the broader implications of the Breakdown Assistance Application, considering its potential effects on roadside safety, driver well-being, and environmental sustainability**.**
- **Chapter 7: Conclusion and Future Work** summarizes the key findings of the Breakdown Assistance Application project and outlines potential future enhancements and developments, paving the way for continuous improvement and adaptation to user needs.

This structured organization ensures a comprehensive understanding of the project, facilitating a clear presentation of the research and development process.

1.7 Summary

The Breakdown Assistance App connects drivers with nearby mechanics and garages to provide fast, real-time roadside help for services like towing, flat tire repair, and battery assistance. Using GPS tracking and in-app communication, it ensures efficient service delivery and enhanced safety. Key features include digital payments, cost transparency, and user feedback for quality assurance. While network limitations and rural coverage remain challenges, future updates aim to expand services and incorporate advanced technologies for better support and user experience.

CHAPTER 2

Background

2.1 Overview

The Breakdown Assistance App is a mobile solution designed to offer quick and reliable roadside help to drivers experiencing vehicle issues. Its primary function is to connect users with nearby garages and mechanics using GPS technology, ensuring real-time service dispatch based on location. The app caters to a variety of common breakdown scenarios, including towing, tire changes, battery jump-starts, and fuel delivery. It also supports electric and hybrid vehicles, offering specialized assistance like towing to charging stations. Key features of the app include current location share of the drivers, creating a seamless and transparent user experience. Drivers can specify their service needs, receive cost estimates, and track the mechanic's arrival in real-time. A feedback system allows users to rate services, ensuring quality control and continuous improvement. A feedback system allows users to rate services, ensuring quality control and continuous improvement.

2.2 Literature Review

The Breakdown Help Assistance Application effectively delivers a thorough, intuitive, and efficient platform that enhances the service experience for users, optimizes mechanic workflows, and simplifies administrative duties. Through the incorporation of functionalities such as GPS tracking, service request processing, complaint resolution, and adaptive account management, the application improves customer satisfaction as well as service quality. The app's ability to scale guarantees that it can develop and progress alongside the business, fostering enduring success and flexibility in the service sector. These applications have streamlined service requests, improved user experience, and optimized operational processes, such as service delivery, complaint handling, and user management.

International Platforms:

Even though our nation does not have access to the worldwide systems covered here, they offer insightful information about features and functionalities that could improve our system.

- **RACQ Roadside Assistance:**

  Link: https://play.google.com/store/apps/details?id=com.racq.racq&hl=en

  This type of platform provides nearby garage location from the drivers. The drivers could find nearest garage and they can send request with their vehicles details and their contact number. Besides the mechanics of the garage will see service request from customer. This app is effectiveness for seeking detailed information garage and mechanics. [6]

  The tracking page of the app is displayed in figure 2.2.1 below, where nearby garages are displayed icons.

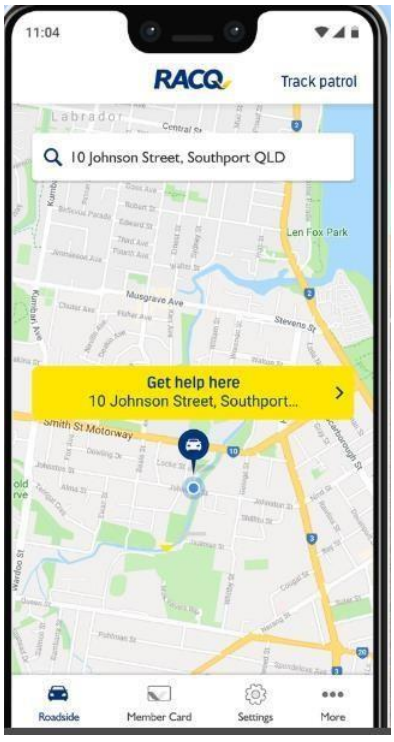

Figure 2.2.1: Nearest garage tracking page

- **Roadside Assistance 24:**

Link:
https://play.google.com/store/apps/details?id=ru.softformobile.Evakuator&hl=en

Roadside Assistance 24 is a mobile application designed to offer quick and direct access to towing and roadside assistance services. The app allows users to find nearby service providers using real-time GPS data. Key features include the ability to view the exact or approximate distance to available tow trucks and roadside services, call drivers directly without intermediaries, and discuss pricing upfront. The app also displays traffic conditions and user reviews, helping motorists choose the best service provider for their needs.[7]

Figure 2.2.2 below shows the app's tracking page, with many tow truck service. Find the nearest towing company - get roadside assistance faster and cheaper 24 hours.

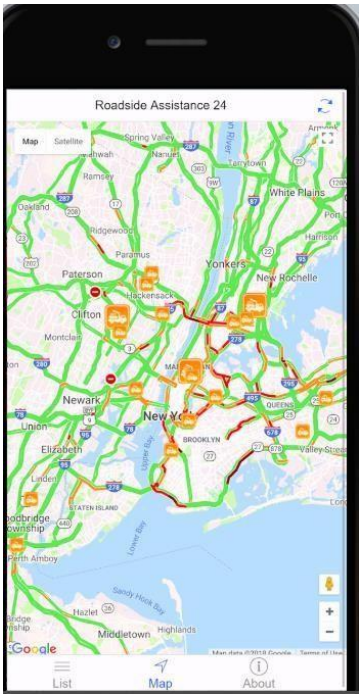

Figure 2.2.2: Roadside Assistance 24 – Tow truck services tracking page

AAA Mobile:

Link:
https://play.google.com/store/apps/details?id=com.aaa.android.discounts&hl=en

The AAA Mobile App is a comprehensive tool designed to support users with automotive, travel, and insurance needs. Its primary feature is 24/7 roadside assistance, which allows users to request help during vehicle breakdowns. Using GPS technology, the app pinpoints the user's exact location to facilitate quick response from service providers. A real-time service tracker lets users monitor the progress of the assistance vehicle, including estimated arrival times. The app also offers access to AAA-approved auto repair facilities, mobile battery services, and fuel price comparisons at nearby gas stations.[8]

The app's services screen is shown in Figure 2.2.3 below, where different types of services is given there.

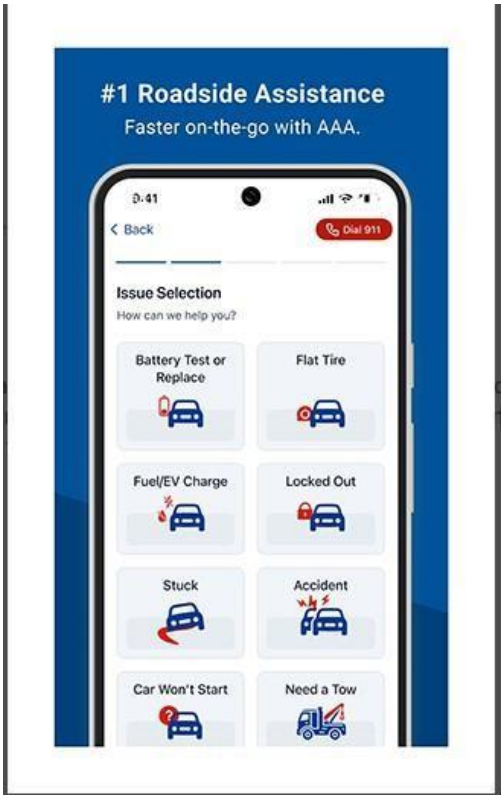

Figure 2.2.3: AAA roadside assistance services page

Urgently Technician:

Link: https://play.google.com/store/apps/details?id=ly.urgent.rsa.provider&hl=en

The Urgently Technician app, developed by Urgent.ly, is designed exclusively for service providers offering roadside assistance. It facilitates seamless job management and real-time tracking, allowing technicians to receive service requests, update job statuses, and communicate efficiently throughout the service process.

Key features include GPS-based job tracking, service request management, and data insights to help technicians and companies optimize their operations. The app's primary focus is to enhance the efficiency of roadside assistance by connecting service providers directly with customers in need.[9]

The tracking page of the app is displayed in figure 2.2.4 below

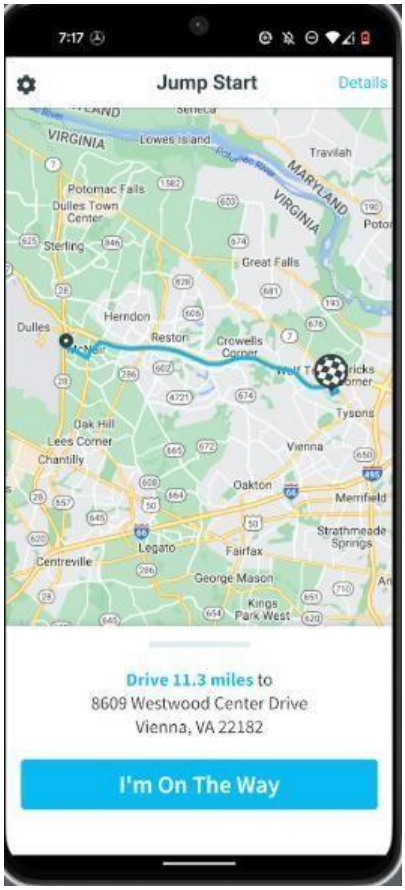

Figure 2.2.4: Urgently Technician roadside assistance tracking page

2.3 Gap Analysis

To better understand the strengths and weaknesses of existing breakdown assistance solutions, a comparison of several international platforms and region-specific services is presented below in Table 2.3.1. This comparison highlights essential features, key advantages, and potential limitations, offering valuable insights for enhancing the Breakdown Help Assistance app. The table focuses on aspects such as service delivery models, pricing transparency, technological integration, and user experience, which can inform improvements and adaptations for local contexts and user needs.

Table 2.3.1: Comparison between existing works

Features	**RACQ Roadside Assistance**	**Roadside Assistance 24**	**AAA Mobile**	**Urgent.ly**	**Breakdown Help Assistance**
Real-time GPS tracking	Yes	Yes	No	Yes	Yes
Service Request Portal	No	No	No	No	Yes
Location Sharing	No	No	No	Yes	Yes
User Feedback and Reviews	Yes	No	No	No	Yes
Service History and Records	No	No	No	No	Yes

Cost Estimations	No	No	Yes	No	Yes
Report Issue	No	No	No	No	Yes
Administrator Announcements	No	No	Yes	No	Yes
Nearby Garage Information	No	Yes	No	Yes	Yes
Assign Role of Users	No	No	No	No	Yes

2.4 Open Issue

- **Coverage Limitations**: While the app connects users with service providers, it may face challenges in offering consistent coverage in remote or rural areas where providers are sparse. Expanding the network and partnerships is essential to address this issue.
- **Technological Dependencies**: The app's functionality heavily depends on mobile connectivity and GPS accuracy. In areas with poor network coverage or technical disruptions, service reliability may be compromised.
- **Data Privacy and Security**: Handling sensitive user data, such as location and payment details, requires robust security measures. Ongoing updates to data encryption and adherence to privacy regulations are necessary to maintain trust.
- **Pricing Transparency and Fluctuations**: Although the app offers transparent pricing, fluctuations due to location or demand can lead to unpredictability for users. Developing a standardized pricing model or offering user-friendly cost estimates could help mitigate this.
- **Scalability**: As user demand grows, the app must efficiently handle increased traffic without compromising performance.

2.5 Summary

The Breakdown Help Assistance app is a mobile solution designed to provide on-demand roadside assistance for drivers experiencing vehicle issues, such as flat tires, dead batteries, and fuel shortages. Users can connect with nearby service providers through GPS-based tracking and communicate directly for real-time updates. The app emphasizes flexibility with a pay-per-use model and transparent pricing. Comparatively, similar services like AAA Mobile**,** RACQ Roadside Assistance**,** Roadside Assistance 24**,** and Urgent.ly offer various strengths, such as membership-based benefits, regional expertise, and flexible pricing models. However, common challenges include inconsistent service quality and limited coverage in rural areas. The app faces open issues like maintaining consistent service quality, expanding coverage, ensuring user safety, and protecting data privacy. Addressing these challenges will be key to enhancing user experience and ensuring long-term success.

CHAPTER 3
RESEARCH METHODOLOGY

3.1 Requirement Analysis & Design Specification

This phase defines the app's requirements and creates detailed system designs to ensure effective development.

3.1.1 Overview

To provide effective roadside assistance, this chapter examines the crucial elements of requirements analysis and app design for Breakdown Help Assistance. The system architecture and the specific hardware and software requirements needed for smooth operation will be discussed. Project management techniques such as work distribution and timetable monitoring will also be covered to guarantee on-time delivery and app maintenance.

Potential revenue models, service provider agreements, and development costs will all be assessed in the financial analysis section. This all-encompassing strategy guarantees that all financial, logistical, and technical elements work together to produce a dependable and easy-to-use platform for drivers needing emergency roadside help.

3.1.2 System Design

The design of the Breakdown Help Assistance app focuses on delivering a seamless and user-friendly experience while ensuring efficient service dispatch, GPS tracking, and secure data handling. The system architecture is divided into key components that work together to manage requests, connect users with nearby service providers, and provide updates throughout the service process.

- **User Interface (UI):** The UI is designed using xml to create a clean, responsive and user-friendly interface. The **User Interface (UI)** of the Breakdown Help Assistance app is designed to ensure simplicity, accessibility, and efficiency, especially during stressful roadside emergencies.

- **Backend Services:** Firebase is employed in the Breakdown Help Assistance app for essential backend task including database management, user authentication, media file storage. It allows the storage, retrieval and synchronization of data in real time ensuring that user and service provider can access current information continuously.

- **Location Tracking:** The Breakdown Help Assistance app relies on GPS based location tracking to identify the user's location and match them with the nearest service provider. This process ensures that assistance is provided as quickly as possible.

- **Service Request System:** This system allows users to make service requests for quick roadside help. It enables drivers to indicate their vehicle's problem, choose a service type, and send a request straight to local mechanics or repair shops. Service providers get alerts about the request and can accept it instantly. The system enables bidirectional communication between users and service providers, guaranteeing prompt response times and precise service execution.

3.1.3 Hardware/Software Requirements

Hardware Requirements:

- **Android Devices:** Varied models for testing, including smartphones and tablets.
- **Virtual Devices:** Emulators to simulate different Android devices and screen sizes for comprehensive testing.

- **Development Workstations:** Computers equipped with adequate processing power and memory to manage development tasks effectively.

Software Requirements:

- **Android Studio:** Integrated Development Environment (IDE) for building and testing the Breakdown Help Assistance app.

- **Java:** Programming language used for developing the app.

- **Firebase:** Backend services for real-time database operations and user authentication.

- **Google Maps API:** For map integration, providing directions, and geocoding services.

3.1.4 Use Case Diagram

The interrelationship between different actors (**User**, **Mechanic**, and **Admin**) and the system are descriptive in the **use case diagram** (figure 3.2.1), which highlights essential features and processes. Each actor and their respective use cases are described in detail below.

Actors:

1. **User:** Vehicle driver or user who require emergency roadside assistance. Users have the option to generate and send a request for roadside assistance by deta iling the type of vehicle malfunction (e.g., flat tire, engine failure, etc.). Users can interact with mechanics by using this app and find nearby service provider. Users could see the servicing history to see whether the mechanics have accepted requests or not.

2. **Mechanic:** Local service providers such as garages or technician that react to calls for roadside assistance. Mechanic can view of incoming request from user for roadside assistance that are near them. Mechanics have the option to accept or reject a request based on their availability or distance from the user.

3. **Admin:** The system executive in charge of managing and handling the application's operations. Admins can post important updates, emergency notices, or policy changes to users and mechanics. Admins have ability to monitor current service requests, assess completed jobs and evaluate user-mechanic interaction. Admins also can see complain history of users. They have the capability to create, update, and delete operations related to their duty.

Use Cases:

1. **Login:**
    i. **Description:** Allows actors to log into the system.
    ii. **Actors:** User, Mechanic, Admin
2. **Logout:**
    i. **Description:** Allows actors to log out of the system.
    ii. **Actors:** User, Mechanic, Admin
    iii. **Extends:** Login
3. **View Announcements:**
    i. **Description:** Allows users to view announcements posted by the admin.
    ii. **Actors:** User
4. **View Nearby Garages:**
    i. **Description:** Allows users to view garages near their location.
    ii. **Actors:** User
5. **View Garage Details:**
    i. **Description:** Allows users to view the garage details.
    ii. **Actors:** User
6. **View Services:**
    i. **Description:** Allows users to view the service list.
    ii. **Actors:** User
7. **Complaint Issue:**
    i. **Description:** Allows users to submit complain of garages service.
    ii. **Actors:** User
8. **Service Request:**
    i. **Description:** Allows users to send service requests to mechanics.
    ii. **Actors:** User

9. **Check Location:**
    i. **Description:** Allows users to check their current location.
    ii. **Actors:** User

10. Share Location:

i. **Description:** Allows users to share their current location to their nearby garages.

ii. **Actors:** User

11. View Service Request:

i. **Description:** Allows mechanics to view service requests from users with their vehicle details and what services they needed.

ii. **Actors:** Mechanic

12. Accept Service Request:

i. **Description:** Allows mechanics to accept service requests from users.

ii. **Actors:** Mechanic

13. Reject Service Request:

i. **Description:** Allows mechanics to reject service requests from users.

ii. **Actors:** Mechanic

14. View Service History:

i. **Description:** Allows mechanics to view service history how many services they had done.

ii. **Actors:** Mechanic

15. View User Complaints:

i. **Description:** Allows admins to view users complaints reported by users

ii. **Actors:** Admin

16. Post Announcement:

i. **Description:** Allows admins to post announcement for users and mechanic

ii. **Actors:** Admin

17. Add New Garage:

i. **Description:** Allows admins to add garage with details.

ii. **Actors:** Admin

18. Add New Service:

i. **Description:** Allows admins to add new services for users.

ii. **Actors:** Admin

19. Manage Account:

i. **Description:** Allows mechanics, users and admin to create and update their information.

ii. **Actors:** Mechanic, User, Admin.

20. View User List:

i. **Description:** Allows admins to view all user list who are connected this app.

ii. **Actors:** Admin

21. Filter User List:

i. **Description:** Allows admins to filter user list.

ii. **Actors:** Admin

22. Assign Role:

i. **Description:** Allows admins to assign user, mechanic and admin.

ii. **Actors:** Admin

3.1.5 Use Case Diagram:

Figure 3.1.4.1 below displays the Breakdown Help Assistance system's use case diagram.

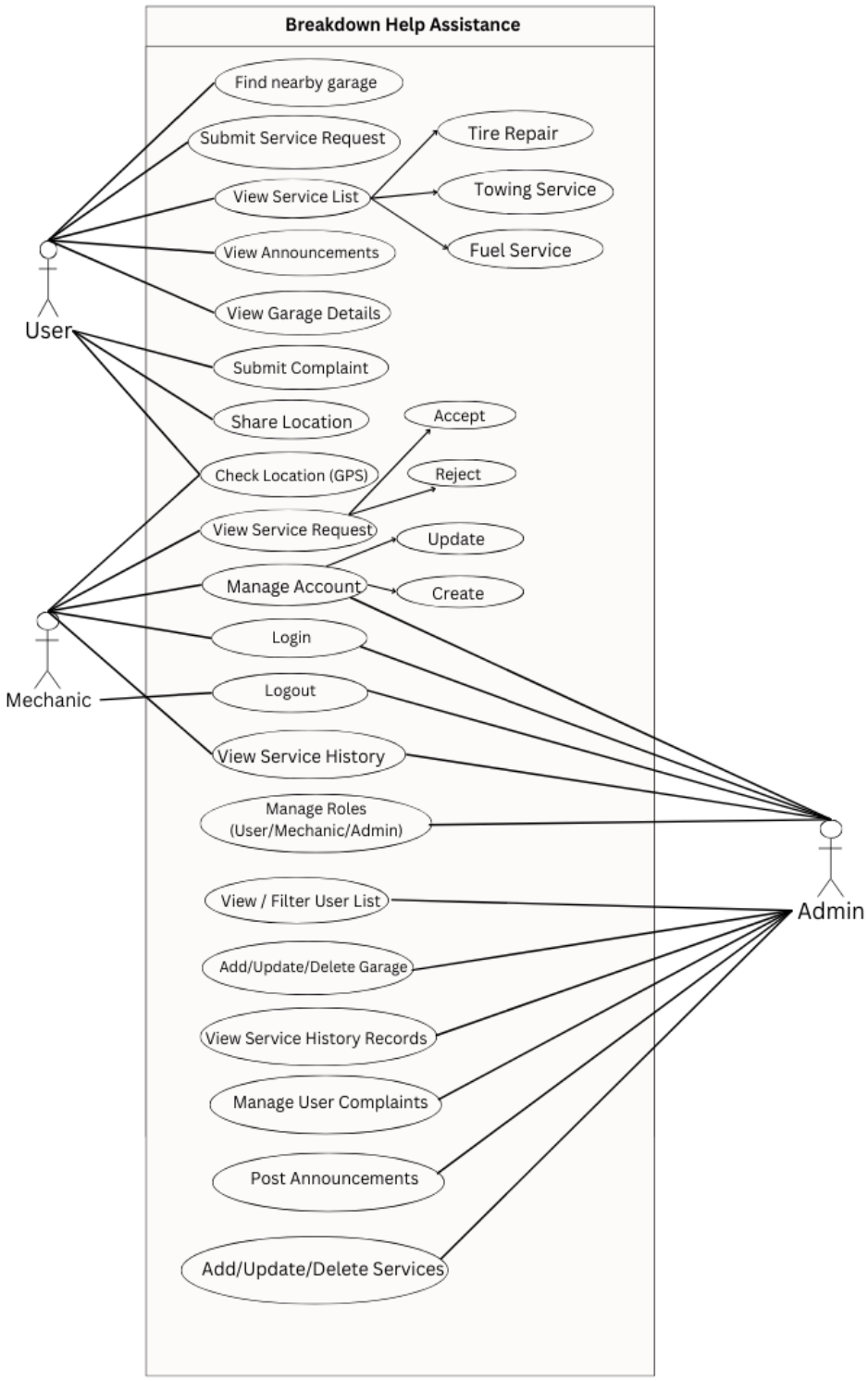

Figure 3.1.4.1 Use Case Diagram

3.1.6 Class Diagram:

Figure 3.1.5.1 below displays the Breakdown Help Assistance system's class diagram.

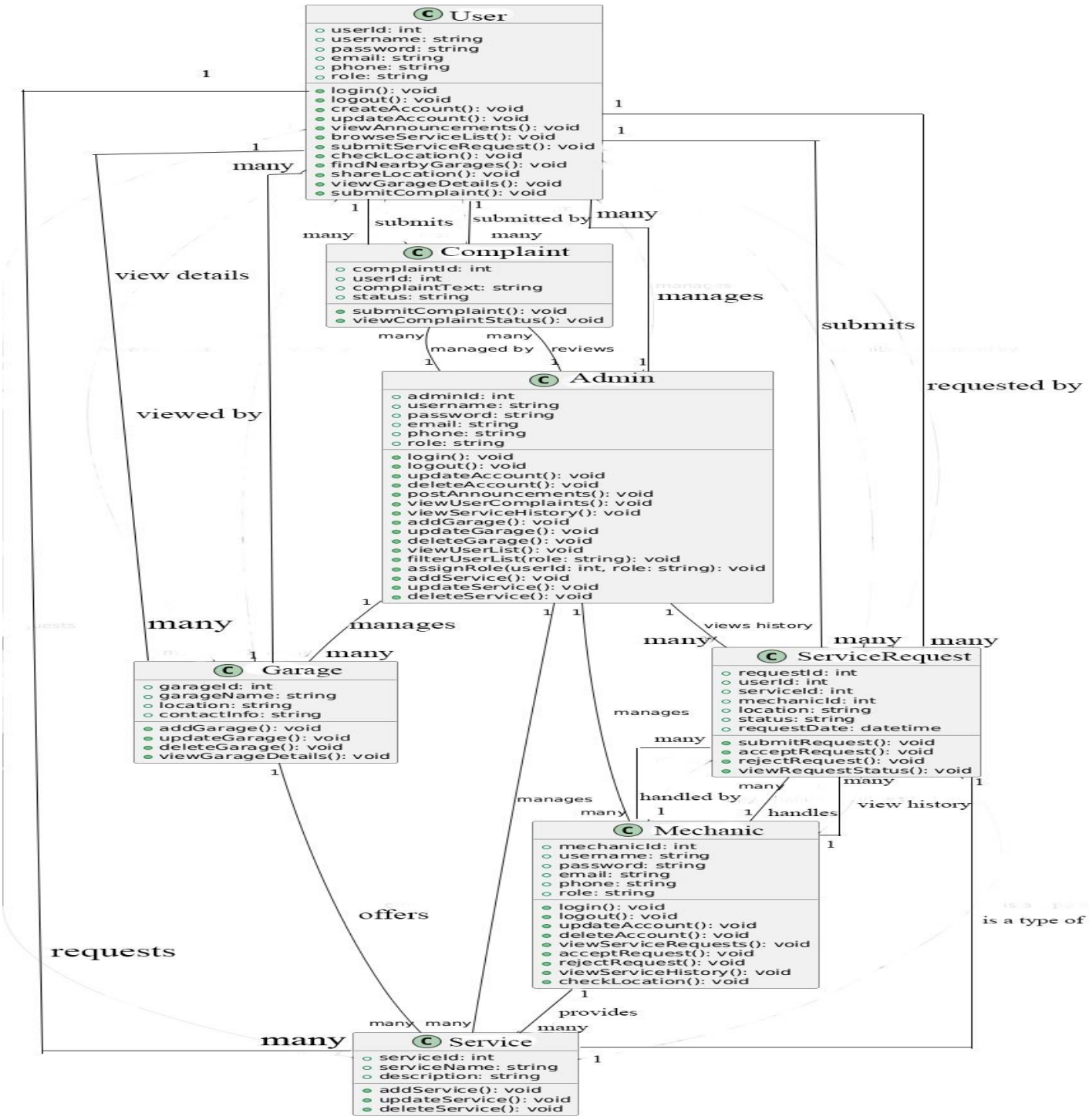

Figure 3.1.5.1 Class Diagram

3.1.7 ER Diagram:

Figure 3.1.6.1 below displays the Breakdown Help Assistance system's ER diagram.

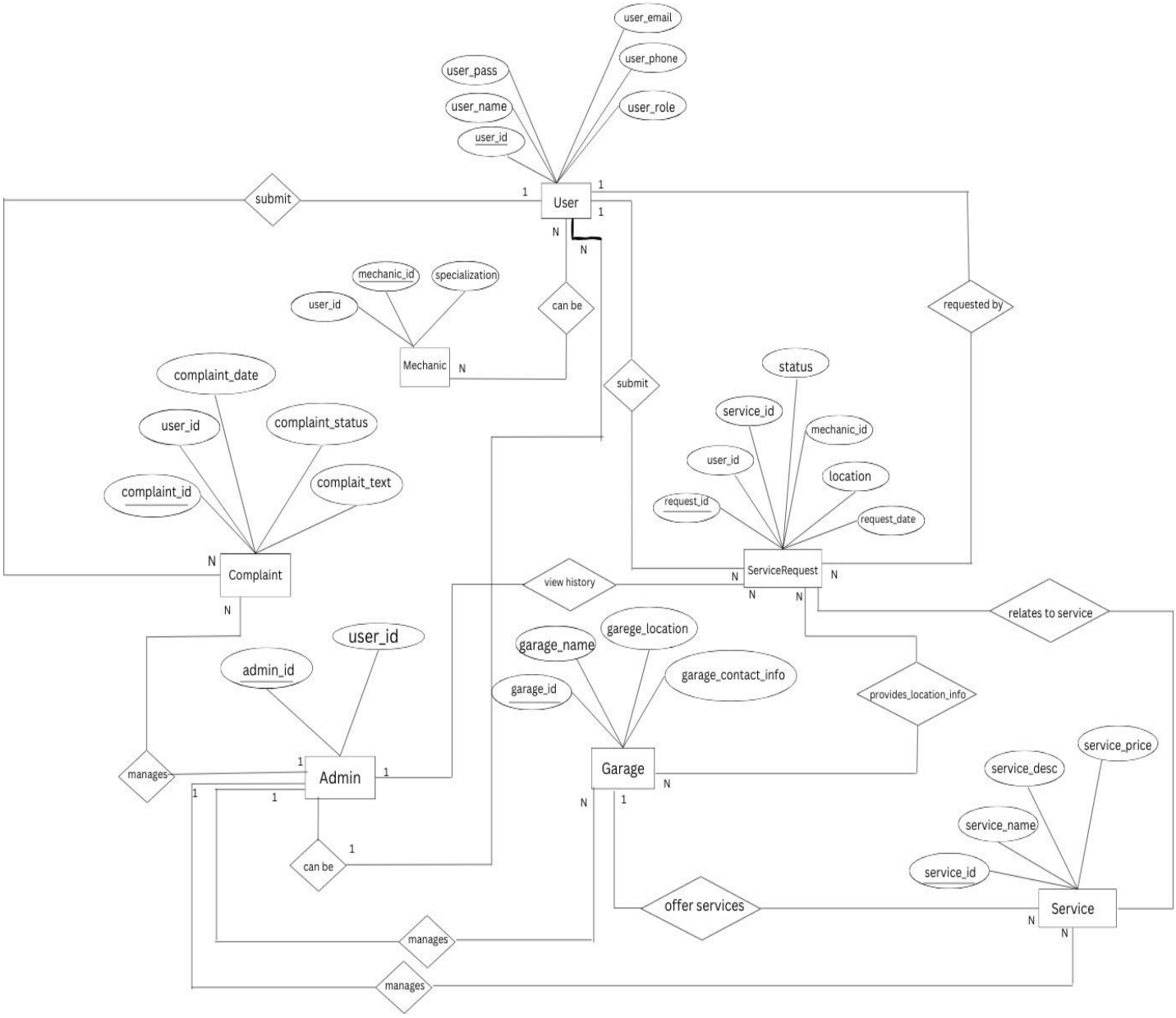

Figure: 3.1.5.2 ER Diagram

3.1.8 UI Design:

The initial prototype of the Breakdown Help Assistance app was build to validate core functionalities and gather user feedback. Using Android Studio, the focus was on building a responsive and user-friendly interface. The prototype included essential features such as service request submission**,** where users can specify the nature of their vehicle breakdown and request assistance from nearby garages. Mechanic can see the service requests from users. It also featured current location tracking of the users location. This initial version aimed to ensure smooth interactions between users, mechanics, and admins while identifying areas for improvement through user feedback.

The design process involved several key steps:

1. **User Interface (UI) Development:** The development of the Breakdown Help Assistance app began with designing the primary screens to ensure a smooth and user-friendly experience. The design focuses on simplicity, easy navigation, and instant responsiveness to enable users to rapidly reach important features during roadside emergencies. It includes emergency notice, view different types of vehicle services.
2. **Backend Integration:** Applying Firebase, I executed real-time data synchronization, ensuring that users current location. User authentication was also blended to provide a personalized experience.
3. **Real-Time Tracking:** Google Maps API was used to display the real-time locations of users. This included establishing location markers and refreshing them in real-time as the users progressed.

The primary design objectives of the prototype were to guarantee a seamless user experience and a scalable architecture. To attain this, various essential design principles were applied, emphasizing intuitive navigation, adaptable design, and optimal performance. Every screen was carefully crafted to offer intuitive access to all functionalities, guaranteeing that users could effortlessly engage with the app without any uncertainty.

Landing Page: Figure 3.1.7.1 The landing page for the Breakdown Help Assistance app provides a stripped and inherent entry point for new users. Users have an option for choosing language such Bangla or English.

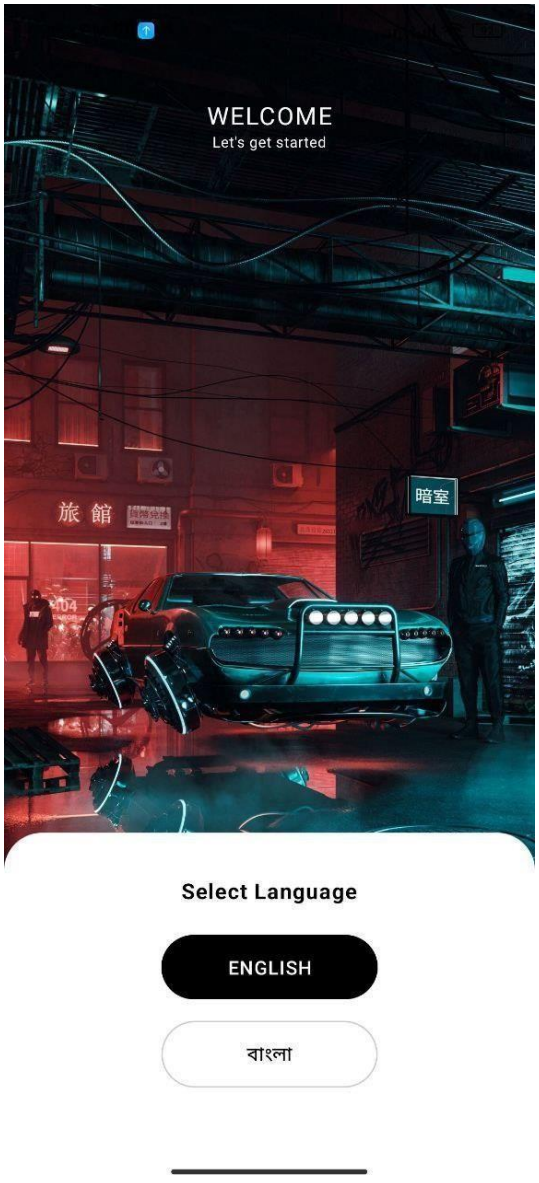

Figure 3.1.7.1: Landing Page

Login Page: Figure 3.1.7.2 below illustrates the login page, which offers two login methods: email or phone number. Email login demands verified email, and phone number login is protected by two-step OTP verification. Furthermore, a password recapture option is available for users who forget their password. If users do not have an account, there is also an option to register. They can easily login by phone number.

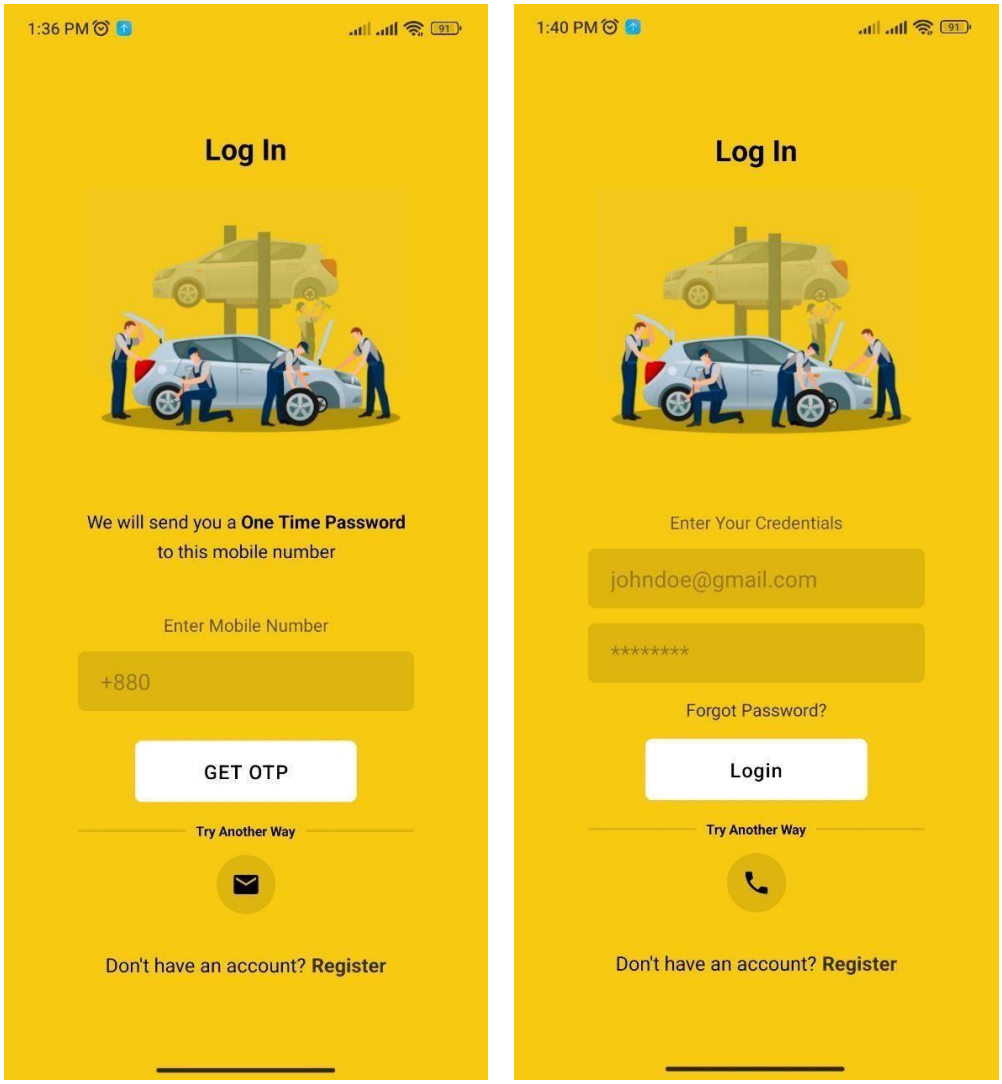

Figure 3.1.7.2: Login Page

Registration Page: Figure 3.1.7.3 below illustrates the registration process. Primarily, users are required to provide general information such as their full name, email, password, vehicle company and vehicle model.

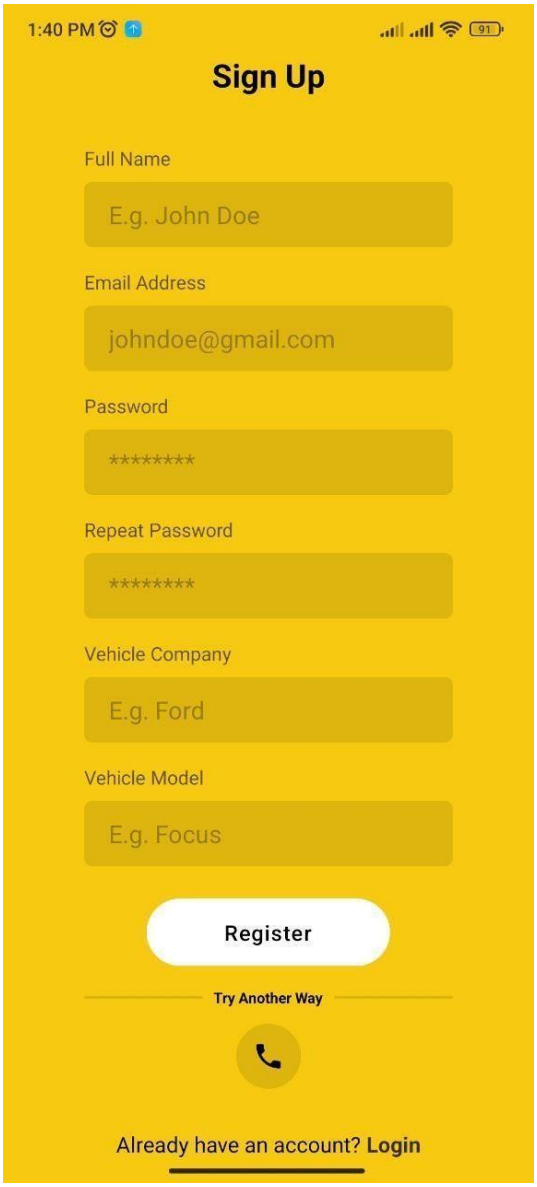

Figure 3.1.7.3: Registration Page

User Screen:

- **Home Page:** Figure 3.1.7.4 below demonstrates the user home page, where users can view notices from administrants. This page also provides information about vehicle services.

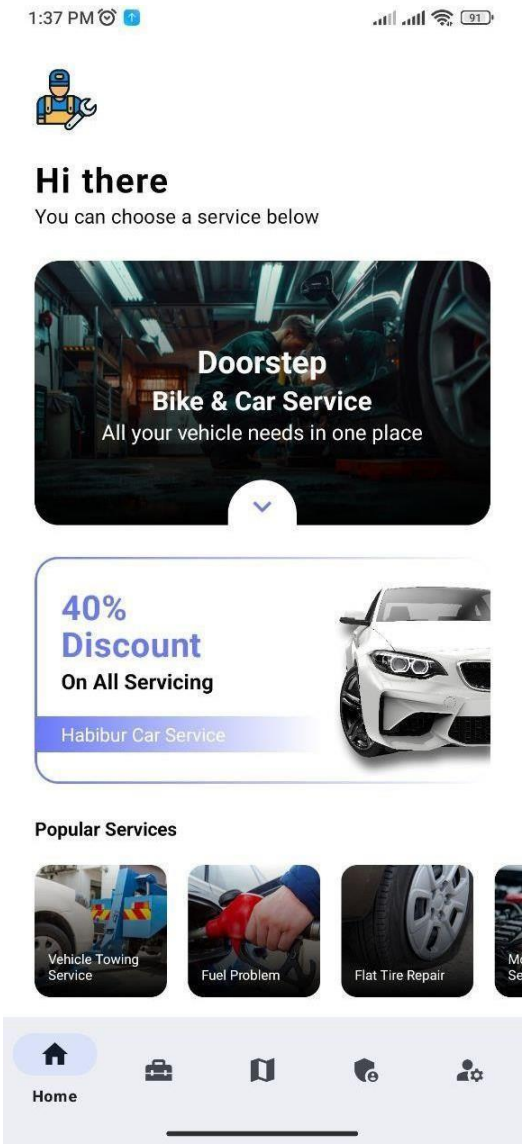

Figure 3.1.7.4: Home Page for User

- **User Nearby Garage Details:**

When users click on the location then they can see nearby garage with details. 3.1.7.5 below illustrates the nearby garages location along with garage information.

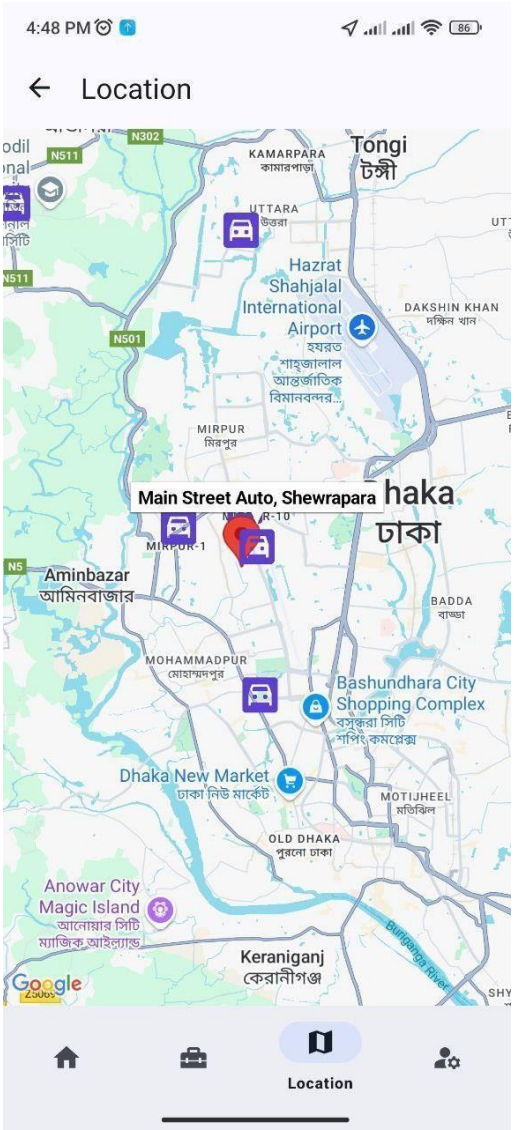

Figure 3.1.7.5: Nearby Garage Details

- **Services Page:** Figure 3.1.7.6 below illustrates the vehicle services page, which displays a list of available services. Each service is clickable and displays with along information.

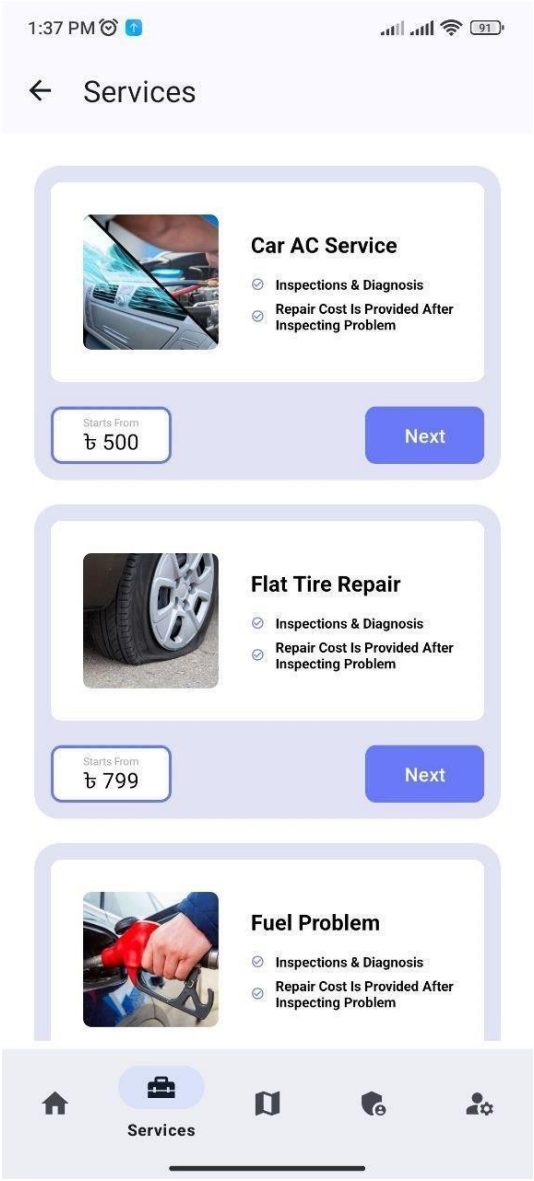

Figure 3.1.7.6: Services Page

Figure 3.1.7.7 illustrates the services details page. When a user click on an item they can view services details information such as minimum of service charge, duration and how much money is need for service. Besides users will share their location to nearby garages.

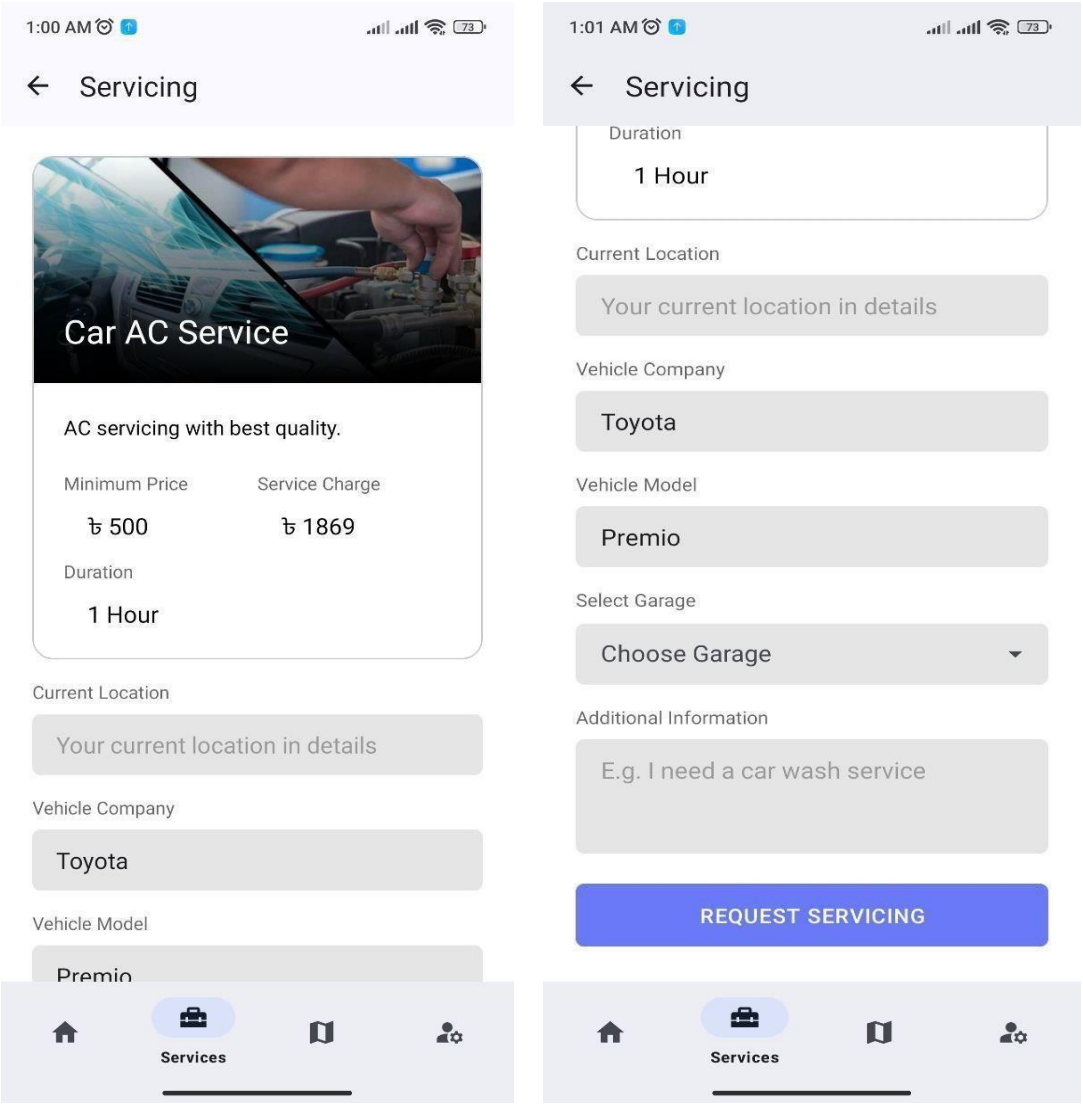

Figure 3.1.7.7: Services Details

- **Complaint Page:** Figure 3.1.7.8 illustrates the complaint page, where users can submit their bad experience with description.

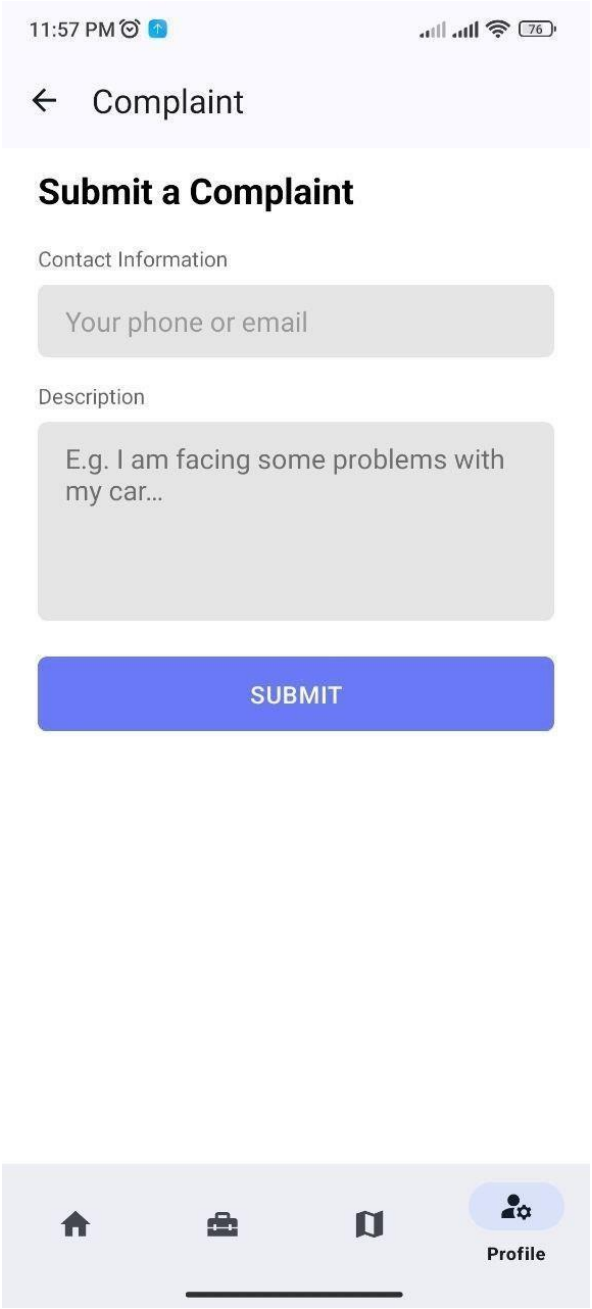

Figure 3.1.7.8: Complaint Page

- **Servicing Requests Page:** Figure 3.1.7.9 below decorates where users are check their requests and also check mechanic will accepted requests or not.

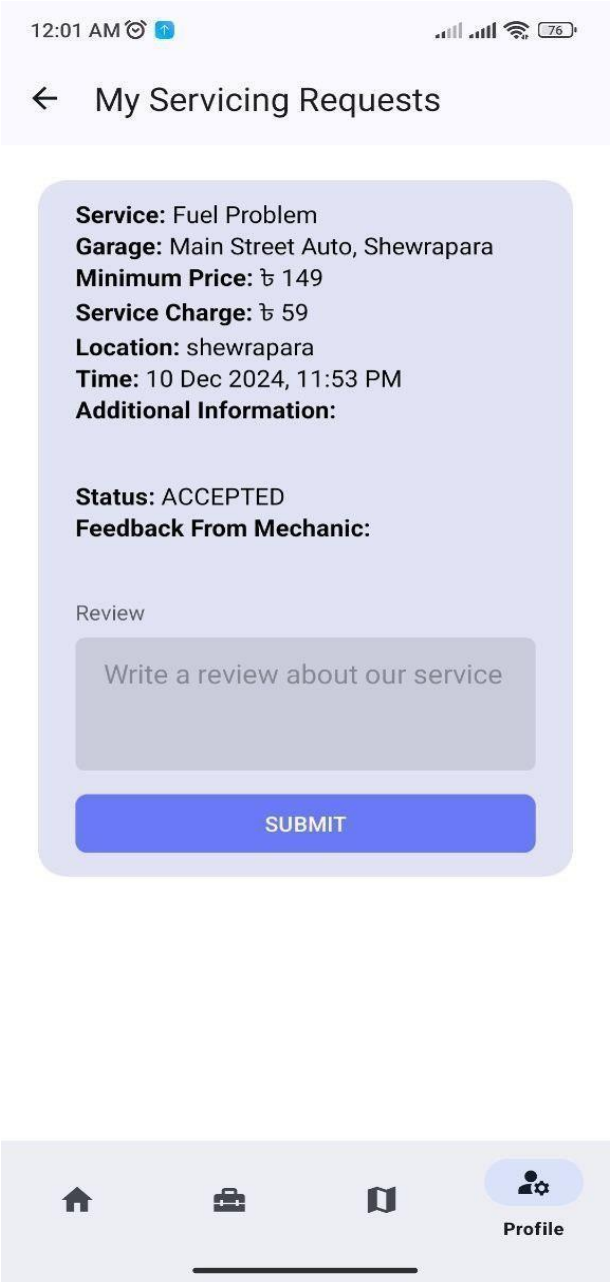

Figure 3.1.7.9: My Servicing Requests Page

- **My Location Page:** Figure 3.1.7.10 below depicts the My Location page, allowing users to see their present location, which is particularly helpful if they are disoriented or in an unknown area. This position is identified by GPS and shown in real-time, with automatic adjustment according to the device's compass sensor.

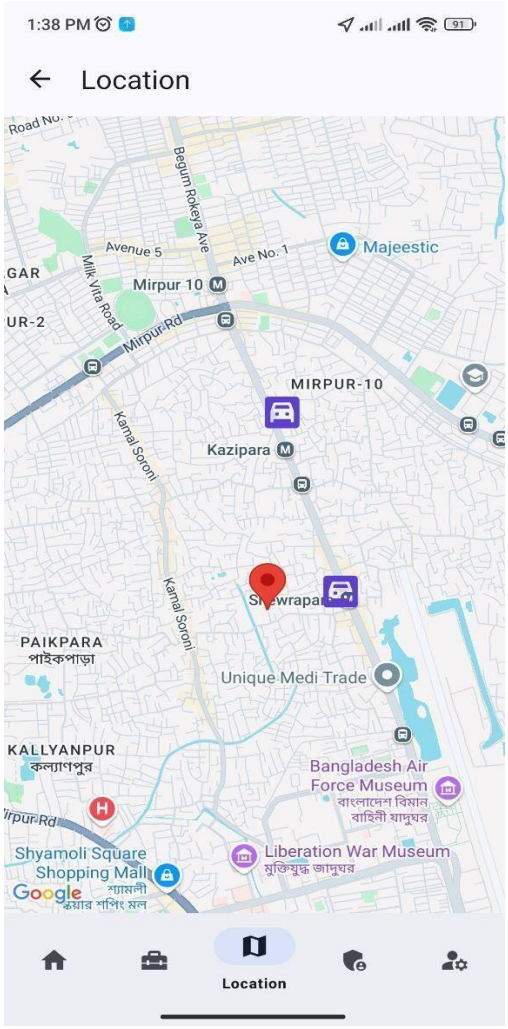

Figure 3.1.7.10: My Location Page

- **Profile Update Page:** Figure 3.1.7.11 below illustrates profile update page where users have access to update their information such as full name, phone number, vehicle company and vehicle model.

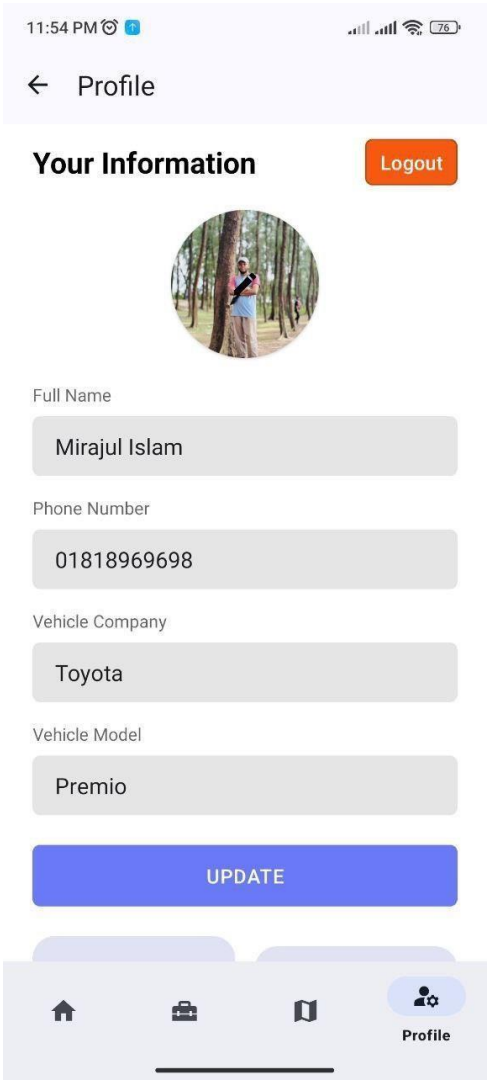

Figure 3.1.7.11: Profile Update Page

Mechanic Screen:

- **Home Page Screen:** Figure 3.1.7.12 below illustrates the home page for mechanics where they can view control panel such as service requests and their servicing history.

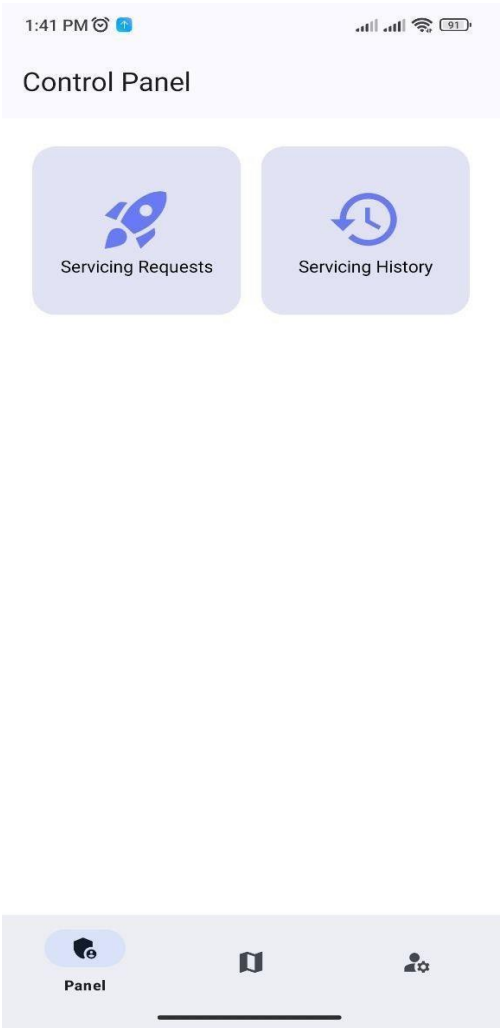

Figure 3.1.7.12: Mechanic Home Page

- **Service Requests Screen:** Figure 3.1.7.13 below illustrates the service requests page for mechanics where they can view request for vehicle service and their services history.

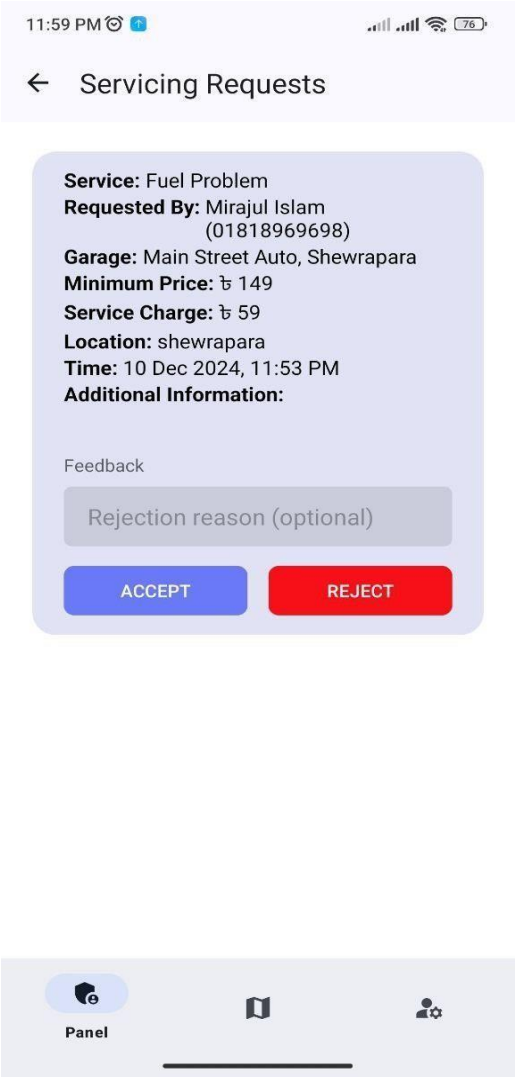

Figure 3.1.7.13: Service Request Screen

- **Service History Screen:** Figure 3.1.7.14 below illustrates the service requests page for mechanics where they can view request for vehicle service and their services history what they had done.

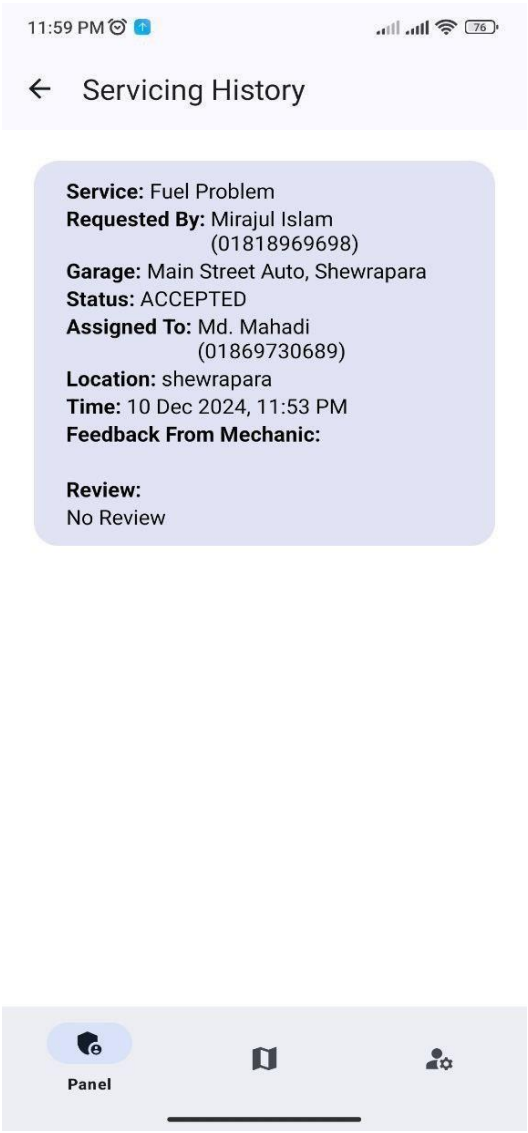

Figure 3.1.7.14: Servicing History Screen

- **Edit Profile Page:** Figure 3.1.7.15 below illustrates the mechanic profile screen where mechanics will update their information.

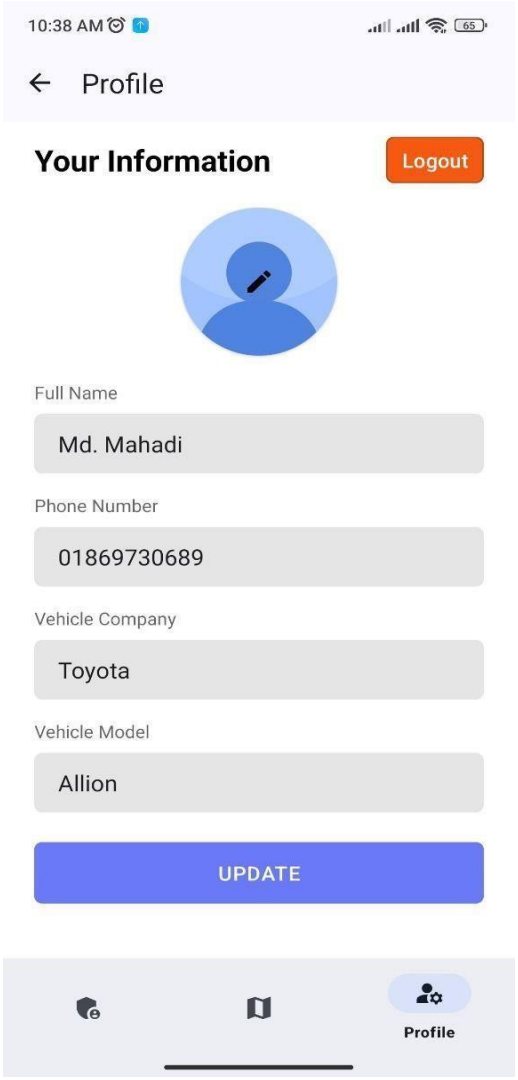

Figure 3.1.7.15: Edit Profile Screen

Administrator Screen:

- **Admin Panel Page:** Figure 3.1.7.16 below illustrates the Admin Panel page. Here, the admin can post new announcements, add garages, add new services. Admin can view user list, user complain and servicing history.

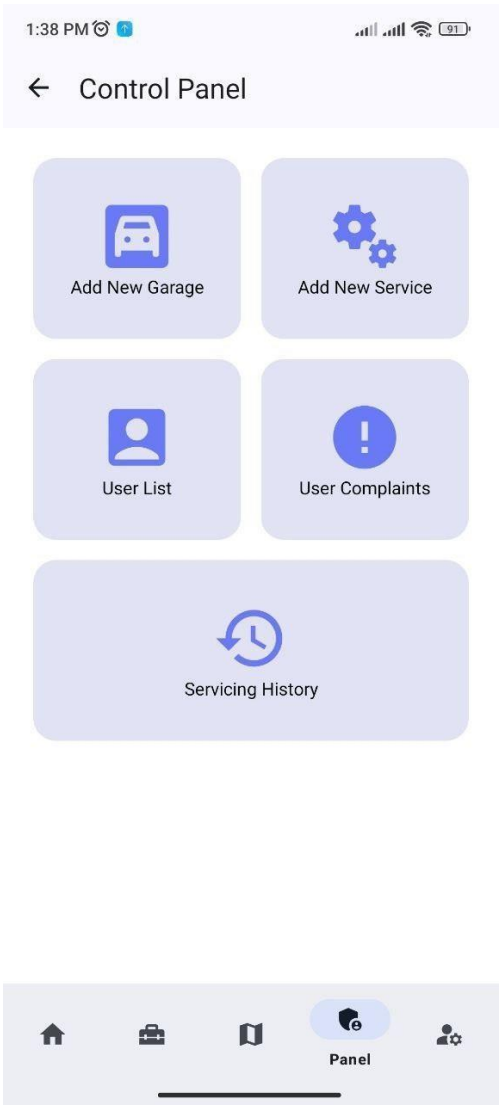

Figure 3.1.7.16: Admin Panel Page

- **Add New Garage Page:** Figure 3.1.7.17 below illustrates where admin can add new garage.

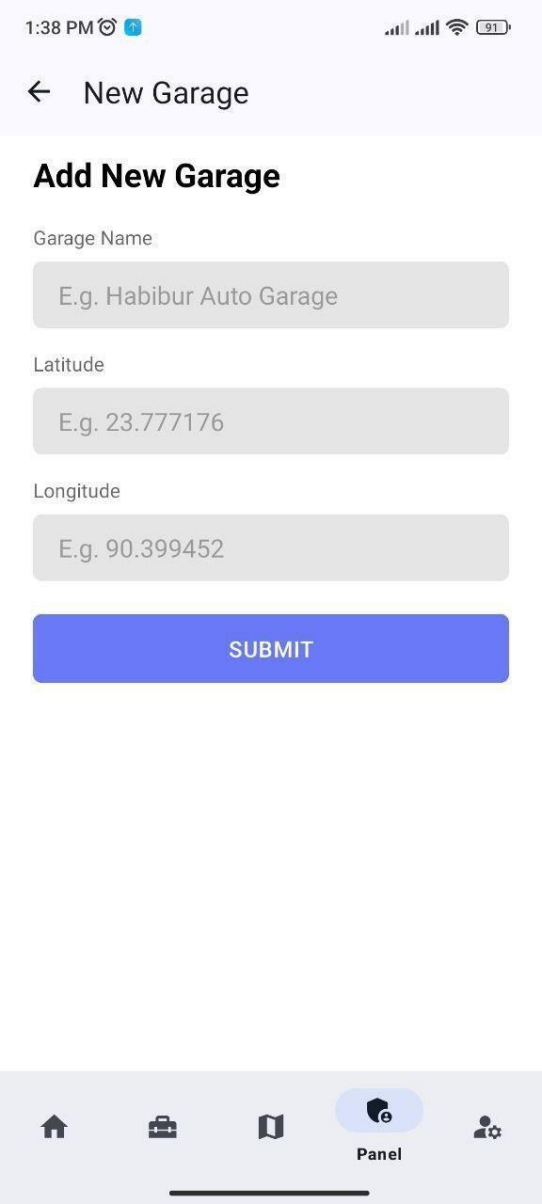

Figure 3.1.7.17: Add New Garage Page

- **Add New Service Page:** Figure 3.1.7.18 below illustrates where admin can add new services with details.

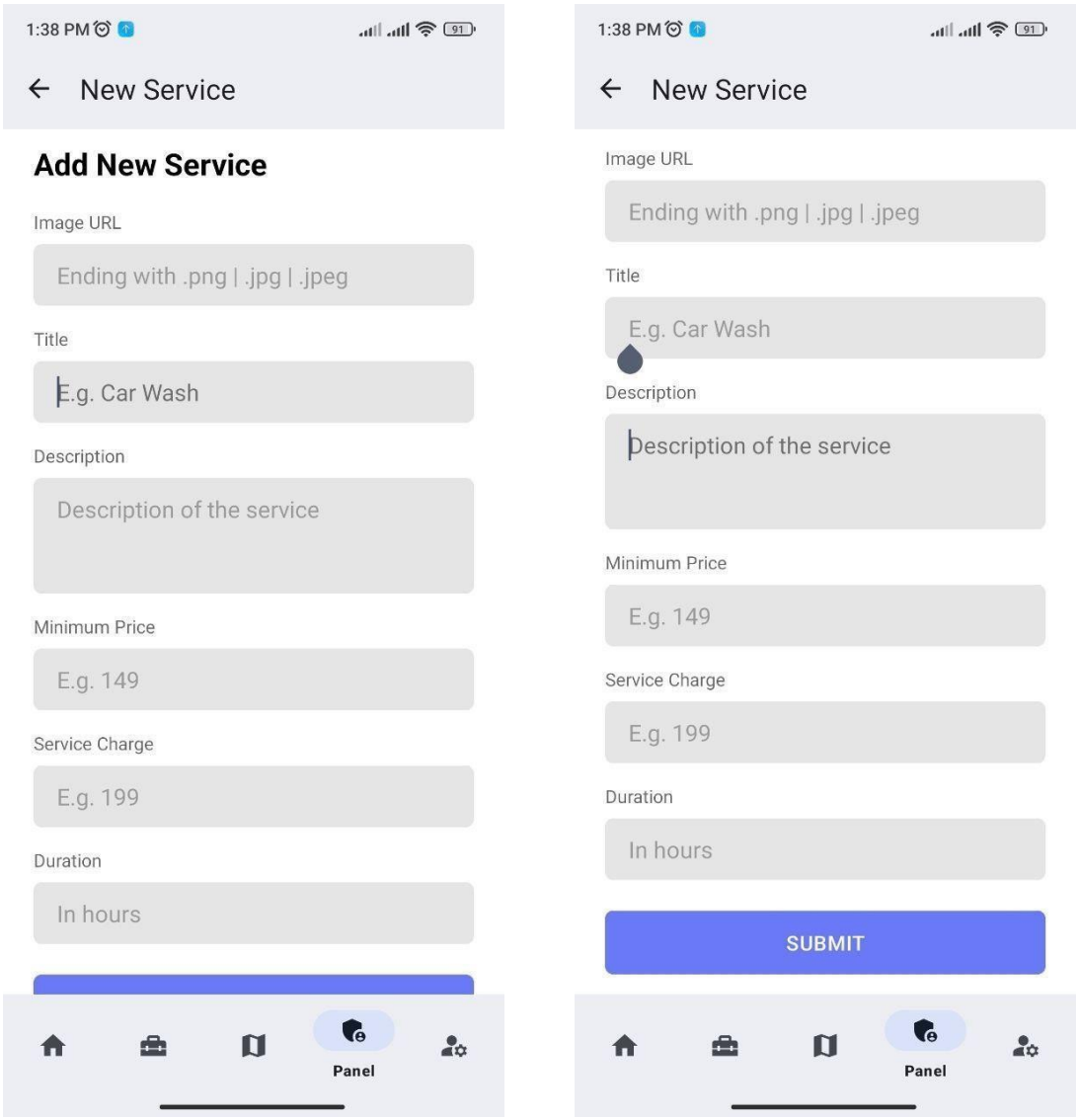

Figure 3.1.7.18: Add New Service Page

- **View User List Page:** Figure 3.1.7.19 below illustrates where admin can view user list who are connected this app.

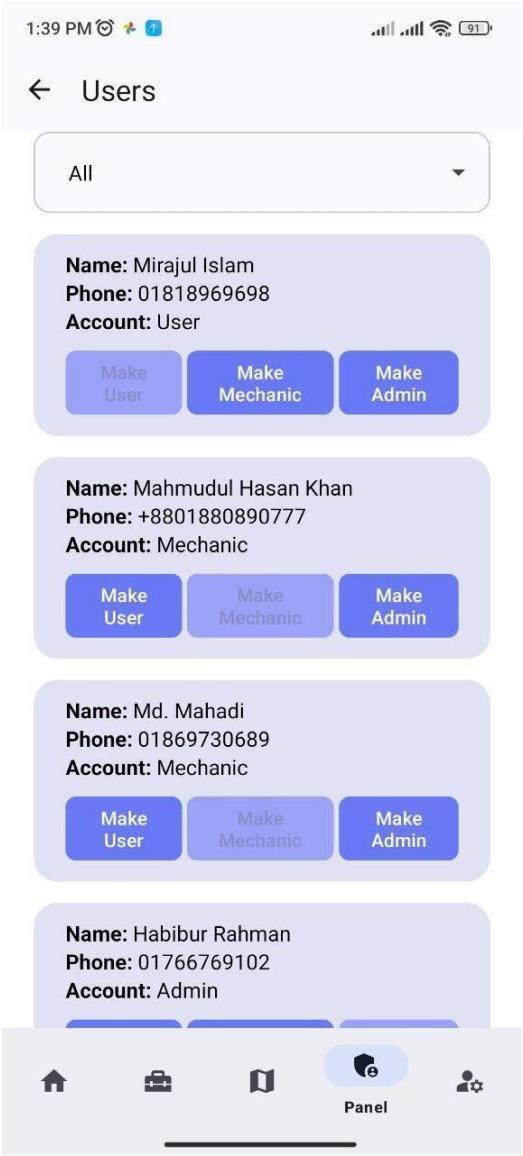

Figure 3.1.7.19: View User List Page

- **Assign Role of User List:** Figure 3.1.7.20 below illustrates where admin can assign roles to users such as user, mechanic and admin.

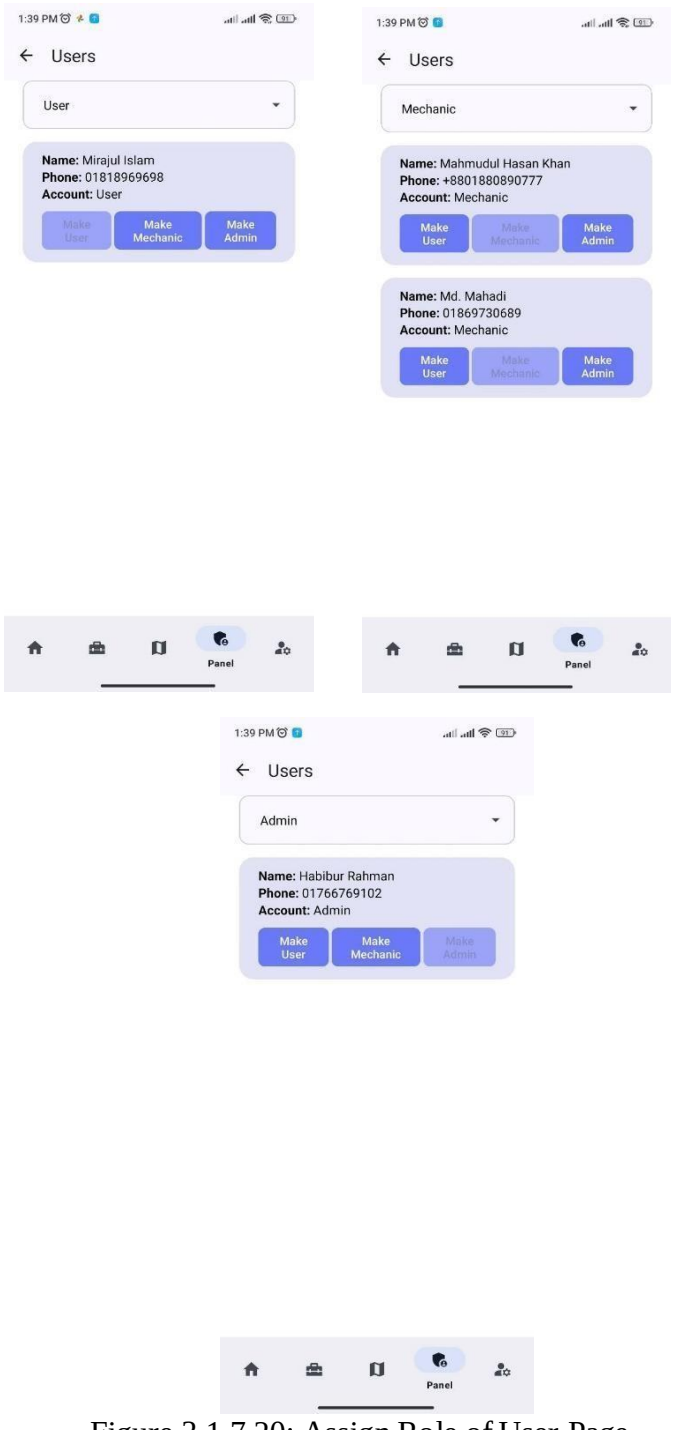

Figure 3.1.7.20: Assign Role of User Page

- **View User Complaint:** Figure 3.1.7.21 below illustrates where admin can view user complaint about garage and mechanic. Admin can resolve this problem.

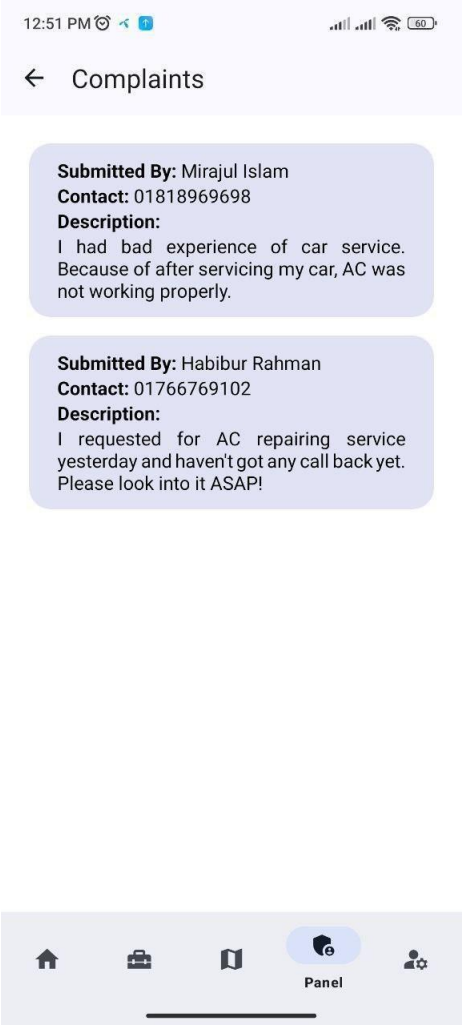

Figure 3.1.7.21: View User Complaint Page

- **View Servicing History:** Figure 3.1.7.22 below illustrates where admin can view servicing history that helps admin to identify mechanic and user interaction.

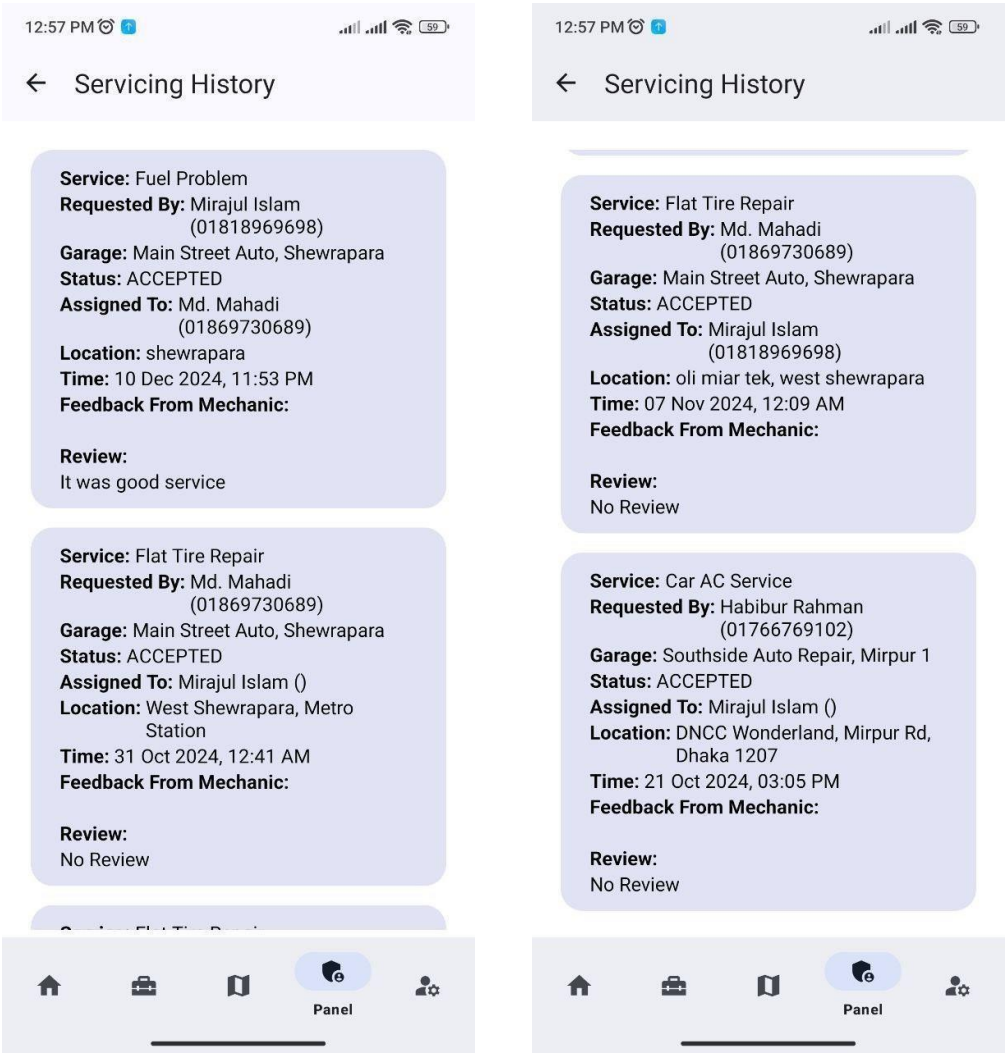

Figure 3.1.7.22: View Servicing History Page

- **Edit Profile Page:** Figure 3.1.7.23 below illustrates the admin profile screen where admin can update their information.

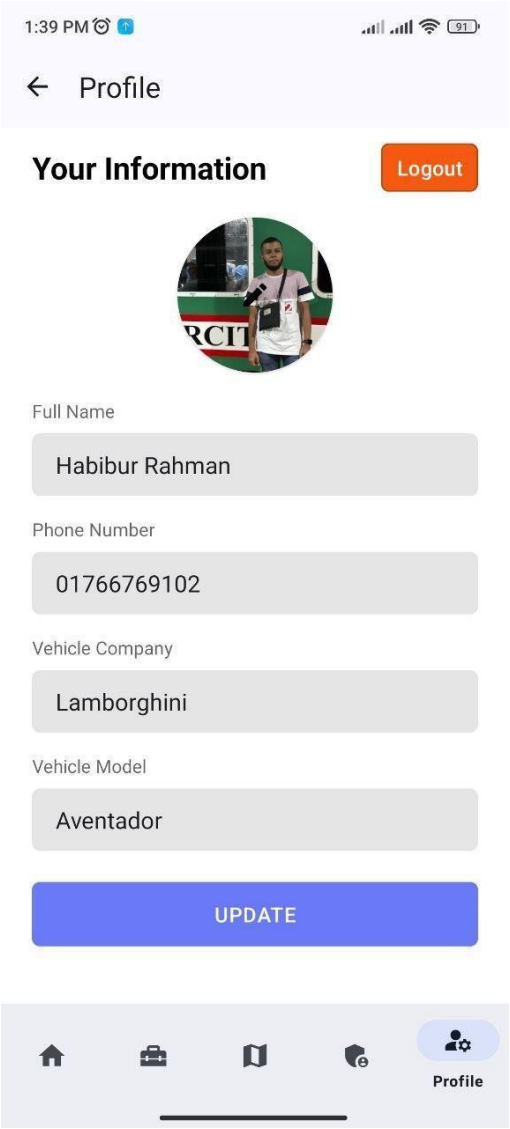

Figure 3.1.7.23: Edit Profile Page

3.2 Detailed Methodology and Design

The Breakdown Help Assistance app is created to offer vehicle operators a quick, effective, and easy-to-use platform for requesting emergency roadside help. The design procedure included multiple essential stages to guarantee an ideal user experience, cost efficiency, and smooth real-time monitoring.

- **System Architecture:** The app employs modern mobile technologies. The frontend utilizes XML and features a user-friendly interface, whereas the backend is powered by Firebase for real-time data synchronization and user administration. Integration with the Google Maps API enables real-time tracking of user locations.
- **Core Features:**
  - Users can ask for emergency roadside help for problems like flat tires, dead batteries, lack of fuel, or engine troubles.
  - Users can track their location live location via GPS.
  - Mechanics can view the users name, phone number, service name, time and location.
  - After the service is completed, users can provide feedback and rate the mechanic, assisting in upholding high service standards.
  - Users can check their servicing requests it includes update status it means that when service requests is accepted, they can view it.
- **Alternate Solution:** A different option explored was the installation of specialized GPS tracking devices in users' cars or with automotive technicians. These devices would transmit real-time location information straight to the app. Although this approach offered precise real-time monitoring, it presented multiple difficulties, such as significant initial expenses for acquiring devices, shipping, and setup. Moreover, these devices needed regular maintenance and updates, which further raised operational costs. A significant limitation was the restricted flexibility of GPS devices, as they were only capable of tracking and lacked other vital functions such as notifications or user authentication.

- **Choice of Method:** The Breakdown Help Assistance app uses a smartphone-based system for real-time tracking and service requests. This approach is cost-effective since users and mechanics already own smartphones, eliminating the need for additional hardware. It offers versatility, supporting features like reviews, feedback and service request forms, unlike single-purpose GPS devices. The system is also scalable, allowing easy expansion to support more users, mechanics, and locations. Moreover, it ensures ease of use by leveraging familiar smartphone interfaces, reducing the learning curve for users and mechanics. This method provides a flexible, cost-efficient, and user-friendly solution for roadside assistance.

3.3 Project Plan

The project was divided into distinct phases to guarantee organized advancement and on-time finishing:

1. **Phase 1: Requirement Gathering and Initial Design** (Duration: 4 weeks)
    - Carried out surveys and focus group discussions with drivers, mechanics, and roadside assistance service providers.
    - Identified core features such as real-time tracking, service request system, mechanic profiles and review and feedback system to ensure user satisfaction and seamless service.
2. **Phase 2: Development and Prototype Testing** (Duration: 5 weeks)
    - Created the first prototype of the app with essential features.
    - Performed internal evaluations for UI/UX and functional verification.
3. **Phase 3: User Feedback and Refinement** (Duration: 3 weeks)
    - Introduced the prototype to a limited audience of users, such as vehicle operators and mechanics, to collect input on usability and performance.
    - Made modifications according to user suggestions, including UI changes, bug corrections, and performance enhancements to enhance user experience and system dependability.

4. **Phase 4: Final Testing and Pre-Deployment Preparation** (Duration: 3 weeks)
    - Comprehensive testing to guarantee stability, scalability, and data precision.
    - Prepared deployment paperwork, with intentions to launch on the Play Store following additional optimization.

Gantt Chart:

The following Gantt chart 3.3.1 shows the project schedule that has been maintained:

Table 3.3.1: Project Schedule Gantt Chart

Phases	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13
Phases1													
Phases2													
Phases3													
Phases4													

3.4 Task Allocation:

The project was segmented into specific tasks to guarantee effective workload distribution:

- **UI/UX Design:** The design of the Breakdown Help Assistance app aimed at developing an intuitive, accessible interface for both drivers and mechanics. The process started with creating wireframes and prototypes to illustrate the user experience and guarantee smooth navigation. The main objective was to create an interface that is straightforward, tidy, and responsive, allowing users to easily request help and monitor their location.
- **Backend Development:** I managed every aspect of Firebase integration for real-time data syncing, user authentication, and management of cloud storage. This involved configuring Firebase Firestore for data storage and retrieval while making sure that updates and synchronization of user locations and garage information occurred smoothly.
- **API Integration:** I integrated Google Maps API for real-time tracking of users current location. Users can find the garages their nearby location.
- **Deployment and Documentation:** I oversaw the app's deployment procedure, which involved getting the final version ready for release. Furthermore, I developed comprehensive user manuals and technical documents to guarantee that users could effortlessly comprehend and maneuver through the app, while also laying the groundwork for future enhancements and upkeep.

By structuring the tasks in this manner, I guaranteed the project's on-time progress and successful completion. Managing every facet of the project independently provided complete oversight of the development process, allowing me to improve and enhance the app according to user feedback and technical specifications.

3.5 Summary

The Breakdown Help Assistance App provides a strong answer for roadside crises, allowing users to seek quick help from local mechanics. The application employs real-time tracking and location-based service matching, a method that links stranded drivers to local service providers. Utilizing smartphone technology, the system eliminates the requirement for expensive GPS equipment, lowering expenses while improving flexibility and scalability. Main characteristics consist of live user location monitoring, user evaluations and opinions, along with immediate status notifications. This effective, intuitive design promotes prompt roadside assistance and guarantees a seamless user experience. The organized development process, from collecting requirements to final testing, ensures a dependable platform that can be consistently enhanced and expanded for wider use.

CHAPTER 4
IMPLEMENTATION AND RESULTS

4.1 Overview

In this chapter, the findings from testing the Breakdown Help Assistance App are presented, along with an evaluation of its performance and insights from users. Main points of emphasis consist of experimental outcomes, comparison with current roadside assistance applications, and significant discoveries. The evaluation phase assesses the app's responsiveness, accuracy in real-time tracking, and the overall user experience. Comparative evaluation emphasizes the application's advantages in affordability, scalability, and live monitoring relative to other systems. The results show that the app can achieve its goals, providing an easy-to-use, effective, and trustworthy solution for roadside emergencies.

4.2 Experimental/Simulation Result

To evaluate the performance of the Breakdown Help Assistance App, a series of tests were conducted to assess its tracking accuracy, user interface responsiveness, and notification system functionality. The results of these tests are as follows:

- **Real-Time Tracking Performance**: The app was tested under varying network speeds and GPS signal strengths. The system achieved an average tracking accuracy of **90%**, enabling users to see their current location in real-time. Location updates were typically received within **5 seconds**, with occasional delays up to **10 seconds** during low network connectivity. This performance ensures users have reliable, up-to-date information on mechanic arrival times.
- **User Feedback on Usability**: A test group of users evaluated the app's user interface (UI) and user experience (UX). Feedback revealed that 90% of users found the app intuitive and simple to navigate. The app's load time averaged around 2 seconds, ensuring a smooth, fast experience for users requesting emergency roadside assistance.

These results highlight the app's strong performance in real-time tracking, timely notifications, and user-friendly design, all of which contribute to a seamless roadside assistance experience.

Test Results and Analysis:

Table 4.2.1: Summary of test results

SN.	Test	Expected Result	Result
01	Registration	New user information will be stored in Firebase upon registration.	Success
		Display a toast message with the appropriate error notification.	Failed
02	Login	Users are able to sign in with their email and password or their phone number.	Success
		Display a toast message with the appropriate error notification.	Failed
03	Forgot password	A registered user will receive a recovery email by clicking "Forgot Password."	Success
		Session time has expired.	Failed
04	Find Garages	Users can find garages their nearby location.	Success
05	Get location	Retrieve the user's current location with the highest accuracy.	Success
06	Check servicing requests	Users can check update status from mechanic that they are accept request or not	Success
07	Service Requests	Users can send service request to their nearby garages.	Success

11	Post announcement	The admin will post a new announcement that will be instantly visible to all users.	Success
		The user account does not have administrator privileges.	Failed
12	Add new garage	The admin will add a new garage, which will be immediately visible to users.	Success
		The user account does not have administrator privileges.	Failed
13	Add new service	The admin will add a new service, which will be instantly visible to users.	Success
		The user account does not have administrator privileges.	Failed
14	Filter user list	The admin will filter all user lists such as user, mechanic and admin.	Success
		The user account does not have administrator privileges.	Failed
15	Assign role	The admin will assign roles in user lists.	Success
		The user account does not have administrator privileges.	Failed
16	View user complaint	The admin will view of users complaint.	Success
		The user account does not have administrator privileges.	Failed

17	View servicing history	The admin will view servicing history of mechanics what they had done.	Success
		The user account does not have administrator privileges.	Failed

Performance Testing:

During Breakdown Help Assistance performance testing, I used Android Profiler to monitor CPU, memory, and network usage, as shown in Figure 4.2.2.

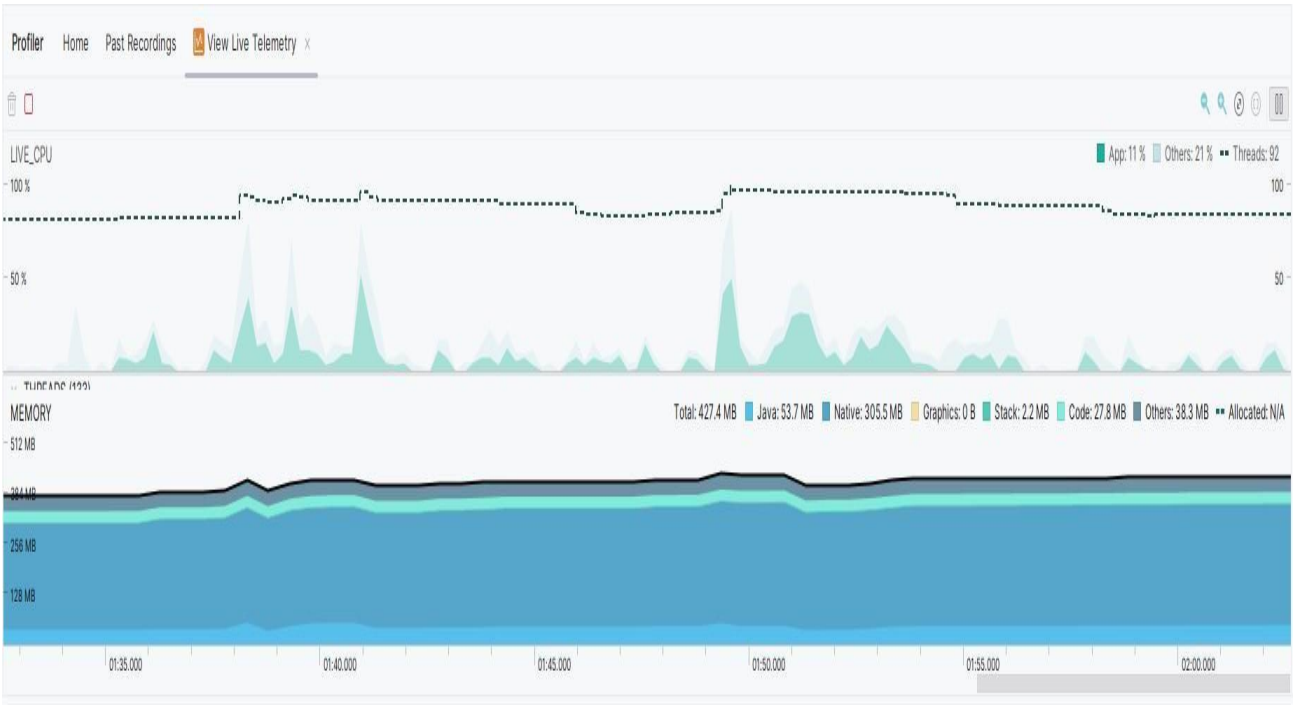

Figure 4.2.2: Performance monitoring using Android Profiler

During the testing phase, the Breakdown Help Assistance App demonstrated strong performance across key metrics, ensuring a smooth and responsive user experience. Below are the key performance highlights:

- **CPU Usage:** The application exhibited consistent CPU usage during testing, even at high-demand moments like real-time location tracking and service request updates. This efficiency minimized the chances of app freezes, guaranteeing a seamless user experience in crucial moments.
- **Frame Rendering:** Frame rendering was smooth, with few instances of stuttering frames. The application reliably sustained a rendering speed of 60 frames per second (FPS), especially when illustrating the motion of mechanics on the map. This led to fluid animations and visual responsiveness, improving user satisfaction.
- **Thread Utilization:** Efficient multi-threading was utilized, allowing all background tasks (such as location updates and status updates) to operate on worker threads. This design decision guaranteed that the primary UI thread stayed available for user interactions, delivering a smooth and responsive experience even amidst data-intensive tasks.
- **Memory Usage:** Memory utilization was efficiently optimized, showing no indications of memory leaks or unnecessary garbage collection. This optimization is crucial for ensuring consistent app performance, particularly on devices with restricted system resources. Coding practices that prioritize memory efficiency was implemented to prevent crashes due to out-of-memory (OOM) errors.
- **Network Performance:** The application demonstrated strong network performance. Real-time information, including the mechanic's position and service request progress, was refreshed with very little delay. This almost immediate data synchronization guaranteed that users obtained prompt updates, an essential element of emergency assistance applications where real-time information is vital.

4.3 Comparative Analysis:

To assess the effectiveness and characteristics of the Breakdown Help Assistance app, a comparative study was performed alongside similar emergency roadside aid apps such as AAA, RACQ Roadside Assistance, and Urgently. Here is a summary of the results presented in a table format:

Table 4.3.1: Comparative analysis

Feature	**Existing Roadside Assistance Apps**	**Breakdown Help Assistance**
Real-Time GPS Tracking	Yes	Yes
Service Request	Yes	Yes
User-Friendly Interface	Moderate	High
24/7 Service Availability	Limited	Yes
User Reviews & Feedback	Average or below average	Good
Nearby Garage Visibility	No	Yes
Issue Reporting System	No	Yes
Check updated status of the mechanic	No	Yes

4.2 Summary

The Breakdown Help Assistance App provides a quick, easy-to-use, and effective option for emergency roadside assistance. Its main characteristics comprise real-time monitoring of user location, a user-friendly interface, and providing prompt updates on service requests. The application offers profiles and reviews of mechanics, fostering transparency and building user confidence. In comparison to similar apps such as AAA, RACQ, and Urgently, it distinguishes itself through its emphasis on visibility, support for multiple languages, and incorporation of user feedback. These attributes provide a smooth and dependable experience, simplifying the process for users to request, monitor, and assess emergency assistance services. The testing results confirm that the Breakdown Help Assistance app achieves its main goals of user-focused design, clarity, and effectiveness. It not only delivers excellent performance in key aspects such as real-time tracking and alerts but also offers extra value through mechanical visibility and language assistance. These results emphasize the app's capability for broad acceptance and additional expansion in the competitive roadside assistance industry.

CHAPTER 5

ENGINEERING STANDARDS AND DESIGN CHALLENGES

5.1 Compliance with the Standards

Adhering to industry standards is essential for assuring that the Breakdown Help Assistance application fulfills quality, performance, and security requirements. This part describes the software, hardware, and communication standards followed during the project's development.

5.1.1 Software Standards

The development of the Breakdown Help Assistance application followed several established software standards to ensure robust and maintainable code:

- **ISO/IEC 25010:2011** (Systems and software engineering — Systems and software Quality Requirements and Evaluation (SQuaRE) — System and software quality models): This standard was followed to ensure the application met high standards of functionality, reliability, usability, efficiency, maintainability, and portability.
- **Agile Methodology:** Agile methodologies were utilized to guarantee iterative development, enabling frequent updates and enhancements driven by user input.
- **Google's Material Design Guidelines:** The UI design followed these standards to guarantee a cohesive and user-friendly experience.
- **OWASP Mobile Security Guidelines:** These protocols were adhered to in order to guarantee that the application is safeguarded against typical vulnerabilities and threats.

5.1.2 Hardware Standards

The hardware specifications guaranteed that the Breakdown Help Assistance application operated effectively on different devices:

- **Android Compatibility Definition Document (CDD):** The application was created to align with the guidelines detailed in the Android CDD, guaranteeing it operates efficiently on various Android devices.
- **Minimum Device Requirements:** The application was tested on devices meeting the following minimum standards:
  - **i)** Android OS version 8.0 (Oreo) or higher
  - **ii)** Minimum 2GB RAM
  - **iii)** Minimum 1.4 GHz processor
  - **iv)** GPS functionality for real-time tracking
  - **v)** Reliable internet connection (Wi-Fi or mobile data)

5.1.3 Communication Standards

Following communication standards was essential for guaranteeing smooth data transfer and user engagement.

- **HTTP/HTTPS Protocols:** The use of HTTPS guaranteed secure communication between the client application and the Firebase backend, safeguarding data during transmission.
- **Google Maps API Guidelines:** Adherence to the terms of service and usage policies of Google Maps API was upheld, guaranteeing the correct utilization of mapping services and location information.
- **RESTful API Standards:** The incorporation of external APIs (like Google Maps and Gemini) adhered to RESTful principles, guaranteeing scalable and maintainable interactions.

5.2 Impact on Society, Environment and Sustainability

The Breakdown Help Support App simplifies roadside assistance services, improving user safety and convenience. It enables users to seek assistance, check their location through GPS, and receive prompt updates on service conditions. This application promotes sustainable practices through efficient resource distribution and minimizing wait times, thereby fostering safer and more interconnected communities.

5.2.1 Impact on Life

The Breakdown Help Assistance App greatly influences users' everyday lives in multiple important aspects:

- **Convenience:**
    - Users can seek assistance with a couple of taps and track their current location, minimizing doubt and anxiety during vehicle malfunctions.
    - The app provides users with the estimated time of arrival (ETA) for the mechanic, allowing them to plan accordingly while waiting.

- **Safety:**
    - Users can view the services list with along information like that service name, service type and there are displayed service charge, minimum price and duration.
    - Users can seek assistance with a few taps and monitor their live location, minimizing uncertainty and anxiety during vehicle failures.

- **Increased Efficiency and Transparency:**
    - Users can detail the specifics of their malfunction, allowing mechanics to get ready beforehand. Real-time monitoring guarantees that users remain informed about the advancement.
    - Users can keep a digital log of previous service requests, enhancing transparency and responsibility.

- **Economic Benefits:**
    - Rather than committing to yearly subscriptions, users can opt to pay whenever help is required, lowering overall expenses.
    - As the app enables on-site fixes for problems such as flat tires and battery jumps, users avoid expensive towing charges.

- **Community Building:**
    - By enabling users to evaluate and comment on mechanics, the app fosters accountability, motivating enhanced service quality and ongoing progress.
    - Feedback and scores from past users assist new users in making educated choices when choosing service providers.

- **Social Considerations:**
    - The application provides easily reachable roadside help for individuals who might lack standard insurance coverage or premium subscriptions.
    - The app guarantees that assistance is accessible to everyone, no matter their location, economic standing, or type of vehicle.

5.2.2 Impact on Society & Environment

The Breakdown Help Assistance app encourages sustainable habits and enhances community well-being, presenting both benefits and possible disadvantages.

- **Potential Benefits:**
    - **Reduced Carbon Footprint**: By encouraging timely on-site repairs, the app reduces the need for towing services, which typically involve large, fuel-consuming tow trucks.
    - **Fewer Abandoned Vehicles**: Quicker breakdown assistance prevents users from abandoning immobilized vehicles on the roadside, helping to avoid traffic obstructions and reducing emissions linked to congestion.

- **Decreased Traffic Congestion**: By enabling quicker resolution of on-road breakdowns, the app helps avoid traffic congestion created by immobilized vehicles, enhancing traffic flow and minimizing fuel consumption.
- **Increased Awareness of Sustainable Practices**: The application might inform users about preventive maintenance, decreasing the chances of future failures, which indirectly promotes sustainability.
- **Economic Empowerment**: The application encourages the gig economy by providing job options for independent mechanics, aiding local economies and livelihoods.

- **Potential Drawbacks:**
  - **Increased Energy Consumption**: The functioning of mobile devices and servers may result in increased energy consumption, yet this can be reduced by implementing efficient methods.
  - **Dependence on Technology**: Users might become too dependent on the app for trivial fixes, possibly overlooking more environmentally friendly options such as walking or cycling for short-range help.

5.2.3 Ethical Aspects

Ethical factors are crucial in the creation and implementation of the Breakdown Help Assistance app to guarantee user confidence, fairness, and just treatment for every stakeholder involved. Important ethical considerations consist of:

- **Fair Access and Non-Discrimination**: The application must offer services fairly to every user, no matter their location, economic status, or vehicle type.
- **Worker Rights and Fair Compensation**: Protocols must be established to ensure mechanics' safety when journeying to new locations.

- **Accountability and Dispute Resolution**: User assessments of mechanics need to be monitored to avoid misuse, biased feedback, or slander. A system for appeal must be established for mechanics to contest unfavorable reviews.
- **Data Privacy and Security**: The app must have clear privacy policies to inform users about the data being collected, its usage, and their rights.
- **Marketing and User Expectations**: The marketing for the app should deliver transparent and truthful communication regarding its functions and offerings, steering clear of exaggerated claims about features that may not be assured.

5.2.4 Sustainability Plan

To achieve the long-term success and sustainability of the Breakdown Help Assistance app, various essential strategies will be put in place to uphold operational efficiency, minimize environmental impact, and guarantee ongoing user satisfaction.

- **Regular Updates and Maintenance**: Ongoing technical assistance will be offered to resolve bugs, enhance security features, and improve system performance.
- **User Feedback Integration**: Feedback and grievances will be evaluated to prioritize upcoming enhancements and guarantee the app stays user-friendly and efficient.
- **Community Collaboration**: Collaborations with nearby service providers (mechanics and repair shops) will be enhanced to guarantee quick and dependable support for users.
- **Environmental Impact Reduction**: The application will shorten the distance covered by mechanics, lowering fuel usage and emissions.
- **Sustainable Business Model**: Sources of income like subscription charges, enhanced features, and collaborations with auto insurance firms will ensure financial viability.
- **Data Analysis and Behavior Insights**: Usage data will be analyzed to identify patterns, such as high-demand areas and frequent service needs, allowing for better resource allocation.

Through the adoption of these sustainability strategies, the Breakdown Help Assistance app seeks to achieve lasting success while fostering environmental stewardship, ethical labor practices, and user satisfaction.

5.3 Project Management and Financial Analysis

Planning:

- **Define Project Scope**: The Breakdown Help Assistance app will provide essential features like check current location of users, emergency roadside assistance, find nearby garage of users location and send service requests to nearby garages.
- **Create Development Timeline**: A well-defined timeline will be established with significant milestones, encompassing prototype creation, feature execution, internal testing, beta launch, and final rollout. This organized method guarantees prompt delivery.
- **Identify Resources Needed**: Required resources include development tools (like Android Studio, Firebase, and third-party APIs), infrastructure (cloud servers, storage, and testing devices), and a budget for hosting, maintenance, and technical support.

Execution:

- **Track Progress:** Consistently track advancement towards reaching milestones and deadlines to guarantee the project remains on schedule.
- **Manage Communication**: Establish effective communication channels among developers, stakeholders, and users for ongoing feedback, quick issue resolution, and alignment on project goals.
- **Address Roadblocks:** Quickly identify and address any issues that emerge during the development process to reduce delays and preserve progress.

Monitoring and Control:

- **Monitor App Performance:** Regularly assess the app for its functionality, stability, and security, while collecting user feedback to facilitate continuous enhancement. Performance KPIs, including response time and crash frequency, will be monitored to guarantee the app stays efficient.
- **Implement Enhancements:** Resolve any bugs or problems identified by users and implement updates to improve app functionality and features according to feedback.

Project Management:

The creation and deployment of the Breakdown Help Assistance app utilize an Agile methodology to guarantee adaptability, ongoing enhancement, and responsiveness to user requirements. This method facilitates ongoing development and prompt modifications driven by user input. Essential practices and tools for project management consist of:

- **Scrum Framework:** Daily stand-up meetings take place to assess progress, tackle obstacles, and synchronize team activities. Sprint planning and review meetings guarantee that development remains aligned and stakeholder feedback is integrated.
- **Self-Reflection:** Following each sprint, evaluate what was successful and what could be refined in upcoming iterations, facilitating ongoing learning and improvement of the development process.
- **Financial Management Tools:** Utilize budgeting and accounting programs to monitor project costs and income.
- **Resource Allocation:** Resources are distributed to harmonize budget limitations with development objectives. This involves overseeing development duration, cloud resources, expenses for third-party APIs, and team availability.
- **Flexibility:** The Agile methodology enables the development team to stay flexible in response to shifts in user requirements, market trends, and technical obstacles.

Finance:

- **Budgeting:**
    - **Estimate Development Costs:** Incorporate expenses for development tools, hosting providers, and any required software licenses.
    - **Potential Revenue Streams:** Investigate options for income creation, including exclusive features for users or possible collaborations.

- **Financial Reporting:**
    - **Budget Tracking:** Consistently provide updates on budget conditions and resource distribution to maintain transparency.
    - **Analyze Revenue Opportunities:** Generate financial reports to assess and validate possible revenue-generating tactics.

Budget Allocation:

- **API Costs:** Expenditure for Google Maps API for tracking and analysis.
- **Firebase Costs:** Costs for real-time database, storage, and authentication services.
- **Maintenance Costs:** Budget for app maintenance, including updates, feature enhancements, and server maintenance. Continuous oversight, cybersecurity measures, and server upkeep to guarantee application availability and data safety.
- **Deployment Costs:** Expenditure for Play Store setup and app deployment.
- **Marketing Costs:** Digital advertising initiatives via Google Ads, social media platforms, and app store advertisements. Materials to teach users and technicians about utilizing the app, such as video instructions and manuals.
- **Operational & Administrative Costs:** Project managers, developers, testers, designers, and customer support staff.

Cost Estimation:

Table 5.3.1: Cost estimation

SN.	Category	Description	Estimated Cost (BDT)
01	API Costs	Google Maps API	500,000 annually
02	Firebase Costs	Real-time database, storage and authentication	10,00,000 annually
03	Maintenance Costs	Bug Fixes, Updates, Feature Enhancements, Server Maintenance	4,00,000 annually
04	Deployment Costs	Play Store setup and deployment expenses	3,000 one time
05	Marketing Costs	Advertising and promotional expenses	10,0000 one time
		Total Estimated Cost	20,000,3000

Ongoing Maintenance:

To keep the Breakdown Help Assistance app operational, secure, and current, funds have been designated for ongoing maintenance and support. This encompasses ongoing updates to fix bugs, improve security, and implement new features that cater to user demands and market developments. User feedback will be gathered and examined to prioritize enhancements that improve overall app functionality and user contentment.

The budget additionally includes crucial backend services like Firebase for real-time data syncing, secure cloud storage, and user authentication. By maintaining a strong and scalable infrastructure, the app is able to provide prompt responses during crisis situations. API usage costs are included in the budget to finance external services such as GPS tracking.

These anticipatory actions intend to deliver a smooth, effective, and easy-to-use experience for motorists and service providers, enhancing response times and fostering confidence in the Breakdown Help Assistance app.

5.4 Complex Engineering Problem

This section addresses the complex engineering challenges encountered throughout the development of the Breakdown Help Assistance.

5.4.1 Complex Problem Solving

The difficulties encountered in these processes necessitated continuous iterations and troubleshooting to enhance the system, guaranteeing seamless operation under different real-world scenarios. The thorough examination and creative solutions implemented emphasize the project's intricacy and the strong engineering methods employed to tackle them.

Table 5.4.1.1 below illustrates how the Knowledge Profile (K), and the Attainment of Complex Engineering Problems (EP) are addressed:

Table 5.4.1.1: Mapping of Complex Problem Solving and Knowledge Profile

EP1 Depth of Know-ledge	**EP2 Range of Conflicting Requirements**	**EP3 Depth of Analysis**	**EP4 Familiarity of Issues**	**EP5 Extent of Applicable Codes**	**EP6 Extent of Stakeholder involvement**	**EP7 Inter-dependence**
√	√	√	√		√	√

Mapping with Knowledge Profile for EP1

The following table 5.4.1.1 shows how EP1 is mapped to the Knowledge Profile. This mapping includes the relevant categories of knowledge that align with the engineering problem solving approach taken in the project.

Table 5.4.1.2: Mapping with Knowledge Profile

K3 Engineering Fundamentals	**K4 Specialist Knowledge**	**K5 Engineering Design**	**K7 Comprehension**	**K6 Engineering Practice**	**K8 Research Literature**
√	√	√		√	√

5.4.2 Rationale for Mapping

EP1 - Depth of Knowledge

For EP1, the project aligns with several categories from the knowledge profile:

Engineering Fundamentals (K3): The project relies on core principles of engineering, such as data collection, analysis, and system design, essential for real-time bus tracking and route planning.

Specialist Knowledge (K4): Specialized knowledge is applied in understanding GPS technology, mobile app development.

Engineering Design (K5): The project involves the design and development of an Android application, requiring a deep understanding of software engineering and user interface design.

Engineering Practice (K6): Practical application of these technologies in real-world scenarios is essential to validate and enhance the breakdown assistance system.

Comprehension (K7): The project applies engineering practices to real-world scenarios by incorporating GPS tracking for real-time location sharing, ensuring quick and precise assistance during vehicle breakdowns. Firebase technology facilitates robust backend support, including secure data storage, real-time database synchronization, and reliable user authentication.

Research Literature (K8): The development of the Breakdown Help Assistance app is informed by extensive research in GPS tracking technologies, mobile application frameworks, and user feedback systems.

EP2 - Range of Conflicting Requirements

Addressing challenges like integrating diverse features such as check current location of users, check update status of users servicing requests, find nearby garage while maintaining usability, security, scalability, and compliance with regulations. This requires a solid understanding of engineering practice (K6), engineering design (K5), and mathematics (K2) for managing complex systems.

EP3 - Depth of Analysis

Selecting appropriate technologies and frameworks to optimize user experience, such as Google Maps API for tracking location. This involves comprehension (K7), engineering fundamentals (K3), and specialist knowledge (K4) in mobile app and backend development.

EP4: Familiarity of Issues

Incorporating knowledge from roadside emergency people and logistics systems to improve the platform for better user experience and data protection. This necessitates a comprehensive grasp of research literature (K8) and engineering methods (K6). This ensures faster and more efficient responses to vehicle breakdowns.

EP5: Extent of Applicable Codes

The project mainly emphasizes incorporating current APIs and libraries instead of creating large amounts of new application code. This restricts the level of custom code used in the project, thereby influencing the engineering design (K5).

EP6: Extent of Stakeholder Involvement

The project mainly emphasizes incorporating current APIs and libraries instead of creating large amounts of new application code. This restricts the level of custom code used in the project, thereby influencing the engineering design (K5).

EP7: Interdependence

Tackling major issues throughout various phases, guaranteeing data integrity, security, and performance in database execution, while enhancing user experience via continuous feedback and development iterations. This necessitates engineering basics (K3), engineering design (K5), and understanding (K7).

5.4.3 Engineering Activities

In this section, we map the activities associated with solving the complex engineering problem of real-time breakdown assistance and location sharing to different engineering activity categories. Each mapping includes a rationale, demonstrating how our project aligns with these categories:

Table 5.4.2.1 below illustrates the complex engineering activities (EA) performed:

EA1 Range of Sources	**EA2 Level of Interaction**	**EA3 Innovation**	**EA4 Consequences for Society and Environment**	**EA5 Familiarity**
√	√	√	√	√

Mapping with Engineering Activities for EA1: Range of Sources

The project utilized a variety of resources, including GPS technology for real-time tracking to pinpoint user locations during roadside emergencies, Firebase for backend data management to securely handle user information and service requests, Google Maps API for location visualization and navigation support, and a feedback system to facilitate user reviews and provider ratings. These tools collectively ensure efficient service coordination, enhanced user experience, and robust backend functionality.

Mapping with Engineering Activities for EA2: Level of Interaction

The project involved extensive interaction with stakeholders, including vehicle owners and drivers for real-time location updates, service providers such as mechanics for ensuring timely assistance, and administrators for system oversight and approval. Additionally, user feedback was actively sought to improve usability and ensure the features aligned with practical roadside assistance needs.

Mapping with Engineering Activities for EA3: Innovation

The project demonstrated innovation by implementing imaginative features such as find nearby garages, get an emergency helps and residency status updates, which are not commonly found in existing roadside assistance apps.

Mapping with Engineering Activities for EA4: Consequences for Society and Environment

The project's impact includes significantly reducing wait times for vehicle repair services and improving roadside assistance efficiency. It enhances user safety by providing real-time GPS tracking, nearby garage suggestions, and live status updates for service requests. Additionally, the system contributes to a smoother and more predictable experience during vehicle breakdowns by streamlining communication between users and mechanics, ensuring quick resolutions and promoting better reliability on the go.

Mapping with Engineering Activities for EA5: Familiarity

The methods employed, including GPS tracking and mobile app integration, are well-established. However, the project's innovation lies in its application to streamline roadside assistance, addressing the unique challenges of vehicle breakdowns. By combining real-time location sharing, service request management, and user-mechanic interaction within a single platform, the application provides a tailored solution for efficient and reliable breakdown support.

5.5 Summary:

The Breakdown Help Assistance app is an all-in-one solution aimed at offering immediate aid for drivers encountering roadside crises. By offering functionalities like real-time location tracking and immediate access to emergency support, the app guarantees fast response times, ease of use, and enhanced safety. By following software, hardware, and communication standards, the application ensures dependability, data protection, and user contentment.

The application benefits society and the environment by encouraging safer driving behaviors, decreasing the duration vehicles are stuck on the road, and lowering traffic congestion. Ethical concerns, including user data confidentiality, also bolster the app's enduring sustainability and public confidence.

Efficient project management and thorough financial analysis have facilitated the optimal allocation of resources, whereas problem-solving and structured engineering tasks have tackled important issues like emergency response enhancement, live tracking precision, and multilingual assistance. Consequently, the Breakdown Help Assistance app provides a scalable, secure, and effective solution for drivers, enhancing a safer, more interconnected, and efficient road system.

CHAPTER 6
CONCLUSION

6.1 Summary

In summary, the Breakdown Help Assistance app provides a thorough response to the essential issues encountered by drivers during car breakdowns. Through the incorporation of immediate location tracking, with its intuitive interface, the application greatly enhances the emergency response experience for motorists. The initiative tackles critical concerns related to safety, efficiency, and accessibility, allowing users to request prompt assistance and minimize the dangers linked to extended delays on the roadside. In addition to its primary features, the app encourages safer road conditions, alleviates traffic caused by immobilized vehicles, and instills a feeling of safety for distressed drivers. This accomplishment emphasizes its potential to transform roadside assistance, offering drivers a quicker, safer, and more dependable way to obtain help in emergencies.

6.2 Limitation

The Breakdown Help Assistance application encounters various constraints. Accessibility poses difficulties, particularly for users with limited technological skills or those experiencing stress in emergency situations. Reliance on GPS, cellular data, and internet access means that users in regions with weak signals might experience delays in getting help. User information protection necessitates transparency and adherence to regulations, making data privacy a significant issue. Finally, disparities in access may occur, particularly for individuals in low-income or rural regions who have restricted smartphone or network availability. Tackling these challenges by implementing more straightforward interfaces, offline capabilities, and data security measures can improve user experience and accessibility.

6.3 Future Work

The creation of the Breakdown Help Assistance Application has notably enhanced how users, mechanics, and admins engage with service systems. The following are important aspects of future efforts that may be investigated to enhance user experience, increase operational efficiency, and boost system scalability.

- **Integration of Artificial Intelligence:** Machine learning algorithms can recommend relevant services to users based on their past service history, location, and preferences.
- **Real-Time Tracking Enhancements:** Enable users to monitor the live location of designated mechanics, akin to ride-hailing services (such as Uber), providing them with information on the arrival time of assistance.
- **Integrate Chat-Box:** Enable users and mechanics to communicate with each other by messaging text.
- **Service Invoices and Receipts**: Create automated invoices for each service request and deliver them to users through email or the app.
- **Comprehensive Service Analytics and Reports:** Leverage data analytics to forecast the demand for particular services (such as towing or tire changes) during specific periods of the year, enabling the system to adjust in advance.

These future improvements will help the app become a global, scalable, and multi-functional platform that not only addresses customer needs but also fosters trust, efficiency, and transparency in service delivery.

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