CAR MAINTENANCE SERVICE BOOKING APPLICATION

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Abstract

With the rapid expansion of the automotive industry, car maintenance has become essential for ensuring car safety, performance, and longevity. The increasing complexity of modern cars has led to a growing demand for maintenance services. However, traditional manual car maintenance management systems struggle to meet this demand efficiently due to issues such as lost records, delayed scheduling, and ineffective communication between customers and service providers. To address these challenges, this study proposes the development of a Car Maintenance Service Booking System that enhances operational efficiency by integrating real-time service tracking, automated notifications, and a user-friendly booking platform, streamlining maintenance processes for both car owners and service providers. Adopting a prototype-driven development approach, the system undergoes iterative refinement through six key phases: requirement gathering, quick design, prototype development, user evaluation, iterative improvement, and final implementation. The results show that the system effectively reduces scheduling errors, enhances service transparency, and improves customer experience. By integrating real-time updates and centralized service records, it optimizes the maintenance process and supports the digital transformation of automotive after-sales services.

Keywords: Car maintenance, Car maintenance service booking system

1.0 INTRODUCTION

With the rapid development of the car market, car maintenance has gradually become a crucial part of the automotive aftermarket. The increasing complexity of modern cars, particularly with the rapid growth of electric cars, has driven a rising demand for maintenance services. According to data from the China Association of Automobile Manufacturers (CAAM), the sales volume of new energy cars in China increased by 33.7% in 2023. According to data from the International Organization of Motor Vehicle Manufacturers (OICA), Car sales have steadily rebounded from a decline in 2020 to more than 65 million units by 2023. contributing significantly to the overall expansion of the maintenance market.

According to road safety expert Professor Dr Kulanthayan K.C. Mani of University Putra Malaysia. Malaysia had 33.3 million verfied vehicles in 2021 compared to the country's population size of 32.6 million people. Of those 33.3 million, as many as 47.3 percent were cars(Chan, 2022).

Regular car maintenance is crucial for ensuring car safety, optimal performance, and longevity. Proper maintenance can prevent major mechanical failures, reduce repair costs, and maintain the car's value over time. Furthermore, with modern cars incorporating increasingly sophisticated electronics and safety systems, regular maintenance has become even more critical for preventing system malfunctions that could compromise driver safety and car reliability.

However, as the number of cars continues to rise and the maintenance market expands rapidly, effectively addressing the growing demand has become a pivotal A challenge for the industry.

Current systems largely rely on manual processes, which lead to critical issues such as lost records, delayed maintenance scheduling, and poor communication between customers and service providers (Mansor, H.et al.,2017).

Current maintenance booking systems designed for cars are inefficient in handling the complex service needs. most people find it hard to book an appropriate date and time for their car to get serviced/repaired (Sagir, Z.et al.,2023). These systems typically use telephone appointments and communication. More car enterprises, dealers, and service centres tend to use the store maintenance scenarios and owners to communicate with each other at relatively low frequency, and a lack of active communication in the daily use of car owners (Post-Maintenance Market of Chinese Passenger Cars, 2024). which can prevent mechanics from obtaining accurate information about the condition of the car, making it difficult to effectively and efficiently diagnose and repair problems.

2.0 METHODOLOGY

This project will use a prototype model approach consists of six phases, which will be explained in detail below. This approach involves creating a simplified, working prototype of the system early in the development process, allowing for continuous feedback and iterative improvements before final implementation.

1. Requirements: In this phase, requirements are gathered by communicating with car owners and service providers. Key needs include maintaining records, online booking, real-time status updates, online payment, and security features.

2. Quick Design: Based on the requirements, an initial design framework is created, focusing on key components like maintenance record interfaces, booking layout, and notification display areas. The design at this stage is a simple outline or mockup to give users an early view of the system's layout and interaction flow.
3. Build Prototype: Using the initial design framework, a basic prototype is built to implement core functionalities like online booking, record management, and basic notification features.
4. User Evaluation: Owners and service providers test the prototype and provide feedback, focusing on ease of booking, efficient communication of information, completeness of maintenance records, and timelines of notifications. This feedback helps to identify functionality gaps or usability issues that need improvement.
5. Refine Prototype: Based on user feedback, improvements are made to enhance both functionality and user experience. Multiple iterations may be carried out until users are satisfied, and the system aligns with expected standards.
6. Implement and Maintain: After several iterations, all feedback and improvements are incorporated into the final product.

3.0 RESULT AND DISCUSSION

The car rental management system has been developed successfully and complete documentation has been completed.

Figure 3.1 presents the Home Page. It features a simple design with the system's logo and a "Start" button, allowing users to proceed to the login page seamlessly.

Figure 3.1 Home Page

Figure 3.2 presents the Login Page. After the user registers an account, they can use their email and password to log in. The login page is designed with simplicity in mind, offering input fields for email and password along with options for password recovery. Once logged in, users can access the system's main functionalities, such as booking services or viewing their profile.

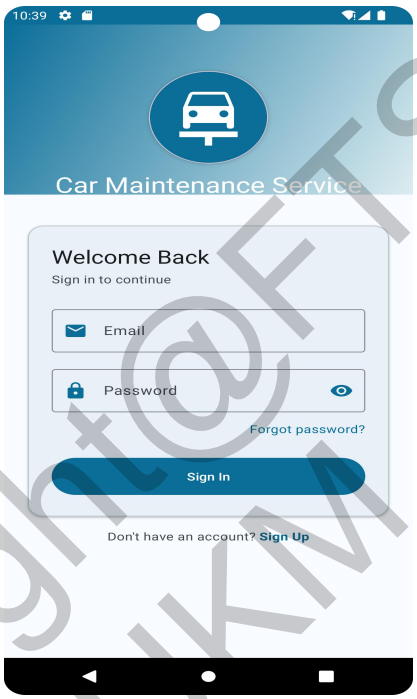

Figure 3.2 Login Page

Figure 3.3 presents the Main Page. The main page serves as the central navigation hub for users, displaying key functionalities such as booking services, checking progress, and managing profiles. With an intuitive layout and prominently placed icons or buttons, users can easily access the system's core features.

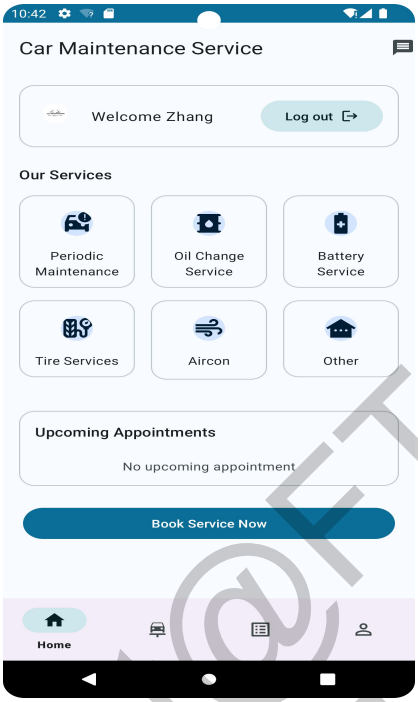

Figure 3.3 Main Page

Figure 3.4 presents the Booking Page. On this page, users can schedule a service by selecting a garage, service type, and preferred appointment time and filling down the car details. The page ensures clarity with dropdown menus, calendars, and clear confirmation options to finalize the booking.

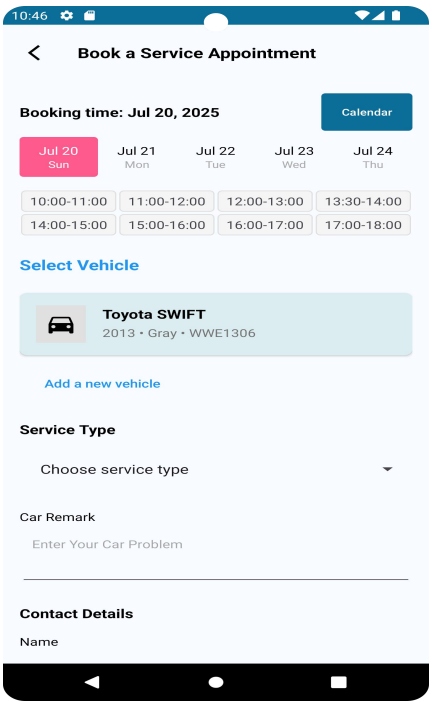

Figure 3.4 Booking Page

Figure 3.5 presents the Task List Page. The task list page displays a comprehensive list of assigned tasks, sorted by priority or deadlines. It helps service providers efficiently manage and track their workload, ensuring timely service completion.

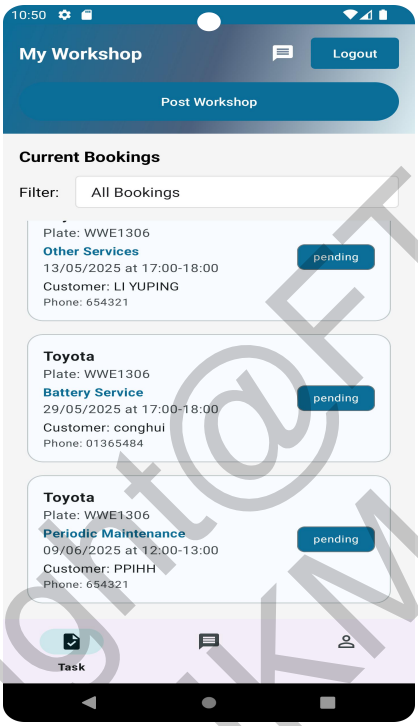

Figure 3.5 Task List Page

Figure 3.6 presents the Update Service Page. This page is primarily for service providers to update the status of ongoing tasks. It includes fields to mark tasks as complete, add notes, or provide estimated completion times, ensuring clear communication with users.

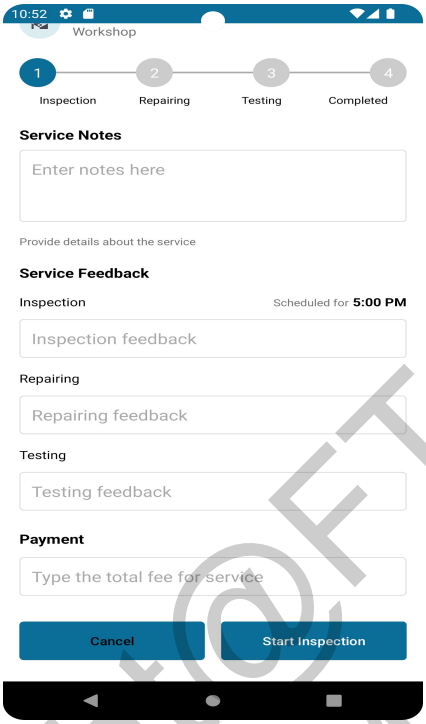

Figure 3.6 Update Service Page

Figure 3.7 presents the Profile Page, which allows users to manage personal information, such as name, contact details, and password. It also provides options to update preferences or view system notifications.

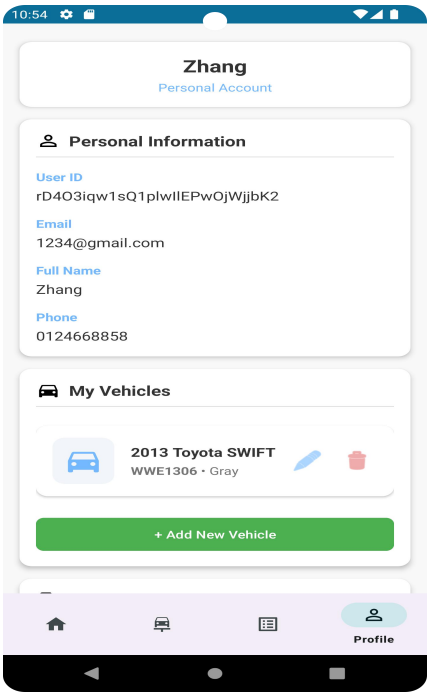

Figure 3.7 Profile Page

3.1 System Flowchart

The system flowchart illustrates the overall operational logic and process flow of the Car Maintenance Service application. It provides a visual representation of how different components interact, from user login, service selection, appointment booking, to service status tracking and completion. This flowchart helps clarify the system architecture, data flow, and user journey, offering a comprehensive overview of how the app functions behind the scenes.

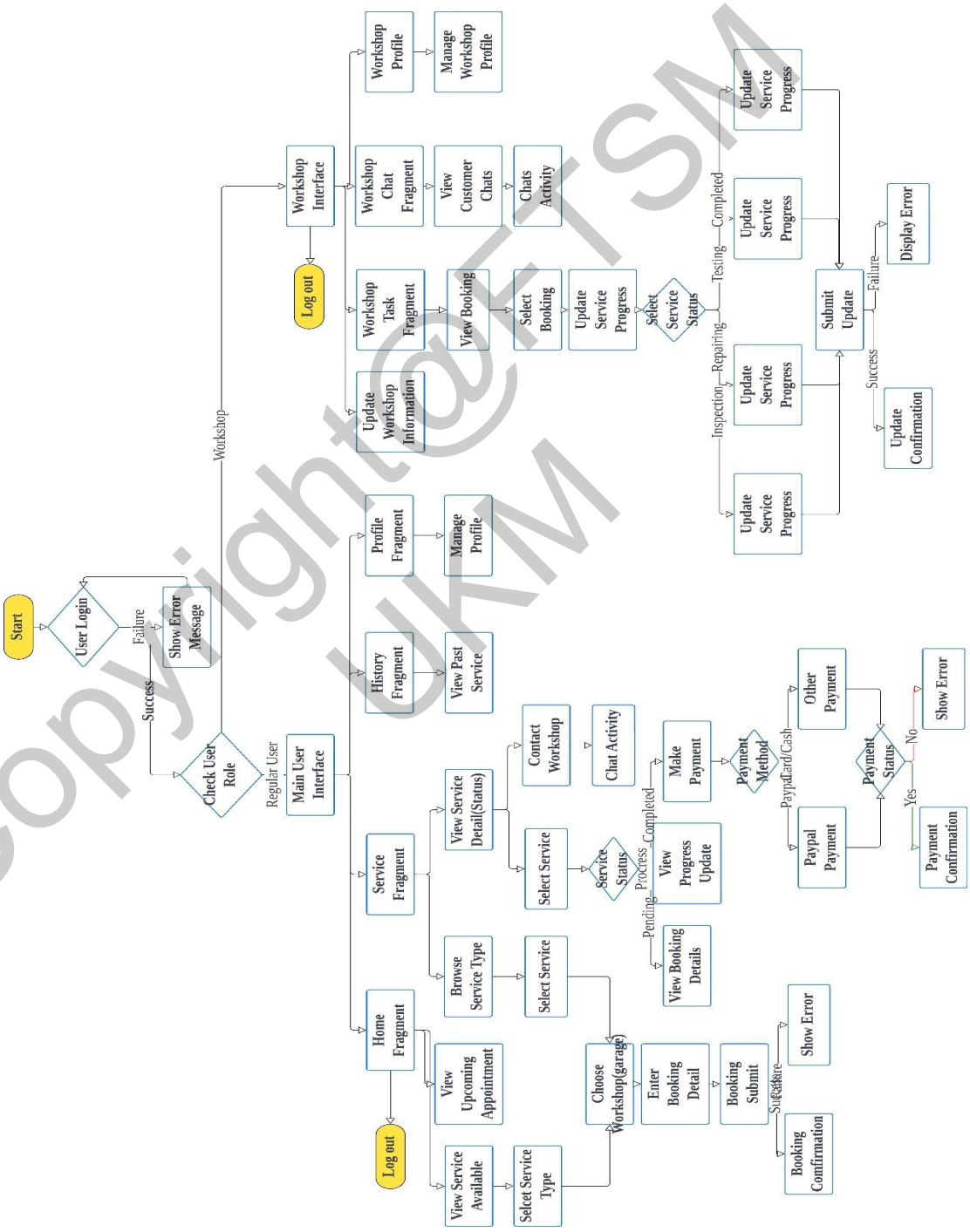

Figure 3.8 System Flowchat

3.2 Application Evaluation

The application evaluation was conducted to ensure that all the developed features, including booking, payment, communication, and history tracking, function correctly and meet user expectations. This section discusses both the functional testing and usability testing carried out on the Car Maintenance Service Booking Application.

i. Functional Testing

Functional testing was conducted based on black-box testing methodology to verify whether the system's functionalities behave according to requirements, without considering internal code structure. The core modules tested include booking, appointment viewing, service management, communication, and payment functionalities.

The tests were performed on an Android device after deploying the APK. Each functionality was tested by simulating real user actions. The results are summarized below:

Test Phase	Feature Tested	Result
1	Booking car maintenance services	Passed
2	Viewing upcoming appointments	Passed
3	Viewing list of available services	Passed
4	Maintenance history viewing	Passed
5	Real-time communication with workshop	Passed

ii. Usability Testing

Usability testing was conducted to evaluate the ease of use, interface clarity, and overall user satisfaction of the application. This testing involved 10 representative users, including both novice and experienced individuals. The Post-Study System Usability Questionnaire (PSSUQ) was used as the evaluation instrument.

Participants were instructed to complete several core tasks such as:

1. Registering and logging in
2. Booking a service
3. Viewing maintenance history
4. Sending a message to the workshop
5. Making an online payment

After analyzing the responses, the average score across all statements was 2.0, indicating a high level of usability. The results are presented in Table 4.3.

ID	Statement	Result (Average Score)

U01	Overall, I am satisfied with how easy it is to use this system.	1.5
U02	It was easy to learn how to use this system	1.8
U03	I was able to complete the tasks quickly and efficiently using this system.	1.6
U04	It was easy to learn how to use this system	2.2
U05	The system provided clear feedback or error messages when something went wrong.	2.4
U06	The information provided by system was clear and helpful	2.1
U07	The layout and interface of the system were visually clear and well-organized.	2.3
U08	I felt confident using this system	1.7
U09	This system has all the features and functions I expected it to have	2.4

The usability test confirms that the system meets its non-functional requirements. Participants found the interface intuitive, navigation smooth, and features well-aligned with expectations. Only minor suggestions were made, such as adding tooltips for first-time users.

4.0 CONCLUSION

The Car Maintenance Service Booking Application was developed to address the limitations of traditional manual service booking by offering an integrated digital solution for car owners. The system allows users to book maintenance services, track service status, communicate with workshops in real time, and complete secure payments, all within a single Android-based platform.

The application was built using the MVC architecture and Firebase integration to ensure scalability, modularity, and real-time data synchronization. Through iterative development and comprehensive testing—including functional, performance, compatibility, and usability evaluations—the system was proven to be reliable, user-friendly, and effective in improving service transparency and operational efficiency.

Key strengths of the system include a responsive interface, secure cloud-based operations, and convenient booking features. However, limitations were observed, such as support for Android only, limited payment options, and the absence of a workshop rating system.

Future improvements should focus on expanding to iOS platforms, integrating a user review mechanism for workshops, and offering more diverse payment methods. These enhancements will further improve system inclusivity, trust, and user satisfaction.

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