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U-Drive: UTHM Car Rental System for University Student (ANDROID)

Ahmad Syazwan Shahnizam[1], Noor Zuraidin Mohd Safar[1]*

[1] *Fakulti Sains Komputer dan Teknologi Maklumat,*
Universiti Tun Hussein Onn Malaysia, Parit Raja, Batu Pahat, 86400, MALAYSIA

*Corresponding Author: zuraidin@uthm.edu.my
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Abstract

U-Drive UTHM Car Rental System is intended to resolve the transportation obstacles encountered by students at Universiti Tun Hussein Onn Malaysia (UTHM), such as the high costs, limited accessibility, and inefficiencies of conventional rental options. The mobile car rental solution provided by the system is user-friendly and cost-effective, incorporating real-time vehicle availability, GPS tracking, flexible reservation options, and contactless payment integration through Card and E-Wallet. Agile methodology was employed to facilitate iterative design, development, and testing processes, with the Flutter framework serving as the development platform and the Dart programming language employed for application logic. Real-time data synchronization was performed using Firebase, which enabled the system to guarantee scalability, security, and usability. In addition to enhancing transportation accessibility, car-sharing practices align with sustainability objectives and facilitate fleet management for administrators. The potential for similar scalable solutions in future research is underscored by key findings from the study, highlighting opportunities for improvements, such as integrating advanced analytics into fleet optimization.

1. Introduction

The U-Drive UTHM Car Rental System is a mobile application developed to address the transportation challenges faced by students at Universiti Tun Hussein Onn Malaysia (UTHM), offering a solution to the limitations of conventional car rental services and public transportation in terms of affordability, accessibility, and convenience [1]. Traditional services often suffer from inefficient booking processes, limited vehicle availability, and a lack of affordability, especially during peak times, while public transport schedules fail to align with students' dynamic routines, causing delays and frustration [2]. U-Drive integrates advanced technologies, including real-time vehicle tracking, through Card and E-Wallet payment processing, and eco-friendly practices such as car-sharing, to provide a user-centric, sustainable transportation system. Built using the Flutter framework and Firebase for cross-platform functionality and real-time data synchronization, the application aims to improve network performance, scalability, and usability under varying demands [6]. By focusing on these objectives, U-Drive seeks to revolutionize campus transportation and support UTHM's sustainability and mobility goals [3].

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1.1 Problem Statement

The current inadequate transportation options pose significant transportation challenges for students, including inefficiencies, delays, and elevated stress levels, due to the extensive campus layout and adjacent areas of Universiti Tun Hussein Onn Malaysia (UTHM). The high costs, limited accessibility, and inflexible rental terms of traditional car rental services render them unsuitable for students. University life's dynamic academic and extracurricular demands frequently conflict with public transport schedules [8]. The U-Drive system provides a unique, cost-effective, and accessible car rental solution specifically designed for UTHM students to address these issues. U-Drive promotes eco-friendly practices, such as car-sharing, while improving transport efficiency by streamlining the booking process, assuring vehicle availability during peak times, and offering affordable rental options. This initiative is consistent with the sustainability objectives of UTHM and promotes a more environmentally cognizant, productive, and well-rounded university experience for students.

1.2 Objective

The objectives of this project are listed as follows:

1. To develop a mobile car rental application for Android using the Flutter framework, ensuring seamless and intuitive user experience tailored to meet the transportation needs of UTHM students.
2. To incorporate key features such as real-time vehicle availability, a smooth booking process, and car-sharing options, thus enhancing the reliability and accessibility of transportation for students.
3. To create an efficient admin dashboard that allows for easy vehicle management, including adding, updating, and removing vehicles, always ensuring smooth operations and availability.

1.3 Scope

The "U-Drive: UTHM Car Rental System" is the project's focus, divided into three primary scopes. First, the system provides a mobile application that allows students to peruse available vehicles, make reservations, and process secure cashless payments through Card and E-Wallet, ensuring a user-friendly and efficient experience. Secondly, it equips administrators with the requisite tools for fleet management, including real-time fleet monitoring through GPS integration, vehicle maintenance scheduling, damage reporting, and booking confirmation [4]. This facilitates efficient monitoring and decision-making. To guarantee cross-platform compatibility, the system is constructed with the Flutter framework, Firebase for real-time data synchronization, and cloud-based storage for operational scalability. Critical modules include booking management, analytics reporting, payment processing, user authentication, and vehicle maintenance. This initiative aims to enhance student mobility, optimize fleet operations, and promote environmentally conscious transportation solutions on the UTHM campus.

2. Literature Review

This section provides a literature review on topics related to car rental systems, mobile application development, and existing comparative platforms such as SOCAR, Trevo, and Avis [1]. The literature review aims to provide an understanding and discussion of the project background, including the design of student-centric transportation solutions, the integration of real-time tracking and cashless payments, and the limitations of existing systems.

2.1 Study of Development U-Drive: UTHM Car Rental System

This section delves into the fundamental technologies that underpin the U-Drive: UTHM Car Rental System. Firebase offers real-time data synchronization, user authentication, and cloud storage, while Flutter guarantees cross-platform compatibility and efficient interface design. Card and E-Wallet integration ensures secure, contactless payment transactions, while GPS technology facilitates real-time vehicle tracking. The structured booking feature of the system enables users to observe vehicle availability and make and modify reservations seamlessly. UTHM students are provided with a user-friendly, secure, and scalable solution tailored to their requirements, as automated processes reduce errors and delays and enhance efficiency compared to manual rental systems. Accessibility and pricing are tailored to university students, highlighting the need for a solution like U-Drive, which effectively addresses these limitations.

2.2 Comparison with the Existing Tools

Table 1 shows the comparison between existing tools, such as Trevo, Avis, Socar and the proposed application. This table compares the features of the application.

Table 1 *Comparison between tools*

Features \ Tools	Trevo	Avis	Socar	U-Drive Car Rental
Student-Friendly Pricing	No	No	No	Yes
Flexible Rental Periods (Hourly/Daily)	No	No	Yes	Yes
Integration with Campus Shuttle Schedules	No	No	No	Yes
Simplified Payment System	Yes	Yes	Yes	Yes
Multiple Vehicle Options	Yes	Yes	Yes	Yes
Installation Difficulty	Moderate	Moderate	Moderate	Moderate

All platforms aim to offer efficient vehicle rental solutions that are customized to accommodate a wide range of transportation requirements. Except for U-Drive, which incorporates advanced features such as real-time GPS tracking, campus-specific vehicle availability, and flexible rental terms to provide superior user experience compared to traditional platforms, each platform utilizes its distinctive system architecture [8]. In contrast, the proposed U-Drive system employs a student-centric approach to resolve the affordability and accessibility constraints that university students encounter. Card and E-wallet seamless payment integration and emphasis on sustainability through car-sharing practices render it an optimal solution for university environments. Furthermore, U-Drive eliminates the need for off-campus rental services, providing a centralized and efficient system accessible from within the campus. The proposed U-Drive system generally guarantees dependable transport solutions for UTHM students and increases user satisfaction.

3. Methodology

The materials and methods section, otherwise known as methodology, describes all the necessary information that is required to obtain the results of the study. Subheadings will depend on the phases in the methodology used. In the testing phase, the outcomes from functional and non-functional testing must be reported.

Fig. 1 *Agile Methodology phases[10]*

3.1 Requirement Analysis

In this phase, the requirements needed and the justification for developing the U-Drive UTHM Car Rental System are identified and documented. Additionally, a feasibility analysis is performed to ensure that the proposed

requirements are suitable for the application. Before this, user analysis is crucial to study the needs of the target users: the students and staff at UTHM who will utilize the car rental service. The user analysis was conducted through interviews with a selection of potential users, as well as consultations with the relevant stakeholders, including representatives from UTHM administration. This project's user analysis is tabulated in Table 2.

Table 2 *User Analysis*

Stake Holder Category	Role in Product	Design Implications	Actions Needed
Target Users	End User of the application	Based on interviews with potential users.	• Enable access to the target users' mobile phones.
		The application should be usable anytime and anywhere.	• Ensure the app is available 24/7 for car rental bookings.
		All the necessary car rental information should be displayed	• Include details such as car types, availability, prices, and booking status.
		All the relevant information should be up-to-date and accurate.	• Regularly update the car availability and pricing information.
		The system should be easy to learn and use.	• Use clear, simple language in instructions
			• Avoid complex or technical terms in the app's interface.
		Easy to navigate	• Include the main menu, back button, and a simple navigation bar.
			• The app should have quick access to booking details and car information.
		Simple user interface design	• Use icons for key functions (e.g., car booking, account, and settings).
			• Use a consistent font (e.g., Open Sans) and a readable font size.

Subsequently, the functional and non-functional requirements are gathered to provide a clear direction for the U-Drive UTHM Car Rental System's software development. The functional requirements focus on delivering specific services or functions that directly cater to the end-users' needs, as illustrated in Table 3. These requirements ensure the application fulfills its purpose of providing an efficient and seamless car rental experience. On the other hand, the non-functional requirements define the quality attributes of the system, such as performance, security, and usability, ensuring that the system operates efficiently and reliably under various conditions, as shown in Table 4. Together, these requirements lay the foundation for building a robust and user-centric application.

Table 3 *Hardware requirements*

Hardware	Function
User Devices	Smartphones or tablets with a minimum of 2GB RAM and 500MB free storage
Development Machines	Computers with at least Intel i5 processor, 8GB RAM, and 256GB SSD for smooth operation.

Server Infrastructure	Cloud servers with minimum 4 vCPUs, 16GB RAM, and 100GB storage for hosting backend.
Internet Connectivity	Reliable internet connection (minimum 10 Mbps) for real-time operations and updates.
GPS Hardware	Devices with built-in GPS for location tracking and navigation.

Table 4 *Software requirements*

Hardware	Function
Operating System	Android 8.0 (Oreo) and above for end-user devices; Windows/Linux for development platforms.
Development Framework	Flutter for cross-platform mobile application development.
Backend Services	Firebase for real-time database synchronization, user authentication, and server-side logic.
Payment Gateway	Card and E-Wallet integration for cashless and secure payment processing.
Programming Language	Dart for application logic and integration with Flutter.
Cloud Service	Google Cloud and Firebase for scalable hosting and backend operations.
Security Protocols	SSL/TLS encryption for secure data transmission

Table 5 *Functional requirement*

Module	Function
Account Registration	• The system shall not allow users to register with duplicate accounts. • The system shall only allow users to successfully sign up after all required information is filled in. • After users successfully register, the system shall save their information into the database.
User Login	• The system shall allow users to log in with valid credentials. • If the password is incorrect, the system shall display an error message.
Vehicle Browsing	When users enter the vehicle browsing interface, the system shall display available vehicles with key details such as car type, availability, rental price, and a picture of the vehicle.
Booking System	• The system should allow users to book available vehicles by selecting rental periods and other options. • The system shall automatically calculate the total rental price based on the selected rental period and car type.
Payment System	The system shall integrate with payment gateways for secure payment processing.
GPS Navigation	The system should provide real-time tracking for vehicles, enabling users to see the location of their booked car.
Payment System	Integrates with Card and E-Wallet and other e-wallets for seamless payments, with automatic receipt generation.

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Booking Confirmation	The system shall automatically send notifications to users confirming their booking details.
Vehicle Availability	The system shall automatically update vehicle availability in real-time, ensuring users see accurate information.
Admin Panel	The system shall provide the admin with the ability to manage vehicle data (add, edit, delete) and update vehicle status.
Order Process Management	The system shall allow admins to monitor and manage all vehicle bookings and transactions.
Reports and Analytics	Generate reports on usage, booking trends, payments, and fleet utilization insights

Table 6 *Non-Functional requirement*

Module	Description
Performance	The system shall allow users to complete vehicle bookings in under 5 seconds.
Implementation	• The system should be compatible with Android devices running Android 8.0 and above. • The system should function optimally with a reliable internet connection.
Usability	The system should offer a simple, intuitive, and responsive user interface, providing smooth booking experience.
Security	• The system shall encrypt sensitive user data (e.g., phone number, password) using SSL/TLS. • The system shall ensure secure transactions, protecting users' personal and payment information.
Maintainability	Maintain a modular and well-documented codebase to simplify updates and fixes, supported by regular maintenance schedules for continuous system enhancements.

3.2 System Design

The Use Case Diagram, Activity Diagram, Entity Relationship Diagram (ERD), and flowchart for using the U-Drive UTHM Car Rental System are designed during this phase. These diagrams play a crucial role in clearly defining the system's modules, their functions, and the flow of data between them. Additionally, they establish the relationships between entities and their attributes within the database. The use case diagram, illustrating the key interactions between users and the system, is shown in Figure 2. These visual representations provide a comprehensive overview of how the application operates, ensuring the system is well-organized and user-friendly.

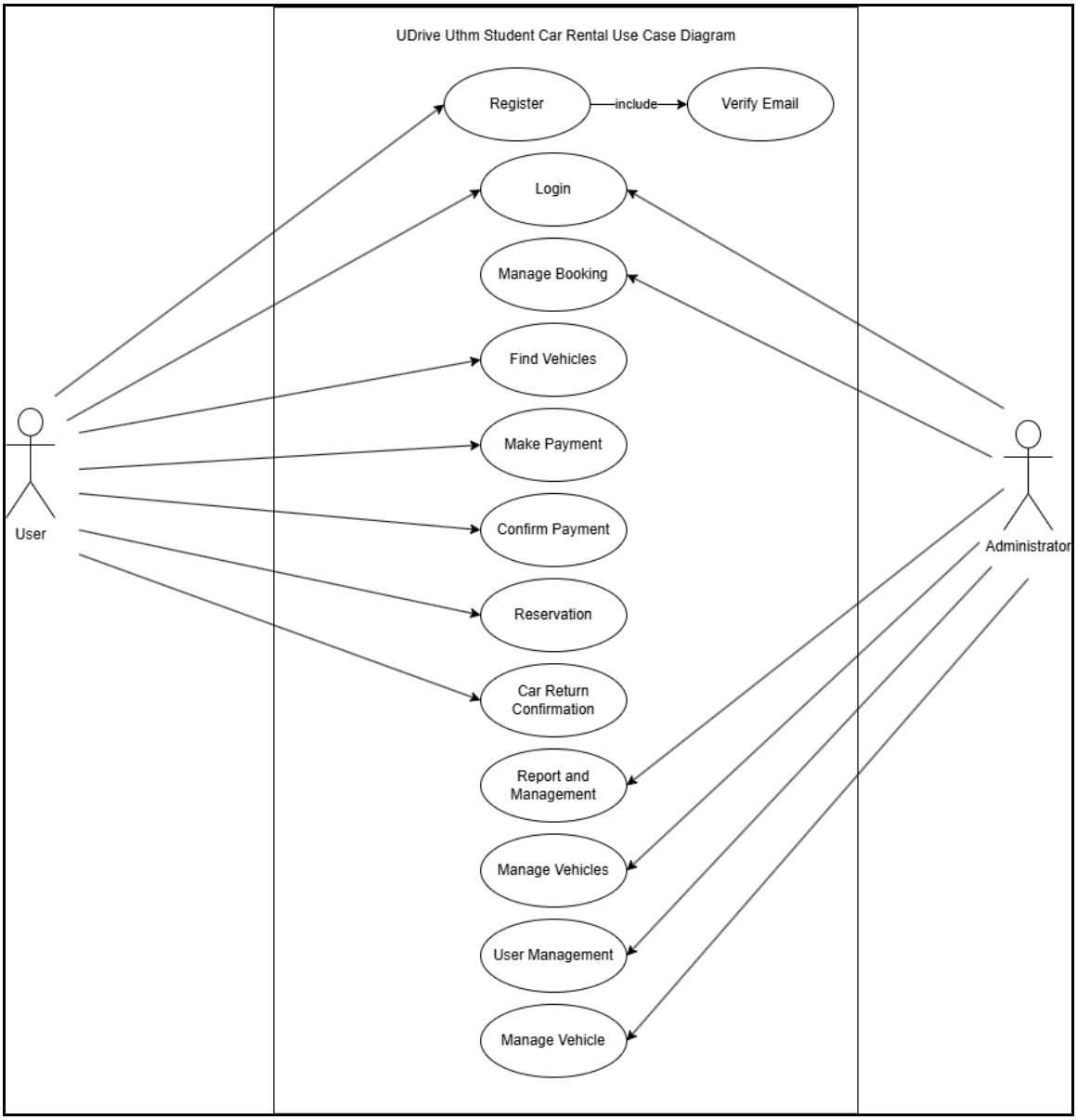

Fig. 2 *Use Case Diagram*

The application design for the U-Drive UTHM Car Rental System includes system, database, and user interface design. System design is illustrated through flowcharts, showing the process of a user booking a car and the overall system flow (Appendix B). The database design is represented by an Entity Relationship Diagram (ERD) the design prioritizes simplicity and usability. Interfaces, such as booking and vehicle details screens, feature a clean, minimalist layout with icon-based buttons for better clarity and accessibility.

3.3 Implementation

Next, followed by the implementation phase, the development of the U-Drive UTHM Car Rental System application begins. In this phase, coding is carried out in individual units based on the system design from the previous phase. The application is developed using Flutter for cross-platform compatibility and Dart as the programming language [6]. For the backend database, Firebase is chosen for seamless real-time data synchronization and secure storage. Three key Firebase functions are employed in the application: Authentication, Real-time Database, and Storage [2]. For Firebase Authentication, phone number authentication is enabled to ensure secure user login. In case users forget their password, they can easily reset it by verifying their phone number and entering a One-Time Password (OTP) sent to their phone. This approach enhances security and provides user-friendly experience for students and administrators to access the U-Drive system.

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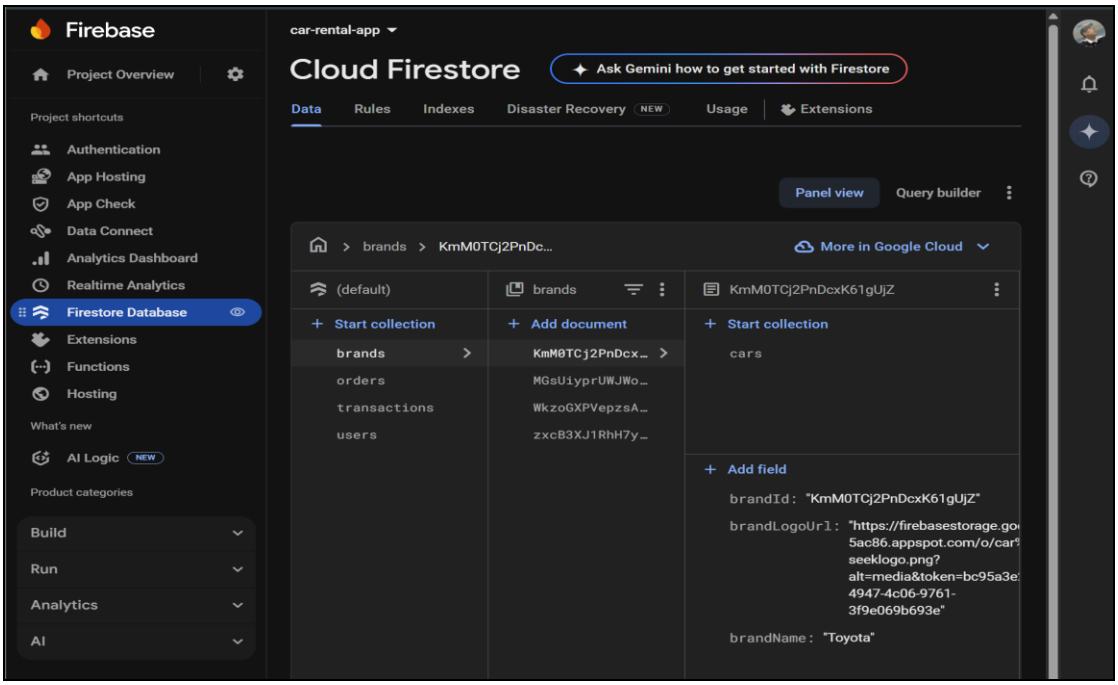

Fig. 3 *Firebase real-time database interface*

The second main function, Firebase Real-Time Database, enables the U-Drive UTHM Car Rental System to add, delete, and update data within the application [5]. The real-time database stores information related to users, vehicles, bookings, payments, and reports, as shown in Figure 3. When a new user registers, their data is stored in the database, ensuring accurate user information management. Administrators can add, update, or delete vehicle details, booking statuses, or payment records, with changes reflected immediately in the real-time database. The database also stores information about rental statuses, payment methods, and order details, ensuring they are consistently updated. Firebase Storage is used to store vehicle images, allowing users to view pictures of available cars. Admins can update vehicle images by uploading new photos, ensuring the application always displays the most up-to-date vehicle information. This integration ensures smooth real-time updates and secure data management for the U-Drive system.

3.4 Testing

After The testing phase ensures quality assurance and identifies any defects. Alpha testing is employed, where the developer conducts all testing activities, thoroughly checking each module. Functional modules, such as user registration, login, vehicle booking, and payment, undergo unit testing to verify their proper functionality and the absence of errors or bugs. For instance, unit testing for user registration ensures that new users cannot sign up if the input text exceeds the specified length or if the password doesn't meet the required criteria.
Additionally, the developer ensures the application meets all specified requirements and performs as expected. A small group of volunteers tested the user modules, while the system administrator tested the admin module. User Acceptance Testing results are discussed in Chapter 4, with any identified bugs or defects reviewed and resolved to ensure seamless operation of the application.

3.5 Maintenance

The last phase of the U-Drive UTHM Car Rental System development process is maintenance. This phase focuses on delivering improvements based on feedback collected from the testing stage and users of the application. During this phase, any bugs or issues identified are fixed, and the functionality of the application is enhanced to ensure it meets user expectations. As a result, the application is updated to a better version, which is released for users to enjoy an improved experience. This ongoing maintenance helps ensure that the system remains functional, efficient, and responsive to user needs over time.

3.6 Development Phase

The U-Drive UTHM Car Rental System's features are implemented during the development phase by utilizing Flutter for cross-platform development and Firebase for real-time data synchronization, secure authentication, and storage [10]. Fleet monitoring, vehicle perusing, booking, payment integration Card and E-Wallet and GPS tracking are among the most significant functionalities. Firebase Authentication guarantees secure access. To

optimize feature deployment and preserve stability, the iterative approach incorporates user feedback and rigorous testing and refining.

3.7 Deployment Phase

The U-Drive UTHM Car Rental System's Deployment Phase entails the activation of the application and its preparation for distribution on the Google Play Store. Live databases and backend infrastructure are configured to facilitate real-time operations. System administrators monitor the app to resolve issues, gather feedback, and ensure performance after launching it. Tutorials and user orientation are offered to facilitate efficient utilization. Consistent maintenance and updates guarantee user contentment, enhanced functionality, and reliability.

3.8 Application Development Workflow

The parallel model methodology's synopsis of all phases is elucidated in the application development workflow.

Table 7 *Project Development Workflow*

Phase	Task	Output
Planning	1. Conduct project background investigation. 2. Identify objectives and scope. 3. Gather stakeholder requirements. 4. Create project schedule and resource allocation.	• Project proposal • Defined objectives and scope • Gantt chart
Design	1. Develop system architecture and user interface designs. 2. Create UML diagrams (use case, sequence, activity, class). 3. Design database schema. 4. Plan system workflows for booking, GPS, and payments	• System architecture • Database schema • UML diagrams • UI mockups
Development	1. Develop mobile applications using Flutter. 2. Integrate Firebase for real-time data and authentication. 3. Implement core features: GPS tracking, booking, payment, and notifications. 4. Conduct continuous integration and module testing.	• Functional mobile application • Integrated GPS and payment modules • Working modules
Testing	1. Conduct unit, integration, and system testing. 2. Perform User Acceptance Testing (UAT) with students and administrators. 3. Debug and resolve issues based on testing results.	• Debugged system • UAT results • Improved performance and functionality
Deployment	1. Prepare application for release on Google Play Store. 2. Establish backend infrastructure for live operation. 3. Provide user support resources and onboarding tutorials.	• Deployed application • User onboarding materials • Operational backend
Reviewing	1. Collect user feedback and monitor system performance. 2. Analyze KPIs such as user engagement and booking frequency. 3. Plan future updates to address identified improvements.	• User feedback and performance analysis • Updated system plan for enhancements

4. Result and Discussion

This section presents the results of user acceptance testing for the U-Drive UTHM Car Rental System. Five target users, including students and administrators, tested the app and provided feedback to improve the user experience.

4.1 Module Implementation

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4.1.1 User Module

The User Module of the U-Drive UTHM Car Rental System is designed to offer a smooth and secure process for user registration, sign-in, and account management. Users must provide their username, email address, and password to register. A verification link is then sent to the provided email to confirm the user's identity. Once verified, users can access the system.

After registration, users can log in with their credentials, and the system authenticates the information against the stored database. Upon successful authentication, users are granted access to their personalized dashboard. The User Module also enables users to update their profile, change their phone number, and view their rental history, allowing them to keep their information up to date and track their rental activities easily.

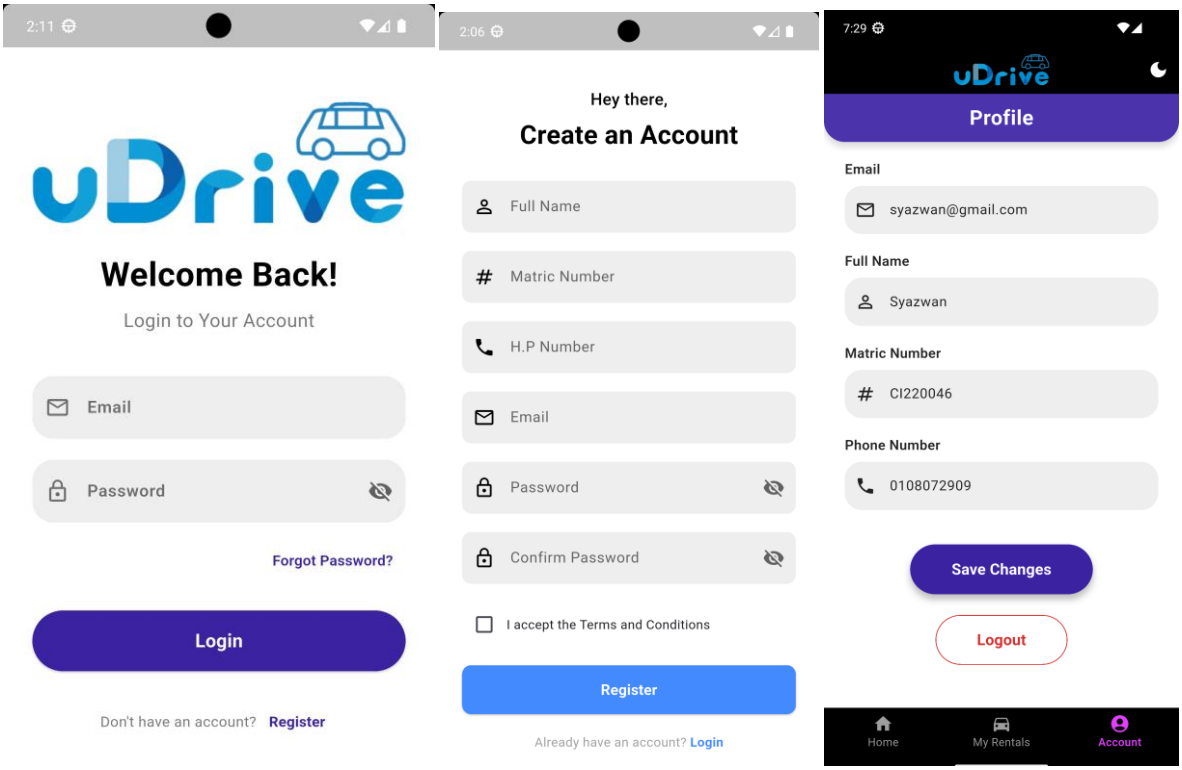


Fig. 6 *Initial Screens (a)Login; (b)Register; (c)User Profile Account page*

4.1.2 Booking, Return and Payment Module

The Booking and Return Module of the U-Drive UTHM Car Rental System enables users to easily book and return vehicles, streamlining the process for both customers and administrators. When a booking is confirmed, the system records all relevant details, such as vehicle type, rental duration, and total price, in the Firebase database, ensuring accurate storage and real-time vehicle availability updates. Users are then prompted to complete payment through the secure Stripe payment module, which processes payments via Stripe's payment sheet. Upon successful payment, booking details, including payment status, are updated, and the user receives a confirmation email and receipt.

When returning the vehicle, users update its status in the system, marking it as "available" for future bookings. The system also checks if the vehicle was returned on time and calculates any late return charges. This ensures that the vehicle's status is always accurate and ready for new bookings. Overall, the module facilitates an efficient and secure booking and return process, with Stripe payment integration improving the payment experience, and ensuring effective management of vehicle availability, payment, and return statuses for smooth rental operations.

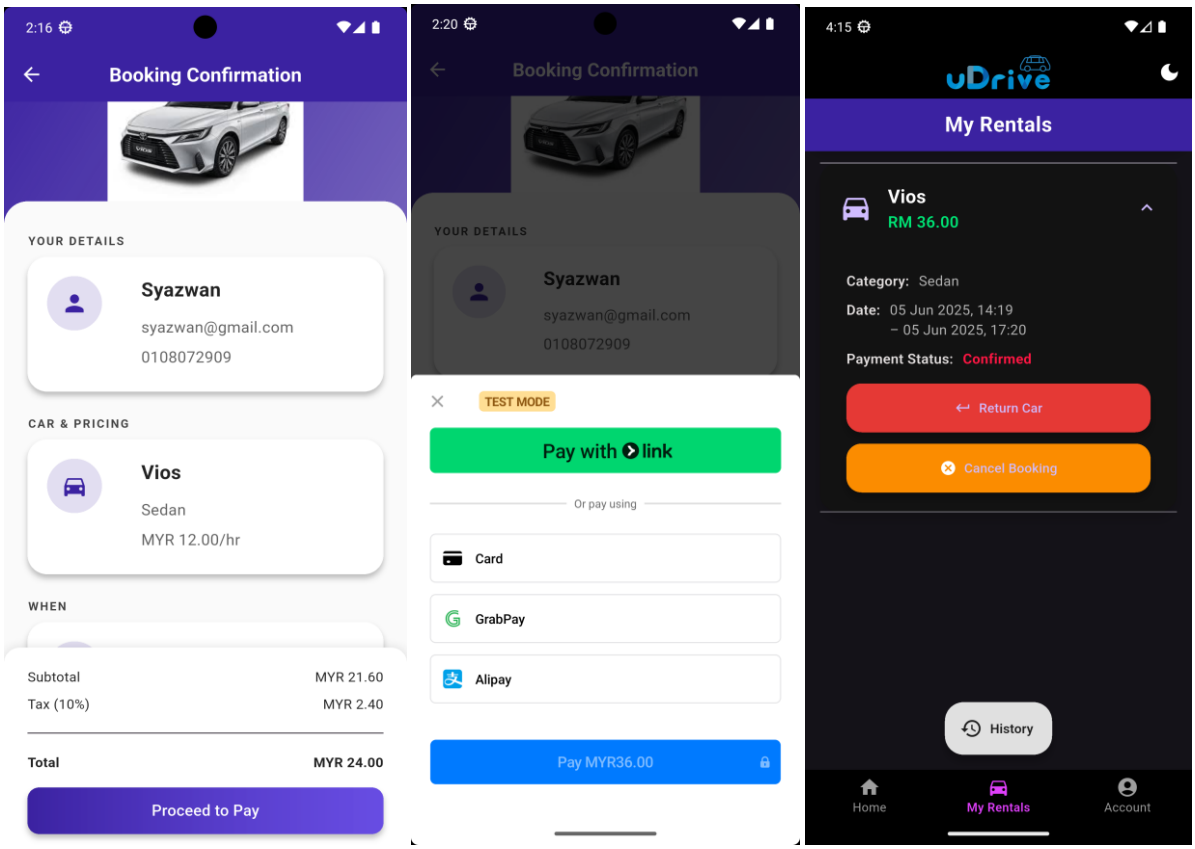
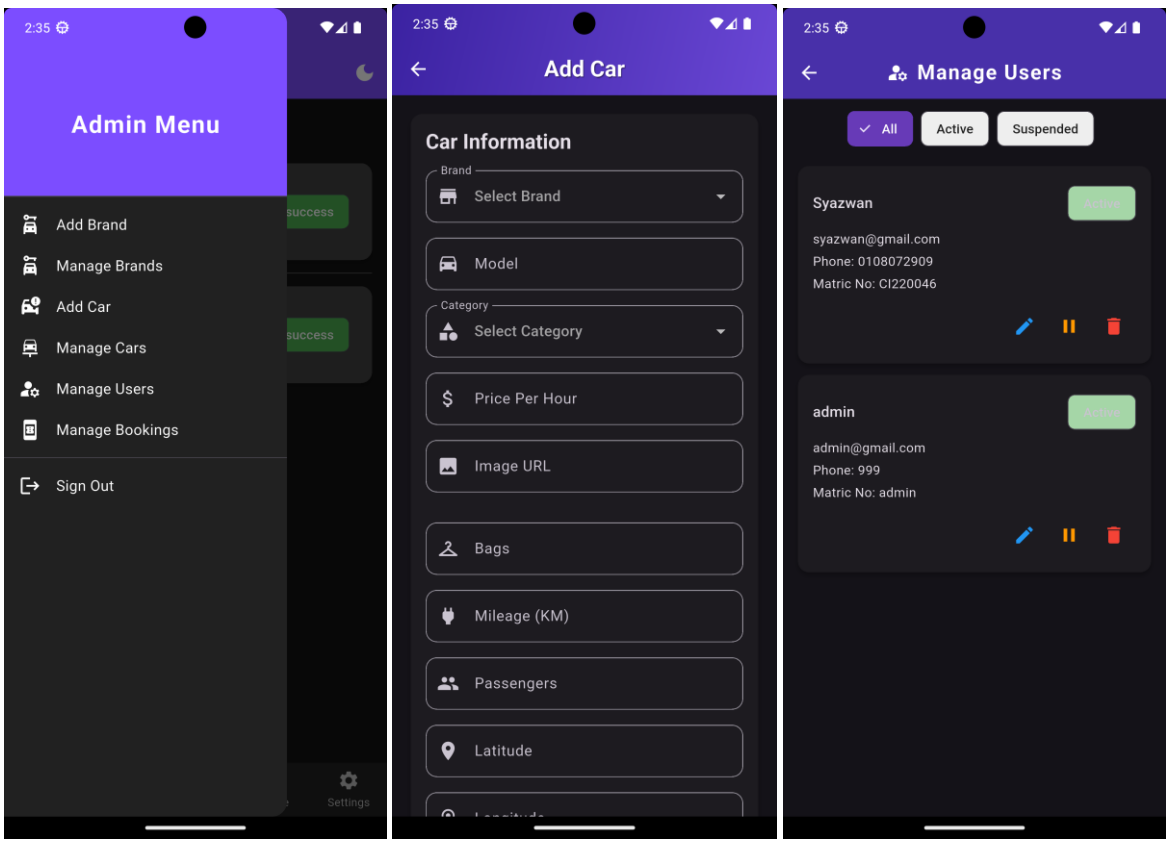


Fig. 7 *Modules Interface (a) Booking Confirmation; (b) Payment Method; (c) User's Order*

4.1.3 Admin Module

The Admin Module of the U-Drive UTHM Car Rental System provides administrators with essential tools to manage daily operations. Administrators can manage vehicle availability, process bookings, oversee payments, and generate reports. They can add, update, or remove vehicles, ensuring vehicle details such as model, type, and pricing are current, and monitor real-time availability to display only available cars [9].

Additionally, administrators can view active bookings, including customer details, vehicle assignments, and rental durations. They can update booking statuses, approve or cancel reservations, and resolve payment issues. The module also allows for generating reports on vehicle utilization, revenue, and customer feedback. Role-based permissions ensure data security by limiting access to authorized personnel. This module is crucial for efficient fleet management and enhancing the user experience.



(a) *(b)* *(c)*

Fig. 8 *Modules Interface (a) Admin Navigation Bar; (b) Add Car; (c) Manage User*

4.2 Testing

System testing ensures that all components of the U-Drive Car Rental application work as intended and meet the requirements specified in the design. This section covers functional testing and user acceptance testing (UAT) for the system. The major deliverables of this phase are shown in Appendix C.

4.2.1 User Acceptance Test

User Acceptance Testing (UAT) was conducted to ensure that the U-Drive Car Rental System Android app meets the needs of its end users and functions effectively in real-world scenarios. A diverse group of participants, covering various age groups, genders, and travel frequencies (from infrequent to frequent travelers), took part in the testing. Their main travel purposes included leisure and a combination of leisure and business. The functionalities tested during UAT are outlined in Appendix C, Table C. The app received a user rating of 5 out of 5 stars, indicating high satisfaction with the system.

Table 8 *User Acceptance Test Result*

User Acceptance Testing	1	2	3	4	5
How simple is the system to use and comprehend?			1	9	4
How user-friendly is the system?				7	7
Do you like the system's design and colors?			2	4	8
How do you feel about the login process				7	7

How satisfied are you with account management?		3	8	3
How easy is it to update your profile?		3	6	5
How satisfied are you with managing violations?		2	11	1
How useful is the report creation feature?			9	5
How easy is the admin panel for managing accounts and permissions?			8	6

4.2.2 Test plan

The Booking and Payment Management module in the U-Drive Car Rental System allows users to make car rental bookings and process payments, while administrators are responsible for managing vehicle availability, booking approvals, and processing transactions. The system supports input field validation, tracks the status of bookings, and restricts access to non-logged-in users. Table 9 outlines the test plan for booking and payment management, ensuring the functionality of the booking process, payment gateway integration, and the seamless experience for both users and administrators.

Table 9 *Test Case Results for User Registration Module*

No	Test Case Description	Expected Outcome	Actual Outcome	Pass/Fail
1	Test user registration with valid data	User is successfully registered and redirected to the dashboard	User registered successfully and dashboard loaded	Pass
2	Test registration with an invalid email format	System shows an error for missing required fields	Error message displayed for invalid email format	Pass
3	Test registration with missing fields	System shows an error for missing required fields	Error message displayed for missing fields	Pass
4	Test registration with existing email	System prevents registration with duplicate email	Error message displayed for existing email	Pass

Table 10 *Test Case Results for Vehicle Booking Module*

No	Test Case Description	Expected Outcome	Actual Outcome	Pass/Fail
1	Test booking a car with valid details	Car is successfully booked, and confirmation is received	Car booked successfully with confirmation	Pass

2	Test booking a car without selecting a vehicle	System prompts for vehicle selection	Error message displayed for missing vehicle selection	Pass
3	Test booking with past date	System shows errors for past date	Error message displayed for invalid date	Pass

5. Conclusion

In conclusion, the U-Drive UTHM Car Rental System has successfully achieved its goal of providing a convenient, user-friendly platform for vehicle rentals. The system reduces physical interaction and enhances the car rental experience for students and staff at UTHM. By incorporating features like real-time vehicle availability, booking, and secure payment processing, the system delivers an efficient solution for campus car rentals. Additionally, the application encourages users to make informed decisions by providing transparent information on available vehicles, rental prices, and booking durations.

Despite its success, user feedback highlighted potential improvements, such as adding real-time GPS tracking and expanding payment options. The system's development followed an Agile methodology, which allowed for iterative development and continuous feedback, ensuring it met user needs at every stage. Regular sprints facilitated incremental improvements, and user testing identified both strengths and areas for refinement. Future work may include adding location services, real-time tracking, and further enhancing payment options to improve the system's functionality.

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Conflict of Interest

Authors declare that there is no conflict of interest regarding the publication of the paper.

Author Contribution

This journal requires that all authors take public responsibility for the content of the work submitted for review. The contributions of all authors must be described in the following manner:

The authors confirm contribution to the paper as follows: **study conception and design**: Ahmad Syazwan bin Shahnizam, Dr. Noor Zuraidin bin Mohd Safar; **data collection**: Ahmad Syazwan bin Shahnizam, Dr. Noor Zuraidin bin Mohd Safar; **analysis and interpretation of results**: Ahmad Syazwan bin Shahnizam, Dr. Noor Zuraidin bin Mohd Safar; **draft manuscript preparation**: Ahmad Syazwan bin Shahnizam, Dr. Noor Zuraidin bin Mohd Safar. All authors reviewed the results and approved the final version of the manuscript.

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Appendix A: Gantt Chart

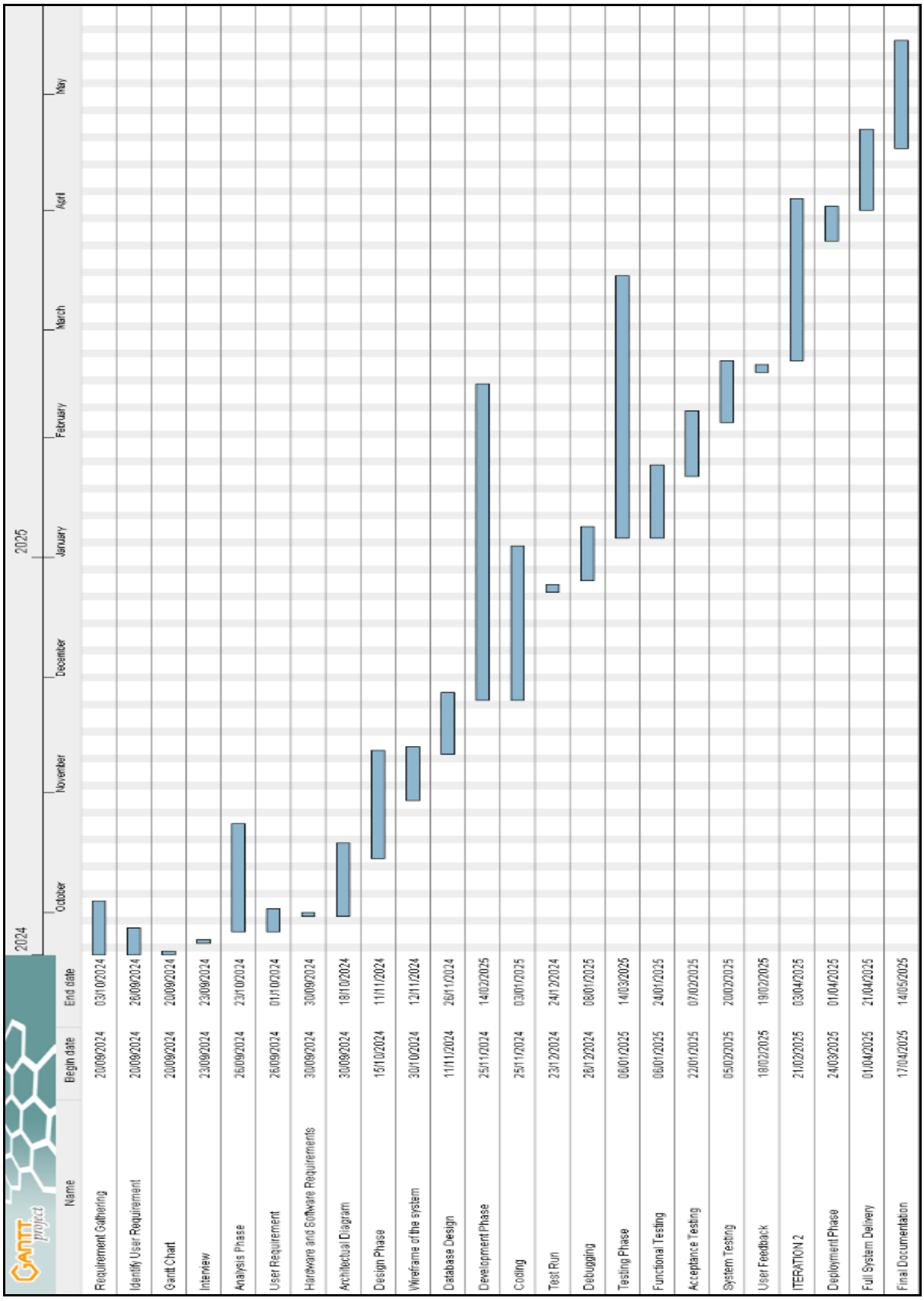

Fig. A1 *Gantt Chart of Final Year Project*

Appendix B: Deliverables during Requirement Analysis Phase

B.1 Activity Diagram

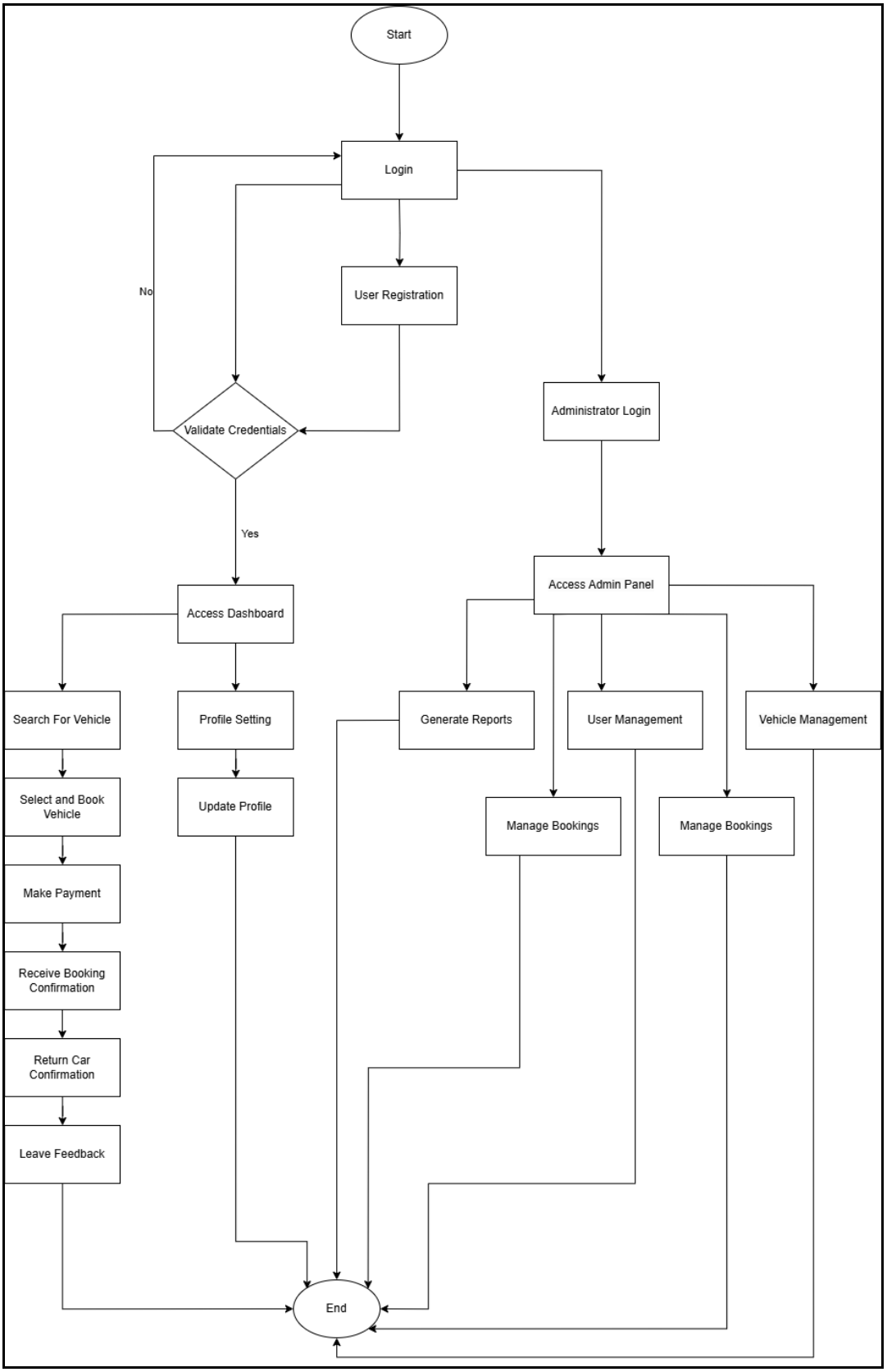

Fig. B1 *Activity Diagram*

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B.2 Class Diagram

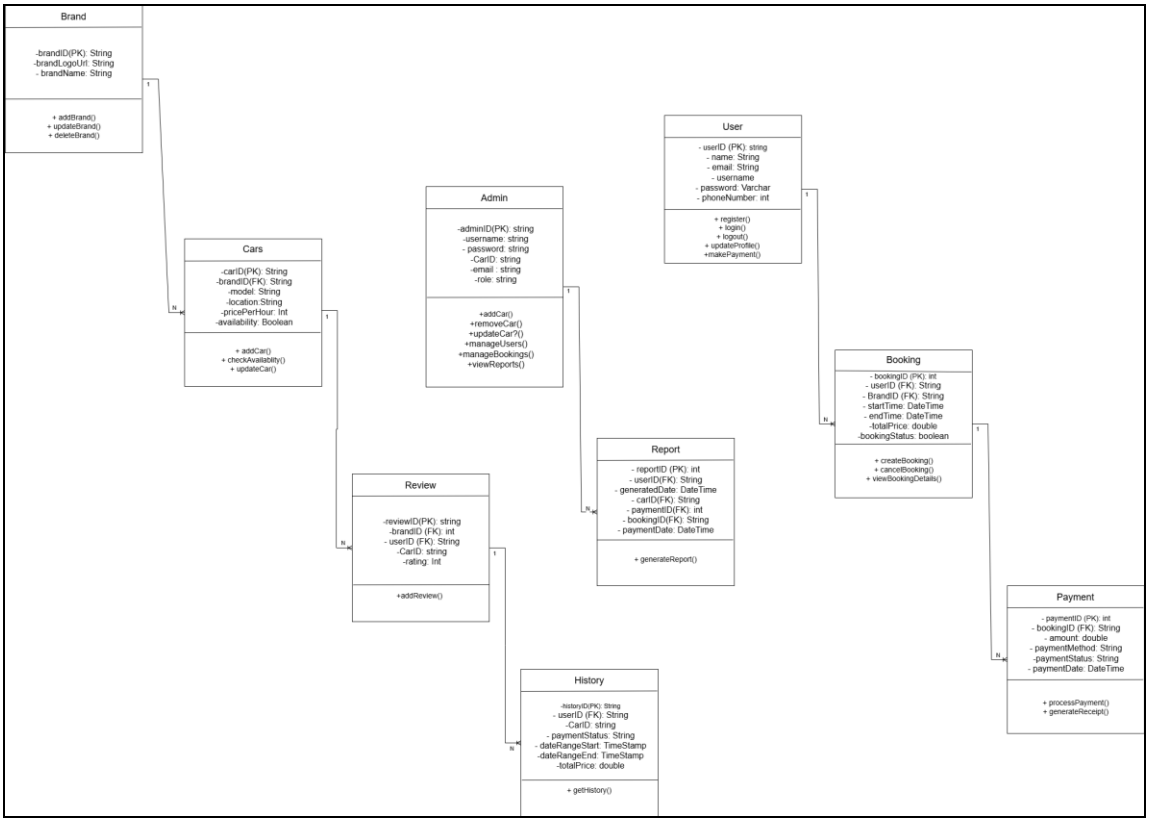

Fig. B2 *Class Diagram*

B.3 Entity Relationship Diagram

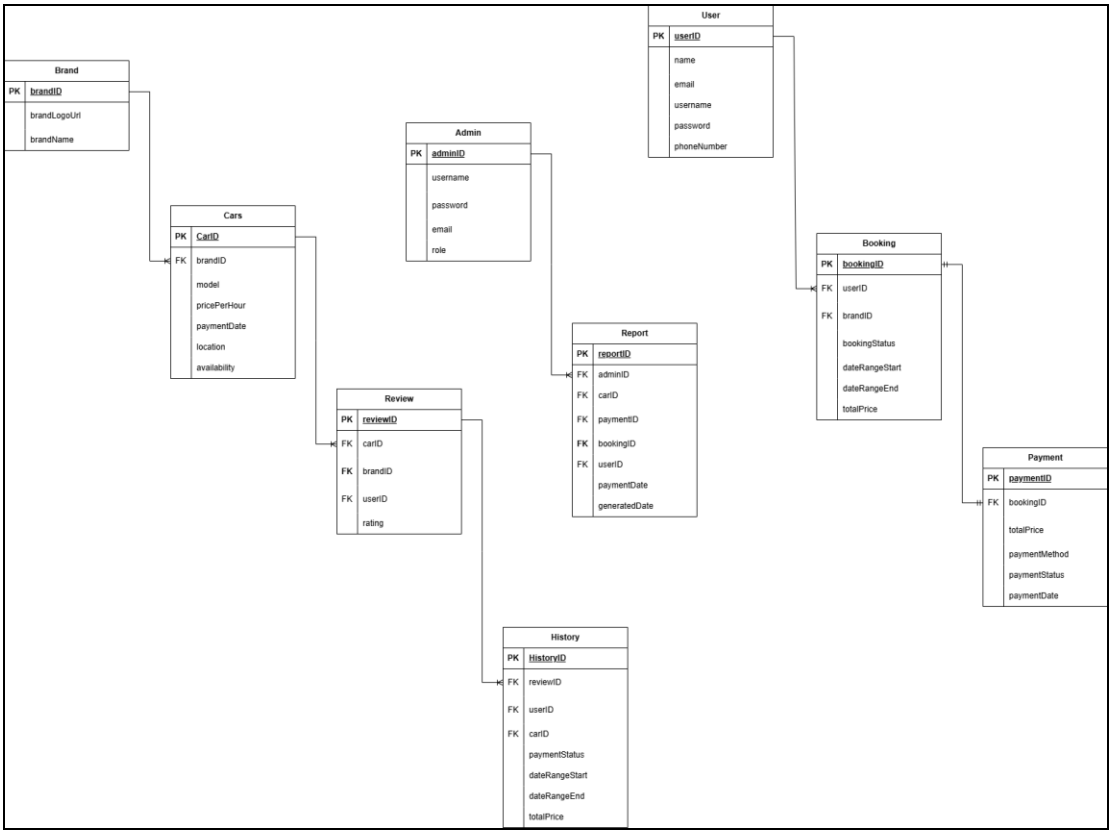

Fig. B3 *Entity Relationship Diagram of U-Drive UTHM Car Rental System*

Appendix C: User Acceptance Testing

Table C *User Acceptance Test of U-Drive UTHM Car Rental System*

System Testing						
No	**Acceptance Requirement**	**Test (Scale from 1 to 5)**				
		1	2	3	4	5
	User Interface					
1	How simple is the system to use and comprehend?					
2	In what ways is the system user-friendly?					
3	Is the interface's colour scheme, backdrop, and typeface design to your liking?					
	System Function					
4	In what ways has the system's login functionality met your expectations?					
5	What is your level of satisfaction with the system's account management features?					
6	How well can update your profile meet your needs?					
7	What is your level of satisfaction with the features that allow you to manage violations?					

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8	What is your level of satisfaction with the system's report creation capabilities?					
9	The admin panel allows you to manage user accounts and permissions; how easy is it to use?					
10	In terms of giving insights and real-time updates regarding student statuses and operations, how useful is the administrator dashboard?					