SECD2613 - 04

SYSTEM ANALYSIS AND DESIGN

SEMESTER 1 SESSION 2024/2025

GROUP PROJECT PHASE 1

NAME OF LECTURER: DR. ARYATI BINTI BAKRI

NO	NAME	MATRICS
1	NISHAT TABASSUM	A24CS4101
2	AZAAM AHMED DIGALE	A24CS4092
3	MUHAMMAD FIRDAUS BIN MD SHAHRUNNAHAR	A24CS5031
4	MUHAMMAD RENDY ATSARY	A24CS9003

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1.0 Introduction

In the majority of organizations today, especially those that rely on day-to-day operations to operate effectively, inefficiencies are most likely brought about by outdated systems or manual processes. This project thus proposes the development of a HASTA Travel UTM's system to solve such problems. The main aim is to come up with a system that will allow the company to manage its operations better, reduce errors, and make critical information more available and manageable.

By designing and developing an organization-specific system, we hope to exchange time-consuming procedures for faster, automated processes. Not only will the system improve day-to-day functionality, but it will also facilitate making informed decisions with complete and current information. Throughout this proposal, we hope to illustrate ways in which the new system can benefit the organization in the near future and the long run.

2.0 Background Study

2.1 Organizational Background

Presently, the company relies on a lot of manual work for vital processes like item tracking, booking, or information handling. This habitually leads to delays, errors, and miscommunications between departments. Staff sometimes have to double-check or redo work, which is time wastage and can contribute to frustration.

2.2 System Coverage (Scope)

To address these issues, the new system will focus on improving the most vital areas:

Within the system:

- Automated tracking and updating of data
- Secure login and user access levels
- Centralized information management system
- Rapid and precise report generating facilities

Not included in the first version:

- Additional financial functionality like integration with accounting systems
- Mobile app functionality
- Full migration of legacy historical data (only recent data will be migrated)

2.3 Contribution and Benefits

The new system will benefit the organization in the following manner:

- It will be a time-saver by reducing manual input and checking.
- Information will be more accurate and organized, which enables everyone to function more efficiently.
- The system makes it easier to manage tasks and resources, especially when things get busy.
- A more user-friendly interface will make the system easier to learn and use.
- As the business grows, the system can be adapted and expanded without starting from scratch.

3.0 Problem Statement

HASTA, is a campus car rental service, which uses manual processes for important functions like booking reservations, tracking vehicles and handling data. The use of outdated systems results in regular problems like booking conflicts as well as delayed confirmations and staff-to-customer communication errors. Without a centralized platform, vehicle availability information cannot be updated in real-time which creates challenges for customers who want to plan and reserve vehicles. Employees must often redo tasks and perform double checks which leads to time wastage and decreased operational efficiency. Management lacks an analytical tool to assess fleet performance metrics alongside customer behavior patterns and resource distribution. The company's service quality and customer satisfaction decline because inefficiencies stop operational growth and digital expansion potential.

Identified Issues:

- The manual booking system increases error probability and delays processing time.

- Without real-time data on vehicle availability customers face booking conflicts which leads to a negative experience.

- Without centralized information management systems data becomes inconsistent which creates operational delays.

- The lack of effective internal communication alongside missing customer notifications leads to diminished service efficiency.

- The business cannot grow or adapt due to system limitations in scalability, analytics capabilities and automation features.

4.0 PROPOSED SOLUTIONS

To address the inefficiencies and challenges faced by HASTA's current manual car rental process, we propose a web-based Car Rental Management System designed specifically for campus-based use. This system will serve as a centralized platform for booking, tracking, managing, and analyzing car rental operations, accessible to both staff and students.

Key Features of the Proposed Solution:

- Online Booking Interface for students/staff to reserve vehicles in real-time.
- Admin Dashboard for managing vehicle availability, user accounts, and bookings.
- Automated Notifications for booking confirmation, reminders, and updates.
- Data Analytics Module to monitor fleet usage, customer behavior, and operational performance.
- Secure Login System with role-based access (Admin, Staff, Student).

Feasibility Study

1. Technical Feasibility

- The system will be developed using standard web technologies (HTML/CSS, JavaScript, PHP/Python, MySQL).
- Easily deployable on existing university servers or cloud infrastructure (e.g., GitHub, Firebase).
- Compatible with any modern browser and responsive on desktops, tablets, and mobile devices.

2. Operational Feasibility

- Staff can be easily trained to manage the system via user-friendly dashboards.
- Students and users will benefit from a simple interface requiring minimal onboarding.
- Daily operations will improve significantly with centralized access to booking and vehicle status.

3. Economic Feasibility

- Initial development can be done in-house by the student team, minimizing upfront costs.
- Long-term savings through reduced manpower, fewer booking errors, and better time management.
- Potential for scalable integration of advanced modules (payments, GPS tracking) in the future.

COST-BENEFIT ANALYSIS (CBA)

The Cost-Benefit Analysis evaluates the financial feasibility of implementing the HASTA Car Rental Management System by comparing the estimated costs against the expected benefits over one year.

Assumptions	Value
Sensitivity factor (cost)	0.85
Sensitivity factor (benefit)	0.9
Annual change in production cost	3%
Annual change in benefits	8%
Discount	6%

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DEVELOPMENT COST					
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ACCUMULATED BENEFITS		37,925	76,532	115,932	156,239
GAIN/LOSS		32,925	70,982	109,381	134,688
PROFITABILITY INDEX	**134,688/ 60,000= 2.2448**				

Profitability Index = 2.24 , showing a good investment as its index is more than one.

5.0 Objectives

1. The project aims to create a car rental management system that meets HASTA's operational requirements for campus use.

The development of automated systems for booking and vehicle tracking will lead to a substantial decrease in both mistakes and administrative tasks.

2. A real-time vehicle availability feature will be implemented to boost booking accuracy and minimize customer complaints.

3. A centralized dashboard will be created to support data-driven decision-making by monitoring rental activity and fleet performance.

4. Future scalability of the system is guaranteed to support upcoming features like user roles management along with analytics functions and integration of digital services including notifications and campus ID logins.

6.0 SCOPE OF THE PROJECT

Goals of The Project:

To develop a centralized and automated Car Rental Management System for HASTA, which addresses existing operational inefficiencies, enhances service quality, and supports digital scalability while providing a smooth and transparent vehicle booking experience for students and staff.

Project Implementation:

1. Online Booking System

- Users can view available vehicles in real-time.
- Bookings can be made instantly through a web-based interface.
- Eliminates double bookings and minimizes conflicts.

2. Centralized Vehicle Inventory Management

- Real-time vehicle tracking and availability updates.
- Admin dashboard to manage fleet status, maintenance, and scheduling.
- Ensures all staff access consistent and updated data.

3. Notification & Communication System

- Automated notifications for booking confirmations, changes, and reminders.
- Internal alerts for staff regarding upcoming reservations and vehicle statuses.
- Promotes better customer engagement and internal coordination.

4. Customer and Staff Portal

- Role-based access for admins, staff, and users.
- Secure login and profile management.
- Booking history and activity logs for transparency and record-keeping.

5. Analytics Dashboard

- Management view of fleet performance metrics, popular vehicle usage, and customer trends.
- Helps identify bottlenecks, peak usage periods, and resource allocation gaps.
- Supports data-driven decision-making.

System Boundaries (What will not be included):

- No third-party payment integration in the initial version.
- No mobile application (limited to web-based platform only).
- Advanced AI-based recommendation systems are out of scope.
- External API integration with external GPS trackers not included.

Expected Benefits:

- Streamlined car rental process reducing manual effort.
- Enhanced customer satisfaction through improved booking experience.
- Centralized and accurate data management.
- Improved communication among staff and users.
- Data visibility for strategic planning and performance monitoring.

7.0 project Planning:

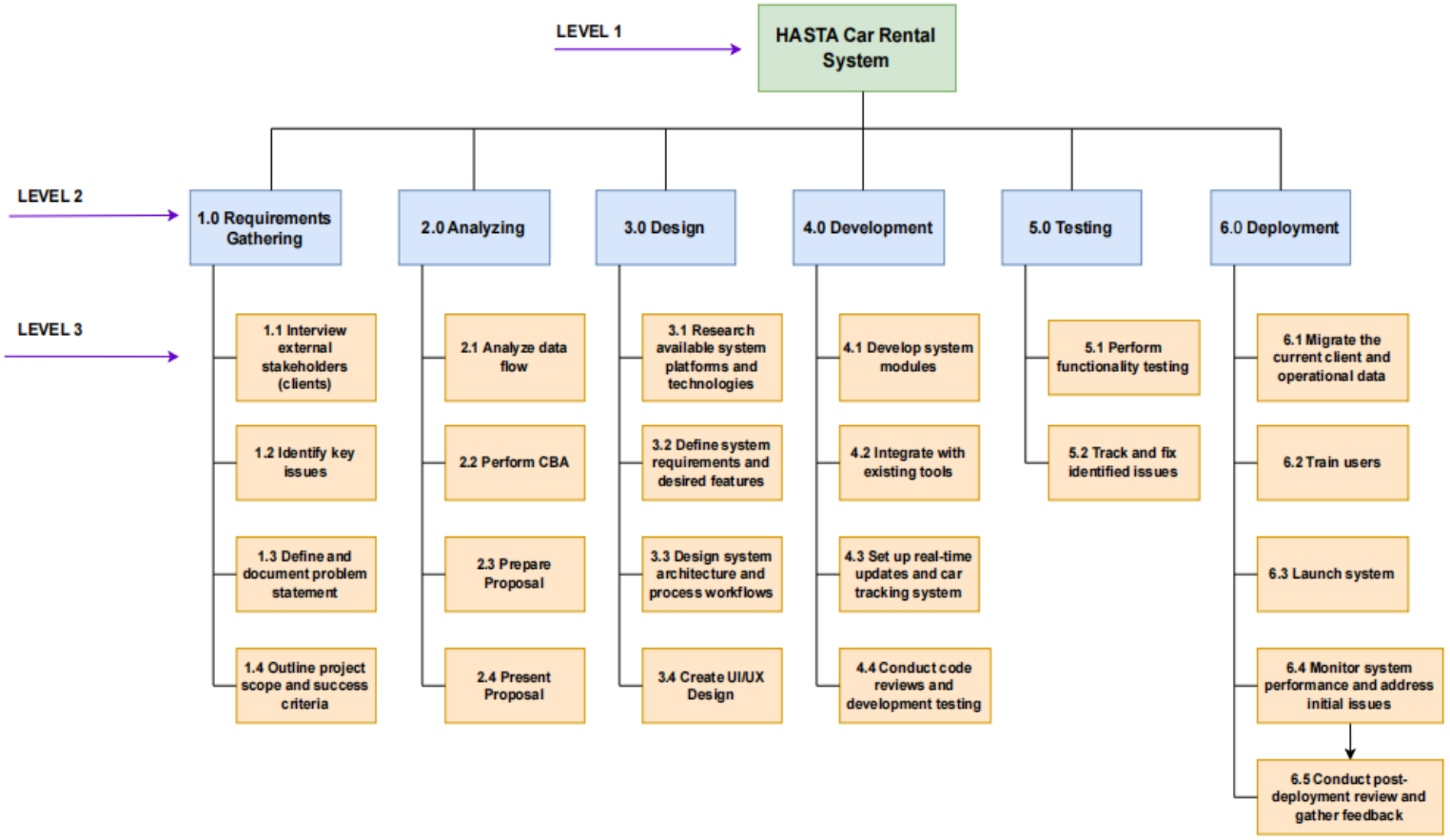
To ensure effective project planning for the development and implementation of the HASTA Car Rental System, a formal and realistic project planning approach has been adopted. This includes the application of human resources assignment, a clear time plan, and task decomposition in detailed fashion. The planning process also establishes key deliverables, milestones, and system analysis to release dependencies.

With the aid of tools such as Work Breakdown Structure (WBS), Gantt chart, and PERT chart, the team has outlined a very clear plan for phases that are critical, such as requirement gathering to testing and user training. The planning tools help in keeping track of progress, avoiding delays, and in clearly delineating responsibilities.

7.1 Human Resource Allocation

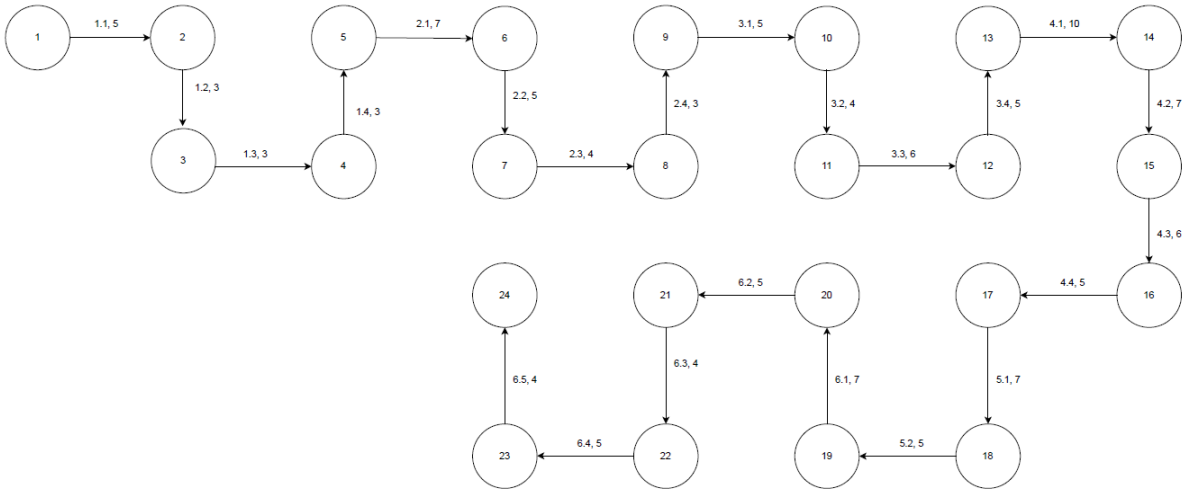
Team Role	Member Name	Responsibilities
Project Manager	Azaam	Oversees the entire project, coordinates tasks, creates WBS, PERT & Gantt charts.
System Analyst	Nishat	Defines problem statement, determines scope, outlines system features.
Research Lead	Rendy	Conducts organizational background study, identifies existing problems.
Technical Analyst	Firdaus	Handles technical feasibility, assesses system compatibility and infrastructure needs.
Operational Analyst	Azaam	Studies operational feasibility and organizational impact.
Financial Analyst	Nishat	Conducts economic feasibility, prepares cost-benefit analysis (CBA).
Documentation Lead	Rendy	Compiles proposal document, maintains formatting, integrates team input.
Quality Reviewer	Firdaus	Reviews proposal draft, ensures clarity, coherence, and alignment with guidelines.
GitHub Coordinator	Rendy	Sets up repository, manages commits, organizes Kanban board, tracks team progress.

7.2 WBS

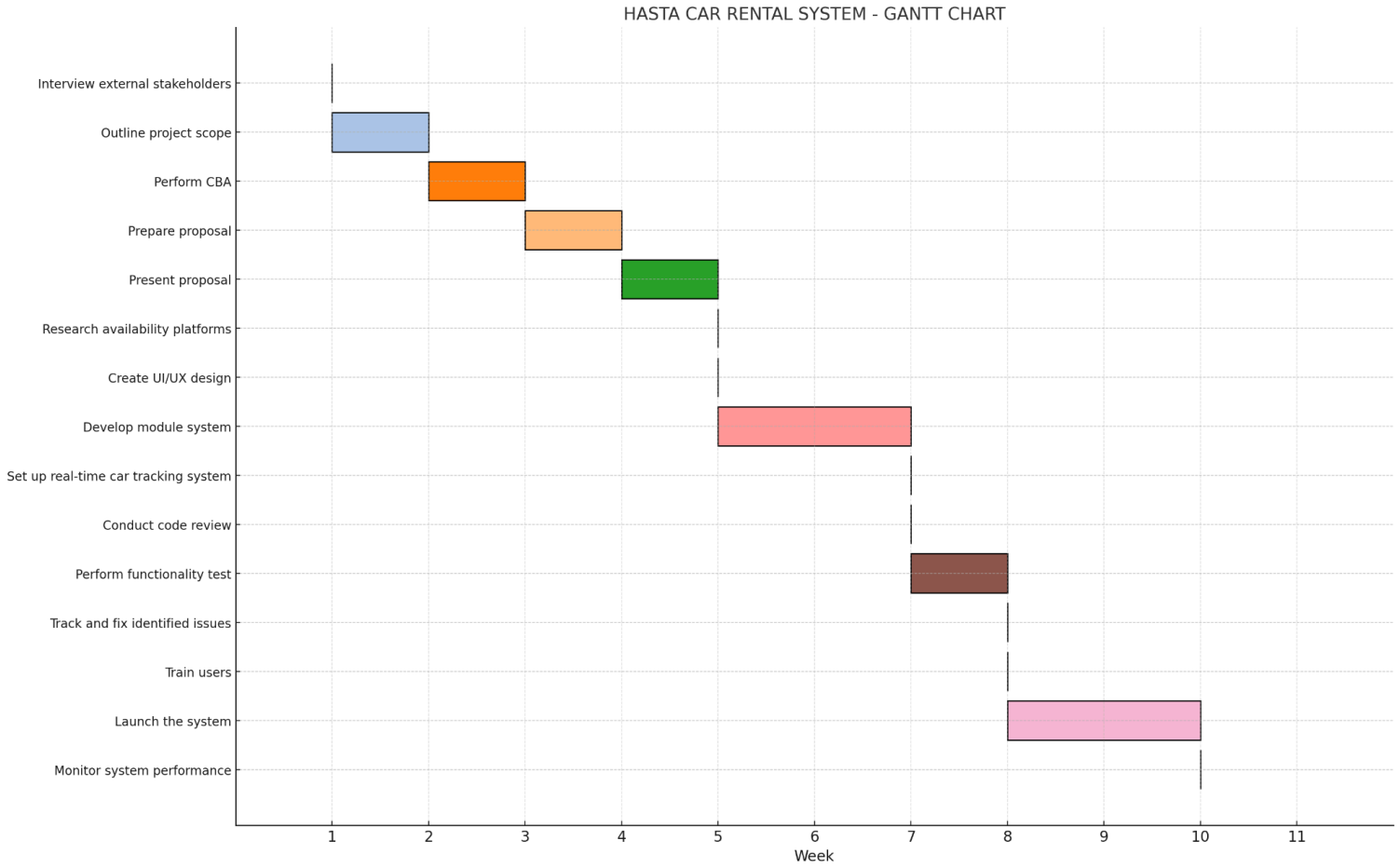

LEVEL 1
HASTA Car Rental System
LEVEL 2
1.0 Requirements Gathering
2.0 Analyzing
3.0 Design
4.0 Development
5.0 Testing
6.0 Deployment
LEVEL 3
1.1 Interview external stakeholders (clients)
1.2 Identify key issues
1.3 Define and document problem statement
1.4 Outline project scope and success criteria
2.1 Analyze data flow
2.2 Perform CBA
2.3 Prepare Proposal
2.4 Present Proposal
3.1 Research available system platforms and technologies
3.2 Define system requirements and desired features
3.3 Design system architecture and process workflows
3.4 Create UI/UX Design
4.1 Develop system modules
4.2 Integrate with existing tools
4.3 Set up real-time updates and car tracking system
4.4 Conduct code reviews and development testing
5.1 Perform functionality testing
5.2 Track and fix identified issues
6.1 Migrate the current client and operational data
6.2 Train users
6.3 Launch system
6.4 Monitor system performance and address initial issues
6.5 Conduct post-deployment review and gather feedback

7.3 Pert Diagram

Activity	Description	Predecessor	Duration (Days)
1.1	Interview external stakeholders (clients)	none	5
1.2	Identify key issues	1.1	3
1.3	Define and document problem statement	1.2	3
1.4	Outline project scope and succes	1.3	7
2.1	Analyze data flow	1.4	5
2.2	Perform CBA	2.1	4
2.3	Prepare proposal	2.2	3
2.4	Present Proposal	2.3	5
3.1	Research available system platforms and technologies	2.4	4
3.2	Define system requirements and desired features	3.1	6
3.3	Design system architecture and process workflows	3.2	5
3.4	Create UI/UX Design	3.3	5
4.1	Develop system modules	3.4	10
4.2	Integrate with existing tools	4.1	7
4.3	Set up real-time updates and car tracking system	4.2	8
4.4	Conduct code reviews and development testing	4.3	5
5.1	Perform functionality testing	4.4	7
5.2	Track and fix identified issues	5.1	5
6.1	Migrate the current client and operational data	5.2.	7
6.2	Train users	6.1	5
6.3	Launch system	6.2	4
6.4	Monitor system performance and address initial issues	6.3	5
6.5	Conduct post-deployment review and gather feedback	6.4	4



7.4 GANTT CHART



8.0 BENEFITS AND OVERALL SUMMARY OF PROPOSED SYSTEM

Benefits of the Proposed System

1. Real-Time Vehicle Availability
   - Enables users to instantly view and reserve available cars, reducing booking conflicts and improving user satisfaction.

2. Improved Operational Efficiency
   - Automation of booking, tracking, and notification processes minimizes manual work, reduces errors, and saves staff time.

3. Centralized Data Management
   - A unified system ensures consistent and accurate vehicle and user data, streamlining daily operations and decision-making.

4. Enhanced Communication
   - Integrated notifications and alerts improve coordination between staff and customers, enhancing the overall service experience.

5. Data-Driven Insights
   - Built-in analytics allow management to monitor fleet performance, identify trends, and optimize resource usage for future planning.

6. Scalability & Adaptability
   - The system is designed to support future upgrades and expansion, such as payment integration, mobile apps, or external fleet partnerships.

7. User Convenience
   - A web-based portal simplifies the reservation process, provides booking history, and builds trust through transparency.

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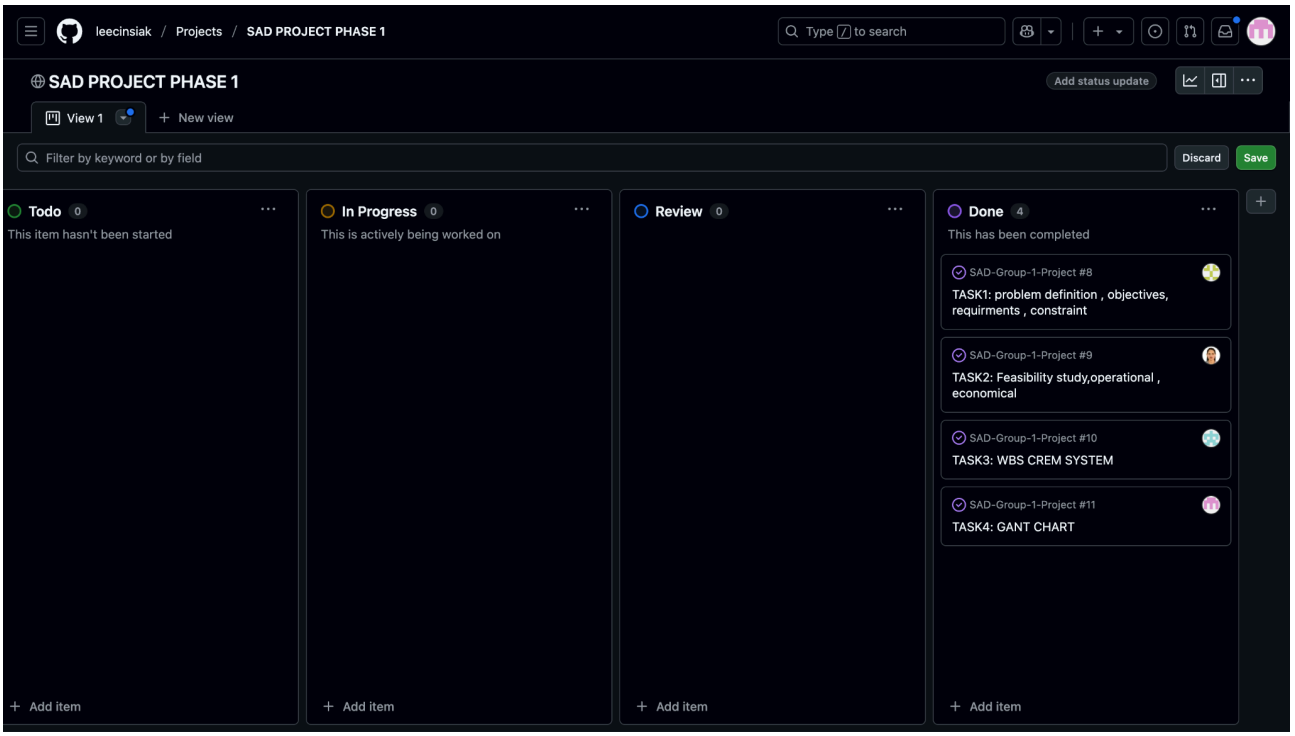
Overall Summary

The HASTA Car Rental Management System aims to transform the university's outdated, manual vehicle rental process into a modern, automated, and centralized platform. By addressing key pain points such as booking delays, communication gaps, and inefficient fleet tracking, the proposed system ensures a smoother user experience and a more productive operational workflow. This project will not only increase customer satisfaction and internal efficiency but also position HASTA for digital growth and long-term service enhancement.

GITHUB LINK:
https://github.com/users/leecinsiak/projects/3/views/1?layout=board



UTM

UNIVERSITI TEKNOLOGI MALAYSIA

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4.	MUHAMMAD RENDY ATSARY	A24CS9003

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1.0 Overview of the Project

HASTA, a car rental service with an affiliation with academic institutions, currently employs a manual system for vehicle rental reservation, monitoring, and administration. This old system is plagued by numerous inefficiencies such as booking conflicts, delays in processing, and inefficient communication between staff and customers. The recommended solution is the use of a web-based Car Rental Management System (CRMS) with campus application. This system will automate reservations, consolidate vehicle data, provide real-time status, and enhance communication between users and staff.

By substituting the manual process with a computerized system, HASTA hopes to:

- **Enhance operational efficiency**
- **Reduce human error.**
- **Enhance customer satisfaction**
- **Furthermore, it will facilitate prospective scalability, encompassing potential collaborations with payment systems and mobile applications.**

2.0 Problem Statement

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4.0 Information Gathering

In order to enhance the HASTA car rental system, our group gathered data in a structured manner to identify issues in the present manual process. In this stage, we employed typical means of data collection in system analysis: interviews and observation. Rather than conducting an online survey, we preferred to obtain in-depth details right from the individuals operating and maintaining the system themselves.

We employed an approach to observe how the users act and what issues occur in operations. We performed this by observing the day-to-day work of HASTA and conducting a live interview with the system team to examine the existing process.

4.1 Method Used

Initially, we employed observing as our technique. Rather than approaching the HASTA rental counter ourselves, we observed the entire interview and noted down everyday tasks based on questions posed and answers provided by the HASTA employees. We observed that they were writing down car bookings, storing user information, and updating availability. Our team observed that bookings were being written down manually, confirmations were taking a long time, and car availability wasn't updated immediately. Through this technique, we came across issues such as entering the same information twice and lack of effective communication among workers and clients.

We reviewed documents and viewed a video interview of the HASTA team. You can view the entire video here: https://www.youtube.com/watch?v=BjRPUQs2viM
The interview took around one hour and had open questions and follow-up questions regarding the booking processes, how communication occurs, demand management issues, and system issues. Some of the key issues covered in the session were:

- The reservation procedure and how we determine whether vehicles are available.
- Issues arising when the vehicles are not available for use when required.
- Methods employed to validate bookings with users.
- Operations problems that delay or reduce efficiency

Recommendations for added features or capabilities that could enhance the existing system.

We employed two approaches, observation and interviews to obtain the user's perspective and an overall sense of the system. Analysis revealed issues, what the

users need, and how to improve it. This real-world perspective makes our requirement analysis more reliable and assists us in developing a digital car rental system that emphasizes the user.

4.2 Summary of Method Used

We went to the HASTA website and observed a recorded session with the HASTA group on youtubeThis helped us understand how the existing manual car rental system operates. Through the presentation and responses, we saw that the reservation process is largely based on written forms, meetings, and verbal confirmations. The legacy system generates issues such as delayed confirmations, absence of real-time updates on the availability of cars, and double bookings.

HASTA staff discussed a number of issues with the way things are done. These issues are not being able to view available vehicles correctly, confusion between staff and users, and difficulties having consistent records. Staff stated that it takes a significant amount of time to maintain the booking log and respond to student queries, particularly when lots of bookings are taking place. They added that the lack of system messages frequently causes confusion and further questions.

We discovered that we must enhance real-time tracking of vehicles, automate confirmations, and maintain digital records. Our study also dictates that we develop an easy-to-use online booking system that is accessible on mobile devices for the convenience of students and staff.

Most of the reservations are done manually at the counter of the rental. Certain individuals also use calls and casual text messages. This method is not effective and results in errors in bookings.

Users experience issues such as slow confirmations, no updates in real time, and confusing messages. They result in double bookings, data loss, and dissatisfied users. Both the staff and the students enjoyed the concept of an online system. They envisioned a system that indicates real-time car availability, provides automatic reminders, allows the users to view the history of their bookings, functions on mobile, and has multiple login roles. All these functions should simplify things and significantly enhance the overall user experience.

5.0 REQUIREMENT ANALYSIS (based on AS-IS analysis)

The requirement analysis process is a critical foundation for the development of any information system. For this project, the objective of the requirement analysis is to identify, understand, and document the current challenges within the existing manual HASTA car rental system (referred to as the AS-IS system) and to define the necessary features and functionalities for the new proposed system (TO-BE system). This process ensures that the final system is tailored to meet user expectations, operational goals, and organizational needs.

To begin the requirement analysis, the project team first examined the current operational methods used by HASTA. This involved investigating how car rental bookings were made, how vehicle availability was monitored, and how confirmations were communicated to users. The AS-IS system heavily relies on manual processes such as handwritten logs, physical booking forms, and verbal or phone-based communication. As a result, numerous inefficiencies were identified, including delays in confirmation, overlapping bookings, lack of proper data tracking, and limited visibility into vehicle availability.

To validate these issues and gather user-specific requirements, the team conducted a structured data collection process involving two main methods: direct observation and an online questionnaire. Each team member visited the HASTA car rental counter to observe the booking and rental process in real-time. These observations revealed system constraints such as the absence of real-time data updates, reliance on paper-based logs, and difficulties in maintaining accurate transaction records.

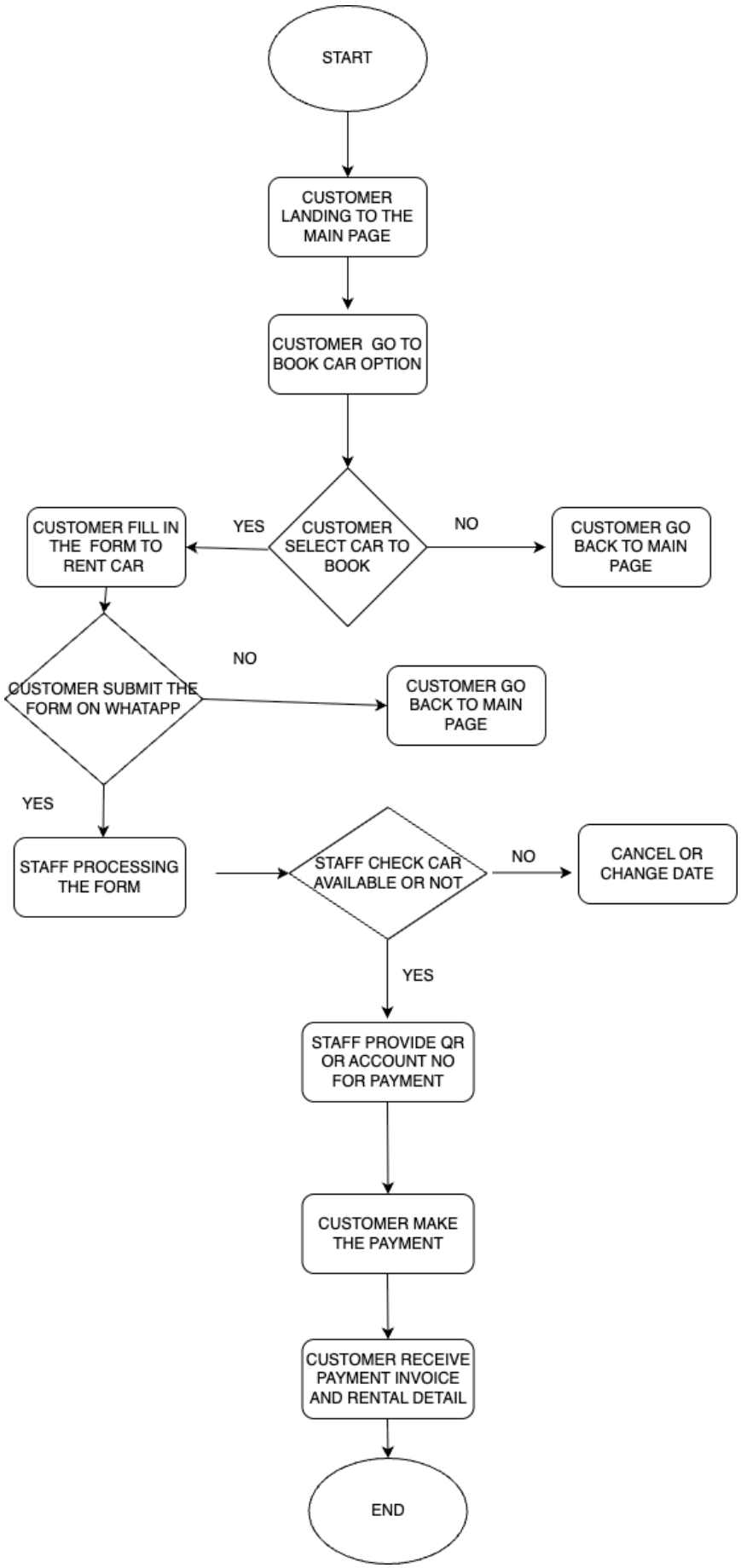
In parallel, a digital questionnaire was distributed among students and staff who had previously interacted with the HASTA rental service. This allowed the team to gather both quantitative and qualitative data from a broader set of users. The questionnaire results highlighted key pain points experienced by users, including slow confirmations (reported by 70% of respondents), double bookings (50%), and the lack of automated reminders or notifications (60%). Additionally, when asked about their preference for a digital system, 90% of users expressed support for a web-based booking platform, clearly indicating a strong demand for digital transformation.

Using this feedback, the team evaluated the gap between the current system and what users expected. Functional gaps such as real-time availability checking, digital confirmation, payment integration, and improved communication features were noted as high-priority requirements. Moreover, expectations around system speed, reliability, and ease of use informed the non-functional aspects of the new system's design.

The requirement analysis concluded by documenting both the functional and non-functional requirements based on the AS-IS analysis. These requirements include system login, rental booking with validation, payment processing, and automatic notification mechanisms. In addition, performance targets such as response time, system availability, security features, and scalability have been defined to ensure the system performs efficiently and securely under various conditions.

Through this structured and evidence-based approach, the requirement analysis serves as a roadmap for the development of the HASTA Car Rental Management System. It ensures that the system design is driven by real user needs, grounded in operational reality, and focused on solving actual problems in the existing manual process. Ultimately, this phase strengthens the foundation for the system's success, supporting both the short-term goals of improved service and the long-term vision of scalable, digital transformation.

5.1 CURRENT BUSINESS WORKFLOW:



Logical DFD (AS-IS) system (based on current business process/workflow)

Context Diagram:

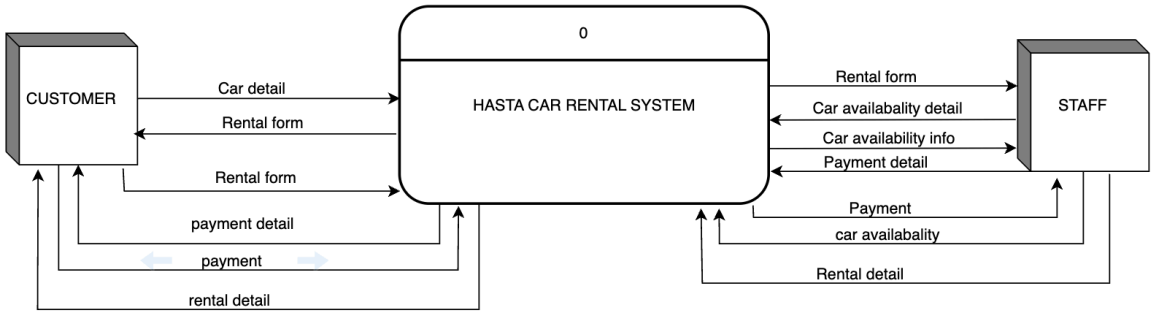
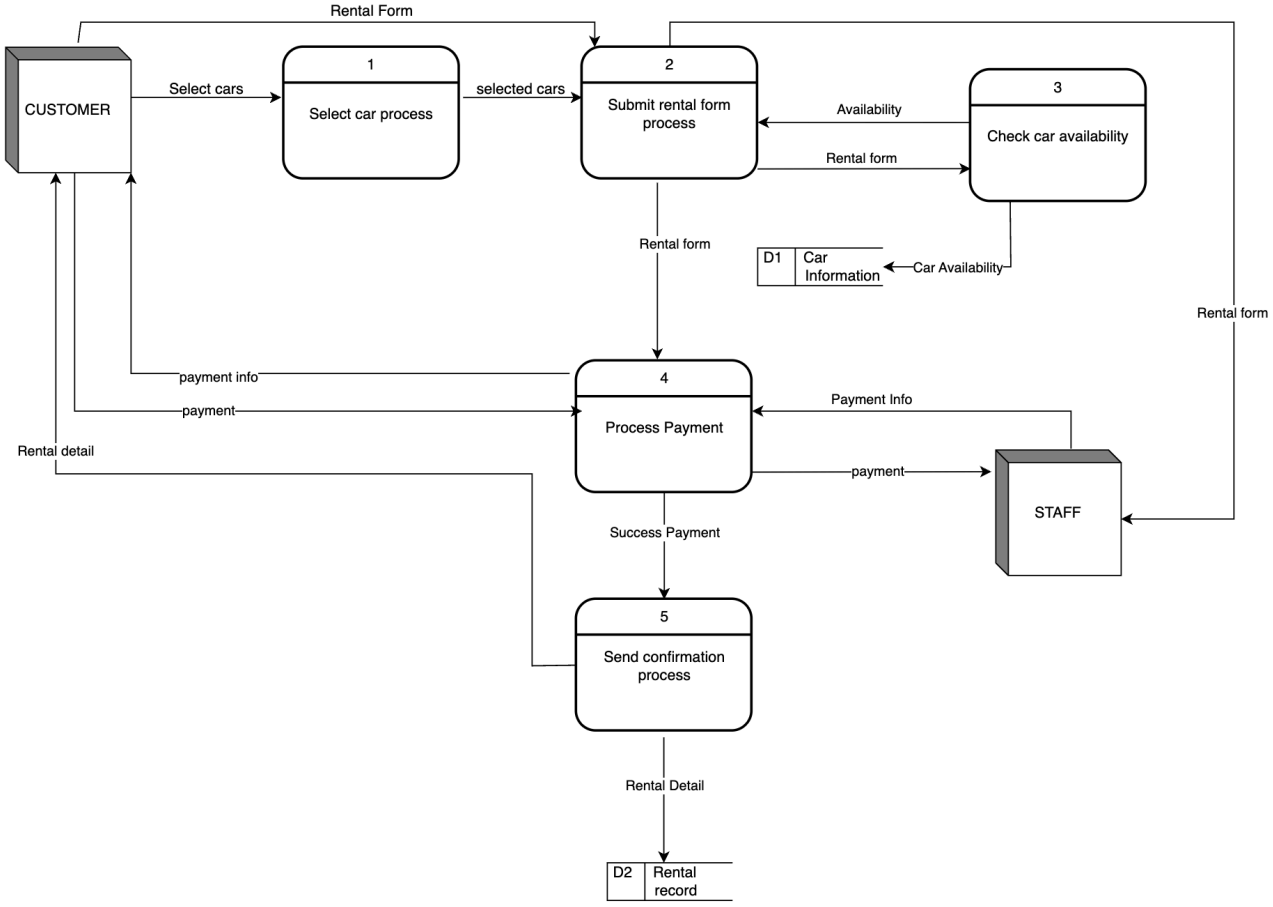
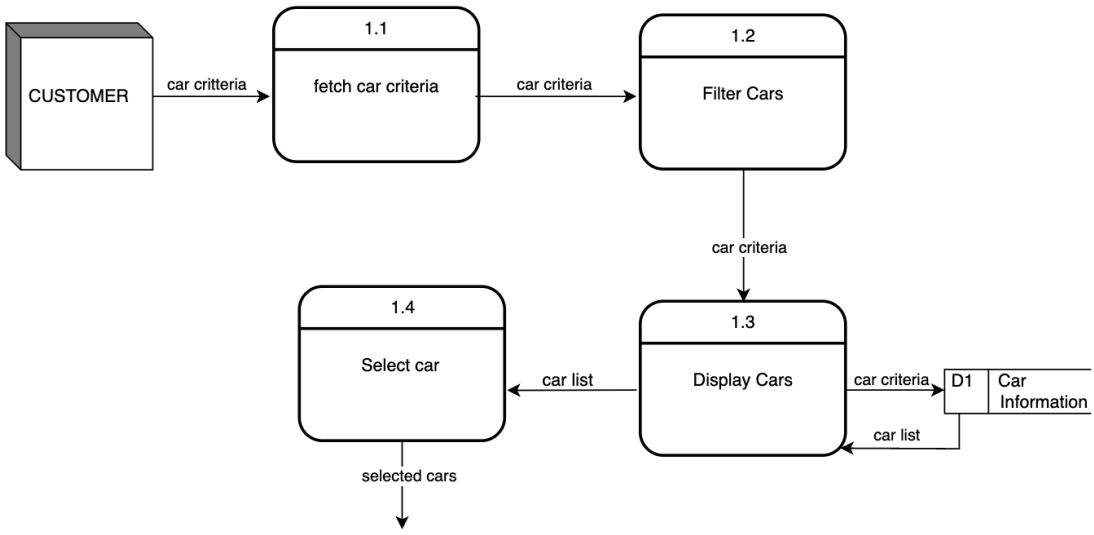


Diagram 0:

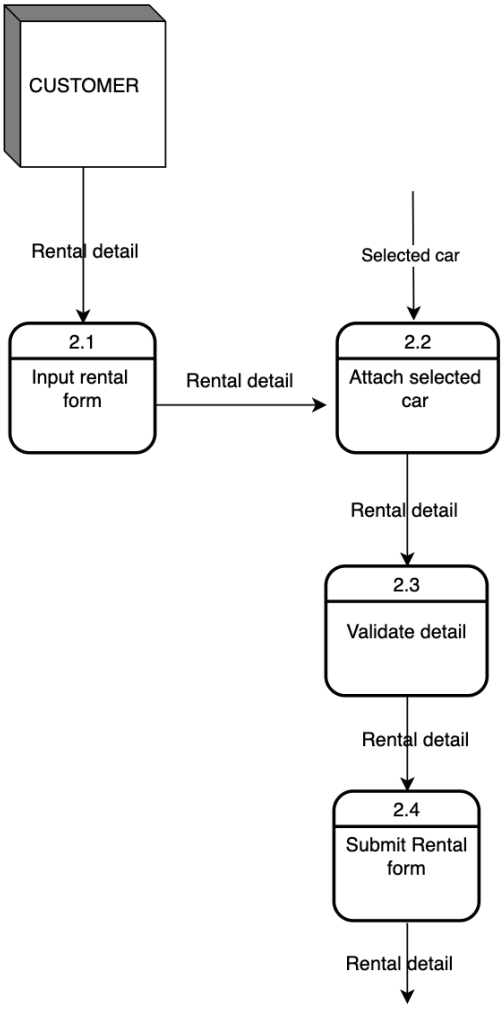


Child Diagram (Level 1):

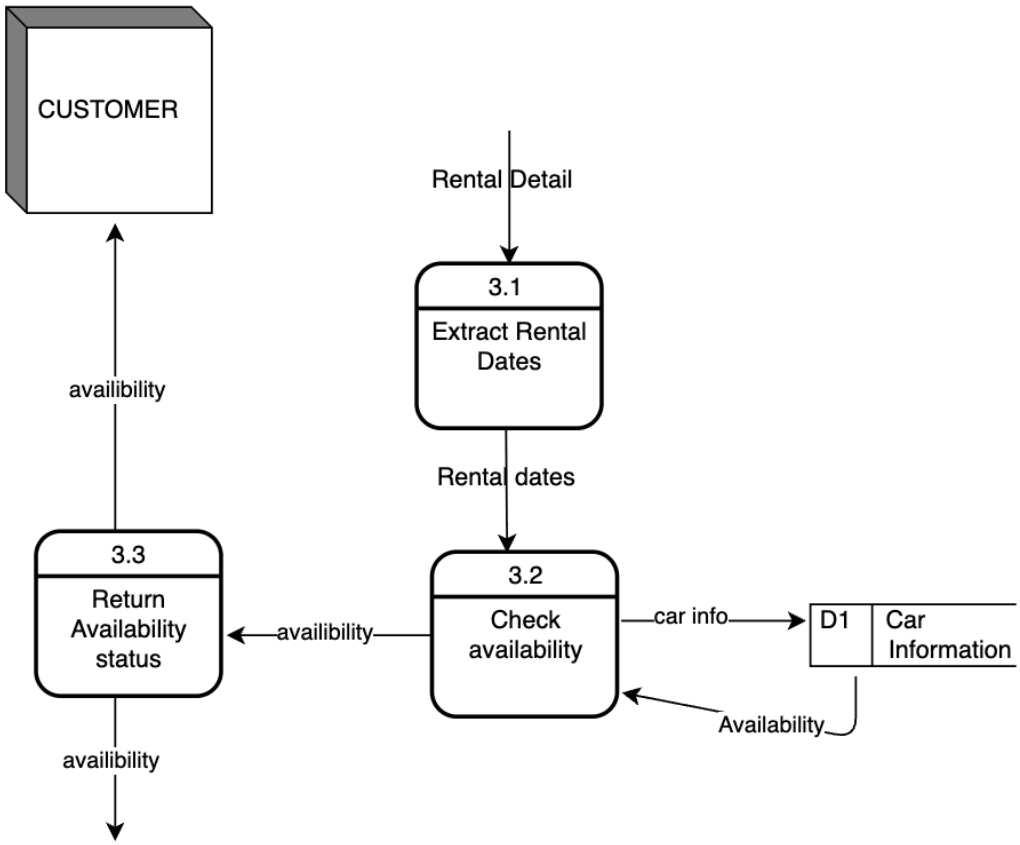
1.Process 1 Child Diagram:



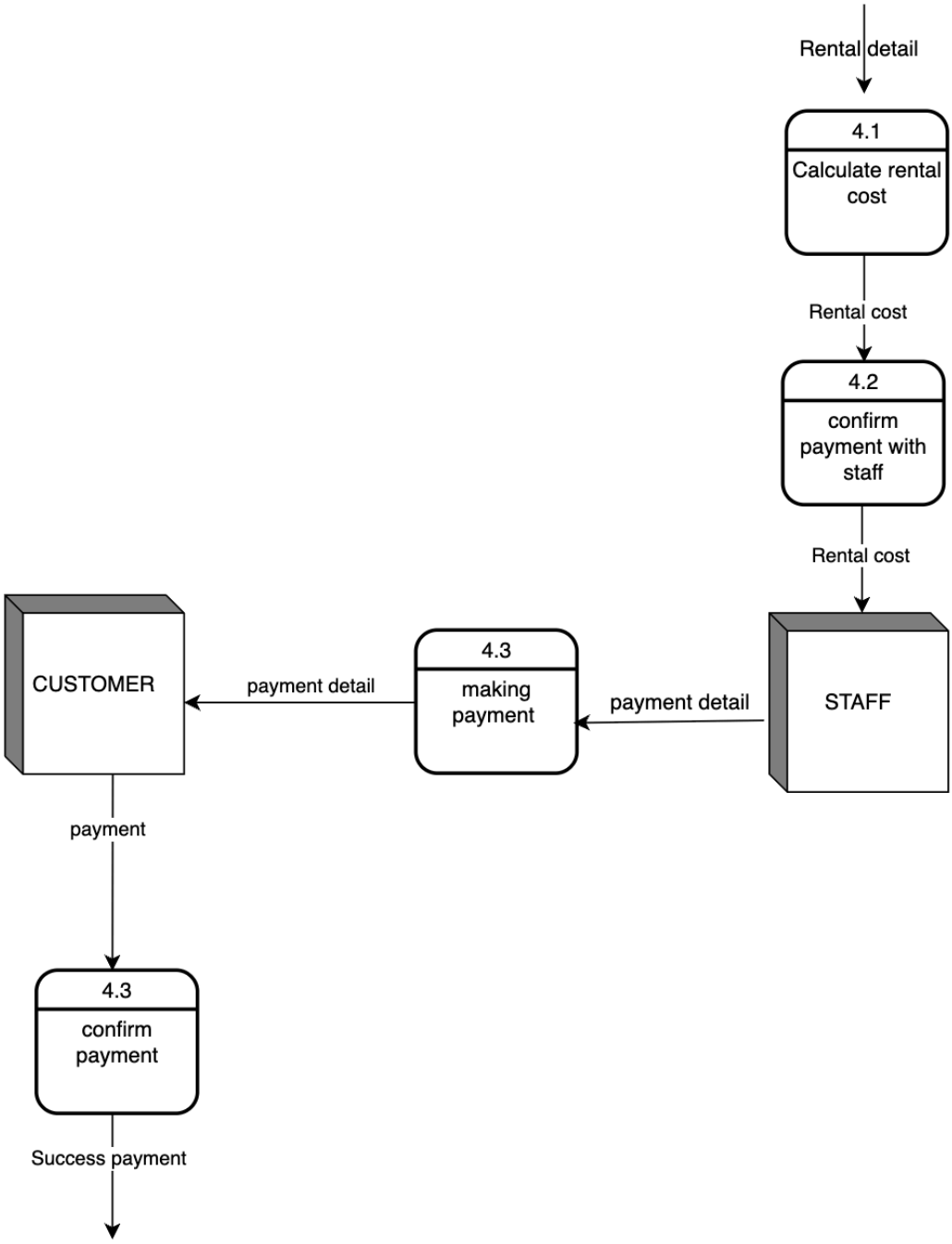
2. Process 2 Child Diagram:



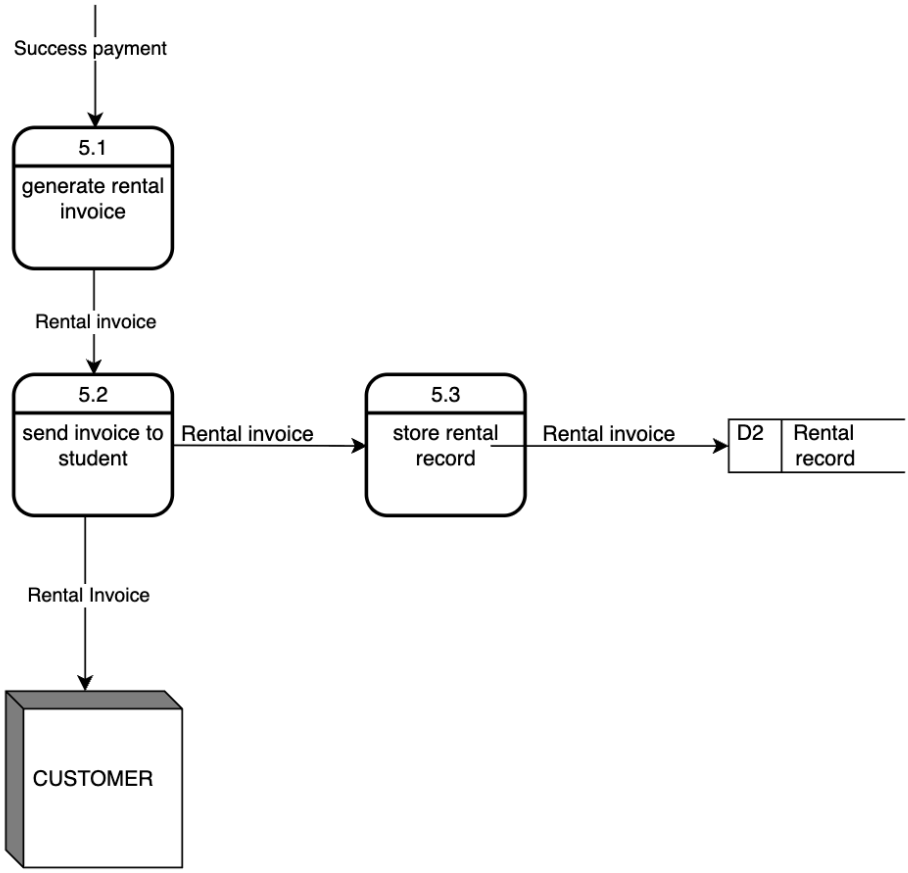
3. Process 3 Child Diagram



4. Process 4 Child Diagram:


Rental detail
4.1
Calculate rental cost
Rental cost
4.2
confirm payment with staff
Rental cost
CUSTOMER
payment detail
4.3
making payment
payment detail
STAFF
payment
4.3
confirm payment
Success payment

5. Process 5 Child Diagram:



Functional requirements

Add login process:

- Input:
  - Student ID and password
- Process:
  - Validate student credential
- Output:
  - View page

Improve Rental System:

- Input:
    - Select car type (sedan, MPV, SUV, e.g)
    - Student input rental details (start and end dates, contact number, purpose of rental, Destination)
- Process:
    - System check selected car availability during selected dates
    - Sends availability status to the student
- Output:
    - Availability confirmation
    - Message to student(“Car is available”, “ Car not available”)

Enhance Payment Process:

- Input:
    - Validated form and car availability confirmation
    - Payment through FPX, debit card, credit card, etg.
- Process:
    - System calculates totals rental cost (rate * number of days rented).
    - Display summary of payments to students.
    - Sends payment details to Staff for confirmation.
- Output:
    - Payment status (success or failure)
    - Payment record.

Automatic Send Rental Confirmation Detail:

- Input:
  - Success payment
  - Rental details and payment Receipt
- Process:
  - Generates digital rental receipt
  - Send confirmation to students and notifies staff.
  - Store rental transactions in Rental records.
  - Update car availability on the selected date.
- Output:
  - Digital Rental and payment detail message to student via email.
  - Staff notified of completed Rental.
  - Selected status changed to Unavailable on the selected dates.

By establishing these functional criteria with explicit inputs, procedures, and outputs, the HASTA car rental may be upgraded to better suit the demands of its users, boosting overall functionality and user satisfaction.

5.4 Non-functional requirements:

Non-functional requirements refer to the system's operating characteristics and restrictions, rather than particular behaviours or functionalities. They ensure the system satisfies user expectations in performance, usability, dependability, and security.

Performance requirements:

- Response Time: The system responds to 95% of queries within 2 seconds.

- Scalability: Allow up to 1,000 concurrent users.

- Throughput: Manage 100 car rentals per minute.

- Availability: 99.9%.

- Capacity: Support data for 100,000 students and 1TB of car information and car rental information.

Control requirements:

- Security: Includes SSL/TLS encryption, hashed passwords, and role-based access control.

- Backup and Recovery: Daily backups, off-site storage, and four-hour recovery.

- Audit Logging: Detailed records of user activity are retained for 2 years.

- Data integrity: Includes transaction management and data validation procedures.

- Compliance: Adherence to data privacy standards and frequent security audits.

Including non-functional criteria in the HASTA Car rental system ensures efficient performance, security, and compliance with applicable standards.

6.0 Summary of Requirement Analysis process

Together, we discovered that a crucial component of the AS-IS system is the Requirement Analysis Process, which is based on AS-IS analysis. It assists our team members in guaranteeing the success of the process of developing our new system as a solution.

Understanding user and stakeholder scheduling requirements and preferences is the aim of the requirement analysis process. We will be able to establish a clear vision for the system's evolution and define its scope.

Obtaining information about the present system was the first thing our team performed. In order to get system insights, we used the interactive approach, which involves questionnaires, to administer an online survey to users of the existing systems. We can also determine the system's weak points and areas for development thanks to the survey.

Then we examine the data that was collected from the users. We determine the present system's circumstances and process. This makes it simpler for us to research the issues and user-submitted improvement ideas. Next, we'll look at each issue to see which has the most effects on the system and is most effective. We then go ahead and start recording the criteria.

Based on the existing system AS-IS analysis, we provide the current business process workflow in this system requirement. Additionally, we demonstrated the Context Diagram and Diagram 0 that make up the logical DFD AS-IS system. Next, we outlined the functional and non-functional requirements for the TO-BE system.

In order to effectively design the AS-IS system and make sure that the solutions provided can satisfy the demands of users and stakeholders, we firmly believe that a requirement analysis should be effective. We think that by acting appropriately, our team can improve cooperation and lower risks.

UTM

UNIVERSITI TEKNOLOGI MALAYSIA

SECD2613 - 04

SYSTEM ANALYSIS AND DESIGN

SEMESTER 1 SESSION 2024/2025

GROUP PROJECT PHASE 3

NAME OF LECTURER: DR. ARYATI BINTI BAKRI

NO :	NAME	MATRICS
1	NISHAT TABASSUM	A24CS4101
2	AZAAM AHMED DIGALE	A24CS4092
3	MUHAMMAD FIRDAUS BIN MD SHAHRUNNAHAR	A24CS5031
4.	MUHAMMAD RENDY ATSARY	A24CS9003

Table of Contents

1.0 Overview of the Project

HASTA, a car rental service with an affiliation with academic institutions, currently employs a manual system for vehicle rental reservation, monitoring, and administration. This old system is plagued by numerous inefficiencies such as booking conflicts, delays in processing, and inefficient communication between staff and customers. The recommended solution is the use of a web-based Car Rental Management System (CRMS) with campus application. This system will automate reservations, consolidate vehicle data, provide real-time status, and enhance communication between users and staff.

By substituting the manual process with a computerized system, HASTA hopes to:

- **Enhance operational efficiency**
- **Reduce human error.**
- **Enhance customer satisfaction**
- **Furthermore, it will facilitate prospective scalability, encompassing potential collaborations with payment systems and mobile applications**.

2.0 Problem Statement

HASTA, is a campus car rental service, which uses manual processes for important functions like booking reservations, tracking vehicles and handling data. The use of outdated systems results in regular problems like booking conflicts as well as delayed confirmations and staff-to-customer communication errors. Without a centralized platform, vehicle availability information cannot be updated in real-time which creates challenges for customers who want to plan and reserve vehicles. Employees must often redo tasks and perform double checks which leads to time wastage and decreased operational efficiency. Management lacks an analytical tool to assess fleet performance metrics alongside customer behavior patterns and resource distribution. The company's service quality and customer satisfaction decline because inefficiencies stop operational growth and digital expansion potential.

Identified Issues:

- The manual booking system increases error probability and delays processing time.

- Without real-time data on vehicle availability customers face booking conflicts which leads to a negative experience.

- Without centralized information management systems data becomes inconsistent which creates operational delays.

- The lack of effective internal communication alongside missing customer notifications leads to diminished service efficiency.

- The business cannot grow or adapt due to system limitations in scalability, analytics capabilities and automation features.

3.0 PROPOSED SOLUTIONS

To address the inefficiencies and challenges faced by HASTA's current manual car rental process, we propose a web-based Car Rental Management System designed specifically for campus-based use. This system will serve as a centralized platform for booking, tracking, managing, and analyzing car rental operations, accessible to both staff and students.

Key Features of the Proposed Solution:

- Online Booking Interface for students/staff to reserve vehicles in real-time.
- Admin Dashboard for managing vehicle availability, user accounts, and bookings.
- Automated Notifications for booking confirmation, reminders, and updates.
- Data Analytics Module to monitor fleet usage, customer behavior, and operational performance.
- Secure Login System with role-based access (Admin, Staff, Student).

Feasibility Study

1. Technical Feasibility

- The system will be developed using standard web technologies (HTML/CSS, JavaScript, PHP/Python, MySQL).
- Easily deployable on existing university servers or cloud infrastructure (e.g., GitHub, Firebase).
- Compatible with any modern browser and responsive on desktops, tablets, and mobile devices.

2. Operational Feasibility

- Staff can be easily trained to manage the system via user-friendly dashboards.
- Students and users will benefit from a simple interface requiring minimal onboarding.
- Daily operations will improve significantly with centralized access to booking and vehicle status.

3. Economic Feasibility

- Initial development can be done in-house by the student team, minimizing upfront costs.
- Long-term savings through reduced manpower, fewer booking errors, and better time management.
- Potential for scalable integration of advanced modules (payments, GPS tracking) in the future.

COST-BENEFIT ANALYSIS (CBA)

The Cost-Benefit Analysis evaluates the financial feasibility of implementing the HASTA Car Rental Management System by comparing the estimated costs against the expected benefits over one year.

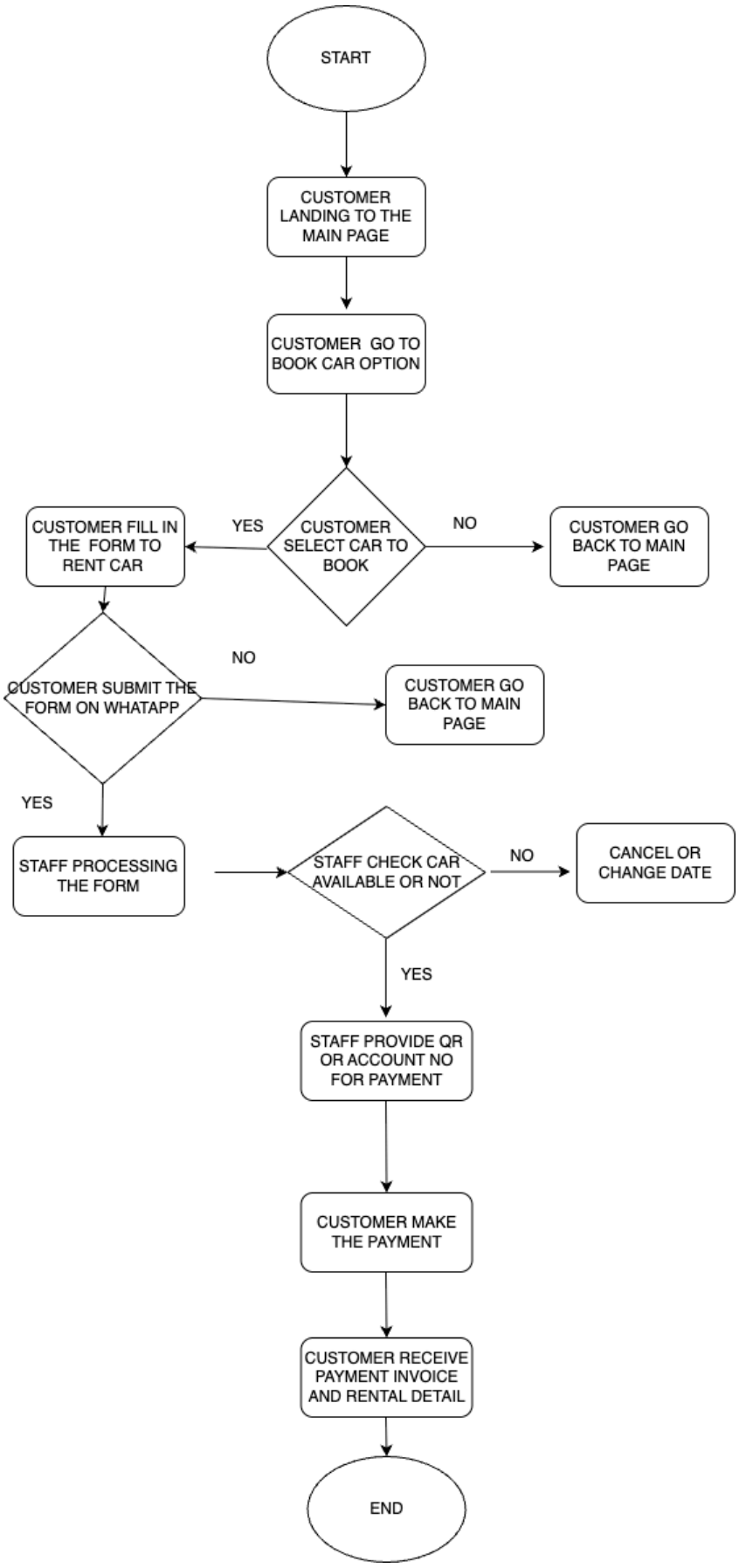
Assumptions	Value
Sensitivity factor (cost)	0.85
Sensitivity factor (benefit)	0.9
Annual change in production cost	3%
Annual change in benefits	8%
Discount	6%

COST	YEAR 0	YEAR 1	YEAR 2	YEAR 3	YEAR 4
DEVELOPMENT COST					
HARDWARE	25,000				
SOFTWARE	18,000				
CONSULTANT	10,000				
TRAINING	7,000				
TOTAL	60,000				
OPERATIONAL COST					
PRODUCT COST					
SUPPLIES		3,000	3,150	3,308	3,473
MAINTENANCES		5,000	5,250	5,513	5,788
TOTAL PRODUCT COST		8,000	8,400	8,821	9,261
PRESENT VALUE		7,547	7,470	7,392	7,314
ACCUMULATED COST		67,547	75,947	84,768	94,029

BENEFITS	YEAR 0	YEAR 1	YEAR 2	YEAR 3	YEAR 4
STAFF TIME SAVED		39,000	42,120	45,489	49,128
REDUCED BOOKING ERROR		1,200	1,272	1,348	1,429
TOTAL BENEFITS		40,200	43,392	46,837	50,557
PRESENT VALUE (DISCOUNT)		37,925	38,607	39,400	40,307
ACCUMULATED BENEFITS		37,925	76,532	115,932	156,239
GAIN/LOSS		32,925	70,982	109,381	134,688
PROFITABILITY INDEX	**134,688/ 60,000= 2.2448**				

Profitability Index = 2.24 , showing a good investment as its index is more than one

4.0 Current Business Process (Scenarios / Workflow)



5.0 Logical DFD (AS-IS System)

Logical DFD (AS-IS) system (based on current business process/workflow)

Context Diagram:

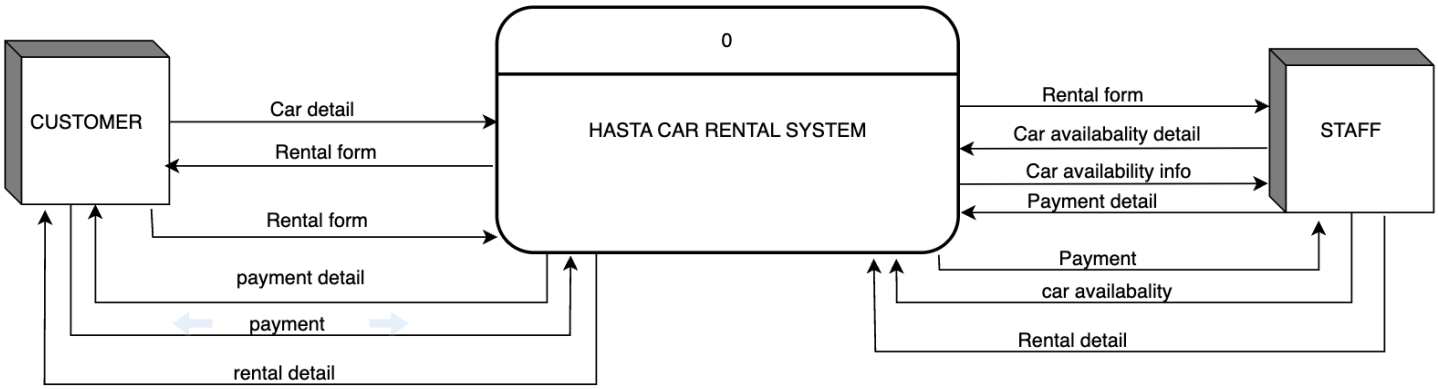
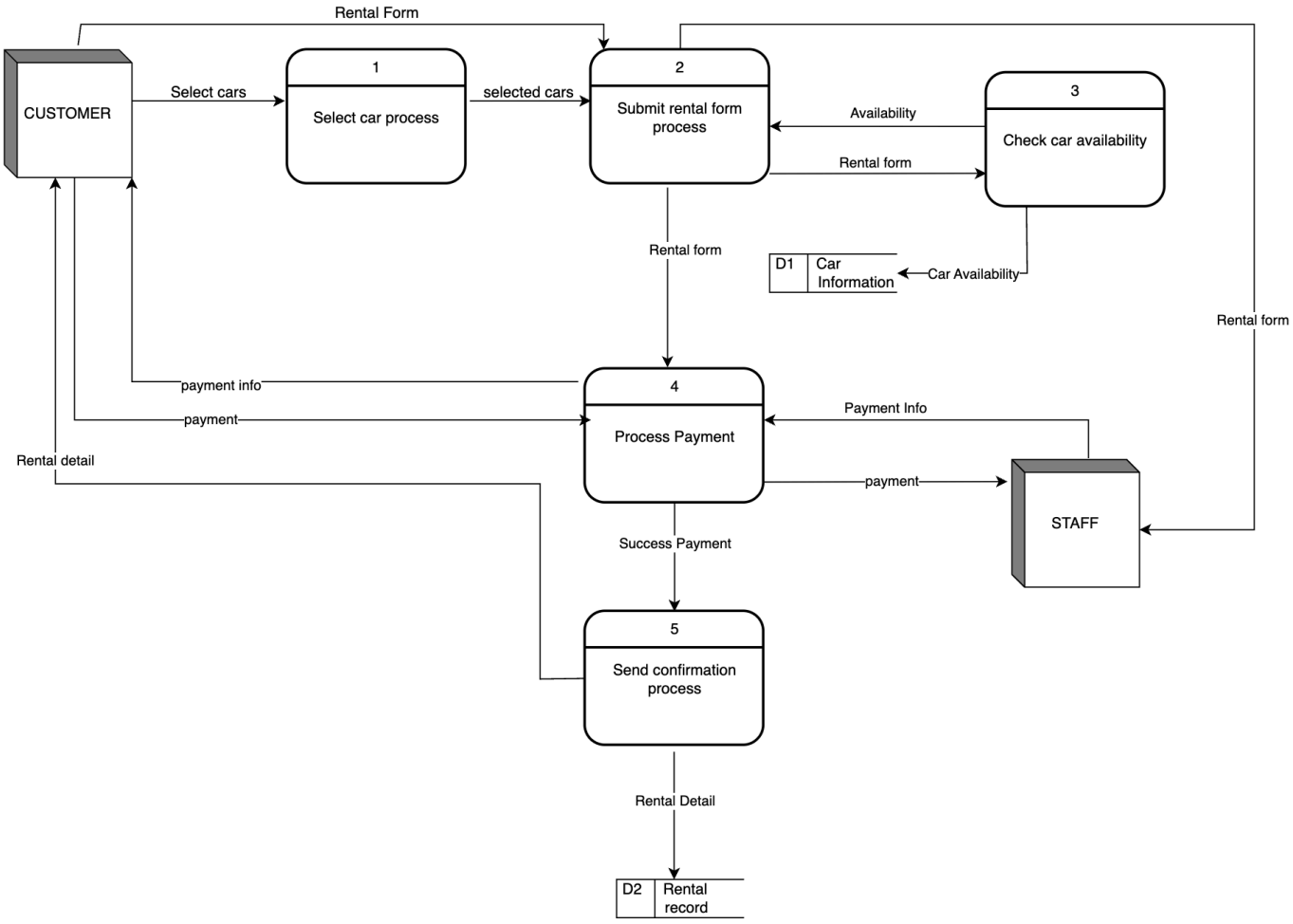
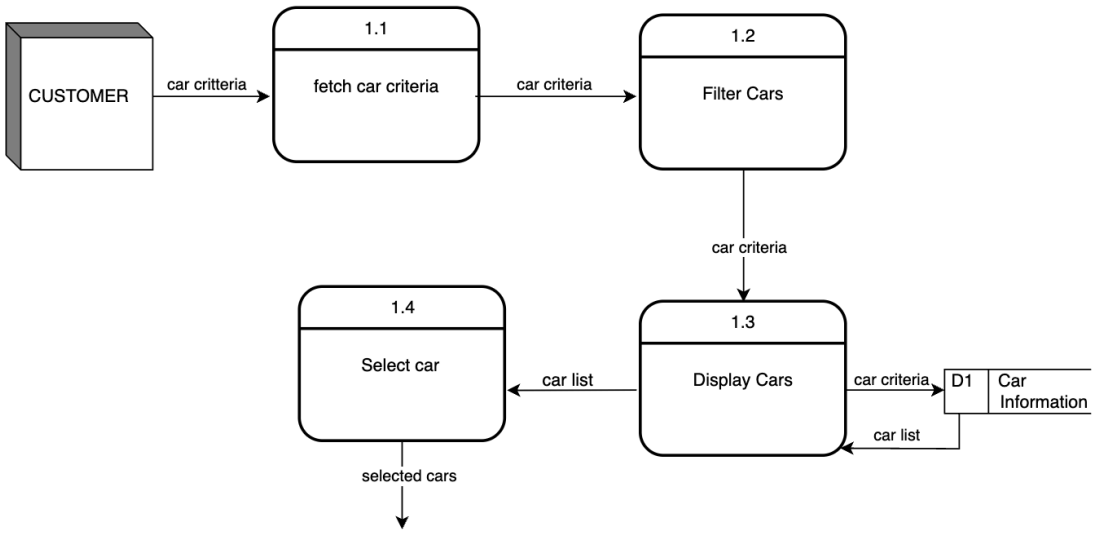


Diagram 0:

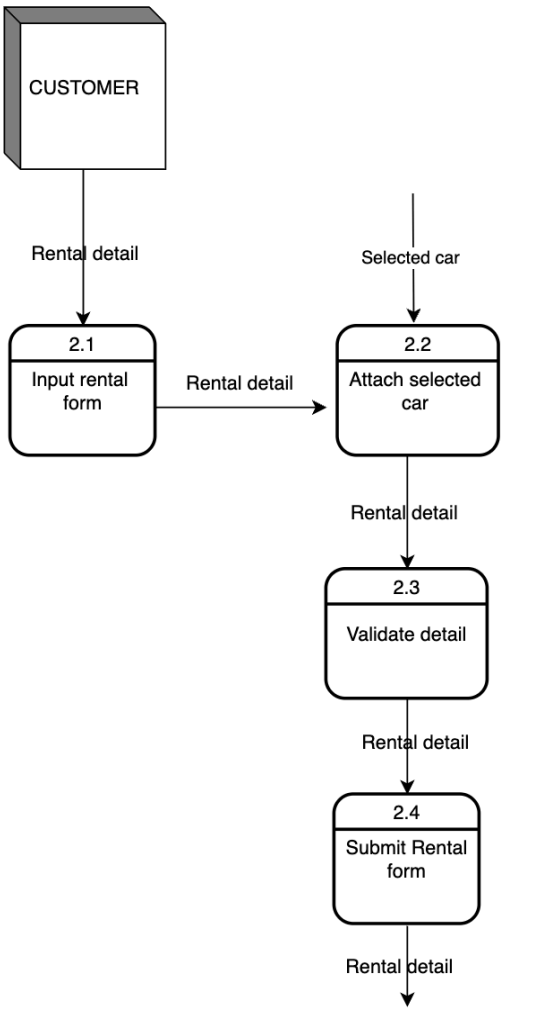

Rental Form
CUSTOMER
Select cars
1
Select car process
selected cars
2
Submit rental form process
Availability
3
Check car availability
Rental form
Rental form
D1
Car Information
Car Availability
Rental form
payment info
payment
4
Process Payment
Payment Info
Rental detail
payment
STAFF
Success Payment
5
Send confirmation process
Rental Detail
D2
Rental record

Child Diagram (Level 1):

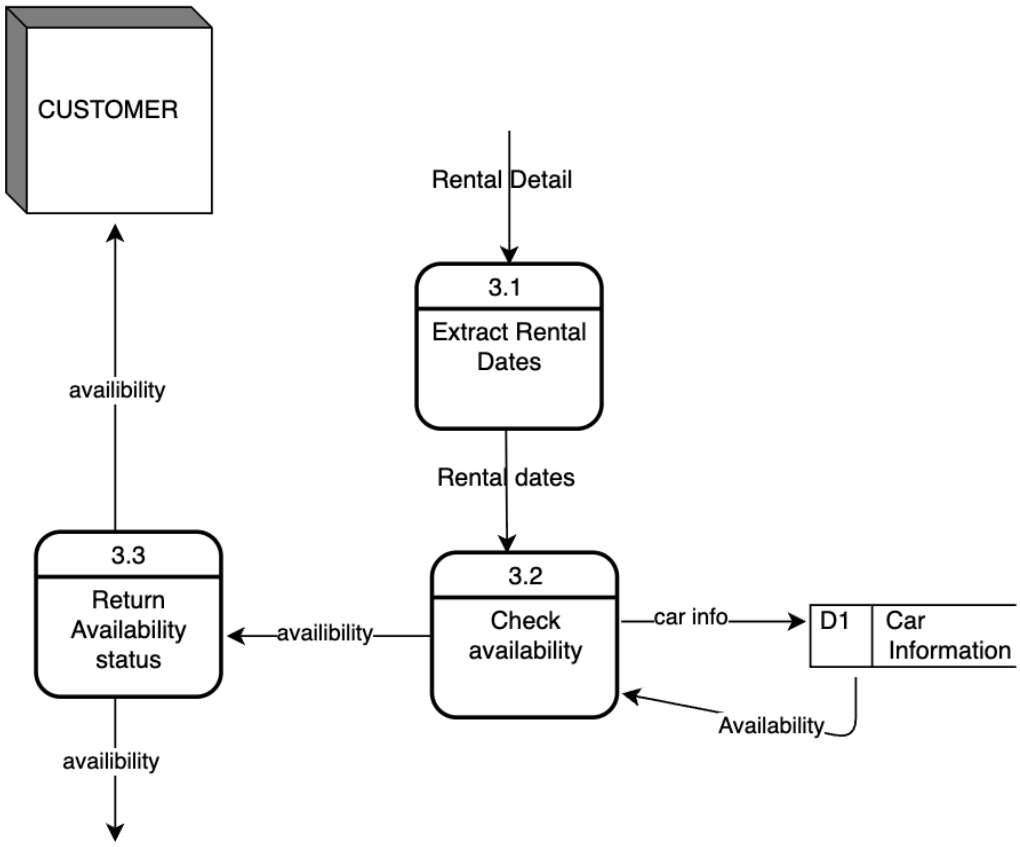
1.Process 1 Child Diagram:



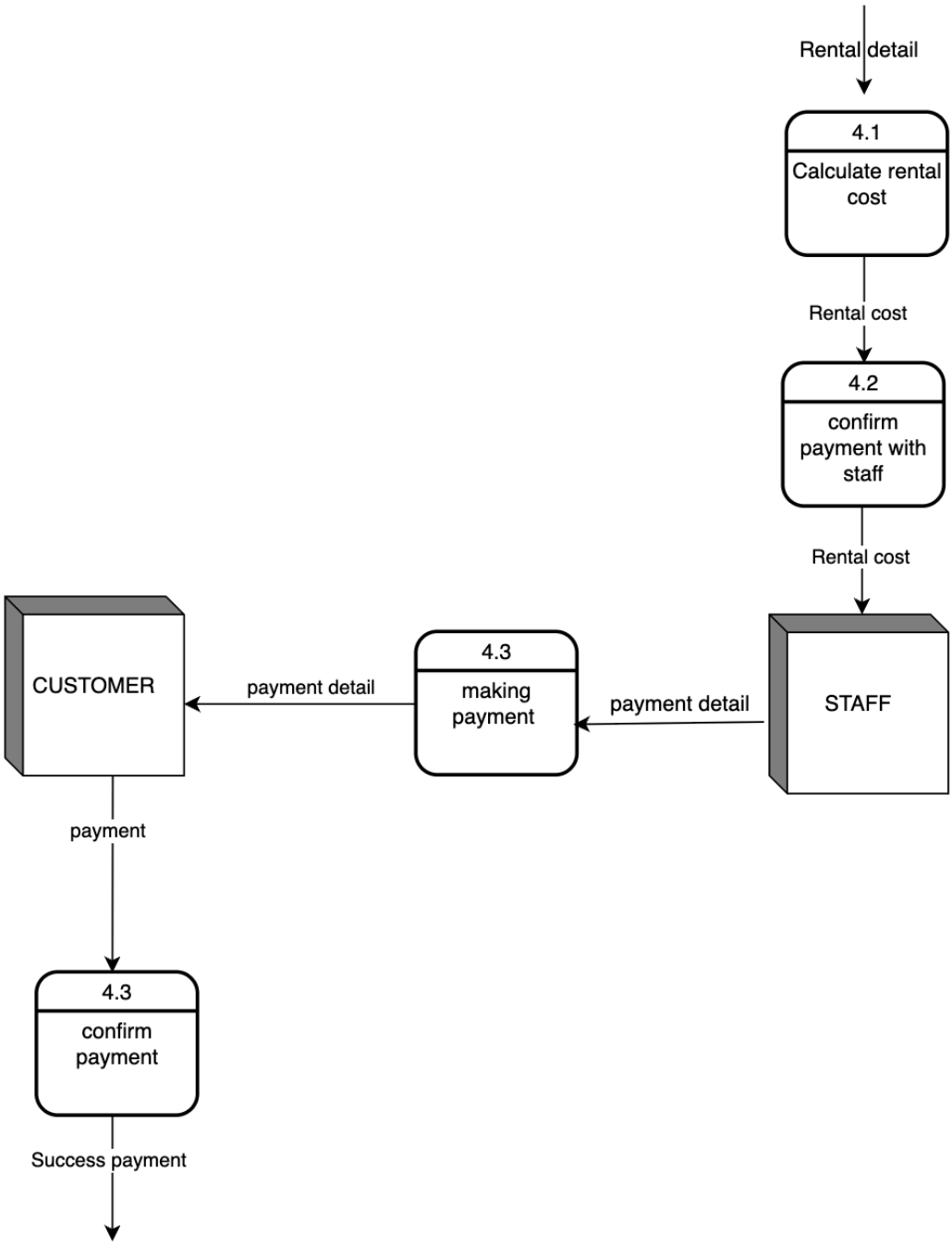
2. Process 2 Child Diagram:



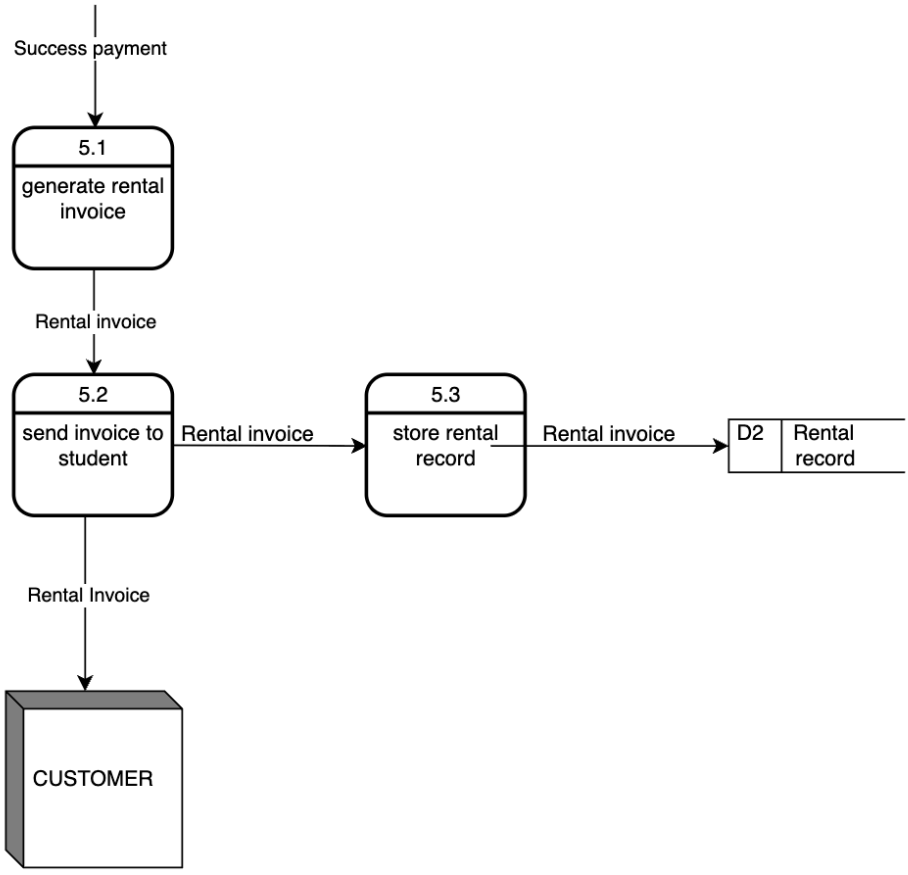
3. Process 3 Child Diagram:



4.Process 4 Child Diagram:



5. Process 5 Child Diagram:



6.0 System Analysis and Specification

There is a comprehensive analysis of the functional and non-functional requirements and the logical Data Flow Diagram (DFD) of the system in this section. The purpose of this analysis is to identify to what extent the system meets the goals of increasing efficiency, eliminating errors, and extending a smooth user interface.

6.1 Functional Requirements

User Authentication: The system needs to be capable of allowing logging on securely for customers, manager and administrator using user name and password.

Booking Management: The user should be able to book, cancel, or amend car bookings. There should be booking confirmations and status in real-time.

Vehicle Availability: The system should display real-time vehicle availability and let the user know whether vehicles are bookable or not.

Payment Processing: The software should be able to let users select an option for payment, facilitate payments, and notify users about processed and failed transactions.

Rental Confirmation: Once payment processing is done, the system should provide a confirmation page showing rental details.

Vehicle Status Update: When a rental comes back, the system must update the vehicle's availability status to "Available" or "Maintenance Required" based on the vehicle's condition.

Admin Dashboard: The admin panel will be used to manage users, vehicles, bookings, payments, and vehicle status

.

6.2 Non-Functional Requirements

Performance: The system must support a maximum of 1000 concurrent users without any appreciable loss of performance.

Usability: The system needs to be easy to use and navigate for students, faculty, and administrators.

Scalability: The system must be scalable to accommodate future additions including integration of mobile apps and outside payment platforms.

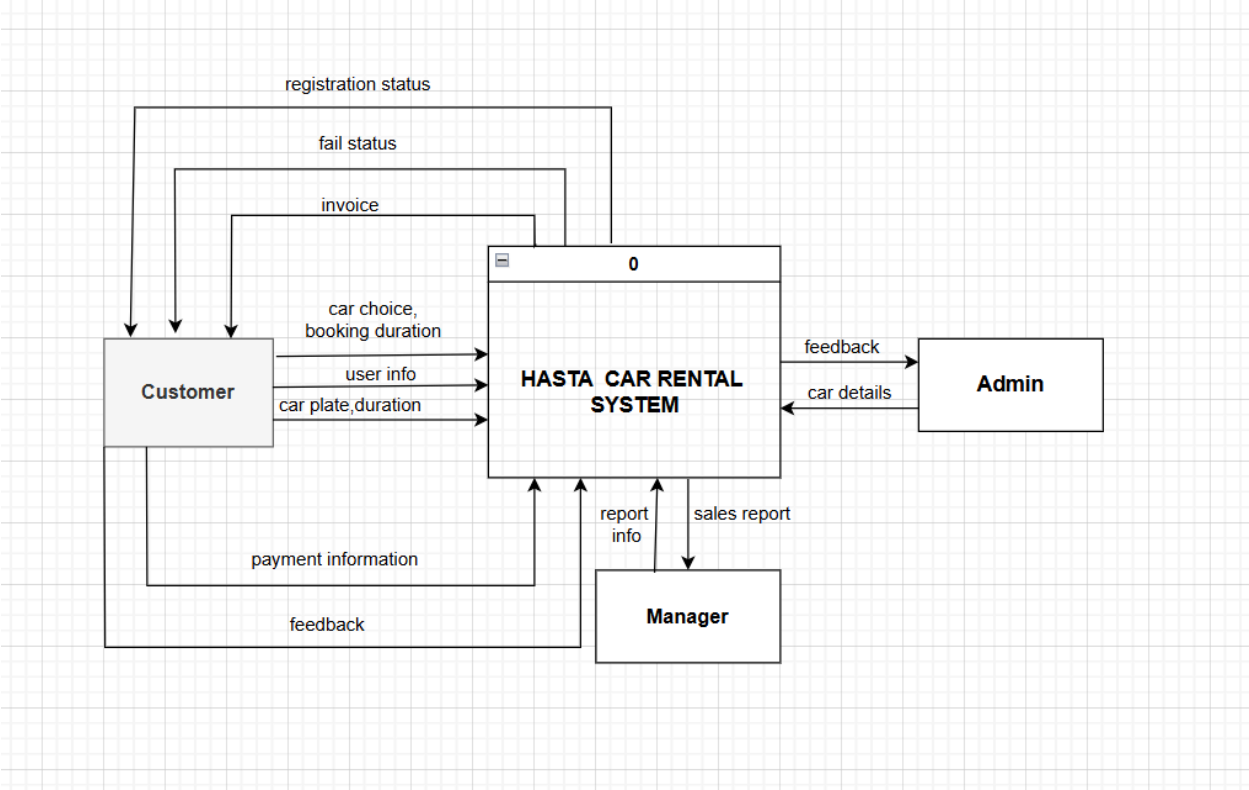
Security: It must be able to securely authenticate and authorize and use encryption on sensitive information like user credentials and payments.

Availability: The system will have an availability of 99.9%, with scheduled maintenance downtime.

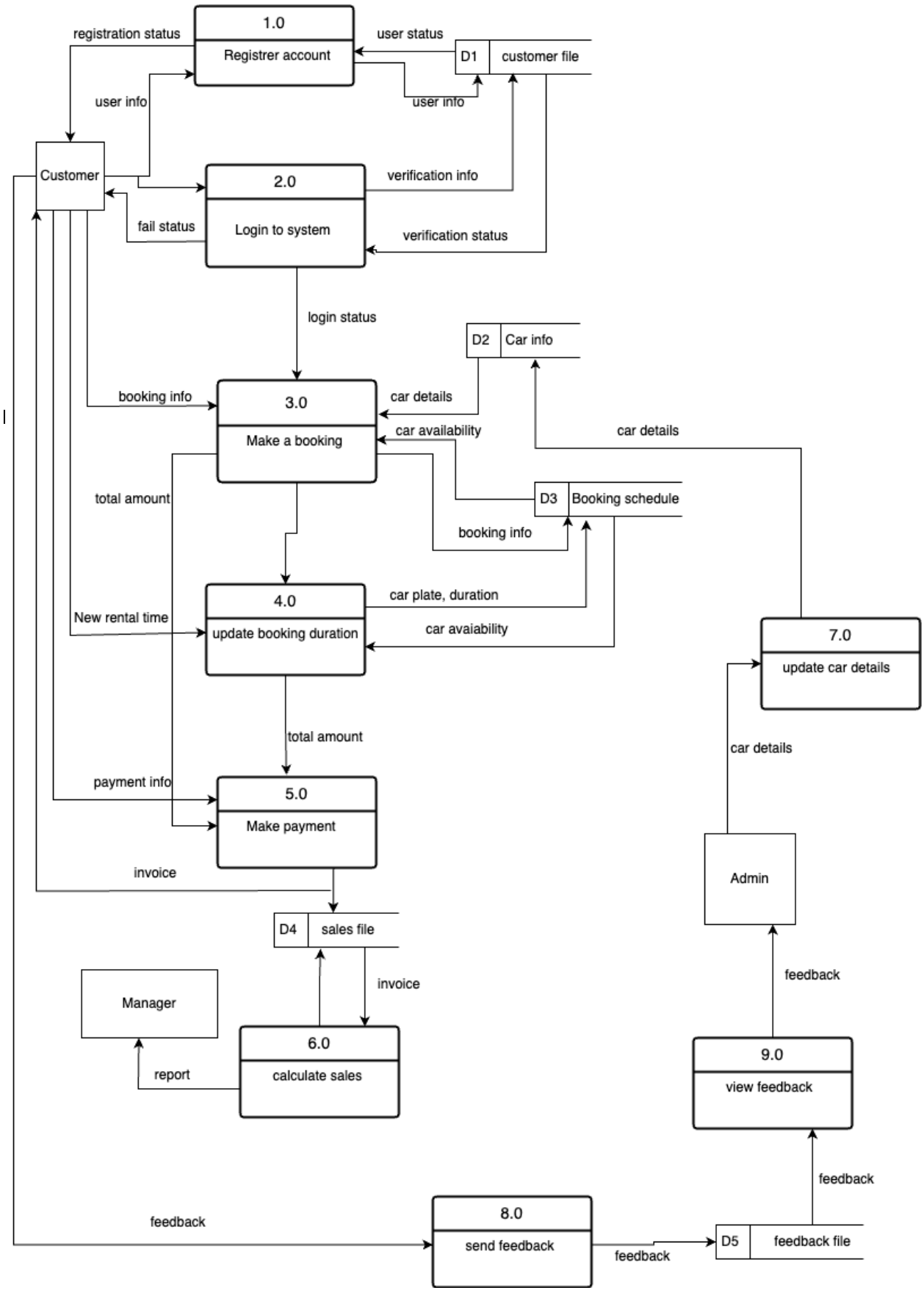
Compatibility: The application needs to be compatible with current browsers and responsive on desktop, tablet, and mobile. Data Integrity: All bookings, payments and vehicle status information should be completely and accurately stored and updated in the system.

6.3 Logical DFD (TO-BE System)

i .Context Diagram

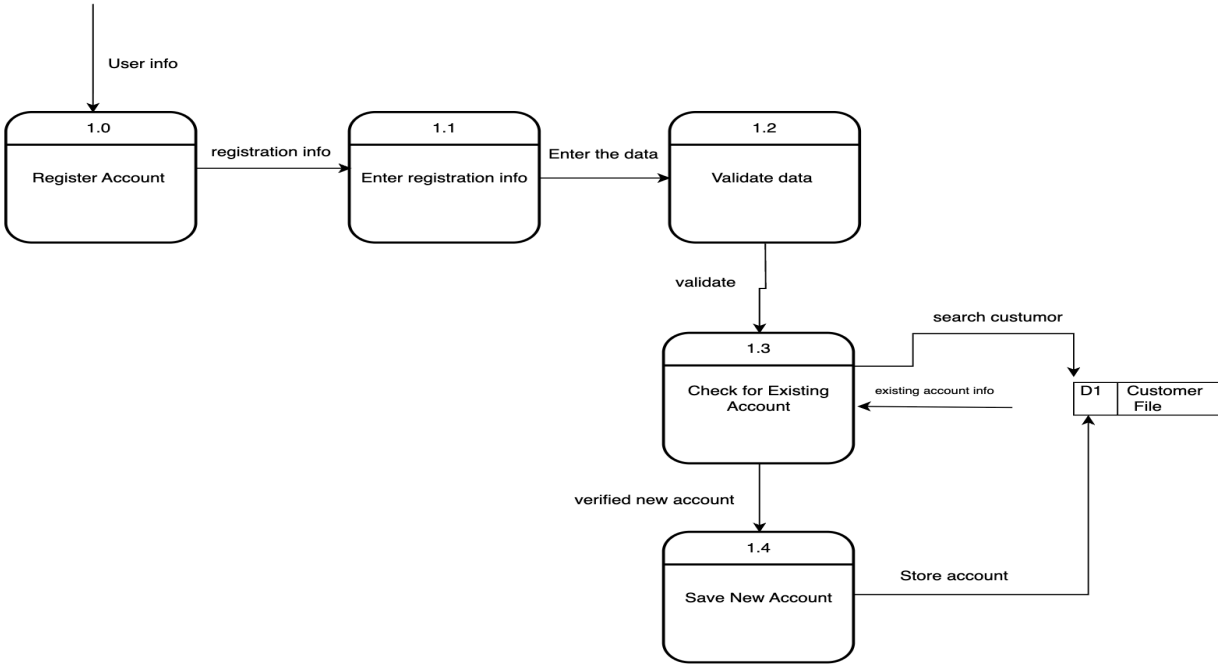


ii.Diagram 0

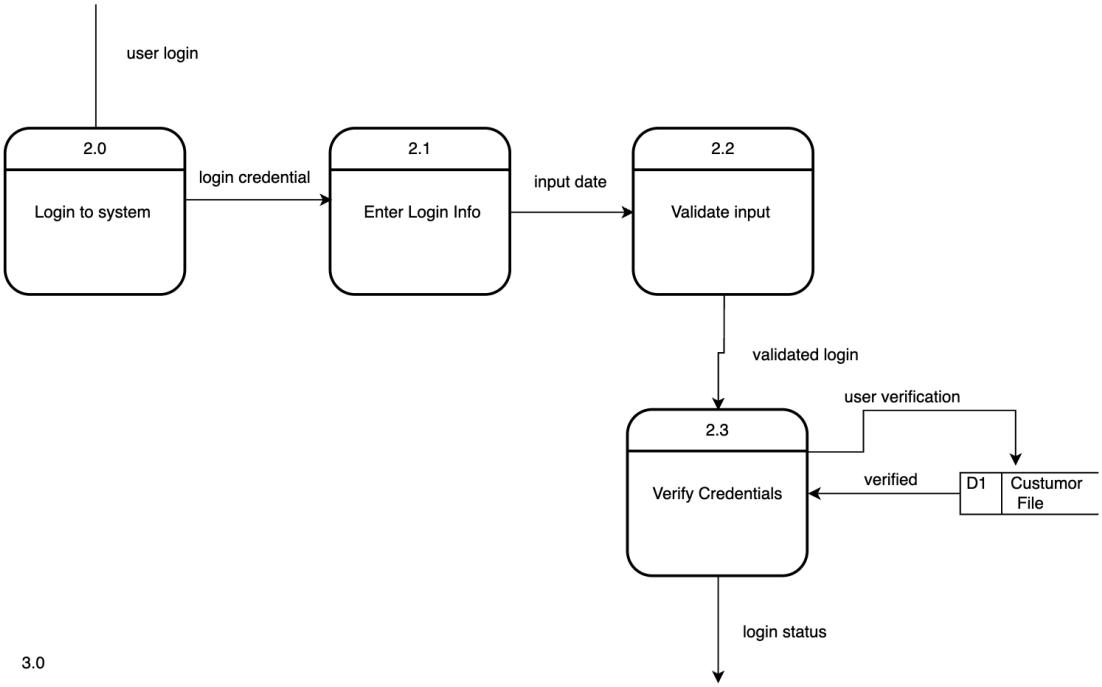

1.0
Registrer account
registration status
user status
D1
customer file
user info
user info
Customer
2.0
Login to system
verification info
fail status
verification status
login status
D2
Car info
booking info
3.0
Make a booking
car details
car availability
car details
total amount
D3
Booking schedule
booking info
4.0
update booking duration
car plate, duration
New rental time
car avaiability
7.0
update car details
total amount
car details
payment info
5.0
Make payment
invoice
Admin
D4
sales file
feedback
invoice
Manager
6.0
calculate sales
report
9.0
view feedback
feedback
feedback
8.0
send feedback
feedback
D5
feedback file

ii) Child Diagram

Process 1.0

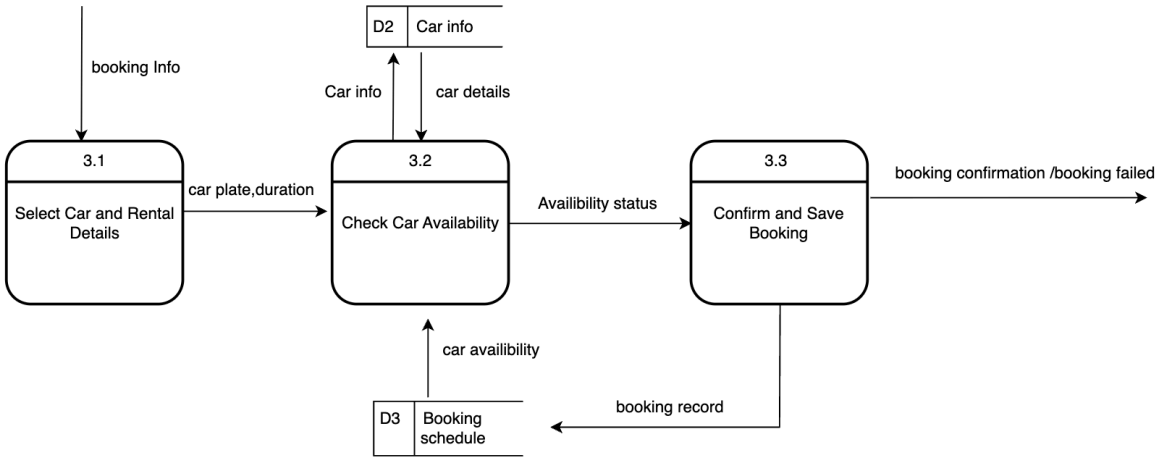


Process 2.0

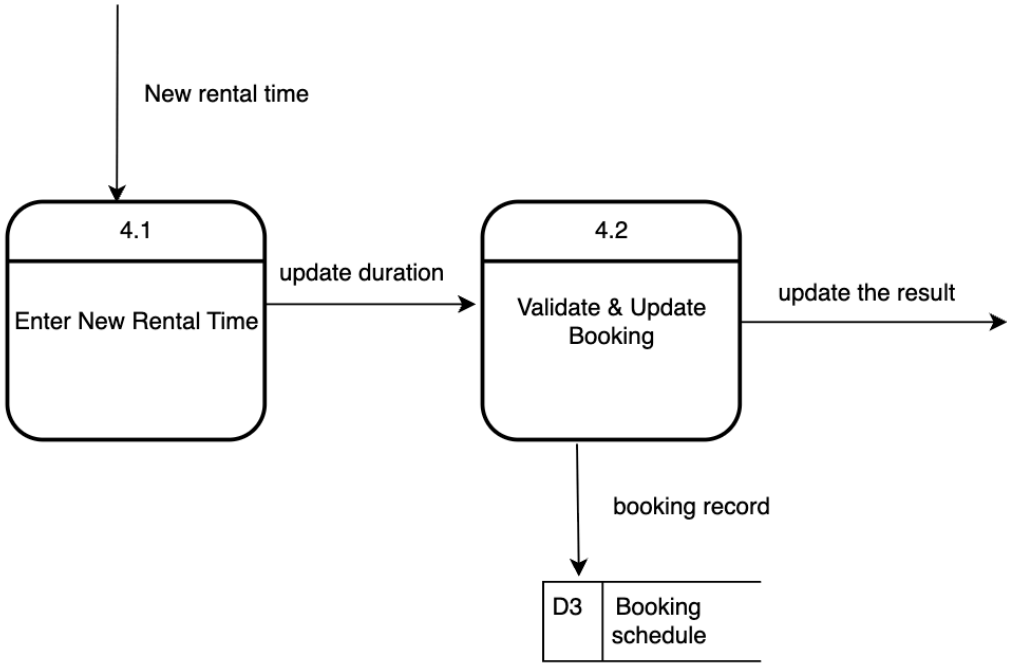


3.0

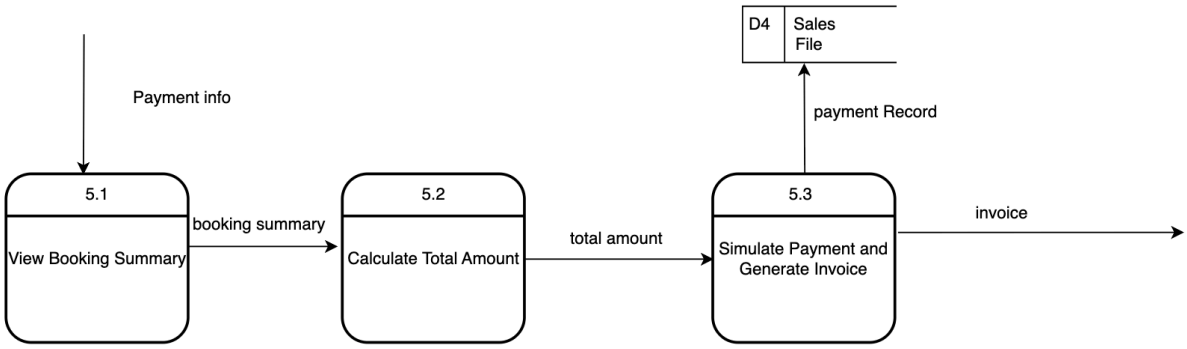
Process 3.0



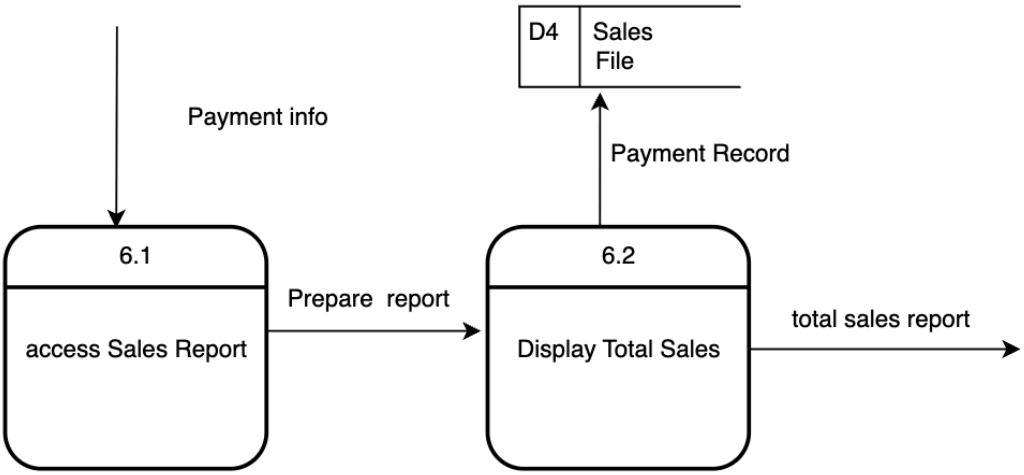
Process 4.0



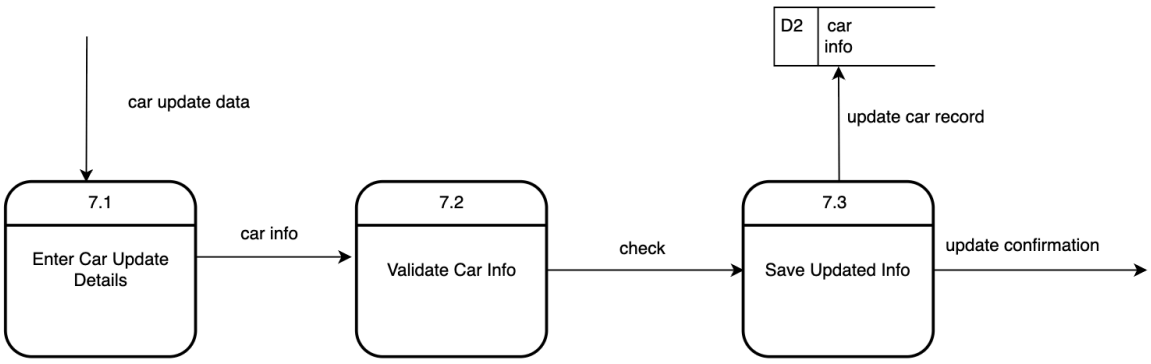
Process 5.0



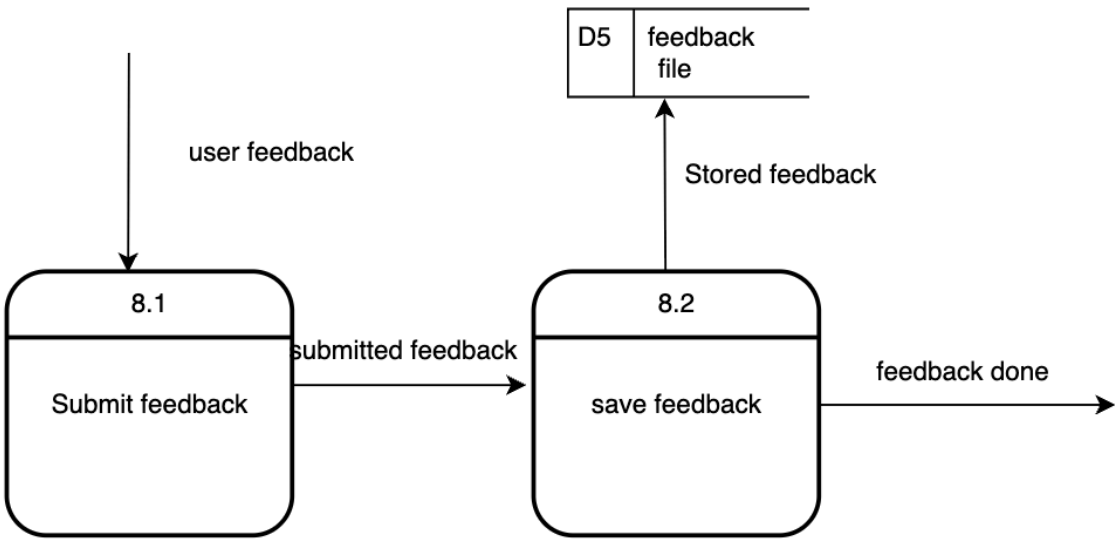
Process 6.0



Process 7.0



Process 8.0


D5
feedback file
user feedback
Stored feedback
8.1
Submit feedback
submitted feedback
8.2
save feedback
feedback done

6.4 Process Specifications (based on Logical DFD TO-BE)

Process 1.0 – Login

Structure Type: Sequential + Decision

READ username and password

IF username and password are correct

    THEN grant access to the system

ELSE

    DISPLAY "Invalid credentials. Please try again."

    RETURN to login

ENDIF

Process 2.0 – Manage Booking

Structure Type: Case Structure

DISPLAY booking options

READ user input

IF user selects "New Booking"

    THEN collect customer details

        collect vehicle preferences

        assign booking ID

ELSE IF user selects "Modify Booking"

    THEN READ booking ID

        FETCH current booking details

        UPDATE booking details as per user input

ELSE IF user selects "Cancel Booking"

    THEN READ booking ID

DELETE booking from system

CONFIRM cancellation

ELSE

DISPLAY "Invalid booking option"

ENDIF

Process 3.0 – Process Payment

Structure Type: Decision + Iteration

DO

DISPLAY payment options

READ user selected payment method

IF payment method is valid

THEN process transaction

IF transaction is successful

THEN DISPLAY "Payment Successful"

UPDATE payment status

ELSE

DISPLAY "Payment Failed. Try Again."

ELSE

DISPLAY "Invalid Payment Method"

UNTIL payment is successful OR user exits

Process 4.0 – Confirm Rental

Structure Type: Sequential + Decision

CHECK payment status for booking ID

```
IF payment status is "Paid"
   THEN generate rental confirmation
      DISPLAY confirmation with booking details
ELSE
   DISPLAY "Rental cannot be confirmed without payment"
ENDIF
```

Process 5.0 – Update Vehicle Status

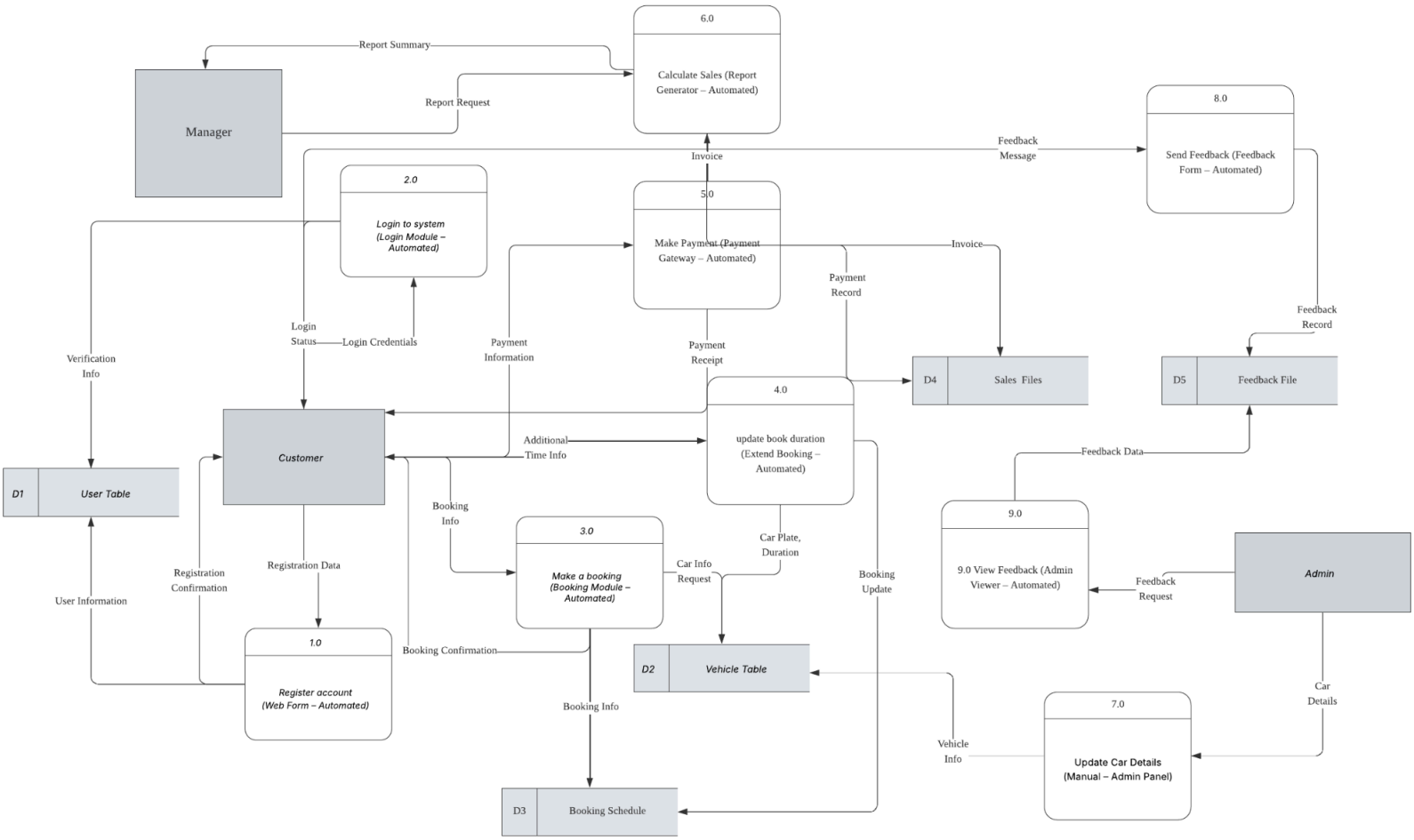
Structure Type: Sequential + Case Structure

```
READ booking completion status
IF booking is completed
   THEN READ vehicle ID
      CHECK vehicle return condition
      IF condition is "Good"
         THEN SET vehicle status to "Available"
      ELSE
         SET vehicle status to "Maintenance Required"
ENDIF
UPDATE vehicle status in system
DISPLAY "Vehicle status updated"
```

7.0 Physical System Design

7.0 Physical DFD (TO-BE System)

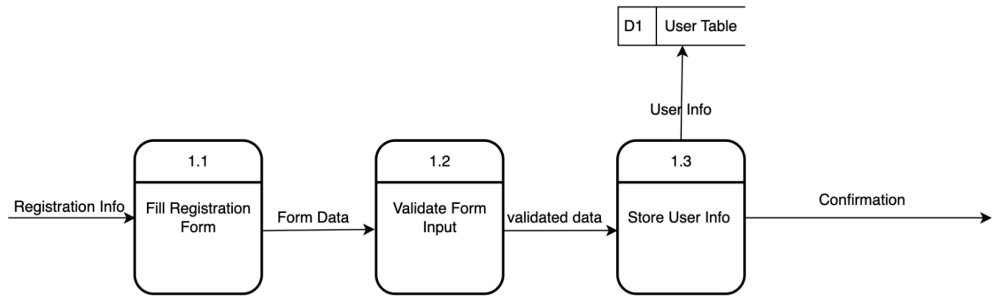
7.1 Diagram 0



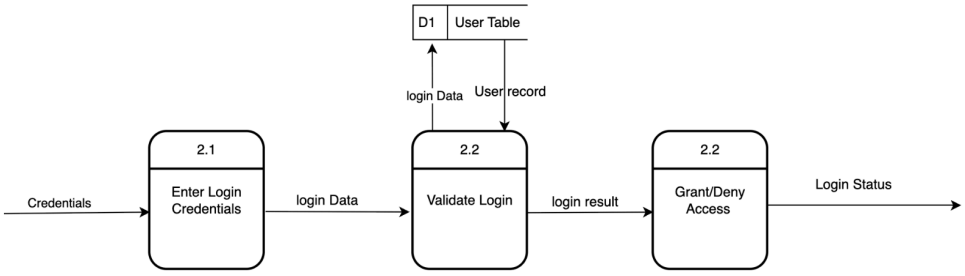
LINK:
https://lucid.app/lucidchart/c36ca858-d860-43e8-addc-32896628f16a/edit?viewport_loc=-284%2C246%2C2104%2C1202%2C0_0&invitationId=inv_97713414-a9b0-49bb-a7e7-99e8ffc1a606

7.2 Child Diagram(s)

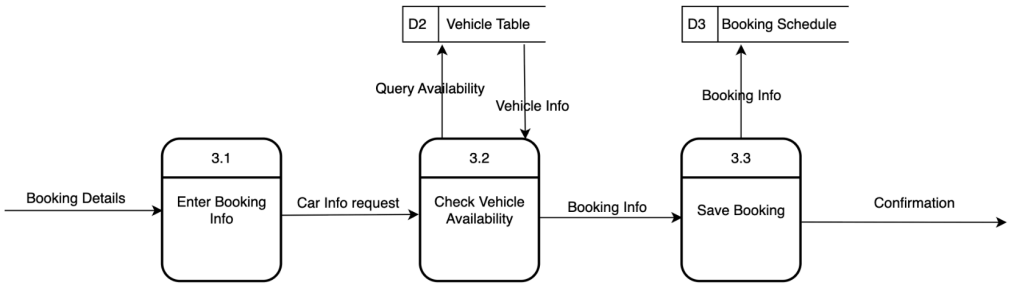
1.0 Register Account:



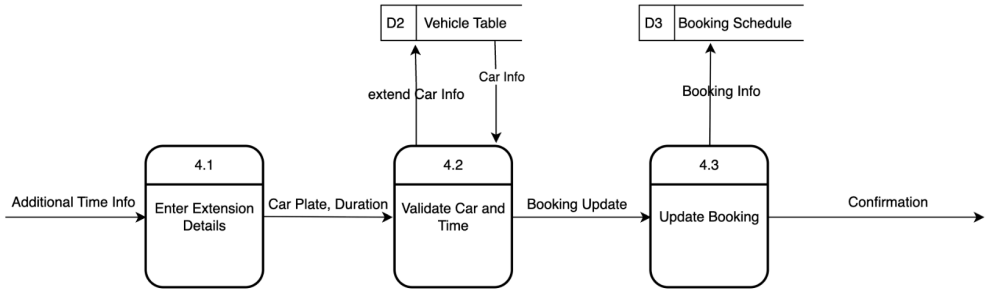
2.0 Login To System:



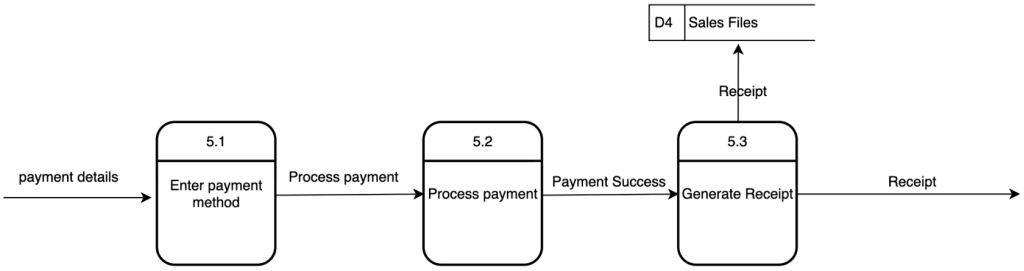
3.0 Make a Booking:



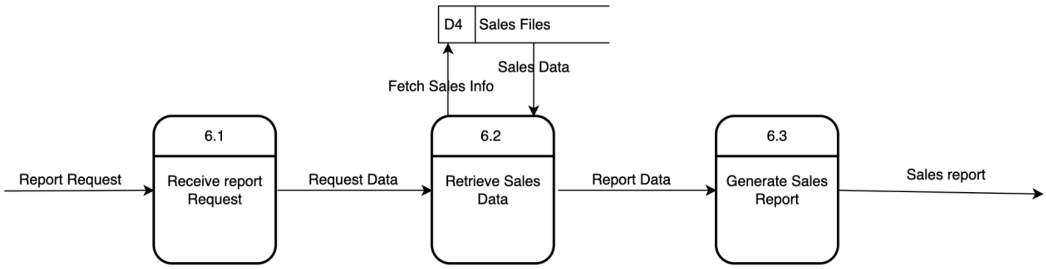
4.0 Extend Booking:



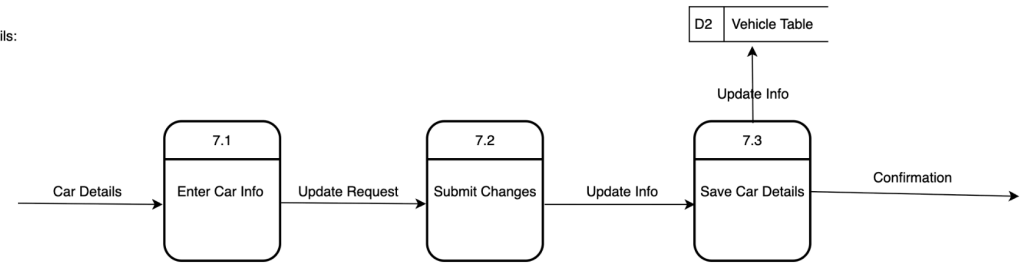
5.0 Payment process:



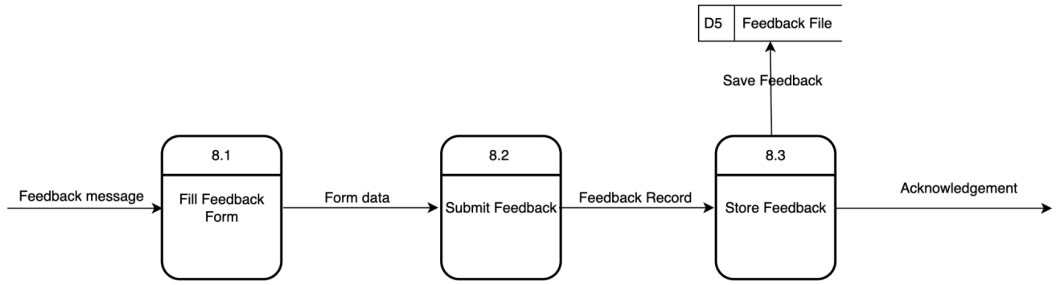
6.0 Calculate Sales:



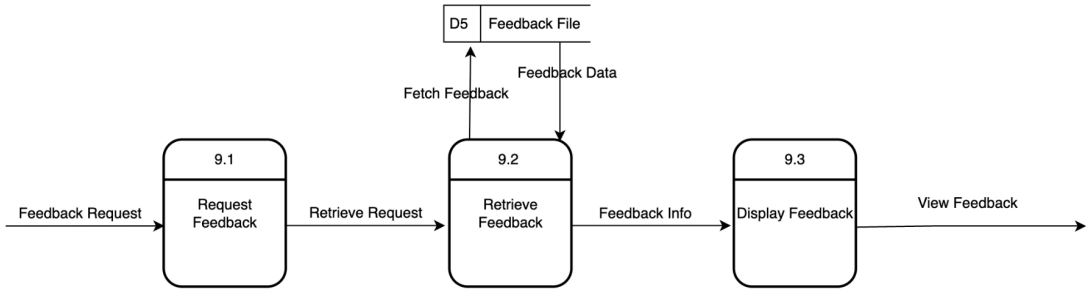
7. 0 Update Car Details:



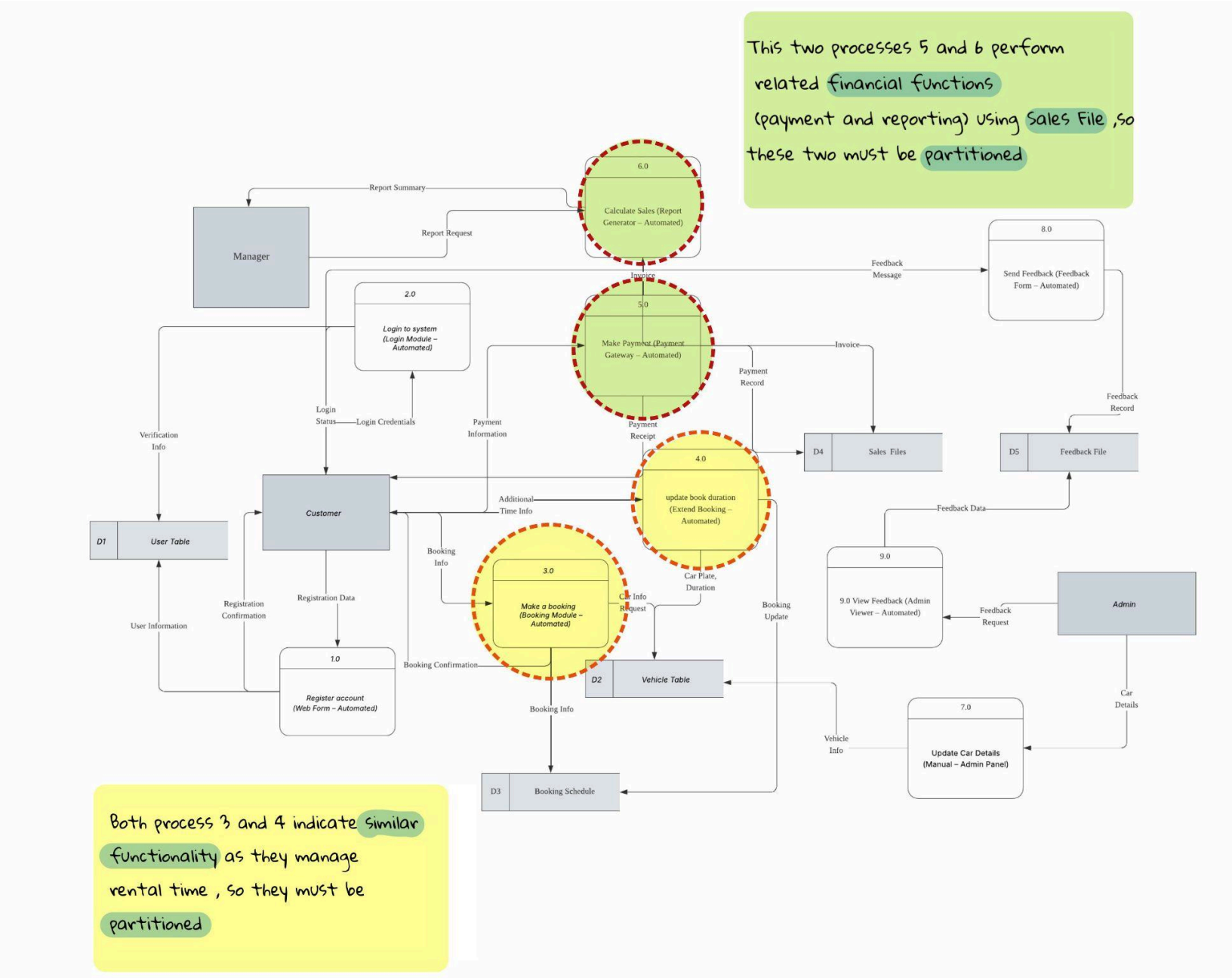
8.0 Send Feedback:

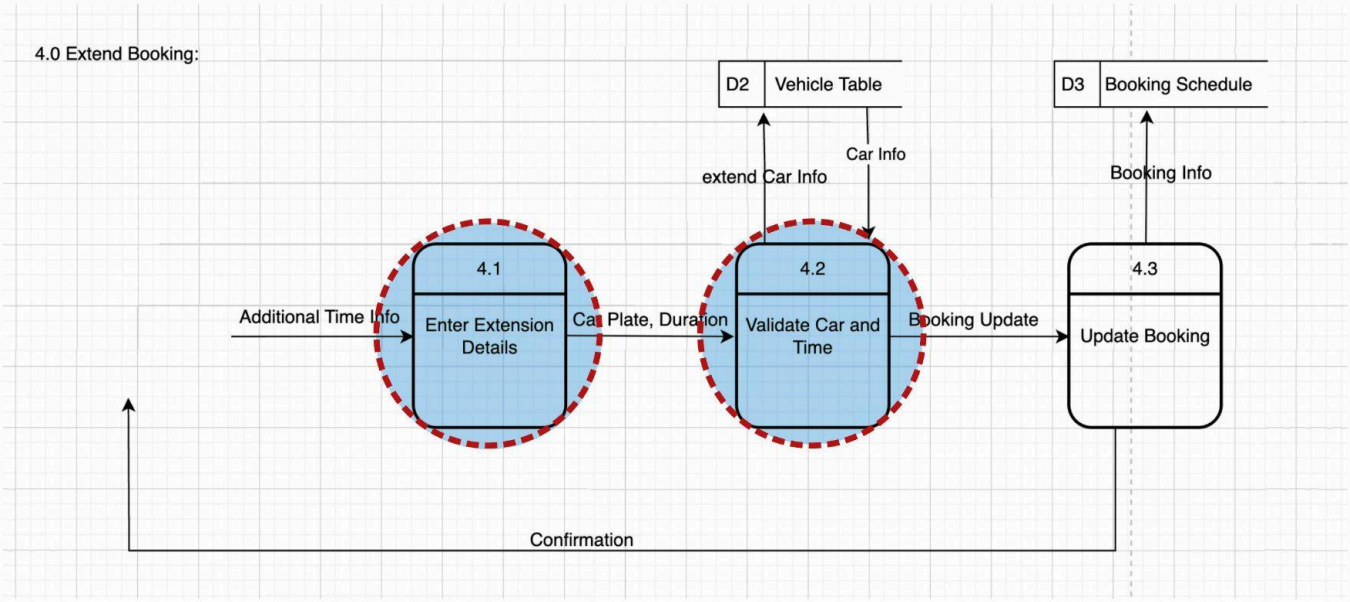


9.0 View Feedback:



7.3 Partitioning





These two processes handle booking extension and run on the same screen, perform related actions, so they have both similar functionality and timing, so must be partitioned

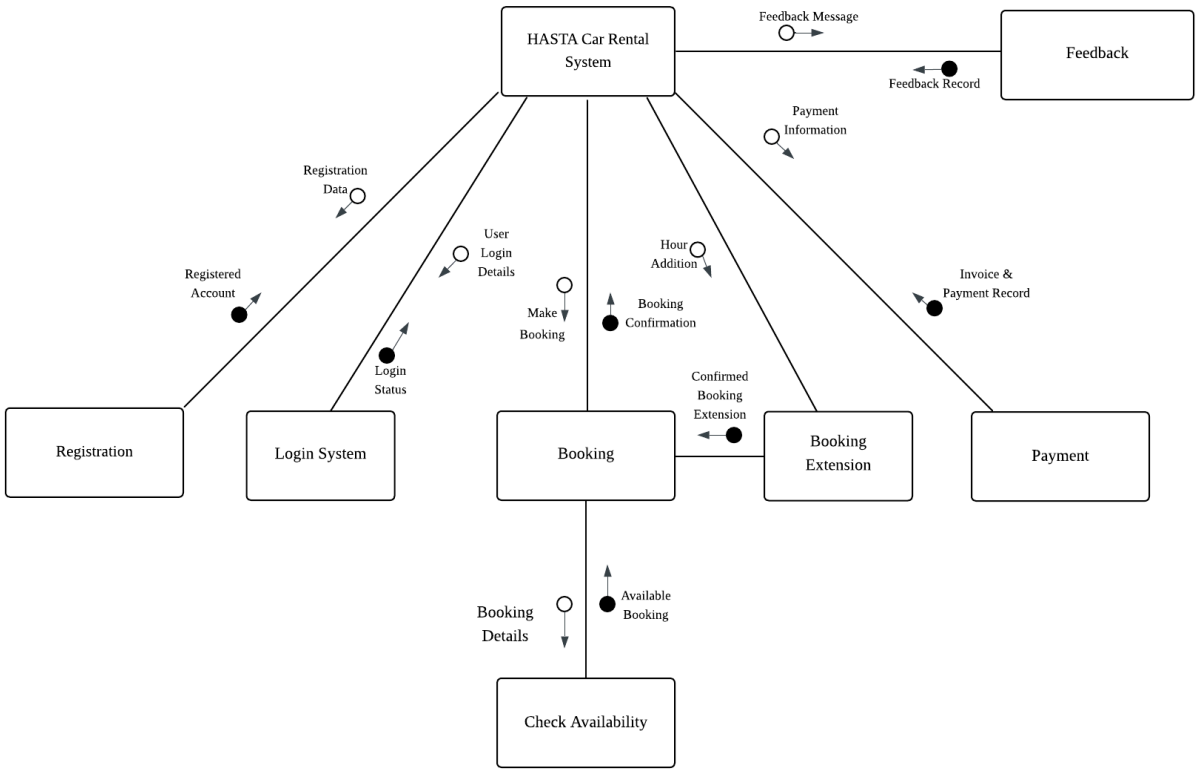
7.4 CRUD Matrix

Activity	Customer File	Vehicle Table	Booking Schedule	Sales File	Feedback File
1.0 Register Account	C				
2.0 Login to System	R				
3.0 Make a Booking	R	R	C		
4.0 Update Booking		R	U		
5.0 Make Payment			R	C	
6.0 Calculate Sales				R	
7.0 Update Car Details		U			
8.0 Send Feedback	R				C
9.0 View Feedback					R

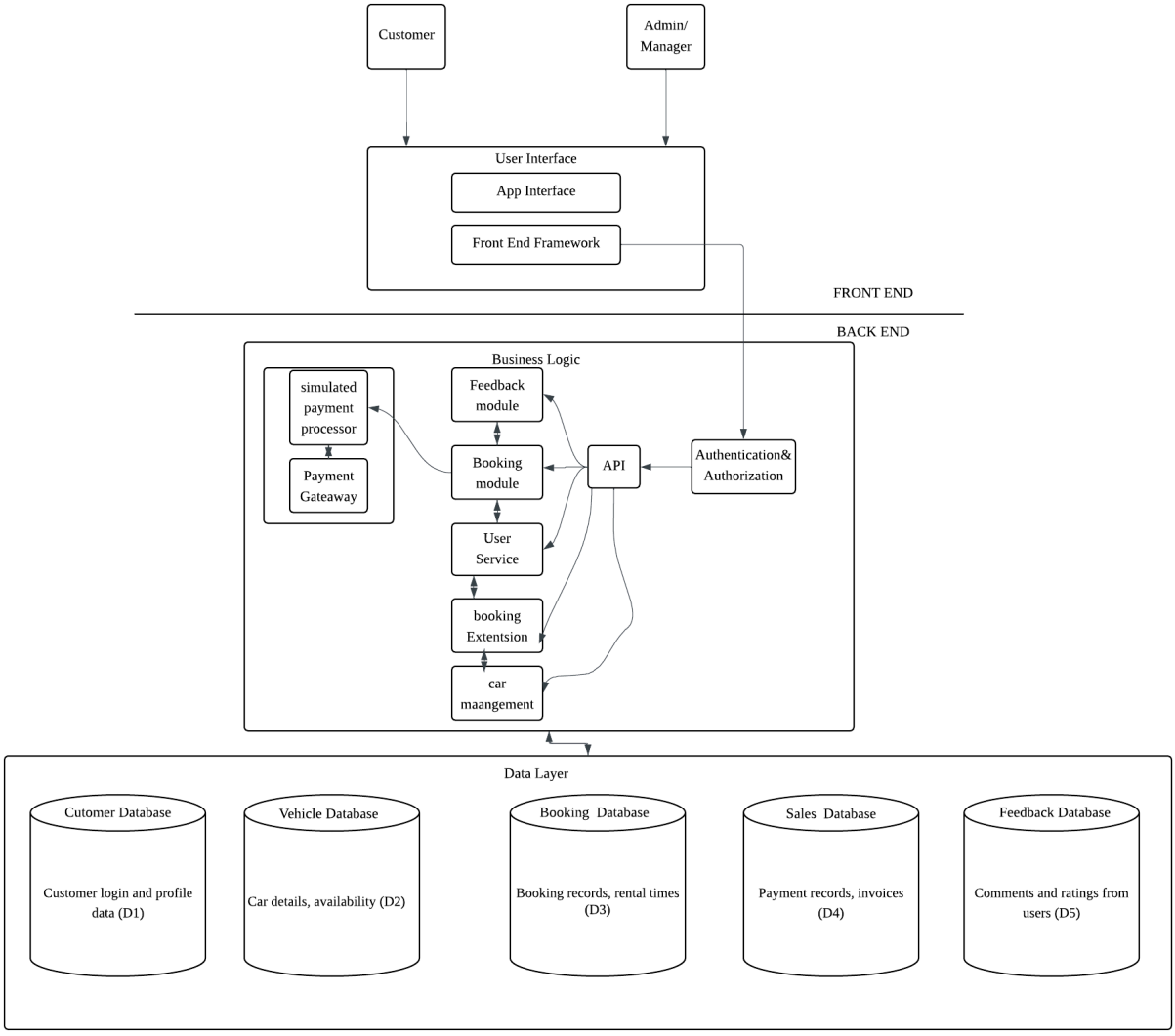
7.5 Event Response Table

Event Source	Trigger	Activity	Response	Destination
Customer	Click "Register"	Create new account	Registration confirmation	Customer account
Customer	Enter login credentials	Authenticate user	Login success/failure message	Customer account
Customer	Click “Book Vehicle”	Submit booking	Booking confirmation	Booking schedule
Customer	Click “update booking duration”	Extend booking	Updated booking details	Booking schedule
Customer	Enter payment details	Process payment	Payment receipt & invoice	Sales file
Admin	View report request	Generate sales report	Report summary	Manager
Admin	Enter/update vehicle data	Update vehicle information	Updated vehicle record	Vehicle table
Customer	Submit feedback form	Store feedback	Feedback recorded	Feedback file
Admin	View feedback section	Retrieve feedback	Feedback displayed	Feedback viewer (admin)

7.6 Structure Chart



7.7 System Architecture Diagram



The HASTA Car Rental System is based on a 3-tier web-based system architecture that organizes the system into three fundamental layers: User Interface Layer, Business Logic Layer, and Data Storage Layer. This layer division makes the system more secure, efficient, scalable, and maintainable.

1. User Interface Layer (Frontend)

It is the highest level at which users access the system through a web browser. It offers an interface between two categories of users: Customers (students) and Administrators (managers/staff).
The primary interfaces are:
Login/Register Page – where people register or log in
Booking Form - where clients choose vehicles and rental periods
Booking Extension Page - allows customers to book extra rental time
Payment Page – amount to be paid is determined and validated
Customer Feedback Form - for customers' review
Admin Dashboard – where the administrators can edit car information, run reports, and search for feedback
It deals with only display logic and interacts with Business Logic for processing.

2. Business Logic Layer (Application Server)
This is the system's central processing layer. It provides all system functionality and logic required to facilitate operations. Each module is tasked with a specific function:

Authentication Module - Facilitates user registration and login. It validates user credentials and handles sessions.
Booking Module – Manages car choice, date input, and confirmation of booking.
Booking Extension Module - Enables customers to extend rental duration and updates the calendar accordingly.
Simulated Payment Processor – Computes rental charge, simulates approval of payment, and triggers generation of invoice (no actual payment gateway is used).
Feedback Module – Records and saves feedback from customers and displays it for admins.
Car Management Module – Used by admins to update the car details, status, and availability of the vehicles.
Sales Reporting Module – Enables the generation of summary sales reports based on payment records.
Each of these modules interacts directly with the corresponding database(s) located in the data layer.
3. Data Storage Layer (Database Tier) It is responsible for securely storing all of the information used by the system. It consists of five separate databases, each of which handles a particular set of information:
User Database – Stores all the admin and customer account details (from registration and login).
Car Database - Contains car information such as model, license number, rental price, and availability.
Booking Database - Tracks all bookings, rental periods, and extensions.

Sales Database - keeps payment history, charge grand totals, and simulated bills.
Feedback Database – Contains all customer ratings and reviews submitted through the system.
These databases are accessible only by the business logic layer for reasons of data integrity and security.

System Flow and Interaction

The Customer logs on through the login page, which is handled by Authentication Module.
Upon logging into their respective domains, they can reserve an automobile via the Booking Module, which interacts with Vehicle and Booking databases.
If they want to prolong their reservation, the Booking Extension Module alters the Booking Database.
The payment is made by the customer using the Simulated Payment Processor, which logs the transaction into the Sales Database.
After the customer has utilized the service, he/she can give feedback through the Feedback Module.
An Admin logs into the Admin Dashboard to conduct car information updates through the Car Management Module, or to see reports through the Sales Reporting Module.

This architecture is chosen because:

It separates things - frontend deals with UI only, backend deals with logic, and storage is left to the database.
It is scalable — any individual module can be expanded or updated independently.
Safe — direct user interaction with information is prohibited. It corresponds to the actual running of an advanced online system.

8.0 System Wireframe (input and output design)

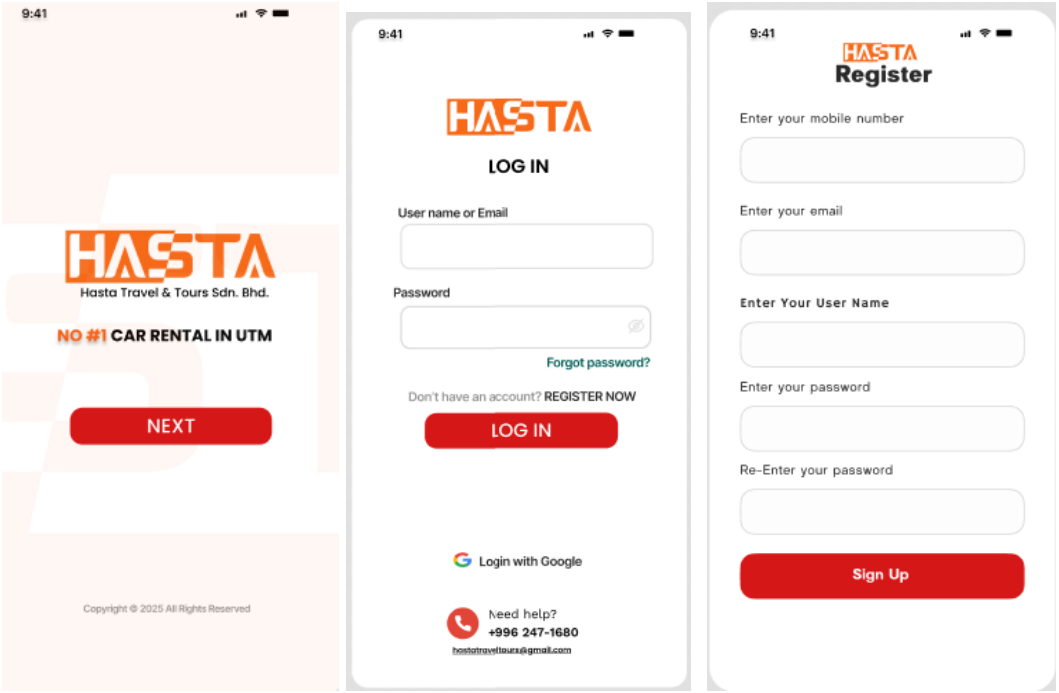
Full Link:

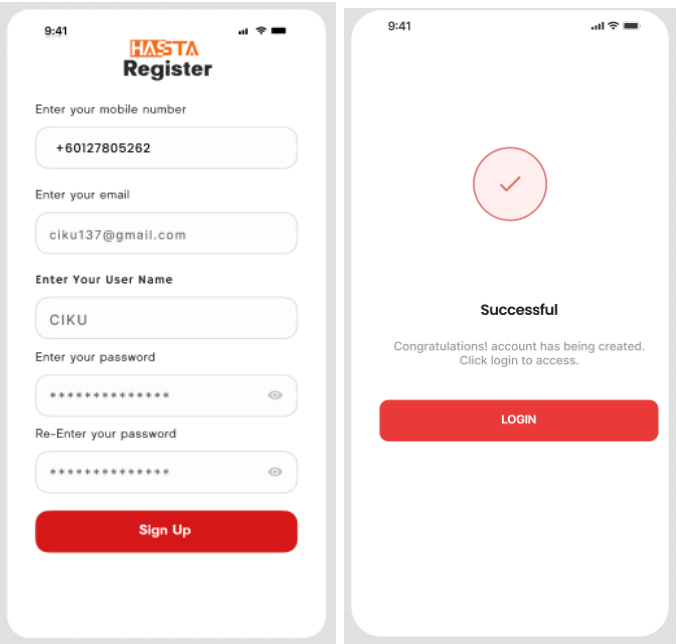
:

https://www.figma.com/design/rhh0CkJlbu5OoovpbCYDaC/HASTA-CAR-RENTAL?node-id=0-1&t=1DHvW9YlmV2apqFx-1

CUSTOMER

CUSTOMER REGISTER PROCESS:

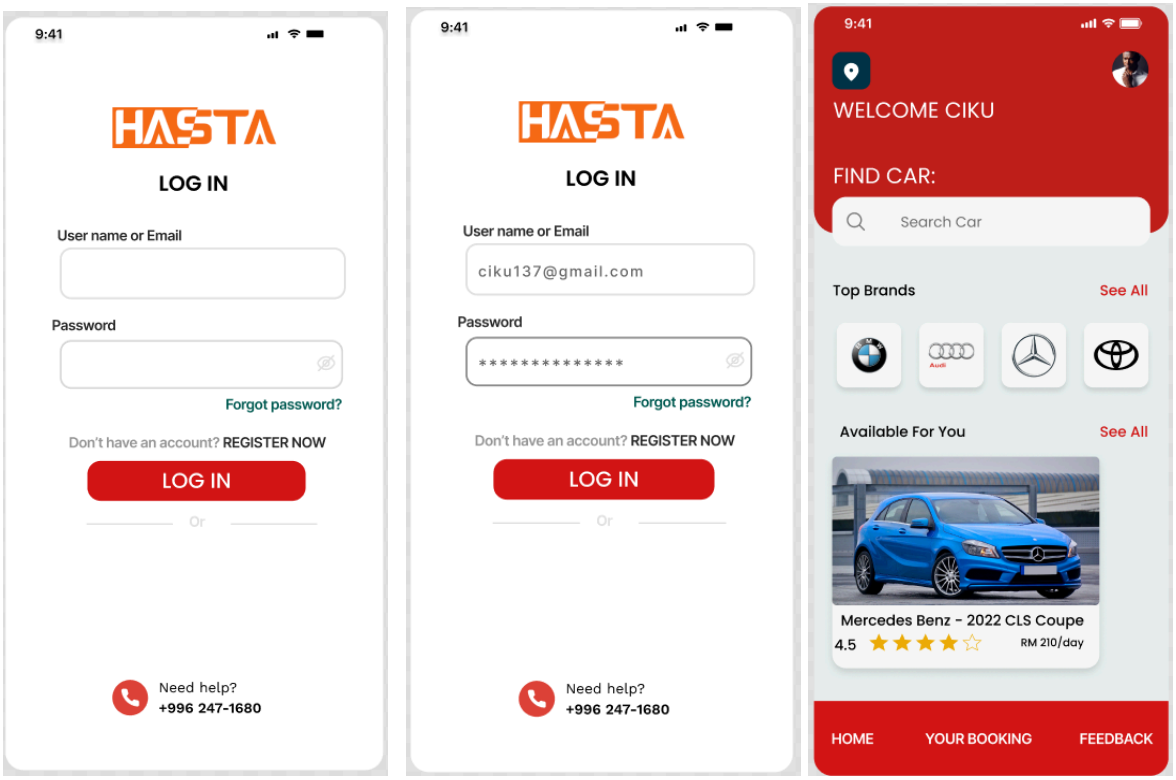




Customer register process:

A first-time user must establish a customer account in order to access the customer module. A customer must click on " REGISTER NOW " and then fill out the following form. Once all of the essential information is entered, the client must click sign up and get a successful message and a button to login to his account.

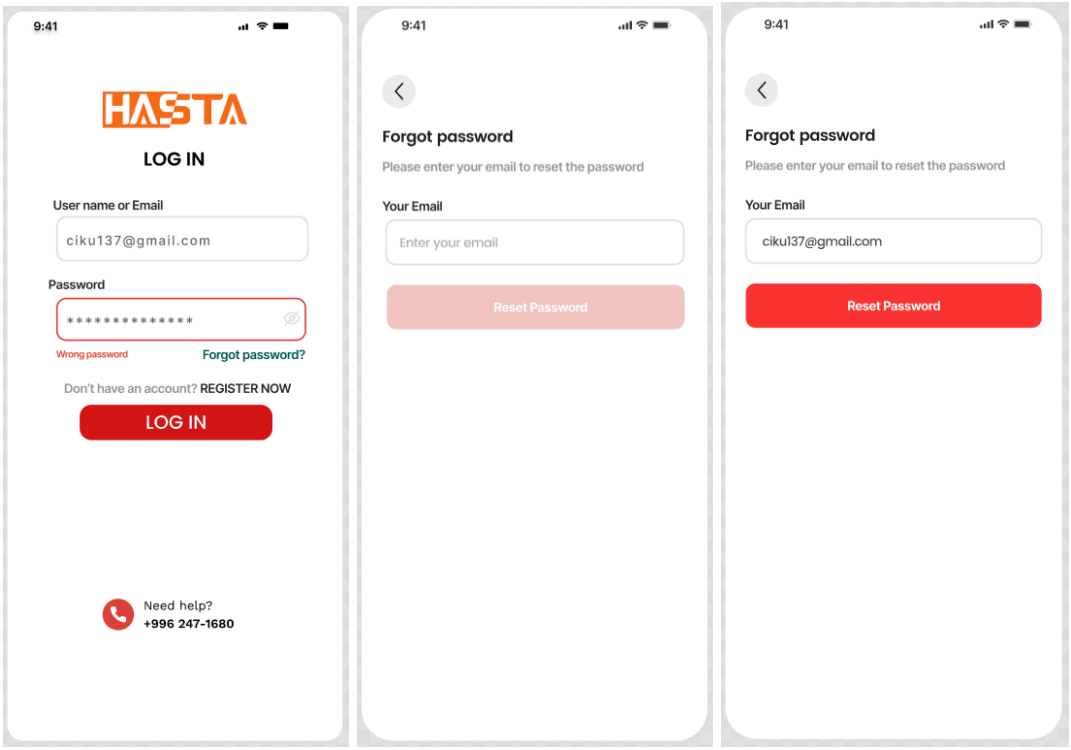
USER LOGIN PROCESS

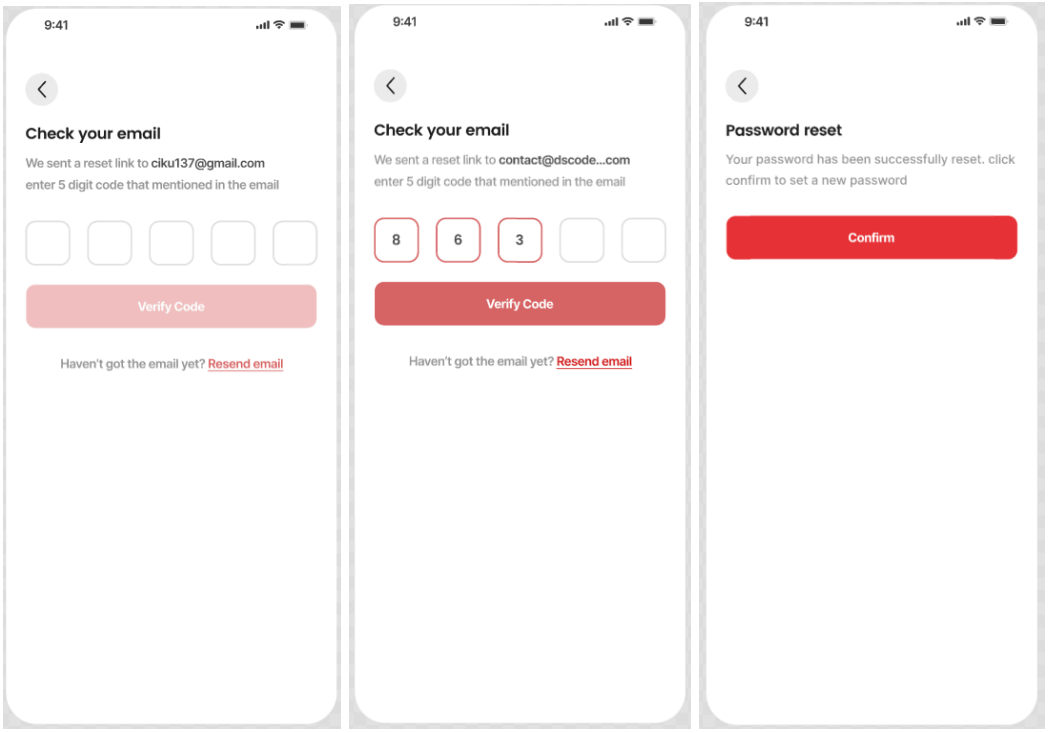


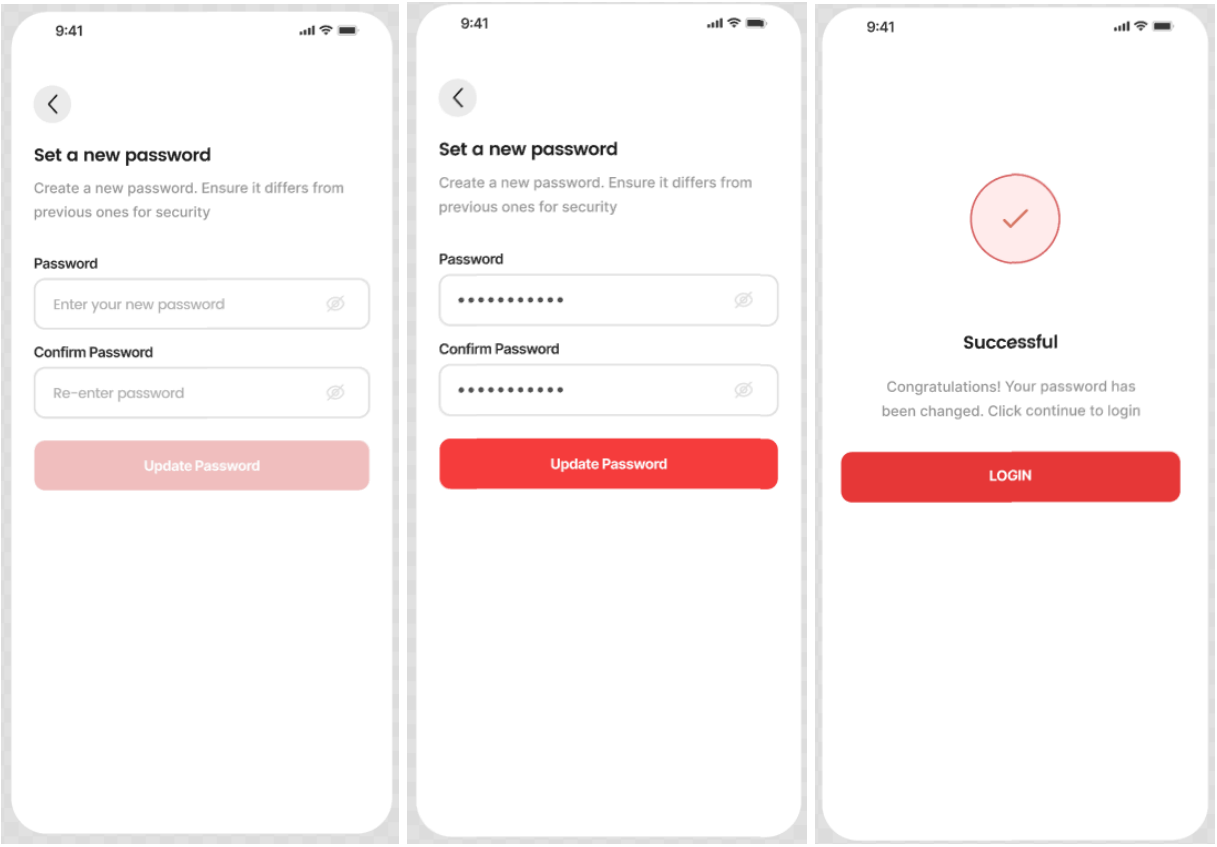
customer login process:

To access the system, the customer must enter their USERNAME OR EMAIL, as well as the PASSWORD that they have previously generated. After entering the requirements, the system will verify its credentials and, if TRUE, lead the client to its module; if FALSE, the customer will be prompted to provide the correct credentials.

USER FORGET PASSWORD:



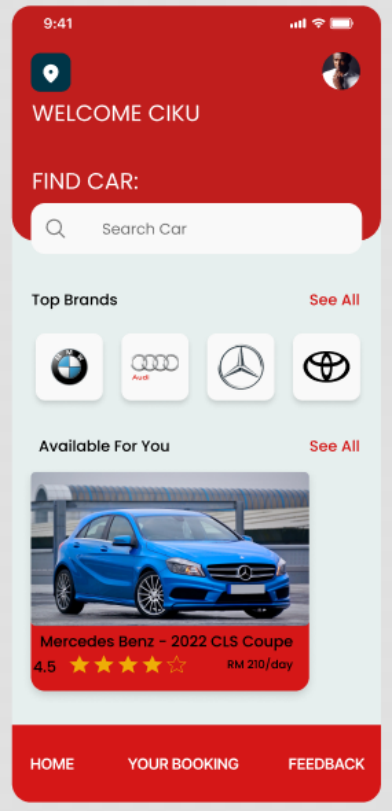


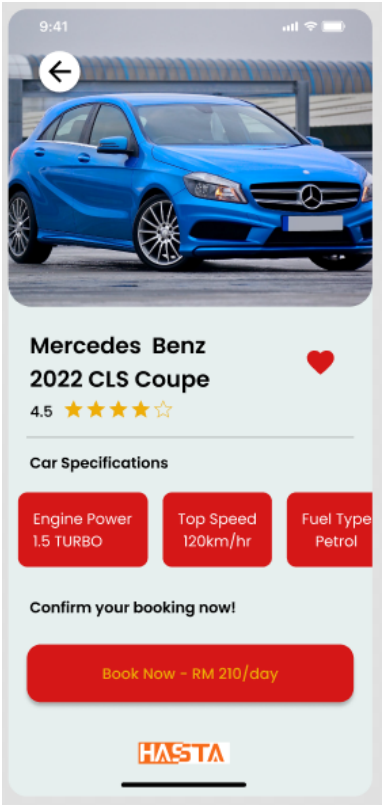


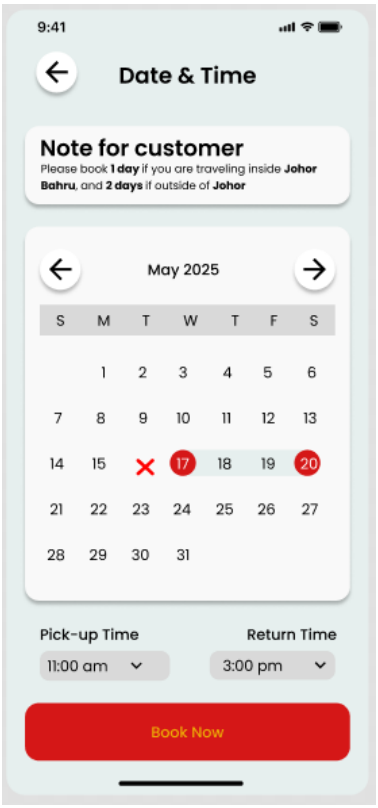
user forgot password process:

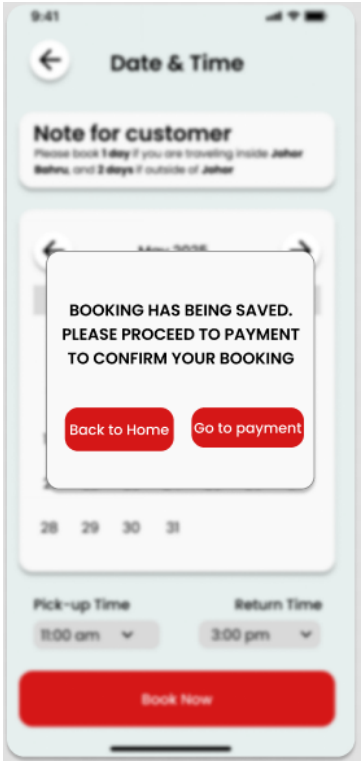
If a consumer forgets their password, they may recover their account by clicking "FORGET PASSWORD". When they click it, the system will prompt them for their Gmail account information and email them 5 CODE. If they get a code on their Gmail, it signifies they have an account there; otherwise, it suggests they are using the incorrect account. After entering the five-digit number, they will be able to reset their password and establish a new one for their account. After that, they will get a successful message and may attempt to log in again by clicking the LOGIN button.

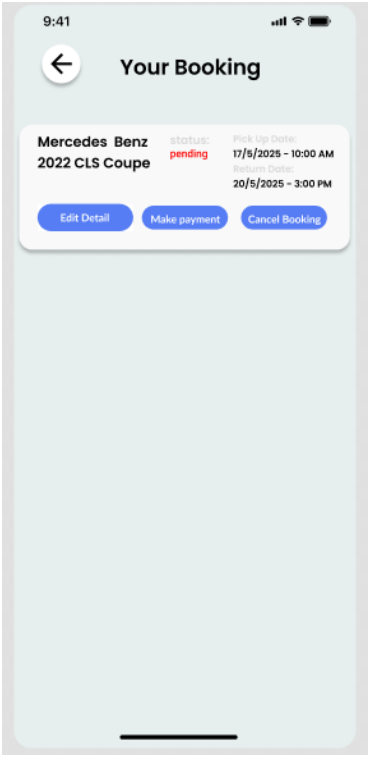
USER BOOK A CAR AND VIEW CAR AVAILABILITY:







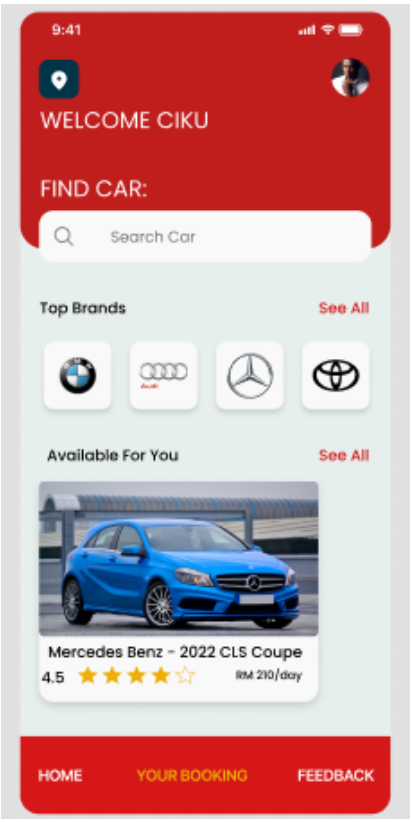


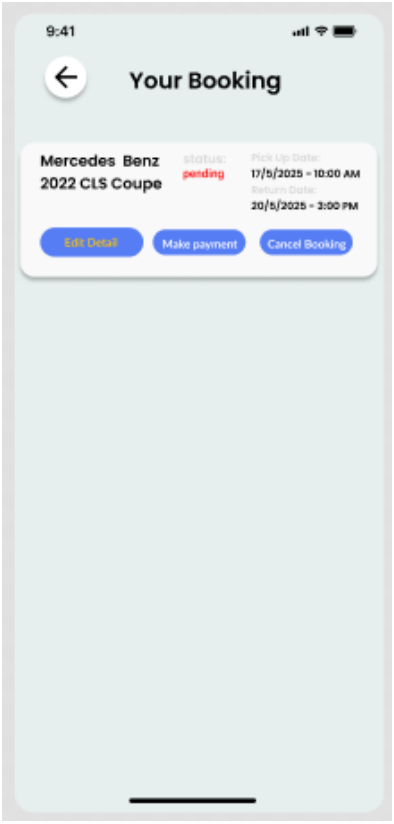


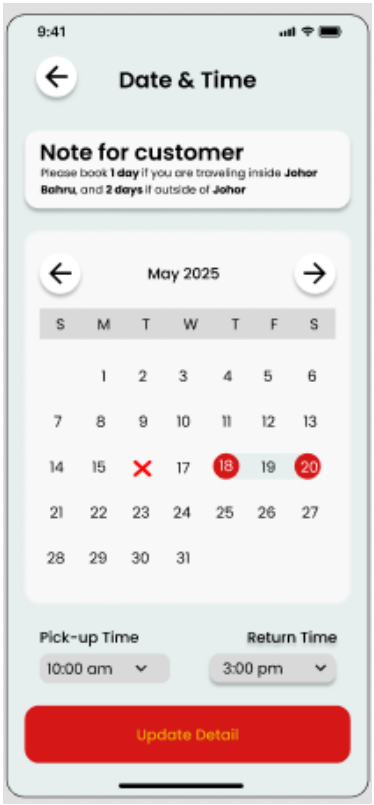
user book a car and view car availability:

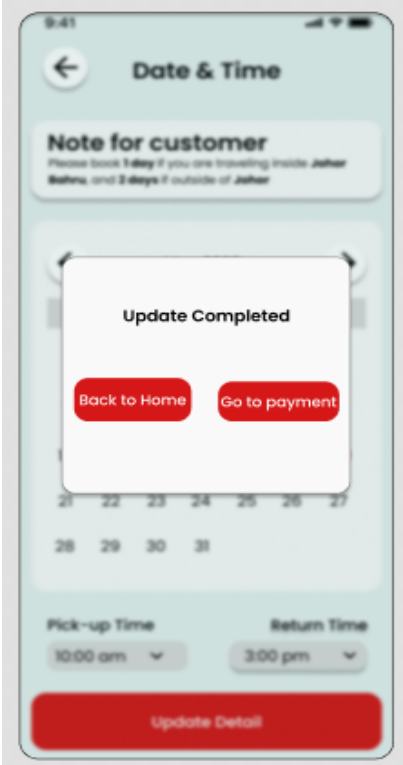
To book a car, customers must first choose their preferred car and click on it to access more information about the car, including engine type, top speed, and fuel type. They then click the "BOOK NOW" button to view availability and select the start and end dates, pickup and return times. After filling out the requirements, customers click the "BOOK NOW" button to save their booking details. A pop-up message will appear asking customers to back to the main page or proceed to payment. If they choose back to home, their booking is saved but the status is PENDING, while if they choose go to payment, they proceed to the payment process.

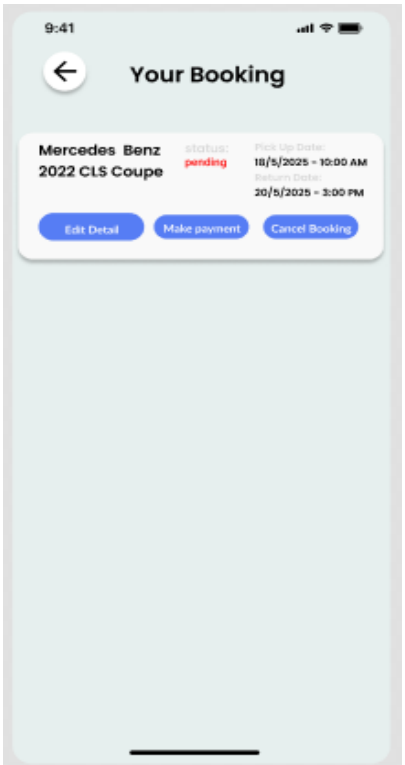
CUSTOMER EDIT BOOKING DETAIL:







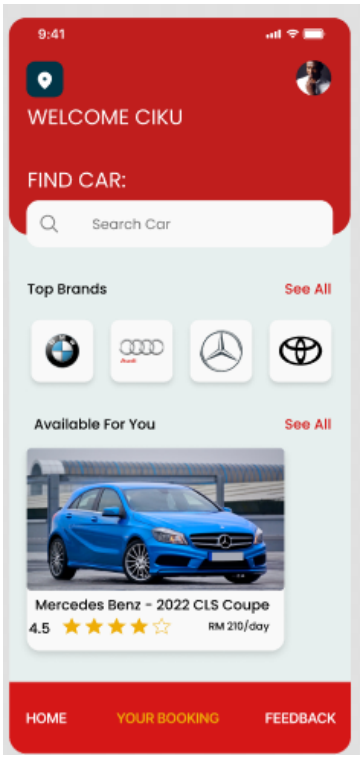


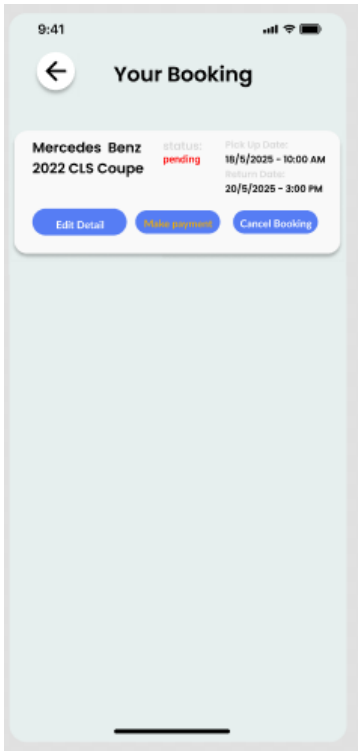


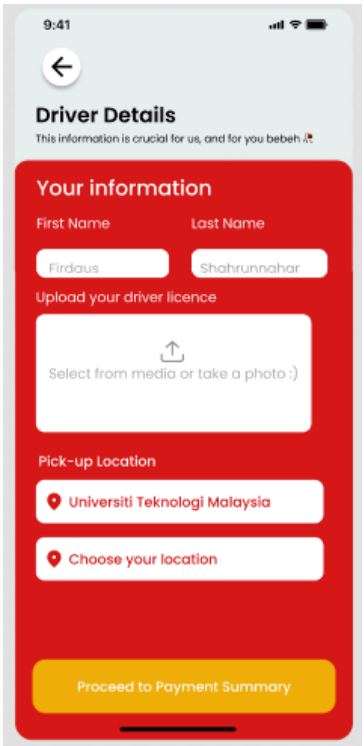
CUSTOMER EDIT BOOKING DETAIL:

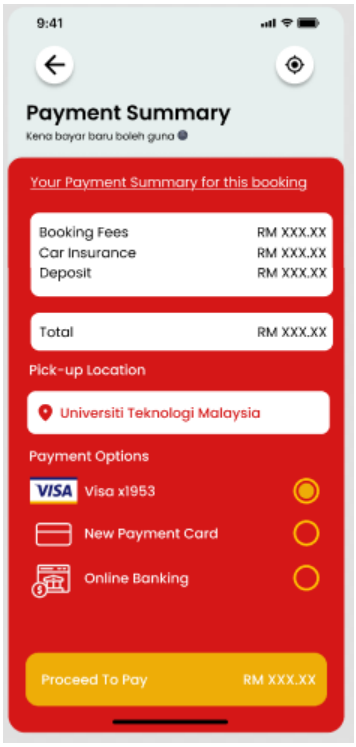
This approach allows customers to change their booking details if they have not yet made a payment. To modify the detail, first click the "YOUR BOOKING" button below, followed by the "EDIT DETAIL" button. After that, they will be sent back to examine the availability, but their input is already there; all they need to do is alter it depending on what they want to edit. After changing the date, customers must click the "UPDATE DETAIL" option, and a pop-up message will appear indicating that their booking has already been updated.

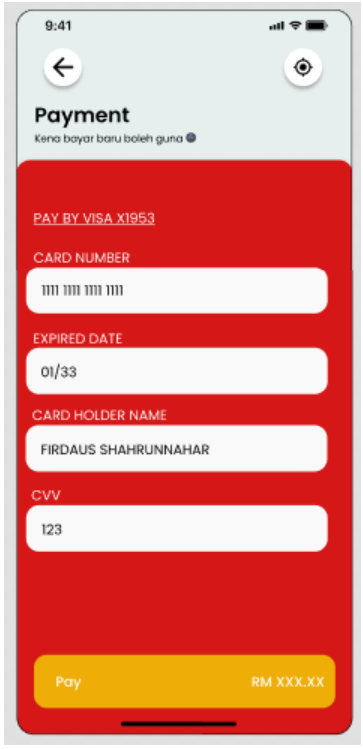
CUSTOMER MAKE A PAYMENT:

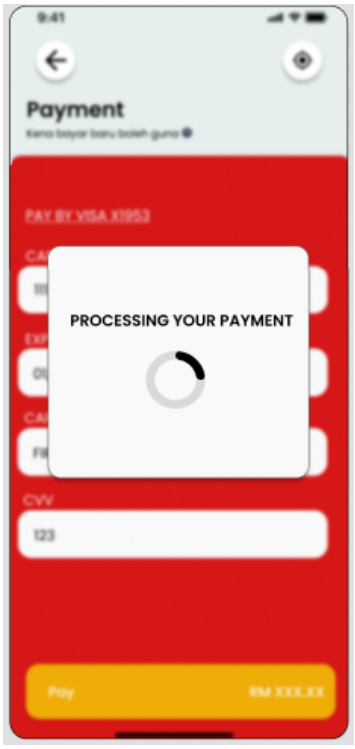


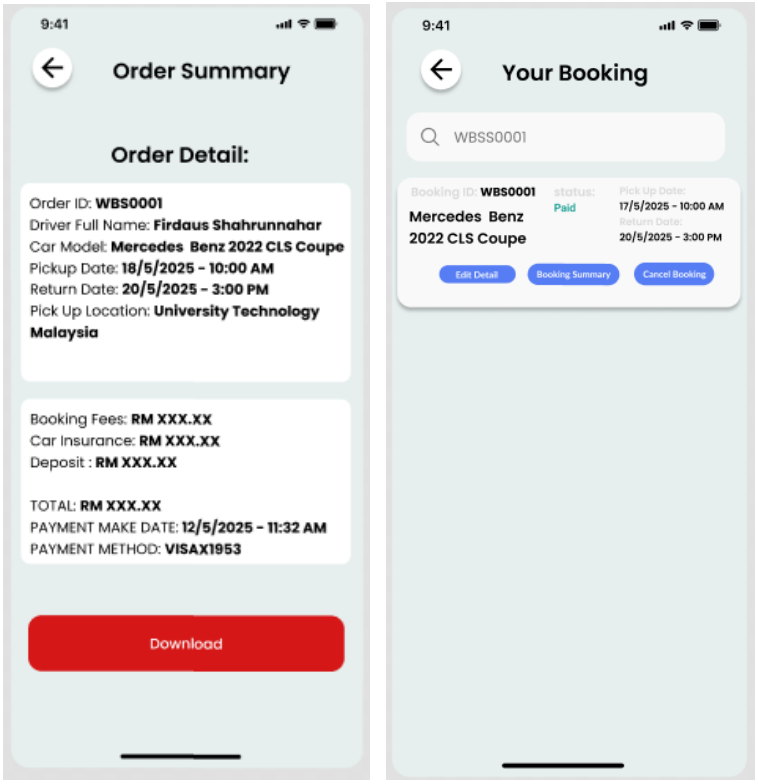








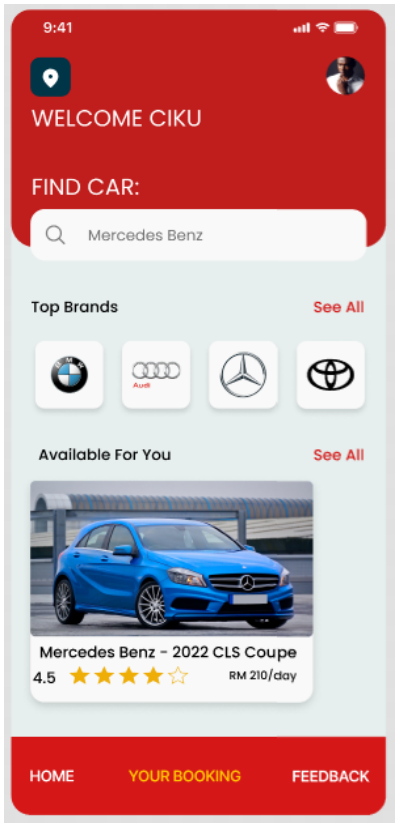


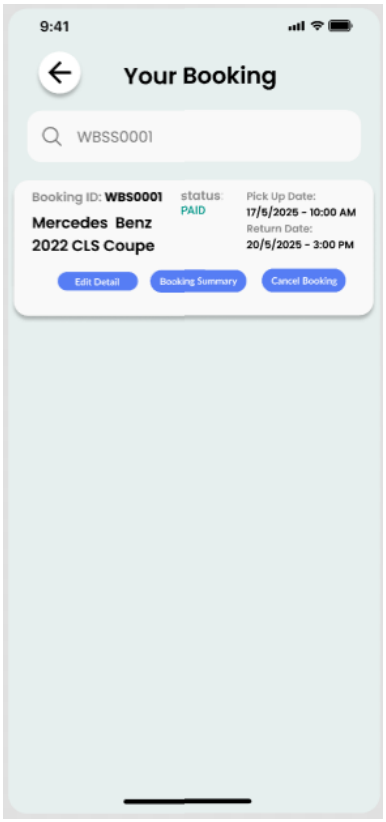


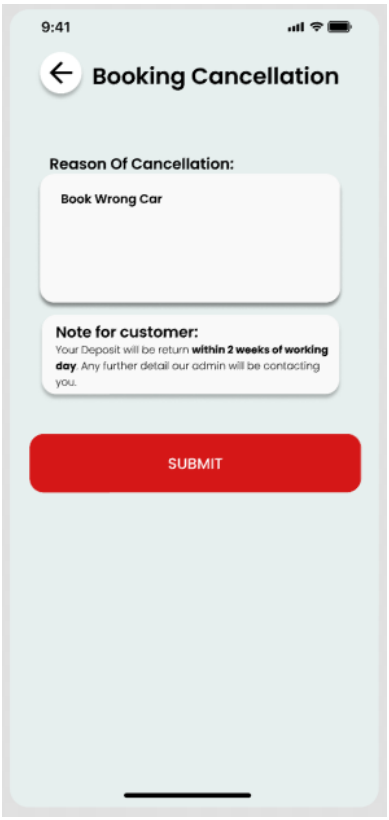
ON CUSTOMER MAKE A PAYMENT:

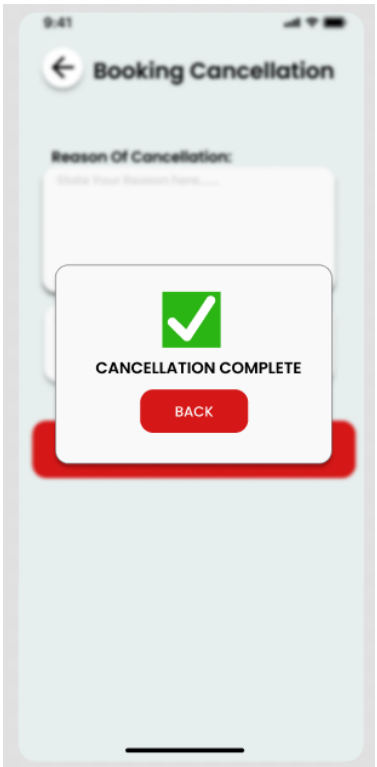
Customers can view their booking or directly proceed to payment after booking by clicking the "YOUR BOOKING" button. Next, they must enter driver information and select "PROCEED TO PAYMENT SUMMARY" to see the total and payment details. They can select their desired payment option and click "CONTINUE TO PAYMENT" to finalize the booking fees. Once the payment is completed, customers obtain a summary or receipt that they can download, and their booking status will be updated to PAID.

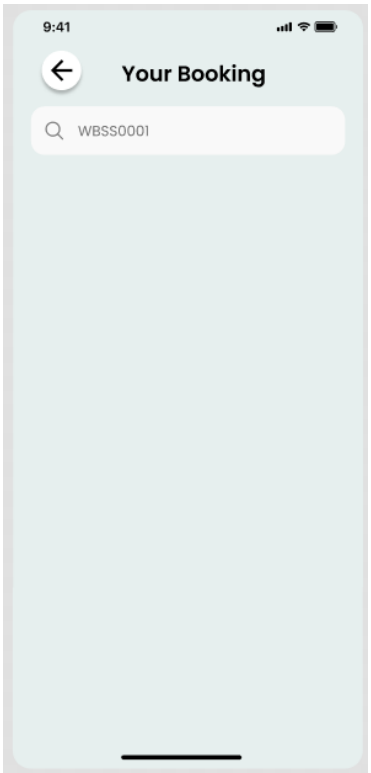
CUSTOMER CANCEL BOOKING:







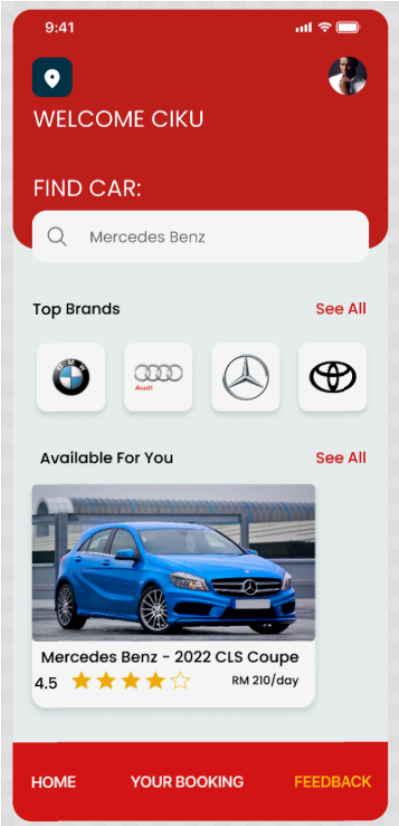


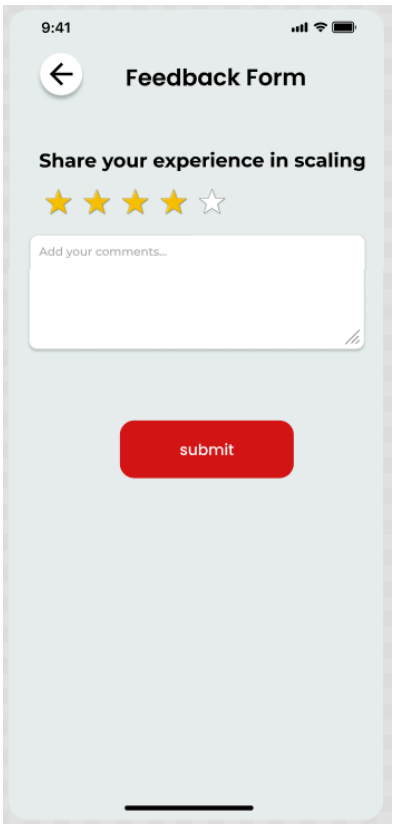


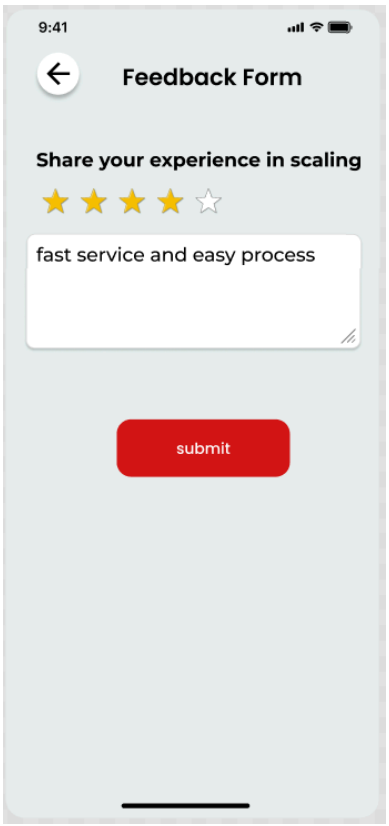
CUSTOMER CANCEL BOOKING:

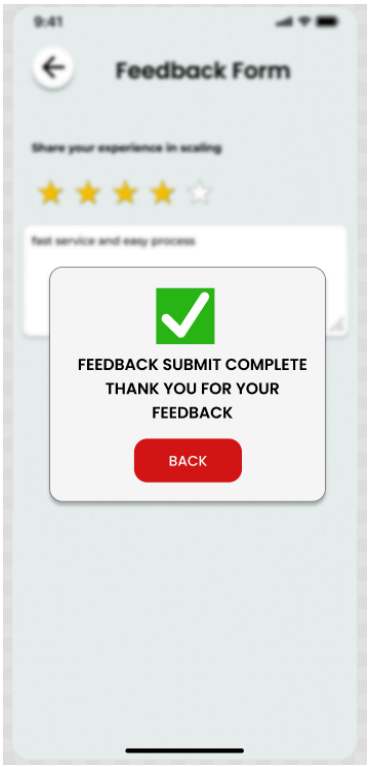
To cancel a booking, the customer should access their “YOUR BOOKING” page and click on the “CANCEL BOOKING” button. They will be directed to the booking cancellation page where they must provide the reason for their cancellation. Once the requirements are filled and submit is clicked, a pop-up message will appear asking if they truly wish to cancel their booking. Clicking yes will result in the cancellation and removal of their booking. The payment they have already made will be refunded within 2 weeks of working days

CUSTOMER WRITE A FEEDBACK:







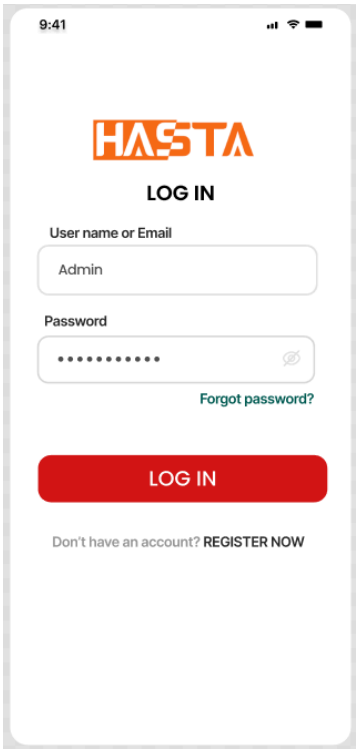


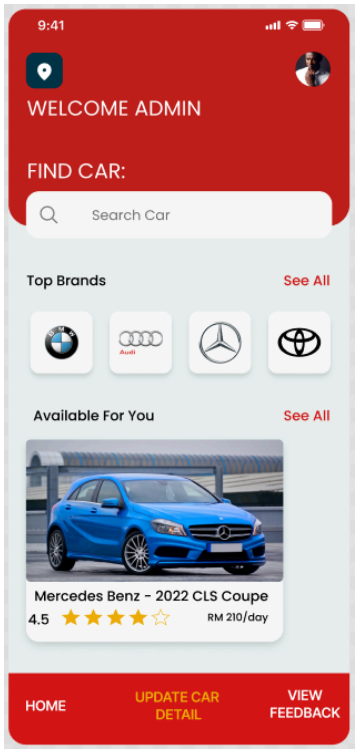
CUSTOMER WRITE A FEEDBACK:

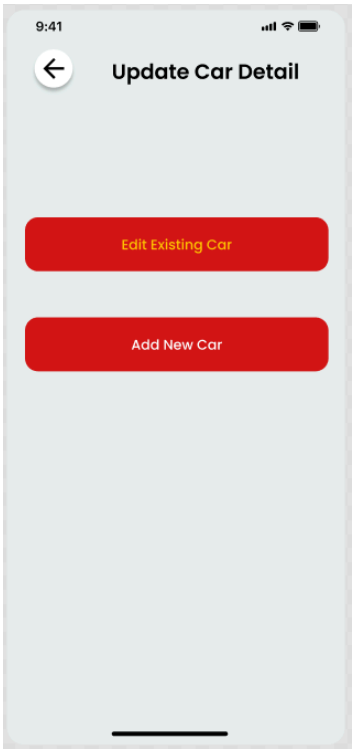
To provide feedback, customers must go to the feedback page. On the page, they need to share their experiences with scaling and provide their feedback on the system. Then they must click submit, and a pop-up message will show up.

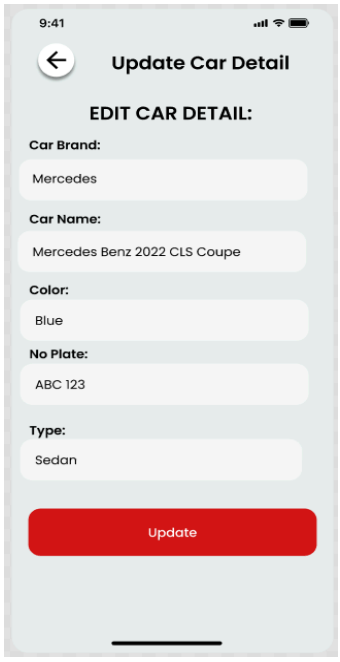
ADMIN:

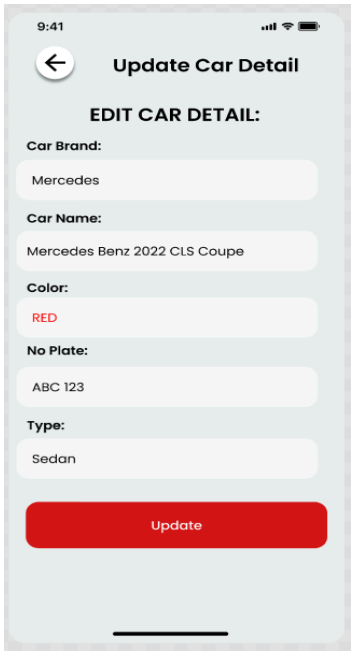
ADMIN EDIT EXISTING CAR DETAIL:

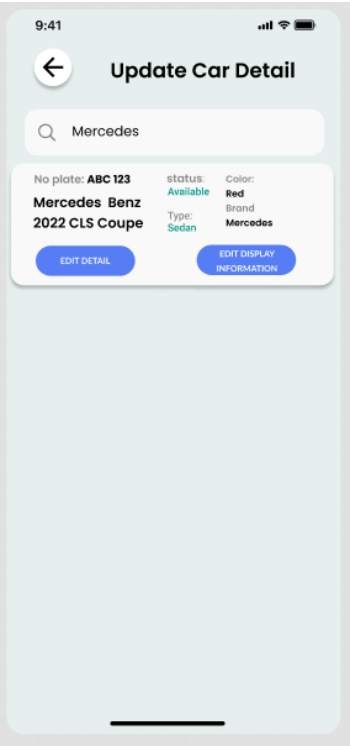








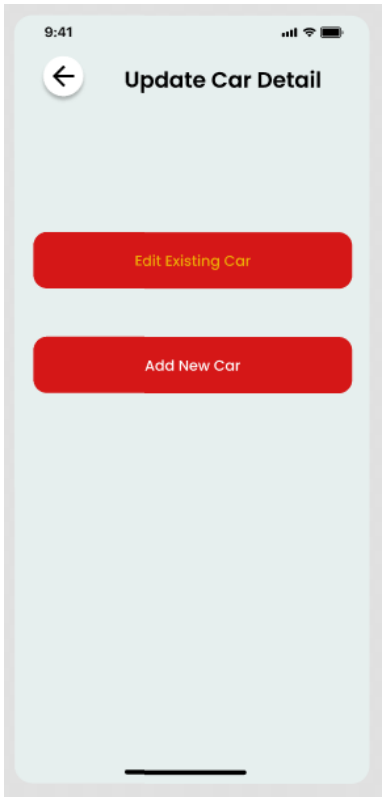


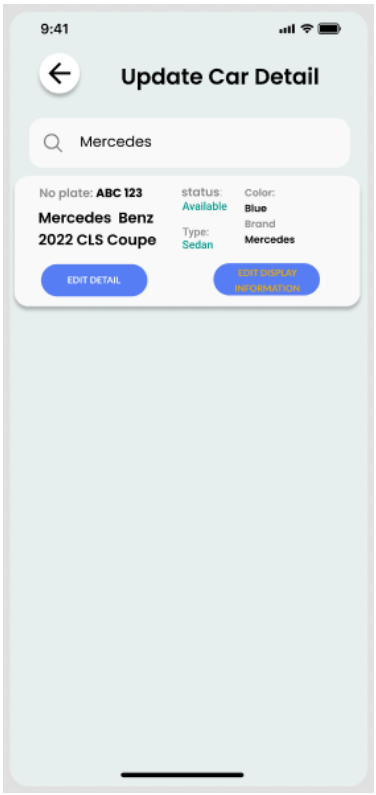


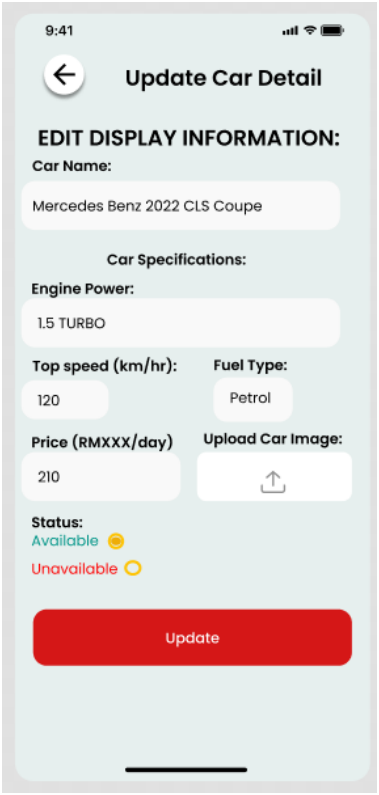
ADMIN EDIT EXISTING CAR DETAIL:

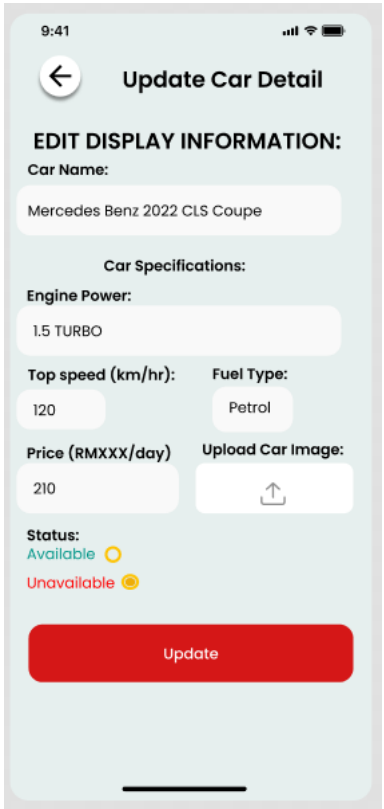
The administrator can modify existing car information by visiting the edit existing car page. Upon accessing the page, the details of the current car are already displayed, but users can modify and refresh the information in the system

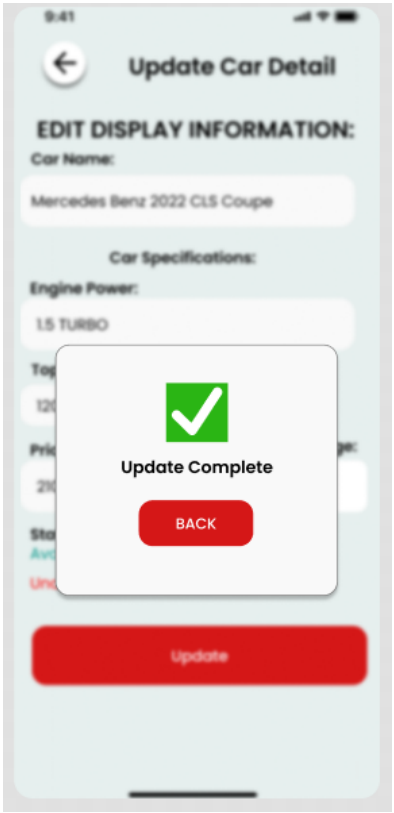
ADMIN EDIT EXISTING CAR DISPLAY INFORMATION:

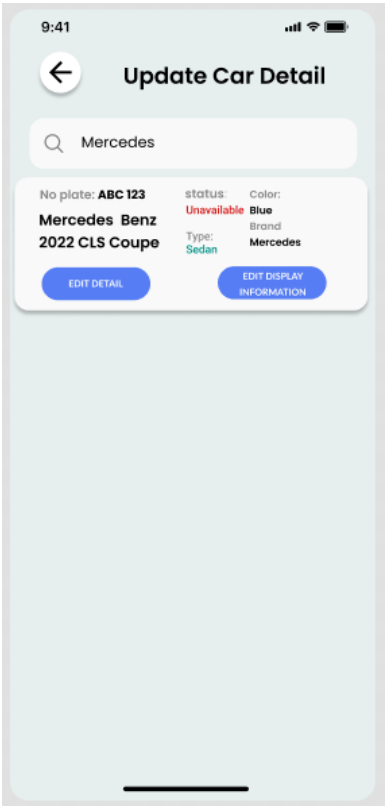


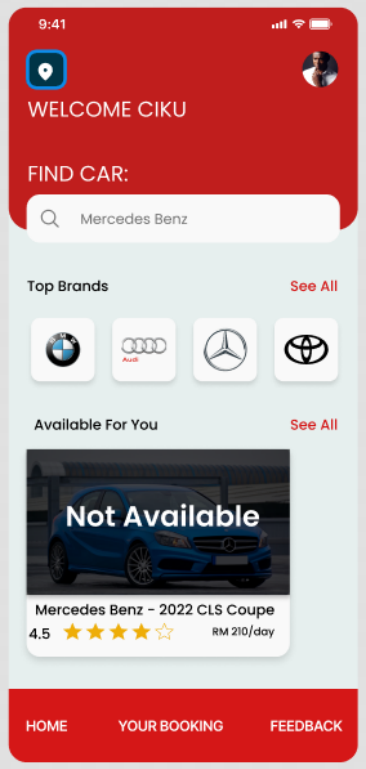








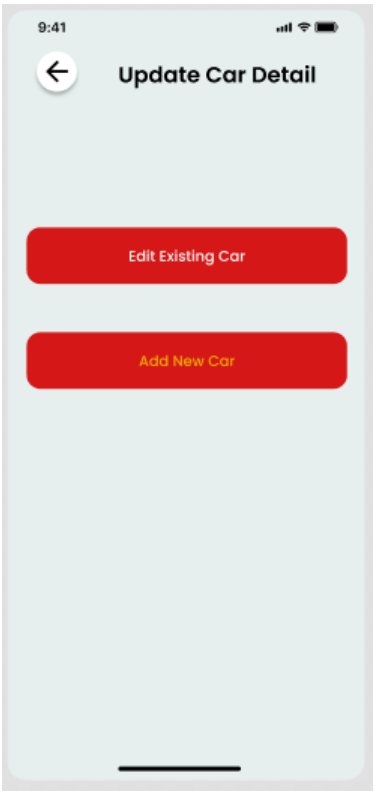


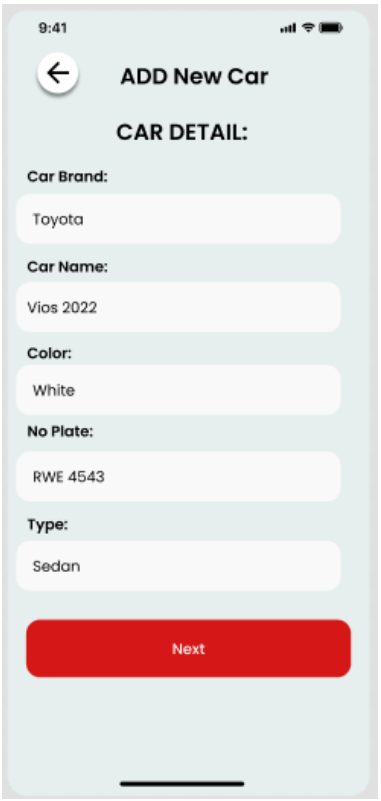


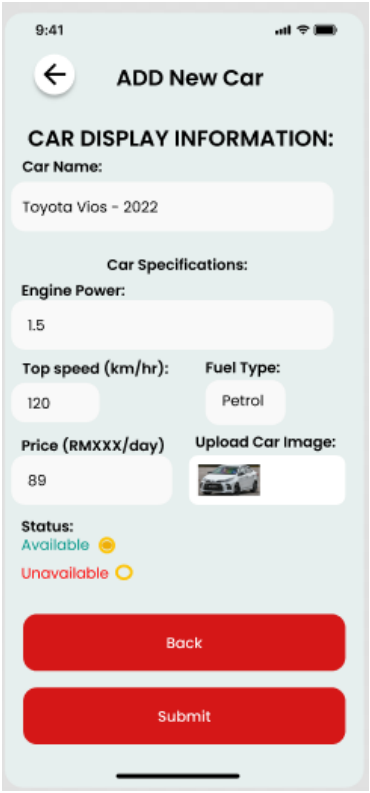
ADMIN EDIT EXISTING CAR DISPLAY INFORMATION:

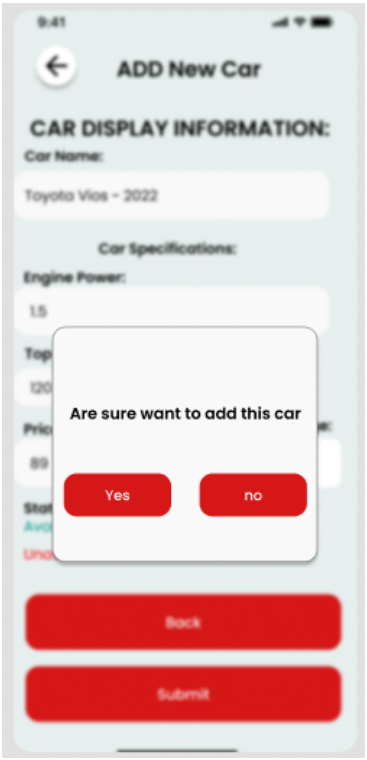
The displayed information consists of the car details shown to customers when they wish to book a vehicle. The admin can modify the display information by visiting the edit display information page. The system currently stores the available information, but the admin has the option to modify it.

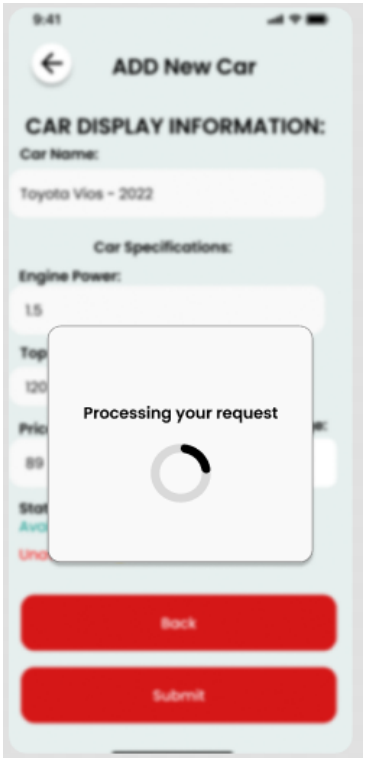
ADMIN ADD NEW CAR:

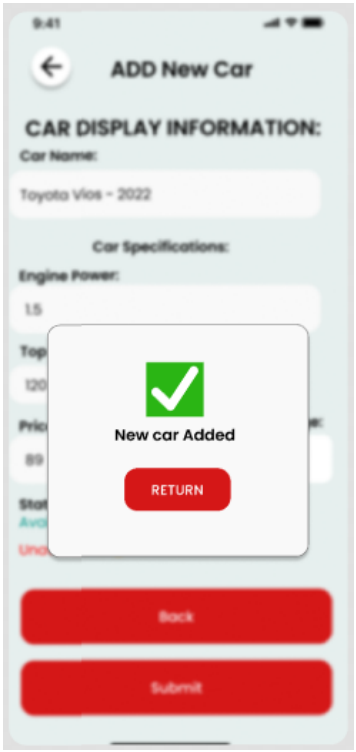


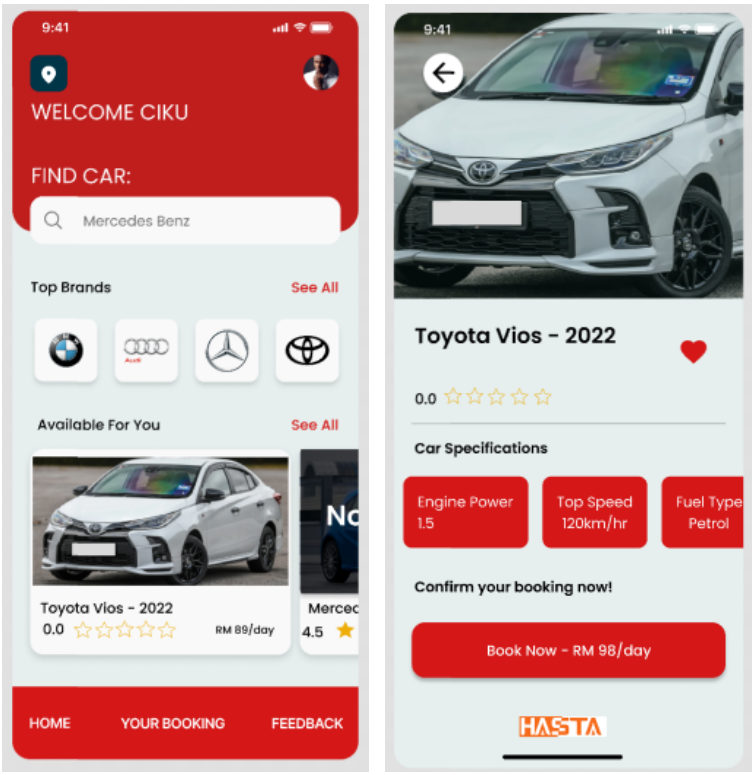








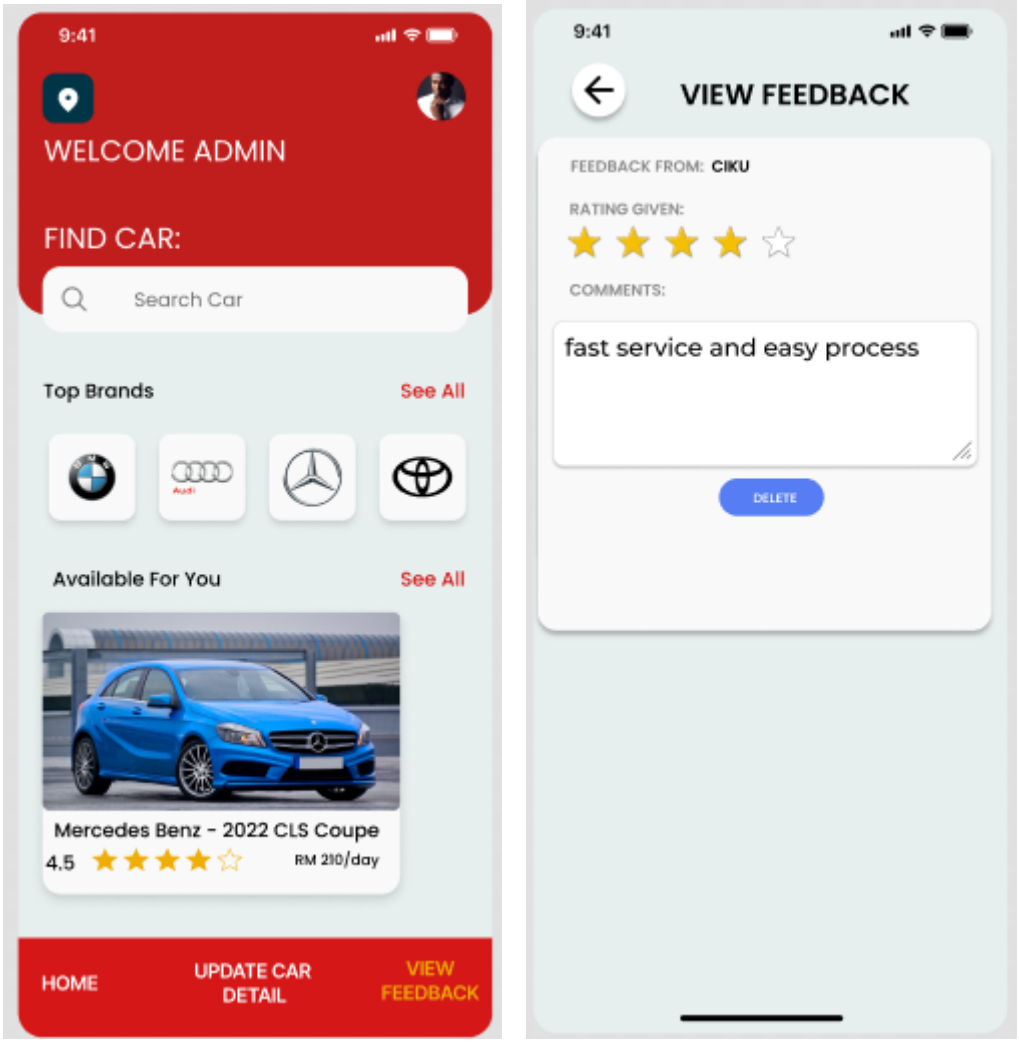




ADMIN ADD NEW CAR:

The admin can add a new car by navigating to the update car details page, selecting the option to add a new car, after which the system will prompt the admin to complete the necessary requirements to add the new car. Once all the requirements are fulfilled, the new car will be added for display and available for customer booking.

ADMIN VIEW CUSTOMER FEEDBACK:

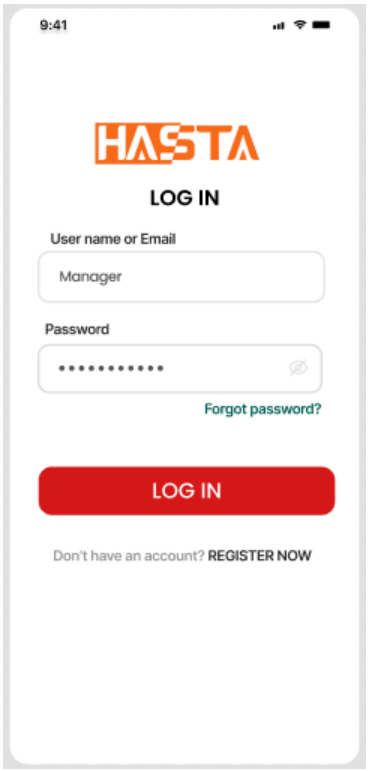


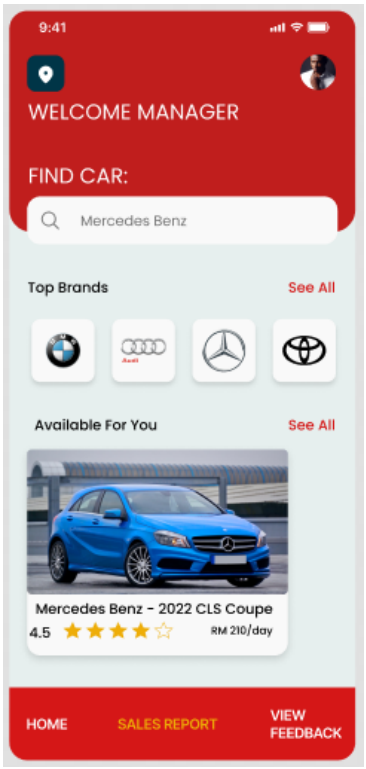
ADMIN VIEW FEEDBACK FROM CUSTOMER:

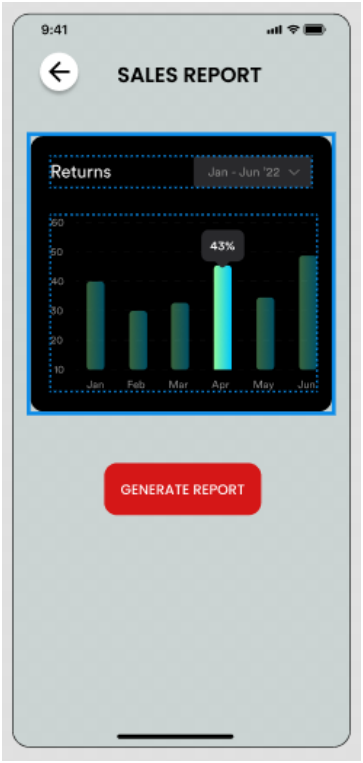
The admin can see customer feedback by accessing the feedback view page. On that page, the system will show the feedback written by the customer. The admin will have the choice to either delete the feedback message or to retain it.

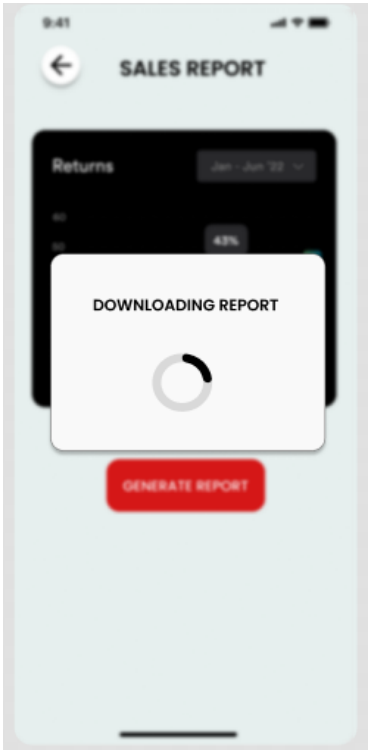
MANAGER:

MANAGER GENERATE REPORT:









MANAGER GENERATE REPORT:

The manager can view their company's overall sales by accessing the sales report page. From the report display, the manager can produce a sales report to summarize the version.