



System Analysis and Development
Group Project
PRO220130
Proposal Document

Lesi Parking Management System

G.D Shanilka UGC0122033

P.V.A Perera UGC0122025

M.H.G.D Mapa UGC0122020

Mr. Chandana Deshapriya

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Declaration

The Lesi Parking System is designed to simplify parking management in Sri Lanka by enabling users to find, book, and pay for parking spaces online. This project aims to support both commuters and landowners with features like real-time availability, automated entry/exit, secure payments, Additionally, it promotes environmentally friendly parking incentives.

The system will be developed to meet high standards of performance, scalability, security, and usability. Our team commits to delivering a reliable and user-friendly solution by the project deadline.

Abstraction

The Lesi Parking System is designed to address the increasing demand for efficient and accessible parking solutions in urban areas of Sri Lanka. This project set out to create an online platform that enables users to locate, reserve, and pay for parking spaces with ease. By analyzing the needs of commuters, tourists, and landowners, we developed a system with key features including real-time availability updates, automated entry and exit processes, user accounts with loyalty programs, and incentives for environmentally friendly practices. The platform was developed using a combination of frontend and backend technologies, ensuring a seamless and secure user experience. Extensive testing was conducted to verify system functionality, usability, and reliability. The results demonstrate that the Lesi Parking System effectively reduces parking congestion, enhances user convenience, and provides a reliable income stream for landowners. We conclude that this system not only simplifies parking for users but also contributes positively to urban infrastructure by promoting sustainable parking practices. The Lesi Parking System is expected to be a valuable tool for both individuals and communities, supporting the growing need for smart city solutions in Sri Lanka.

Acknowledgments

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List of Acronyms

ER Diagram – Entity Relationship Diagram

Chapter 1 - Introduction

The **Parking Management System** project seeks to address the growing parking challenges faced in urban areas of Sri Lanka, where increased vehicle ownership has led to congestion and inefficiencies in finding available parking spaces. This digital solution will enable users to easily locate, reserve, and pay for parking spots through a user-friendly mobile application and web interface.

By incorporating real-time tracking, online payments, and advanced space monitoring technologies, the system aims to enhance the parking experience for drivers while also providing valuable insights for parking facility operators. This comprehensive approach not only promotes convenience and efficiency but also contributes to reducing traffic congestion and environmental impact, fostering a more sustainable urban mobility framework. Ultimately, this project aims to create a more organized and accessible parking ecosystem that benefits both users and city infrastructure.

1.1 Project title

Lesi Parking Web site

In Sri Lanka, finding a parking spot, especially in busy areas, is often difficult and time-consuming. With the growing number of vehicles on the road, people face daily struggles locating a safe and nearby place to park. Despite the demand, there isn't a proper system to help drivers find and book parking spaces easily. Our project aims to solve this problem by developing a *Parking Management System*, which will allow users to quickly find, book, and pay for parking online, saving them both time and effort.

This system will help in several key areas:

- **Making Parking Easier for Commuters and City Residents:** Many people waste valuable time looking for parking, especially in crowded city centers. Our system will show available spots in real time, allowing users to find and book parking right from their mobile device or computer. This will make parking more convenient and reduce stress.

- **Helping with Parking for Events and Busy Areas:** Places like shopping malls, hospitals, and event venues often face heavy parking demand. With our system, people can book a spot before they arrive, making it easier to plan trips during busy times and avoid last-minute struggles.
- **Supporting Tourism:** As more tourists visit Sri Lanka, especially in popular spots, finding parking can be challenging. Our system will help tourists locate parking easily, providing them with a smoother experience and encouraging more travel around the country.
- **Allowing Property Owners to List Parking Spaces:** People or businesses with unused parking spaces can list them on our platform, giving drivers more options while also helping property owners earn extra income. They can set their own rates and availability, making it a flexible way to share resources.
- **Reducing Traffic and Fuel Wastage:** Often, drivers end up driving around in circles looking for parking, which uses extra fuel and adds to traffic. By using our system, drivers can go directly to an available spot, saving fuel and reducing unnecessary congestion.

Our *Parking Management System* will make parking easier, faster, and more organized, benefiting drivers, businesses, tourists, and property owners alike.

1.2 Motivation

With rising vehicle numbers in Sri Lanka, finding parking is increasingly difficult, causing wasted time, fuel, and stress. Lesi Parking aims to simplify this by offering a digital platform for easy parking search, booking, and payment. This solution will reduce congestion, support sustainable commuting, and make parking more accessible and efficient for drivers and property owners alike.

1.3 Aim

To develop a scalable and efficient Parking Management System that simplifies parking for users by enabling easy discovery, booking, and management of parking spaces, while promoting sustainable urban mobility.

1.4 Objectives of the Project

1. Real-Time Updates and Space Monitoring:

- Implement sensors and IoT integration for live tracking of available spots, updating the system automatically when spaces become occupied or free.
- Enable users to see real-time updates on space availability, reducing parking search time and congestion in high-traffic areas.

2. Automated Entry and Exit Management:

- Integrate automated entry and exit controls, like license plate recognition or QR code scanning, to reduce the need for physical tickets or manual validation.
- Allow seamless entry/exit for users with pre-booked spots, ensuring a streamlined experience that reduces wait times at parking facilities.

3. User Account and Loyalty Features:

- Allow users to create accounts for tracking parking history, payments, and preferences, making it easier for them to manage bookings and earn loyalty rewards.
- Encourage user retention by offering rewards or discounts for frequent use, which could increase customer loyalty and usage.

4. Advance Booking and Reservations:

- Allow users to book parking spaces in advance, ensuring they have a guaranteed spot upon arrival and reducing last-minute hassles.
- Include a flexible booking management system so users can modify or cancel reservations as needed.

5. Responsive Web pages

- Ensure the Parking Management System features web-responsive pages that automatically adjust for different screen sizes, offering a seamless experience across desktops, tablets, and smartphones.
- Prioritize mobile-first design to enhance usability on mobile devices, ensuring users can easily access key features like parking search, booking, and payment.

1.5 Scope of the Project

The Lesi Parking Management System will provide a comprehensive digital platform to simplify parking in urban areas of Sri Lanka. It will allow users to create accounts, search for parking spots, and make advance reservations with real-time availability updates. Secure online payments will be supported, offering both one-time and subscription options. Automated entry and exit features will streamline the parking experience. Property owners can list and manage their spaces, while administrators will have tools for managing users, transactions, and system compliance. The system will also encourage sustainable practices by providing incentives for electric vehicles. Additionally, reporting and analytics features will help parking facility owners optimize space usage and track performance. This project scope aims to make parking more accessible, efficient, and environmentally friendly for drivers, property owners, and city infrastructure.

1.6 Summary

The Lesi Parking Management System project addresses the challenges of finding and managing parking in urban Sri Lanka by offering a digital solution that allows users to locate, book, and pay for parking easily. This platform aims to reduce the time, stress, and environmental impact associated with parking by providing real-time availability, automated entry/exit systems, and online payment options. The project promotes sustainable urban mobility through eco-friendly features, including incentives for electric vehicles and efficient parking space management.

The development process includes detailed design, implementation, and testing phases, with technologies such as vehicle number recognition for automated entry and exit, along with web development tools driving the system's functionality. With features for both drivers and property owners, the system ensures a seamless and efficient parking experience. The thesis chapters follow a structured approach, beginning with the problem and objectives, through methodology and implementation, and concluding with testing outcomes and recommendations. This project aims to create a more efficient, user-friendly, and sustainable parking experience.

Chapter 2 - Analysis

2.1 Explanation about the system using a Flow Chart

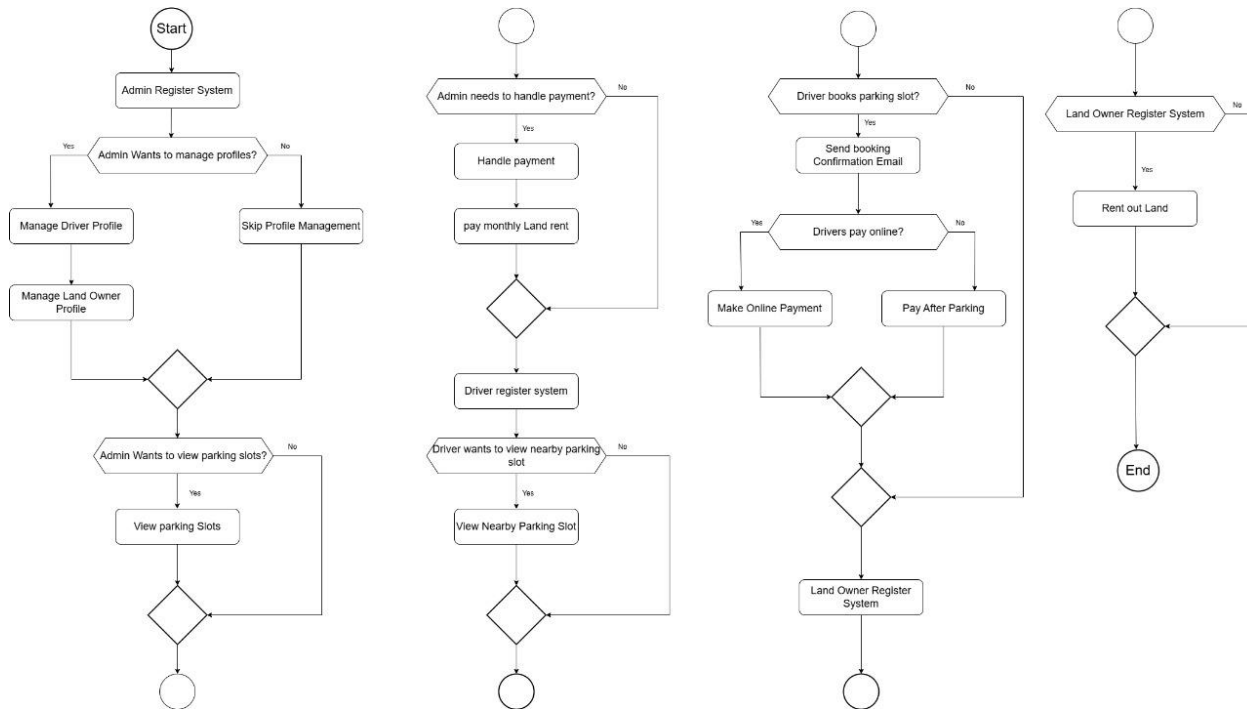


Figure 1 Flow Chart

1. Admin Control Center:

- The admin serves as the backbone of the system, ensuring smooth operations. They begin by registering on the platform, where they can oversee both driver and landowner profiles. This includes:
 - **Profile Management:** The admin has the flexibility to manage driver profiles (for users seeking parking) and landowner profiles (for those offering parking spaces).

- **Real-Time Parking Slot Monitoring:** The admin can view available parking slots in real time, which helps in coordinating bookings and optimizing slot usage.
- **Efficient Payment Management:** The admin handles payments, such as ensuring monthly land rent payments to landowners, making the platform financially sustainable.

2. Driver Journey:

- Drivers enjoy a streamlined experience from booking to payment. Key steps include:
 - **Convenient Booking & Confirmation:** Drivers can browse nearby parking options, choose a slot, and receive an immediate booking confirmation via email, enhancing reliability.
 - **Flexible Payment Options:** Drivers can pay for their slots in advance through online payment or choose to pay after parking, accommodating different user preferences.

3. Landowner Opportunities:

- Landowners can participate by registering to rent out their land for parking, turning unused spaces into a revenue source. The system guides landowners in listing their spaces and handling rental agreements with the admin's oversight.

This flowchart encapsulates a user-friendly system designed for seamless parking, helping drivers, landowners, and admins collaborate effortlessly. The flexible payment options, real-time updates, and organized profile management make Lesi Parking an efficient solution for urban parking challenges.

2.2 Review Similar Systems with References

Several parking management systems have been developed globally to address urban parking challenges, providing valuable insights for the development of the Lesi Parking Management System:

1. **Parkmobile (USA)**

Parkmobile allows users to find, book, and pay for parking through a mobile app, incorporating features like vehicle number plate recognition for automated entry and exit. This system has inspired our approach to automating parking access and simplifying the booking process for users.

Reference: "Parkmobile: Parking Made Easy," Parkmobile, 2024. <https://parkmobile.io/>

2. **JustPark (UK)**

JustPark enables users to search for and book parking spaces in advance. It also allows private property owners to list their spaces, fostering a peer-to-peer model. This feature has influenced our system's capability to let property owners list available parking spaces, increasing access and convenience.

Reference: "How JustPark is Changing the Way We Park," JustPark, 2024.
<https://www.justpark.com/>

3. **Parkopedia (Global)**

Parkopedia offers a global database of parking spaces, providing users with real-time information on parking availability, pricing, and locations. It also includes options for booking parking in advance. Parkopedia's emphasis on real-time parking information has influenced our system's focus on providing accurate, up-to-date details to users.

Reference: "Parkopedia: The Wikipedia of Parking," Parkopedia, 2024.
<https://www.parkopedia.com/>

Comparison with Our System

The Parkmobile, JustPark, and Parkopedia systems all provide key features such as real-time parking availability and seamless booking. Our system draws on these models while adapting them to the local needs in Sri Lanka. We aim to integrate vehicle number recognition for automated entry, as seen in Parkmobile, while also enabling property owners to list available

spaces, as demonstrated by JustPark. Additionally, like Parkopedia, we will offer real-time updates, but our system will take it a step further by including the option for users to reserve parking spots in advance and make online payments. Our focus on sustainability, such as incentives for electric vehicles, and a local context tailored to Sri Lanka further distinguishes our system from these global models.

2.3 Functional Requirements

Users (Possible Actors) of the System:

- Drivers (Users)
- Parking Facility Owners
- Administrators

Main Functionalities of the System

Drivers (Users)

1. Search Parking Spots:

- Users can search for available parking spaces based on their preferences, including location, price range, and type of parking (e.g., covered, open lot).
- The search functionality allows users to filter results by availability and distance from their intended destination.

2. View Parking Details:

- Users can view detailed information about parking spots, including pricing, availability, facility features (e.g., security, lighting), and user ratings.
- This functionality includes a gallery of images showcasing the parking area.

3. Make Reservations:

- Users can reserve parking spots in advance based on real-time availability.
- Reservations can be modified or canceled within specified timeframes.

4. Payments:

- Users can complete payments for their parking reservations online, offering options for one-time payments or subscriptions for regular users.
- Payment methods include credit/debit cards and digital wallets.

5. Notifications and Alerts:

- Users receive notifications for upcoming reservations, availability updates, and special promotions or discounts offered by parking facilities.

Landowner

1. Sign Up and Registration:

- Parking facility owners must register to create a profile and list their available parking spaces.
- Registration includes submitting details about the facility, such as location, capacity, pricing, and operating hours.

Administrators

1. User Management:

- Administrators can review and manage user registrations for both drivers and parking facility owners.
- They have the authority to approve or deny registrations based on compliance with system guidelines.

2. Monitor Reservations and Transactions:

- Administrators can oversee all reservations and transactions within the system, ensuring proper functionality and security.
- This includes resolving disputes and managing refunds as necessary.

3. Content Management:

- Administrators can manage the content displayed on the homepage, including promotions, announcements, and featured parking facilities.
- They ensure the information is up-to-date and relevant for users.

2.4 Non- Functional Requirements

1. Performance

The system should provide quick response times, with search results and page loads within 2-3 seconds to enhance user satisfaction. It should handle a high volume of concurrent users without performance degradation, especially during peak hours.

2. Scalability

The system should be designed to scale, allowing it to handle growing numbers of users and parking facilities. It should support future expansions, like adding new locations or services, without requiring complete redesigning.

3. Reliability and Availability

The system must be available 24/7 with minimal downtime, ensuring that users can access it at any time. Scheduled maintenance should be planned during low-traffic times and communicated to users in advance.

4. Usability

The interface should be intuitive and user-friendly, requiring minimal training or technical knowledge. Clear instructions and error messages should be provided, and the system should be accessible to users of different ages and abilities.

5. Security

The system must comply with data protection standards to secure user data, including payment information and personal details. Multi-factor authentication (MFA) should be implemented for user accounts, and sensitive data should be encrypted both in transit and at rest.

2.5 Identifying the suitable process model with justification

For the *Lesi Parking Management System*, the **Agile development model** is the most suitable due to its iterative approach, flexibility, and responsiveness to evolving requirements.

- **Flexibility with Requirements:** Agile accommodates changes, which is crucial for this project as it involves user feedback and evolving functional needs (like adjusting to new user requirements or additional features).
- **User-Centered Development:** Agile's iterative cycles allow us to release incremental features and gather user feedback regularly, ensuring the system aligns with user expectations and needs.
- **Rapid Delivery:** Agile enables faster delivery of usable parts of the system, such as core booking or payment features, allowing early testing and validation.
- **Improved Collaboration:** The Agile approach promotes collaboration with stakeholders throughout development, allowing real-time feedback from users and property owners, enhancing the final product quality.

This model supports a flexible, responsive, and user-focused approach essential for delivering a successful parking management system.

Chapter 3 - Design

3.1 Relevant Design Diagrams

3.1.1 Use Case Diagrams

In the *Lesi Parking Management System*, use case diagrams outline interactions for three main roles:

1. **Driver:** Search for parking, view details, make reservations, and pay for spots.
2. **Admin:** Manage user accounts, monitor reservations, oversee transactions, and update system content.
3. **Landowner:** Register and list parking spaces, set availability and rates, and view booking details.

These use cases demonstrate each role's functions, helping clarify system requirements and interactions.

➤ Driver

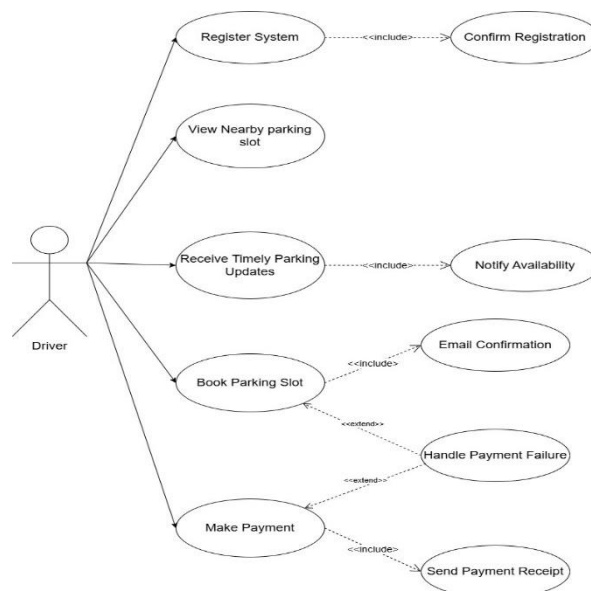


Figure 2 driver use case

This case diagram illustrates the core functionalities of a parking system from a driver's perspective. It shows how a driver can register, view available parking slots, receive real-time updates, book slots, and make payments. The diagram also highlights the system's flexibility in handling potential payment failures and providing confirmation for completed transactions. This visual representation aids in understanding the user journey and system requirements.

➤ Admin

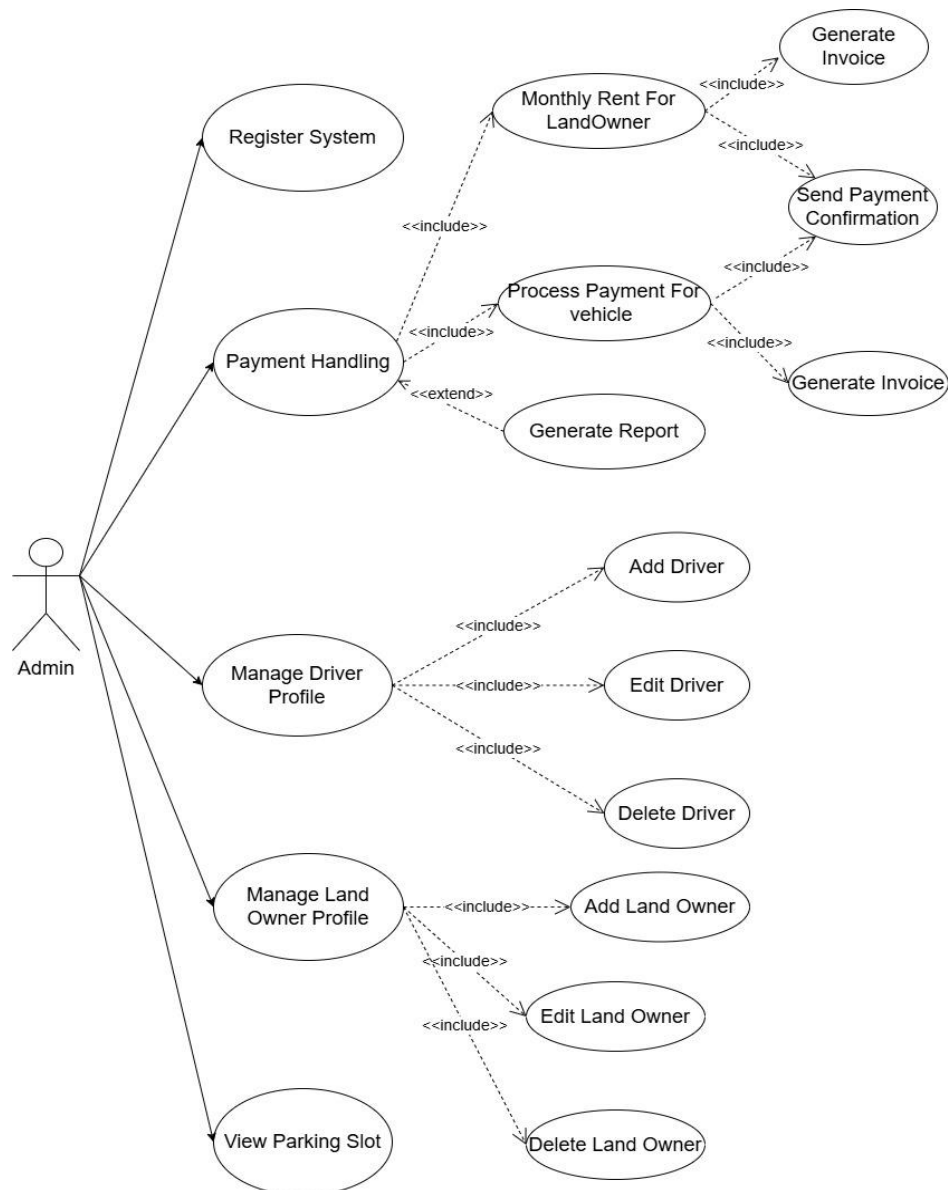


Figure 3 admin use case diagram

This use case diagram illustrates the core functionalities of a parking system from an admin's perspective. It shows how an admin can manage driver and landowner profiles, process payments, generate reports, and handle various system operations. The diagram also highlights the inclusion and extension relationships between use cases, indicating how certain actions are part of larger processes or can be extended under specific conditions.

➤ Landowner

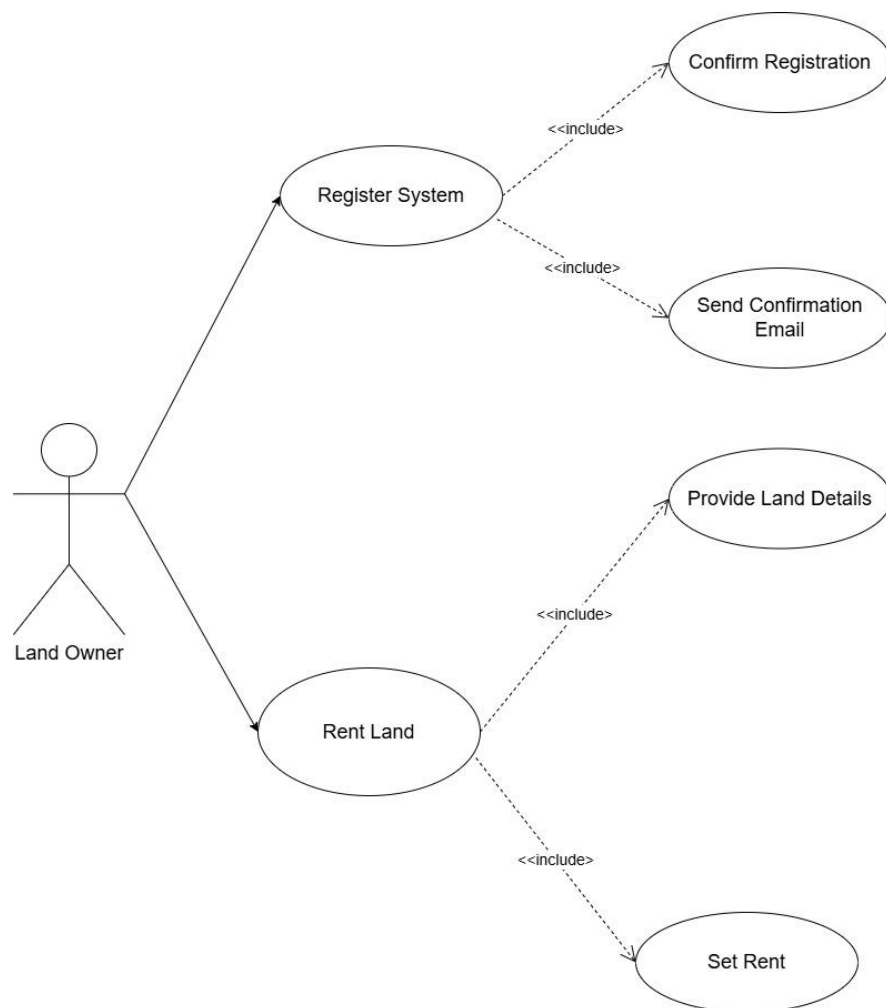


Figure 4 landowner use case diagram

This use case diagram illustrates the core functionalities of a land rental system from a landowner's perspective. It shows how a landowner can register with the system, rent out their land, and manage the rental process. The diagram also highlights the inclusion relationships between use cases, indicating how certain actions are part of larger processes.

3.1.2 Class Diagram

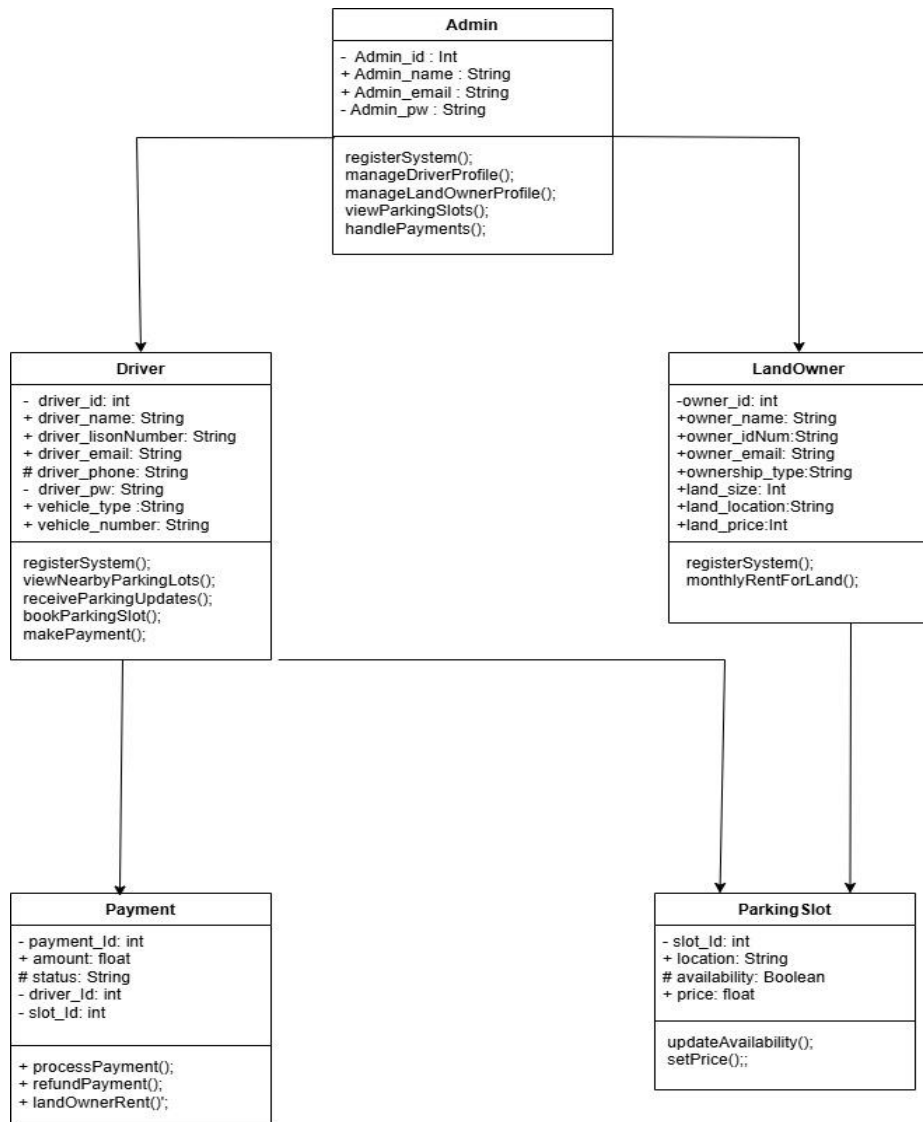


Figure 5 class diagram

This class diagram illustrates the core components of a parking management system. It showcases the relationships between entities like Admin, Driver, Land Owner, Payment, and Parking Slot. Each class represents a specific role or entity within the system, and their methods define their actions and interactions.

3.1.3 ER Diagram

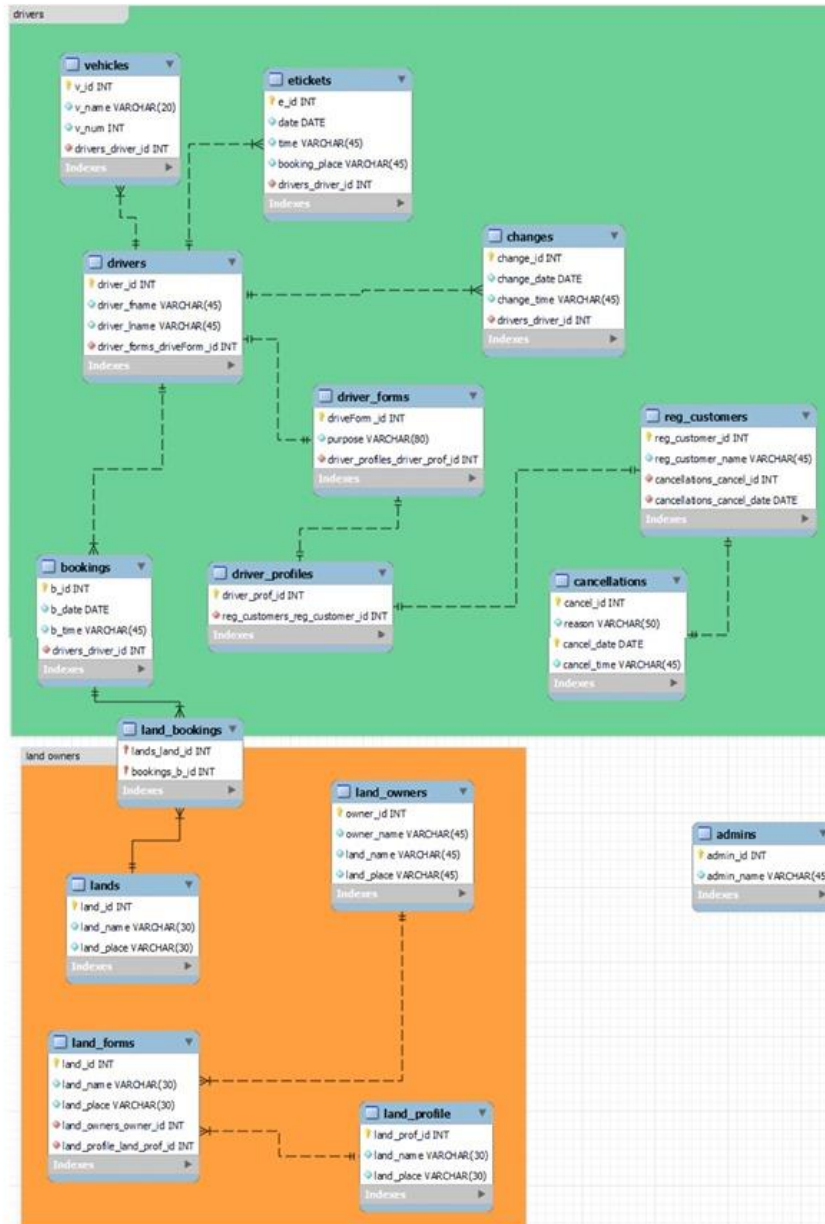


Figure 6 er diagram

This ER diagram depicts a parking management system's database structure. It showcases entities like Drivers, Vehicles, Bookings, Landowners, and Lands, along with their attributes and relationships. The diagram provides a visual representation of how data is organized and connected within the system, aiding in database design and understanding.

3.1.4 Software Architecture Diagram

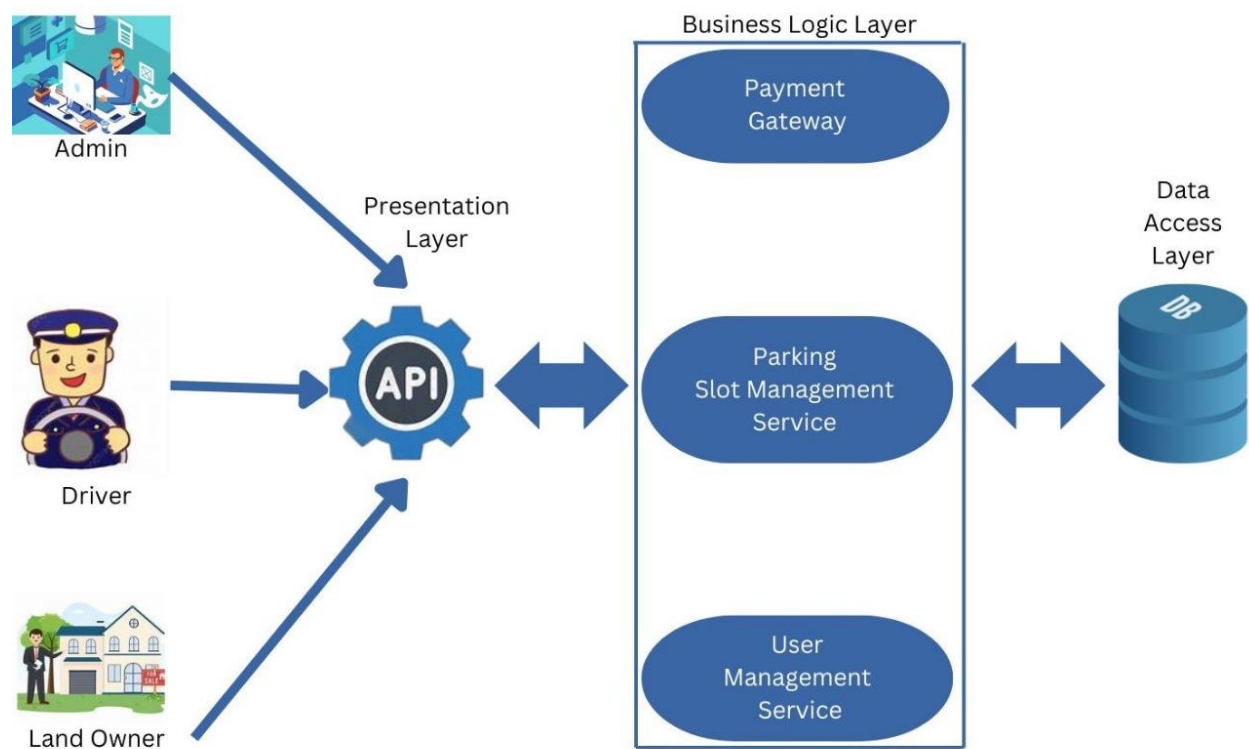


Figure 7 software architecture diagram

The diagram illustrates a system for managing parking slots. The system includes an API that serves as a central point of communication between various components. The Business Logic Layer houses services for parking slot management, user management, and payment processing. The Data Access Layer interacts with the database to store and retrieve information. The Presentation Layer handles the user interface and interacts with the API. The system caters to three main user groups: Admins, Drivers, and Landowners.

3.1.5 Activity Diagram

1. Search Parking Spots

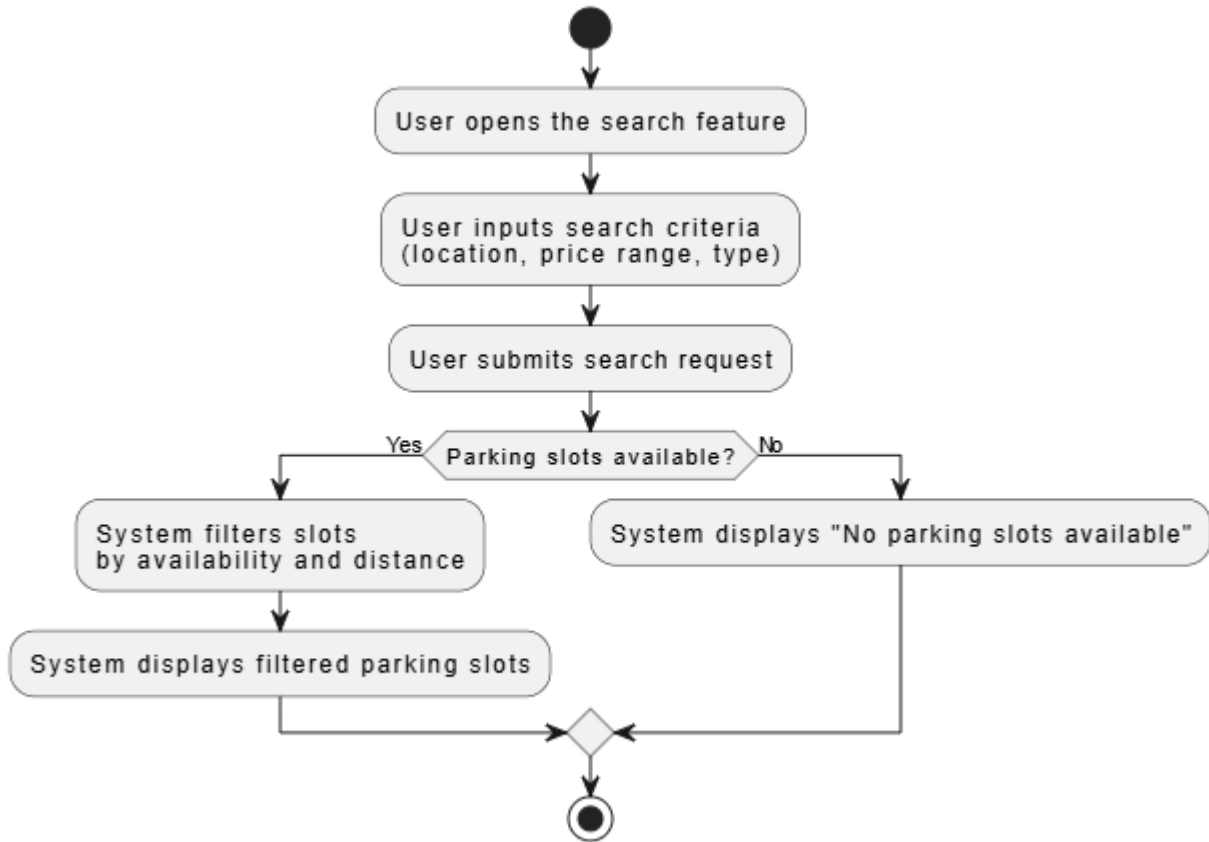


Figure 8 Activity Diagram 1

This activity diagram illustrates the process for searching parking slots. The user starts by entering their search criteria such as location, price range, and type of parking. The system checks if matching parking slots are available. If found, it filters the results and displays them to the user. Otherwise, the user is notified that no slots are available. This flow ensures an intuitive search experience.

2. View Parking Details

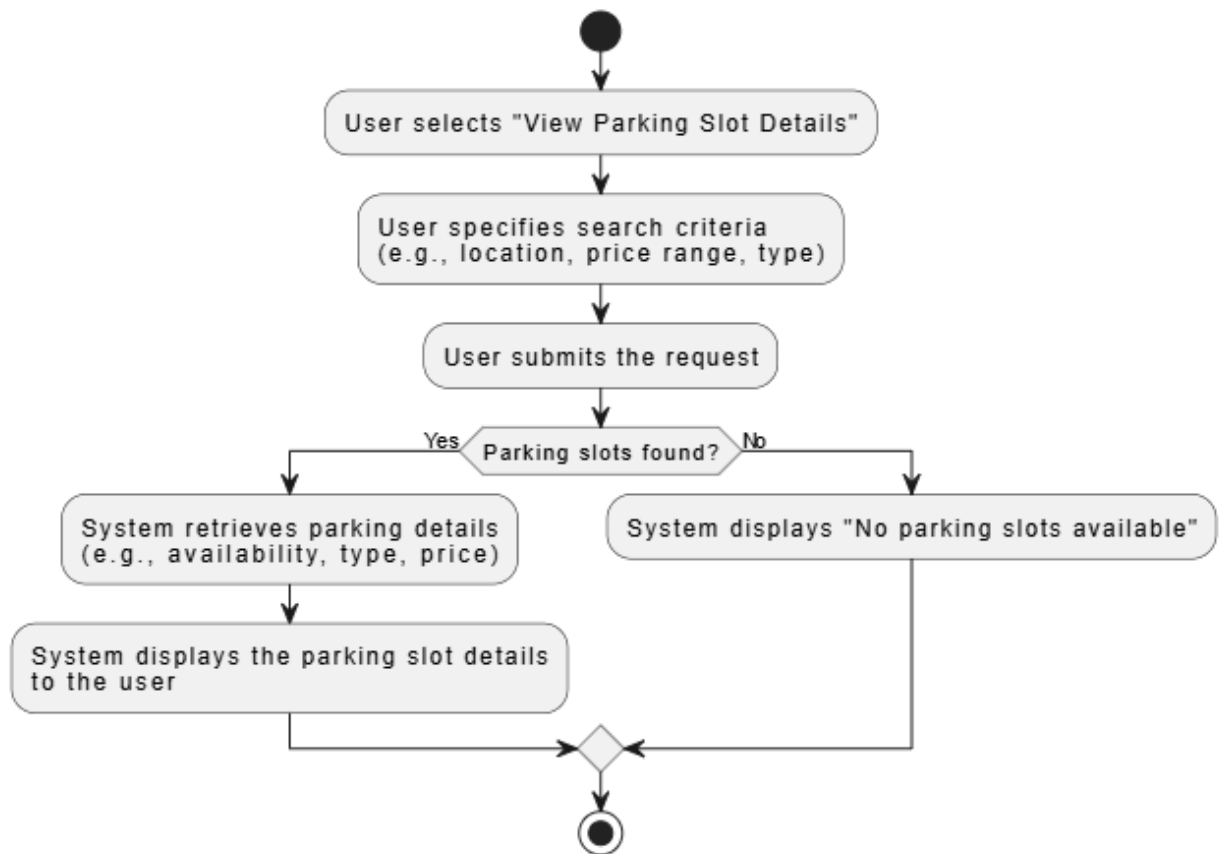


Figure 9 Activity Diagram 2

This diagram shows how users view parking slot details. Users select a slot, the system retrieves details, and displays them if available. Otherwise, the system informs users that the details are unavailable.

3. Make Reservations

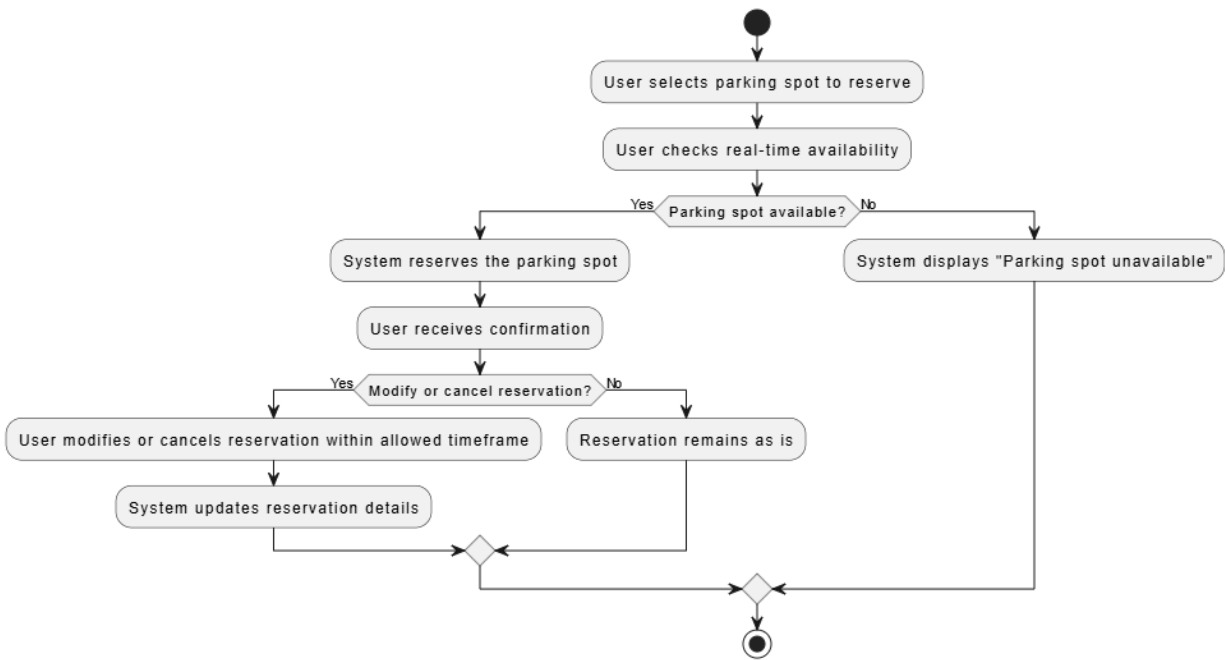


Figure 10 Activity Diagram 3

This diagram represents the reservation process. Users select a parking slot, and the system checks availability. If available, the reservation is confirmed, with options for modification or cancellation. Otherwise, users are notified of unavailability.

4. Payments

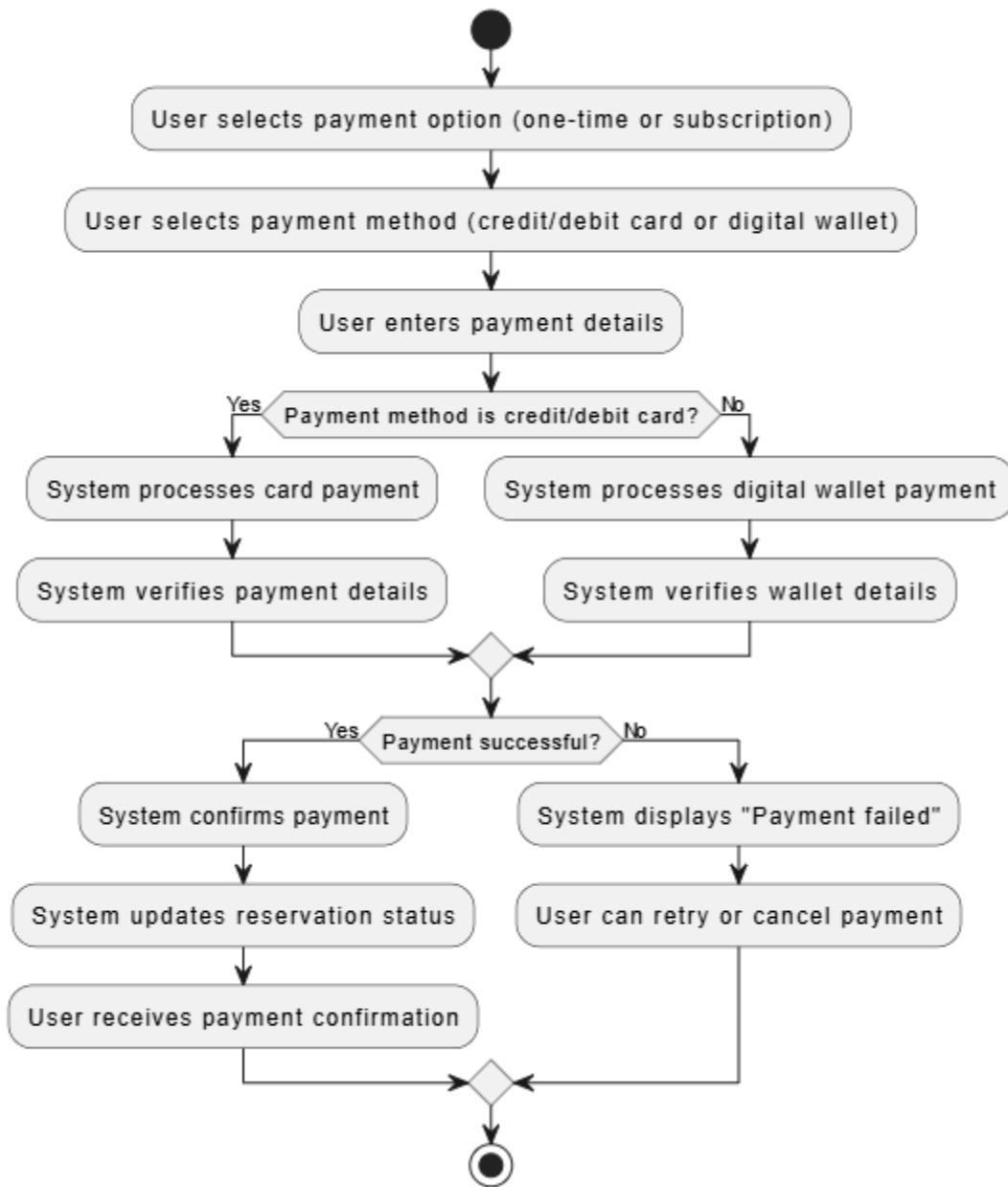


Figure 11 Activity Diagram 4

This activity diagram depicts the payment process. Users choose a payment method, provide details, and initiate payment. Successful payments are confirmed with a receipt. For failed payments, users are notified and prompted to retry.

5. Notifications and Alerts

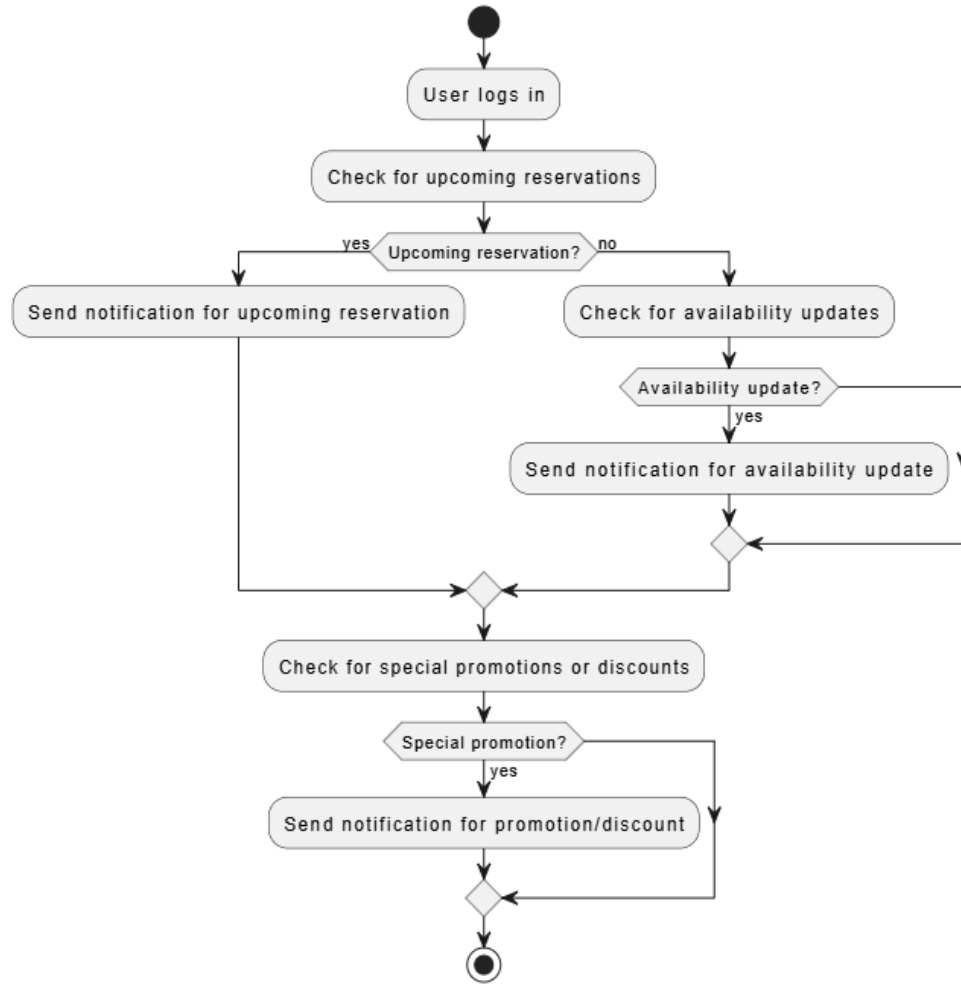


Figure 12 Activity Diagram 5

This diagram illustrates the notification process. The system identifies triggers such as reservations, availability, or promotions, then generates and sends notifications. Users can acknowledge the alerts, marking them as read, or leave them unread for later review.

6. Sign Up and Registration

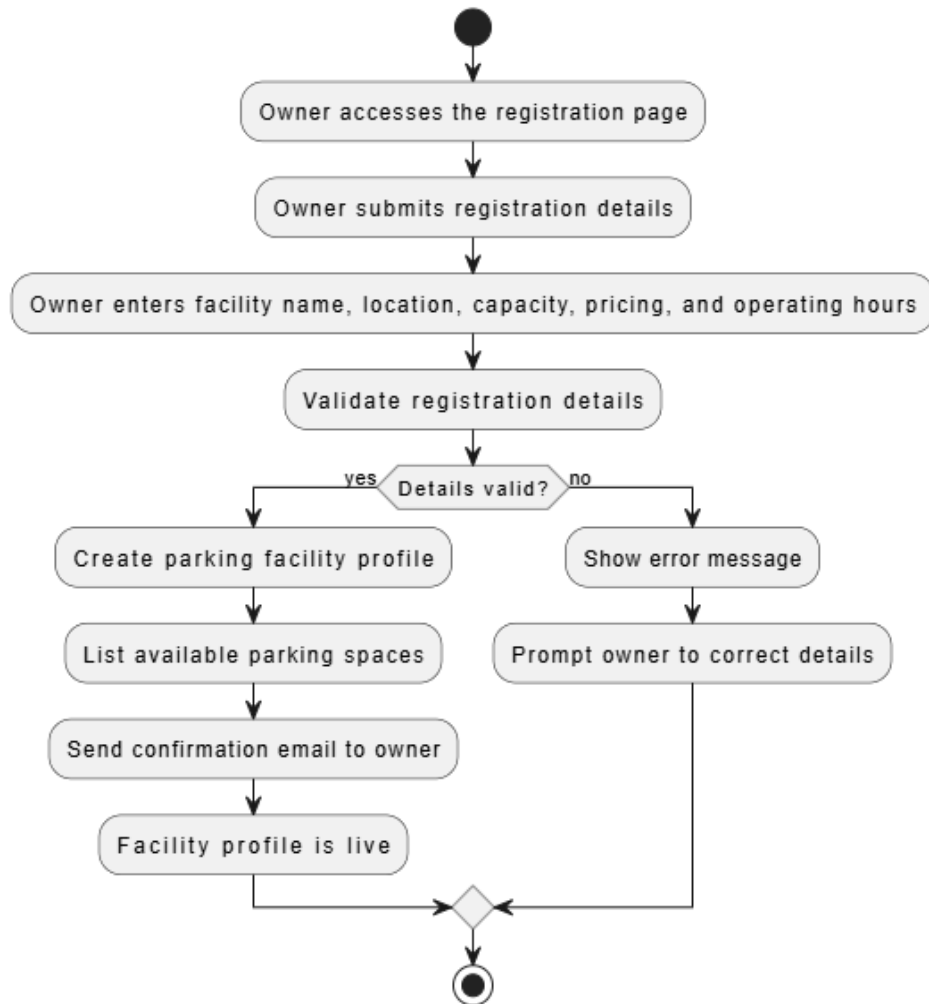


Figure 13 Activity Diagram 6

This diagram represents the registration process for parking facility owners. Owners provide details about their facilities. The system verifies the information, creates a profile, and lists parking spaces if valid. If invalid, owners are asked to correct their submissions.

7. User Management

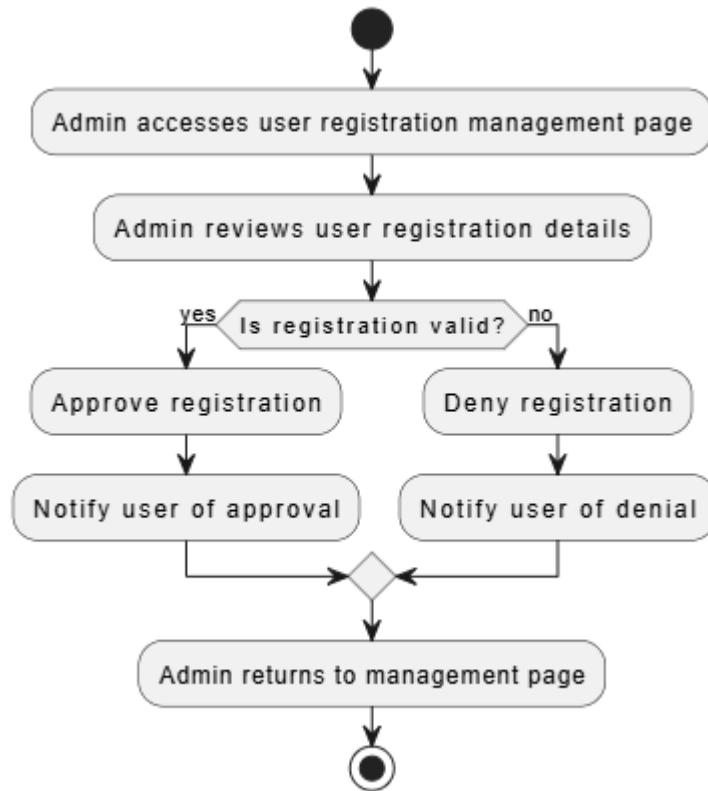


Figure 14 Activity Diagram 7

This diagram illustrates the user management process. Administrators review registrations, ensuring compliance with system guidelines. If the submission meets requirements, the registration is approved and users are notified. Otherwise, the registration is denied, and the users are informed accordingly.

8. Monitor Reservations and Transactions

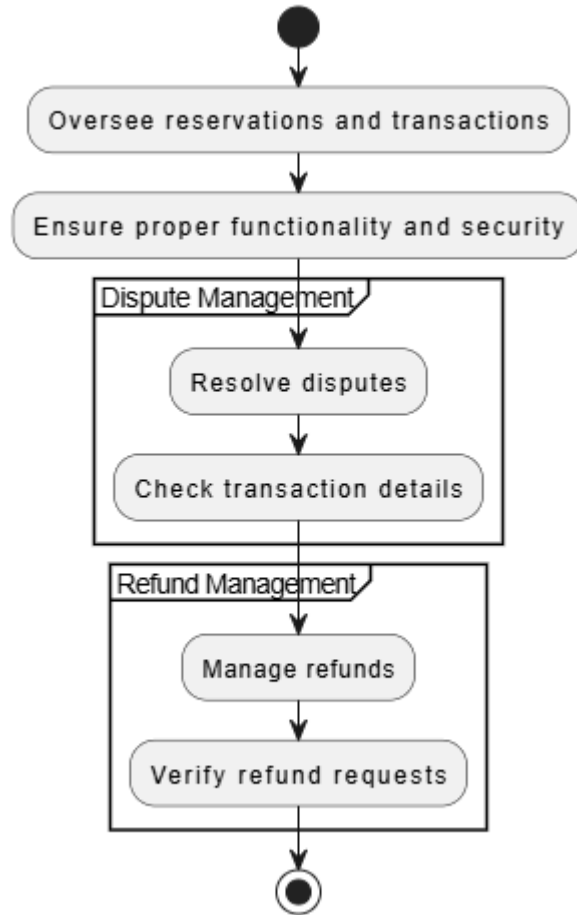


Figure 15 Activity Diagram 8

This diagram showcases the administrator's role in monitoring reservations and transactions. They review activities, address disputes, and process refunds if necessary. For normal operations, administrators ensure system functionality and security, maintaining a smooth experience for all users.

9. Content Management



Figure 16 Activity Diagram 9

This diagram illustrates content management by administrators. They review the homepage content and update it as necessary, such as adding promotions or announcements. Once finalized, the updated content is published to ensure it remains relevant for users.

3.1.6 Sequence Diagram

1. Search for Parking Spots

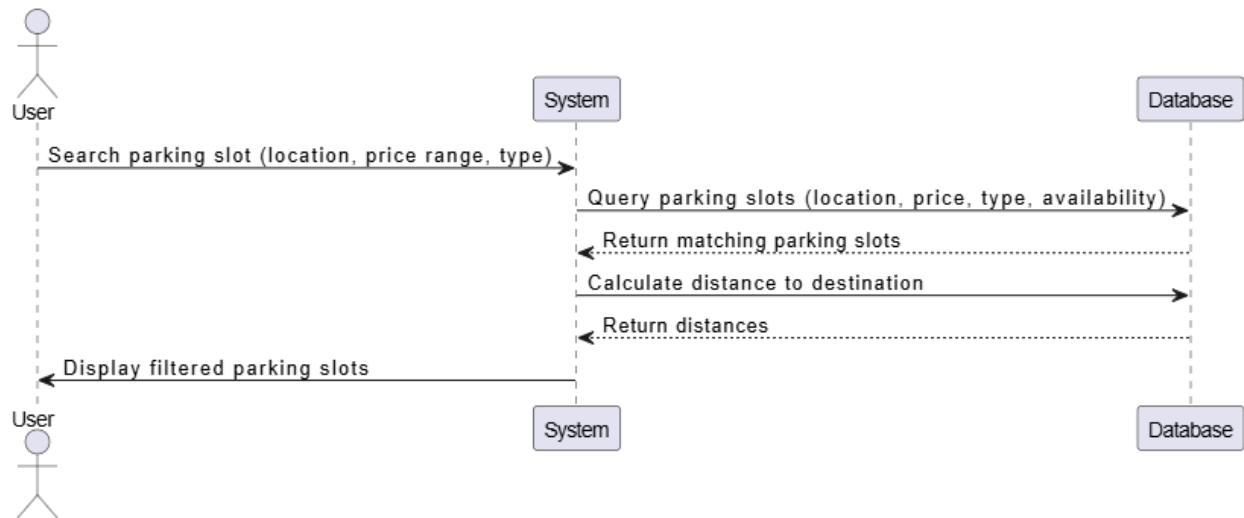


Figure 17 Sequence Diagram 1

This sequence diagram shows how the user searches for available parking slots by entering preferences. The system queries the database for available slots. If found, it filters and displays the results; otherwise, it notifies the user of unavailability.

2. View Parking Details

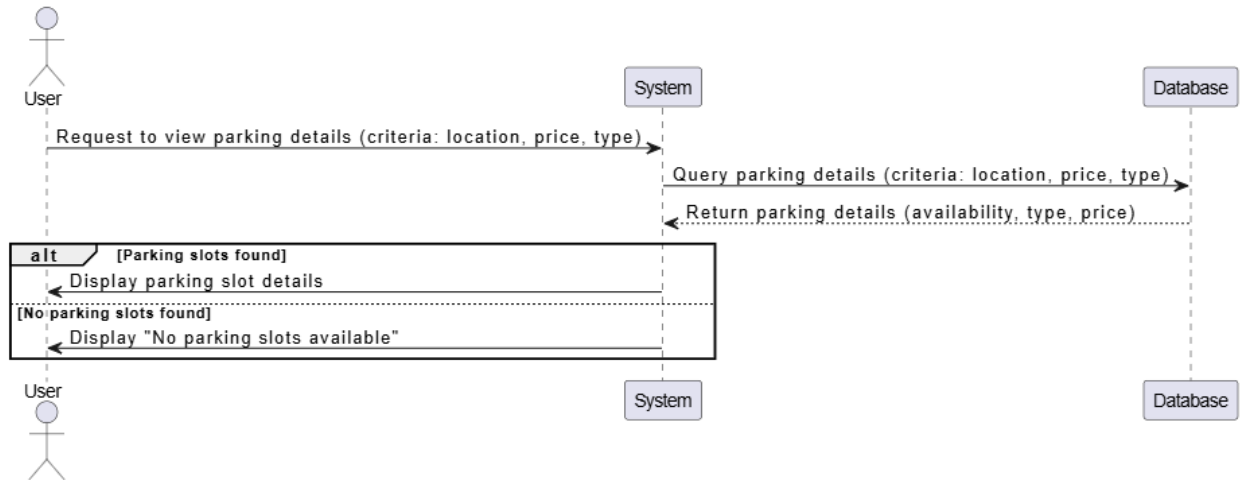


Figure 18 Sequence Diagram 2

In this diagram, the user requests the details of a selected parking slot. The system queries the database for the necessary information, such as location, type, price, and availability, then displays the results to the user.

3. Make Reservations

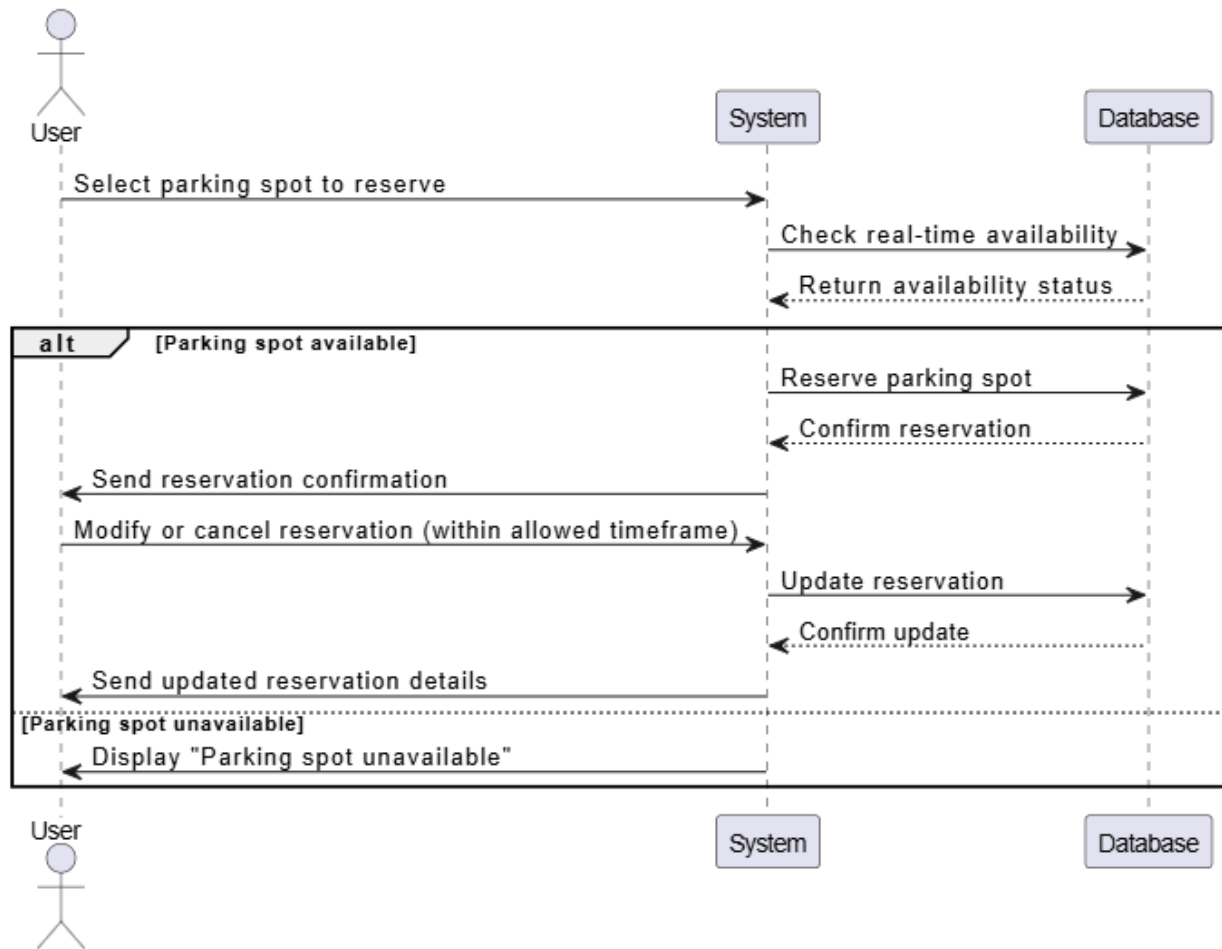


Figure 19 Sequence Diagram 3

This diagram shows the process of making a reservation. After selecting a parking slot, the system checks availability and, if the slot is available, confirms the reservation while offering modification options. If not, the user is notified.

4. Payments

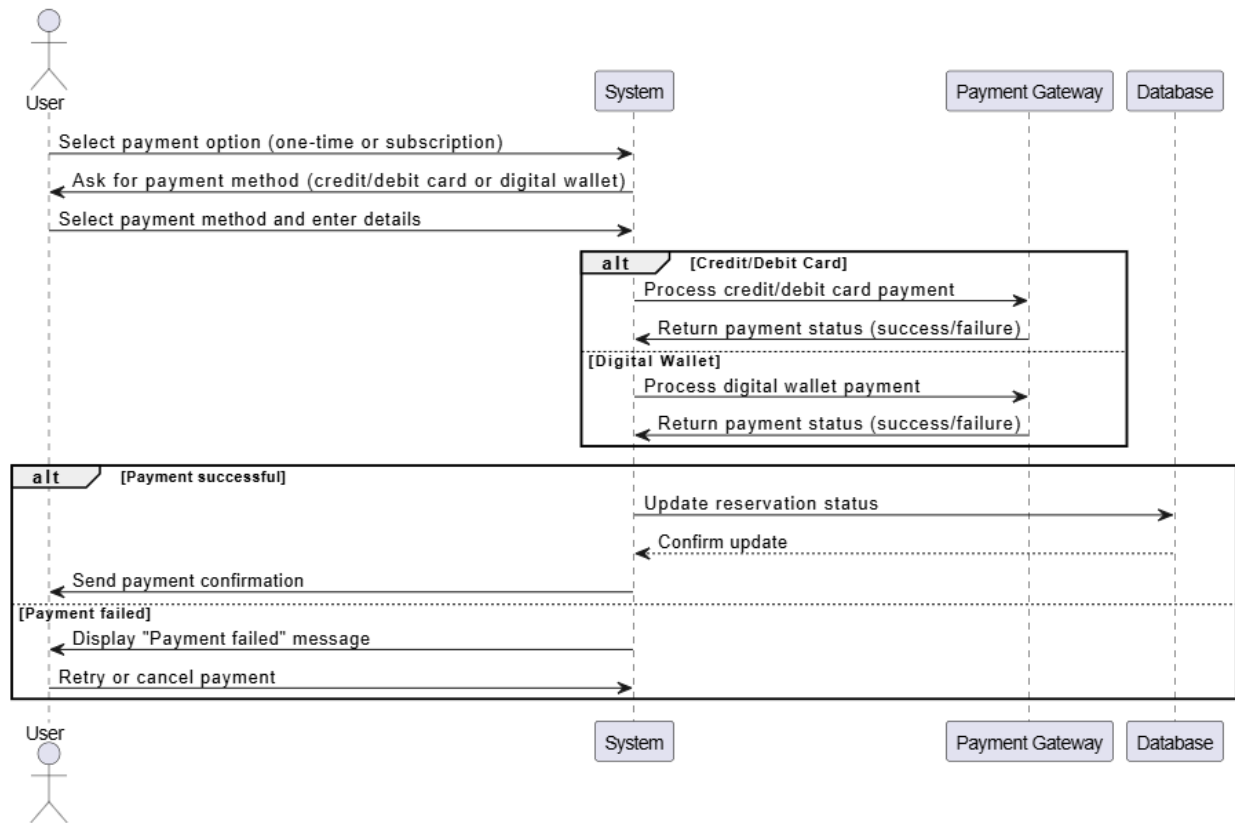


Figure 20 Sequence Diagram 4

In this sequence, the user selects a payment method, and the system processes the payment through a gateway. If successful, the user receives confirmation and a receipt; if failed, the user is notified and prompted to retry.

5. Notifications and Alerts

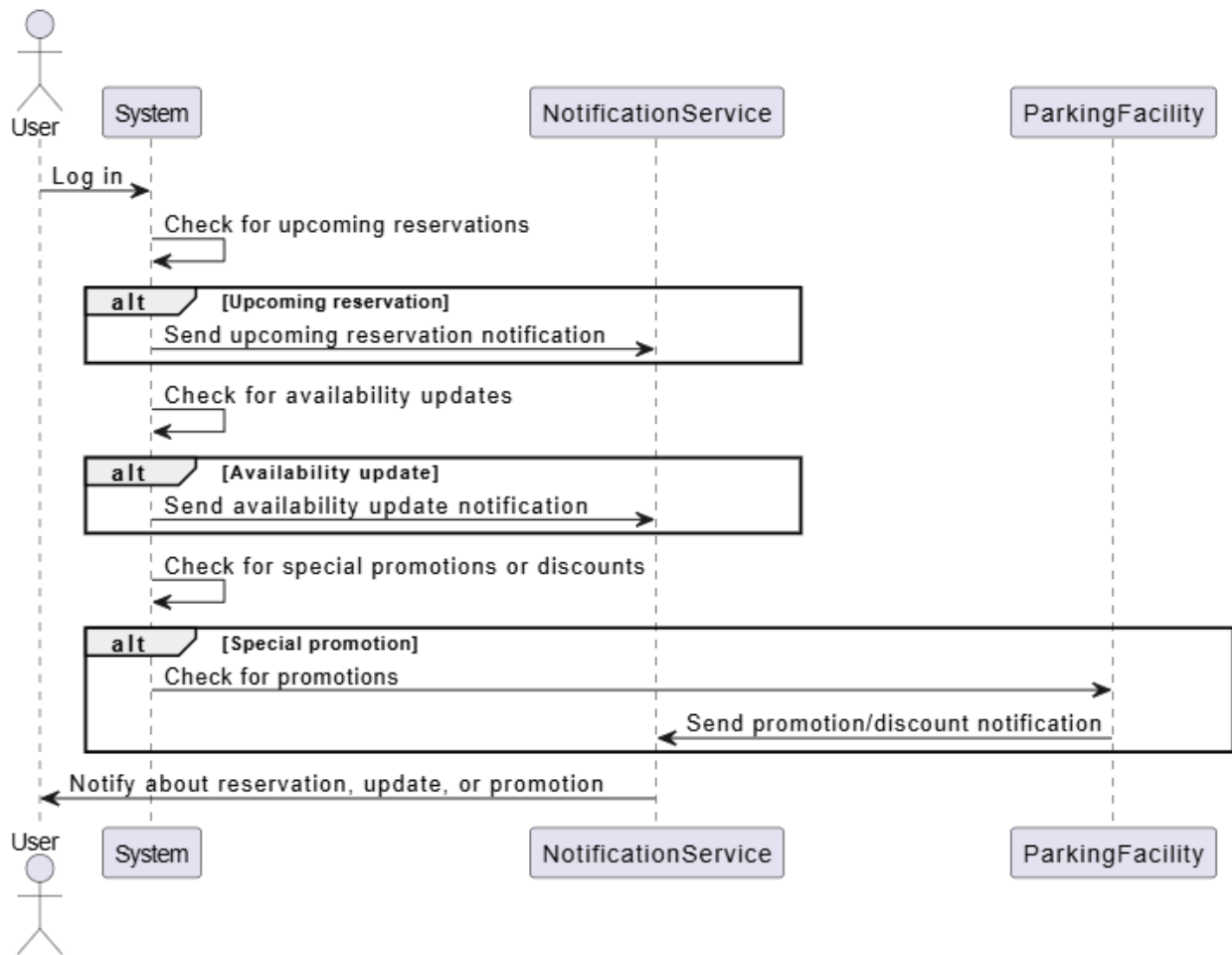


Figure 21 Sequence Diagram 5

This sequence shows how the notification system works. It sends alerts for events such as upcoming reservations, availability updates, or promotions. The user acknowledges the notifications, and the system marks them as read.

6. Sign Up and Registration

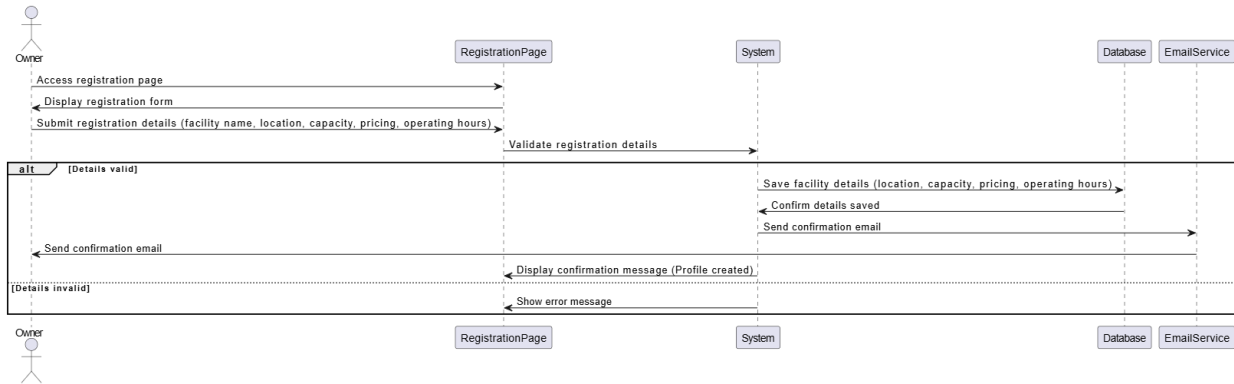


Figure 22 Sequence Diagram 6

This diagram shows how a facility owner registers by submitting necessary details. The system stores these details in the database, confirms the registration, and notifies the facility owner of profile creation

7. User Management

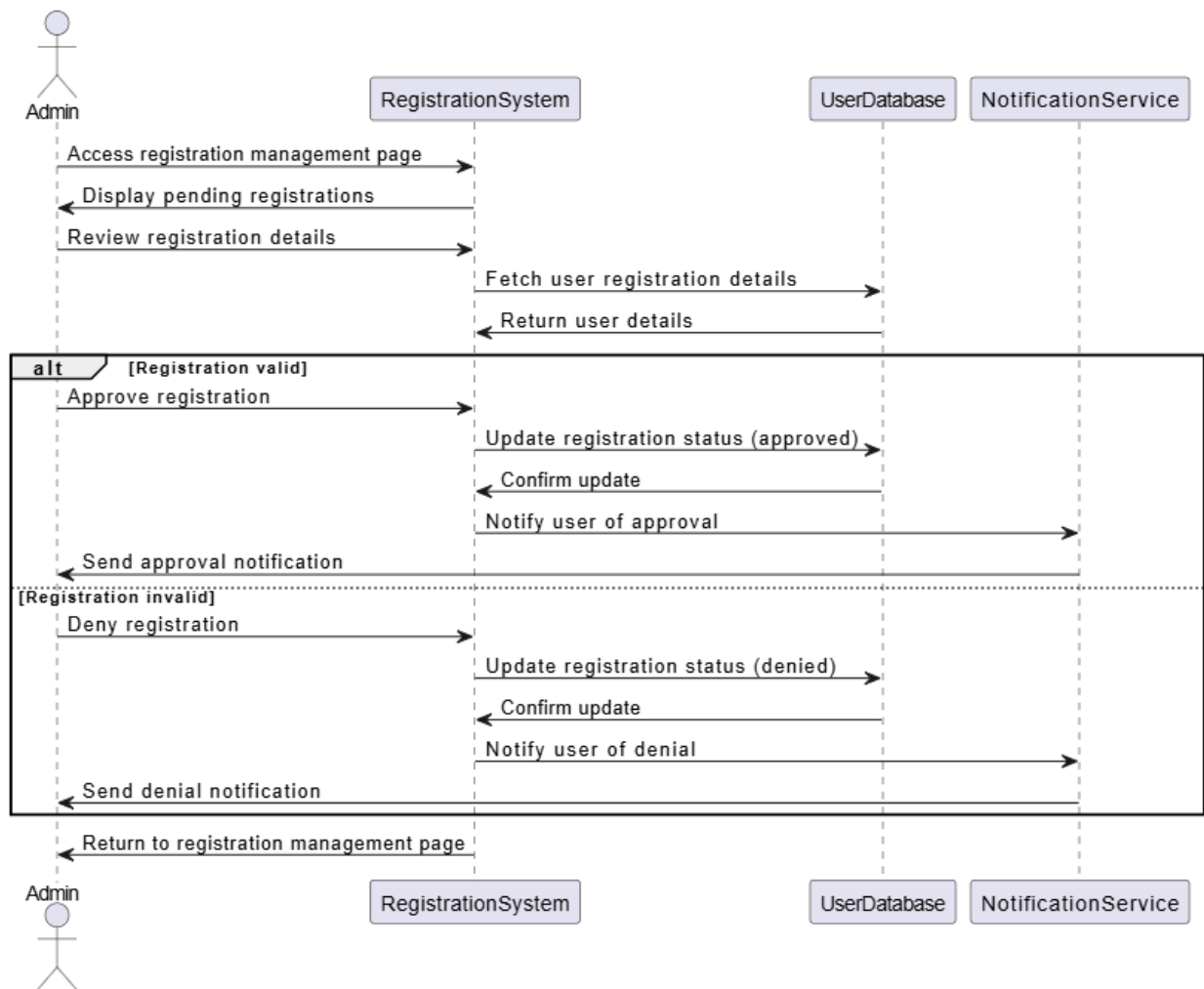


Figure 23 Sequence Diagram 7

This diagram shows the admin reviewing user registrations. The system queries the database for user details. Based on compliance with guidelines, the admin approves or denies the registration and notifies the user accordingly.

8. Monitor Reservations and Transactions

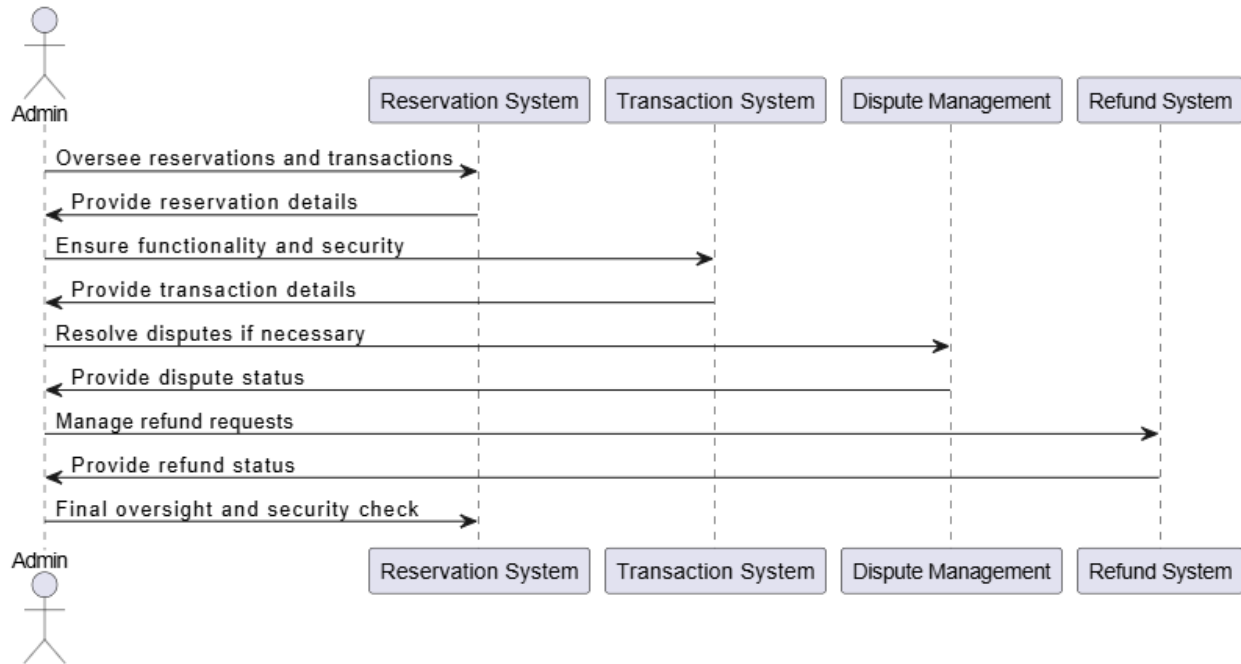
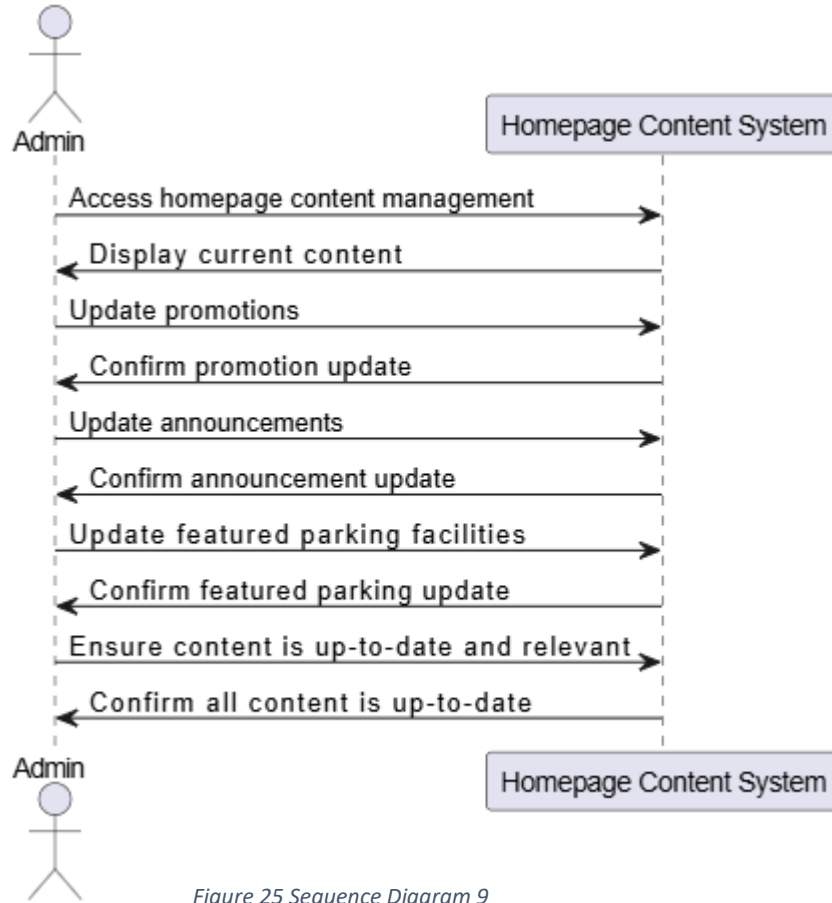


Figure 24 Sequence Diagram 8

This sequence diagram shows how the admin monitors reservations and transactions. If a dispute is found, the admin investigates and processes refunds if necessary; otherwise, the system ensures smooth operation of reservations and transactions.

9. Content Management



This diagram illustrates the process where the admin manages content on the homepage. They review, edit, and update content if necessary, and publish it. If no update is needed, they confirm the content is current.

3.1.7 State Chart

1. Search for Parking Spots

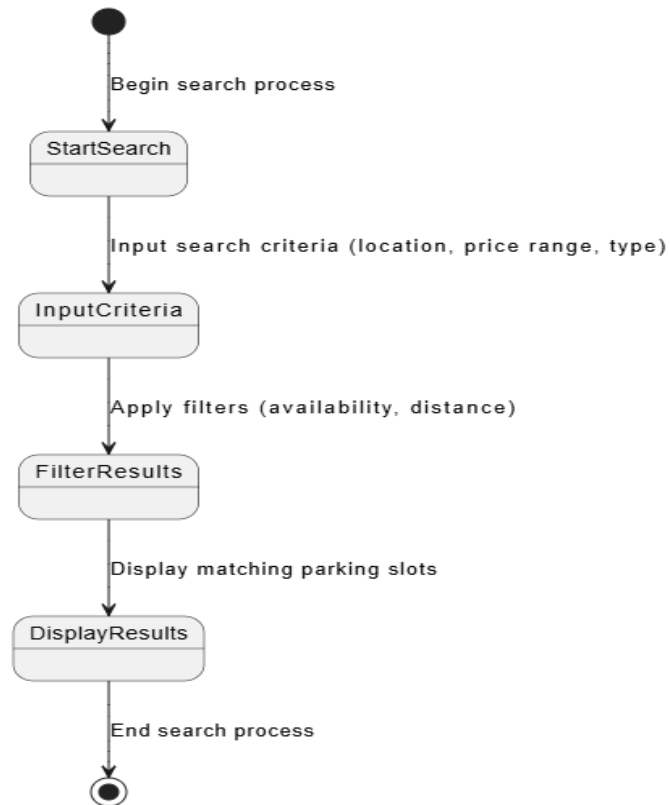


Figure 26 State Chart 1

This state diagram shows the process of searching for parking slots. The user enters preferences, the system filters results, and displays available options or notifies if no slots are found. The user can retry or start a new search.

2. View Parking Details

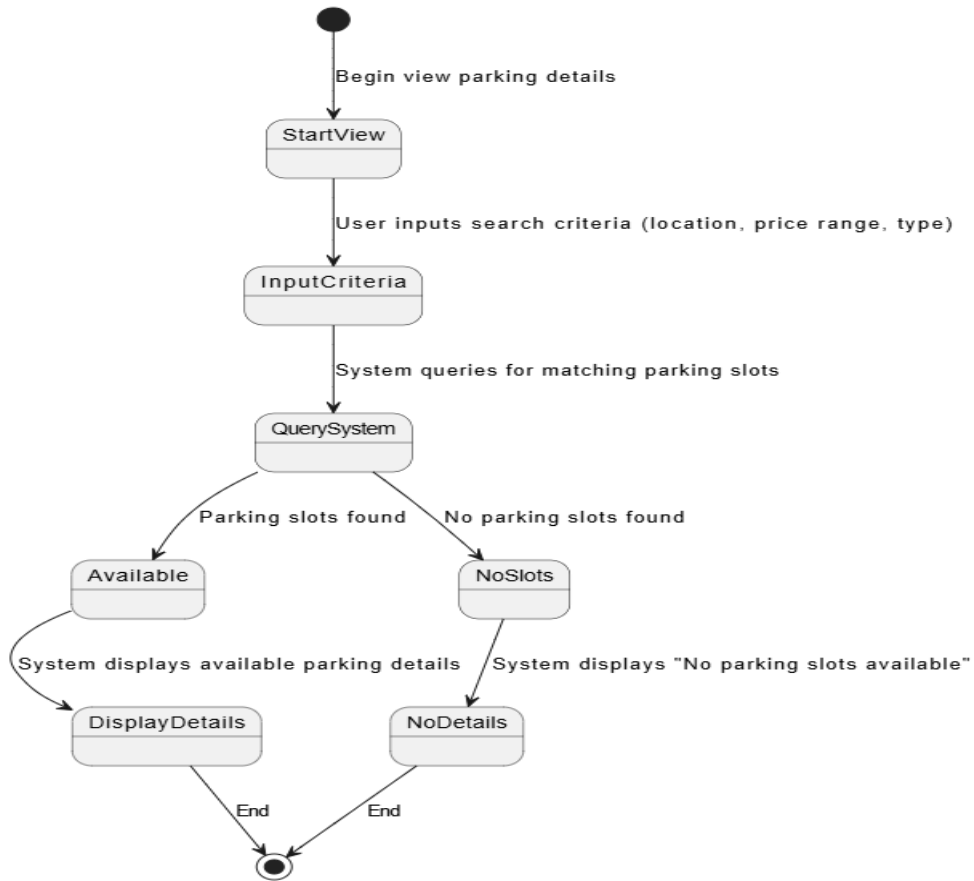


Figure 27 State Chart 2

This state diagram represents viewing parking details. The user requests parking slot details, and the system displays them. The user can request new details if needed, transitioning back to the "RequestDetails" state.

3. Make Reservations

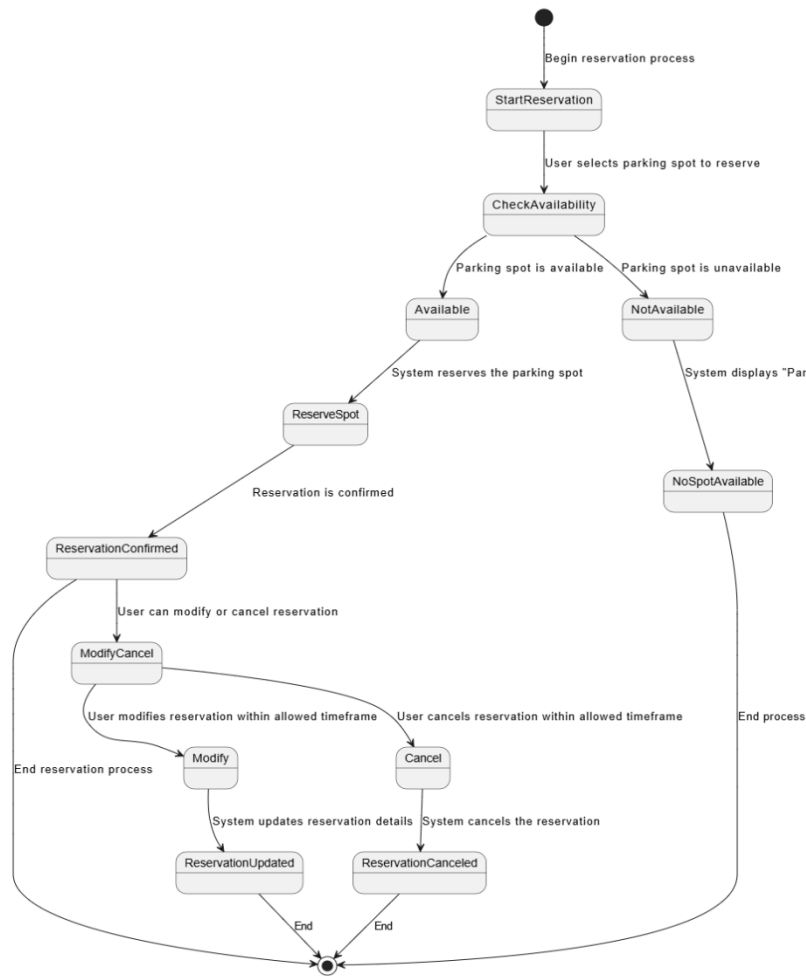


Figure 28 State Chart 3

The state diagram for making a reservation shows that after selecting a parking slot, the user confirms the reservation. The reservation state allows modification or cancellation, returning the system to the idle state after completion.

4. Payments

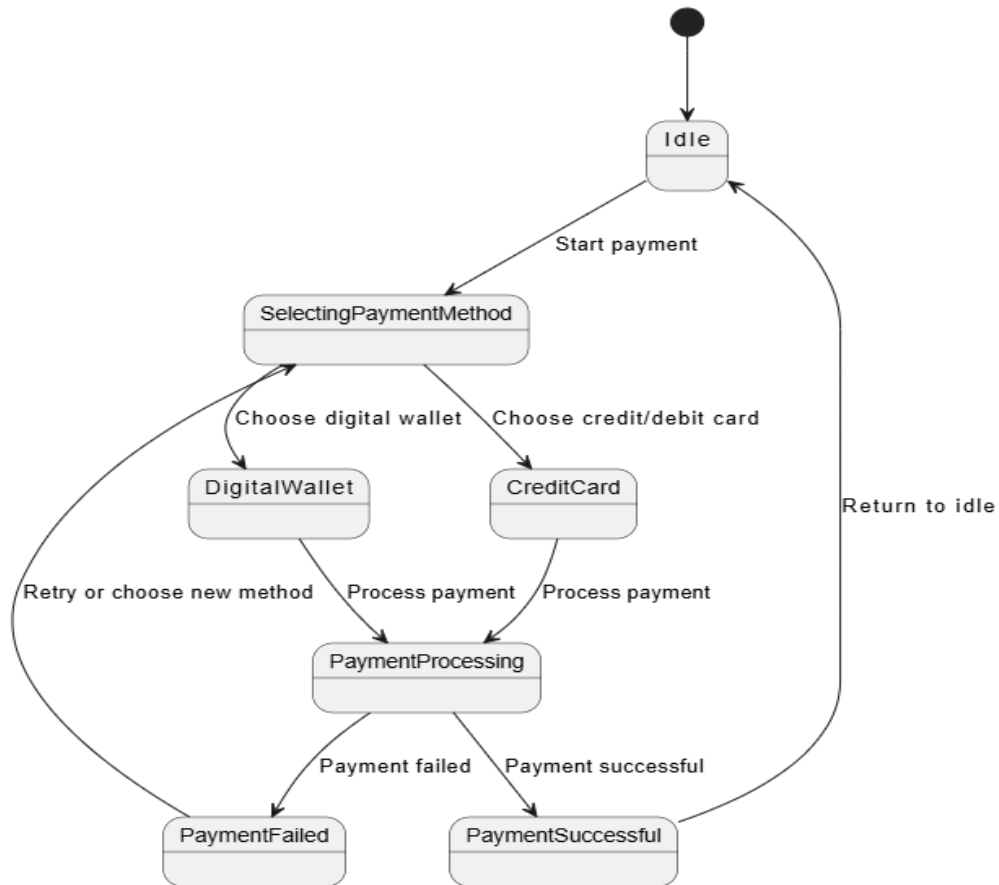


Figure 29 State Chart 4

The state diagram for payment starts with a pending state. If the payment is processed successfully, it transitions to the success state. In case of failure, the user can retry payment, which leads back to the pending state.

5. Notifications and Alerts

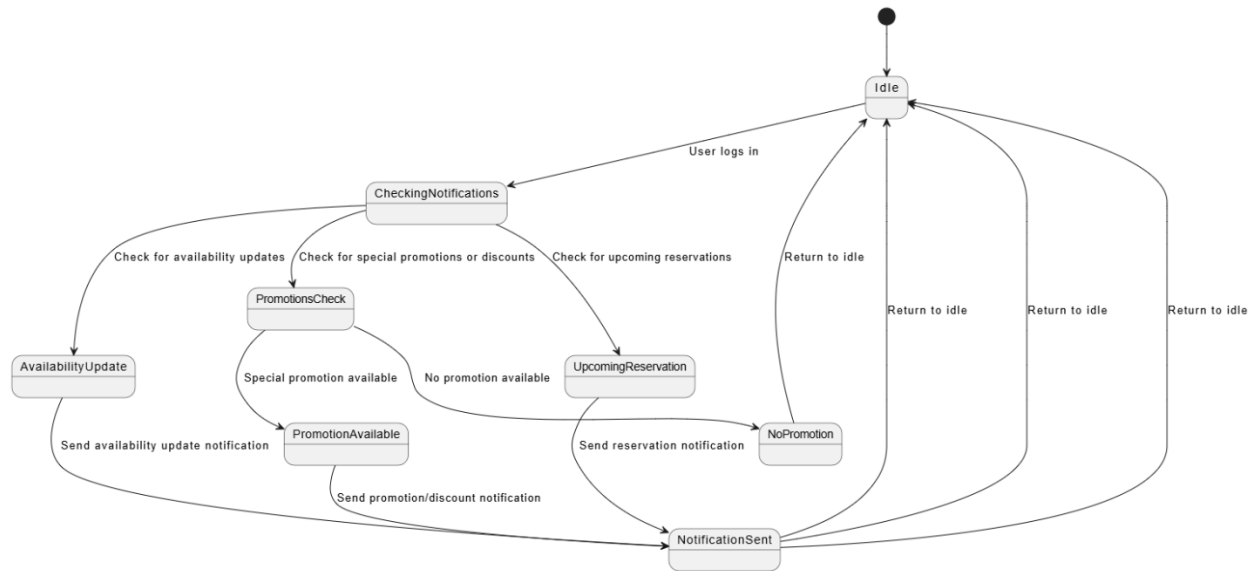


Figure 30 State Chart 5

This state diagram describes the notification and alert system. When the system receives an alert, it transitions to the "NewNotification" state. The user acknowledges it, and the system returns to "NoNotifications."

6. Sign Up and Registration

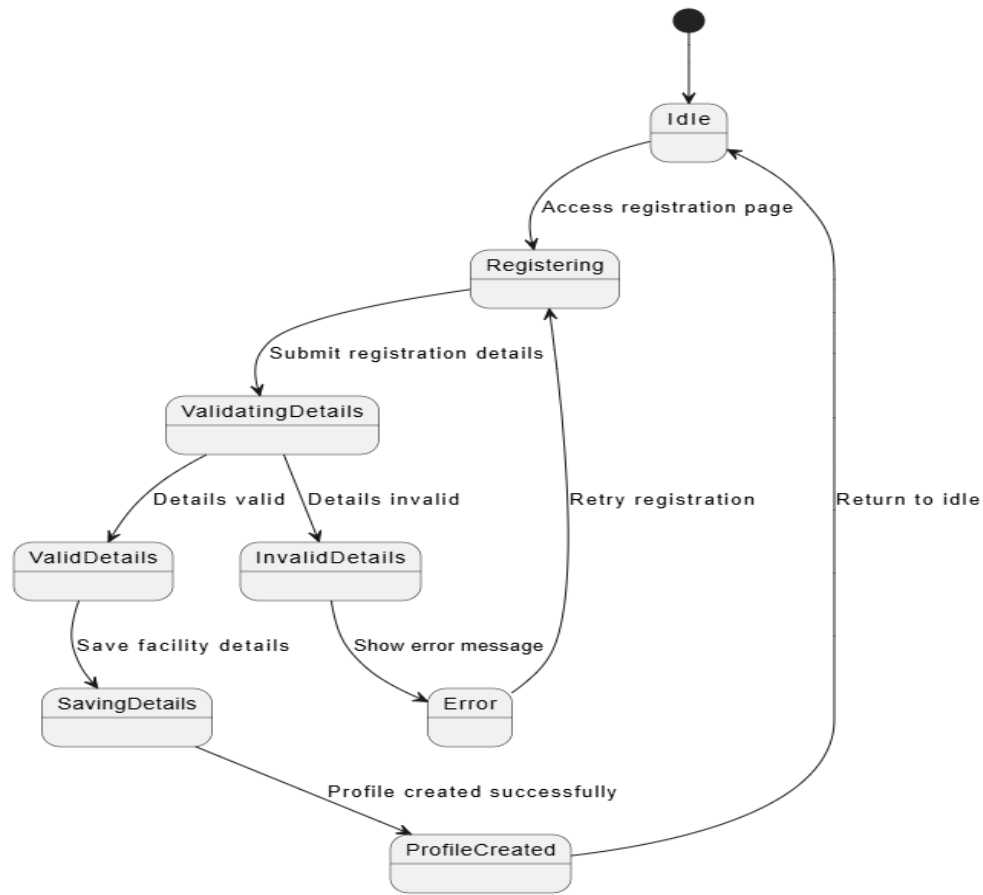


Figure 31 State Chart 6

In this state diagram, the facility owner initiates the registration process. After submitting details, the system confirms the registration. If modifications are needed, the system allows returning to the "RegistrationPending" state

7. User Management

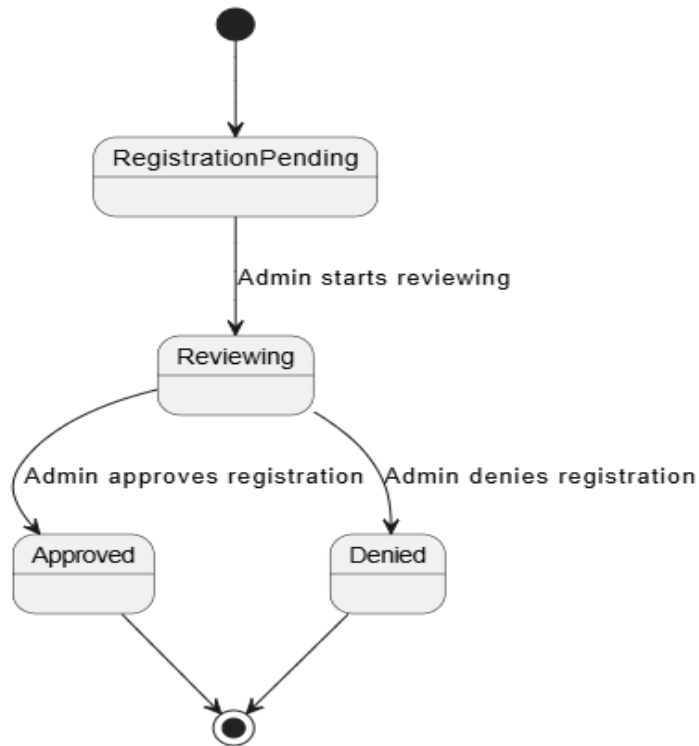


Figure 32 State Chart 7

This state diagram represents the user management process. Administrators review user registrations. Based on compliance, the system either approves or rejects the registration. The admin continues to review new registrations as they come in.

8. Monitor Reservations and Transactions

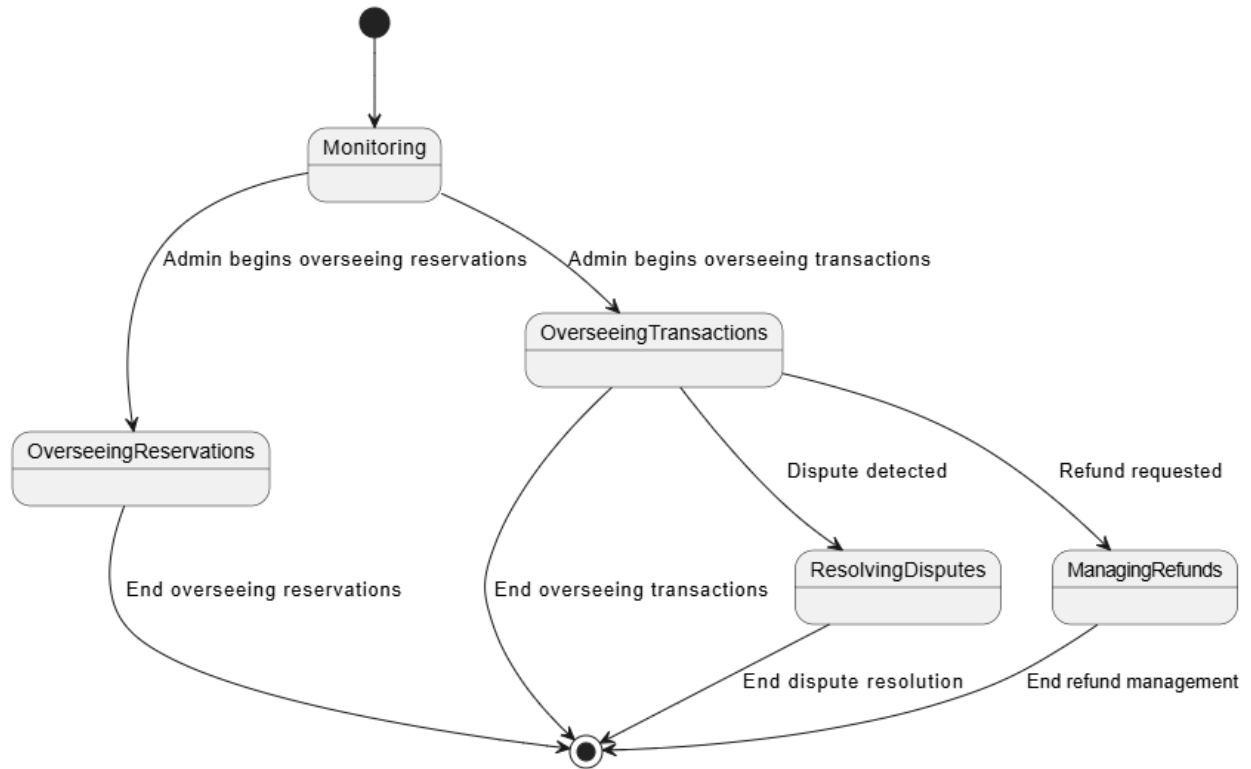


Figure 33 State Chart 8

This diagram illustrates how the admin monitors reservations and transactions. If a dispute arises, it transitions to the "Investigating" state. Otherwise, it stays in normal operation, ensuring smooth transactions and reservations.

9. Content Management

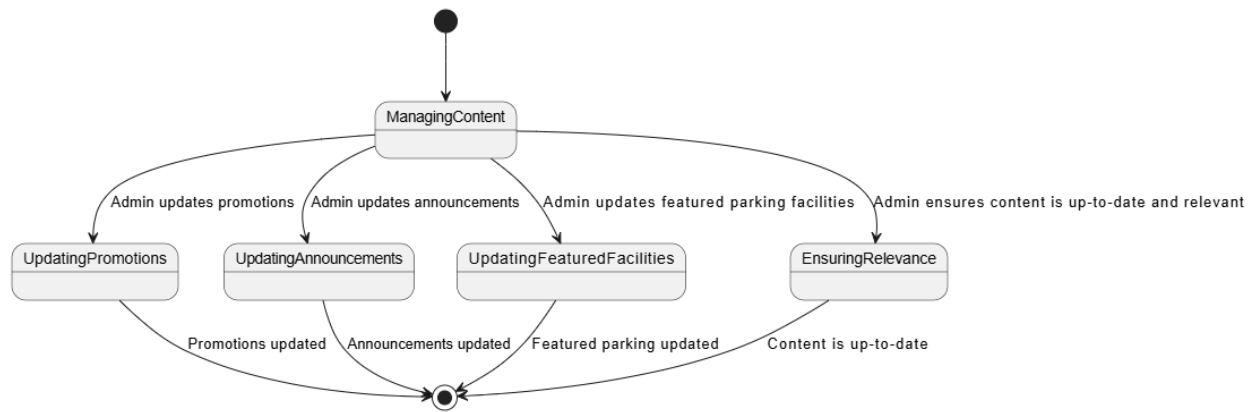


Figure 34 State Chart 9

This state diagram shows the admin's role in content management. The system starts in an idle state. Upon editing homepage content, the system transitions to "EditingContent," and after publishing, it returns to the idle state.

3.2 User interface design with Wireframes

These are the UI and wireframes of our system, showcasing the layout and design of key screens and user interactions.

➤ Home page

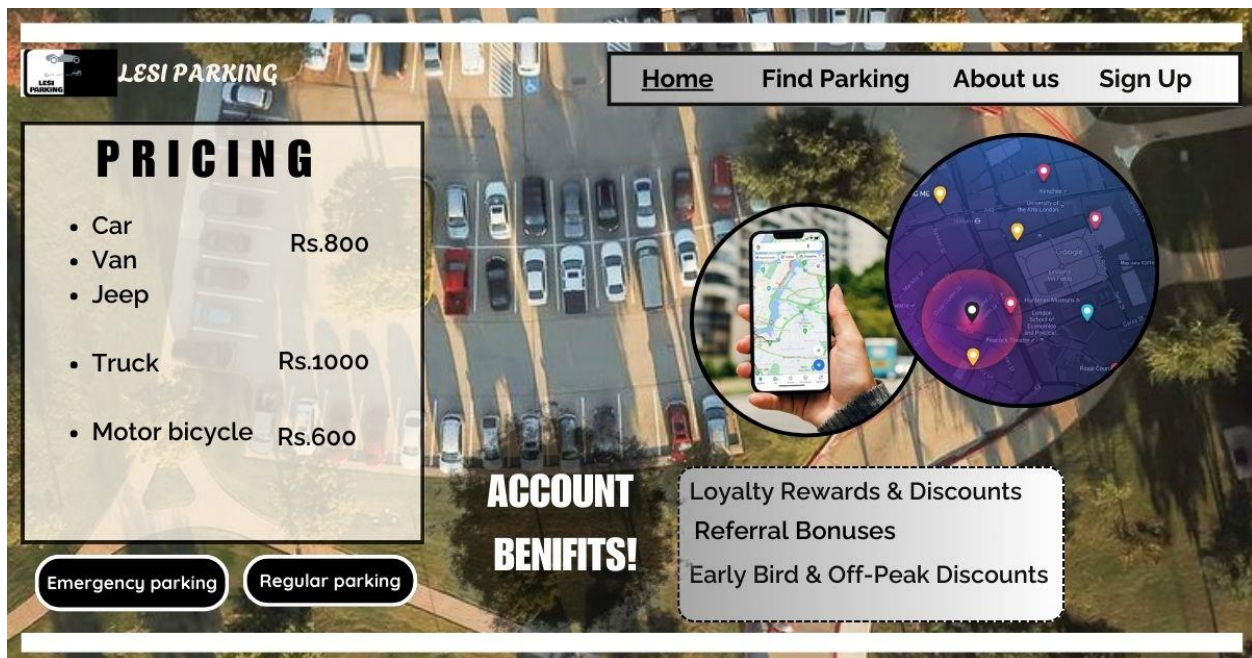


Figure 35 Home page

The homepage of LESI PARKING presents a user-friendly interface with a clear pricing list for various vehicle types. Below the pricing, two buttons—Emergency Parking and Regular Parking—redirect users accordingly: the former leads to the "Find Parking" page, while the latter takes users to the login page. The Account Benefits section highlights perks for registered users, including loyalty rewards, discounts, and referral bonuses. The navigation bar at the top-right offers easy access to sections like "Home," "Find Parking," "About Us," and "Sign Up." The background features an aerial view of the parking lot and a map interface.

➤ About us

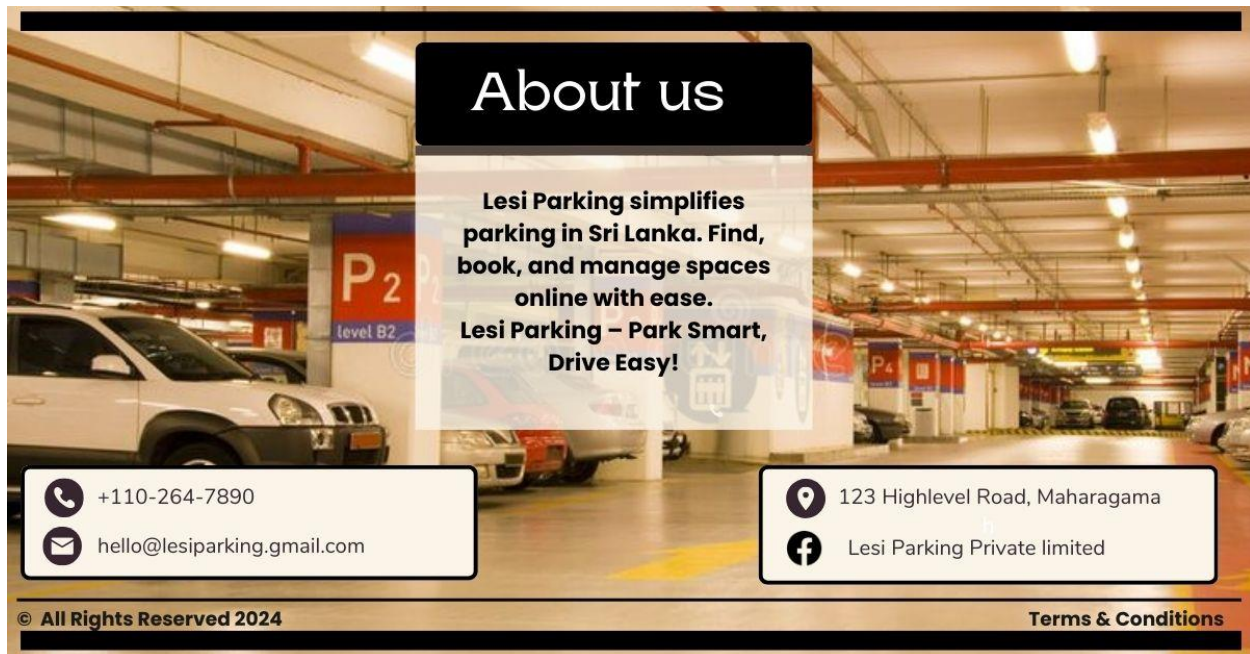


Figure 37 About us

When the customer clicks the About Us button in the navigation bar, they are directed to the About Us page. Here, they can view detailed information about the Lesi Parking system. This includes the address of the head branch, contact telephone number, email, and a short description of the system, which explains the services offered, such as emergency and regular parking bookings, real-time availability updates, and other features designed to provide a seamless parking experience.

➤ Emergency Booking Form

LESI PARKING

Welcome to Emergency Booking

FULL NAME

VEHICLE NUMBER

VEHICLE TYPE

CONTACT NUMBER

PARKING SLOT

Maharagama	Negegoda	Kottawa
<input checked="" type="radio"/> NIE	<input checked="" type="radio"/> Syzygy	<input checked="" type="radio"/> Abans Kottawa
<input type="radio"/> Apeksha Hospital	<input type="radio"/> Salon LIYO	<input type="radio"/> Makumbura Highway Station

Confirm Emergency booking

ADVANCE PAYMENT

* Advanced Payment starts from 500

Figure 38 Emergency booking Form

The Emergency Booking page allows customers to confirm their parking reservation after selecting an available parking slot. Once the customer clicks Book Now from the search results, they are directed to this page where they must fill out a form with details such as full name, vehicle number, vehicle type, and contact number. On the right, parking slots are displayed as radio buttons under the selected city (e.g., Nugegoda), with the available parking slot (e.g., Syzygy) enabled, and any already booked slots (e.g., Salon LIYO) disabled. After completing the form, clicking Confirm Emergency Booking redirects the customer to a confirmation success page.

➤ Emergency Customer's Booking Confirmation Page

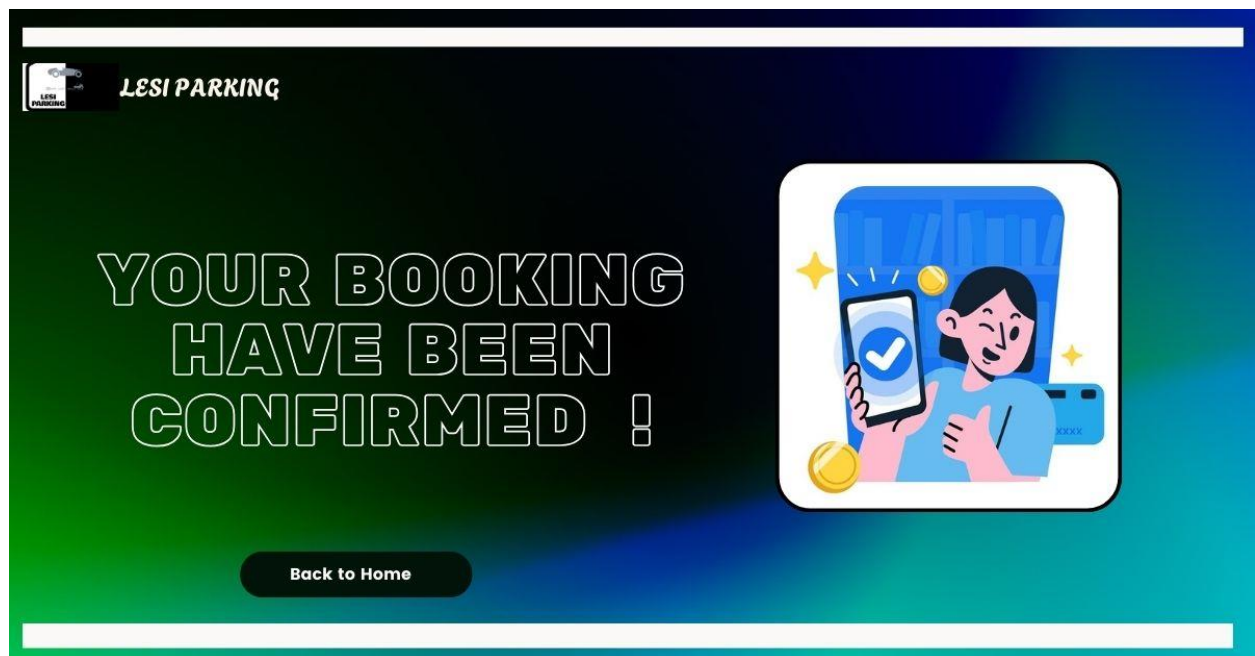


Figure 39 Emergency Customer's Booking Confirmation

When an emergency customer fills out the booking form and clicks the Confirm Booking button, they are directed to the "Your Booking Has Been Confirmed" page. This page provides a confirmation message to assure the customer that their emergency booking has been successfully processed. Additionally, it includes a "Back to Home" button, allowing the customer to quickly return to the homepage. This confirmation page offers a sense of urgency and assurance, ensuring that the booking details have been promptly recorded.

➤ Finding Parking

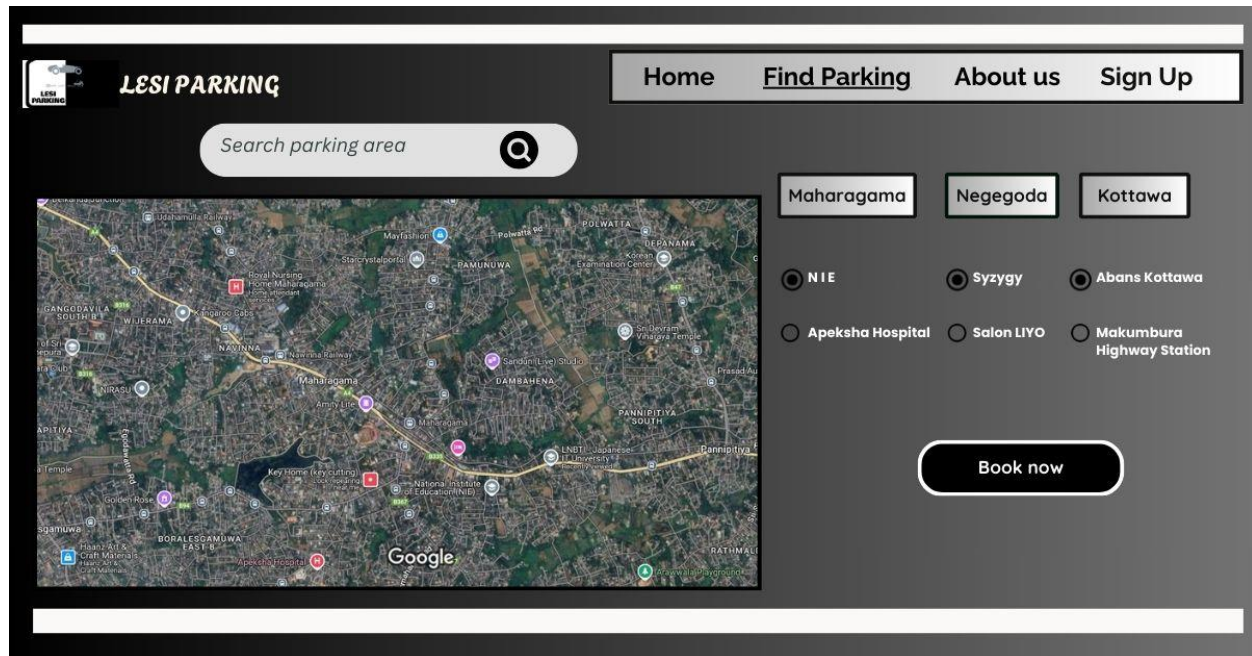
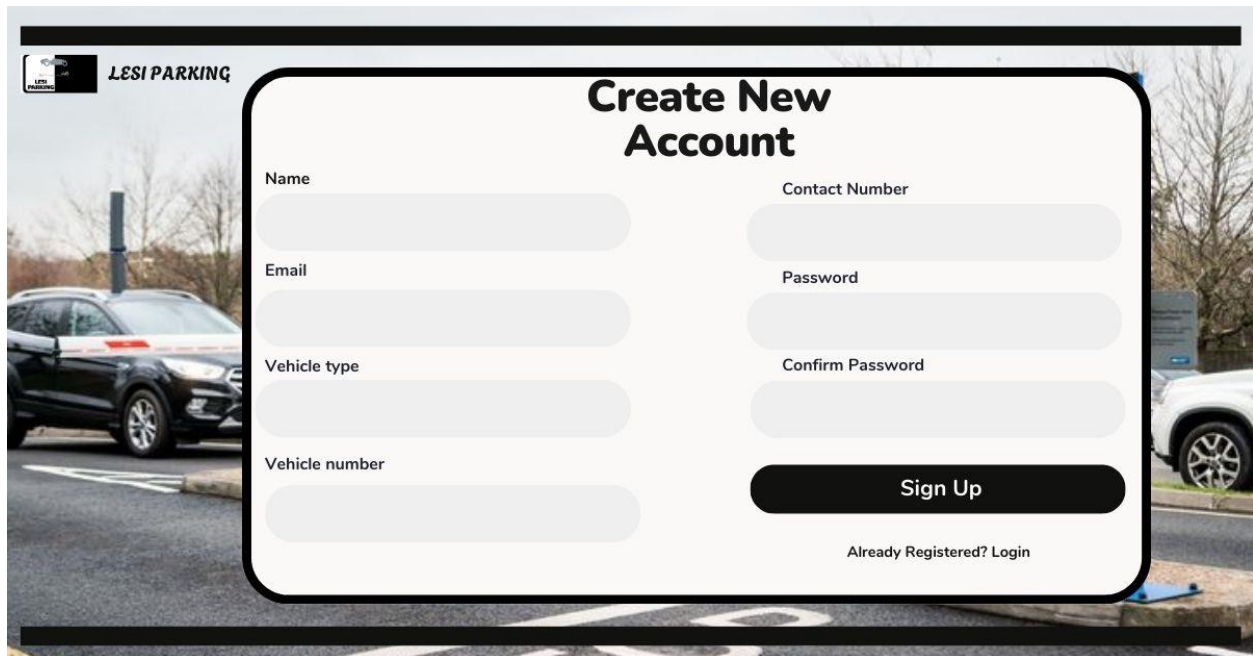


Figure 40 Find Parking

The Find Parking page allows users to search for available parking slots by city. Upon clicking the Emergency Parking button, users are redirected to this page, where they can enter a city name (e.g., Maharagama) in the search bar. The map then displays available parking slots in that area. Once the user identifies a spot, the Book Now button becomes active, allowing them to proceed with booking the selected parking space. The page also features city filters such as Maharagama, Negegoda, and Kottawa, and shows nearby locations like Apeksha Hospital and NIE.

➤ Sign Up



LESI PARKING

Create New Account

Name

Contact Number

Email

Password

Vehicle type

Confirm Password

Vehicle number

Sign Up

[Already Registered? Login](#)

Figure 41 Create Account

When a new customer clicks the Sign-Up button in the navigation bar, they will be directed to the Create New Account form. In this form, they need to fill in their details to create a new account. After submitting the form, they can successfully sign up. Below the Sign-Up button, there will be a link saying "Already registered? Login". If the customer has already created an account, they can click this link to be redirected to the Login page, where they can enter their credentials to access their account.

➤ Account Create form



Figure 43 Create Account Successfully

The "Account Created" page will display a message confirming that the user has successfully created an account. After filling in the Create New Account form and submitting it, the user will be redirected to this page with a clear message like:

"Account Created Successfully!"

This message will reassure the user that their account has been set up, and they can now proceed to log in. A button or link such as "Go to Login" will be provided, allowing the user to directly access the Login page to enter their credentials and start using their account.

➤ Login page

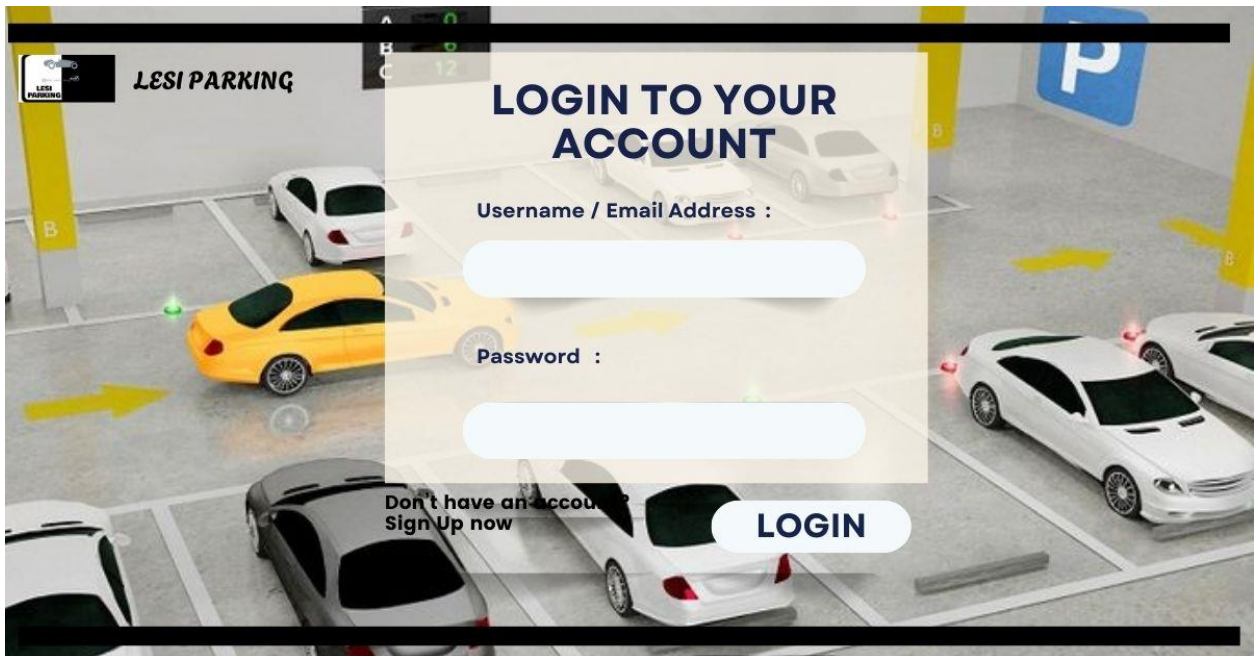


Figure 44 Login form

On the Login page, if the user already has an account, they can log in by entering their email and password. After entering the correct credentials, they will be granted access to the website.

If the user doesn't have an account, there will be an option labeled "Don't have an account? Sign up now". By clicking this link, the user will be redirected to the Create New Account page where they can fill in their details to register. This offers an easy way for new customers to sign up and create an account on the platform.

➤ Booking page

LESI PARKING

Select a day
27.09.2021

Select time
00:00 AM

User name

Vehicle No :
Vehicle type :
Contact No :

Delete account

Maharagama	Negegoda	Kottawa
<input checked="" type="radio"/> NIE	<input checked="" type="radio"/> Syzygy	<input checked="" type="radio"/> Abans Kottawa
<input type="radio"/> Apeksha Hospital	<input type="radio"/> Salon LIYO	<input type="radio"/> Makumbura Highway Station

Advanced Payment

Confirm booking

Figure 45 Booking Page

This Booking Page allows both regular and new customers to make parking reservations. After logging in, regular customers can access this page directly via the "Regular Customer" button. New customers must first sign up, create an account, and then log in to reach this page. The page requires customers to enter their booking date, time, parking slot, and advance payment details. On the left, user details are displayed with an option to Delete Account, pending admin approval for database removal. Once all required fields are completed, the Confirm Booking button is enabled to finalize the booking process.

➤ Regular Customer's Booking Confirmation Page

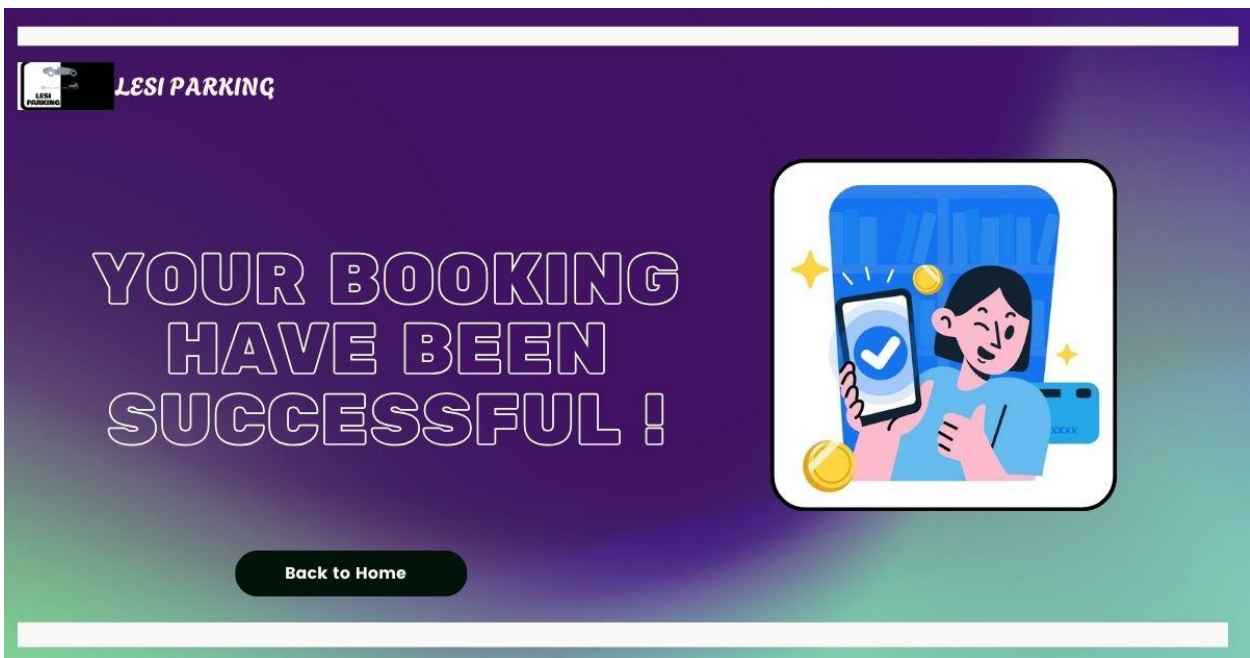
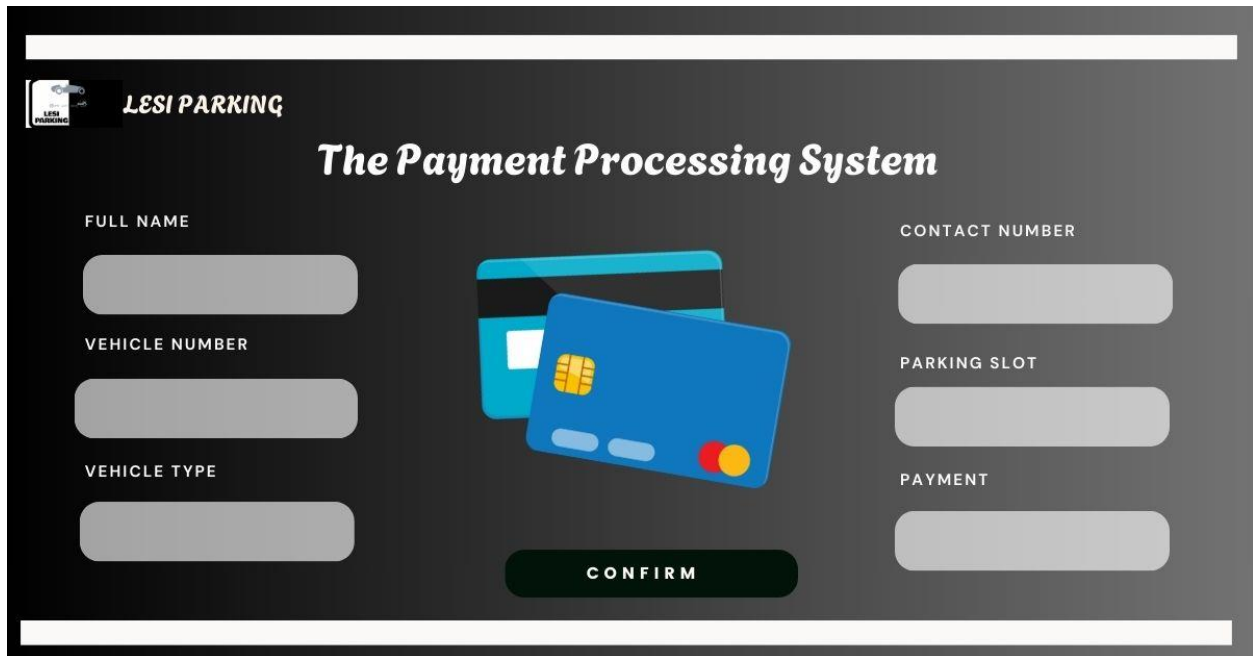


Figure 46 Regular Customer's Booking Confirmation

When a registered customer fills out the booking form and clicks the Confirm Booking button, they are directed to the "Your Booking Has Been Confirmed" page. This page provides a confirmation message to assure the customer that their booking has been successfully processed. Additionally, it includes a "Back to Home" button, enabling the customer to return to the homepage conveniently. This confirmation page provides a sense of completion and satisfaction, ensuring the customer that their booking details have been recorded.

➤ Payment Processing Page



The screenshot displays a web interface for 'LESI PARKING' titled 'The Payment Processing System'. The interface is set against a dark grey background. In the top left corner, there is a small logo and the text 'LESI PARKING'. The main title 'The Payment Processing System' is centered at the top in a large, white, serif font. Below the title, the form is organized into three columns. The left column contains three input fields labeled 'FULL NAME', 'VEHICLE NUMBER', and 'VEHICLE TYPE'. The right column contains three input fields labeled 'CONTACT NUMBER', 'PARKING SLOT', and 'PAYMENT'. In the center of the form, there is a graphic of two overlapping credit cards, one blue and one teal. At the bottom center, there is a dark green button with the word 'CONFIRM' in white capital letters. The entire form is enclosed in a dark grey border with a thin white line at the top and bottom.

Figure 47 Payment Processing

This Payment Processing Page is a mandatory step for all customers to complete their booking. Customers need to provide essential details, including their Full Name, Contact Number, Vehicle Number, Vehicle Type, Parking Slot, and Payment Amount. All fields must be filled accurately to enable the Confirm button. Upon clicking the Confirm button, the system processes the payment and redirects the customer to a confirmation page that displays the message "Your booking has been successful/confirmed."

➤ Admin Dashboard for Registered customers

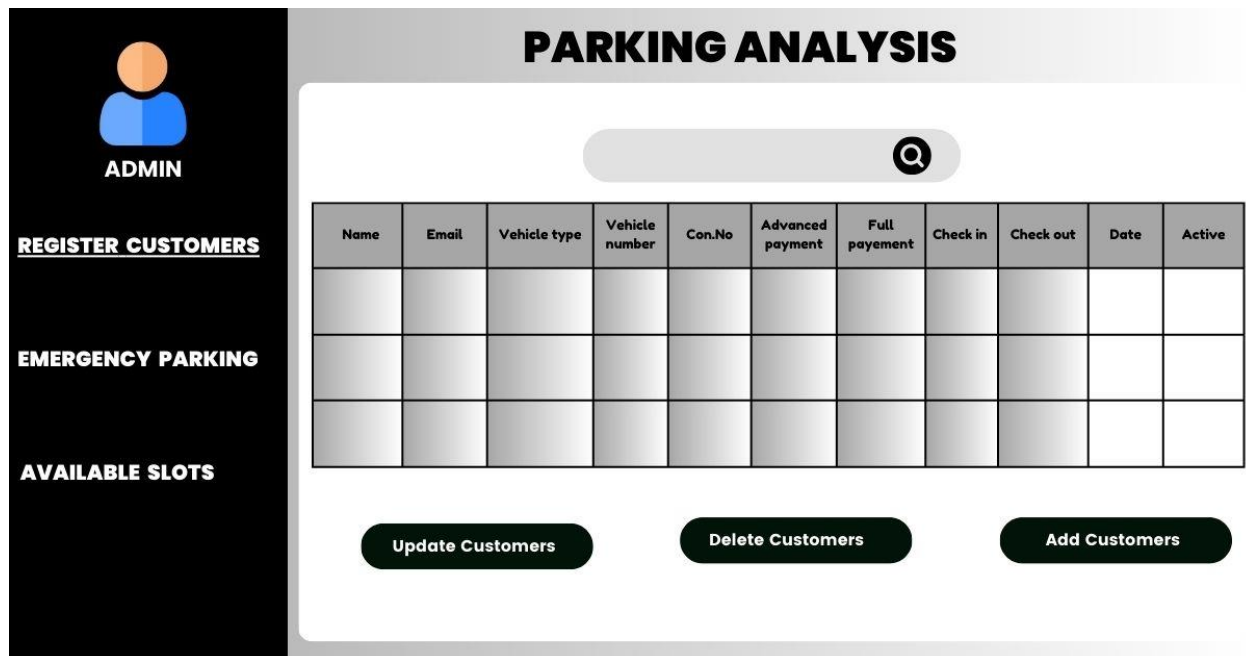


Figure 49 Admin Dashboard for Registered

This is the Register Customer View page, where the admin can manage all customer-related information and operations for registered users. The page displays a detailed table containing customer details, including their name, email, vehicle type, vehicle number, contact number, advanced and full payments, check-in and check-out times, dates, and active status. The admin can perform essential tasks such as viewing, updating, and deleting registered customer data using the provided "Update Customers" and "Delete Customers" buttons. Additionally, the search bar at the top enables quick access to specific customer records, ensuring efficient management of parking registrations.

➤ Admin Dashboard for Emergency Customers

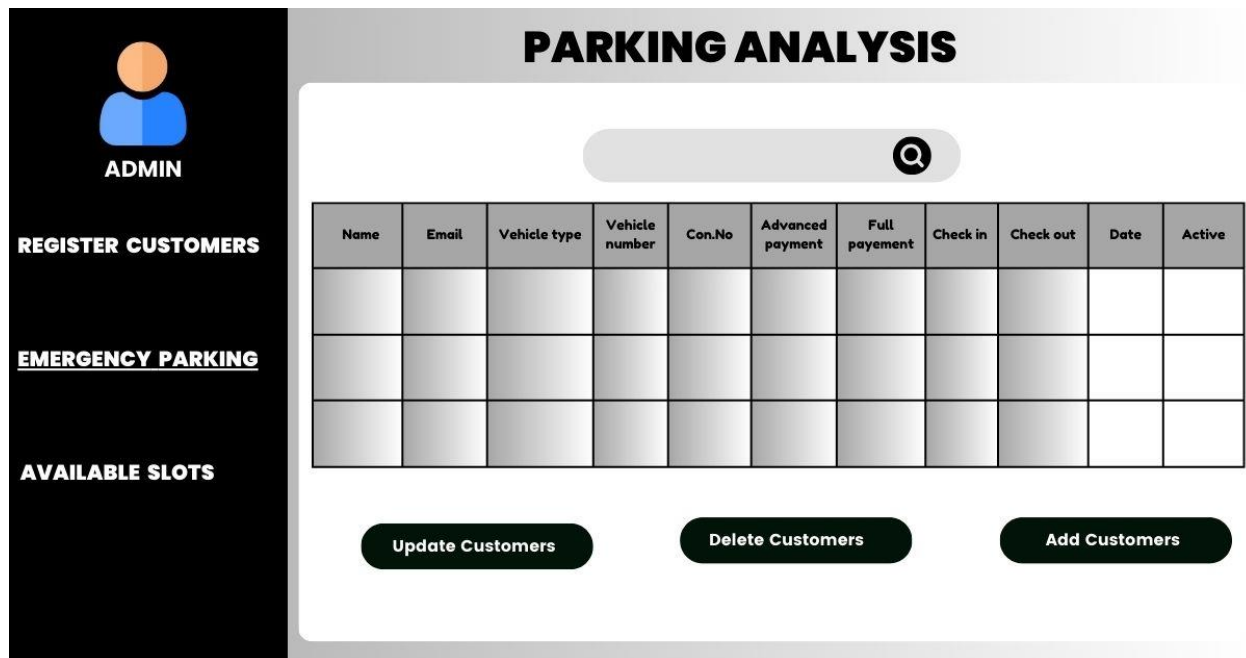


Figure 50 Admin Dashboard for Emergency Customers

This is the Emergency Customer Parking View page, designed for managing information and operations related to emergency parking customers. The page features a comprehensive table that displays details such as customer name, email, vehicle type, vehicle number, contact number, advanced and full payments, check-in and check-out times, dates, and active status. The admin can efficiently view, update, or delete emergency customer records using the "Update Customers" and "Delete Customers" buttons. Additionally, the search bar at the top allows for quick retrieval of specific records, ensuring seamless management of emergency parking operations.

➤ Admin Dashboard for Parking slots

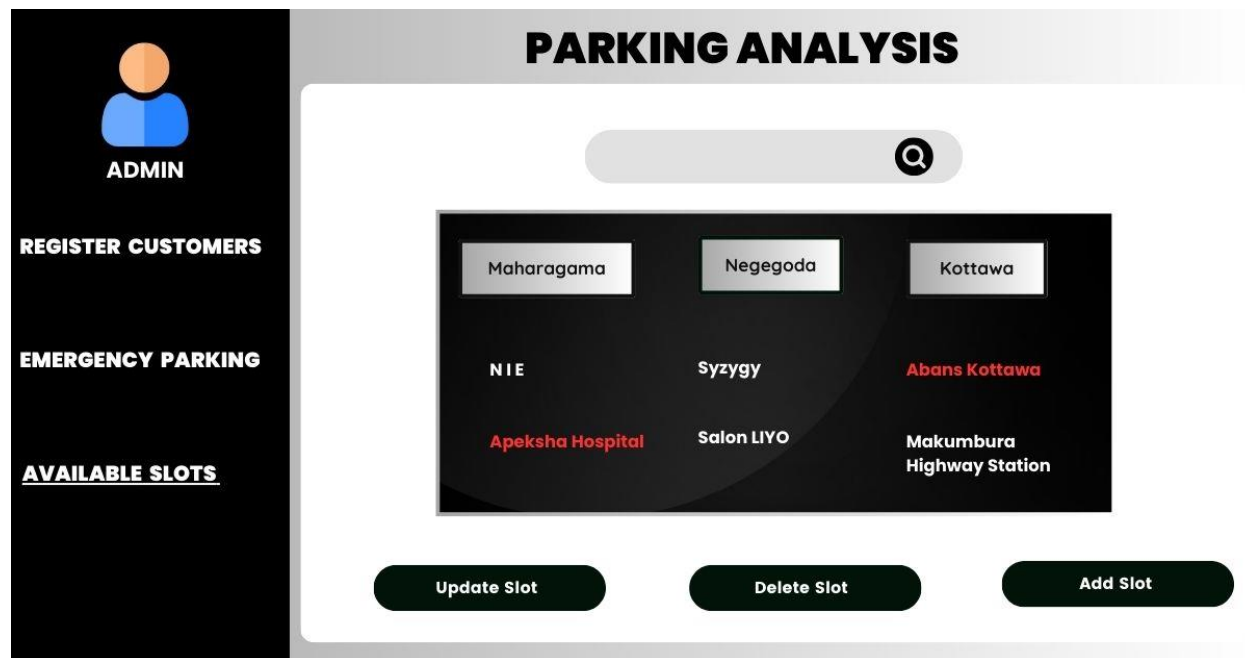


Figure 52 Admin Dashboard for Parking slots

This is the Available Slots View, where the admin can manage parking slot information. The page displays a list of available parking slots categorized by location, such as Maharagama, Nugegoda, and Kottawa. Slots marked in red indicate locations that are already booked. The admin can perform CRUD operations, including adding, updating, and deleting slots, using the respective buttons provided at the bottom of the page. A search bar at the top allows the admin to quickly locate specific slots, ensuring efficient parking management.

3.3 Gantt charts to visualize the progress of the project and individual tasks

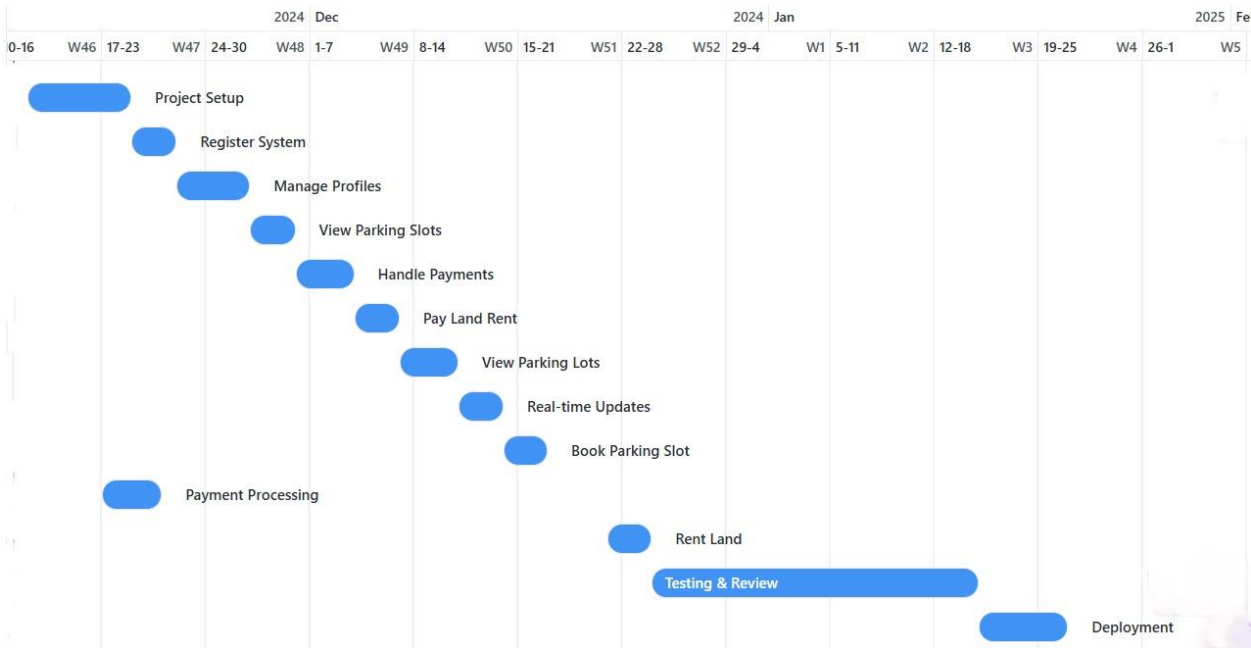


Figure 53 Gantt chart

This Gantt chart outlines the comprehensive timeline for the development and deployment of the *Lesi Parking System*, a smart parking management solution, from mid-November 2024 to early February 2025. Below is a detailed phase-by-phase breakdown:

1. **Project Setup** (Weeks 46-48):

- This initial phase focuses on setting up the project's infrastructure, including server setup, database configuration, and establishing development environments. It also includes defining project goals, requirements gathering, and team alignment.

2. **Register System** (Weeks 47-48):

- This phase establishes the registration module where new users can create accounts, input essential data, and gain access to the system. It covers user authentication, role assignment, and basic data security protocols.

3. **Manage Profiles** (Weeks 48-49):

- The focus here is on developing a user-friendly interface for managing user profiles. This includes editing profile information, viewing account history, and managing preferences. It's essential for a personalized user experience.

4. **View Parking Slots** (Weeks 49-50):

- A feature enabling users to view available parking slots in real time. It includes visual elements like a map or grid view, and it's designed to offer clear insights into parking availability at various locations.

5. **Handle Payments** (Weeks 50-51):

- This critical phase involves implementing secure payment processing. It will cover different payment methods (credit cards, digital wallets) and include features like transaction history and notifications for successful payments.

6. **Pay Land Rent** (Week 51):

- Designed for users renting parking spaces on a long-term basis, this feature enables the payment of monthly or annual land rent. It involves integrating invoicing and a reminder system to keep users updated on due payments.

7. **View Parking Lots** (Weeks 51-52):

- This functionality provides an overview of available parking lots across different locations. Users can see location details, capacity, and availability, making it easier to plan for parking needs.

8. Real-time Updates (Week 52):

- A crucial addition for dynamic updates, this feature ensures users receive up-to-date information on slot availability, traffic, and potential issues. Real-time updates are especially important during peak hours to enhance user convenience.

9. Book Parking Slot (Weeks 52-1):

- This phase enables the functionality for booking specific parking slots. Users can reserve a spot ahead of time, with options for different durations, enhancing the overall user experience by securing parking in advance.

10. Rent Land (Week 1):

- This feature provides an option for users or business owners to rent larger land sections for parking purposes, either for personal or commercial use, adding versatility to the system's offerings.

11. Payment Processing (Weeks 50-51):

- This phase focuses on integrating robust payment gateways, ensuring secure transactions, and setting up the backend for handling financial data. This also includes fraud detection and compliance with industry standards.

12. Testing & Review (Weeks 2-4):

- A comprehensive testing and review phase where the system is assessed for performance, usability, and security. This includes unit testing, integration testing, and user acceptance testing to ensure *Lesi Parking System* is reliable and user-friendly.

13. Deployment (Week 5):

- The final stage involves deploying *Lesi Parking System* to the production environment, making it accessible to end-users. Post-deployment monitoring and minor adjustments may follow to ensure optimal performance

3.3.1 Work Breakdown Structure

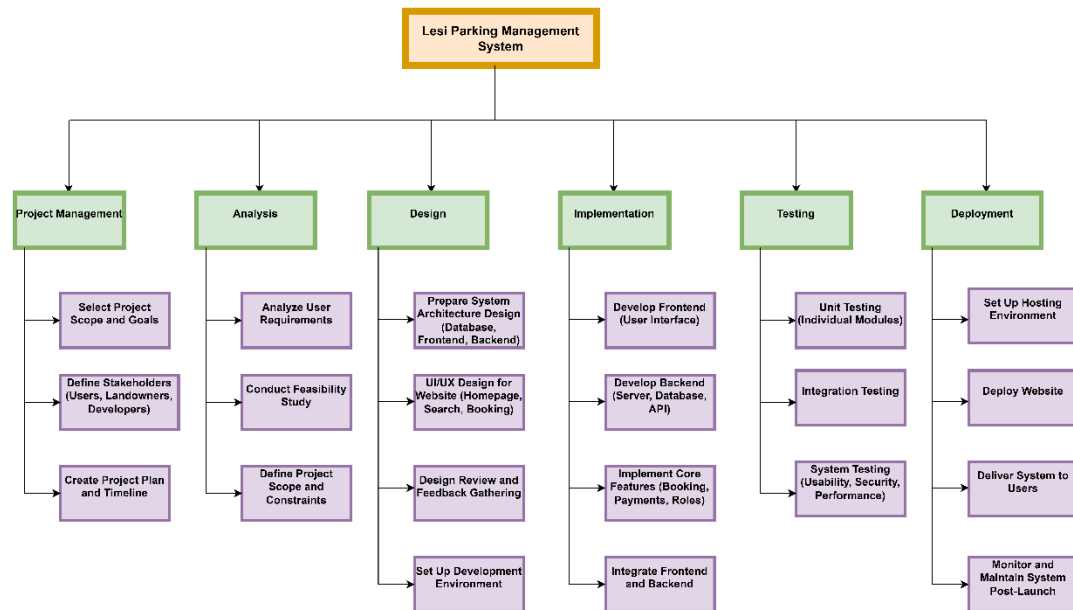


Figure 54 Work Break down Structure

The Work Breakdown Structure (WBS) for the *Lesi Parking Management System* outlines a systematic approach to project development by dividing it into six primary phases: **Project Management**, **Analysis**, **Design**, **Implementation**, **Testing**, and **Deployment**.

1. **Project Management** focuses on establishing project goals, defining stakeholders, and creating a detailed project timeline to guide the development process.
2. **Analysis** involves understanding user requirements, conducting a feasibility study, and defining the project's scope and constraints to ensure alignment with user needs.
3. **Design** entails creating the system's architecture, developing UI/UX for key features (e.g., homepage, booking interface), and setting up the development environment based on gathered feedback.
4. **Implementation** is where the actual development occurs. This includes building the frontend, backend (database, server, API), and integrating core functionalities like booking and payments.

5. **Testing** encompasses various levels, such as unit, integration, and system testing, to verify usability, security, and overall performance.
6. **Deployment** involves setting up the hosting environment, launching the website, and providing post-launch monitoring and maintenance to ensure smooth operation and reliability for users.

Chapter 4 – Implementation

For the *Lesi Parking Management System*, the implementation utilizes the following technologies:

Frontend

- **HTML:** The structure and layout of each page are defined with HTML, creating the foundation of the user interface.
- **Tailwind CSS:** A utility-first CSS framework, Tailwind is used for styling the website to ensure a responsive, modern, and cohesive look across different devices.

Backend

- **Spring Boot:** A framework that handles the server-side logic, user authentication, and connects the frontend with the database. It simplifies building web apps by providing ready-made solutions for common tasks like security and database access. Spring Boot also helps manage data processing and ensures the app works smoothly.

Database

- **pgAdmin 4 and PostgreSQL:** The database for storing essential data, such as user profiles, parking slot records, and location data. PostgreSQL offers robustness and reliability, while pgAdmin 4 provides a graphical interface for easy management.

Google Maps API

- **Google Maps API:** Used to display an interactive map on the website, allowing users to locate nearby parking facilities. The integration with Google Maps helps users visualize locations and navigate to their selected parking spot with ease.

Chapter 5 - Evaluation

The evaluation of the *Lesi Parking Management System* assesses the effectiveness, usability, and functionality of the system in meeting its goals of simplifying parking for users and providing value to landowners. The evaluation process covers several key aspects:

1. Functionality

- **Objective Assessment:** The system's core features, such as account management, parking slot booking, and Google Maps integration, are checked to ensure they work as intended. Each feature is tested to confirm that it aligns with user needs and performs accurately under various conditions.
- **Integration Testing:** Ensures that all components—frontend, backend, database, and APIs—work seamlessly together, delivering a smooth user experience.

2. Usability

- **User Interface:** The evaluation considers if the Tailwind CSS-based design provides a responsive, accessible, and visually appealing experience across devices.
- **User Testing:** By collecting feedback from potential users, the system's ease of use and navigation are evaluated. Testers provide insights into how intuitive and efficient the interface is for locating and booking parking spaces.

3. Performance

- **Speed and Responsiveness:** The system is tested for load times and response rates, particularly during peak usage times, to ensure that users experience minimal delays.
- **Scalability:** Checks are done to evaluate if the backend and database can handle increased traffic as the user base grows.

4. Reliability and Security

- **Data Security:** The system's data handling processes are reviewed to ensure they meet security standards, protecting user data, and payment details.

- **Error Handling:** Evaluation of how the system manages errors, such as failed connections or incorrect data input, ensures that it responds appropriately and provides helpful feedback to users.

Chapter 6 - Conclusion

The **Lesi Parking System** is a comprehensive parking management solution designed to address the parking challenges in Sri Lanka. By enabling seamless discovery, booking, and management of parking spaces, it simplifies the process for commuters, tourists, and landowners. The system includes key features such as real-time updates, automated entry/exit processes, user accounts with loyalty programs, advance booking options, and feedback mechanisms. Additionally, it incorporates environmental incentives to encourage eco-friendly parking choices.

The system is built with scalability, performance, reliability, and security in mind, ensuring a smooth user experience across various platforms. The platform also allows landowners to list and manage parking spaces, making it a win-win for both users and property owners. The focus on usability makes the platform accessible to everyone, regardless of technical expertise.

By streamlining the parking experience and introducing innovative solutions, Lesi Parking aims to transform the parking landscape in Sri Lanka, offering a convenient, efficient, and sustainable alternative to traditional parking systems. With a clear emphasis on user satisfaction and operational efficiency, the system is positioned to play a pivotal role in improving the parking experience while contributing to the development of smarter urban environments.

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- [1] S. F. S. Sadati and M. S. K. A. Rahman, "Smart Car Parking Management System," *IEEE Transactions on Intelligent Transportation Systems*, vol. 21, no. 8, pp. 3289–3298, Aug. 2020. doi: 10.1109/TITS.2020.2960154.
- [2] M. G. Chatterjee and N. R. Ganguli, "A Survey on IoT-Driven Smart Parking Management System," *IEEE Access*, vol. 8, pp. 74212–74228, 2020. doi: 10.1109/ACCESS.2020.2989757.
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