CPIT 250-system analysis and design
Project Proposal

AI-Powered Car Wash System

Presented By:

Fares Abduljawad 2139305

Fares AlHazmy 2335994

Yazan Al Yami 2339804

Khalid Shubayli 2359091

Instructor: **Prof. Awny**

Table of contents

Introduction

The AI-Powered Car Wash System project was developed as part of the CPIT 250 – System Analysis and Design course. The primary objective of this project is to design a smart and efficient system that enables customers to easily book car wash services through an AI-driven platform. Traditional booking methods often suffer from delays, miscommunication, and limited accessibility. This project aims to address these challenges by providing an intelligent, fast, and user-friendly solution. The project emphasizes the creation of clear forms, informative reports, and intuitive interfaces that enhance the experience for both customers and service providers. This report documents the overall design process, including the problem analysis, proposed solution, stakeholder interviews, UML diagrams, form designs, developed interfaces, and final conclusions.

Problem statement

The Car Wash Industry faces many challenges that lead to inefficiencies and customer dissatisfaction, operational problems. The ratio of these problems are particularly high in dry big cities where the demand for car wash services are high. some key problems include:

1. Long Waiting Times: Customers often have to wait in long queues at car wash stations, during rush hours it may take hours long.

2. Service options: Few service choices available, along with poor cleaning quality from employees, resulting in customer dissatisfaction.

3. Limited capacity: Not being able to serve multiple customers simultaneously, leading to longer wait times and potential customer dissatisfaction.

4. High cost: Car wash services are overpriced relative to the quality provided, making customers question the value for money.

5. Uncomfortable experience: Failure to provide a comfortable environment during the allocation of the service.

6. Resource Management: Car Washes often struggle with resource management such as equipment and staff. Without a proper system in place it can be challenging to manage the resources efficiently. This not only affects the customers but also employees who have to deal with the fallout of the system.

7. Inconsistent Quality Control & Inspection: Traditional quality control methods in car washes often rely on manual inspection, which can be subjective, inconsistent, and time-consuming.

These problems highlight the need for a more efficient, transparent, and customer-friendly system that can streamline the car wash process and enhance the overall customer experience. By addressing these issues, car wash service providers can improve customer satisfaction, increase operational efficiency, and ultimately grow their business all while making life easier for both customers and employees.

Proposed solution

To address the problems identified in the car wash industry, we propose the development of a Car Wash App. This app will provide a user friendly interface for customers and improve operational efficiency for car wash service providers. The app will use modern technology to offer features designed to enhance user experience. Key features include:

1. Online booking: Through the app or web, customers may schedule vehicle wash services by choosing the service type, day, and time. This function will cut down on waiting times and do away with the requirement for manual booking. A more easy and effective booking procedure is ensured by allowing customers to browse various time slots and select the one that best suits their schedule.

2. Water & Chemical Usage Optimization: AI can analyze data on vehicle type, dirt level, and washing parameters to optimize water and chemical usage, reducing costs and environmental impact**.**

3. Transparent Pricing: All service prices will be shown clearly in the app so that users are aware of what they are paying for. The prices for each service, including any additional fees for additional services, are broken down in full for customers to view. This openness will foster confidence and lessen the possibility of price conflicts.

4. Feedback System: Through the app, users can write their experience and leave comments. By using this feedback, car wash service companies can make sure they are meeting consumer expectations and pinpoint areas for improvement. Customers will also be able to consult user reviews and ratings on the app, which will assist them in selecting the best car wash service. The car wash can address the issues of a consumer who had a bad experience and make improvements.

5. Computer Vision for Quality Control: AI algorithms analyze the images to identify areas that need additional cleaning using cameras to capture images of washed vehicles. The system alerts staff to address the issues before the vehicle is returned to the customer.

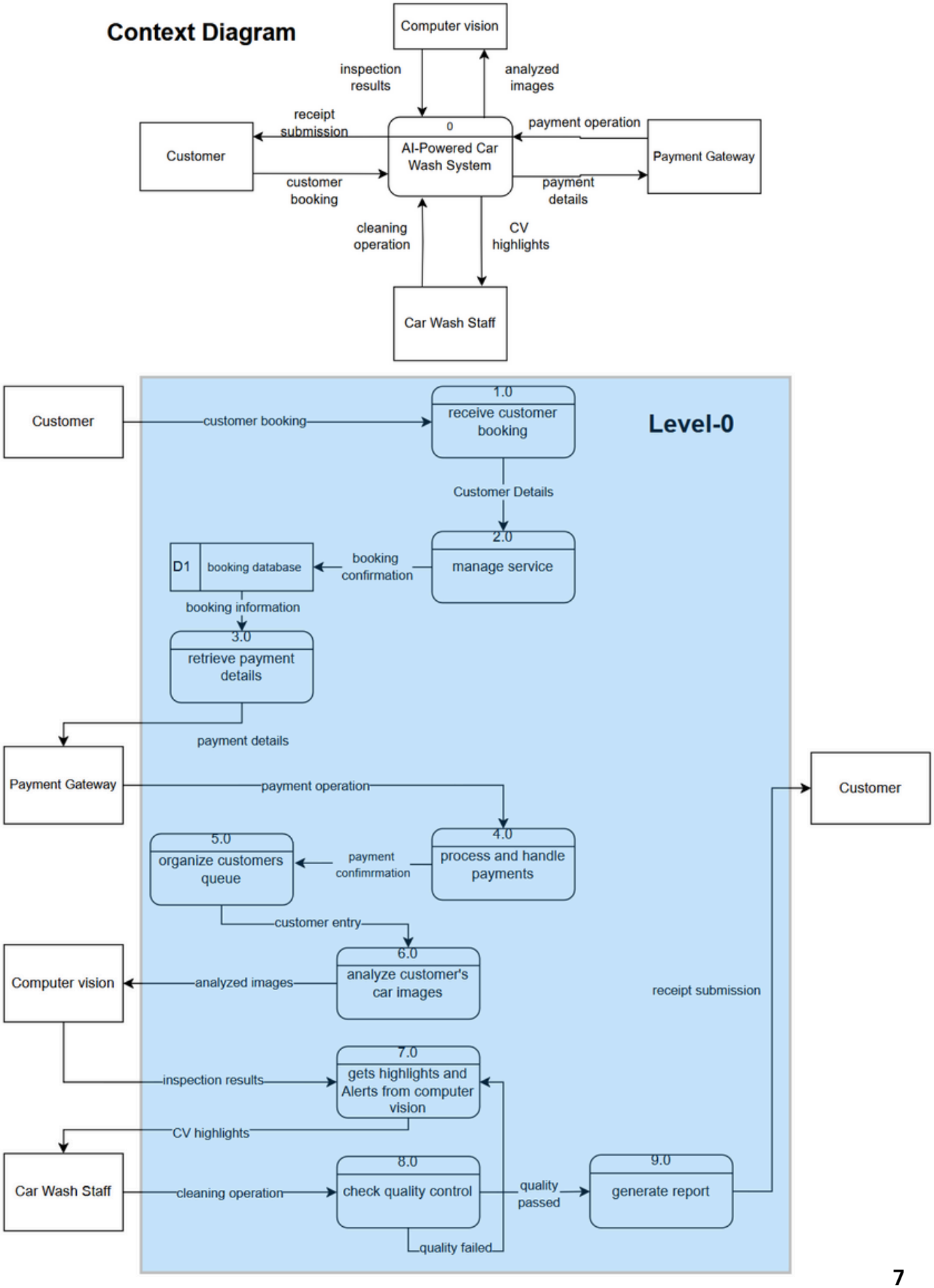
The app's user-friendly interface will make it simple for users of all ages to use and navigate. Additionally, car wash service providers will be able to use the app's backend system to handle reservations, track customer information, and assess business success. This backend technology will help operators make data-driven decisions and improve their offers by providing them with useful information about customer behavior.

Interviews

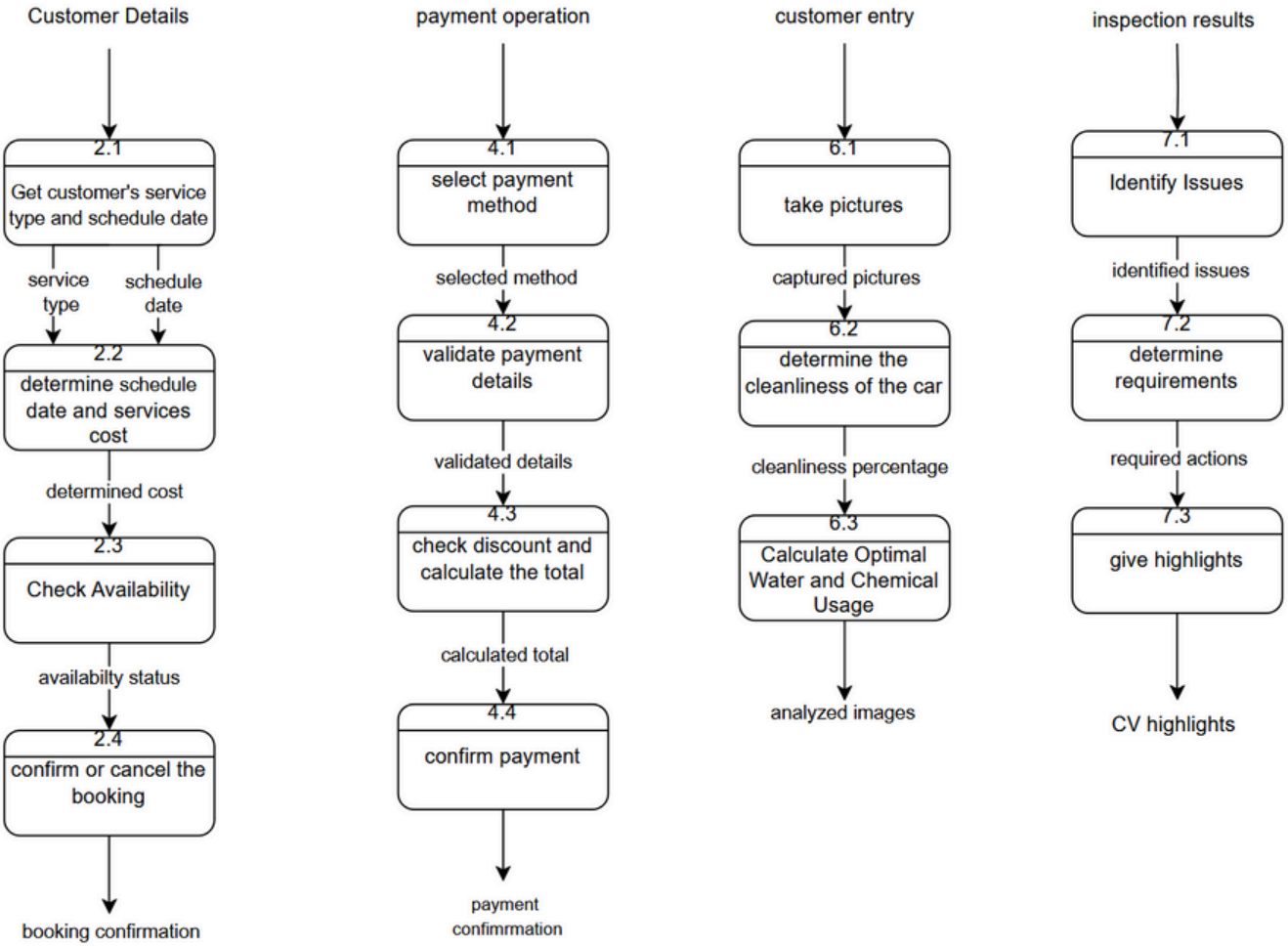
Questions	Answers
Q1: What are the current challenges you face in managing car wash operations?	Managing appointments manually, inconsistent service quality, and resource wastage are major challenges.
Q2: How do you currently manage customer appointments and service schedules?	Mostly phone calls and walk-ins. It can get annoying during busy times.
Q3: What specific features would you like to see in a car wash application?	Online booking, clear service selection, transparent pricing, and better resource management.
Q4: How important is transparent pricing to your customers, and how do you currently handle it?	Very important. Customers want clear pricing
Q5: Do you face challenges with resource management (water, chemicals, staff)?	Yes, it’s tracked manually.

Questions	Answers
Q6: Would you be open to using AI-driven systems to improve quality control and inspection? (Yes/No)	Yes, AI would help spot missed cleaning areas and improve service quality.
Q7: Do you currently collect customer feedback digitally? (Yes/No)	No, mostly feedback is collected verbally.
Q8: Would an online booking system help reduce customer wait times? (Yes/No)	Yes, it would allow better appointment scheduling and less crowding.
Q9: Is tracking customer behavior and resource usage important for your operations? (Yes/No)	Yes, it would help understand service demand and manage water/chemical supplies better.
Q10: Do you require strong security measures like encryption for customer data and payments? (Yes/No)	Yes, secure payments and encrypted storage are critical for customer trust.

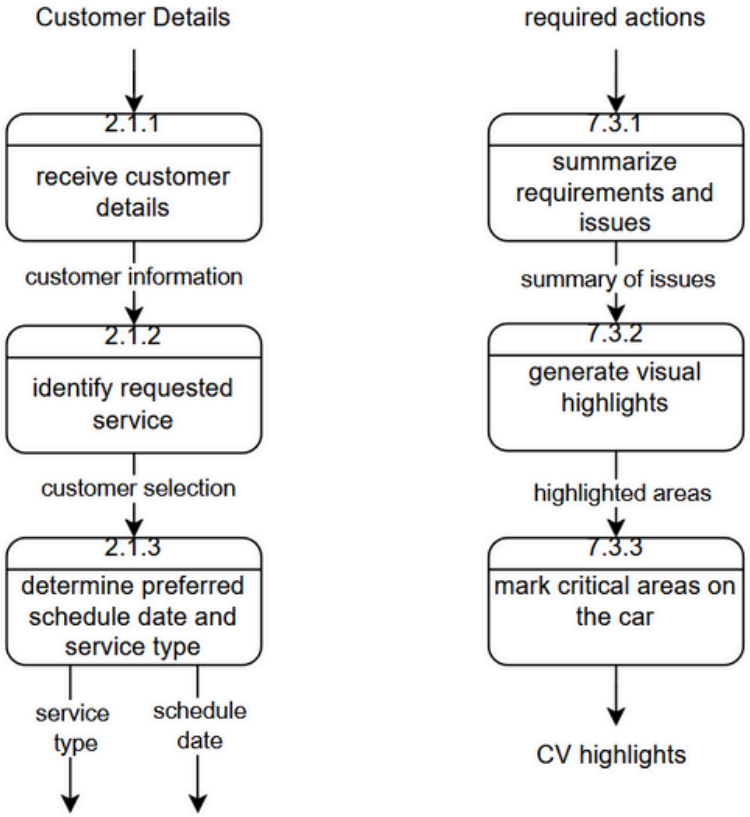
DFD Diagram


Context Diagram
Computer vision
inspection results
analyzed images
receipt submission
payment operation
0
AI-Powered Car Wash System
Customer
Payment Gateway
customer booking
payment details
cleaning operation
CV highlights
Car Wash Staff
Level-0
Customer
customer booking
1.0
receive customer booking
Customer Details
2.0
manage service
D1
booking database
booking confirmation
booking information
3.0
retrieve payment details
payment details
Payment Gateway
payment operation
4.0
process and handle payments
payment confimrmation
5.0
organize customers queue
customer entry
6.0
analyze customer's car images
Computer vision
analyzed images
receipt submission
Customer
7.0
gets highlights and Alerts from computer vision
inspection results
CV highlights
Car Wash Staff
cleaning operation
8.0
check quality control
quality passed
quality failed
9.0
generate report

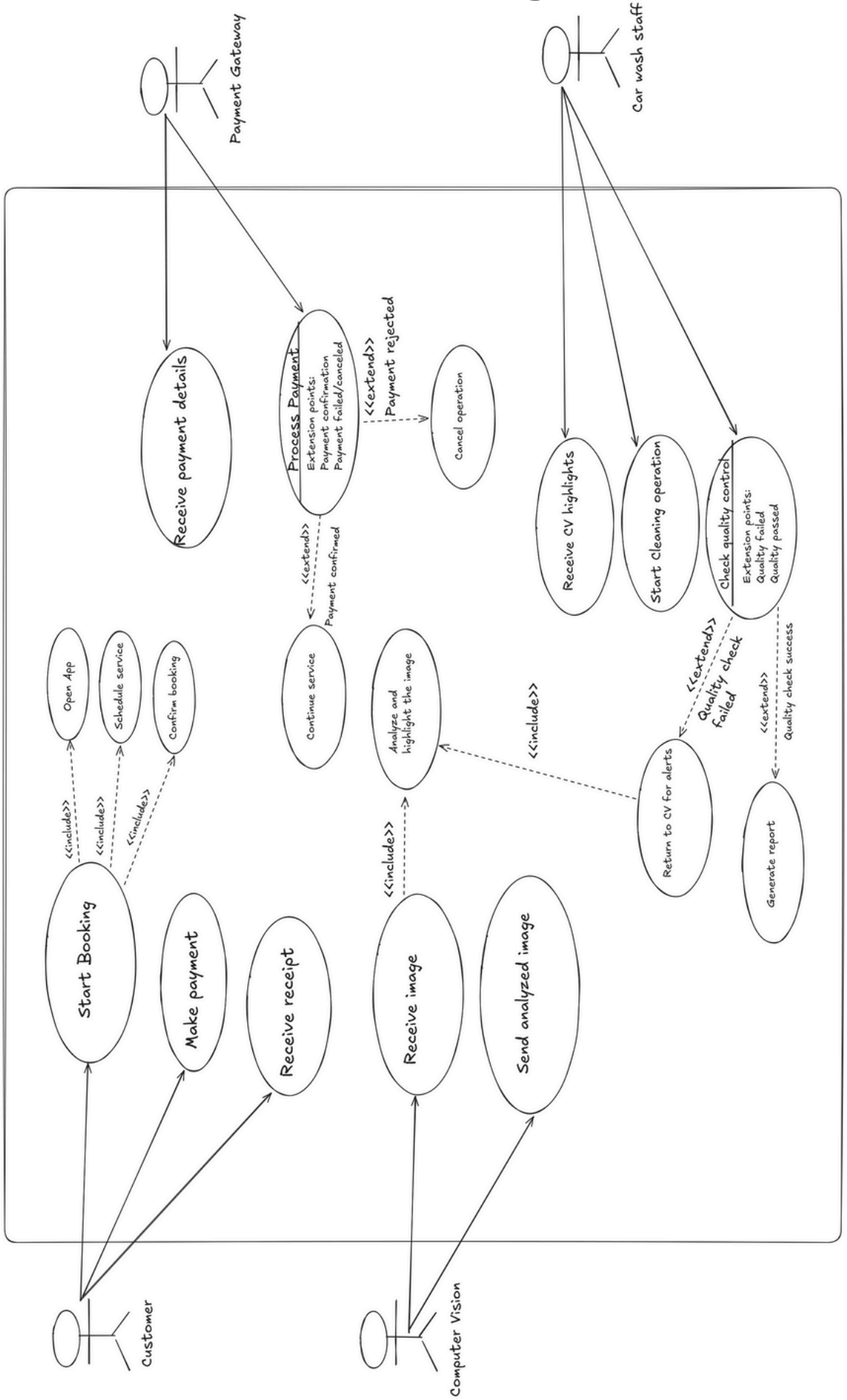
Level-1



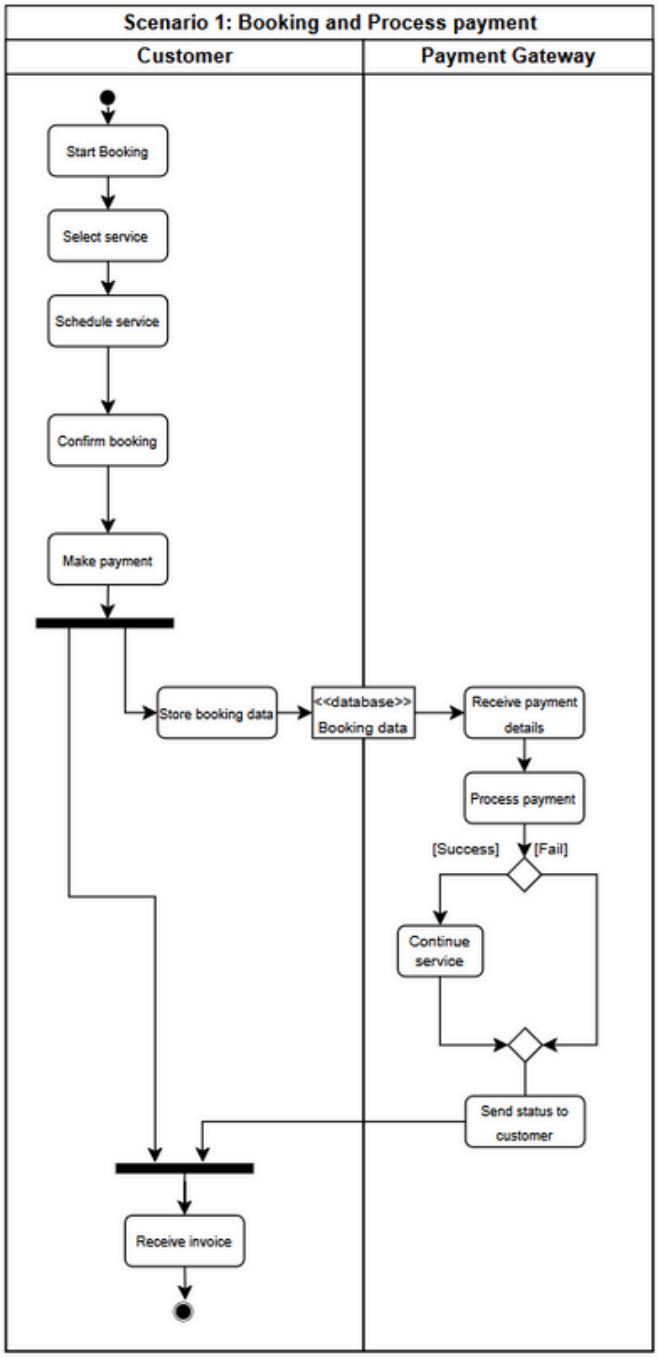
Level-2

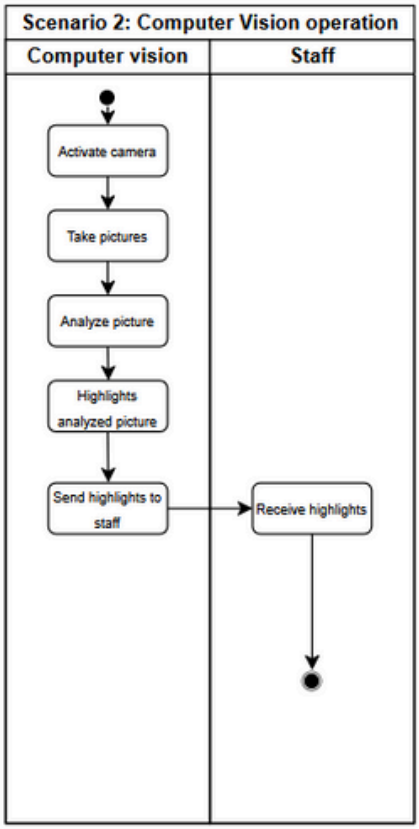


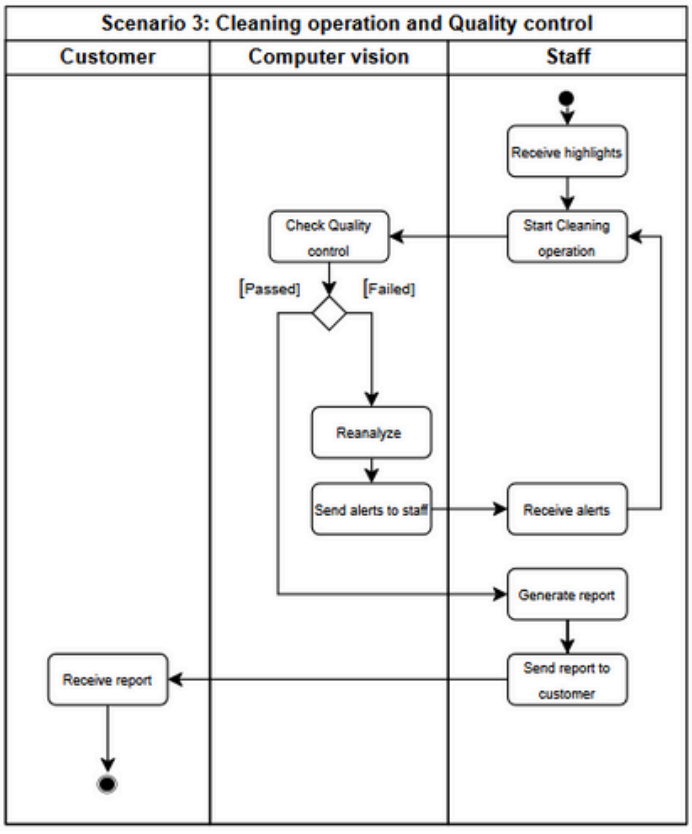
Use Case Diagram



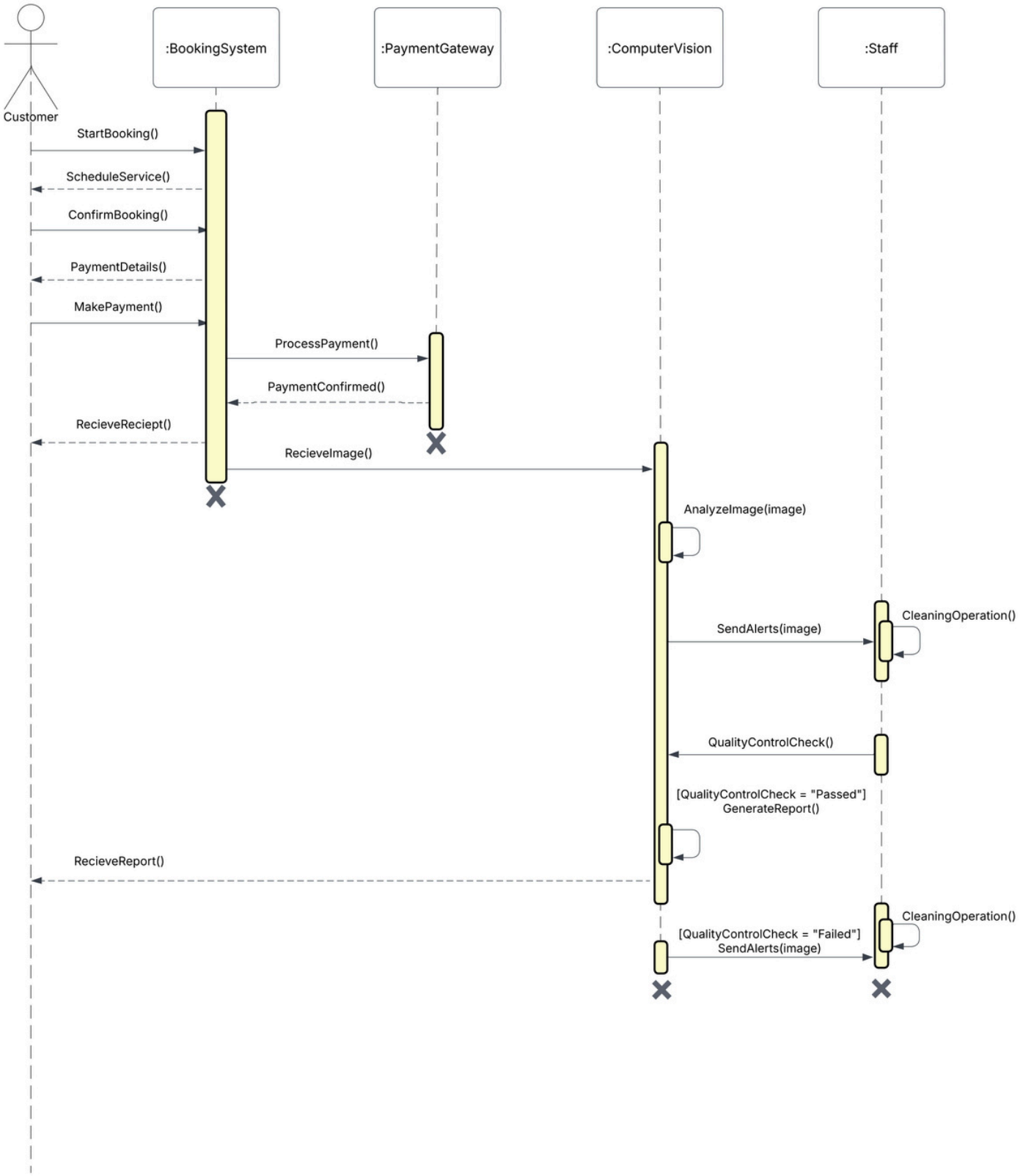
Activity Diagram



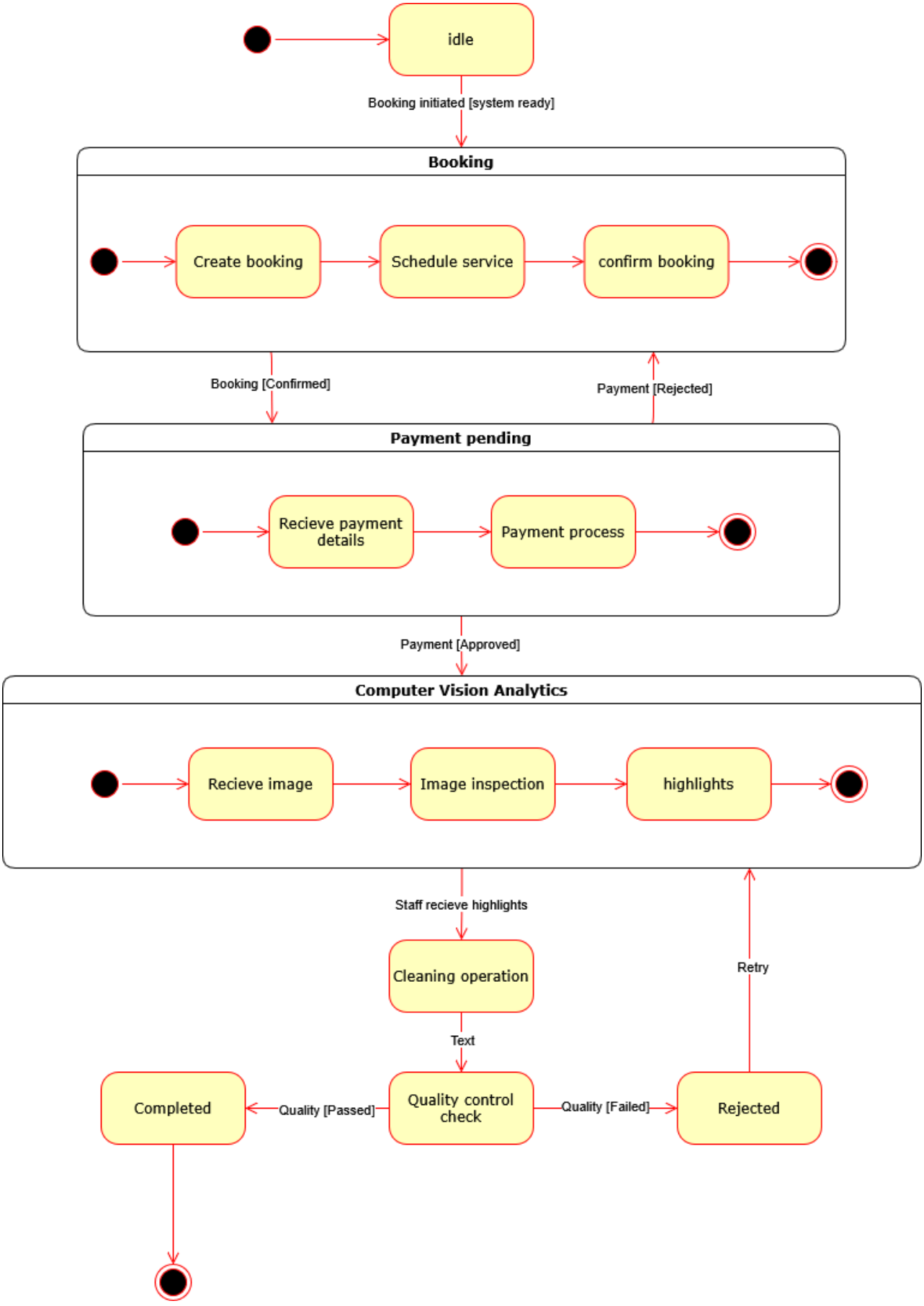




Sequence Diagram



State Diagram



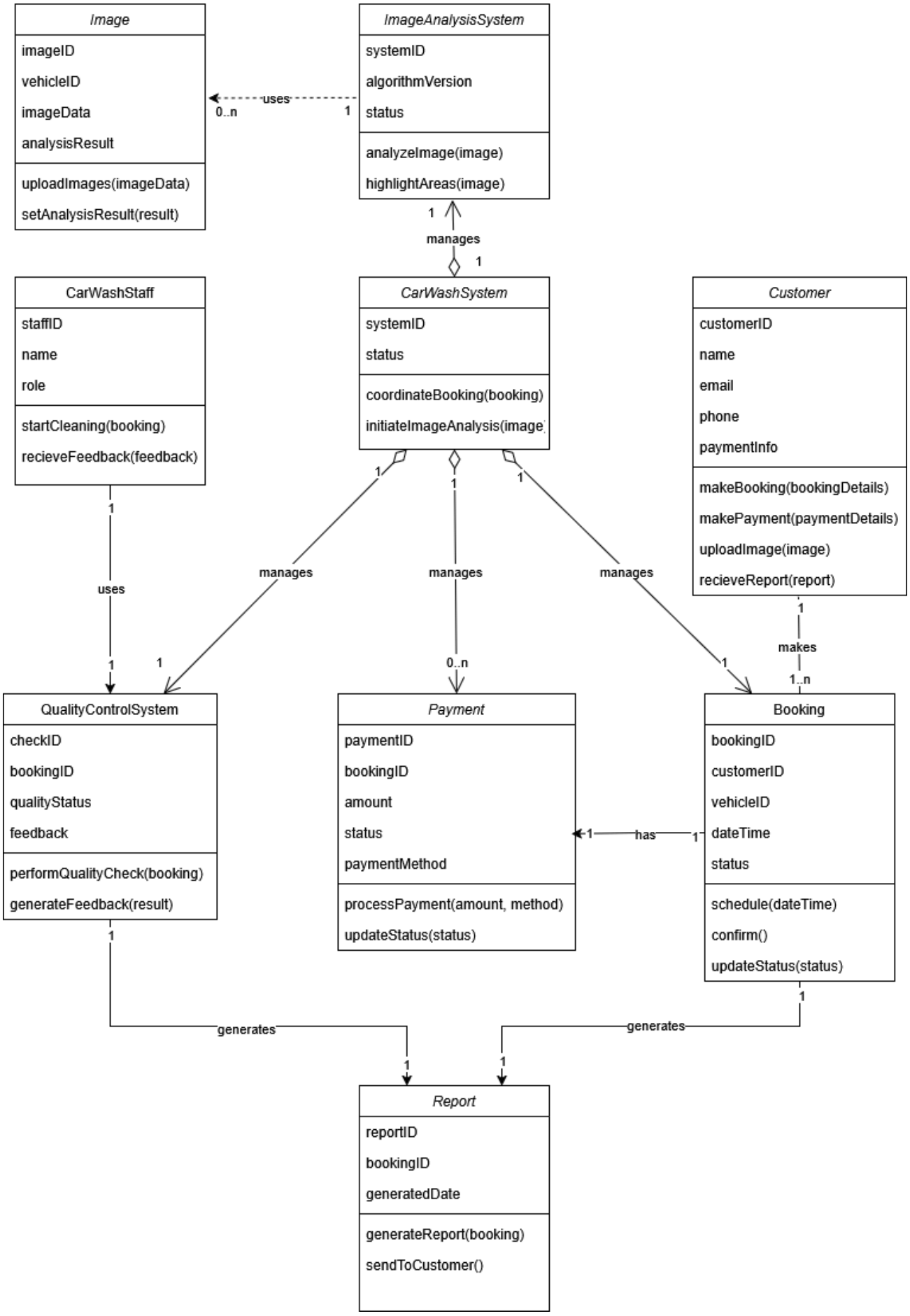
State Description

State	Description
Idle	System is idle, waiting for user to start booking.
Create Booking	User begins the booking process.
Schedule Service	User selects a suitable time slot for the service.
Confirm Booking	Booking details are confirmed before payment.
Receive Payment Details	System collects payment information from the user.
Payment Process	System processes the user's payment.
Cleaning Operation	Cleaning service is performed after payment confirmation.
Quality Control Check	System verifies service quality before finalizing.
Completed	Service is completed successfully and the process ends.
Rejected	Quality check failed and service is rejected.

Stimulus Description

Stimulus	Description
Booking initiated	User initiates the booking process from idle state.
Booking Confirmed	User confirms the booking details.
Payment Rejected	System confirms payment is unsuccessful.
Payment Approved	System confirms payment is successful.
Staff recieve highlights	Staff recieves instructions and highlights from CV.
Perform Quality Check	System or staff conducts quality control.
Quality Pass	Service quality is acceptable and marked as completed.
Quality Fail	Service quality is not acceptable, retry or reject.
Retry	Cleaning operation is repeated after failed check.

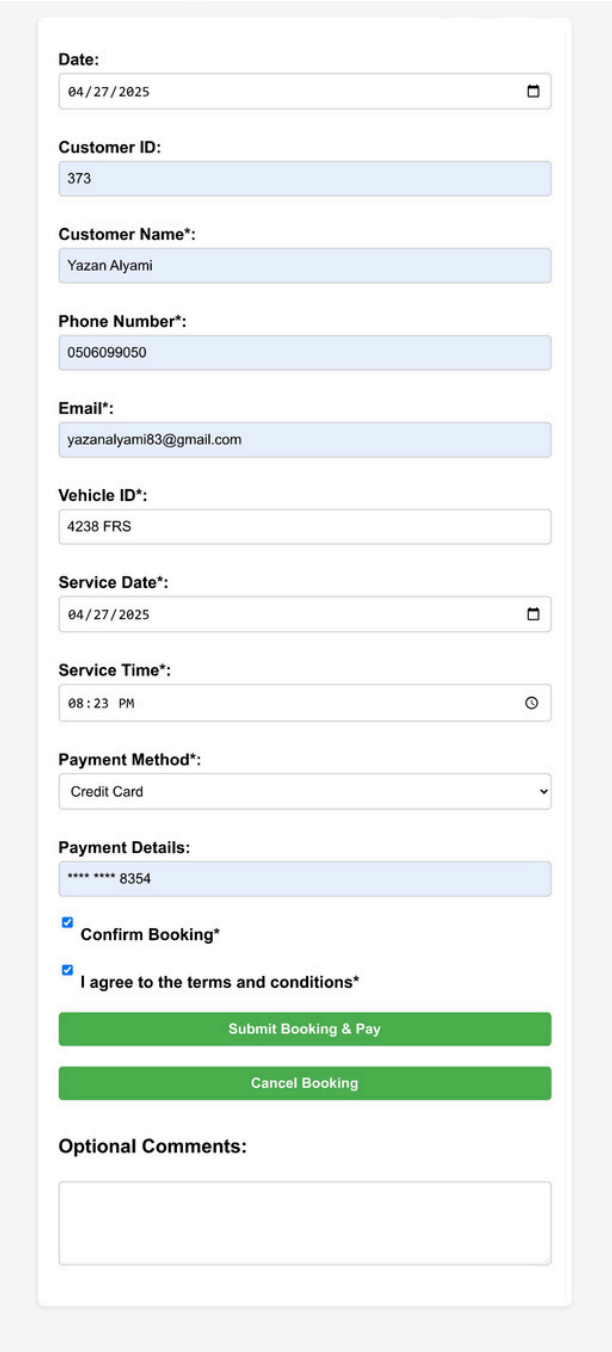
Class Diagram



Forms and Reports

Form

Car Wash Service Booking



Report

Service Completion and Quality Inspection Report

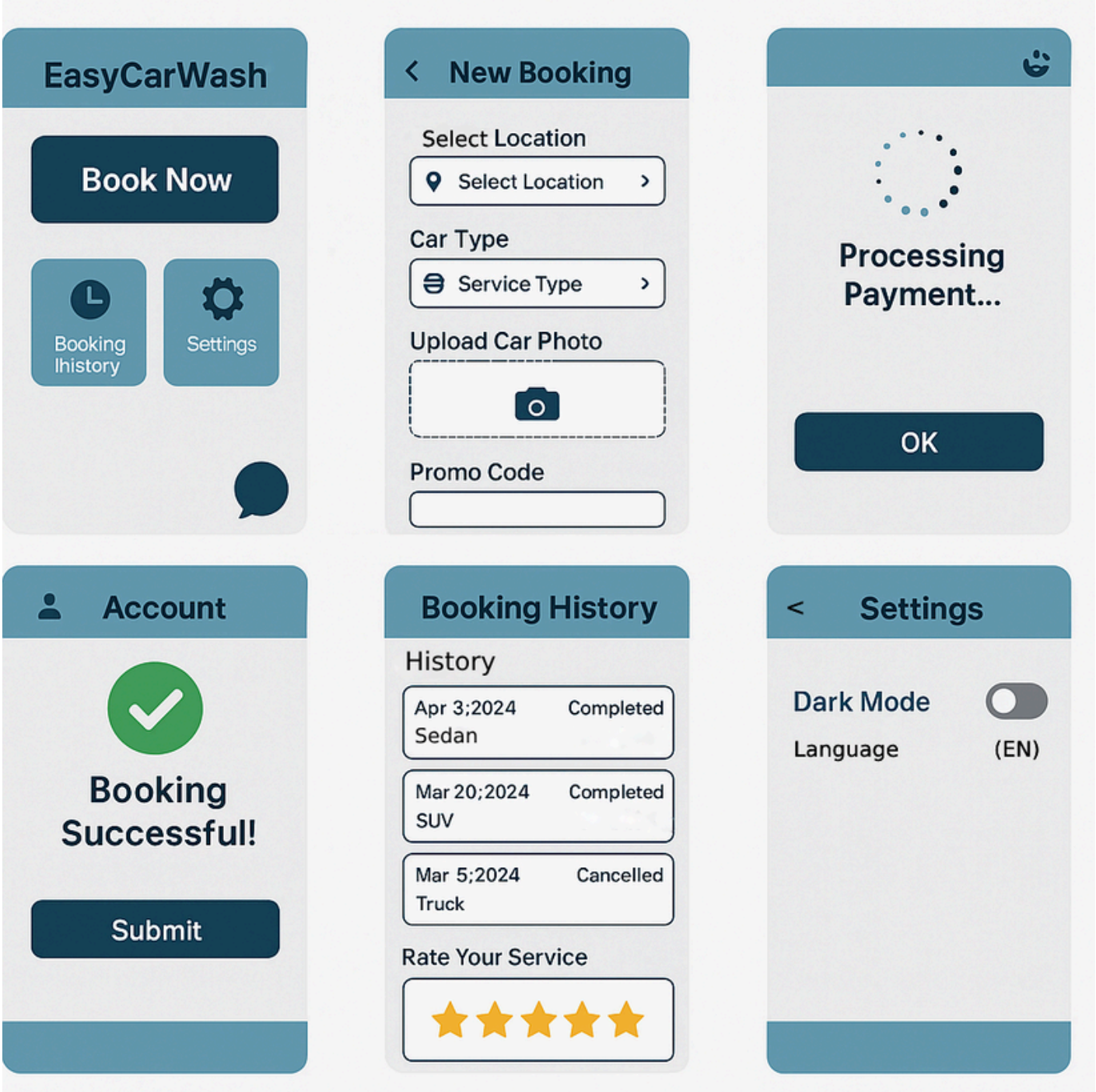
Booking Information	Details
Date	2025-04-27
Customer ID	373
Customer Name	Yazan Alyami
Phone Number	0506099050
Email	yazanalyami83@gmail.com
Vehicle ID	4238 FRS
Service Date	2025-04-27
Service Time	20:24
Payment Method	Credit Card
Payment Details	**** **** 8354
Comments	

Generated By: _____

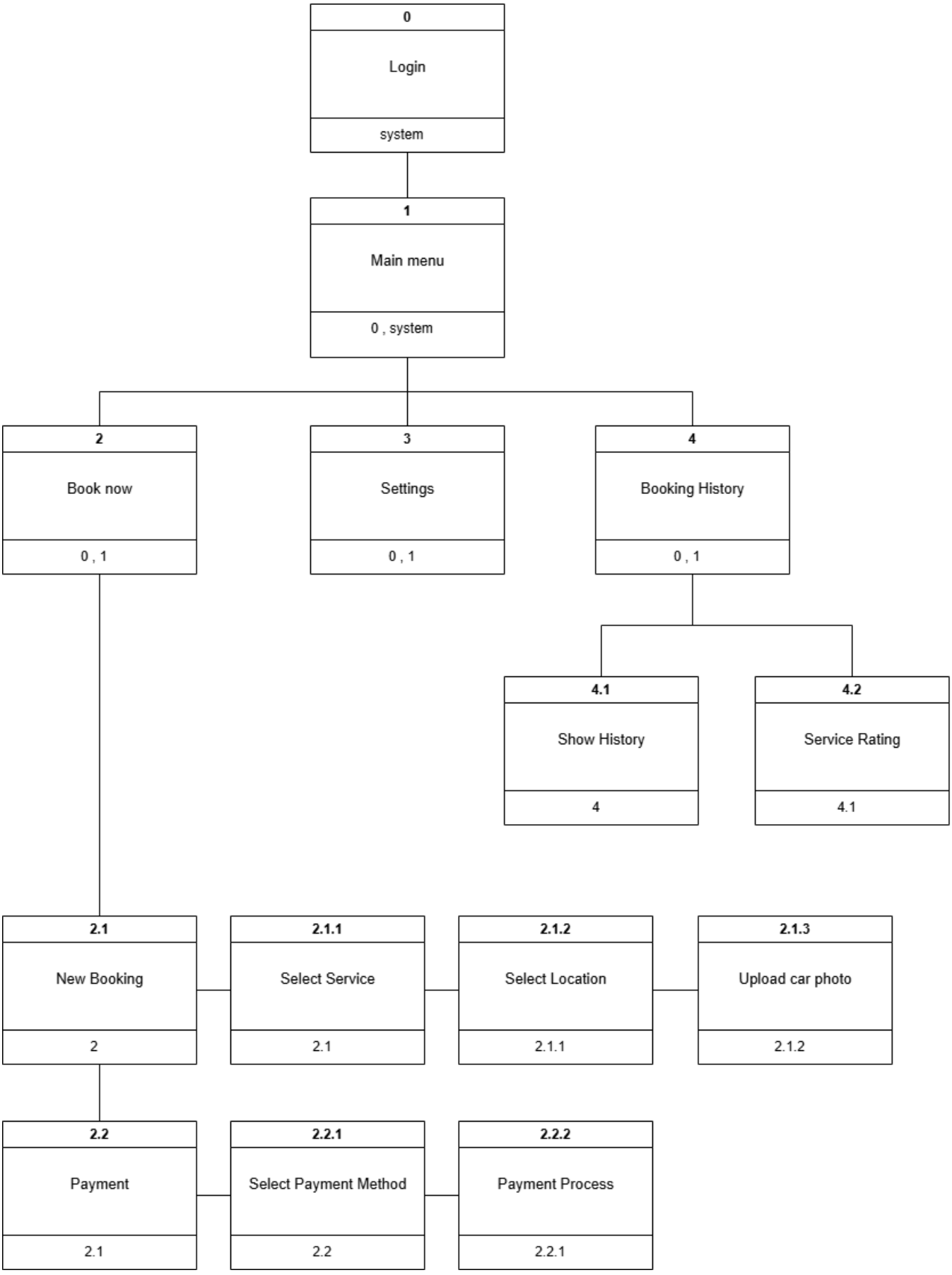
Customer Acknowledgment: _____

Interface and Dialogues

Interface



Dialogue


0
Login
system
1
Main menu
0 , system
2
Book now
0 , 1
3
Settings
0 , 1
4
Booking History
0 , 1
4.1
Show History
4
4.2
Service Rating
4.1
2.1
New Booking
2
2.1.1
Select Service
2.1
2.1.2
Select Location
2.1.1
2.1.3
Upload car photo
2.1.2
2.2
Payment
2.1
2.2.1
Select Payment Method
2.2
2.2.2
Payment Process
2.2.1

Conclusion

The AI-Powered Car Wash System project successfully addresses the major challenges in the traditional car wash system by offering a smart, efficient, and user-friendly solution. Through the integration of AI technologies, online booking, transparent pricing, and quality control systems, the project significantly enhances the overall customer and service provider experience.

The system ensures reduced waiting times, better resource management, and improved service quality. This report documented the complete system development process, including problem analysis, proposed solutions, interviews, UML diagrams, forms, reports, and user interface designs. Overall, the project demonstrates the importance of innovative technology in transforming and modernizing car wash services.