



# **Architecture and User Interface Design Document**

***SOFTWARE DEVELOPMENT LIFE CYCLE***

## ***Car Rental System***

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## Revision History

Version	Date	Author	Description
1	2/7/2025	Pujan Bhuva	Started Initial Draft of the Document
1.1	2/9/2025	Deepasree Meena Padmanabhan	Added GUI for Sign-Up, Sign-In, Password Reset and Policies and terms Page.
1.2	2/9/2025	Pujan Bhuva	Including GUI for Car Rental, Search , booking details, form, and payment pages
1.3	2/11/2025	OgheneRukevwe Esegba	Appended GUI pages for Create, View, Update and delete rental booking by staff and customer
1.4	2/12/2025	Simranjeet Kaur	Including GUI Admin screens for Dashboard, Reports, manager users. Finalized Document.



# 1. Introduction to UI Documentation

## 1.1. Purpose

The purpose of this UI documentation is to define the visual, interaction, and functional aspects of the Car Rental System using Java and JavaFX. It ensures consistent and intuitive user experience across all systems and user types.

## 1.2. Scope

This document covers:

- **UI components**
- **Page layouts**
- **User interaction patterns**
- **Accessibility standards**
- **Navigation flow**
- **Error handling**

## 1.3. Audience

This document is intended for:

- **Developers** – to implement the UI effectively.
- **UI/UX Designers** – to ensure design consistency.
- **Testers** – to validate usability and accessibility.
- **Project Managers** – to understand the UI workflow.

## 1.4. Glossary of Terms

- **Mockup** – A UI design of what the actual screen will look like.
- **UI / UX** – User Interface, User Experience
- **Wireframe** – A basic blueprint of a UI screen layout.



## 2. UI Design Principles and Standards

### 2.1. UI Design Guidelines

The UI will follow principles of:

- **Usability** – Simple, easy-to-use interfaces.
- **Consistency** – Uniform color schemes, typography, and element placements.

### 2.2. Design Standards

The design follows:

- **JavaFX UI Components for cross-platform consistency.**

### 2.3. UI Patterns and Best Practices


- **Card-based layout** for displaying vehicles and booking information.
- **Tab navigation** for organizing user bookings.
- **Popup models** for error messages and confirmations.



### 3. UI Layout and Design Specifications

#### 3.1. Wireframes and Mockups

##### 3.1.1. Login to the Car Rental System

 Harmony

## Log in Your Account

**Star Your Journey Today !**  
Ready to hit the road? Let's get you signed in to explore the best rides tailored just for you.

User Id

Invalid User ID. Please try again.

Password

Incorrect password. Please try again.

[Login](#)

[Forgot password ?](#)

[Sign Up](#)



### 3.1.2. User Registration

 Harmony

Create Your Harmony Account

\* Required to complete your Signup nrollment)

My Profile

\* First Name

Enter a valid first name.

\* Last Name

Enter a valid last name.

\* Email Address

Enter a valid email address.

\* Confirm Email Address

Email address do not match.

\* Password

The password must be over 8 characters long and include an uppercase letter, a lowercase letter, and a special character.

\* Confirm Password

Passwords do not match.

Contact Information

\* Address Line 1

Enter a valid Address Line 1.

Address Line 2

Enter a valid Address Line 1.

\* City

Enter a valid City

\* Province/State

Enter a valid Province/State

\* Postal/Zip Code

Enter a valid Postal/Zip Code

\* Country

Enter a valid Country

Payment Information

\* Name on Card

Enter Card Name

\* Card Number

Enter Card Number

\* Card Expiration

Month

Year

Select Month/Year

\* Security Code

Enter Security code

\* Postal/Zip Code

Enter Postal/Zip code

\* Country


Enter Country

Sign Up

### 3.1.3. Reset Password





Harmony

## Reset your password

To reset your password, enter the email address you use to login.

A OTP link will be emailed to reset your password

Email address

Please enter a valid email address. [Cancel](#)

[Send OTP by email](#)

We have sent an OTP to user@email.com  
Enter the OTP and then your new password below to complete your reset.

Passcode will expire in 30 seconds

Code

Invalid or expired OTP. Please try again.

Password

The password must be over 8 characters long and include an uppercase letter, a lowercase letter, and a special character.


Confirm Password

Password do not match. Please re-enter.

[Change password](#) [Resend OTP](#) [Cancel](#)



3.1.4. Search & Reservation Page

Harmony

SearchMy Bookings

Select Pickup Location ▾

Select Dropoff Location ▾

Select Pickup Date ▾

Select Pickup Time ▾

Select Dropoff Date ▾

Select Dropoff Time ▾

Search


Search Results

Car Name 1

Automatic  
32,000 Kms

\$120 / day

Reserve




Car Name 2

Automatic  
32,000 Kms


\$170 / day

Reserve






### 3.1.5. Confirm Reservation Page

Harmony

SearchMy Bookings

## Confirm Reservation



**Car Name 1**  
Automatic  
32,000 Kms  
**\$120 / day**

### User Details

**Name :** John Snow  
**Email :** abc@gmail.com  
**Phone :** +1 222 555 3322

### Booking Details

**Pick up Location :** 111 Oxford St, Toronto, ON, A4B C5E  
**Pick up Date :** 25th January 2025  
**Pick up Time :** 9:30 AM  
**Drop off Location :** 111 Oxford St, Toronto, ON, A4B C5E  
**Drop off Date :** 26th January 2025  
**Drop off Time :** 5:30 PM

### Billing Details

**Subtotal :** \$240.33  
**Tax :** 43.55  
**Total Charges :** \$290.55

### Credit / Debit Card

Cardholder's Name

Credit / Debit Card Number

CVV


Card Type

Confirm Booking




## Architectural and GUI Specification for Car Rental System

### 3.1.6. My Bookings Page

Harmony

SearchMy Bookings

#### My Bookings




**Car Name 1**  
Automatic  
32,000 Kms  
**\$120 / day**

**Booking Details**  
Pick up Location : 111 Oxford St, Toronto, ON, A4B C5E  
Pick up Date : 25th January 2025  
Pick up Time : 9:30 AM  
Drop off Location : 111 Oxford St, Toronto, ON, A4B C5E  
Drop off Date : 26th January 2025  
Drop off Time : 5:30 PM

**Billing Details**  
Subtotal : \$240.33  
Tax : 43.55  
Total Charges : \$290.55

Cancel Booking



**Car Name 1**  
Automatic  
32,000 Kms  
**\$120 / day**


**Booking Details**  
Pick up Location : 111 Oxford St, Toronto, ON, A4B C5E  
Pick up Date : 25th January 2025  
Pick up Time : 9:30 AM  
Drop off Location : 111 Oxford St, Toronto, ON, A4B C5E  
Drop off Date : 26th January 2025  
Drop off Time : 5:30 PM

**Billing Details**  
Subtotal : \$240.33  
Tax : 43.55  
Total Charges : \$290.55

Cancel Booking



### 3.1.7. Booking Lists

 Harmony

SearchBooking List


CarsBookings

Search: Car Name1Search

#### Booking List


Booked By: User1  
Car Name 1  
Automatic  
32,000 Kms  
\$120 / day  
Cancel Booking

Customer Information  
Age:  
D.O.B:  
ID:



Booked By: User2  
Car Name 2  
Automatic  
32,000 Kms  
\$170 / day  
Cancel Booking


Customer Information  
Age:  
D.O.B:  
ID:



Load More



3.1.8. Available Vehicles

Harmony

Search Available Vehicle

Available VehiclesBooked Vehicles


Available Vehicles

Car Name 1

Automatic  
32,000 Kms

\$120 / day

Book




Car Name 2

Automatic  
23,000 Kms

\$170 / day

Book




Car Name 3

Automatic  
54,000 Kms

\$90 / day


Book



Load More



### 3.1.9. Car Management


**Harmony**

SearchMy Bookings

Car Form


Car Name: Car Name1  
Gear System: Automatic  
Booking Price: \$120 / day  
Mileage: 37,000

Delete vehicles



Car Name: Car Name2  
Gear System: Manual  
Booking Price: \$100 / day  
Mileage: 40,000


Delete vehicles



Add Vehicles




### 3.1.10. Returned Vehicles

Harmony

SearchMy Bookings

Returned Vehicles



Car Name 1  
Automatic  
32,000 Kms  
  
\$120 / day


User Details  
Name : John Snow  
Email : abc@gmail.com  
Phone : +1 222 555 3322  
  
Booking Details  
Drop off Location : 111 Oxford St, Toronto, ON, A4B C5E  
Drop off Date : 26th January 2025  
Drop off Time : 5:30 PM  
Returned by: User1  
  
Billing Details  
Subtotal : \$240.33  
Tax : 43.55  
Total Charges : \$290.55

Maintenance Report  
  
Vehicle Status: Good  
  
Tire Pressure: Good  
  
Mileage Used: 700ms  
  
Service Required: Nil





### 3.1.11. Policies and Terms

Harmony

SearchMy Bookings

## Policies & Terms

### Terms of Service

**Eligibility:** Customers must be 21 or older and have a driver's license and credit card.

**Booking & Payment:** Valid credit/debit card required. Payment is necessary to pick up vehicle.

Cancellations 24 hours or more before pick-up will be fully refunded. No-shows or late cancellations may be penalized.

Harmony cars can only be used for authorized reasons and must be returned in good condition, minus acceptable wear and tear.

### Policy on Privacy

**Data Collection:** We collect your name, email address, contact information, and payment information to better our services.

**Data Usage:** Use your information strictly for bookings, customer service, and law compliance. We will only release your information if required by law.

**Data Protection:** Harmony encrypts financial and personal data.

### Policy of Liability

**Damages and accidents:** The renter is responsible for any damage or theft during the rental period. Optional insurance provides further protection.

**Fines and Penalties:** Renters pay all rental-related fines, penalties, and tolls.

**Breakdowns:** Please call Harmony's 24/7 customer service immediately if the car breaks down. Fixes that violate this agreement will not be paid for.

### Policy on Refunds

**No-show Policy:** Harmony may forfeit the booking fee if not notified.

**Early Returns:** Returned cars before rental time are non-refundable.

### Contact Us

For questions about our policies, please contact Harmony's customer service staff at [support@harmonycarrentals.com](mailto:support@harmonycarrentals.com) or 1-800-HARMONEY.



## 3.2. Page Layout Structure

### 3.2.1. Login

The Login Use Case for the Car Rental System describes how the Customers, Staff, and Administrators use a username and password to log in to the system. The user calls the login page, enters User ID and Password, and then clicks on Login. The system verifies the credentials from the database. After verification, the user is redirected to his/her own dashboard based on his/her role Customers for car rental, Staff to handle rentals, and Administrators to handle systems. Otherwise, the system displays error messages: "Invalid User ID. Try again." in the case of an unknown user or "Incorrect password." Try again." in case of a wrong password. In the case of a failed user, he/she may retry or simply click "Forgot Password?" and reset his password.

### User Registration

The Car Rental System Signup Use Case outlines administrator account management and sign-up of customers. Users are directed to the registration page, provide personal information (name, email, password, address), and the system checks for valid email format and safe password (at least 8 characters, one uppercase, one lowercase, special character). Users provide payment information (credit card, expiration date, CVV, billing address), which are checked by the system. Once successfully, an account is opened, and a confirmation mail is sent. Users log in upon verification. "Invalid email address" or "Passwords don't match" errors prompt corrections. The sequential process involves authentication, payment validation, and activation of accounting.

### 3.2.2. Reset Password Page

The Password Reset Use Case in the Car Rental System shows how the customer can reset the password. The user goes to the Reset Password page, enters the registered email, and clicks on "Send OTP by email". If correct, OTP is sent; otherwise, an error message is shown. The user enters the OTP, which is verified.



If correct, the user provides a new password, following security measures (min 8 characters, uppercase, lowercase, special character). If passwords are not matched, an error occurs. After authentication, the system updates the password and redirects to the login page. Users can choose to use the newest OTP or can cancel the process.

### 3.2.3. Search & Reservation Page

This is the first search page from which customers can search for available rent cars by their desired location, date, and time of preference. The upper part consists of dropdowns in which customers can insert their pickup place and region, date, and time. After data selection, if they press the "Search" button, it displays available cars with price and specifications. Customers can then click on the "Reserve" button to proceed and book a car of their preference.

### 3.2.4. Confirm Reservation Page

After the vehicle selection, the customers are taken to the booking confirmation page where they can accept the booking details like pickup/drop location, dates, and charged amount. User details like name, email address, and phone number are given space before the credit/debit card payment details form. The users enter the payment details and click on "Confirm Booking" to confirm the booking.

### 3.2.5. My Bookings Page

This page allows users to view their existing car reservation bookings. A card for the booking indicates details like car model, rental date, pick-up and drop-off, and billing summary. There is even a "Cancel Booking" button for cancelling the reservation. The layout serves to display all the details required in a simplified manner so that the users may easily manage bookings.

### 3.2.6. Staff Bookings List Page

The Car Rental System's Booking List Page shows user bookings with car information, price details and customer information. It also provides search facilities with cancel booking buttons and load more entries buttons. From its



simple interface, the user as well as the administrator can easily handle bookings while tracking and editing bookings

### **3.2.7. Available Vehicle Page**

Available Vehicles Page of Car Rental System shows the list of vehicles that can be booked by providing information on car name, transmission type, mileage, and daily rental charge with the image. The customers are invited to book the vehicles at once by clicking on the "Book" button. The "Load More" option will download more listings so browsing is made easy. Navigation tabs enable clients to manage their automobile selections through toggling among options that are available and booked. The simple-to-operate interface simplifies the hiring process to make speedy and efficient service.

### **3.2.8. Car Management Page**

The Car Management Page enables system administrators to perform car viewing operations and insert new car entries and delete existing ones in the Car Rental System. The list holds details about the car name with gear system information and booking price per day with mileage and a supporting image. The "Delete Vehicles" button removes cars from the system, but the "Add Vehicles" button allows admins to insert new cars. The interface provides smooth control of automobiles in inventory with current availability to rent. The Search and My Bookings navigation buttons increase the usability of the system and allow users to effectively handle vehicle listings.

### **3.2.9. Returned Vehicles Page**

The Returned Vehicles Page of the Car Rental System keeps information regarding returned vehicles which are car name, mileage details, rental charge details and user information. The website displays booking information along with drop-off details and billing charges. A maintenance report confirms vehicle condition before re-rental by noting its status and tire pressure along with mileage usage and needed services. With this page, managers monitor returned vehicles and confirm



billing while scheduling repairs to maintain rental operations without interruptions. Navigation links enable users to show their search history and booking records.

## **Admin Dashboard & Reports Page**

The Admin Dashboard and Reports Page literally gives the admin a graphical output of all of the business's most important attributes such as: total users grouped as customers, staff and admins; Total company money earned summing up rides booked total count, earnings, and tax; and the cars data with total cars, currently rented cars, cars servicing and cars ready to rent. Additionally, there are reports being delivered to track revenue, rentals, and users.

### **3.2.10. User Management Page**

The User Management Page indeed has all the information of all the users such as their name, email, address, and phone. The list comprises regular customers, employees, and admins so that admins can adjust the user type so that they can access the website accordingly and perform the respective work.

### **3.2.11. Policies and Terms Page**

Policies and terms give the rules and regulations of the software for a sample project to be used in an educational environment. They dictate eligibility booking, payment, privacy, liability, and refunds for clear compliance. These rules educate users about their responsibilities and rights in the car rental system structure.



### 3.3. Visual Design Specifications

#### 3.3.1. Color palette and typography:

##### **Color Palette:**

- **Primary Color:** #1b4f91 (Dark Blue) – Main background color
- **Secondary Color:** #ffffff (White) – Form input fields and text
- **Accent Color:** #f4a261 (Orange) – Validation error messages and important text
- **Button Color:** #dfe6e9 (Light Gray) – "Sign Up" button background
- **Border & Divider Color:** #ced6e0 (Light Blue-Gray) – Input field borders and separators

##### **Typography:**

- **Font:** Roboto Regular (16pt) – Used for form labels and general text
- **Headings and Buttons:** Roboto Bold (18pt+) – Used for section headings and buttons
- **Error Messages:** Italicized Red (14pt) – Used to highlight form validation errors

#### 3.3.2. UI Components

- **Buttons:** Rounded, sky-blue background, hover state in darker blue.
- **Forms:** Input fields with validation messages in red.
- **Cards:** Vehicle listings in card format.

#### 3.3.3. Interaction Design

- Hover effects on buttons to provide visual feedback.
- Error messages displayed in red for invalid inputs.



## 4. Navigation and Information Architecture

### 4.1. Navigation Structure

Navigation will be different depending on the user's role. Navigation includes:

- **Normal User** Navigation includes Search & My Bookings.
- **Staff User** Navigation includes Car Management & Bookings Management.
- **Admin User** Navigation includes Car Management, Bookings Management, User Managements & Dashboard/Reports.

### 4.2. Menus and Navigation Elements

We will implement dropdowns for Pickup/Drop-off Locations and tabbed navigation for Bookings.

### 4.3. Breadcrumbs and Links

There will be no breadcrumbs in this version of the application.

### 4.4. Search and Filters

- We will implement sorting and filter by price, vehicle type, and mileage.
- There will also be search for cars and user management dashboard screens.

### 4.5. User Flows

Example: Search Car → Click Reserve Car → Enter Details → Make Payment → Booking Confirmation



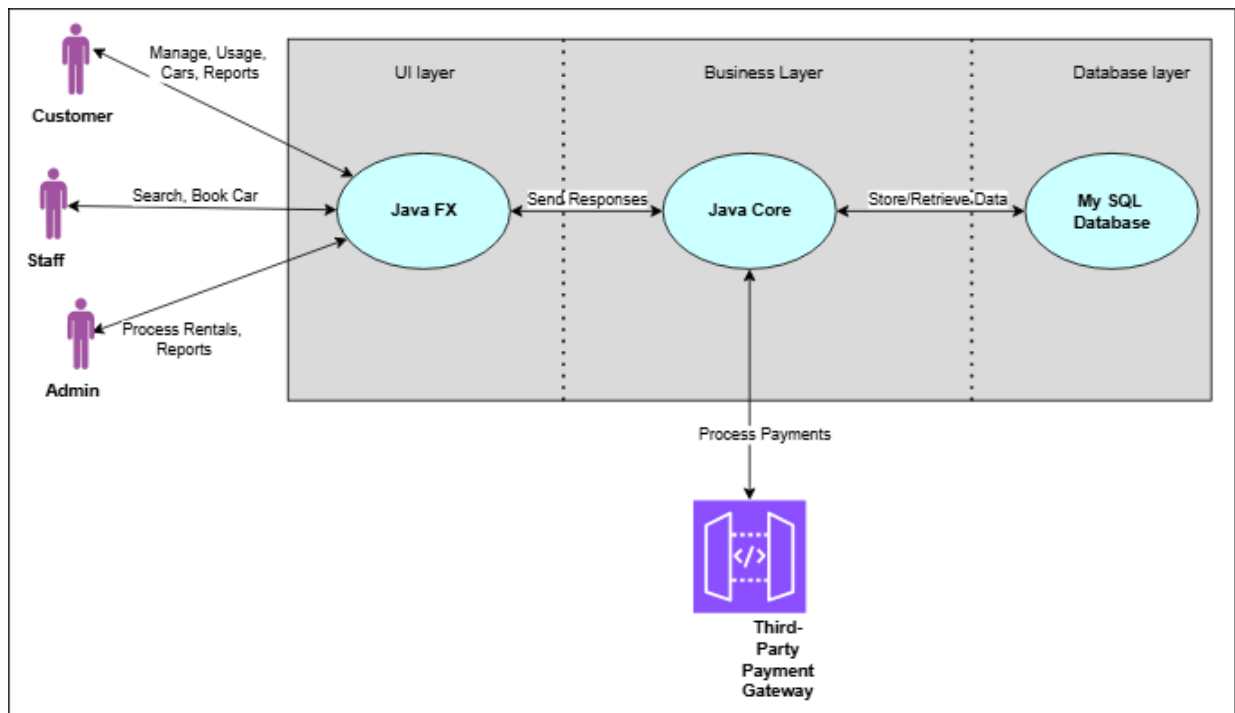
## 5. System Architecture

### 5.1. Architecture Overview

The Car Rental System follows three-tier architecture, ensuring separation of concerns and better system management:

- **Presentation Layer (UI):** Handles user interactions and displays relevant information. Built using **JavaFX**.
- **Business Logic Layer:** Manages the core functionalities like authentication, booking, and reporting using **Java classes**.
- **Data Layer:** Stores user, vehicle, and booking details in a **MySQL database**.

### 5.2. System Context Diagram







## **6. Responsive Design and Mobile Specifications**

### **6.1. Responsive Design Principles**

The version 1 of this application will not implement responsive design and will only be compatible as a desktop application.

## **7. Accessibility Guidelines**

### **7.1. Accessibility Standards**

We plan to implement high contrast mode support for user accessibility.

### **7.2. Keyboard Navigation**

We will implement Tab navigation support across all pages.

### **7.3. Screen Reader Compatibility**

We will implement Alt text for images.

## **8. Error Handling and Feedback**

### **8.1. Error Messages**

Red inline messages for form validation.

Popup notifications for critical errors.

### **8.2. Success Messages and Feedback**

Green banners for successful actions.

### **8.3. Loading Indicators**

Spinners for background processes.



## 9. Prototyping and Usability Testing

### 9.1. Prototyping

We have created Interactive prototype created using Penpot. You can use it here

<https://design.penpot.app/#/workspace/37d6e7bf-72f9-806c-8005-b65e79bc3ab3/02968425-bc48-80f1-8005-b65e854d6e4e?page-id=bfef9c74-e2c0-802e-8005-bb7403a3d5af>

### 9.2. Usability Testing

We will implement a feedback mechanism from test users to refine our UI elements for future versions.

## 10. Version Control and Change Management

### 10.1. Version Control

We will use GitHub repository with version tracking. We plan to use the Git flow strategy to handle design and code changes.

### 10.2. Handling Design Changes

Changes are reviewed and approved by all project stakeholders.

## 11. Appendices

### 11.1. Design Assets

All Design Assets are stored as a part of our GitHub repository design folder.

### 11.2. References

General Guidelines for preparing UI Documentation – provided by professor

#### Other References

Version	Date	Author	Description
1	2/7/2025	Pujan Bhuvra, Deepasree Meena Padmanabhan, OgheneRukevwe Esegba, Simranjeet Kaur	COSC3506 001_Final Project Software Requirement Specification Car Rental System.pdf