Tribhuvan University

Institute of Science and Technology

A Final Year Project Report

(CSC412 Project Work)

On

"Car Rental Portal System"

Submitted to:

Department Of Computer Science and Information Technology

Mahendra Multiple Campus

Nepalgunj, Banke

In partial fulfilment of the requirements for the Bachelor's of Science in Computer Science and Information Technology (B.Sc.CSIT)

Submitted by:

Janaki Singh Thakuri (Symbol No: 27841/077)

Prashis Tiruwa (Symbol No: 27851/077)

Under the Supervision of

Keshav Poudel

February, 2025

Tribhuvan University
Institute of Science and Technology
Mahendra Multiple Campus
Nepalgunj, Banke

SUPERVISOR'S RECOMMENDATION

I hereby recommend that the project report titled "Car Rental Portal System" prepared under my supervision by Janaki Singh Thakuri **(Batch 2077, TU Registration No. 5-2-55-39-2020, Symbol No. 27841/077)** and Prashis Tiruwa **(Batch 2077, TU Registration No. 5-2-55-48-2020, Symbol No. 27851/077)** is satisfactory. It fulfills partial requirements for the degree of Bachelor in Computer Science & Information Technology (BScCSIT) is recommended for the final evaluation.

.....

Keshav Poudel
Supervisor
Assistant Professor
Mahendra Multiple Campus, Nepalgunj

Tribhuvan University
Institute of Science and Technology
Mahendra Multiple Campus
Nepalgunj, Banke

LETTER OF APPROVAL

This is to certify that the project work (CSC412), prepared by **Janaki Singh Thakuri (Symbol No: 27841/077) and Prashis Tiruwa (Symbol No: 27851/077)** entitled **Car Rental Portal System**, has been completed in partial fulfillment of the requirements for the degree of **Bachelor in Computer Science and Information Technology (BSc CSIT)** under the **Institute of Science and Technology, Tribhuvan University**. The project has been evaluated and in our opinion, it meets the required scope and quality standards for the degree.

……..
Keshav Poudel
Supervisor

……..
Madan Adhikari
Program Coordinator
Department of Computer Science and Information Technology

……..
Internal Examiner

……..
External Examiner

ACKNOWLEDGEMENT

It is a great pleasure to have the opportunity to extend our heartfelt gratitude to everyone who helped us throughout the course of the project. We are profoundly grateful to our supervisor Mr. KESHAV POUDEL and Mr. ASHOK CHAND for their expert guidance, continuous encouragement, and ever-willingness to spare time from their otherwise busy schedules for the project's progress reviews. Their continuous inspiration has helped us to complete this project and achieve its target.

Also we would like to express our deepest appreciation to Mr. Keshav Poudel for his constant motivation, support and for providing us to a suitable working environment. We also place our gratitude to our parents, who always encouraged us to pursue our interests and guided us on the right path. Many are responsible for the knowledge and experience we have gained during the project and throughout the course.We would like to express sincere thanks to all our friends for their support in the completion of the project.

At last, our special thanks to all the staff members of the BSc.CSIT department who directly and indirectly extended their hands in making this project a success.

ABSTRACT

Car Rental Portal System is a web-based application which is designed to offer users for renting cars online. It focuses on providing essential components and functionalities such as car browsing, booking management, payment processing, and user registration and many more. The system allows users to search for cars based on parameters like date, city, and district enabling a seamless and efficient rental process. This documentation provides a detailed guide for both developers and designers involved in building and maintaining the Car Rental Portal. It highlights critical aspects like user management, vehicle listing, booking workflow, payment handling, and administrative features. By emphasizing the usability, security, and scalability this portal aims to enhance the user experience and provide a smooth and efficient service. This project utilizes technologies like HTML, CSS, and JavaScript for the frontend, PHP for the backend, MySQL for the database and Apache as the server for local development.

KEYWORDS: *Online Car Rental Portal, Rent Cars*

TABLE OF CONTENTS

LIST OF ABBREVIATIONS

B2C	Business to Consumers
CSS	Cascading Style Sheets
DFD	Data Flow Diagrams
ER	Entity-Relationship
HTML	HyperText Markup Language
IEEE	Institute of Electrical and Electronics Engineers
PHP	Hypertext Preprocessor
SQL	Structured Query Language
SWEBOK	Software Engineering Body of Knowledge
UI	User interface
UX	User Experience

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1: INTRODUCTION

1.1. Introduction

In this technology advancement era, online platforms have emerged as a bridge between different types of car rental businesses and consumers. A Car Rental Portal designed for the local market aims to revolutionize how the individuals and consumers interact with car rental companies, offers, accessibility, and a personalized rental experience. Car rental services are rapidly becoming a popular choice for consumers, with the growth of urbanization and tourism. In demand more and more car rental companies are transitioning to online platforms to provide a seamless experience and make it easier for users. The ability to rent a vehicle with just a few clicks is now becoming a standard expectation for every customer.

This portal system is a web based application which is designed to satisfy both users and car rental businesses. It allows users to browse a variety of car options, compare prices, and select vehicles based on different factors such as location, car type, and rental duration. Once a car is selected, users can book it through online with a secure process. The system also includes options for payment processing, booking management, and customer interaction ensuring that all necessary information is captured efficiently.

At the time of booking, customers will be required to provide additional information such as billing and shipping addresses, rental period, and payment details and more. Once the reservation is confirmed, the system will send an email notification to the customer, confirming the booking. This system will significantly improve the rental experience by providing a user-friendly interface for browsing, booking, and managing car rentals.

1.2. Problem Statement

Most of the people do not have access to their own personal vehicle at all time and anywhere. A car rental system provides a vehicle that can be used temporarily for the specific time of period without purching a vehicle and do not need have own car. Getting a rental car helps individual who needs a car must contact a rental car company and contract out for a vehicle. This system increase customer retention and simplify vehicle and staff management process.

This section outlines the specific problems and challenges faced by the car rental companies that the proposed system aims to solve. There might be several issues includes the manual handling of reservations, difficulties in tracking vehicle availability, inefficient customer management, and the lack of an integrated platform to manage all aspects of the business. This problems help in justifying the need for the car rental management system.

1.3. Objectives

There are several objectives in this project that are listed below:

1. To automate the car rental booking process and provide customers with a seamless and user-friendly experience for online registration and vehicle reservation.
2. To make easy for vehicle reservation process by enabling customers to book cars through a web-based platform or mobile app.
3. To create a module that gives real-time updates on vehicle availability that ensure customers have access to the most current datas to make easy for decision making.

1.4. Scope and Limitation

The Car Rental Portal System provides a platform for individuals to rent cars from local businesses offering an easy, accessible, and convenient way to book vehicles online. It connects customers with car rental companies to allowing them to browse available vehicles, compare prices and book cars based on their requirements. This system supports a variety of car types for different rental periods along with payment processing and confirmation. This portal enhances the customer experience by providing a digital solution to traditional car rental processes that will ensure customers can rent cars with easy and from the comfort of their own homes.

The scope of this project extends to the development of a web application that provides several effective functionalities such as car listings, booking management, user authentication, payment processing, and review management. The system aims to improve business efficiency for rental companies and provide customers with a simple, secure and userfriendly interface to complete their bookings.

Also the Car Rental Portal has certain limitations that need to be considered. One limitation is that not all car rental companies may have the technical infrastructure or

resources to fully integrate with the portal system. Smaller rental businesses especially in rural or less urbanized areas may not have the equipment or expertise to participate in the online booking system. Additionally, not all customers may feel comfortable using online platforms for car rental services. Some traditional methods for booking are such as in person reservations or phone calls.

Another limitation is the dependency on internet connectivity which could affect the user experience specially in that areas with limited or unstable internet access.

1.5. Development Methodology

The development of the project named Car Rental Portal System uses the Prototype Methodology, which allows developers to create a prototype to demonstrate the operational functionality before building the final product. This approach ensures that client feedback is incorporated during the development process, allowing for necessary improvements and modifications. The development of the Car Rental Portal System begins with a clear understanding of the user needs and the requirements of the car rental industries. By addressing potential issues during the prototyping phase, this methodologyhelps avoid common challenges seen in traditional waterfall models. This stage involves a comperative evaluation of the market and competitive solutions to ensure the project can provide value and meet user expectations.

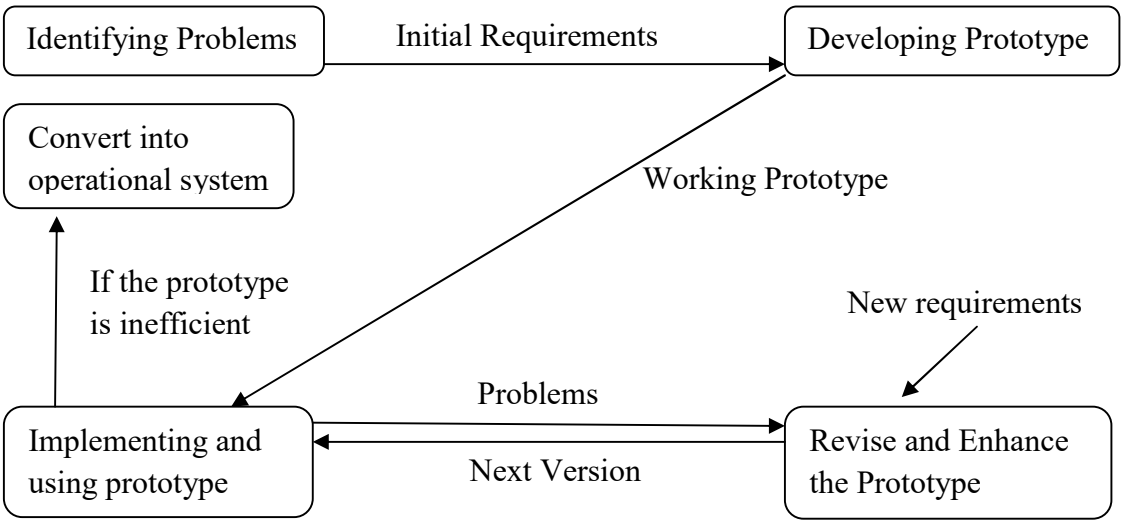


Figure 1.1: Prototyping methodology

1.6. Report Organization

The report has been prepared by the guidelines provided by Tribhuvan University.The preliminary section of the report consists of Title Page, Acknowledgement, Abstract, Table of Contents, List of Abbreviations, List of Figures and List of Tables. The main report is organized into six chapters are as follows:

1. Chapter 1: Introduction of the project in detail including the problem statement, objectives, scope and limitaions and development methodology of the Car Rental Portal.
2. Chapter 2: Provides a background study and literature review related to the car rental industry and similar systems.
3. Chapter 3: Analyze the system which includes a feasibility study and requirement analysis for the Car Rental Portal with flowcharts, ER diagrams and DFDs.
4. Chapter 4: Focuses on the system design, which includes the design of databases, forms and interface along with details of algorithm used.
5. Chapter 5: Explains the methods and tools used to implement the Car Rental Portal including technologies like PHP, MySQL, and JavaScript.
6. Chapter 6: Contains the conclusion and recommendations for further development and improvements of the portal system.

CHAPTER 2: BACKGROUND STUDY AND LITERATURE REVIEW

2.1. Background Study

The need for an efficient Car Rental Portal arises from the increasing demand for reliable transportation options in urban areas, particularly as people seek alternatives to personal car ownership. With growing urbanization, tourism and changing travel habits customers expect to easily access and book rental cars online. Understanding the local transportation landscape is essential for developing a platform that serves the specific needs of the community. Market research plays a critical role in understanding the types of vehicles in demand, pricing expectations and the rental duration preferences of users. This research helps identify key areas where the current car rental offerings may be lacking such as availability, pricing and user friendly booking systems.

Additionally, addressing main points like trust, safety and security is crucial in the online car rental space. Consumers may can hesitate to book services online due to concerns about payment security, vehicle availability and personal data protection. For the success of Car Rental Portal, measures must be taken to ensure secure online payments, safeguard personal information and provide reliable customer support. Clear policies regarding rental terms, vehicle conditions and customer responsibilities can further enhance trust for the consumers.

Furthermore, global and local trends in the car rental industry should be studied to understand what features and practices are working for successful platforms like this. Learning from competitors both locally and internationally, helps identify areas of improvement such as vehicle maintenance, booking system reliability and customer satisfaction strategies. This background study ensures that the Car Rental Portal is built on a solid understanding of both the market demands expertise and user expectations.

2.2. Literature Review

A Car Rental Portal System is an essential web-based platform that streamlines vehicle reservations and provides solution for both customers and rental service providers. In the context of the car rental industry several studies have explored. One such prior research by Sharma and Singh (2016) suggests that an online car rental system should incorporate

user authentication, payment gateways, and a seamless booking interface to enhance user experience [1].

A feasibility study is also a critical aspect of project management as emphasized by Simple Learn (2021), ensuring that the system is important in terms of technical, economic and operational factors. A thorough feasibility study helps in risk mitigation, cost estimation and determining the potential success of the system in a competitive market from user preferances.[2] Additionally, Salam and Kumar (2017) discuss the significance of software engineering methodologies in designing robust applications that can handle real-time transactions and user demands. Their research stresses the importance of software testing, user feedback loops and iterative development to enhance system reliability and user satisfaction.[3]

Furthermore, Deshmukh (2017) explores the role of cloud-based technologies in car rental management, emphasizing the benefits of real-time data synchronization and accessibility. Cloud-based implementations allow for better scalability and remote access, reducing infrastructure costs for service providers. [4] Urban mobility studies also indicate that online rental portals significantly impact customer preferences and travel behavior (Patel and Mehta, 2020). Their findings suggest that digital transformation in the car rental industry has led to increased ride-sharing trends and improved urban transportation efficiency.[5]

In Nepal, the car rental industry is still in its poor stages of digital transformation. Traditional car rental businesses often rely on manual processes that is totally offline and time-consuming. A study by Sharma and Gurung (2020) explored the challenges faced by these businesses in booking processes, lack of automation and limited customer reach. The researchers proposed a web-based car rental system tailored to the Nepali market, focusing on affordability and ease of use. The system was designed to support multiple payment options, including cash on delivery, which is a preferred payment method for nepali users.[6]

Another study by Thapa and Bhandari (2021) focused on the potential of mobile-based car rental applications in Nepal. The researchers highlighted the growing penetration of smartphones and internet services in the country which presents an opportunity for digital car rental platforms. The study proposed a mobile application that supports multiple languages like nepali and english, to make it accessible to a wider audience. The application also integrated local payment systems such as eSewa and Khalti, to facilitate seamless transactions.[7]

To ensure a systematic development process, Kitchenham (2004) recommends following structured software engineering methodologies which are further reinforced by the SWEBOK guide (IEEE Computer Society, 2014).[8] Combining these principles ensures the development of a user-friendly, secure, and scalable car rental portal system capable of meeting evolving market demands while optimizing operational efficiency.[9]

CHAPTER 3: SYSTEM ANALYSIS

3.1. System Analysis

The system analysis for a car rental portal involves understanding and identifying the key components and their interactions within the system. The core components include the user interface (UI), vehicle listings management, booking system, payment gateway, booking confirmation and notifications, user authentication, profile management and the admin dashboard. The UI allows customers to browse car listings, select vehicles and complete bookings, while the admin interface enables managing vehicle details, bookings, and customer data. The booking system ensures real-time availability and facilitates the reservation process, while the payment gateway securely processes the transactions. Once a booking is confirmed, customers receive notifications and admins can monitor and manage bookings from a dashboard.

3.1.1. Requirement Analysis

The requirements are divided into several parts are given below:

i. Functional Requirements

To develop a successful car rental portal, the system must meet several functional requirements. Admin can login and logout. Admin can add, delete, edit and update the vehicle and brand details. Admin can manage the booking vehicles. User can login and books the vehicle. Customer can pay for booked vehicles online and visitor can view vehicles details.

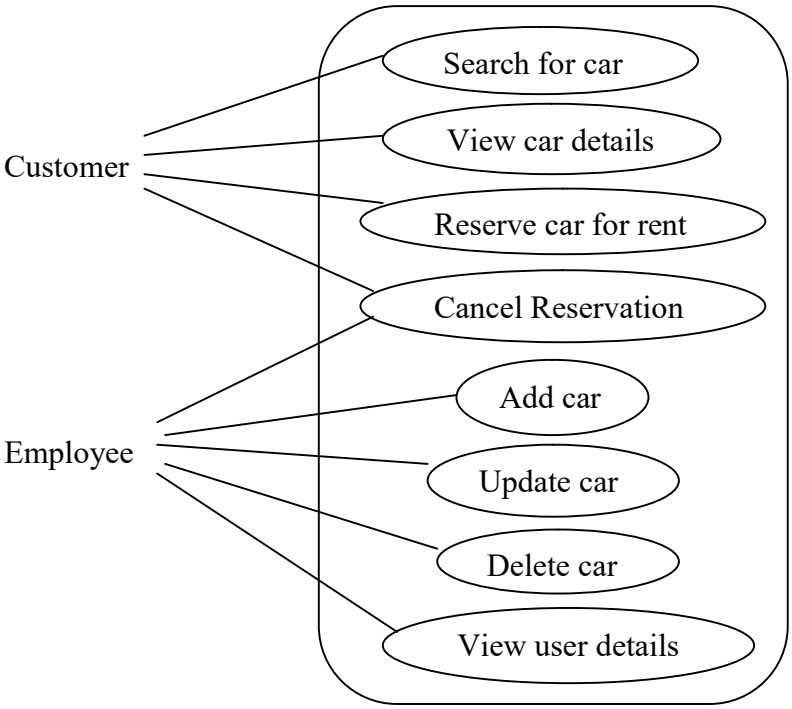


Figure 3.1: Use case diagram for car rental system

ii. Non Functional Requirements

The car rental portal system have to give fast responsive and ensure minimal loading times. A smooth experience is essential for users to quickly find and book cars. Security measures must be implemented to protect user data and payment transactions. This portal system also designed in a way that it is accessible to users with screen reader compatibility, alternative text for images and easy navigation. The car rental portal also have to work across various devices and web browsers like desktop, mobile and tablets. The provided user interface design to navigate easily and can quickly search for available cars, book them and proceed to payment.

3.1.2. Feasibility Analysis

The study of feasibility is performed in a several way are given below:

i. Technical

The car rental portal will utilize the several technologies such as HTML, CSS and JavaScript for the frontend, PHP for the backend, MySQL for database management and Bootstrap for responsive design. The system does not require any specialized hardware and it can operate on standard server environments making it accessible and cost-effective. Additionally as a web-based application, it is easily scalable and upgradable in the future to add new features.

ii. Operational

The operational structure of this portal system involves 2 key user roles such as the admin and the customers. The admin is responsible for managing car listings, user bookings, updating car availability and monitoring payment transactions. On the other hand, customer will be able to browse available cars, select booking dates, make payments and track the status of their rentals. The system is designed to be user-friendly to ensure a smooth booking experience for customers.

iii. Economic

The project uses open-source technologies that significantly reducing software costs. Hosting costs will depend on fixed expenses, depending on the chosen hosting provider and the server specifications. Maintenance costs will be minimal but will include bug fixes, updates and potentially new features. The development and ongoing operational costs are manageable and well within budget.

iv. Schedule

The estimated development time for the portal is three months. This includes all phases from initial design to testing and deployment. Given chart is the detailed working shedule from the project planning to completion within the specified time period.

Weeks Activities	2081/04/19	2081/05/19	2081/06/19	2081/07/19	2081/08/19	2081/10/19
Project Planning						
Study and Analysis						
Frontend and Backend Coding						
Algorithm Implementation						
Testing						
Documentation						
Deployment and Review						
Presentation						*

Figure 2.2: Gantt Chart of Working Schedule

3.1.3. Analysis

The analysis phase includes following stages are given below:

3.1.3.1. Data modelling using ER Diagrams

It involves creating a conceptual representation of the data structure to understand the relationships between different entities within the system. Key entities in this model include Users, Cars, Bookings, Payment, Admin, Transactions and more. The relationships among these entities are defined as follows: Users can make multiple Bookings and each Booking involves a specific Car. Payments are linked to Users where each payment are leading to a Transactions. Admin manages the car listings, bookings, and payments.

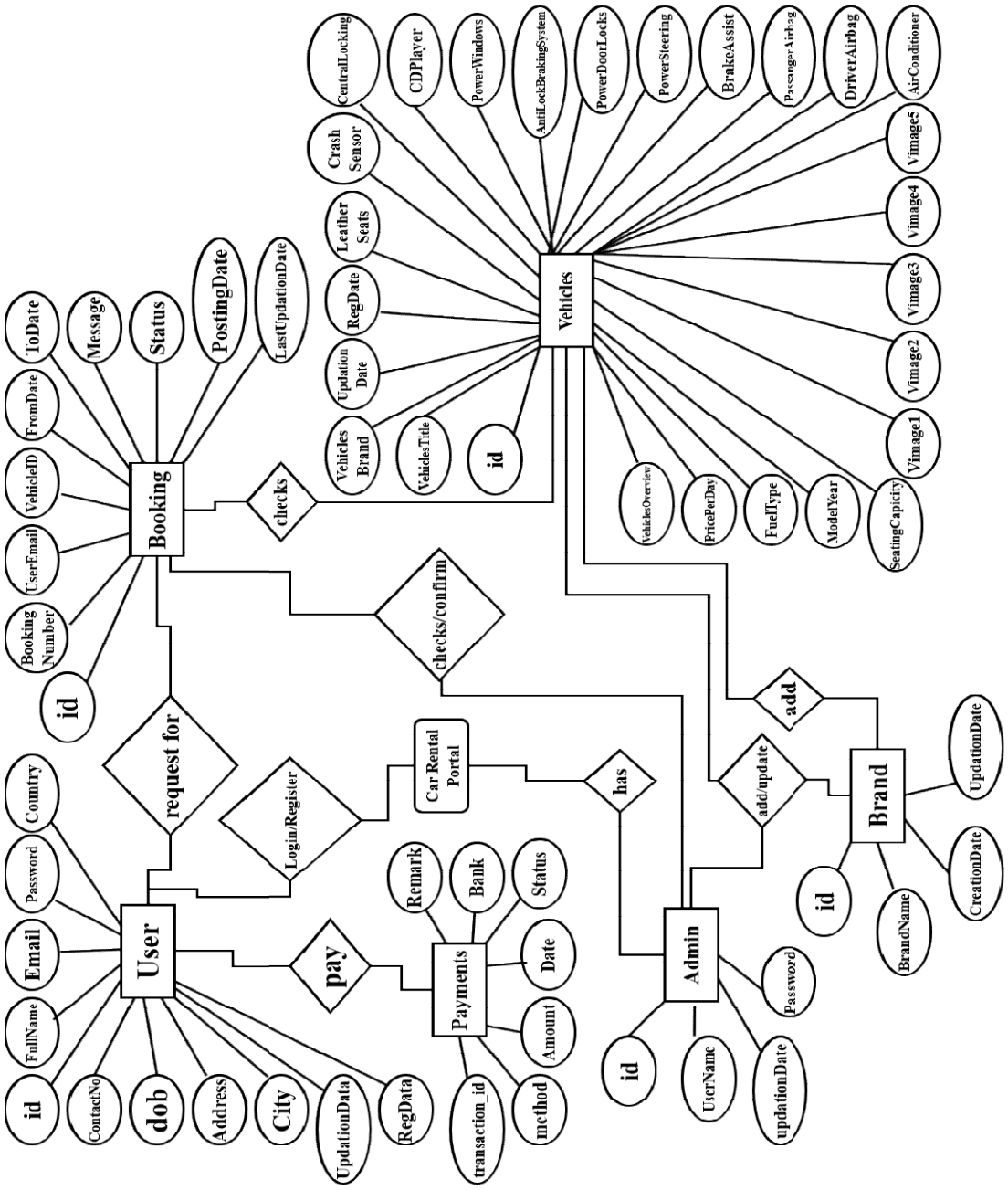


Figure 3.3: E-R Diagram of car rental portal

3.1.3.2. Process modelling using DFD

It classifies and represents the various processes within the portal. The main processes include User Registration, Car Selection, Booking Confirmation, Payment Processing and Booking Management by Admin. These processes are designed to showcase the user experience, ensuring easy browsing, booking and payment for users, while enabling admins to manage the system effectively. The process model also visualizes the

relationships between different systems components that describe all functions work together.

Data Flow Diagrams (DFD) are used to represent the physical and logical flow of information within the system. The Level 0 DFD or context diagrams, shows the system as a whole and how it interacts with external entities like Users and Admin. The Level 1 DFD breaks down the system into high-level processes such as User Registration, Car Selection, Payment Processing and Admin Management of Cars and Bookings. Each of these processes involves the flow of data such as user details, car availability, and payment information through various data storage. The Level 2 DFD would further detail these processes showing how specific system components interact to complete the overall tasks.

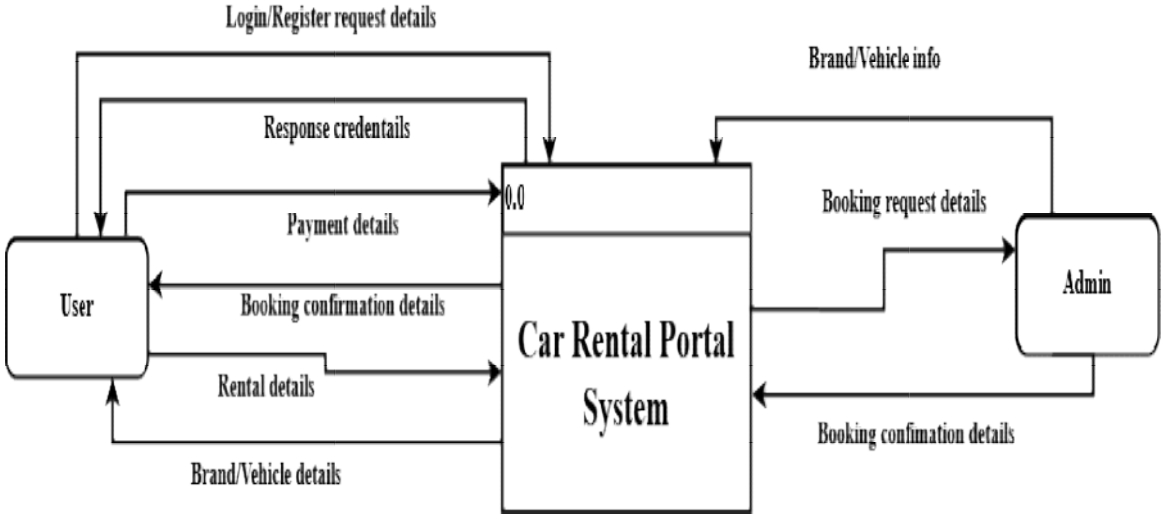


Figure 3.4: Context Diagram for the Car Rental System

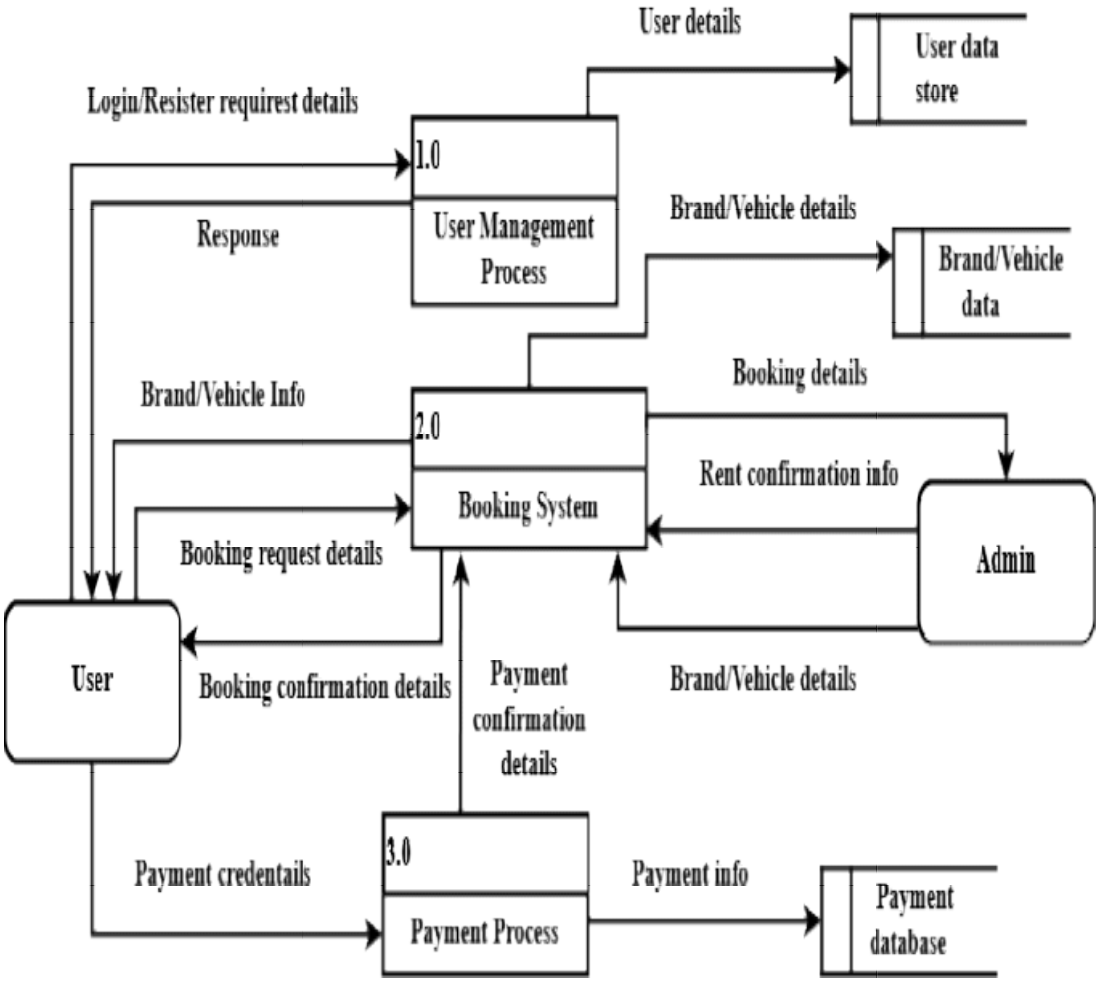


Figure 3.5: Level 1 DFD for Car Rental Portal

CHAPTER 4: SYSTEM DESIGN

4.1. Design

It is a crucial phase in software development that outlines how a system's functionality will be implemented through various components and their interactions with eachother. It translates the requirements and analysis into actionable designs by organizing the system into manageable modules, defining their roles and specifying interactions to meet the overall objectives. For a car rental portal system, it involves defining architecture (web-based client-server), components like admin and user modules, payment gateways and car databases along with interfaces like bookings, dashboards and payment processing. It also shows flow to manage user details, car listings, bookings and transactions which ensures security and integrity throughout the system.

The system is divided into the following main modules:

1. Admin Module

This module is responsible for managing the entire car rental portal. It provides features to control car listings, user bookings, add or upadate vehicles and brands and payment records.

2. Admin Login Module

This is the login functionality specially for admins. Admins can input their email addresses and passwords to access the portal securely.

3. Admin Interface Module

This module provides an interface for the admin to add, edit, and delete car listings. Admin manage user bookings and availability. Also view and update payment transactions. Admin usally monitor system activity logs.

4. User Module

This module is designed for customers or users to interact with the portal system.

5. User Login Module

This module allows users to register if they are new or log in if already registered. Successful login directs users to their dashboard.

6. User Interface Module

The user interface enables customers to browse all the available cars based on location, date, and distance. They can select rental dates and view pricing details. They confirm bookings and proceed to payment options. User can view and track their booking status.

4.2. Architectural Design

The architectural design of this car rental system integrates HTML, CSS and JavaScript on the frontend to deliver a dynamic and interactive user experience. HTML structures the web pages, while CSS ensures a visualization to make responsive design across devices. JavaScript enable features such as real-time car availability checks and form validation. On the backend, PHP provides powers to the server-side logic, efficiently processing user requests and handling business operations like user authentication, car bookings and payment processing. The backend interacts with a MySQL database for data management, storing and retrieving information related to users, cars, bookings, payments and transactions. PHP ensures seamless communication between the application and the database with prepared statements and validation mechanisms to enhance security. This integration of modern frontend technologies with PHP-based backend processing and a structured SQL database ensures an efficient and responsive application for both users and admins.

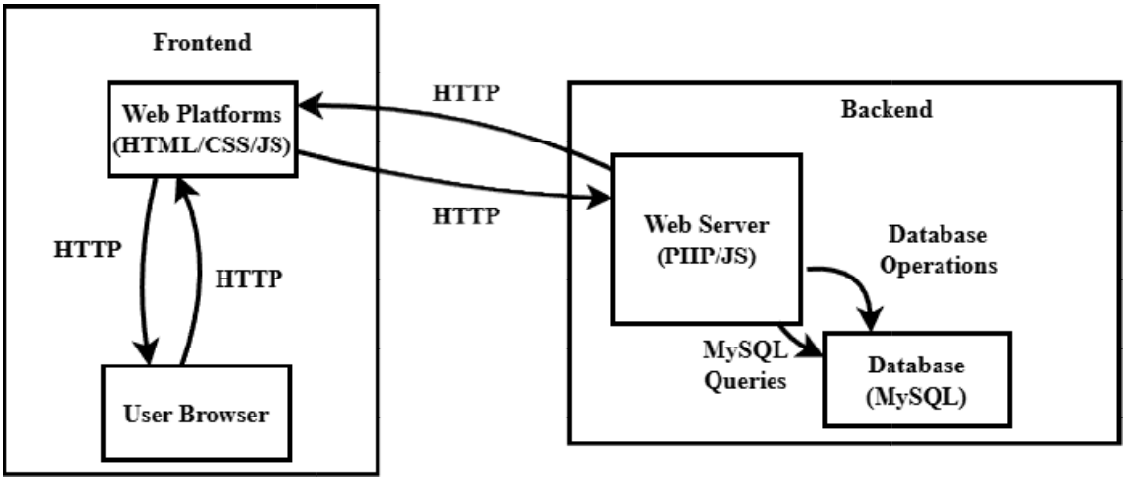


Figure 4.1: Architectural Design

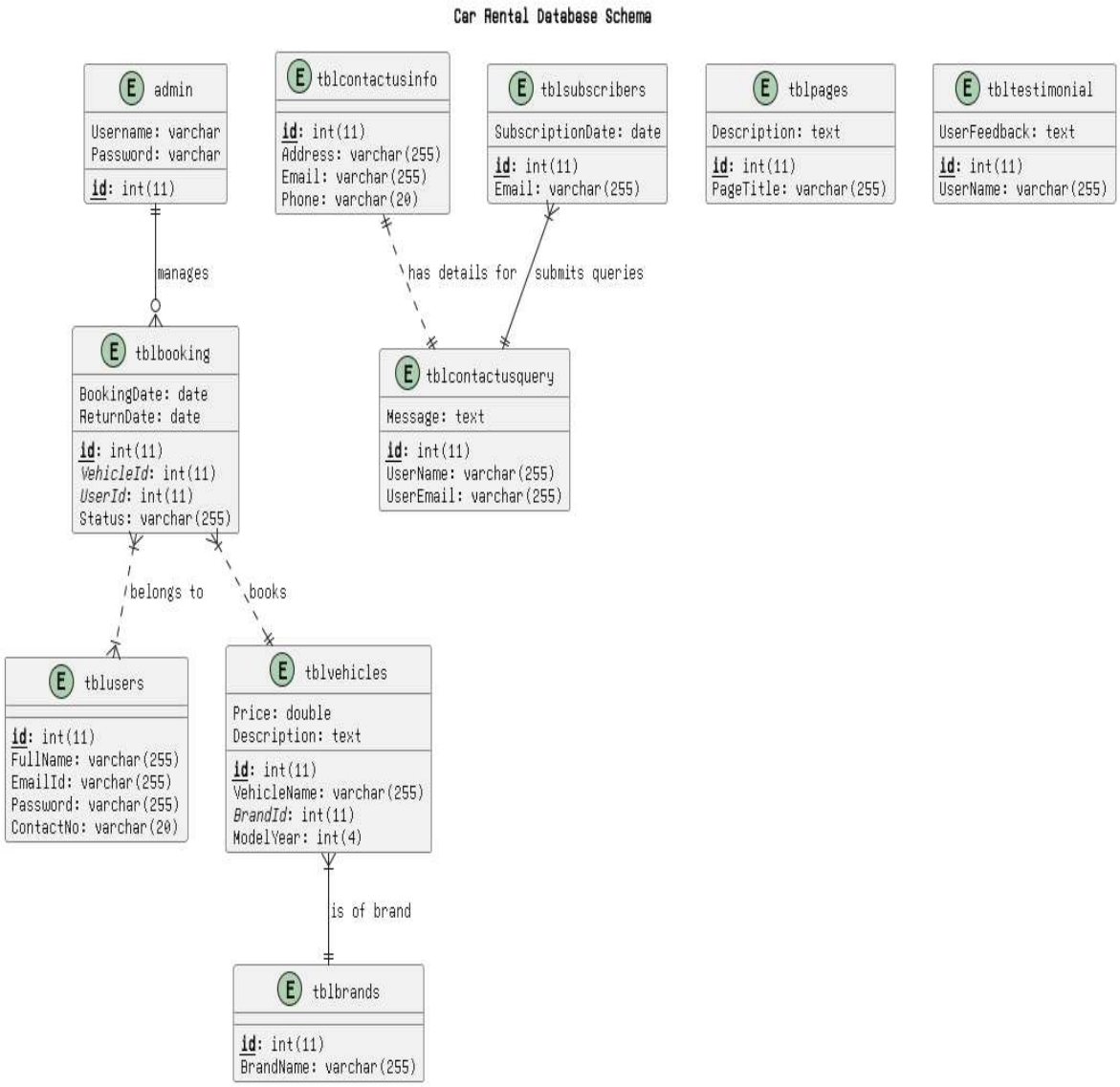


Figure 4.2: Database Design for Car Rental System

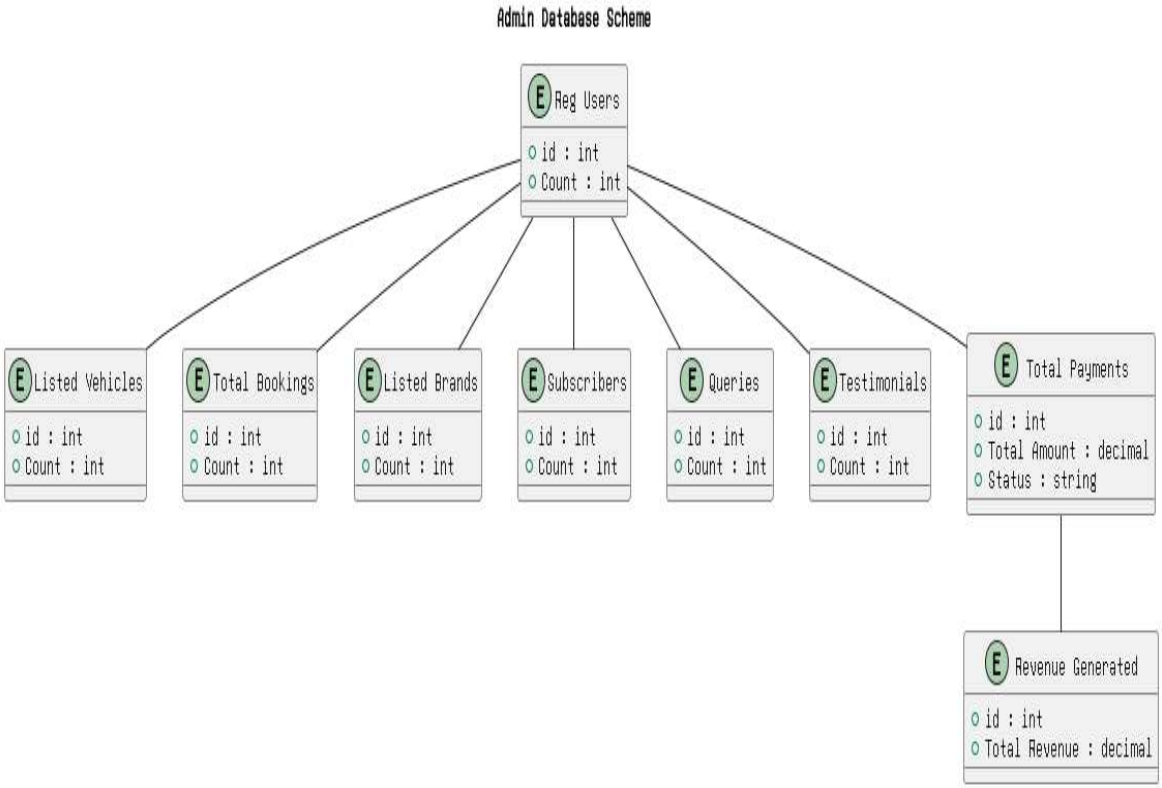


Figure 4.3: Database Design for Admin

4.3. User Interface Design

The car rental portal system uses user interface design that integrates with HTML, CSS, JavaScript, PHP and MySQL for creating a responsive, user-friendly, and efficient website for both users and administrators. The frontend is built with HTML to structure content, CSS to deliver visualiazation and mobile-responsive designs, where JavaScript interactivite with real-time features such as dynamic search filters, live availability checks and instant form validation. The backend is powered by PHP which processes user inputs, manages authentication, handles bookings and facilitates secure payment workflows. It ensures smooth communication with MySQL databases that stores and retrieves critical data related to users, cars, bookings and payments. The design prioritizes user-friendliness and security, encrypted passwords, and validation mechanisms to protect sensitive information.

Key pages such as the homepage, registration, login, car listings, booking and payment are streamlined to provide the workflow of the interactive system. The portal's responsive

layout ensures the webpages is available for all across devices. The administrative tools allow efficient management for bookings, payments and user data.

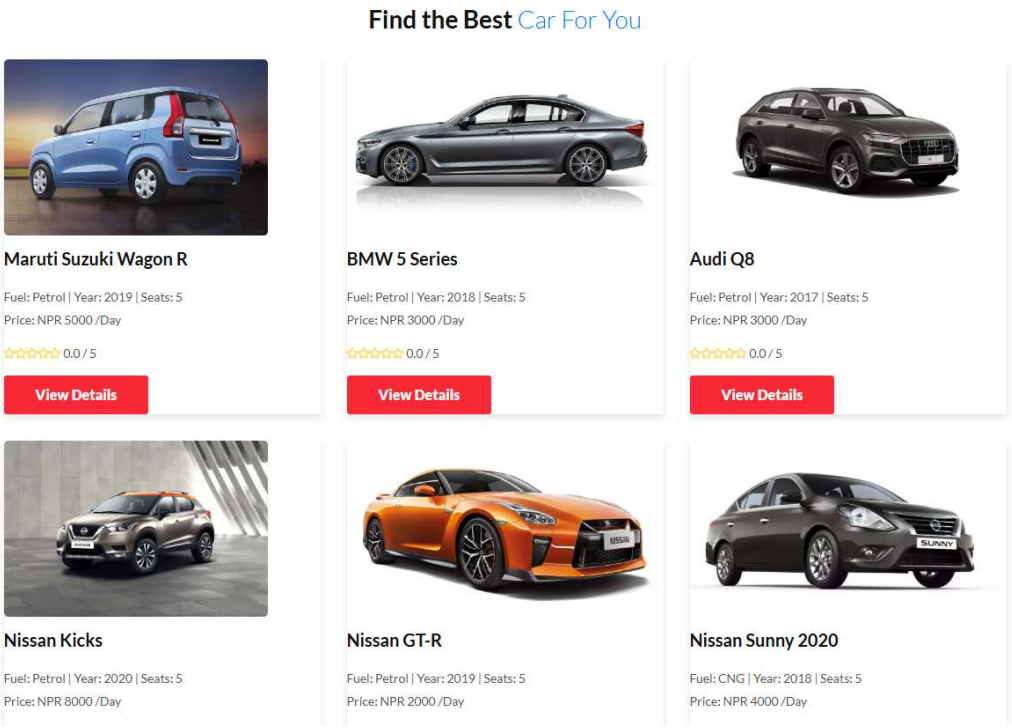


Figure 4.4: User Interface Design

Figure 4.5: Admin Interface Design

4.4. Algorithm Details

Following are the algorithms that are used in this car rental portal system:

4.4.1. Sorting Alorithm

It is a method to arrange the elements of an array or list in a specific order like ascending or descending order. This algorithm takes numbers, objects and strings as input for sorting. The project mainly uses Bubble sort as a sorting algorithm which requires a small and constant amount of additional storage space.

4.4.1.1. Bubble Sort Algorithm

This algorithm sort the tblbooking results in ascending order of their PostingDate.The bubble sort algorithm exits on manage_booking section on a file named Admin.

Steps:

1. List of booking objects (i.e results) are count according to PostingDate.
2. Outer loop (i) performs n-1 passes after that the largest unsorted element will be bubble to its correct position.
3. Inner loop (j) compare each element according to PostingDate for swap them.
4. Swap them and assign a new value in the list.
5. Repeat the steps 1 to 4 until the elements are in correct order.

Code:

```
for ($i = 0; $i < count($results) - 1; $i++) {
   for ($j = 0; $j < count($results) - $i - 1; $j++) {
      if (strtotime($results[$j]->PostingDate) > strtotime($results[$j + 1]->PostingDate)) {
         // Swap the bookings
         $temp = $results[$j];
         $results[$j] = $results[$j + 1];
         $results[$j + 1] = $temp;
      }
   }
}
```

Example: Consider an array or list having [4,2,7,3,1]

First Pass:

Compare 4 with 2 and swap – [2,4,7,3,1]

Compare 4 with 2 and no swap – [2,4,7,3,1]

Compare 4 with 2 and swap – [2,4,3,7,1]

Compare 4 with 2 and swap – [2,4,3,1,7]

Second Pass: ….similar and so on.

Now the sorted lsit is [1,2,3,4,7].

Complexity:

Time Complexity:

Worst-case: $O(n^2)$, where n is the number of bookings.

Best-case (already sorted): O(n) when no swaps occur.

Space Complexity: O(1) because it operates in-place.

4.4.2. Filtering Algorithm

The algorithm is based on dynamic filteing relia on user input.After fetching all data from database this algorithm apply on large datasets for filtering. This filtering algorithm is more efficient and flexible for user preferences. The 'filterCars' function is used to operate this algorithm in the car_listing.php file.

Steps:

1. The fucntion filtersCars is defined with 2 parameters.
   function filterCars($cars, $criteria)
2. Initialize a new variable named 'filteredCars'.
   $filteredCars = $cars;
3. Check and apply filter for Brand properties.
   ```
   if (!empty($criteria['brand'])) {
      $filteredCars = array_filter($filteredCars, function($car) use ($criteria) {
         return stripos($car->BrandName, $criteria['brand']) !== false;
      });
   }
   ```
4. Check and apply filter for FuelType with their properties.
   ```
   if (!empty($criteria['fueltype'])) {
      $filteredCars = array_filter($filteredCars, function($car) use ($criteria) {
         return stripos($car->FuelType, $criteria['fueltype']) !== false;
      });
   }
   ```
5. Check and apply minimum Price filter under conditions.

```
if (!empty($criteria['minprice'])) {
    $filteredCars = array_filter($filteredCars, function($car) use ($criteria) {
        return $car->PricePerDay >= $criteria['minprice'];
    });
}
```

6. Check and apply maximum price filter with conditions.

```
if (!empty($criteria['maxprice'])) {
    $filteredCars = array_filter($filteredCars, function($car) use ($criteria) {
        return $car->PricePerDay <= $criteria['maxprice'];
    });
}
```

7. Return filteredCars as a result.

```
return $filteredCars;
```

Types of filtering algorithm used in this project:

1. Simple Filtering:

```
$filteredCars = array_filter($cars, function($car) {
    return $car->PricePerDay < 500;
});
```

2. Multi-Criteria Filtering:

```
$filteredCars = array_filter($cars, function($car) {
    return $car->BrandName === 'Toyota' && $car->FuelType === 'Petrol';
});
```

3. Range-Based Filtering:

```
$filteredCars = array_filter($cars, function($car) {
    return $car->PricePerDay >= 500 && $car->PricePerDay <= 1000;
});
```

4. Search-Based Filtering:

```
$filteredCars = array_filter($cars, function($car) {
    return stripos($car->BrandName, 'Honda') !== false;
});
```

Example Code

```
$cars = [
    (object)['BrandName' => 'Toyota', 'FuelType' => 'Petrol', 'PricePerDay' => 600],
    (object)['BrandName' => 'Honda', 'FuelType' => 'Diesel', 'PricePerDay' => 800],
    (object)['BrandName' => 'Ford', 'FuelType' => 'Petrol', 'PricePerDay' => 500],
];
// Filter cars with price less than $700
$filteredCars = array_filter($cars, function($car) {
    return $car->PricePerDay < 700;
});
// Result: Toyota and Ford
print_r($filteredCars);
```

CHAPTER 5: IMPLEMENTATION AND TESTING

5.1. Implementation

Implementation is a realization of technical specification in a program or software component through computer programming. This chapter describes the different phases of the Car Rental portal system to show how the system is developed and implemented using the suitable tools, programming language and technologies. At the previous chapter, the paper began with the description of required analysis and design of the proposed system in detail and in this chapter, the paper shall explore the several aspects of the joined system that associates the leave management, employee profile, edit employee details, project management and soon which refines the function of the system and guide employees on how to operate.

5.1.1. Tools Used

The Waterfall methodology has been used in this project as input of the implementation process. After a careful analysis of the database, design and implementation there was simple and understanding GUI was built as the site structure of the system with controls to add and retrieve information based on user needs. So, forward looking of database table we create DFD and ER draigrams in draw.io online tool. The actual implementation has been done by using PHP. The PHP has been used to interact with the backend database. In this implementation, the user input given by employees and translates them in the commands understandable to the backend database. The output produced by the backend database is also handled by PHP code which then displayed on the browser screen.

5.1.2. Implementation Details of Modules

Following are all the modules designed for the Car Rental Portal:

1. Admin Module

From here admin can have access to login and add or create new vehicles & brands. Moreover, admin also can manage the contact messages from the users through the admin panel and change the info of contact.

2. Booking Module

In this module, normal users can book specific cars for certain days. User must verify their email ID before they proceed to book any vehicles.

3. Pages Module

From this module, admin is allowed to changes and manage the different informative pages which have been implemented in the website.

5.2. Testing

The overall aim for testing a system is to ensure that the system meets its entire functional requirement and to check its performance from the expexted results. The accuracy of the program can be tested with some varying data. Testing gives assurance that the new system can achieve its objectives and purpose. Testing is basically an attempt of executing a program to find bugs and error. It consists of various types for which a system is subjected to but the main ones to be carried out are the testing objectives. The test plan presents the test in details through identifying the test case areas within the system.

5.2.1. Test Cases for Unit Testing

Unit testing is a type of software testing which is required where individual units or components of software are tested. The purpose is to validate that each unit of the software code performs as expected. Unit testing is done during the development or coding phase of an application development by the developers. Unit Tests isolate a section of code and verify its correctness in the system.

Each and every component of this “Car Rental Portal” website has been tested individually by different components which have been shown in the table below. We have tested each component and manipulating each and every kind of input by checking the corresponding output until the components working effectively and correctly.

5.2.2. Test Cases for System Testing

System testing is a level of testing that validates the complete and fully integrated software products. In software testing the behavior of whole system is tested as defined by the scope of the developed project. It is the final test that verify the system to be delivered have to meets the specification and purpose. System testing should focus on

testing interactions between the components and objects to check that they work as expected when they integrated with new components.

Table 5.1: Test Cases for Admin Login

Test Case	Test Scenario	Test Steps	Test Details	Expected Result	Actual Result	Pass/Fail
TC-1	Check the login module with correct input to access the system	1. Go to site http://local host/carrental/admin 2. Enter username 3. Enter password 4. Click to login	Username: main admin Password: Welcome12	Allow the admin login to the system	The admin logged into the system	Pass
TC-2	Check the login module with incorrect input access the system	1. Go to site http://local host/carrental/admin 2. Enter the username 3. Enter the password 4. Click to login	Username: admin Password: admin	Deny the access of the system	The admin unable to login into the system Error message: "Incorrect username or password"	Pass

Table 5.2: Test Cases for Booking Vehicles

Test Case	Test Scenario	Test Steps	Test Details	Expected Result	Actual Result	Pass/Fail

TC-3	Testto book a car with correct data or upcoming g date	1. Go to site http://localhost/carrental/vechicle-details.php?vhid=3 2. Select the date to book a vehicle and fill the 3. Click on Book Now	From Date: 05/09/2024 To Date: 05/19/2024 Message: I would like to book this car	Allow user to book a car and waiting for admin approval	User successfully requested to book a car and waiting for admin approval	Pass
TC-4	Test to book a car with past date or incorrect date	1. Go to site http://localhost/carrental/vechicle-details.php?vhid=3 2. Select the date to book a vehicle and fill the message 3. Click on Book Now	From Date: 05/07/2024 To Date: 05/19/2024	Prompt an error "please choose upcoming dates!"	User fails to book a car	Pass

Table 5.3: Test Case for Update Password

Test Case	Test Scenario	Test Steps	Test Details	Expected Result	Actual Result	Result Analysis
TC-5	Test to update Admin Password with correct input	1.Go to site http://localhost/carrental/admin/account 2.Click on Account and select Update Password option 3.Enter the current password and new password which you want to change 4.Click save changes	Current Password: Welcome12 New Password: Thanks123 Confirm Password: Thanks123	Allow the admin to update password successfully	Your password changed	Pass
TC-6	Test to update Admin passwo	1.Go to site http://localhost/carrental/admin/account 2.Click on Account and select	Current Password: Welcome12 New	Prompt an error: "Error: Your	The admin is unable	Pass

	rd with incorre ct input incorre ct date	Update Password option 3.Enter the current password and new password which you want to change 4.Click save changes	Password: Thanks Confirm Password: Thanks	current password is not valid"	to change passwo rd	

5.3. Result Analysis

The project justifies all the mentioned objectives for this project and initial planning. The main objectives of this project are to facilitate the normal customer who does not own their vehicles can rent or come to a company through our system for certain days and pay it through online. As the project has limited objectives at this stage, the project may not serve at its best but the project covers all the mentioned objectives which were to be completed.

CHAPTER 6: CONCLUSION AND FUTURE RECOMMENDATIONS

6.1. Conclusion

Car rental business has emerged with new ideas compared to the past experience where every activity that showing the car rental business is limited to a physical location only. Even though the physical location has not been totally integrated online, the nature of functions and how these functions are achieved has been reshaped by the power of the internet. Nowadays, customers can reserve cars online, rent cars online and have the car once the customer is a registered member or goes to the office to pick the car.The web-based car rental system has offered an advantage to both customers as well as the Car Rental Company to efficiently and effectively manage the business and satisfy customers needs at the click of a button.

At the end, it has been a great pleasure for us to get the opportunity to work on this challenging project by using PHP, JavaScript, MySQL and different algortihms.

6.2. Future Recommendations

For the future work, some more stuff can be implemented and integrated into the application code making it more practical, reliable and convenient to use for users.

Since this project still has chance to grow, this project may have some additional features like automatically suggesting suitable vehicles according to the route of the customer and providing them time to travel that route with certain cars which the customer selects. Recommending features and be added which work on when the users rent any one or more cars.

REFERENCES

[1] S. Sharma and P. Singh, "Design and Implementation of a Web-Based Car Rental Management System," *International Journal of Advanced Research in Computer Science and Software Engineering*, vol. 6, no. 7, pp. 112–118, Jul. 2016.

[2] Simple Learn, "Feasibility Study And Its Importance in Project Management," 2021, *[Online]. Available: http://www.simplilearn.com/feasibility-study-article. Accessed: Nov. 23, 2024.*

[3] G. S. Salam and L. Kumar, *Software Engineering*, Kathmandu: KEC Publication and Distribution, 2017.

[4] A. S. Deshmukh, "Development of a Cloud-Based Car Rental Portal System," *International Journal of Computer Applications*, vol. 169, no. 10, pp. 7–10, Jul. 2017.

[5] S. Patel and K. Mehta, "A Study on the Impact of Online Car Rental Portals on Urban Mobility," *Journal of Urban Transport*, vol. 12, no. 3, pp. 45–53, Sep. 2020.

[6] S. Sharma and P. Gurung, "Challenges and opportunities in Nepal's car rental industry," *Nepal Journal of Information Technology*, vol. 7, no. 2, pp. 32-40, 2020.

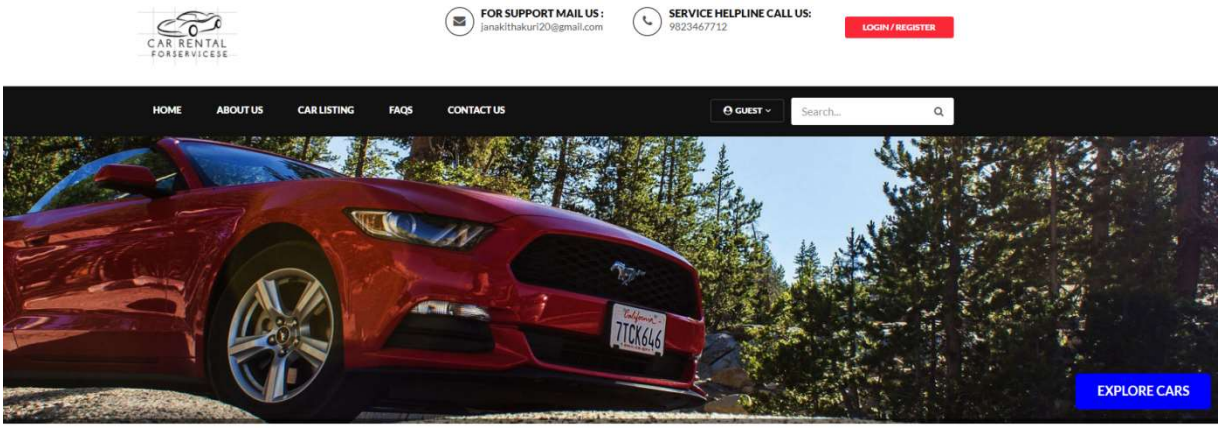
[7] B. Thapa and R. Bhandari, "Mobile-based car rental applications in Nepal," *Asian Journal of Mobile Computing*, vol. 9, no. 1, pp. 55-63, 2021.

[8] B. Kitchenham, *Procedures for Performing Systematic Reviews*, Keele University, 2004.

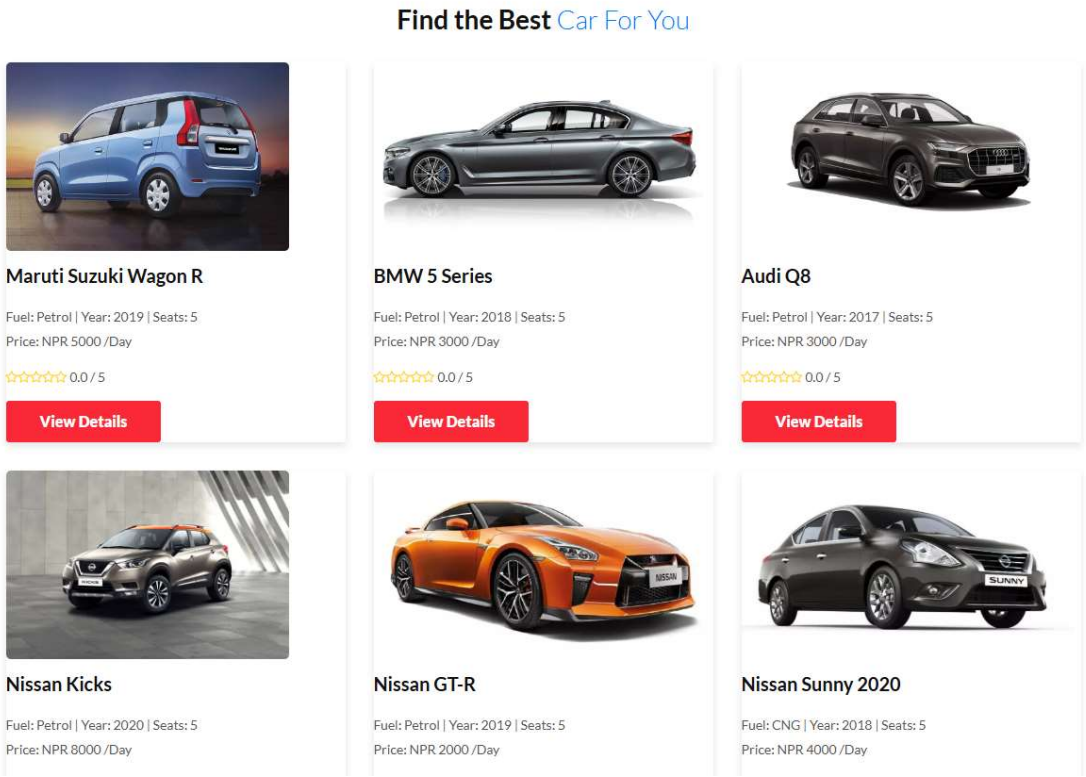
[9] IEEE Computer Society, "Guide to the Software Engineering Body of Knowledge (SWEBOK)," 3rd ed., IEEE Computer Society, 2014.

APPENDICES

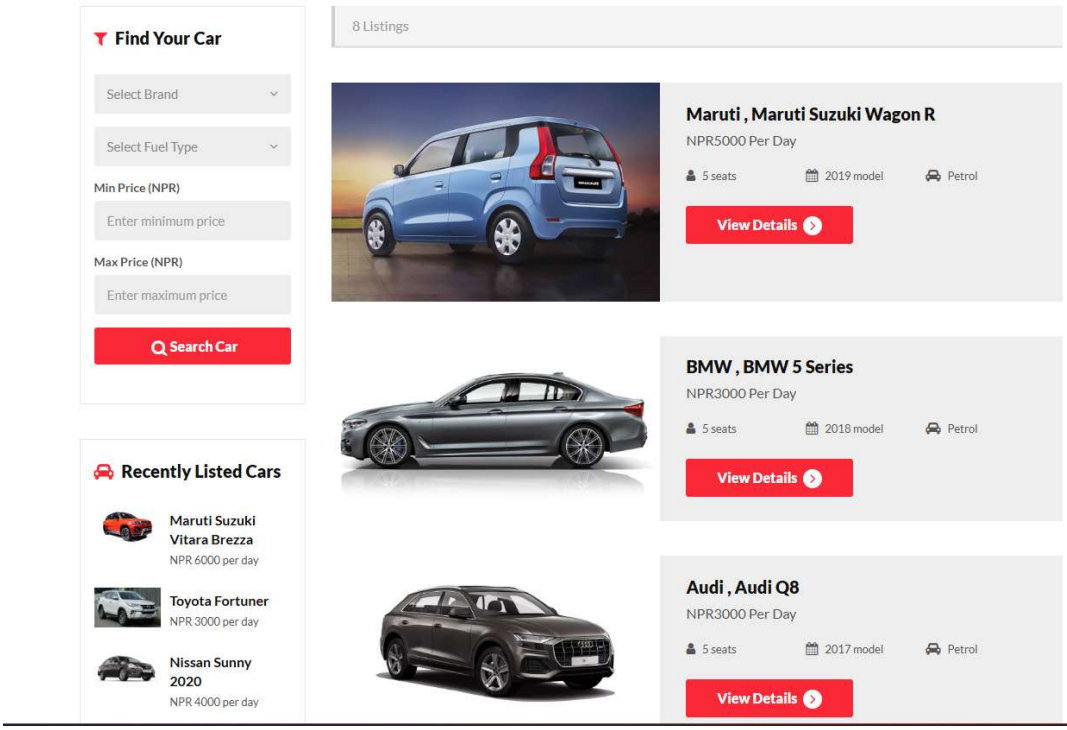
Screenshots:



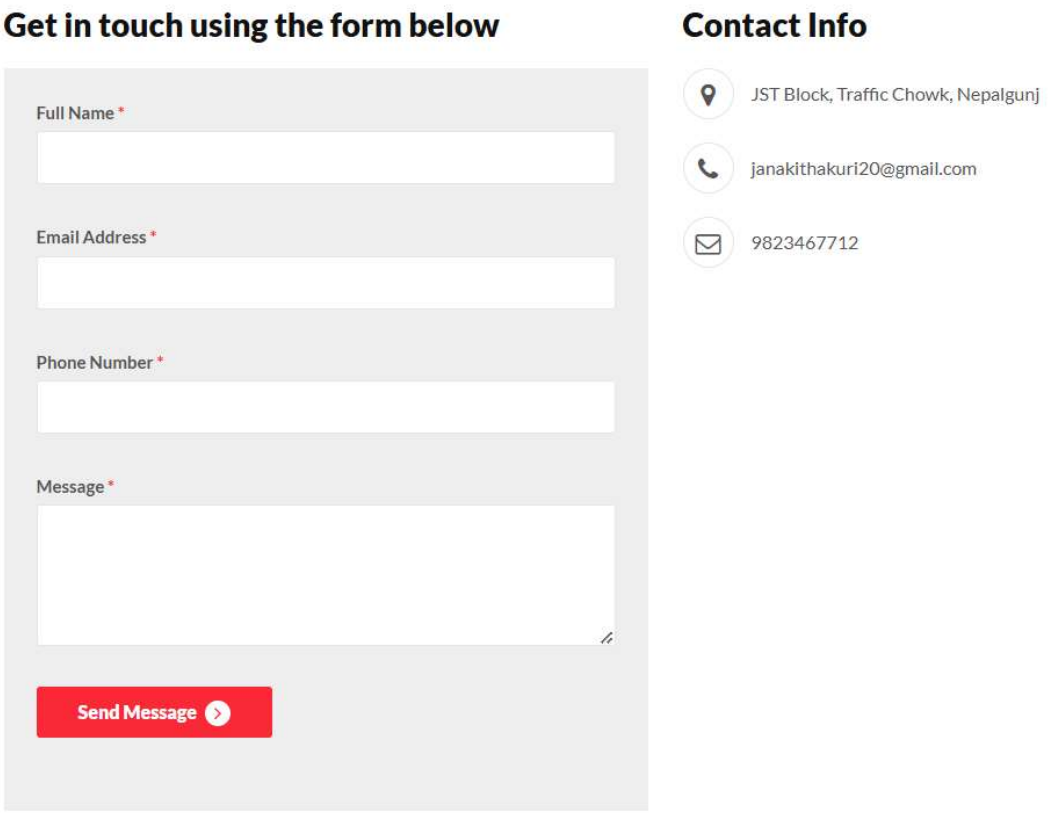
Home Page of CRP



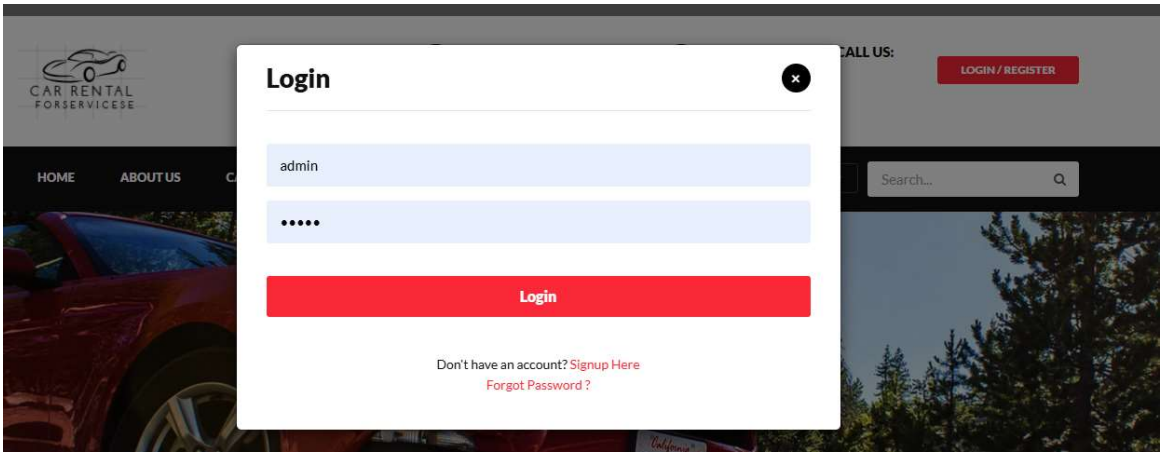
Recent Cars page



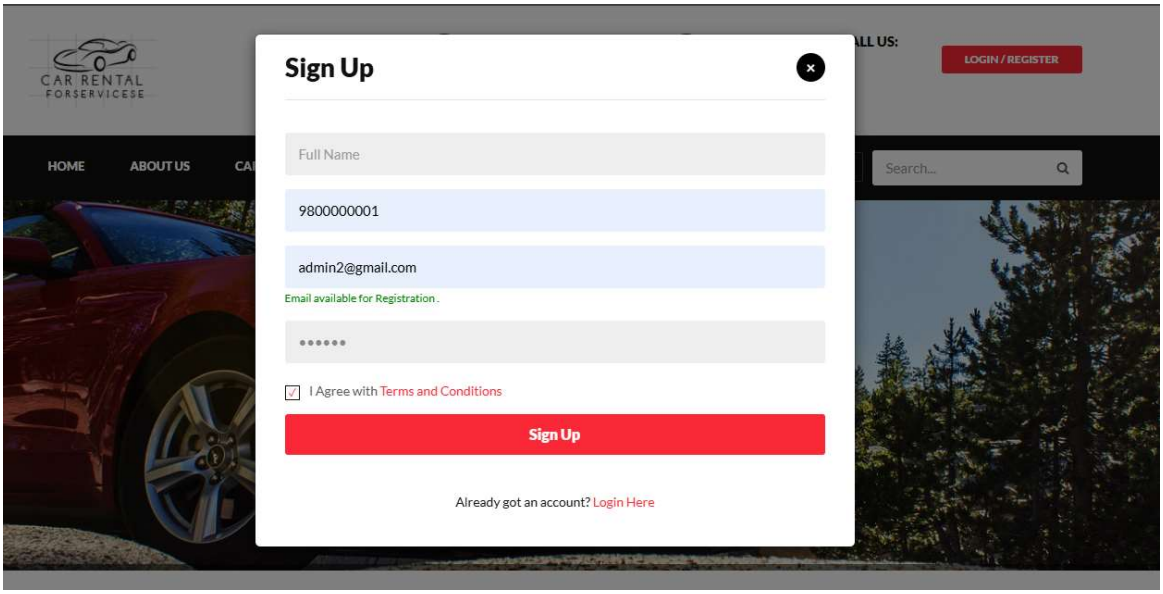
Car listing page



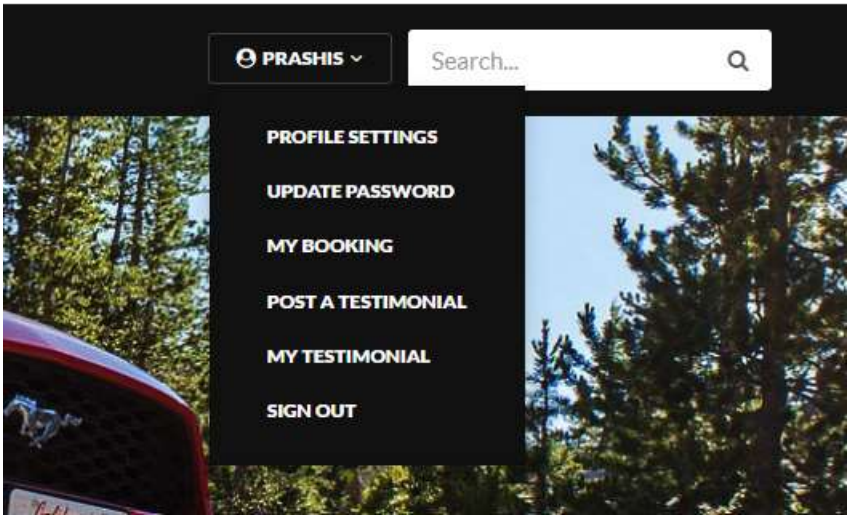
Contact Us page



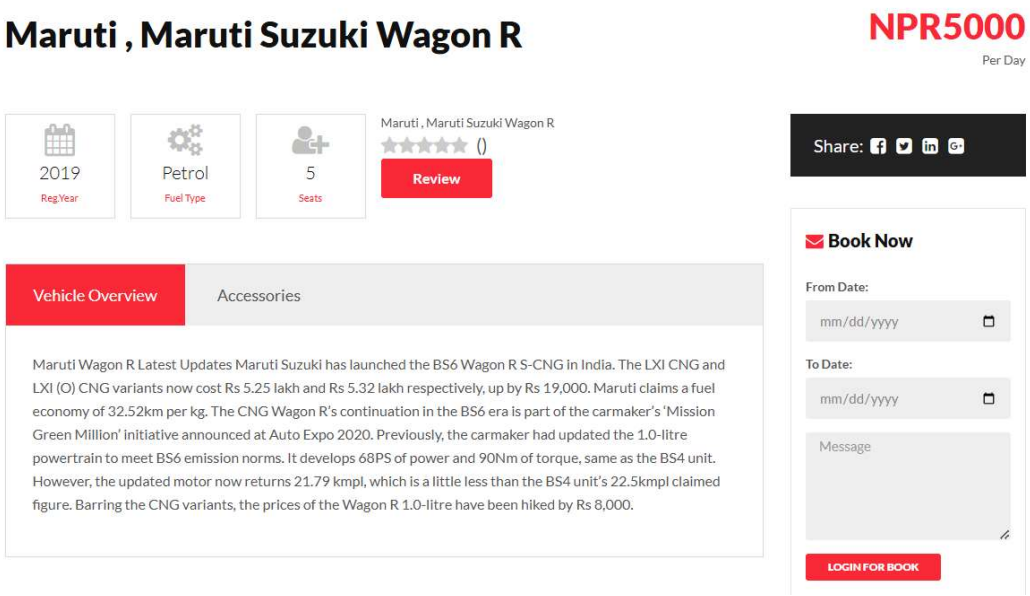
User Login page



User SignUp page



After User Login



Booking page

MY BOOKINGS

Booking No #761841387

Audi , Audi Q8

Invoice

Not Confirm yet

From 2025-01-27 To 2025-01-30

Message: ktm

Car Name	From Date	To Date	Total Days	Rent / Day
Audi Q8, Audi	2025-01-27	2025-01-30	3	3000
Grand Total				9000

Booking Details

Submit Your Review for BMW 5 Series

Total Reviews: 0

View Ratings Distribution

Rating:

★★★★★

Rating: 0

Feedback:

Upload a Photo (optional):

Choose file No file chosen

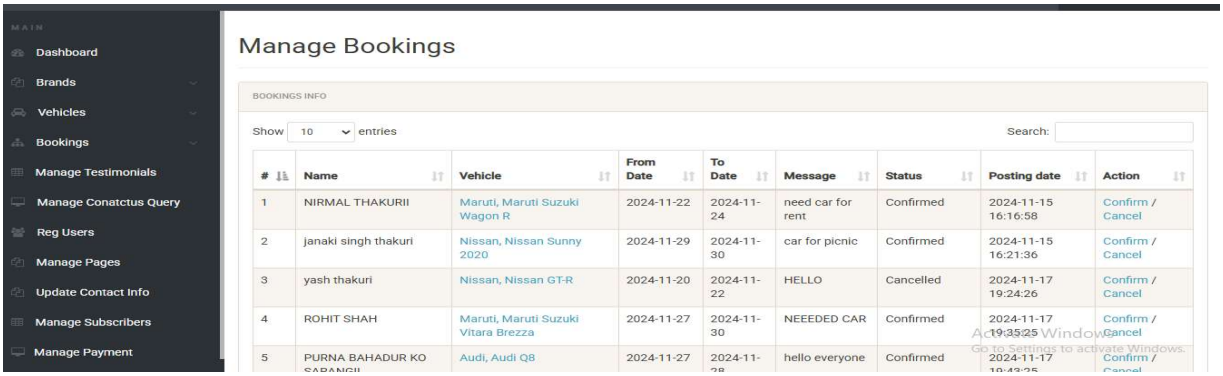
Submit Review

User Reviews:

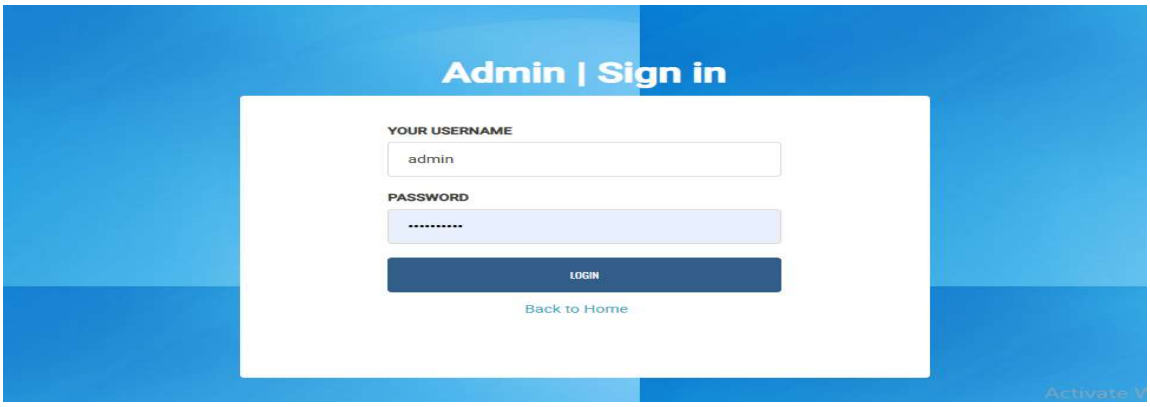
No reviews yet for this vehicle.

User review

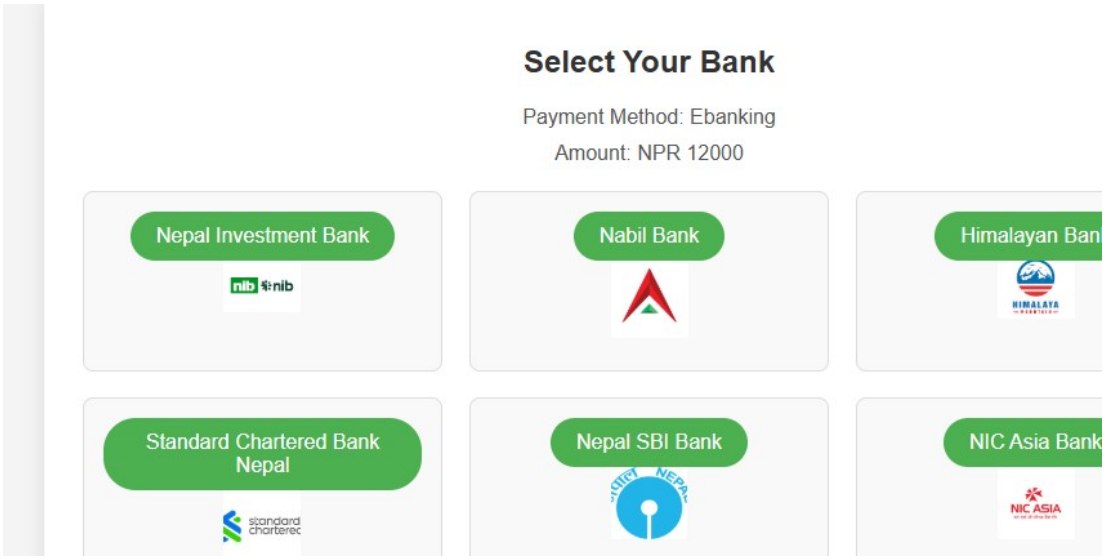
Admin Dashboard of CRP



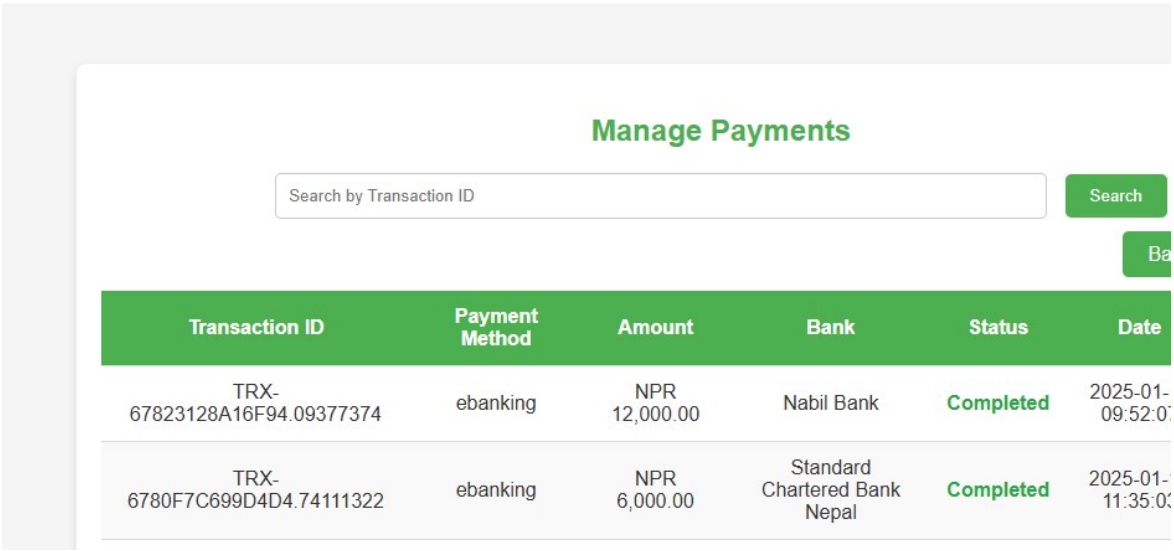
Manage Booking Page



Admin Login Page

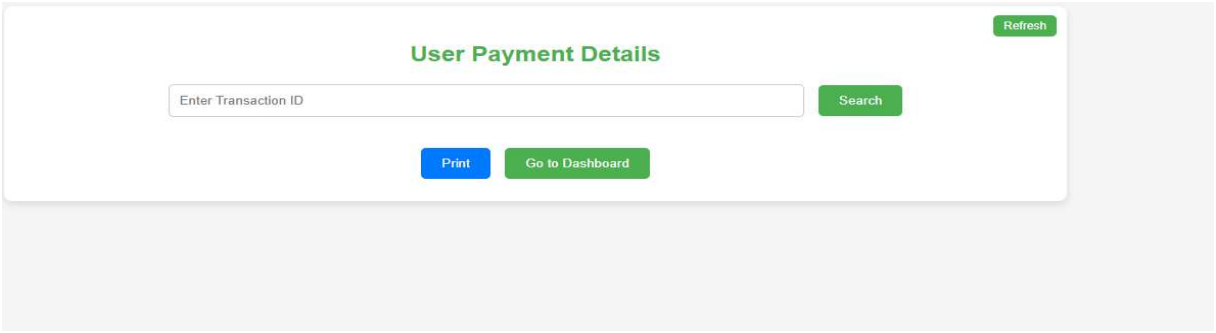


Payment Method

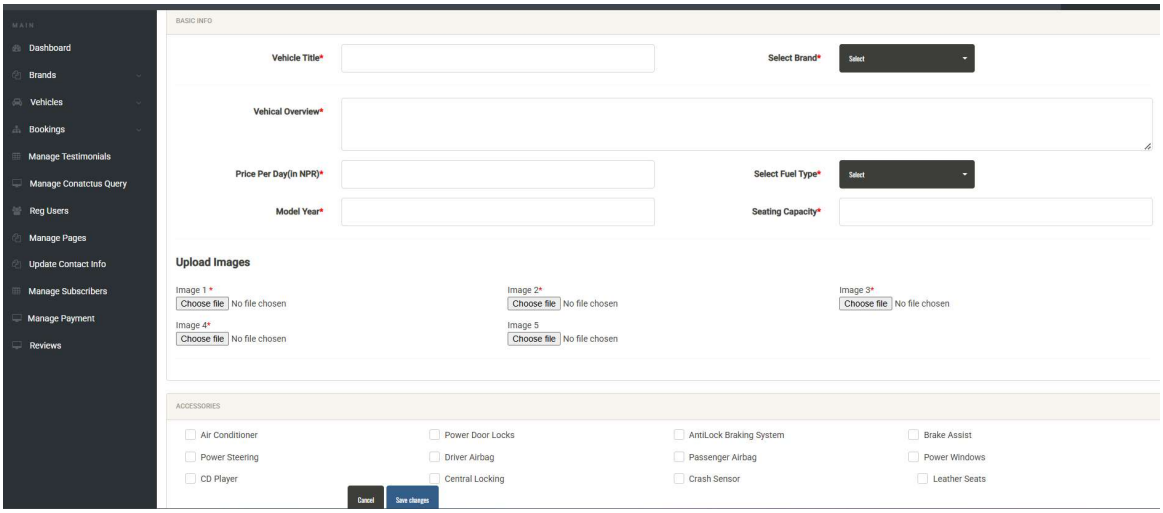


Manage Payment

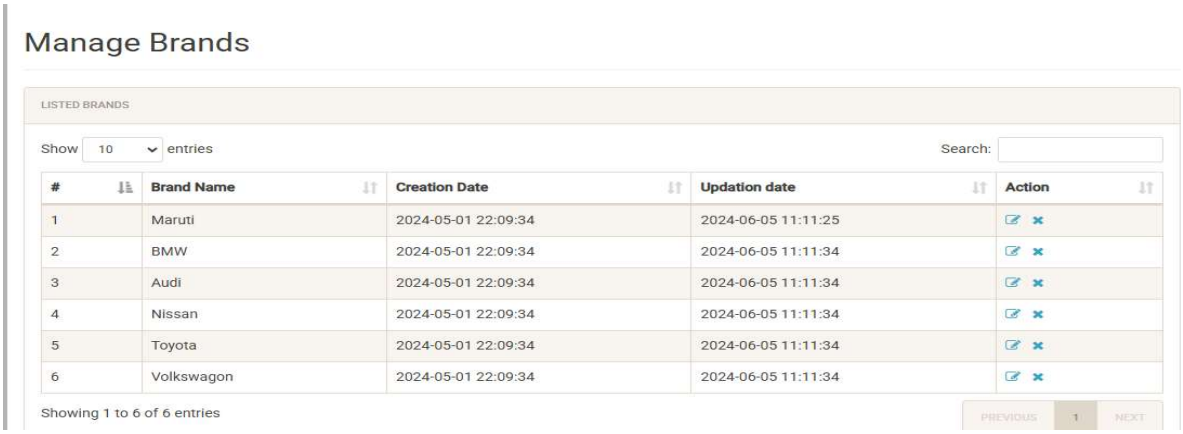
Revenue Generate



View Payment Details



Post a vehicle



Manage Brands