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Automobile Rental System

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Abstract: The web-based rental automobile system can enhance the performance of the current manual system. An automobile rental service enables customers to reserve vehicles for a predetermined amount of time and pay for their use. Users can typically browse the available automobiles on the system's website or mobile application, choose their preferred rental duration, and book a vehicle there. A physical site where the rental automobiles can be picked up and returned may also be part of the system. A vehicle is only rented out when it is available, thanks to the car rental system that keeps track of each vehicle's availability. This system was developed by using Visual Studio Code software and php MyAdmin as a database. The development is using a structured approach and prototyping methodology as a guideline. The goal of this project is to make it easier for automobile agencies to manage their assets and for customers to make vehicle reservations.

Keywords: Management system, Automobile rental, Web-based system

1. Introduction

Human uses many types of automobiles as a means of transportation to go from point A to point B, from point B to point A within a country, etc. It has become one of the most important elements of our daily life. A rental car or car rental company is a company that rents cars to people for a short period. The automobile rental company is a global and local industry. It is a continuous and seasonal industry that grows over time. Automobile rental services are important to the public, especially students in colleges and universities. Students prefer to rent an automobile rather than use public transport as they move around freely. Some students do not have their transportation and need to use other services. In addition, the increase in taxi fares, public transport and e-hailing makes people not use the service.

However, most companies use manual methods to manage rental automobile operations in their areas. The procedure is unorganized since client data is recorded in a booking form or a log book. In addition, the automobile rental company requires a large number of employees to manage various jobs while operating their business without a system. The manual system does not allow users to book automobile rentals online. Users must contact a rental owner and this can cause a delay process of renting a vehicle. Customers also cannot reserve their reservations ahead of time to avoid surprises

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while picking up the vehicle. Besides, automobile rental user also faces problems when they have to struggle to find the best rental automobile in that area. Many companies provide automobile rental but some of them did not advertise their company and are not well known to the public.

At the end of this project, users will be easy to find an automobile that is available in the system and this system will make it easier for students to connect with any rental agency. This system can help user to make decisions based on what they want to find. Also, automobile rental owners can be easier to advertise their available vehicles through the system. Besides, an automobile rental system enables the owner to have an accurate record of in-out data, which makes it is running smoothly and easily.

2. Literature Review

In this chapter, it is essential to review and evaluate all data in order to create and propose a better system to replace the existing manual automobile rental management system. The rapid growth of interactive Internet services has led to constantly increasing Web sites [1]. As a result, a functional web application should be developed around standard graphical user interface designs that rely on menu selection and navigation. However, these interfaces need a significant cognitive overhead.

2.1 Management System

According to new research, a management system is described as a function that uses a combination of consciously designed processes and procedures to ensure that a company achieves its objectives successfully [2]. Several sectors of work management use web-based systems as an example of management in the service industry, such as attendance management, hotel management, restaurant management and various management including various information for recording and storing. The management system is an important in-service industry because it is to develop the necessary process to provide services that meet customers' requirements and increase customer satisfaction.

2.2 Web-based System

Web-based system is a system that used web technology to deliver information and services to consumers. Web-based systems are also used to collect, process, store existing data, and provide information for decision making. The flexible web, which includes the web browser, and the web application are the two most important components of a modern website. The use of web-based systems has implications for organizations in terms of organizational structure and culture, as well as the roles and skills of individuals within the organization [3]. A web browser is a piece of software that allows users to securely store important data in a database Besides, web-based systems are in charge of sending and storing data from any database using a web browser over the Internet. This allows the user to store data in a web-based system while also ensuring that the entered user data is safe from data loss. Next, a computer system web-based has been proposed to manage order traffic flow, generate accurate billing reports, reduce customer waiting time, improve workflow efficiency and reduce the margin of error [4].

2.3 Avis Malaysia

Avis is a well-known car rental company that operates globally. Avis operates in over 5,500 locations in more than 165 countries worldwide. In this system, data validation is done when the user enters data in the reservation screen in Avis's homepage. A range check is used to validate the time and date of rental. The interface is a simple website that can provide comfort to the user using it. Based on observation, the existing system has many functions that can be used in Automobile Rental System.

2.3 Socar.my

Socar.my is an application system used by users to find the best can rental in that area. this system contains the content of choosing the best car that are still available and select a certain date and time. Socar allows consumers to hire a car by the hour, day, or week using an app. Cars may be picked up at

Socar zones, which are high-traffic places such as shopping malls or LRT or MRT stations. All cars feature a keyless system controlled by the Socar app. Customers can unlock the car using the app on their phones.

2.4 Hawk Rental

Hawk Rental is a car rental agency based in Malaysia that assures the lowest car rental rates as well as interest advertising. Users may now access the car rental website using any search engine such as Google or Safari. In the Hawk Rental website, the features are well designed. The main page interface shows the function that has in the website. The Hawk Rental also suggest other application that have the same function as the website does.

2.5 Comparison of Existing System

To ensure that the resulting system is competitive and has a market value of its own, some web-based system and application system was used as the reference. This section describes three existing automobile rental systems and comparisons with the system to be developed. In contrast, three booking systems are available this will be compared with the Automobile Rental System that will be developed.

Table 1: System Comparison

Features/System	Avis Malaysia	Socar.my	Hawk Rental	Automobile Rental System
Login	√ user id and password	√ phone number	√ email and password	√ user email and password
Technology	Web-Based System	Mobile Application	Web-Based System	Web-Based System
Register Module	Available	Available	Not available	Available
Login Module	Available	Available	Available	Available
Booking Module	Available	Available	Not available	Available
Menu Module	Available	Not available	Available	Available
Payment Module	Unknown	Unknown	Not available	Available

3. Methodology

Prototype model was chosen as the software development approach for this project because prototyping ensures that the end users constantly work with the system and provide feedback which is incorporated in the prototype. The Prototype Model is defined as a system development methodology that can be fully realized and can identify the necessary changes and analyse the actual needs in the project to be developed. It is also a system that has the potential to give ideas to developers and users about the functionality of the system in its complete form [5].

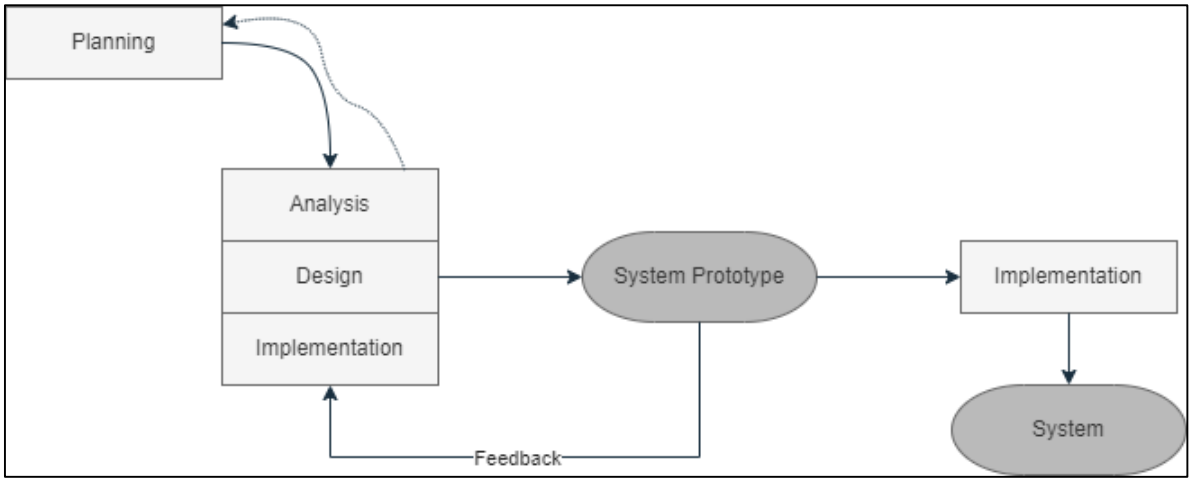

Figure 1: Prototyping Model [6]

3.1 Prototyping Model Phase

Table 2 shows the list of tasks performed at each phase in the Prototyping Model for the Automobile Rental System. There are five phases which include in prototype model such as planning, analysis, design, implementation and testing.

Table 2: List of Tasks for Each Phase in Prototype Model

Phase	Task
Planning	• Defining the problem of existing system, choose the scope of the project, project objective and methodology • Make project planning schedule.
Analysis	• Analyse the requirement needed for the proposed project
Design	• Design the user interfaces, system interfaces, network requirements and database
Implementation	• Participating activities include database testing, programming, module testing, and system testing.
Testing	• Demonstrate and validate the system features • The module testing, unit testing and user acceptance must be function.

4. Analysis and Design

4.1 Functional Requirement

Functional requirement is about the system functionality and explains the main function and capabilities that have in the website. It also explains how users interact with the system and the response users get from the system.

Table 3: Functional Requirement Automobile Rental System

Module	Function
Login Module	- The system should allow user to login using email and password - The system should alert any invalid input - The system should direct to main menu once successfully login
Registration Module	- The system should allow new user to register before login - The system should show error when empty field is found
Menu Module	- The system should allow user and admin to view menu
Booking Module	- The system should allow user to book a vehicle - The system should alert any unavailable vehicle
Payment Module	- The system should allow user to make payment

4.2 Non-Functional Requirement

Non-functional requirements define how a system should work rather than what the system should do. These requirements are concerned with the general behavior and characteristics of the system, rather than specific functions or features.

Table 4: Non-Functional Requirement Automobile Rental System

Requirement	Description
Operational Requirement	The system can be used in any web browser such as Google Chrome, Microsoft Edge or Safari
Security Requirement	System only can be accessed with invalid username and password
Culture Requirement	System provides a user-friendly interface

4.3 Flowchart

A flowchart is a graphical representation of a process or system that shows the steps or tasks involved, typically using symbols and connecting lines to show the flow of information or execution. The flowchart shows the overall structure and flow of a system. Figure 2(a) shows a flowchart for the admin and Figure 2(b) shows the flow of the user.

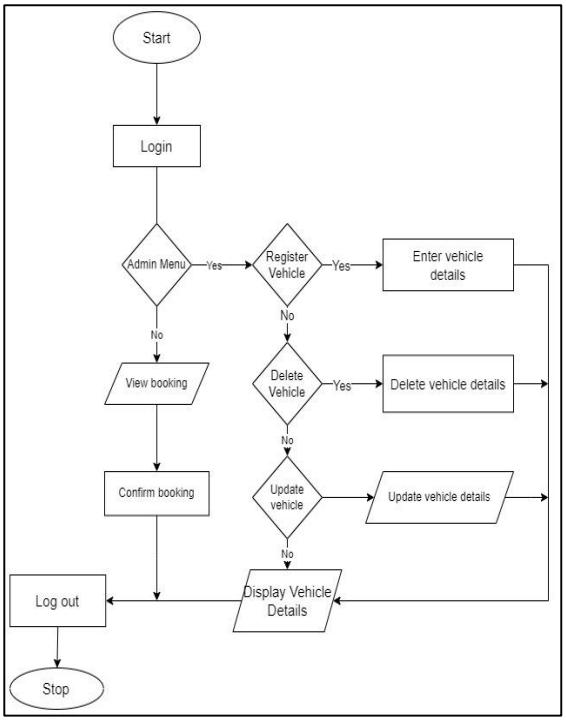

Figure 2(a): Flowchart of the Admin

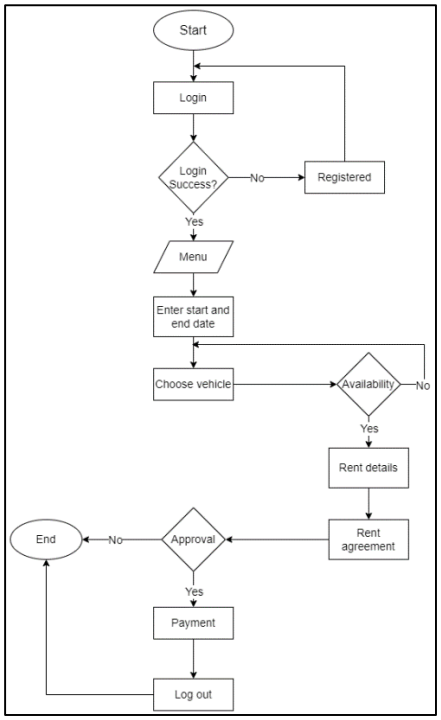

Figure 2(b): Flowchart of the User

4.4 Context Diagram

A context diagram represents the system as a single process and does not show the internal details of the system. Instead, it shows the flow of data into and out of the system and the relationships between the system and the external entities. Figure 3 shows the Context Diagram of the system.

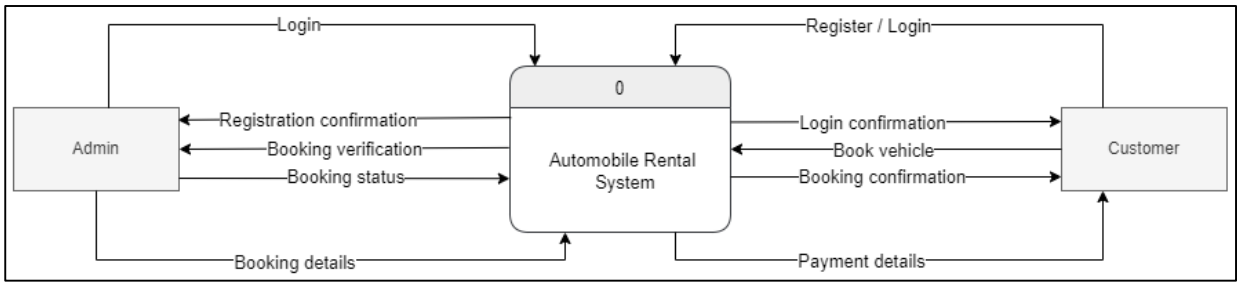

Figure 3: Context Diagram

4.5 Data Flow Diagram Level 0

Data flow diagram level 1 represents the as a whole and shows the relationships between the system and the external entities that interact with it. The system development process of this purposed system consists of four process which are register, login, manage vehicle and book. Figure 4 shows Data Flows Diagram Level 0.

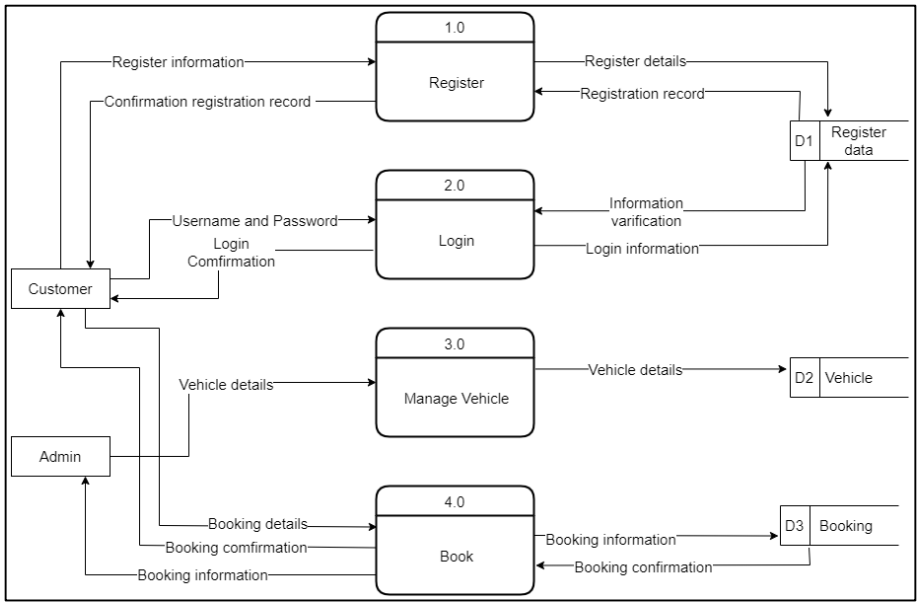

Figure 4: Data Flow Diagram Level 0

4.6 Data Flow Diagram Level 1

A level 1 Data Flow Diagram is a decomposition of the context diagram (level 0) and provides a greater level of detail, breaking down the single process of the context diagram into several sub-processes that occur within the system. It is a more detailed representation of a system that shows the internal processes of the system and the flow of data between them. Figure 5 to 7 shows the Data Flow Diagram Level 1 for the process in system development.

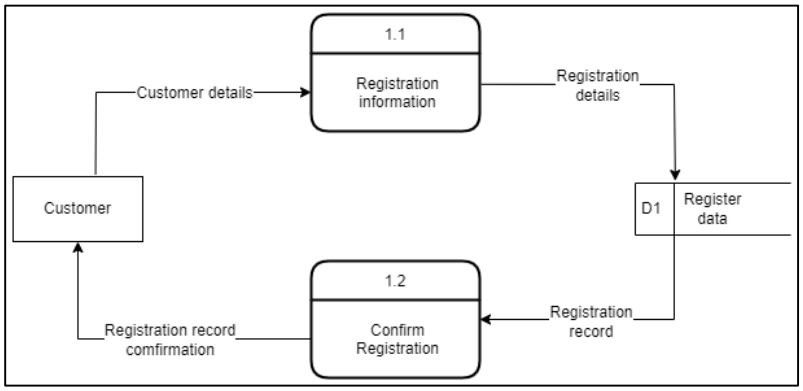

Figure 5: DFD Level 1 for Registration Process

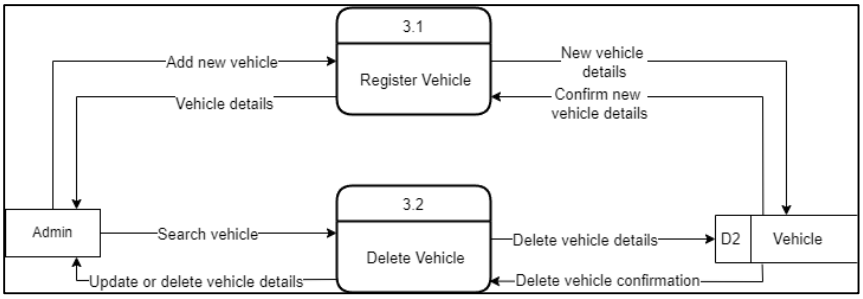

Figure 6: DFD Level 1 for Manage Vehicle Process

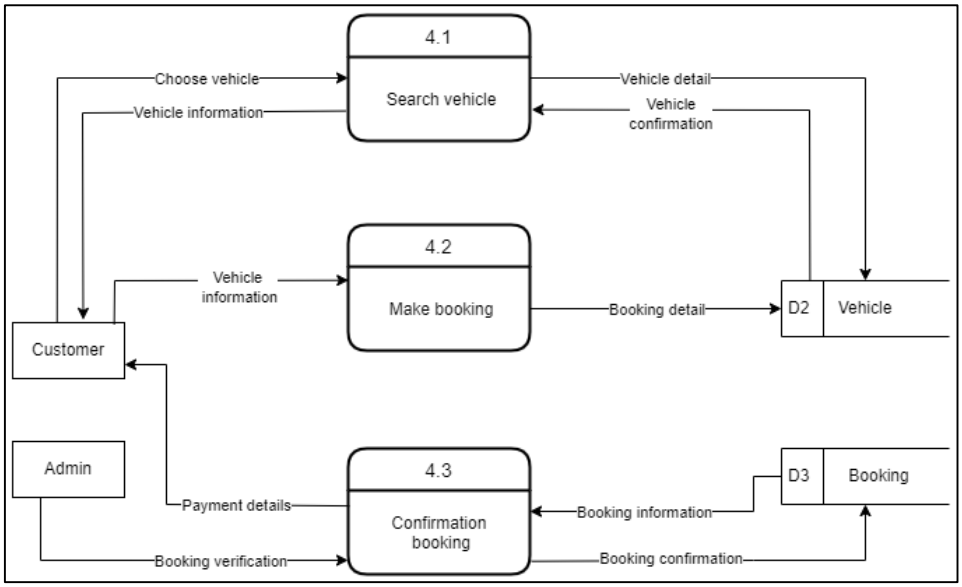

Figure 7: DFD Level 1 for Book Process

4.7 Entity Relationship Diagram

An entity relationship diagram (ERD) is a graphical representation of the entities and relationships within a system. An ERD was developed for Automobile Rental System to give overall database that developed for the system. Figure 8 shows entity relationship that involved in database of the purposed system.

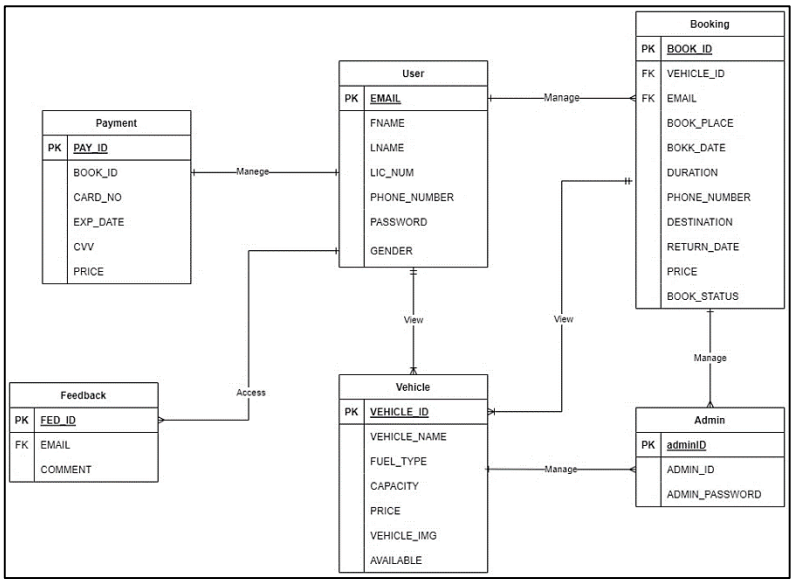

Figure 8: Entity Relationship Diagram

4.8 User Interface Design

User interface design is the process of designing the visual appearance and interaction of a user interface that is easy and efficient for users to interact with a system. The interface has been designed based on the user requirement using this system. Figure 9 to 12 shows the interface design of the Automobile Rental System.

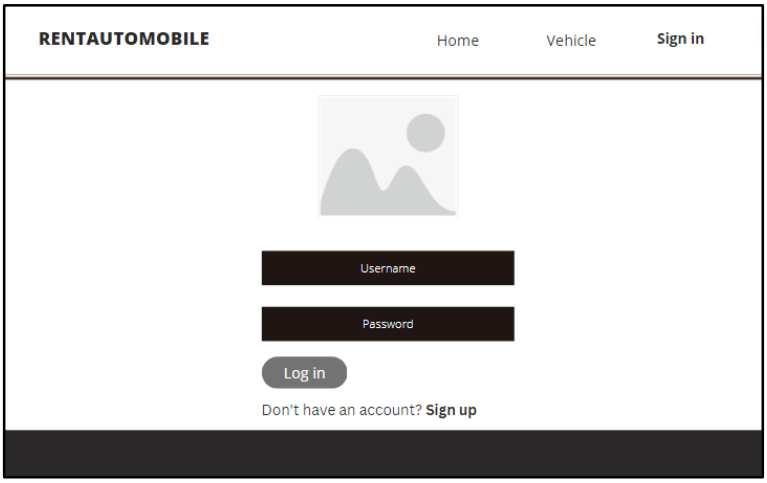

Figure 9: Login interface

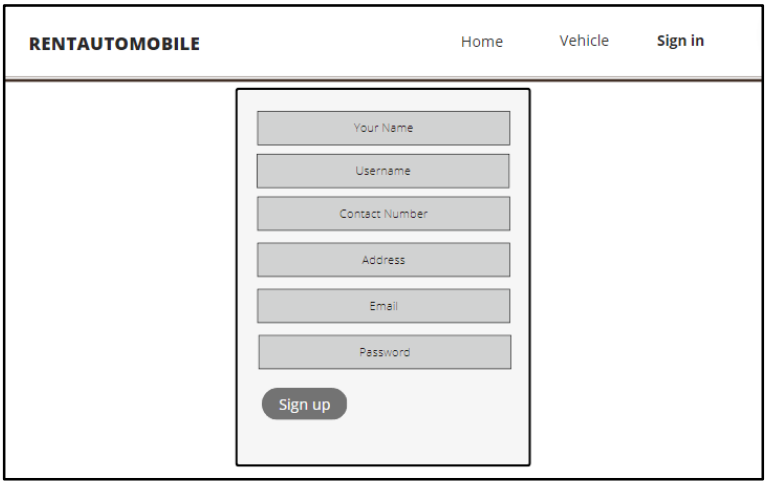

Figure 10: Register Interface

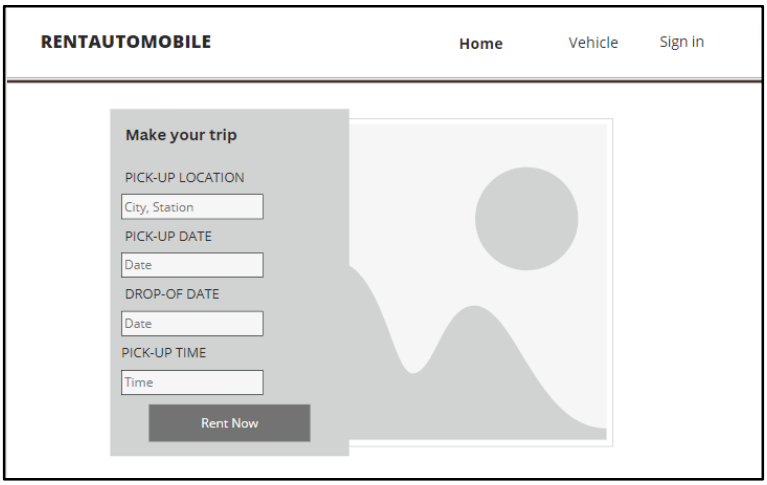

Figure 11: Main Menu Interface

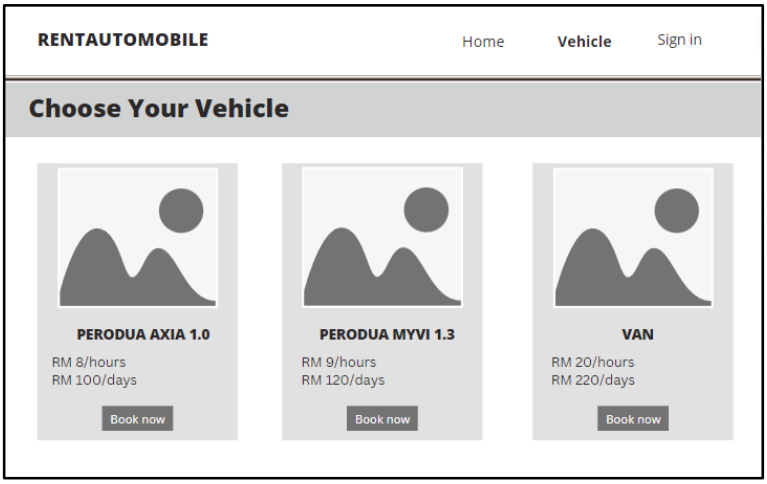

Figure 12: Vehicle List Interface

5. Implementation and Testing

An automobile rental system is expected to be user-friendly, reliable, secure, and able to handle a large number of requests. The system should also be able to perform necessary operations like managing and booking, easily. The system should provide data that can be used to measure the performance of the automobile rental business in order to make the necessary decisions. Furthermore, customers can save time by getting all of the information they need in one location with an online reservation system. The development of the system has been using Visual Studio Code as a tool and phpMyAdmin as the database. This System contains five main modules that were successfully developed.

5.1. Registration Module

Registration module allow new user to register by providing personal information such as full name, license number, email, phone number and password. User can submit the registration and the system will be navigated to the login page.

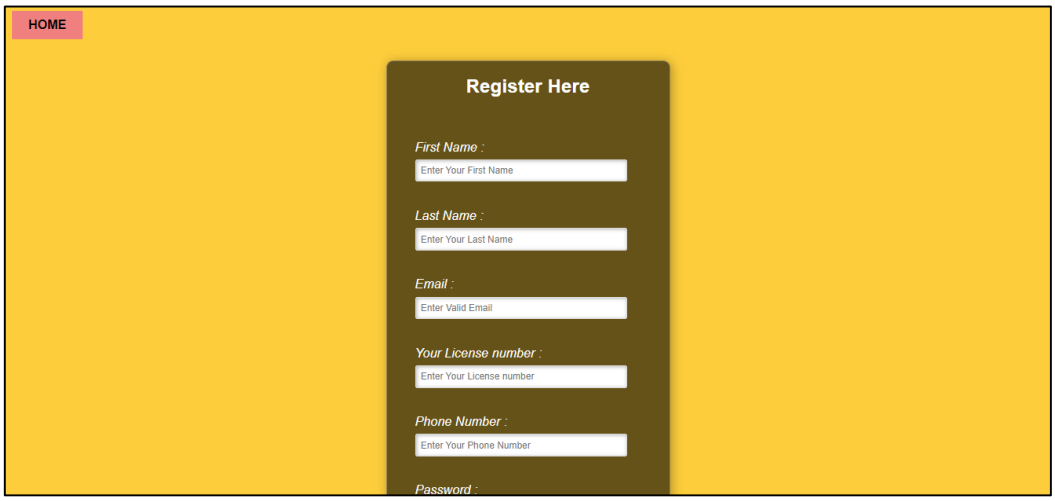

Figure 13: Interface for User Registration

```php
<?php
require_once('connection.php');
if(isset($_POST['regs']))
{
    $fname=mysqli_real_escape_string($con,$_POST['fname']);
    $lname=mysqli_real_escape_string($con,$_POST['lname']);
    $email=mysqli_real_escape_string($con,$_POST['email']);
    $lic=mysqli_real_escape_string($con,$_POST['lic']);
    $ph=mysqli_real_escape_string($con,$_POST['ph']);

    $pass=mysqli_real_escape_string($con,$_POST['pass']);
    $cpass=mysqli_real_escape_string($con,$_POST['cpass']);
    $gender=mysqli_real_escape_string($con,$_POST['gender']);
    $Pass=md5($pass);
    if(empty($fname)|| empty($lname)|| empty($email)|| empty($lic)|| empty($ph)|| empty($pass) || empty($gender))
    {
        echo '<script>alert("please fill the place")</script>';
    }
    else{
        if($pass==$cpass){
        $sql2="SELECT *from users where EMAIL='$email'";
        $res=mysqli_query($con,$sql2);
        if(mysqli_num_rows($res)>0){
            echo '<script>alert("EMAIL ALREADY EXISTS PRESS OK FOR LOGIN!!")</script>';
            echo '<script> window.location.href = "index.php";</script>';

        }
        else{
        $sql="insert into users (FNAME,LNAME,EMAIL,LIC_NUM,PHONE_NUMBER,PASSWORD,GENDER) values
        ('$fname','$lname','$email','$lic',$ph,'$Pass','$gender')";
        $result = mysqli_query($con,$sql);
```

Figure 14: Code Segment for Registration

5.2. Login Module

The login module required the admin and user to enter valid email and password in order to get into the user or admin dashboard. When the user or admin enters an invalid email or password, the system will notice an error message " Enter a proper email or password". The user and admin are required to re-enter their email and password.

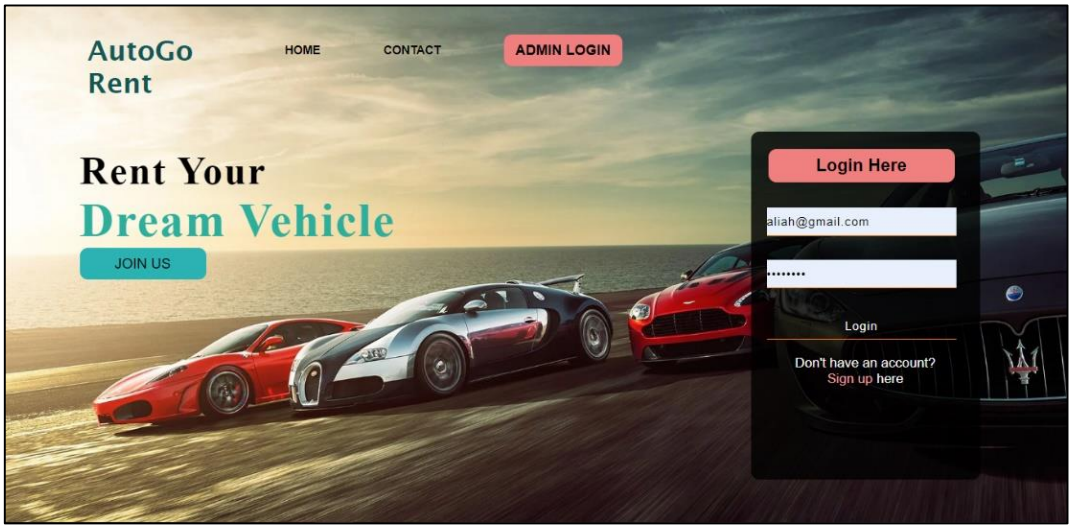

Figure 15: Login Interface for User

```
            <div class="icon">
                <h2 class="logo">AutoGo Rent</h2>
            </div>
            <div class="menu">
                <ul>
                    <li><a href="#">HOME</a></li>
                    <li><a href="contactus.html">CONTACT</a></li>
                  <li> <button class="adminbtn"><a href="adminlogin.php">ADMIN LOGIN</a></button></li>
                </ul>
            </div>
        </div>
        <div class="content">
            <h1>Rent Your <br><span>Dream Vehicle</span></h1>
            <button class="cn"><a href="register.php">JOIN US</a></button>
            <div class="form">
                <h2>Login Here</h2>
                <form method="POST">
                <input type="email" name="email" placeholder="Enter Email Here">
                <input type="password" name="pass" placeholder="Enter Password Here">
                <input class="btnn" type="submit" value="Login" name="login"></input>
                </form>
                <p class="link">Don't have an account?<br>
                <a href="register.php">Sign up</a> here</a></p>
            </div>
        </div>
```

Figure 16: Code Segment for Login

5.3. Booking Module

Users can make a booking of the selected car in the booking module. Users need to enter a valid booking and return date that is required in the booking form. An error message will occur if the user leaves a space in the booking form.

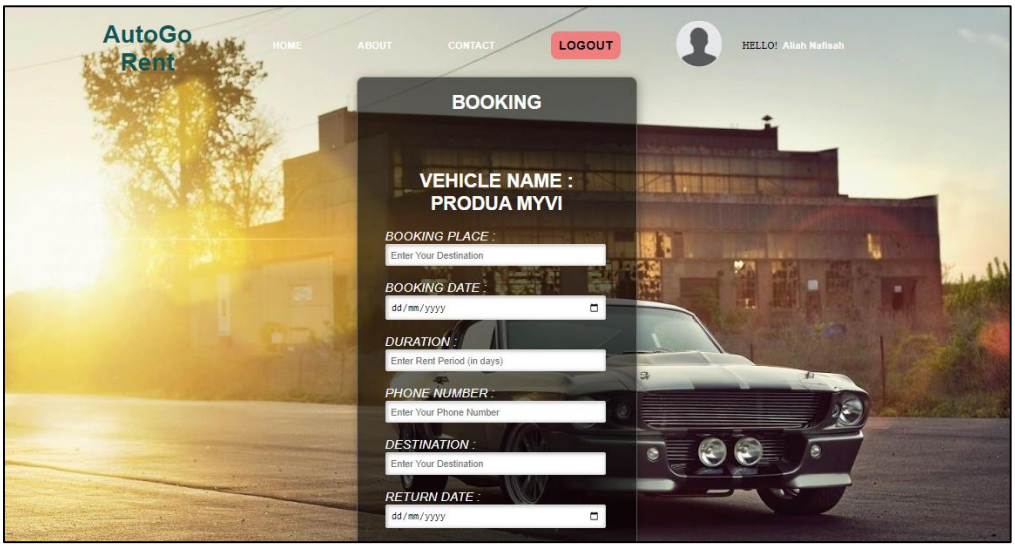

Figure 17: Booking Form Interface

```php
<?php

    require_once('connection.php');
    session_start();

    $carid=$_GET['id'];

    $sql="select *from cars where CAR_ID='$carid'";
    $cname = mysqli_query($con,$sql);
    $email = mysqli_fetch_assoc($cname);

    $value = $_SESSION['email'];
    $sql="select * from users where EMAIL='$value'";
    $name = mysqli_query($con,$sql);
    $rows=mysqli_fetch_assoc($name);
    $uemail=$rows['EMAIL'];
    $carprice=$email['PRICE'];
    if(isset($_POST['book'])){

        $bplace=mysqli_real_escape_string($con,$_POST['place']);
        $bdate=date('Y-m-d',strtotime($_POST['date']));;
        $dur=mysqli_real_escape_string($con,$_POST['dur']);
        $phno=mysqli_real_escape_string($con,$_POST['ph']);
        $des=mysqli_real_escape_string($con,$_POST['des']);
        $rdate=date('Y-m-d',strtotime($_POST['rdate']));

        if(empty($bplace)|| empty($bdate)|| empty($dur)|| empty($phno)|| empty($des)|| empty($rdate)){
            echo '<script>alert("please fill the place")</script>';
```

Figure 18: Code Segment for Booking Form

This module also contains booking status which user can check if their booking either has been approved or is still under processing.

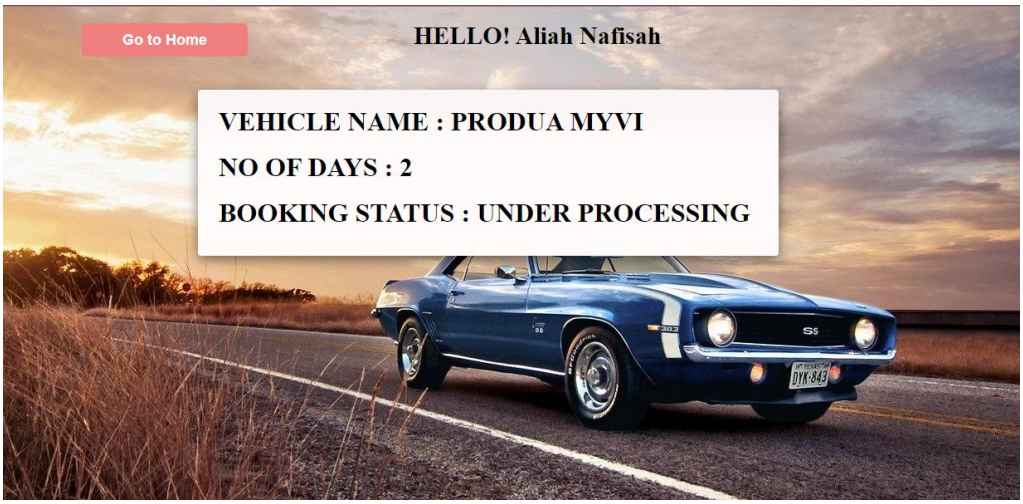

Figure 19: Booking Status Interface

5.4. Menu Module

The menu module in the automobile rental system provides a user-friendly interface that allows users to interact with the system and perform various actions such as viewing available vehicles, renting a vehicle and giving feedback to the rent company. The menu module enhances the user experience by providing a structured interface for customers to interact with the automobile rental system.

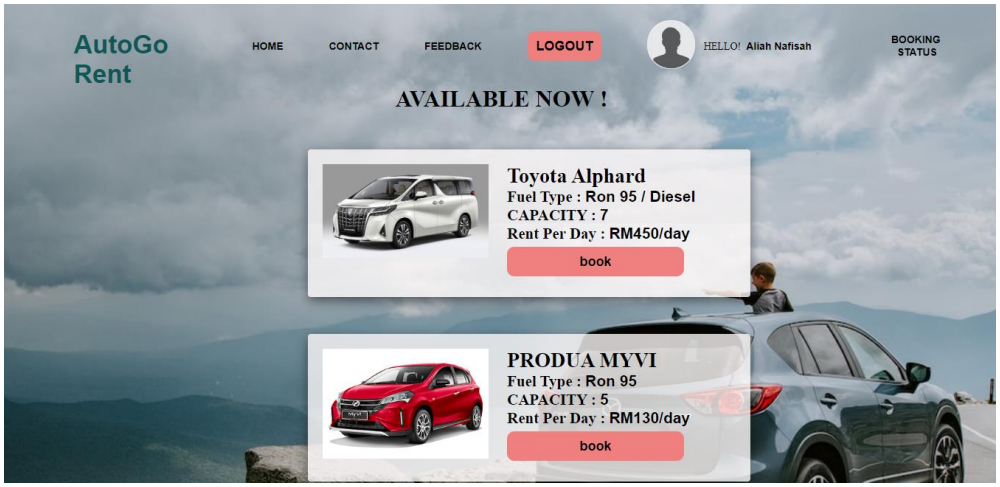

Figure 20: Vehicle Menu Interface

```
<li>
<form method="POST">
<div class="box">
   <div class="imgBx">
       <img src="images/<?php echo $result['CAR_IMG']?>">
    </div>
    <div class="content">
       <?php $res=$result['CAR_ID'];?>
       <h1><?php echo $result['CAR_NAME']?></h1>
       <h2>Fuel Type : <a><?php echo $result['FUEL_TYPE']?></a> </h2>
       <h2>Capacity : <a><?php echo $result['CAPACITY']?></a> </h2>
       <h2>Rent Per Day : <a>RM<?php echo $result['PRICE']?>/day</a></h2>
       <button type="submit"  name="booknow" class="utton" style="margin-top: 5px;"><a href="booking.php?id=<?php e
    </div>
</div></form></li>
<?php
    }

?>
<?php
require_once('connection.php');


$value = $_SESSION['email'];

$sql="select * from users where EMAIL='$value'";
$name = mysqli_query($con,$sql);
$rows=mysqli_fetch_assoc($name);
```

Figure 21: Code Segment for Vehicle Menu

5.5. Payment Module

The payment module in the automobile rental system provides the payment process when the user rents a vehicle. It offers a convenient and secure way for users to make a payment after booking a vehicle. The payment module offers credit and debit card payment gateway options.

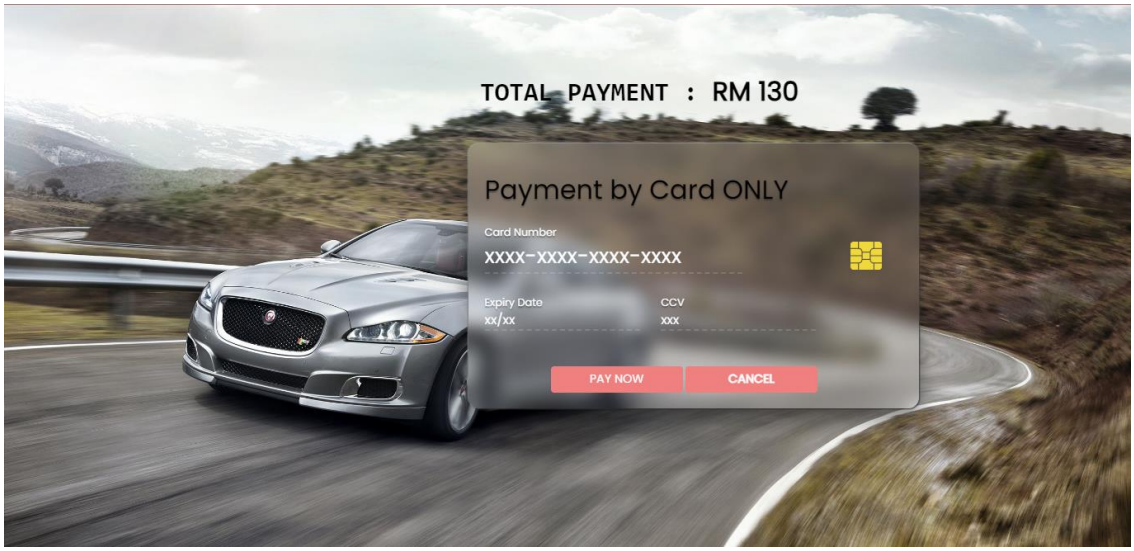

Figure 22: Payment Form Interface

```php
<?php
require_once('connection.php');
session_start();
$email  =   $_SESSION['email'] ;

$sql="select *from booking where EMAIL='$email' order by BOOK_ID DESC ";
$cname = mysqli_query($con,$sql);
$email = mysqli_fetch_assoc($cname);
$bid=$email['BOOK_ID'];
$_SESSION['bid']=$bid;

if(isset($_POST['pay'])){
  $cardno=mysqli_real_escape_string($con,$_POST['cardno']);
  $exp=mysqli_real_escape_string($con,$_POST['exp']);
  $cvv=mysqli_real_escape_string($con,$_POST['cvv']);
  $price=$email['PRICE'];
  if(empty($cardno) || empty($exp) ||  empty($cvv) ){
    echo '<script>alert("please fill the place")</script>';
  }
  else{
    $sql2="insert into payment (BOOK_ID,CARD_NO,EXP_DATE,CVV,PRICE) values($bid,'$cardno','$exp',$cvv,$price)";
    $result = mysqli_query($con,$sql2);
    if($result){
      header("Location: psucess.php");
    }
  }
```

Figure 23: Code Segment for Payment

5.6. Functional Testing

Functional testing is carried out to test the system's functionalities. This test is performed to find errors and limitations of the developed system so that all the problems can be solved at the beginning of the development. This functional testing is the best way to make sure the Automobile Rental System can fulfil user needs.

Table 5: List of Test Cases

Test Case ID	Test Case Description	Test Data	Expected Result	Test Result	User
TEST_100_001	The user able to register with personal information	• Personal information	User can register personal information into the system	Success	User
TEST_100_002	The user and admin login using email and password	• Email • Password	User and admin can log in into the system	Success	User Admin
TEST_100_003	User Enter a valid booking detail.	• Booking details	User can enter booking information without any error	Success	User
TEST_100_004	The system will display booking information	• Booking details	User can view booking information	Success	User
TEST_100_005	The admin able to confirm booking details	• Booking details	The admin can approve the booking application into the system	Success	Admin
TEST_100_006	User is able navigate to the main menu of the system	• Main menu	User can view main menu id displayed without any error in the system	Success	User
TEST_100_007	User is able to view the vehicle availability	• Vehicle details	User can view availability of vehicle before booking in the system	Success	User
TEST_100_008	The admin can add and delete vehicle details	• Vehicle details	The admin can access to manage the system	Success	Admin
TEST_100_009	User enter a valid payment detail	• Payment details	User is redirected to a booking confirmation page	Success	User

5.7. User Acceptance Test

A user acceptance test is a system testing for users that is to test and see the level of effectiveness of the developed system. User acceptance testing has been conducted to identify the level of satisfaction of users who use this system. This test is used to ensure that systems are designed and developed to satisfy the needs of users. These criteria were scaled from 1 to 5, where 1 is and 5 is very good.

Figure 24 shows the bar chart for the first question, which rate of system interface design. There are 63.6% of respondents satisfied with the system interface while 9.1% give a moderate rate of the interface design.

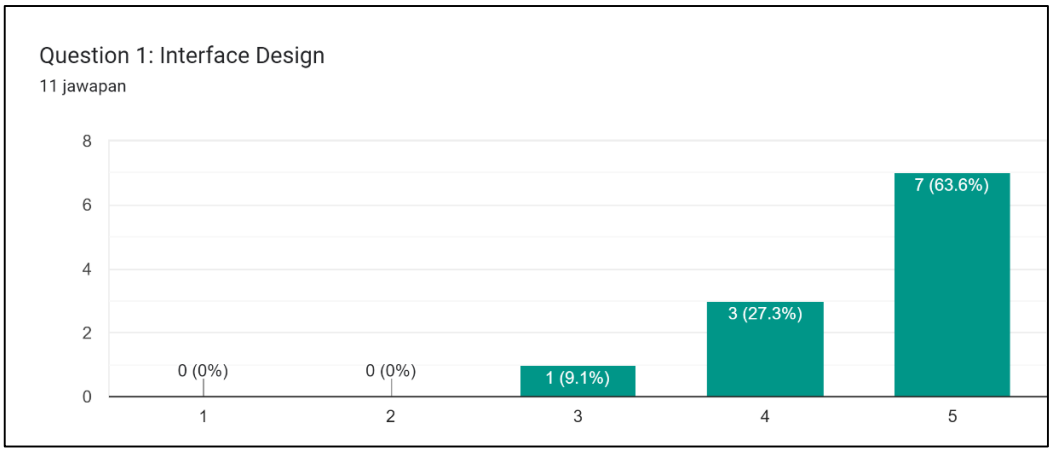

Figure 24: Question 1 of User Acceptance Test Questionnaire

Figure 25 shows, the question of functionality of booking vehicles which is the effectiveness of the booking process by using the Automobile Rental System. There were 45.5%, of which 5 respondents, vote that the booking process is very good while 45.5% voted for good and 9.1% of 1 respondent vote for moderate.

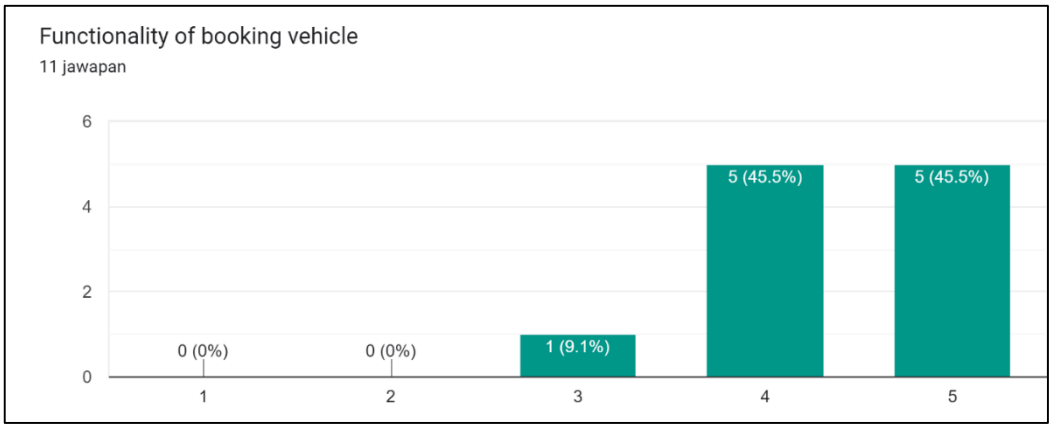

Figure 25: Question 2 of User Acceptance Test Questionnaire

6. Conclusion

In conclusion, the automobile rental system has been developed and implemented to make it easy, efficient, and enjoyable for customers to rent a vehicle. The system met the requirement and expectations set for it. As a result, the business operations become more efficient and also save time and effort to owner and client. Furthermore, customers can save time by getting all of the information they need in one location with an online reservation system. User feedback and technical evaluation

showed a high level of satisfaction with the system. Business performance indicators also show an increase in revenue and customer acquisition as well. However, certain areas can be improved in order to make the system even better. With that the unit and user testing to be done to ensure the system is always providing the best customer experience. As a result, the business operations become more efficient and also save time and effort to owner and client.

6.1. System Advantages

There are several advantages of the automobile rental system which are the system helps users to rent a vehicle easily and can save users time rather than a conventional renting system based on paper. This system also provides an interface for the administrator to receive and view bookings made by the user. The automobile rental system has a user-friendly interface that makes it easy for users to navigate through the rental system and complete rental processes without confusion.

6.2. System Disadvantages

Although this system has met its objectives, there are still some disadvantages and limitations. In this system, user can only make payments for renting using a credit or debit card. There is no other option to choose their payment gateway. Besides, this system lacks of navigation, where the user cannot cancel a booking after making payment. This system does not have filters and navigation for the type and price of the vehicle. If the car has been booked, the user can't make a booking of the same vehicle at a different date or time.

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References

[1] Berners-Lee, T., Cailliau, R., Groff, J., & Pollermann, B. (1992). World-Wide Web: The Information Universe. Internet Research, 2(1), 52–58. https://doi.org/10.1108/eb047254

[2] Kazmi, S. A. Z., & Naarananoja, M. (2014). Significance of Management System for Effective Organizational Management. GSTF Journal on Business Review (GBR), 3(2). https://doi.org/10.7603/s40706-013-0022-2

[3] Liang, H.K., & Wang, K.C. (2000). Web-based systems development: A review of the state of the art. Journal of Management Information Systems, 17(1), 57-78.

[4] Cheong, S. N., Chiew, W. W., & Yap, W. J. (2010, December). Design And Development Of Multi-Touchable E-Restaurant Management System. In 2010 International Conference on Science and Social Research (CSSR 2010) (pp. 680-685). IEEE

[5] Fauziah, Z., Latifah, H., Rahardja, U., Lutfiani, N., & Mardiansyah, A. (2021). Designing Student Attendance Information Systems Web-Based. Aptisi Transactions on Technopreneurship (ATT), 3(1), 23–31. https://doi.org/10.34306/att.v3i1.114

[6] Dennis, A., Wixom, B., & Tegarden, D. (2015). Systems Analysis And Design: An Object-Oriented Approach With UML. John Wiley & Sons

[7] Asri, S. A., Astawa, I. N. G. A., Sunaya, I. G. A. M., Yasa, K. A., Indrayana, I. N. E., & Setiawan, W. (2020). Implementation of Prototyping Method on Smart Village Application. Journal of Physics: Conference Series, 1569(3), 032094. https://doi.org/10.1088/1742-6596/1569/3/032094