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Thong Heng Workshop Appointment System

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Abstract: Thong Heng Workshop Appointment System (THA) is a web-based appointment system that was developed for Thong Heng Motor and Battery Services (Thong Heng) which is a traditional workshop that provides repair services for vehicles. When a large number of clients need auto repairs at once, the shop may not have enough workers to meet their needs. This project is to solve that problem for Thong Heng's customers as they can make car service appointments online. The project was developed based on the waterfall method by using Visual Studio Code software and the MySQL database. The web-based system will make it easy for Thong Heng to manage car service appointments. The success of the evaluations shows that the appointment system works as intended. It will be easier for Thong Heng to control the number of customers arriving at the workshop.

Keywords: appointment, web-based, waterfall method

1. Introduction

Thong Heng Motor and Battery Services (Thong Heng) is a traditional auto repair shop that has been in business for over 20 years. It is located in Simpang Renggam, Johor and provides repair services for a variety of vehicles including cars, vans and bus. The workshop operates on a first-come, first-served basis and currently does not have a system to allow customers to make appointments. This can lead to understaffing issues when multiple customers arrive at the workshop at the same time seeking service. Another issue was the difficulty of managing the appointment service. This is because Mr. Gan manually handles all the appointments, which may lead to missed appointments if he does not have time to answer the phone and is time-consuming when handling appointment changes and cancellations.

To solve these problems, the author decided to develop a web-based reservation system called the Thong Heng Workshop Appointment System (THA System). The web-based system lets users schedule auto maintenance visits at convenient times and assign a specific staff to perform that service.

This web-based system will be used by Thong Heng and the customers who support its business. The scope of the project includes appointment module, account module and outstation service module.

The THA system is intended to be a web-based system that will enable customers to view and make appointment services provided by Thong Heng. Customers will be able to request outstation services with this system. Administrator can manage and view customer appointments, which will help control

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the number of customers arriving at the shop. The administrator will also be able to add new accounts for staff to log into the system, which will allow for better management of the system.

The rest of this article will be divided into five sections. Section 2 explains the related work. Section 3 which is Methodology and Analysis and Design, explains the prototype development model chosen by the author, the system development workflow, the system requirements analysis and Data flow diagrams (DFD) context diagram, and the entity relationship diagram. Section 4 displays implementation and testing. In this part shows how the author create the THA system and the result of the testing. Section 5 is the conclusion of the paper.

2. Literature Review

The appointment system provides efficient appointment scheduling and processing. The advantages of appointment systems are increased effectiveness, greater customer experience, and optimal use of resources [1]. In this literature review, the main emphasis is on the functionality of the appointment system for this project and their comparison of different appointment systems. The comparisons and limitations of existing appointment systems are pointed out and the need for the developed system to create a creative and effective appointment system is presented.

2.1 Research on similar systems

In order to develop a standard for the developed appointment system, the author of the study examined four existing appointment systems namely "Janji Temu Klinik Kesihatan", "Online Auto Repair Appointments ", "MyJanjiTemu" and "Autohaus KL". The purpose of the analysis is to clarify the strengths and weaknesses of these systems, to highlight their key attributes and functions, and to provide guidance for creating a creative and effective appointment system in the developed system.

System Janji Temu Klinik Kesihatan is the Ministry of Health clinic appointment system on the Malaysian government portal by Klinik Kesihatan Malaysia (KKM) for clients who wish to seek treatment at clinics across Malaysia [2]. Government agencies provide online services to the public through various channels for the health and safety of the people, bridging the digital divide with the cooperation of various parties including the private sector and the community. The system will be used by selected health clinics of the Malaysian Ministry of Health, including government dental clinics.

The Online Auto Repair Appointments system was developed by Pep Boys for his customers to learn about the company and to book a vehicle service. Pep Boys is an American chain of automotive service centers and retailers of aftermarket automotive parts and accessories. The company was founded in 1921 in Philadelphia, Pennsylvania by Emanuel "Manny" Rosenfeld, Maurice "Moe" Strauss, W. Graham "Jack" Jackson and Moe Radavitz [3]. Pep Boys' goal is to be number one in their community and make it easy and convenient for everyone to get quality car care.

MyJanjiTemu is an online appointment system that is an initiative launched by the government to prevent people from showing up at government institutions through uncontrolled walk-in [4]. Through this MyJanjiTemu, people can complete various transactions easily and quickly. *Jabatan Pendaftaran Negara (JPN)* transaction services can be done through this online appointment. JPN is a department under *Kementerian Dalam Negeri*. It is responsible for registering important events for each individual, such as birth, death, adoption, marriage and divorce information. In addition, JPN is responsible for determining citizenship status and subsequently issuing personal identification documents in the form of ID cards to those who qualify.

Autohaus KL is a car service and repair company founded in 2015 by a group of enthusiastic people with the mission of improving the local automotive scene. The aftermarket industry will see new levels of development thanks to Autohaus KL's competence in automotive service and repair, which will lead

to change across the board. In the upcoming years, Autohaus KL wants to grow its business countrywide and become Malaysia's top vehicle repair and tire shop [5].

2.2 Comparison with the Existing Systems

Table 1 shows the comparison between the existing and developed systems. The appointment systems that the author chose to compare are Janji Temu Klinik Kesihatan, Online Auto Repair Appointments, MyJanjiTemu and Autohaus KL. The features will be discussed in the table are sign up and login module, platform used, outstation service, frequently asked questions, view history appointment, edit appointment, programming languages, appointment, appointment with specific person, appointment with the service and service area.

According to Table 1, the developed THA System aims to be a comprehensive appointment system, with features not found in other systems, such as an outstation service that allows customers to receive car services without coming to the workshop. Additionally, it can view and edit appointments, and the ability to book appointments with specific people. However, the system is limited to serving customers in the vicinity of Simpang Renggam.

Table 1: Comparison of Existing and Developed Systems

System Characteristic	Janji Temu Klinik Kesihatan	Online Auto Repair Appointments	MyJanjiTemu	Autohaus KL	Developed System
Sign up and login module	Login Only	Yes	No	No	Yes
Platform used	Web Browser & Application	Web Browser	Web Browser	Web Browser	Web Browser
Outstation request service	No	No	No	No	Yes
Frequently asked questions	No	Yes	Yes	Yes	Yes
View history appointment	Yes	No	No	No	Yes
Edit appointment	Yes	No	No	No	Yes
Appointment	Yes	Yes	Yes	Yes	Yes
Appointment with specific person	No	No	No	No	Yes
Appointment with choosing category the service	Yes	Yes	Yes	Yes	Yes
Service area	Malaysia	America	Malaysia	Kuala Lumpur	Simpang Renggam

3. Methodology

3.1 Waterfall Methodology

The author used the Waterfall model to develop the Thong Heng Workshop Appointment System, as it is simple and easy to understand. The Waterfall model, also known as the linear-sequential life cycle model, is a predictable and straightforward approach that follows a linear sequence of phases from analysis to design, implementation, testing and maintenance. The model is also easy to manage, as each stage comes to a close before moving on to the next stage and there are a set of deliverables and a review process for each stage. Felix Lorenzo Torres and Herbert D. Benington gave the first known presentation detailing the usage of such phases in software engineering on June 29, 1956, at the Symposium on Advanced Programming Methods for Digital Computers [6]. Figure 1, the waterfall method is a sequential development approach that moves through all project phases in a waterfall-like fashion, from planning, analysis through design, implementation, testing, and maintenance [7].

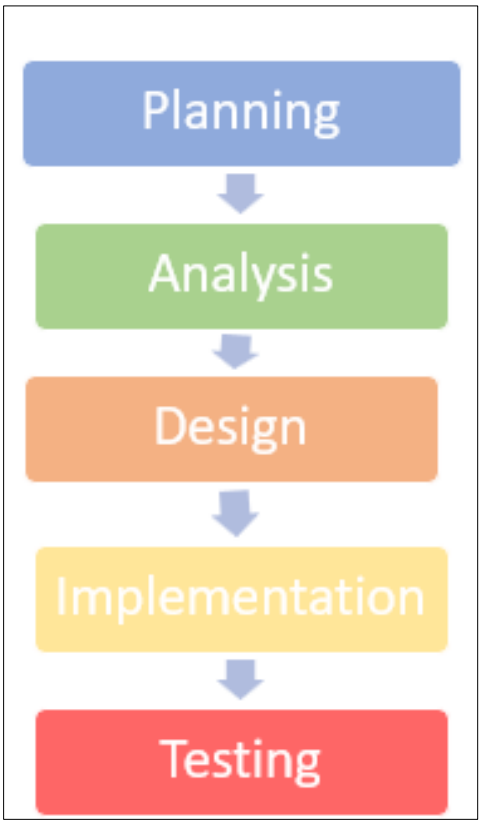

Figure 1: Waterfall Model

The workflow for developing the system is shown in Table 2. This model contains five phases, which are taken from the prototype model. Each phase has a different task and output. The project started from the planning stage. The author wrote a draft of the developed project with the owner of Thong Heng. During this phase, the author created a Gantt chart to show the progress of the project. In addition, the author interviewed the owner of Thong Heng to gather information and prepared some question and answer(Q&A) sheets to ask questions to owner.

The second phase is the analysis phase. In this phase, the author collects all the necessary information about the developed system and defines the initial concept of the system. To complete this phase, the author first reviews the information that has been collected. Once the author has analysed this information, the author can begin writing a plan for the developed system. This plan should outline the steps to develop the system and a timeline for completing each step. The author also compares the

developed system to the four existing appointment systems to see how it compares in terms of features and functionality. This can help the author identify any areas where the developed system may be lacking and adjust the plan accordingly.

The design phase is the third phase of the waterfall model. In this design phase, the database is designed along with the user and administrator interfaces and the appointment system processes. The author begins by creating a wireframe for the system being developed. As part of the web design process, the wireframe is a low-fidelity design plan that allows the author to establish criteria. In addition, depending on the purpose and scope of the developed system, the author can create contextual and activity diagrams. To illustrate the operation of the developed system, the author creates a DFD. Finally, the author designs the database by creating an Entity-Relationship Diagram(ERD).

The implementation phase is the fourth phase in the waterfall model. In this phase, the author uses all the data from the previous phase as a reference for creating the reservation system. The author used several programming languages to create the appointment system for Thong Heng Workshop, including Hypertext Preprocessor(PHP), Cascading Style Sheets(CSS), and JavaScript. PHP was used to create the website, while CSS and JavaScript were used to adjust the website. The author chose MySQL as the database management system to store the data in the appointment system.

The last phase of the waterfall model is testing. The testing phase is the process of evaluating the system to see if it meets the requirements and if there are any errors. Before launching the system, the author can use the testing phase to find errors and fix critical problems. To avoid system problems, the author performed various types of tests, such as integration tests, functional tests, and system tests. The author also conducted user testing with the client and Tong Heng. During the testing process, the author identified areas for improvement to make the system more reliable.

Table 2: Software Development Activities and the Task

Phase	Task	Output
Planning	1. discuss for the project 2. Interview the owner workshop 3. Draft a work plan	1. Determine developed project 2. Gather information of the workshop. Gantt Chart
Analysis	1. Define the problem statement, the objectives, and the scope of the project. 2. Find an existing system that is similar	1. Project proposal 2. A comparison of the developed system with existing systems
Design	1. Design process model flows. 2. Design wireframes 3. Design database	1. Data Flow Diagram (DFD), Context Diagram, Activity Diagram. 2. Wireframes 3. Entity Relationship Diagram(ERD)
Implementation	1. Analyse hardware and software requirements for develop system	1. Hardware and software requirements for developed system
Testing	1. Perform functional testing 2. Perform user testing	1. Fix the bugs in the system 2. Test report

4. System Analysis and Design

In this part, the DFD, flowchart and ERD are used to describe the requirements analysis and design of the system. The exact needs and requirements of the functions in the developed system are identified and described in the functional requirements. The Table 3 shows the functional requirements in the developed system.

Table 3: Functional Requirements

Function	Descriptions
Login	Allow admin and user to login the developed system
Manage user profile	Enable user to update their information and enable admin to view it
Manage appointment	Enable user to make car service appointment and update it. Admin can view the appointment.
Outstation service	Enable user to request outstation service and admin can accept or reject it.
Manage admin	Allow admin to add, edit and delete new admin

Non-functional requirements are those that specify system behavior rather than functionality. Table 4 shows the non-functional requirements in the developed system.

Table 4: Non-Functional Requirements

Function	Descriptions
Performance	The system should be stable, smooth and without any bugs.
Reliability	The system needs to function reliably and constantly deliver correct results.
Security	The system only accepts administrator logins to access the system
Usability	The system is easy to use for the user.

A DFD is a graphical representation of the data flow of an entire system, which represents the elements of the system and their interactions by providing data on the inputs and outputs of each entity and activity [8]. Figure 2 shows the DFD context diagram for developed system.

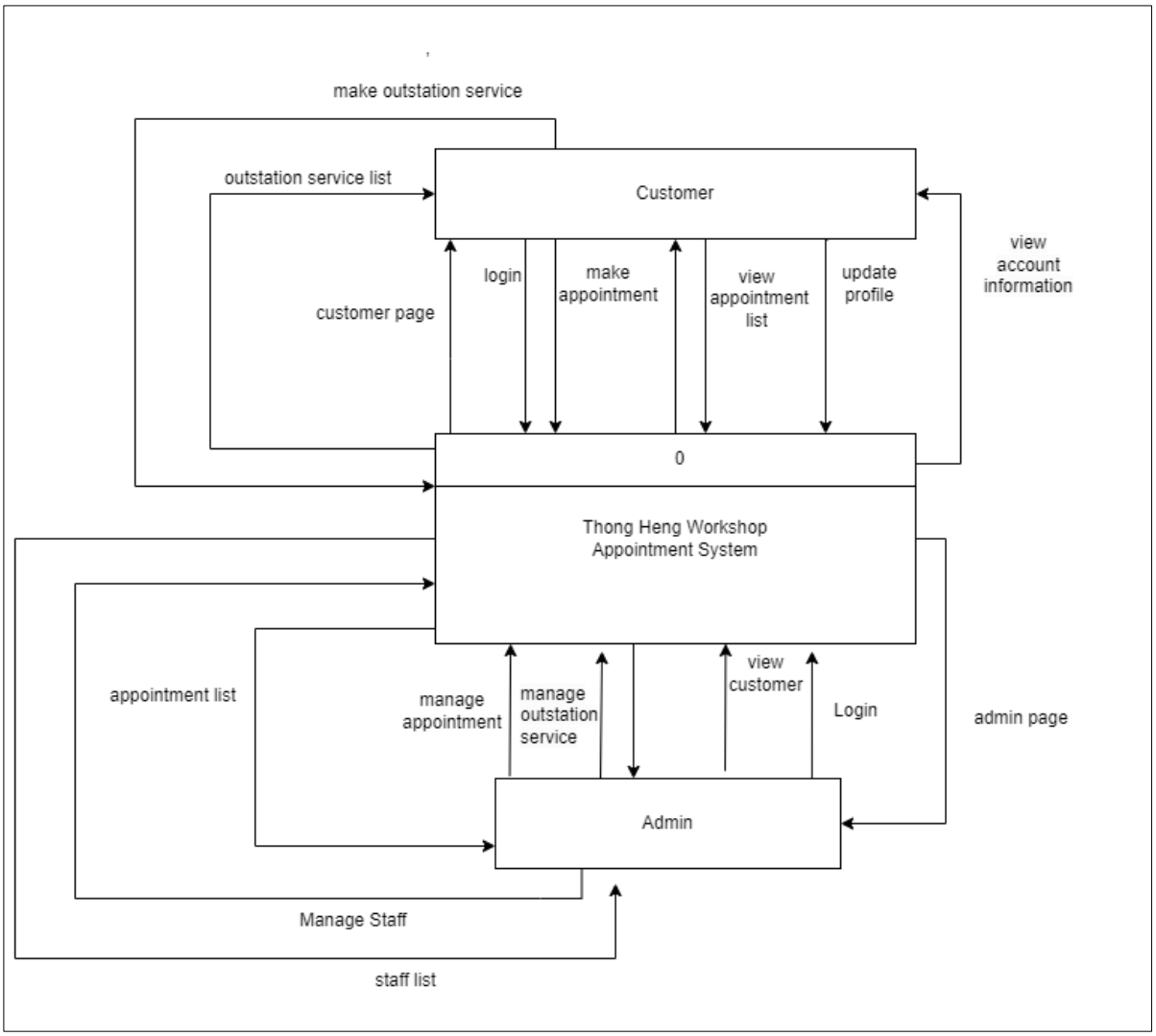

Figure 2: Context Diagram (CD)

Figure 3 shows the data flow diagram level 1(DFD Level 1). In the DFD Level 1, there have five processes in the system which are login, manage user profile, manage appointment, request outstation service and the manage admin. The database table included admin, user, appointment and the outstation.

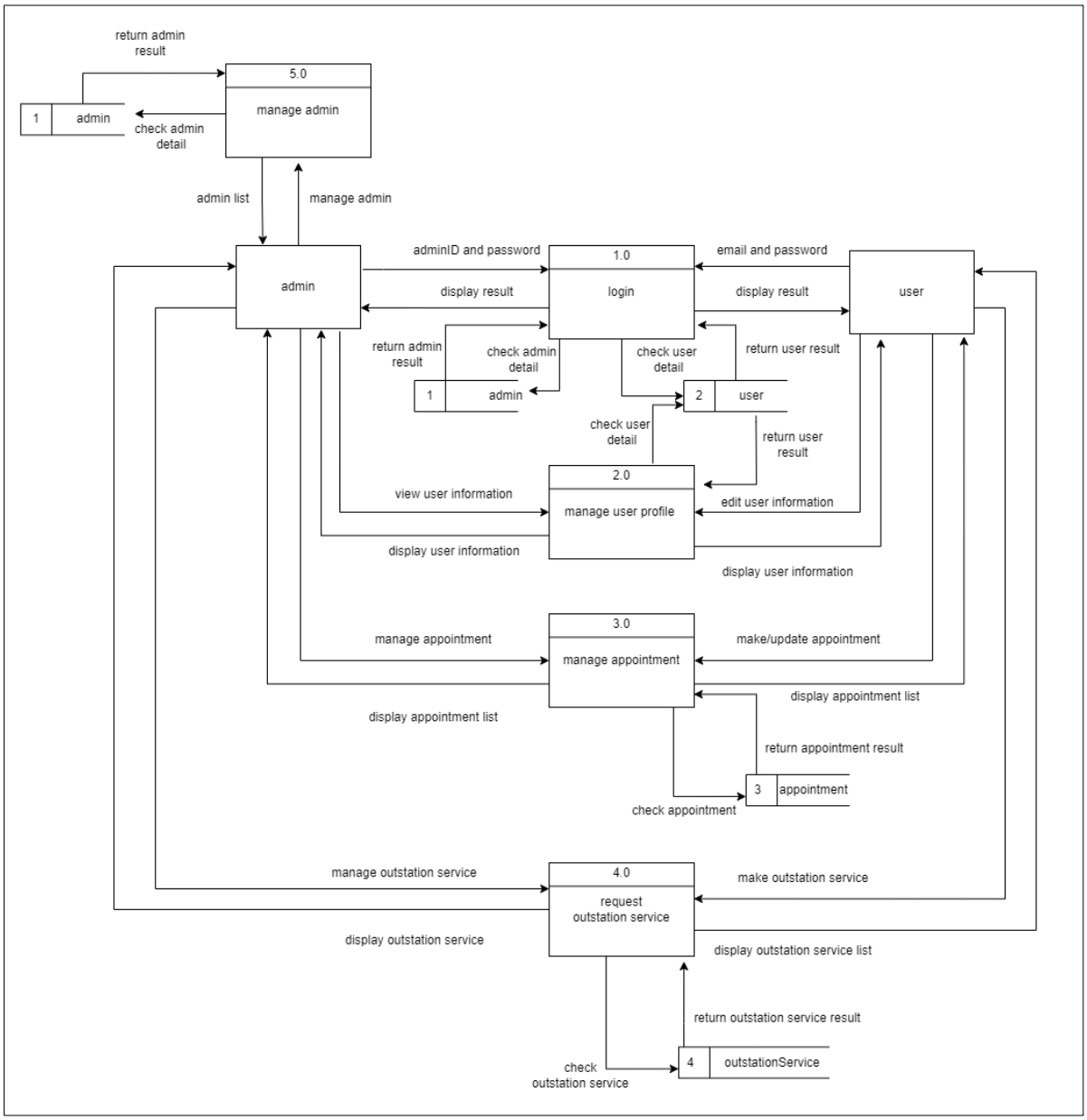

Figure 3: Data Flow Diagram Level 1 (DFD Level 1)

An ERD is a graphical depiction of the relationships between entities in a database. Figure 4 shows the ERD for the developed system.

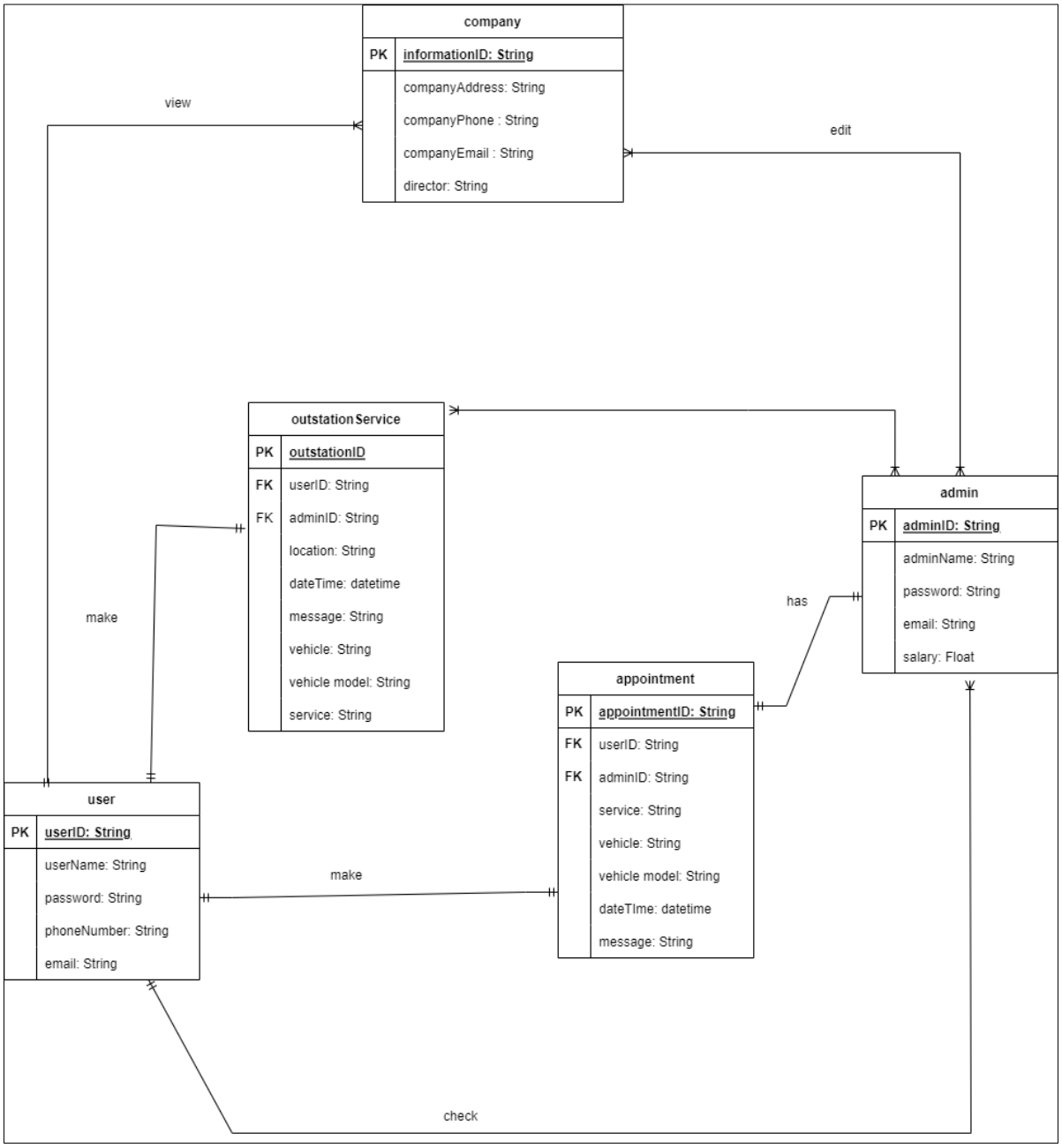

Figure 4: Entity Relationship Diagram

5. Implementation and Testing

The implementation and testing phase entails developing the system according to design requirements and specifications and conducting extensive testing to ensure its reliability and performance.

5.1 Implementation

The author used Visual Studio Code software to create Thong Heng workshop appointment system, where several programming languages were used including Hypertext Preprocessor (PHP), Cascading Style Sheets (CSS), and JavaScript. PHP was used to create the website, while CSS and JavaScript were used to tweak the website. The author chose MySQL as the database management system to store the data in the appointment system.

Figure 5 shows the pseudocode for the forgot password part. The users need to enter their email and the system will send the link to the email address of the users to reset password when they forgot the password.

```
Start

    1. Check if it already exists in the database.
       $check_email = "SELECT * FROM customer WHERE email='$email'";
       $run_sql = mysqli_query($con, $check_email);
       if(mysqli_num_rows($run_sql) > 0)
    2. If the email is correct, send the link to the email for reset password.
       if(mysqli_num_rows($run_sql) > 0){
            $token = bin2hex(random_bytes(16));
            $query = "INSERT INTO password_resets (email, token, created_at) VALUES ('$email',
            '$token', NOW())";
            $result = mysqli_query($con, $query);
            $mail = new PHPMailer\PHPMailer\PHPMailer();
            $mail->isSMTP();
            $mail->Host = 'smtp.gmail.com';
            $mail->SMTPAuth = true;
            $mail->Username = 'qingxianggan1757@gmail.com';
            $mail->Password = 'jysutmbhgyenccfi';
            $mail->SMTPSecure = 'tls';
            $mail->Port = 587;
            $mail->setFrom('qingxianggan1757@gmail.com');
            $mail->addAddress($email);
            $mail->isHTML(true);
            $mail->Subject = 'Reset your password';
            $mail->Body = "Hello,<br><br>Please click on the following link to reset your
           password:<br><br>";
            $mail->Body .= "https://di200037.azurewebsites.net/reset_password.php?token=$token";
          }

End
```

Figure 5: Pseudocode for Reset the Password

Figure 6 and Figure 7 show the pseudocode appointments part which Figure 6 shows the coding for inserting appointments into database and Figure 7 shows the interface of the appointments. The users must login to their account first to access the appointment page. Users need to enter the date and time, select type of service and the staff to serve for do an appointment. The name of the user and phone number will be taken from the user account. So, the user must complete the account information first when using the google signup for do appointment.

```
Start

1. Check Validation for the input.
2. If the input is correct, insert the appointment into database.
   if ( $_POST['action'] == "submit" && $_POST['hide'] == '1' ){
      $name = escapeString($_POST['name']);
      $phone = escapeString($_POST['phone']);
      $date = escapeString($_POST['date']);
      $time = escapeString($_POST['time']);
      $staff = escapeString($_POST['staff']);
      $vehicle = escapeString($_POST['vehicle']);
      $model = escapeString($_POST['model']);
      $service = escapeString($_POST['service']);
      $message = escapeString($_POST['message']);
      $sql = "INSERT INTO appointment(name, phoneNumber, date, time, vehicle, model, staff,
      service, message, customer_id) VALUES (?,?,?,?,?,?,?,?,?,?);";
      if (!updateQuery($sql, [$name,$phone,$date,$time,$vehicle,$model,$staff,$service,$message,
      $_SESSION['website_id']]))
      {
         die('Error: ' . mysqli_error($con));
      }
      header("Location: customer_appointment_list.php?submit=success");
      exit;
   }

End
```

Figure 6: Pseudocode for Inserting Appointment into Database.

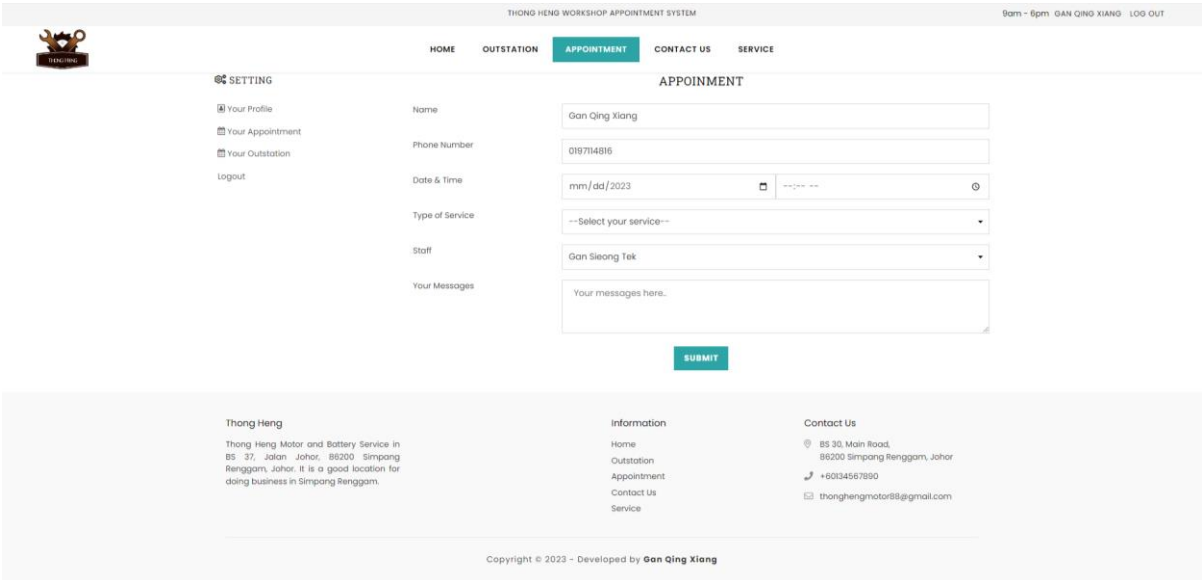

Figure 7: Interface Appointment Page

Figure 8 shows the interface of the appointment for the administrative part. The staff can view the customer's appointment here and can click the button detail for see detail. Staff can use the search function to find the appointment.

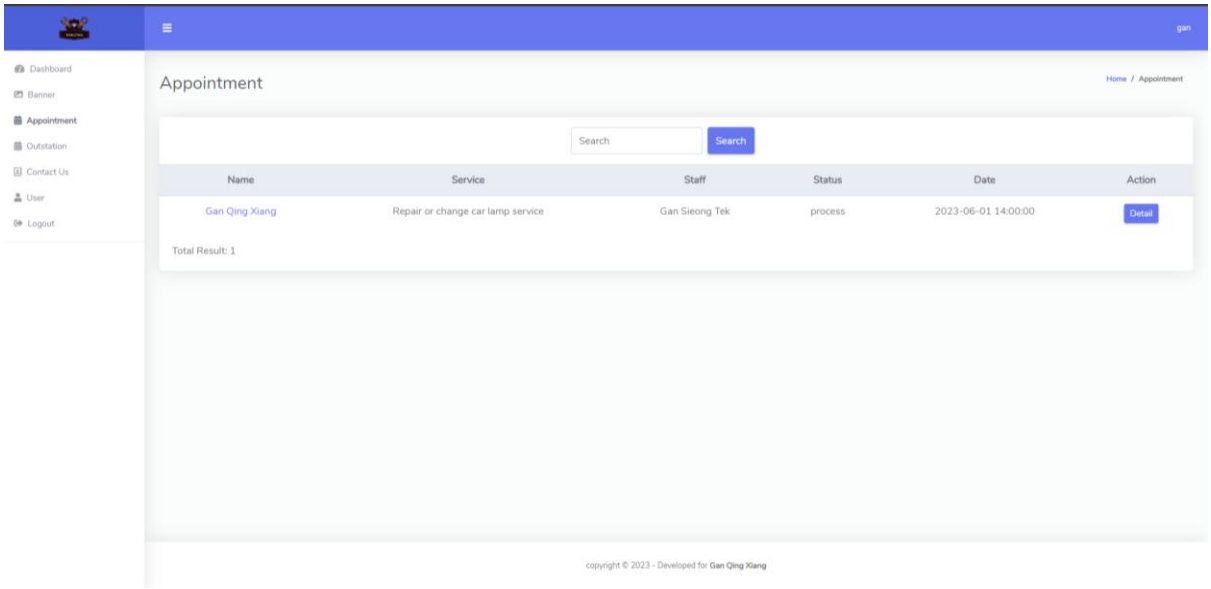

Figure 8: Interface of Admin Appointment Page

5.2 Testing

The author tested the functionality of the appointments to verify the implementation of the system and to ensure its accuracy. The result of the functionality test is shown on table 5.

Table 5: Result Functionality Test of the System

Module	Function	Test	Result	Actual Result
User module	Registration	invalid input	a message displays the error input	Pass
		enter a username already have in the system	a message displays already has the username	Pass
		successful register	go to the login page	Pass
	Login with username	invalid input	a message displays the error	Pass
		successful login	go to home page	Pass
	Login with Google account	successful login	go to home page	Pass
		failed login	stay on the login page	Pass
	Forget Password	invalid email	display message the email no exists	Pass
		valid email	display a message to tell user go email for reset password and send a link to email	Pass

Table 5: (cont)

Module	Function	Test	Result	Actual Result
		successful reset password	go to the login page and display successful reset password	Pass
	User Profile	empty name and phone number	display a message to call user enter the information	Pass
		invalid phone number	display a message to call user enter Malaysia phone number	Pass
		update successful	update the data on database	Pass
	Change Password	invalid current password	display message wrong current password	Pass
		wrong format password	display message password must contain with the format	Pass
		password no same with confirm password	display message the passwords are no same	Pass
		update password successful	update the password on database	Pass
	Appointment	invalid input	a message displays the error input	Pass
		add appointment successful	insert data into database	Pass
		cancel appointment	update status of appointment as cancel	Pass
	Outstation Request	invalid input	a message displays the error input	Pass
		outstation request successful	insert data into database	Pass
		cancel outstation request	update status of outstation request as cancel	Pass
Admin Module	Dashboard	view the data	view the data from database	Pass
	Banner	add, edit and delete banner	update the banner on the user page	Pass
	Appointment	view and accept or reject appointment	update the status of the appointment.	Pass
	Outstation	view and accept or reject outstation request	update the status of the outstation request	Pass

Table 5: (cont)

Module	Function	Test	Result	Actual Result
	Outstation	view the vehicle fuel costs by distance	display the calculation of the cost fuel	Pass
	Contact	update the contact information	update the contact information on database	Pass
	Admin	add, edit or delete the admin account	open an admin account, change the information and delete admin account	Pass
	Customer	view customer account	display customer account information	Pass

6. Conclusion

All in all, the creation and implementation of the Tong Heng Workshop Appointment System has greatly improved the efficiency of appointment management. PHP, MySQL and JavaScript are just a few of the powerful programming languages used in the system, ensuring its reliability and scalability. Through extensive testing of its usability, reliability and utility, the system has proven to work as expected.

Customer satisfaction with the system's usability has been verified through testing and input from actual users. The system has undergone rigorous testing to ensure that it performs its assigned functions as expected. Users have expressed satisfaction with the system, praising its simplicity and ease of use. The project has accomplished its main goal, however there is still room for improvement. Automated reminders could be implemented to help customers and employees get organized and reduce the likelihood of forgetting commitments. In addition, incorporating in-depth reporting elements will aid in decision making and operational optimization, providing insight into appointment patterns, customer preferences, and employee performance. By linking to external calendar systems, such as Google Calendar, appointments can be handled efficiently across different platforms with the help of integration and synchronization. As a result, consumers will have more leeway and convenience in organizing their time.

In terms of streamlining appointment management, Thong Heng Workshop's Appointment System has shown itself time and time again. The success of the project has opened the door for further improvements, allowing the system to remain flexible in the face of changing requirements and technological developments. The system's position as a reliable and effective answer to workshop appointment management will be strengthened as it is further improved and incorporates user feedback.

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