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Bicycle Rental Management System for UTHM Student

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Bicycle Rental Management System, UTHM Students, Short-Term Rentals, Web-Based System, PHP and MYSQL

Abstract

A comprehensive digital platform called the "Bicycle Rental Management System for UTHM Students" was created to completely transform University Tun Hussein Onn Malaysia (UTHM) students' mobility experience. The main objective of this system is to make short-term bicycle rentals easily accessible to UTHM students. The system includes intuitive mobile and online interfaces for bike booking, real-time tracking, administrative monitoring, and registration. This system comprises many important components, such as booking administration, payment processing, user authentication, and inventory control for bicycles. Students may register, access rental services, pay reserve bicycles for particular times, and manage their rentals using a web-based system. The system was developed using PHP and MySQL. The data of the students will be saved into the database automatically when they register their account to the website. In the dashboard, student can see the page of Bicycle List that allow them to chos their bicycle. After that, they will have to set their time to rent the bicycle. The process will last for the payment process that user need to pay the rental cost.

1. Introduction

The present bicycle rental system at UTHM is based on manual reservations, requiring students to pay in cash and keep records in a logbook, creating efficiency and data security concerns. To solve this, the project's goal is to provide a user-friendly web-based bicycle reservation system, improving the entire experience for UTHM students. The system, created with students as the primary end-users in mind, provides a simple online reservation procedure supported by QR codes. Booking, financial transactions, billing, rental, invoice, and client administration are all required elements for a complete solution. The booking module makes it simple to reserve bicycles, while the financial transaction module enables safe payment processing. The technology creates itemized invoices, streamlines rental procedures, and keeps accurate records, boosting efficiency and transparency. Furthermore, the client module enables user data control and changes, which contributes to successful database administration. The proposed system intends to transform bicycle rentals at UTHM by making them more convenient, secure, and user-friendly for students. The system will optimize the system to rent the bicycle like the other company have built [7].

2. Related Work

In this project there are few projects that is related to this system. These systems are for the references to build the bicycle rental system to make sure the system is suitable for student. The references aim to observe how the system function and how the interface of the system. The references from the existing project can make lower error for the system. The existing related system are House Rental Management System, the Web-Based Car

Rent Management System for Hayelom and Online Vehicle Rental System. These systems are web-based system which is user-friendly system. All the system is for rental vehicle and house that allow user to rent property through online system. This alternative can save user time to rent their property without have to queue to register manually.

2.1 Design of Campus Bicycle Rental Management System Based on SSM Framework

Bicycle rental management system tackles all aspects of bicycle rental management at educational institutions [1]. Modules for managing users, bicycle rentals, completed orders, and rentals are included. Both students and administrators will benefit from the system's user-friendly interfaces for activities such as bicycle rentals, information modification, and user registration. It contains a view layer for interface presentation, a control layer for business flow control, and a DAO layer for data storage in a three-layer design for increased flexibility and reusability. Stakeholders, such as students and administrators, benefit from faster bicycle rental operations, with administrators having tools for effective control over users, bikes, and financial data [1]. The Model-View-Controller (MVC) paradigm and the MyBatis functional diagram are used to demonstrate the system's efficiency in isolating domain logic, enabling data persistence, and automating query results mapping with Java objects and dynamic SQL splicing.

2.2 Web-Based Car Rent Management System for Hayelom

The change of era need a system that is efficient for a company to use the online management [5]. The project's goal was to replace the antiquated manual system with a cutting-edge online that would facilitate customer communication, strengthen data security, and offer other advantages to the company. The technology might be used to track automobiles, provide data, facilitate online reservations, and manage vehicle information. The web-based vehicle rental management system brought about several benefits by solving the issues with the existing manual system, such as data security breaches, labour-intensive processes, and inefficiencies. These benefits included better record-keeping, lower costs, quicker service, and higher customer satisfaction. Compared to the propose system, the similaritylabor-intensive of these two systems is about the tracking automobile. For this project system, the bicycle will be track using the user mobile phone. It will use the GPS in the mobile phone that will track where the student goes. This will make sure the bicycle will not be lost and student will give back the rent bicycle. This second system was aimed to lower costs and quicker service. These reasons were same for the system that want to build because, college does not have to ask personal in charge to control and manage the rental bicycle every day.

2.3 Online Vehicle Rental System

Online Vehicle Rental System is a system that allow user to rent cars through online that administrator and user has many features [2]. Through the online collection of client data and needs, online vehicle booking, and effective personnel and vehicle management, this system expedites the rental car procedure. When the process is done manually it will be take much time [4]. This web-based platform seeks to improve all the while guaranteeing prompt and effortless access to relevant data. The functions that increase overall efficiency in the vehicle rental process include user and admin login modules, car booking, vehicle administration, and feedback gathering. Using MEAN stack technologies, the system is characterized by its speed, robustness, and maintainability. Both the vehicle rental system and the bicycle rental management system have as their common goal giving clients an online platform to efficiently reserve and rent cars or bicycles. These systems provide an easy-to-use interface and streamline booking procedures through the use of web-based interfaces. The car rental

system makes use of Brackets for front-end development, HTML5, PHP code, and MySQL to improve user experience (UX) through an aesthetically pleasing and well-organized interface. A login module is used by both systems, enabling users to register or log in prior to booking.

3. Methodology

The prototype model, a well-known strategy in software engineering, was chosen as the technique for the development of the bicycle rental management system. To develop a system, the planning and the analysis must be clear [3]. The prototype model, a well-known strategy in software engineering, was chosen as the technique for the development of the bicycle rental management system. The prototype model is based on what the user need in a short period and the application is based on the user [3]. By using the prototyping model, user can see and interact directly with the system. Prototype methodologies also have the weakness if did not use in the right way for build the system [6]. There are five crucial steps in the prototype model. Planning establishes the framework for the development process by defining project objectives and user requirements. In the analysis phase, requirements are carefully examined, and first prototypes are built to give stakeholders a visual representation of the system's anticipated capabilities. A more complete prototype is produced as a

consequence of the design phase's incorporation of improvements based on user feedback and system performance. Table 1 show the phase in the prototype.

Table 1 *Software development activities and their task*

Phase	Task	Output
Planning	The title is presented	Proposal submitted
	The objectives and the scope are identified	Background and the objective are prepared in chapter 1
	The task is arranged and the time is managed to develop the system	The Gantt Chart is prepared
Analysis	The data and information are analysed	Data collected from the research
	Hardware and software are analysed	PHP and MySQL are chosen Web-based system will be developed
	Methodology is selected	Prototype model has been chosen
	The structured analysis design is created which is the ERD and DFD	The ERD and DFD diagram is prepared
Design	The web-based system is develop based on the objective and scope	The system architecture, database design and user interface will be developed
Implementation	The system that has been finish develop, is displayed	The system is showed to the end user
	The error and problem in the system has been checked	Finished system that do not have any error, and the documentation is produced
Testing	The system and process examination are display to the end user	The system is tested

4. Analysis and Design

The system requirement analysis is concerned with the structure of the system, taking into account user needs, hardware and software specifications, and functional and non-functional requirements. User requirements define the system's core demands, addressing issues such as product performance, necessary throughput, and system circumstances. The technologies used in the system, such as PHP and MySQL, are identified through hardware and software examination. Modules that interact with users directly or indirectly are included in functional and non-functional needs. This study is critical to ensuring that the system meets the project's objectives.

4.1 Functional and Non-Functional Requirements

The system's ability to perform as intended depends on its functional requirements, which specify what the system must accomplish. These include of specifications, business rules, tracking information, reporting needs, authentication methods, user authorization levels, transaction procedures, external interfaces, and legal or regulatory compliance. Conversely, non-functional criteria outline the operation of the system and concentrate on its performance features. Although these criteria don't directly affect functionality, they have a big impact on how usable the system is. Table 2 and Table 3 show the functional and non-functional requirements in the Bicycle Rental Management System.

Table 2 *Functional requirements.*

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No	Module	Description
1	User Registration and Authentication	• Allow the new users to register new account before login. • Allow the existing users to login with the id and password. • Redirect the valid users to dashboard when successful login.
2	Bicycle Information Management	• Allow user to browse available bicycles and choose bicycle they want. • Allow user to state their time rental of the bicycle.
3	Rental Process	• User will be able to browse available bicycle for rent and complete the rental process including specifying rental time and making deposit. • User can see the summarization of the transaction
4	Administrator Management	• Admin will control the system if any bugs of problem happen • Admin can send system-wide announcements or notifications to users
5	Invoices Module	• Allow to store the invoice histories from student. • Show the payment that has been made.

Table 1 *Non-functional requirements*

No	Requirement	Description
1	Performance	The system needs to operate with efficiency, guaranteeing prompt user interactions. This includes minimal latency in GPS tracking for bicycle location, fast page loading, and quick request processing.
2	Availability	Users should always be able to access the system. It must run around-the-clock to fulfill requests for bicycle rentals at any time, improving accessibility and user convenience.
3	Security	The security and privacy of user data, including payment card information and personal information, must be given top priority by the system.
4	Usability	Users should be able to easily navigate the system, search for bicycles, make reservations, and complete transactions without the need for extensive training if the user interface is clear and easy to use.

4.2 Data Flow Diagram level 0

Data Flow Diagram (DFD) is a graphical representation of the flow of data or input from an entity through a process, which then generates output either to another entity or stored in data storage. DFD shows each input and output for each entity and process. Figure 4.2 shows the Level 0 Data Flow Diagram (DFD 0) of the Bicycle Rental Management System for UTHM Student.

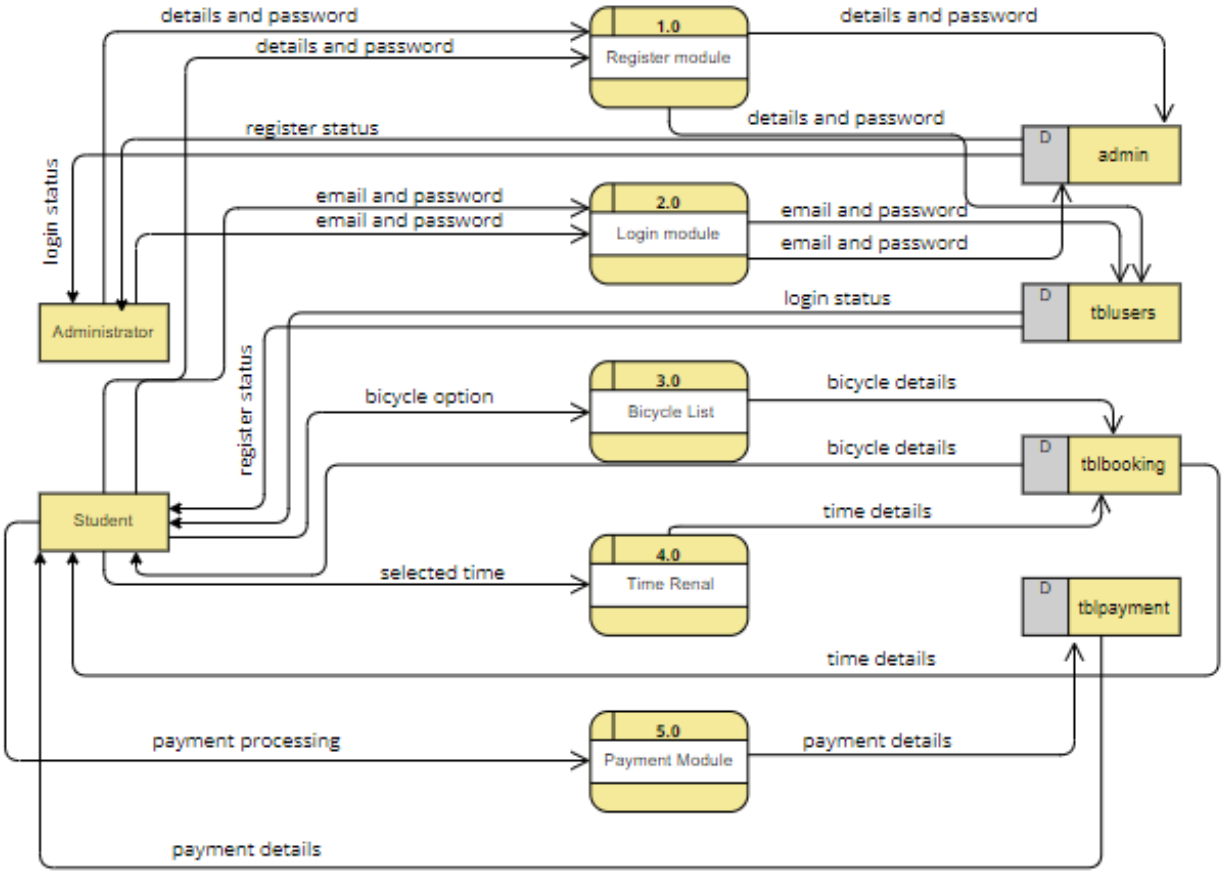

Fig. 1 *Level 0 data flow diagram (DFD)*

4.3 Entity Relationship Diagram (ERD)

The Entity Relationship Diagram (ERD) is a critical visual tool in system analysis, representing entity relationships in the Bicycle Rental Management System in a passive but illuminating manner. It depicts significant data elements such as "Student," "Administrator," "Bicycle Type," "Rent Detail," and "Payment Detail," as well as the interrelated relationships between them. Lines indicate relationships, such as student reservations and payment linkages, and serve as the system's structural base. Each entity's attributes, such as student information and bicycle specs, contribute to a thorough knowledge of the system's data architecture. Figure 2 show the entity relationship diagram for the system.

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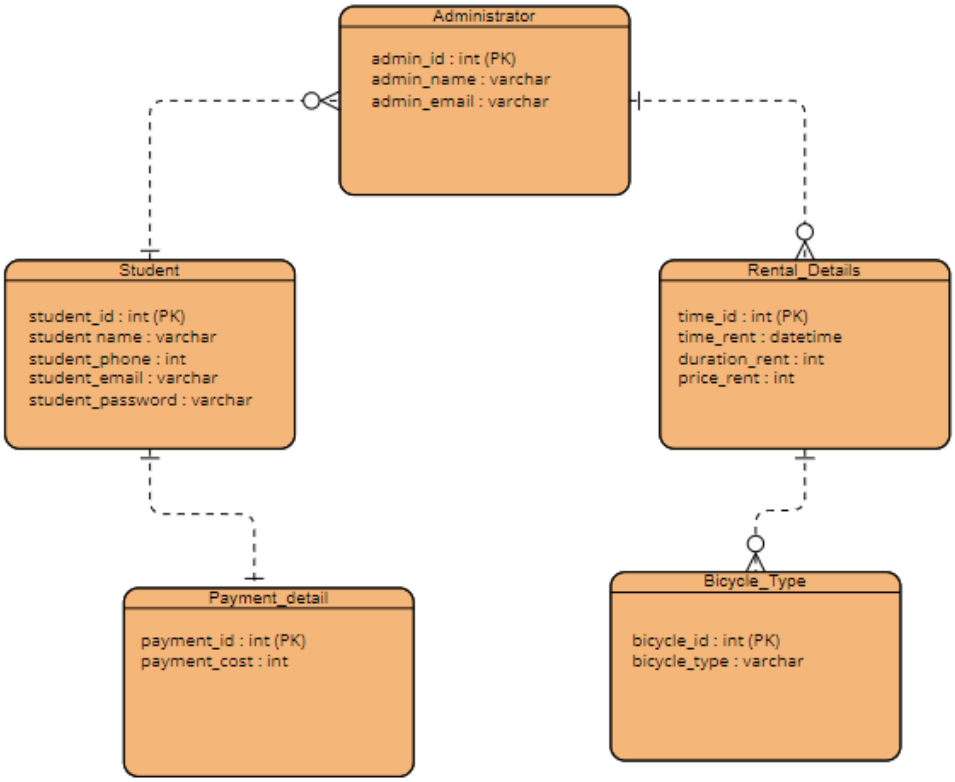

Fig.2 *Entity relationship diagram*

4.4 System Architecture

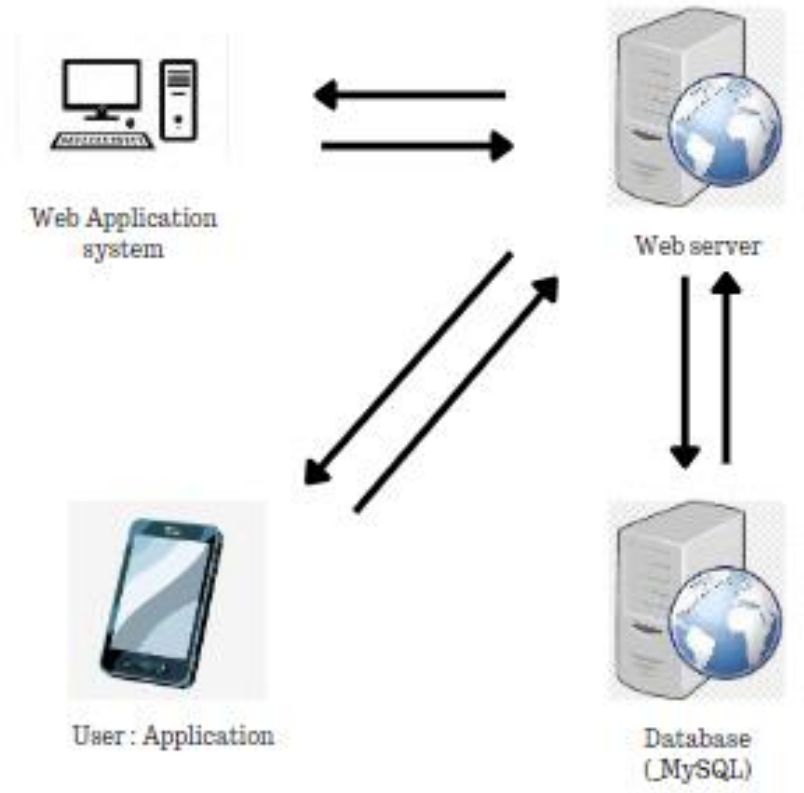

Fig.3 *System Architecture*

The Bicycle Rental Management System's system architecture incorporates the smooth interaction of numerous components. The system program, which is housed on a web server, is used by users. The web server acts as a mediator, allowing the user to communicate with the database. The database contains critical information about users, rental transactions, and bicycle availability. This well-structured design enables a seamless data flow, allowing users to quickly access and manage bicycle rentals. The system application processes the user's requests, relays them to the web server, and stores or retrieves them from the database, establishing a coherent and integrated system that improves the overall operation of the Bicycle Rental Management System.

4.5 System interface

The "Bicycle Rental Management System for UTHM Students" has a user-friendly and efficient interface, with important components such as registration, login, bicycle selection, time input, and payment. The registration screen allows users to submit information like their name, matriculation number, phone number, email address, and password. After successful registration, users can log in using the login interface, providing a secure way to access the system. The bicycle list module allows users to select from different types of bicycles, including road bicycles, electric bicycles, and fixed bicycles. The time interface prompts users to enter the rental period, return time, and other relevant information. Lastly, the payment interface offers consumers the option to pay with cash or online, providing a smooth and easy transaction process. Figure 4.0 and Figure 5.0 display the login interface and register interface in the system.

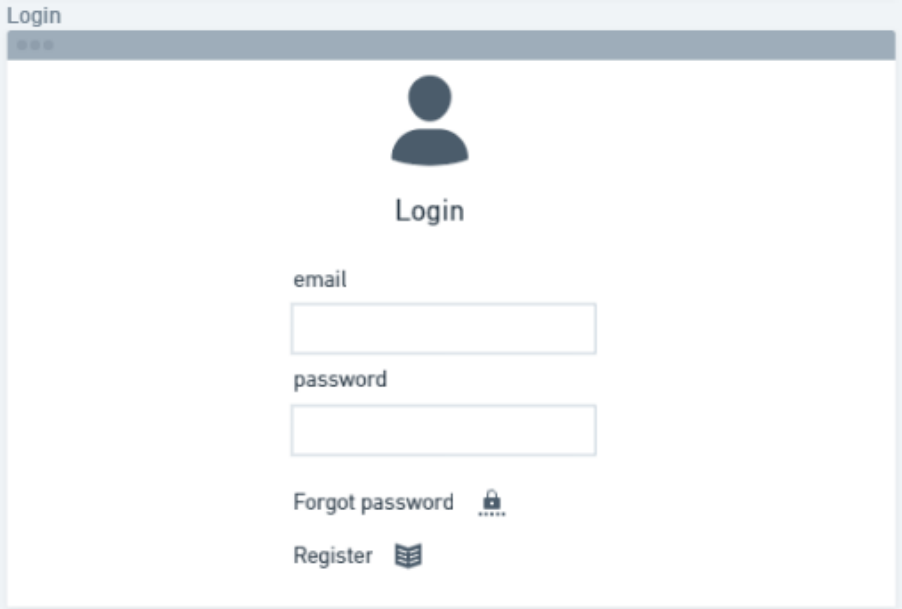

Fig 4 *Login interface*

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Fig 5 *Register interface*

5. Result and Discussion

This section will discuss the results and discussion of this system. This system has five modules: the register module, login module, bicycle list module, time rental module, and payment module. These modules were developed using Visual Studio with PHP, HTML, and CSS. The system can be accessed after the user scans a QR code that will be provided. The QR code will direct the user to the system dashboard before they register. After registering, they can log in as an existing user and start booking bicycles. This system has several types of bicycles: road bicycles, electric bicycles, and fixed bicycles. Each bicycle has its comfort and use, depending on the user's choice. The system can be accessed using a smartphone, making it very convenient for students

5.1 Functional Module Development

The functional module is the module in this system that will interact with the user to book and rent their bicycle. This section will explain the interface of the system for each of the modules. The interface includes the administrator and user interface.

5.1.1 Register module

The first module that the student will have to go through is the register module. After they scan the QR code, they will see the dashboard of the system and in the dashboard, they will see the register button at the left top of the dashboard. They must register first before they log in to the system. They must enter their full name, mobile email address, password, and confirmation password. The data will be saved in the database and they do not have to register again. Figure 6 below shows the register module interface for the user.

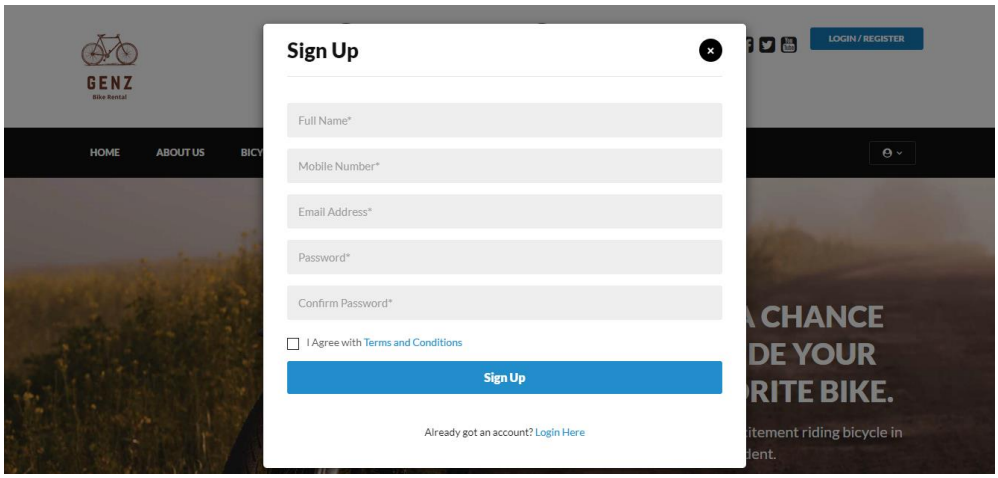

Fig 6 *Register Module interface*

5.1.2 Login module interface

The login module enables the student to access the system and make a rental by using their email. The data in the login module is just email and password only. If they forget their password, they can make their new password and log in to the system as usual. After that, the module verifies the user's credentials against a pre-established database of authorized users, and depending on the outcome of the authentication procedure, it either gives or refuses access. Figure 7 shows the Login Module.

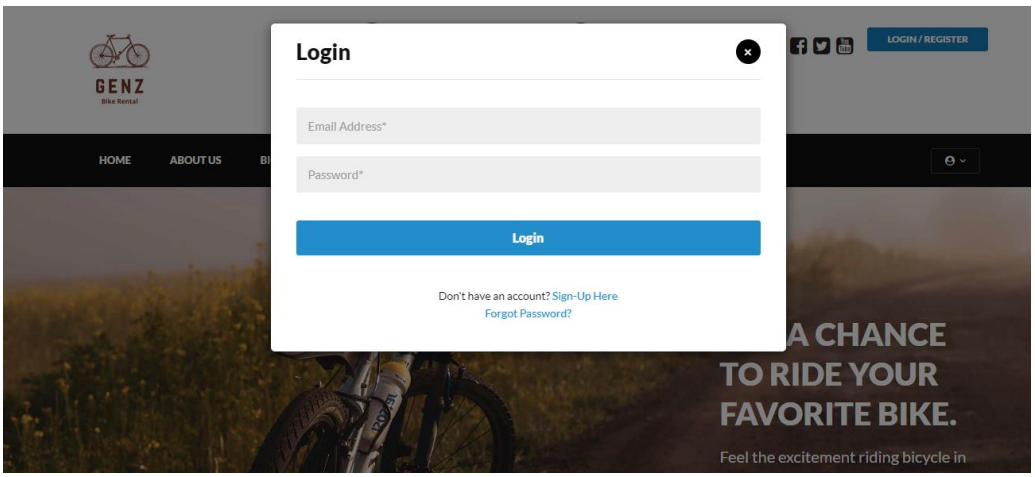

Fig 7 *Login Module interface*

5.1.3 Bicycle List Module Interface

In this module, students will be able to choose their type of bicycle with road, electric, or fixed bicycles. For each type of the bicycle have a few choices that have different colours, seat and basket. Bicycles that are not available are because users have not yet returned them and the bicycles are being maintained. Borrowed bicycles are immediately classified as unavailable in the system. They can see the availability of the bicycle to make sure they rent the right bicycle. If the bicycle is not available, they cannot select the bicycle even though they click it. Figure 8 shows the Bicycle List module.

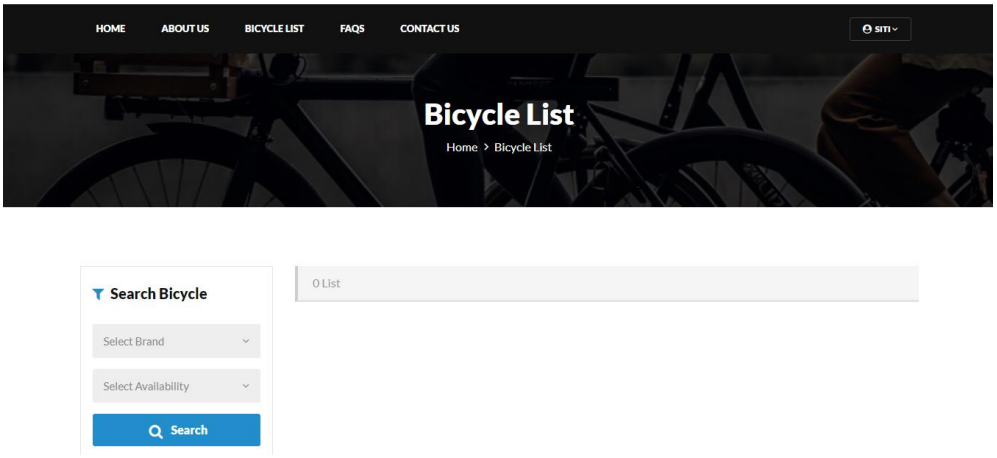

Fig 8 *Bicycle List Module source code*

5.1.4 Time Rental Module Interface

Students will have to select the date and time they want to rent the bicycle after they select a bicycle. In this module, there is a button that will display a calendar when pressed. Users need to use this calendar to select the date they want to rent a bicycle. After selecting the date, they can write a message they desire. This message is intended to inform the admin whether the bicycle will be picked up late or on time. Users can also leave any message they want for the admin's information. Figure 9 shows the Time Rental Module.

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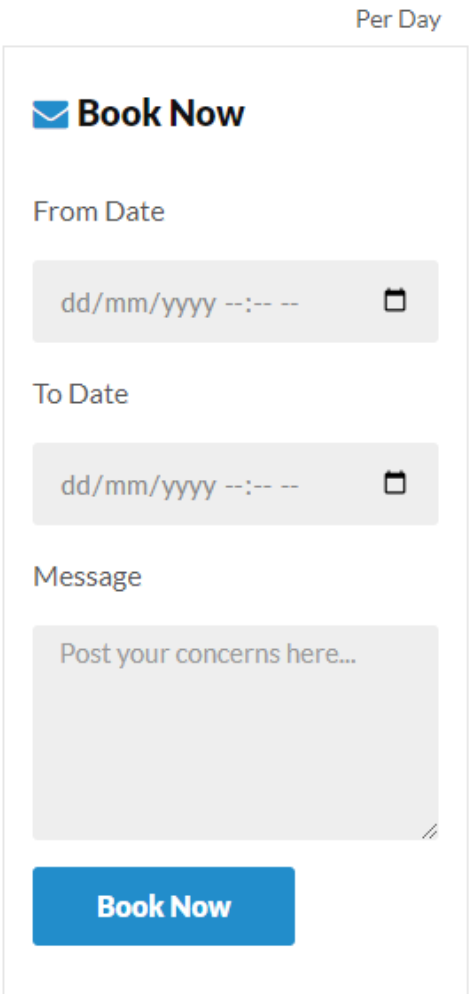

Fig 9 *Time Rental Module interface*

5.1.5 Payment Module Interface

The payment module gives access to the student to pay their rental cost. They can choose whether to pay via cash or online Duit Now. In this module, they can see how much cost they have to pay and they can see the total hours from the day they rent the bicycle. Figure 10 shows the payment module.

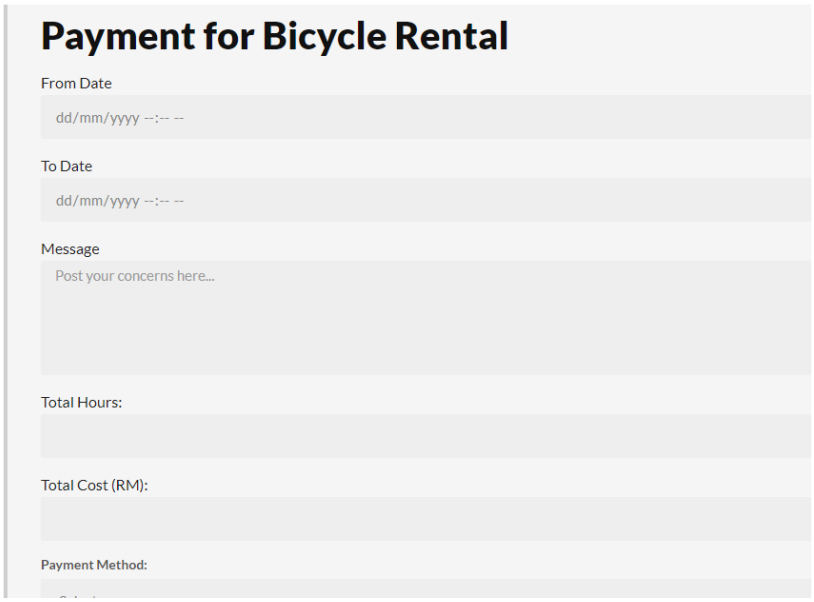

Fig 10 *Payment Module*

5.1.6 Dashboard Administrator

Dashboard administrator is the interface that shows all the pages in the system. It is the page the administrator can see the summary of all the registered users, listed bicycles, total booking, and listed brands. Administrators can see the total number for all of them on one page. Figure 11 shows the dashboard for administrator.

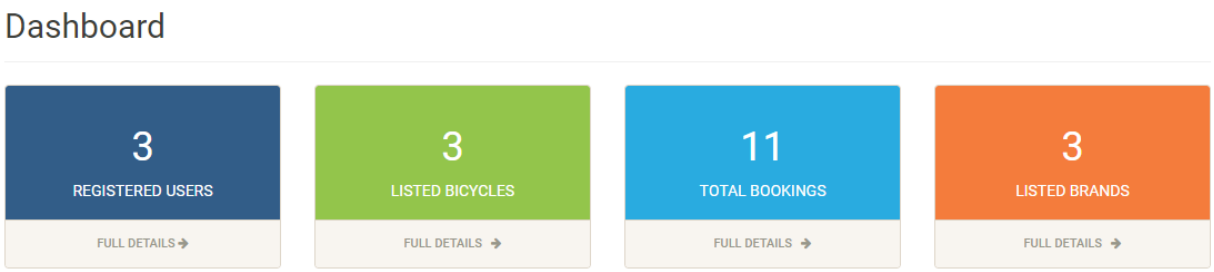

Fig 11 *Dashboard administrator*

5.1.7 Login for administrator

The login module for the administrator is different from the user. The administrator just has to enter their name and password and does not have to register their account. It is because their data has been saved in the database and this system just allows one administrator to control the system. Figure 12 shows the login module for an administrator.

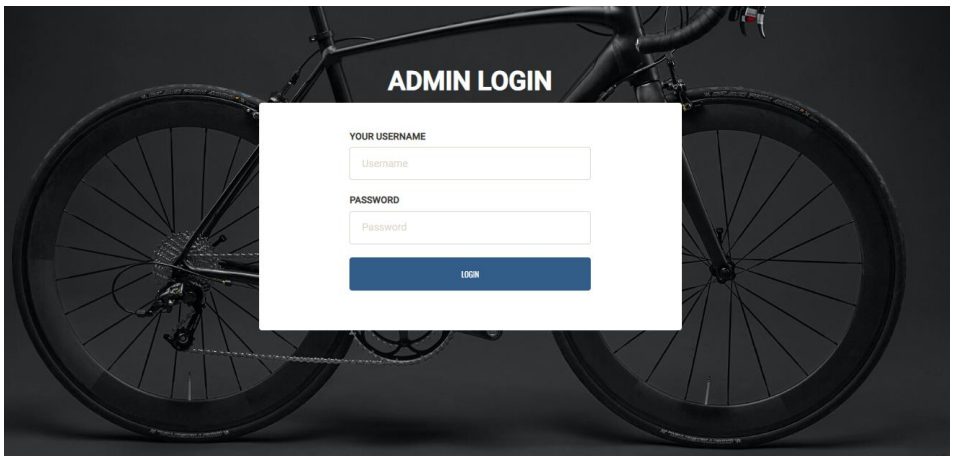

Fig 12 *Register module for administrator*

5.1.8 Post a Bicycle

The interface of the post-a-bicycle module for the administrator let the administrator to insert the new bicycle. Administrators need to insert a few pictures that will be appear in the website. The picture will be the reference for the user when they want to choose their bicycle. Figure 13 show the post a bicycle module.

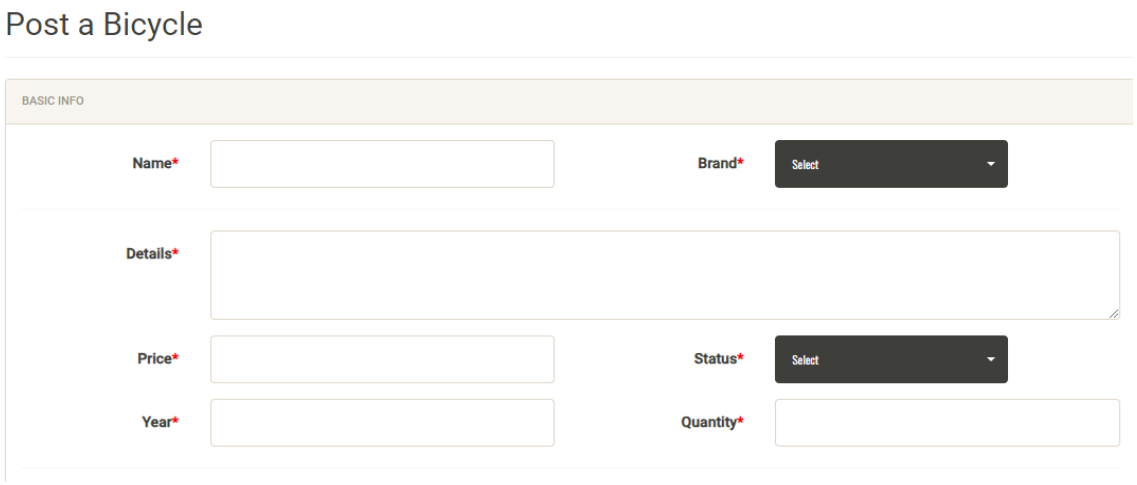

Fig 13 *Post a Bicycle*

5.1.9 Manage Booking

Manage booking for the administrator allows them to manage the booking from the user. They can see who book the bicycle and they can see the message that the user leave when booking bicycle. In this section, administrator can take action whether the booking is confirmed or cancel when the bicycle is available. Figure 14 shows manage booking for administrator interface.

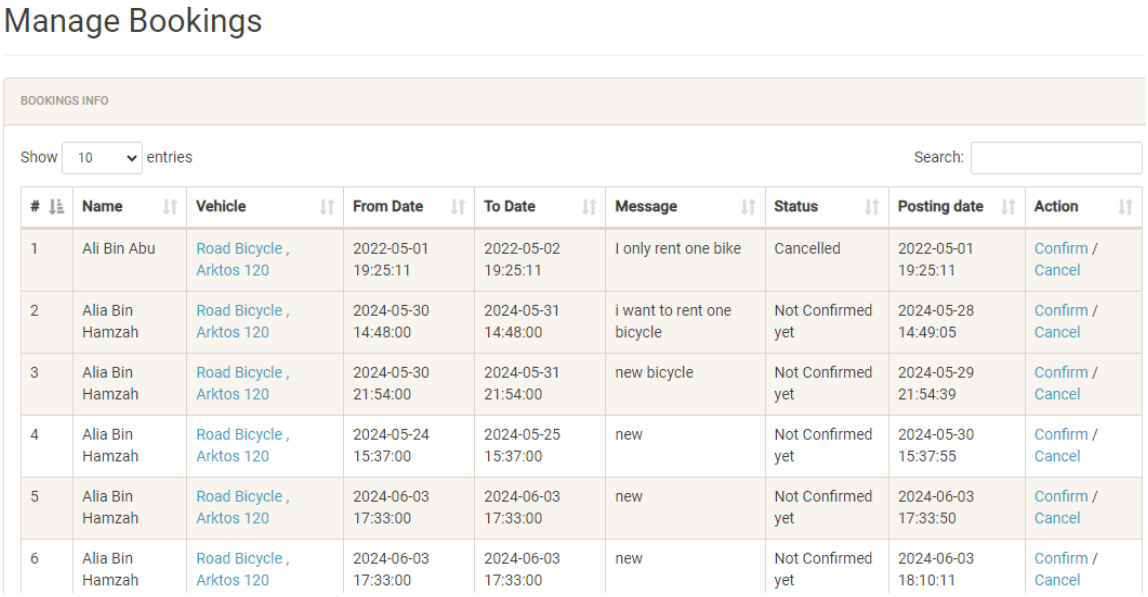

Fig 14 *Manage Booking*

5.1.10 Register Users

The administrator can see who logs in to the system and their details. This data is important if anything happens to the bicycle, they know who rent the bicycle. Administrator has their name, email, contact number, date of birth, and registered date. Figure 15 shows the registered users for the administrator interface.

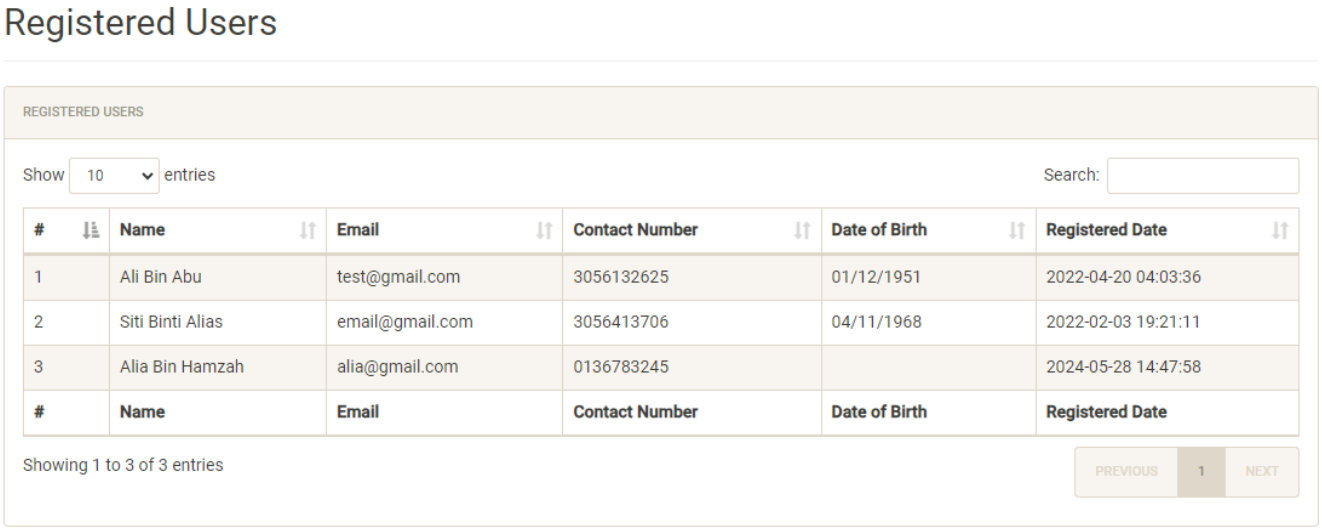

Fig 15 Register Users

5.1.11 Database of the system

The database of the system is using Xampp which it is widely used cross-platform web servers, which helps developers to create and test their programs on a local webserver. In this database named bikerental, some tables save data from the user and administrator. The tables that have in the database bikerental are 'admin', 'tblbooking', 'tblbrands', 'tblcontactusquery', 'tblpages', 'tblpayment', 'tbltestimonial', 'tblusers' and 'tblvehicles'. Figure 16 shows the database of bikerental.

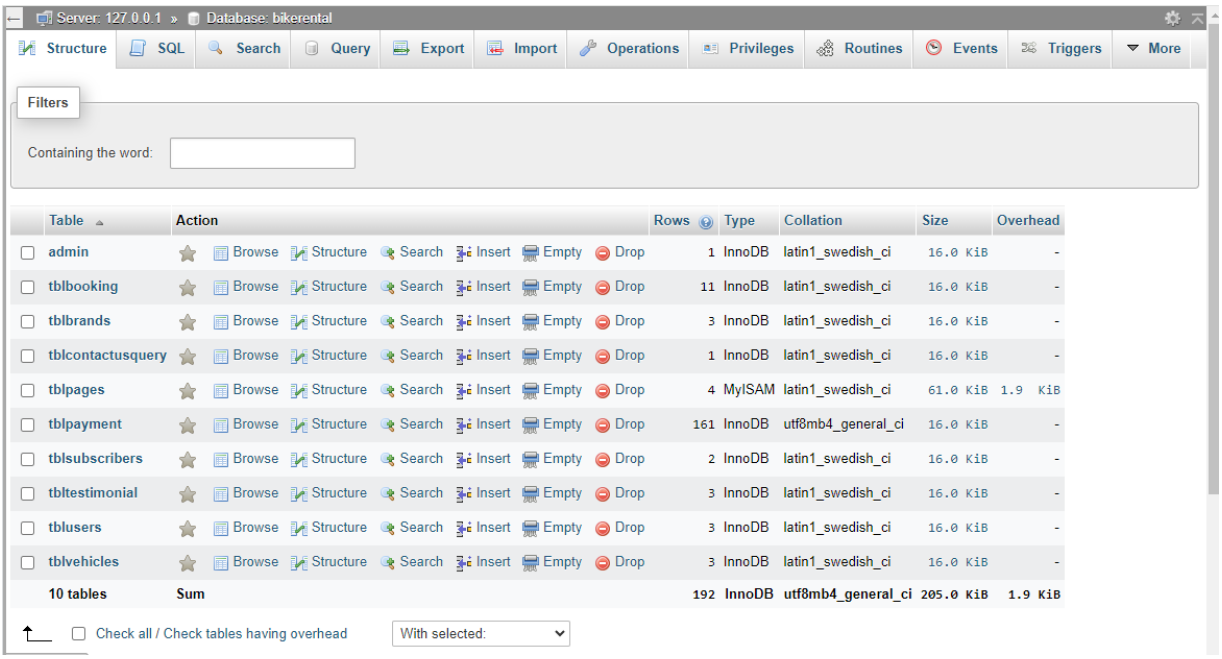

Fig 13 Database bikerental

5.2 Testing Module

Testing is the phase in which all the modules have been tested to make sure it is functional and do not have any errors. Table 3 below shows the explanation of each of the modules and the expected result. All the modules should be passed for the testing to give the user the best experience when using the system.

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Table 3 *Testing Module*

Test Case ID	Description	Expected Result	Actual	Pass/Fail
Module: Account Registration and Login				
M1-1	To check whether administrator can register for an account	The user should be able to create for an account	The user has successfully created for an account	Pass
M1-2	To check whether a administrator can login into the system	The user should be able to login into the system	The user has successfully logged into the system	Pass
M1-3	To check whether the system will restrict login whenever a wrong credential is entered	The system should restrict login when an incorrect credentials has been entered	The system restricted the login when an incorrect or no credentials has been entered	Pass
Module: Bicycle Module				
M2-1	To check whether user can see list of bicycles	The user should see the lists of bicycles	The user successful see the lists of bicycles	Pass
M2-2	To check whether user can scroll the lists of bicycles	The user should can scroll the lists of bicycles	The user successful scroll the lists of bicycles	Pass
M2-3	To check whether user can select bicycle.	The user should can select their bicycle	The user successful select their bicycle	Pass
Module: Time Schedule Module				
M3-1	To check whether user can open the calendar	The user should can open the calendar	The user successful open the calendar	Pass
M3-2	To check whether user can choose the date	The user should can choose the date	The user successful choose the date	Pass
M3-3	To check whether user can confirm the date	The user should can confirm the date	The user successful confirm the date	Pass
Module: Payment				
M4-1	To check whether user can choose type of payment	The user should can choose type of payment	The user successful choose the type of payment	Pass
M4-2	To check whether user can see the total of payment	The user should can see the total of payment	The user successful see the total of payment	Pass
M4-3	To check whether user can pay the payment	The user should can pay the payment	The user successful pay the payment	Pass

6. Conclusion

This project's conclusion emphasizes the successful creation and deployment of the "Bicycle Rental Management System for UTHM Students." The project's goal was to provide students with a simple, efficient, and user-friendly platform for renting bicycles at UTHM. The system's essential elements, such as user registration, bicycle selection, time input, and payment, were meticulously created and integrated during the system's methodical phases of analysis, design, and implementation. The web-based solution maintains data integrity and accessibility by leveraging PHP and MySQL. However, the system has the limitations which it maybe cannot update the bicycle in the real-time. Student cannot see the latest bicycle in the list because administrator have to update the list manually in the system. It will distract the system if the system is not update by administrator.

For the future, the system will have the GPS features that can detect the student where ever they go by the bicycle. The new features make the bicycle more save and secure when student rent the bicycle. Administrator can know where the bicycle if quantity of the bicycle is not enough.

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Conflict of Interest

Authors declare that there is no conflict of interests regarding the publication of the paper.

Author Contribution

This journal requires that all authors take public responsibility for the content of the work submitted for review. The contributions of all authors must be described in the following manner:

The authors confirm contribution to the paper as follows: ***study conception and design:*** *Nurul Najwa Mardiustari, Rozita Abdul Jalil;* ***data collection:*** *Nurul Najwa Mardiustari;* ***analysis and interpretation of results:*** *Nurul Najwa Mardiustari;* ***draft manuscript preparation:*** *Nurul Najwa Mardiustari. All authors reviewed the results and approved the final version of the manuscript.*

References

[1] Y. C. H. Wanxin Ping, "Design of Campus Bicycle Rental Management System Based on SSM Framework," *Journal of Physics Conference Series,* vol. 10, 2019.

[2] R. M. Ansh Agrawal, "Online Vehicle Rental System," *International Journal of Scientific Research & Engineering Trends,* vol. 6, no. 3, 2020

[3] A. A. H. B. M. G. A. H. A. Dewi Ayu Nur Wulandari1*, "PROTOTYPING MODEL IN INFORMATION SYSTEM DEVELOPMENT OF AL-RUHAMAA' BOGOR YATIM CENTER FOUNDATION," *Jurnal Pilar Nusa Mandiri Vol 17,* 2021.

[4] R. K. Y. M. Yves Cyuzuzo, "Automation system of vehicle requisition in public sector, Rwanda," researchgate, 2016.

[5] G. T. M. H. S. T. Yemene Tesfay, "Web-Based Car Rental Management System For Hayelom," November 2009.

[6] A. Shah, "A Framework for the Prototype-based Software Development Methodologies," *Journal of King Saud University-Computer and Information Sciences,* vol. 13, pp. 111-131, 2001.

[7] D. P. A. Amal D Philogin, "Revolutionizing Car Rental: A Cutting-Edge Online Administration System," *Tuijin Jishu/Journal of Propulsion Technology,* vol. 44, 2023.