

A Web-Based Student Residential Searching Integrated with Google Maps and WhatsApp API: A Case Study of UiTM Arau Perlis

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HIGHLIGHTS

- The web-based application with Google Maps and WhatsApp elements was designed and implemented to enhance and enrich the search experience of non-resident students to find rental rooms nearest to UiTM Arau, Perlis.
- One experiment involved in this study, is Usability Testing with positive, acceptable, and encouraging results.
- Majority of the students preferred a website that can help them to rent a room or house that is nearest to their university, the implementation of technology location-based search and real-time communication will make it easier for tenants, landlords, and admin.

ABSTRACT

Every year, the university receives many students from all over the state or country. Consequently, the college facilities at the university are unable to accommodate the volume of students who recently enrolled sufficiently. Besides, some old students do not get college facilities because the university gives those facilities to newly registered students. This causes some students to experience problems in finding a rental room that suits their needs. Therefore, a web-based Student Residential search integrated with Google Maps and WhatsApp API was designed and implemented, that allows students, especially non-resident students to find and rent rooms near UiTM Arau Perlis. The rental rooms displayed on this website are rental rooms that the landlord wants to rent. Landlords can register the rental rooms they want to rent by logging into the website, while tenants can only rent the house after logging in. Besides, the Student Residential Searching System also was integrated with the WhatsApp API, enabling the admin to notify the landlord if the information such as the electric or water bill they uploaded, was invalid for validation purposes. While the integration of Google Maps allowed students to search for rental properties based on location. The system uses the System Development Life Cycle (SDLC) by implementing the waterfall model as the methodology. Usability testing was conducted to determine user acceptance using a set of questionnaires, where thirty participants were chosen to test and evaluate the proposed system. The findings and analysis showed that the system was manageable, usable, and reached participants' expectations and achievement. Hence, the system helps the rental management between admin, landlord, and tenant to be more effective and smoother to complete the process.

Keywords: Student Residential Searching, Google Maps, WhatsApp API, Non-resident Students, Landlords



INTRODUCTION

Finding or searching for a rental house or room at an affordable and reasonable price is very hard, especially for students. Besides, the search process is a tedious task, especially when a lot of information, location data, or other versatile data are provided. However, due to the lack of residence in university, students must spend a lot of money to pay for the rental house or room every month with their landlord. It is observed that some students who are unable to secure residence on campus are required to seek rental accommodations near their university (Misyam & Selamat, 2021). To get a well-planned college residential management system requires a top-notch system that will cut down on both the expense and the time (Gommans et al., 2014). For instance, the student welfare of UiTM Arau Perlis needs to increase the number of rooms for students so that all students can have facilities at the university.

Furthermore, when the students rent a house or rooms outside the campus, the UiTM staff may have difficulties tracking the location of the student's house as they do not have the latest information on the student's house or room location. As the staff of UiTM, it is the campus's responsibility to take care of their students by keeping the information of those who do not reside on campus in the cloud. Hence the potential for data loss or destruction is very low (Gommans et al., 2014). Thus, this is one of the reasons why we need a web-based system using web hosting or a cloud database, as it will prevent data loss and keep the latest information on students' rental houses or room locations.

In some cases, when students want to find a house or room rental, they are afraid that they will be scammed by the person who wants to rent their house or room (Jakobsson, 2016). Furthermore, when such occurrences happen, landlords who want to rent out their homes will face difficulties, as many tenants are hesitant to rent because there is no systematic system for renting out houses or rooms.

Thus, the university's inability to accommodate all enrolled students leads to difficulties in finding suitable rental rooms, prompting the development of a web-based application called Student Residential Searching Integrated with Google Maps and WhatsApp API. Moreover, search functionality can significantly improve the user experience of the application. This application allows non-resident students to easily find and rent rooms near UiTM Arau Perlis while enabling landlords to advertise available rooms. Through the integration of Google Maps, students can locate rental options conveniently. Landlords can register their rental rooms on the website, while tenants can access and rent them after logging in. In addition, the tenant can search for a rental room based on their preference such as location and range of price. To make tenants able to find a house based on the distance from UiTM Arau Perlis. Geocoding is used to convert addresses into JSON format and decode them into latitude and longitude. After the address has been changed to latitude and longitude, it will be calculated by using the haversine formula. This system follows the System Development Life Cycle (SDLC) using the waterfall model as the methodology. Usability testing with thirty participants confirms the system's manageability, usability, and effectiveness.

In this paper, the main sections are organized as follows: section 2 provides the related work. Section 3 elaborates on the details of the methodology for the proposed work. Section 4 discusses the results based on the experiment conducted. Finally, section 5 concludes the paper.

RELATED WORK

According to Cambridge English Dictionary, the term rent or rental is described as “an arrangement to rent something, or the amount of money that a person pays to rent something” (*Cambridge English Dictionary*, 2022). Furthermore, the rental term is usually used when a person or family wants to rent a house, bicycle,



building, or vehicle. A rental management system enables users or customers to make a rental search online where they can search it by using the Internet. Meanwhile, the use of online systems become a popular trend due to the services can be accessed remotely by using a web browser and can be accessible from anywhere in the world. Nowadays, a rental management system has been implemented into wide-range different sectors such as transportation (Albino, 2021; Mohite et al., 2022), property (Rathore et al., 2021; Voumick et al., 2021), and others (Manvalasundaram, V. K. et al., 2020; Ramya et al., 2022). In addition, a rental management system is easier than the rental system in the traditional method, in which the person needs to find the rental building physically by walking or using a vehicle (Voumick et al., 2021). However, the main consideration for the tenants in searching for a house or room to rent is the cost of renting. Then, the location of the rental house or room also needs to be considered as it is important to have a facility such as transportation to make it more convenient (Ke, 2017). Therefore, a group of researchers developed SpeedHome an online property platform or mobile application that directly connects landlords and renters, It is frequently used by people, especially students and workers to find rental houses or rooms that are nearest to their university or workplace (Ikuomola & Asefon, 2020). This system is a secure cloud-based functionality that operates in real-time, giving it an advantage over the manual system.

In addition, WhatsApp API was used in this project as it plays a crucial role in the Student Residential Searching system due to its numerous features and widespread adoption among admin and landlords. WhatsApp technology has become prevalent because most people often use mobile phones which gives convenience to users who are familiar with WhatsApp technology. Therefore, it serves as an effective communication tool, enabling seamless and instant interaction between admin and landlords, thereby simplifying the process of finding suitable rental accommodations. With WhatsApp, the admin can easily connect with landlords, and inquire about the property. The platform's messaging capabilities allow the admin to remind landlords regarding their electric and water bill information. If the information entered by the landlord is not valid, the admin will click on the "Bell" button to remind the landlord to enter the valid electric or water bill. Thus, the rental room will only be published after the admin has verified the information.

Other than that, Geocoding is defined as "the attribution of a geographic code" in the dictionary. Geocoding is the process of converting an address or location's description into geographic coordinates, which are latitude and longitude. It enables the mapping of physical addresses or place names to their corresponding positions on the Earth's surface (Panasyuk et al., 2019). Once geocoding is performed, the resulting coordinates can be used for various purposes, such as displaying locations on maps, calculating distances between points, conducting spatial analysis, and enabling location-based search functionalities.

In this research, Google Maps API was used to inform students, especially non-resident students about the rental house or room around UiTM Perlis Branch, Arau Campus. This API is important as it will give information about the rental house location to the person who wants to find the rental house by using the website. Furthermore, Google Maps API enables the UiTM staff, under the Student Affairs Division of the UiTM Arau Perlis, to easily locate the location of non-resident students. The proposed system is developed by using web-based technology, and the system will involve multiple users tenants or landlords, and an administrator, that can access the system. This system is also more manageable as the users and administrator can access the system by using an Internet connection, or a common browser and do not need to install the system on a computer or handphone (Misyam & Selamat, 2021).



METHODOLOGY

A. Model Used for the Developing Student Residential Searching System

The Waterfall Model was chosen as the methodology for Student Residential Searching Integrated with Google Maps and WhatsApp API. There are five phases which are Preliminary Study, Analysis, Design, Development, and Testing.

Preliminary Study

A preliminary study was the first phase of this project. It was an important phase where the researcher had to identify problem statements and define the project's objective, scope, and significance. All activities were completed by conducting Internet-based research using journals, articles, and websites. Moreover, the journals and articles were found in the online database and others such as Google Scholar. By performing the activities, the problems, objectives, scope, and significance were identified.

System Analysis

The analysis phase was to analyze this project's related topics, including rental service, web application, Google Maps API, geocoding, WhatsApp API, and related work. Research from many sources was one of the techniques used to analyze the related topics. Sources from journals, papers, and websites on the Internet with various researchers were being studied. Furthermore, suitable programming languages, integration techniques, and API technologies have been determined from the reviewed literature. Other than that, this phase also analyzes the hardware specifications and software requirements to develop this project.

System Design

This phase describes the interface system and the content that will be added to the web application system. To create the system, a Data Flow Diagram (DFD) and Site Map are used to show the flow of the student residential searching website system. Furthermore, the Entity Relationship Diagram (ERD) was designed as the initial design of the project. Included were the system components and system flowchart.

System Development

Two activities needed to be done in this phase. First, developing a web-based application. The methods to develop the web application were by using PHP scripting language as the server-side. Furthermore, the software would be used to write the PHP scripting language code, which was Visual Studio Code. As a result, the Student Residential Searching System of a web-based application was developed using those techniques and software.

After the web application has been successfully developed, the web application needs to be integrated with the Google Maps API. Google Maps API can be found on the Google Maps website, where it provides free APIs. Moreover, the web application also will be integrated with WhatsApp API from Meta for Developers. The website also will be hosted on the public website by using 000webhost as a hosting platform for the system.

System Testing

The testing phase was the last in this methodology and consists of two activities, which measure system effectiveness, satisfy requirements, and carry out usability testing. To achieve the objective, a sample of 30 users among UiTM students, staff, and landlords were chosen to use the Student Residential Searching Integrated with Google Maps and WhatsApp API system. A quantitative research approach has been used for data collection by providing a survey questionnaire to the respondents. The experiment was conducted by allowing the participants to use and explore the proposed system independently. Then, they were required to answer a set of questionnaires, which consisted of several categories such as personal



information, user interface satisfaction, usefulness and ease of use, usability of the system, and Google Maps and WhatsApp API functions. From this survey, the users will give their user acceptance and feedback for the web application. All user feedback will be reviewed to enhance and improve the proposed system for usage in future deployments. In addition, the data were analyzed using the arithmetic mean technique based on the ranking score value. Then, the overall mean was calculated and classified into three categories, which are negative, neutral, and positive based on the range of mean value between zeros to five as shown in Table 1.

Table 1: Range of mean value

Category	Range of Mean
Negative	0.00 – 1.66
Neutral	1.67 – 3.33
Positive	3.34 – 5.00

B. Integration of Google Maps

The Google Maps API integration in the proposed system adds significant mapping features to the rental search experience. It allows for accurate position visualization, distance computations, and other map-related functions. The Google Maps API also enables the system to display markers on the map, representing available rental rooms near UiTM Arau, Perlis. Each marker is associated with specific coordinates obtained through Google’s Geocoding API, ensuring an accurate position on the map. Figure 1 shows the map marker and info window in the Student Residential Searching System after the tenant searched for a room to be rented.

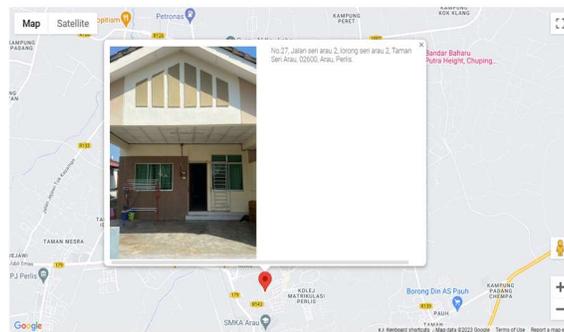


Figure 1: Map marker and info window in Student Residential Searching

C. Integration of WhatsApp API

The integration of WhatsApp API and the Student Residential Searching System can be shown when the admin logs in to the website and clicks on the “Bell” button under the landlord's navigation menu. The integration of the WhatsApp API utilized by Meta for developers by creating a WhatsApp Business account. The API provides easy communication between landlords, and administrators by leveraging the WhatsApp Business account and the Facebook Developer platform. WhatsApp was being used to notify the landlord regarding their uploaded electric and water bills. If the information that the landlord had uploaded was invalid, the admin will click on the “Bell” button to notify the landlord regarding the issues. Figure 2 shows the message that had been sent to the landlord.



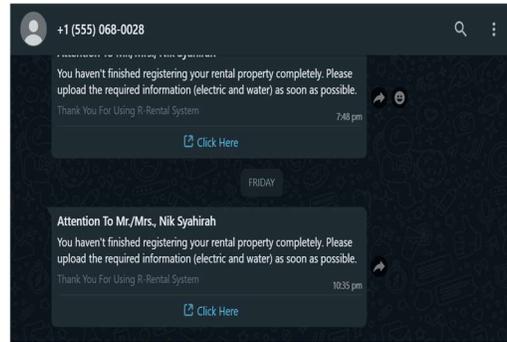


Figure 2: Example of Message

RESULTS AND DISCUSSIONS

A. Interfaces of the Student Residential Searching System

This section explains the interfaces of the Student Residential Searching system. Figure 3 shows the main interface of the system. This page contained five tabs which are Home, About, Properties, Login, and Search. Each of the tabs will redirect the user to another page according to its tab's name.

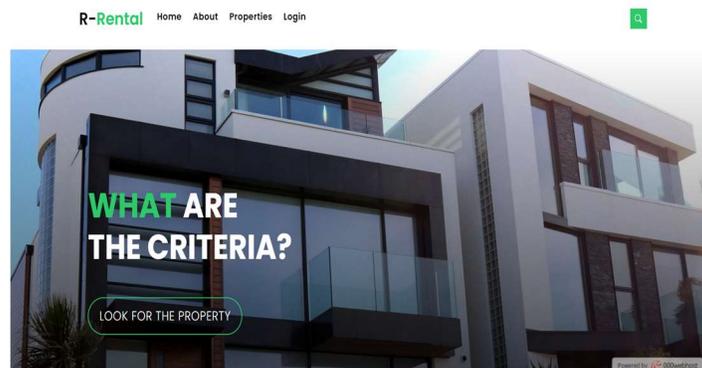


Figure 3: Main page of Student Residential Searching

Register/Login Page

Users need to register as first-time users or log in to access the Student Residential Searching system. The register tab requires the users to fill in their full name, email, phone number, type of user, and password. Meanwhile, for the login tab, the user needs to fill in the email and password. An alert message will appear when the user is unable to fill in the correct information.

About Page

This page contains a description of the web-Student Residential Searching and organization of UiTM Arau, Perlis.

Admin Page

The manage navigation menu will appear after the login process. It will redirect the admin to the admin page. In the Admin Page, there are 5 navigation menus which are Dashboard, Overview, Houses, Tenants,



and Landlords. Figure 4 shows the Dashboard of the admin page after the admin clicks on the Manage menu. Figure 5 illustrates the search and filter function on the overview page. Figure 6 shows the list of rental rooms that have been uploaded by the admin while Figure 7 shows a profile of the landlord after the admin clicks on the “eye” button. Figure 8 shows the list of tenants that have been registered under the Student Residential Searching Website while Figure 9 shows the Landlord’s page, where it displays the information of the properties such as the Landlord’s Name, Address, and Verification. Figure 10 shows the verification process and Figure 11 shows the notification on the admin page.

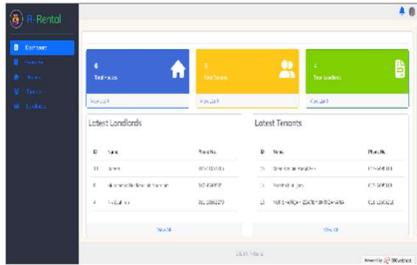


Figure 4: Admin Page

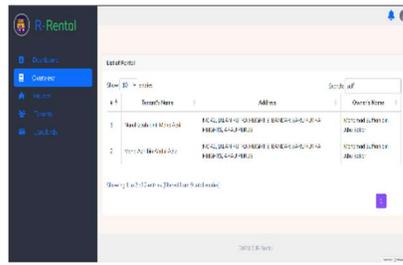


Figure 5: Search and Filter function

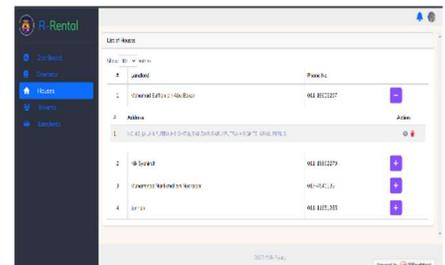


Figure 6: List of Rental Room



Figure 7: Profile of Landlord



Figure 8: List of Tenants



Figure 9: List of Properties

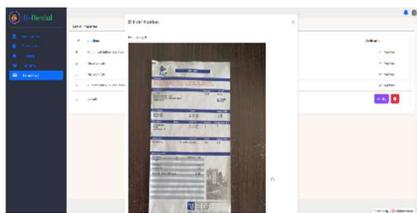


Figure 10: Verification Process

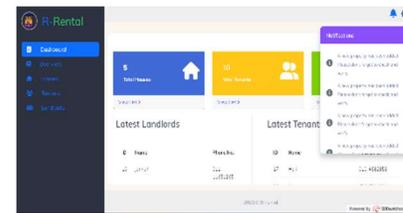


Figure 11: Notification for Admin Page

Landlord Page

The Landlord’s page contained six navigation menus which are Home, About, Properties, Logout, Manage, and Search. Figure 12 shows the Dashboard of the landlord page after the landlord clicks on the Manage menu. Figure 13 shows the list of properties that have been registered by the landlord. Landlords can create, edit, view, and delete the property according to their preferences. Figure 14 shows the list of tenants under the landlord page, while Figure 15 shows the messages between landlord and tenant.



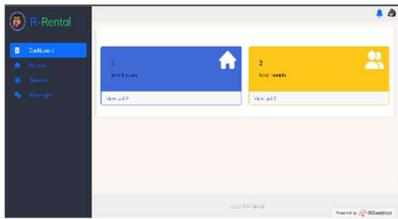


Figure 12: Dashboard

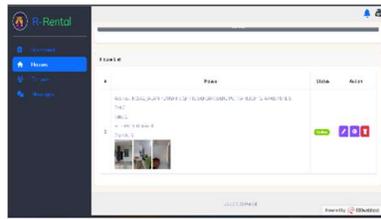


Figure 13: List of Registered Property

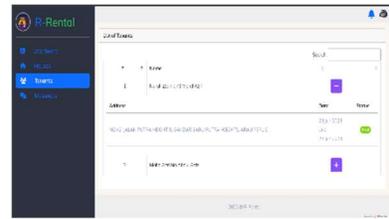


Figure 14: List of Tenants

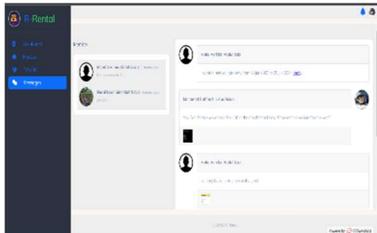


Figure 15: Messages between Landlord and Tenants

Tenant Page

The tenant's page contained six navigation menus which are Home, About, Properties, Logout, Manage, and Search. Figure 16 shows the Your Houses of the tenant page after the tenant clicks on the Manage menu, while Figure 17 shows the messages between landlord and tenant.

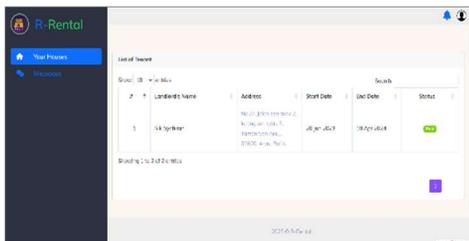


Figure 16: Your Houses Page

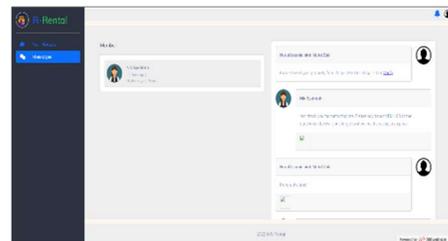


Figure 17: Messages between Landlord and Tenants

Search Function

The Search Function in the navigation menu is used to allow users to search for a rental room that is nearest to UiTM Arau Perlis. Users can enter the distance they want in kilometers and filter the price range according to their preferences. Figures 18 and 19 show the process of the search function in the Student Residential Searching System.

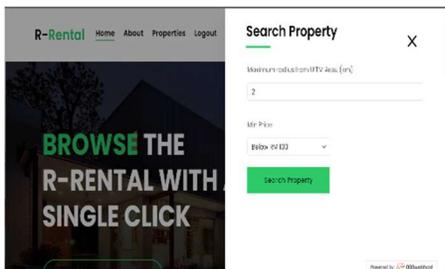


Figure 18: Example of Input Data in Search Menu

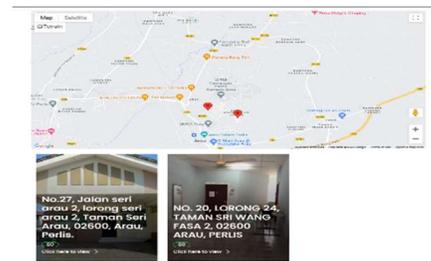


Figure 19: Result After Input Data



B. Usability Testing

The usability testing for the proposed system was carried out by randomly selecting 30 people from the UiTM Perlis community, comprising admin, landlord, and tenant, to test on the web-based system by the task assigned, as well as sending a notification to their WhatsApp application. In addition, after testing the system, a series of questionnaires was distributed to the participants to gain feedback from them. The questionnaires were categorized into three parts, which included user interface satisfaction, usefulness and ease of use, and WhatsApp notification and Google map function. Figure 20 summarizes the result for the identified criteria and total mean for each category respectively.

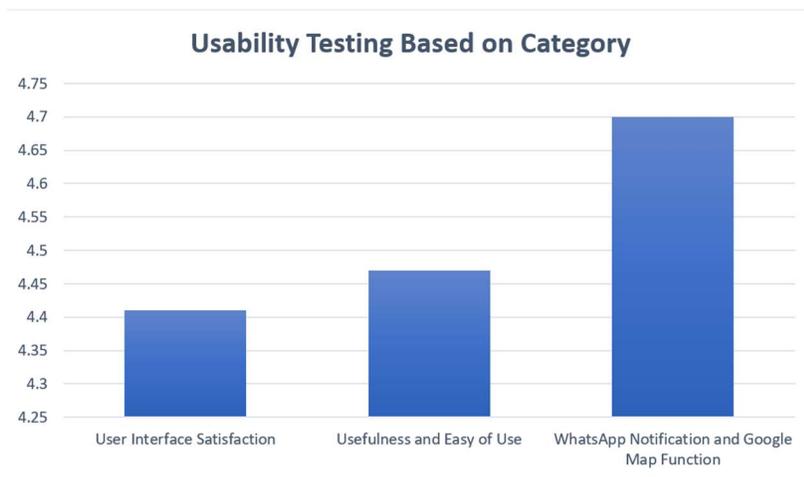


Figure 20: Total Mean for Each Category

The study was successfully done for each type of the criteria to evaluate the effectiveness of the system. The result showed that the respondents were satisfied and positively accepted all functionalities provided by the system since the average total mean for all categories was over 4.0. Furthermore, the integration between the web-based system, WhatsApp notification, and Google Map API with the highest score of 4.70 indicated that the participants were satisfied, and it can help them complete their tasks easier and faster. Meanwhile, the overall total mean for the usability testing was 4.38, which means the participants positively accepted the proposed system as a tool for residential searching for a room or house to rent.

CONCLUSION

The development of the proposed system made significant research contributions in the field of the rental management system. The research addressed the specific needs and challenges of non-resident students seeking rental accommodations near UiTM Arau Perlis. By investigating the student's preferences and requirements, the system was tailor-made to cater precisely to this niche group, providing a seamless and user-friendly experience. The integration of Google Maps allowed students to search for rental properties based on location, while the WhatsApp API facilitated real-time communication between administrators and landlords, streamlining the rental process.

Moreover, the research contributed to the advancement of usability testing methodologies by conducting thorough Usability Testing with a diverse group of 30 participants, including students, staff members, and landlords from UiTM Arau Perlis. The positive feedback and satisfaction from the participants validated



the system's effectiveness and user-friendliness. The results not only demonstrated the success of the developed system but also provided valuable insights into areas for improvement, guiding future enhancements and refinements.

The incorporation of the WhatsApp API for real-time verification of electric and water bills introduced an innovative approach to rental management, enhancing transparency and accuracy in the rental information provided to tenants. This feature showcased the system's potential to address critical aspects of rental processes and improve the overall rental experience.

Overall, the research and development of the proposed system offered a practical and efficient solution to the housing search challenges faced by non-resident students. The system's success demonstrated the power of integrating technology to cater to specific user groups, and its positive impact on the residential experience highlights its potential as a valuable tool for non-resident students at UiTM Arau Perlis. The research contributions from this project open opportunities for further developments in the field of student housing solutions and add to the growing body of knowledge in the domain of technology-driven residential searches.

CONFLICT OF INTEREST DISCLOSURE

The authors declared that they have no conflicts of interest to disclose.

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