

# UTMSIR: UTM Smart International Residence

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**Abstract**— Accommodation challenges are more prevalent among international students than among local ones. This study presents the Universiti Teknologi Malaysia Smart International Residences (UTMSIR), a web-based solution addressing these issues. UTMSIR consists of four key components: UTM, representing the study context; smart, denoting the incorporation of artificial intelligence (AI) functionalities; international, indicating the target group; and residence, highlighting the accommodation problem. The system allows property owners and agents to post vacant apartments, allowing students to view, request, and comment on these listings. The AI algorithms embedded in UTMSIR recommend suitable rooms and potential roommates to international students based on their preferences. System administrators manage access rights; monitor user activities; and generate reports on user interactions, posts, requests, and recommendations. Technologies such as the Model View Controller (MVC) architecture and Mongo Express React Node (MERN.js) stack are employed to develop UTMSIR.

**Keyword:** Accommodation, International students, Model View Controller, Mongo Express React Node

## I. INTRODUCTION

In the modern era, globalization has led to an increase in international travel for various purposes, including work, education, healthcare, and tourism. Such travel endeavors impose new responsibilities and necessitate a comprehensive understanding of the host country's intricacies. Among the primary concerns when traveling abroad are fundamental necessities such as accommodation, amenities, and sustenance. While tourist companies or travel agencies often cater to short-term stays, individuals relocating for work or educational purposes face the onus of independently managing their basic needs over an extended duration.

Accommodation is the most important problem that international students and workers are looking to solve first since it will give them long-term stability. Effective communication serves as the linchpin for addressing this crucial issue. While the Internet, with its vast resources, offers a valuable tool for connecting with individuals from diverse backgrounds, existing social media platforms primarily serve general purposes and may not adequately meet the specific needs of those seeking accommodation solutions. Consequently, there is a need for a specialized application that can facilitate efficient communication and address the

multifaceted aspects of the accommodation problem, thereby offering a comprehensive solution to a wide range of users.

International students encounter various challenges related to accommodation, cultural adaptation, academic pursuits, and financial management. Among these challenges, finding suitable accommodation and compatible roommates can be particularly daunting. New students often spend significant time residing in hotels while searching for appropriate housing options near the university campus. This prolonged search process often leads to hasty decisions and inadequate consideration of important factors such as location, amenities, and compatibility with potential roommates. Moreover, financial mismanagement can have detrimental effects on students' academic progress, potentially causing delays in degree completion or even jeopardizing their educational pursuits altogether. Furthermore, international students require a conducive environment that respects designated study hours and facilitates their adherence to university graduation requirements.

Although senior and experienced students may provide guidance in navigating the housing market, the availability and accessibility of these resources are not always guaranteed. Communication barriers, especially for new students prior to the commencement of the semester, further hinder their ability to seek assistance from seniors. As a result, there is a pressing need for a dedicated platform that addresses the accommodation challenges faced by international students and facilitates effective communication with owners and agents.

Most international students face difficulties in receiving timely answers to their questions, deepening the problem further. The current system's inefficiency and lack of a streamlined communication channel hinder students' ability to obtain quick and satisfactory resolutions, ultimately impacting their academic progress and overall campus experience.

The remainder of this paper is organized as follows; Section 2 provides the related works existing system on different scale, and Section 3 provides an overview of the proposed method while, the system requirements and design is discussed in Section 4, while Section 5 concludes the entire paper.

## II. PROBLEM BACKGROUND

Creating a new system requires a feasibility study to measure the performance of the proposed system compared with existing and similar systems on different scales [1]. This study begins with an examination of current related systems in order to identify the ideal features for the new system. The project analyzes existing accommodation platforms like WhatsApp, Mudah, and iProperty to determine key functionalities that should be incorporated into UTMSIR (UTM Smart International Residences). By comparing these systems, the researchers were able to identify gaps and opportunities to enhance the accommodation search process for international students through features like AI-powered recommendations, specialized property listings, and integrated communication tools.

### A. UTM Campus Resident System (KLG)

UTM previously offered a website called KLG for international students seeking accommodation. This site featured static pages that linked to external resources such as Google Maps, WhatsApp, and email contacts for additional information. KLG provided details about available accommodations and the amenities offered by management [2]. Students could submit inquiries and receive responses via email. For easier communication, WhatsApp was also available. The website exclusively listed on-campus housing options with fixed rates, which included utilities like electricity, water, and internet. While students were unable to select their roommates, transportation to all UTM facilities was provided.

### B. Whatsapp

WhatsApp is a complimentary messaging platform that enables users to interact through voice calls or instant text messages [3]. Users can engage in private conversations or participate in group chats, facilitating discussions on specific topics among multiple individuals. For instance, ISS-Yemen created a group titled "Find Me a Room - ISS YEMEN" to simplify conversations about shared housing among students. For rental websites, WhatsApp serves as the most suitable tool to establish connections between property advertisers and potential tenants.

### C. Mudah

Mudah stands out as one of Southeast Asia's largest and most rapidly expanding marketplace platforms [4]. The platform facilitates the buying, selling, and renting of a diverse range of products and properties. Users can browse through an extensive selection, including automobiles, photographic equipment, real estate, pets, smartphones, motorcycles, exercise machines, books, timepieces, household appliances, job listings, and more. While Mudah serves a broad purpose, it has become particularly popular among international students for apartment rentals. The website offers filtering options based on price, location, and property type. Although users cannot leave comments on listings, which eliminates the possibility of sharing accommodations, contact information for advertisers is provided to enable direct communication.

### D. IProperty

IProperty is an online marketplace utilized for the sale and rental of properties. The platform offers users access to a vast array of properties, complete with comprehensive information,

including cartographic representations and photographic documentation. It facilitates user-driven searches and filtration based on financial parameters, geographical location, room quantity, and urban center. However, similar to Mudah, the platform lacks functionality for discussing property sharing arrangements with other users. For communication with real estate agents, the website redirects users to the WhatsApp messaging service.

### E. Discussion

Based on the comparison presented in Table 1, Mudah, IProperty, and UTMSIR provided users with the capability to post rental advertisements and apply filtration criteria to display specific elements. IProperty and UTMSIR, specializing in the property rental sector, possess the potential to expand their functionalities to enhance efficiency without considering other products in their portfolio. WhatsApp and UTMSIR incorporate human interaction in their systems, thereby enabling students to engage in discussions regarding available apartments with agents and peers.

## III. COMPARISON BETWEEN EXISTING SYSTEMS AND UTMSIR

System Features	WhatsApp	Mudah	IProperty	UTMSIR
Accommodation post	✗	✓	✓	✓
Discussion	✓	✗	✗	✓
Specialized in rent	✗	✗	✓	✓
Filtration	✗	✓	✓	✓
Room recommendation	✓	✗	✗	✓
Mates recommendation	✓	✗	✗	✓
AI capabilities	✗	✗	✗	✓

Students may receive biased recommendations on WhatsApp due to its lack of artificial intelligence capabilities, in contrast to UTMSIR, which can provide quantifiable recommendations. This observation demonstrates that analogous systems may not be sufficient to perform all requisite functionalities. WhatsApp and IProperty could potentially complement each other; however, they lack the capacity to provide instantaneous AI-generated recommendations, as they rely on input from other users, which may result in significant delays or a lack of response.

### A. Tools and Technology Used

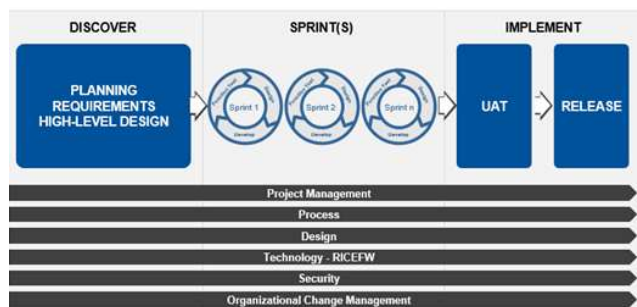
This project utilizes various software technologies and tools to document and develop the proposed system. This section will delineate each software and its application during the development process. The system has implemented MERN.js full stack application, interfacing with the AI components in Azure Machine Learning through APIs.

#### IV. TOOLS AND TECHNOLOGY USED IN DEVELOPING THE SYSTEM

Tool/Technology	Version	Description
Enterprise Architecture	12	To create diagrams for software architecture design.
Visual Studio Code	20	IDE to develop web applications
React	18.2.0	React will be used to build the front-end with JS as it is a very good library framework to use.
NodeJs & Express	4.18.2	Will be used to build the back-end part of the system.
MongoDB	6.0	The main database to be used with the system.
Azure ML	Latest	A cloud computing service for creating and managing a machine learning models.

#### V. METHODOLOGY

The development of UTMSIR can be approached through various methodologies to achieve the final product. The selected method should be precise, incorporating only necessary phases and avoiding time expenditure on superfluous tasks. UTMSIR will employ a hybrid methodology combining waterfall and agile approaches. Software Development Life Cycles (SDLCs) differ from one another; some can be executed once, while others may require preceding or subsequent cycles for additional components, as illustrated in Figure 1. For instance, requirements gathering may be conducted once; however, implementation of any system component necessitates prior design. The exception to this is that implementation of the first part need not be delayed pending the design of second or third parts of the system.



Hybrid Waterfall-Agile SDLC for the system

The Waterfall methodology will serve as the overarching approach, comprising requirements, design and implementation, and testing phases. Within the second phase, Agile methodology will be incorporated by dividing objectives into sprints, each encompassing design and implementation components, thereby facilitating the resolution of errors in subsequent sprints. This approach enables external assistance to be limited to single instances during the requirements and testing phases [5].

#### A. Phases details for the SDLC

This subsection presents a discussion of each phase of the methodology as illustrated in Table 3.

#### VI. DETAILED METHODOLOGY PHASES

Phases	Activities
Requirement Gathering	A survey was previously conducted and published among various senior students, with an interview administered to an agent to ascertain their requisite system requirement.
Sprint 1	A prototype design and a fully functional component will be developed to enable all users to register, authenticate, and modify their profiles, while administrators will have the capability to manage other user.
Sprint 2	A prototype design and a fully functional component will be developed to enable advertisers to create and edit posts, while students can comment on and request these posts.
Sprint 3	A prototype design and a fully functional component will be developed to enable students to receive recommendations regarding accommodation and potential roommates, subsequently allowing for review. Concurrently, administrators will have access to reports and a dashboard for monitoring purposes.
System Testing	Black box and User Acceptance testing are the testing methodologies that will be employed to ensure that all actors can access and execute all functionalities correctly.

#### VII. SYSTEM REQUIREMENTS AND DESIGN

The stakeholders are responsible for providing the requirements through completing questionnaires or participating in interviews. UTM international students constitute most users in UTMSIR; therefore, obtaining a substantial number of responses through form completion will enhance the precision of the requirements. Conversely, advertisers may participate in interviews, as they are fewer in number and may require preparation before responding to questions. The form will inquire about existing systems and the primary functionalities that users employ. The questions will be close ended at the beginning and open-ended at the conclusion. Additionally, it will include ratings for functional and non-functional requirements in the closed questions, while soliciting suggestions for edits or additions in the open-ended section.

#### A. Use Case Diagram

Use cases and actors are the main elements in the use case diagram. The diagram is used to show the core functionalities and the users who can apply them. The system consists of 6 actors and 13 use cases.

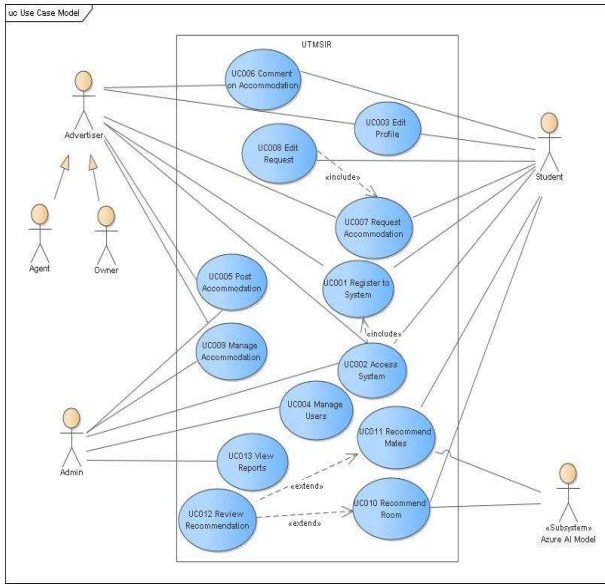


Figure 16. UTMSIR Use Case Diagram

Users will act and see different interfaces.

- 1 - Student: can access the system to view, request, and comment on accommodations and get suggestions for rooms and roommates.
- 2 - Advertiser: can access the system to post and manage accommodations.
- 3 - Agent: can behave like an Advertiser and post more than 3 houses.
- 4 - Owner: can behave like an Advertiser and post only 3 houses.
- 5 - Admin: can access the system to accept adding or modifying posts and to manage users' access to the system.
- 6 - Azure AI Model: provides recommendation services to Students as a subsystem in UTMSIR.

### VIII. USE CASE DESCRIPTION

Use Case	Description
Register to System	Students and Advertisers can submit a form to the system and Admins need to accept them.
Access System	Any existing user on the system with email and password can login and logout without any requirements
Edit Profile	Students and Advertisers can navigate to profile pages to explore their basic details and edit it.
Manage Users	Admins can show a list of existing users and can modify their access to the system
Post Accommodation	Advertisers can store basic information about accommodation and wait for admins to accept it

Use Case	Description
Comment on Accommodation	Students can access any accommodation and write comments then the post's advertiser can reply
Request Accommodation	Students can access any accommodation and ask the advertiser of the post to deactivate the post and negotiate with him/her privately
Edit Request	Students can access the requests list page and edit currently running requests.
Manage Accommodation	Advertisers can modify basic details in their post and wait for the new edits to be accepted by admins
Recommend Room	Students should provide their preferences about the room to the AI component then it will return an appropriate room
Recommend Mates	Students should provide their preferences about mates to the AI component then it will suggest some suitable students
Review Recommendation	Students can give feedback about the AI recommendations and how it went.
View Reports	Admin can display reports about posts and recommendations.

Use cases can show a lot of functional requirements that users could do, and developers will take care to ensure high efficiency and performance.

#### A. Architecture Design and Implementation

Software projects traditionally incorporate architectural design to structure all components within the system. UTMSIR, an online web system, relies on a CRUD matrix for its internal operations, necessitating an MVC architectural design. The MVC pattern is employed to delineate the interface, backend, and database components. Within this framework, the model component manages database records, while the controller processes requests from the interface and returns results. The view component is responsible for the elements in the web page and handles the operations that users request from the controller.

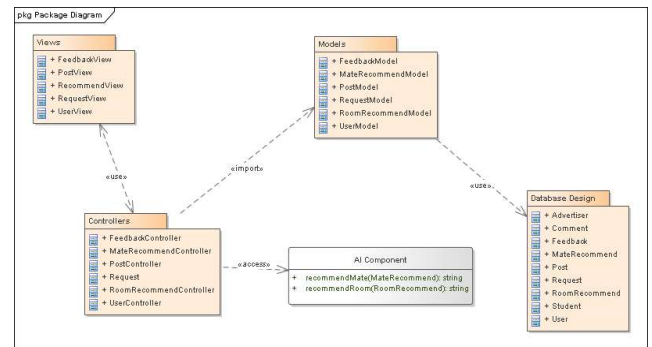


Figure 17. MVC architecture of UTMSIR

As illustrated in Figure 3, the package diagram demonstrates that the "views" component encompasses the primary classes, which include all pages and interface components. These components can utilize the controllers to process user orders, and the controllers can subsequently return

the results. Controllers have the capability to perform operations on models and the AI component, as they import the models and have access to the operations within the AI component. The models exert a direct influence on the database by accessing and modifying the collections on the server.

#### 1) *Front End*

ReactJS was utilized for the development of the User Interface (UI). The objective was to create a dynamic and responsive UI that enhances the overall user experience. The focus was on designing a clean and intuitive UI, ensuring that students can efficiently interact with the accommodation and navigate through the system. The UI elements were modularized using ReactJS's component-based architecture, thereby improving the maintainability of the codebase and facilitating reusability. This approach enabled efficient management and updating.

#### 2) *Back End*

This project developed a backend server application utilizing NodeJS with the Express framework, which provided a scalable and efficient runtime environment for the server-side logic. The application facilitated the handling of incoming requests from the user interface, data processing, and communication with the database. Concentrated APIs were designed and implemented using ExpressJS, responsible for managing various user requests, including user authentication and post management functionalities. NodeJS's event-driven architecture enabled the concurrent handling of multiple requests, ensuring high responsiveness and performance. JavaScript dependencies were utilized to enhance efficiency and scalability, taking into account factors such as request handling, error management, and security.

#### 3) *Database*

MongoDB was integrated as the database solution. MongoDB's flexible and schema-less architecture was appropriate for efficiently managing the system's data. The database schema was designed and implemented to store user, post, request, mateRecommend, roomRecommend, and feedback models that directly impact the database by accessing and modifying the collections on the server. MongoDB's document-based model facilitated structured data handling, ensuring efficient storage and retrieval. MongoDB's indexing capabilities were utilized to optimize data search and retrieval performance, enhancing the system's responsiveness. Furthermore, data encryption and access control mechanisms were prioritized to safeguard sensitive information, such as passwords, in the database.

## IX. CONCLUSION

The UTMSIR system addresses a critical need for international students at Universiti Teknologi Malaysia by providing an integrated platform to streamline the accommodation search process. Leveraging artificial intelligence and a user-friendly web interface, UTMSIR offers centralized listing and search functionality, AI-powered recommendations, direct communication channels, and administrative oversight. Built on the MERN stack and MVC design pattern, the system's architecture enables scalability and maintainability, while Azure Machine Learning integration allows for intelligent matching algorithms. Future enhancements could include expanding AI capabilities, integrating virtual tours, developing a mobile application, and incorporating blockchain technology.

By addressing the unique challenges faced by international students in finding suitable accommodation, UTMSIR has the potential to significantly improve their transition and overall experience at UTM.

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