

Digital Transformation in Room Management: Development of a Web-based Booking System

Nur Syarafina Binti Abdul Rahman^{1*}, Zainal Fitri Bin Mohd Zolkifli¹,
Liyana binti Mat Rani¹

¹ Department of Information and Communication Technology (JTMK), Politeknik Sultan Mizan Zainal Abidin,
23000 Dungun, Terengganu

*Corresponding author E-mail: syarafina@psmza.edu.my

Abstract

Room allocation and scheduling needed to be managed efficiently institutions such as universities, corporate offices, and co-working environments to ensure resources such as shared spaces are well managed. This research presents the design and implementation of a web-based booking system to transform the current method towards digital operation. The current method which uses paper form often led to delays, overlapping bookings, and forgotten reservations. As a result, students and lecturers facing difficulties when planning classes or programs, and sometimes lead to having to conduct them outside the JTMK building to avoid scheduling conflicts. To address these issues, a web-based room booking system was introduced. This system allows users to check room availability in real time and make bookings directly through the website. The JTMK Room Booking System was developed using a combination of modern technologies such as PHP and MySQL. The system was tested in JTMK's setting and significantly advances digital transformation by automating traditional manual booking processes, reducing administrative overhead, and enhancing user accessibility. The paper discusses unit testing, functional testing, performance testing, and user acceptance testing (UAT). The results confirmed the system's stability, usability, and compliance with user expectations. Future enhancements will focus on usage analytics and support for mobile applications to extend system accessibility.

Key Words: Room Management, Booking System, System Development

1.0 Introduction

In today's digital era, online systems via website play a key role in making everyday tasks easier and more efficient. Information technology has become very dominant in the process of managing many things (Murtiyoso et al., 2021). One common use is online booking, where users can quickly make reservations or access important information. Recognizing this, the Department of Information Technology and Communication (JTMK) at Politeknik Sultan Mizan Zainal Abidin (PSMZA) has developed a room booking system to help improve the management of lecture rooms and laboratories.

Previously, room reservations at JTMK were done manually using letters or written schedules. The current method often led to delays, overlapping bookings, and forgotten reservations. As a result, students and lecturers face difficulties when planning classes or programs, sometimes having to conduct them outside the JTMK building to avoid conflicts.

To address these issues, a web-based room booking system was introduced. This system allows users to check room availability in real time and make bookings directly through the online system. All data stored in a centralized database, making it accessible anytime, anywhere and reducing the chances of scheduling conflicts.

This paper presents the development and implementation of the JTMK Room Booking System as a step toward digital transformation in academic resource management in education institutions specifically in JTMK, PSMZA.

2.0 Literature Review

2.1 Manual vs. Digital Room Booking Systems

Traditional room reservation systems in educational institutions often rely on manual processes such as written schedules, noticeboards, or verbal communication. These methods are prone to errors, scheduling conflicts, and inefficiencies (Murtiyoso et al., 2021). The introduction of digital systems significantly reduces administrative workload, increases accuracy, and improves user satisfaction by providing real-time updates and automated records (Artes et al., 2024; Bagde, 2024).

Digital booking systems also allow institutions to track usage patterns, generate reports, and manage space utilization more effectively (Federal Polytechnic Kaltungo, 2023). Studies have shown that adopting a web-based approach can improve accessibility and ensure equitable use of shared resources (AppStay, 2023; Bagde, 2024).

2.2 Existing Room Booking Systems in Malaysian Institutions

To support the development of the JTMK Room Booking System, several existing systems from Malaysian higher education institutions were reviewed. These systems provided useful insights into user interface design, core functionalities, and limitations.

2.2.1 Booking System for Sport Facilities (UiTM)

This system allows students and staff to log in and make sports facility reservations. It includes features such as a reservation form, booking list page, and a navigation menu. One of the key advantages of the system is its ability to perform real-time availability checks, allowing users to view and book available rooms instantly. Additionally, the system automatically updates bookings when cancellations occur, ensuring that room availability is always up to date. However, there are some drawbacks to this system. It heavily relies on a stable internet connection, meaning that users may face difficulties accessing the system if the internet is unreliable. Moreover, if the system is not well-developed or lacks essential features, it could lead to subpar user experience, limiting its effectiveness.

No.	Applicant Name	Event	Space Category	Space Name	Start Date	End Date	Applied Date	Status	Action
1	ALI BIN SARA	FOOTBALL	SEMA - ZONE 1 (JALAN SARA)	SEMA 3.1	22-MAR-2027 17:00	22-MAR-2027 18:00	22-MAR-2027 00:00	APPROVED BY MUHAMMAD HAZRI BIN MUHAMMAD (SARA)	View Details
2	ALI BIN SARA	TENNIS	3.1 - AREA 1	41075	22-MAR-2027 15:00	22-MAR-2027 17:00	15-MAR-2027 00:00	APPROVED BY SALAH BIN SUKRI SULAIMAN	View Details
3	ALI BIN SARA	TEST	4.1 - AREA 1	41071	22-MAR-2027 15:00	22-MAR-2027 18:00	22-MAR-2027 00:00	APPROVED BY SALAH BIN SUKRI SULAIMAN	View Details

Figure 1: Booking List Page for Sport Facilities Booking System (UiTM)

2.2.2 Laboratory and Room Booking System (POLIMAS)

A web-based system designed for laboratory or classroom bookings. The system is accessible via login and includes location/contact information. The system offers several advantages, including being time-saving and accessible at any time, providing users with the flexibility to make bookings whenever needed. Additionally, its simple layout ensures that users can navigate the system quickly and efficiently. However, there are some disadvantages to consider. The system carries a risk of input errors during the booking process, which could lead to incorrect reservations. Furthermore, it requires the admin to be readily available to manage incoming booking requests and ensure smooth operation.



Figure 2: Home Page for Laboratory and Room Booking System (POLIMAS)

Table 1 presents a comparative analysis based on the literature review. The JTMK Room Booking System represents a significant step toward digital transformation, offering enhanced functionalities when compared to traditional room booking systems. Additionally, it demonstrates more advanced notification features than both sport facility booking systems and laboratory room booking systems.

Table 1: Comparison Table for Literature Review

Functionality	Traditional Booking	Sport Facility Booking	Lab & Room Booking System	JTMK Room Booking System
Manual vs. Automated Booking	Manual	Automated	Automated	Automated
Real-time Availability Display	No	Yes	Yes	Yes
User Authentication	None	Yes	Yes	Yes
Booking Conflict Detection	Manual	Automated	Automated	Automated
Calendar	No	Optional	Optional	Yes
Notification System	No	No	No	Yes

3.0 Methodology

The methodology for developing the JTMK Room Booking System follows the Agile development model, which is designed to address the dynamic and evolving needs of both students and staff within the JTMK department at PSMZA. Agile emphasizes iterative development, flexibility, and continuous feedback, making it an ideal approach for a project where requirements may evolve during development.

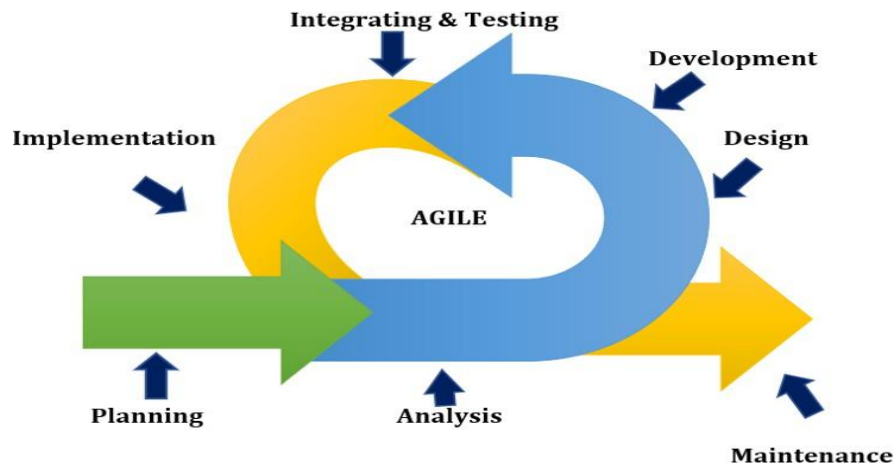


Figure 3: Agile Methodology

The Agile model was chosen for the JTMK Room Booking System because of its flexibility and focus on collaboration, adaptive planning, and iterative development. The model allows for continuous feedback and regular improvements to the system, making it particularly useful for accommodating the specific needs of users (Artes et al., 2024). Agile promotes collaboration between the development team and stakeholders, such as students, lecturers, and administrators, ensuring that their needs are addressed throughout the development lifecycle (Bagde, 2024; AppStay, 2023).

This approach is especially suitable for developing systems like the JTMK Room Booking System, where features and requirements may evolve, and quick adjustments are essential to meet users' needs.

The JTMK Room Booking System was developed using a combination of modern technologies to ensure a robust, efficient, and user-friendly solution. PHP was chosen as the primary server-side programming language due to its flexibility, scalability, and wide usage in web development. MySQL was selected as the relational database management system (RDBMS) for storing and managing the system's data, ensuring secure and efficient handling of room bookings, user information, and reservations. To streamline the development process and enhance the system's functionality, the Laravel framework was employed. Laravel is a powerful PHP framework known for its elegant syntax, built-in features like authentication, routing, and database management, and its ability to simplify complex tasks such as form handling and security. This combination of PHP, MySQL, and Laravel allowed for the creation of a dynamic, secure, and maintainable booking system that meets the needs of the JTMK department while providing optimal user experience.

To gather the necessary information for the development of the JTMK Room Booking System, two primary data collection methods were used: interviews and system testing. Interviews were conducted with key stakeholders, including lecturers, students, and

administrative staff within the JTMK department. These interviews aimed to identify user requirements, current challenges with the manual booking process, and suggestions for system features. The feedback collected helped shape the functional and non-functional requirements of the system. In addition to interviews, testing was performed throughout the development phase to evaluate the system's functionality, usability, and performance. This included unit testing, integration testing, and user acceptance testing (UAT), which ensured the system met user expectations and operated smoothly in a real-world environment. Together, these methods provided comprehensive insights that guided both the design and refinement of the system.

4.0 System Design and Implementation

The system design phase focuses on outlining the architecture and components of the web-based booking system developed for JTMK at PSMZA. This system aims to streamline room reservation processes, improve administrative efficiency, and provide real-time availability of rooms. This section presents the system architecture, data flow, and context diagram to offer a comprehensive understanding of how the system operates.

4.1 System Architecture

The web-based Room Booking System is designed as a layer architecture consisting of the presentation layer, application layer, and data layer. The presentation layer is built using HTML, CSS, and JavaScript to provide an interactive user interface for students, lecturers, and administrators. The application layer is powered by PHP, handling the business logic and processing user requests. The data layer is managed using MySQL to store user data, room details, and booking records. The system is accessible via web browsers on both desktop and mobile devices, connected over a secure HTTP protocol. User authentication and authorization are implemented to control access based on roles.

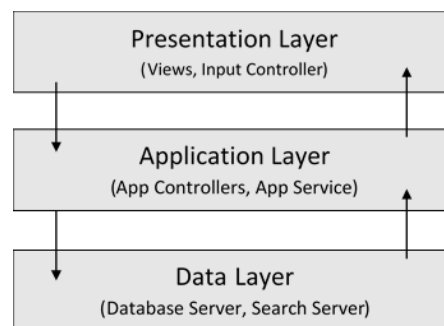


Figure 4: Layer Architecture

4.2 Use Case Diagram

The web-based Room Booking System encompasses several key functions designed to streamline the room reservation process. Figure 5 presents the use case diagram illustrating the system's main components and user interactions. The system supports two types of users: administrators and end users. It includes six primary functions: user registration, login, calendar viewing, room booking, notification and status viewing. The user registration function is exclusively accessible to administrators, who are responsible for ensuring that only verified students and staff are granted access to the system. The login function is required for all users to ensure that only authenticated individuals can interact with the system's features. The calendar viewing function allows users to check the availability of rooms, which may be displayed as available, booked, or pending. Additionally, the system incorporates a notification function. When a new booking application is submitted, an email

notification is automatically sent to the administrator to prompt timely review and action. Similarly, once the administrator updates the booking status either approves or rejects the request. A notification is sent to the user to inform them of the status. Administrators also have access to the application table, where they can manage booking requests, while end users can view the status of their applications once a decision has been made.

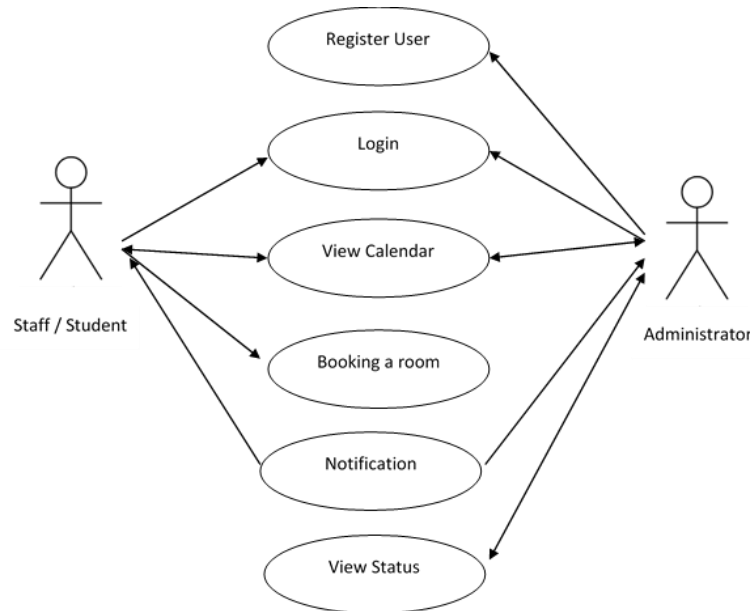


Figure 5: Use Case Diagram

4.3 User Interface

In the context of digital transformation, user interface (UI) design plays a pivotal role in enhancing the usability and efficiency of web-based room booking systems. As organizations increasingly adopt intelligent technologies to streamline resource management, intuitive and accessible UI design becomes essential in ensuring user adoption and optimizing the booking experience. Figure 6 below show the UI for login function which all user need to verify their account first in order to use all of the function in the system.

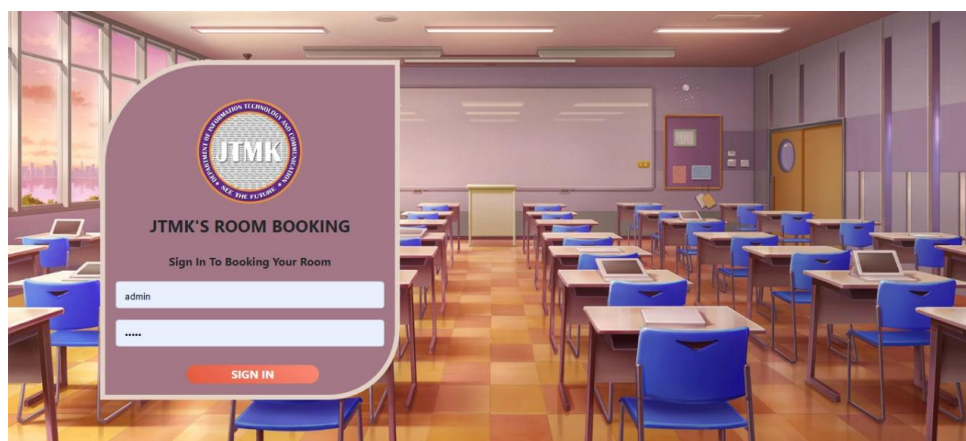


Figure 6: Login function

The next UI (Figure 7) is the interface for calendar and booking form in order to facilitate user to do the booking. User can view the available, booked or pending room status. In the

booking form, user need to insert their name, address, phone number, email address, reservation date, reservation time and room number.

Figure 7: Calendar and Booking Form

5.0 Results and Evaluation

Before deploying the web-based Room Booking System, a series of tests were conducted to validate that the system meets all specified requirements and performs reliably under typical usage conditions. These tests included unit testing, functional testing, performance testing, and user acceptance testing (UAT). The results confirmed the system's stability, usability, and compliance with user expectations.

5.1 Unit Testing

Unit testing involved testing individual components of the system in isolation to ensure that each unit functioned correctly. The tests were executed using both valid and invalid inputs to verify system behavior and error handling.

Table 1: Unit Testing Result

No.	Test Case Name	Description	Pre-Condition	Expected Result
1	Login Test	User logs in with a valid username and password.	Valid user credentials	Redirects to home page based on user role.
2	Logout Test	User clicks logout to exit the system.	User is logged in	Redirects to login page.
3	User Details Test (User)	User views account information.	User is logged in	Displays accurate user details.

5.2 Functional Testing

Functional testing validated whether the system behaves in accordance with its requirements. The focus was on core features such as booking rooms, viewing status, and administrative functions.

Table 2

No.	Test Case Name	Description	Pre-Condition	Expected Result
4	Booking Calendar Test	User accesses the booking calendar.	User is logged in	Booking calendar is displayed.
5	Booking Form Test	User fills out the booking form.	User has referred to class & position	Form submission is successful.
6	Booking Details Test	User views booking details after submission.	Booking is made	Booking details are displayed.
7	Booking Status Test	User checks booking approval status.	Booking is submitted	Displays status (Approved, Pending, or Rejected).
8	User Management (Admin)	Admin manages user accounts (create, lock, delete).	Admin is logged in	Admin can perform user actions.
9.	Notification Function	Notifications are sent to admin and users based on booking activity.	Booking submitted / status updated	Admin receives email alert; user receives status notification.

5.3 User Acceptance Testing

User acceptance testing was conducted with actual end users and administrators. The participants are from JTMK staff and students. Participants were asked to complete common tasks such as logging in, making a booking, and managing users. Feedback was collected via observation and post-test questionnaires.

Table 3

Task Tested	User Type	Feedback Summary
Login and Navigation	End User	Interface was intuitive and easy to navigate.
Room Booking Process	End User	Booking flow was smooth; calendar was clear and useful.
Status Checking	End User	Notifications were clear and timely.
User Management	Administrator	Admin tools were functional and efficient.
Notification Alert	End User/ Admin	Notifications were timely and improved system responsiveness.

The comprehensive testing of the web-based Room Booking System including unit, functional, and user acceptance testing has demonstrated that the system reliably meets its design objectives. All core functionalities, such as user authentication, room booking, calendar viewing, and the newly integrated notification feature, performed as expected.

Several challenges were encountered during development such as authentication errors, UI clarity issues, and email delivery delays. These issues were successfully addressed through iterative improvements and reinforcing the system's robustness.

6.0 Discussion

The web-based Room Booking System significantly advances digital transformation by automating traditional manual booking processes, reducing administrative overhead, and enhancing user accessibility. By providing a centralized digital platform, the system streamlines room management, enabling real-time visibility of room availability, efficient resource allocation, and instant communication through notification alerts. This transition from

paper-based or fragmented systems to a fully integrated digital solution aligns with the broader institutional goals of modernization and operational efficiency.

Despite its robust design, the system has certain limitations. The current implementation assumes stable internet connectivity and relies heavily on email-based notifications, which may delay communication under poor network conditions or spam filtering. The user interface, while intuitive, could be further enhanced with mobile responsiveness and multilingual support to increase accessibility. Future enhancements will focus on usage analytics and support for mobile applications to extend system accessibility.

7.0 Conclusion

This study developed and evaluated a web-based Room Booking System designed to support digital transformation in room management. Through extensive testing, including unit, functional, performance, and user acceptance tests, the system proved to be reliable, efficient, and user-friendly. Key features such as real-time calendar viewing, secure authentication, and automated notifications contributed to a seamless booking experience and improved administrative oversight.

The system offers substantial contributions by reducing manual intervention in room booking, minimizing scheduling conflicts, and promoting transparency in resource utilization. For academic institutions, this translates to more efficient classroom management and enhances user satisfaction. Administratively, the platform supports data-driven decision-making and improved communication channels between staff and users.

Building upon the current work, future research could explore the integration of advanced technologies such as AI-driven booking recommendations, IoT-enabled room occupancy monitoring, and cross-platform mobile applications to enhance system usability. Additionally, longitudinal studies assessing user engagement and system impact on institutional efficiency would provide valuable insights for continuous improvement.

References

- AppStay. (2023). *Development and assessment of AppStay: A web-based room, dorm, and apartment reservation system*. ResearchGate. https://www.researchgate.net/publication/374371492_Development_and_Assessment_of_AppStay_A_Web-Based_Room_Dorm_and_Apartment_Reservation_System
- Artes, A. L., Lorzano, E. R., Tayam, J. R., & Intal, G. L. (2024). *Cardinal Reserve: A proposed online room reservation system for a higher educational institution*. ACM Digital Library. <https://dl.acm.org/doi/abs/10.1145/3664968.3664982>
- Bagde, S. D. (2024). *Innovations in school room reservation management: Towards smart and sustainable solutions*. Gurukul International. <https://gurukuljournal.com/innovations-in-school-room-reservation-management-towards-smart-and-sustainable-solutions/>
- Federal Polytechnic Kaltungo. (2023). *Development of a web-based reservation system for Federal Polytechnic Kaltungo*. ResearchGate. https://www.researchgate.net/publication/372769856_Development_of_a_Web-Based_Reservation_Systems_for_Federal_Polytechnic_Kaltungo
- Murtiyoso, O., Athian, M. R., Mujiyono, M., Ichsan, I., & Adi, S. (2021). Design of gallery web-based space booking system as media service. *IOP Conference Series: Materials Science and Engineering*, 1098(5), 052104. <https://doi.org/10.1088/1757-899X/1098/5/052104>