JURNAL TEKNOLOGI DAN OPEN SOURCE
Vol. 8, No. 2, December 2025, pp. 453~466
e-ISSN: 2622-1659, accredited Four Grade by Kemenristekdikti, Decree No: 152/E/KPT/2023
DOI: https://doi.org/10.36378/jtos.v8i2.4633

Implementation of a Classroom Reservation Information System at Esa Unggul University

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Article Info

Article history:

Received 07 02, 2025
Revised 09 10, 2025
Accepted 1101, 2025

Keywords:

Information System
Room Reservation
Web Application
Application Security
Administrative Efficiency

ABSTRACT

The manual management of room reservations at Esa Unggul University has long faced various administrative challenges, including irregular scheduling, delays in the approval process, and limited access to real-time room availability information. These issues reduce the overall efficiency of academic and administrative services. To address these problems, this study aims to design and implement a web-based information system that facilitates a more structured, transparent, and efficient room reservation process.The system was developed using the CodeIgniter 4 framework for the backend, while Bootstrap 5 and custom CSS were utilized for the frontend interface. MySQL served as the database management system, and application security features were enhanced with session-based authentication, input validation, data encryption, CSRF protection, Honeypot, and CloudFlare integration. Testing was conducted using the gray box method to evaluate both code reliability and system functionality from the user's perspective.The results indicate that the application effectively handles room reservation requests, minimizes scheduling conflicts, and supports administrative staff in centrally monitoring room usage. This research contributes significantly to the digital transformation of campus administration and may serve as a reference for developing similar systems in other higher education institutions..

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1. Introduction

The development of information and communication technology (ICT) has accelerated digitalization across various sectors, including higher education. Modern universities not only function as centers of learning and research but are also required to provide administrative services that are efficient, responsive, and transparent. One essential component that supports both academic and non-academic activities on campus is the management of classroom reservations. Classrooms are vital assets used for a wide range of activities, such as lectures, seminars, organizational meetings, and student events. Unfortunately, in many universities, including Esa Unggul University, the room reservation process is still carried out manually or in a semi-digital manner. This often leads to several administrative issues, such as scheduling conflicts, delays in approval, uncertainty regarding room availability, and insufficient documentation. [1], [2].

The limitations of the manual system have a direct impact on the operational effectiveness of the campus. For example, slow verification of room reservation requests can hinder the execution of scheduled activities, while the absence of digital documentation makes it difficult for management to evaluate facility usage[1]–[3]. However, with the increasing intensity of academic activities and student organizational events, the need for a reliable room management system has become increasingly urgent. In the context of campus digital transformation, developing a centralized, responsive, and easily accessible room reservation information system for all members of the academic community is a strategic step toward addressing these issues.

This study aims to design and implement a web-based classroom reservation application specifically developed for the environment of Esa Unggul University. The application is designed as a digital solution to replace conventional reservation methods by offering key features such as real-time room availability checking, transparent online reservation processes, and an integrated approval management system [3], [4]. The application was developed using modern and open web-based technologies [5], [6]. The development of an online Room Reservation Information System has also been implemented in other institutions using the Prototype Method, in order to meet user needs and simplify the booking process [2]. This aligns with the approach adopted in this research, which utilizes technology that is tailored to needs and easy to implement. For the interface, the Bootstrap 5 framework and custom CSS are used to ensure the user interface remains responsive and easy to use across various devices. [7], [8]. Meanwhile, for server-side development, the CodeIgniter 4 framework based on PHP 8.1 is used, which is known to be lightweight, modular, and efficient. [6]–[8]. MySQL is used as the database management system to ensure performance and stability in managing loan data. This application is also designed to run in a shared hosting environment using Apache Server and CPanel, making it a cost-effective yet robust solution.

Data security and system integrity are important aspects in the development of this application [11], [12]. For this reason, the system is equipped with various protection features such as session-based login authentication, strict input validation to prevent security holes, protection against CSRF (Cross Site Request Forgery) attacks, the use of encryption on important data, the implementation of CloudFlare to protect the server from DDoS attacks, and Honeypot on form submissions to detect and filter bot activity [9]–[16].

In this implementation, system testing was carried out using a gray box testing approach, which is a combination of internal structure-based testing methods (white box) and user-side testing (black box). This testing aims to ensure that the system not only runs according to its expected function, but is also robust to complex usage scenarios and free from logical and security errors [21].

Overall, this research is directed to answer several main problems, namely: (1) How to design a user-friendly room rental information system that can be accessed online by all campus users? (2) How to ensure the system runs safely and efficiently in a resource-limited web environment? and (3) How to test the system to meet user needs without neglecting technical and security aspects? The objectives of this research include: developing an effective and efficient room rental information system, ensuring the system can be operated well on existing campus infrastructure, and providing a real contribution to the digitalization of academic services in the university environment.

In terms of benefits, this research is expected to have a positive impact on increasing the efficiency of campus administrative services, making it easier for users to borrow rooms without face-to-face meetings, and providing a more organized and transparent documentation system. Furthermore, the results of this research are also expected to serve as a reference for developing similar systems at other institutions facing similar challenges in managing campus facilities [1]–[4].

2. Research Method

This research employed a Research and Development (R&D) method with a software development approach using the Waterfall Software Development Life Cycle (SDLC) model [22]. This model was chosen because the system development flow can be designed systematically and sequentially, starting from the needs analysis stage to the final evaluation stage. This method has been widely used in the development of similar information systems in higher education institutions [23], [24].

The first stage was a system requirements analysis, conducted through direct observation of the manual room rental process at Esa Unggul University. This manual process was found to have several obstacles, such as difficulty tracking rental data, potential room schedule conflicts, and the lack of digitally documented historical data. Furthermore, informal interviews with administrative staff provided additional information regarding frequently encountered administrative obstacles, such as delays in the verification and recording of rentals. Based on this analysis, it was determined that the system to be developed must be able to simplify the rental process, automatically manage room usage schedules, and provide a centralized history

of rental data. A comparison between the previously used manual system and the web-based information system is shown in Table 1.

Table 1. Comparison of Manual Loan Systems and Information Systems.

Aspects	Manual System	Information System (Automatic)
Processing Time	± 1–2 days	< 5 minutes
Schedule Confirmation	Manual via chat	Automatic via system
Loan Documentation	Undocumented	Digitally stored
Potential Schedule Conflicts	High	Low (with system validation)
Information Access	Limited	Real-time and online

The next stage is system design, which is carried out to map the functional and technical structure of the information system to be built. The design is carried out by describing Use Case Diagrams to identify interactions between users and the system, as well as Entity Relationship Diagrams (ERD) to design the database structure to be used. In addition, the interface design is carried out with responsive and user-friendly design principles using Bootstrap 5 and custom CSS [7], [8]. This design aims to ensure that the system can be easily accessed through various devices, both desktop and mobile devices.

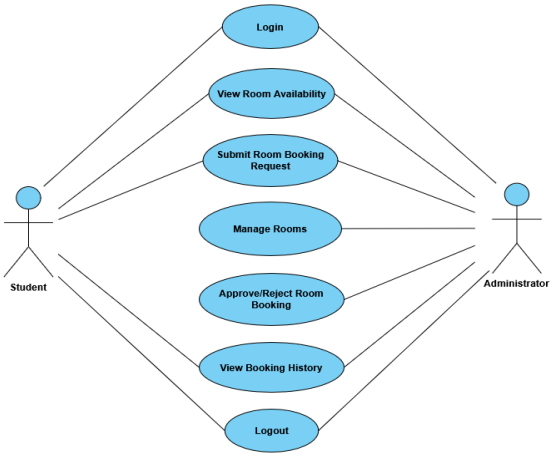

Figure 1. Use Case Diagram of Room Lending System.

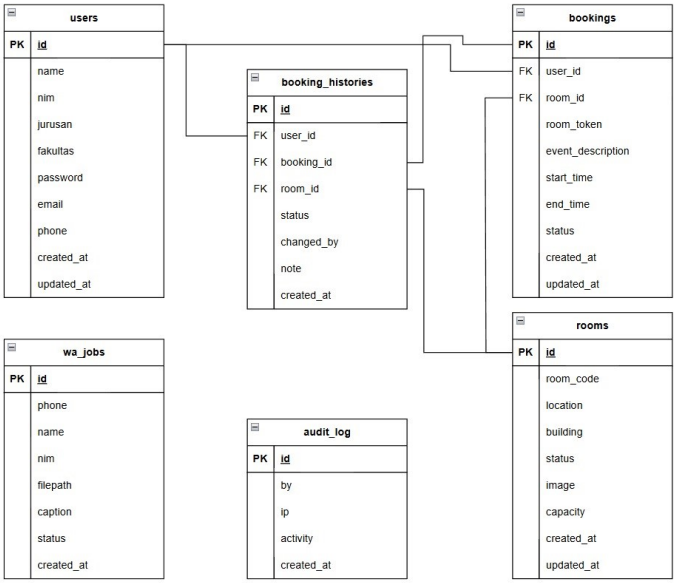

Figure 2. Entity Relationship Diagram (ERD) of the Room Lending System.

To illustrate the process flow within the system, a flowchart is used to map the functional steps from both the student's perspective as the service user and the administrator's perspective as the request processor. This flowchart provides a logical overview of the sequence of activities in the system being developed..

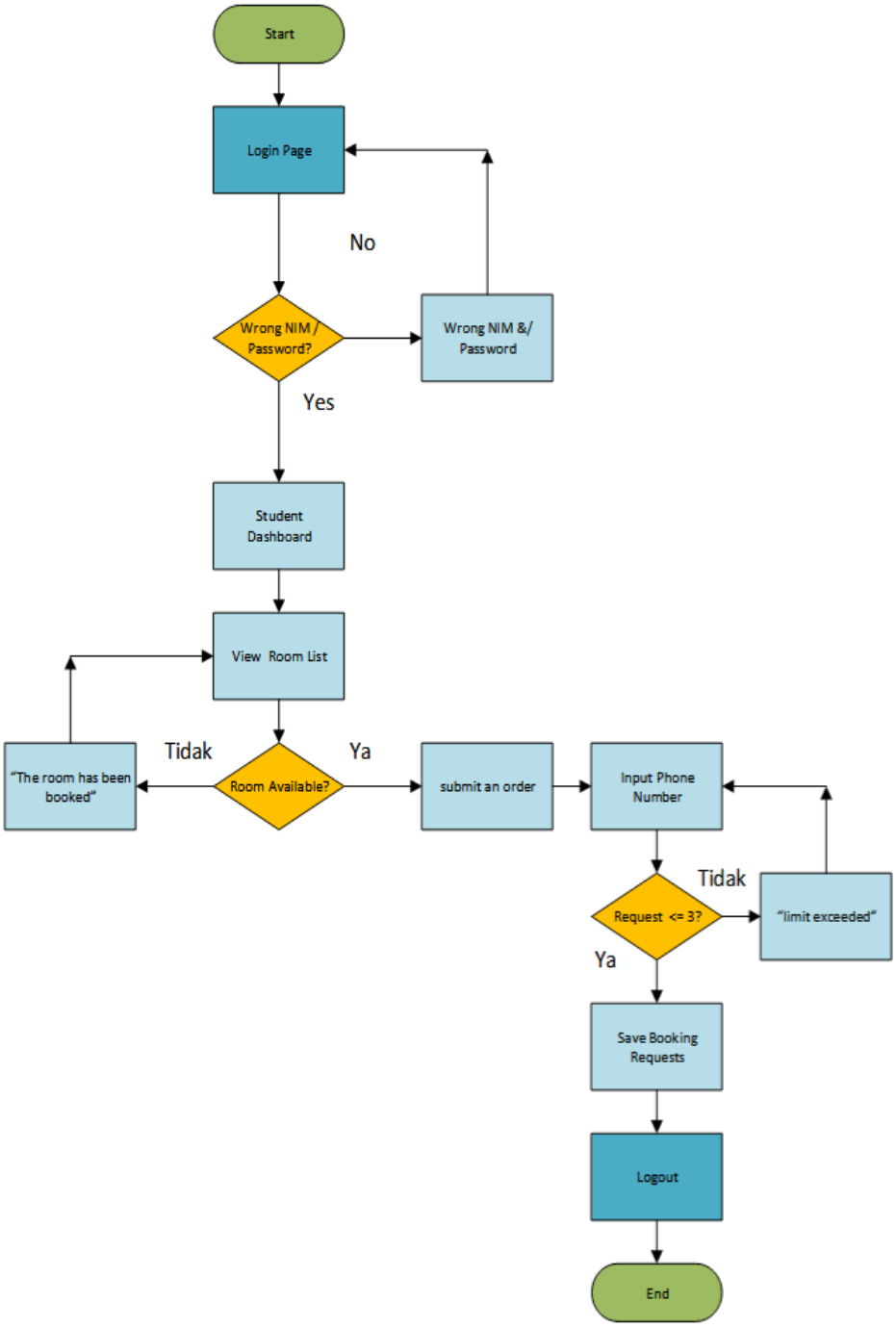

Figure 3. System Flowchart from a Student's Perspective.

Figure 3 shows the process flow from the student's perspective, starting from logging into the system, checking room availability, applying for a loan, to validating the number of requests and storing data..

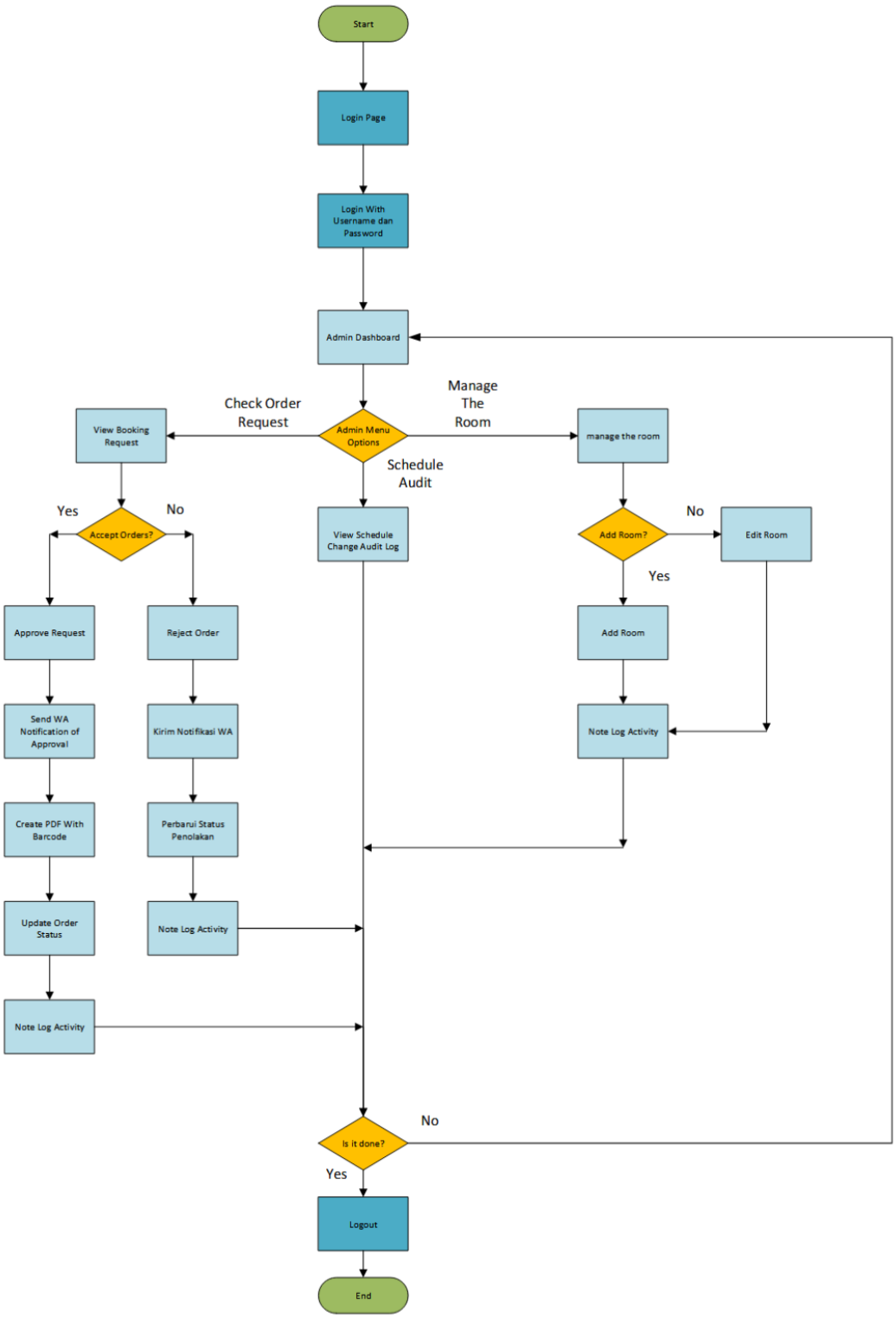

Figure 4. System Flowchart from Admin's Perspective.

Figure 4 illustrates the process carried out by the admin, starting from logging in, checking loan requests, the approval or rejection process, room management, to recording activity logs.

The next stage is implementation, where system development is carried out using the CodeIgniter 4 framework as the basis for the backend side. This framework was chosen because it has good documentation, an organized MVC structure, and supports the efficient development of PHP-based applications. Meanwhile,

for data management, a MySQL database system is used, which is set up to store various key entities such as users, rooms, schedules, and loan logs. In the implementation process, security features are also a top priority, such as the use of session-based authentication, input validation on all forms to prevent errors and injections, password encryption using the bcrypt algorithm, and protection against Cross-Site Request Forgery (CSRF) [13], [14], [25], [26]. In addition, CloudFlare is also implemented at the server layer to protect the application from DDoS attacks and suspicious traffic before it reaches the server [15], [16]. Honeypots are also implemented on important forms, namely a hidden field that is useful for detecting and preventing automatic submissions (bots) [19], [20].

The fourth stage is system testing, which is conducted using the gray box testing method. This method combines white box techniques (testing program logic and code flow) and black box techniques (testing from the user's perspective without knowledge of the code structure) [21]. Testing is conducted to ensure that every developed feature, from the login process and room loan applications, approval or rejection notifications from the admin, to loan history recording, operates according to the designed specifications.

The final stage involves evaluating the system by conducting live trials with a number of initial users, consisting of students and administrative staff on campus. Testing is conducted to obtain feedback on user experience, the clarity of system navigation, and the accuracy of data recording. The evaluation results indicate that the application is able to reduce schedule recording errors, speed up the loan approval process, and simplify administrative tasks previously performed manually. Based on this feedback, several improvements are made before the system is declared suitable for wider use.

Overall, this research method provides a systematic framework for developing an efficient room loan information system tailored to the needs of higher education institutions, without relying on external systems or additional integrations.

3. Result and Discussion

The Room Rental Information System developed in this research was designed and implemented to meet the needs of the Esa Unggul University academic community, namely by providing a platform that can facilitate the room booking process easily, quickly, transparently, and widely accessible. This is also in line with implementations at other institutions using a similar approach [3], [4], [22]. Therefore, it can be said that the design implemented in this system aligns with the problem posed in the introductory chapter and meets the desired design aspects, namely a user-friendly interface, a secure and structured process, and service that adheres to procedures. The system can be accessed from two perspectives: Administrator and Student, allowing for a more organized management and use process. This is useful for maintaining transparency, effectiveness, and user satisfaction, in line with the problems and objectives outlined in the introductory chapter. Prior to deploying the system, CloudFlare was implemented as a front-end layer to filter traffic and detect suspicious activity. CloudFlare is useful for preventing unauthorized third-party access, such as bots, DDoS attacks, and hacking attempts. With the implementation of CloudFlare, the access process can run more safely, stably and securely, so that services can run optimally without problems arising from cyber attacks that can harm the institution [15], [16], [18].

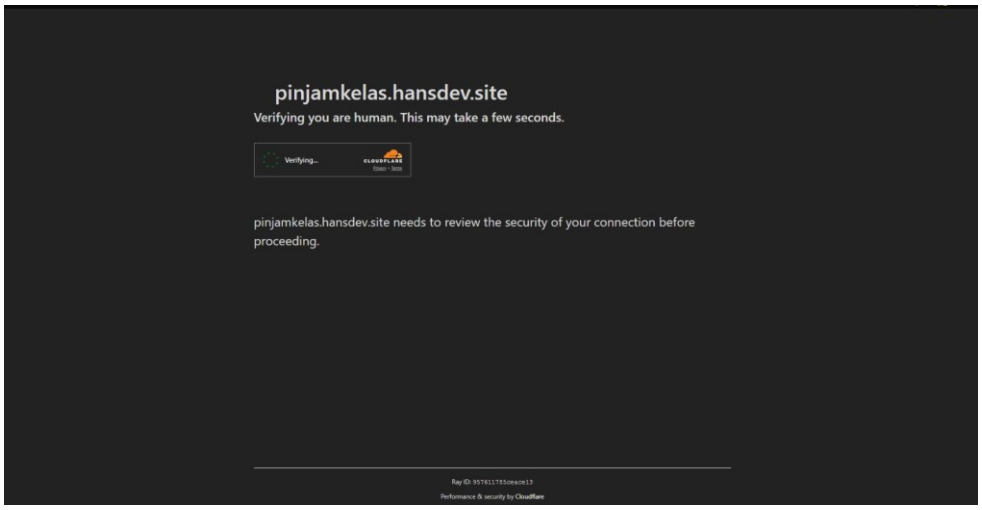

Figure 5. CloudFlare Security Verification Page.

Users, both Administrators and Students, can then proceed to the login page available on the same display. During the login process, users are asked to enter their student ID number and password, then check "I'm not a robot." After the authentication process is complete, each user will be directed to the appropriate Home screen based on their role (Administrator or Student). This is useful for maintaining transparency, effectiveness, and user satisfaction, in accordance with the issues and objectives outlined in the introduction..

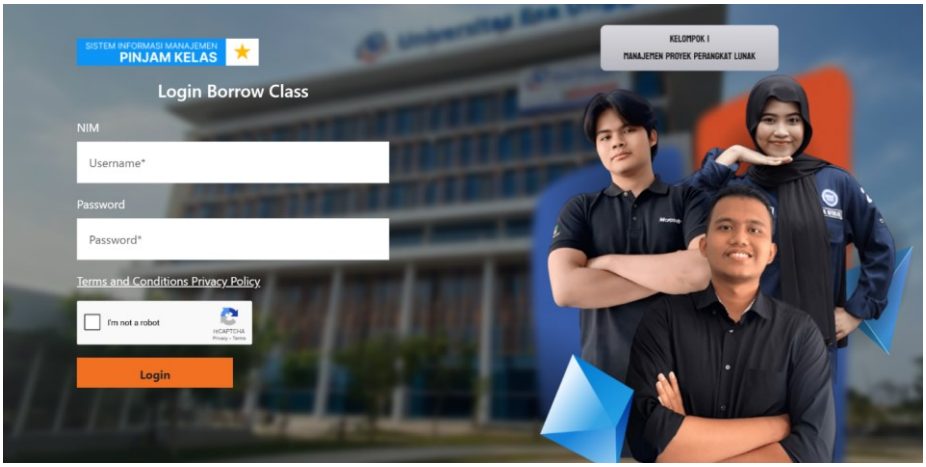

Figure 6. User Login Page (Admin and Student).

From the Administrator's perspective, after the authentication process is complete, the admin will be directed to the Home page, which contains a list of admin users, important announcements, and a list of bookings currently being submitted.

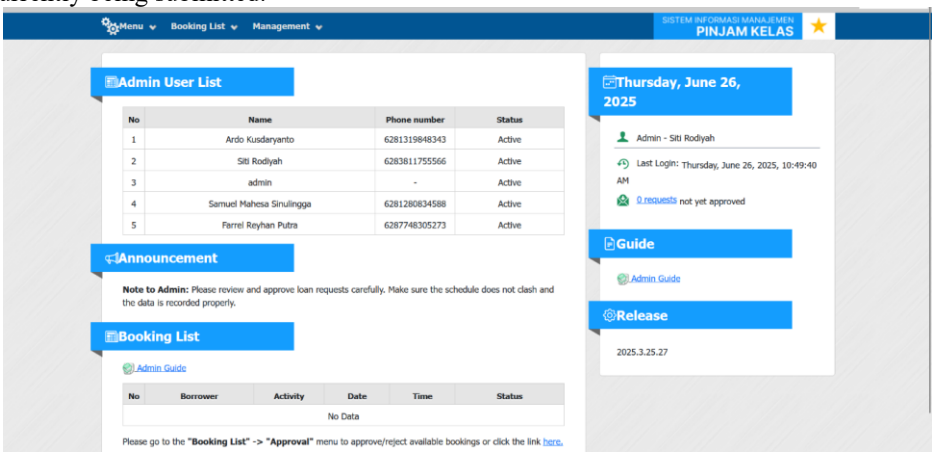

Figure 7. Admin Home Page.

In addition to the Home screen, there are several navigation buttons at the top: Menu, Booking List, and Management. When opened, the menu button displays the Home, Siakad, and Logout options, which are useful if the administrator wants to change accounts, return to the initial screen, or navigate to the Academic System (Siakad).

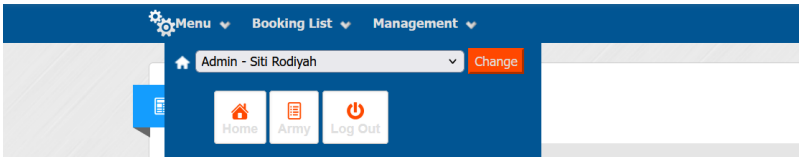

Figure 8. Menu Button.

The Booking List is useful when admins want to approve or reject room use requests. The Approvals view offers a search field by name, student ID number, or building, and a date filter, allowing for

a faster and more organized approval process. Once approved or rejected, the request is recorded in the Approval History..

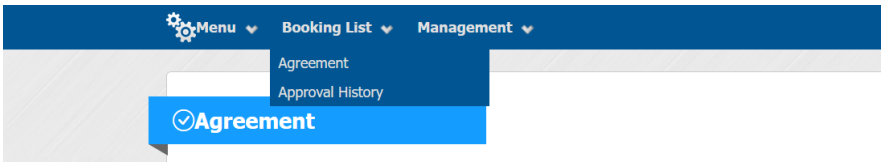

Figure 9. Booking List Button.

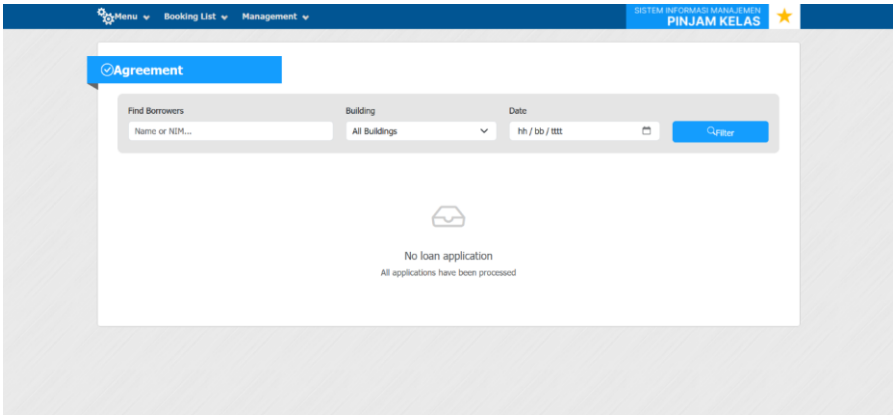

Figure 10. Consent Page.

Figure 10 illustrates the Consent Page, which serves as an important step to ensure that users fully understand and agree to the terms, conditions, and policies established by the platform. This page provides clear explanations regarding data usage, privacy practices, and user responsibilities before they proceed with accessing the system. By presenting this information transparently, the platform aims to build trust and encourage informed decision-making. Users are required to read through the provided statements and indicate their agreement, ensuring that all actions taken within the platform are legally compliant and ethically sound. The Consent Page also supports accountability and reinforces user awareness regarding their rights and obligations.

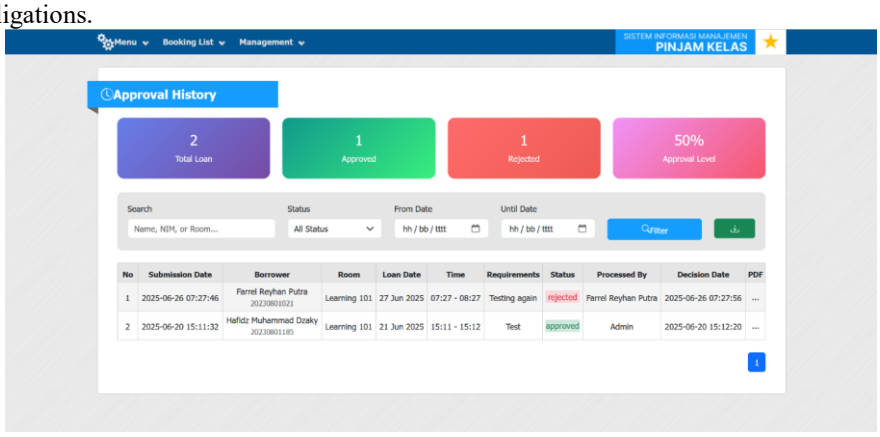

Figure 11. Approval History Page.

After the Approval History, there's also a green Export Data button located next to the filter. This button is useful if the Administrator wants to save a room usage report. Clicking the Export button automatically downloads an Excel or CSV file, which will include the booking number, booking date, renter, room, time, purpose, status, processed by, and decision date. This detailed report makes it easier for Administrators to create reports, submit accountability reports, and maintain structured room usage records.

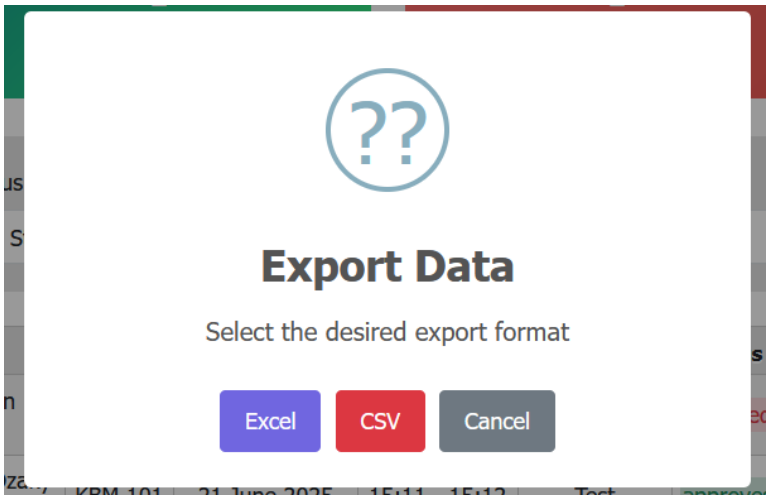

Figure 12. Export Data Button Reaction on the Approval History Page.

Additionally, the Management button provides a Manage Rooms subpage, where admins can search and manage room data by building, number, and status. This page is useful for adding, removing, or maintaining rooms.

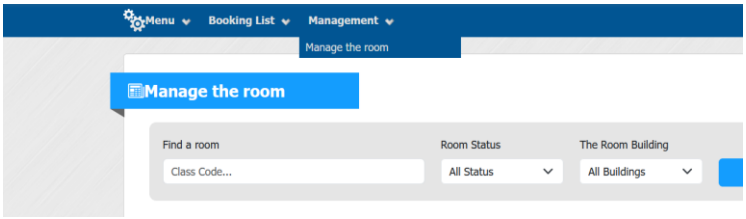

Figure 13. Management Button.

Figure 13 displays the Management Button, which functions as a central access point for administrators to oversee various operational features within the system. This button directs authorized users to a dedicated management interface, where they can monitor product data, update inventory, manage orders, and review user activity. By consolidating essential administrative tools into a single entry point, the platform enhances efficiency and ensures that management tasks can be performed quickly and accurately. The presence of the Management Button also reflects the system's commitment to structured workflow control, making it easier for admins to maintain smooth operations and ensure that all platform functions run reliably.

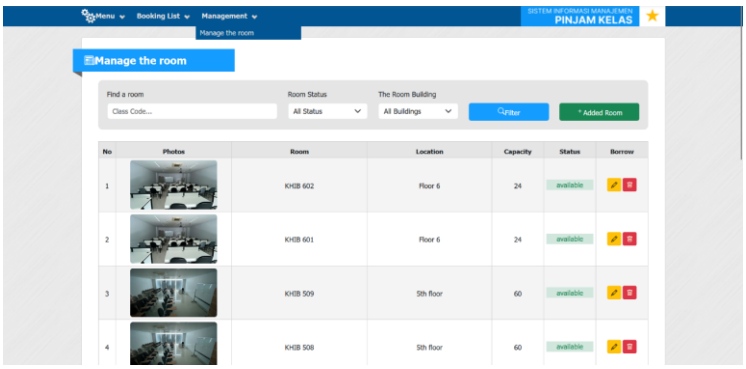

Figure 14. Manage Room Page.

From a student perspective, after successful authentication, users are redirected to the Home page. This Home page displays the user's identity, room usage instructions, and a list of available rooms. This display allows students to easily view room availability, understand the procedures and terms of use, and then proceed with the booking process as needed. This is essential for maintaining transparency, certainty, and orderly room use within Esa Unggul University..

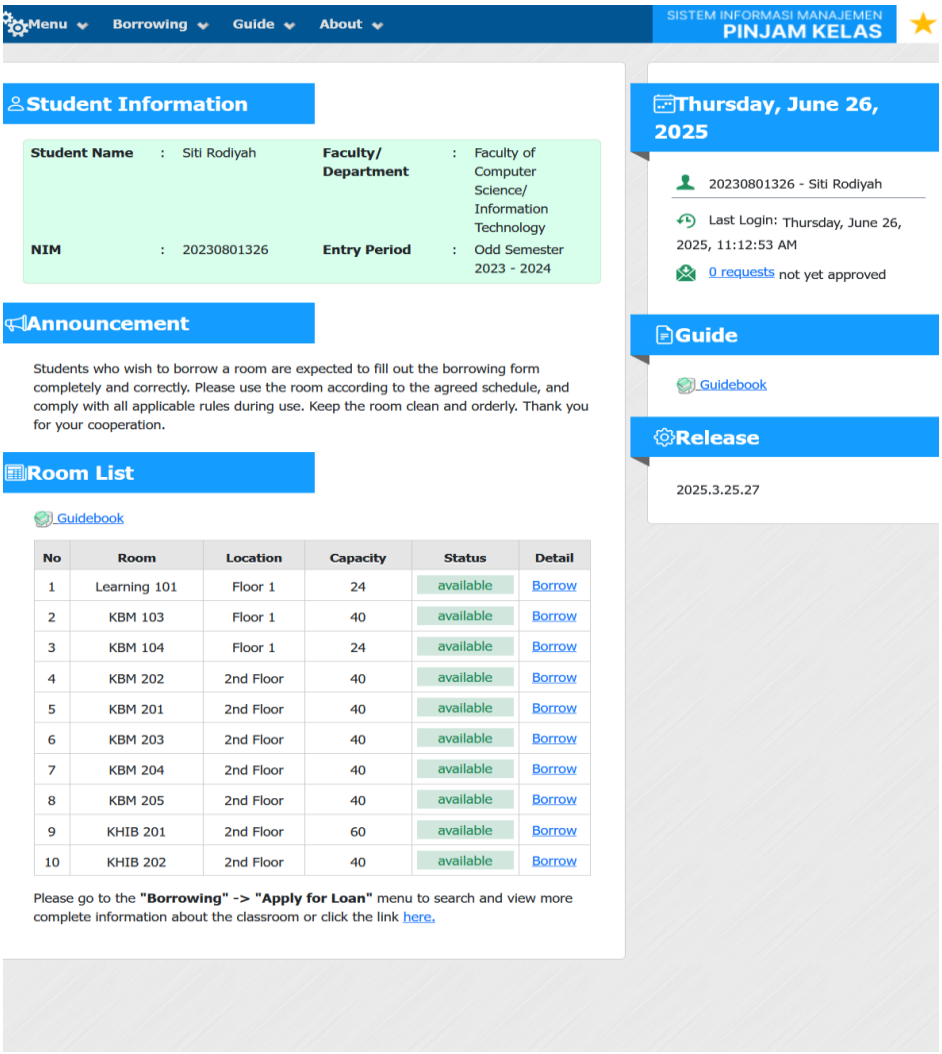

Figure 15. Student Home Page.

In addition to the Home screen, there are several navigation buttons at the top: Menu, Borrowing, Guide, and About. The menu is useful if students want to switch accounts, return to the initial screen, or navigate to the Academic System (Siakad).

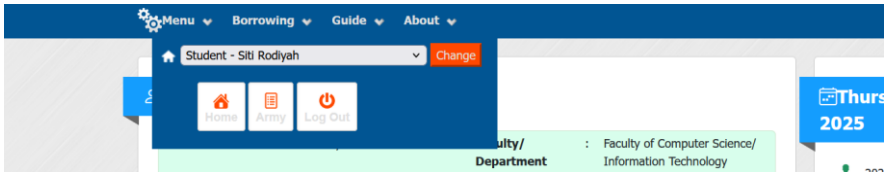

Figure 16. Menu Button

The "Borrow" button is useful for students who wish to request a room loan. During the booking process, users can select an available room, then fill out the booking form according to their needs, and submit it. To maintain security and prevent bot submissions, a "honeypot" field has been implemented within this booking form. This is a hidden field that is invisible to human users but can be automatically filled in if a bot attempts to submit the form. This way, if the "honeypot" field is detected as filled in during submission, the booking request will be immediately rejected. This helps maintain data integrity and prevent unauthorized use. Users can track their application in "My Loans" and are notified via WhatsApp if it is approved. They can also cancel their application up to one day before use to ensure space availability and the interests of other users.

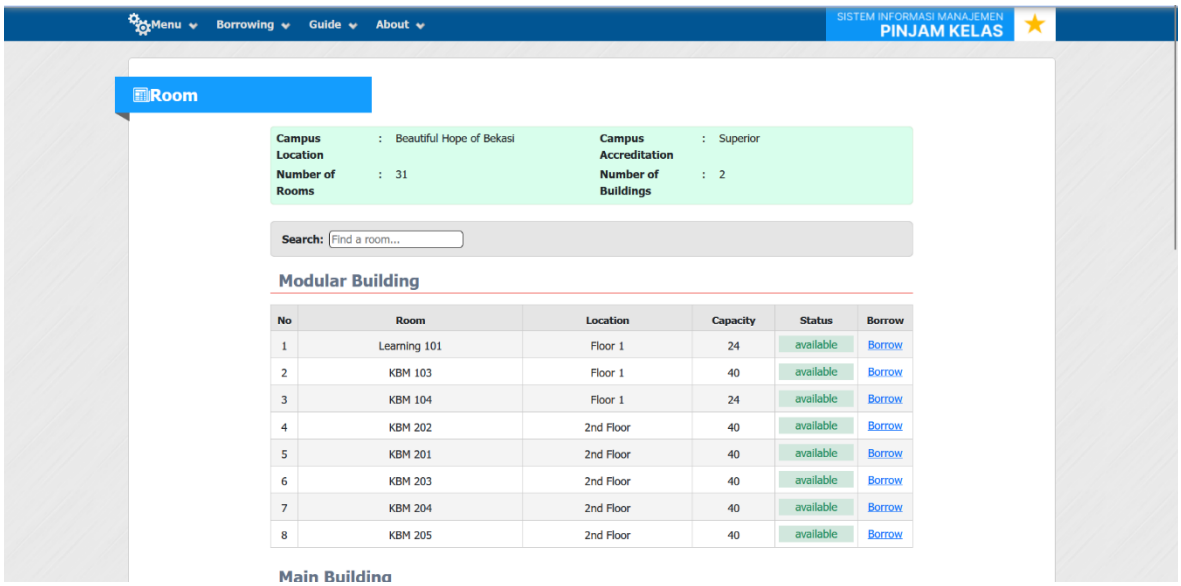

Figure 17. Apply for Loan Page.

Figure 17 shows the Apply for Loan Page, where users can submit their loan applications by providing the required personal and financial information. This page is designed to guide users through the process clearly and efficiently, ensuring they understand each step while allowing the system to collect accurate data for evaluation.

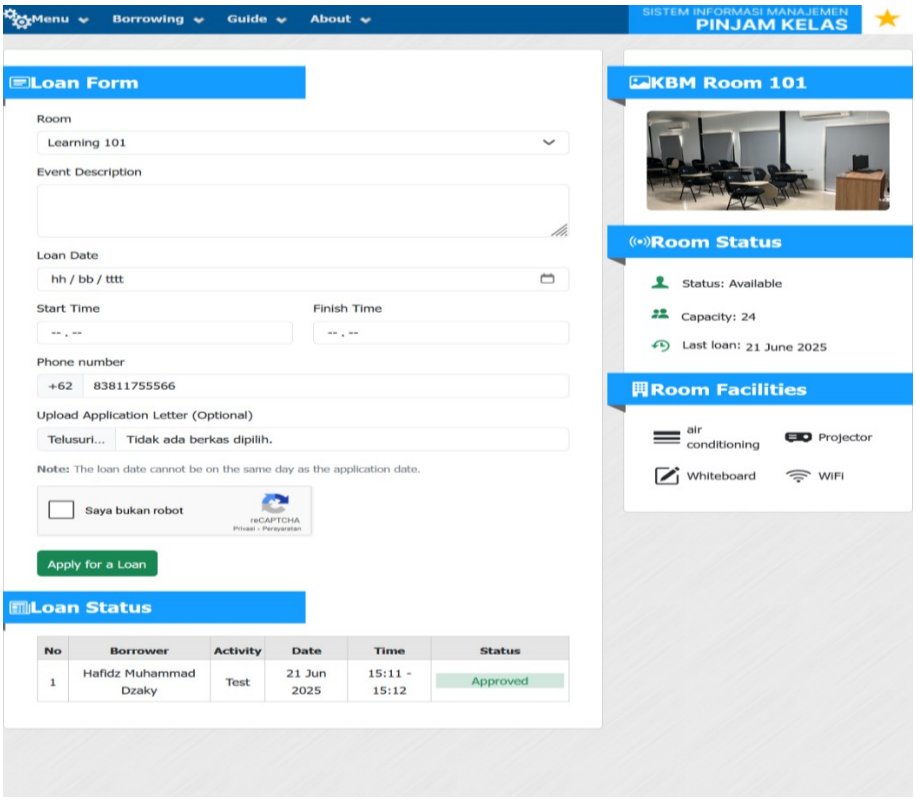

Figure 18. Loan Form Page.

Figure 18 displays the Loan Form Page, which serves as the main interface for users to enter detailed information required for loan processing. This page includes fields such as personal data, loan amount, purpose, and supporting documents. Its structured layout helps users provide accurate information, ensuring a smooth and efficient loan application workflow.

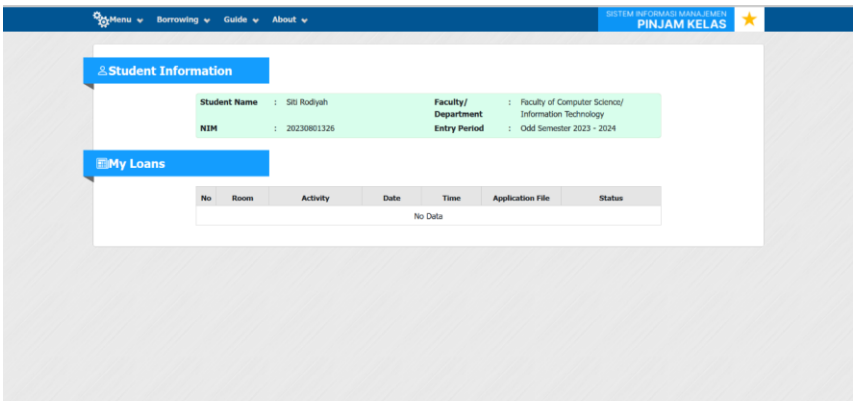

Figure 19. My Loans Page.

In addition to the booking process, the Guide button provides complete procedures and regulations for room use. This is useful for ensuring compliance and orderly room use.

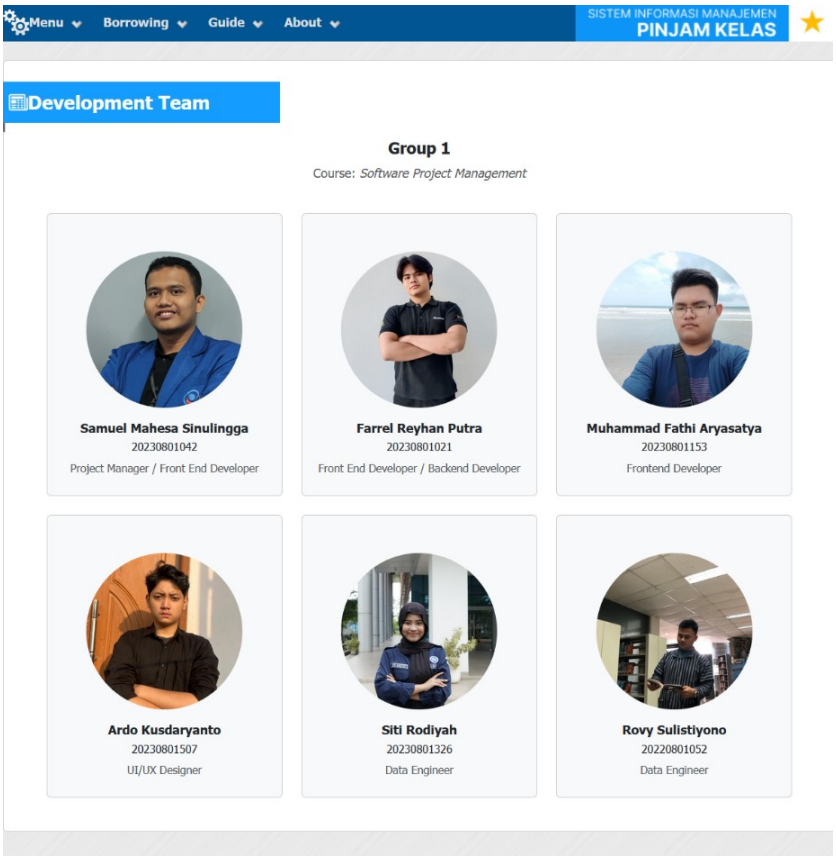

Figure 20. Development Team Page.

According to the manual, the booking process begins with logging in, selecting an available space, completing the booking form as needed, and submitting it. Once submitted, the process is forwarded to the Administrator. Users can monitor their applications in My Loans and are notified via WhatsApp if they are approved. Users can also cancel up to one day before use, to ensure space availability and the interests of other users.

In addition to a simple and structured booking process, several regulations are implemented to ensure compliance and orderly use of the space. The loan date cannot be the same as the application date, to allow sufficient time for the Administrator to process the application. If a request is submitted one day before or closer to the date of use, the booking will be automatically rejected by the system to ensure schedule

certainty and space availability. Furthermore, to ensure equitable access for the academic community, space usage is limited to a maximum of four hours per booking, ensuring equitable and equitable use of the space.

With the implementation of these regulations and procedures, the booking process can be more orderly, transparent, and accountable. This aligns with the issues raised in the introduction and the objectives to be achieved. With this implementation, the previously manual and unstructured room booking process can be streamlined, integrated, and directly monitored. This contributes to the effectiveness, accuracy, and satisfaction of users, namely the academic community of Esa Unggul University, in line with the institution's vision and mission.

Based on the discussion above, it can be concluded that the Esa Unggul University Room Rental Information System provides a relevant and significant solution. A complete summary of the implementation and discussion can be found in the next chapter.

4. Conclusion

Based on the design, implementation, and discussion outlined above, it can be concluded that the Esa Unggul University Room Rental Information System can meet the needs of the academic community by providing a room booking platform that is easy, fast, transparent, and widely accessible.

This system was designed based on the problems and needs encountered in the manual room booking process, namely the difficulty of managing schedules, disorganized room usage, and low process transparency. By implementing website technology, the CodeIgniter framework, and the Waterfall method, the booking process can be more structured, integrated, and directly monitored, thereby increasing effectiveness, accuracy, and user satisfaction [8], [9], [22], [23].

From the Administrator's perspective, booking management, approval, and room management can be easier, more organized, and more transparent. Meanwhile, from the Student perspective, the booking process can be carried out independently, quickly, and practically, from logging in, selecting a room, filling out the form, to tracking the booking status. This aligns with and fulfills the aspects expected in the introductory chapter and the objectives to be achieved.

Based on testing and feedback, the Room Rental Information System has been well-received and useful, as reflected in user satisfaction with the faster, more transparent, and more widely accessible process. This implementation allows the previously manual and unstructured room booking process to be more streamlined, accountable, and procedurally compliant.

The system can also be applied to other institutions requiring online room booking, adapting to their individual policies and needs. This way, technology can be leveraged to its full potential for improved, more transparent, and more accountable service..

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