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Web-based development of room management information system at Universitas Pertahanan using Rapid Application Development

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ABSTRACT

Unhan RI is an educational institution responsible for facilitating the continuity of student's academic activites, including the scheduling process that managed by the department's staff. The scheduling process requires components such as courses, lectures, time slots, and the classrooms. The number of available classrooms at Unhan RI is less than it need. Therefore, a proper scheduling system is necessary to manage scheduling and avoid conflicts between schedule. The development of information management system for administration's process that are still done manually are needed in this digital era. Because the large and continuously growing amount of data is difficult to process manually. The development is using Rapid Application Development method. This method is chosen because of the requirement time for the developing is short. By using the room management information system, the process of scheduling courses and managing rooms can be done easily. This system provides information of room availability and ongoing activites, helping to prevent scheduling conflicts.

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Introduction

The Republic Of Indonesia Defence University is one the university that is academically under the Ministry of Education and functionally under the Ministry of Defence (www.idu.ac.id). As an educational institution, academic activities are the main focus of the university. The university has the resposibility to facilitate the suistainability of student academic activities, including scheduling, class assignment, and student administration that are managed by staff of the department (Maulana et al., 2022). There are two type of scheduling in higher education level, course scheduling and exam scheduling (Suwondo et al., 2023). The scheduling process requires components such as courses, lectures, time slots, and classrooms. . Classrooms are used to conduct scheduled lectures. Additionally, rooms can be used for seminars and discussion.

The number of available rooms at The Republic Of Indonesia Defence University is less than the number of rooms needed. Due to this condition, classes are conducted with moving between different classrooms or nomadic. More over, the varying number of students in each department, for example, the medical department with 75, requires a suitable type of classroom. With these challenges, the process of scheduling and managing rooms becomes a complex task. However, The Republic Of Indonesia Defence University is a new university that is still undergoing development, including the addition of new study

programs and faculties. This development has an impact on the procurement of infrastructure to meet the learning facilities, including classrooms. Due to this development, the process of determining the number of classes and rooms used will still undergo many changes.

The process of scheduling and managing rooms requires good management. Currently, the scheduling process at the Republic of Indonesia Defence University, which includes the management of lectures, time, subjects, and rooms, is done manually using Excel by department staff, and it is not integrated. Staff still use chat group application to coordinate the usage of the room because there's no system that provides information about room availability. This makes it difficult for staf to create schedules due to challenges in room allocation and can occur schedule conflicts in the same room.

This study aims to develop a system that provides direct information on room availability to staff of department, in order to avoid schedule conflictsin the rooms. This system ia also provides an information system that is easy to access and use for staff of department. So the scheduling processcan be done easily and quickly.

Scheduling is a information that contains plans for activities or tasks to be performed, including the time and place of the activities, so it become orgnized activities and aligned with the target (Sallaby & Kanedi, 2020). According to the Kamus Besar Bahasa Indonesia, shedule is the allocation of time based on a planned sequence of task, a list or table of activities, in the form of an activity plan with detailed time distribution.

The information system consist of two words, system and information. A system is defined as a network of work that consists of interconnected procedures or methods to perform and complete a specific task (Sallaby & Kanedi, 2020). Information is a collection of data that has been processed into a form that has important value. The information becomes useful if it is presented to the right person at the right time (Kustina et al., 2022). An information system is an arrangement of data and information technology to collect, process, store, and provide the reequired information output to support an organization (Dwiyatno et al., 2022). Therefore, an information system is a system that provides information in accordance with its purpose.

become the industry-standard language for illustrating requirements, analysis, design, and also describing architecture in object-oriented programming (Putra & Andriani, 2019). UML is a popular modelling language that provides good system visualitation and documentation. Moreover, UML diagrams can be easily implemented into programming code (Maylawati et al., 2018). In this development project, we use several uml such as use case diagram and activity diagram. (a). Use case is a diagram to describe the logic and functionality of a software application (Akbar et al., 2021). A use case should be able to depict the behavior of the information system. Moreover, it describes the interaction between the user and the system through diagram. So that, programmers can understand the needs and desires of the users. (b). Activity diagram is a UML used to depict behavior of a system in terms of flow (Arora et al., 2020). Each activity diagram is uses oval shapes to describe functional requirements that are interconnected to establish a series of activities or scenarios. An activity diagram represent the workflow of a system.

Technology Stack Architecture is a diagram containing information about technologies used in a system development (Nikulchev et al., 2021). The used of technology in a development project affects the performance of the system being created. Technology stack architecture is determined at the beginning of the system development planning phase. It is important to select the appropriate technology stack (Martinsson & Svanqvist, 2022). In this study, the room management information system is developed in the form of a web application using React.Js, Express.Js, Node.Js, and PostgreSQL technologies.

A web application is a multi-platform application that can be accessed with various devices. Web applications are preferred because they have high access flexibility and are designed to be accessible from various types of user devices (Wijaya et al., 2021). React.Js is a Javascript library used to create efficient and easily developed web applications. React has component-based development method, provides smooth data transfer and offers the concpet of a virtual DOM (Abdurakhimovich, 2023). React is supported by comprehensive documentation and is based on a RESTful API, which allows for the development of complex applications (Muhammad & Lukman, 2018).

For the back-end application development using Express.Js and Node.js. Express.js is a web application framework for Javascript that is part of Node.js, providing ease in web application development by managing models, views, and controller (Yuliana et al., 2021). Node.js is one of the popular server-side Javascript execution programs that supports full-stack web application programming (Shcherbakov et al., 2023). Node.js operates asychronously, allowing it to handle multiple operations in a time. Node.js performs tasks according to needs, meaning that if there are no tasks to be executed, Node.js will enter sleep mode. Therefore, the use of Node.js in this study can save resources. . PostgreSQL is a database system designed by Postgres to process relational databases. PostgreSQL provides a client-server database system service (Felius, 2022). PostgreSQL supports the development of application with various programming languages such as Javascript and Python.

Suwondo et al. (2023) has developed a web-based scheduling information system using the extreme programming methode. This method is suitable for short-term application development and grouping development. The system can facilitate and optimize the performance of administration in scheduling process according to the latest regulation in the Accounting Department of Poliness. However, in this information system, there's no feature that displays room availability, so staff can only input scheduled data that has already been prepared for distribution to student and lectures.

The similar information system is developed by Samosir et al. (2020), the study is developed a web application that makes it easy for studeent to view their schedules. Because, before this study conducted, students only recorded the schedules given by teachers. The system is supported by a database to store a schedules. However, the system only handles fixed schedules with rooms that do not change.

Method

Rapid Application Development or RAD is a method for developing an information system that is commonly used by developers. This method is employed to shorten time required for the developing process, from design to implementation of an information system (Felius, 2022). RAD is suitable for saving development time and using resources effeciently according to their function (Susilo et al., 2023). RAD is considered to have faster development compared to the Waterfall, R&D, and Prototype methods, therefore this method is required by the author to build the system that will be designed (Fahma et al., 2022).

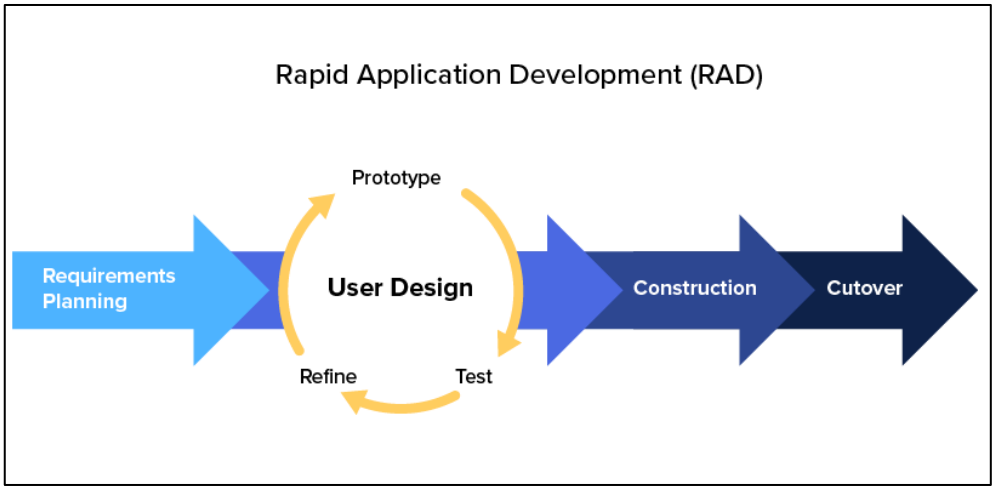

Figure 1. Rapid Application Development

The following are the stages of the Rapid Application Development (RAD) method process (Ardhana et al., 2022):

1. Planning

Planning is a step for analyzing and identifying the purpose of system creation. It is the process of identifying problems to determine the goals and functional requirements of the system. To determine this, information is needed as the basis for system formation, which is obtained from the problem identification process and the data collection process. In this study, the problem identification process was carried out by conducting interviews with study program staff and observing the system already used at the Republic Of Indonesia Defence University.

2. Design

Design is a stage to create a visual representation of the system using diagrams. In this process, system design is carried out based on problem identification and previous requirement planning. In this study, the system design is represented using UML diagram, use case and activity diagram, to help developers implement the system requirement in the application program.

3. Construction

Contruction is the execution phase of the program script that is carried out by programmer. This phase is the process of coding the system design that has been created. In this study, the design system is implemented using Javascript programming language with React.Js, Node.Js, and Express.js technologies. React.js provides many library to facilitate and accelerate the front-end development process, while Node.js and Express.Js are used for their ability to handle multiple processes. Additionally, PostgreSQL is chosen as the database management system due to its support for JSON data.

4. Cutover

Cutover is the testing phase of the system that has been built. The entire system is tested to ensure it meets the requirements and work as expected. In this study, the application testing process uses Blackbox testing method by preparing several test scenarios to test whether the system runs as planned.

Result and Discussion

1) Use Case

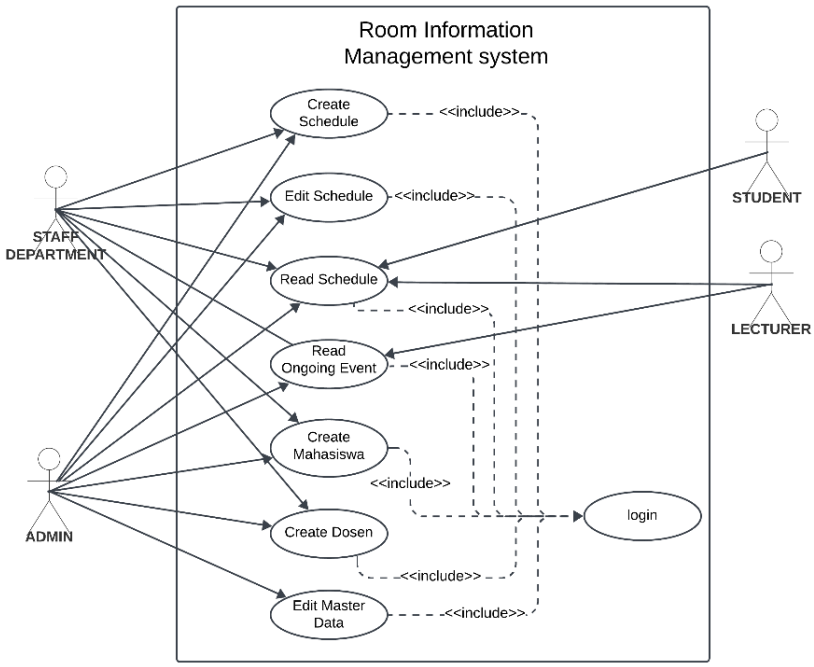

Figure 2. Use Case Room Management Information System

Based on Figure 2, the room management information system consist of four roles, namely student, lecturer, staff of the department, and admin. This system has seven main features which

assigned to each role according the their requirements within the system. The student can only use the feature to view the schedule in a week. Meanwhile dosen only have access to view their schedule and view ongoing event. Staff, as the primary users of this application, have access to the main features of the system, schedule creation and room management. As the full controller of the system, admin has special access to managed the master data ststem.

Table 1. Use Case Description Create Schedule

Use Case Name	Create Schedule
Actor	Staff and Admin
Description	Activities of the user to create a schedule in the system
Precondition	Login
Postcondition	If successful, the system will display a pop-up indicating that the data has been uploaded successfully.
alternatif	If it fails due to scheduling conflicts (e.g. the chosen time and room already booked), the system will show a pop-up notification to the user, informing them that the data upload was unsuccessful.

Table 2. Use Case Description Read Schedule

Use Case Name	Read Schedule
Actor	Student, Lecture, Staff, and Admin
Description	Activities of the user to read a schedule in the system
Precondition	-
Postcondition	If data exist then the system will show the schedule data based on department and day that is chosen.
alternatif	If data didn't exist then return a null table

2) Activity Diagram

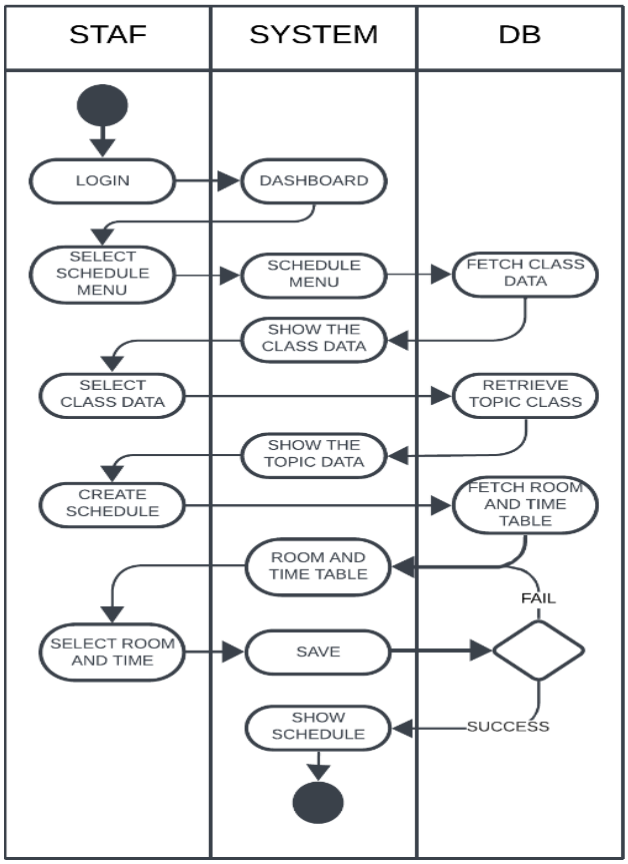

Figure 3. Activity Diagram Create Schedule

Staff are the main actor in the process of scheduling. Therefore, staff have the responsibility to always input schedule data to the system. Fig 2 explains the process flow of adding a schedule, which is performed by staff. The staff need to log in first before add the schedule. Then, staff should select the schedule menu to choose the class data. After that, the system will show a list of topic based on class data that is chosen. Next, staff will chose the topic, then the system will display a table of room and time that has been plotted. Staff only can choose an empty time slot in the same room. After selecting the time, the data will be sent and become a schedule that can be accessed by everyone.

3) Database

The database used in the system is Relational Database. The reason for choosing this type of database is that every data in the system is interconnected with each other. The data is linked by Primary Key and Foreign Key. The technology that is used to manage the database is PostgreSQL database. The following diagram is describe the relation between the data.

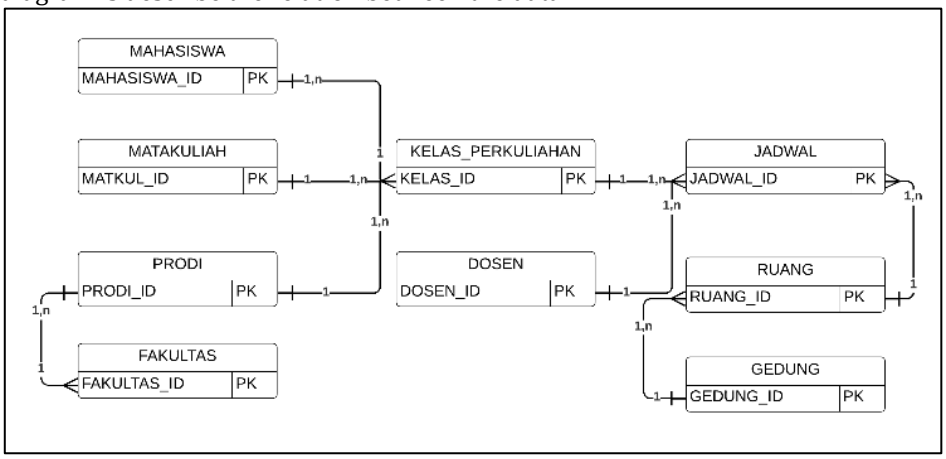

Figure 4. ERD System

4) System Architecture

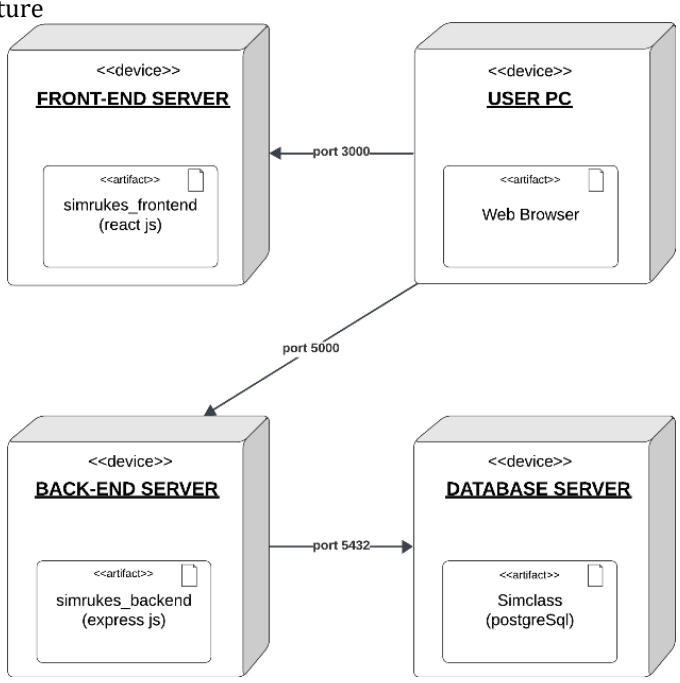

Figure 5. System Architecture

The system architecture of the room management information system application consist of several parts, such as User PC, front-end application server, back-end application server and database server. As shown in Fig 4, the first node is the user PC used by users to access the application. Next node is front-end application node developed with React.Js. Meanwhile, the back-end server is developed with Express.Js. The database node, which is directly connected to the back-end server node, is developed with PostgreSQL. The connection path to access the room managemen information system application start with user PC accessing the front-end application through port 3000, at the same time accessing the back-end server on port 5000. Then, on the back-end server, it connects to the database server using port 5432.

5) Implementation

The system implementation process is the process of programming the designed system into a finished product that can be used. In this study, the feature of the system is devided into modules. Such as dashboard, ongoing event, schedule, and master. Each module consist of several sub-modules. For example, schedule module consist of three sub-module, namely class, topic of class, and time table.

User interface is used for connect the user with the application system. Users can interacting in the application by providing a clear and consistent way of communicating with the system. It provides a way for user to input commands, receive output, and navigate through the system.

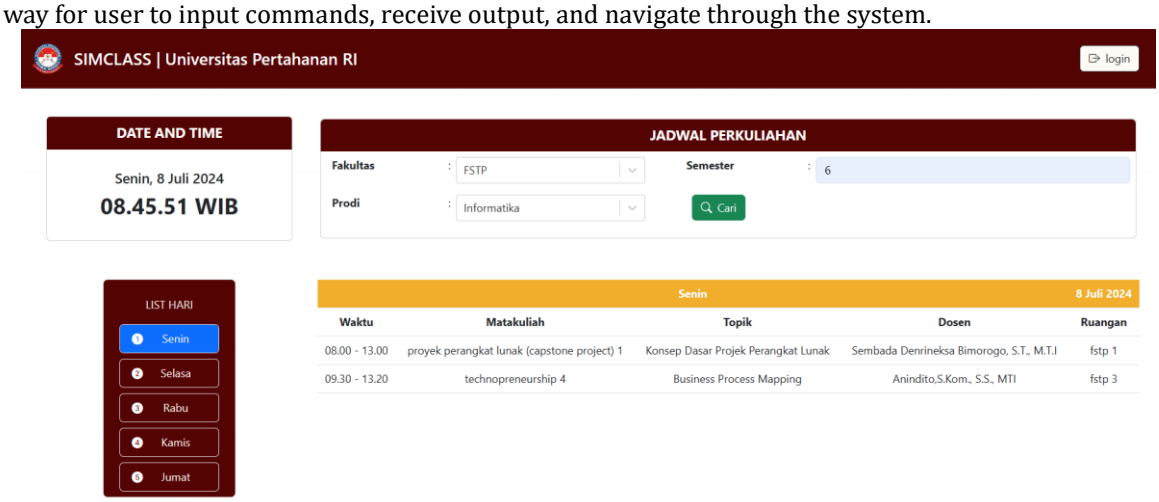

Figure 6. User Interface Read Schedule Dashboard

Figure 6 is user interface for viewing schedule. This feature can be accessed by all the users. To view the schedule the user need to input several data such as faculty, department and semester. After input the data, the user select the date to show the schedule data based on date.

Figure 7. User Interface Ongoing Event Dashboard

Figure 7 is user interface that provides information about ongoing schedule. From this page, lecturer can find out information which rooms that are currently in use. Therefore, if a lecturer needs to use a room, they can use an available room.

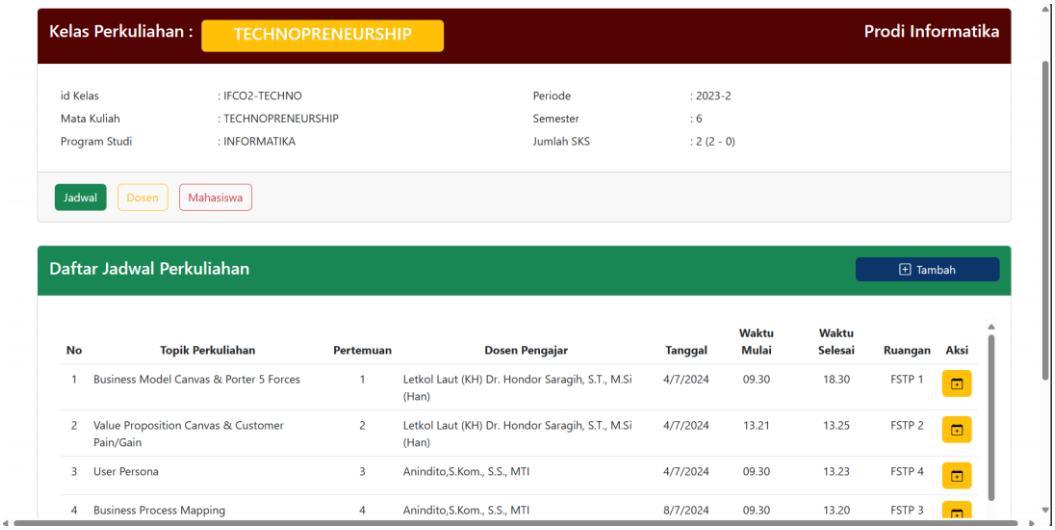

Figure 8. User Interface Topic of Subject

Figure 8 is a page that show a list of topic based on a class. This page is only can be accessed by staff and adminstrator. Each topic from this page will be scheduled to the time table.

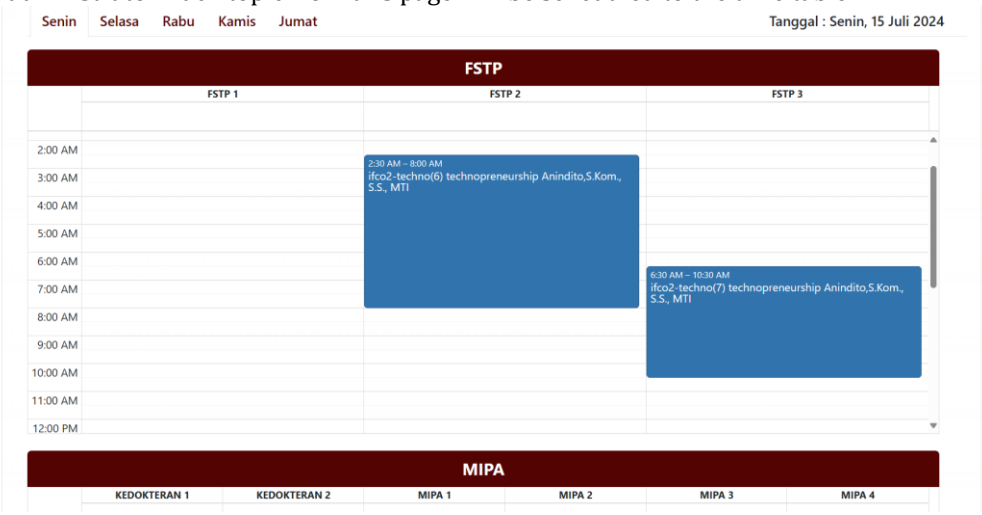

Figure 9. User Interface Timetable

Figure 9 is time table user interface. This page provides information about time slots where users can see which rooms and times are already occupied. This allows staff to avoid selecting rooms and times that already booked and helps to prevent schedule conflicts.

6) Testing

To ensure the application runs according to its function, application testing is necessary. This study using blackbox testing method runs the application testing. The blackbox testing method is used to observe the execution results with test data and provide an evaluation of the functions in the application (Febrian et al., 2020). Here's the result of the testing :

Table 3. Blackbox Testing

No.	Test Case	Input	Expecting Result	Actual Result	Pass/Fail
1	Login	Invalid Username and Password	Error message	System show the pop up "login unsuccessfull	Pass
2	Read Schedule Dashboard	Valid data and chose the date	System show the schedule data based on inputed data and chosen date	System show the schedule data based on inputed data and chosen date	Pass
3	Ongoing Event Dashboard	Exist Data	System show the on going event data	System show ongoing event data	Pass
4	Create Schedule	Same time with the currently data	Error message	System show the erorr message that the time has already occupied with other schedule	Pass
5	Create Schedule	Valid Data	System save the data to the database	System show the schedule data that currently save	Pass

Conclusion

A Web-Based Room Management Information System can be used to help staff make schedules more easily. The system provides information about the availability of rooms to staff for scheduling purposes. This allows staff to avoid using rooms and times that have already been booked by other department. The system also provides information about ongoing activities. Through the system, lectures, staff, and administrator can find out which rooms are currently in use. Because of the schedule menu can be accessed on the dashboard page, the students do not need log in to the system. this makes it easier for students to access their schedules. With this application, the process of scheduling and distributing schedules to lectures and students in Republic Of Indonesia Defence University can be done easily and shortening the time required for scheduling process. Moreover, the monitoring of room usage can also be viewed directly. So it can improve the efficiency and effectiveness of the scheduling process. The development of this room management information system still has many shortcomings. Therefore, further development is needed to improve the application such as the addition of a student list for classes with a checklist student names, status feature for class topic to ensure that the topic has been completed and cannot be edited, log activity, and attendance recap feature.

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