Design and Construction of Computer Usage Reporting System Application for the Department of Electronic Engineering Laboratory, FT UNP

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Abstract -Management of computer usage in the laboratory requires a system that can facilitate recording and monitoring of usage by students and laboratory technicians. Currently, recording is still done manually using control sheets, making it prone to recording errors and difficult to recapitulate data. This study aims to design and develop a web-based laboratory computer usage reporting system application for monitoring. The development method used is a prototype, with Laravel as the framework, Bootstrap for the interface display, and MySQL as the database. The test results show that this system is able to increase the efficiency of recording computer usage and make it easier for technicians to access usage reports in real-time. The implementation of this system is expected to be an effective solution in managing computer laboratories.

Keywords— Reporting System, Computer Usage, Laboratory, Monitoring, Prototype Method.

I. INTRODUCTION

Information technology plays a crucial role in modern industry, enhancing business strategy, competitive management, and productivity—especially through advances in the internet and modern computing[1]. As these technologies advance, human work can be completed more quickly. However, despite rapid progress, computer lab management still faces significant challenges.

The computer lab serves as a means of testing, experimenting, and learning information technology. With 172 computers and a high level of use—an average of three students per computer per day—efficient management is critical. Without an adequate system, monitoring computer usage is at risk of being ineffective, which can lead to hardware damage, wasted time, and suboptimal resource utilization[2].

DOI:
10.24036/int.j.emerg.technol.eng.educ..v1i2.36

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Received: 05-02-2025
Revised: 10-02-2025
Accepted: 15-02-2025
Published: 16-02-2025

The average laboratory usage ranges from 4 to 12 hours per day, making manual record keeping increasingly difficult and inefficient. A digital reporting system is essential to address inefficiencies, reduce workloads, and prevent data loss. In this fast-paced digital era, the ability to manage data in real time is essential to speed decision making and response to problems.

Therefore, the development of a laboratory computer usage reporting system application is not only a strategic choice, but also an urgent need. This application is expected to be able to monitor computer usage more efficiently, reduce the risk of damage, and improve the student learning experience. With a better system, laboratory technicians can focus on maintaining and improving the quality of service, not just dealing with problems due to the current suboptimal management.

Based on an interview with a laboratory technician, Mr. Fahlul, on Friday, August 2, 2024, it was discovered that recording computer usage was still done manually. This confirms the urgency of switching to a more modern and efficient system. With this application, monitoring and reporting of laboratory usage can be done more quickly and accurately, supporting the smooth running of the teaching and learning process in the Department of Electronic Engineering.

II. LITERATURE REVIEW

A. Application

In the context of laboratory management, an application is a software system designed to facilitate the tracking and reporting of computer usage. This application not only serves to complete specific tasks, but also to improve operational efficiency in a computer laboratory environment, including the management of usage data and device maintenance[3].

B. Reporting System

A reporting system is a system used to collect, manage, and generate reports or information needed for business or organizational purposes. In the context of a laboratory, a reporting system plays an important role in monitoring computer usage and hardware maintenance effectively. A good reporting system can collect data from various sources, analyze it, and generate relevant reports for decision makers[4].

Key components of a reporting system include software used for data collection, analysis, and visualization. The use of appropriate reporting software can improve the efficiency of data management and produce more accurate and understandable information[5]. The technological infrastructure that supports this system includes servers, networks, and databases capable of handling large volumes of data.

C. Laboratory

The laboratory is an educational facility that functions as a place for practical work and research in various disciplines. In a computer laboratory, monitoring device usage is essential to maintain operational efficiency and effectiveness. With 172 computer units and a high level of usage, computer laboratory management must be carried out with a structured system in order to maximize resource usage[6].

Laboratories play an important role in practical-based learning, especially in developing digital skills in today's digital era[7].

D. Prototype

Prototype is a system design method that emphasizes the creation of programs quickly and gradually, so that the system can be evaluated earlier by users. This prototype functions as an initial model of the system to be built, providing a clear picture of the structure, function, and operations that will be applied in the development of a laboratory management system[8]. By using this method, developers can obtain direct feedback from users to ensure that the system built is in accordance with needs.

E. Laravel

Laravel is a PHP-based web framework designed to simplify the development of web systems using the Model-View-Controller (MVC) architecture. Laravel was chosen for this laboratory management system because of its ability to handle common tasks such as authentication, routing, and caching in an efficient manner. With its MVC structure, Laravel ensures the development of a structured, maintainable, and scalable system[9].

Laravel has several advantages, including complete documentation, a large community, and various built-in features such as Eloquent ORM and an authentication system that make it easier for developers to build applications[10]. This framework also supports automated testing, thus helping to ensure the quality of the application before it is implemented. However, Laravel also has several disadvantages, such as relatively high resource consumption compared to other PHP frameworks and a fairly challenging learning curve for beginners. However, with the features offered, Laravel remains the right choice for developing this laboratory management system.

F. Bootstrap

Bootstrap is an open-source framework used to build responsive web applications, namely applications that can adjust their appearance to the screen size of the device being used. Bootstrap was chosen for this laboratory management system because of its ability to create a friendly and easy-to-use user interface, as well as responsive on various devices, so that users can access the application comfortably[11].

G. Database

A database is a collection of information stored systematically in a computer to facilitate data management and retrieval by the system. In a laboratory management system, a database is used to store data related to computer usage, device maintenance, and user information needed to produce accurate and timely reports[12].

III. METHOD

This study uses a prototype development method, an approach in software engineering that allows developers and users to interact through an early model of the system before further development is carried out. This method helps in understanding user needs better and allows for iterations of improvements based on the feedback received.

The prototype method in this research follows several main steps:

1. Communication: The initial stage in the system development process, where developers and users discuss the needs of the system to be built.
2. Quick Plan: The initial planning stage that determines the system's primary requirements and development constraints.
3. Modelling Quick Design: Creation of an initial design that includes a rough outline of the interface and main features of the system.
4. Construction of Prototype: Implementation of an initial model of the system that can be tested by users.
5. Deployment, Delivery & Feedback: The prototype is tested by users, feedback is collected, and improvements are made iteratively until the system optimally meets user needs.

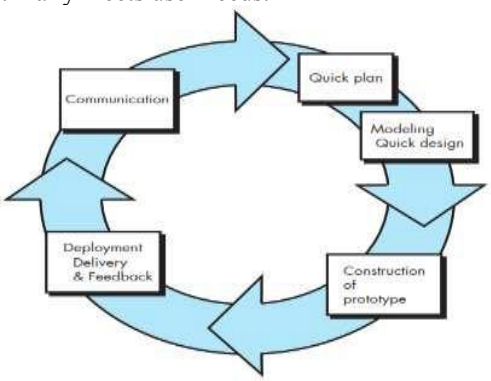

Figure 1. Prototype method

1. Communication

The research on the design of the laboratory computer usage reporting system application was carried out using a number of tools and materials and a number of system design steps. The method used is the prototype method, which is a software development method that uses an approach to create designs quickly and gradually so that they can be immediately evaluated by prospective users/clients. With this prototype method, developers and clients can interact with each other during the system prototype creation process.

2. *Quick Planning*

A. Running System Analysis

Communication is the initial stage in system design that aims to obtain data to analyze user and system needs. At this stage, communication with users is carried out through interviews with parties involved in laboratory management. Communication or interviews are conducted with laboratory technicians and laboratory heads as the main users of this computer usage reporting system. At this communication stage, several data and facts are obtained relating to the condition of the computer usage recording system that is currently running in the laboratory of the Department of Electronic Engineering, FT UNP.

B. Proposed System Analysis

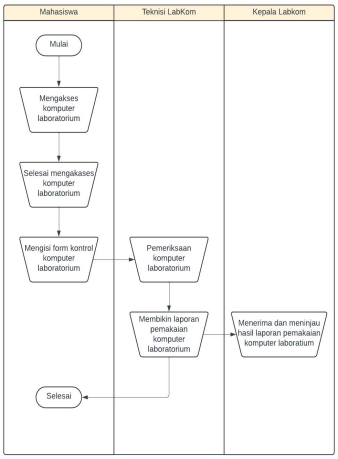

Figure 2. Flowmap of the running system

3. *Quick Design Modeling*

A. Use Case

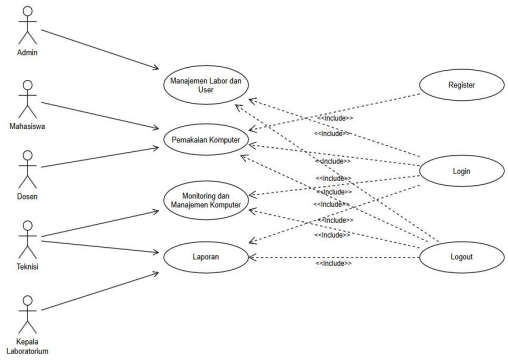

Figure 3. Use Case

B. Activity Diagram

1. Registration Activity Diagram

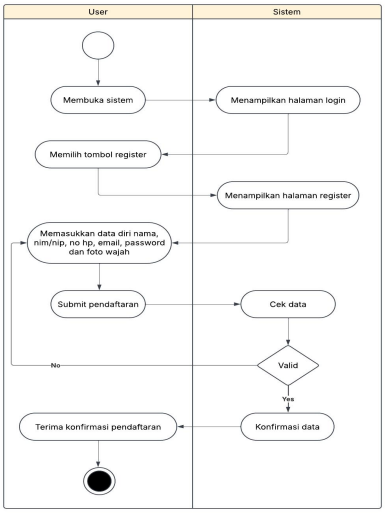

Figure 4. Registration Activity Diagram

2. Activity Diagram Usage Process

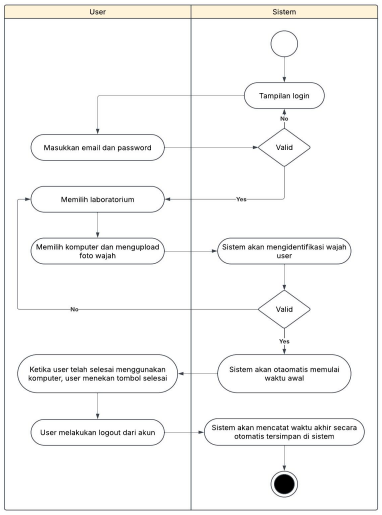

Figure 5. Activity Diagram of Usage Process

3. Activity Diagram Admin

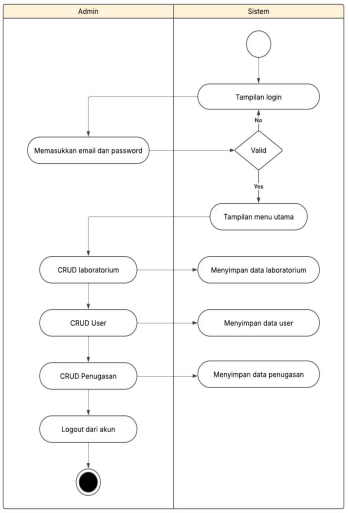

Figure 6. Admin Activity Diagram

4. Technician activity diagram

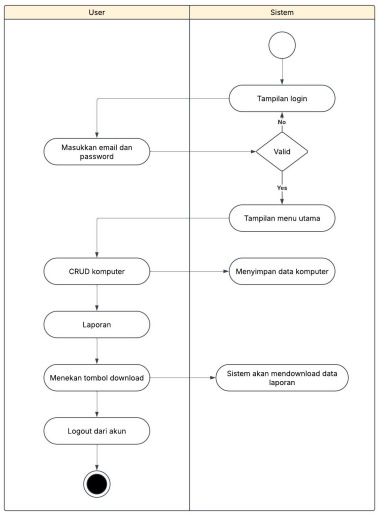

Figure 7. Technician Activity Diagram

5. Activity Diagram Head of Laboratory

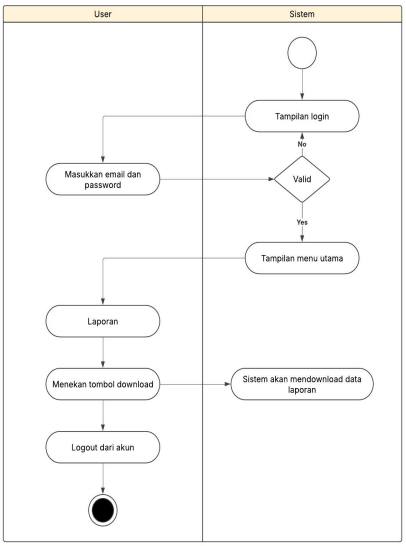

Figure 8. Activity Diagram of the Head of Laboratory

C. Class Diagram

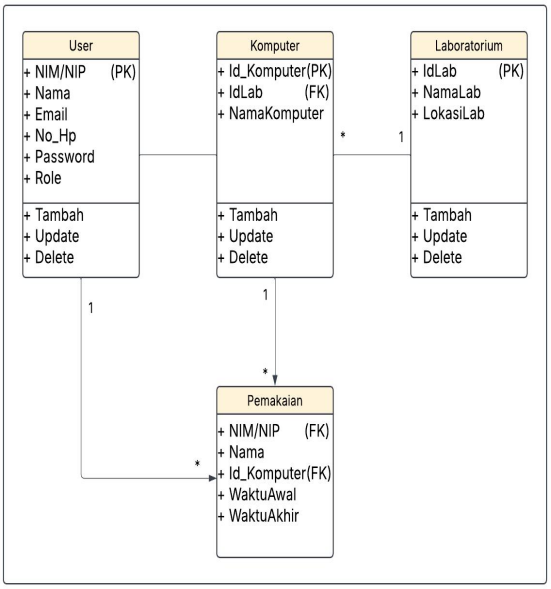

Figure 9. Class Diagram

4. Prototype Construction

This stage is the peak stage in building a software, namely the use of computers is very large in this step. After coding, the programmer will do testing. Testing aims to find errors or bugs in the system/software that has been built to be fixed before being submitted to the client.

A. System Interface Design Results

1. Login Page

The login page is the first page displayed when the system is running. This page serves as an intermediary for users who have been granted access rights to enter the system. On the login page, there is a system name, a form to enter email and password, and a login button for users who want to access the system. The login page display is as follows:

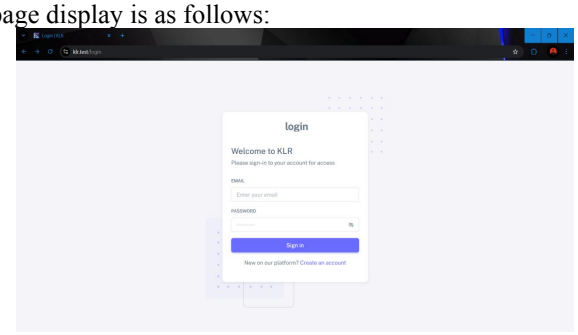

Figure 10. Login Page

2. Admin Page

a. Laboratory Management

This laboratory management menu allows admin to manage laboratory data in the system.

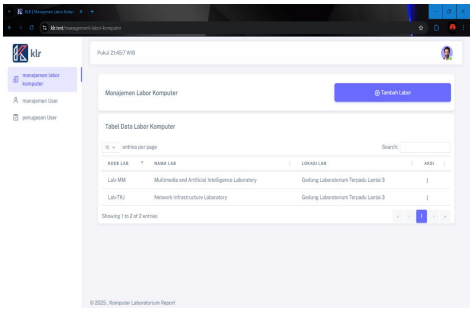

Figure 11. Laboratory Management Menu

Admin can add laboratories by pressing the "Add Laboratory" button on the laboratory management page as needed.

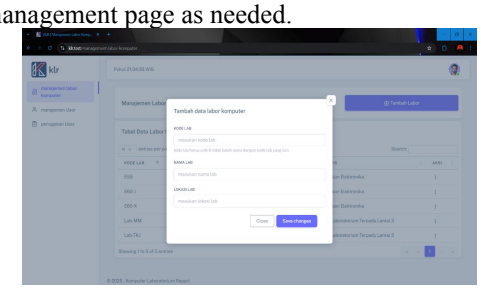

Figure 12. Add Labor Feature

b. User Management

This user management menu is used by the admin to manage user data in the system, including students, lecturers, technicians, and laboratory heads.

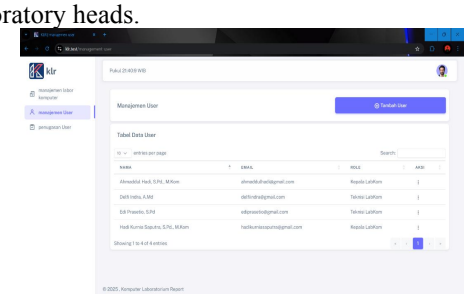

Figure 13. User Management Menu

Admin can add technicians and laboratory heads by pressing the "Add User" button on the user management page as needed.

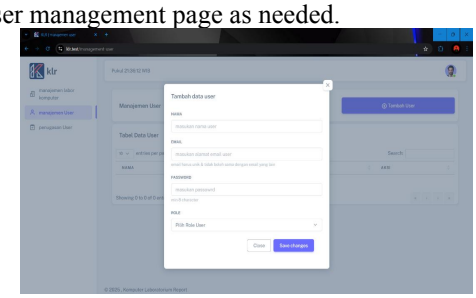

Figure 14. Add User Feature

c. User Assignment

This user assignment menu is used by the admin to assign laboratory roles or responsibilities to technicians and laboratory heads in the system.

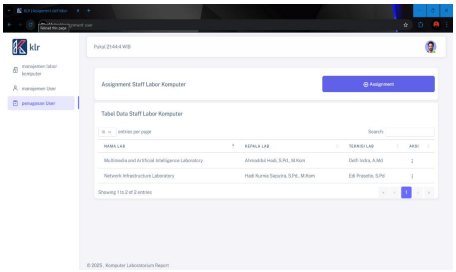

Figure 15. User Assignment Menu

Admin can add technician and laboratory head assignments in each laboratory by pressing the "Assignment" button on the user assignment page according to their placement.

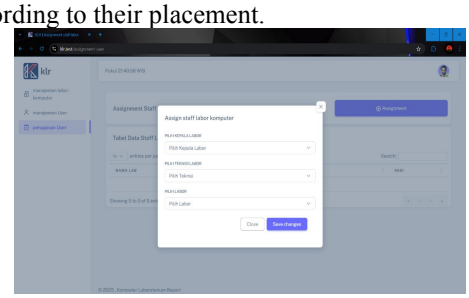

Figure 16. Assignment feature

3. Technician Page

a. Home

The home menu is the main page displayed to technicians after logging in, which displays a display like the image below:

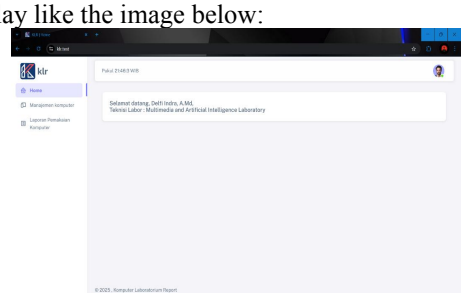

Figure 17. Home Menu

b. Computer Management

This computer management menu is used by technicians to manage data within the system.

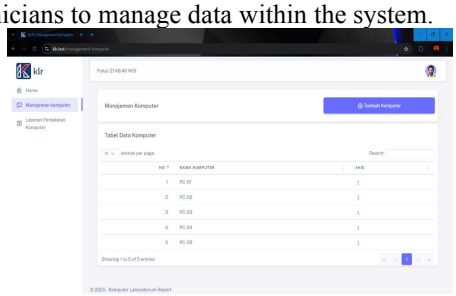

Figure 18. Computer Management Menu

Technicians can add computer data to the system by pressing the "Add Computer" button on the computer management page as needed.

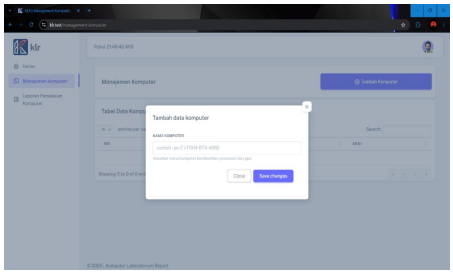

Figure 19. Add Computer Feature

c. Report

This report menu is used by technicians to view computer usage records and can download computer usage reports by pressing the "Download" button.

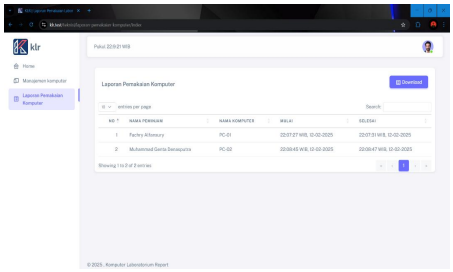

Figure 20. Report Menu

4. Head of Laboratory Page

a. Home

The home page is the main page displayed to the laboratory head after logging in, which shows a display like the image below:

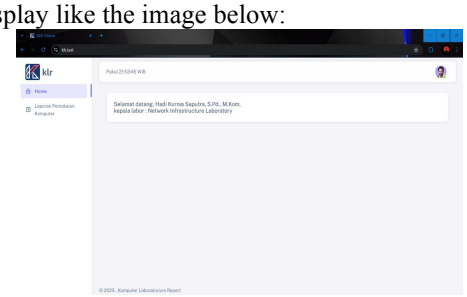

Figure 21. Home Menu

b. Report

This report page is used by the laboratory head to view computer usage records and can download computer usage reports by pressing the "Download" button.

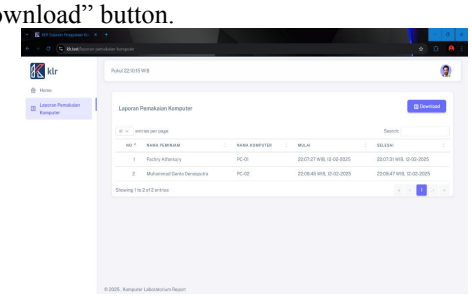

Figure 22. Report Menu

5. Registration Page

The registration page is a page used to register new users into the system. This page allows users who do not yet have an account to create an account by filling in the required information. The registration page display is as follows:

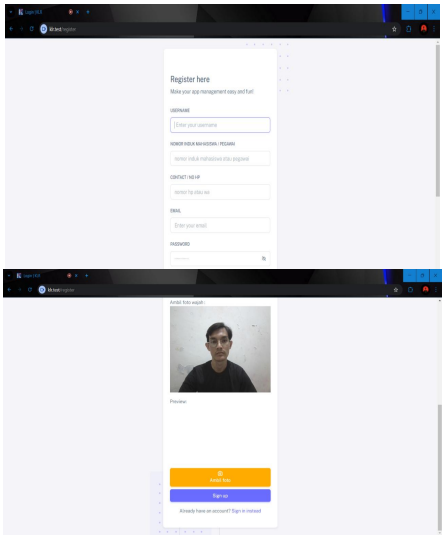

Figure 23. Registration Page

6. Laboratory Computer Usage Page

The laboratory computer usage page is a page used by students and lecturers to access computers in the laboratory. On this page, students and lecturers must select the laboratory they are currently occupying.

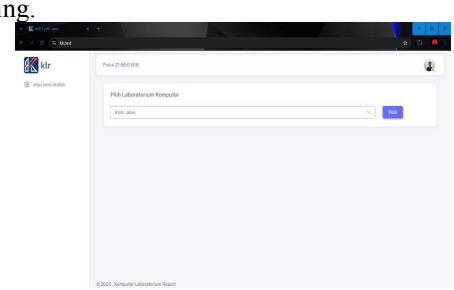

Figure 24. Select Laboratory Feature

Students and lecturers must select the computer they will use and take a facial photo to upload as user identification.

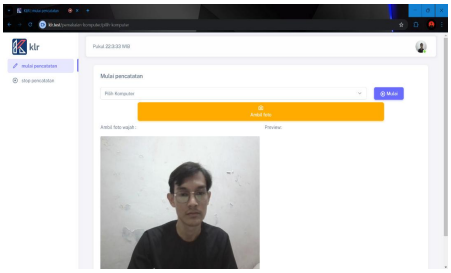

Figure 25. Select Computer and Upload Face Photo Features

Computer usage starts automatically. After finishing using the computer, students and lecturers must press the "Finish" and "Logout" buttons from the account so that the start and end times of computer usage are automatically recorded into the system.

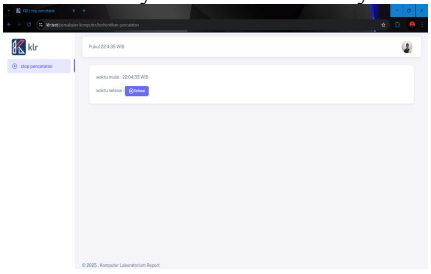

Figure 26. Computer Usage End Time and Logout Features

B. Discussion

The user interface design result points have displayed the pages and features of the Laboratory Computer Usage Reporting System. The following is a discussion of the results of the display design.

1. Login Page

The login page is the starting point for users to access the system. Users are asked to enter their registered email and password. If the data entered is valid, the user will be directed to a page according to their role, whether as an admin, student, lecturer, technician and head of the laboratory. The login page ensures that only users with access rights can enter the system, maintaining security and access control according to the assigned role.

2. Admin Page

The admin page is designed to provide full control over laboratory management, user management and assigning users in the system. Here are some menus that the admin can do:

a. Laboratory Management

The laboratory management menu is a menu that contains laboratory data. Admin can add, edit, and delete laboratory data in the system. This feature allows admin to manage laboratory-related information, such as laboratory code, laboratory name and laboratory location.

b. User Management

The user management menu is a menu that contains user data consisting of borrowers (students and lecturers), technicians and laboratory heads. Admin can edit, delete data and add technician and laboratory head data in the system, admin also ensures they have access according to their role in the laboratory.

c. User Assignment

The user assignment menu is a menu that contains data on the assignment of special tasks or roles to technicians and laboratory heads to manage computers in the laboratory. This assignment helps ensure that each role functions optimally in laboratory management. Admin can edit, delete data and add data on the assignment of technicians and laboratory heads in the system

3. Technician Page

The technician page functions to manage computers, monitor computer usage and download computer usage data in the report. Here are some menus that technicians can do:

a. Computer Management

b. Report

4. Head of Laboratory Page

The lab head page functions to monitor computer usage and download computer usage data in the report. Here are some menus that technicians can do:

a. Report

The report menu is a menu that contains records of computer usage data. The head of the laboratory can monitor computer usage data and download the computer usage data report into an excel file.

5. Register Page

The register page is a new user page to create an account in the system. Users are asked to fill in the required information, such as name, nim/nip, email, cellphone number, password and upload a face photo for identification. After successful registration, users can use the credentials that have been created to log in to the system. The register page ensures that only authorized users can register and access the system, maintaining the security and integrity of user data.

6. Computer Usage Page

The laboratory computer usage page is a page that can be accessed by students and lecturers to access computers in the laboratory. After students and lecturers log in, the system will display the selection of laboratories and computers. Each user is required to select a laboratory according to the place they occupy and select the computer to be used. Next, the user must take a photo of the face to be identified by the system, then the user presses the start button. If the start time in the system runs automatically, it means that the face photo has been successfully detected, if the start time does not appear, it means that the face photo has failed to be detected and the system will return it to the beginning, namely the selection of laboratories and computers. If the user has finished using the computer, the user is directed to press the finish button to stop the start time from the end time. Then the user logs out so that the computer usage data is automatically recorded in the system.

C. Testing

No	Tested page	Test scenario	Input	Output expectations	status
1	Login page	User enters correct email and password	Valid Email & Password	User successfully logged into the system according to his role	V
		User entered incorrect email or password	Email / Password is incorrect	The system returns to the login page	V
2	Register page	Students/ lecturers fill out the registration form	Name, NIM/ NIP, Email,	Account has been successfully created	V

		with valid data	cellphone number, Password and face photo	and can be used to login.	
3	Laboratory admin-management page	Admin added new lab with valid data	Laboratory code, laboratory name and laboratory location	Laboratory successfully added	V
		Admin deletes available labs	Delete button	Lab successfully deleted	V
4	Admin page-user management	Admin adds technician or lab head account	Name, email, password and role	Account has been successfully created and can be used to login.	V
		Admin deletes user from system	Delete button	User account successfully deleted	V
5	Admin page-user assignment	Admin assigns labs to technicians and lab heads	Select the laboratory head, technician and laboratory name.	Assignment successfully saved	V
6	Computer technician-management page	The technician adds a new computer to the system.	Computer name	Computer successfully added	V
		The technician removed	Delete button	Computer successfully	V

		the computer from the system.		erased	
7	Technician-report page	Technician accesses list of computer usage reports	Click "Report"	The list of reports is displayed	V
		Technician downloads usage report	Click "download"	Report successfully downloaded	V
8	Head of laboratory page-report	The head of the laboratory looks at the list of computer usage reports.	Click "Report"	The list of reports is displayed	V
		The head of the laboratory downloads the computer usage report.	Click "download"	Report successfully downloaded	V
9	Laboratory computer usage page	Students/ lecturers choose laboratories and computers	Select lab & computer	The system records laboratory and computer selection.	V
		Students/ lecturers take facial photos for identification	Camera active & photo uploaded	The system saves the photo for verification.	V
		Students/ lecturers press the "Finish" button after using the computer	Click "Finish"	The system records the start and end times of use.	V

5. Deployment Delivery & Feedback

After the prototype development and testing process is complete, the next step is the Deployment, Delivery, & Feedback stage. At this stage, the developed web-based laboratory computer usage reporting system with camera features for monitoring and user authentication will be implemented and handed over to the end user. Testing is carried out to ensure that the system functions optimally according to the needs and objectives that have been set, making it a very important stage in the software development cycle.

This testing aims to verify whether the system works well and meets the specified requirements, including in terms of functionality, performance, and security. After the system is launched, developers also collect feedback from users, such as laboratory technicians, students, and lecturers, to evaluate their experience in using the system. This feedback is very valuable for identifying areas that need to be fixed or improved, as well as understanding whether the system has met user expectations. If problems or new needs are found, development will continue to make the necessary improvements or adjustments.

IV. CONCLUSION

The conclusions obtained from the design results of the Computer Usage Reporting System for the Electronics Department Laboratory, FT UNP are as follows:

1. The system built significantly reduces manual workload, increases data accuracy, and makes it easier for laboratory technicians to record and manage computer usage data more efficiently.
2. The results of the system testing test obtained system function results with 100% accuracy.

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