Jurnal Media Teknik Elektro dan Komputer
Vol. 01, No. 02 (July – December, 2024)
E-ISSN: 3063-2927

Web-Based Information System for Borrowing Practical Laboratory Equipment for The Faculty of Public Health

Suthan Farras Ashar[1], Farhan Iqbal[2]

[1] Universitas Islam Negeri Sumatera Utara; suthanfarras160@gmail.com
[2] Universitas Islam Negeri Sumatera Utara; farhaniqbal089123@gmail.com

ABSTRACT

Adequate lecture facilities and infrastructure are important factors in supporting the teaching and learning process, especially at the Faculty of Public Health Sciences, State Islamic University of North Sumatra, where there is a Health Laboratory Unit with the availability of tools to support practicum activities. Lecture facilities such as practical tools and measuring instruments have a great risk of damage and loss, so a good tool loan transaction recording system is needed so that borrower data and the existence of tools can be known. With the condition of students who increase every year, the application of the manual system is no longer efficient and effective to apply. Therefore, this study focuses on the development of a web-based information system to support the laboratory equipment lending process at the Faculty of Public Health. The main results show that this system can help improve the efficiency of the equipment lending and returning process by reducing administrative barriers and providing transparency on laboratory equipment inventory data. The research process involves problem identification, system development, testing, evaluation and revision. The main problems found at the research location were such as the equipment lending process which was previously done manually, causing recording errors and data loss and lack of transparency in equipment availability so that there were often schedule conflicts or user ignorance about the status of the equipment. The system developed aims to overcome the problems that exist in the laboratory by presenting a more practical and integrated information technology-based solution.

Keywords: Website Application, Information System, Laboratory Services, Practical Laboratory

Corresponding Author:
Suthan Farras Ashar
Universitas Islam Negeri Sumatera Utara; suthanfarras160@gmail.com

1. INTRODUCTION

A laboratory is a container or place of buildings, rooms with all kinds of equipment and materials needed for scientific activities. As one of the departments in the Faculty of Public Health, State Islamic University of North Sumatra, in the Public Health Science Study Program there is a health laboratory that has the most and most complete equipment in the Faculty of Public Health. All of this equipment is managed by the Technical Implementation Unit (UPT) which provides health equipment facilities and infrastructure. Some of the duties of the UPT Health Laboratory include supervising, checking and repairing damage that occurs to health equipment facilities used by users in carrying out their activities on campus and off campus.

Adequate lecture facilities and infrastructure are important factors in supporting the teaching and learning process. Lecture facilities such as practical tools and measuring instruments have a great risk of damage and loss, so a good tool loan system is needed so that borrower data and the presence of tools can be known. The development of information technology has changed humans in completing their work to solve the problems they face. Previously, humans looked for information limited to books, print media and verbally. The internet is a tool for finding information quickly and easily used. The application of a computerized system is also needed by laboratory staff in the laboratory of the Faculty of Public Health, State Islamic University of North Sumatra in serving the supply of laboratory practice tools. This is because the service process has long used a manual system by recording in a book. With the condition of students who increase every year, the application of the manual system is no longer efficient and effective to apply. Because with the increase in the number of students, the intensity of the need to borrow laboratory practice tools also increases.

An information system is a configuration that performs a series of transformations or better known as a series of processes. This process starts from observing a certain reality, defining entities and their attributes and converting them into data, then into information that users need. Laboratory Management is a systematic process that includes collecting, storing, maintaining, processing, retrieving, and validating data needed by the laboratory to make appropriate management decisions. The Faculty of Public Health Laboratory serves the loan of equipment, rooms and packages to students and lecturers, both for use in the learning process, as well as for research and community service purposes. The loan transaction process with many packages containing various types of equipment requires an effective and efficient data recording system. The purpose of this study is to assist the laboratory staff of the Faculty of Public Health in serving all processes of borrowing, returning, procuring and repairing equipment. This information system provides information on student activities in practicing and using equipment in the Faculty of Public Health laboratory, as well as the availability of equipment with a student ratio so that it can support decisions for faculty leaders in procuring and monitoring the use of equipment in the laboratory.

2. LITERATURE REVIEW

2.1. Tool Inventory

In building a Web-based Information System for Lending Laboratory Practice Tools for the Faculty of Public Health, there are several theories that form the basis for the development of this system. The following foundation theories include the concepts of information systems, inventory, web development, and related technologies.

Tool Inventory is an asset that is stored to support student operational activities. In the laboratory, inventory includes laboratory equipment, chemicals, and practicum equipment. Poor inventory management can result in stock errors, practice delays, and budget wastage. An automated and web-based system helps minimize these risks. With good management, the inventory of practical tools in the Faculty of Public Health laboratory can be optimally used to support student learning and research.

2.2. Web Technology

Web technology involves various components, such as HTML, CSS, JavaScript, PHP, and other web frameworks, to build web-based information systems. In this research, web technology is used to

design a user-friendly user interface (UI), process data through server-side programming, and display data stored in the database to users in real-time.

2.3. Application Design Theory Using UML

UML (Unified Modeling Language) is a modeling language used to describe, design, and document software systems. In the context of system information development, UML provides various diagrams that help in understanding the requirements and processes of the system involved. Two diagrams that are often used in application design are use case diagrams and activity diagrams. Use case diagrams are diagrams that describe the interaction between users (actors) and the system, while activity diagrams are diagrams that describe the workflow of a process in the system.

2.4. UML Application in Projects

The application of UML in real projects is essential to ensure that the design system can be understood and implemented properly. In the development of a laboratory equipment lending system, UML is used to document and design the system effectively. The application of UML in software development projects provides benefits such as better communication and clear documentation. From the student's perspective, this system has a positive impact by ensuring the availability of tools needed in practical activities. With better stock management, the risk of delays or disruptions in the implementation of practice due to lack of materials can be minimized. This also improves the quality of the learning process in the laboratory, which is an important element in education at the Faculty of Public Health. Overall, this web-based laboratory practice tool lending information system is an innovative step in the digitalization of laboratory management.

This implementation system not only supports operational efficiency, but also increases transparency, accuracy, and effectiveness of laboratory material management. In developing a laboratory tool lending information system, the use of UML, especially use case diagrams and activity diagrams, is very important to ensure that all identified user needs and processes involved in the system can be clearly understood. With this systematic approach, developers can create more efficient and effective systems, as well as increase user satisfaction.

3. METHODS

This study aims to build a web-based laboratory equipment lending information system in the laboratory of the Faculty of Public Health (FKM). This system is designed to improve efficiency and effectiveness in the laboratory inventory management process. Further explanation of the research stages is as follows:

3.1. Research Phase

This research goes through several stages, starting from data collection to system implementation and evaluation. The flowchart and table presented below illustrate the working process of the web-based laboratory equipment loan information system at the Faculty of Public Health. This web-based information system will be able to facilitate the laboratory equipment loan process in a more organized and efficient manner, thus supporting teaching and learning activities. The following is a flow diagram and table in the Laboratory Practical Equipment Loan Information System at the Faculty of Public Health:

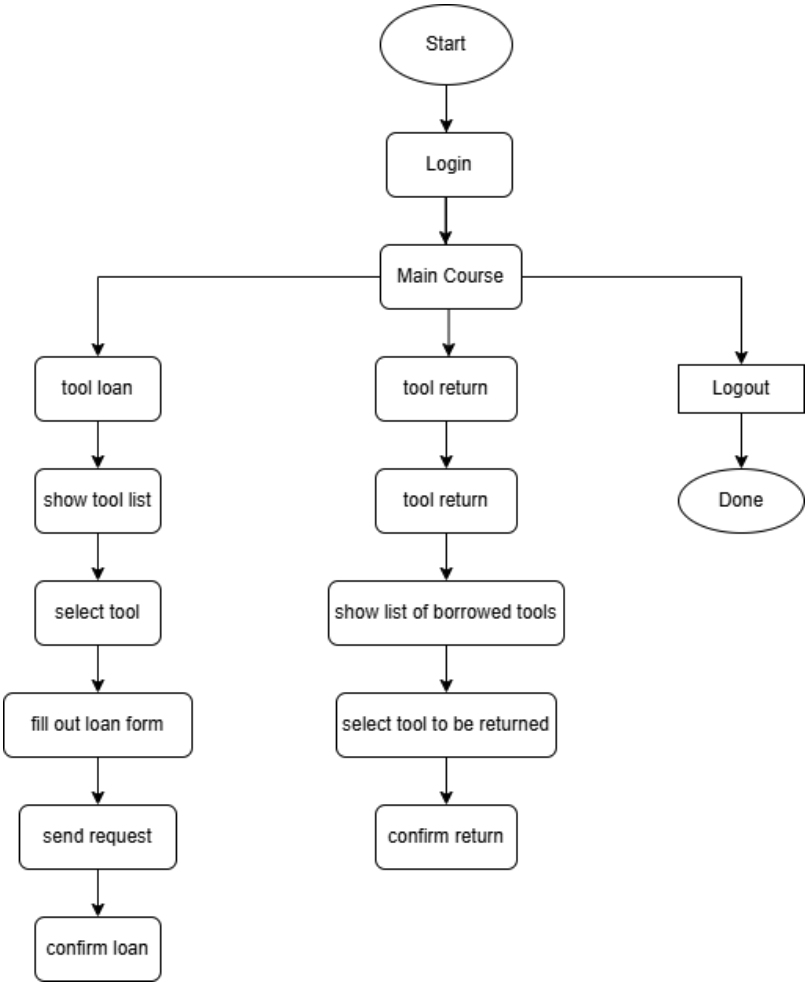

Figure 1. Diagram of Laboratory Practice Equipment Loan Information System

The flowchart above illustrates the workflow of a web-based laboratory practice tool loan information system. This system is designed to facilitate the borrowing of laboratory equipment at the Faculty of Public Health. With this system, it is expected that the loan of laboratory practice tools will be more efficient and organized, thus supporting teaching and learning activities at the Faculty of Public Health. As for the table containing the tools needed in the UINSU Faculty of Public Health Laboratory, the following table shows a list of laboratory equipment available at the FKM Laboratory:

Table 1. Table of Practical Tools in the FKM Laboratory

No	Tool	Type	Amount
1	Beaker glass	100 mL; 250 mL; 500 mL/pyrex	10
2	Pestle and mortar	Small	8
3	Dropping tube	Long yellow rubber	40
4	Test tube clamp	Wood	40
5	Test tube	Pyrex	50
6	Test tube rack	Wood	10
7	Stirring rod	Glass	8
8	Erlenmeyer flask	50 mL; 250 mL/pyrex	15
9	Measuring cylinder	5 mL; 10 mL/pyrex	8

No	Tool	Type	Amount
10	Buret	25 mL/pyrex	10
11	Clamp and stabilizer	Iron	5
12	Aquades bottle		8
13	Analytical balance		1
14	Electric stove		4
15	Magnetic stirrer	Long	4
16	Hg thermometer		5
17	Volume pipette	10 mL/pyrex	5
18	Rubber bulb		5
19	Measuring flask	50 mL/pyrex	5
20	Micropipette		-
21	UV visible spectro		-

The table above is a list of practicum tools used in the Faculty of Public Health (FKM) laboratory. The table contains information about the name of the tool, the type or type of tool, and the number of tools available in the laboratory. For example, in the first row, the table shows that there are 10 beakers with volumes of 100 mL, 250 mL, and 500 mL and made of pyrex. This table is useful to give students or researchers an overview of the tools available in the laboratory and their number. This helps in planning and carrying out practicum or research.

3.2. Data Collection

From this research, first there is data collection where from this data collection there is some data needed as follows:

1. Literature Study, reviewing theories and previous research related to information systems for inventory of practical equipment in the Faculty of Public Health laboratory, and designing web-based systems.
2. Observation, Direct observation of the Faculty of Public Health laboratory to understand the existing work process, the types of services provided, and the obstacles faced.
3. Interviews, conducting interviews with related parties, such as laboratory managers, administrative staff, lecturers, and students to get more in-depth information about system needs.

3.3. System Design Stage

At this stage, the system design is made based on the results of the needs analysis. Information system design is a complex and systematic process to create a system that is able to meet the needs of organizations or individuals in managing certain data, information, or processes. In the context of practical equipment loan management in the Faculty of Public Health laboratory, system design aims to replace manual processes that are often slow, prone to errors, and difficult to access with a digital system that is more efficient and organized. The process includes:

1. System architecture design: Determine whether the system is desktop, web, or mobile based.
2. Database design: Create a database design that includes tables for tool data, stock, users, transactions, and reporting.
3. Interface design: Design a user-friendly interface for data input, tool search, and report generation.

3.4. Implementation Stage

The implementation stage of the web-based laboratory equipment researcher information system includes a series of structured steps to ensure that the system can be implemented effectively and efficiently. The implementation process begins with ensuring that the system that has been designed and developed is ready for deployment. At this stage, system developers usually conduct a series of final tests to ensure that the system works according to specifications and is free of technical errors. These tests involve simulating the processes that will be performed by the users of the system to ensure that each feature works as it should, the tests are done well independently.

3.5. Implementation and Evaluation Phase

In the implementation stage, the web-based laboratory equipment loan information system has been successfully implemented and runs on the specified server. The process of uploading the application to the server and integrating the database with real data from the laboratory was carried out smoothly, without any significant technical problems. Initial testing of the system showed that all main functions, including tool borrowing, returning, and generating reports, can run according to plan with a very low error rate. Training provided to users, such as students and laboratory staff, showed that they could easily access and use the system. The process of borrowing and returning tools became faster and more organized, which previously took longer with the manual system. Evaluation of the system based on user feedback revealed several areas that needed improvement. For example, several users reported that the user interface (UI) needed to be more responsive, especially on devices with small screen sizes, and there was a need to add an automatic notification feature for upcoming borrowings or late returns. In addition, performance testing showed that although the system ran well in general, the response time of certain pages, especially when accessing reports, was slightly slower than expected.

4. RESULTS AND DISCUSSION

4.1. Login Page

Login page that serves as the initial gate to access the laboratory information system. In this display, it can be seen that the page design is designed with simplicity and professionalism in mind, reflecting a modern and organized laboratory environment.

Figure 2. This image is the FKM Laboratory Website Login page.

The background in the form of a photo of the laboratory gives an immediate impression to users about the purpose of this system, which is to support laboratory-related activities, such as tool management, facility lending, or reporting on laboratory activities. The login page display in the image shown below is well designed, prioritizing ease of use and aesthetics that are relevant to the laboratory theme. The use of simple design, concise layout, and informative visual elements help create an inspiring user experience. This shows that this application strives to provide convenience for users in accessing available services.

4.2. Main menu page

The dashboard page is the main display of the laboratory equipment loan information system application. This display is designed to be intuitive and easy to use, so that users can find and access the necessary features quickly. Here are some sections and features on the dashboard page:

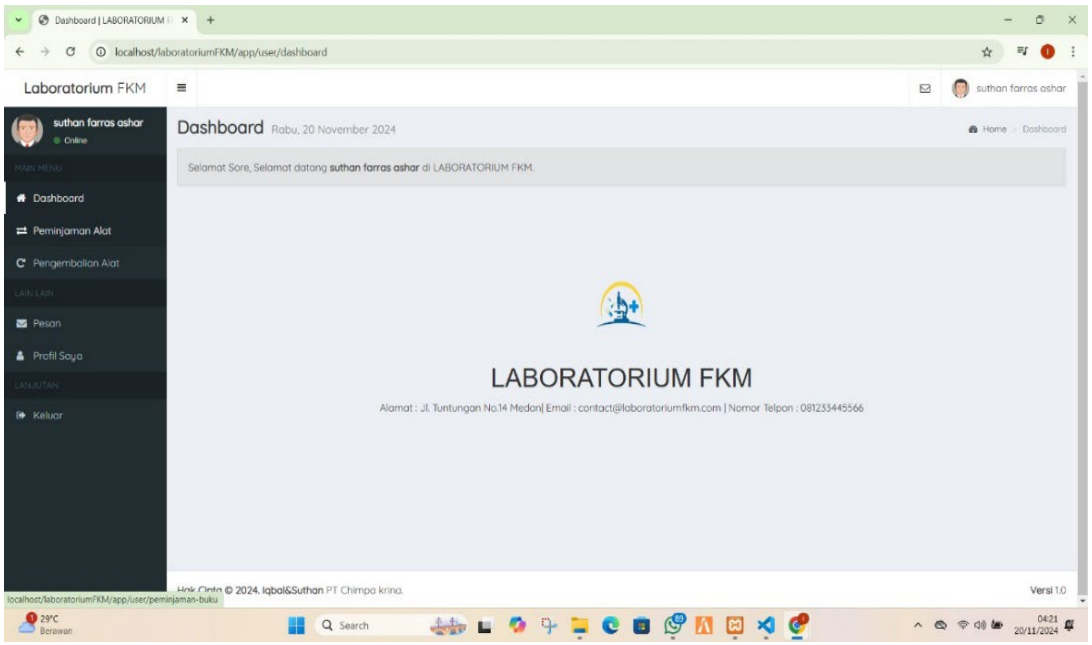

Figure 3. Dashboard page display of the laboratory equipment loan information system.

4.3. Tool List View

The Tool List view provided has significant benefits in supporting the operation of the FKM laboratory, especially in the process of maintaining the loan of laboratory equipment. The benefits of the tool list display are making it easier to manage loan data, Laboratory operational efficiency, Transparency and accountability, Support for the continuity of practicum and research, and improve the professionalism of Laboratory management.

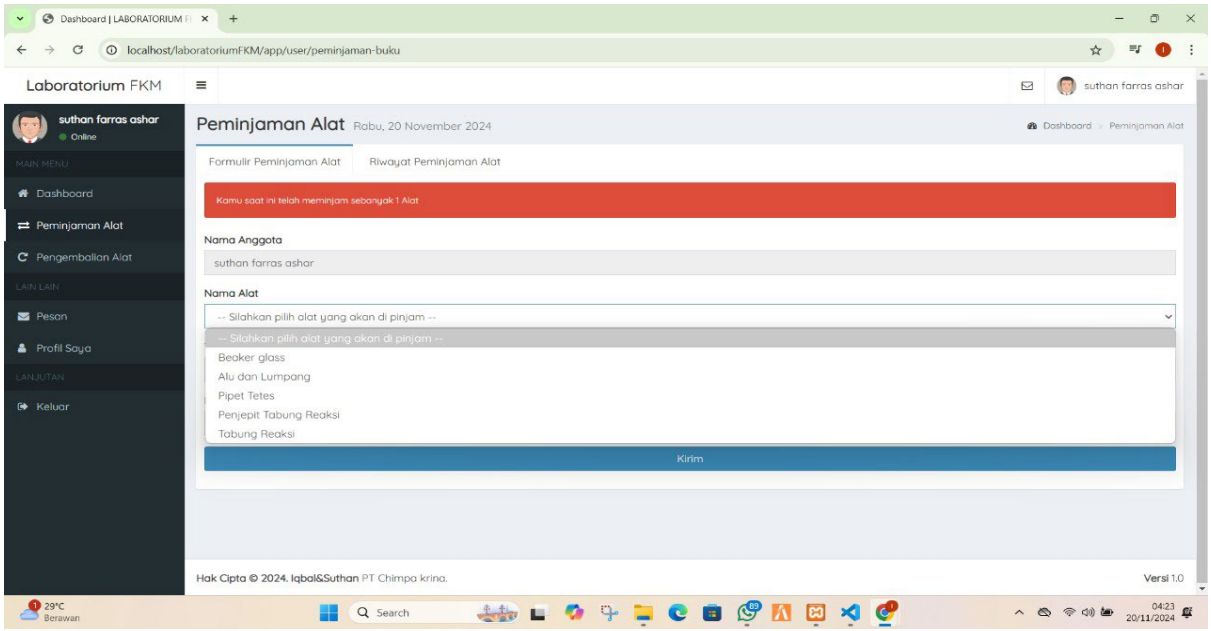

Figure 4. List Of Tools Available in The Laboratory Equipment Loan Information.

4.4. Equipment Loan Page

The lending view page is an interface designed to make it easier for users to view and manage laboratory equipment loans. This page provides clear and detailed information about the equipment available for loan, the status of the lender, and the options for applying for a loan.

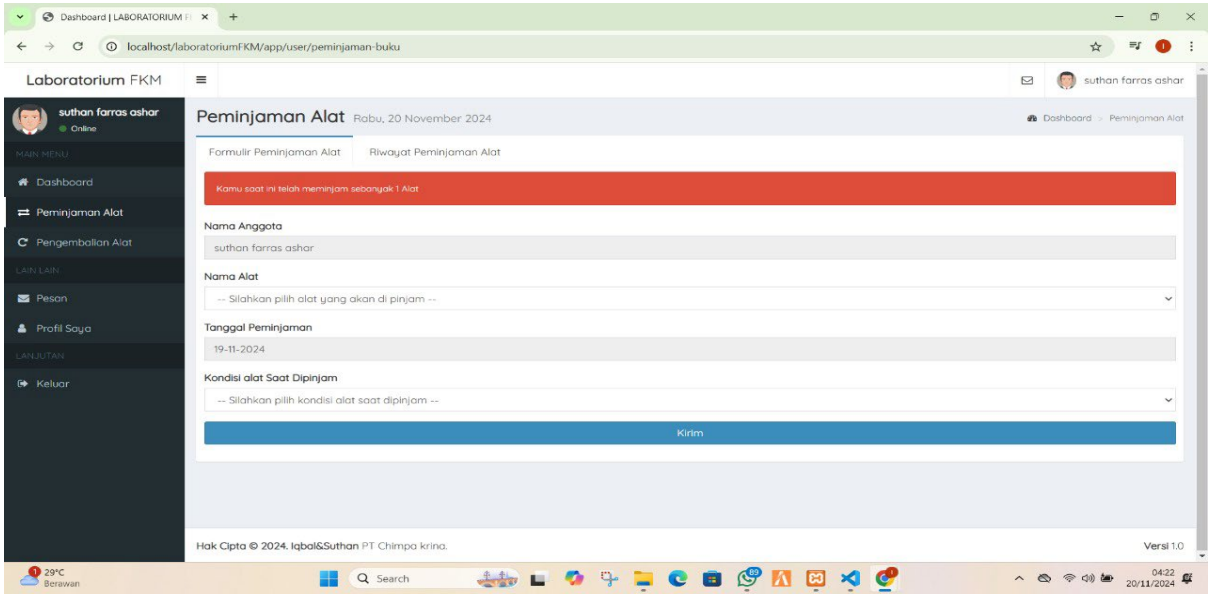

Figure 5. Lending View" Page of The Laboratory Equipment Lending Information System

4.5. Borrowed Tools Page View

The borrowed tools page is designed to provide users with information about the tools they have borrowed. This page allows users to view the details of the loan, including the name of the tool, the date it was borrowed, the scheduled return date, and the status of the loan. This interface aims tomake it easier for users to manage their tool loans and ensure that they can return the tools on time.

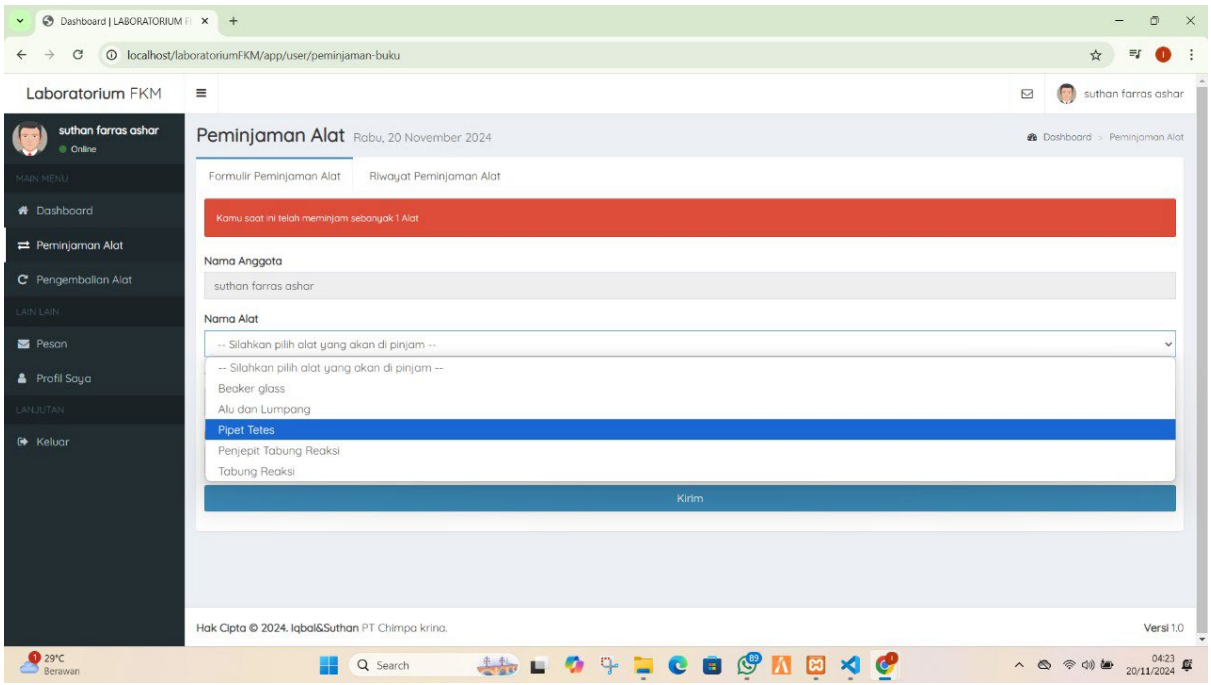

Figure 6. Borrowed Equipment Page of The Laboratory Equipment Loan Information System

4.6. View Page Filling Out Equipment Loan Form

The fill in equipment loan form page is designed to make it easier for users to apply for equipment loans. This page provides a form that must be filled in by the user with the information required for the loan process. With an intuitive interface, users can easily fill in the required data and authorize the desired equipment loan permission.

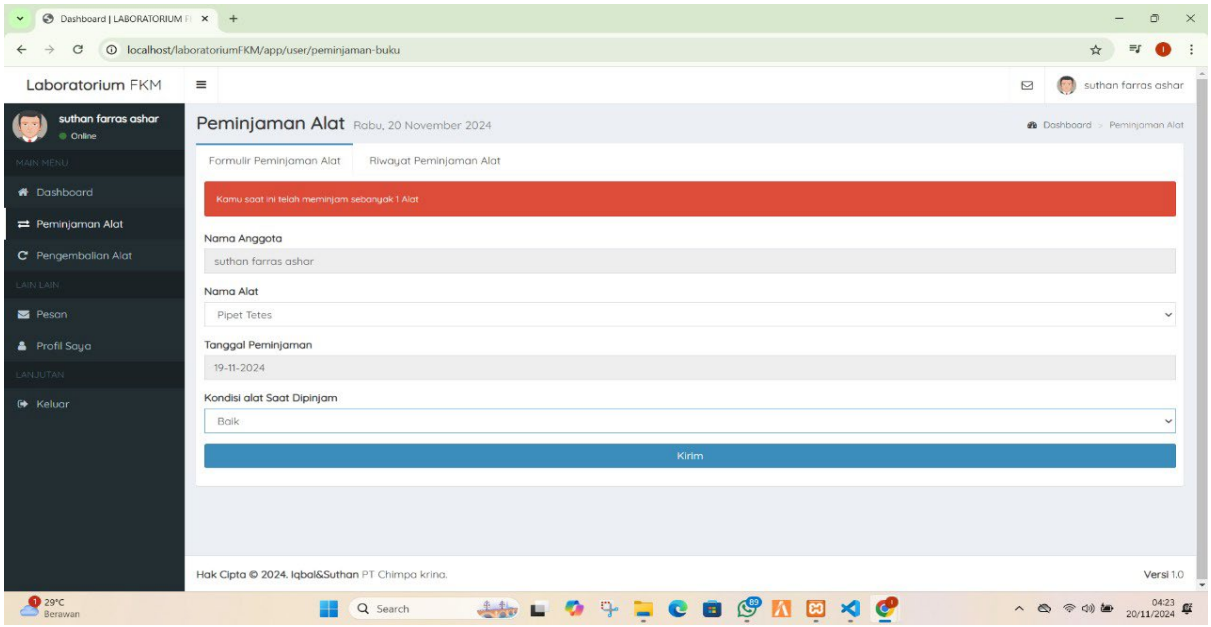

Figure 7. Filling Out Equipment Loan Form Page of The Laboratory Equipment Loan Information System

The confirm equipment loan page is an important step in the equipment loan process, where users can review and confirm the loan details before submitting an official application. This page provides a summary of the pre-filled information, including the name of the equipment, loan date, return date, and user information. With a clear and structured display, users can ensure that all information provided is accurate before proceeding to the loan process.

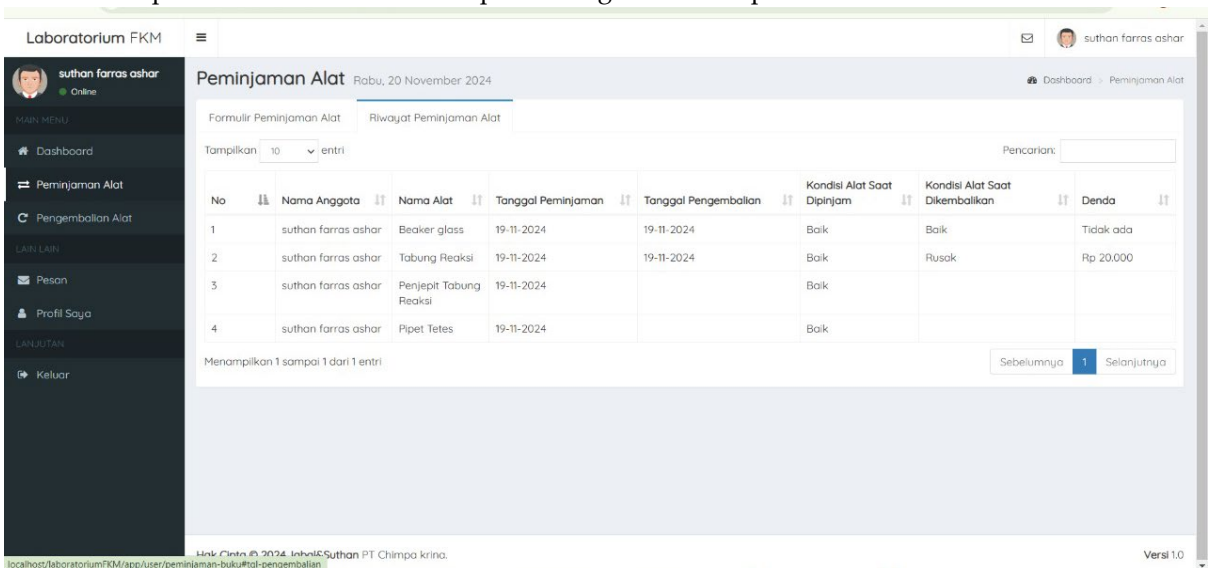

Figure 8. Confirm Equipment Loan Page of The Laboratory Equipment Loan Information System

4.7. Equipment Return Page

The equipment return page is designed to make it easier for users to return tools that have been borrowed. This page provides a form that must be filled out by the user to record the return of the tool, as well as provide information regarding the loan status. With a simple and luxurious interface, users can easily complete the tool return process and ensure that all information is recorded correctly.

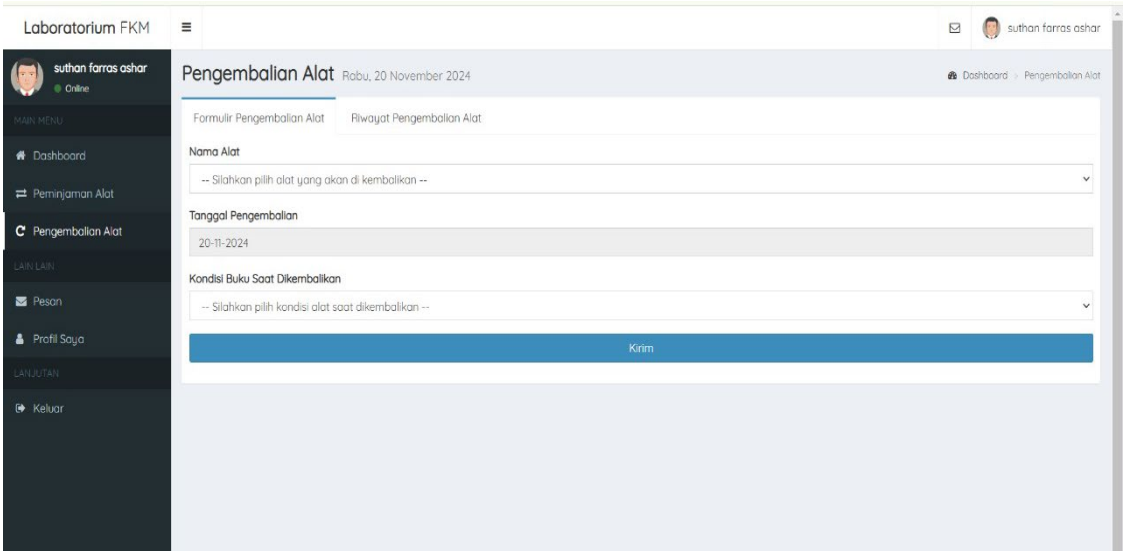

Figure 9. Equipment Return Page of The Laboratory Equipment Loan Information System

4.8. Displaying the Borrowed Tools List Page

The borrowed tools list page is designed to provide complete information about all the tools currently borrowed by the user. This page displays a list of tools that includes important details such

as the tool name, borrower name, borrow date, and scheduled return date. With a structured and easy-to-read display, users can quickly view the tool borrowing status and take necessary actions, such as returning the tool or extending the loan period.

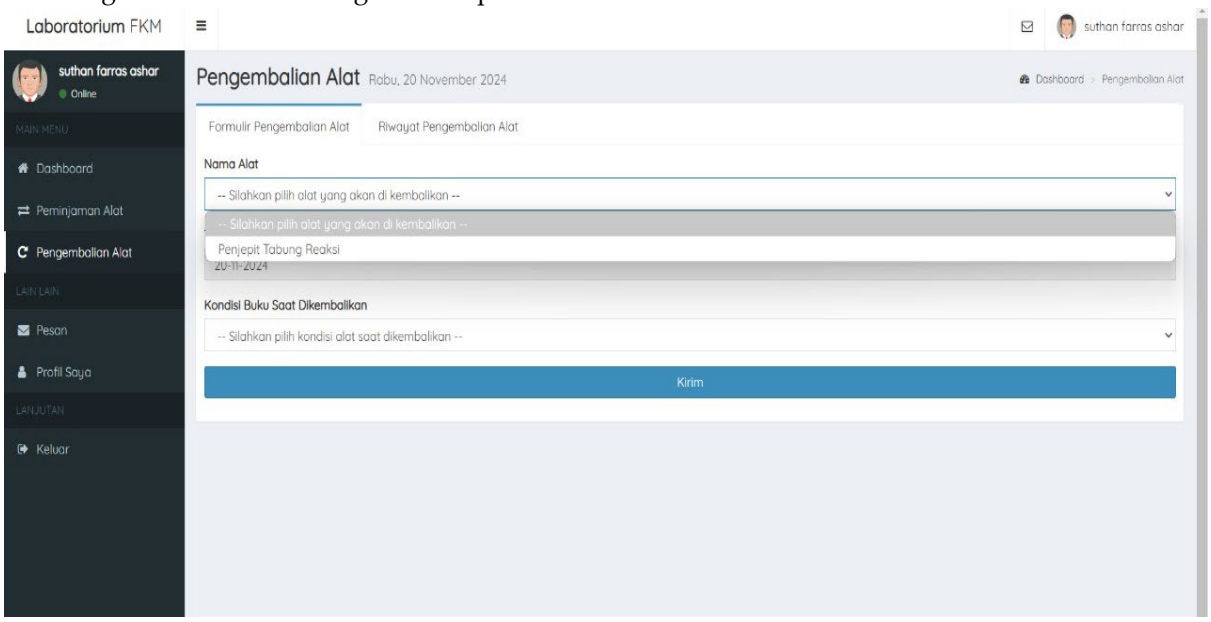

Figure 10. List Of Borrowed Equipment Page of The Laboratory Equipment Loan Information System

4.9. Page View: Select Tools to return.

The select tools to return page is designed to make it easy for users to choose which tools to return after the loan period ends. This page displays a list of tools that have been loaned by users, allowing them to select one or more tools to return. With an intuitive interface, users can quickly review the loaned tools and efficiently complete the return process.

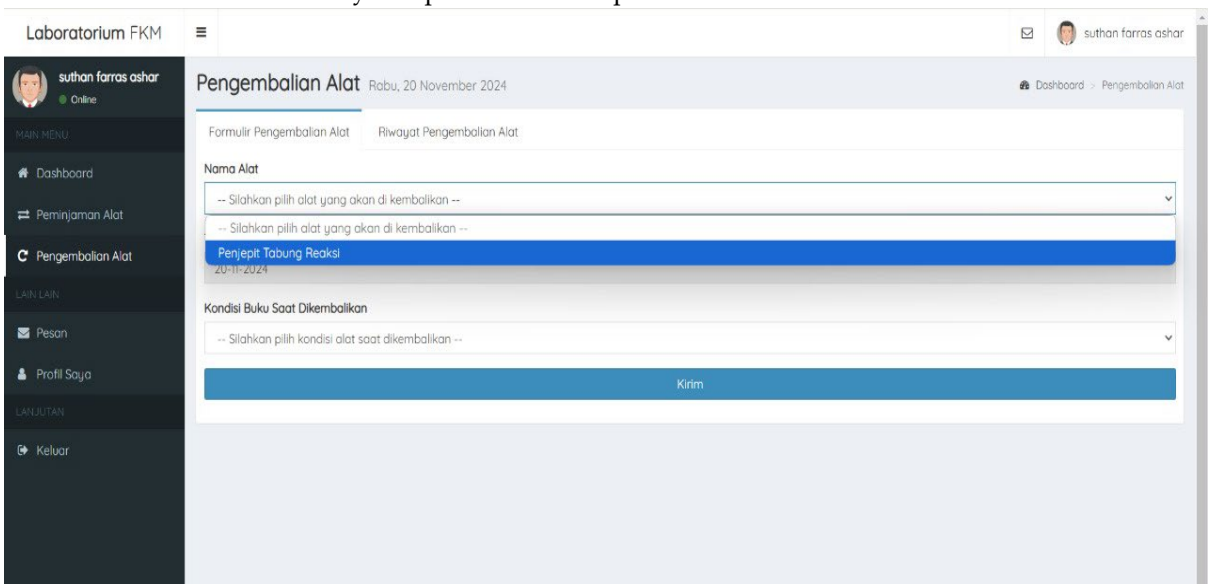

Figure 11. The Select Tools to Return Page

4.10. Tool Return Confirmation Page View

The confirm tool return page is an important step in the process of returning a borrowed tool. This page is designed to give users the opportunity to review and confirm information about the tool

they are returning before completing the process. With a clear and structured display, users can ensure that all details displayed are accurate, reducing the possibility of errors in the return.

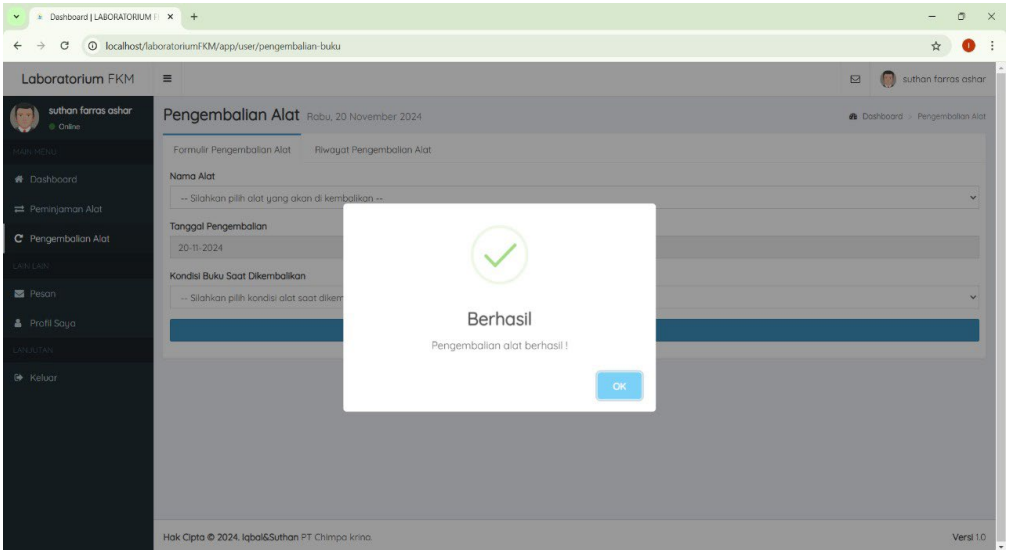

Figure 12. Confirm Return of Equipment Page of The Laboratory Equipment Lending Information System

4.11. Logout Display

The logout display page is the display that appears after the user has successfully logged out of the system. This page is designed to provide confirmation to the user that they have successfully logged out. With a display that ensures simplicity and clarity, this page shows that the user feels safe and confident that their session has ended properly.

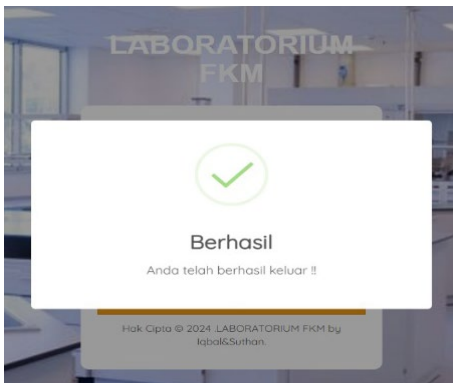

Figure 13. Logout Display page of the information system

5. CONCLUSION

The development of a web-based laboratory equipment lending information system at the Public Health Faculty Laboratory, State Islamic University of North Sumatra has successfully answered the challenges faced in manual equipment management. Through a systematic research process starting from problem identification to application testing, this system shows significant improvements in terms of efficiency and effectiveness of equipment lending and returning services. The results of application testing show that the system functions well, providing easy access and transparency regarding equipment availability. User feedback shows that this website meets their needs and helps reduce errors and improve the organization of the lending process. Overall, this application plays an important

role in solving problems in the laboratory, providing digital solutions that support better operations and improve the student learning experience. The implementation of this information system is an innovative step in the digitalization of laboratory management, which is expected to continue to be developed and refined to improve the quality of service in the future.

REFERENCES

Aini. (2023). Perancangan Sistem Manajemen Laboratorium Yang Terintegrasi Dengan Rps (Studi Kasus: Prodi Keperawatan Universitas Abdurrab). *Semaster*, *2*.

Ajeng. (2023). Optimalisasi Sistem Informasi Pelayanan Laboratorium Keperawatan. *Teknosains*, *17*.

Andika. (2023). Sistem Informasi Manajemen Persediaan Peralatan Laboratorium Komputer. *Jtt*, *3*.

Darmanto. (2022). Implementasi Sistem Informasi Dalam Upaya Optimalisasi Pengelolaan Laboratorium Komputer Jurusan Teknik Informatika Politap. *Aicoms*, *1*.

Dori. (2023). Sistem Informasi Quick Response Code (Qr Code) Sederhana Untuk Mengoptimalkan Inventarisasi Peminjaman Dan Penggunaan Alat-Alat Laboratorium Di Jurusan Ilmu Tanah, Universitas Mataram. *Abdi Insani*, *10*.

Fauzi. (2019). Sionlap V2: Desain Dan Implementasi Internet Of Things Monitoring Temperatur Dan Kelembaban Ruang Laboratorium. *Integrated Lab*, *7*.

Hayati. (2021). Sistem Informasi Pemilihan Asisten Laboratorium Dengan Metode Weighted Product Dan Weighted Sum Model. *String*, *6*.

Husna. (2023). Pelayanan Pengelolaan Laboratorium Menggunakan Qr Code Berbasis Google Form. *Abdi Insani*, *10*.

Ikhsan. (2022). Pelatihan Pengenalan Aplikasi Berbasis Web Tinkercad Sebagai Media Simulasi Mikrokontroler Pada Smk Taruna Tekno Nusantara. *Jurnal Pengabdian Kepada Masyarakat*, *28*.

Ikhsan. (2023). Rancang Bangun Sistem Informasi Pengelolaan Inventaris Berbasis Web Pada Pt Bprs Amanah Insan Cita. *Jurnal Ilmiah Teknik Mesin, Elektro Dan Komputer*, *3*.

Ikhsan. (2024). Pemodelan Algoritma Ahp Dan Smart Pada Sistem Rekomendasi Penerima Bantuan Rumah Layak Huni Di Desa Sialambue. *Jurnal Teknologi Informasi Dan Komunikasi*, *15*.

Ikhsan. (2024). Implementasi Aplikasi Stok Barang Perangkat Jaringan Berbasis Web Di Pt Zathco. *Jurnal Ilmiah Research Student*, *1*.

Ikhsan. (2024). Sistem Manajemen Informasi Notulensi Rapat Pada Biro Pemerintahan Dan Otonomi Daerah Di Kantor Gubernur Sumatera Utara. *Journal Of Informatics And Busisnes*, *1*.

Junaidi. (2022). Sistem Layanan Laboratorium Berbasis Website Laboratorium Jurusan Sejarah Unnes. *Manajemen*, *5*.

Juniarti. (2023). Pengembangan Sistem Inventaris Berbasis Web Laboratorium Keperawatan Fak-Fak (Labku). *Keperawatan*, *17*.

Marwah. (2024). Digitalisasi Manajemen Laboratorium Farmasi Pada Poltekkes Kemenkes Jambi Berbasis Web. *Fortech*, *8*.

Muhasshanah. (2021). Implementasi Sistem Informasi Manajemen Laboratorium Kebidanan Pada Fakultas Ilmu Kesehatan Universitas Ibrahimy. *Ilmiah*, *6*.

Mustafa. (2021). Optimalisasi Panduan Praktikum Laboratorium Biomedis Dan Laboratorium Epidemiologi Berbasis Sistem Informasi Silabkemas. *Unnes*, *5*.

Putra. (2024). Aplikasi Pengenalan Alat Laboratorium Farmakognosi Di Smk Kesehatan Sidimpuan Husada Menggunakan Augmented Reality. *Ilmu Pengetahuan Dan Penelitian Sosial*, *7*.

Ramadhani. (2023). Rancang Bangun Sistem Informasi Peminjaman Alat Kesehatan Berbasis Web Di Lab Fik Unipdu Jombang. *Unipdu*, *1*.

Tyas. (2024). Sistem Manajemen Aset Laboratorium Berbasis. *Uii*, *2*.

Yudin. (2020). Analisis Metode Pengembangan Sistem Informasi Berbasis Website: A Literatur Review. *Interkom*, *15*.