Article

Excellence Service Strategy through Laboratory System Development in Health Department

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Abstract: The Health Department has nineteen laboratories that serve various important purposes, including practicums and learning, supporting clinical research, clinical case simulations, research and system development, professional training, and health services. Despite their significance, these laboratories face challenges in presenting their profiles effectively to the public and stakeholders. This research aims to develop an Information System designed specifically for these laboratories to improve visibility and access to information regarding their services, technology, achievements, and advantages. The research follows a prototyping method to develop the system, which is chosen due to its flexibility, the complexity of the laboratories' needs, and the iterative nature of system development. The research was conducted over a period of six months, and the main steps involved included: early prototype development, rapid design and system testing. The web-based Laboratory Information System has been successfully developed and deployed, effectively addressing the challenges of information presentation, and supporting the growth and development of the laboratories.

Keywords: *Laboratory Information System; Health Sector; Prototyping Method*

1. Introduction

As healthcare services evolve rapidly with technological advancements, education in the health field must adopt a comprehensive and adaptive approach. Especially in the Health Department at Politeknik Negeri Jember, students are expected not only to understand theory but also to master practical skills relevant to facing the evolving challenges of the medical world. Laboratories play a key role in health education, providing students with practical experience to effectively and efficiently understand and apply medical concepts [1]. Through the laboratory, Health Department students can develop critical technical skills, such as using medical equipment and performing analytical procedures for their future professional practice [2]. With hands-on simulations and experiments, students gain a better understanding of how medical devices work and the analytical techniques commonly used in daily clinical practice [3]. While students can learn medical theory and information technology theory in healthcare services from textbooks or lectures, direct experience in the laboratory allows them to see how these theories are applied in real situations. This helps them develop problem-solving and critical thinking skills that are essential in the medical field [4]. Through practice and supervision, students can refine their abilities to adhere to strict industry standards and regulations [5]. Furthermore, the laboratory also supports the development of

interpersonal and teamwork skills. In many cases, students need to work in groups to complete tasks or experiments, preparing them for collaboration in a professional environment [6].

The Health Department at Politeknik Negeri Jember has laboratories that serve various important purposes in practical training and learning, supporting clinical research, clinical case simulations, system research and development, professional training, and healthcare services. There are nineteen laboratories in the Health Department across three study programs (Health Information Management, Clinical Nutrition, and Health Promotion). The laboratories frequently used under the Health Information Management program include the computer laboratory, electronic medical record laboratory, and clinical coding and reimbursement laboratory. The laboratories under the Clinical Nutrition program consist of the food processing laboratory, biomedical laboratory, and nutritional analysis laboratory. The laboratories under the Health Promotion program include the photography laboratory, videography and film laboratory, and health multimedia laboratory. The 19 laboratories include computer lab, electronic medical record lab, clinical coding and reimbursement lab, food processing lab, assessment & microteaching lab, biomedical lab, nutrition analysis lab, photography lab, videography and film lab, media production workshop lab, health promotion computer lab, health multimedia lab, health graphic design lab, anthropometry lab, nutrition education lab, manual medical record lab, anatomy and physiology lab, dietetics and culinary lab, and agricultural data analysis lab. However, the laboratories still face challenges in effectively presenting their profiles to the community, business partners, and other stakeholders.

The numerous laboratories in the Health Department are not being utilized to their full potential, as information about their advantages and services does not reach stakeholders. As a result, the laboratories are primarily used for student coursework and faculty research, limiting potential collaboration with the community and other stakeholders. Limitations in presenting laboratory profiles can hinder their ability to attract new clients, establish partnerships with related industries, and promote the latest research and development [7]. The laboratories still rely on manual methods or non-integrated systems to manage their information, making details about services, technologies, and laboratory achievements hard to access. This makes information about the laboratory's services, technologies, and achievements difficult to access [8]. As a result, laboratories struggle to present a complete and appealing profile to potential clients or industry partners. These limitations reduce their ability to highlight technological advantages, service quality, and research outcomes achieved. The lack of an effective information system also hampers the promotion of the latest research and development [9]. Laboratories that cannot showcase their innovations and achievements risk losing research support, academic collaborations, or grants that could aid in the development of new technologies. Poorly structured information limits the laboratory's appeal to researchers, investors, and other potential partners. To address these challenges, it is crucial to develop and implement a comprehensive laboratory information system in the Health Department at Politeknik Negeri Jember.

The research aims to develop an information system specifically designed for laboratories in the Health Department. This system will assist laboratories in presenting information effectively to various stakeholders, enhancing the visibility and image of the laboratories, and supporting their overall growth and development. The system will integrate features relevant to the laboratories' needs, such as service descriptions, technologies and equipment used, professional team profiles, and project and research portfolios. By developing an effective laboratory information system, it is expected that the laboratories in the Health Department can improve their transparency, efficiency, and appeal. This system will not only facilitate access and information management but also strengthen the laboratories' position in the healthcare industry, open opportunities for collaboration, and support the development of more innovative and relevant research.

2. Materials and Method

The method used in this research is prototyping. This approach allows for the gradual development of the system while receiving direct feedback from users. By creating an initial model, stakeholders can observe how the system functions and provide valuable input, resulting in a final product that better aligns with their needs. This method also helps developers gain a deeper understanding of user preferences and needs, enabling early improvements and adjustments throughout the development cycle [16]. However, this article has some limitations, as it only presents the user interface and system testing. The stages in Phase 2 and activities in Phase 3, other than black-box testing, are discussed outside the scope of this article[10]. The research was conducted over a period of six months, from June 2024 to November 2024. It adopts an applied research design, focusing on the development and testing of a web-based Laboratory Information System. The research approach is qualitative, utilizing the prototyping method to gather feedback from users and refine the system throughout its development. The users of the department's laboratory system are the technicians assigned to the laboratories. In conducting this research, interviews related to needs analysis and data collection were carried out with the administrators of the Health Department website.

Phase 1: Initial Prototype Development

1. Objective: To develop an initial version of the system or solution to provide a basic overview of how the system will function.
2. General Activities:
    a. Requirements Gathering: Compiling and analyzing user needs. At this stage, the researchers conducted in-depth interviews with the administrators of the Health Department website.
    b. Rapid Design: Creating an initial design focused on key features.
    c. Prototype Development: Building the initial prototype with basic functionality. The system development is web-based, utilizing Figma for design and MySQL for the database, with HTML, CSS, and JavaScript on the frontend.

Phase 2: Testing and Evaluation

1. Objective: To test the prototype with users to gather feedback and evaluate whether the prototype meets their needs. The method used during testing and evaluation is user-centered design. Prototypes can be refined to better meet user needs.
2. General Activities:
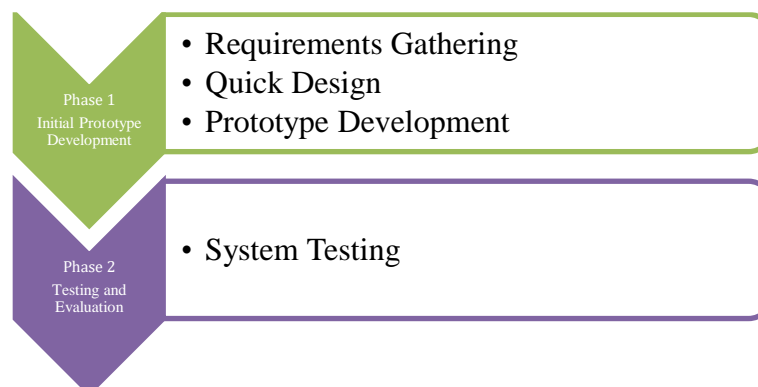   a. System Testing: Conducting functionality tests of the prototype in real-world conditions.

Figure 1. Enhancing presentation with figure

3. Results

The laboratory information system has two users. The Admin User is the Laboratory Head, responsible for approving bookings and verifying payments in the system. The Client User is the stakeholder who registers, makes bookings, and processes payments within the system. The development of the Laboratory Information System for the Health Department is web-based, providing a solution for data management, broader information accessibility, and improved reporting [11]. With the implementation of a web-based information system for laboratories, the laboratories in the health department can be utilized more optimally.

3.1. User Interface for Admin Users

1. Dashboard
    The dashboard in the application is used to present information concisely and visually, making it easier for users to understand data and performance [12]. This is an overall view of the laboratory information system managed by the admin user. It includes menus for bookings, laboratories, news, research, reports, user data, and activity logs.
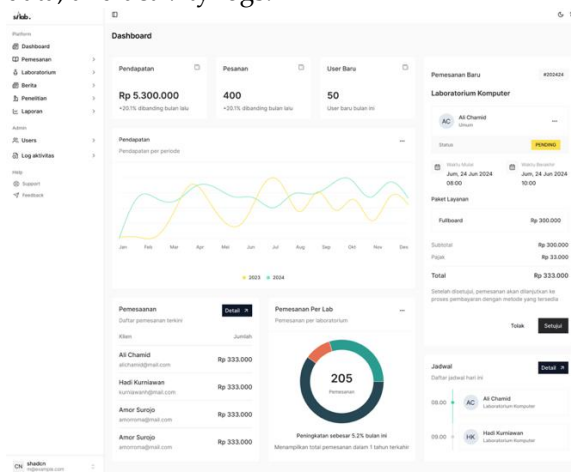

Figure 2. Dashboard

2. Order Dashboard
    In this view, the admin can approve bookings and verify payments in the system. In other menus, the admin can manipulate the necessary data within the laboratory information system.
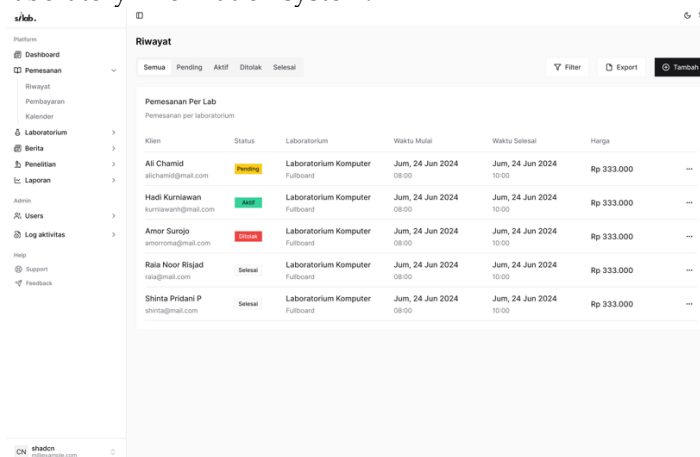

Figure 3. Order Dashboard

3.2. User Interface for Client Users

1. Register
    This menu is intended for clients to register in the laboratory information system before proceeding with the booking of equipment and laboratory space.
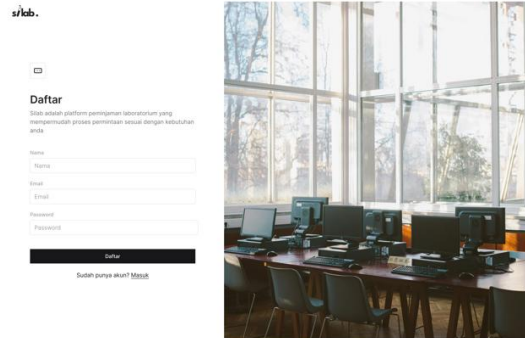

Figure 4. Register

2. Sign-In
    The Sign-In menu is the initial interface where client users can enter the ID and password created during the registration process.
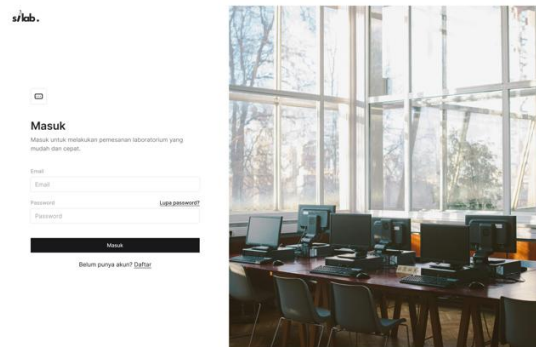

Figure 5. Sign-In

3. Forget Password
    The "Forgot Password" menu is used when a client user forgets the password data registered in the registration menu.
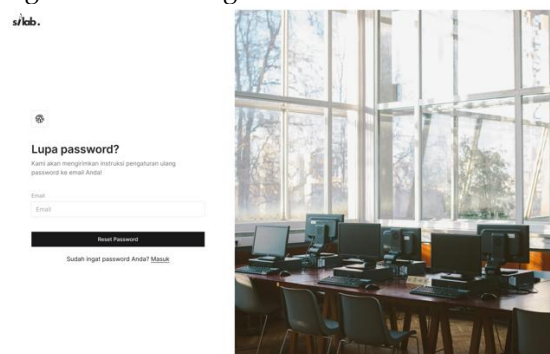

Figure 6. Forget Password

4. Reset Password
    This menu is used for client users to change their old password to a new one, allowing them to access the laboratory information system again.
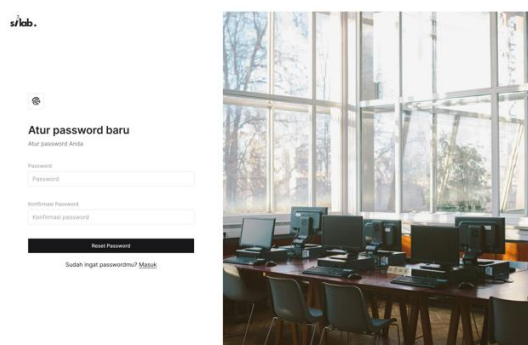
Figure 7. Reset Password

5. Home

   After successfully entering the ID and password, the client user will be presented with the Home page. This page contains menus for renting equipment and laboratory space, detailed information about the laboratories in the Health Department, the latest news related to the Health Department, research conducted in the Health Department, contact information for each laboratory, and FAQs.

6. Laboratories

   This menu displays a list of laboratories available for rent. Each laboratory's information includes a description, facilities, services, floor plan, research portfolio, reviews, and ratings. The service characteristics in renting for 19 laboratories are no different. The rental flow is the same. In the service, you can choose the equipment or lab room that you want to rent.
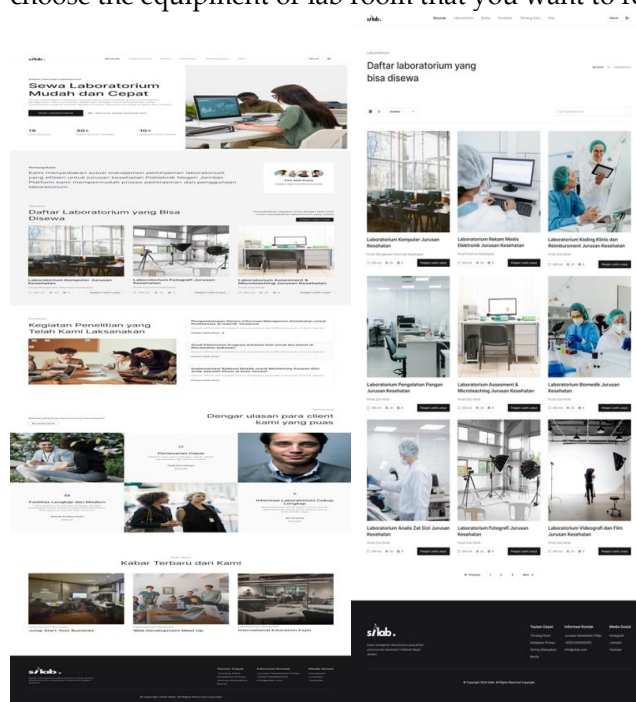

Figure 8. Home and Laboratories

7. News

   Providing articles or content that educates users about a specific topic, industry trends, or helpful tips [13]. This section displays the latest news from the Health Department.

8. Research
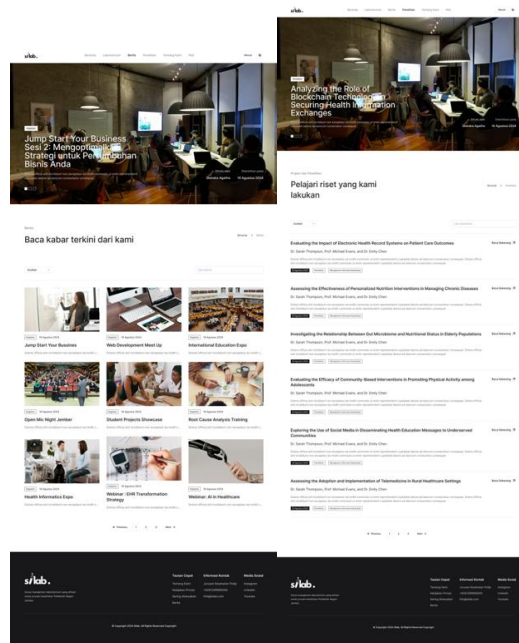   This section showcases the research conducted by the Health Department team.

Figure 9. News and Research

9. About Us
   Featuring key team members, including the founders or leaders behind the Information System[14]. This section provides information about the team behind SILAB (Laboratory Information System) and contact details for each laboratory.

10. FAQ
    This section displays frequently asked questions by prospective clients of the Laboratory Information System. Make it easier for users to find the answers they need, thereby increasing their satisfaction [15].
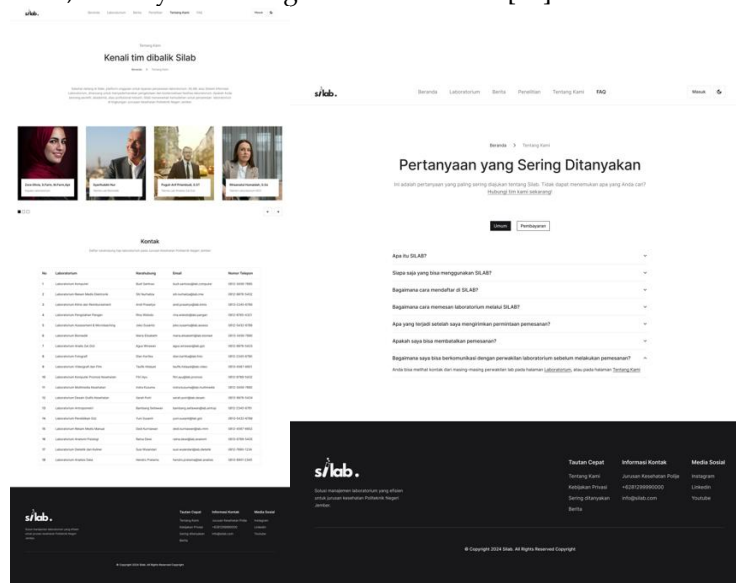

Figure 10. About Us and FAQ

3.3. System Testing

The functionality testing phase of the system uses the black-box method, which is suitable for a laboratory information system because it focuses on validating the system's outputs against user requirements without delving into the internal code. This approach allows for efficient identification of usability issues and ensures that the system meets the needs of laboratory personnel effectively. From the user's perspective, black-box testing has several important aspects that can influence user experience and satisfaction. This is because the development phase of the Laboratory Information System focuses on user needs [16]. In the testing phase, the booking process was thoroughly tested to ensure it operates smoothly, from registration to booking confirmation. Simulations of user interactions were carried out, and users were able to successfully book and complete the payment process. This testing confirmed that the system allows for smooth user interactions and successfully handles both the booking and payment processes, meeting the expected functionality.

Table 1. System Testing

No	Menu in Information System for Two Users	Result
1	Dashboard	Successful
2	Order Dashboard	Successful
3	Register	Successful
4	Registration detail	Successful
5	Sign-In	Successful
6	Forget Password	Successful
7	Reset Password	Successful
8	Home	Successful
9	Laboratories	Successful
10	Laboratory Detail	Successful
11	News	Successful
12	News Detail	Successful
13	Research	Successful
14	Research Detail	Successful
15	About Us	Successful
16	FAQ	Successful

4. Discussion

The development of the Laboratory Information System for the Health Department at Politeknik Negeri Jember addresses a critical gap in the effective presentation and management of laboratory data. By providing a centralized, web-based platform, this system enhances the accessibility of laboratory services, technologies, and achievements to a broader audience, including potential collaborators and stakeholders. This finding aligns with prior research that highlights the importance of centralized information systems in improving organizational transparency and facilitating collaboration in academic and healthcare settings [17].

In comparison with previous studies, such as those by [Novendra A S et al., 2018] [18], our findings reinforce the value of user-centered design and iterative prototyping in developing systems that cater to real-world needs. Similar to their work, our research

confirms that involving end-users throughout the system's development significantly improves its usability and effectiveness. Specifically, the feedback-driven approach ensured that the final system met the actual requirements of laboratory staff and stakeholders, resulting in a user-friendly interface and smooth functionality. Integration of various features such as service descriptions, team profiles, and research information conducted in the laboratory not only simplifies information management, but also increases the attractiveness of the system to external partners. The findings suggest that implementing such a system can increase the visibility of ongoing research and innovation, thereby positioning the laboratory to play a more active role in the health sector [19], [20].

However, challenges remain. Although the system has proven effective in terms of functionality and user experience, further research is needed to explore its long-term impact on laboratory operational efficiency and external collaboration. Future developments could focus on expanding the system's capabilities, such as adding more advanced analytical features or integrating it with other health data management systems to enhance inter-institutional collaboration.

In conclusion, the Laboratory Information System has the potential to significantly enhance the visibility, efficiency, and growth of the laboratories within the Health Department at Politeknik Negeri Jember, while also contributing to a broader context of technological advancements in the health sector.

5. Conclusions

The laboratory information system for the management of equipment and lab rentals has been successfully developed. This study developed a Laboratory Information System specifically designed to enhance the visibility and accessibility of information regarding the services, technology, achievements, and advantages of the laboratories within the Health Department at Politeknik Negeri Jember. The web-based system developed successfully addressed the challenges of presenting laboratory information to the public and stakeholders, supporting the growth and development of the laboratories. With this system, the laboratories can be utilized more effectively, facilitate collaborations with external parties, and improve transparency and efficiency in data and service management. This system not only provides a solution for better data management but also enhances accessibility to the information needed for research. As a result, the system is expected to facilitate collaboration between researchers and practitioners in the health field, ultimately leading to more impactful collaborative research in health sciences. Through the utilization of this system, the laboratories in the health department are anticipated to contribute significantly to innovation and the improvement of health services in the community.

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