Equipment Borrowing and Room Booking Information System at the Politeknik Statistika STIS

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Abstract. The management of goods and space lending services at the Politeknik Statistika STIS is currently still done manually, resulting in various operational constraints such as limited access to information, inefficient processes, and potential errors in recording. This impacts the quality of service and the effectiveness of campus asset utilization. This study aims to design and build a website-based goods and space lending information system to address these issues. The system developers aimed to provide users with access to information on goods and space availability, simplify the loan application process, and improve the accuracy of inventory data. The system was developed using the SDLC method with a prototyping approach, while The researchers carried out the evaluation process using Black Box Testing and a PSSUQ survey survey to measure ease of use and user satisfaction. The developers successfully built the system and confirmed through Black Box Testing that all features operate correctly, and the PSSUQ evaluation shows an average score of 1.69, indicating that this system is well received and provides a high level of satisfaction for users.

Keyword: system, service, loan, goods

1. Introduction

Politeknik Statistika STIS is a higher education institution under the auspices of the Central Statistics Agency (BPS) that focuses on the development of applied statistics and statistical computing. As a vocational college, the Politeknik Statistika STIS plays a crucial role in producing professional statisticians to meet national data needs. To support the smooth running of academic, research, and campus operations, the institution manages various assets and facilities, such as inventory and space used by students, lecturers, and educational staff [1].

Campus assets and facilities are managed by the General Affairs Division, as stipulated in BPS Head Regulation Number 87 of 2017 concerning the Organization and Work Procedures of the Central Statistics Agency [2]. One of the important services managed by the Administration and Household Affairs Subdivision is the loan of goods and space. However, based on initial observations, the management system for this service is still carried out manually.

Manual systems for managing borrowed goods and premises create various limitations, both for managers and borrowers. From the manager's perspective, manual recording is prone to errors, such as inconsistencies in inventory data and discrepancies between documents and actual conditions.

Furthermore, managers have difficulty monitoring the status of goods in real time and face challenges in terms of control and accountability [3].

Meanwhile, for borrowers, including students, lecturers, and educational staff, the manual system presents various obstacles. Interviews with several service users revealed that the borrowing process, which requires direct interaction with the manager, is perceived as inefficient. Borrowers struggle to determine the availability of items or space due to the lack of fast and accurate access to information. Dependence on verbal processes or decentralized written records also causes uncertainty, such as delayed confirmation or application rejections without clear reasons.

This situation has the potential to hinder the smooth running of academic activities and student organizations, as well as negatively impact the overall quality of campus services. In the context of higher education institutions, responsive and efficient facility management is a crucial factor in supporting the continuity of the learning process [4].

As a solution to these problems, this study proposes the development of a digital-based goods and space lending information system. This system is expected to simplify the administrative process, improve recording accuracy, and provide direct availability information for both managers and borrowers. The implementation of a web-based asset management information system in a higher education environment provides significant benefits in terms of operational efficiency, ease of asset tracking, and service transparency [5].

In addition, the implementation of an Asset Management Information System (AMIS) enables institutions to calculate asset depreciation based on government regulations, improve the accuracy of asset documentation, and facilitate real-time monitoring of asset conditions. The system also supports broader institutional adoption by allowing customization according to organizational profiles, thereby enhancing scalability and interoperability across different higher education environments [6]. The development of this system also supports the strategic direction of the Politeknik Statistika STIS as stated in the 2020–2024 Strategic Plan, namely the modernization of facilities and infrastructure to support digital transformation. Thus, this study aims to design and build an information system that supports the institution's vision as a modern, adaptive, and technology-based service-oriented higher education institution.

2. Research Method

This study applies the System Development Life Cycle (SDLC) with a prototype approach, providing a systematic and iterative framework for information system development. The prototype model was selected because it enables continuous interaction between developers and users, ensuring that the system aligns with actual needs and expectations [7]. According to Foster, this approach effectively bridges the gap between user expectations and system functionality by allowing early visualization, iterative refinement, and reduced ambiguity in requirements. It also increases user involvement and satisfaction by enabling stakeholders to test a working model before final implementation, minimizing the risk of system–user misalignment [8].

The research focuses on developing a goods and space borrowing information system at Politeknik Statistika STIS to facilitate students, lecturers, and alumni in submitting loan requests while assisting General Affairs staff in managing, tracking, and confirming loans. Data were collected through interviews, observation, literature review, and questionnaires. Interviews and observations were conducted to understand the existing borrowing process and its challenges, while literature review provided theoretical foundations for system design. Questionnaires were distributed to 30 respondents, including students, lecturers, and alumni, using the Post-Study System Usability Questionnaire (PSSUQ) to assess usability and user satisfaction [9].

The SDLC prototype implementation in this study consists of seven stages: (1) requirements gathering, (2) prototyping, (3) prototype evaluation, (4) system coding, (5) system testing, (6) system evaluation, and (7) system implementation. Development was carried out using Next.js, Tailwind,

Node.js, and MySQL with the Express.js framework. Black-box testing verified system functionality, and PSSUQ evaluation measured usability and satisfaction. This structured process ensures improved administrative efficiency, reduced recording errors, enhanced transparency, and better monitoring of goods and space borrowing activities.

3. Result and Discussion

3.1. Problem Analysis

The researchers analyzed problems with the existing system using a fishbone diagram. This diagram is particularly useful in identifying root causes of inefficiencies in manual systems. The fishbone diagram (also known as a cause-and-effect diagram) is an effective tool for systematically analyzing the underlying causes of problems within a process, helping teams visualize and categorize potential sources of error or delay [10]. These problems can be seen in figure 1 below:

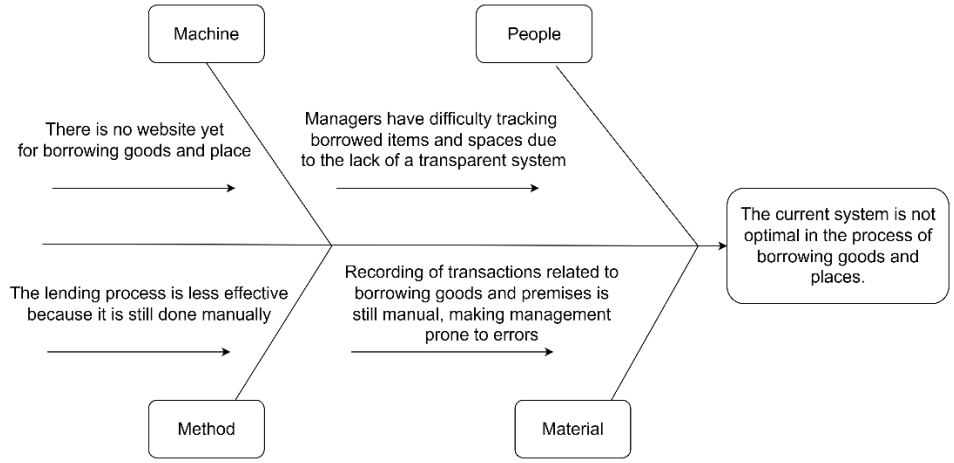

Figure 31. Fishbone Diagram of the Current System Analysis.

The current system for borrowing goods and space is still manual, requiring users to visit the General Administration Department to inquire about availability and apply for a loan. As illustrated in figure 1, the fishbone diagram shows that the main causes of inefficiency in the current system are related to machines, people, methods, and materials. Specifically, the lack of a website for borrowing goods and places makes the process less effective and transparent, while manual transaction recording causes errors and tracking difficulties. Managers also face challenges in monitoring borrowed items and spaces due to the absence of an integrated system. Therefore, a web-based borrowing system is needed to simplify information access, expedite the approval process, assist in tracking borrowed goods or spaces, and generate automatic and accurate borrowing reports.

3.2. Analysis of the Running System

The researchers used a flowchart diagram to analyze problems with the current system process. These problems can be seen in figure 2 below:

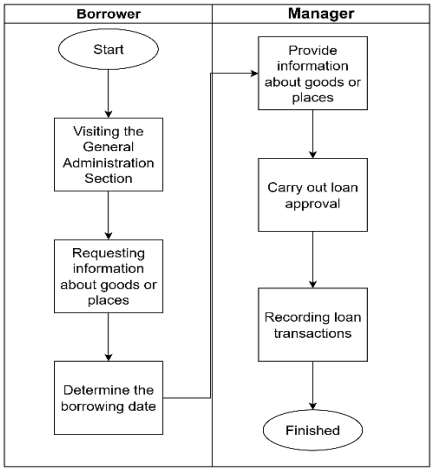

Figure 2. Analysis of the Running System.

In figure 2, there are two actors. The first actor, the manager, provides information on the availability of goods and premises, approves loans, and records loan transactions. The second actor, the borrower, visits the General Administration Section directly, searches for information on the availability of goods and premises, determines the loan date to ensure the goods are available on that date, selects the goods or premises to be borrowed, and then proceeds with the loan.

3.3. System Requirements Analysis

This section discusses the results of the system requirements analysis based on the problems outlined previously. The requirements for this system are divided into two categories: functional and non-functional. To support the development of a system that meets its objectives, these requirements must be detailed.

Functional Requirements

Functional requirements describe the functions a system must have to function as expected. The table below lists the functional requirements for the system.

Table 1. System Functional Requirements.

No	Actor	Functional Requirements
(1)	(2)	(3)
1.	Borrower	Borrowers can see the list of items and places.
		Borrowers can apply for borrowing goods or premises.
		Borrowers can cancel loan applications that have not been approved.
		Borrowers can see the history of previous loans.
		Borrowers can return items or places that have been borrowed.
		Borrowers can find out the availability of goods or places they wish to borrow.

		Borrowers can receive notifications or alerts regarding loan status.
2.	Admin	Admin can view and manage the list of incoming loan applications.
		Admin can approve or reject loan requests.
		Admin can track all user loan transactions.
		Admin can export loan data into a specific format (Excel).
		Admin can manage asset data into the system.

The system's functional requirements were identified based on the needs of two main actors, namely borrowers and administrators. As shown in table 1, the functional requirements describe the main features and capabilities that each actor should have within the system. Borrowers can view available items and places, submit and cancel loan applications, check loan history, return borrowed items, and receive notifications regarding loan status. Meanwhile, administrators can manage loan requests, approve or reject applications, monitor all loan transactions, export loan data in specific formats (such as Excel), and manage asset information in the system. These requirements serve as the foundation for the system's design and ensure that both users and administrators can efficiently perform their respective tasks.

Non-Functional Needs

Non-functional requirements describe requirements or characteristics that a system must meet beyond its primary function, such as system performance, efficiency, and quality. These requirements are identified using the PIECES framework to help map out the aspects that must be considered for the system to function properly. This addition reinforces the use of the PIECES framework in analyzing non-functional requirements. The PIECES framework is a comprehensive method for evaluating system needs across six critical dimensions: Performance, Information, Economy, Control, Efficiency, and Service. It helps ensure that the system not only meets functional goals but also aligns with broader organizational expectations for quality, cost-effectiveness, and user satisfaction [11]. The table below shows the PIECES framework used to analyze a system's non-functional requirements.

Table 2. PIECES Framework.

Aspect	Running System	System Requirements
(1)	(2)	(3)
Performance	• The loan process is slow because it has to be done manually. • It is difficult to monitor the availability of goods/space directly.	• Fast and responsive system. • Access information on item/space availability directly.
Information	• There is no information on the availability of goods and places that	• Automatic notification for loan status (accepted or rejected). • Accurate reports on item/space availability.

	can be accessed quickly and accurately. • Lack of transparency of loan status for borrowers.	
Economy	-	-
Control	• Limited control over the use of goods/space. • It is difficult to track borrowing history.	• Authorization system to ensure only STIS accounts can borrow. • Tracking of borrowing and return history.
Efficiency	• Iterative and time-consuming process (verbal/written). • Borrowers must come in person for confirmation.	• Automation of the loan process (online submission). • Reduction of admin workload through a centralized system.
Service	• The service is inefficient and less than satisfactory for borrowers. • There is no self-service access to check availability.	• Online search and submission features. • Increased user satisfaction with faster and more transparent services

To further analyze system requirements, the evaluation was conducted using the PIECES framework, which considers six key aspects: Performance, Information, Economy, Control, Efficiency, and Service. As shown in table 2, this framework highlights the main problems of the current manual system and the corresponding requirements for improvement. In terms of performance, the current process is slow and difficult to monitor, while the proposed system should be fast and provide direct access to item or space availability. From the information aspect, the lack of transparency and real-time data in the existing system will be addressed through automatic notifications and accurate availability reports. The control aspect focuses on implementing an authorization mechanism and tracking system for better monitoring. Efficiency improvements include automating the borrowing process to reduce administrative workload, and in the service aspect, the system aims to provide online submission and search features to enhance user satisfaction and transparency.

3.4 Proposed System Design

The designers used a flowchart diagram to analyze the proposed system design. These design can be seen in figure 3 below:

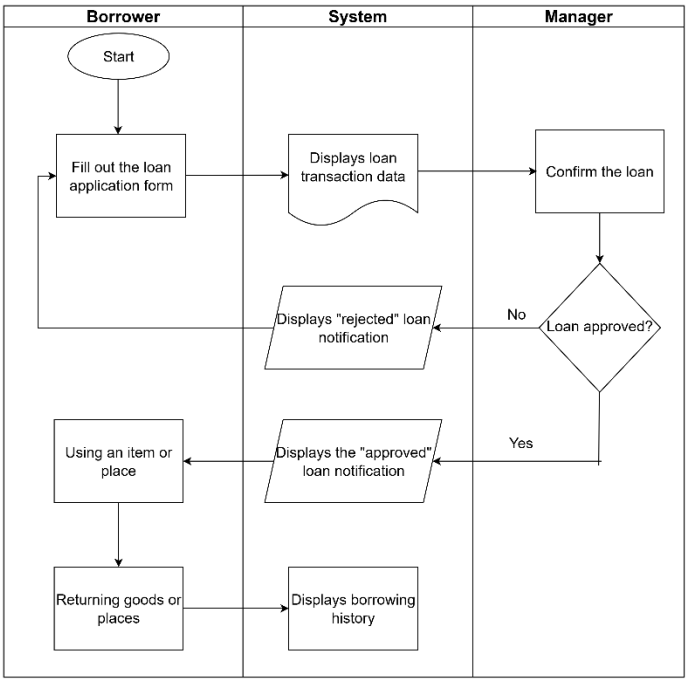

Figure 3. Proposed System Business Process.

The business process of the proposed system is illustrated in figure 3, which shows the interaction between the borrower, system, and manager. The process begins when the borrower fills out the loan application form, after which the system records and displays the loan transaction data. The manager then reviews and confirms the loan request. If the loan is approved, the system sends an “approved” notification to the borrower, allowing them to use the requested item or space. Conversely, if the loan is rejected, the system displays a “rejected” notification. After using the borrowed item or place, the borrower returns it, and the system updates and displays the borrowing history. This proposed process aims to automate and streamline the loan approval workflow, reduce manual interventions, and improve transparency between users and administrators.

3.5 Creating Use Case Diagrams

The design of the proposed system procedures is the initial stage of the system to be created. Use case diagrams play a critical role in mapping the interactions between users and the system. According to Dennis et al., use case diagrams help identify system functionalities from the user's perspective, clarify user roles, and define the boundaries of the system. They serve as a communication tool between stakeholders and developers, ensuring that the system design aligns with user expectations and operational needs [12]. The following is a use case diagram for designing an application for borrowing goods and space at the Politeknik Statistika STIS.

Figure 4. Use Case Diagram of the Proposed System.

In figure 4, The use case diagram illustrates the interaction of two main actors, namely Borrowers and Admins, in the goods and premises lending system. Borrowers can log in, apply for loans, check the availability of goods or premises, view notification notifications, view loan history, and return or cancel loan applications. Meanwhile, Admins have a more complex role, including logging in, viewing the loan list, approving or rejecting loans with the possibility of adding notes, managing loan reports, and exporting loan data. In addition, Admins are also responsible for asset data management, which includes adding, editing, and deleting asset data. This diagram shows how the system is designed to provide easy access for borrowers and full control for admins in managing assets and the lending process digitally and efficiently.

3.6 Database Structure Design

Entity Relationship Diagram (ERD) plays a vital role in designing an efficient database structure. As Coronel and Morris explain, ERDs help model the logical relationships among data entities, clarify data requirements, and ensure normalization principles are applied during design. By visually representing entities, attributes, and relationships, ERDs facilitate communication between developers and stakeholders, reduce redundancy, and support the creation of scalable and consistent database schemas [13]. The database structure design for the web-based application for borrowing goods and places at the Politeknik Statistika STIS is as follows:

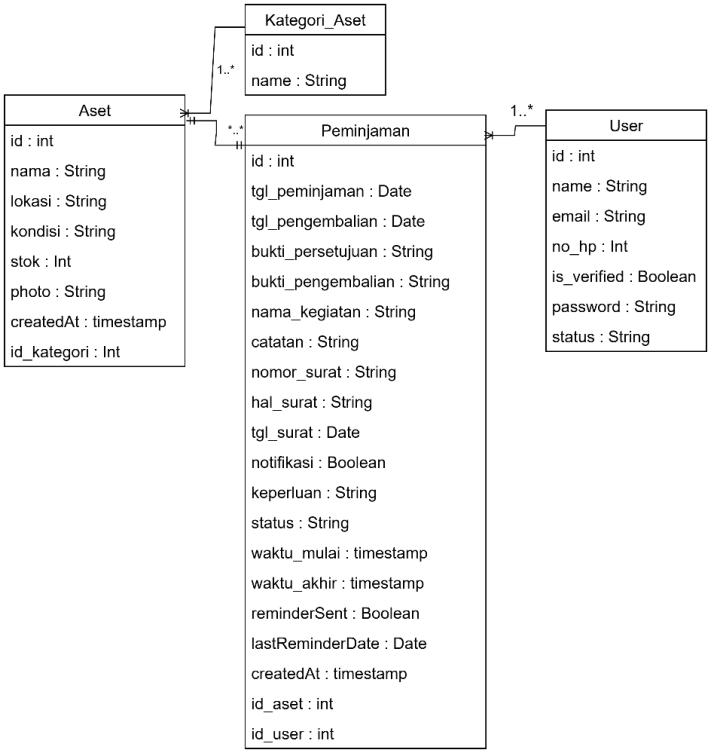

Figure 5. Database Structure Design.

In figure 5, The entity relationship diagram (ERD) shows the relationships between tables in the goods and premises lending information system. The User table has a one-to-many relationship with the Loan table, meaning one user can make multiple loans. The Asset table also has a one-to-many relationship with the Loan table, indicating that one asset can be borrowed in many different loan transactions. In addition, the Asset table has a many-to-one relationship with the Asset_Category table, meaning each asset has only one category, but a single category can include many assets. These relationships support structured and efficient loan data management.

3.7 Proposed System Architecture Design

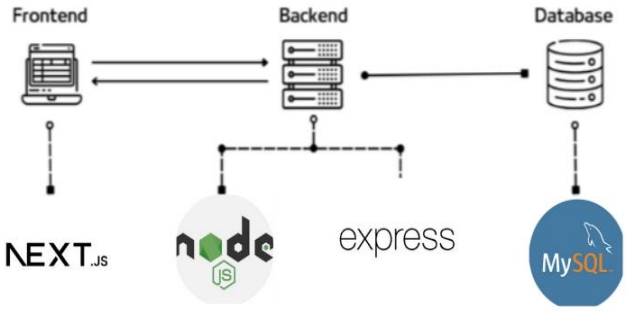

Figure 6. Proposed System Architecture Design.

In figure 6, The proposed system architecture design shows the architecture of a goods and place lending information system built using the Next.js, Node.js, Express.js, and MySQL technology stack. Next.js is used on the frontend to create an interactive and responsive user interface. On the backend, Node.js and Express.js handle application logic such as loan submission, approval, and data management. MySQL is used as the database to store user data, assets, and loan history. This

architecture supports the development of an efficient, structured, and easily accessible system in real time.

3.8 System Evaluation

Black Box Testing

Developers use blackbox testing to determine whether the system's functions function as expected [14]. Blackbox testing uses user input and observes the system's response output. After conducting blackbox testing, it is determined that all functions implemented in the system meet their intended purpose.

Post-study System Usability Questionnaire (PSSUQ)

The PSSUQ is used to measure the level of user satisfaction after using a system or application [15]. Website testing using the PSSUQ was conducted by 32 respondents who were Level 4 Statistics Politeknik Statistika STIS students majoring in Information Systems. The average score obtained was 1.69. According to Sauro and Lewis [9], an average PSSUQ score below 3.0 generally indicates a good level of user satisfaction with the system being tested. Thus, it can be concluded that users are satisfied with the system that has been developed.

3.9 Interface Design

Login Page

The following is a design of the interface for the login page, namely as follows:

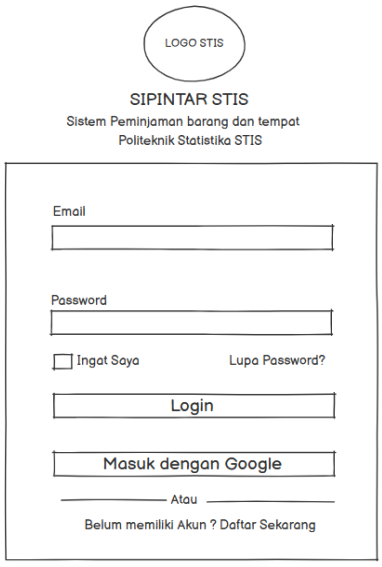

Figure 7. Login Page Interface Design.

The interface design for the login page of the proposed system is shown in figure 7. This page serves as the main access point for users to enter the system by providing their registered email and password. It includes essential features such as a “Remember Me” checkbox, a “Forgot Password” option for account recovery, and alternative login access through Google to enhance user convenience. Additionally, the interface provides a registration link for new users who have not yet created an account. The design aims to offer a simple, intuitive, and user-friendly layout that ensures secure authentication while maintaining accessibility for all users.

Admin Dashboard Page

The following is a design of the interface for the admin dashboard page, namely as follows:

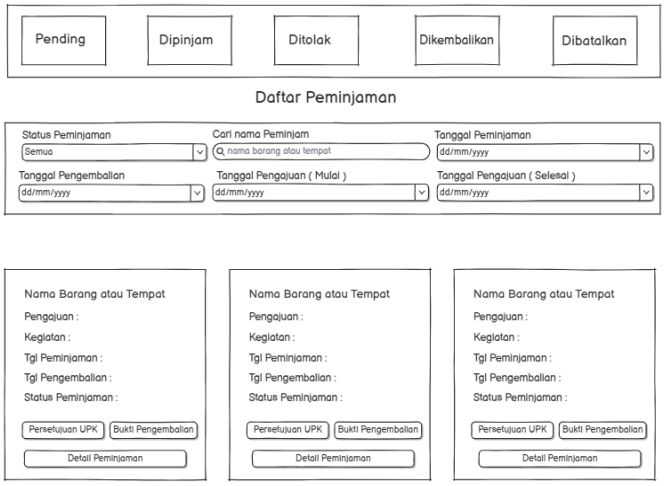

Figure 8. Admin Dashboard Page Interface Design.

The interface design of the admin dashboard page is illustrated in figure 8. This page serves as the main control panel for administrators to manage and monitor all loan activities within the system. It displays a summary of loan statuses—such as pending, borrowed, rejected, returned, and canceled at the top section, allowing admins to easily track the overall progress of borrowing requests. Below this, the system provides a detailed list of loan records with search and filter options based on borrower name, loan status, and date range. Each loan entry includes essential information such as item or place name, request details, loan and return dates, and current status. Additionally, the interface includes buttons for actions like approving or rejecting loan requests, as well as viewing proof of loan or return. This design ensures that administrators can efficiently manage loan data through a structured and user-friendly interface.

Loan Page

The following is a design of the interface for the borrowing page, namely as follows:

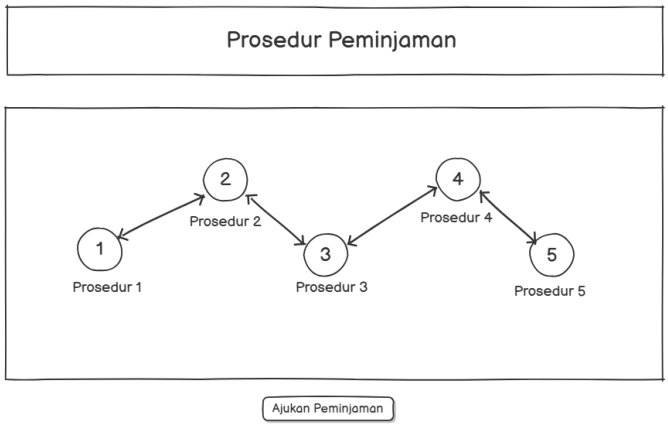

Figure 9. Loan Page Interface Design.

The design of the loan page interface is shown in figure 9. This page guides users through the borrowing procedure by presenting a clear and structured sequence of steps. The interface visually represents each stage of the loan process, labeled as Procedure 1 through Procedure 5, connected by

directional arrows to indicate the order of completion. This step-by-step layout helps users understand the required process before submitting a loan request. At the bottom of the page, there is an “Apply for Loan” button that directs users to initiate their loan submission. The design aims to enhance user comprehension, provide an intuitive navigation flow, and ensure that borrowers complete all necessary procedures systematically before applying.

Loan History Page

The following is a design of the interface for the Loan History page, namely as follows:

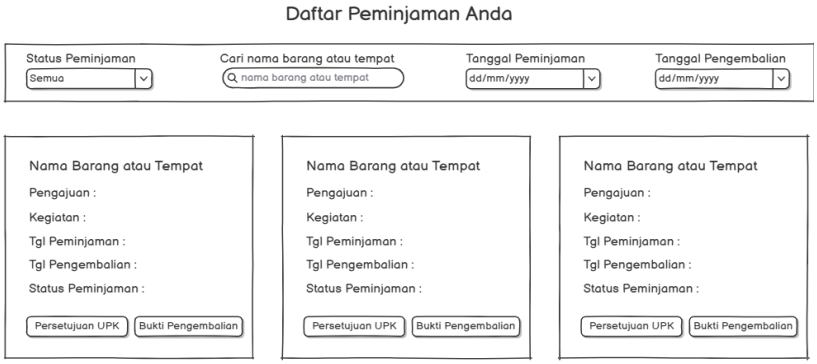

Figure 10. Loan History Page Interface Design.

The interface design of the loan history page is illustrated in figure 10. This page allows users to view and track their previous borrowing activities in a clear and organized manner. It provides search and filtering features based on item or place name, loan date, and return date, enabling users to quickly locate specific loan records. Each loan entry card displays essential information such as the item or place name, activity details, loan and return dates, and the current loan status. Additionally, the interface includes buttons for viewing approval documents and return receipts, ensuring that users can easily access related records. This design focuses on improving transparency, user accessibility, and the efficiency of monitoring borrowing history within the system.

3.10 Interface Implementation

Login Page

The following is a implementation of the interface for the login page, namely as follows:

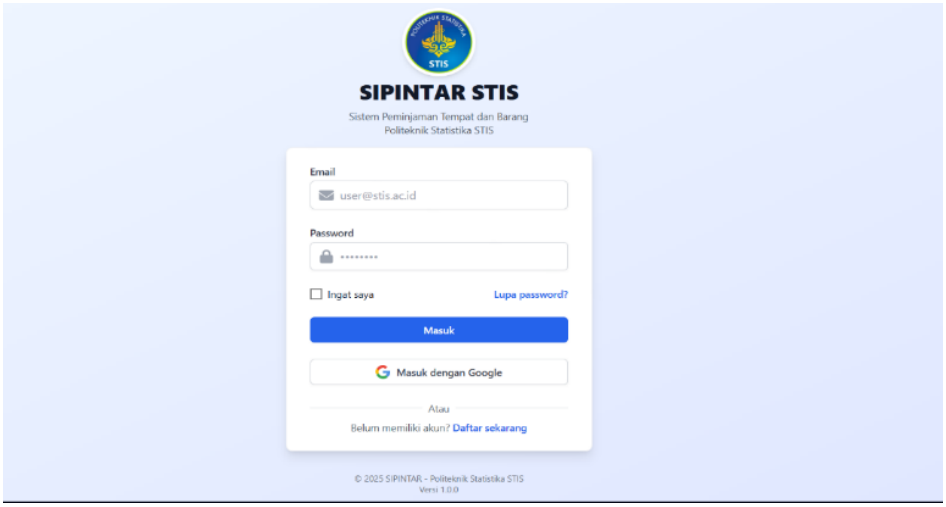

Figure 11. Implementation of the Login Page Interface.

The implementation of the login page interface is presented in figure 11. This page represents the actual design of the SIPINTAR STIS login system, allowing users to access the application securely. The interface includes input fields for email and password, a "Remember Me" checkbox, and a "Forgot Password?" link to help users recover their accounts easily. It also provides an alternative login option using Google accounts, enhancing accessibility and convenience. The layout follows a clean and minimalistic design, featuring the official STIS logo and system name to maintain institutional identity. Overall, this interface implementation emphasizes user-friendliness, security, and consistency with the system's visual design standards.

Admin Dashboard Page

The following is a implementation of the interface for the admin dashboard page, namely as follows:

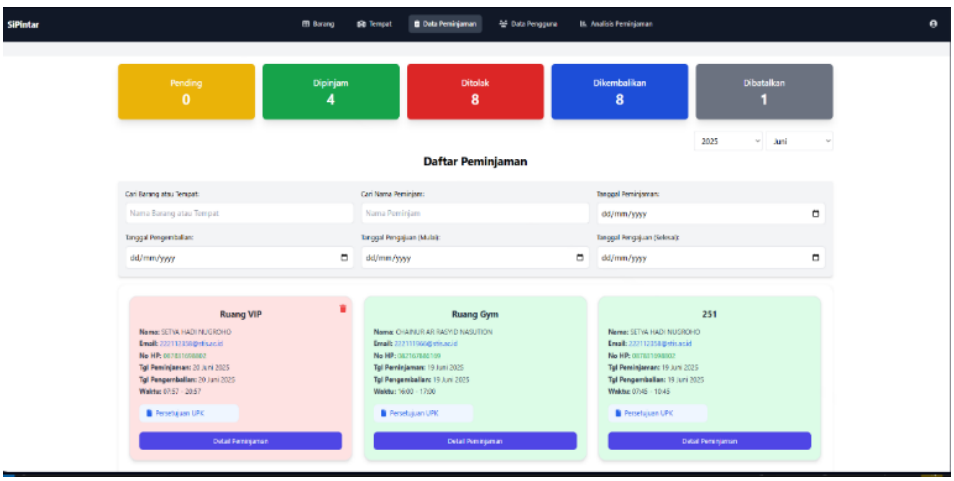

Figure 12. implementation of the Admin Dashboard Page Interface.

The Admin Dashboard Page Interface, shown in figure 12, provides a clear overview of borrowing activities. The top section displays color-coded status cards for Pending, Borrowed, Rejected, Returned, and Cancelled items. Below, search and filter fields allow administrators to quickly find records by item name, borrower, or dates. Individual borrowing records are presented in cards with key details and action buttons, enabling efficient management directly from the dashboard.

Loan Page

The following is a implementation of the interface for the borrowing page, namely as follows:

Figure 13. implementation of the Admin Dashboard Page Interface.

The Borrowing Procedure Page Interface, shown in figure 13, guides users through the step-by-step process of borrowing items. The interface presents a numbered roadmap with five steps, each highlighted with a distinct color for clarity. Step 1 instructs students to negotiate borrowing with the relevant department (UPK). Step 2 emphasizes scheduling borrowing outside class hours. Step 3 requires students to obtain approval from the academic administration (BAAK). Step 4 involves submitting the borrowing form after receiving approval. Step 5 reminds students that borrowing must be completed before 18:00. A prominently placed "Ajukan Peminjaman" button allows users to initiate the borrowing request directly from the page.

Loan History Page

The following is a implementation of the interface for the Loan History page, namely as follows:

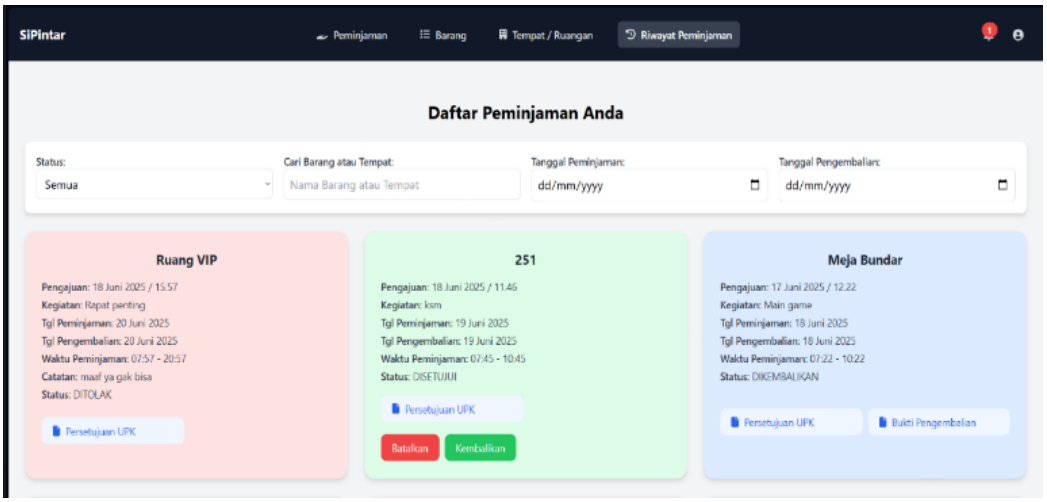

Figure 14. Implementation of the Loan History Page Interface.

In figure 14 shows the design implementation of the loan history page. This page enables users to clearly and systematically review their past borrowing activities. It features search and filter options by item or location name, loan date, and return date, allowing users to quickly find specific loan records. Each loan record card presents key details, including the item or location name, activity description, loan and return dates, and current status. The interface also provides buttons to access approval documents and return receipts, making related information easily available. This design aims to enhance transparency, user convenience, and the efficiency of tracking borrowing history within the system

4. Conclusion

Based on the results and discussion, it can be concluded that the borrowing of goods and space at the Politeknik Statistika STIS was previously carried out manually, requiring direct communication between borrowers and managers, while managers faced difficulties in tracking assets and were required to record transactions using spreadsheets for reporting. This study successfully designed and implemented a digital information system that enables users to access availability information and submit loan requests online, thereby simplifying the manual process. The system has been tested using the Black Box Testing method, which confirmed that all features function as expected from both user and administrator perspectives. In addition, the usability evaluation using the Post-Study System Usability Questionnaire (PSSUQ) showed that the system provides a good level of ease of use and user satisfaction, indicating that the developed system is feasible and effective in supporting the process of borrowing goods and space within the Politeknik Statistika STIS.

This study identifies three main limitations and offers suggestions for future research. First, the system was only tested within the Politeknik Statistika STIS environment and has not yet been evaluated in other institutions or settings, which limits the generalizability of the results. Second, the developed prototype does not yet include integration with mobile applications or real-time notifications such as WhatsApp or email. Third, The researchers limited the evaluation to Black Box Testing and PSSUQ, without conducting deeper assessments of system performance or security. Based on these limitations, the study recommends that future researchers expand testing to multiple campuses or government institutions, develop a mobile version with integrated push notifications, and conduct penetration testing or load testing to achieve a more comprehensive system evaluation.

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