

## Design of a Web-Based E-Perpus Information System for The Faculty of Tarbiyah and Teacher Education UIN Sumatera Utara

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### ABSTRACT

The Faculty of Tarbiyah and Teacher Training UIN Sumatera Utara requires a more efficient and integrated library management system to support the learning process. The goal of this study is to create an electronic library information system (E-Perpus) that allows lecturers, students, and academics to digitally access library collection information. We designed this information system to streamline the process of searching, borrowing, returning, and managing library collection data. This study employs a system development approach, which involves stages of needs analysis, design, implementation, and system testing. Problems that occur at the research location of the Faculty of Teacher Training and Education UIN Sumatera Utara include difficulties in accessing library information, limitations of the manual system, and lack of data integration. The design process for the web-based E-Perpus application begins with an analysis of user needs, followed by interface design and system development using the Rational Unified Process methodology. We designed this application to streamline the process of searching, borrowing, and returning books. The test results show that the application functions well on various devices, with a responsive and user-friendly interface. Testing was carried out using a black box, and all features ran well. The study yielded a prototype of the E-Perpus application, which includes features for book searching, information availability, online book borrowing and return, and data management for library members. We expect the implementation of this E-Perpus system to enhance library management efficiency and streamline user access to the necessary learning resources.

**Keywords:** Library Information System, E-Perpus, System Design, Library Data Integration

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### 1. INTRODUCTION

The Faculty of Tarbiyah and Teacher Training at UIN North Sumatra is one of the faculties with a significant number of students, making it very important for this faculty to have a library management system, which has become a necessity, so that its students can access and read the information available in the library effectively and efficiently through the implementation of a system called e-library. Thus, the faculty can improve the quality of library services; this will also facilitate students in accessing information, as well as the performance of librarians. (Arbianti et al., 2024).

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E-library, as a center of information and learning resource, plays a very important role in supporting academic activities. With the rapid development of information technology today, libraries must be more conventional in starting to implement digital library systems or e-libraries. Electronic libraries offer various advantages, such as faster and easier access to information, unlimited storage capacity, and more flexible services. (Rianti et al., 2023).

The issues that often arise are, of course, efficiency, such as the borrowing process, book retrieval, and searching, which are still largely done manually, taking a long time, and of course, errors always occur. Then there is also capacity, such as limited book storage space, which can hinder the addition of new collections. Information about the book collection is often outdated and difficult for users to access.

Based on the identified problems, the design of a Web-Based E-Library Information System for the Faculty of Tarbiyah and Teacher Training (FTIK) at UIN North Sumatra becomes important to improve the efficiency, accessibility, and services of the library. This application is designed to address issues of manual management, limited information access, and the lack of integrated digital services. This research aims to continue and transform the use of a web-based electronic library information system effectively and efficiently for the Faculty of Tarbiyah and Teacher Training at UIN North Sumatra, thereby improving the quality of existing library services and facilitating students in borrowing and reading at the library (Yuningsih & Silaningsih, 2020).

The user service process is still conventional, making it less interactive and unable to meet the diverse needs of users (Lee et al., 2015). Of course, the problem formulation in the implementation also includes how to design an e-library information system that meets the needs of the Faculty of Tarbiyah and Teacher Training at UIN Sumatera Utara, as well as what features need to be integrated into the e-library information system, and how to implement the e-library information system to run effectively and efficiently (Ibrahim & Nada, 2022).

With the presence of a web-based system like e-library, we hope to accelerate the process of borrowing and returning books, improve the accuracy of book collection data, expand access to information for users, enhance the efficiency of librarian work, and provide more interactive and personalized services to users (Baroroh et al., 2023).

## **2. LITERATURE REVIEW**

### **2.1. Information System**

Information system, or commonly abbreviated as IS, is a system that combines human activities and the use of technology, which serves to collect, store, manage, and disseminate information relevant to an organization. The use of technology includes hardware, software, people, databases, and procedures that work together. Information systems are not just technology infrastructure, but are at the heart of modern business operations. By understanding the role and components of information systems, companies or organizations can make optimal use of them to improve efficiency, decision making, and competitiveness in the market (Mulyana et al., 2023). Information systems can also be defined as a combination of technologies to support operations and management. A system is an important tool and is needed by a company or official agency. This is because with an integrated system, the performance of a company or agency will be more directed and systematic. But to get a positive impact from using the system, all the elements involved in it must work together to achieve predetermined goals.

The method used in this research is UML (Unified Modeling Language). UML (Unified Modeling Language) is a standard modeling language used to design and document software systems. UML provides various diagrams that help in depicting the structure and behavior of a system. Dana is also a Black Box method. The use of UML in designing E-Library applications helps the development team to understand system requirements more clearly, facilitates communication between team members, and provides documentation required for system development and maintenance. Black Box is a software testing technique that focuses on testing system functionality without considering the internal structure or implementation code. In this method, the tester only sees the input given to the system and the resulting output, without knowing how the system processes the input. The Black Box method is very effective in ensuring that the E-Perpus application meets user needs and functions well in real situations. By combining UML and Black Box methods, the application design and testing process becomes more structured and efficient.

## 2.2. E-Perpus

E-Perpus is a digital library application that gives access to its users to become library managers and members. In collaboration with hundreds of well-known publishers, ePerpus provides thousands of digital reading collections in the form of books, magazines, and newspapers. The ePerpus service can be accessed through iOS and Android-based smartphone devices. To view the collection of textbook titles, reference, and literacy. E-Perpus is also a digital library application that gives users access to become library managers and members. In collaboration with hundreds of well-known publishers, ePerpus provides thousands of digital reading collections in the form of books, magazines, and newspapers. The ePerpus service can be accessed through iOS and Android-based smartphone devices (Devitasari et al., 2021).

## 3. METHODS

This research implements the concept of designing a web-based e-Perpus information system at the Faculty of Tarbiyah and Keguruan Sciences at UIN North Sumatra. the research method goes through several stages, namely needs analysis, system design, development, and testing. Meanwhile, the development model carried out using the waterfall model aims to visualize and document the library information system design of a web-based software e-perpus information system website.

According to Robith (2020), the waterfall method is one type of application development model and belongs to the classic life cycle, which emphasizes sequential and systematic phases. For the development model, it can be analogized as a waterfall, where each stage is done sequentially from top to bottom. Figure 1 illustrates the process description for the waterfall method, which is a system design method (Rifki et al., 2023).

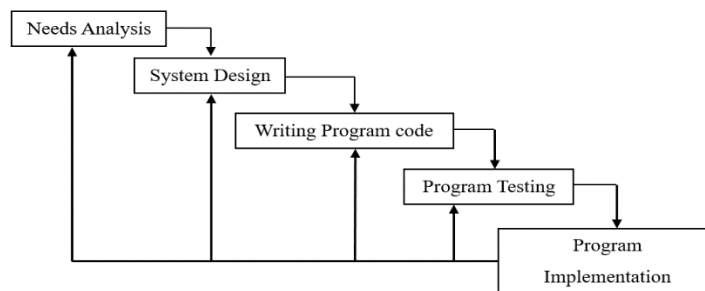


Figure 1. Waterfall Process Model

### 3.1. Research Stages

There are several stages that research goes through in this study, starting from data collection to research approaches. The stages in this research against Figure 2 (Rianti et al., 2023).

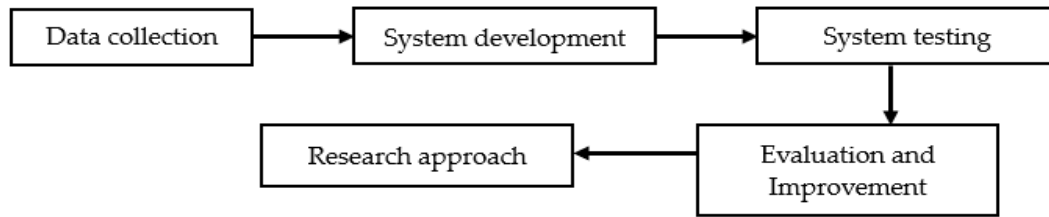


Figure 2. Research Stages

### 3.2. Data Collection

The research is carried out through several stages, the first stage is to collect data, there are some data needed as follows:

1. Literature Study, talk about the theory and research on library information systems, designing web-based systems, and using systems in educational institutions.
2. Observation: Make direct observations at the library of the Faculty of Tarbiyah and Keguruan Sciences to understand the existing work processes, the types of services provided, and the obstacles faced.
3. Interview: Conducting interviews with related parties, such as library managers, administrative staff, lecturers, and students, to get more in-depth information about system needs.
4. Questionnaires, distributing questionnaires to prospective users to find out their needs and expectations of the e-Perpus system (Lumbanraja, 2018).

### 3.3. System Development

Using the SDLC (Software Development Life Cycle) Method or Waterfall Method in the system development process because this method is suitable for projects that have specific needs from the start. Stages that are passed include:

1. Needs Analysis, Determining the functional and non-functional needs of the system, such as book search features, borrowing, returning, notifications, and others.
2. System Design: Create a system design, including database design, user interface, and process flow in the application.
3. Implementation: Develop the system using appropriate programming languages and web technologies, such as PHP, HTML, CSS, and MySQL for the database.
4. Testing: Testing the system using black-box and white-box testing methods to ensure each feature runs according to its function and find errors or bugs that need to be fixed.

### 3.4. Black Box System Testing

Black box testing is a type of testing method that treats software whose internal performance is unknown. So that the tester views the software like a "black box" which is not important to see the contents, but is sufficiently subjected to the testing process on the outside. Research conducted by

Anisah shows that black box testing is a type of testing that treats software whose internal performance is unknown. So that the testers view the software like a “black box” which is not important to see the contents, but it is enough to be subjected to the external testing process. In this type of black box testing, the software will be executed, then tried to be tested whether it has met the user needs defined at the beginning without having to disassemble the program listing. Apart from using black box testing, system testing can be done using beta testing. Beta testing is a form of testing carried out by users by making questionnaires about the applications made (Hoar & Jatmiko, 2024).

1. Login: input User enters username and password, Process: The system verifies user credentials with the database. Output: If successful, the user is directed to the dashboard as desired. If it fails, the system displays an error message.
2. Search for Books: Input User enters keywords (title, author, or category) in the search field. Process: The system searches for books that match keywords in the database. Output: List of relevant books, complete with information such as title, author, and availability.
3. Book Category: Input User selects the book category he wants to search for. Process: The system displays a list of books that match the selected category. Output: List of relevant books, complete with information such as title, author, and availability.
4. Library Report Entry Date Borrowing: Input The librarian enters the book borrowing date into the system. Process: The system records the loan date for each transaction. Output: Borrowing date recorded in the borrowing report.
5. Library Report Entered Date of Borrowing: Input The librarian enters the book return date into the system. Process: The system records the return date for each transaction. Output: The return date is recorded in the return report.
6. Library Report Member Name (Student) : Input the name of the member (student) who borrowed or returned the book. Process: The system records the names of members involved in the transaction. Output: Name of member recorded in the loan and return report.
7. Incoming Message: Input Users (students or lecturers) send messages or questions via the message feature. Process: The system receives and stores incoming messages. Output: Messages received in the system to be followed up by library staff.
8. Sent Message: Input Librarians reply to messages received from users. Process: The system sends a message reply to the user. Output: The sent reply message is recorded in the system, and the user receives a notification.

With these steps, the E-Perpus application can provide a better experience for users in accessing and borrowing books, as well as ensuring that all processes run efficiently and transparently. In addition, the report feature helps library staff better manage borrowing and return data. After the initial implementation, evaluate the performance of the system based on user feedback. This evaluation can be done through follow-up interviews or surveys. After obtaining evaluation results, system improvements can be made to improve performance and better meet user needs (Titus Ardia Meva et al., 2024).

## **4. RESULTS AND DISCUSSION**

### **4.1. Needs Analysis**

Requirement’s analysis is a very important early stage in system development, where we identify the functional and non-functional needs of the system to be built. The following is a needs analysis for

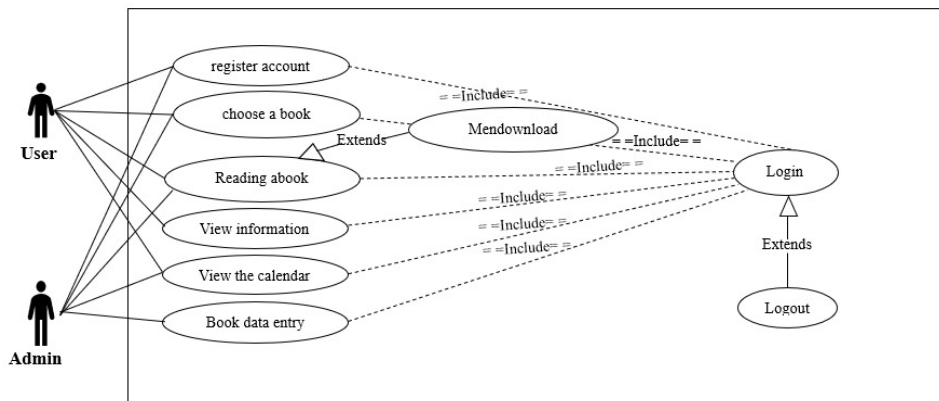
research on e-perpus or libraries. This stage collects information and determines user needs for the e-perpus system, such as book search features, borrowing, returning, and reading digital books.

**4.2. System Design**

Based on the collected requirements, this stage designs the system architecture and components. This design includes the database, user interface, and backend system to be used. The system design includes: Unified Modeling Language (UML), database, and user interface. UML is a modeling of a system that uses diagrams and texts as explanatory diagrams. The system design process using UML is divided into 2 parts, namely from the admin and student side. As an admin, you will have full access rights regarding the functions and features of the system that will be created based on the needs as an admin on system management. Students are only users who have certain functions and have limited access rights.

**1. Use case Diagram**

At this stage, the Use case diagram contains a description of what activities and interactions are carried out on a system and actors, what is described is what is done not how to do it (Rianti et al., 2023).



**Figure 3.** Use Case Diagram of Website-based E-Perpus

From Figure 3 above, it can be explained that activities are carried out by two actors consisting of admin and user. In this system, the user has five use cases, namely registering an account, selecting a book, reading an ebook, and viewing a calendar. The admin in this application plays a role in inputting books into the system. 1. Users (Students or Academic Community) My users, Register Account: Users can create an account bar, Select Books: Users can search d, Read Books: Setextend of \*CSelect Books , meaning, View Information: Users can View Calendar: Users can complete, Download: Users can download information, books, include several other features, Login and Logout: All ak. Then Admin, Book Data Entry: Admin View Information and View Calendar: Same Download: kendi admin Login and Logout: Admin must also log in

**2. Activity Diagram**

A user activity diagram is a visual representation of the flow of actions performed by a user when interacting with a system or website. At this stage, the activity diagram will explain in

the form of images all activities on the website designed in the form of a collection of interactions

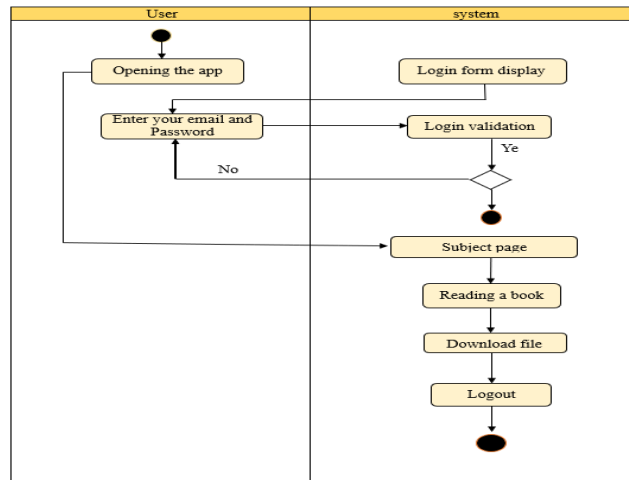


Figure 4. Login and BookActivity Diagram

In Figure 4, the login and book activity diagrams above can be seen that the activities carried out by the user are logging in and reading the book which begins with entering the email and password before entering the main page, then reading the book and downloading the file or book that you want to download from the webtie (Maulany & Bako, 2020).

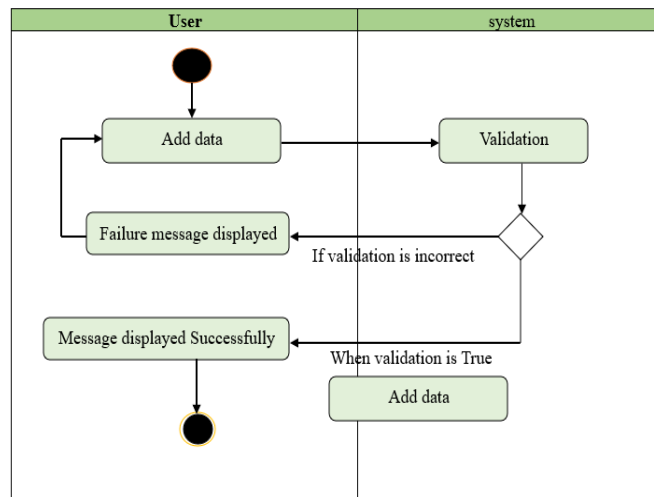


Figure 5. Activity Diagram of Adding Data

In Figure 5, the admin activity diagram above can be seen that the activity carried out by the admin is to add data from the website. When a user wants to add data to the e-library, for example adding a new book, there will be a series of activities carried out.

#### 4.3. Home Page Display

The initial view of the application for the admin role is the first user interface that officers or consumers will see when they attempt to log into the system. This interface is designed to provide ease in the login process, so that users can quickly access the available features. An intuitive and responsive design is essential for a better and more efficient user experience (Saputra et al., 2023).

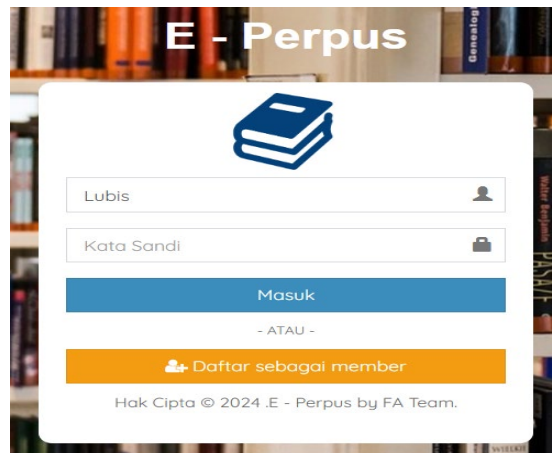


Figure 6. App Start View

#### 4.4. Login Page Display

Users, whether students, lecturers, or other library members, can access the E-Perpus login page securely and easily. Users will be required to enter their previously registered username and password on this page. On the Login Page, the admin enters the username and password to enter the application. If the username or password is wrong, the system will provide information that the username or password is wrong, so the admin is returned to the login page and must enter the username and password until it is correct according to what has been entered in the databases (Bukhori & Artika, 2023).

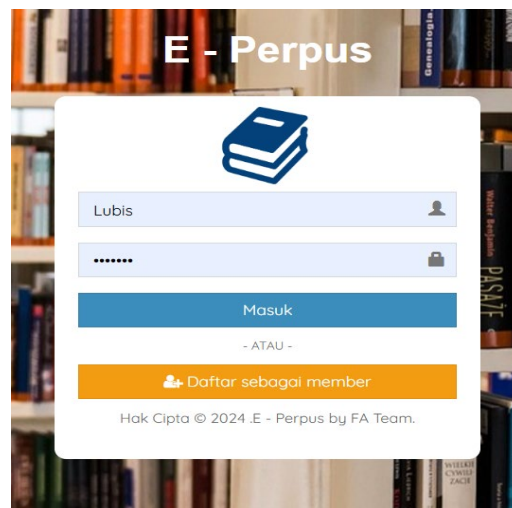


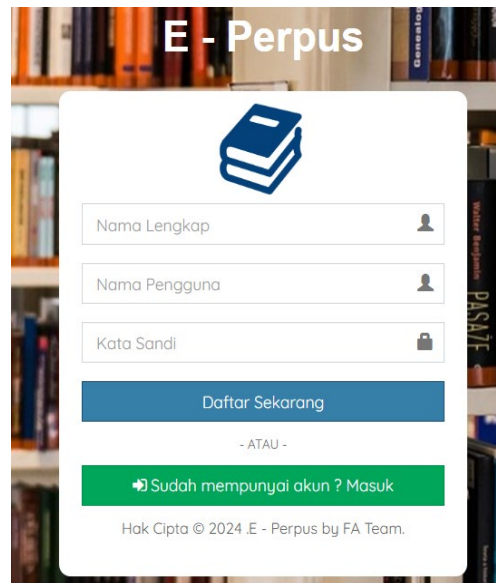
Figure 7. Login View

On the Login Page, the admin enters the username and password to enter the application. If the username or password is wrong, the system will provide information that the username or password is wrong, so the admin is returned to the login page and must enter the username and password until it is correct according to what has been entered in the databases (Bukhori & Artika, 2023).

#### 4.5. Display Registering an E-Perpus member account

Registering an E-Perpus member account is a process where users register to gain access to digital library or E-Perpus services. In this process, users need to fill in personal information, such as full name, username, and password. After registering, they can log in with the account that has been

registered by the member. With this account, users can borrow, read, and manage digital book collections, as well as enjoy various other features provided by the E-Perpus service, such as book recommendations, special reading collections, and book borrowing history (Tegal et al., 2024).



**Figure 8.** E-perpus membership registration

#### **4.6. Admin Dashboard View**

The E-Perpus system's Admin Dashboard page offers a comprehensive and user-friendly interface for library administrators to oversee various aspects of system operations. This page, which displays various information and functions related to library management, will direct the administrator upon successful login. The admin dashboard page can be seen in Figure 9.



**Figure 9.** Admin Dashboard

#### **4.7. Master Data View**

Master Data View is an interface or page in an application or information system that is used to display and manage the main data (master data) that is the basis of the system's operation. Master data includes important and basic data such as information about users, members, products, books, or other data that is often accessed and processed. This view usually contains CRUD (Create, Read, Update,

Delete) features to allow users to add, view, change, and delete the main data, so that the data remains accurate and relevant in supporting the operational needs of the application or system.

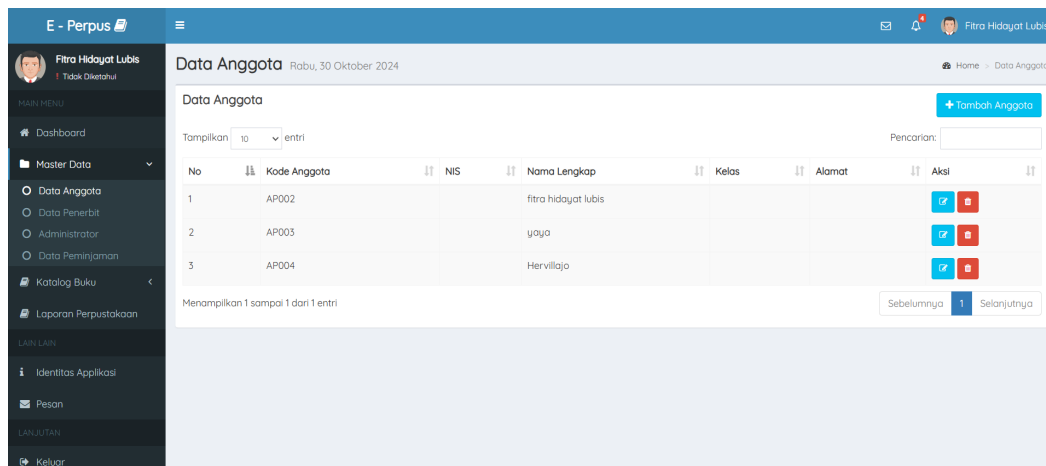


Figure 10. Data master

#### 4.8. Book Catalog

Book Catalog is a list or set of information about book collections available in a library or digital library system. This catalog contains complete data about each book, such as title, author, publisher, year of publication, ISBN, and a brief description of the book. In an E-Perpus, or digital library system, book catalogs are usually equipped with search and filter features to make it easier for users to find the desired book. The book catalog helps users to know the availability, location, and category of books, making it easier for them to search and borrow books.

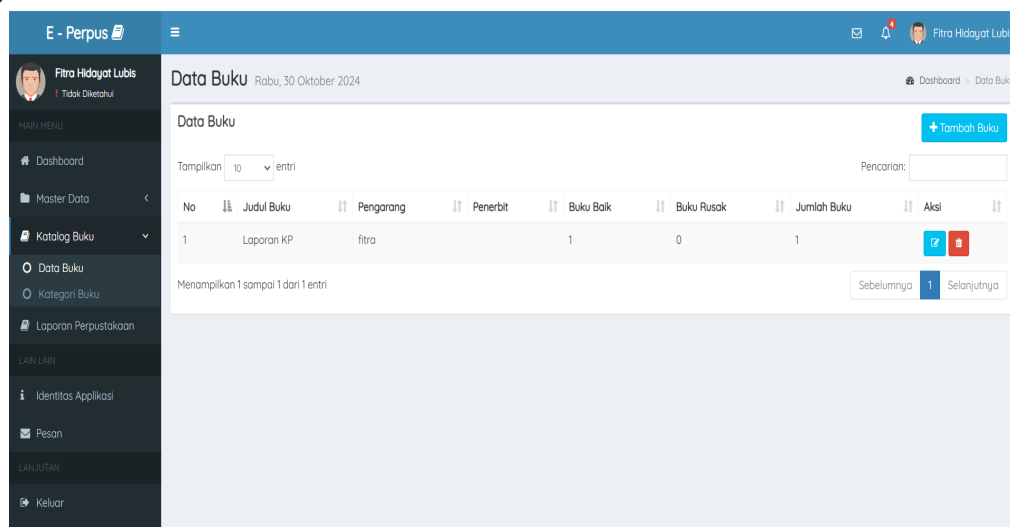


Figure 11. Book data

#### 4.9. Show App Identity

In Figure 9 above there is the notion of Show Application Identity, which is a feature or function in the application that functions to display important information about the application to the user. Information (Wardhana et al., 2023).

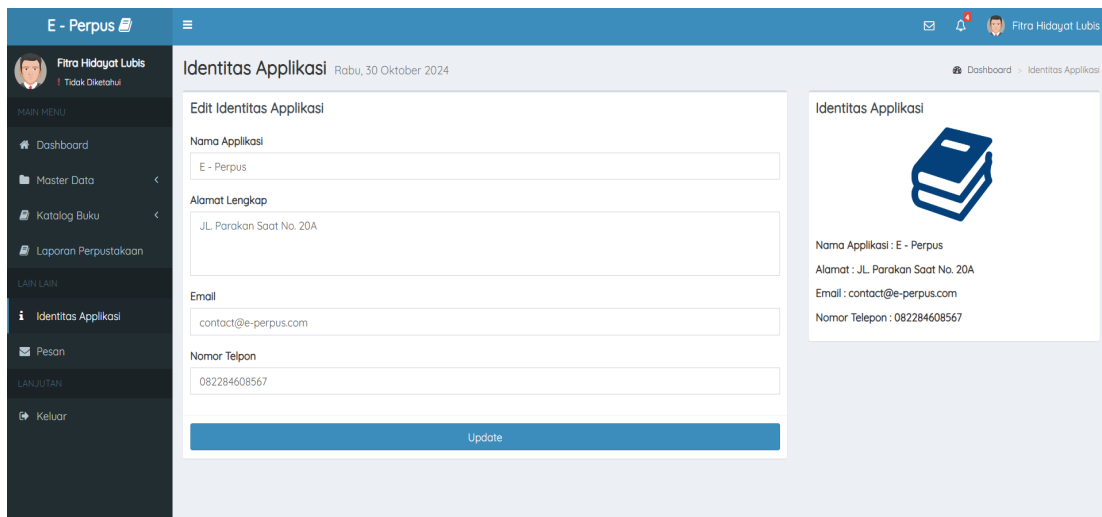


Figure 12 App Identity

#### 4.10. Information System Modeling Test

Conditions in the test procedure, inform the description of the website test. Of course, it is aimed at the successful condition, which is where the website runs with reality or runs with expectations that meet the requirements of the components made on the website. This process requires direct access from the browser system to run it. Testing of this software is a critical element of system device quality assurance and represents a key review of specifications, design, and coding (Sayuri et al., 2023).

Table 1. Black Box Testing of Academic Information System Admin

No.	Design Process	Expected results	Results
1.	Fill in the Login Form and Click the Login Button	Main Page Input	As per
2.	Click Master Menu and Fill in Master Form	Display the master menu options and Save Data	As per
3.	Click Transaction Menu	Display Transaction Menu Options and Fill in Transaction Data	As per
4.	Click on Report Menu	Display Report and Print Menu Options	As per
5.	Click the Graphics Menu	Display Student Graph	As per
6.	Click Logout	Exit the Home Page	Meets the requirements

#### Explanation of Steps

1. Fill Out the Login Form and Click the Login Button

Description: Users fill in the login (with data such as username and password) and press the login button.

- Expected result: Users are directed to the main page after a successful login.  
 Actual Result: The system meets expectations.
2. Click Master Menu and Fill Out Master Form  
 Description: The user clicks the Master menu and fills out the master form to input master data, such as book data, categories, or users.  
 Expected result: The system displays the master menu options, and the data can be saved correctly.  
 Actual Result: The system functions as expected.
  3. Click the Transactions Menu  
 Description: The user clicks on the Transactions menu, which allows for the entry of transaction data, such as borrowing or returning books.  
 Expected result: The system displays the transaction menu options and receives transaction data.  
 Actual Result: The system operates as expected.
  4. Click the Report Menu  
 Description: The user clicks on the Reports menu to view reports and selects the option to print the report.  
 Expected Result: The system displays the available reports and the print menu.  
 Actual Result: The reports and print menu are displayed as expected.
  5. Click the Graph Menu  
 Description: The user clicks the Graph menu to view a specific graph, such as a student data graph or a book usage graph.  
 Expected Result: The system displays the student data graph or other relevant data.  
 Actual Result: The displayed graph meets expectations.
  6. Click Logout  
 Description: The user clicks the Logout menu to exit the system.  
 Expected Result: The system directs the user out of the main page and ends the session.  
 Actual Result: The system meets expectations.

In accordance with the black box testing table above, which specifies only two choices in the form of Boolean data, the above test can be declared valid according to the findings when running the program regularly (Hasyim & Wijayanti, 2019).

Then there is a table 2 that explains the main functions of the e-library (e-perpus) system from a black box perspective. This approach shows how the system works based on inputs, processes, and outputs without paying attention to the implementation details (Saadah et al., 2023).

**Table 2.** The main functions of an e-perpus from a black box perspective

No	Testing Procedure	Input	Output	Description
1.	Login	Username & Password	Input username Lubis Password : fitra111	Application Dashboard page and login success notification

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2.	Book Search	Keywords (title, author, category)	Data search in book catalog	The data you are looking for is in the keywords
3.	Book Category	Category Code	Category Name	The data you are looking for is in the keywords
4.	Library Report	Login Date Borrowed	Display the file	On Displaying PDF Files
5.	Library Report	Incoming Date of Purchase	Display the file	On Displaying PDF Files
6.	Library Report	Name of member (student)	Display the file	On Displaying PDF Files
7.	Order	Incoming Messages	Recipient Name and Message Title, Message Content	The message will be sent to members
8.	Order	Message Sent	Display Mail delivery	The result sent earlier appears

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Component:

1. Login: This is the first step where users need to enter their username and password to access the system.
2. Book Search: Users can search for books using keywords, such as title, author, or category.
3. Book Categories: Allows users to browse books based on category codes, displaying the corresponding category names.
4. Library Reports: This component provides access to various reports related to the library, such as borrowed books, purchase entry dates, and member names.
5. Sequence: Used to send messages to members. Users can enter the recipient's name, message title, and message content.
6. Sent Messages: Displays the message delivery status, indicating whether the message has been sent or not.

Explanation of Columns:

1. Use Case: Description of features or activities that a user performs in the system.
2. Input: Data required as input by the system to execute the feature.
3. Process: Stages or steps performed by the system to process the input.
4. Output: The result or output provided by the system after processing the input (Salamah & Khasanah, 2017).

## 5. CONCLUSIONS

E-Perpus is a web-based digital library system that streamlines the access and management of library information in a contemporary manner. This system integrates features that allow users and library managers to interact with physical and digital book collections efficiently and in a structured manner. With a digital approach, e-Perpus provides solutions to various challenges faced by conventional libraries, such as limited geographic access, manual borrowing processes, and catalogue management constraints. Then, e-Perpus is an innovation that fundamentally transforms the operations

of traditional libraries. By integrating digital technology, this system makes it easier for users to access book collections and makes it easier for managers to manage catalogs. Features such as online borrowing, digital book access, and automatic catalogue management are also available. E-Perpus, as an information center and learning resource, plays a very important role in supporting academic activities. Efficiency issues frequently surface, including the manual process of borrowing, retrieving, and searching for books, which can be time-consuming and prone to errors. Then there is also the problem of capacity, such as limited book storage space, which can hinder the addition of new collections. Information about the book collection is often outdated and difficult for users to access. We designed this application to address the issues of manual management, restricted information access, and the absence of integrated digital services. This study aims to continue and transform the use of web-based electronic library information systems effectively and efficiently for the Faculty of Tarbiyah and Teacher Training, UIN North Sumatra, so that it can improve the quality of existing library services and make it easier for students to borrow and read in the library. The results of testing the application using the black box method demonstrate the functionality of the features in the e-library system. We recommend the application design for use at FITK UIN North Sumatra.

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