

Design of Web-Based Book Borrowing and Return Application at the Regional Library and Archives Office of North Sumatra Province

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ABSTRACT

A library is a room managed by an educational institution, providing a variety of book collections. The purpose of this study is to develop a web-based application that can facilitate the process of borrowing and returning books at the provincial library of North Sumatra. The web-based book borrowing application at the Provincial Library and Archives of North Sumatra is used to facilitate the process of borrowing and returning books, as well as to help the people of North Sumatra in finding information and expanding their knowledge from the books available at the Provincial Library and Archives of North Sumatra through more advanced library services. The method used in the development of this system is the waterfall model (Software Development Life Cycle). This model uses a systematic and sequential approach, with phases such as requirements, design, implementation, verification, and maintenance. The results of this study show that the web-based book borrowing and returning application at the Provincial Library and Archives of North Sumatra can facilitate the process of borrowing and returning books, with features such as users being able to borrow and return books online, view a list of available books, and track the status of their book loans online.

Keywords: Web Applications, Waterfall Model, Digital Library

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1. INTRODUCTION

A library is a room managed by an educational institution that provides various collections of books. To create a library that is well organized and systematic. The library must have a web-based application, which can facilitate the process of borrowing and returning books in the regional library of North Sumatra Province (Fahmi et al., 2016). Law Number 43 of 2007 concerning libraries states that a library is an institution that manages collections of written works, printed works and/or recorded works professionally with a standard system to meet the educational, research, preservation, information and recreation needs of users.

Information technology has developed rapidly in recent years. This allows users to access information quickly and easily from anywhere. A library information system is a system that uses

computers to manage library data and information. This system can be used to monitor book availability, new book lists, book borrowing history and book returns (Firman et al., 2016).

The purpose of this study is to develop a web-based application that can facilitate the process of borrowing and returning books at the Provincial Library of North Sumatra. The web-based book borrowing application at the Provincial Library and Archives of North Sumatra is designed to streamline the borrowing and returning processes, as well as assist the people of North Sumatra in finding information and expanding their knowledge through advanced library services.

The development of this application utilized the waterfall model, a systematic and sequential approach that includes phases such as requirements gathering, design, implementation, verification, and maintenance. This model is particularly suitable for projects with clearly defined requirements, ensuring that each phase is completed before moving on to the next, thereby minimizing the risk of errors in system development (Sofyan et al., 2020).

2. LITERATURE REVIEW

Library information systems play a pivotal role in modern library management by facilitating the organization and accessibility of information. These systems are designed to streamline various library functions, including cataloging, circulation, and user management. By employing advanced technologies, libraries can enhance their operational efficiency and provide better services to their patrons. For instance, the implementation of a web-based library information system allows users to access the library's catalog remotely, check the availability of books, and manage their borrowing activities online. This not only saves time for users but also reduces the workload on library staff, enabling them to focus on more critical tasks such as user engagement and community outreach (Astianto et al., 2020).

In the process of designing and developing a web-based library application system, there are several relevant literature references that support successful implementation. A literature review was conducted to understand the basic concepts of library information systems, software development methods, and the use of web-based applications for book borrowing and returning services (Sutrisna et al., 2021).

Web-Based Library Information System A web-based library information system plays an important role in improving the efficiency of library services. According to Firman et al. (2016), this system allows users to access library data online, including information on book availability, borrowing, and returning books. This system also allows integration with databases to monitor library activities in real-time. Users can make book borrowing and returning transactions without having to come directly to the library, thereby increasing the convenience and efficiency of services (Firman et al., 2016).

Use of Information Technology in Library Services Information technology has become an important element in modern library management. Law Number 43 of 2007 concerning Libraries emphasizes that libraries as institutions that manage information collections must be managed professionally by utilizing technology to meet the educational, research, and recreational needs of user. The use of web-based applications for borrowing and returning books can help libraries carry out these tasks more efficiently, as well as enable the public to access information quickly and easily.

Waterfall System Development Model In software development, the Waterfall method is one of the models that is often used. This model is known for its systematic and sequential approach, where each stage such as planning, design, implementation, verification, and maintenance is carried out in a

structured manner. Abdul Wahid (2020) explains that the waterfall method is suitable for projects whose needs and specifications are clear from the start, such as library application development. The use of this method ensures that each phase is completed before proceeding to the next phase, thereby reducing the risk of errors in system development (Abdul Wahid, 2020).

Web-Based Library Applications The development of web-based library applications aims to provide services that are more easily accessible to users. A study by Fahmi et al. (2016) shows that this application can facilitate the management of book collections and borrowing activities in the library. Features such as online book catalogs, borrowing management, and book return notifications provide convenience for users and increase the efficiency of library management. A well-designed system can help libraries meet the information needs of the community more effectively (Fahmi et al., 2016).

The Importance of User Interface Design One important aspect in designing a web-based library application is the user interface design. An intuitive and easy-to-use interface design can improve the user experience in accessing library services digitally. Users who can access and understand the system easily will use library services more often, which ultimately increases the number of library collection usage (Nurhayati et al., 2023). Thus, these various literatures provide a strong theoretical basis in the development of web-based library applications. An integrated library system that uses information technology optimally is expected to facilitate book management and improve library services to the community.

3. METHODS

The method used in developing this system is the waterfall model. The software development method is also known as the Software Development Life Cycle (SDLC). The waterfall method is the earliest SDLC approach used in software development. This model uses a systematic and sequential approach. The stages in this model start from the planning stage to maintenance and are carried out in stages. The purpose of this study is to find out more details about the waterfall model if used by developers in building and developing information systems or software (Abdul Wahid, 2020).

The Waterfall model is one of the earliest methodologies used in software development, characterized by its linear and sequential approach. This model is particularly effective for projects where requirements are well-defined and unlikely to change throughout the development process. Each phase of the Waterfall model—requirements gathering, system design, implementation, verification, and maintenance—must be completed before moving on to the next, creating a structured framework that promotes thorough documentation and clear milestones. This systematic progression allows developers to focus on one aspect of the project at a time, reducing the likelihood of errors and ensuring that each component is fully functional before integration. Additionally, the Waterfall model facilitates better project management, as stakeholders can easily track progress and assess the completion of each phase. However, it is essential to note that while the Waterfall model is beneficial for projects with stable requirements, it may be less adaptable to projects where user needs evolve over time, necessitating careful consideration of the project's nature before selecting this methodology (Desy Ria & Budiman, 2021). The stages of the waterfall model can be seen in Figure 1

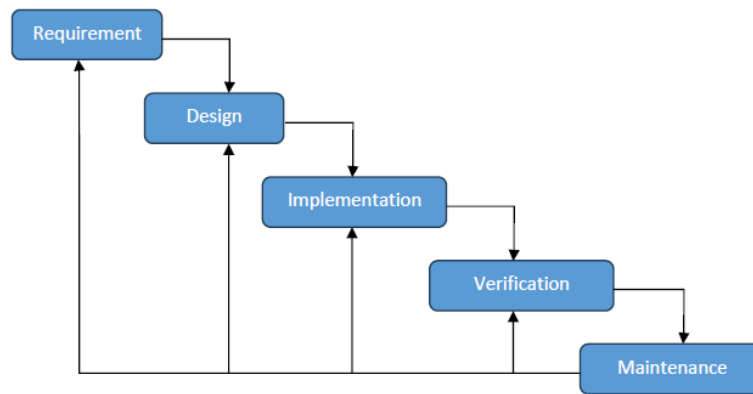


Figure 1. Waterfall Model

1. Requirement

At this stage, system developers need to communicate with users to understand the software needs, both in terms of functionality and limitations. Information can be obtained through various methods, such as interviews, discussions or direct surveys. The information is to obtain data needed by users.

2. Design

At this stage, the system developer creates a system design that includes hardware, system requirements and overall system architecture.

3. Implementation

At this stage, the system is developed in the form of small units which are then integrated in the next stage. These units are developed and tested for their functionality, which is called unit testing.

4. Verification

At this stage, the system is tested to ensure that the system meets the system requirements. Testing can be done on code units (unit testing), the system as a whole (system testing) or together with users (recipient testing)

5. Maintenance

The final stage of the waterfall method is software deployment and maintenance. Maintenance includes fixing errors, improving functionality and adapting to user needs.

4. RESULTS AND DISCUSSION

4.1. System Requirements

Software specifications that the author uses in creating and displaying the Web-Based Library Classification System, namely:

1. Visual Studio Code

Visual Studio Code (VS Code) is a powerful and versatile source code editor developed by Microsoft, widely used by developers for building and debugging applications across various programming languages. Its lightweight design, combined with a rich set of features, makes it an ideal choice for both novice and experienced programmers. One of the standout features of VS Code is its extensive support for extensions, allowing users to customize their development environment with tools for version control, debugging, and language support, among others. This flexibility enables developers to tailor the editor to their specific needs, enhancing productivity and streamlining workflows (Harjono & Kristianus Jago Tute, 2022).

2. XAMPP

XAMPP is a free and open-source cross-platform web server solution stack package developed by Apache Friends, designed to facilitate the deployment and management of web applications. It is an acronym that stands for **X** (cross-platform), **A**pache, **M**ySQL, **P**HP, and **P**erl. XAMPP provides an easy-to-install and configure environment that allows developers to run PHP applications locally on their computers, making it an essential tool for web development (Andani & Hendrayudi, 2021).

3. PHPMyAdmin

PhpMyAdmin is a widely-used open-source web application designed to manage MySQL and MariaDB databases through a user-friendly graphical interface. It is written in PHP and provides a convenient way for users to interact with their databases without needing to use command-line tools. phpMyAdmin is particularly popular among developers and database administrators for its ease of use and extensive features, making it an essential tool for managing database-driven applications (Mianti et al., 2023).

This application flowchart diagram is a general description when the application is used. The following is a flowchart diagram of a library web-based application that can be seen in Figure 2.

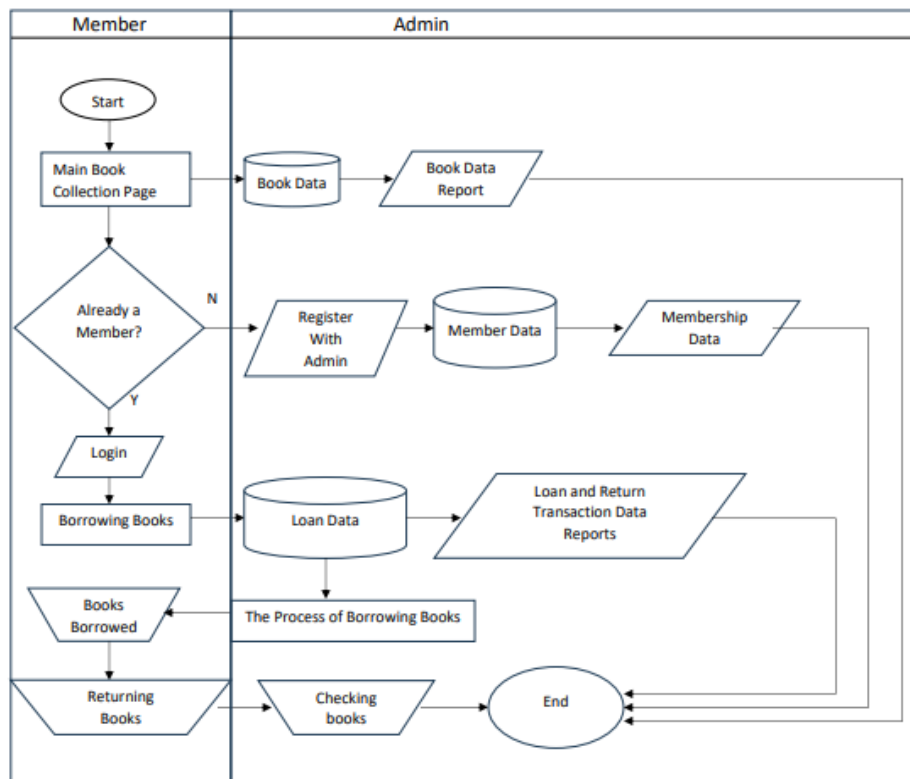


Figure 2. Application Flowchart

System requirements are a critical aspect of the software development process, outlining the necessary specifications and conditions that a system must meet to function effectively and fulfill user needs. In the context of a web-based library application, system requirements encompass both functional and non-functional elements. Functional requirements detail the specific features and capabilities the

application must provide, such as user registration, book search functionality, online borrowing and returning processes, and administrative controls for managing the library's inventory. Non-functional requirements, on the other hand, address the performance, security, usability, and scalability of the system, ensuring that it operates efficiently under varying loads and provides a positive user experience. For instance, the application should be designed to handle multiple simultaneous users without performance degradation, maintain data security to protect user information, and offer an intuitive interface that enhances accessibility. By clearly defining these system requirements, developers can create a comprehensive blueprint that guides the design, implementation, and testing phases of the project, ultimately leading to a robust and user-friendly library application that meets the expectations of its stakeholders (Rahmanto et al., 2022).

4.2. Application Implementation

Application implementation is the process of changing application design into executable program code. This process is carried out so that the application can meet user needs. This Library and Archives application has two user roles, namely admin (officer) and user (visitor).

User interface design is a critical component of any web-based application, as it directly impacts how users interact with the system. A well-designed interface should be intuitive, allowing users to navigate the application with ease. Key principles of effective UI design include clarity, consistency, and responsiveness. Clarity ensures that users can easily understand the functions of various elements within the application, while consistency helps users develop familiarity with the interface, reducing the learning curve. Additionally, a responsive design adapts to different devices and screen sizes, providing a seamless experience for users accessing the library application from desktops, tablets, or smartphones (Puspitasari et al., 2021).

4.2.1. Admin

1. Login Display

The following in Figure 3 is the home page of the North Sumatra Regional Library and Archives. The login page is the admin page where you must enter your username and password to enter the system.



Figure 3. Admin Login

2. Admin Home View

The following Figure 4 is the admin home view of the North Sumatra Regional Library and Archives. The admin home page is the main page of a website's administration system. This page can usually only be accessed by users who have admin access rights.

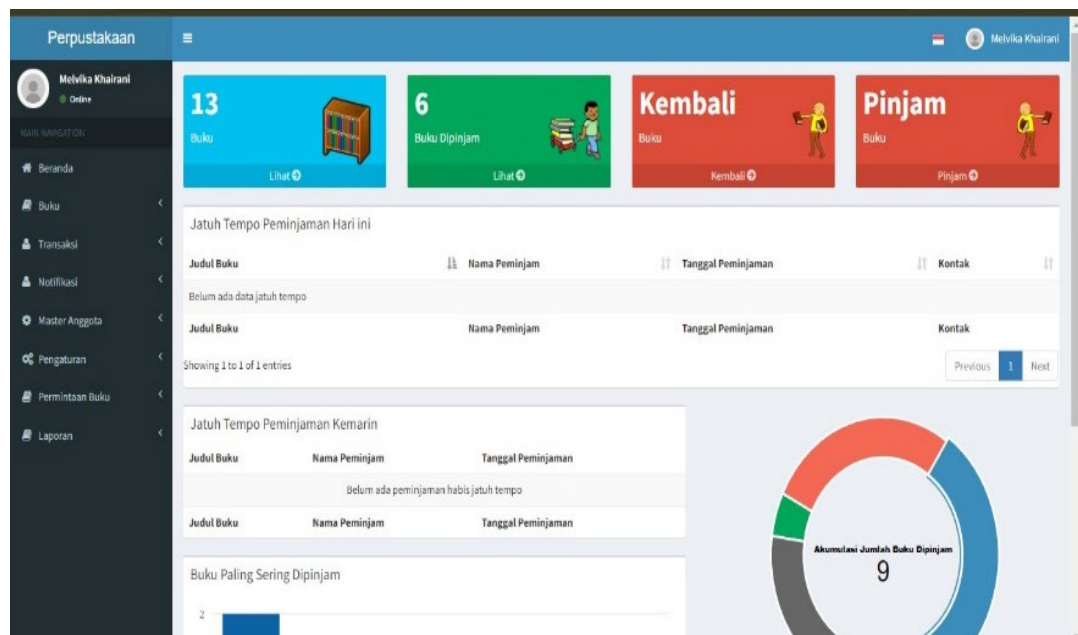


Figure 4. Admin Home

3. Loan Data Display

The following Figure 5 shows the loan display on the admin homepage. This section displays a list of books borrowed by visitors.

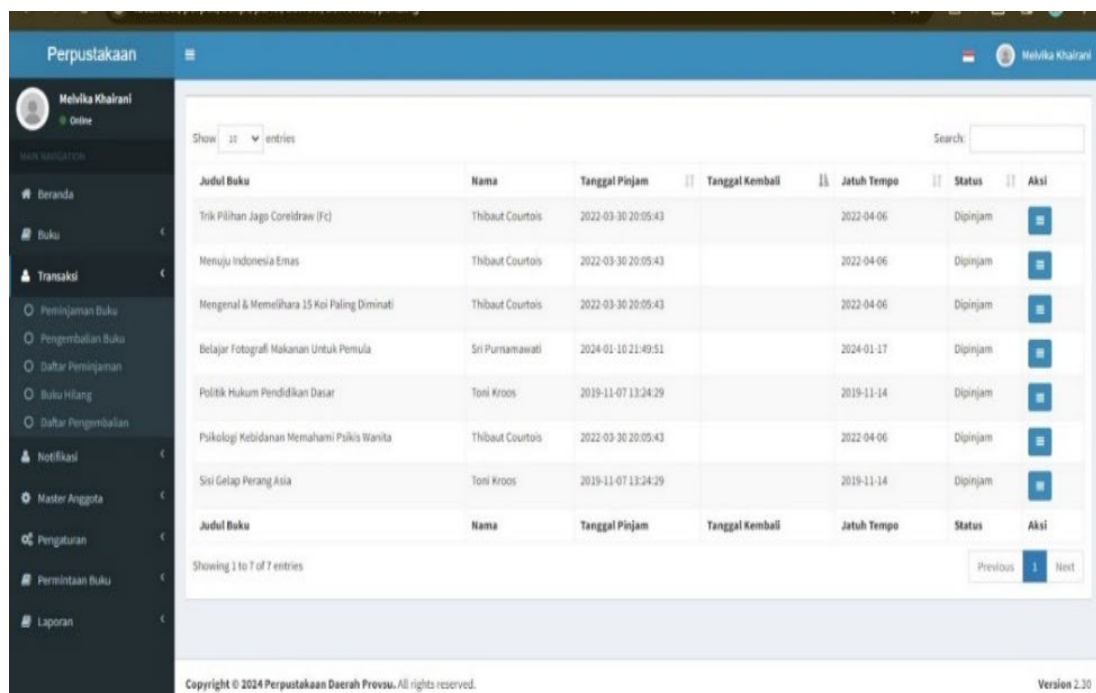


Figure 5. Loan Data Collection

4. Return Data Display

The following Figure 6 shows the return display on the admin homepage. This section displays a list of books that have been returned by visitors.

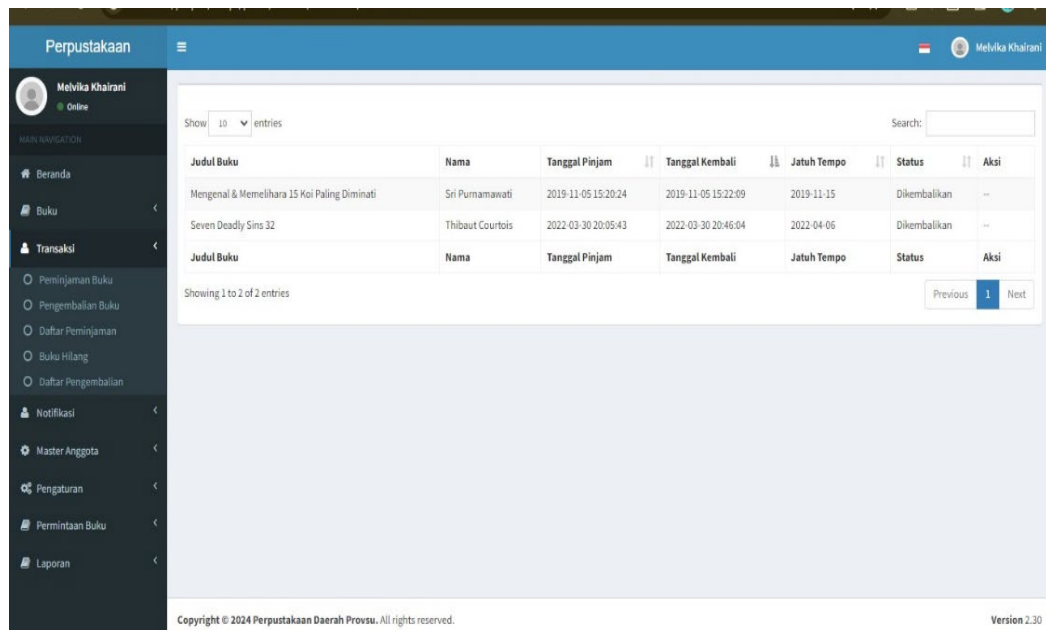


Figure 6. Book Return Data Collection

5. Lost Book List View

Figure 7 shows the lost book list view on the admin homepage. This view displays a list of lost books, which can be viewed by title, author, and date of loss.

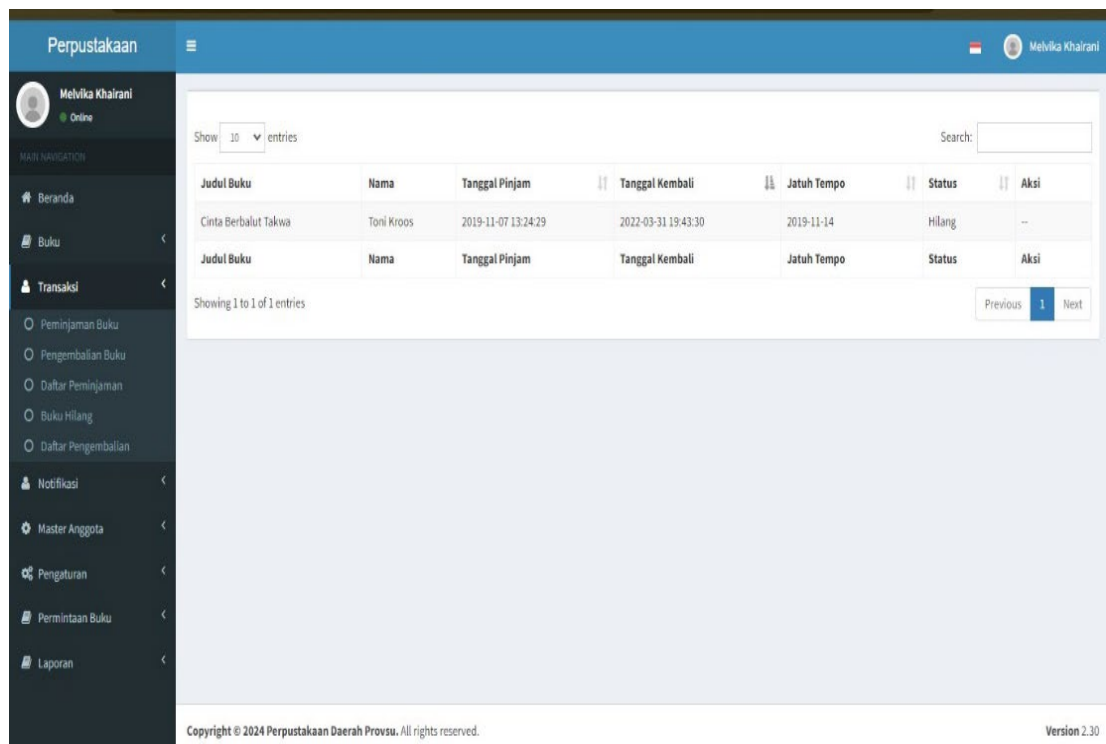


Figure 7. Lost Book Registration

6. Book Borrowing Display

Figure 7 shows the display of the user account that borrows a book. This display displays the user account information, book title, year, ISBN and book description, as well as a picture of the book to be borrowed.

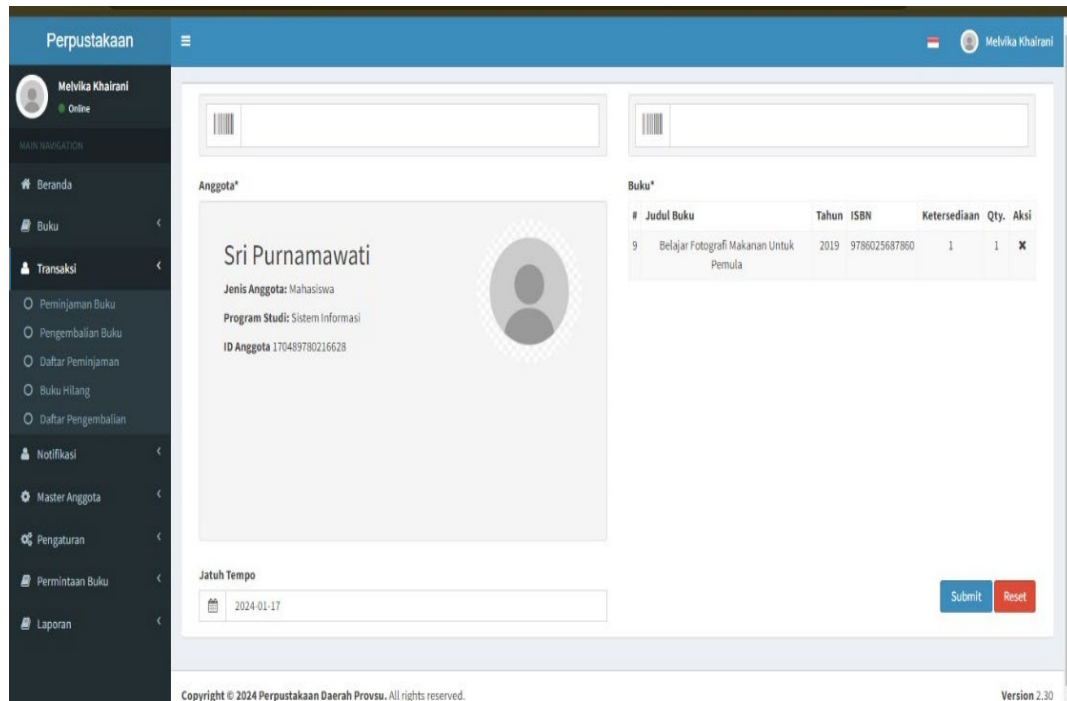


Figure 7. Book Borrowing

7. Book Return View

Figure 8 shows the view of the user account that will return the book. This view displays the user account information, book title, year, ISBN and book description, as well as a picture of the book to be returned.

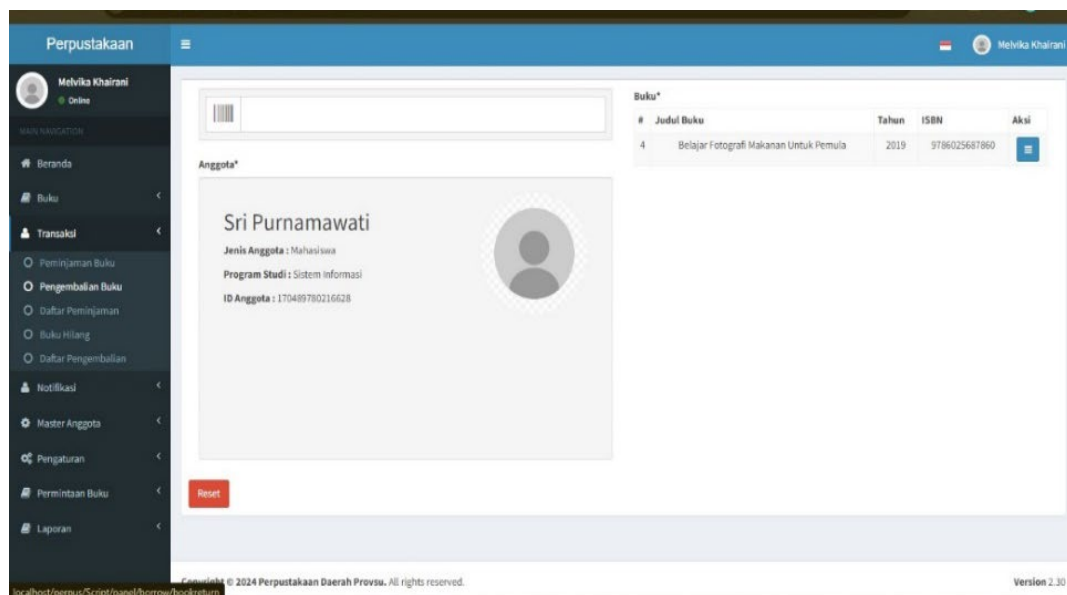


Figure 8. Book Returns

4.2.2. User

1. Login Display

The following in Figure 9 is the home page of the North Sumatra Regional Library and Archives. The login page is the admin page where you must enter your username and password to enter the system.



Figure 9. Visitor Login

2. Visitor Homepage View

The following Figure 10 is the visitor homepage of the North Sumatra Regional Library and Archives. This page displays information about the user account, which was active when the image was taken.



Figure 10. Visitor Home

3. Book List Display

The following figure 11 is a list of books being borrowed by visitors at the North Sumatra Provincial Library and Archives.

Gambar	Judul Buku	Kategori	Harga	Status	Jatuh Tempo	Baca
	Sisi Gelap Perang Asia(9786232410091) Penerbit : Penerbit Buku Kompas Pengarang : Alio Kurasawa	Sejarah	58000	Dipinjam	2019-11-14	Tidak Tersedia
	Politik Hukum Pendidikan Dasar(9786026111654) Penerbit : Pt Semesta Merdeka Utama Pengarang : Ichsan Yasin Limpo	Hukum	90000	Dipinjam	2019-11-14	Tidak Tersedia

Figure 11. Book List

4. Loan History Display

The following Figure 12 is a list of borrowing and returning history of books that have been borrowed by users at the North Sumatra Regional Library and Archives.

Gambar	Judul Buku	Kategori	Harga	Status	Jatuh Tempo	Tanggal Kembali
	Cinta Berbalut Takwa(9786230008320) Penerbit : Elex Media Komputindo Pengarang : Sukron Abdilah	Agama	55000	Hilang	2019-11-14	2022-03-31 19:43:30
	Sisi Gelap Perang Asia(9786232410091) Penerbit : Penerbit Buku Kompas Pengarang : Alio Kurasawa	Sejarah	58000	Dipinjam	2019-11-14	
	Politik Hukum Pendidikan Dasar(9786026111654) Penerbit : Pt Semesta Merdeka Utama Pengarang : Ichsan Yasin Limpo	Hukum	90000	Dipinjam	2019-11-14	

Figure 12. Book Borrowing and Return History

5. Edit Profile Display

The following Figure 13 is the edit profile display for visitors to the North Sumatra Regional Library and Archives.

Figure 13. Edit Profile

5. CONCLUSION

The web-based book borrowing and returning application at the North Sumatra Provincial Library and Archives Service can simplify the process of borrowing and returning books. This conclusion can be drawn from the results of the study which shows that the application has several features that can simplify the process of borrowing and returning books, such as:

1. Users can borrow and return books online, without having to come to the library.
2. Users can see a list of available books, as well as information about the book, online.
3. Users can track the status of their book loans online.

With this application, it is expected to increase the efficiency and effectiveness of library services at the North Sumatra Provincial Library and Archives Service.

It is further in line with the growing demands of library users to migrate towards electronic services. The application enhances user experience by providing current access to the status of the availability of library books and the status of loans in real time, reducing much labor on the part of library staff in operations. The result of switching to this digital service is an effective, accessible, responsive library system that would help establish a more lively reading culture in the community and would take into account the position of the North Sumatra Provincial Library and Archives Service in Education and Literacy Development.

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