

Design and Development of a Digital Library Book Lending Information System at Matrip Jombang with WhatsApp Notification Integration

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ABSTRACT

The development of information technology has driven the transformation of library services into more effective and efficient digital systems. One of the common problems faced by libraries is the delay in book returns and the lack of effective communication media between librarians and users. This study aims to examine the implementation of a digital library book borrowing system integrated with WhatsApp as an automatic notification medium. The research method used is descriptive qualitative with a literature study and system analysis approach. The results indicate that the integration of WhatsApp into the library borrowing system improves the accuracy of borrowing information, reduces delays in book returns, and enhances service quality. Moreover, the system facilitates real-time information delivery through a communication platform that is widely used by users. Therefore, utilizing WhatsApp as a notification medium is a relevant solution for developing digital library services in the information technology era.

Keywords: Digital Library, Borrowing System, WhatsApp Gateway, Automatic Notification, Information System.

INTRODUCTION

Libraries are essential facilities that support education, research activities, and the dissemination of information to the public. However, many libraries still face challenges in managing book lending services, particularly those that rely on manual processes. Conventional recording methods often lead to problems such as data inaccuracies, delays in book returns, and difficulties in monitoring borrowing status.

The development of information technology has created opportunities for libraries to transform toward digital systems. Digital library systems enable more structured data management, faster access to information, and improved service efficiency. One important aspect of a lending system is the delivery of information to users regarding borrowing status and book return deadlines.

WhatsApp, as an instant messaging application, has a very high level of usage in Indonesia and has been widely utilized across various service sectors. Integrating WhatsApp into a library system can serve as an automatic notification medium to deliver information on book borrowing, returns, and overdue reminders directly to users. Therefore, this study focuses on examining a digital library book lending system integrated with WhatsApp as a notification medium in order to enhance the quality of library services.

METHOD

Type and Research Approach

This study employs the Waterfall system development method, which is a software development model characterized by a systematic, sequential, and well-structured process. The Waterfall method is selected

because it provides a clear and organized workflow at each stage of developing a digital library book lending system integrated with WhatsApp as a notification medium. The Waterfall model consists of several interrelated stages that are carried out in a step-by-step manner, as described below.

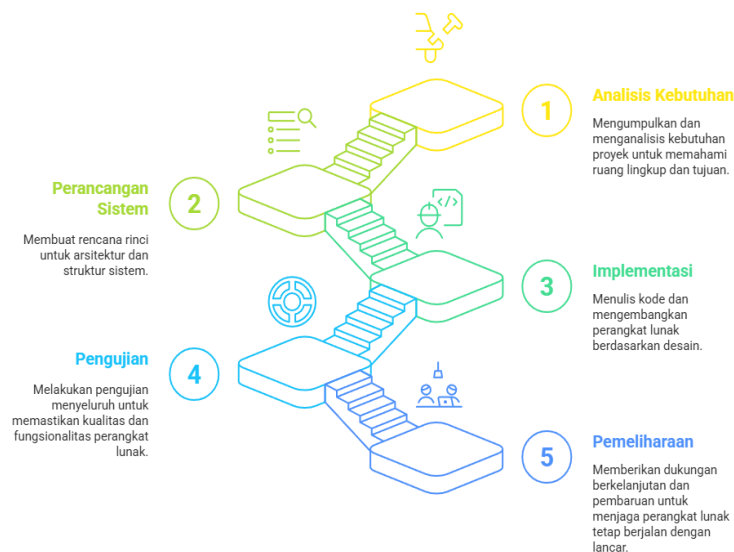


Figure 1. Research Method

1. Requirements Analysis

This stage involves the process of collecting and identifying system requirements, including both functional and non-functional requirements. The analysis focuses on the existing book lending procedures, the problems encountered in manual management, and user needs related to borrowing and returning notifications delivered through WhatsApp.

2. System Design

The system design stage aims to develop the overall system architecture. This includes designing the lending process flow, database structure, and user interface. In addition, this stage also defines the integration mechanism between the digital library system and the WhatsApp Gateway service to enable automated notifications.

3. Implementation

Implementation is the stage where the system design is translated into program code. The system is developed using web-based technologies and integrated with the WhatsApp API to support real-time notifications for users regarding borrowing status, return deadlines, and overdue information.

4. System Testing

System testing is conducted to ensure that all system functions operate according to the specified requirements. Functional testing is performed using the black box testing method to evaluate each feature, including book lending processes, data management, and the delivery of WhatsApp notifications.

5. Maintenance

The maintenance stage involves system improvement and refinement based on testing results and user feedback. This stage aims to maintain optimal system performance and to support future development of additional features.

By applying the Waterfall method, the development of a WhatsApp-integrated digital library book lending system can be carried out in a structured and well-documented manner, resulting in a stable system that is easy to understand and aligned with user needs.

Data Sources

To develop an effective system that meets user requirements, this study utilizes two types of data sources:

1. Primary Data

Primary data are obtained directly from respondents involved in library book lending and management activities. Data collection techniques include interviews with library staff and direct observation of ongoing borrowing and returning service processes.

2. Secondary Data

Secondary data consist of information gathered from literature studies, institutional reports, existing system documentation, as well as references from journals and previous research related to web-based library information systems and automated notification services using the WhatsApp platform.

RESULT AND DISCUSSION

Result

System implementation represents the realization stage of the requirements analysis and system design that were systematically described in the previous chapter. At this stage, all conceptual and technical designs are translated into a functional system that can be operated by users. The developed system is a web-based digital library book lending system integrated with WhatsApp as an automated notification medium, enabling more modern and efficient library services.

The system development is carried out in accordance with the identified functional and non-functional requirements, including the management of book data, member data, borrowing and returning transactions, fine management, and periodic report generation. The system is designed to store and manage data centrally within a database, ensuring that the information produced is consistent, accurate, and easily accessible to authorized users. As a result, administrative processes that were previously handled manually can be minimized and replaced with more structured and efficient digital processes.

The integration of WhatsApp services in this system serves as an automated communication channel between the library and its members. Notifications are delivered in real time to provide information on book borrowing activities, return deadline reminders, and fine notifications in the event of overdue returns. The implementation of this feature is expected to enhance member discipline in returning books on time while simultaneously reducing the workload of librarians in delivering manual notifications.

Navigation Structure

The navigation structure is designed to provide ease of access for users in utilizing all system features according to their assigned access rights. The main menus are organized in a systematic, hierarchical, and intuitive manner, ensuring a clear and efficient system workflow while minimizing potential operational errors.

Main Page (Dashboard)

a. Home

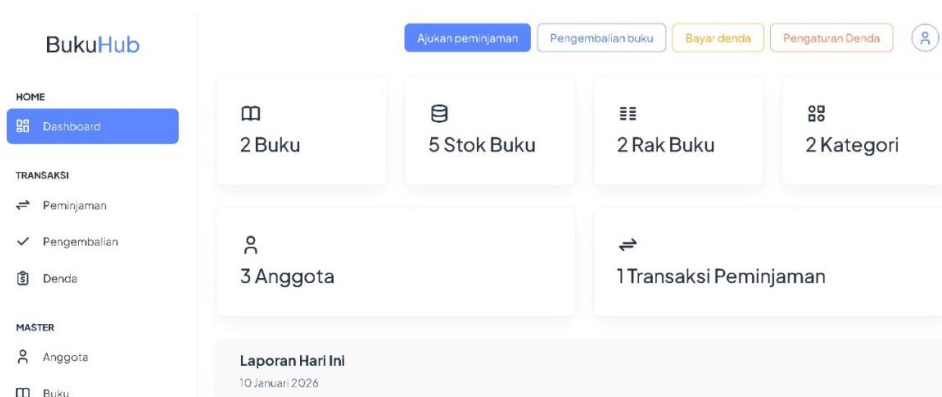


Figure 2. Main Page Interface

The home page displays a summary of key system information, including the total number of book collections, registered members, available book stock, book racks, book categories, and reports. This information is presented concisely to enable librarians and administrators to quickly monitor the overall condition of the library.

b. Notifications

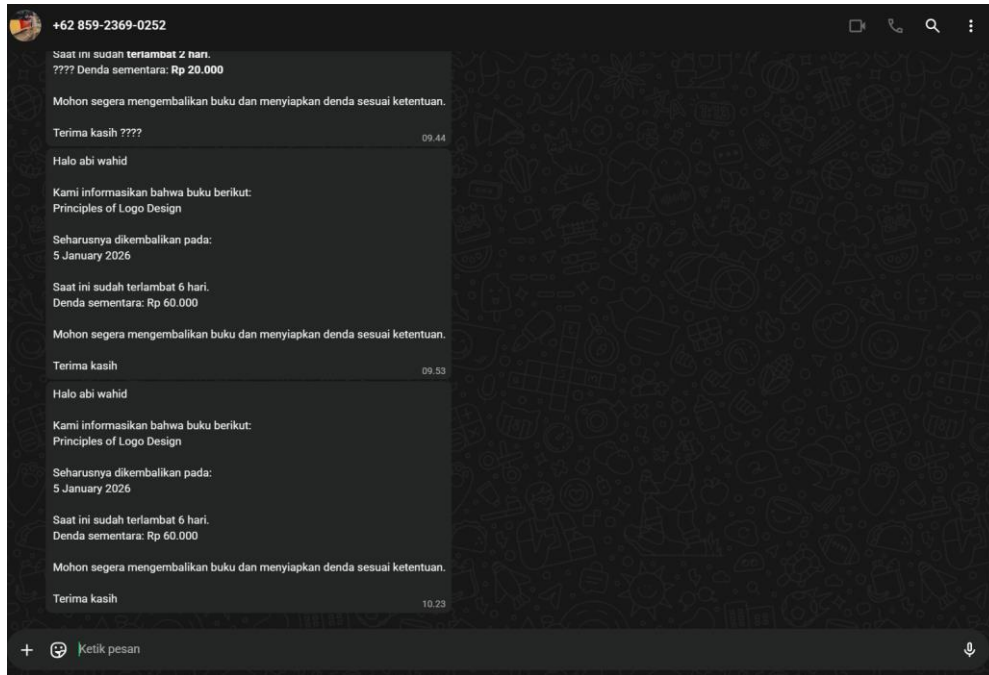


Figure 3. Notification Chat Interface

The notification menu functions to display information related to WhatsApp message delivery, such as book return due date reminders, overdue notifications, and borrowing confirmations. This feature enhances communication between the system and library members by ensuring timely and accurate information delivery.

c. Statistics and Graphs



Figure 4. Graphical Display

This section presents data visualization in the form of graphs illustrating book borrowing and return activities over specific periods. These statistics serve as an evaluation tool to analyze library collection utilization levels and support decision-making processes.

Book Data Management

a. Book List

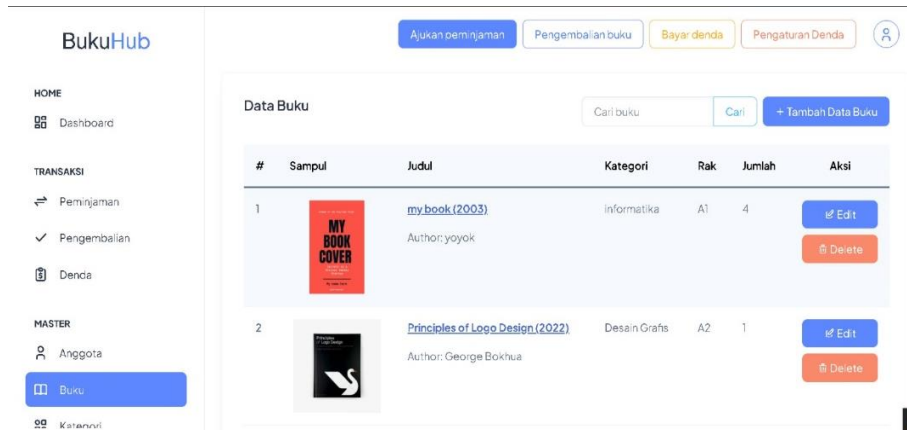


Figure 5. Book List Interface

This menu displays the entire library book collection along with detailed information such as title, author, category, publication year, and availability status. The system is equipped with search and filtering features to facilitate efficient book retrieval.

b. Add Book

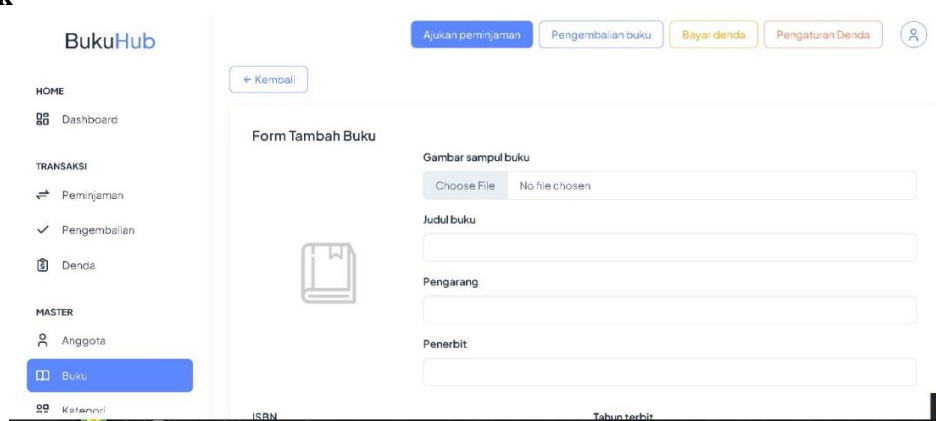


Figure 6. Add Book Interface

This feature allows administrators or librarians to add new book data to the system through a structured input form.

c. Edit Book



Figure 7. Edit Book Interface

This feature enables authorized users to update existing book data stored in the system, ensuring data accuracy and relevance.

4.1.3 Borrowing and Returning Transactions

a. Book Borrowing



Figure 7. Book Borrowing Data Interface

This menu is used to record book borrowing transactions by members. The system automatically records the borrowing date and calculates the return due date.

b. Borrowing Transaction History

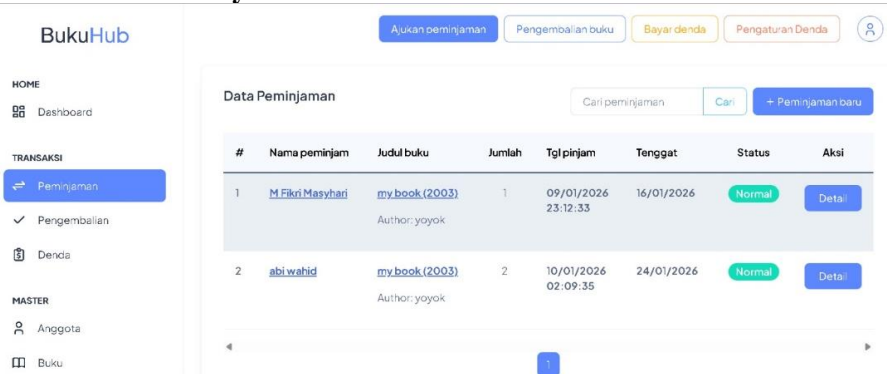


Figure 9. Borrowing Transaction History Interface

This section displays the complete history of book borrowing transactions, making it easier to track and audit borrowing activities.

c. Return Transaction History

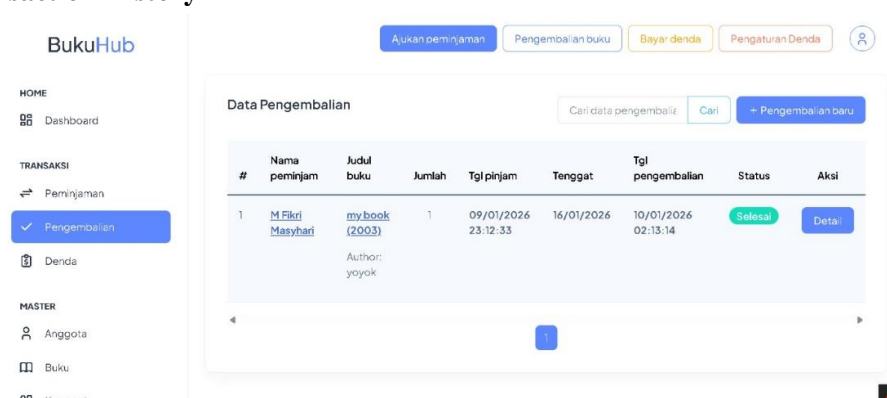


Figure 10. Return Transaction History Interface

This menu is used to record book return transactions. The system automatically calculates any delays and applicable fines, ensuring accurate and efficient return management.

Discussion

Evaluation of Implementation Results

The evaluation of implementation results was conducted to assess the effectiveness of the digital library book lending system integrated with WhatsApp as a notification medium. This evaluation covers several aspects, including system functionality, performance, security and access control, user satisfaction, and the overall impact of the system on service efficiency and borrowing data management.

1. System Functionality Evaluation

After the system was implemented, testing was carried out on the main features based on the predefined functional requirements. The evaluation results indicate that all core features—such as book borrowing and returning, management of book and member data, data searching, generation of borrowing reports, and WhatsApp notification delivery—functioned properly and stably. The system was able to process input data accurately and present information in real time. During the trial period, no critical functional errors were identified.

2. System Performance Evaluation

Performance testing was conducted using real borrowing data commonly encountered in daily library operations. The results show that the system provides fast response times for borrowing, returning, and book search processes. The generation of borrowing reports was completed in less than five seconds for a medium-sized dataset (approximately 1,000 transactions). Throughout the testing phase, the system experienced no disruptions, errors, or downtime.

3. Security and Access Evaluation

The system is equipped with a login authentication mechanism and role-based access control, including administrator, librarian, and member roles. Security testing results demonstrate that the system effectively restricts user access according to assigned permissions. Additionally, password encryption and input validation mechanisms function properly, helping to prevent unauthorized access and common security threats.

4. User Satisfaction Evaluation

User satisfaction was evaluated through a survey conducted among several respondents consisting of librarians and library members after one week of system usage. The survey results indicate that:

- a. 90% of users stated that the system is easy to use and understand.
- b. 85% of users stated that the system helps accelerate the book borrowing and returning process.
- c. 75% of users stated that WhatsApp notifications are very helpful in reminding users of book return deadlines.

User feedback, such as the development of a mobile application and the integration of digital fine payment features, will be considered for future system enhancements.

5. Impact on Library Service Processes

Following system implementation, there was a significant increase in efficiency in managing book borrowing and returning processes. Tasks that were previously performed manually and required considerable time can now be completed within minutes. Furthermore, the rate of late book returns has decreased due to automated WhatsApp notifications sent directly to library members.

CONCLUSIONS

The digital library book lending system integrated with WhatsApp as a notification medium has proven to enhance both the efficiency of library management and the quality of services provided to users. The implementation of this system enables centralized and structured recording and monitoring of borrowing activities, thereby assisting librarians in managing data and generating reports more effectively. Furthermore, the integration of WhatsApp as a notification channel supports the rapid, accurate, and timely delivery of information related to borrowing activities, return deadlines, and overdue reminders. These conditions contribute to increased user discipline in returning books on time and foster a positive perception of library

services, which are regarded as more responsive, informative, and aligned with user needs in the digital era.

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