Development of a Book Borrowing & Returning System Using the Extreme Programming Method

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Abstract

Based on the researcher's observations at the SMA Negeri 7 Palembang Library, the identified issues include errors in recording book loans and a lack of well-documented data. This problem arises because the book loan recording process relies solely on manual note-taking, which is relatively slow. Additionally, the library does not have a medium to inform students about its book collection, reducing students' interest in borrowing books. To address these issues, the author aims to develop a book borrowing information system to enhance the efficiency of book management and borrowing in the library while also providing students with information about the available book collection. This research employs the Extreme Programming system development methodology. The objective of this study is to build an information system for book borrowing and returning, which also serves as an informational medium for the library's book collection at SMA Negeri 7 Palembang. The system is designed and developed as a web-based application using PHP as the programming language and MySQL as the database, with UML as the modeling tool. The research results show that the developed system can improve time efficiency in the book borrowing process by 75%. This conclusion is based on the fact that the borrowing process previously took an average of 20 minutes before using the system, but it now takes less than 5 minutes with the system. Therefore, the developed system will significantly assist in the management and borrowing process at the SMA Negeri 7 Palembang Library.

Keywords*: System, Book Borrowing, Extreme Programming, UML, Website.*

1. Introduction

An information system consists of various subsystems that interact and work together to form an integrated unit. This system processes data through a series of steps, starting from receiving input in the form of data, then processing it, and finally producing output in the form of information that can serve as a basis for decision-making [1]. An information system is also a combination of work procedures, information, people, and information technology that are organized to achieve a predetermined goal within a company [2].

According to the author's study, the term "library" originates from the Greek word *bibliotheca*, which means books or scriptures. A library is a place where various book collections are stored in an organized manner. Libraries are commonly found in schools or certain cities [3]. The primary goal of a school library is to enhance students' reading interest. The use of technology can support the provision of more modern, high-quality, and accurate educational information while also simplifying service systems [4]. Technological advancements have driven libraries to become a key component in information management, allowing visitors to search for and borrow books more efficiently [5].

A library information system is a system specifically designed to manage and provide library services [6]. This system supports various library business processes, such as member registration, book borrowing and returns, collection procurement and data management, as well as archive and research journal management [7]. With the implementation of a library information system, it is expected that service quality will improve, making it more efficient and accessible to users through both websites and library applications, whether online or offline [8].

From the author's observations, the main issue in the library of SMA Negeri 7 Palembang is the frequent errors in book loan records, with much data not being properly documented. This occurs because book borrowing transactions are not well recorded or documented. This challenge persists, particularly for

library staff, as many documents pile up, and circulation forms are often misplaced or lost. This issue must be addressed by developing a book borrowing information system for the SMA Negeri 7 Palembang Library, specifically to improve organization within the library and enable better control over book borrowing policies and procedures.

The information system to be developed should have a simple process and reliable data storage. This is intended to replace the old manual recording method using notebooks or other less practical data entry media [9]. The system will be web-based and built using a database as a storage medium, ensuring that stored data can be retrieved whenever needed. For its implementation, the research utilizes the Extreme Programming (XP) software development method. The XP method is chosen to ensure that the developed system is efficient in creating small to medium-sized software applications.

2. Method

In this study, the author employs the Extreme Programming (XP) development method. This development method is an object-oriented software methodology designed to enhance software quality and customer satisfaction through an interactive, iterative, and incremental approach [10]. XP is based on four core values: communication, simplicity, feedback, and courage.

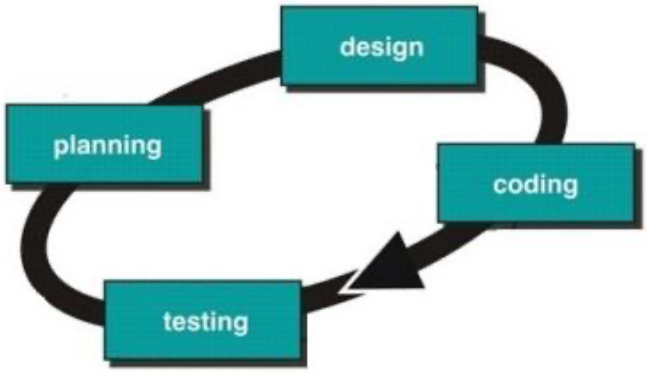

Fig. 1 Stages of Extreme Programming

From Figure 1, the stages involved in developing software using the Extreme Programming (XP) development method are presented. These stages include:

1. Planning
   This stage begins with gathering information through observations and interviews with relevant parties to understand the current system flow.
2. Design
   In this phase, use case diagrams are used to analyze the system and model interactions between users and the system. Additionally, the system design and layout are developed.
3. Coding
   This stage involves implementing the program design into code using the PHP programming language.
4. Testing
   The designed system is tested to ensure it functions properly

3. Result and Discussion

This section discusses the research results while also providing a comprehensive analysis. The research findings can be presented using images, graphs, tables, and other visual elements to help readers easily understand the results. The discussion can be structured into several sub-sections.

3.1. Application Design

Unified Modeling Language (UML) is a modeling approach that visually represents a system in the development of object-oriented systems or applications. UML is generally recognized as a tool for visually designing and documenting a system or software [11]. This modeling approach facilitates software development by effectively addressing user requirements within the system while considering factors such as scalability, robustness, security, and others [12].

3.2. Usecase Diagram

A Use Case Diagram is a part of UML that explains and visualizes the relationships and interactions of each actor within a system. Use cases can be used to describe the relationships and interactions between users and the application [13].

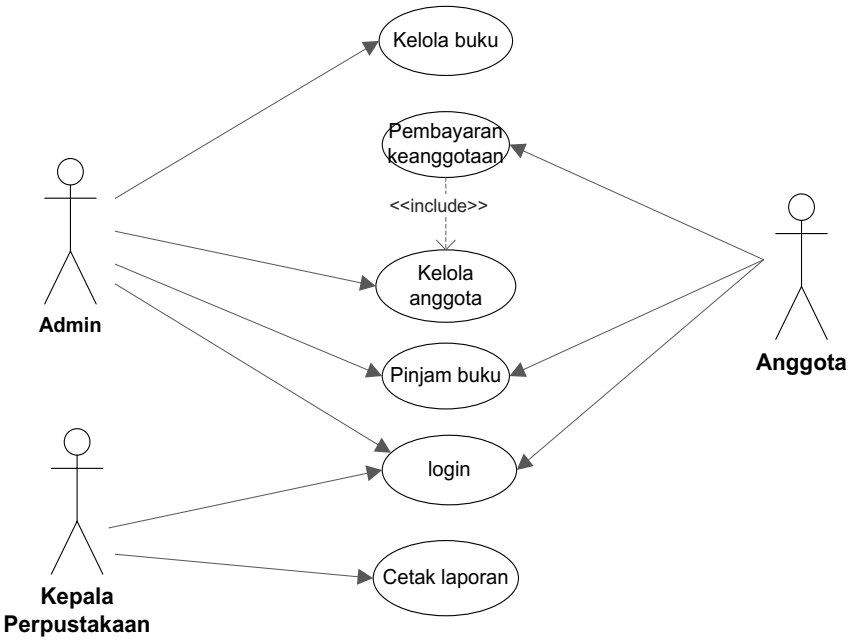

Fig. 2 Usecase Diagram

Figure 2 illustrates the use case diagram, which includes several actors: Library Members, Admin, and the Head Librarian. Library Members can make membership fee payments and borrow books online. The Admin is responsible for managing the book catalog and processing book loans for members. The Head Librarian has the authority to view and print reports.

3.3. Activity Diagram

An Activity Diagram is a part of UML that represents the dynamic elements or aspects of a system in the form of a flow and control model from one activity to another. It does not describe the nature of actors but is solely used to illustrate the workflow or activities within the system [14].

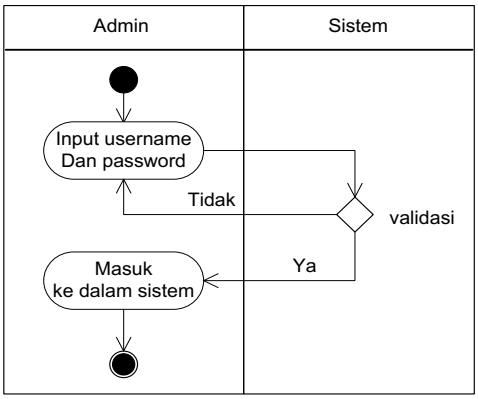

Fig. 3 Activity Diagram Login

Figure 3 illustrates the process within the system, where the admin first enters a username and password, which are then validated by the system. If the username and password are correct, the system will direct the admin to the Admin menu.

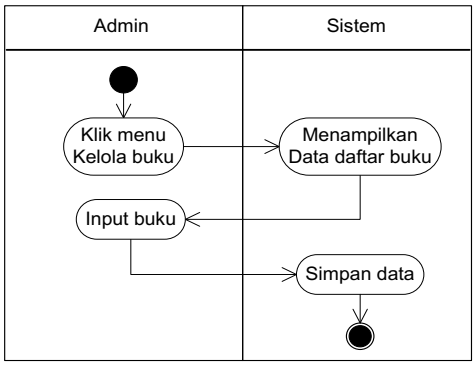

Fig. 4 Activity Diagram for Book Management

This diagram illustrates that the admin can manage book data, including the processes of adding, editing, and deleting data. The book data will then be displayed in the book collection menu, which can be accessed by members.

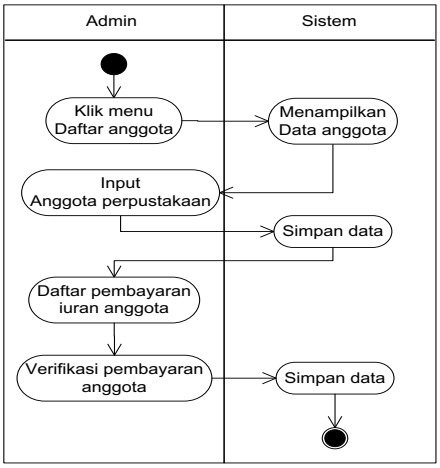

Fig. 5 Activity Diagram for Member Management

This diagram illustrates the admin's access to managing library member data. Students who have become library members are also required to pay the library membership fee.

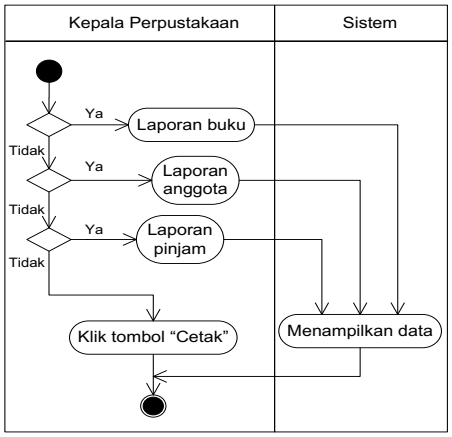

Fig. 6 *Activity Diagram Laporan*

Figure 6 explains that the head librarian has access to view and print book loan reports periodically. These reports are needed as input to monitor the number of book loans and serve as an evaluation material for formulating library policies.

3.4. Discussion

The next step is implementing the system through coding using the PHP programming language, successfully developing a book borrowing and return system.

Fig. 7 Home Page Display

Figure 7 shows the initial screen when the application is running, displaying available menu buttons along with images and the application title.

Fig. 8 Book List Page Display

Figure 8 presents the page displaying the entire collection of books available at the SMAN 7 Palembang Library. The displayed data includes book cover images, book titles, and a summary that can be viewed in the details of each book.

Fig. 9 Login Page Display

Figure 9 shows the login page where users can log in by entering their username and password. Users input their credentials and press the login button. If the username and password are correct, the system grants access to the user menu. If incorrect, a login failure warning is displayed.

Fig. 10 Book Detail Page Display

Figure 10 shows the book detail page. This page contains information about the publication year, author, publisher, book cover image, and a summary of the book's content.

Fig. 11 Book Borrowing Page Display

Figure 11 displays the book borrowing page for students. On this page, students can make online borrowing requests. This feature is only for booking or reserving books, while students must visit the library in person to collect the borrowed books.

Fig. 12 Report Page Display

Figure 12 shows the report page for the Head Librarian to view and print reports periodically. The reports are presented in a table format containing book loan data.

3.5. System Testing

After developing the application, the next step is the evaluation or testing phase using the black-box method. This method is applied to test and evaluate the results, interface, basic functions, and menu features of the developed application [15].

Table 1. Test Results for Library Member Actor

Menu Page	Testing	Expected Results	Result
Home	Does it display information about the school	Displays school information	Success
Book List	Displays the list of books	Shows book cover images and titles	Success
	Click on the book cover image	Displays book details and pages	Success
Guest Book	Filling in the guest book	Saves guest book data	Success
Login	Enter the correct username and password	Redirects to the library member menu	Success
	Incorrect username and password	Displays a failed login notification	Success
Borrowing History	Displays borrowing history data	Shows the date and borrowing history	Success
Membership Fee	Input payment form	Saves payment data	Success
Logout	Exit the application	Logs out from the system	Success

From the testing results using the black box method on library members, it was found that the system built is functioning properly and can be used by members to request book loans in the library.

Table 2. Test Results for Admin Actor

Menu Page	Testing	Expected Results	Result
Home	Does it display information about the school	Displays information about the school	Success
Book List	Display book list	Displays book cover images and book titles	Success
	Click on the book cover image	Displays book details and page sheets	Success
Guest Book	Fill in the guest book	Saves guest book data	Success
Login	Enter correct username and password	Redirects to the Admin menu page	Success
	Incorrect username and password	Displays login failed notification	Success
Manage Books	Input data	Data successfully saved and displayed in the book list	Success
	Edit data	Data successfully updated	Success
	Delete data	Data successfully updated	Success
Manage Members	Input data	Data successfully saved and displayed in the member list	Success
	Edit data	Data successfully updated	Success
	Delete data	Data successfully updated	Success
Logout	Exit the application	Logs out from the system	Success

From the testing results using the black box method on library admin users, it was found that the system built is functioning properly and can be used by admins to manage book data, member data, and book loan data.

Table 3. Test Results for Head Librarian Actor

Menu Page	Testing	Expected Results	Result
Home	Does it display information about school	Displays information about the school	Success
Daftar Buku	Display book list	Displays book cover images and book titles	Success
	Click on the book cover image	Displays book details and page sheets	Success
Login	Enter correct username and password	Redirects to the Head Librarian menu page	Success
	Incorrect username and password	Displays login failed notification	Success
Book Report	View report	Displays book report	Success
	Print report	Displays printed report	Success
Member Report	View report	Displays book report	Success
	Print report	Displays printed report	Success
Loan Report	View report	Displays book report	Success
	Print report	Displays printed report	Success
Logout	Exit the application	Logs out from the system	Success

From the testing results using the black box method on the library head user, it was found that the system built is functioning properly and can be used by the library head to view and print reports.

4. Conclusion

The research conducted has resulted in a library data management system in the form of a website, allowing library members to view and borrow books online. The research findings indicate that the developed system can improve time efficiency in the book borrowing process by 75%. This conclusion is based on the fact that the borrowing process previously took an average of 20 minutes before using the system, but now takes less than 5 minutes. Additionally, the system can reduce data entry errors by up to 90% since data is input automatically, eliminating the risk of errors that occurred in the previous manual recording process. The system also facilitates library management at SMA Negeri 7 Palembang by making it easier to manage book data and generate and print reports on library members, books, and borrowings.

For future development, the application can be expanded to the Android platform, allowing access via mobile devices and integration with the academic system of SMA Negeri 7 Palembang

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