JURNAL TEKNOLOGI DAN OPEN SOURCE
Vol. 9, No. 1, June 2026, pp. 453~464
e-ISSN: 2622-1659, accredited Four Grade by Kemenristekdikti, Decree No: 152/E/KPT/2023
DOI: https://doi.org/10.36378/jtos.v9i1.5316

Web-Based Qr-Code System In The Library Data Processing Process At State Senior High School 1 Bangkinang City

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Article Info

Article history:

Received 02 16, 2026
Revised 04 30, 2026
Accepted 06 25, 2026

Keywords:

Library
Application
Waterfall
Web
QR-Code

ABSTRACT

The school library plays an important role in supporting the learning process. However, the library data processing at SMA Negeri 1 Bangkinang Kota is still conducted manually, which may lead to problems such as data recording errors, slow services, and difficulties in generating reports. Therefore, an information system is needed to improve the effectiveness and efficiency of library data management. This study aims to design and develop a Web-Based Library Information System integrated with QR-Code technology. The system is designed to manage book data, member data, borrowing and returning transactions, and automated report generation. The system development method used in this study is the Waterfall method, which consists of requirements analysis, system design, implementation, testing, and maintenance stages. The result of this study is a web-based library application that is able to accelerate transaction processes through the use of QR-Code technology, reduce data input errors, and facilitate librarians in managing and generating library reports. Based on the results of testing using the Black Box Testing method, the developed system operates according to functional requirements and can be implemented as a solution to improve the quality of library services at SMA Negeri 1 Bangkinang Kota.

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1. Introduction

SMA Negeri 1 Bangkinang Kota is one of the high school (senior high school) educational institutions located in Kampar Regency, Riau Province. SMA Negeri 1 Bangkinang Kota has a fairly large library facility with the number of books available reaching more than 1000 books. In data processing such as book data, borrowing and returning is still done by recording in an agenda book manually, making it difficult to find information on book data, borrowing and returning books. If a member wants to look for a book and asks the officer, the officer has difficulty in providing information whether or not the book is available. In addition, the service of borrowing and returning books tends to be slow because the data is still recorded in bookkeeping and in reporting library data requires a relatively long time because it has to summarize member data, books, borrowing and returning.

A library is a public facility containing neatly arranged books, usually found in schools or certain cities. It is a very quiet place and is often visited for reference or simply reading. For students who attend school, this place is very valuable because it is where students can borrow books for assignments without paying. Therefore, a library information system can help provide information on book availability, data processing, borrowing and returning books, and generate reports required by librarians, which are submitted to the head librarian.

In this study, the researcher chose the library at SMA Negeri 1 Bangkinang Kota as the object of the final assignment. SMA Negeri 1 Bangkinang Kota has a library where the ongoing data processing is still relatively manual in the process of borrowing, returning and recording books. As is done when borrowing books, if a member wants to look for a book and asks the librarian, the librarian has difficulty showing the location of the book and providing information on the status of the book to the borrower, returning and recording the book so that the librarian needs time to find the book so that the process of borrowing, returning and recording the book can be recorded properly. Currently, school libraries are prone to errors in the process of borrowing, returning and recording books caused by data that has not been recorded properly. This should be able to be overcome with a web-based library information system, because with a website-based information system, library data processing can be more structured.

As a secondary education institution, SMA Negeri 1 Bangkinang Kota has a library that serves the information needs of students and teachers. However, in practice, library data processing, such as book registration, membership registration, and loan and return transactions, is still done manually and has not been optimally computerized. This has led to several problems, including frequent recording errors, delays in data retrieval, and difficulties in reporting.

QR-Code (Quick Response Code) technology is an innovation that can be utilized to simplify the identification process and quickly retrieve data through code scanning. By integrating QR-Code into a web-based library information system, the process of borrowing and returning books can be more practical, efficient, and minimize data input errors. Based on these problems, a web-based QR-Code system is needed to assist the library data processing process at SMA Negeri 1 Bangkinang Kota, thereby improving the quality of library services and supporting academic activities at the school.

Based on the above background, the author intends to design an information system that can address the existing problems and will be scientifically written in a Project 3 assignment entitled "WEB-BASED QR-CODE SYSTEM FOR LIBRARY DATA PROCESSING AT SMA NEGERI 1 BANGKINANG KOTA."

2. Research Method

2.1 Data Collection Methods

Data collection methods were used to obtain accurate and relevant information as a basis for designing a web-based QR-Code system for library data processing at SMA Negeri 1 Bangkinang Kota. The methods used were as follows: The first method was observation, which involved directly observing the library data processing process at SMA Negeri 1 Bangkinang Kota, such as book data collection, membership registration, and book borrowing and return transactions. The purpose of this observation was to understand the current system workflow and any problems encountered.

The second method is interviews, conducted with library staff and related parties to obtain information regarding system requirements, frequently encountered obstacles, and expectations for the system to be developed. This method aims to explore data in-depth regarding user requirements.The third method is literature review, conducted by examining books, journals, scientific articles, and other references related to library information systems, web-based applications, and QR-Code technology. This method is used to strengthen the theoretical foundation and serve as a reference in system design.

The fourth method is the documentation method, conducted by collecting data in the form of documents available in the library, such as book data, member data, report formats, and transaction archives. This data is used as material for analysis and system database design.

2.2 System Development Method

The system development method used in this research is the Waterfall method. The Waterfall method is a software development model that is carried out systematically and sequentially, where each stage must be completed before proceeding to the next (Pressman, 2015). The stages of the Waterfall method in this research are as follows:

2.2.1 Needs Analysis

The design of a web-based library management system at SMAN 1 Bangkinang Kota aims to upgrade the existing system to a new one that utilizes website technology for data management. The methodology used in the research to develop a web-based library management system at SMAN 1 Bangkinang Kota involved several stages. The initial stage involved conducting a literature review, such as

searching for information related to the research, followed by observations and interviews with school librarians. The final stage, which utilizes the waterfall system model, is shown in the following figure.

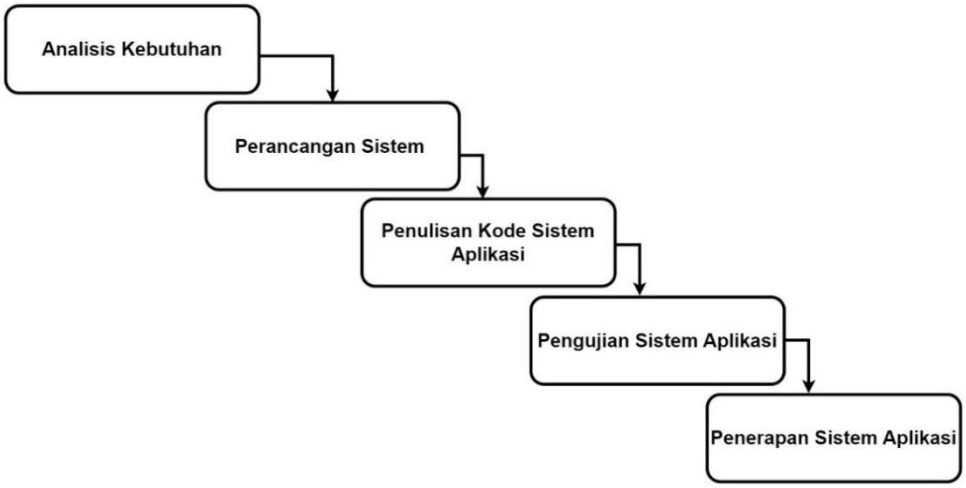

Figure 3.1 SDLC method using the Waterfall Model

Needs analysis in the waterfall method is a detailed data collection stage based on user needs, functions, and system limitations with the aim of understanding the features of the system to be created (Nugroho & Supriyono, 2019). The data collection method for the library management system at SMAN 1 Bangkinang Kota was carried out using observation and interview methods. Based on the results of observations and interviews conducted, the author obtained data related to the processing, documentation, and presentation system of school library data. Then from the collected data, the author concluded that the system would be created with 2 accesses. Librarians with system access as officers who play a role in monitoring the management of library data.

Based on the description that has been presented, the functional requirements of the library data management information system are as follows: (a) The system has a login feature which is the user's entry point to access the dashboard and its system. The system has a dashboard menu which is used as the first access after the admin logs in. The dashboard contains information on the number of each available data. (b) The system has a feature for managing book data, member or student data, user data or officer data (by the admin), transaction data which includes borrowing, extending the borrowing period, and returning books by students as well as printing data summaries. For each member data, a feature for printing free library documents from each member's borrowing data is provided. (c) The borrowing, extending the borrowing period, and returning books feature will utilize web technology to enter book data based on the identification of the book ID entered. (d) The system has a feature for printing transaction reports for borrowing, returning and fines, as well as basic data grouped by filter categories in each menu.

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2.2.2 Non-Functional Analysis

The non-functional requirements of the library data management system at SMAN 1 Bangkinang Kota include hardware requirements such as a laptop with an Intel Core i7 processor and 8GB of RAM, or a PC, keyboard, and mouse. Software requirements include the Windows 10 operating system, the Visual Studio Code text editor for system development, a web browser such as Chrome, XAMPP v3.3.0, MySQL as the database system, Apache as the web server, and PHP as the programming language.

2.2.3 System Design

The system design explains the access rights held by users, how the system works, and the design methods used. The library data management system has two users: an admin and an officer. The admin has full access to data management, along with features that facilitate their duties. These features include adding, editing, and deleting data. The admin can manage data by adding, viewing, modifying, and deleting library data, such as book, member, officer, user, and transaction data, including borrowing, extending, and returning books. Officers are also provided with system access to add, edit, and delete book and member data, conduct borrowing transactions, extend borrowing and returning books, and print library data summaries. The system will utilize web-based technology for borrowing, returning, and extending books, with the goal of streamlining service, increasing efficiency, and ensuring data accuracy.

1) Use Case Diagram

A use case diagram is used to illustrate the interaction between actors and a web-based library information system using QR codes. This diagram shows the main functions that each actor can access according to their access rights.

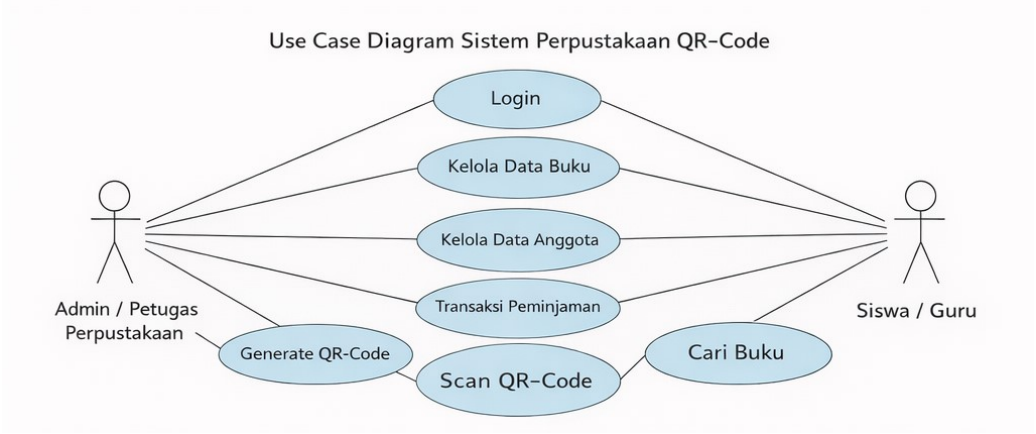


Figure 2.1. Use Case Diagram

2) Flowchart

A system flowchart is used to illustrate the overall system workflow, from user login to data processing and library transactions. This flowchart helps explain the process steps within the system in a structured and easy-to-understand manner.

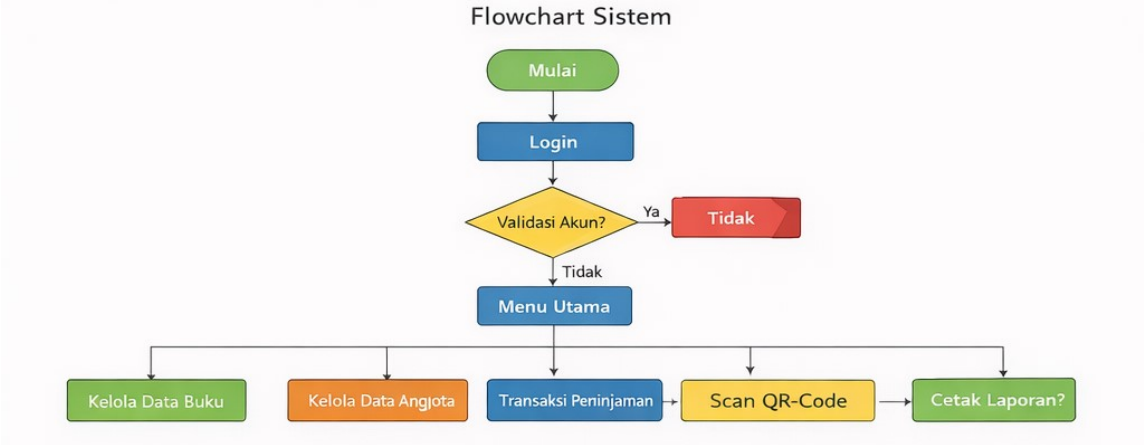
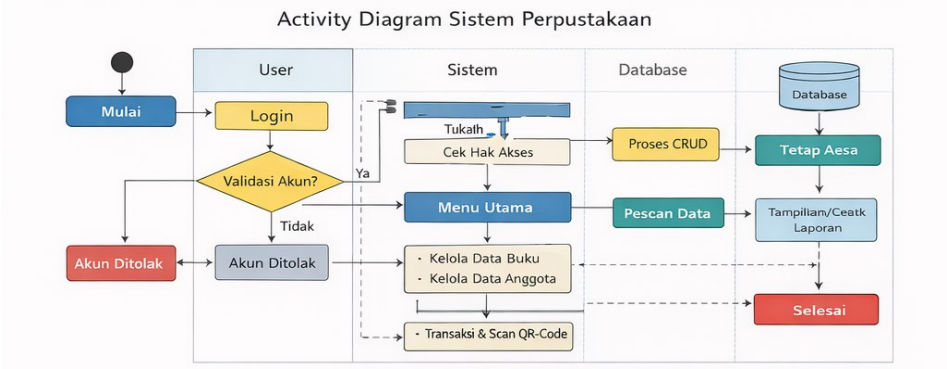


Figure 2.2. System Flowchart

3) Activity Diagram

3) Activity Diagram

Activity diagrams are used to describe the flow of activities or work processes within a system in detail, from start to finish, and to show the sequence of activities performed by users and the system. This diagram emphasizes the workflow and decision-making within the system.



Gambar 2.3. Activity Diagram

2.2.4 Menu Structure

In this library data management system design, there are two interrelated actors. The administrator has full access to the system to manage data, including adding, changing, and deleting book, member, user or staff data, transactions, and printing data summaries. Staff are also given access to add, change, and delete data on book and member data. Furthermore, staff are given access to manage service transaction data and make changes to staff data from their own account. Library members cannot access the system because it is entirely managed by the administrator and staff.

2.2.5 Interface

The user interface design for the library data management system website at SMAN 1 Bangkinang Kota, used for data transaction input, includes a login menu and menus on the admin and staff pages. The login menu allows both admin and staff to access the system. The login menu provides a form for entering a username and password and a login button. The menus on the admin and staff pages are divided into three sections. The header section features features such as a logout button and access to view profiles. The sidebar menu is used to access menus within the system, including menus for book management, member data, loan transactions, returns, and loan extensions, and a menu for printing data summaries. The content menu contains the contents of the menu selected in the sidebar.

2.2.6 Database Structure

The system database design describes the relationships between tables in a database, including the entities user, book, book_category, bookshelf, member, class, and borrowing_det. The system database design is illustrated using the database relational table layout in Figure 3.

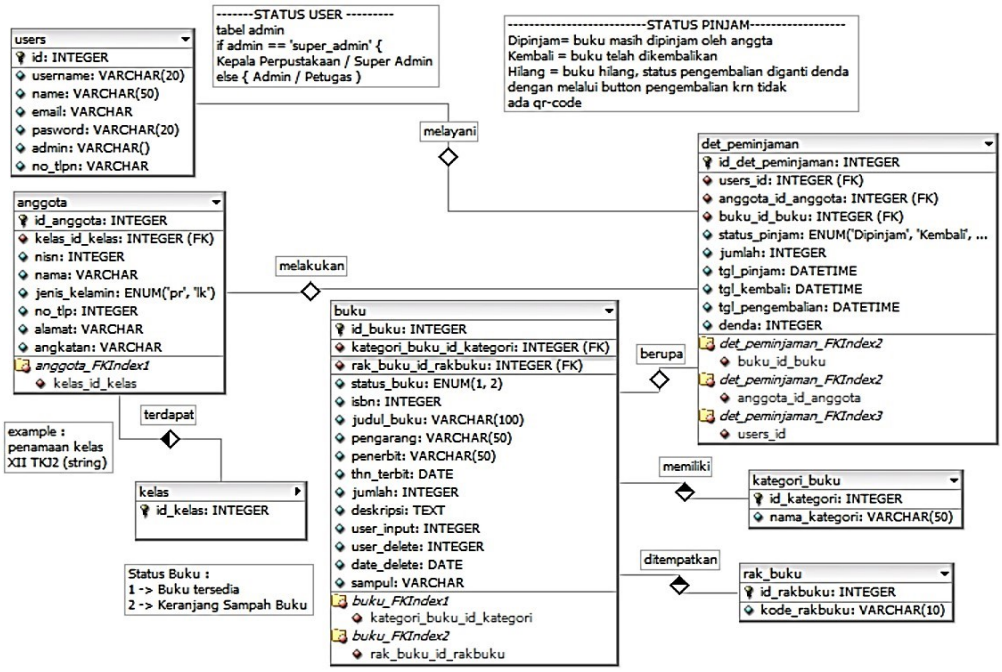


Figure 2.4. Database Structure

2.2.7 Implementation (Coding)

This stage translates the system design into a program using web programming languages such as PHP, HTML, CSS, and JavaScript, as well as frameworks (e.g., Laravel). The system is also integrated with a translation feature and QR-Code scanning for book and/or member identification. This stage involved librarians at SMA Negeri 1 Bangkinang City.

2.2.8 System Testing

This stage translates the system design into a program using web programming languages such as PHP, HTML, CSS, and JavaScript, as well as frameworks (e.g., Laravel). The system is also integrated with a translation feature and QR-Code scanning for book and/or member identification.

2.2.9 Implementation and Maintenance

This stage involves implementing the system in the SMA Negeri 1 Bangkinang Kota library. After the system is deployed, maintenance is performed to fix bugs and adjust the system as requirements change.

3. Result and Discussion

3.1 Implementation Results

The implementation result of this research is a web-based library information system integrated with QR-Code technology to support library data processing at SMA Negeri 1 Bangkinang Kota. This system was developed based on the needs analysis and design conducted in the previous phase using the Waterfall method.

The system can be accessed through a web browser and used by library staff as administrators, as well as students and teachers as users for searching book information. The system aims to support library data processing, from book data management, member data, loan and return transactions, to automated and computerized report generation.

3.2 Implementation Environment

The implementation environment of this application uses supporting hardware and software, so that the design of this system can be used properly, the hardware and software used are as follows:

3.2.1 Hardware

Laptop/PC with Intel Core i5 processor
8 GB RAM
Device camera or QR code scanner

3.2.2 Software

Windows Operating System
Apache Web Server
PHP Programming Language
MySQL Database
Laravel Framework
Google Chrome Web Browser

3.3 User Interface

The user interface of the web-based library information system is designed with user-friendliness, consistency of appearance, and efficiency in the work processes of library staff in mind. The system interface is kept simple to be easily understood by users with non-technical backgrounds. It presents clear navigation menus, structured layouts, and readable content to support smooth interaction. Each feature is organized logically to minimize user confusion and improve task completion speed. In addition, the interface design emphasizes responsiveness and accessibility so it can be used across different devices. Overall, this design approach enhances usability, reduces learning time, and supports effective library management operations.

3.3.1 Login Page

This is the screen displayed when a user attempts to log in by clicking the Login menu and entering the username and password specified during the account registration process. The login interface is designed to verify user credentials and ensure secure access to the system. After entering the required information, the system will authenticate the data before granting access to the user's account. If the credentials are correct, the user will be successfully directed to the main dashboard. However, if the information is incorrect, the system will display an error message and request the user to re-enter valid login details for security purposes.

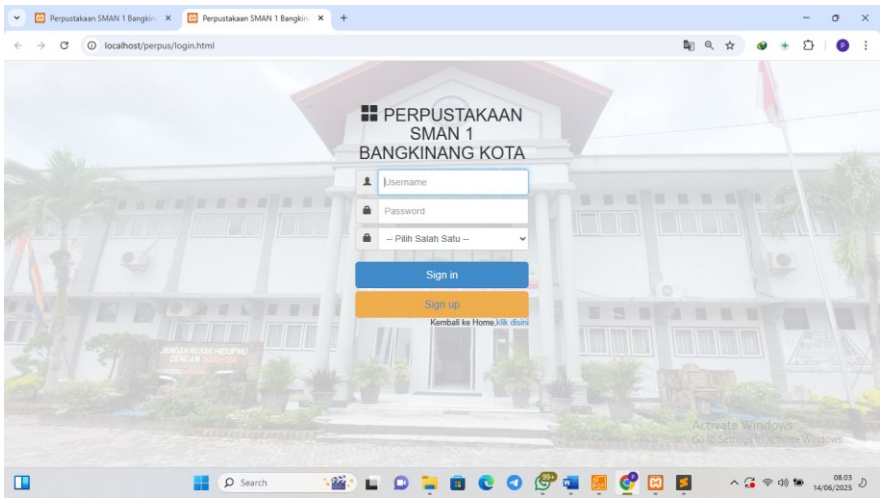


Figure 3.1. Login Page

3.2.2 System Dashboard / Home Page

The system home page displays calculations for each database's total and percentage of data. It also displays the total number of books available and the number of library visitors.

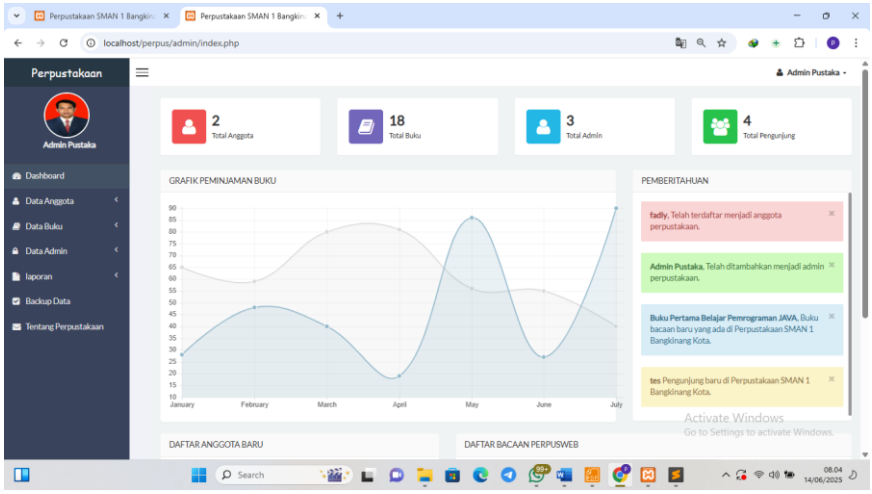


Figure 3.2. Dashboard Page

3.3.3 Member Data Page

The member data page displays the number of library members registered in the application.

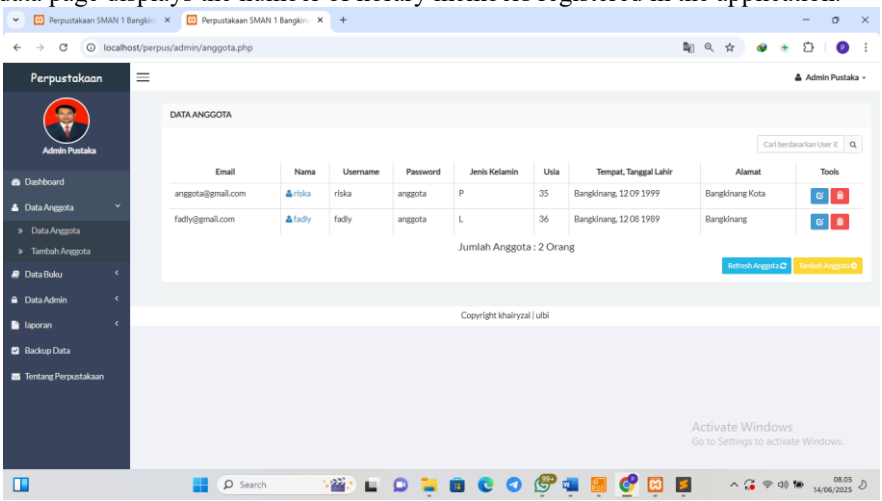


Figure 3.3 Member data page

3.3.4 Member Input Page

The member input page displays a form for entering new member data. Commonly entered data includes: full name, student ID number, class, gender, and other relevant information.

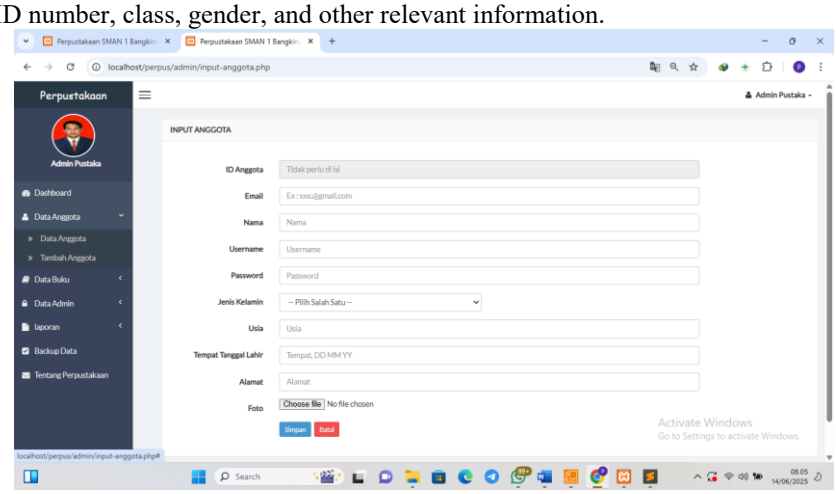


Figure 3.4 Member Input Page

3.3.5 Book Data Page

The Book Data page displays information about the availability of books in the Library, including the book title, author, year of publication, publisher, and number of pages per book.

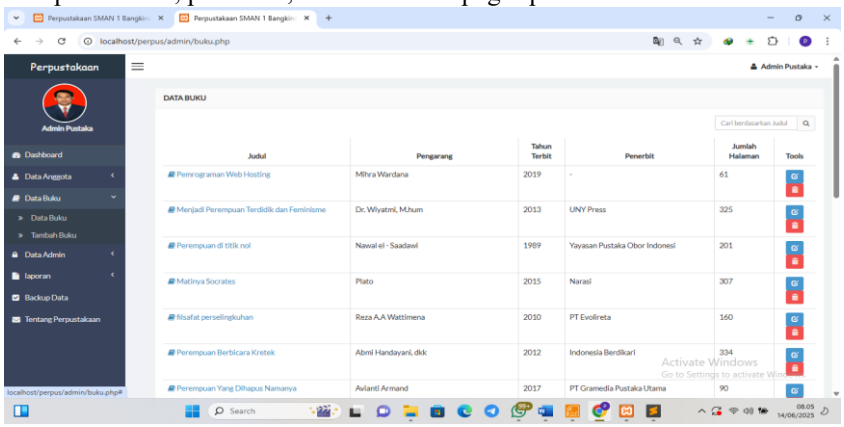


Figure 3.5 Book Data Page

3.3.6 Add Book Data Page

The Book Data input page displays a form for entering new member books that are not yet in the library application. This information generally includes: book code, title, author, publisher, year of publication, quantity, and location. Additionally, there may be an option to select the book's status.

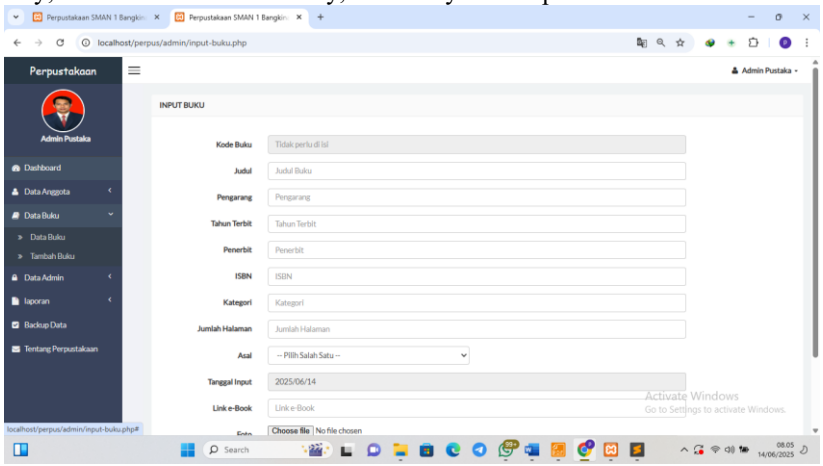


Figure 3.6 Add Book Data Page

3.3.7 Admin Data Page

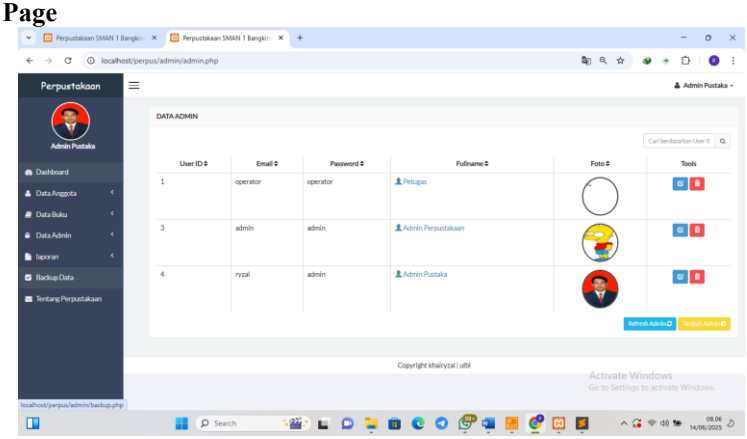


Figure 3.7 Admin Data Page

3.3.8 Admin Data Input Page

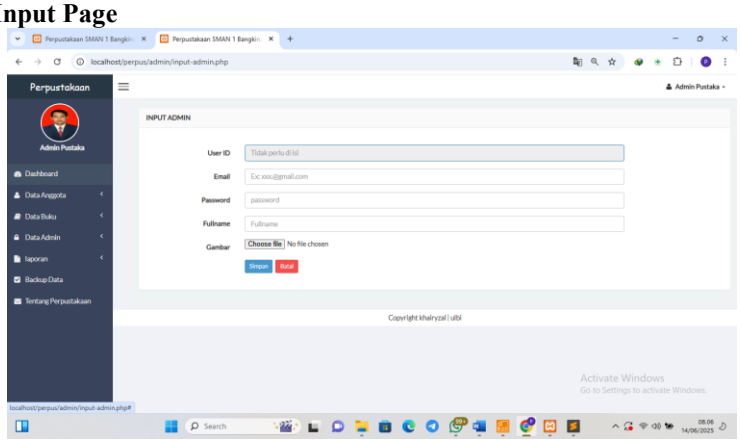


Figure 3.8 Admin Data Input Page

3.4 Testing

System testing aims to verify whether the system being developed is performing as expected. The method used in this testing is Blackbox Testing, which is a quality assurance method for a system that emphasizes ensuring the system functions properly (Gultom & Maryam, 2020). Blackbox testing on this library data management system is conducted through several steps. The application system is tested by checking each feature to determine whether the features are suitable.

Table 3.1 Application System Testing Using the Blackbox Testing Method

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No	Testing	Skenario	Result	Status
1.	Login.	Enter your username and password, click the Login button.	Enter the Admin/Officer Home Page.	Valid
2.	Logout.	Logout from the system by clicking the Logout button	The system displays the Login page.	Valid
3.	Book Tools.	Perform CRUD data execution for book data, book categories, and bookshelves.	The system can display, add, edit and delete data	Valid

4.	Members tools.	Perform CRUD data execution for member and class data.	The system can display, add, edit and delete data.	Valid
5.	User Menu.	Perform CRUD data execution for Officer data.	The system can display, add, edit and delete selected data.	Valid
6.	Book Trash Menu.	Perform data CRUD execution for book recycle bin data.	The system can display, restore, delete selected data.	Valid
7.	Loan Menu	Perform CRUD data execution for loan transaction data.	The system can display, add, update status and fines as well as delete selected ones.	Valid
8.	Returns Menu	Perform data CRUD execution for return data.	The system can display, as well as delete selected data.	Valid
9.	Extension Menu.	Make a book return transaction by scanning the QR Code and selecting member data.	The system stores return data, with updated borrowing and return dates.	Valid
10.	Loan and Repayment Data Recap	Prints data based on the selected data.	Download selected data in pdf / excel format.	Valid
11.	Profile Menu.	Perform CRUD data execution for logged in user data.	The system can display, edit data and change data passwords.	Valid

After conducting system testing based on the results obtained from table 1, it can be concluded that the system is running well, thus helping the data management process in the library effectively, efficiently and accurately. The validity level of library data management testing reached 100%.

4. Conclusion

Based on the description presented in this proposal, it can be concluded that:

The library data processing process at SMA Negeri 1 Bangkinang Kota still requires the support of a computerized information system to be more effective and efficient. The design of a web-based library information system integrated with QR-Code technology is expected to address issues in book data collection, membership, and loan and return transactions. The proposed system can improve the speed, accuracy, and security of data processing, as well as facilitate library staff in reporting. This proposal serves as the basis for planning and reference for the implementation of research and system development to be carried out in the next phase.

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