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Design a Web-Based Library Information System Using the Waterfall Method (Case Study of SMA Muhammadiyah 2)

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ABSTRACT

Information technology is a technology that is developing rapidly at this time. Computers as student learning media have many functions such as audio, animation, visual, and interactive capabilities. The main problem in the field of education is the low interest in reading students and reading habits. The library is expected to help increase students' interest in reading and reading habits. SMA Muhammadiyah has a new library and is still manual in recording borrowing and returning books. This makes it difficult for librarians to search for data and is at risk of losing books. It is difficult for students to find book information and the irregular placement of books makes the process of borrowing books ineffective and inefficient. Therefore, a web-based library information system is needed to make it easier for students to borrow books. The Waterfall method will be used to help design the library system at SMA Muhammadiyah 2 Cipondoh. The Waterfall method is a method that is very commonly used in the early stages of the manufacturing process. Application features developed by researchers at the Muhammadiyah 2 Cipondoh High School library include logins, book master data, book loan transaction data, book return transaction data, and book borrowing reports. Library information system development uses the PHP CodeIgniter 3 framework. The front ends used are HTML 5, CSS 3, and Bootstrap version 4.

Keywords: bootstrap; HTML; technology; waterfall method; libraries.

INTRODUCTION

Information technology is currently a rapidly developing technology. With the development of information technology, the availability of data or available information can be done quickly, efficiently, and accurately. In development of information and communication technology (ICT) is used as a tool in the world of education both online and offline (Sherley et al., 2021). Computers as a learning environment for students have many functions, such as audio, animation, visual, and interactive functions (Ahdan et al., 2020). This computer function can help students more easily in the learning process.

The biggest problem in education is the low interest in reading and reading habits of students. Therefore, the library aims to improve students' reading interests and reading habits. The library can be interpreted as a place of many collections in one room, ranging from collections of textbooks, biographies, magazines, scientific works, dictionaries, atlases, and others (Pratiwi et al., 2018). The concept of a school library as a learning resource that focuses on institutions, development strategies and opportunities, development of ideal school parameters, and promotion of reading interests and habits in the school environment as a learning resource. A library is a unit of work consisting of several parts, namely collection development, collection processing, user support, and maintenance of buildings and infrastructure (Hutagalung & Arif, 2018). School libraries have a very important impact on the teaching and learning process (Hastuti, 2018) Increasing student achievement and motivation is one of the tasks of the library, and can provide services to student readers, teachers, principals, and other administrative personnel (Huradju et al., 2020). SMA Muhammadiyah has a new library and still records the borrowing and returning of books manually. This makes it difficult for librarians to find information and risk losing books. Students have difficulty finding book information, and the erratic placement of books makes the process of borrowing books inefficient and efficient.

Therefore, a web-based library information system is needed that makes it easier for students to borrow books. The application of information technology in school libraries in the form of information systems is considered necessary because the use of information systems can increase the efficiency of librarians in managing information and data in school libraries (Anggoro & Hidayat, 2020). Meanwhile, according to [there are citations], the library information system is an internal system of public service institutions that performs the task of processing loan transactions, returning and updating books, compiling daily, monthly, and annual reports, as well as having management and organizational functions and providing certain external parties with the necessary reports. The process of creating computer programs and information systems is always determined by different development methods. Software development methodology can be interpreted as creating new software or simply perfecting existing software (Bolung & Tampangela, 2017). Therefore, the right method or model must be chosen in the analysis, concept, and implementation to provide good and meaningful services.

A software model or SDLC (System Development Life Cycle) is a process by which a software system is developed or modified by developing previous software systems (Komalasari & Fauziah, 2018). There are several methods in SDLC such as waterfall, prototype, RAD, and spiral (Nur, 2019). The waterfall method was used to design the library system of SMA Muhammadiyah 2. The waterfall method is a method that is very often used in the early stages of creation (Nurseptaji et al., 2021). The essence of the waterfall method is to work sequentially or linearly in a system (Lesmono, 2018). As in the previous study, namely the design of an asset inventory system with the waterfall method. This research can facilitate the work system from entering results to reporting, data can be stored neatly and errors can be avoided (Ponidi & Fitrajaya, 2017). Furthermore, in research conducted at SMK PGRI 1, the waterfall method describes the development of a model that represents the process of software life cycle rules with influential systems sequentially before analysis, design, coding, testing, and support. maybe called the procedure Section (Irwanto, 2021). The purpose of this research is to design or create a library system that will facilitate information processing by librarians, find information in book information and speed up the process of borrowing books.

RESEARCH METHODOLOGY

Data Collection

There are two methods of data collection, namely, observation and interviews. The observation method is a fairly effective method for collecting data. In the observation method, make direct observation of an ongoing activity (S. Pratama & Putra, 2019). At this stage, we observed the activities of borrowing books in the library of SMA Muhammadiyah 2. The interview method is a method that many system developers do. The interview was conducted by asking directly related parties about library activities.

Waterfall Method

The method used in creating a library information system uses a waterfall model that can be seen in Figure. 1. Waterfall is a classic model that has a sequential nature in designing and building an information system (Nisa et al., 2017). Here are the stages of the waterfall model (Sommerville, 2009):

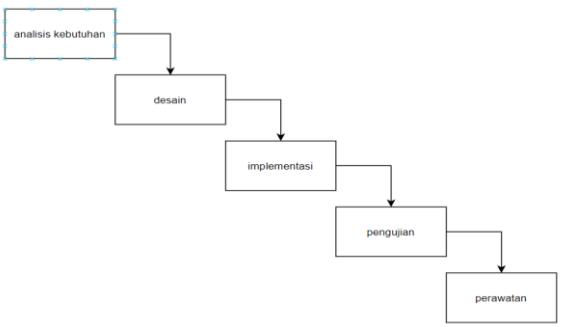

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Figure 1. Waterfall Method

Needs analysis

In this phase, gather the necessary information to create a website to design the user interface. At this stage, the developer needs communication aimed at understanding the software the user expects and the limitations of the software. This information can usually be obtained through in-person interviews, discussions, or direct surveys (E. B. Pratama & Marjun, 2022).

Planning

Design is the activity of describing, planning, and editing or arranging several separate elements of a system so that it forms a whole and functions properly (Suryadi & Zulaikhah, 2019). This step is done based on needs, which is then implemented using a use case diagram. The database design is then described using an Entity Relationship Diagram (ERD) and a Logical Record Structure (LRS).

Implementation

The next step is to implement the combination of systems planned in the previous step and execute them in a unified program from the first part. This system design phase is implemented as a series of programs (Sasmito, 2017). In this phase, a coding process is carried out based on a mutually agreed design. It starts with designing system architecture, databases, application program functions, and user interfaces.

Testing

After implementation, the program is tested as a whole system to ensure it meets requirements and avoids errors. After testing, the system can be handed over to the user.

Treatment

The last phase of treatment, this phase is long. This maintenance phase fixes bugs not found in the previous phase, improves system unit implementation, and improves system services as new requirements.

RESULTS AND DISCUSSION

Needs Analysis

In this study, researchers designed a web-based information system that can be used by users, namely students. Some of the policy specifications of the web-based library information system are as follows:

Identify the Problem

The problems that occur in the library of SMA Muhammadiyah 2 are as follows:

1. Borrowing and returning books are still written manually which takes a long time and long queues
2. Difficulty finding information on the availability of books in libraries
3. Librarians have difficulty organizing and compiling book information
4. Frequent errors in recording loans and returning books
5. Librarians need to write manuals on library reports

Functional Needs

1. The login process for admins
2. Admins manage book data including creating, reading, updating, and deleting
3. Admin management of member data includes creating, reading, updating, and deleting
4. Category data management by admins includes creating, reading, updating, and deleting
5. Admin management of publisher data includes creating, reading, updating, and deleting
6. Admin management of shelf data includes creating, reading, updating, and deleting

7. Management of book procurement data by admins includes creating, reading, updating, and deleting
8. Management of book borrowing data by admins includes creating, reading, updating, and deleting
9. Admin management of book return data includes restoring and deleting
10. User data management by admins includes creating, reading, updating, and deleting
11. Management of book procurement report data by admins includes filtering, updating, and printing reports
12. Data management of book lending reports by admins includes filtering, updating, and printing reports

Design

Based on the previous stage, it can be described the analysis of the needs needed in the library system, the needs analysis that has been obtained is then described using a use case diagram that can be seen in Figure 2.

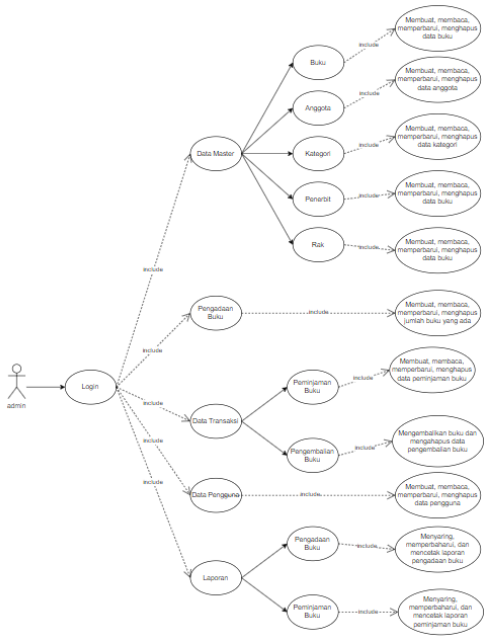

Figure 2. Use Case Diagram

After making a use case diagram, then making a database design is depicted in the form of an Entity Relationship Diagram (ERD) and Logical Record Structure (LRS). The ERD database design can be seen in Figure 3. In the ERD below there are 5 entities, namely students, loans, returns, books, and admin. Admin entity as a user (attendant) of the library system.

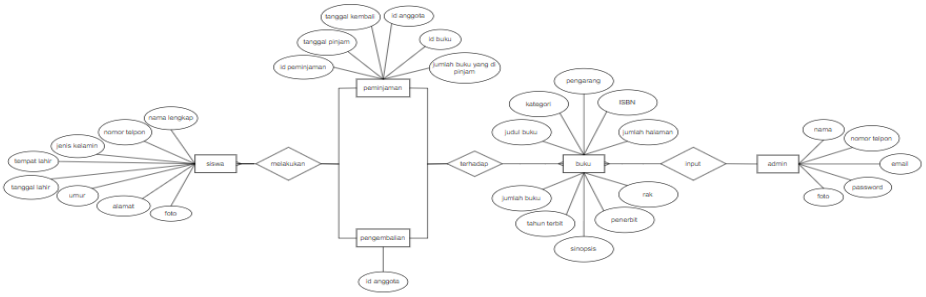

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Figure 3. Entity Relationship Diagram (ERD)

After creating the ERD, next create LRS. LRS is a representation of ERD. Each entity in the previous ERD will turn into a table. Each table consists of attributes, of which the primary key and foreign key are predefined. The LRS design can be seen in Figure 4.

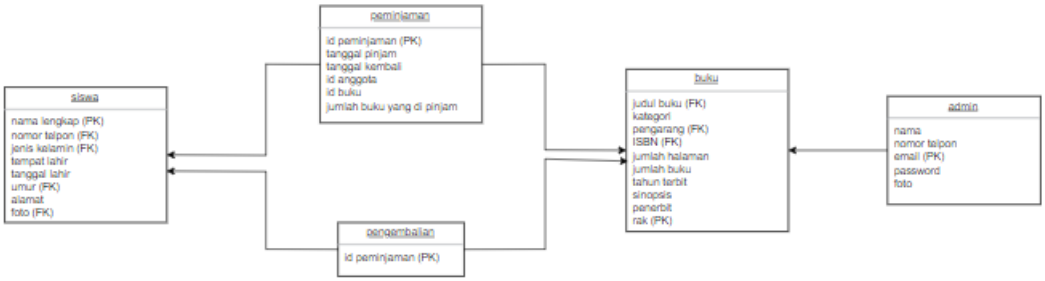

Figure 4. Logical Record Structure (LRS)

Application Implementation (if any)

The result of the implementation stage is the design of the library system interface. This library system is built web-based using PHP and HTML languages. To access the system, the login page is the initial view. The admin login page can be seen in Figure 5.

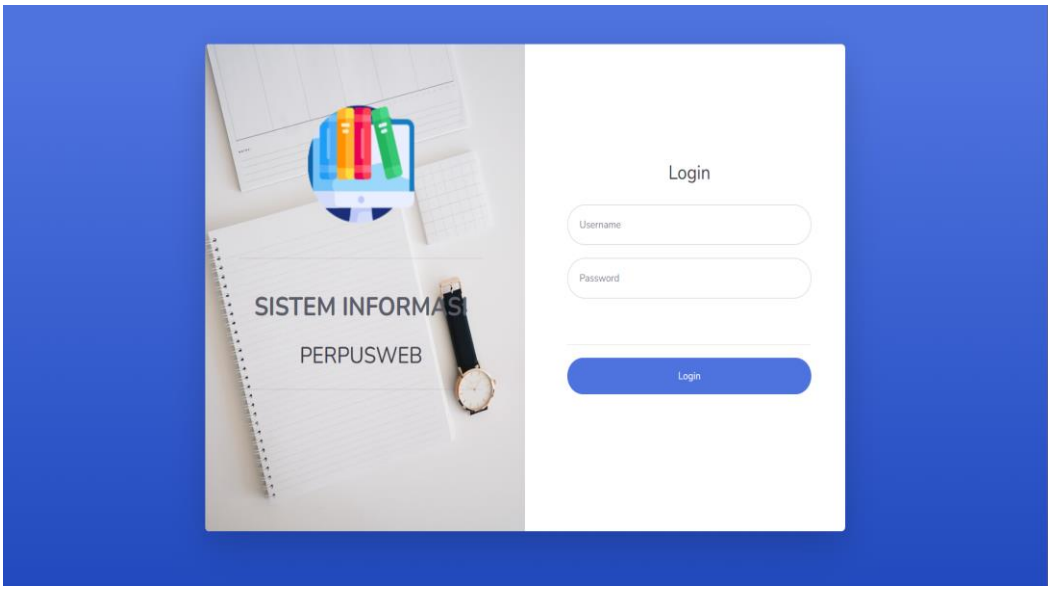

Figure 5. Admin Login Page

Furthermore, if the username and password are correct it will display the dashboard page in Figure 6. This page will display lending charts and information about members, books, and procurement. On the left page of the dashboard, there are several menus, namely master data, book procurement, transaction data, user data, and reports.

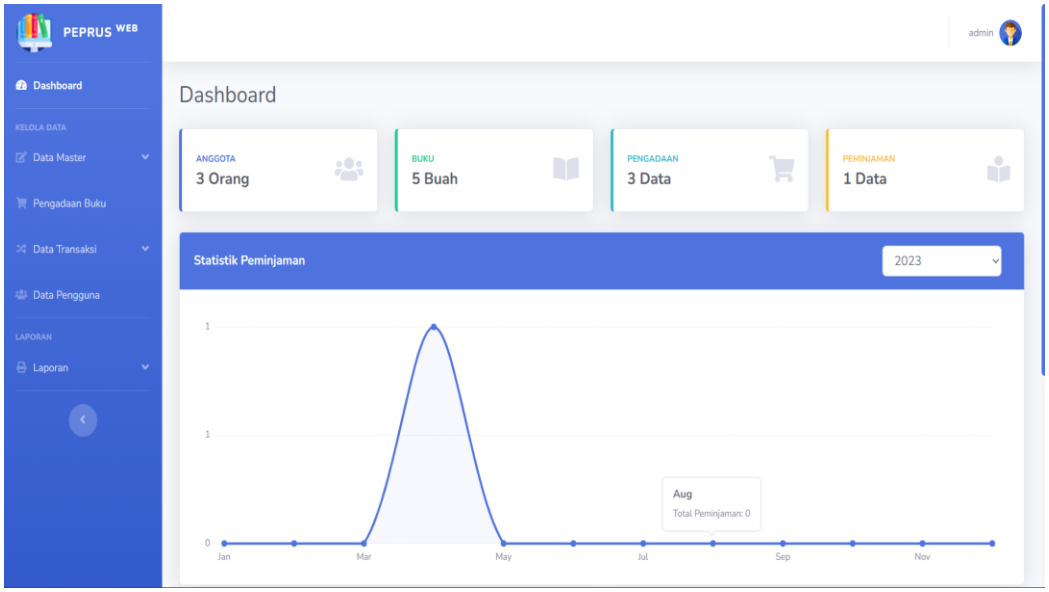

Figure 6. Dashboard Page

In the master data, there are 5 choices, namely books, members, categories, publishers, and shelves. The book master data serves to create, view, update, and delete library book data. The display of the master data of the book can be seen in Figure 7.

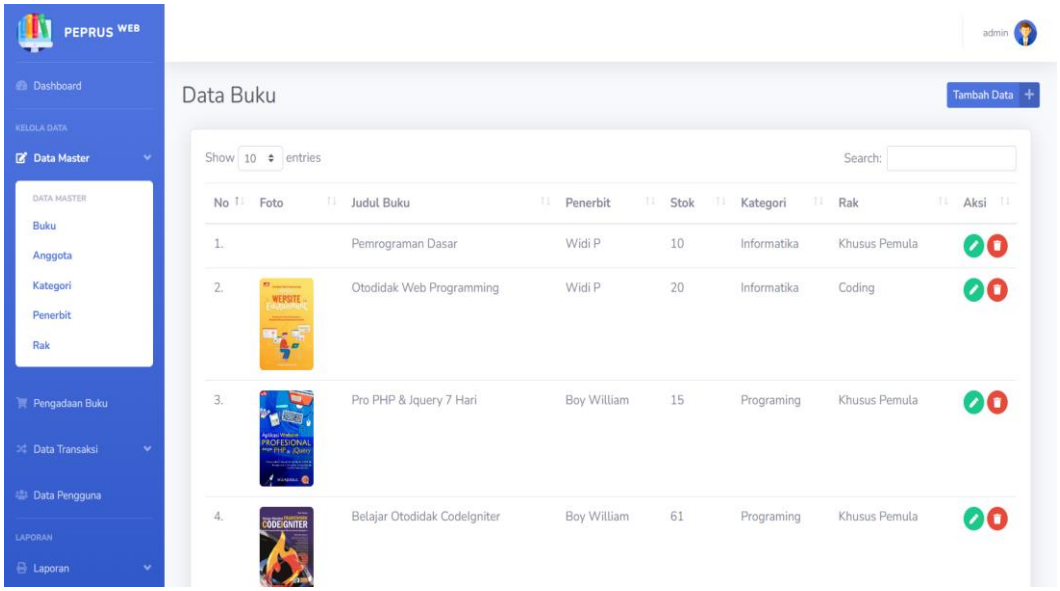

Figure 7. Book Master Data Page

In the master data, members function to create, view, update, and delete library member data. The view of the member master data page can be seen in Figure 8.

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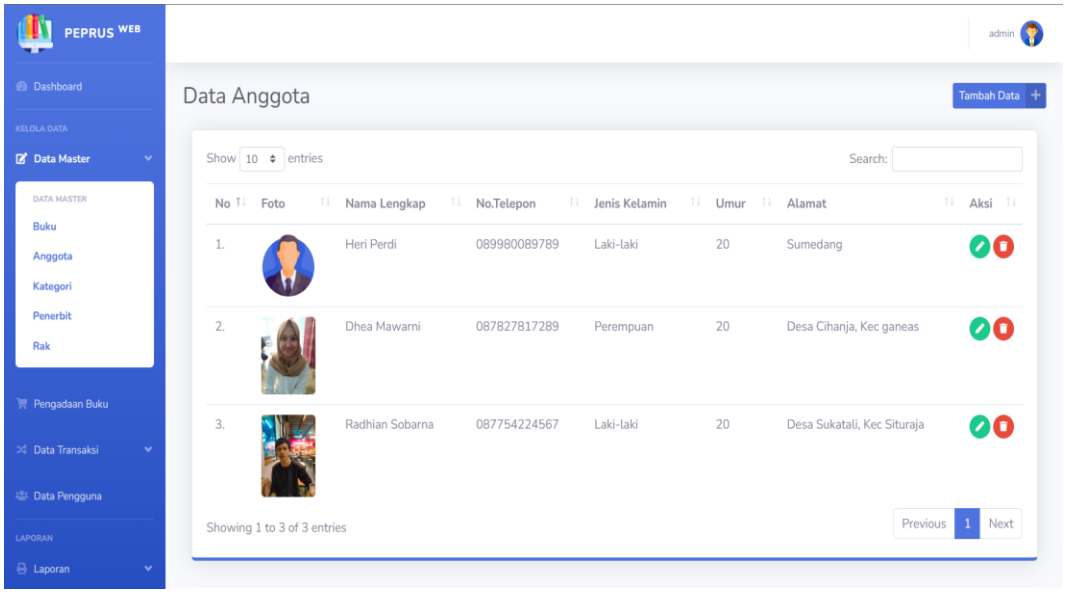

Figure 8. Member Master Data Page

The category master data serves to create, view, update, and delete library book category data. The category master data page view can be seen in Figure 9.

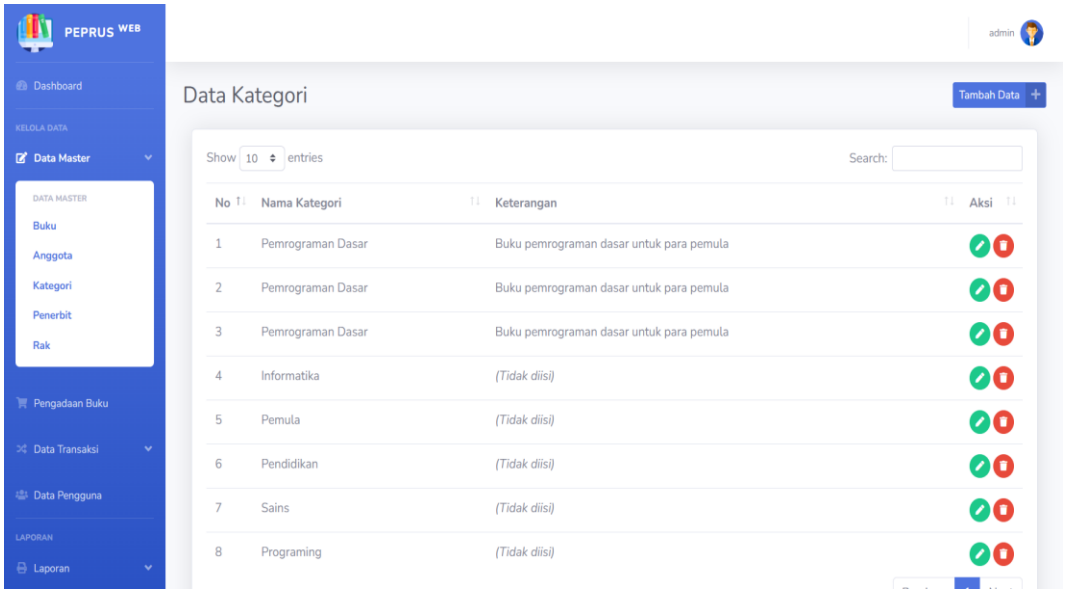

Figure 9. Category Master Data Page

The publisher master data serves to create, view, update, and delete library book publisher data. The publisher's master data page view can be seen in Figure 10.

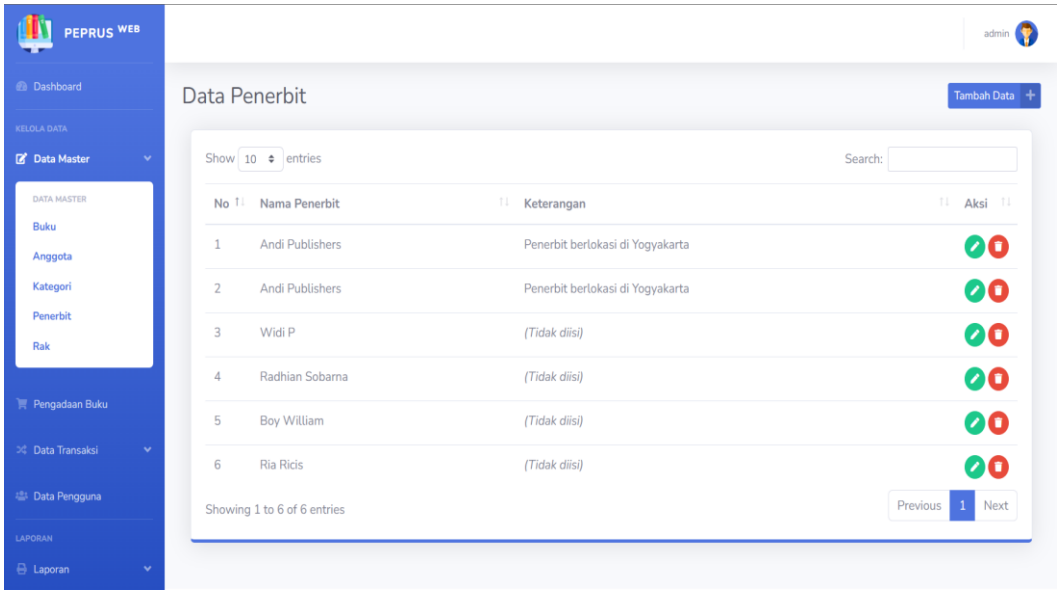

Figure 10. Publisher Master Data Page

In the shelf master data, it functions to create, view, update, and delete library bookshelf data. The view of the shelf master data page can be seen in Figure 11.

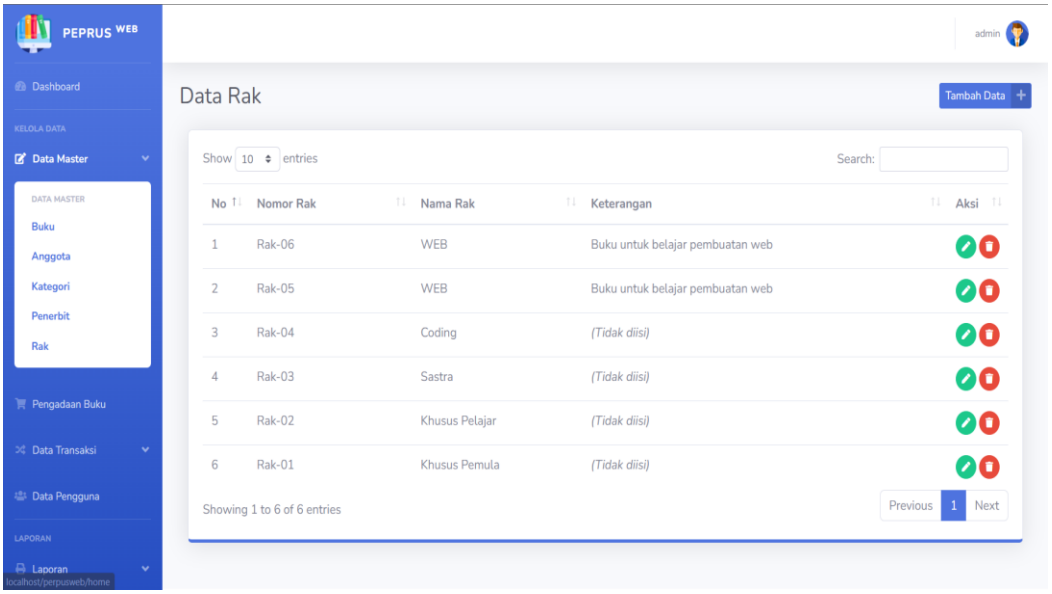

Figure 11. Shelf Master Data Page

In book procurement, it functions to create, view, update, and delete the number of books that enter the library. The display of the book procurement page can be seen in Figure 12.

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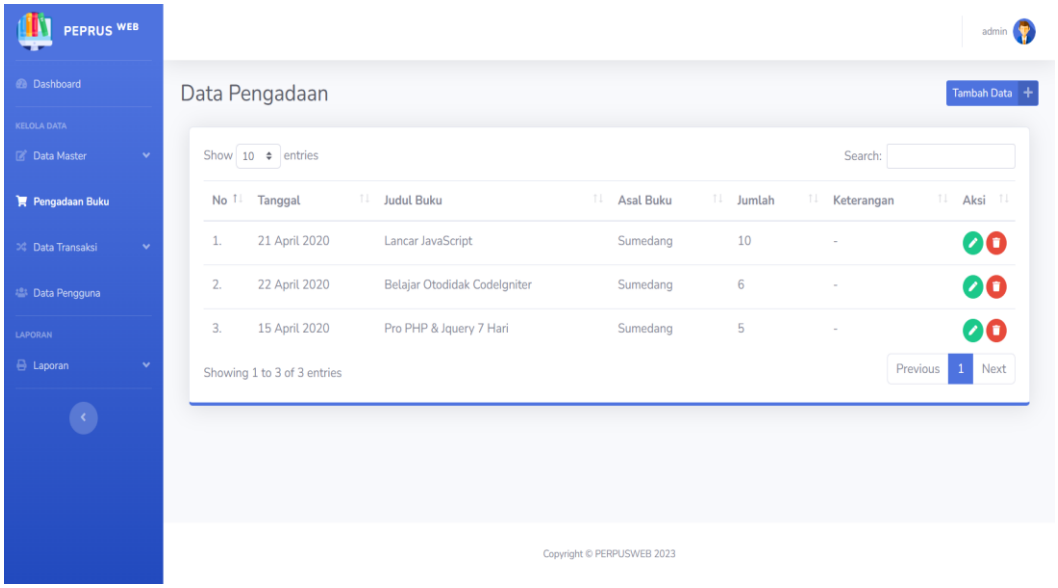

Figure 12. Book Procurement Page

In the transaction data, there are two options, namely book borrowing and returning books. Book borrowing serves to create, view, update, and delete library book borrowing data. The display of the book borrowing page can be seen in Figure 13.

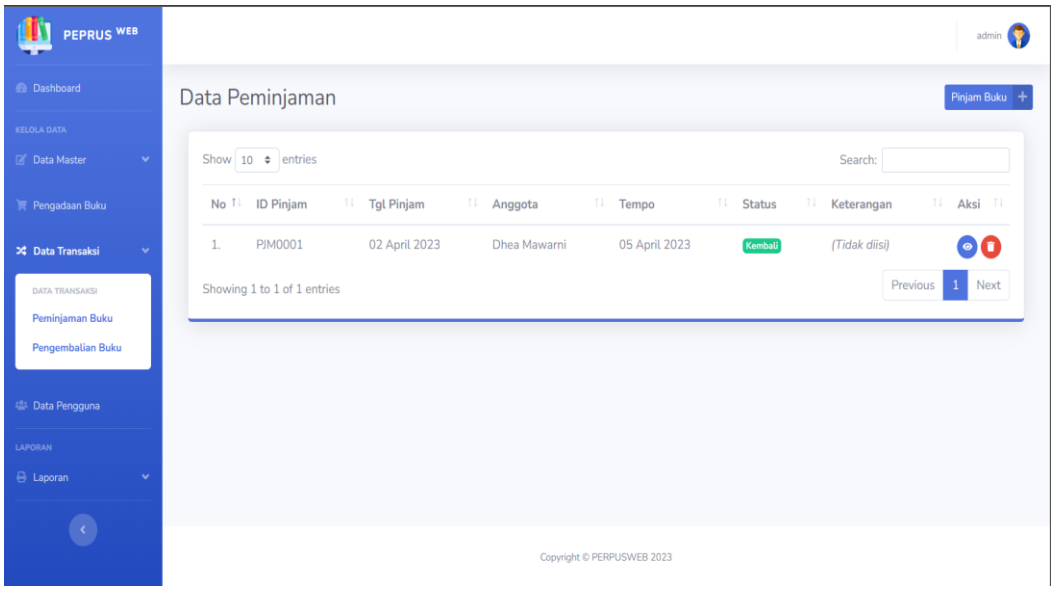

Figure 13. Book Lending Transaction Data Page

Book return serves to return borrowed books, and delete library book return data. The display of the book return page can be seen in Figure 14.

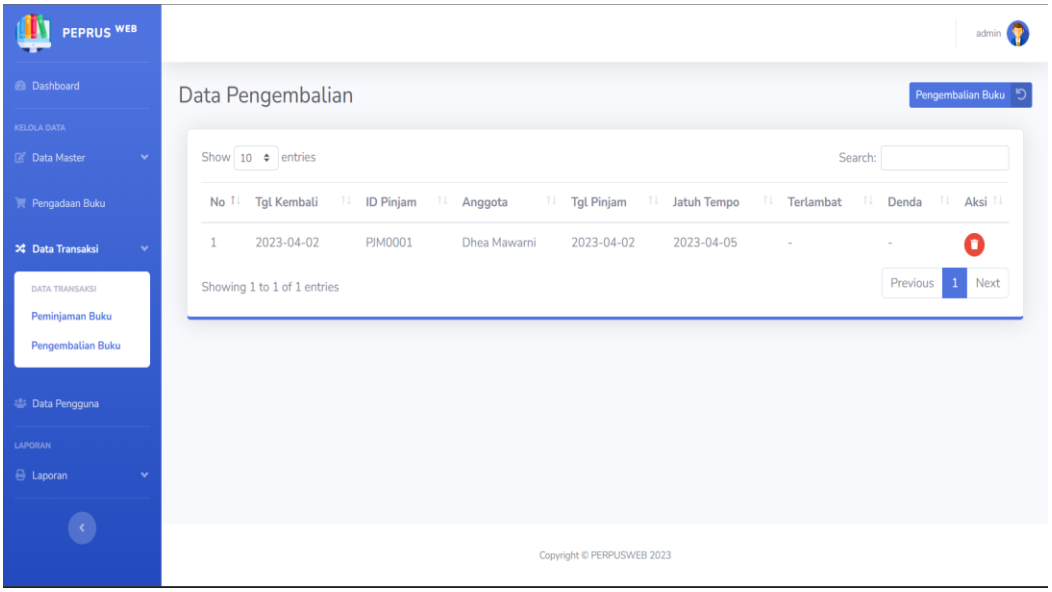

Figure 14. Book Return Transaction Data Page

Furthermore, user data serves to create, view, update, and delete library system user data. The user data page view can be seen in Figure 15.

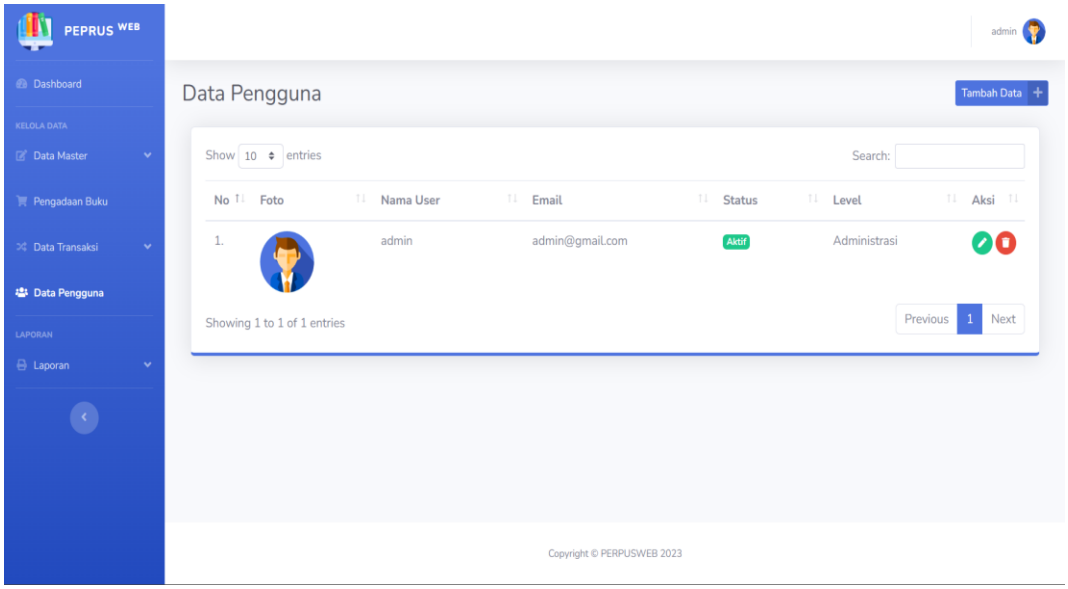

Figure 15. User Data Page

In the report, there are two options, namely book procurement and book borrowing. The book procurement report serves to filter, update, and print reports on the number of books entered into the library. The book procurement report page can be seen in Figure 16.

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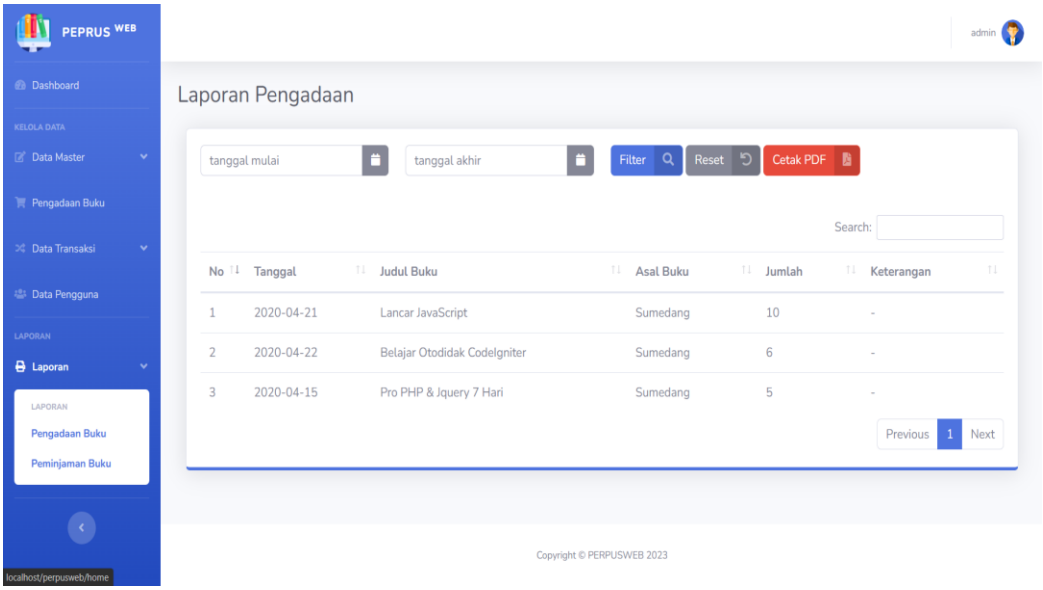

Figure 16. Book Procurement Report Page

Then the book borrowing report serves to filter, update, and print library book borrowing reports. The book loan report page can be seen in Figure 17.

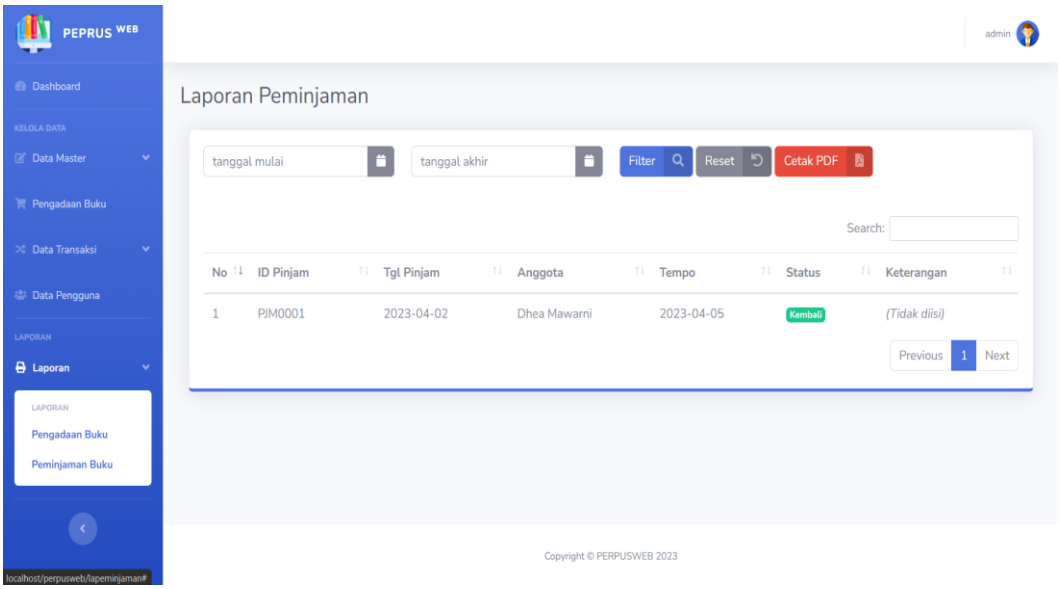

Figure 17. Book Lending Report

Testing

After carrying out the implementation stage, the next stage is testing the system. Testing this library system uses black box testing which aims to find out how far the success of the system is built. The features to be tested are login, book master data, book loan transaction data, book return transaction data, and book loan reports. The results of testing this library system show the success of the system built in facilitating data management in the library. The test results can be seen in Table 1 below.

Table 1. The results of testing this library system

Test Scenarios	Expected results	Test Results	Conclusion

Fill in the username and password with the correct data then click the Login button	The system will enter the dashboard page	The system can enter the dashboard page	Succeed
Add books and fill in book data	The system will add the book	The system can add books	Succeed
Borrow books and fill out loan forms	The system will display the newly created borrowing	The system can display newly created borrowings	Succeed
Return books	The system will display refund and penalty information	The system can display return and fine information	Succeed
Print book lending reports in pdf form	The system will generate a book loan report in pdf form	The system can generate book borrowing reports in pdf form	Succeed

Treatment

The final stage is system maintenance. This stage performs maintenance on the system by evaluating the newly created system. Are there any flaws or weaknesses in the new system. From the evaluation carried out, it is expected to improve the performance of the library system of SMA Muhammadiyah 2.

CONCLUSION

Based on the results of the study, the following conclusions were drawn: (1) Researchers have succeeded in developing a website-based library information system at SMA Muhammadiyah 2 Cipondoh using the Waterfall software development model. (2) Application features developed by researchers at the library of SMA Muhammadiyah 2 Cipondoh include login, book master data, book loan transaction data, book return transaction data, and book loan reports. (3) Development of library information system using PHP Codeigniter framework 3. (4) The front-ends used are HTML 5, CSS 3 and Bootstrap version 4.

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