SIPER: Development of a Web-Based Library Information System at SMK Negeri 7 Makassar Using the Agile Method

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ARTICLE INFO	ABSTRACT
Keywords: Library Information System Agile SMK 7 Makassar Digitalization	The development of a web-based library information system at SMK 7 Makassar uses the Agile method to improve service efficiency through digitizing the process of managing books, members, borrowing, and reporting. Agile was chosen because of its flexibility in adjusting the system to user needs through iteration and continuous collaboration. The results of testing 11 main features such as login, add/edit/delete book data, add members, borrow, return, book search, transaction reports, logout, and notifications showed that all functions were running well (100% valid). This system is considered responsive, user-friendly, and ready to be implemented to support the needs of a modern, technology-based library.
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INTRODUCTION

Advances in information technology have driven the digital transformation of library systems. The adoption of web based applications such as Laravel enables more efficient and integrated management of book data, members, and transactions [1]. Such systems not only streamline administrative processes but also improve speed and accuracy in searching and storing collection data [2]. Consequently, modern libraries can deliver information access that is fast, structured, and readily available to students and academic staff through digital devices [3].

According to Article 1 of Law Number 43 of 2007 on Libraries, a library is a professional institution that manages written works, printed works, and recorded works using standardized systems. The purpose of this management is to meet user needs in education, research, cultural preservation, information provision, and recreation. Sound management and adequate facilities are therefore essential to support optimal library service quality [4].

Libraries now function not only as repositories but also as active information service centers. With digital systems, activities such as searching, borrowing, and returning books become more efficient and practical without reliance on time consuming manual procedures [5]. Information technology has been implemented across sectors including education, and library information systems in educational institutions strongly support administration, particularly for managing borrowing and return data. As a result, deploying a school library information system is an appropriate solution for organizing book data and other library activities [6].

Libraries are critical learning resources for schools and universities, providing convenient access for students to obtain information and knowledge [7]. Beyond storage, libraries encompass collection management, user services, and maintenance of facilities and infrastructure. With technology, library management is now more optimal through web based information systems [8]. These systems assist administrators in managing borrowing data and simplify book data processing [9].

School libraries are transforming into digital information hubs [10]. Web based library information systems such as SIPER accelerate searching, borrowing, and collection management with greater efficiency [11]. SIPER eases information access for students and teachers anytime and anywhere, thereby enhancing information service quality and supporting the learning process [12].

Improvements in quality of life encourage society to focus more on education and information access, including through the application of information technology in library systems [13]. User oriented digital libraries facilitate interaction and raise service efficiency. Manual data handling can lead to recording errors and difficulties in finding books, so web based library information systems such as SIPER are needed to increase efficiency and service quality [14].

This article contributes to the development and implementation of a web-based library information system using Laravel as a solution to improve the efficiency and service quality of school libraries. The objective is to design and build a system that simplifies the digital management of book data, members, and borrowing and return transactions, thereby supporting a more modern and integrated teaching and learning process.

METHOD

Provide a detailed enough method for possible reproduction of the work. The method has been published and must be shown with reference: only relevant modifications should be explained.

Agile is a software development approach that emphasizes flexibility, collaboration, and rapid response to change. Unlike the Waterfall method that follows a fixed plan, Agile uses iterative development cycles, allowing the team to adapt the system to evolving user needs. In developing a library information system, Agile supports active collaboration between the team and stakeholders, resulting in a system that is more aligned with user requirements [15].

Figure 1. Agile Method

The Agile technique relies on short development cycles known as sprints, and it emphasizes continuous improvement in the development of products or services. Agile focuses on incremental delivery in which software is released in stages. In this way, development becomes

more efficient, code quality improves, and customers can participate directly in each stage of development [16].

An iterative approach is a defining characteristic of Agile, where development proceeds in short cycles iterations or sprints. Each iteration focuses on priority features, enabling the team to quickly apply updates and changes based on user feedback without waiting for the entire project to finish [17].

Agile begins with joint planning with stakeholders to prepare a product backlog that lists priority features. Each sprint produces software that can be tested and adjusted according to user feedback. After each sprint, a review and a retrospective are conducted to evaluate outcomes and plan improvements. In this way, the system evolves continuously and remains aligned with user needs [18].

1. System Planning

   Planning for SIPER under the Agile approach starts from user requirement submission System Request followed by a feasibility study that covers technical, economic, and operational aspects. This ensures that the system is developed according to the needs and conditions of the school.

2. Analysis

   The analysis stage aims to understand SIPER requirements through interviews and document analysis related to borrowing and returning books. The results are formulated in a use case diagram and a requirement list that cover the management of book data, users, transactions, and reports, ensuring clear understanding before design.

3. Design

   SIPER design begins with building a responsive user interface in Figma to support searching, borrowing, and returning books. The class diagram represents data structures and object relationships, while the sequence diagram shows the order of interactions among components.

4. Implementation

   Implementation starts after design completion and follows the defined technical specifications. The system is built to include the user interface and data management for ease of use. The database is prepared for book, user, and transaction data. After implementation, the system is tested to ensure that features work correctly and securely.

   a. Coding

   Coding uses PHP Laravel for the backend and HTML, CSS, and JavaScript for the frontend. It covers modules for book management, user management, borrowing and return transactions, and reporting, and it is conducted iteratively in line with Agile principles.

   b. Testing

   After coding, functional, security authentication and encryption, and performance testing are conducted to ensure the system operates optimally and safely. Testing involves school administrators, students, and teachers as system users to verify that all features work properly for each role.

RESULTS AND DISCUSSION

The development resulted in SIPER, a web based school library information system used by students, teachers, and library administrators. The project applied the Agile method with four main stages, namely system planning, requirement analysis, design, and implementation that includes coding and testing. The outcomes of these Agile stages are presented as follows.

1. System Planning Results

The SIPER system request document was analyzed through a feasibility study to evaluate technical, operational, and economic viability. This analysis helped identify potential project success, estimate risks, and provide an early overview of possible technical and non technical challenges. These steps ensure that the system delivered is effective and efficient.

Table 1. Technical Feasibility

Feasibility Study for the SIPER Web Based School Library Information System
Technical Feasibility
SIPER is considered technically feasible, although several risks require attention.
Risks related to familiarity with the application risk rating low
1. Users are fairly familiar with using the application, yet still need adaptation to certain features.
2. Developers are very familiar with SIPER since it has been developed and tested internally.
Risks related to familiarity with the technology risk rating low to medium
1. Users are not yet familiar with the technologies that support the application, so basic training is required.
2. Developers are very familiar with the technologies in use, including programming languages, frameworks, and the supporting IDE.
Risks related to project size risk rating medium
1. The SIPER project is estimated to require 7 man/months and can be completed within 6 months.
2. System complexity remains at a moderate scale and therefore requires efficient time planning.
Compatibility with external systems risk rating low to medium
1. SIPER shows a reasonably good level of compatibility with the organization's technology environment.
2. Integration with other systems such as the academic management system or external databases still needs further evaluation.
Economic Feasibility
Based on the cost–benefit analysis, SIPER development indicates long term operational efficiency, although it is not yet financially profitable within the first three years.
a. Return on Investment ROI after three years minus seventy two point one percent not yet profitable.
b. Break Even Point BEP not reached within the three year analysis horizon.
c. Net Present Value NPV Rp 93.572.843.
Organizational Feasibility
At the organizational level, the risk of developing the SIPER Library Information System is considered low. The system aligns with the organization's vision and mission and supports

operational efficiency of the work unit, especially the school library. SIPER plays an important role in advancing the digitization of library services, facilitating borrowing and returning processes, and remaining consistent with business processes and digitalization targets set by the organization. Therefore, the system's development is viewed as strategic in supporting digital transformation.

The project champion for SIPER development is Insyira Syahwa Naswari, who serves as User Product Owner.

2. Analisis Results

At the SIPER analysis stage, the functional requirements were specified to ensure the system effectively supports library operations. The essential features include account registration, user login, book searching and borrowing, book return, administrative management of book data by the librarian, and loan notification to users.

Beyond functionality, the non functional requirements cover technical qualities that ensure dependable service. These include protection of user data, system performance that can handle simultaneous access, twenty four hour system availability, and ease of use. Together, these requirements form the foundation for the subsequent design, implementation, and testing of SIPER.

Table 2. Technical Feasibility

Non-Functional Requirements		
ID	**Parameter**	**Explanation**
NFR 001	Availability	The system must be accessible twenty four hours a day seven days a week with a minimum uptime of ninety nine point nine percent.
NFR 002	Reliability	The system must have a very low failure rate not exceeding zero point one percent of operating time.
NFR 003	Ergonomy	The system must provide a user friendly interface that is easy to use by admins teachers and students.
NFR 004	Portability	The system must be accessible across multiple devices and platforms including Windows macOS Android and iOS.
NFR 005	Memory	The system must be efficient in memory usage and should not require more than two hundred megabytes on the server.
NFR 006	Response Time	The system must process book searches and transactions in less than three seconds.
NFR 007	Security	The system must use data encryption to protect user information and support two factor authentication for admins.
NFR 008	Data Backup	The system must include automatic daily backup features to prevent information loss.
NFR 009	Scalability	The system must handle up to ten thousand concurrent users without performance degradation.
NFR 010	Others Communication Language	All information and instructions in the system must use Bahasa Indonesia.

Table 3. Technical Feasibility

Functional Requirement		
ID	**Functional Requirement**	**Explanation**
FR 001	Login	Users students teachers and admins can sign in to the system by entering valid credentials.
FR 002	Manage Books	Admin can add edit and delete book records in the system.
FR 003	Borrowing and Return Reports	Admin can view reports related to borrowing and return activities by students and teachers.
FR 004	Manage User Data	Admin can manage user data students and teachers including adding editing and deactivating accounts.
FR 005	Borrowing History	Students and teachers can view the history of books they have borrowed.
FR 006	Book Search	Students and teachers can search for books by title author category or ISBN.
FR 007	Borrowing	Students and teachers can request book loans online and the system records the borrowing date and due date.
FR 008	Returns	Students and teachers can return borrowed books and the system records the return and calculates fines in case of lateness.
FR 009	Logout	Users can sign out of the system after using the available features.
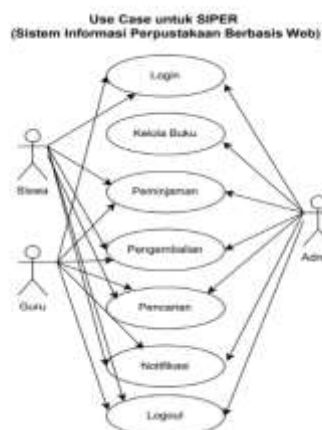
Figure 2. Use Case

1. Login
   This use case allows users admin, teachers, and students to sign in to the system using a username and password as the authentication parameters for accessing system features.

2. Manage Books
   This use case allows the admin to add update or delete library book records so that collection information remains up to date.
3. Borrowing
   This use case allows teachers and students to borrow books available in the system in accordance with applicable rules and current availability.
4. Returns
   This use case allows teachers and students to return previously borrowed books and the system automatically updates each book's status.
5. Search
   This use case allows all users to search for books by keywords such as title author or category to simplify discovery.
6. Notifications
   This use case sends automatic notifications to users students teachers and admin including due date reminders borrowing and return confirmations announcements of new books and late fee alerts.
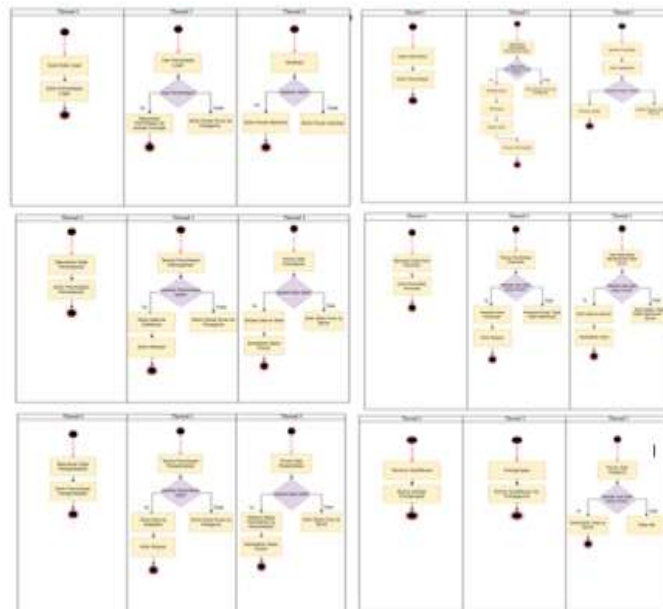
Figure 3. Activity Diagram

3. Design

   The design stage produced the core artifacts for SIPER the web based Library Information System. These artifacts comprise the Class Diagram the Sequence Diagram and the User Interface which were adapted from the given references and further refined to match SIPER features. The overall goal is to ensure that SIPER has a clear structure and can be implemented reliably.

A. Use Case and Class Diagram Design

   Unified Modeling Language UML is a standard modeling language for designing and documenting object oriented software systems [19]. UML provides graphical views of the system

that improve communication among developers system analysts and end users and helps structure complex problems into forms that are easier to understand [20], [21].

Within the design phase the Class Diagram is a primary artifact. It identifies key classes attributes methods and relationships among classes such as users book collections and borrowing transactions and it clarifies how system objects interact [22]. The Class Diagram reduces implementation errors by providing a clear structural blueprint and it facilitates subsequent testing and maintenance [23], [24].
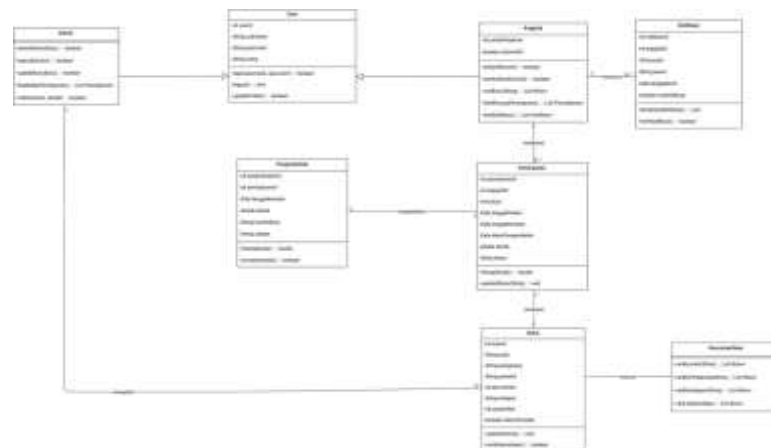
Figure 4. Class Diagram
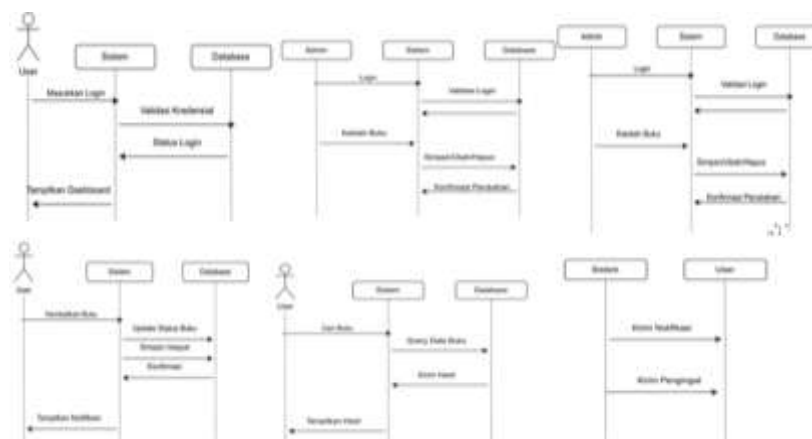
Figure 5. Sequence Diagram

B. User Interface Design

The user interface for the library information system was designed in Figma following a style guide to maintain visual consistency. Free icons from Google and Figma libraries were used during development. Significant revisions were made to the menu layout navigation icons and the book search flow [25]. The final UI reflects three improvement iterations based on user feedback collected during sprints and is shown in the following figure.

Figure 6. Figma Design

4. Implementation Results

Based on the completed analysis and design, the web based library information system was developed across several sprints and successfully implemented. The system is designed to streamline library data management and provide easy access for users. The implementation is presented in two parts.

a. Coding Outcomes

Table 4 System Functionality Coding Outputs.

Coding	Resulting View
Login	
Admin	
Dashboard Menu	
Manage Books Menu	

Manage Users Menu 	
Manage Borrowing Menu 	
Manage Returns Menu 	
Reports Menu 	

Settings Menu	

Profile Menu	

User	

Dashboard Menu	

Book Search Menu	

Borrowing History Menu	
Return History Menu	
Notifications Menu	

b. Testing Results

Table 5.Black Box Testing

No	Feature Tested	Test Scenario	Expected Outcome	Test Result	Status
UB 1	User Login	User enters a valid username and password	User logs in according to role	As expected	Passed
UB 2	Add Book Data	Admin enters a new book record and saves it	Book is stored in the database and appears in the book list	As expected	Passed

UB 3	Edit Book Data	Admin updates an existing book record	Book information is updated in the database and on the interface	As expected	Passed
UB 4	Delete Book Data	Admin deletes a book record	Book record is removed from the system	As expected	Passed
UB 5	Add Member	Staff registers a new member	New member data is stored and visible	As expected	Passed
UB 6	Book Borrowing	Staff records a borrowing transaction by a member	Transaction is recorded and book stock decreases	As expected	Passed
UB 7	Book Return and Fine	Staff inputs a return date that exceeds the due date	Fine is calculated automatically based on lateness	As expected	Passed
UB 8	Book Search	User searches for a book by title or author	Requested books appear based on the keyword	As expected	Passed
UB 9	Transaction Reports	Admin views borrowing and return reports for a given period	Reports are complete and consistent with transactions	As expected	Passed
UB 10	User Logout	User presses the logout button	User session ends and the user is redirected to the login page	As expected	Passed
UB 11	Notifications	The system sends notifications	Notifications appear automatically	As expected	Passed

		when loans approach the due date or a fine applies	according to the defined conditions		

Table 6. White Box Testing

No	Feature Tested	Test Description	Expected Outcome	Status
WB 1	User Login	Validate username and password input logic at code level	System allows login only when inputs match records in the database	Passed

5. Discussion

This study develops SIPER, a web based library information system designed for SMK Negeri 7 Makassar. SIPER integrates service features for member data, book catalog, borrowing, returns, and donated book management. Using the Agile method, SIPER adapts quickly to librarian and user needs, which makes the system responsive and accessible at any time. Implementation results indicate significant efficiency gains in library services, both in processing speed and data accuracy. These findings are consistent with prior studies, which also report that web based library systems improve service speed and accuracy [1], [2], [4]. In contrast with the Waterfall approach used [10], the Agile method in this research enables more flexible development that responds to change. SIPER also stands out with its donated book management feature, which is rarely discussed in earlier studies such as [14]. Thus, this work not only confirms the effectiveness of web based systems, it also extends the contribution through an Agile approach and richer service features aligned with school library needs.

6. Conclusion and Recommendations

This research successfully implements a web based library information system using the Agile method, enabling more efficient and structured management of book data, borrowing, and returns. Through an iterative approach, the system is developed in stages based on user needs, thereby improving convenience, accuracy, and service accessibility. The system simplifies library administration and provides a responsive and user friendly digital experience for users. The main limitation is that testing has not yet involved a large user base in a real time school environment, so effectiveness under real operating conditions has not been fully measured. Future work should include broader testing with actual users in an operational setting and continued feature enhancement and platform expansion so the system can serve more educational institutions.

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