

Article

Development of the MY PERPUS Digital Library Website for SMA Muhammadiyah 4 Porong

Muhammad Najih Fairuzzamani¹, Mochamad Alfian Rosid^{2*}, Nuril Lutvi Azizah³, Ade Eviyanti⁴

1. Muhammadiyah University of Sidoarjo, Indonesia
 2. Muhammadiyah University of Sidoarjo, Indonesia
 3. Muhammadiyah University of Sidoarjo, Indonesia
 4. Muhammadiyah University of Sidoarjo, Indonesia
- * Correspondence: alfanrosid@umsida.ac.id

Abstract: The rapid development of information technology has encouraged educational institutions to adopt digital systems to improve administrative effectiveness, including school library services. The library at SMA Muhammadiyah 4 Porong still relies on a manual system, resulting in recording errors, difficulty locating books, and inefficient borrowing and return processes. This study aimed to develop a website-based library information system named MY PERPUS to support library administration and improve service quality. The Waterfall model was used, comprising requirements analysis, system design, and website development. Data were collected through observations and interviews with library staff and visitors. The system includes login and registration, book-master data management, borrowing and return transactions, and Gmail-based book-return reminders. Black-box testing showed that all functions operated correctly and produced the expected outputs. User testing with 12 respondents produced an overall mean Likert score of 4.51, indicating a very positive level of acceptance. The MY PERPUS website therefore improves library-management efficiency, simplifies book searches, and helps reduce overdue returns.

Keywords: library information system; website; Waterfall method; library administration; MY PERPUS

Citation: Fairuzzamani, M. N., Rosid, M. A., Azizah, N. L. & Eviyanti, A. Development of the MY PERPUS Digital Library Website for SMA Muhammadiyah 4 Porong. International Journal of Human Computing Studies 2026, 8(2), 24-40

Received: 10th Apr 2026
Revised: 21st May 2026
Accepted: 8th June 2026
Published: 15th July 2026



Copyright: © 2026 by the authors. Submitted for open access publication under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>)

1. Introduction

The rapid development of information and communication technology has significantly affected many areas of life, including education. Educational institutions must adapt quickly to technological developments to improve teaching, learning, and school administration. One essential implementation is a library information system. Libraries that continue to rely on manual management face several weaknesses, including recording errors, lengthy data-entry processes, and the risk of data damage [1], [2].

Another problem is the difficulty readers experience when searching for book information. Manual searches are time-consuming and may ultimately reduce students' interest in reading. Disorganized library catalogs further increase this difficulty and often require library staff to assist visitors in locating the books they need [3], [4].

At SMA Muhammadiyah 4 Porong, these problems are particularly evident in library administration. The existing manual system is no longer adequate to accommodate the continuously increasing number of books, requires substantial storage space, is vulnerable to damage, and frequently produces inefficient or inaccurate records.

To address these problems, an information-technology-based solution is needed to improve the efficiency and effectiveness of library management. The implementation of a website-based library information system named MY PERPUS represents a strategic response to these challenges. The system supports recordkeeping and book-data management while reducing processing time and physical storage requirements. It also improves book-search efficiency, records borrowing and return activities, minimizes book loss, and provides return reminders and overdue-fine information.

Overall, the development of this website-based library information system is expected to enable the library of SMA Muhammadiyah 4 Porong to provide better services, improve management efficiency, and strengthen its image among users [5], [6], [7]. Further studies should evaluate the effectiveness of the implemented system and identify areas requiring improvement so that the library can continue adapting to technological developments and user needs.

2. Materials and Methods

This study used the Waterfall method because it matched the requirements of website development. In the Waterfall model, each phase must be completed before the next phase begins. The method emphasizes a sequential workflow, clear task separation, and close monitoring of progress at every stage to achieve optimal results [8], [9]. The research stages are described below.

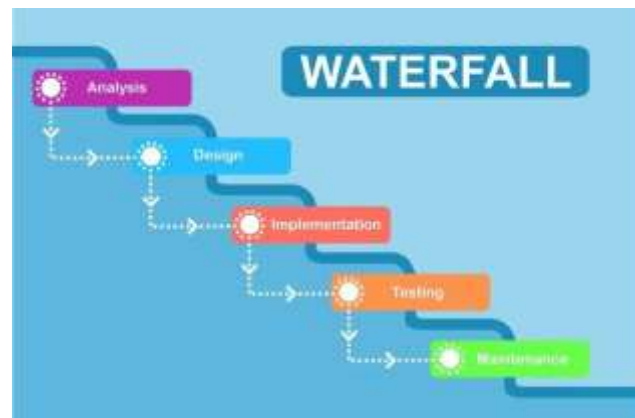


Figure 1. Stages of the Waterfall method

2.1 Requirements Analysis and Data Collection

Data were collected through observations at the library of SMA Muhammadiyah 4 Porong and interviews with two library staff members and ten library visitors. The researchers also reviewed several existing websites as references for the proposed website.

2.2 Feature and Website Design

Based on the collected data, the researchers identified features capable of addressing the problems observed in the field. A preliminary design for the website interface was then prepared.

2.3 Website Development

Website development began with the creation of the user interface and user-experience design and the preparation of the database. Coding was then performed to implement the website according to the approved design. After completion, the database and application files were uploaded to the hosting environment [10].

The MY PERPUS library-website development schedule was implemented in September 2023.

a. Planning (Week 1)

- a) Identify the requirements and objectives of the library website.
- b) Interview students as library visitors and interview library staff.
- c) Identify the required features, such as transaction, book-master, and borrowing

menus.

d) Create a wireframe or initial sketch of the website structure and layout.

b. Design (Week 2)

a) Design the user interface based on the approved wireframe.

b) Select the color palette, typefaces, and other design elements.

c. Development (Week 3)

a) Select the website-development platform or framework, such as WordPress or Django.

b) Build the database structure for library information, including book and member records.

2.4 MY PERPUS Website Design

The stages of MY PERPUS development, the parties involved, and their respective roles are summarized in a context diagram. The diagram provides a simplified representation of the proposed system, as shown below [11].

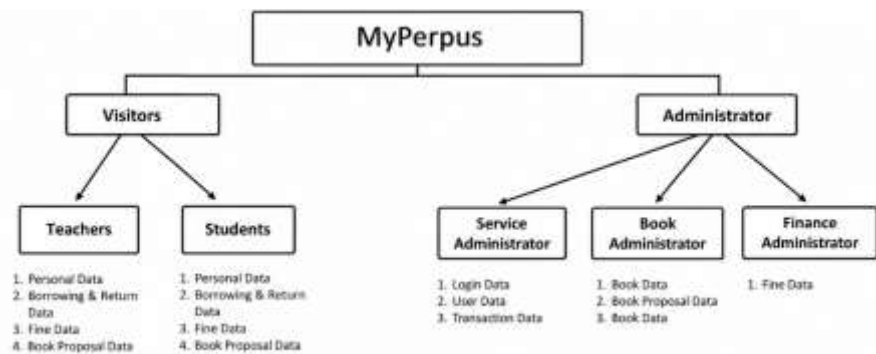


Figure 2. Context diagram of the MY PERPUS website

Figure 2 presents MY PERPUS as the central data-processing system interacting with two principal entities: visitors and administrators. Visitors include teachers and students, who can access personal data, borrowing and return transactions, fine information, and book-proposal submissions.

The MY PERPUS website is further represented through a use-case diagram. The diagram explains how the website operates by showing the two main actors—administrators and visitors—and the data they exchange with the system. In other words, it illustrates the relationship between users and the system [12].

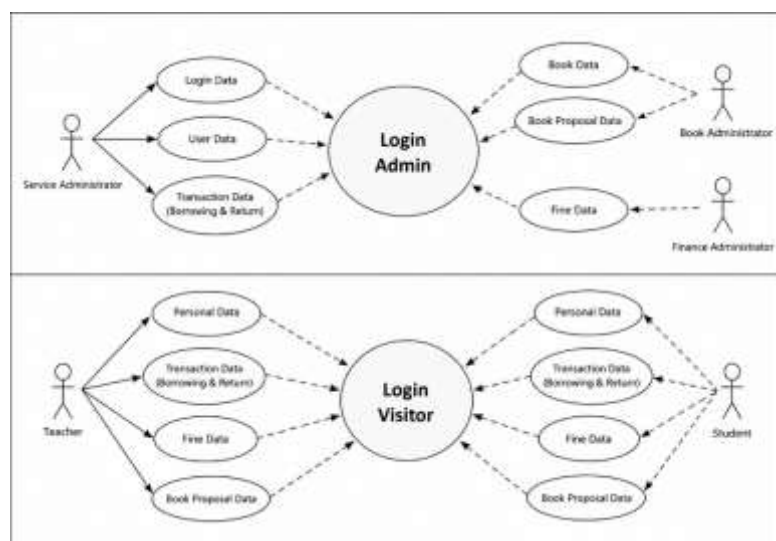


Figure 3. Use-case diagram of the MY PERPUS website

Figure 3 illustrates the interaction between users and the MY PERPUS website through two principal actors: administrators and visitors. Administrators access the system through the administrator login to manage login data, user data, borrowing and return transactions, book data, book proposals, and fine data. These activities involve service, collection, and finance administrators.

Data processing within the application is further described through activity diagrams. Several examples of the system workflows are presented below.

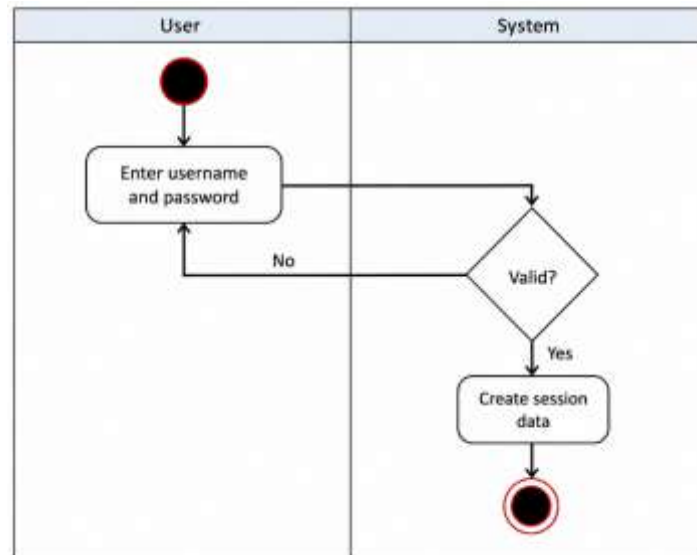


Figure 4. Activity diagram of the visitor-login feature

Figure 4 shows the visitor-login workflow in MY PERPUS. The process begins when a user enters a username and password. The system then validates the submitted credentials. When the data are invalid, the user is returned to the credential-entry stage.

The diagram indicates that visitors must enter a valid username and password to access their accounts. The requested page can be opened only after the credentials have been verified.

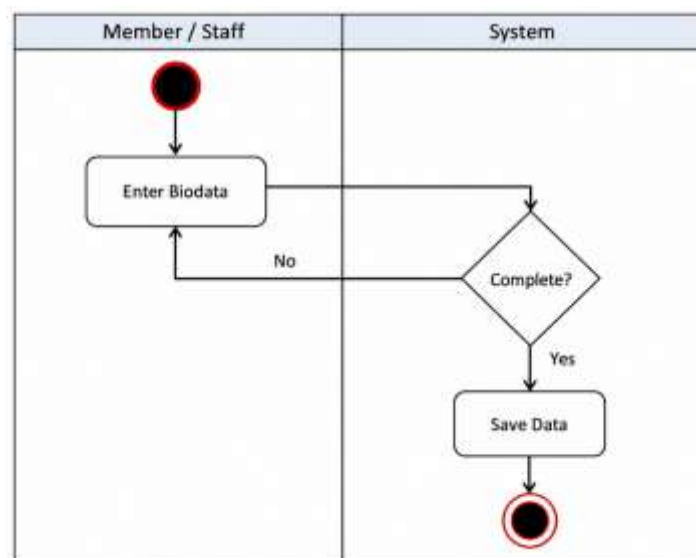


Figure 5. Activity diagram of the visitor-registration feature

Figure 5 presents the visitor-registration workflow. The process begins when a member or staff member enters personal data into the system. The system then checks

whether all required fields have been completed. Incomplete records are returned to the user for completion.

Visitors must complete the personal-information form provided on the website. After submission, the data are checked and verified. Records that satisfy the system requirements are stored in the database.

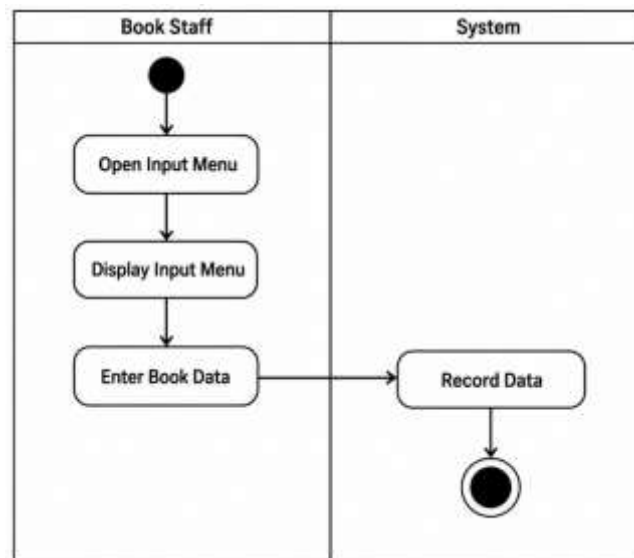


Figure 6. Activity diagram of the book-data feature

Figure 6 describes the book-data management workflow. The process begins when the book administrator opens the input menu, after which the system displays the book-data form. The administrator enters the required information, and the system records the data to complete the management process.

The administrator must access the book-data input page and enter newly acquired books so that the catalog remains current. The recorded information includes the title, publisher, brief description, and shelf location identified by a specific code.

The detailed structure of MY PERPUS is also represented through an entity-relationship diagram. This diagram shows the relationships among system entities and describes the database design, including the relevant entities and attributes [12].

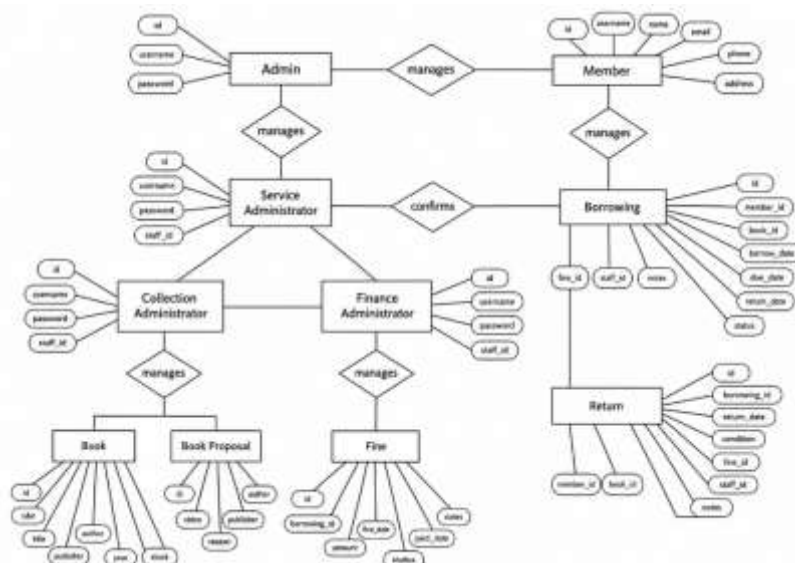


Figure 7. Entity-relationship diagram of the MY PERPUS website

Figure 7 presents the database architecture of MY PERPUS, which centers on the administrator's role in managing library services. The hierarchical structure assigns the

main administrator the highest authority to manage members and supervise three specialized roles: service administrator, collection administrator, and finance administrator.

2.5 Role of MY PERPUS in Supporting School-Library Administration

Observations and interviews conducted at the library of SMA Muhammadiyah 4 Porong produced the following findings:

- a. The arrangement of books in the library was not systematic. Books were not grouped consistently by category; for example, novels were stored together with poetry and rhyme books.
- b. Library staff reported occasional errors in manually assigning book numbers.
- c. Students stated that the library needed a wider range of books, including Islamic studies, history, recent novels, comedy, and animal and plant encyclopedias.
- d. Students requested a website that would simplify book searches and borrowing administration.
- e. Students also requested a website feature that would remind them when borrowed books were due for return.

3. Results

Based on these findings, the researchers developed the MY PERPUS website with features tailored to user needs. The principal features are described below [13], [14].

3.1 Login and Registration Pages

This feature records the identities of library visitors. Before accessing MY PERPUS, students and teachers must enter personal information, including name, class or position, student or employee identification number, telephone number, and address. Because the initial page creates the user's first impression, it must be easy to understand and use readable typography [15].



Figure 8. Administrator and visitor login interface

Figure 8 shows the login-page interface used by both administrators and visitors. Users access the system by entering their username and password.

Figure 9. Student and teacher registration interface

Figure 9 presents the Student and Teacher Registration page within the Master menu of the dashboard. The form includes fields for name, identification number, class, address, telephone number, password, and user level before the data are submitted.

Nama	No Induk	Kelas	No HP	Alamat	Level	Aksi
AGUNG HARDO NADIANTORO	2844	10	085731953680	WARUREJO RT 2 RW 3 GEMPOL	siswa	[Edit] [Delete]
Dyrzhalma Alzam Rafathiyum	2846	10	081238032212	Jl. Telaga Mas RT.3 Persewaan Bu Huriul gang Nalobudi Sepinggan	siswa	[Edit] [Delete]

Figure 10. Successfully registered student records

Figure 10 presents the Student List page after successful registration. The data are displayed in a structured table containing the student's name, identification number, class, telephone number, address, and user level.

Nama	No Induk	Kelas	No HP	Alamat	Level	Aksi
Agustin Deyan Priatnawati	4147754885300023		080264122847	WINDA PORONG RT 01 RW 01 Gubukrejo	guru	[Edit] [Delete]
Angga Prima Pizarib	4107754885300020		085851551167	Giryk Surya Awi Blok B8	guru	[Edit] [Delete]
Dina Kumati	6060767688230223		085648416830	Pemanggungan Kajapenatan	guru	[Edit] [Delete]

Figure 11. Successfully registered teacher records

Figure 11 presents the Teacher List page after successful registration. The data are displayed in a structured table containing the teacher's name, identification number, class or position, telephone number, address, and user level.

3.2 Book-Master Data

The book-master feature contains the book title, category, author, publisher, year of publication, quantity, image file, number of pages, and description. It helps library administrators organize the collection by category, verify inventory, and reduce the risk of missing books. For visitors, the feature accelerates book searches. Clear website navigation also improves the user experience [15]. Visitors can search using known book details or review short descriptions when deciding what to read.

Figure 12. Previous book-master interface

Figure 12 shows the previous book-master interface in MY PERPUS. The page functions as a book-data entry form containing fields for title, category, author, publisher, year of publication, and description. The navigation panel on the left provides access to the dashboard and master data for books, publishers, and students.

Figure 13. Updated book-master interface

Figure 13 shows substantial improvements in both visual design and functionality. The updated interface is cleaner and more modern and includes additional fields for number of pages, quantity, and book-cover image upload. The Category field now uses a drop-down menu to reduce input errors and improve the user experience.

3.3 Borrowing and Return Transactions

Borrowing and return transactions are among the most important system functions. They enable books to be tracked accurately and reduce the risk of loss. Computerizing these processes also simplifies the work of library administrators [16]. The borrowing feature records the borrower's identity, the borrowed book, the due date, and any fine generated by a late return. The return feature records that a book has been returned and makes it available to other users.

Figure 14. Previous book-borrowing menu

Figure 14 presents the previous borrowing menu. The navigation panel includes the Dashboard, Master Data for books, publishers, and students, Book Proposals, and the active Borrowing transaction menu. The main area contains a borrowing-data table and an Add Borrowing button for recording new transactions.

Figure 15. Updated book-borrowing menu

Figure 15 presents a more comprehensive data-entry form for recording borrowing transactions. The form automatically generates a transaction code and allows the administrator to select the borrower, enter the borrowing date, and set the estimated return date using date-picker controls.

Peminjam	tanggal Pinjam	tanggal Kembali	Denda	Status	Aksi
PI/25/00001 Dyrdafina Alzam Rafadhyan - 2046	2025-11-18 Estimasi kembali 2025-11-21	2025-11-25	Rp 200.000 - Taksir: 4 hari - Denda: Rp 0	kembali	
PI/25/00008 MUFIDATUL WAHYUNI - 2778	2025-12-30 Estimasi kembali 2025-12-31	0000-00-00	Rp 0 - Taksir: 0 hari - Denda: Rp 0	pinjam	
PI/25/00007 CHANDRA PUTRI VANESA - 2874	2025-12-30 Estimasi kembali 2025-12-31	0000-00-00	Rp 0 - Taksir: 0 hari - Denda: Rp 0	pinjam	

Figure 16. Student borrowing records and overdue-return status

Figure 16 presents the system output as an active transaction-history table. The system automatically calculates borrowing status. One record, for example, shows a returned book with an overdue fine of IDR 200,000, while other records remain marked as borrowed and display the expected return date.

3.4 Book-Return Reminder Notifications

This new feature extends the library website through Gmail notifications. It informs borrowers of the date on which their books must be returned, helping prevent overdue returns and the resulting fines [17].

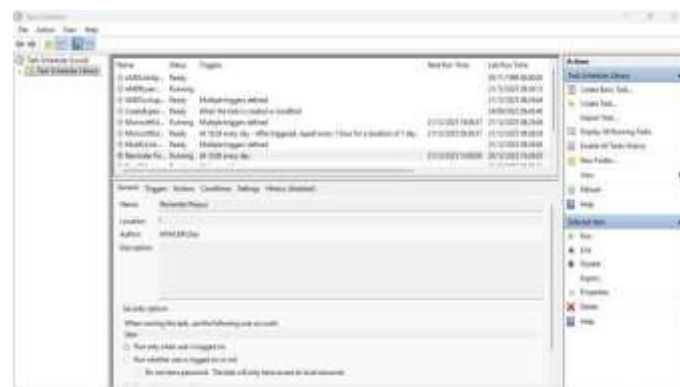


Figure 17. Task Scheduler configuration for book-return reminders

The Task Scheduler must remain active so that data synchronization, reminder delivery, and fine calculations can operate continuously in real time.

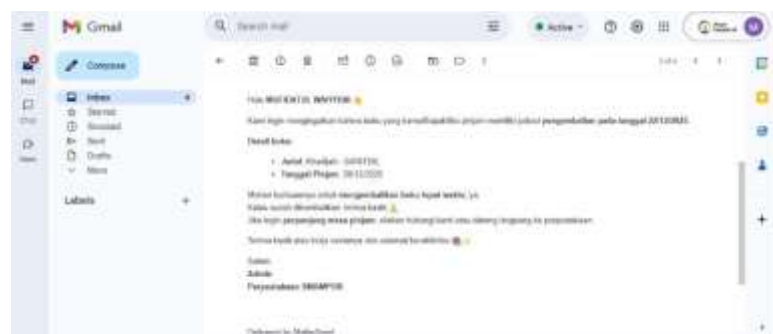


Figure 18. Gmail reminder notification sent after a borrowing transaction

Figure 18 shows an automated Gmail notification sent to a student several days after a book has been borrowed. The message functions as a reminder and provides details of the borrowing transaction.

3.5 System Testing

3.5.1 Black-Box Testing

The system was evaluated using black-box testing to determine whether each function produced output consistent with the expected result. The test results are presented in Table 1 [18].

Table 1. Black-box testing results

No.	Test Scenario	Test Case	Expected Result	Test Result
1	The administrator enters the correct username and password.	Enter the correct username and password.	Login succeeds and the system can be accessed.	Passed
2	The administrator enters student data.	Click Save after completing all student fields.	The data are stored and the system displays a success notification.	Passed
3	The administrator enters book data.	Click Save after completing all book fields.	The data are stored and the system displays a success notification.	Passed
4	A student enters the correct username and password.	Enter the correct username and password.	Login succeeds and the system can be accessed.	Passed
5	The administrator activates Task Scheduler.	Select the library-reminder task.	Click Run.	Passed
6	A student selects the borrower and the book to be borrowed.	Click Save after selecting the book.	The borrowing record is stored with the status "Borrowed."	Passed
7	The administrator approves the transaction by selecting "Borrow."	Select borrowing approval.	The transaction is approved according to the selected action.	Passed
8	The student receives a Gmail notification.	Trigger the return-date reminder.	The reminder is successfully delivered to the student's Gmail account.	Passed

3.5.2 User Testing Using a Likert Scale

User testing was conducted to evaluate acceptance of and satisfaction with the MY PERPUS website. The test involved 12 respondents, comprising two library administrators and ten library visitors (students or teachers). A five-point Likert scale was used.

3.5.2.1 Likert Scale

The Likert scale was used to measure users' attitudes, opinions, and perceptions of the system. Each statement had five response options, as shown below.

Table 2. Likert rating scale

Score	Description
5	Strongly Agree (SA)
4	Agree (A)
3	Neutral (N)
2	Disagree (D)
1	Strongly Disagree (SD)

3.5.2.2 User-Test Statements

The questionnaire statements covered ease of use, interface design, system functionality, and user satisfaction.

Table 3. User-test statements

No.	Statement
P1	The MY PERPUS website is easy to use.
P2	The MY PERPUS interface is attractive and easy to understand.
P3	The book-search feature helps users find books quickly.
P4	The borrowing and return features are easy to use.
P5	The displayed book information is complete and clear.
P6	The system accelerates library-administration processes.
P7	Gmail-based return reminders are helpful.
P8	The MY PERPUS website improves the efficiency of library services.

Likert-Score Calculation

Maximum Score

Total Score

Maximum Score = Number of Respondents × Highest Score

Maximum Score = $12 \times 5 = 60$

Total Score = Σ (Number of Respondents × Score)

3.5.2.3 Score Percentage

Score Percentage = $(\text{Total Score} / \text{Maximum Score}) \times 100\%$

3.5.2.4 Mean Score

Mean Score = Total Score / Number of Respondents

Rating-Scale Intervals

The rating intervals were used to determine the evaluation category based on the mean score.

Interval = $(\text{Highest Score} - \text{Lowest Score}) / \text{Number of Categories}$

Interval = $(5 - 1) / 5 = 0.8$

Table 4. Likert-scale intervals

Mean Score	Category
1.00–1.80	Strongly Disagree
1.81–2.60	Disagree
2.61–3.40	Neutral
3.41–4.20	Agree
4.21–5.00	Strongly Agree

3.5.2.5 User-Test Results

Table 5. Likert-scale user-test results

No.	Statement	Total Score	Mean
P1	Website ease of use	54	4.50
P2	Website interface	52	4.33
P3	Book-search feature	55	4.58
P4	Borrowing and return features	53	4.42
P5	Completeness of book information	51	4.25
P6	Administrative efficiency	56	4.67
P7	Gmail notifications	57	4.75
P8	Overall user satisfaction	55	4.58

3.5.2.6 Overall Mean

Overall Mean = Σ Mean Scores / Number of Statements
 $(4.50 + 4.33 + 4.58 + 4.42 + 4.25 + 4.67 + 4.75 + 4.58) / 8$

3.5.2.7 Interpretation

Overall Mean = 4.51

The user test produced an overall mean Likert score of 4.51, which falls within the 4.21–5.00 interval and corresponds to the Strongly Agree category. This result indicates that users were highly satisfied with MY PERPUS in terms of ease of use, interface design, system features, and its contribution to library administration and service quality.

4. Discussion

The results indicate that MY PERPUS is not merely a digital replacement for manual recordkeeping, but a system designed around the specific operational problems identified at SMA Muhammadiyah 4 Porong. The requirements analysis revealed inconsistent book arrangement, errors in manual numbering, difficulty locating titles, and a need for clearer borrowing and return control. The developed features respond directly to those needs through structured member records, categorized book-master data, transaction tracking, and automated return reminders. This alignment between the diagnosed problems and the implemented functions is important because the usefulness of a school information system depends less on the number of features than on whether those features support actual work processes. In this case, the system connects collection management, circulation services, and user communication within one website. The result supports the general argument that web-based library systems can reduce the weaknesses of paper-based administration and improve access to information [1]-[3], [5]-[7].

The login and registration functions provide the administrative foundation for the other modules because each transaction must be linked to an identifiable user. Recording names, identification numbers, classes or positions, contact information, passwords, and access levels allows the library to distinguish students, teachers, and administrators while maintaining more consistent transaction histories. This structure is also relevant to accountability: staff can determine who borrowed a book, when the transaction occurred, and which administrative role processed the data. The separation of service, collection, and finance responsibilities in the system design further reduces ambiguity in task distribution. Although the present testing focused primarily on functional success, the role-based structure has the potential to support better internal control when it is implemented consistently. Similar web-based library designs have emphasized the importance of organized member data and differentiated system access for improving library administration [6], [11], [13], [14]. Therefore, the registration module should be

understood as part of the system's data-governance mechanism rather than only as an entry page.

The book-master module addresses one of the most visible weaknesses of the previous library process: the absence of systematic and easily searchable collection data. The updated interface expands the recorded metadata to include title, category, author, publisher, year, quantity, number of pages, description, and cover image. These additions improve both administrative and user functions. For administrators, standardized fields facilitate inventory checking and collection classification; for visitors, descriptive information and visual identification can make book selection faster and more intuitive. The use of a drop-down category field is particularly useful because controlled choices can reduce inconsistent spelling and classification during data entry. However, the quality of the search experience will still depend on the accuracy and completeness of the metadata entered by staff. The relatively lower score for completeness of book information ($P5 = 4.25$), despite remaining in the Strongly Agree category, suggests that users may still expect richer or more consistent bibliographic descriptions. This finding reinforces the importance of interface clarity and information quality in library websites [4], [15].

The borrowing and return modules demonstrate the main operational value of MY PERPUS. In a manual environment, circulation records may be dispersed, difficult to update, or vulnerable to calculation and transcription errors. By generating transaction codes and recording the borrower, book, borrowing date, expected return date, status, and fine information, the system creates a traceable transaction history. The black-box test confirms that borrowing records can be stored and approved with the expected status, while the displayed history shows that the system can distinguish active loans from returned books and present overdue information. This does not yet prove a measurable reduction in book loss or processing time, because the study did not compare pre-implementation and post-implementation performance. Nevertheless, the functional integration provides the mechanism through which such improvements may occur. The result is consistent with previous studies that positioned computerized circulation as a means of increasing the efficiency and accuracy of borrowing services [3], [5], [16], [18]. Future evaluation should measure transaction duration, error frequency, and overdue rates to verify these operational benefits quantitatively.

The Gmail-based return reminder is the most distinctive feature of the developed system and received the highest user-test score ($P7 = 4.75$). This score indicates that respondents considered proactive notification especially valuable. The result is understandable because overdue returns are not caused only by unwillingness to comply; they may also occur because borrowers forget the due date or do not have convenient access to their transaction records. Delivering reminders through an email service extends the library system beyond the website interface and introduces direct communication with users. This design is conceptually similar to notification functions used in other information systems to support timely user action [17]. At the same time, the reminder feature depends on accurate email addresses, an active Task Scheduler, stable hosting, and successful message delivery. Its practical effectiveness therefore requires routine monitoring rather than one-time configuration. The system should also record whether reminders were generated, delivered, or failed so that administrators can distinguish technical delivery problems from user noncompliance.

The black-box testing results show that all eight tested scenarios produced the expected outputs. This finding provides evidence that the core functions were operational at the time of testing, including administrator and student login, member and book-data entry, borrowing approval, Task Scheduler activation, and Gmail reminder delivery. Functional success is an essential development milestone because the system cannot support administrative improvement unless each module behaves according to its specification. However, a Passed result should not be interpreted as comprehensive evidence of software quality. Black-box testing in this study did not report boundary-

value cases, invalid or incomplete input scenarios, simultaneous-user conditions, security testing, recovery after service interruption, or performance under a larger database. The test also does not establish long-term reliability after repeated transactions. Consequently, the results support functional feasibility but not yet full operational robustness. Additional testing should include failed-login handling, duplicate records, unavailable books, incorrect dates, interrupted email services, database backup and restoration, and role-based access restrictions before wider institutional deployment.

User testing produced an overall mean of 4.51, placing the website in the Strongly Agree category and indicating favorable initial acceptance. The pattern across individual items is more informative than the overall mean alone. Gmail notifications received the highest score (4.75), followed by administrative efficiency (P6 = 4.67), the book-search feature (P3 = 4.58), and overall satisfaction (P8 = 4.58). These values suggest that users most clearly recognized benefits connected with timely reminders, faster administration, and easier access to books. By contrast, completeness of book information (4.25) and interface quality (4.33) received the lowest means, although both remained positive. This difference points to priorities for refinement: users accepted the system's core usefulness but may still expect more complete content and a more polished interface. Because the respondents included only two administrators and ten visitors, the results represent an initial usability indication rather than a generalizable evaluation of all students, teachers, and staff. A larger and more diverse sample is needed to confirm the acceptance pattern.

The positive acceptance result also reflects the relationship between system usefulness and usability. Users are more likely to accept an information system when it reduces effort in tasks they already consider important. In MY PERPUS, the highest-rated functions are directly connected to common library activities: finding books, processing transactions, receiving reminders, and accelerating administration. The interface score, while positive, was not the highest, indicating that visual attractiveness alone was not the primary source of acceptance. This finding suggests that functional relevance may have had a stronger influence on users' judgments than aesthetic design. Nevertheless, usability and functionality should not be treated as separate concerns. A complete feature can still be underused when navigation is unclear, terminology is inconsistent, or forms require unnecessary steps. The updated book-master and borrowing interfaces demonstrate progress toward cleaner interaction, but future usability testing should observe users completing realistic tasks, record completion time and errors, and collect qualitative comments. Such evidence would complement the Likert scores and provide a more precise basis for interface revision [4], [15].

From a methodological perspective, the Waterfall model provided a clear sequence from requirements analysis to design, development, and testing. This structure was suitable for organizing the project because the researchers first identified the problems and requested features, translated them into diagrams and database structures, and then implemented and tested the resulting website. The context, use-case, activity, and entity-relationship diagrams helped formalize user roles, workflows, and data relationships before coding. This supports previous discussions of Waterfall as a systematic approach for web-based school-library development [8], [9]. However, the results also reveal needs that may continue to evolve after implementation, such as richer book information, improved search, automated fine calculation, and interface refinement. These emerging needs illustrate a limitation of a strictly sequential process: user expectations may become clearer only after users interact with a working system. For continued development, the school could retain the documentation discipline of Waterfall while adopting shorter evaluation and revision cycles for future versions.

In comparison with earlier web-based library studies, MY PERPUS confirms several established benefits while adding a locally relevant communication feature. Previous works have described web systems as solutions for organizing collections, member data, and borrowing services [1]-[3], [5]-[7], [13], [14], [16], [18]. The present system produces

similar functional outcomes through centralized records and transaction processing. Its additional contribution lies in connecting circulation data with Gmail reminders, thereby addressing not only administrative recording but also borrower behavior after a transaction has occurred. This feature expands the role of the system from passive information storage to active service communication. Even so, the study's contribution should be interpreted within its context. The system was developed for one senior high school and was tested with a limited number of users. The architecture and features may be transferable to similar schools, but differences in infrastructure, staff capacity, internet access, collection size, and institutional procedures could affect implementation. Replication in other schools would help determine which functions are generally useful and which require local adaptation.

Successful implementation will depend on organizational practices as much as on the software itself. Library staff must consistently enter new books, update quantities, verify member data, close returned transactions, and monitor failed reminders. Without these routines, the database may become incomplete even when the application functions correctly. The school should therefore establish standard operating procedures covering data entry, classification, borrowing approval, return processing, fines, backup schedules, and account management. Training is also needed so that each administrator understands the responsibilities associated with the assigned access level. Because the system stores personal information and transaction histories, access should be limited according to role, passwords should be managed securely, and backups should be protected from unauthorized use. The current study did not evaluate privacy, cybersecurity, or disaster recovery, so these areas require explicit attention before the system is expanded. Institutional ownership, technical maintenance, and periodic data audits will determine whether the initial gains in efficiency can be sustained over time.

Several limitations define the interpretation of the findings. First, user testing involved only 12 respondents, which is adequate for preliminary feedback but insufficient for broad statistical generalization. Second, the evaluation was conducted after development without a documented baseline, so the study cannot quantify how much MY PERPUS reduced processing time, data-entry errors, lost books, or overdue returns. Third, the research measured perceived acceptance rather than actual long-term use. Fourth, the black-box scenarios concentrated on successful core operations and did not cover security, load, compatibility, accessibility, or failure recovery. These limitations do not negate the positive findings, but they indicate that the present results should be viewed as evidence of functional readiness and promising user acceptance. Further research should use a larger sample, compare manual and digital workflows, monitor system logs over several months, analyze overdue-return trends, conduct structured usability observation, and test security and reliability. Such evaluation would establish whether the favorable initial responses translate into sustained improvements in school-library performance.

5. Conclusion

The development of the MY PERPUS website-based library information system provides an effective solution for supporting library administration at SMA Muhammadiyah 4 Porong. The system addresses problems associated with manual management, including recording errors, difficulty locating books, and inefficient borrowing and return processes.

The Waterfall method enabled each development phase to be completed in a structured and systematic manner, producing a website aligned with user requirements. The principal features—user login and registration, book-master data, borrowing and return transactions, and Gmail-based return reminders—improve staff efficiency and make library information and services easier for students and teachers to access.

Black-box testing showed that all system functions operated correctly and produced the expected outputs. User testing also resulted in a mean score of 4.51, indicating strong

acceptance. MY PERPUS therefore improves library-management effectiveness, service quality, user access, and the overall image of the school library.

Future development should add automatic calculation of overdue fines based on the duration of delay, display fine information transparently to users and administrators, and integrate the calculation with the return-reminder system. A dedicated book-search menu should also be added to make the collection easier to explore. These improvements are expected to strengthen user discipline and increase the efficiency and accuracy of library administration.

REFERENCES

- [1] D. Puspitasari, "Sistem informasi perpustakaan sekolah berbasis web," *Jurnal Pilar Nusa Mandiri*, vol. 12, no. 2, pp. 227–240, 2016.
- [2] N. Fatimah and Y. Elmasari, "Perancangan sistem informasi perpustakaan berbasis web untuk SMA Islam Sunan Gunung Jati," *JUPI (Jurnal Ilmiah Penelitian dan Pembelajaran Informatika)*, vol. 3, no. 2, pp. 130–137, 2018, doi: 10.29100/jupi.v3i2.783.
- [3] M. F. Syawalludin and M. E. Al Rivan, "Sistem informasi perpustakaan berbasis website di Sekolah Dasar Negeri 240 Palembang," *MDP Student Conference*, vol. 2, no. 1, pp. 408–415, 2023, doi: 10.35957/mdp-sc.v2i1.4476.
- [4] K. Sari, D. Agustina, and F. Astuti, "Perancangan UI/UX aplikasi manajemen penelitian dan pengabdian kepada masyarakat menggunakan aplikasi Figma," *JSIM: Jurnal Sistem Informasi Mahakarya*, vol. 5, no. 2, pp. 1–7, 2022.
- [5] Munawaroh, M. Aditiya, F. Oktafiansyah, I. Jalal, and A. Saifudin, "Informasi perpustakaan berbasis website guna memudahkan," *Jurnal Informatika Universitas Pamulang*, vol. 7, no. 3, pp. 665–671, 2022.
- [6] A. Albupy and D. Kurniadi, "Perancangan sistem informasi manajemen perpustakaan berbasis web pada SMK Semen Padang," *Voteteknika (Vocational Teknik Elektronika dan Informatika)*, vol. 9, no. 2, pp. 136–146, 2021, doi: 10.24036/voteteknika.v9i2.112264.
- [7] Ispandi, "Membangun sistem informasi perpustakaan digital berbasis web," *Jurnal Pendidikan Teknologi dan Kejuruan*, vol. 16, no. 2, pp. 225–235, 2019.
- [8] R. Maulana and I. H. Ikasari, "Literature review: Implementasi perancangan sistem informasi perpustakaan sekolah berbasis web dengan pendekatan metode Waterfall," *JRIIN: Jurnal Riset Informatika dan Inovasi*, vol. 1, no. 1, pp. 247–251, 2023.
- [9] A. A. Wahid, "Analisis metode Waterfall untuk pengembangan sistem informasi," *Jurnal Ilmu-Ilmu Informatika dan Manajemen STMIK*, pp. 1–5, 2020.
- [10] M. A. Rosid and A. Ardiansyah, "Sistem informasi penjualan dan stock bahan baku berbasis web: Studi kasus Pabrik Krupuk Berkah Jaya," *Journal of Technology and System Information*, vol. 1, no. 1, pp. 43–54, 2024.
- [11] A. Permana, "Rancang bangun sistem informasi perpustakaan berbasis web: Studi kasus Universitas Kuningan," *Journal of Cloud Information*, vol. 3, no. 2, pp. 36–40.
- [12] S. Ramdany, "Penerapan UML class diagram dalam perancangan sistem informasi perpustakaan berbasis web," *Journal of Industrial Engineering System*, vol. 5, no. 1, 2024, doi: 10.31599/2e9afp31.
- [13] A. Hadi, M. Mukramin, and R. Ramdana, "School library development plan application based on web," *PENA Teknik: Jurnal Ilmiah Ilmu-Ilmu Teknik*, vol. 7, no. 1, p. 49, 2022, doi: 10.51557/pt_jiit.v7i1.1122.
- [14] S. Sunardi and B. R. S. Permana, "Designing web-based library applications at Attaufiqiyyah Junior High School using the CodeIgniter framework," *International Research of Multidisciplinary Analysis*, vol. 1, no. 12, pp. 1335–1341, 2023, doi: 10.57254/irma.v1i12.56.
- [15] S. Sutarsyah, "Website perpustakaan sebagai media promosi lembaga riset," *Journal of Documentation and Information Science*, vol. 4, no. 1, pp. 83–92, 2020, doi: 10.33505/jodis.v4i1.161.
- [16] R. Rangkuti and M. Fathoni, "Aplikasi perpustakaan pada SMA Negeri 2 Tanjung Morawa berbasis website," *Cemara Journal*, vol. 1, no. 1, pp. 1–4, 2023.
- [17] D. B. Anjasmara, M. A. Rosid, and A. Eviyanti, "Implementasi fitur notifikasi WhatsApp API pada sistem manajemen tugas akhir," *Physical Sciences, Life Science and Engineering*, vol. 1, no. 2, p. 14, 2024.
- [18] F. L. Asari, R. S. Meimaharini, and T. Khotimah, "Implementasi sistem perpustakaan berbasis web untuk meningkatkan efisiensi layanan peminjaman dan pengguna," *bit-Tech*, vol. 7, no. 3, pp. 770–778, Apr. 2025.