Design of a Web-Based Book Collection Management Information System at Universitas Sains Indonesia

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Abstract

The increasing demand for efficient library resource management has prompted Universitas Sains Indonesia to improve the way book collections are organized and documented. Accurate data on book availability and quantity is not only essential for day-to-day library operations but also plays a significant role in supporting academic departments during accreditation processes, where detailed reports on available study resources are often required. This study aims to design a web-based book collection management information system for the university library. The system is intended to simplify the management of book data, including recording, categorizing, and tracking the quantity of collections by program or department. Additionally, it provides structured and centralized access to collection data, enabling academic programs to retrieve the information needed for accreditation reports quickly and accurately. Data for this study were gathered through interviews with library staff and academic administrators, as well as through a literature review on library information systems and web-based technology development. The resulting system design includes core features such as book data management, classification by academic program, and reporting tools tailored for institutional needs. It is expected that the implementation of this system will enhance the library's operational efficiency and provide strategic support to the university's accreditation process.

Keywords: *Book Collection Management; Web-Based System; University Library; Information System Design; Accreditation Support*

1. Introduction

The web-based information system is a vital innovation in supporting academic and administrative processes in the digital era. The adoption of information technology (IT) in educational institutions is increasingly crucial for enhancing efficiency, transparency, and data accuracy. Universities are implementing IT systems to improve resource management, decision-making processes, and overall operational effectiveness [1]. Universitas Sains Indonesia, through its library, also faces challenges in managing book collection data that continues to grow in volume and complexity. Currently, the management of book collections at the university library still relies on manual or semi-digital methods, which often result in issues such as data inconsistencies, difficulties in tracking inventory, and delays in responding to academic unit requests. Academic libraries face numerous challenges in maintaining quality resources and services, particularly during accreditation processes. Understaffing, inadequate information resources, and poor infrastructure hinder library operations in Nigerian universities [2].

The increasing demand for accurate and real-time information, especially during accreditation evaluations, has driven the need to design a digital-based system. The existing manual system often lacks integration and cannot provide instant access to data across faculties and departments. Consequently, academic departments frequently face difficulties in collecting book data required to support accreditation requirements. To address these problems, this study aims to design a web-based book collection management information system that enables library staff to efficiently manage data related to book inventories and provide easy access to academic programs in need of such information. The system is expected to facilitate tasks such as categorizing books based on study programs, tracking quantities, and generating reports relevant to both daily operations and accreditation needs [3]. This research employs several methods, including observation of current library processes, interviews with librarians and accreditation coordinators, and literature studies on information systems and library management. These methods are used to ensure that the system design aligns with actual user requirements and institutional needs.

The system analysis phase identifies the functional and non-functional requirements based on collected data. The proposed system will address challenges such as data redundancy, information retrieval delays, and the lack of centralized book collection management. Furthermore, the system design is modeled using the UML (Unified Modeling Language) approach, including Use Case Diagrams, Activity Diagrams, Sequence Diagrams, and Class Diagrams to clearly illustrate system workflows and interactions [4].

The designed system is expected to enhance the operational performance of the library and support the academic accreditation process more effectively [5]. By providing fast and accurate access to collection data, the system benefits not only librarians but also faculty members and accreditation teams. This study can serve as a reference for similar initiatives in other universities seeking to improve their library systems using web-based technologies.

2. Research Methodology

This study employs a qualitative approach aimed at analyzing system requirements and designing a web-based book collection management information system for the library of Universitas Sains Indonesia. The qualitative method is chosen to gain an in-depth understanding of the existing library processes, the challenges faced in managing book collections, and the specific needs of both library staff and academic programs, particularly in relation to data reporting for accreditation purposes. The data collection methods used in this research consist of three main techniques: observation, interviews, and literature review [6]. The observation method involves directly examining current library workflows, including how book data is recorded, categorized, and retrieved. This method helps identify inefficiencies and limitations in the manual or semi-digital systems currently in use.

The interview method is conducted with relevant stakeholders, such as librarians, library IT staff, and faculty accreditation coordinators. These interviews aim to gather more detailed insights into user expectations, difficulties faced in data retrieval, and the importance of accurate and accessible book collection data for academic accreditation. A literature review is also carried out to explore previous research and references related to library information systems, system design methodologies, and web-based technologies [7]. Resources such as academic journals, books, and technical documentation are used to provide a solid theoretical foundation for designing an effective and user-oriented system. For the data analysis, this study uses qualitative descriptive analysis to identify system requirements and evaluate existing issues [8]. The analysis includes reviewing current procedures, identifying gaps and inefficiencies, and translating user needs into specific system functionalities.

To support the system design, this research adopts the Unified Modeling Language (UML) methodology. UML diagrams are widely utilized in software engineering for visualizing, designing, and documenting software systems [9]. In this study, several UML diagrams are employed, including Use Case Diagrams, Activity Diagrams, Sequence Diagrams, and Class Diagrams. These diagrams play a crucial role in visualizing the system's structure and behavior, particularly in relation to user interactions and workflow requirements [10]. The design process includes several key stages: identifying user requirements, defining the system architecture, and creating a prototype. User needs are gathered from both library staff and representatives from academic programs. The system architecture is developed to include core features such as book data input, categorization by study program, real-time collection tracking, and report generation. A prototype of the system is created and reviewed by stakeholders to ensure alignment with their expectations and accreditation-related reporting needs.

Although this study is limited to the design phase, system validation is planned through scenario-based reviews and conceptual testing to ensure the design meets functional requirements. These early tests help identify design improvements before moving toward full development. Overall, this methodology is structured to produce a detailed and functional design of a web-based book collection management system that supports both daily library operations and institutional accreditation efforts. The findings from this study are expected to serve as a reference for similar initiatives in other educational institutions seeking to improve their resource management through technology-based solutions.

3. Result and Discussion

In this study, the process analysis at Universitas Sains Indonesia focuses on two main areas: the management of book collections and the availability of data to support academic program accreditation. Currently, the library still uses a manual or semi-digital system to manage book collection data, which involves several stages that are time-consuming, prone to human error, and often inconsistent across departments or study programs. The process of recording new book collections typically involves manual input into spreadsheets or simple databases, followed by classification and cataloging done by library staff. These records are then stored and managed locally without centralized access. When academic departments need data for accreditation, such as the number of relevant book titles per program, library staff must compile reports manually, often by filtering and recalculating data across several files. This makes the process inefficient and prone to data inconsistencies or duplication.

Although the existing process is functional, it presents several major drawbacks. One of the critical issues is the lack of centralized and structured data management, which makes it difficult to retrieve information quickly and accurately. As a result, accreditation reporting becomes burdensome and delays can occur. Furthermore, manual data entry increases the risk of input errors and hampers real-time access to updated information. This situation not only affects administrative efficiency but can also impact the perceived readiness of the institution in accreditation assessments. Another issue is the absence of an integrated system that categorizes books based on relevant academic programs or fields of study. This makes it difficult for departments to validate the relevance of collections to their respective curricula, which is a key element in accreditation evaluations. Additionally, the inability to generate dynamic reports for each program results in repetitive workloads whenever similar reports are needed. To better illustrate the current condition, refer to **Figure 1**, which shows the flow of book data management and report compilation in the existing system. The process begins with manual data entry of new acquisitions, followed by classification, scattered storage of information, and manual filtering for accreditation reports. Although the steps are understandable, the lack of automation and integration affects the overall efficiency.
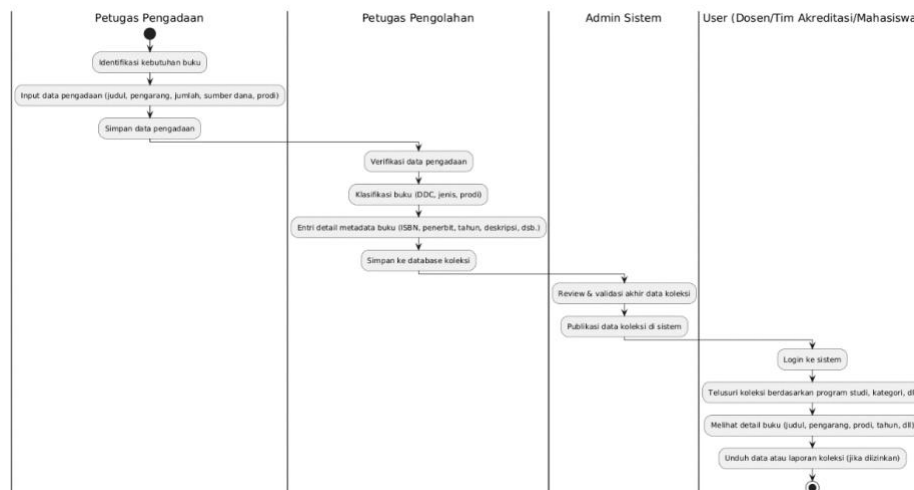
Fig. 1: Flow of Book Collection Management at Universitas Sains Indonesia

Based on this analysis, several challenges have been identified that hinder the library's effectiveness in supporting academic functions. These challenges include the manual recording of book data, which significantly slows down the process of updating and validating information; the lack of real-time access to book collection data for both library staff and academic departments; and the difficulty in filtering data based on study programs, which is essential for supporting accreditation processes. Furthermore, the absence of automated report generation increases the workload of staff and heightens the risk of errors during data compilation. To overcome these limitations, this study proposes the development of a web-based book collection management information system. This system is designed to enable library staff to enter, update, and manage bibliographic data through a centralized and user-friendly interface. It integrates features such as classification by academic program, advanced search and filtering capabilities, and automated report generation, all of which are expected to enhance operational efficiency and data reliability.

One of the significant advantages of the proposed system is its ability to centralize library data while providing real-time access to authorized users, such as department heads or accreditation teams. This ensures that the retrieval of book data for accreditation becomes faster, more accurate, and consistent across departments. Additionally, the use of an automated and integrated system minimizes the risk of data duplication, loss, or input errors, which are common in manual systems.

The implementation of a computerized system will not only improve internal data management processes but also enhance the university's preparedness for accreditation evaluations. The availability of accurate, up-to-date, and well-organized information on book collections plays a crucial role in supporting the quality assurance and continuous improvement of academic programs.
In conclusion, the results of this study emphasize that the adoption of a web-based book collection management system can provide substantial benefits to Universitas Sains Indonesia. These benefits include improved efficiency in managing book data, increased accuracy and consistency in accreditation reporting, faster access to information for decision-making, and greater accountability and transparency in library operations. Through this system, the university is expected to strengthen its academic infrastructure, support accreditation processes more effectively, and deliver enhanced services to its academic community. This research contributes significantly to the institutional development of Universitas Sains Indonesia and may serve as a valuable reference for similar system implementation efforts in other higher education institutions.

3.1. Use Case Diagram

The process of using the web-based book collection management information system at Universitas Sains Indonesia begins with the login step, which is required for the two main actors: the admin and internal campus users (such as accreditation teams, lecturers, or program coordinators). Both actors must log in first to access the available features in the system.
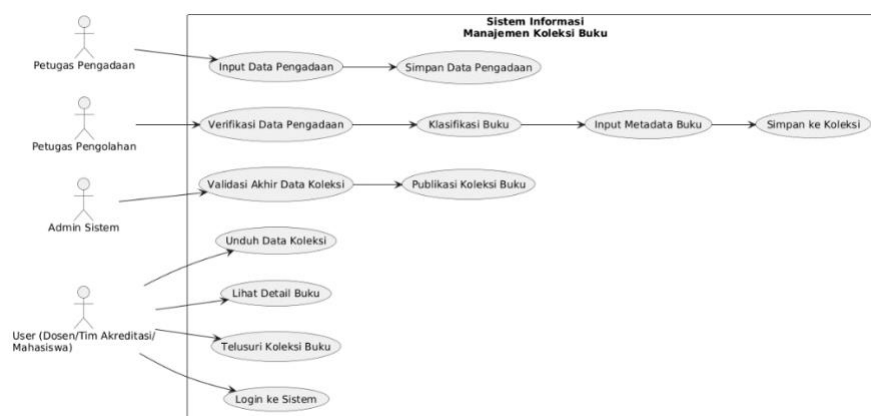

Fig. 2: Use Case Diagram of Book Collection Management at Universitas Sains Indonesia

For the admin, logging in allows access to book data management features. Once logged in, the admin can input new book records starting from the procurement stage, followed by metadata processing, and then categorizing the book type according to the related study program. The admin is responsible for ensuring that every book record contains detailed information that supports accreditation processes, such as the ISBN, book type (e.g., reference, main textbook, practical guide), associated academic program, and publication year.

Meanwhile, internal users can use the system to search and view the book collection data. This feature is designed to assist users in accessing detailed and structured book data, especially for academic and accreditation purposes, such as ensuring that each program has a sufficient number of up-to-date and relevant references. Once the tasks are completed, both the admin and internal users log out to secure their sessions and protect system access from unauthorized users. This logout mechanism helps maintain data integrity and user privacy within the system. This web-based system improves the efficiency of book collection data management and simplifies access to essential information for academic and institutional quality assurance. By replacing manual documentation with a structured and centralized system, it enhances the accuracy of data, supports accreditation compliance, and ensures that each study program has the appropriate reference materials.

3.2. Class Diagram

In the web-based book collection management information system at Universitas Sains Indonesia, several core entities are interconnected to support the accurate and structured recording of book collections. The design focuses on administration-side functionality, especially for supporting accreditation and book collection audits, rather than circulation (borrowing/returning). The first entity is the User class, which stores system user data, including administrators and librarians. This table includes key fields such as id_user as the primary key, username, password, and role, which define the access level of the user. Only authenticated users (admins/librarians) can manage and update book records. Next is the Book class, which serves as the core entity of the system. It includes essential bibliographic fields such as id_book, title, author, publisher, publication_year, isbn, program_study, and description. These fields ensure that each book is recorded with detailed metadata, aligned with the university's program requirements for accreditation purposes.

The Category class represents the classification or type of the book, such as textbooks, references, scientific journals, or program-specific literature. Each book is linked to one category using a foreign key relationship (id_category). The Acquisition class records how and when a book was acquired. It includes fields like id_acquisition, id_book, acquisition_date, source, and notes, providing complete traceability for book procurement. The Cataloging class is responsible for detailed classification information, such as id_cataloging, id_book, classification_code, ddc_code, and cataloger_name. This ensures each book is organized based on a standardized classification system (e.g., DDC). An optional AccessLog class is included to log every update or input activity performed by system users. This includes fields like id_log, id_user, action, and timestamp, helping track user interactions for security and accountability. The relationship between these classes ensures seamless integration of acquisition, cataloging, and metadata updating processes. Admins can input, update, and manage book data efficiently, while ensuring that every book record includes detailed classification, category, and academic program alignment. With this class diagram, the system offers a structured and scalable way to manage book collections. It simplifies data retrieval for accreditation needs, improves collection traceability, and supports effective academic resource planning at Universitas Sains Indonesia.
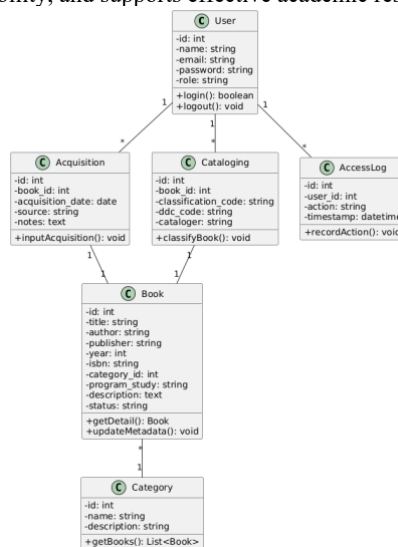

Fig. 3: Class Diagram of Book Collection Management at Universitas Sains Indonesia

4. Conclusion

The conclusion of this study is that the web-based book collection management information system developed for Universitas Sains Indonesia presents a clear, structured, and efficient approach to organizing and maintaining data related to academic book collections. This system integrates several key components from secure login and structured book categorization to cataloging and acquisition tracking designed specifically to assist administrative users in managing book data to meet academic and accreditation requirements. The system is accessed by authorized users, particularly librarians and administrators, who must log in using their credentials. Each user is restricted to functions based on their role, ensuring data integrity and security. Once their data entry or update tasks are completed, users can log out to

maintain session security and prevent unauthorized access. Several interconnected entities are used within the system's database, including tables for users, book categories, books, acquisitions, and cataloging details. The User table stores information related to system accounts and roles. The Category table groups books by types such as textbooks, references, or program-specific collections, enabling structured classification. The Book table is the core component, storing detailed information such as title, author, publication year, program study, and ISBN, ensuring that each collection item is recorded with standardized metadata.

The Acquisition table tracks how and when a book was obtained, including its source and acquisition date. This is especially useful for auditing purposes and long-term inventory control. Meanwhile, the Cataloging table ensures that each book is categorized according to standard classification systems such as the Dewey Decimal Classification (DDC), and includes information about the cataloger responsible for inputting the data. These interconnected tables enable seamless data flow and integrity. For instance, books are linked to categories through a category ID, while acquisition and cataloging data are associated with each individual book. This integration allows administrators to retrieve detailed information for reporting, collection analysis, or accreditation verification with ease. The web-based nature of the system provides significant benefits. Admins can manage collections from any location with internet access, accelerating workflows and reducing the need for manual records. The user-friendly interface further supports effective interaction with the system, even for users with limited technical experience. From the administrative perspective, this system simplifies the management of a growing academic book collection. It provides tools for data entry, updates, and tracking, and offers a foundation for generating reports such as book count per program, acquisition history, and collection readiness for accreditation. These features enhance the university's ability to plan for resource development and align collections with academic needs. Overall, the implementation of this web-based book collection management system at Universitas Sains Indonesia marks a strategic advancement in academic resource administration. It improves data consistency, reduces the risk of human error, and supports institutional goals in terms of efficiency, academic service, and accreditation readiness. By leveraging technology in this way, the university can ensure better oversight and development of its academic collections in an increasingly data-driven and competitive academic environment.

Acknowledgement

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