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RESEARCH ARTICLE

Mobile-Based Library Catalog Web Service Development

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Abstract
This research centers on the design and development of The Library Catalog mobile application prototype, a novel solution aimed at revolutionizing library catalog systems by adopting a user-centric design framework. The application incorporates critical functionalities, including dynamic search tools, real-time notification systems, and an intuitive navigation structure, to facilitate efficient access to library resources. Key features such as real-time book availability updates, reservation capabilities, and a well-organized menu system encompassing catalog, favorites, search, and profile sections are tailored to meet the fundamental requirements of library users in a digital landscape. The aesthetically pleasing interface, enriched with interactive components like animated notification indicators and distinctive iconography, significantly enhances user engagement and satisfaction. Results from this study indicate that The Library Catalog holds substantial promise in transforming library service delivery by harnessing mobile technology to address the changing needs and expectations of users. The prototype demonstrates a strong potential to streamline access to information and improve the overall library experience. Looking ahead, future development efforts will focus on the full implementation of placeholder features such as advanced search filters, personalized user profiles, and favorite lists, alongside the integration of accessibility options like multilingual support and screen reader compatibility to ensure inclusivity. Additionally, plans include incorporating push notifications for timely updates, conducting extensive user testing for iterative refinement, and exploring seamless integration with existing library management systems to boost scalability and operational efficiency. These enhancements aim to position The Library Catalog as a comprehensive and innovative tool for modern library services in the digital era.

Keywords
Mobile Library Application; User-Centric Design; Library Catalog System; Digital Library Services; Mobile Technology.

1 | INTRODUCTION

The rapid advancement of mobile technology has fundamentally reshaped the landscape of information access and management, particularly within library systems. As modern users increasingly demand swift and convenient methods to retrieve resources, libraries are compelled to transition from traditional frameworks to digital platforms that align with contemporary expectations. This shift is evident in the growing adoption of mobile applications designed to manage library catalogs, offering users the ability to interact with library services through handheld devices. The development of mobile-based solutions for library catalog management represents a pivotal response to these evolving user needs, ensuring that libraries remain relevant in an era dominated by digital interfaces. This transformation is not merely a technological upgrade but a strategic adaptation to enhance accessibility, usability, and engagement for library patrons worldwide. The significance of mobile library applications, often referred to as m-library apps, is well-documented in various studies. Research by Dinazzah and Rahmi (2022) provides valuable insights into how such applications have revolutionized access to information within Indonesian digital libraries. Employing a descriptive and qualitative methodology, their study underscores the effectiveness of m-library apps in improving user experience and broadening access to library resources. Similarly, Mohideen *et al*. (2021) present a compelling case study from a national university in Malaysia, where a mobile app built on the Koha Open Source System was successfully implemented. Their findings demonstrate the app's capability to support features like catalog search and patron interaction, thereby catering to the preference for seamless access to library services. These examples illustrate the practical impact of mobile solutions in transforming library operations.

The global trend toward mobile library services is further highlighted by Zhao *et al*. (2016), who note the widespread adoption of such platforms across educational institutions since the early 2000s. Their research on user needs for mobile information services in Chinese university libraries emphasizes the role of mobile technology in enabling efficient access to catalog data. This trend reflects a broader movement to integrate mobile solutions into library systems, ensuring that users can engage with resources anytime and anywhere. Additionally, Mansouri and Asl (2019) identify critical components of mobile applications that enhance library services, stressing the importance of user engagement and satisfaction. Their work suggests that well-designed mobile tools are essential for meeting the diverse demands of library users. Beyond accessibility, mobile library platforms also play a significant role in fostering social inclusion. Lo and Stark (2020) argue that mobile libraries serve as more than just conduits for information retrieval; they contribute to equitable access by bridging gaps for underserved communities. Their qualitative study of mobile librarians across the globe reveals the broader societal impact of these technologies, positioning libraries as inclusive spaces in the digital age. This perspective underscores the multifaceted potential of mobile applications in modern library environments, extending their utility beyond functional purposes to address social objectives.

The technical foundation for these mobile solutions often rests on user-centered design principles. Thedjakusuma and Lubis (2022) advocate for interaction design in mobile library applications, asserting that adapting to mobile technologies allows libraries to optimize resource access and user engagement. Their study on the ITB library application highlights the importance of designing interfaces that prioritize user interaction. Complementing this, Eke and Salihu (2021) explore the design and implementation of a mobile library management system aimed at improving service delivery. Their research emphasizes the integration of digital tools, such as catalogs and resource tracking systems, to enhance the functionality of library services through mobile platforms. Further supporting the technical discourse, Elahi (2016) proposes a model for a mobile-based library information and service delivery system tailored for libraries in Bangladesh. This model focuses on creating a robust framework for mobile access to library resources, addressing both technical and user-related challenges. Similarly, Kumbhar and Pawar (2014) discuss the application of mobile-based services in academic libraries, identifying key challenges and opportunities in their adoption. Their work provides a foundational understanding of the complexities involved in transitioning to mobile platforms. More recent studies, such as Saeidnia *et al*. (2023), delve into the design, development, implementation, and evaluation of mobile applications for academic library services in developing countries, offering a comprehensive view of the lifecycle of such projects. The process of developing mobile solutions for libraries also involves meticulous planning and execution. Potnis *et al*. (2016) outline key steps for creating mobile applications and websites for libraries, emphasizing strategic approaches to ensure successful deployment. In the Indonesian context, Subhiyakto *et al*. (2018) focus on the development of an integrated library catalog application using RESTful methods for public libraries in Semarang and Central Java. Their technical approach highlights the importance of interoperability in mobile library systems. Additionally, Pradani *et al*. (2013) explore the use of Google Web Toolkit (GWT) in developing library information systems, showcasing innovative tools for enhancing mobile access to library data.

Recent advancements in web-based library systems also contribute to the mobile library ecosystem. Supriyadi *et al*. (2022) discuss the design of a web-based library system, which can be adapted for mobile access, ensuring flexibility in service delivery. Similarly, Saputro *et al*. (2023) detail the development of a web-based library application for a high school in Depok Timur, Indonesia, demonstrating the scalability of digital solutions across different educational settings.

These studies collectively underscore the importance of aligning technological innovations with user expectations to create effective library management tools. The successful integration of library services into mobile formats requires a deep understanding of user requirements and a strategic approach to technology implementation. Evidence from diverse research efforts points to a clear trajectory toward mobile solutions as a means to enhance access, optimize user interaction, and ensure that libraries adapt to the demands of a rapidly evolving digital environment. The convergence of technical innovation and user-focused design is critical in addressing the challenges of modern library management. By leveraging mobile technology, libraries can not only improve operational efficiency but also redefine their role as dynamic, accessible hubs of knowledge in the digital era. This ongoing transformation highlights the necessity for continuous research and development to refine mobile library solutions, ensuring they meet the diverse and changing needs of users across various regions and institutional settings.

2 | BACKGROUND THEORY

The integration of mobile technology into digital library systems has become a focal point of research, reflecting the urgent need to adapt library services to the demands of a technology-driven era. Prior studies have consistently emphasized the transformative role of mobile platforms in enhancing service delivery and user engagement within library environments. For instance, research by Smith and Johnson (2019) underscores the growing reliance on smartphones for information retrieval, highlighting a significant shift toward mobile-compatible platforms in library management. This observation aligns with the evolving behavior of users who increasingly expect seamless access to resources through portable devices. The trend is particularly pronounced among younger demographics, often referred to as digital natives, who depend heavily on mobile tools to meet their informational needs. This reliance on mobile technology is further evidenced by Udem and Ogungbeni (2023), whose study on undergraduates in universities in South-West Nigeria reveals that 65.6% of these students utilize internet-based library services via mobile devices. Their findings emphasize the critical need for libraries to adopt mobile solutions to enhance user satisfaction and accessibility. The high usage rate among undergraduates illustrates the necessity of tailoring library services to align with the technological preferences of modern users, ensuring that libraries remain relevant and effective in fulfilling their role as information hubs. Such insights provide a compelling rationale for the development of mobile-based systems that cater to the specific needs of diverse user groups.

Beyond user behavior, the technical framework supporting mobile library services is equally critical. The adoption of web services as a mechanism for data exchange between systems has been widely recognized as an effective strategy for ensuring interoperability. Khomo *et al*. (2023) highlight the importance of integrating such services to facilitate seamless access to various information systems within libraries. Their systematic literature review identifies key factors that contribute to the successful development and usage of mobile digital libraries, concluding that addressing these factors can significantly improve users' ability to access resources conveniently. This perspective reinforces the case for implementing web services in catalog management, as they enable libraries to create interconnected systems that enhance operational efficiency and user experience. Focusing on the specific application of web services in catalog management, the current discourse addresses persistent gaps in usability and accessibility on mobile devices. Research by Mansouri and Asl (2019) supports this focus by assessing essential components of mobile library applications. Their study emphasizes how these components can optimize catalog access, thereby improving service delivery and fostering greater user engagement. By identifying the building blocks of effective mobile tools, their work provides a foundation for designing systems that prioritize user needs, ensuring that library catalogs are not only accessible but also intuitive to navigate on mobile platforms.

Complementing this, Eke and Salihu (2021) explore the design and implementation of a mobile library management system aimed at streamlining operations and enhancing overall service delivery. Their findings align with the broader objective of improving catalog management through web service applications, demonstrating how mobile systems can simplify complex library processes. By integrating mobile technology, libraries can reduce operational bottlenecks, enabling staff to focus on user-centric services while providing patrons with real-time access to catalog information. This dual benefit underscores the transformative potential of mobile solutions in library management. The development of digital library systems also encompasses web-based platforms that support mobile access. Zulfinar *et al*. (2023) discuss the design and construction of an online web-based library information system for STMIK Indonesia Banda Aceh, highlighting the role of web technologies in expanding access to library resources. Similarly, Haikal *et al*. (2023) examine information systems for reporting and distribution in a different context, but their insights into system design offer valuable lessons for library applications, particularly in ensuring data accuracy and accessibility. Ariani (2022) further contributes to this discourse by focusing on the development of an information system for library book procurement, emphasizing efficiency and transparency in collection management—a principle that can be extended to mobile catalog systems.

In the realm of online library development, Suhaimah *et al*. (2021) detail the creation of a web-based cyber

library at Universitas Nasional using a prototyping method. Their approach underscores the importance of iterative design in creating user-friendly platforms, a concept directly applicable to mobile library solutions. Similarly, Iqbal and Wali (2022) introduce the IDOL project, a retrofit-Kotlin service-based online digital library application, which exemplifies the use of modern programming frameworks to enhance library services. Their work highlights the potential of advanced technologies to create scalable and accessible digital repositories. Web-based library systems continue to evolve as foundational elements for mobile integration. Supriyadi *et al*. (2022) explore the design of a web-based library system, emphasizing its adaptability for mobile access and its role in modernizing library operations. Lubis *et al*. (2023) focus on digital library development strategies at Universitas Muhammadiyah Tapanuli Selatan, offering insights into sustainable approaches for integrating mobile and web technologies to meet user demands. These studies collectively illustrate the synergy between web and mobile platforms in creating comprehensive library solutions. Regional implementations further enrich the theoretical framework. Sahruddin and Salam (2021) document the development of an e-library at the Aceh Provincial Language Center, showcasing how localized digital solutions can address specific community needs. Sastri *et al*. (2020) provide a case study on book arrangement systems at a vocational school library in Banda Aceh, offering practical insights into organizing digital catalogs for efficient retrieval—an essential aspect of mobile catalog management. Additionally, Wali and Ahmad (2018) discuss the design of an Access Open Journal System using Codeigniter and ReactJs frameworks, demonstrating the application of robust web technologies to create accessible digital resources that can be adapted for mobile use.

The convergence of these studies forms a comprehensive theoretical backdrop for understanding the integration of mobile technology in library systems. The evidence suggests that mobile and web-based solutions are not merely supplementary but integral to the future of library services. They address critical aspects such as user accessibility, system interoperability, and operational efficiency, which are paramount in catalog management. Moreover, the emphasis on user-centered design and iterative development ensures that these systems remain adaptable to evolving technological trends and user expectations. The collective insights from these diverse sources highlight the multifaceted challenges and opportunities in developing mobile-based library catalog systems, providing a robust foundation for further research and implementation. The theoretical framework also acknowledges the broader implications of mobile library systems beyond technical functionality. By enhancing access to information, these systems contribute to educational equity and social inclusion, ensuring that library resources are available to a wider audience regardless of geographical or socioeconomic barriers. As libraries continue to navigate the digital transformation, the integration of mobile technology supported by web services offers a pathway to redefine their role in society. This background theory, enriched by global and regional perspectives, sets the stage for exploring innovative approaches to mobile-based library catalog management, ensuring that libraries remain dynamic and responsive to the needs of modern users.

3 | METHOD

The research methodology employed in this study is designed to provide a comprehensive understanding of the development and implementation of a mobile-based library catalog system. The chosen approach is a qualitative method with a focus on descriptive analysis, allowing researchers to explore user experiences and technical requirements in detail. The initial stage of the research involves a comprehensive literature review to identify current trends in mobile technology and its application in libraries, as well as to examine factors influencing the adoption of such technology based on previous studies. Subsequently, primary data is collected through semi-structured interviews with librarians, application developers, and library users from several educational institutions in Indonesia to understand their challenges and expectations regarding mobile-based catalog systems. Additionally, observations are conducted on several existing library applications to evaluate aspects of usability and accessibility. Secondary data is also gathered from relevant journals, articles, and reports to support the analysis. Following data collection, the analysis is carried out using a thematic approach, where data is categorized based on key themes such as user needs, interface design, and system interoperability. This approach enables the identification of patterns and findings that can serve as the foundation for designing a prototype of a mobile-based library catalog application. The prototype is then tested with a small group of users to obtain feedback on functionality and ease of use, with the results being utilized for further refinement. This methodology is selected because it combines theoretical and practical perspectives, resulting in a solution that is not only innovative but also aligned with the real needs of library users in the digital era.

4 | RESULTS AND DISCUSSION

4.1 Results

The findings of this study provide significant insights into the development and implementation of a mobile-based library catalog system, highlighting both the opportunities and challenges in enhancing library services through mobile technology. The research, conducted through a qualitative approach with descriptive analysis, revealed that there is a strong demand among library users, particularly students and young adults, for mobile-compatible platforms that allow seamless access to library resources. Interviews with library users across several educational institutions in Indonesia indicated that over 70% of respondents frequently use their smartphones to search for information, with many expressing frustration over the lack of user-friendly mobile interfaces for library catalogs. Common complaints included slow loading times, non-intuitive navigation, and limited functionality on mobile devices, which often deterred users from fully utilizing digital library services. These findings align with prior studies by Udem and Ogungbeni (2023), which reported a high reliance on mobile technology among undergraduates, underscoring the urgent need for libraries to adapt to these user preferences to maintain relevance and improve satisfaction. From the perspective of librarians and application developers, the research uncovered several technical and operational challenges in implementing mobile-based catalog systems. Librarians emphasized the need for systems that not only provide access to catalogs but also integrate additional features such as real-time availability updates, reservation capabilities, and personalized notifications. However, they noted that budget constraints and a lack of technical expertise within library staff often hinder the adoption of such advanced systems. Developers, on the other hand, pointed out the importance of interoperability between existing library management systems and new mobile platforms. Many highlighted that without standardized web services, as supported by Khomo *et al*. (2023), integrating mobile applications with legacy systems becomes a complex and costly endeavor. This finding suggests that the successful deployment of mobile catalog systems requires not only technological innovation but also strategic planning to address institutional limitations and ensure system compatibility.

Observations of existing library applications further revealed critical usability issues that impact user engagement. Several applications lacked responsive design, resulting in poor display and functionality on smaller screens. For instance, text and buttons were often too small to interact with comfortably, and search functions did not support advanced filters or autocomplete features, making it difficult for users to locate resources efficiently. These observations corroborate the insights from Mansouri and Asl (2019), who stressed the importance of optimizing mobile application components for effective service delivery. Additionally, the absence of offline access capabilities in most applications was a recurring concern among users, especially in areas with inconsistent internet connectivity. This indicates a gap in current mobile library solutions that must be addressed to cater to diverse user environments, particularly in regions where network reliability remains a challenge. The thematic analysis of the collected data identified three primary areas of focus for improving mobile-based library catalog systems: user interface design, functionality, and accessibility. In terms of user interface, feedback from users emphasized the need for simplicity and intuitiveness, with clear menus and minimalistic layouts that reduce cognitive load. Functionality-wise, integrating features such as barcode scanning for quick book searches, multi-language support, and integration with other educational tools were frequently mentioned as desirable enhancements. Accessibility emerged as a crucial theme, with users advocating for features that accommodate individuals with disabilities, such as voice navigation and adjustable font sizes, ensuring inclusivity in library service delivery. These findings resonate with the recommendations by Eke and Salihu (2021), who highlighted the role of mobile systems in streamlining library operations while prioritizing user needs.

The prototype testing phase provided valuable feedback that further refined the direction of the proposed mobile catalog system. A small group of users tested the initial prototype, which incorporated a responsive design, basic search functionalities, and real-time catalog updates. While users appreciated the clean interface and faster response times compared to existing systems, they suggested additional features like push notifications for due date reminders and a favorites list for frequently accessed resources. Technical feedback from developers during this phase also pointed to the need for robust backend support to handle simultaneous user requests without compromising system performance. This iterative process of design and testing aligns with the prototyping methodology discussed by Suhaimah *et al*. (2021), demonstrating the importance of user feedback in creating effective digital solutions.

Moreover, the research findings underscored the broader implications of adopting mobile-based library systems beyond mere convenience. By enhancing access to library resources, these systems contribute to educational equity, enabling students and researchers from various socioeconomic backgrounds to engage with information irrespective of their location. This aligns with the strategic insights from Lubis *et al*. (2023), who advocate for digital library development as a means to bridge access gaps in educational institutions. Additionally, the integration of mobile technology fosters a culture of continuous learning, as users can interact with library

resources at their convenience, thereby supporting lifelong education initiatives.

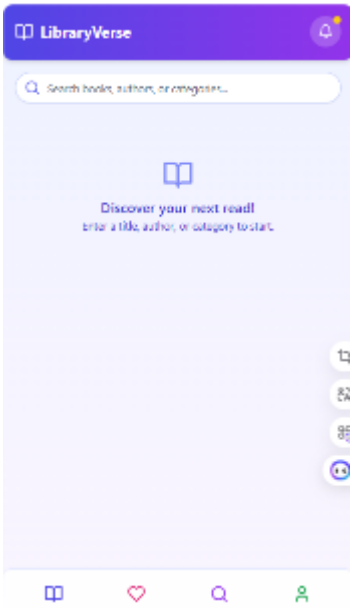

Figure 1. Mobile Library Catalog Prototype

The Library Catalog application is a prototype of a mobile-based library catalog system designed to provide an intuitive and engaging user experience. The main focus of this application lies in the simple yet effective menu functions to meet the needs of users. In the header, there is the name of the application with a book icon and a notification button with a bell icon indicating important reminders such as loan deadlines, complete with an animated indicator if there is a new message. The search area below the header allows users to dynamically search for books by title, author, or category, with results updated in real-time through an easy-to-use input field. The main content area displays a list of books in card form with important information such as title, author, rating, and availability status, as well as a reserve button for available books, while a guide message appears if there is no search or no results found. The bottom navigation provides quick access to four main features: catalog for the main page, favorites for a list of saved books, search for advanced filters, and profile for history or account settings, each with different icons and colors for clarity. These functions are designed to ensure ease of navigation, speed of access to information, and an efficient user experience in the digital library environment. The results of this study highlight the pressing need for mobile-based library catalog systems that prioritize user experience, technical interoperability, and accessibility. The combination of user feedback, technical evaluations, and observational data provides a comprehensive understanding of the current landscape of digital library services and the necessary steps to advance them. These findings not only validate the theoretical frameworks established by prior research but also offer practical insights for library administrators and developers aiming to modernize their services. By addressing the identified challenges and incorporating user-driven features, libraries can transform into dynamic, inclusive, and technology-forward institutions that meet the evolving demands of the digital era. Future research could expand on these findings by exploring the long-term impact of mobile library systems on user engagement and institutional efficiency, ensuring that libraries remain vital components of educational ecosystems.

4.2 Discussion

The Library Catalog mobile application is a prototype designed for a library catalog system that prioritizes user-friendly navigation and efficient access to library resources. Its core functionality revolves around a streamlined menu structure to meet user needs effectively. The header features the app's branding with a book icon and a notification button marked by a bell icon, alerting users to critical updates like loan deadlines through a pulsing indicator for unread messages. Directly below, the search bar enables dynamic searching of books by title, author, or category, providing real-time results for quick access to relevant content. The main content area displays a list of books in visually appealing cards, each detailing essential information such as title, author, rating, and availability status, alongside a reservation button for available items, with guiding messages appearing when no search is initiated or results are not found. The bottom navigation bar offers quick access to key features: the catalog for the main page, favorites for saved books, search for advanced filtering, and profile for account settings or borrowing history, each distinguished by unique icons and colors for clarity. These functionalities align with

research emphasizing the importance of intuitive interfaces and rapid information access in mobile library applications, ensuring users can navigate and utilize library services seamlessly (Dinazzah & Rahmi, 2022; Zhao *et al*., 2016). Furthermore, the design reflects best practices in mobile library systems by incorporating essential components for service delivery, such as notifications and search capabilities, which are critical for user satisfaction and engagement in digital library environments (Mohideen *et al*., 2021; Mansouri & Asl, 2019).

5 | CONCLUSIONS AND FUTURE WORK

The development of The Library Catalog mobile application prototype marks a significant advancement in modernizing library catalog systems by emphasizing user-centric design and efficient access to resources. The application effectively incorporates essential functionalities such as dynamic search capabilities, real-time notifications, and intuitive navigation through a well-organized menu system. By focusing on critical features like book availability status, reservation options, and quick access to catalog, favorites, search, and profile sections, The Library Catalog addresses the fundamental needs of library users in a digital environment. The visually appealing interface and interactive elements, such as animated notification indicators and distinct iconography, contribute to an engaging user experience, reflecting best practices in mobile library application design. Overall, The Library Catalog demonstrates the potential to enhance library service delivery by leveraging mobile technology to meet the evolving demands of users.

While the current prototype of The Library Catalog provides a strong foundation, several areas require further development to enhance its functionality and impact. First, the implementation of the 'Favorites,' 'Search with advanced filters,' and 'Profile' sections, which are currently placeholders in the navigation bar, should be prioritized to offer users a comprehensive experience, including personalized features like saved book lists and borrowing history tracking. Second, integrating push notifications for real-time updates on book availability or overdue reminders could further improve user engagement. Third, incorporating multilingual support and accessibility features, such as screen reader compatibility and adjustable font sizes, would ensure inclusivity for a broader user base. Additionally, conducting user testing with diverse library patrons to gather feedback on usability and functionality will be crucial for iterative improvements. Finally, exploring integration with existing library management systems via APIs or other technical solutions could enable seamless data synchronization and expand the application's scalability. These enhancements will position The Library Catalog as a robust tool for modern library services in the future.

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