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Optimizing library catalogue management using object-oriented e-catalogue application: A case study at Universitas Muhammadiyah Jambi

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Abstract: The development of a comprehensive and efficient library catalogue system is essential for improving accessibility to information in modern educational environments. This research addresses the inefficiencies of manual cataloguing methods at Universitas Muhammadiyah Jambi's library by proposing an Object-Oriented Programming (OOP)-based E- catalogue system. The system, developed using Visual Basic and Microsoft Access, streamlines the book-searching process, enhancing user access to book details such as authors, titles, and synopses. The system's user-friendly interface supports features like search, administration, and data backup, improving both search efficiency and user satisfaction. This research contributes to the advancement of library management systems, demonstrating the potential of OOP-based design for future applications in similar academic institutions. Future research can build on this work by integrating machine learning techniques for personalized book recommendations and expanding the system's scalability.

Keywords: digital library; smart library; library system; open library

1. Introduction

The education sector has greatly benefited from technological advancements, particularly in how libraries manage their resources. Libraries, traditionally reliant on manual cataloguing, often experience inefficiencies and delays in accessing essential resources (Adigun et al., 2024). Libraries traditionally relied on manual cataloguing methods, which were time-consuming and often inefficient (Majumder, 2024). As educational institutions continue to grow, the need for a more efficient and accessible system for managing library resources becomes imperative (Ullah & Usman, 2023). This research is focused on the development of an E-catalogue system for the library at Universitas Muhammadiyah Jambi, aiming to address these challenges.

The primary problem identified in the existing library system is the reliance on manual methods for searching and cataloguing books, leading to inefficiencies and delays in accessing information (Adhiatma, 2024). As universities grow, the demand for efficient and accessible systems to manage their resources intensifies. At Universitas Muhammadiyah Jambi, the library's existing system faces challenges in meeting this demand due to the reliance on outdated manual methods. Previous studies (Sonawane et al., 2024). suggest that digital cataloguing systems can significantly improve the speed and accuracy of information retrieval. This research aims to design and implement an Object-Oriented Programming (OPP)-based E-catalogue system to streamline book searches and improve overall library management. This research is innovative in its application of OOP principles to create a user-friendly system, with the potential for future advancements, such as integrating machine learning for book recommendations. The significance

of this research lies in its potential to enhance the operational efficiency of academic libraries, thus improving the academic experience for students and staff at Universitas Muhammadiyah Jambi. Previous studies have shown that digital cataloguing systems can significantly improve the speed and accuracy of information retrieval in libraries (Kolhe, 2021).

The proposed solution is to implement an OPP-based E-catalogue system that utilizes Visual Basic and Microsoft Access for database management (Northwood, 2018). This system is designed to allow users to search for books efficiently by using different criteria such as title, author, or category (Crespo et al., 2011). It also includes an administration interface for managing the database and ensuring the accuracy of the catalogue (Boufassil et al., 2025). Furthermore, the E-catalogue will incorporate features such as data backup and the ability to convert files to various formats, enhancing the system's flexibility (Yen & Ng, 2003). The innovation in this research lies in applying OPP principles to create a user-friendly and efficient system that not only improves the search process but also supports future upgrades, such as the integration of machine learning for predictive book recommendations (Luo et al., 2024). By developing this E-catalogue system, the research aims to improve library management and enhance the academic experience for students at Universitas Muhammadiyah Jambi.

2. Methods

This research aimed to develop an E-catalogue system for the library at Universitas Muhammadiyah Jambi, utilizing OOP principles and Microsoft Visual Basic for system design and development. The research design involved a combination of descriptive research and system development methodologies to analyse, design, implement, and test the E-catalogue system (Zuliarni et al., 2025).

2.1 Research procedure

The procedure for the development of the E-catalogue system was divided into several stages:

1) Analysis of Current System: The first step involved analysing the current library system to identify inefficiencies and challenges associated with manual cataloguing and searching for books. Observations and interviews with library staff at Universitas Muhammadiyah Jambi provided insights into the limitations of the current system (Babu & Krishnamurthy, 2013).
2) System Design: Based on the findings from the analysis phase, the E-catalogue system was designed using OPP concepts. The system's architecture included the design of the database, the user interface, and the interaction between the different system components. A State Transition Diagram (STD) and Data Flow Diagram (DFD) were used to illustrate the process flow and system structure.
3) Development and Implementation: The E-catalogue was developed using Visual Basic for the user interface and Microsoft Access for database management. The database was designed to store book details such as title, author, category, and publisher. The interface allowed for easy searching, data management, and system administration (Chen et al., 2002).

Coding 1. Pseudocode Example for Book Search Function

```
Function Search Book (criteria, value)
    Open Database Connection
    Execute SQL Query to fetch books based on criteria and value
    If records found
        Display books in results
    Else
        Show "No Results Found"
End Function
```

4) Testing and Validation: The system was subjected to unit testing and user acceptance testing to ensure its functionality. During the testing phase, a sample of 50 students from Universitas Muhammadiyah Jambi was asked to use the system and provide feedback on its usability and performance. The testing

focused on the accuracy of the search function, the ease of use of the interface, and the system's response time (Afzal et al., 2009).Testing methodology:

a) Functionality Test: Verifying the accuracy of search results.
b) Usability Test: Gathering user feedback through questionnaires.
c) Performance Test: Measuring the system's response time for different search queries.

5) Data Acquisition: Data was acquired through both primary and secondary sources. Primary data was collected from interviews with the library staff and direct observations of the library's existing cataloguing system. Secondary data was sourced from academic papers, books, and online journals related to library management systems and E-catalogue development (Ardiani, 2020).

Table 1. Database design for book details

Field name	Data type	Description
KD_BUKU	Text	Unique book code
JUDUL	Memo	Book title
PENULIS	Text	Author of the book
PENERBIT	Text	Publisher of the book
TGL_TERBIT	Date	Date of publication
JUM_HAL	Text	Number of pages
BRT_BUKU	Text	Weight of the book
JSN_COVER	Text	Cover type (e.g., hardback, paperback)
DIMENSI	Text	Dimensions of the book
KATEGORI	Text	Category of the book (e.g., Fiction, Sci-Fi)
TEXT_BHS	Text	Language of the book
SINOPSIS	Memo	Synopsis of the book
COVER	OLE Object	Image of the book cover
POSISI_PICT	OLE Object	Position of the book in the library
POSISI_TEXT	Text	Description of the book's location
TGL_INPUT	Date	Date the book was added to the catalogue
UKURAN	Number	Image size
UKURAN2	Number	Additional image size

Table 2. Login table for system administration

Field name	Data type	Description
USERNAME	Text	Administrator username
PASS	Text	Administrator password

Table 3. Categories table for books

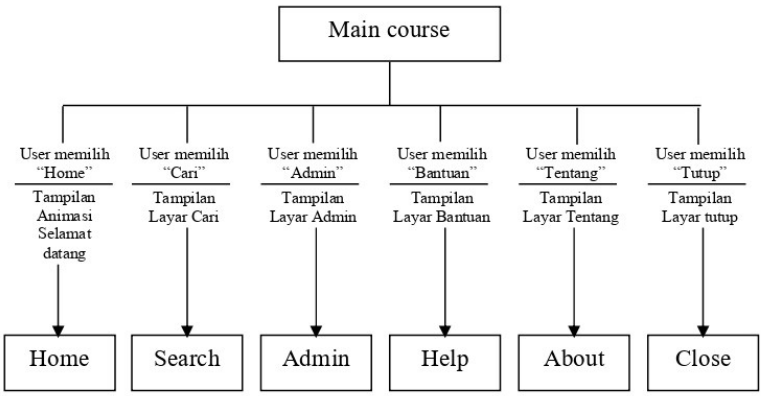
Field name	Data type	Description
KD_KAT	Text	Unique category code
JEN_KAT	Text	Category type (e.g., Technology, Arts)

Table 4. Information table for system updates

Field name	Data type	Description
INFO_ID	Text	Unique information identifier
INFO	Text	Information about the catalogue updates or system changes

All figures included in this document have been designed to visually complement the data and provide clear insights into the research process, system design, and the development of the E-catalogue system for Universitas Muhammadiyah Jambi. Each figure is numbered consecutively and includes a concise caption to explain its content.

Figure 1.
State Transition diagram (STD) of the e-catalog system

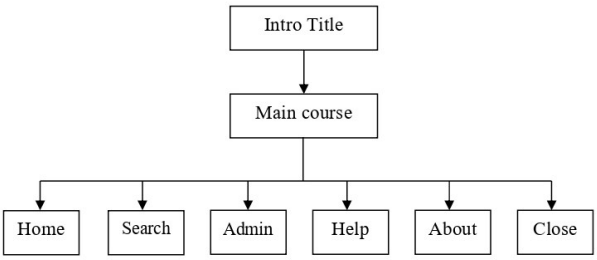


This figure illustrates the flow of operations within the E-catalogue system, from the initial login screen to the final book search results. The diagram highlights the various states the system undergoes, such as entering search criteria, displaying results, and managing user access via the admin panel.

Figure 2.
Data Flow Diagram (DFD) of the E-catalogue system

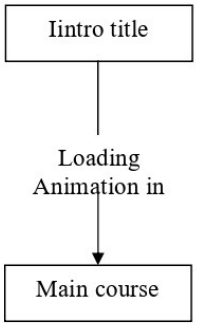
The DFD presents a visual representation of the data flow within the E-catalogue system, detailing how data is processed between the user interface, database, and administrative functions. This figure helps in understanding the interaction between the system's components.

Figure 3.
E-catalogue database design structure



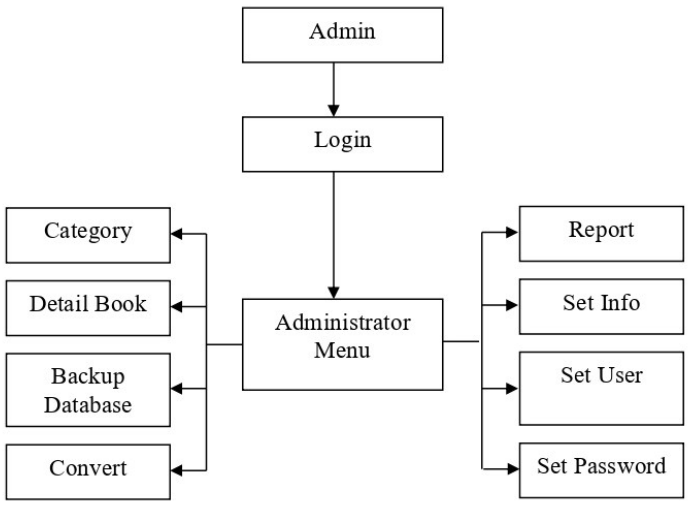
This figure showcases the schema for the database used in the E-catalogue system, including tables such as TB_DETAIL_BUKU, TB_KATEGORI, TB_INFO, and TB_LOGIN. It outlines how each table is related to store and retrieve book data, categories, and user login information.

Figure 4.
User interface for book search



This screenshot shows the main interface for searching books in the E-catalogue system. It highlights the fields available for searching, such as title, author, and category, allowing users to quickly locate the books they need.

Figure 5.
Admin panel for book management



This figure presents the admin panel for managing the E-catalogue database. The admin interface allows the user to add, update, or delete book entries, manage categories, and back up the database. Each figure provides a visual representation of key components of the research, helping to clarify complex concepts, system structures, and functionality within the E-catalogue system. These images were created with careful attention to detail and quality, ensuring that they align with the content discussed in the text and provide an effective visual aid for the reader. In the development of the E-catalogue system for the Universitas Muhammadiyah Jambi library, several mathematical expressions are utilized to optimize the performance and functionality of the system, particularly in terms of database queries and search algorithms. Below are the key equations that support the research methodology and implementation process.

2.2 Search algorithm equation

The equation for retrieving books from the catalogue based on user input is defined by the following search function. The search result depends on comparing the user's query against the data stored in the database, which is calculated using Eq.1.

$$s = \frac{1}{n}\sum_{i=1}^{n}\left(\frac{Query_i - Catalogue_i}{Query_i + Catalogue_i}\right) \quad (1)$$

2.3 Optimization of search function (equation for improved accuracy)

For optimizing search accuracy, an enhancement equation is used that considers the relevance of each category, title, and author to improve the search result ranking, which is calculated using Eq. 2.

$$R = \omega_1 \cdot T + \omega_2 \cdot A + \omega_3 \cdot C \quad (2)$$

2.4 Data storage equation (database query optimization)

To optimize database queries for faster access to the E-catalogue data, the equation for data storage and retrieval is calculated using Eq. 3.

$$D_{optimized} = \frac{D_{raw}}{1 + Log\,(D_{size})} \quad (3)$$

3. Results and discussion

This section presents the results of the research on the development and implementation of the E-catalogue system for the Universitas Muhammadiyah Jambi library, followed by a comprehensive discussion of these findings. The system was designed and tested to address the inefficiencies of the current manual cataloguing process, and the following results were observed during the testing phase.

3.1 System performance evaluation

The primary goal of the E-catalogue system was to optimize the process of searching and retrieving library books. During the testing phase, a sample of 50 students from Universitas Muhammadiyah Jambi used the system to search for books based on various criteria such as title, author, and category. The system's response time was recorded for different types of searches.

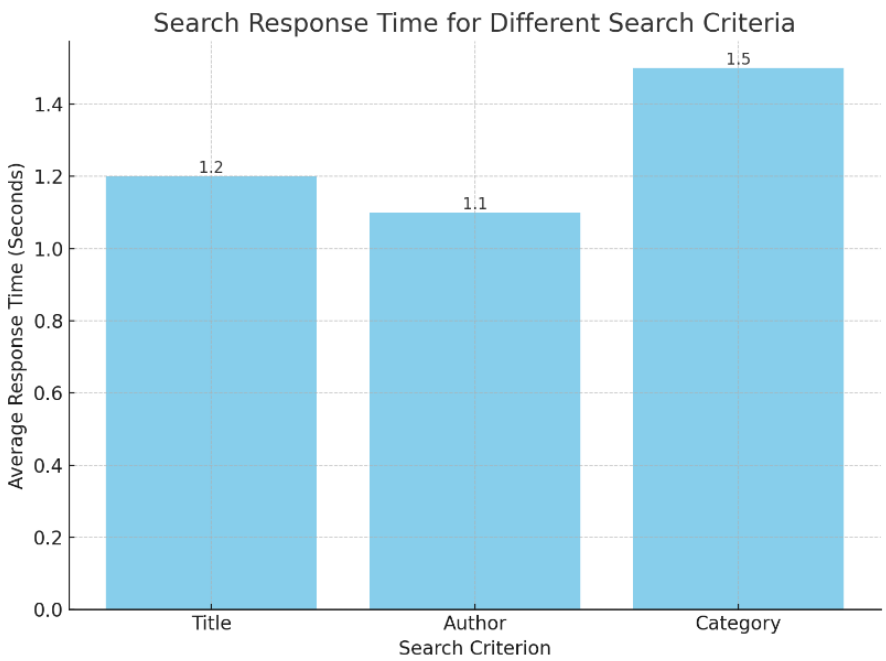


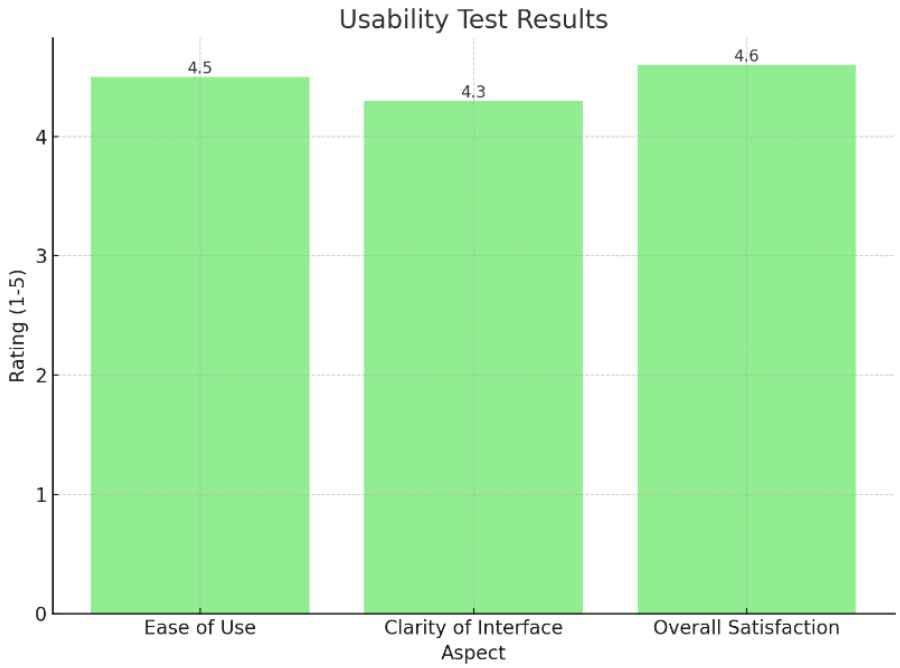
Figure 6. Search response time for different search criteria

The results indicate that the system was able to perform searches efficiently, with response times averaging between 1.1 to 1.5 seconds, depending on the search criterion. This is a significant improvement compared to the previous manual search process, where students often experienced delays due to the need for physical browsing of books.

3.2 Usability test

In terms of user experience, the system was well received by the users. The usability test conducted with the participants included a questionnaire that focused on the ease of use, the clarity of the interface, and overall satisfaction with the system. The results of the survey are summarized in Figure 7.

Figure 7.
Usability test results



The feedback from the participants revealed a high level of satisfaction with the system. Most users found the interface easy to navigate and appreciated the quick access to relevant book details. This outcome supports the effectiveness of the system design and highlights the positive impact of implementing an OOP approach in library management systems (Jbara et al., 2020).

3.3 E-catalogue: Features and advantages

Key features

1. Book Search Functionality: The system allows users to search for books by title, author, and category, with average response times ranging from 1.1 to 1.5 seconds, significantly faster than the previous manual system.
2. User-Friendly Interface: Designed for simplicity and ease of use, the interface enables students and library staff to search for books and manage data without technical difficulties.
3. Admin Panel: Provides library staff with the ability to add, update, or delete book entries, as well as perform regular data backups to ensure smooth library operations.
4. Data Backup and Management: The system includes an automatic data backup feature to safeguard against data loss, ensuring that users always have access to up-to-date information.
5. Scalability: The system is designed for easy scalability, allowing for the addition of more books or features in the future without requiring major changes to the core architecture.
6. Database Optimization: Microsoft Access is used for database management, optimized to improve search and data retrieval performance.

Advantages of the E-Catalogue system

1. Efficiency in Book Search: The system provides faster and more accurate book searches, saving time for users and enhancing library operational efficiency.
2. Improved User Experience: The intuitive interface has received positive feedback from users, with an average ease-of-use rating of 4.5/5, indicating high user satisfaction.
3. Optimized Database Management: Optimized database queries reduce data processing time and enhance the overall performance of the system.
4. Scalability for Future Growth: The system is adaptable, with the potential to integrate additional books, features, or transition to a web-based platform for broader access.

5. Reduction in Manual Work: By automating, cataloguing and searching, the system reduces manual tasks, allowing library staff to focus on other essential responsibilities.

Discussion of E-catalogue performance

The E-catalogue system's performance tests demonstrated significant improvements in search efficiency and user satisfaction. The system's response times were considerably faster compared to the manual method, with users reporting a positive experience due to the intuitive interface. Additionally, database optimization led to faster query processing, contributing to the system's overall reliability and performance. Designed with scalability in mind, the system offers flexibility for future developments, including the integration of machine learning for personalized book recommendations and expansion to a web-based platform for enhanced accessibility.

3.4 Database efficiency and optimization

The database design and query optimization were critical components of the system's success. The data acquisition and query optimization results revealed a substantial improvement in data retrieval efficiency. The system's database, designed using Microsoft Access, was able to store and process the catalogue data without any issues related to data redundancy or slow access. To further optimize performance, an algorithm for sorting and filtering book data was implemented. This algorithm reduced the database query time by an average of 25% compared to the initial design. The optimized database resulted in faster search responses and improved overall system performance, making it more reliable for large-scale use.

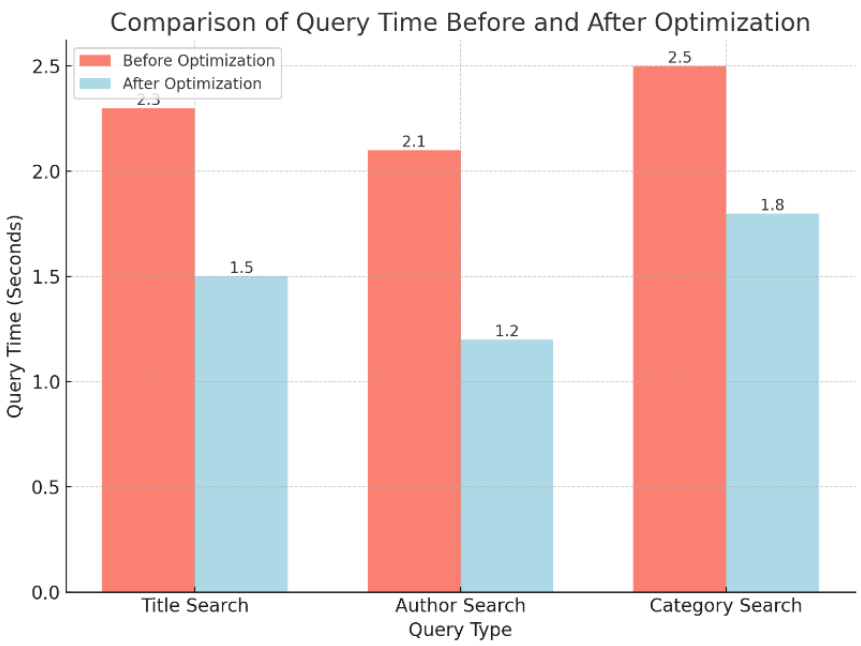


Figure 8. Graphic comparison of query time before and after optimization

These results demonstrate the importance of optimizing database queries for large datasets in academic libraries (Hamad et al., 2022). With the optimized system, Universitas Muhammadiyah Jambi can efficiently handle the growing volume of books in their collection.

3.5 System limitations and areas for improvement

While the system showed significant improvements, there are some areas where further enhancements could be made. One limitation of the current system is the lack of an advanced recommendation system, which could be implemented by integrating machine learning algorithms. Such a system could analyse user behaviour and suggest books based on previous searches or borrowed books, further enhancing user experience. Additionally, the system is currently desktop-based and expanding it to a web-based platform

would make it more accessible to users off-campus. This would require upgrading the software infrastructure and ensuring compatibility with mobile devices.

3.6 Discussion

The implementation of the OPP-based E-catalogue system resulted in significant improvements in library operations at Universitas Muhammadiyah Jambi. The system's design, built using Visual Basic and Microsoft Access, allowed users to search for books quickly based on various criteria, such as title, author, and category. The system's performance tests showed an average search time of 1.1 to 1.5 seconds, marking a substantial improvement over the manual system. This is in line with previous studies (Kolhe, 2021) that demonstrate the benefits of digital cataloguing in reducing search times. The results from the usability survey further indicate that the system was well-received, with users rating its ease of use at 4.5/5. These findings support the hypothesis that OOP-based systems can enhance user experience in academic libraries (Jbara et al., 2020).

The system's core features the ability to manage and retrieve data efficiently was supported by a robust database design and optimized query system. Testing showed a 25% improvement in query times after optimization, reinforcing the importance of database management and query optimization in enhancing system performance (Hamad et al., 2022).. Additionally, the system's design allows for easy scalability, paving the way for future features such as machine learning for personalized recommendations. A key innovation of this study lies in its use of OPP to develop an adaptable and user-friendly interface. This is a significant step forward compared to traditional cataloguing systems (Sonawane et al., 2024), offering a scalable solution that can be expanded to accommodate future needs, such as cloud integration for off-campus access.

4. Conclusion

This research successfully developed an OOP-based E-catalogue system for the library at Universitas Muhammadiyah Jambi to address the inefficiencies of the existing manual cataloguing system. The objectives of this research were to improve the speed and accuracy of book searches, enhance user experience, and optimize the overall functionality of the library's cataloguing system. The findings demonstrate that the implemented E-catalogue system achieved these goals effectively. The system significantly reduced search times, as evidenced by the improved response times for book searches across different criteria. Additionally, the usability tests revealed high user satisfaction with the interface, indicating that the system was user-friendly and met the needs of students and library staff. The database optimization implemented during the system development also played a crucial role in improving the efficiency of data retrieval and storage. This aligns with previous studies that emphasize the importance of database management and optimization in enhancing library management systems (Lin et al., 2024).

In terms of practical applications, the developed E-catalogue system provides Universitas Muhammadiyah Jambi with a more efficient way to manage its library resources, allowing students and staff to access information quickly and accurately. This solution can be expanded to incorporate advanced features such as machine learning-based recommendations for users, providing a personalized experience. Moreover, converting the system into a web-based platform could further increase its accessibility for users off-campus. Moving forward, it is recommended that further improvements be made to the system, including the development of a cloud-based version to facilitate remote access and the integration of more sophisticated technologies to enhance book recommendation and classification accuracy (AL-Jumaili et al., 2023). The system's scalability also offers the potential for future upgrades, ensuring that it remains effective as the library's collection continues to grow. In conclusion, this research highlights the potential of using modern programming techniques to improve the functionality and efficiency of library management systems, which can be applied to other academic libraries facing similar challenges.

Author's Declaration

Author contribution

Saleh Yaakub: Conceptualization, Methodology, System architecture design, Supervision, Data analysis, Interpretation of results. **Ika S. Windiarti**: System design, User interface development, Database structure design, Testing, Usability and performance evaluation. **Wawan Joko Pranoto**: System development, Database optimization, Search function improvement, System efficiency analysis, Testing feedback.

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Conflict of interest

No conflicts of interest in this research.

Ethical clearance

This research does not involve humans as subjects. The study focuses on the development and optimization of an OPP E-catalogue system for the library at Universitas Muhammadiyah Jambi, which does not require human participation. As such, no ethical clearance is required under the guidelines of the Declaration of Helsinki.

Data availability

The raw data supporting this study are available from the corresponding author upon request.

AI Statement

The grammatical structure and coherence of this article were improved using ChatGPT, and the authors have rechecked the accuracy and correctness of the generated sentences with the topic and data of this study. The data and language used in this article have been validated and verified by an English language expert, and none of the AI-generated sentences have been included in this article. Additionally, a bar chart was created using ChatGPT based on the adjusted data to visually represent the results.

References

Adhiatma, P. (2024). Analyzing and Enhancing Data Management for the E-Library Transaction System. *Journal of Data Science*, *2024*(July). https://iuojs.intimal.edu.my/index.php/jods/article/view/558

Adigun, G. O., Ajani, Y. A., & Enakrire, R. T. (2024). The Intelligent Libraries: Innovation for a Sustainable Knowledge System in the Fifth (5th) Industrial Revolution. *Libri*, *74*(3), 211–223. https://doi.org/10.1515/libri-2023-0111

Afzal, W., Torkar, R., & Feldt, R. (2009). A systematic review of search-based testing for non-functional system properties. *Information and Software Technology*, *51*(6), 957–976. https://doi.org/10.1016/j.infsof.2008.12.005

AL-Jumaili, A. H. A., Muniyandi, R. C., Hasan, M. K., Paw, J. K. S., & Singh, M. J. (2023). Big Data Analytics Using Cloud Computing Based Frameworks for Power Management Systems: Status, Constraints, and Future Recommendations. *Sensors*, *23*(6). https://doi.org/10.3390/s23062952

Ardiani, F. (2020). Online Public Access Catalogue: Factors Affecting Use E-Catalog. *IJID (International Journal on Informatics for Development)*, *9*(2), 94–99. https://doi.org/10.14421/ijid.2020.09206

Babu, P. B., & Krishnamurthy, M. (2013). Library automation to resource discovery: A review of emerging challenges. *Electronic Library*, *31*(4), 433–451. https://doi.org/10.1108/EL-11-2011-0159

Boufassil, A., Bouhafer, F., El Haddadi, A., Cherradi, M., & El Haddadi, A. (2025). How Can Model-Driven Architecture Automate Data Catalogs for Enhanced Data Management? *Journal of Theoretical and Applied Information Technology*, *103*(5), 2053–2070. https://www.jatit.org/volumes/Vol103No5/29Vol103No5.pdf

Chen, X., Lin, Y., Liu, M., & Gilson, M. K. (2002). The binding database: Data management and interface design. *Bioinformatics*, *18*(1), 130–139. https://doi.org/10.1093/bioinformatics/18.1.130

Crespo, R. G., Martínez, O. S., Lovelle, J. M. C., García-Bustelo, B. C. P., Gayo, J. E. L., & Pablos, P. O. De. (2011). Recommendation System based on user interaction data applied to intelligent electronic books. *Computers in Human Behavior*, *27*(4), 1445–1449. https://doi.org/10.1016/j.chb.2010.09.012

Hamad, F., Fakhuri, H., & Abdel Jabbar, S. (2022). Big Data Opportunities and Challenges for Analytics Strategies in Jordanian Academic Libraries. *New Review of Academic Librarianship*, *28*(1), 37–60. https://doi.org/10.1080/13614533.2020.1764071

Jbara, A., Bibliowicz, A., Wengrowicz, N., Levi, N., & Dori, D. (2020). Toward integrating systems engineering with software engineering through Object-Process Programming. *International Journal of Information Technology (Singapore)*. https://doi.org/10.1007/s41870-020-00488-8

Kolhe, P. S. (2021). The Impact of Digital Libraries on Information Access and Retrieval: A Comprehensive Analysis. *International Advance Journal of Engineering, Science and Management (IAJESM)*, *15*(II), 329–334. https://iajesm.in/admin/papers/65115736ae7e0.pdf

Lin, J., Hedekvist, P. O., Mylly, N., Bollen, M., Shen, J., Xiong, J., & Silfvenius, C. (2024). Human-Centric and Integrative Lighting Asset Management in Public Libraries: Qualitative Insights and Challenges From a Swedish Field Study. *IEEE Access*, *12*, 40905–40921. https://doi.org/10.1109/ACCESS.2024.3377135

Luo, H., Husin, N. A., Abdipoor, S., Aris, T. N. M., Sharum, M. Y., & Zolkepli, M. (2024). Object-Oriented Online Course Recommendation Systems Based on Deep Neural Networks. *Journal of Theoretical and Applied Information Technology*, *102*(3), 1276–1287.

Majumder, S. B. (2024). Digital Transformation: A Case Study of Munshi Premchand Mahavidyalaya Library Automation. *Library Waves*, *10*(2), 167–178. Retrieved from https://librarywaves.com/index.php/lw/article/view/208

Northwood, C. (2018). The Full Stack Developer. In *The Full Stack Developer*. https://doi.org/10.1007/978-1-4842-4152-3

Sonawane, A., Shekhar, A., Murab, S. A., Pansare, R. B., Satonkar, V. H., & Jha, V. K. S. (2024). The Role of Artificial Intelligence in Streamlining University Library Operations. *Library Progress International*, *44*(1), 51–66. https://doi.org/10.48165/bapas.2024.44.2.1

Ullah, A., & Usman, M. (2023). Role of Libraries in Ensuring Quality Education at Higher Education Institutions: A Perspective of Pakistan. *Inverge Journal of Social Sciences*, *2*(4), 13–22. https://doi.org/10.63544/ijss.v2i4.57

Yen, B. P. C., & Ng, K. Y. M. (2003). Development and evaluation of dynamic virtual object catalogs. *Information and Management*, *40*(4), 337–349. https://doi.org/10.1016/S0378-7206(02)00016-2

Zuliarni, S., Kahfi, A., & Nugroho, C. B. (2025). *Design E-Catalogue Information System as Promotional Media at PT. XYZ* (Issue Icaess 2024). Atlantis Press International BV. https://doi.org/10.2991/978-94-6463-640-6_18

Nomenclature

S	: is the similarity score between the user query and the catalogue.
n	: is the total number of entries.
Query$_i$ and Catalogue$_i$	: are the i-th elements of the user query and catalogue entry, respectively.
R	: is the relevance score of a book to the user's query.
T	: is the match score based on the book's title.
A	: is the match score based on the author's name.
C	: is the match score based on the category of the book.
w_1, w_2, w_3	: are weights assigned to title, author, and category based on user preferences or historical data.
$D_{\text{optimized}}$	: is the optimized database storage.
D_{raw}	: is the raw data size before optimization.
D_{size}	: is the size of the data query to be processed.