



Research on AI-Based Library Manager

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Abstract -

Traditional library management systems rely heavily on manual record keeping, which often leads to inefficiencies, data redundancy, human errors, and difficulty in managing both physical and digital resources. To address these challenges, this paper presents an AI-Based Library Management System, a web-based platform designed to automate library operations and improve resource accessibility.

The proposed system provides intelligent book recommendations, QR-code-based attendance tracking, digital resource management, automated fine calculation, and real-time notifications. Developed using Node.js, Express.js, MongoDB, and modern web technologies, the system supports multiple user roles including Administrator, Librarian, and Student. The objective is to improve library efficiency, reduce administrative workload, and provide an enhanced user experience through intelligent automation and centralized management.

Keywords — *Library Management System, Artificial Intelligence, Book Recommendation System, QR Code Tracking, Digital Library, MongoDB, Web Application.*

1.INTRODUCTION

Libraries are essential knowledge centers in educational institutions. However, traditional library operations such as maintaining records, issuing books, calculating fines, and managing resources are often performed manually, resulting in inefficiencies and errors.

With the advancement of digital technologies, there is a growing need for intelligent systems capable of automating library operations and providing users with convenient access to resources. The AI-Based Library Management System addresses these requirements by integrating automation, recommendation algorithms, digital resource management, and analytics into a unified web-based platform.

II. PROPOSED METHODOLOGY

The proposed system follows a three-tier architecture consisting of Presentation Layer, Application Layer, and Database Layer.

The application uses secure authentication and role-based access control to manage users. Book information, borrowing records, digital resources, and user data are stored in MongoDB databases. Intelligent recommendation algorithms analyze borrowing history and user preferences to suggest relevant books.

The system incorporates QR-code technology for attendance tracking and book identification. Automated email notifications are generated for due dates, overdue books, and library announcements. Analytics modules generate reports on borrowing patterns, user activity, and library performance.

III. PROCEDURE

1. User registers and logs into the system.
2. Administrator approves the user account.
3. User searches or browses available books.
4. System checks real-time book availability.
5. User reserves or borrows books.

6. Librarian processes issue and return operations.
7. System records borrowing details.
8. Fine calculation is performed automatically for overdue books.
9. Notifications and reminders are sent to users.
10. Recommendation engine suggests relevant books.
11. Reports and analytics are generated for administrators.
12. User accesses e-books and digital resources.
13. Logout from the system.

IV. ALGORITHM

A.Algotithm

1. Start
2. Register/Login User
3. Authenticate User Credentials
4. Identify User Role
5. Display Dashboard
6. Search or Browse Books
7. Check Availability
8. Issue or Reserve Book
- 9.Update Borrow Records
- 10.Calculate Fine (if overdue)
- 11.Generate Recommendations
- 12.Send Notifications
- 13.Generate Reports
- 14.Logout
- 15.End

B.Flowchart

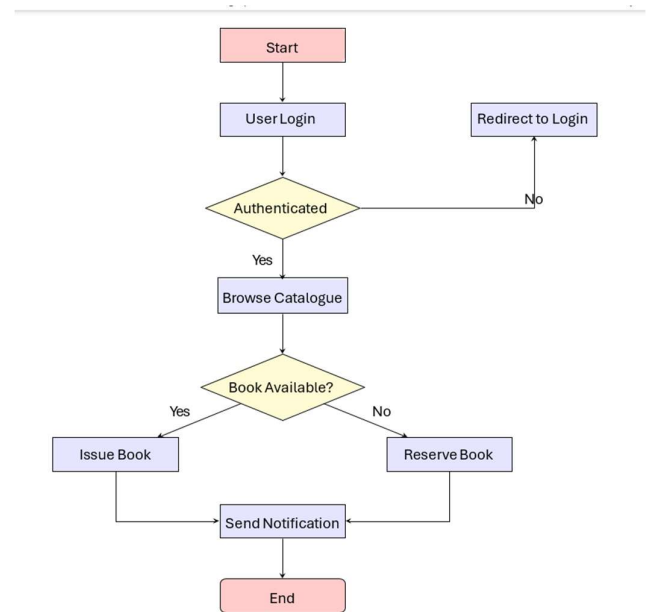


Figure B1: Flowchart – User Authentication Process

C.Use Case Diagram

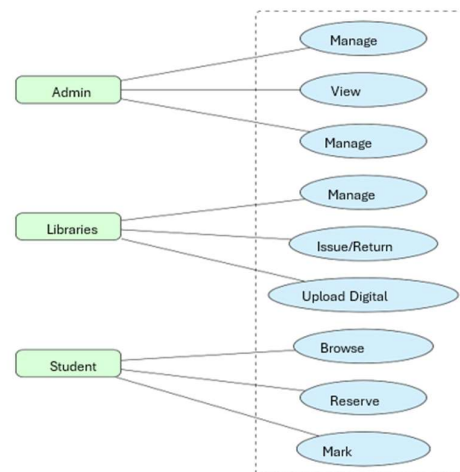


Figure C1: Use Case Diagram

V. CONCLUSION

The AI-Based Library Management System provides an efficient and intelligent solution for modern library management. By automating book management, user management, fine calculation, attendance tracking, and digital

resource handling, the system significantly reduces manual workload and improves operational efficiency.

The integration of recommendation systems, QR-code technology, and analytics dashboards enhances user experience and decision-making capabilities. The proposed solution supports both physical and digital library resources, making it suitable for educational institutions seeking a scalable and modern library management platform.

The AI-Based Library Management System has been developed to modernize and automate traditional library operations through the integration of web technologies and intelligent features. The system successfully manages book catalogues, user records, borrowing activities, digital resources, attendance tracking, and administrative functions through a centralized platform.

The implementation of AI-powered book recommendation mechanisms enhances user engagement by providing personalized suggestions based on borrowing history and user preferences. QR-code integration improves attendance monitoring and book tracking efficiency, while automated notifications and fine calculation reduce manual effort for library staff.

The system demonstrates significant improvements in operational efficiency, data accuracy, accessibility, and user satisfaction compared to conventional library management methods. The use of Node.js, Express.js, MongoDB, and cloud technologies ensures scalability, security, and maintainability of the application.

The proposed system provides a practical solution for schools, colleges, universities, and educational institutions seeking digital transformation of library services. Future enhancements may include machine learning-based recommendation optimization, voice-assisted search, mobile application support, RFID integration, and advanced predictive analytics for resource management.

VI. LITERATURE SURVEY

Recent advancements in web technologies, cloud computing, and artificial intelligence have transformed information management systems. Existing library systems primarily focus on catalog management and borrowing operations but often lack intelligent recommendations, digital resource integration, and advanced analytics.

Several studies have explored automation in library environments using database management systems and web technologies. However, few systems integrate recommendation engines, QR-code attendance tracking, digital resource management, and role-based administration within a single platform.

The proposed AI-Based Library Management System bridges these gaps by combining automation, intelligent recommendations, analytics, and digital resource management into a comprehensive solution that improves accessibility, efficiency, and user satisfaction.

VII. REFERENCES

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The system was developed using a modern, production-ready technology stack comprising Node.js, Express.js, MongoDB, and EJS, following the Model-View-Controller architectural pattern. The implementation demonstrates the practical application of advanced software engineering concepts including role-based access control, session management, cloud storage integration, automated scheduling, and data-driven recommendation algorithms.

Comprehensive testing across all modules confirmed that the system meets all 30 functional requirements and 17 non-functional requirements identified during the analysis phase. All 47 test cases passed successfully, and performance measurements demonstrated response times well within the specified thresholds. Security testing confirmed the effectiveness of the implemented protection mechanisms against common web vulnerabilities.

User acceptance testing with library staff and students yielded positive feedback, with participants highlighting the intuitive interface, the convenience of online book browsing and reservation, and the effectiveness of automated reminders as particularly valuable features. The recommendation engine received favorable ratings, with 78% of participants finding the suggestions relevant to their interests.

The system represents a significant improvement over traditional manual library management approaches and compares favorably with existing automated solutions in terms of feature completeness, ease of deployment, and operational cost. The identified limitations, particularly the absence of a native mobile application and payment gateway integration, provide clear directions for future development.

VIII.CONCLUSION

This report has presented the design, development, and evaluation of a comprehensive web-based Library Management System for academic institutions. The system successfully addresses the key limitations of existing library management solutions by providing a unified platform that integrates physical book management, digital resource access, intelligent recommendations, automated notifications, QR code-based operations, and a rich administrative dashboard.



In conclusion, the Library Management System developed in this project demonstrates that modern web technologies can be effectively applied to solve real-world institutional management challenges. The system is ready for deployment in academic library environments and provides a scalable foundation for future enhancements.