



# Smart Library Management System

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**ABSTRACT:** The Smart Library Management System (SLMS) is a comprehensive digital platform designed to modernize and automate traditional library functions. It provides a user-friendly, web-based solution that simplifies management of books, users, and transactions, thereby enhancing efficiency and accuracy in day-to-day library operations. The system replaces manual record-keeping with a centralized digital database, ensuring quick access to information, reduced human errors, and improved user experience. Three distinct user roles — Super Admin, Admin, and Student — each have well-defined responsibilities. The Super Admin manages admin accounts and overall system security; the Admin handles book inventory, issuance, returns, and automated fine calculation; and the Student module enables book browsing, searching, and real-time request tracking. Developed using React.js, Node.js, Express.js, and PostgreSQL, the SLMS supports cross-platform accessibility from desktops, tablets, and mobiles, promoting a paperless and sustainable library environment.

**KEYWORDS:** Library Management System, Web Application, React.js, Node.js, Express.js, PostgreSQL, Role-Based Access Control, Book Tracking, Automated Fine Calculation, Digital Library

## I. INTRODUCTION

In most academic libraries, records are still managed manually, leading to time consumption and data inconsistencies. The Smart Library Management System (SLMS) introduces an automated, multi-user, centralized platform to handle all library operations efficiently. Traditional library tasks such as book issuing, returning, maintaining records, and calculating fines are performed manually, which is time-consuming and prone to errors. This project aims to overcome these challenges by offering a centralized online system accessible by three distinct user roles.

The system introduces three layers of access:

- Super Admin – Supervises the entire system, manages librarian accounts, assigns permissions, and monitors system security.
- Admin/Librarian – Performs all book- and student-related operations including inventory management, issuance, returns, and fine calculation.
- Student – Accesses library resources, searches for books, checks availability, and places book requests online.

The web-based nature of the application allows users to access it from any device. The application is developed using modern technologies such as React.js, Node.js, Express.js, HTML, CSS, and PostgreSQL, ensuring responsiveness, scalability, and secure data management.

## II. LITERATURE SURVEY

Many libraries today still rely on manual processes or outdated computer-based systems. These methods often slow things down, increase the chances of mistakes, and fail to provide real-time updates. While some modern libraries have started using barcode or RFID technology, they still lack features like dedicated user portals or efficient tracking tools [1]. The proposed SLMS addresses these gaps by providing separate dashboards for students and administrators, making book tracking and management far more effective. However, existing solutions suffer from:

A study published by IEEE highlights the benefits of using a Browser/Server (B/S) architecture, where all business logic runs on the server while users interact through a browser — reducing hardware costs and enabling multi-device access [2]. Successful library systems are built around core modules: user authentication, book management, borrowing/return management, and statistical reporting [3]. Database design using Entity-Relationship (E-R) modeling with core entities like users, books, and borrowing records is a widely adopted approach [4]. Effective platforms follow a modular architecture, support centralized web-based access, use a reliable relational database, and undergo thorough testing [5][6].

#### ***A. Research Gap***

Existing library management systems mainly focus on basic operations such as storing book records and issuing books. However, most systems lack: centralized control with role-based access, real-time tracking, automated fine calculation and overdue alerts, user-friendly multi-device interfaces, and adequate data security mechanisms. The SLMS proposed here addresses all these gaps in a single unified, secure, and automated platform.

### **III. METHODOLOGY**

The Smart Library System is designed around three main user categories. All users interact with the system through a secure credential-based login. Once authenticated, each user gains access to role-specific features and functionalities.

#### ***A. System Workflow***

- Step 1: System identifies user role: Super Admin, Admin/Librarian, or Student.
- Step 1: Super Admin Module: Add and manage library admin accounts; assign permissions; monitor all system activities.
- Step 1: Admin/Librarian Module: Add/update book records; track issued and returned books; approve or reject student requests; manage book allotments and overdue fines.
- Step 1: Student Module: View available books; search by title, author, or subject; request book issue/allotment.
- Step 1: Logout and session termination for all user types.

#### ***A. System Workflow***

- Step 1: User logs in; invalid credentials show error and retry.
- Step 2: System identifies role: Super Admin, Admin/Librarian, or Student.
- Step 3: Super Admin Module: Manage admin accounts, assign permissions, monitor system.
- Step 4: Admin/Librarian Module: Add/update books, track transactions, approve requests, manage fines.
- Step 5: Student Module: View available books, search, place book requests.
- Step 6: Logout and session end.

#### ***B. System Architecture***

- The system follows a three-tier architecture: a React.js frontend providing responsive dashboards for all user roles; a Node.js/Express.js backend implementing RESTful APIs and JWT-based authentication; and a PostgreSQL relational database for structured and secure data storage. This architecture ensures modularity, scalability, and clean separation of concerns.

**IV. EXPERIMENTAL RESULTS**

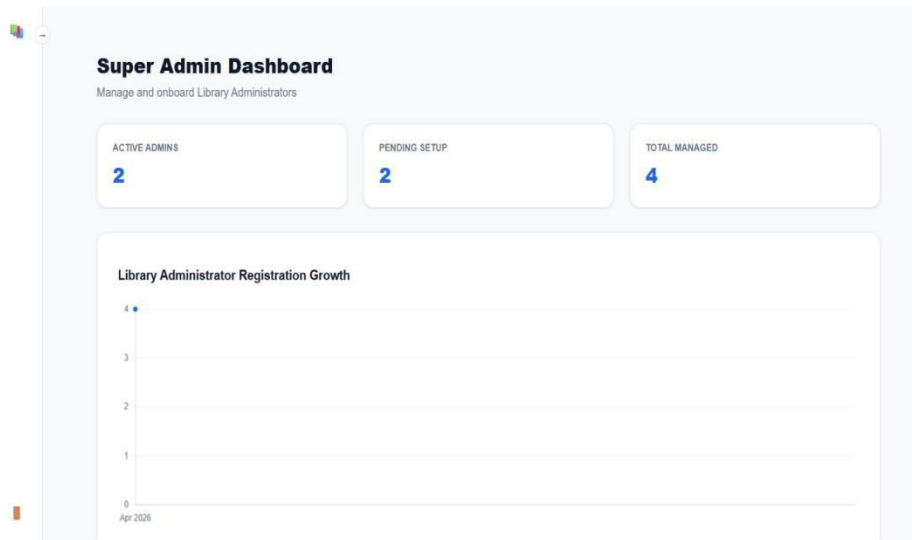
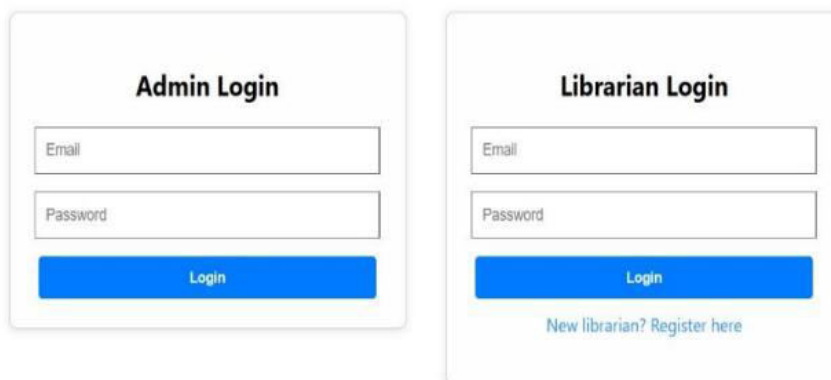


Fig. (a) Super Admin Dashboard — displays Active Admins, Pending Setup, Total Managed cards, and Library Administrator Registration Growth chart.



The image displays two login forms side-by-side. The 'Admin Login' form has fields for 'Email' and 'Password' and a blue 'Login' button. The 'Librarian Login' form has fields for 'Email' and 'Password', a blue 'Login' button, and a link below that says 'New librarian? Register here'.

Fig. (b) : Admin and Librarian Login Page — separate email/password login sections with librarian registration option.

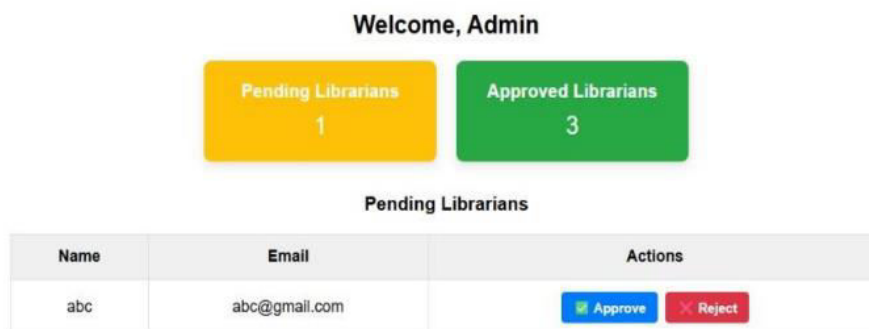


Fig. (c) Admin Dashboard — shows Pending and Approved Librarians counts with Approve/Reject actions.

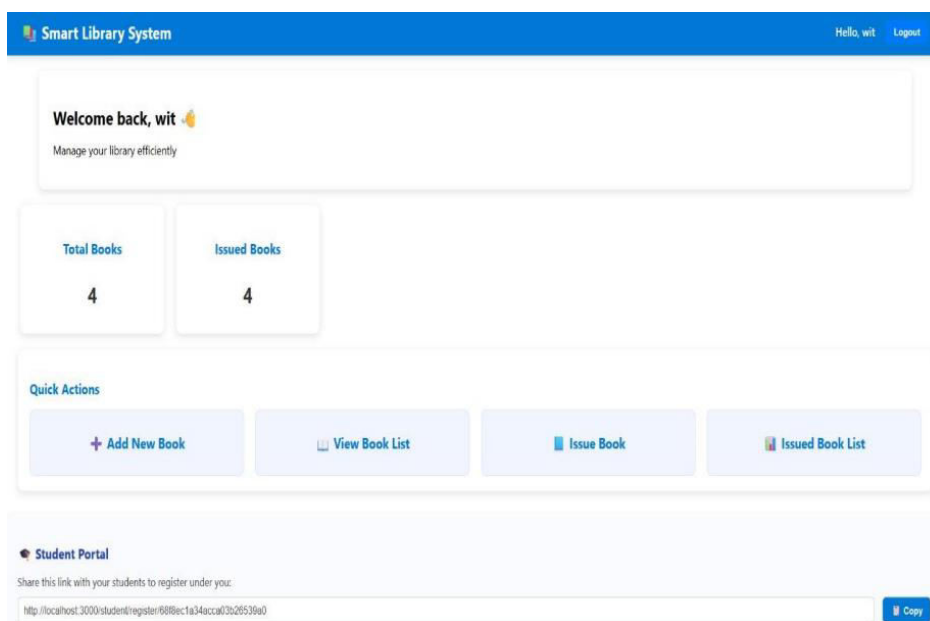
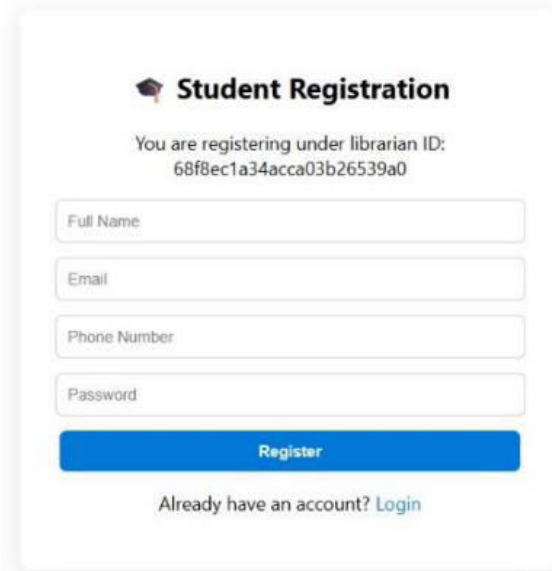


Fig. (d) Librarian Dashboard — Total Books, Issued Books, Quick Actions (Add Book, View List, Issue Book, Issued Book List), and Student Portal link



**Student Registration**

You are registering under librarian ID:  
68f8ec1a34acca03b26539a0

Full Name

Email

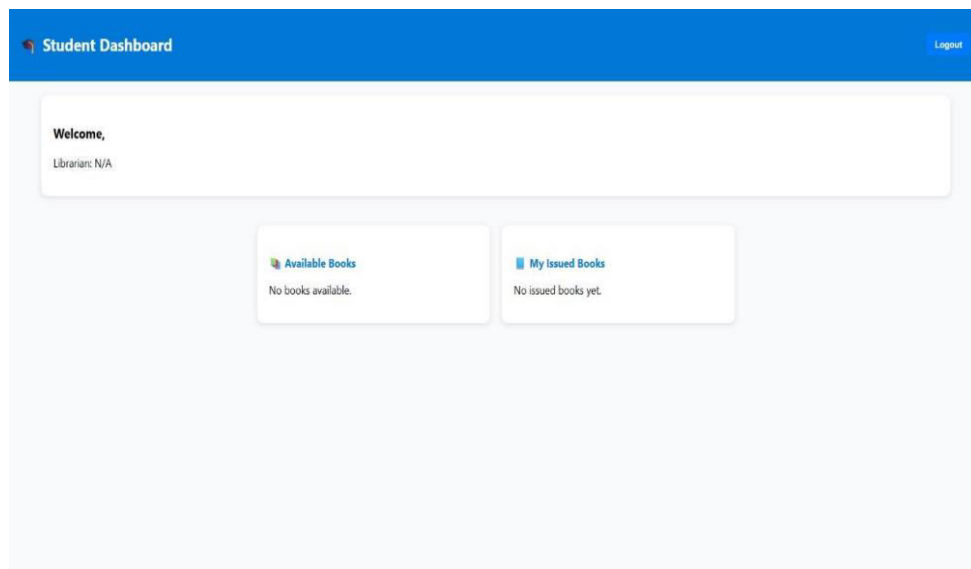
Phone Number

Password

**Register**

Already have an account? [Login](#)

Fig. (e) Student Registration and Login — registration form with Full Name, Email, Phone Number, Password fields under specific Librarian ID.



**Student Dashboard** Logout

Welcome,  
Librarian: N/A

**Available Books**  
No books available.

**My Issued Books**  
No issued books yet.

Fig. (f) Student Dashboard — shows available & issued books.

## V. CONCLUSION

The Smart Library Management System provides an effective and comprehensive solution to overcome the limitations of traditional library management. By automating core operations — book management, user management, issue/return

tracking, and fine calculation — the system significantly reduces manual effort and improves operational accuracy. Role-based access control for Super Admin, Admin, and Student users ensures better security and management control. The use of modern web technologies (React.js, Node.js, Express.js, PostgreSQL) makes the system scalable, secure, and user-friendly, accessible from multiple devices. The SLMS promotes a paperless, efficient, and technology-driven library environment suitable for modern educational institutions.

#### A. Future Scope

- Integration of QR code or RFID technology for faster automated book issuance and returns.
  - Implementation of email, SMS, or push notifications for due date alerts and overdue fines.
  - Development of a dedicated mobile application for enhanced smartphone accessibility.
  - Incorporation of AI and machine learning for personalized book recommendations.
  - Expansion to include e-book management, online reading, and downloadable digital content.
  - Integration with cloud platforms for better scalability, backup, and remote access.
  - Addition of advanced analytics tools for usage pattern tracking and reporting.
  - Multi-language support for a wider range of users.
- Enhanced security features: data encryption and stronger user authentication..

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