

# The Role of Automation in Shaping Next-Generation Digital Libraries and Knowledge System

Aryan Kumar<sup>1</sup>, Himanshu Chauhan<sup>2</sup>, Ayush Saini<sup>3</sup>, Khushboo<sup>4</sup>, Rajeev Kaushik<sup>5</sup>

<sup>12345</sup>Department of Computer Science & Engineering, R.D. Engineering College, Uttar Pradesh, India

---

**Abstract** - Traditional management systems persist in academic libraries despite their vital institutional role because they fail to adapt to modern needs. Such outdated management systems create multiple operational problems through delayed notification systems for book returns alongside confusing fine management and limited payment system choices. A customized solution has been created for Uttar Pradesh colleges libraries. Our proposed solution introduces a two-application library automation system that targets both students and administrators to streamline modernized management of library operations. The system includes digital library cards and delivers real-time alerts which perform automatic computing of fines and enables users to make payments online. The system delivers both simplicity and customized functionality that serves student and staff requirements while delivering a practical and operationally superior experience.

**Keywords**- Digital Library Automation, Academic Libraries, Library Management System, Real-Time Notifications, Fine Management, Online Payment Integration, Library Digitization, Student and Admin Portals, Customized Library Solution, Smart Library Cards, Modern Library Systems, Library Technology Upgrade, Dual-Application System.

---

## I. INTRODUCTION

Library management at numerous colleges presents itself as a frustratingly outdated process for both student users and administrative team members. Different educational institutions spread across several districts of Uttar Pradesh operate mainly with manual library systems. Several persistent problems affect student borrowers who fail to meet deadlines and don't receive notice of fines while also having to process payments by hand. The administrative staff faces difficulties using their manual processes to handle data entry and track distributed books and maintain student record handling.

The situation fosters the development of automation into an effective alternative. Research examines a library automation system which aims to integrate established workplace practices with modern technological development. The system uses two mobile applications running on a single shared database platform which includes applications for students and administrators. Through the Student App students get notifications and fee handling capabilities in addition to digital book access through their identification card. The Admin App manages book issuance cycles as well as student information in addition to processing complete book return operations. The mobile applications function together to propel standard library operational applications into faster operation.

## II. LITERATURE REVIEW

Our analysis of survey form data showed different problems after data collection. Automation-based systems prove successful due to two major strengths which reduce errors while delivering better operational results and satisfied. The existing market systems primarily support the needs of big educational institutions and their high deployment expenses fail to meet requirements of some colleges and schools. Better student attendance needs multiple components to work properly because the present systems fail to link notification platforms and payment systems for monetary fees. This paper develops an economical system that integrates maximum operational efficiency with essential valuable features for university-level college settings.

Recent studies highlight the pressing need for accessible library automation in smaller academic settings According to [Kumar\(2022\)](#)<sup>1</sup> using open-source software represents an economical solution because its features including notifications and payments would suit student requirements. [Hosmani \(2018\)](#)<sup>2</sup> shows that numerous Indian college libraries face automation challenges from financial constraints and demonstrates the need for inexpensive practical systems. [Breeding \(2008\)](#)<sup>3</sup> follows the historical development of library systems as they progressed into web-based platforms that deliver real-time alerts together with online payment capabilities along with reduced staff responsibilities. We're also ideas [Rajat Ari \(2018\)](#)<sup>4</sup> to build our apps. colleges require affordable automated systems delivering modern features because research shows the need exists.

## III. METHODOLOGY

Our approach to developing the library automation system followed a structured process:

- A. Understanding User Needs: Surveys, along with interviews, were directed toward some school students, college students, and staff members from different districts of Uttar Pradesh to discover their challenges and needs in the system.
- B. System Design: The library automation system development adhered to a systematic process in which we conducted surveys and interviews with school students, college students, and staff members of Uttar Pradesh's colleges of several districts to identify user requirements for the system.

## IV. Case Study

Feedback Collection Through Google Forms. The study collected detailed feedback from students who study in school & colleges. All these institutes are situated in different districts of Uttar Pradesh. These educational institutions received a Form which gathered comprehensive feedback about their existing library management routines and system imbalances and future expectations regarding automated library processes.

Students responded to various questions in the form that addressed overdue fines management alongside their choice of notification methods and payment options for fines and their perception of library services overall. Actionable student requirements along with preferences emerged from the collected data in this survey.

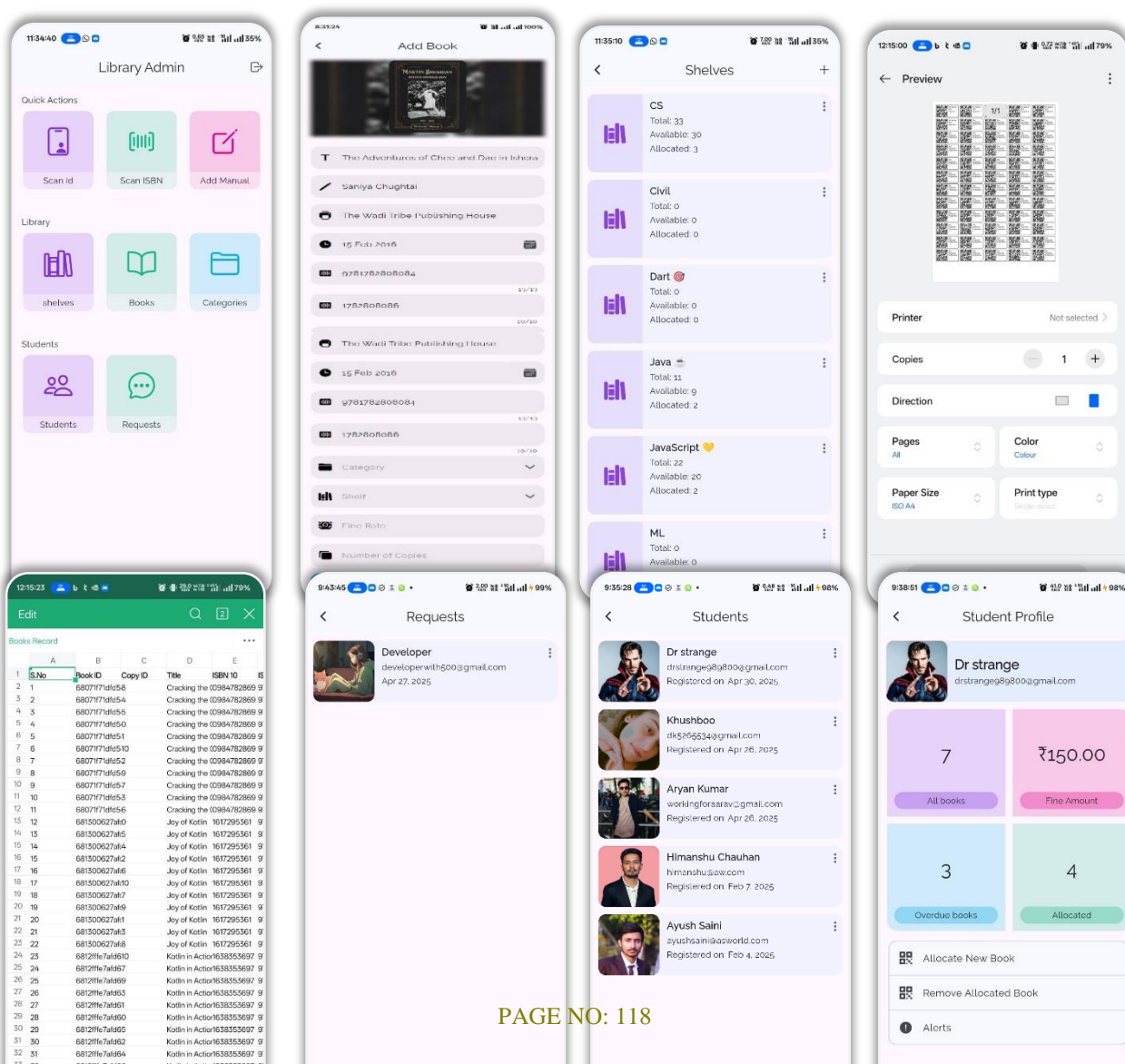
Survey findings indicated students wanted real-time alert systems with digital payments options through a system that simplified both checking out and returning books. The gathered information transformed into direct application for designing the library automation system's functionality because it targeted precisely the issues that users encountered.

## V. Technology Stack:

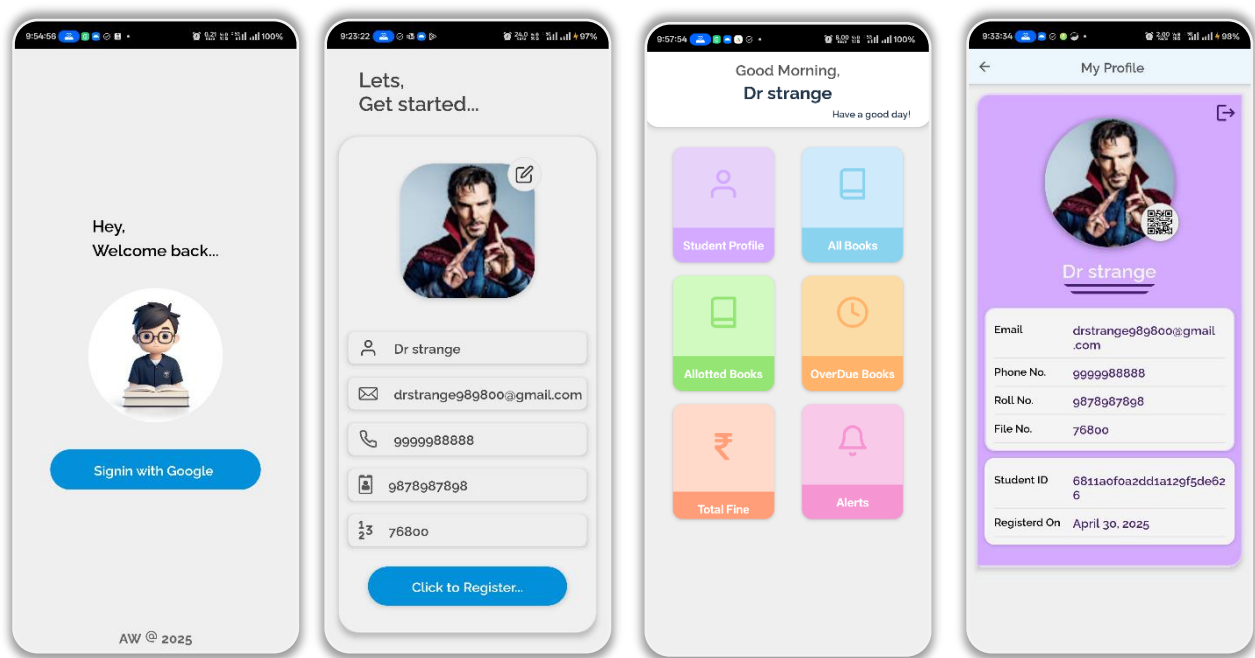
- A. Student App: Our application utilizes the cross-platform features of React Native during its development.
- B. Admin App: Our application benefits from Flutter technology to provide users with a responsive platform featuring an intuitive design.
- C. Backend: We're using Express.js in backend because they managing API endpoints, business logic, and integration between front-end applications and backend.
- D. Database: The system relied on MongoDB (for structured data storage) and Firebase as solutions for data management together with real-time notification functions.
- E. Media Storage: Cloudinary is used for efficient and scalable media storage, enabling fast and secure image and video uploads, transformations, and delivery.
- F. Development and Testing: Both applications went through intensive field testing to spot and fix bugs which generated seamless performance.
- G. Implementation and Training: The platform deployment happened alongside staff training for feature understanding to promote system adoption. (This is used when we implement the system and its very easy to adopted because all things were simple and fully automated).

## VI. Preview of our applications

### 1. Admin's App



2. Student’s App



2.1 Login with



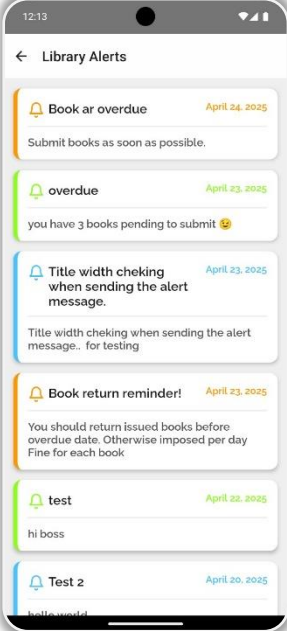
2.2 Student Registration



2.3 Quick Actions



2.4 Student Profile



## VII. Work Flow of Applications

### A. Library Admin App

- i) Sign up with Google (one-time process).
- ii) First, we need to add all books by scanning the ISBN number like we scan a Java book's ISBN number; then the app automatically fetches their details and shows them in the form, and we just need to add the category, shelf, and number of copies of the Java book only and save.
- iii) If we do not get the book data on the Google API, then we have the option to add books manually. It works like what is mentioned in above 1.2.
- iv) In library options (like books, categories, and shelves), we can search for any book and generate their QR codes with different book IDs for every book and simply paste them to all the books. All books are registered in the database.
- v) And librarians also have the option of a custom alert message to send to any student.

### B. Student App

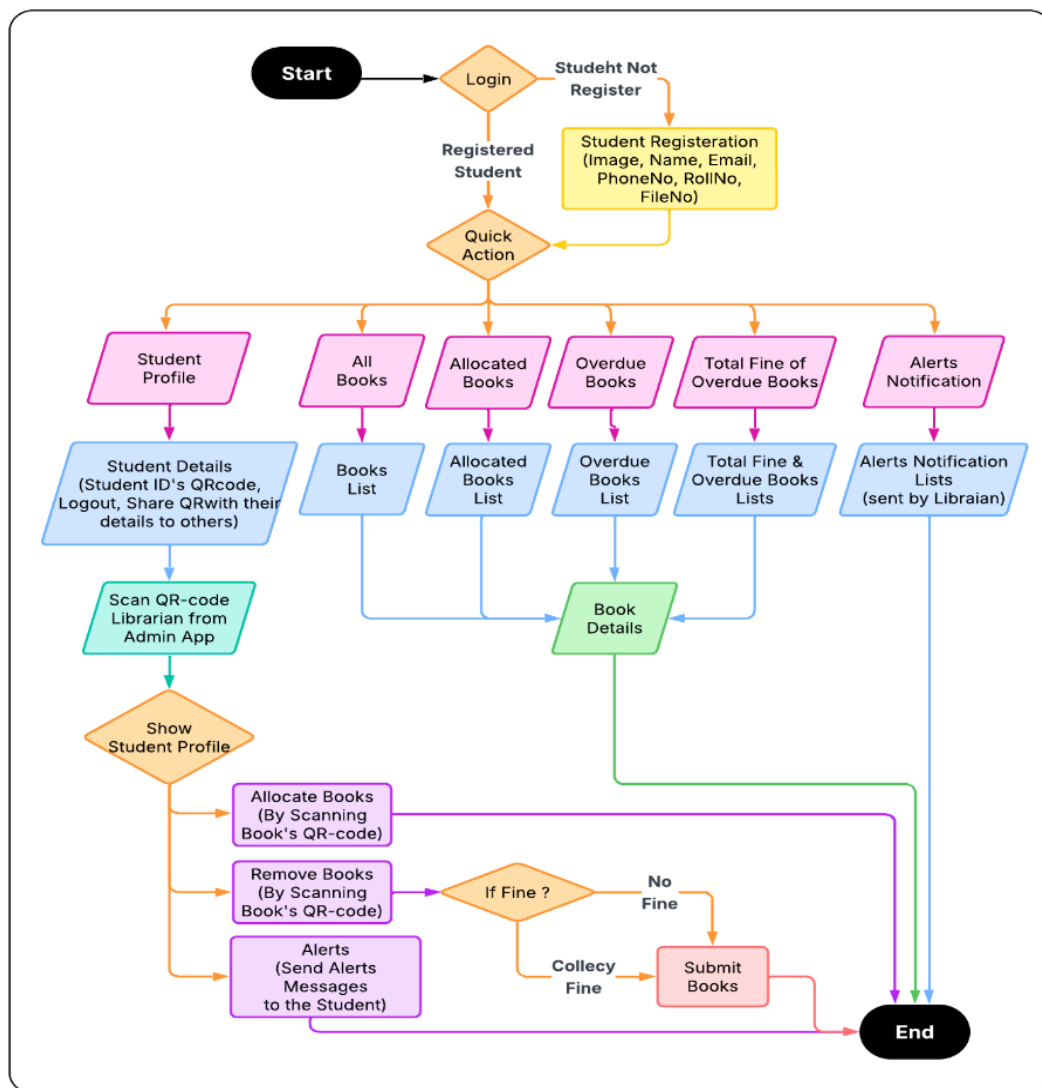
- i) The student first logs in with Google and then registers their information, like roll number, file number, name, email, gender, DOB, and phone number, and then presses the register button. This registered student's details get to the admin. Admins have the option to approve, block, or reject that student.
- ii) If the student has approved, he/she wants to issue some books like Java, Python, or C++, and then the librarian scans the student ID (the student has a QR-code-based profile unique ID) and then redirects to that student profile. and admins have the option to allocate books, remove allocated books, and set alerts. The librarian scanned the book's QR code and allocated it to that student.
- iii) Students have the option to see their allocated books and pending books with a detailed page of the book. And also, to see their total fine with overdue books and also have to see the alert message/notification, which is auto-sent from the admin app for book reminders or overdue books.

### C. Features of Library Admin App

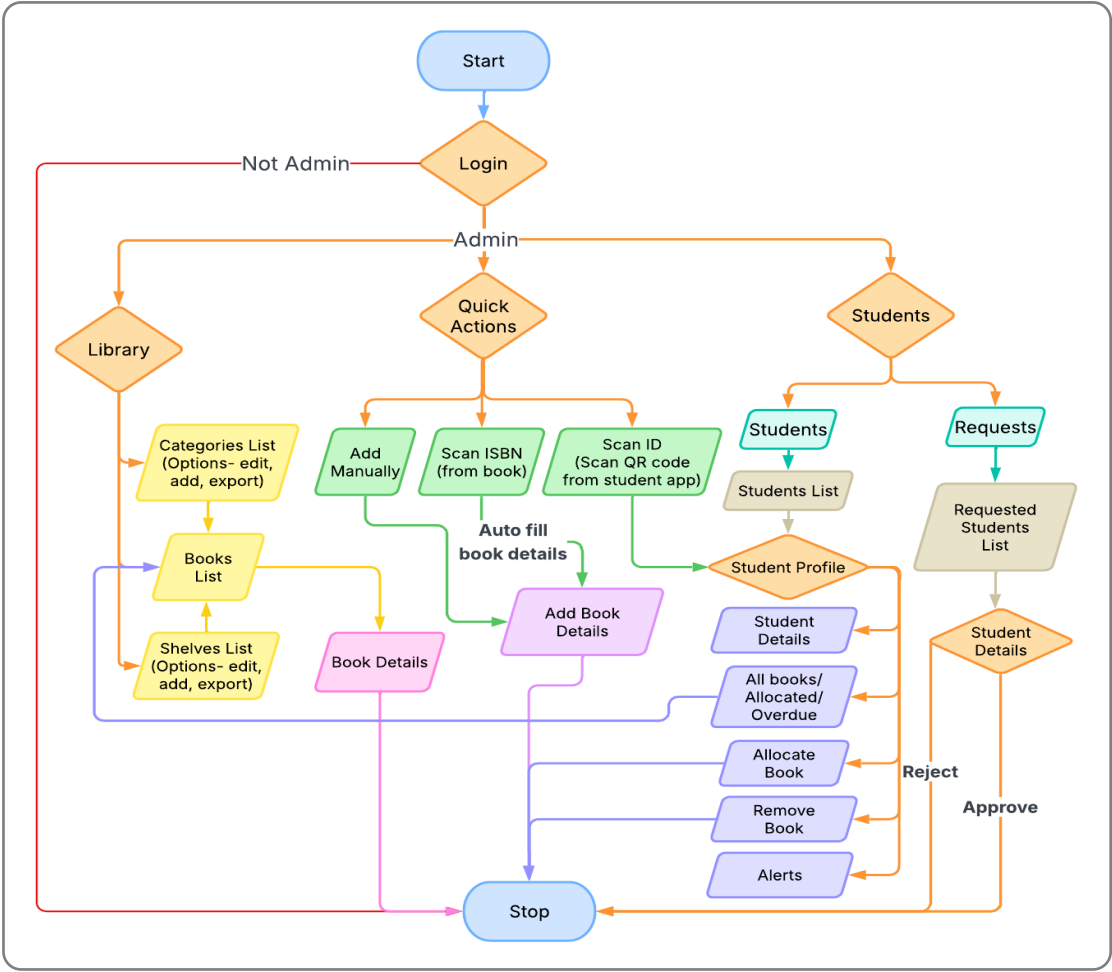
- i) Create a new Selves option. Or to see department-based shelves like CSE, Mechanical, Civil, IT, Electronics, AI & ML, Data Science, Electrical, etc., and also have search and filter options for books on it.

- ii) Create a new category or see a book's category like programming, science, math, etc., and also have search and filter options.
- iii) Books option, show all books that have been saved in the database. We have searched for any books, print books, or QR codes in pdf format.
- iv) A librarian can see all registered students with their data, like student details, allocated books, overdue books, total fines, and allocate new books, remove allocated books, and send alert messages to any student.
- v) Librarians can see requests of new registered students. Admins have the option to approve, reject, or block any student.
- vi) Admin has the option to send a custom alert message to all students.

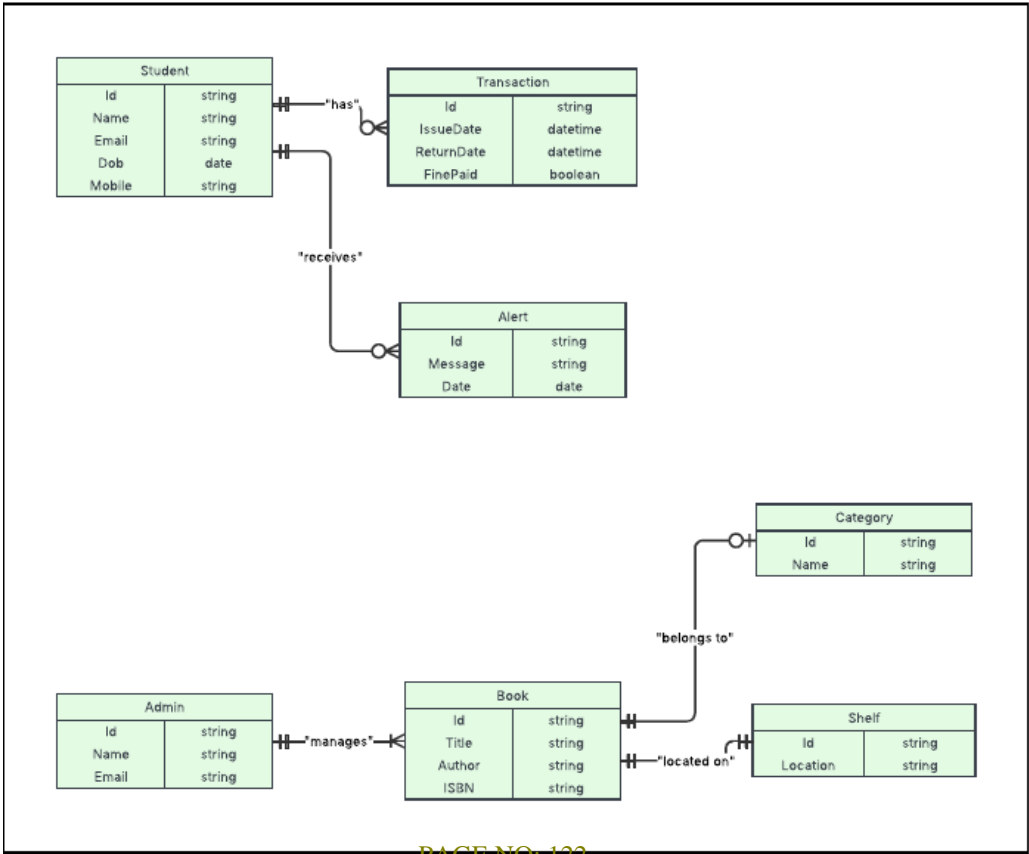
### VIII. Student Flowchart



IX. Admin Flowchart



X. Dataflow Diagram





## XI. Results

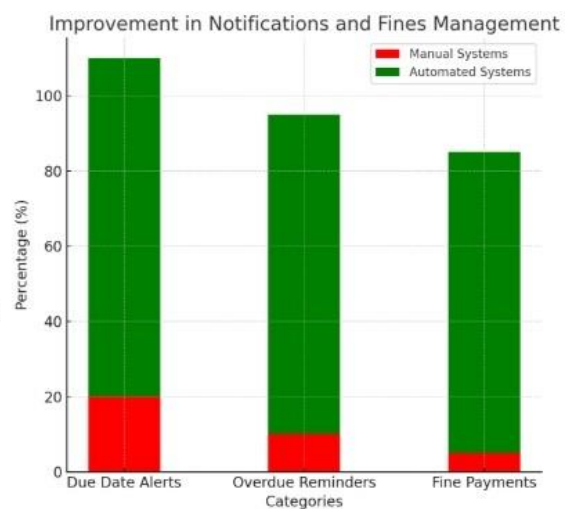
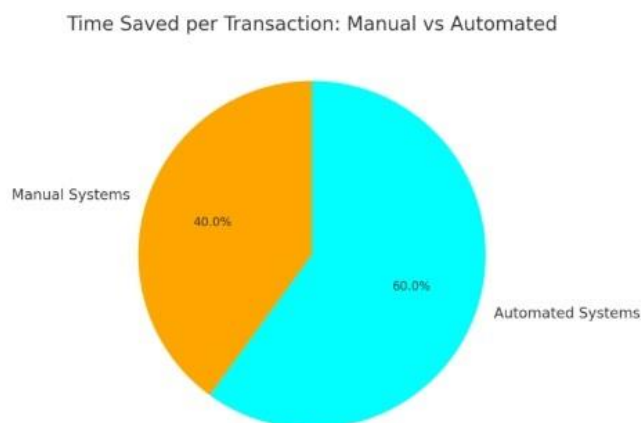
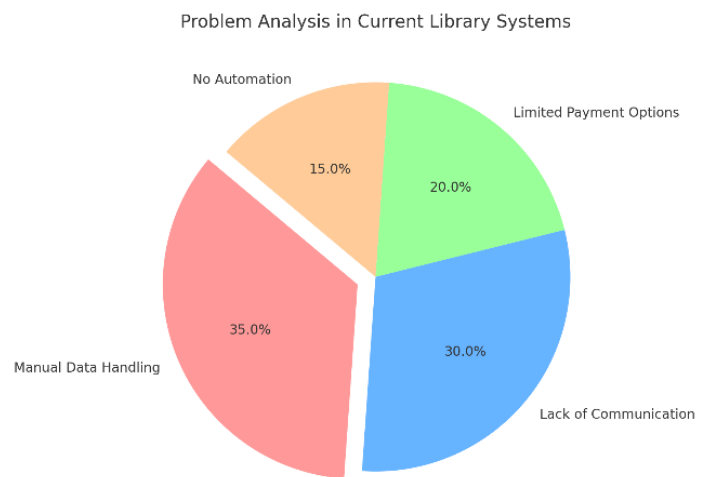
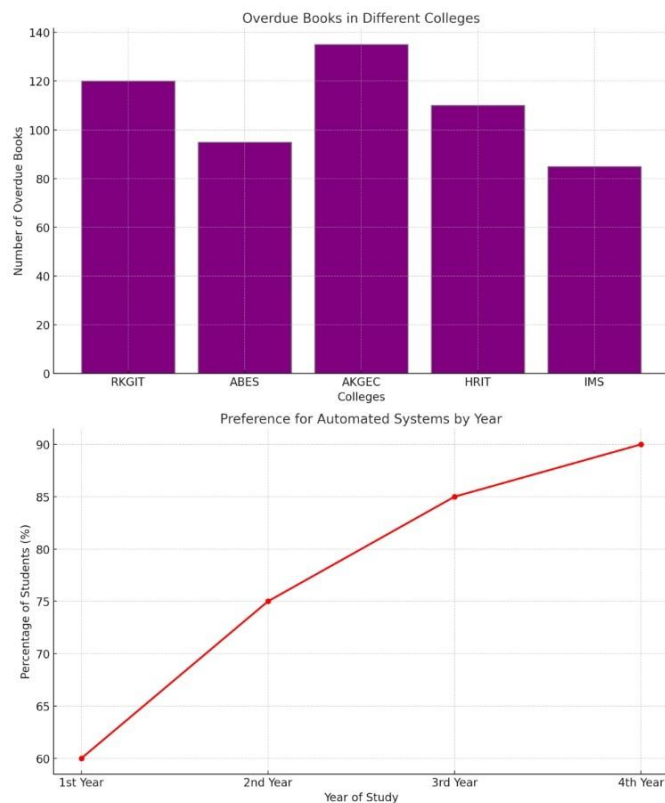
Digital library cards shortened transaction times for library book operations by 60 percent as part of the implemented automation system within the libraries.

The automated combination of book tracking operations and digital fine measurement eliminated all manual worker-based errors from applied procedures.

Expected student satisfaction metrics revealed positive feedback from most students because the system provided them both real-time alerts and online facilities to settle their fines.

Administrative advantages included a decrease of 50% in staff workload so team members engaged in essential responsibilities.

## XII. Graphs and chart





### XIII. Discussion

Under the implemented automation system of libraries digital library cards made the process of borrowing books at the library 60% faster.

The automated merge of book tracking functions with digital fine measurement systems eliminated every error made by manual workers when these procedures were in use.

The system earned positive feedback from most students because it both offered real-time alerts and digital modes for fine payment according to predicted student satisfaction metrics.

Staff time allocation improved by 50 percent after the change reducing personnel commitment to essential work duties.

### XIV. Conclusion

Our library management automation system represents the advancement towards the existing slow and highly human-dependent system. Our library management system solves the issue of human error, time consumption, and manpower. and provide a smooth and high-performance experience to the administrator of the library and students.

### XV. Future Scope

We aim to integrate AI (artificial intelligence) into our app. The AI bot is recommended to search for the best books on the basis of what students want. To implement this tech in our app, we use a recommendation system and trained it on our books database. which comes from the admin app. Students just tell the genre and type of book they want, and the AI bot searches for the best books according to the student preferences. And also check if the book is available in the library or not (maybe that book is already assigned to someone). In that case, they suggest another book that meets the student's preference.

### References

- [1] React Native Documentation link [Introduction · React Native](#)
- [2] Flutter Official Guide link <https://shorturl.at/Z8jBF>
- [3] Firebase Official documentation link [Fundamentals | Firebase Documentation](#)
- [4] Open Library API document link [Developer Center / APIs | Open Library](#)
- [5] Dataflow & flowchart link <https://encr.pw/8kZtk>
- [6] User Surveys Conducted in colleges of several districts of Uttar Pradesh.
- [7] Kumar, G. (2022). Open Source Software for Library Automation: Opportunities and Challenges. Informatics Studies. <https://www.informaticsstudies.org/index.php/informatics/article/view/320>
- [8] Hosmani, V. (2018). Status and Problems of Automation in College Libraries, India: A Review of Literature. Academia.edu. link- <https://encr.pw/ZMPJQ>

[9] Breeding, M. (2008). Circulation Technologies From Past to Future. Library Technology Guides.

<https://librarytechnology.org/document/13133>

[10] Mr. Rajat Ari (2018). " The Future of Libraries: Trends, Challenges, and Innovations." [JETIR1808B35.pdf](#)