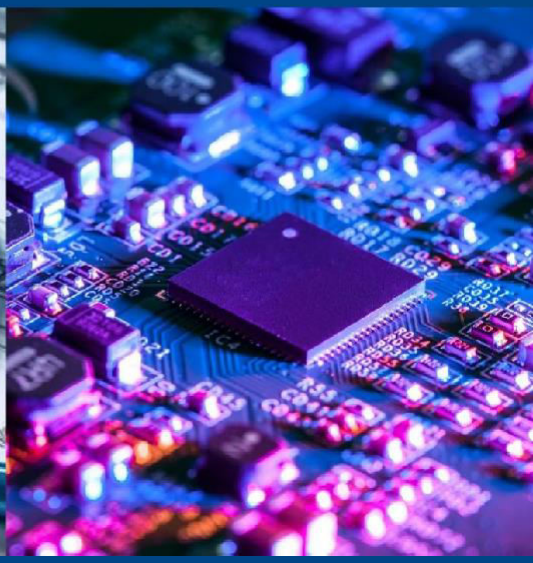
ISSN: 2582-7219





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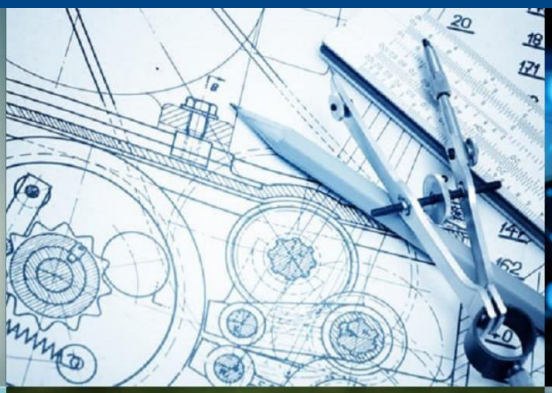

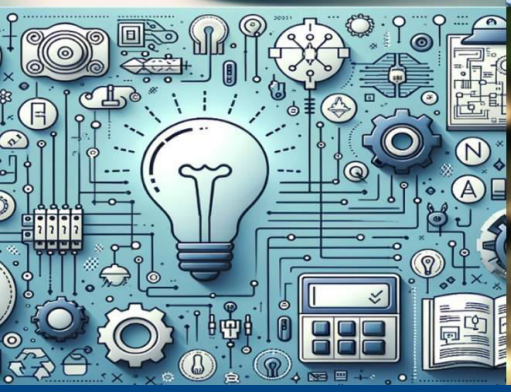

Impact Factor: 8.206

Volume 9, Issue 2, February 2026

© 2026 IJMRSET | Volume 9, Issue 2, February 2026| DOI:10.15680/IJMRSET.2026.0902031

ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 8.206| ESTD Year: 2018|

International Journal of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

Automatic Library Book Locator

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ABSTRACT: The rapid growth of library collections in academic institutions has increased the complexity of locating books efficiently. Although traditional Library Management Systems (LMS) provide catalog and circulation functionalities, they often lack intuitive and precise physical location guidance for users. This paper presents the design and implementation of a **Software-Based Automatic Library Book Locator System** developed using **Flutter for cross-platform mobile application development** and **MySQL as the relational database management system**.The system enables users to search books using metadata such as title, author, ISBN, and category, and provides detailed physical location information including rack number, shelf number, and section. A RESTful API facilitates secure communication between the frontend and database. The proposed system improves user experience, reduces search time, enhances operational efficiency, and supports scalable deployment in educational institutions.

I. INTRODUCTION

Libraries are transitioning from manual record-keeping to digital systems. However, even with digital catalogs, students often struggle to physically locate books within large library spaces. The gap between digital search results and real-world navigation remains a key usability issue.

With the emergence of cross-platform frameworks like Flutter, it is now possible to develop responsive mobile applications efficiently. Combined with MySQL, a robust and widely used relational database, a scalable and reliable book locator system can be implemented.

The proposed system aims to:

- Provide real-time book availability information
- Offer precise rack and shelf details
- Improve search performance
- Enable mobile accessibility
- Support administrative control and management

II. LITERATURE REVIEW

1. Traditional Library Management Systems

Most LMS platforms focus on circulation management (issue/return, fines, inventory tracking). They rely heavily on OPAC systems that provide bibliographic data but limited physical guidance.

2. Web-Based Library Systems

Web-based systems improved accessibility but often lack mobile responsiveness and intuitive navigation design.

3. Mobile Applications in Libraries

Recent research shows that mobile-based solutions increase student engagement and reduce dependency on staff. However, many applications focus only on digital resources rather than physical navigation.

4. Database-Driven Information Retrieval Systems

Relational databases such as MySQL ensure structured storage, efficient indexing, and optimized query performance, which are essential for large-scale library systems.

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The literature indicates a need for an integrated, mobile-friendly solution that combines intuitive UI with structured backend database management.

III. PROBLEM STATEMENT

Despite digital catalog systems, the following problems persist:

1. Users cannot easily interpret call numbers.
2. Books are difficult to locate in large multi-rack libraries.
3. Searching manually consumes time.
4. Limited mobile-based guidance.
5. Lack of user-friendly navigation interface.

Therefore, there is a need for a software-based, mobile-accessible system that bridges the gap between digital catalog search and physical book retrieval.

IV. SYSTEM ARCHITECTURE

The system follows a **Three-Tier Architecture Model**:

1. Presentation Layer (Flutter App)

- Cross-platform mobile UI
- Handles user interaction
- Sends API requests

2. Application Layer (Backend API)

- Developed using PHP/Node.js
- Implements business logic
- Handles authentication and validation
- Communicates with MySQL database

3. Data Layer (MySQL Database)

- Stores structured book and user data
- Uses indexing for faster search
- Maintains relational integrity

Data Flow Process:

1. User inputs search query.
2. Flutter sends HTTP request to API.
3. Backend validates request.
4. SQL query executed.
5. Results returned as JSON.
6. Flutter parses and displays data.

V. SYSTEM OVERVIEW

A. Functional Requirements

1. User Registration & Login
2. Search Books
3. Display Book Details
4. Show Rack & Shelf Location
5. Admin Book Management
6. Update Availability Status

B. Non-Functional Requirements

- Fast response time (<2 seconds)
- Secure authentication
- Scalable database
- User-friendly interface
- Cross-platform compatibility

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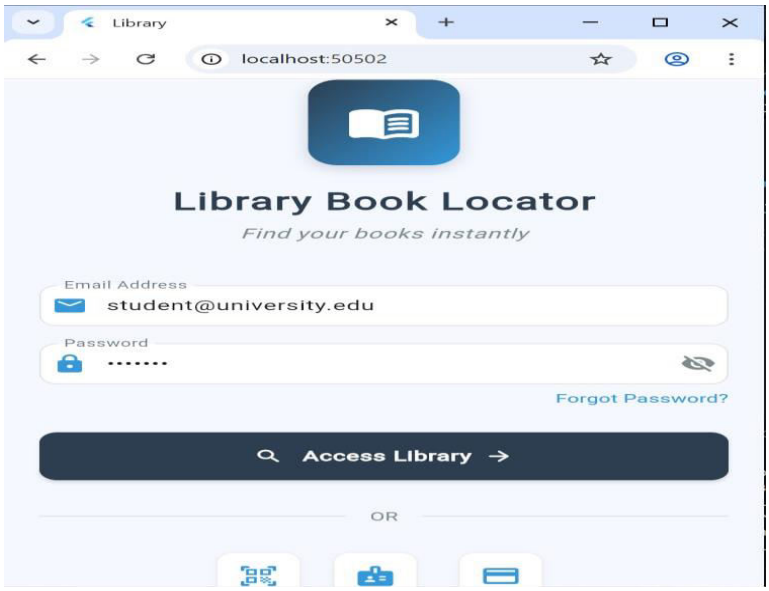
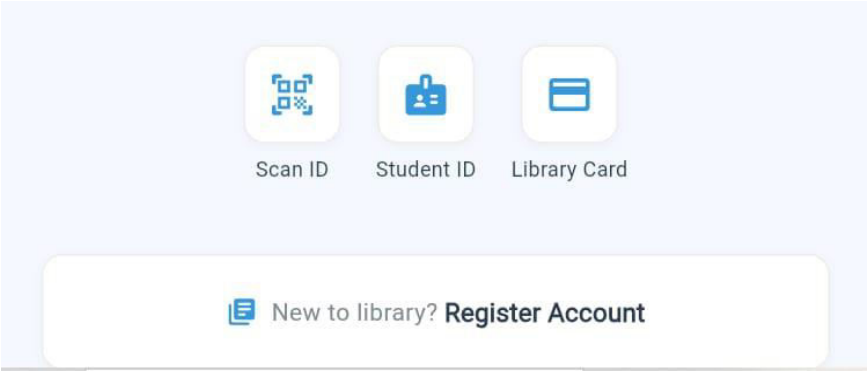
VI. DESIGN



Sensor Used



V. ADVANTAGES & DISADVANTAGES

Advantages:-

1. Reduced Book Search Time

The primary advantage of the system is the significant reduction in time required to locate books. This improves efficiency, especially in large academic libraries with thousands of books.

2. Improved User Experience

The Flutter-based mobile interface provides a simple, interactive, and user-friendly design.

3. Cross-Platform Compatibility

Flutter enables the application to run on both Android and iOS platforms using a single codebase. This reduces development time, ensures consistency across devices, and increases accessibility for a wider range of users.

4. Centralized Database Management

Using MySQL ensures structured data storage and efficient query processing. All book records, rack locations, and availability statuses are maintained in a centralized database, reducing duplication and inconsistencies.

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Limitations:-

1. Dependency on Accurate Data Entry

The system relies heavily on correct rack and shelf information being entered into the database. Any incorrect or outdated data may mislead users.

2. Internet/Network Dependency

The mobile application requires a stable internet or local network connection to communicate with the MySQL database via API. Network failure can temporarily make the system inaccessible.

3. No Physical Tracking Without Hardware Integration

Unlike RFID-based systems, this solution does not automatically track the real-time physical movement of books. If a book is misplaced on the wrong shelf, the system may still show its original location.

4. Initial Setup Effort

Setting up the database, entering book records, mapping rack locations, and training staff require initial time and effort.

VI. CONCLUSION AND FUTURE SCOPE

The Automatic Library Book Locator System developed using Flutter and MySQL provides an efficient and user-friendly solution to the challenges faced in traditional library environments. In large libraries, manually locating books consumes significant time and effort. The proposed system addresses this issue by enabling users to search for books through a mobile application and instantly obtain precise rack and shelf location details.

The integration of Flutter ensures cross-platform compatibility and responsive user interface design, while MySQL offers reliable and structured database management for storing book records, user information, and availability status. The system minimizes manual dependency on library staff, reduces search time, improves operational efficiency, and enhances overall user satisfaction.

Furthermore, the modular three-tier architecture (presentation layer, application layer, and database layer) makes the system scalable, secure, and easy to maintain. The solution is cost-effective compared to hardware-based systems such as RFID, making it suitable for schools, colleges, and medium-scale public libraries.

Overall, the implementation demonstrates how mobile technology and database systems can modernize traditional library management and contribute to smart campus initiatives.

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