Assignment-2: Milestone-1

CS346: Software Engineering Laboratory

Assignment-2 Report

Task:

To develop a Library Management System

Authors:

Group 4A

Durgesam Ajay, 210101038
Faizan Amir, 210101039
Gaurav, 210101040
Gautam Juneja, 210101041
Gautam Sharma, 210101042
Gholap Sarvesh Sarjerao, 210101043

Instructor:

Prof. Pradip K. Das, Dept. of CSE, IITG

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1 Introduction

The library at IIT Guwahati requires an efficient management system to handle its extensive collection of books and serve its diverse user base comprising students, faculty, and administrators. This report outlines the structure of the problem and proposes a solution to streamline library operations.

2 Problem Statement

The task at hand involves the development of a robust Library Management System (LMS) to address the multifaceted needs of the central library at IITG. The existing challenges within the library infrastructure necessitate an integrated software solution capable of efficiently managing book inventories, facilitating user transactions, and maintaining comprehensive records of borrower details. With a diverse user base comprising students, faculty, and librarians, the LMS must offer intuitive functionalities for issuing, renewing, and returning books while ensuring seamless access to library resources. Furthermore, the system must provide administrative capabilities for cataloging books, managing user accounts, and generating insightful reports

3 Proposed Solution

Our solution entails the development of a user-friendly Library Management System (LMS) tailored to the needs of the central library at IITG. This comprehensive software platform will streamline book management processes, optimize user interactions, and enhance administrative capabilities. Leveraging modern technologies like Visual Basic for interface development and MySQL for database management, the LMS will facilitate seamless book transactions for students, faculty, and administrators. By incorporating user authentication and role-based access control, the system will ensure data security.

3.1 User Roles and Functionalities

The Library Management System (LMS) will encompass distinct user roles, each equipped with specific functionalities tailored to their responsibilities within the library ecosystem.

1. **Administrator:**
    - **Book Management:** Administrators can view, add, update, and remove books from the library inventory.
    - **Transaction Management:** Administrators can manually issue, renew, and return books on behalf of users.
    - **Reporting:** They have access to generate reports on book transactions, user activities, and inventory status for administrative purposes.
2. **Student:**
    - **Book Search:** Students can search for books based on title, author, or category to locate desired resources.
    - **Book Transactions:** They can issue, renew, and return books borrowed from the library.
    - **Account Management:** Students can view their transaction history, check due dates for borrowed books, and manage their account details.

3. **Faculty:**

   - **Book Search:** Similar to students, faculty members can search for books to access relevant academic resources.
   - **Book Transactions:** They have the ability to issue, renew, and return books borrowed from the library.
   - **Account Management:** Faculty members can view their transaction history, check due dates for borrowed books, and manage their account details.
   - **Additional Permissions:** Faculty members possess additional permissions, such as higher borrowing limits or extended borrowing durations, compared to students.

By defining clear user roles and functionalities, the LMS ensures efficient management of library resources while providing users with tailored access to necessary functionalities based on their roles and responsibilities within the academic institution.

3.2 Database Schema and Tables

In the Library Management System (LMS), the database schema comprises tables designed to efficiently organize and manage data related to books, students, faculty, and borrowed books. Each table is designed to efficiently organize and manage data relevant to its respective entity.

3.2.1 Book Object Attributes:

1. Book Object Attributes:

   - BookID
   - isIssued
   - Return Date
   - Taken by whom
   - isReserved
   - Last issue
   - Author name
   - Title
   - Subject

3.2.2 Student/Faculty Object Attributes:

1. Student/Faculty Object Attributes:

   - Student ID
   - Password
   - Name
   - Fine

3.2.3 Tables in the Database:

1. Tables in the Database:

   - **students**:
     - Student ID
     - Password
     - Name
     - Fine
   - **faculty**:
     - Faculty ID
     - Password
     - Name
     - Fine
   - **books**:
     - BookID
     - isIssued
     - Return Date
     - Taken by whom
     - isReserved
     - Last issue
     - Author name
     - Title
     - Subject
   - **borrowed_books**:
     - BookID
     - Student ID (or Faculty ID)
     - Issue Date
     - Due Date

These tables facilitate the storage, retrieval, and management of information pertinent to library resources and user activities within the LMS.

4 User Interface

The user interface (UI) of the Library Management System (LMS) plays a pivotal role in ensuring a seamless and intuitive user experience for all stakeholders. While the design of all pages is not finalized, the UI aims to prioritize clarity, functionality, and ease of navigation across all interfaces. Each page will adhere to consistent design principles to maintain visual coherence throughout the system.

The login screen prompts users to authenticate their identity by entering their credentials, while the registration screen allows new users to create accounts by providing necessary information. These processes ensure secure access to the system's features and resources. With clear instructions and user-friendly interfaces, users can seamlessly navigate through the login and registration procedures, enhancing the overall user experience while maintaining robust security measures to safeguard user data.

Figure 1: Login and Register pages

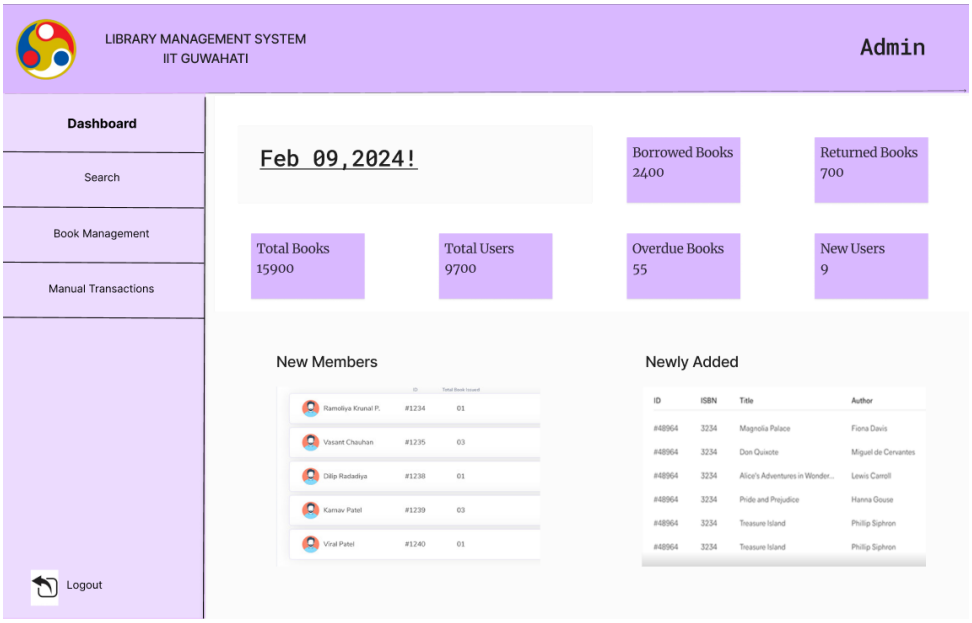

Figure 2: Admin Dashboard

The admin dashboard in the Library Management System (LMS) offers administrators a centralized view of vital statistics and inventory information. It displays metrics such as the total number of books, borrowed books, and registered users, providing insights into system operations and resource utilization. Through intuitive data visualization tools, administrators can track trends, monitor inventory levels, and make informed decisions to optimize library services.

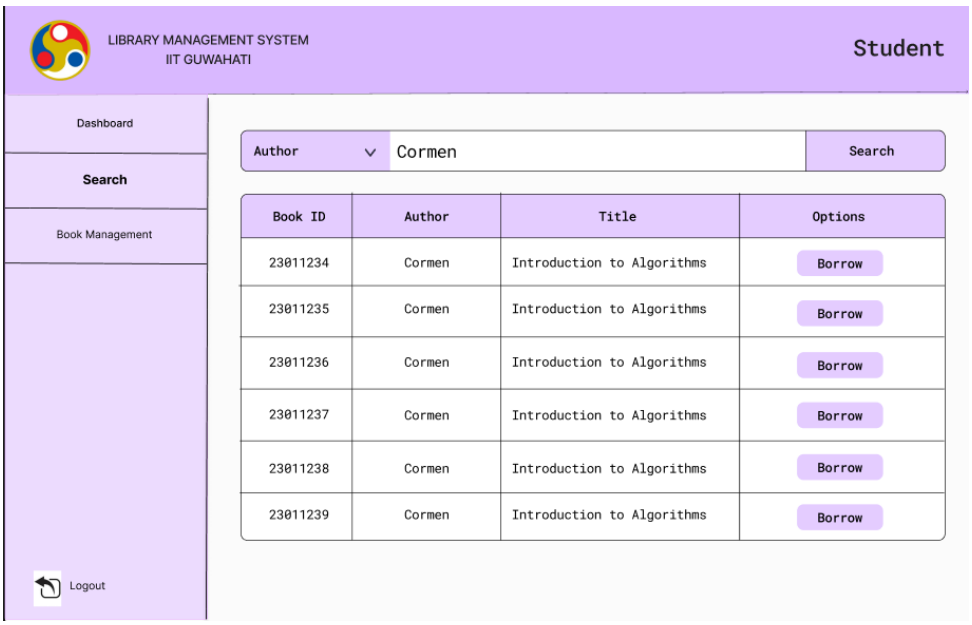

Figure 3: Search Page

The search page serves as a pivotal feature within the Library Management System (LMS), allowing users to efficiently locate desired books based on specific criteria such as title, author, and subject. This page provides a user-friendly interface where users can input keywords or browse through predefined categories to initiate their search. A similar search page is implemented in admin and faculty side as well.

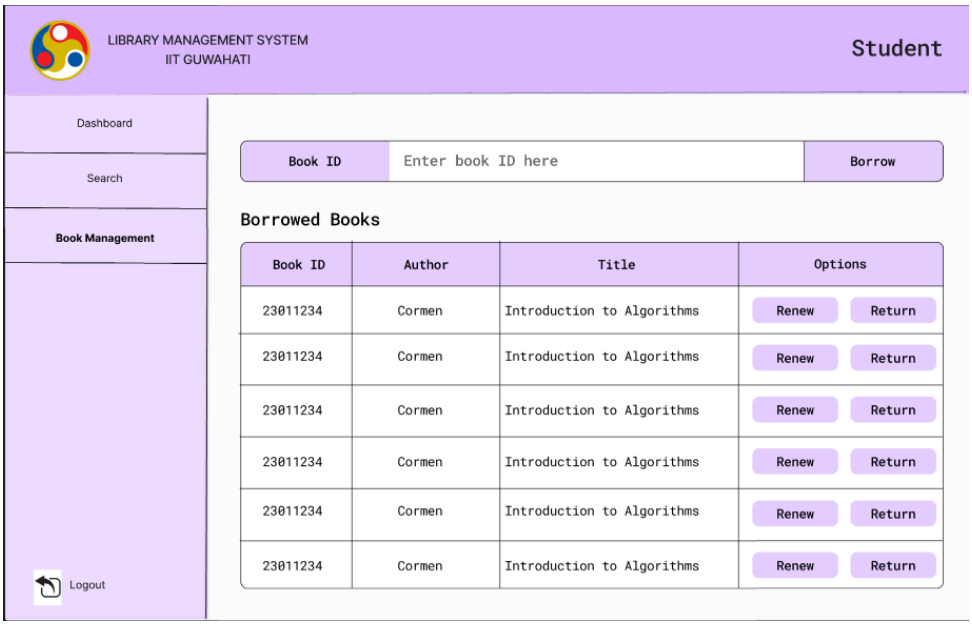

Figure 4: Book Management

The book management screen provides users with the ability to issue, renew, or return books. Borrowed books are displayed on the screen, offering options for renewal and return. Additionally, users can issue new books by entering the book ID. This interface streamlines book transactions, empowering users to manage their borrowed items efficiently.

5 User Flow Diagram

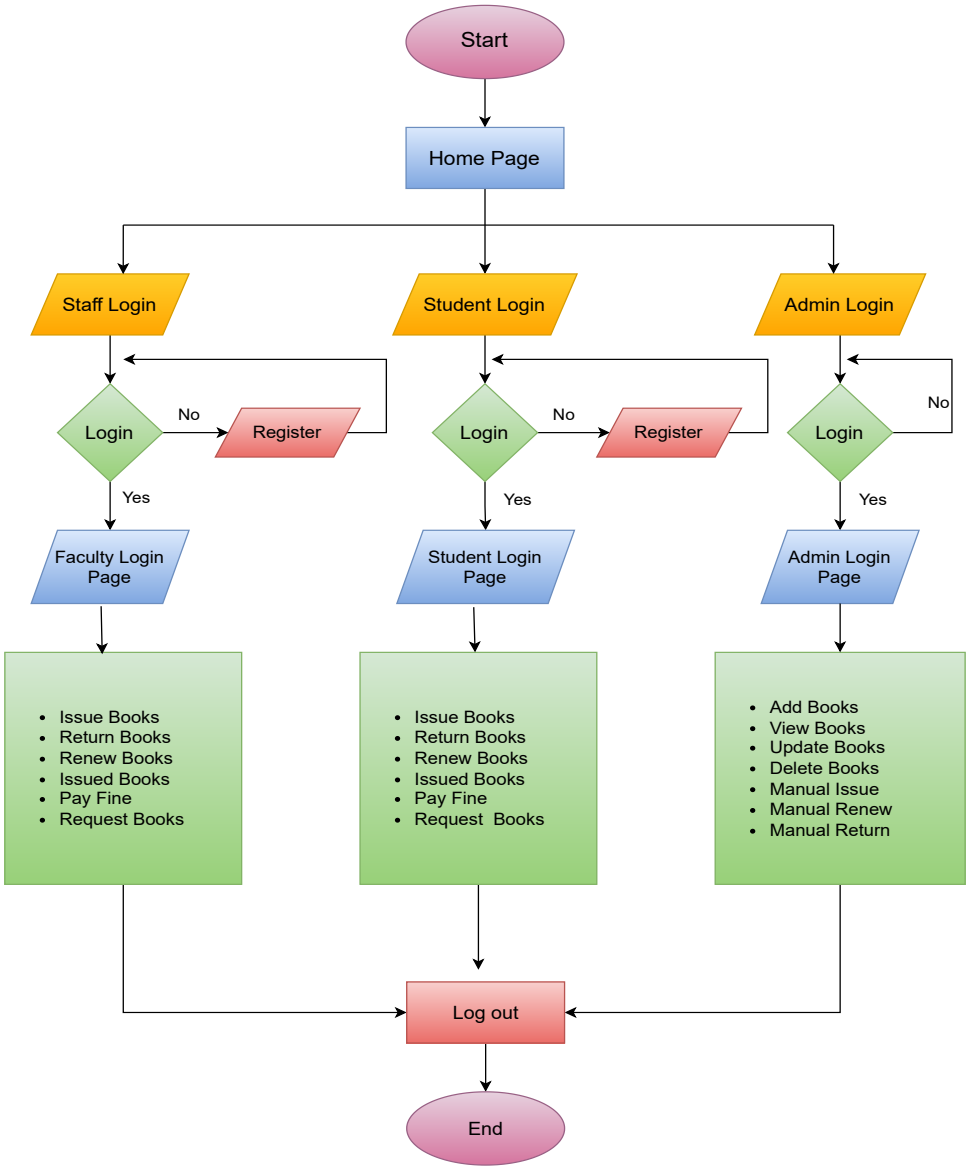

Figure 3: User-flow diagram of the proposed solution

6 Data Flow Diagram (DFD)

The Data Flow Diagram (DFD) illustrates the flow of information within the Library Management System, depicting processes, data stores, and data flows between different components of the system.

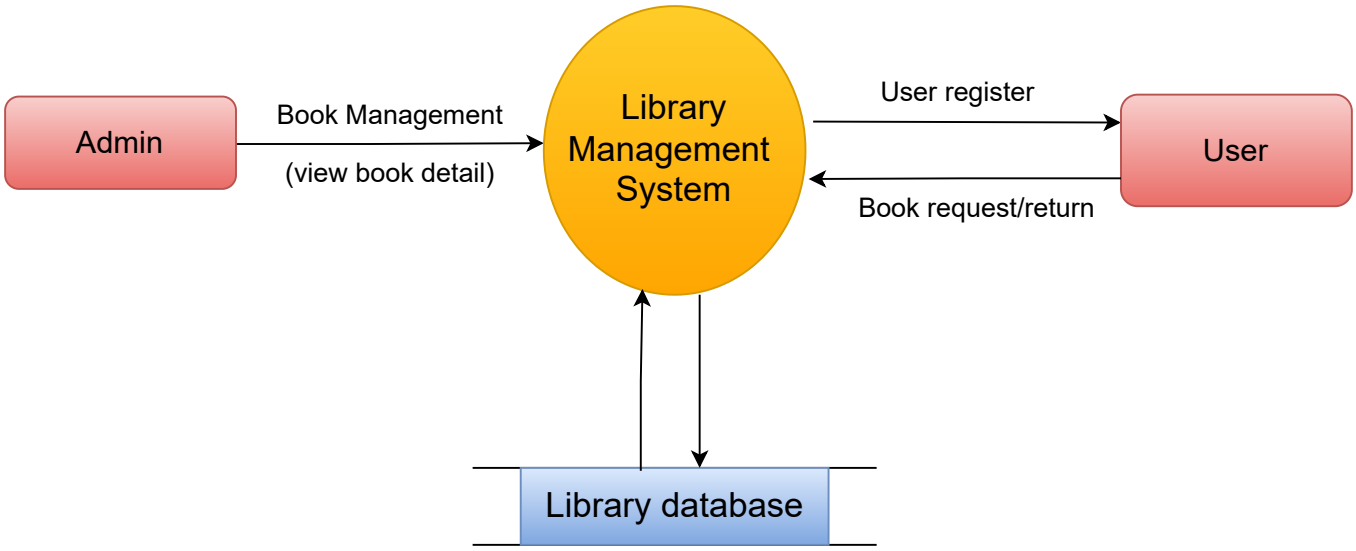

Figure 4: L0-DFD of the proposed solution

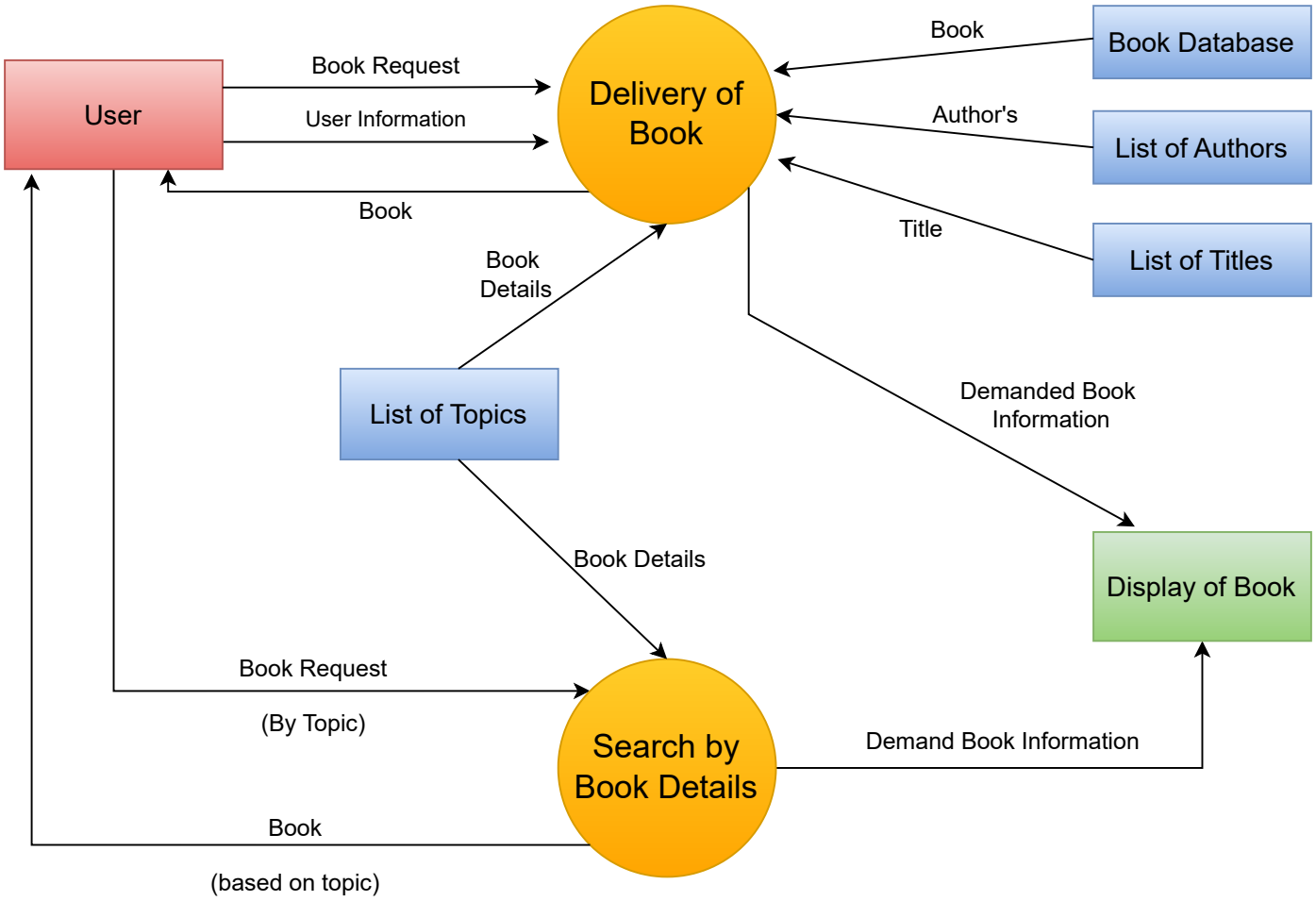

Figure 5: L1-DFD of the proposed solution

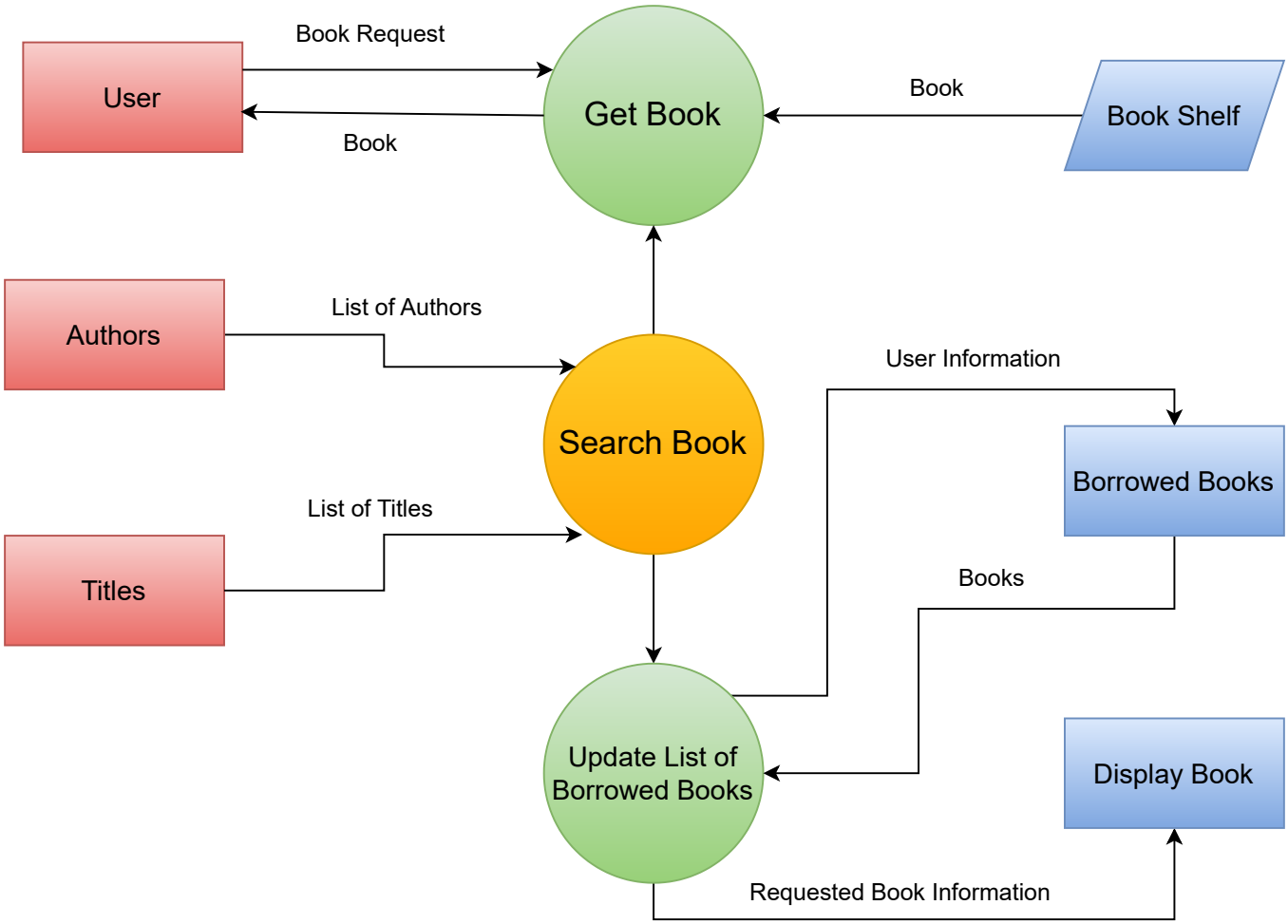

Figure 6: L2-DFD of the proposed solution

7 Assumptions and Error Handling

7.1 Assumptions

In the development and operation of the Library Management System (LMS), several assumptions guide the design, functionality, and user interactions. These assumptions help ensure the integrity, security, and efficiency of the system. Some key assumptions include:

1. **Availability of Physical Copies**: Users have access to physical copies of books for borrowing, renewing, and returning within the library's collection.
2. **User Responsibility for Book Care**: Users are responsible for the proper care and safekeeping of borrowed books to prevent damage or loss.
3. **Timely Return of Borrowed Books**: Users will return borrowed books before leaving the college and/or pay the corresponding fine.
4. **Accurate Data Entry**: Library staff accurately enter book information into the system, ensuring that the database contains correct and up-to-date information about the library's collection.
5. **One Book Corresponds to One Author**: Each book corresponds to one author only, facilitating search by author and simplifying database management.

6. **Verification of Fine Payment**: Fine payments are physically verified by the admin and are not verified within the software, ensuring accuracy and accountability in fine management.

7. **Borrow limit and Return deadline**: For users, there is a limit on the number of books which can be borrowed at a time. Also, there will be return/renew deadline after which fine will start accumulating.

These assumptions shape the development, implementation, and operation of the LMS, ensuring that it meets the needs of users and stakeholders while promoting efficient and effective library services.

7.2 Possible Errors to be Handled

In a Library Management System (LMS) software, several types of errors may occur during user interactions, system operations, and data processing. Here are some possible errors that the software should handle:

1. **Input Validation Errors**: Errors arising from invalid or incorrect user input, such as entering alphanumeric characters in a numeric field or exceeding character limits in text fields.

2. **Data Integrity Errors**: Errors related to data integrity issues, such as duplicate entries, missing or incomplete data, and inconsistencies between database records.

3. **Authentication and Authorization Errors**: Errors occurring during user authentication and authorization processes, including invalid credentials, unauthorized access attempts, and expired session tokens.

By proactively identifying and handling these types of errors, the LMS software can enhance system reliability, maintain data integrity, and provide a seamless user experience for library patrons and administrators alike.

8 Conclusion

The proposed Library Management System offers a robust solution to the challenges faced by the library at IIT Guwahati. By implementing distinct functionalities for administrators, students, and faculty, the system aims to enhance efficiency, accuracy, and user satisfaction.