SOFTWARE ENGINEERING SEMINAR

UNIVERSIDAD DISTRITAL
FRANCISCO JOSÉ DE CALDAS

Team Members:

Wilder Steven Hernández Manosalva - 20212020135

Jhon Javier Castañeda Alvarado - 20211020100

Systems Engineering

BookWiseUD Architecture Document

Bogotá D.C 2025

Library System (BookWiseUD)

Class Diagram

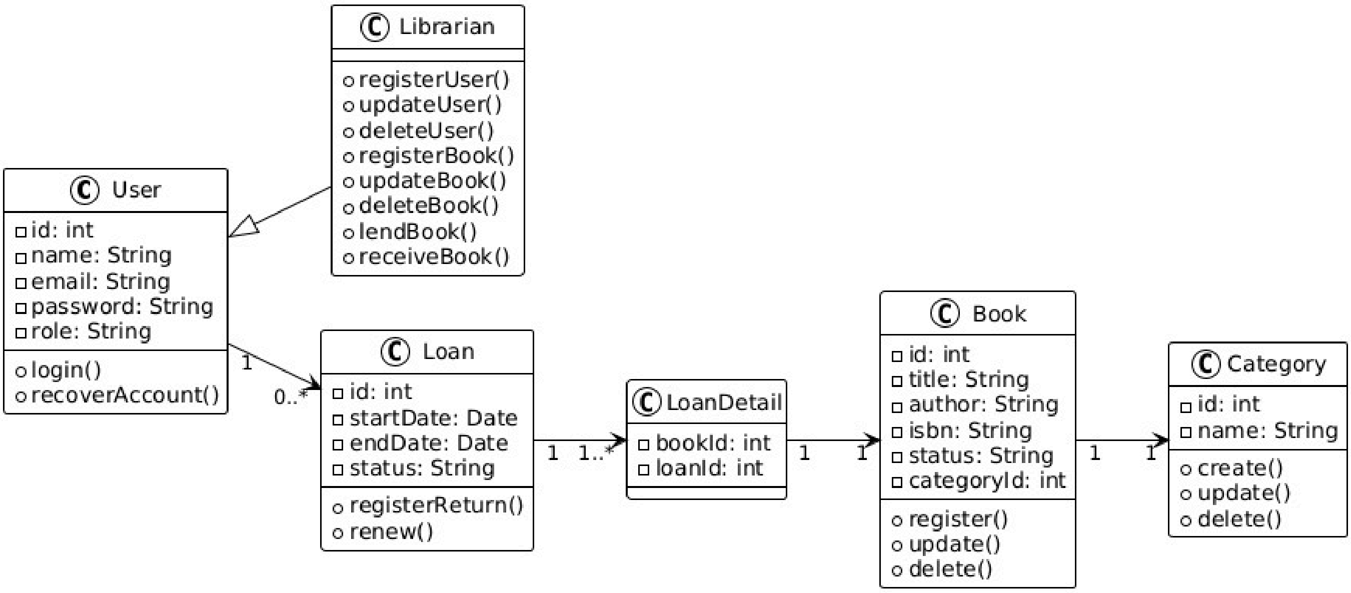


Image 1. Class diagram of Library System.

This class diagram outlines the structure for a library management system. The core entities are User, Book, Category, Loan, and LoanDetail. Users, defined by their role, can log in and recover their account. The Librarian, with elevated permissions, handles the registration, updating, and deletion of both users and books, and also manages the lending and receiving of books. Each Book belongs to a Category and its availability is shown by its status. The lending process is recorded in the Loan class, which holds the dates and status, and is detailed in LoanDetail, linking the specific books to the loan. The Loan class also provides functionality to register returns and renewals, thereby completing the full lifecycle of a book loan within the system.

Architecture Diagram

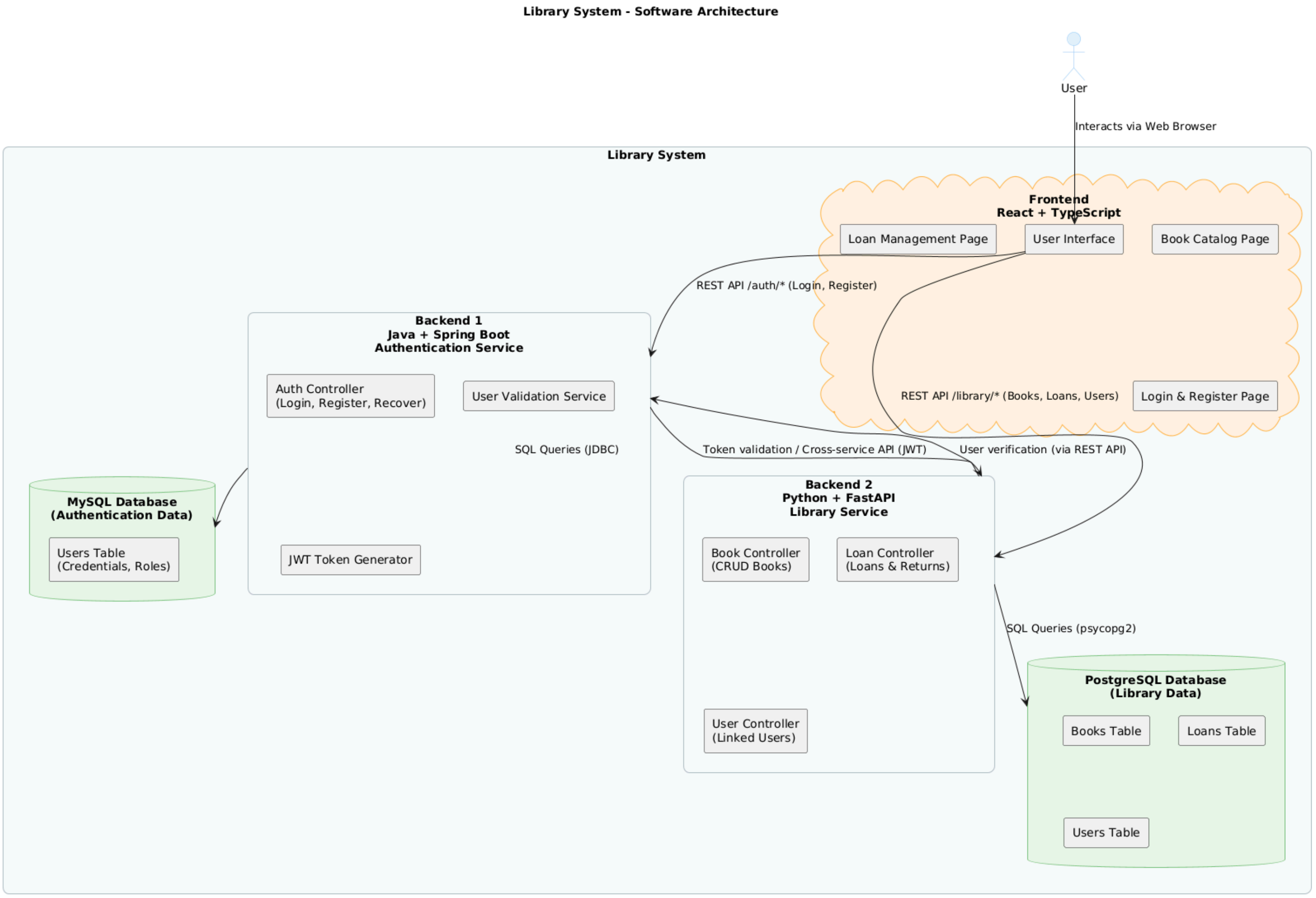


Image 2. Architecture Diagram of Library System.

The architecture diagram represents the structure of the Library System, composed of a React and TypeScript frontend that communicates through REST APIs with two independent backend services. The first backend, developed in Java with Spring Boot, manages authentication and user access, connecting to a MySQL database that stores credentials and roles. The second backend, implemented in Python using FastAPI, handles the core library operations, including book management, loans, and user data, connected to a PostgreSQL database. Both services communicate securely through JWT tokens to validate users and synchronize information. This architecture ensures scalability, modularity, and clear separation of responsibilities, facilitating independent testing, maintenance, and deployment through continuous integration and containerized environments.

Deployment Architecture

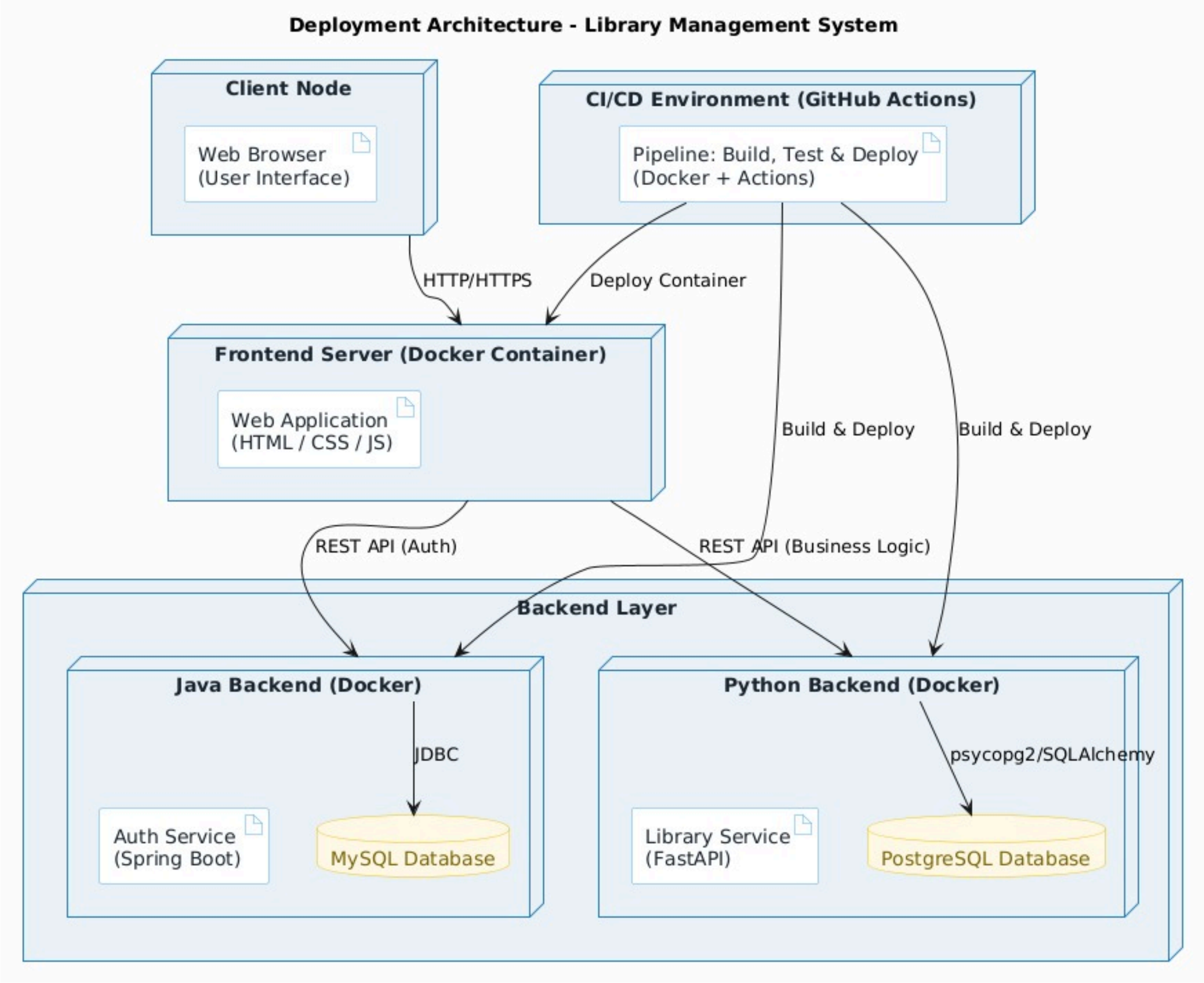


Image 3. Deployment Architecture of Library System.

This diagram depicts the deployment architecture for a Library Management System. The client node consists of a web browser and a CI/CD environment using GitHub Actions to automate the building, testing, and deployment of Docker containers. The frontend, served from a Docker container, hosts the web application and handles authentication. The backend is split into two services: a Java-based Spring Boot service for authentication connected to a MySQL database, and a Python-based FastAPI service for core library logic connected to a PostgreSQL database. The entire system communicates internally and with clients via REST APIs.

Business Model Processes

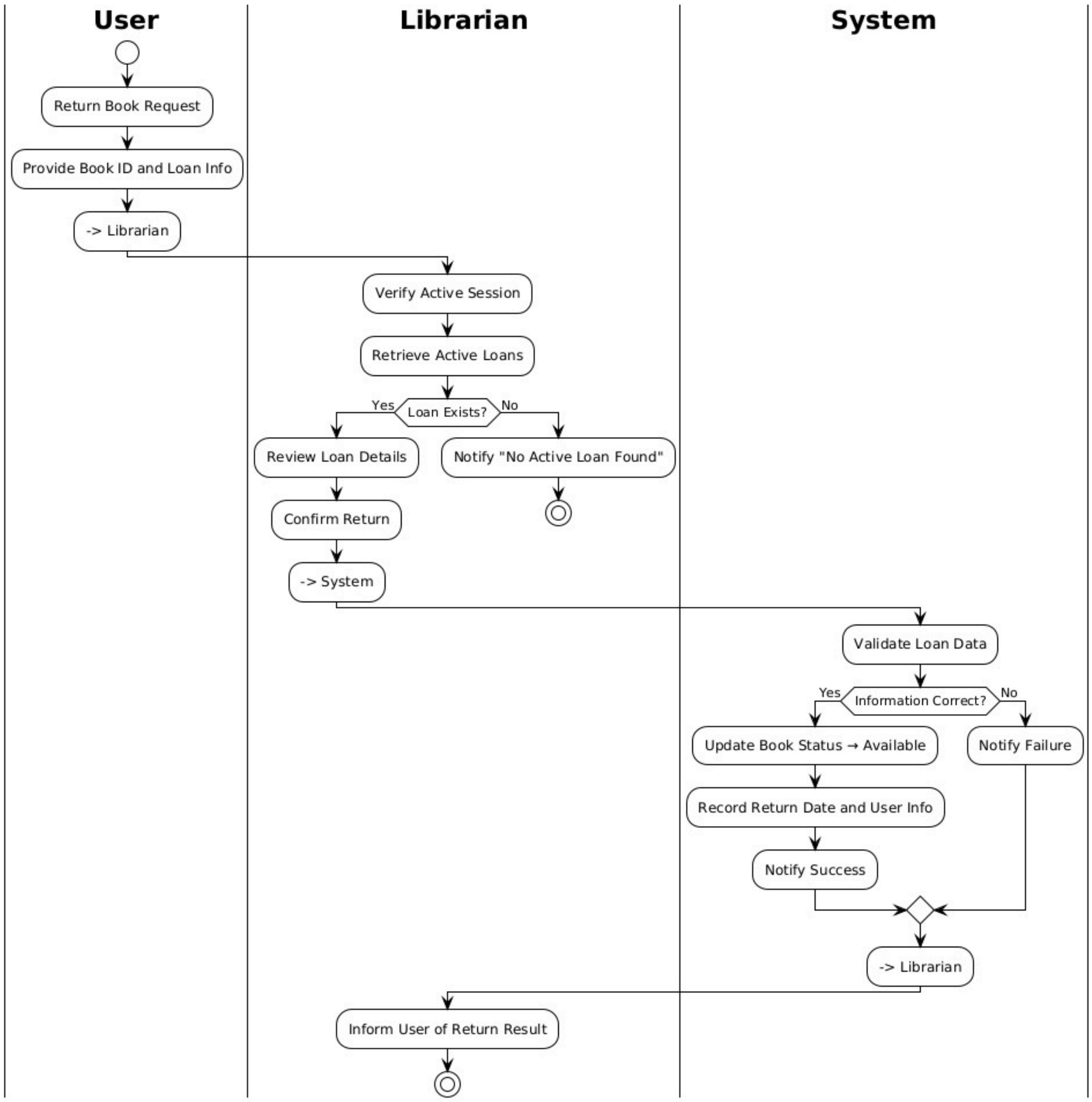


Image 4. US01 – Book Return Management

This process describes how a librarian manages the return of borrowed books. The user initiates the request by providing the book and loan details. The librarian verifies their active session, retrieves the active loans, and confirms that the loan exists. The system validates the information, updates the book status to "Available," and records the return date and user details. Finally, the librarian informs the user of the result, ensuring the inventory and loan records remain accurate and up to date.

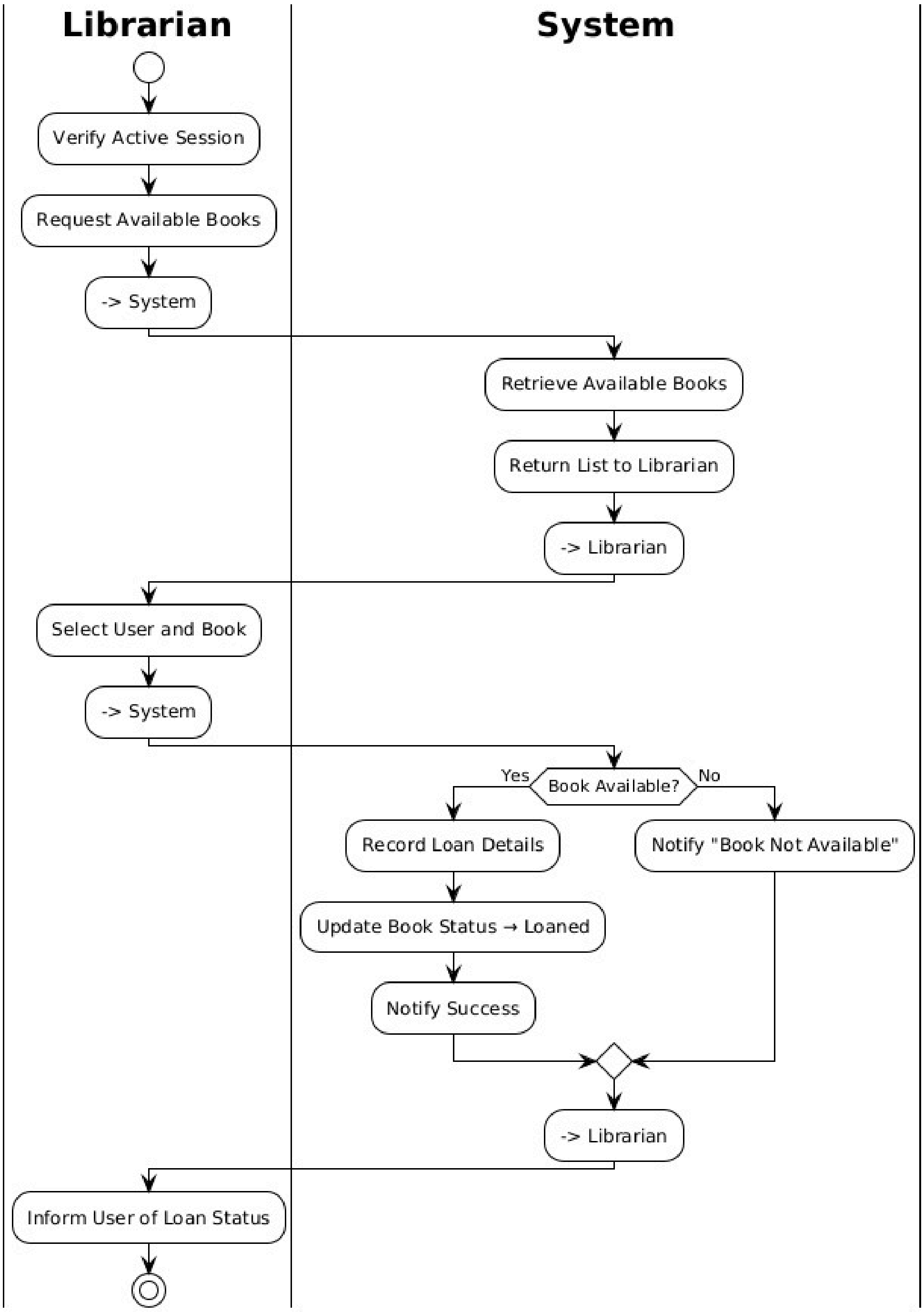


Image 5. US02 – Book Loan Management

This process explains how a librarian lends books to users. After verifying an active session, the librarian requests a list of available books from the system. Once a book and a user are selected, the system validates availability, records the loan details, and updates the book's status to "Loaned." If the transaction succeeds, a confirmation message is returned; otherwise, an error notification is shown. The process ensures each book loan is correctly tracked and prevents duplicate or invalid lending operations.

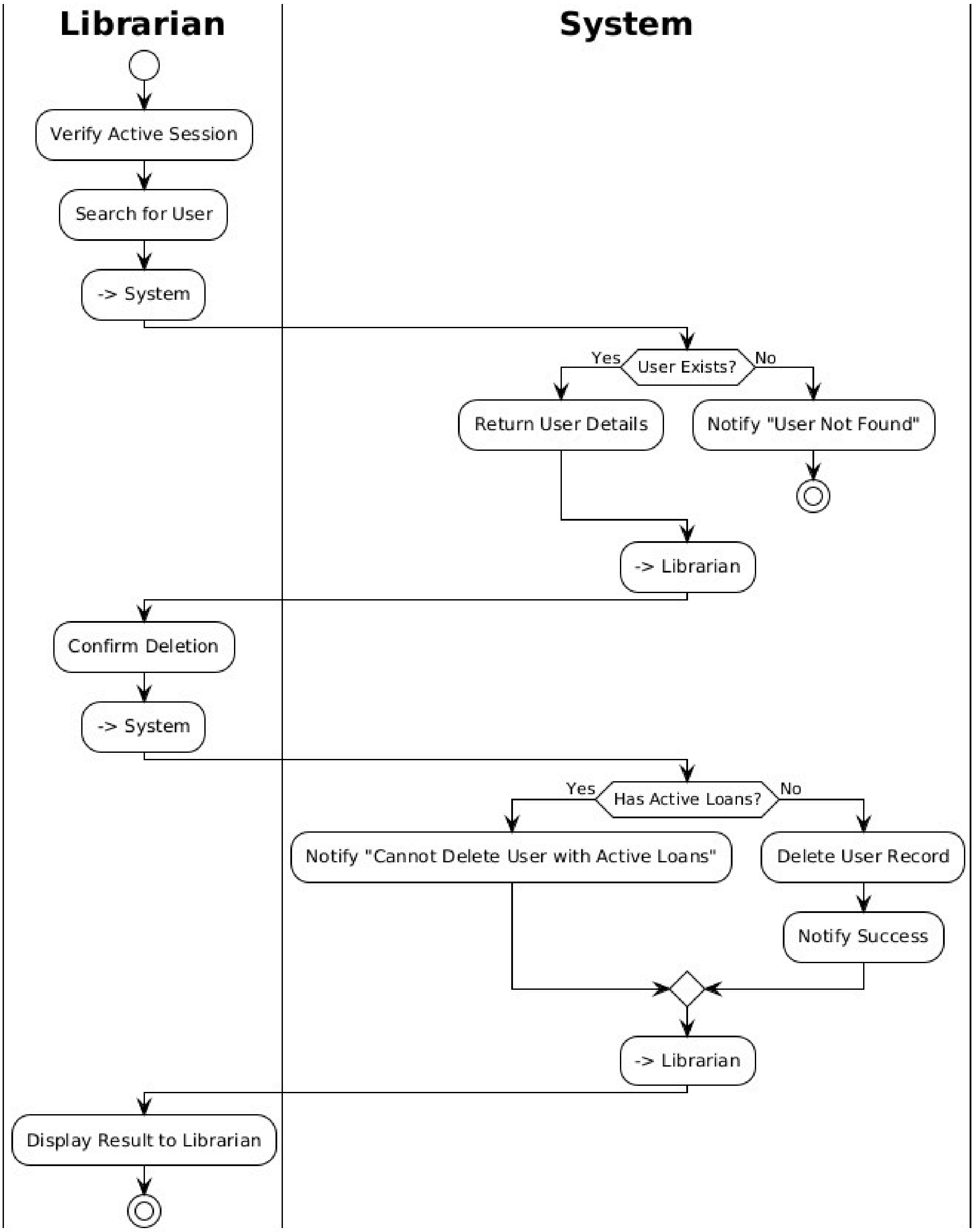


Image 6. US03 – Delete User

This diagram shows the procedure for deleting a user account. The librarian logs in, searches for the user, and requests the system to validate their existence. If the user exists and has no active loans, the system proceeds to remove the account and confirms the deletion. If the user has ongoing loans or does not exist, an error message is displayed. This process guarantees data integrity by preventing the accidental removal of users with active dependencies in the system.

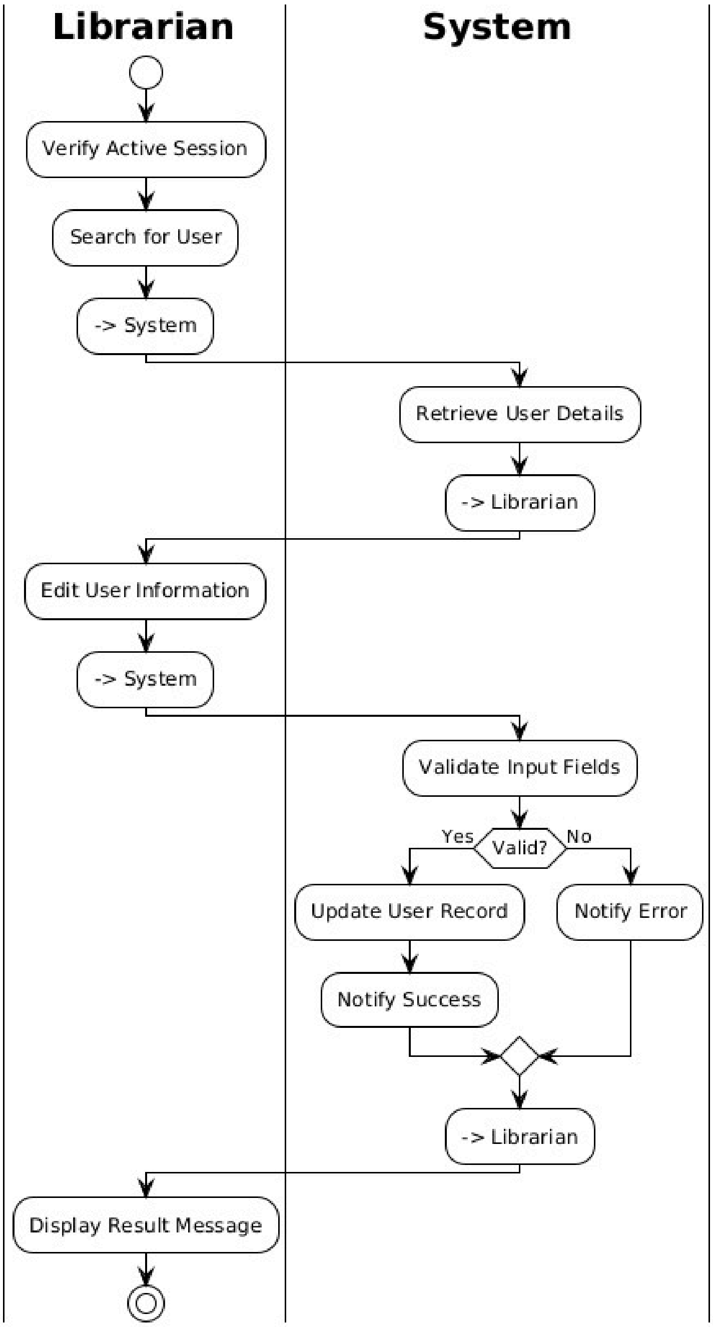


Image 7. US04 – Update User Information

This process describes how a librarian updates a user’s personal data. The librarian searches for the user and retrieves their current information from the system. After editing the necessary fields, the system validates the input to ensure completeness and correctness. If the information is valid, the database is updated, and a success message is shown; otherwise, an error notification appears. The goal of this process is to maintain accurate and reliable user records within the system.

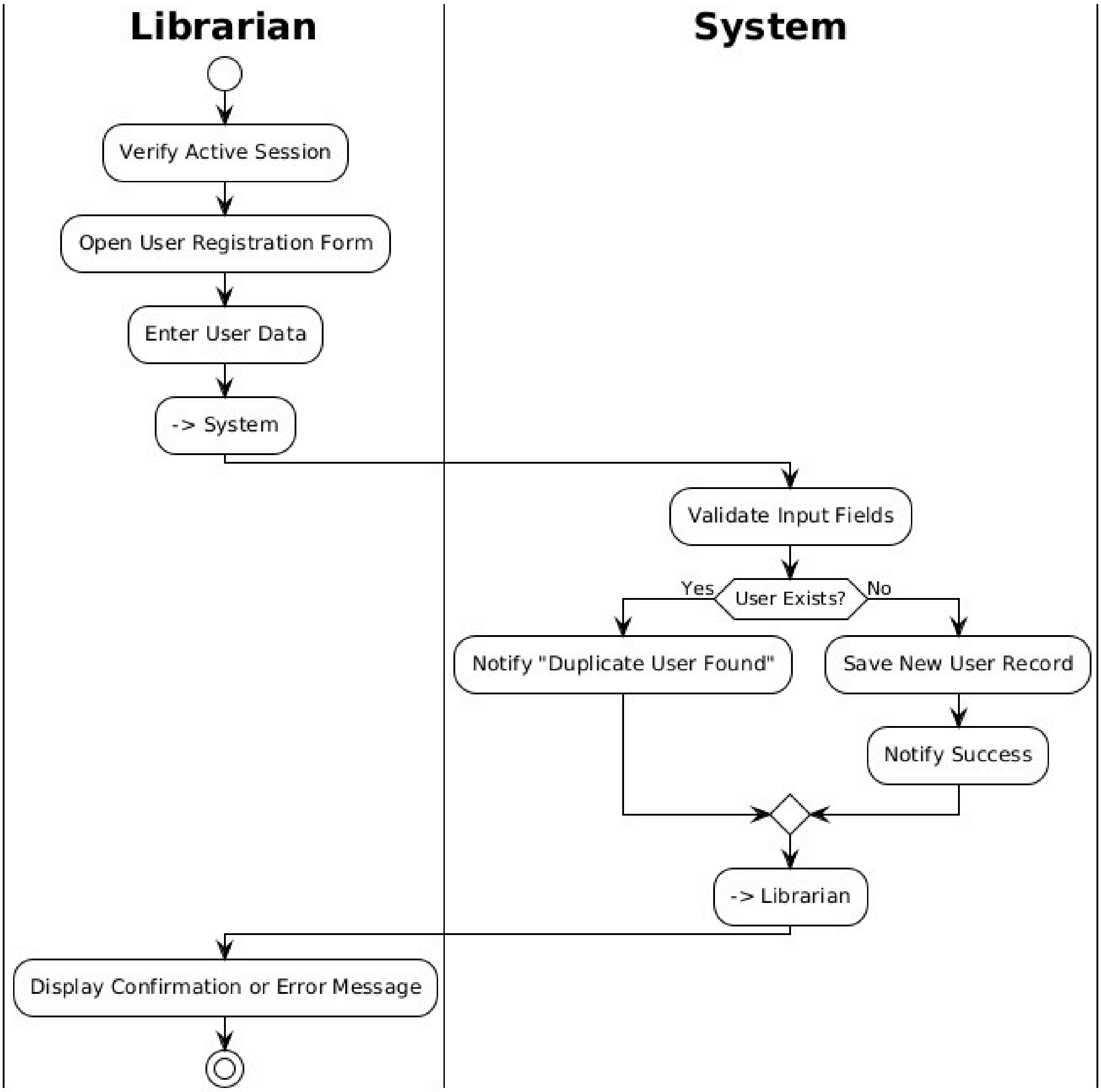


Image 8. US05 – Register New User

This process illustrates how new users are registered into the library system. The librarian opens the registration form, enters all required details, and sends them to the system. The system validates the data and checks if the user already exists. If no duplicate is found, the record is stored in the database, and a success message is displayed. If duplicates exist, an error message appears. This process ensures that every new user is properly registered with unique credentials and complete information.

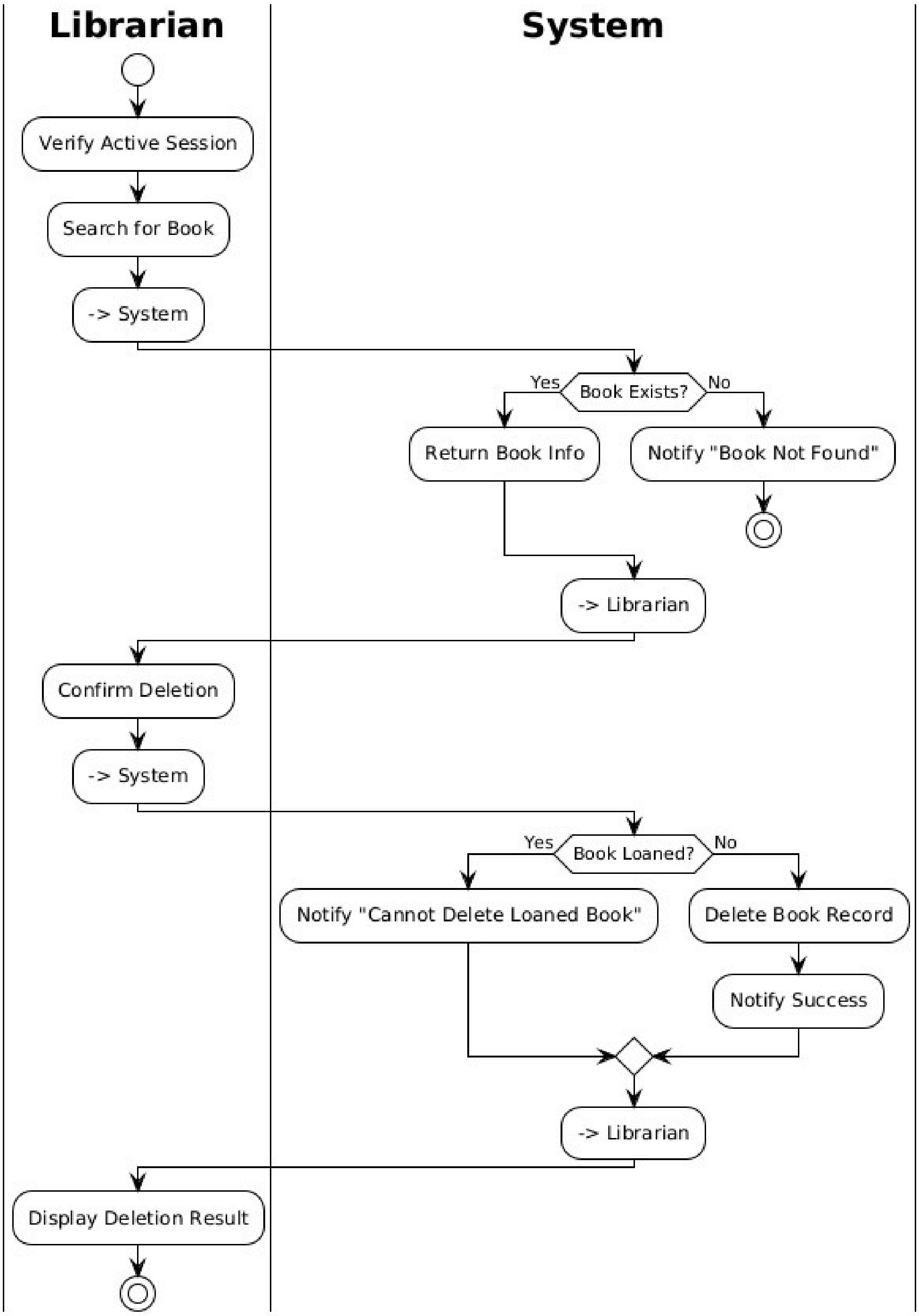


Image 9. US06 – Delete Book

This process defines how a librarian removes obsolete or damaged books from the catalog. The librarian searches for a specific book, and the system verifies its existence. If found, the librarian confirms the deletion. The system checks whether the book is currently on loan. If not, it deletes the record and sends a success notification. If the book is loaned or not found, an error message is displayed. This flow ensures proper control over book removal operations in the inventory.

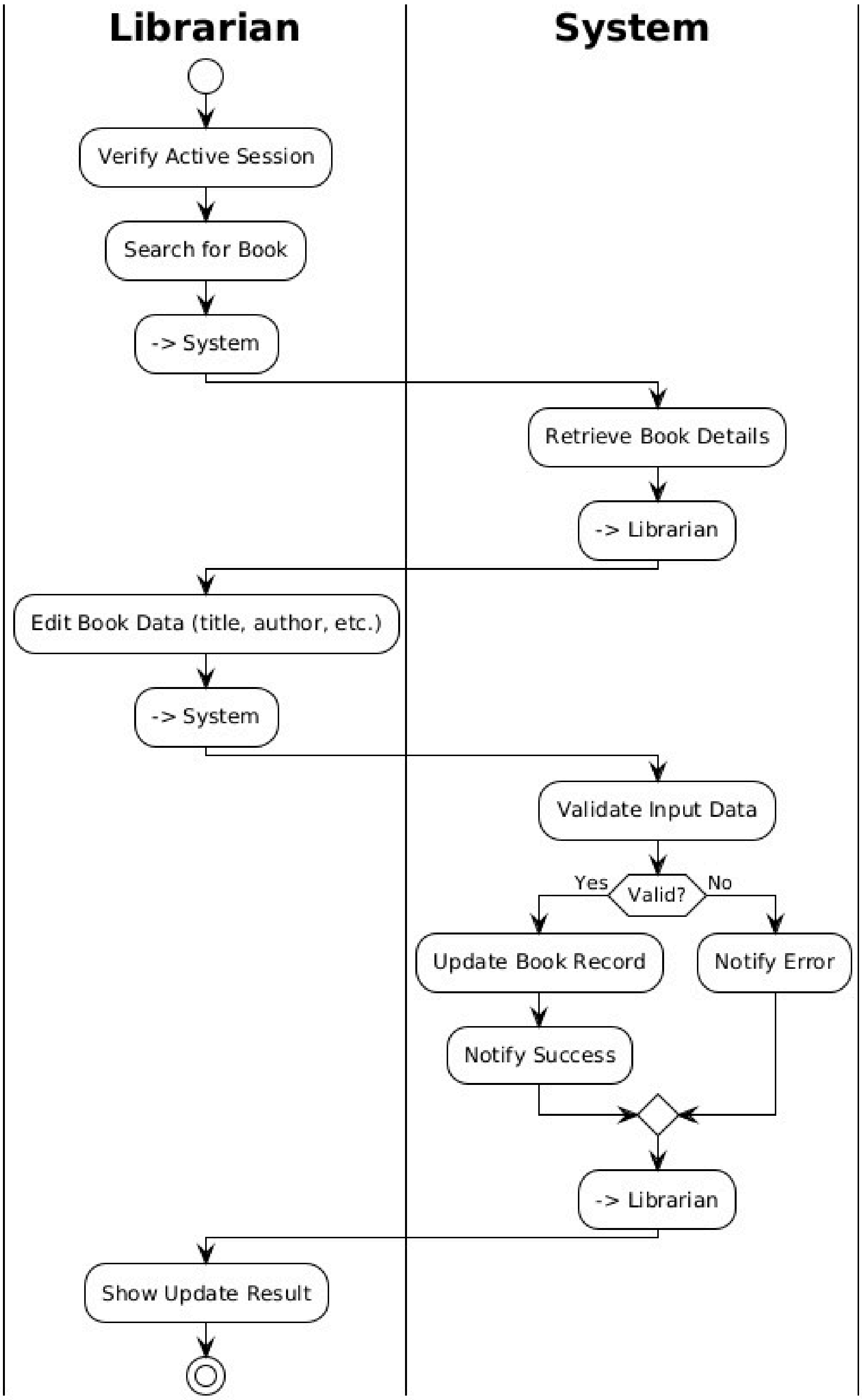


Image 10. US07 – Update Book Information

This process shows how a librarian edits existing book information. After searching for a book, the system retrieves its current details and displays them for editing. The librarian modifies fields such as title, author, or category, and submits the changes. The system validates all inputs and updates the database if the information is correct. If errors occur, a failure message is displayed. The process ensures that the library catalog remains consistent and accurately reflects the current book data.

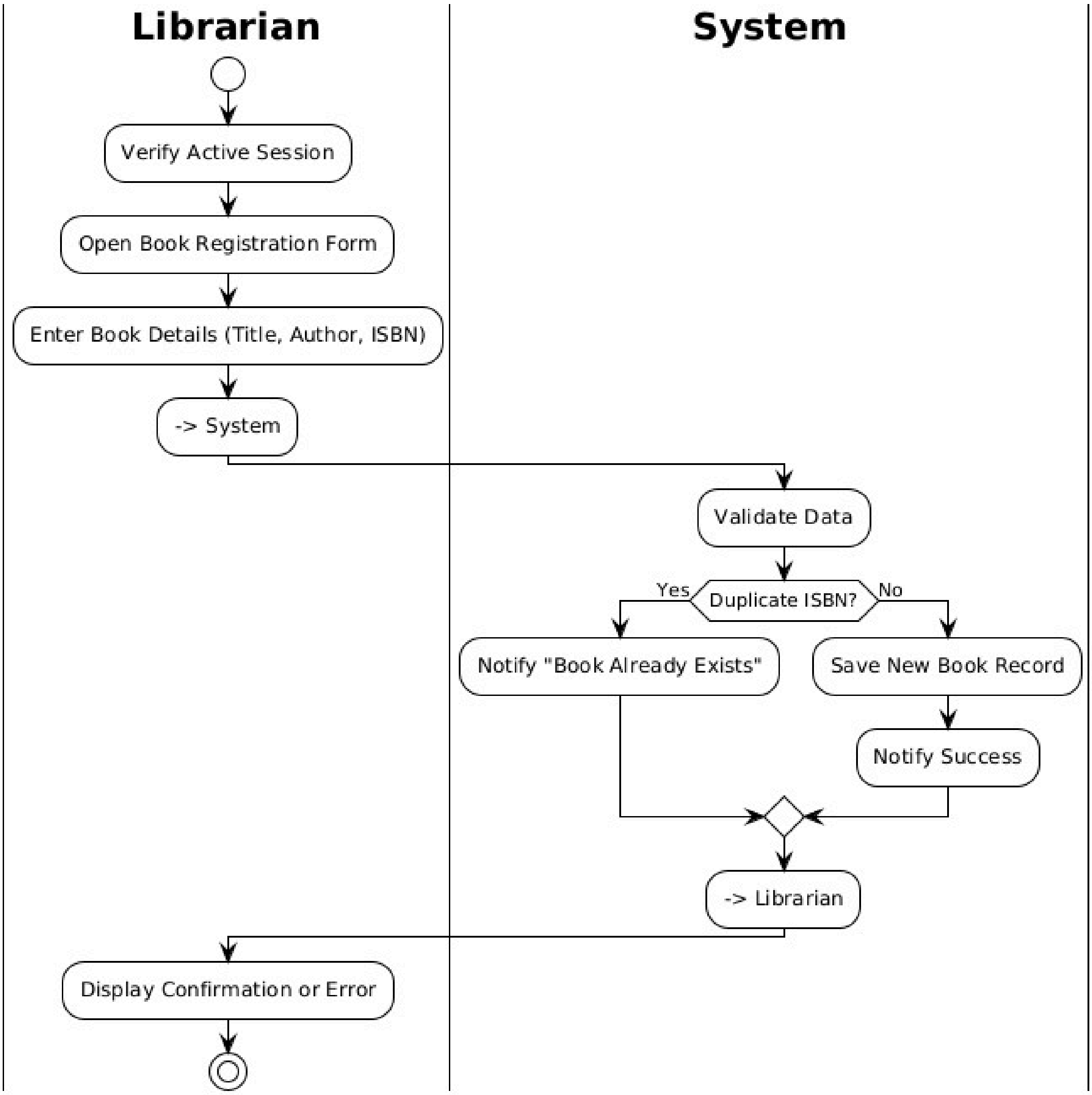

Librarian
System
Verify Active Session
Open Book Registration Form
Enter Book Details (Title, Author, ISBN)
-> System
Validate Data
Yes
Duplicate ISBN?
No
Notify "Book Already Exists"
Save New Book Record
Notify Success
-> Librarian
Display Confirmation or Error

Image 11. US08 – Register New Book

This process represents how a librarian adds new books to the catalog. After logging in, the librarian opens the registration form and enters the book's title, author, ISBN, and category. The system validates the data and checks for duplicates. If the book is not already registered, it saves the record and confirms success. If a duplicate ISBN is detected, it returns an error message. The process guarantees accurate catalog expansion and prevents data redundancy within the system.

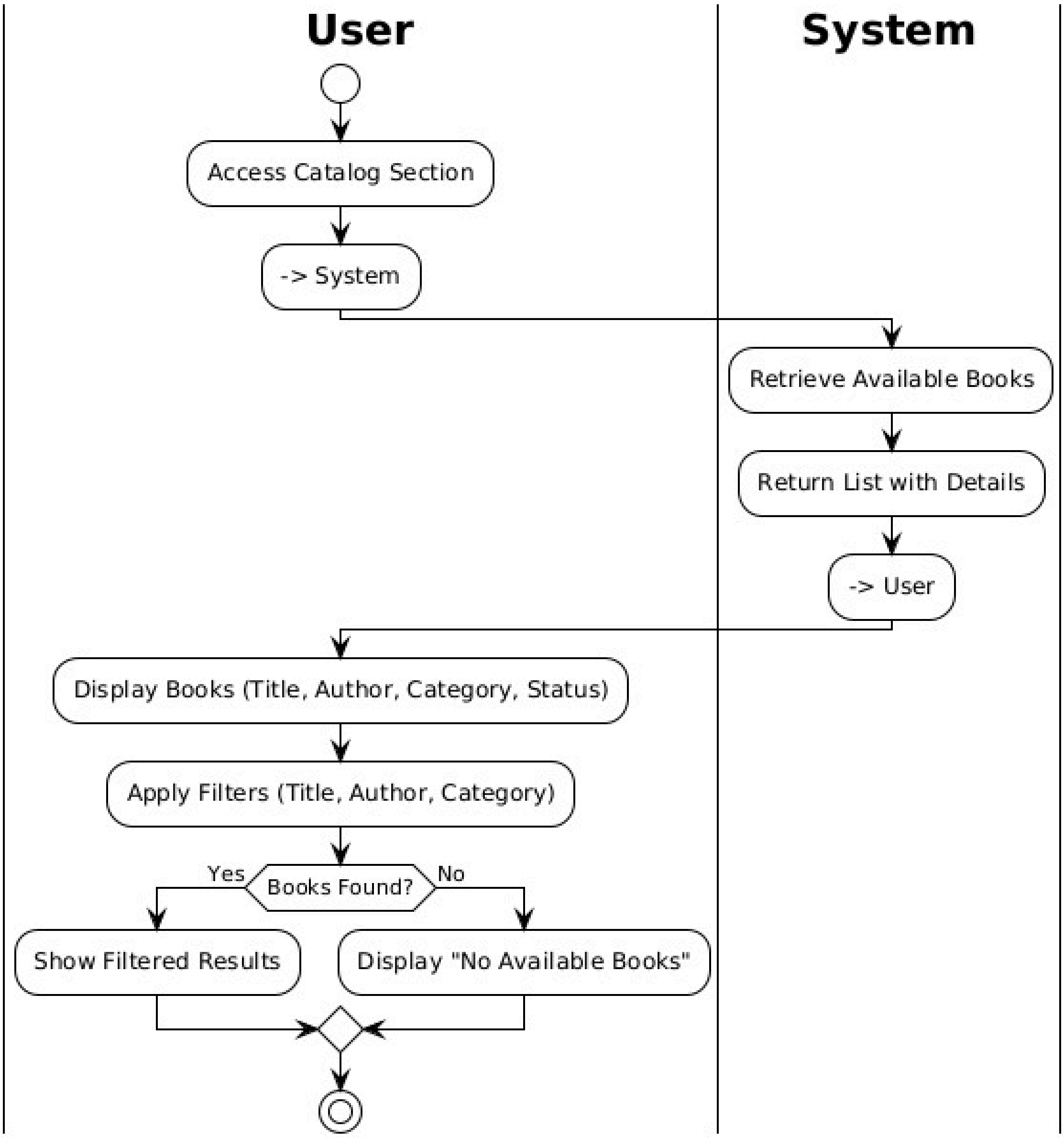


Image 12. US09 – View Available Books

This process illustrates how users browse the catalog to view available books. The user accesses the catalog section, and the system retrieves and displays the list of available titles with details such as author, category, and status. The user can apply filters by title, author, or category to refine the search. If no books match the criteria, the system displays an informative message. This process provides users with an intuitive and efficient way to explore the library's collection.

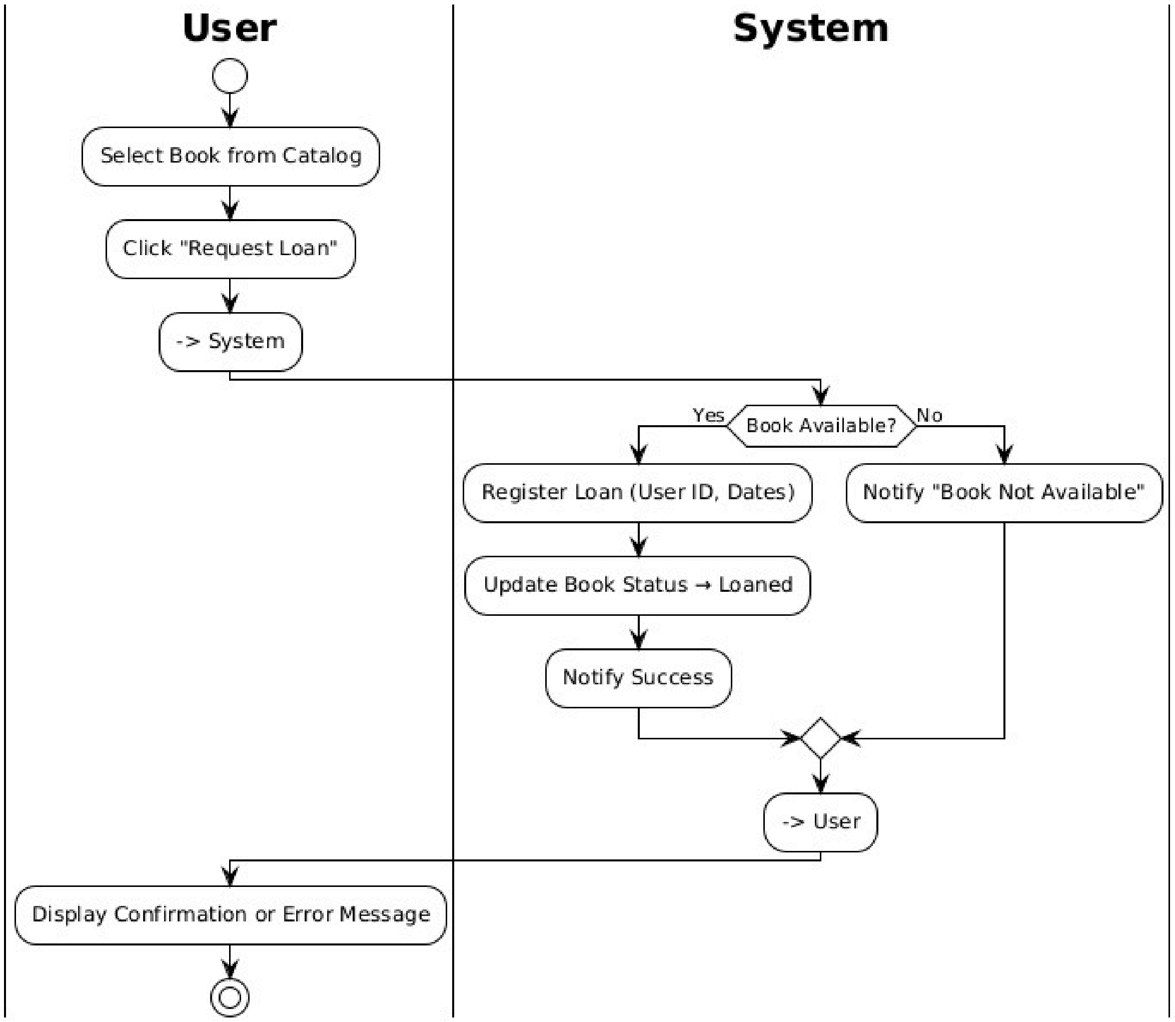

User
System
Select Book from Catalog
Click "Request Loan"
-> System
Book Available?
Yes
No
Register Loan (User ID, Dates)
Notify "Book Not Available"
Update Book Status → Loaned
Notify Success
-> User
Display Confirmation or Error Message

Image 13. US10 – Request a Book Loan

This process explains how a user requests to borrow a book. After selecting a book from the catalog, the user clicks “Request Loan.” The system checks availability and validates the request. If the book is available, it records the loan details, updates the book status to “Loaned,” and notifies success. Otherwise, it displays an error message. The process ensures that users can request loans easily while maintaining accurate book availability across the system.

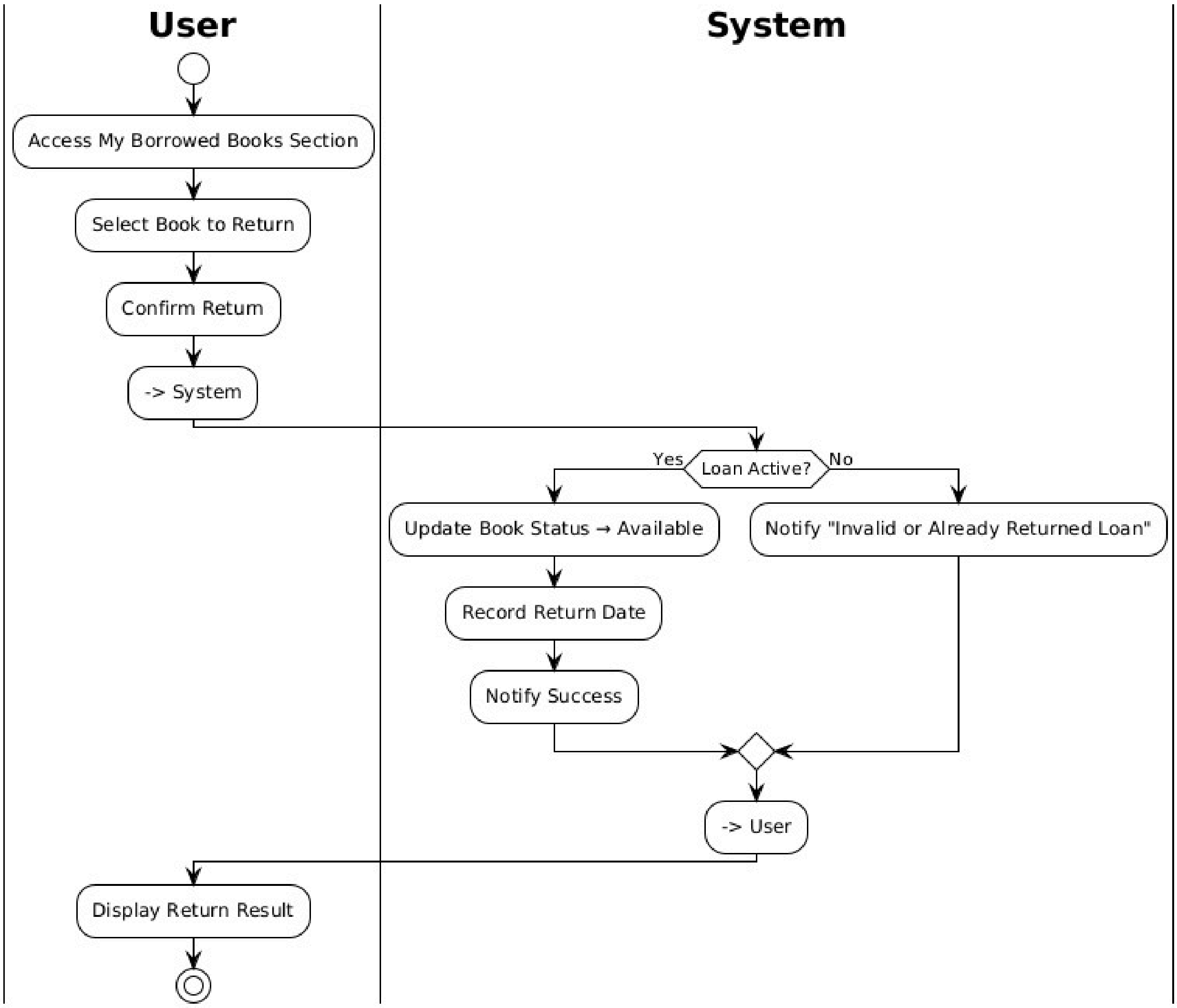


Image 14. US11 – Return a Borrowed Book

This process describes how users register the return of books they have borrowed. The user navigates to the "My Borrowed Books" section, selects the book to return, and confirms the action. The system verifies whether the loan is active. If valid, it updates the book's status to "Available," records the return date, and notifies success. If invalid, an error message is shown. This flow ensures proper synchronization between user actions and system records for book returns.

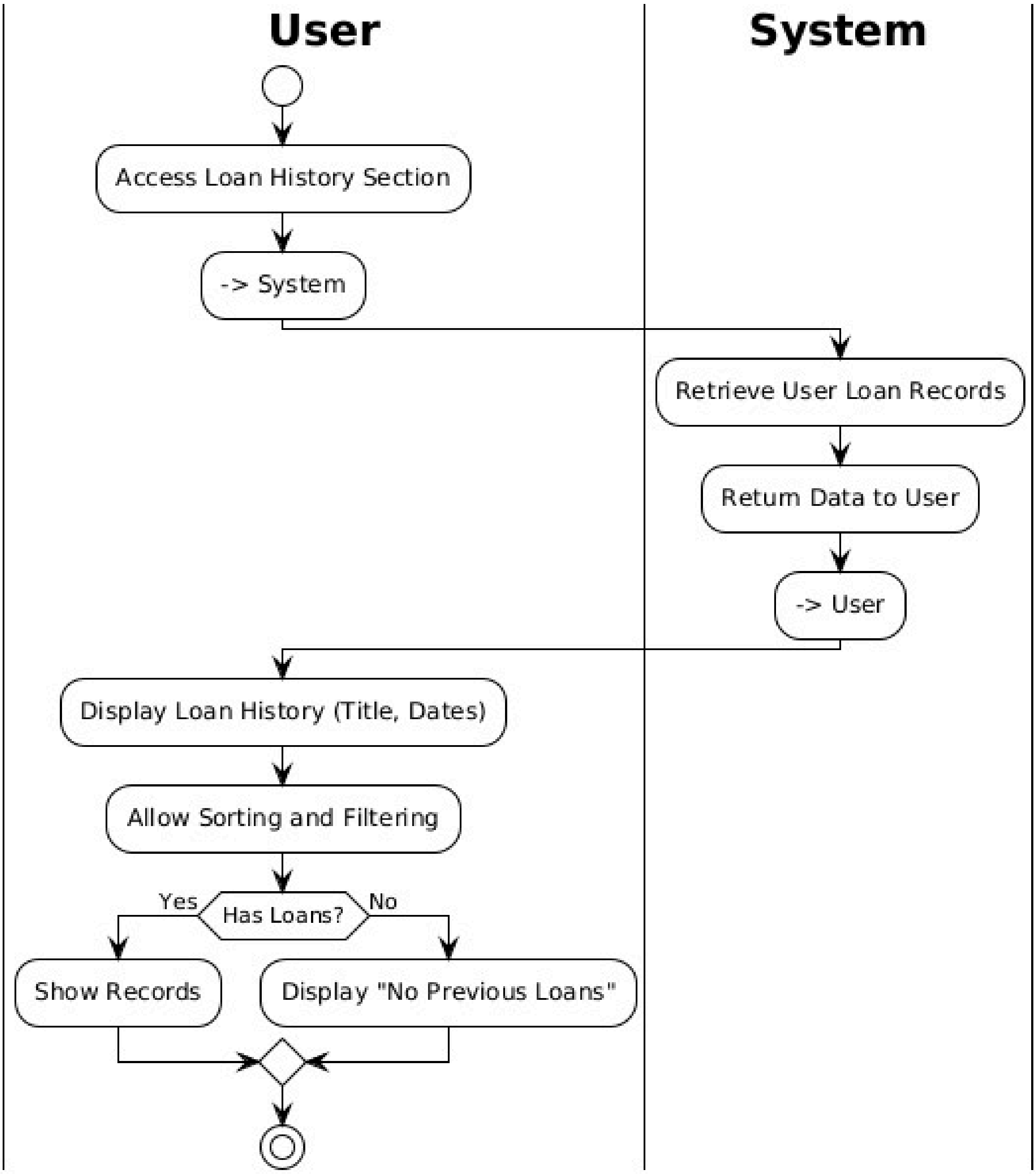

User
System
Access Loan History Section
-> System
Retrieve User Loan Records
Return Data to User
-> User
Display Loan History (Title, Dates)
Allow Sorting and Filtering
Yes
Has Loans?
No
Show Records
Display "No Previous Loans"

Image 15. US12 – View Loan History

This process details how users check their past loan activity. The user accesses the “Loan History” section, prompting the system to retrieve and display previous loans with relevant details such as title, loan date, and return date. Users can filter or sort the records by different criteria. If no history exists, an informative message is shown. The process provides transparency and helps users track their borrowing history within the library management system.

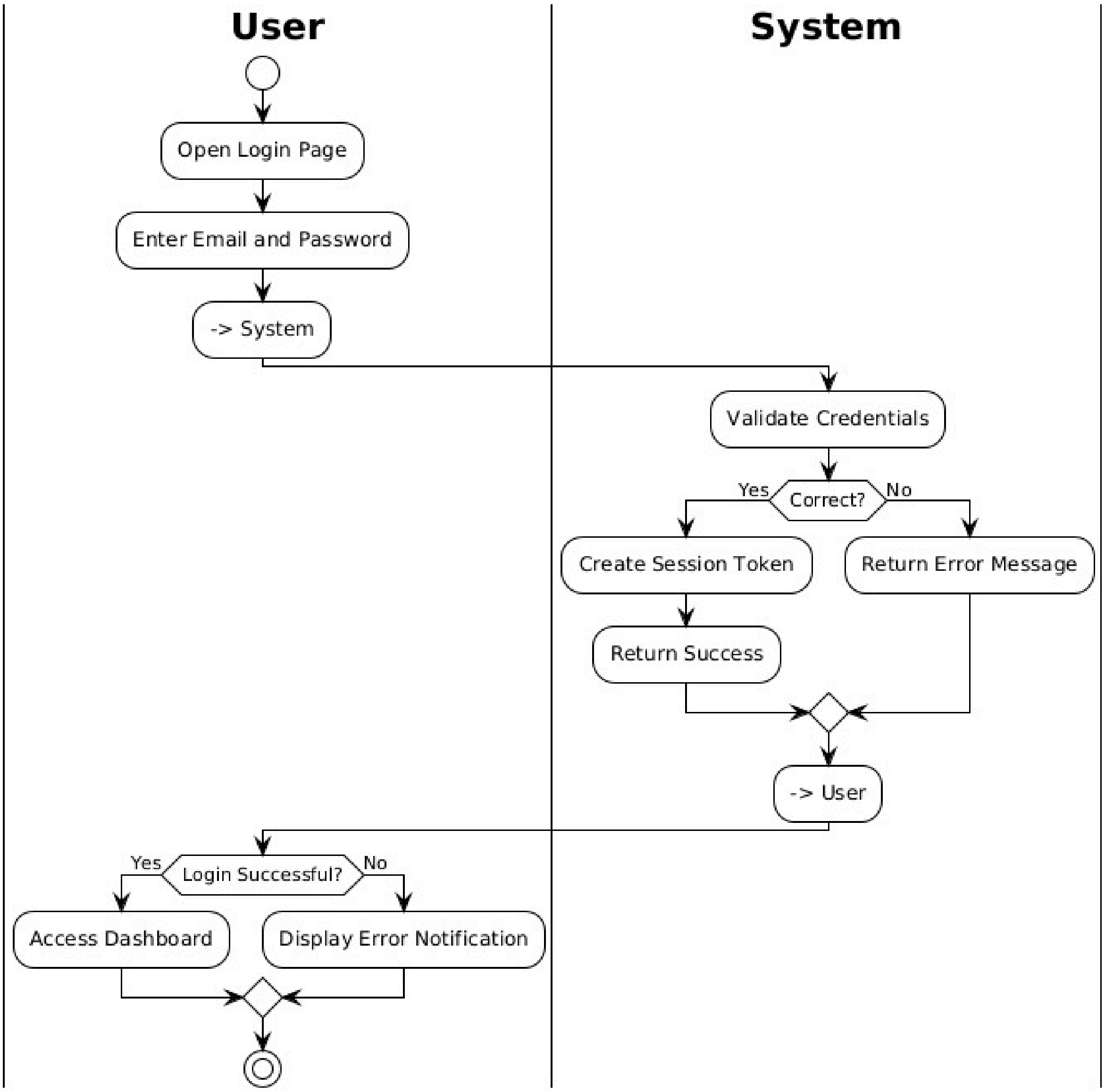


Image 16. US13 – Log In to the System

This process represents how a user accesses their account. The user enters credentials on the login page, and the system validates them. If the credentials are correct, a session token is created, granting system access. If not, an error message appears. Successful authentication redirects the user to their dashboard, while failed attempts display appropriate feedback. This process ensures secure and controlled access to the system, preventing unauthorized entry and maintaining data protection.

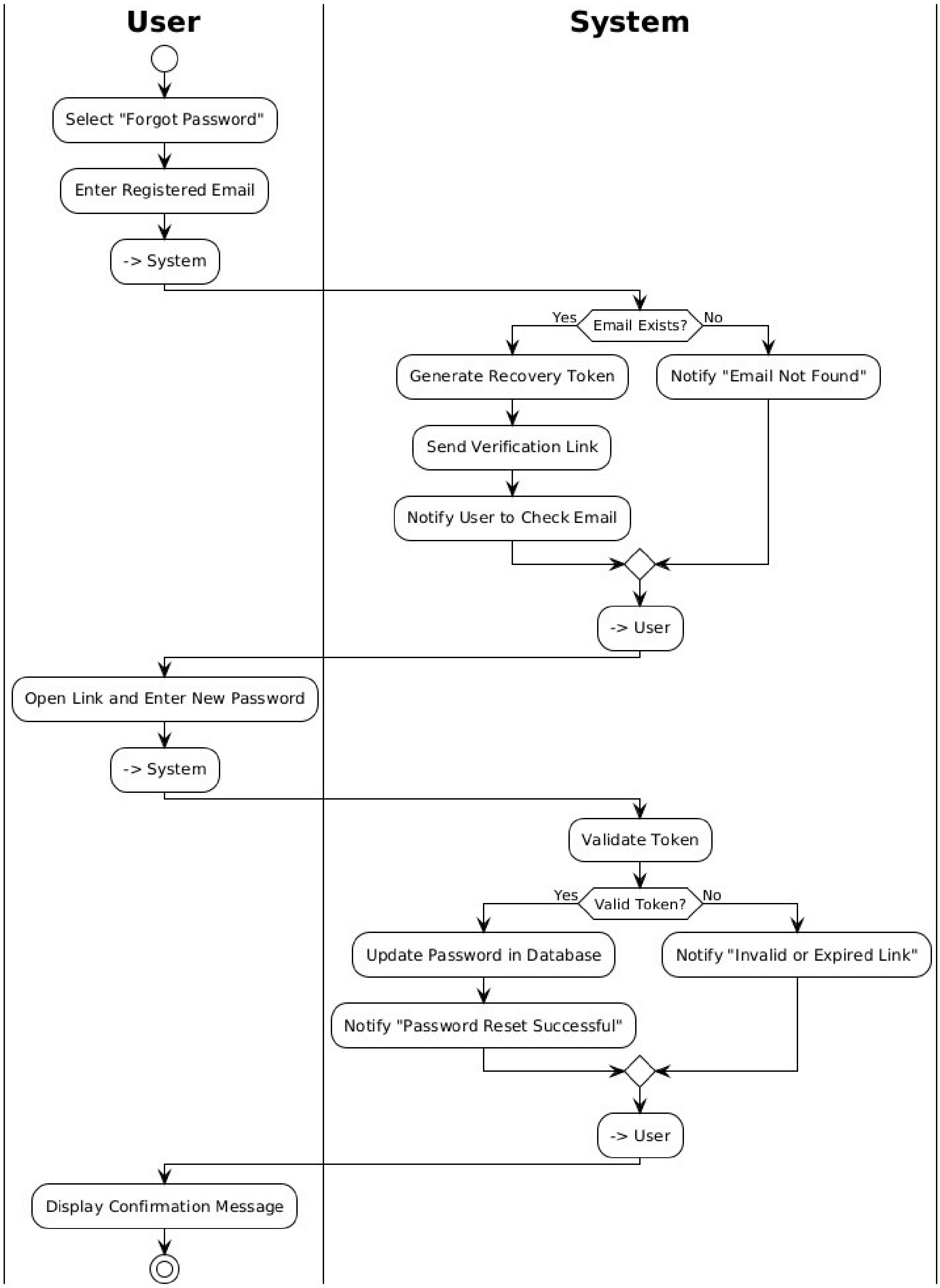
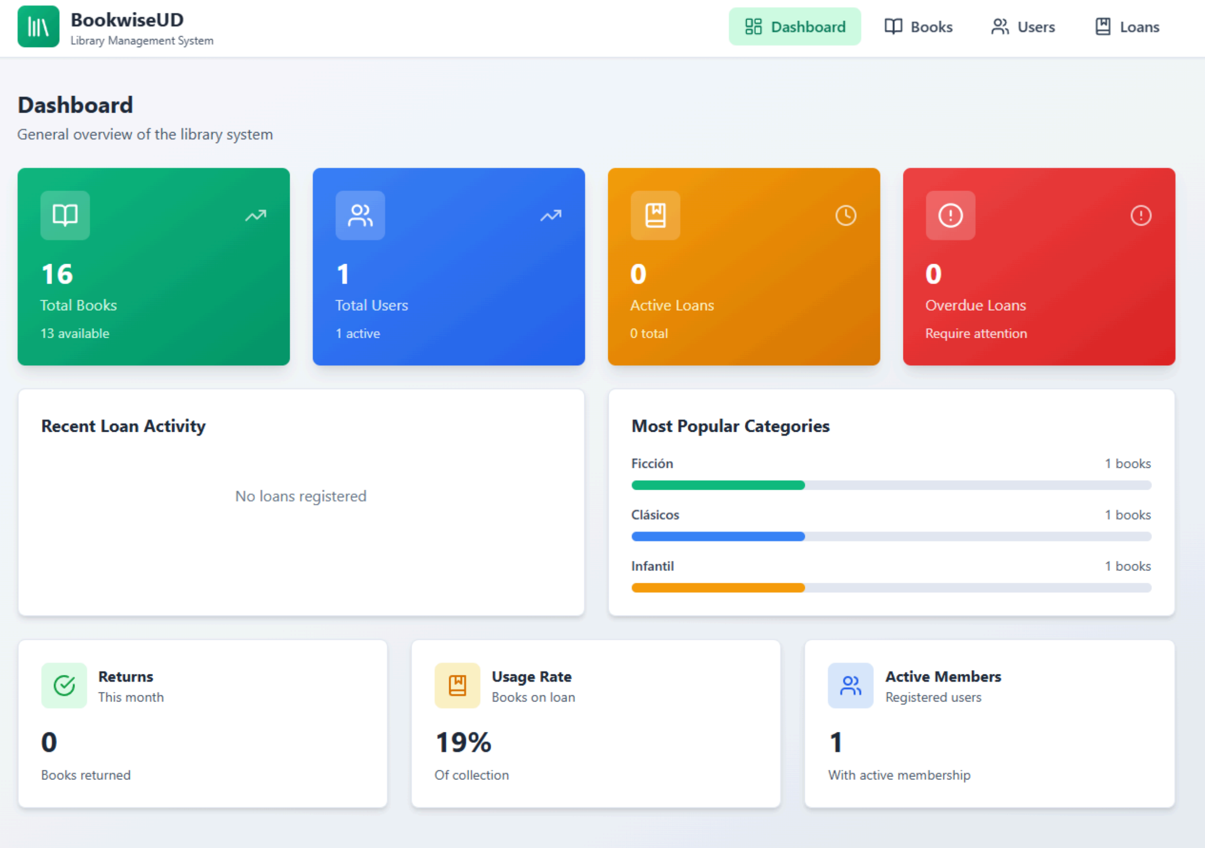


Image 17. US14 – Recover Account or Password

This process explains how users recover their accounts when they forget their passwords. The user selects “Forgot Password” and enters their registered email. The system verifies the email and sends a secure recovery link or code. The user opens the link, enters a new password, and submits it. The system validates the token, updates the credentials, and confirms the reset. If the token is invalid or expired, an error message is displayed. This process ensures secure password recovery and user account protection.

Web UI Progress



Dashboard

General overview of the library system

16
Total Books
13 available

1
Total Users
1 active

0
Active Loans
0 total

0
Overdue Loans
Require attention

Recent Loan Activity

No loans registered

Most Popular Categories

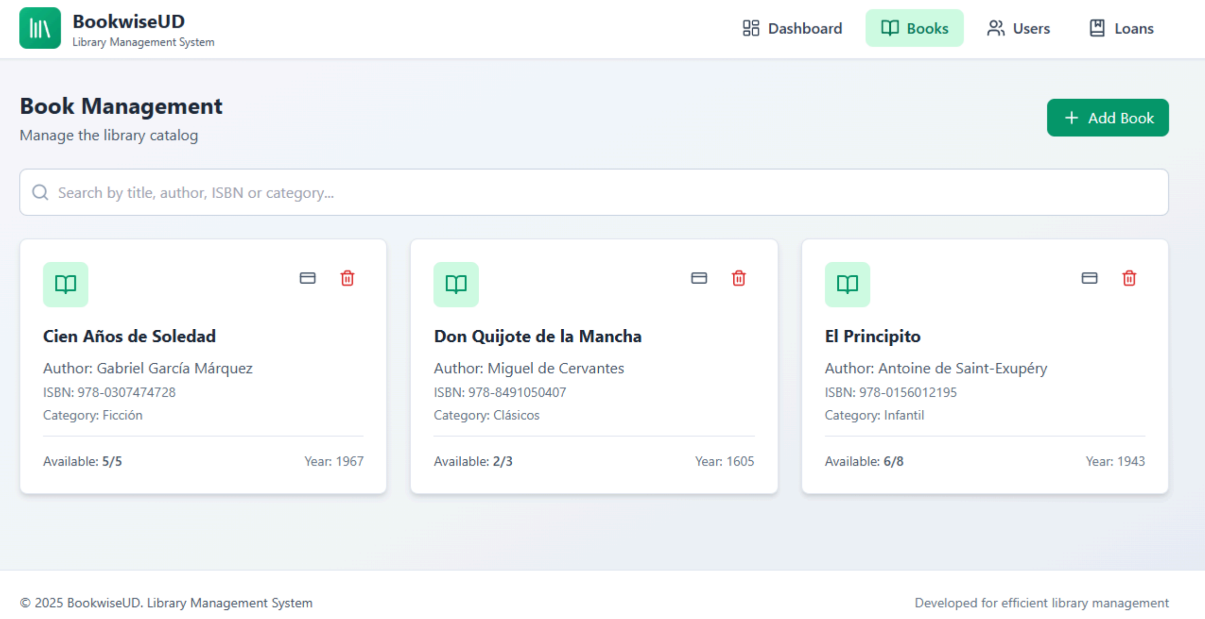
Ficción	1 books
Clásicos	1 books
Infantil	1 books

Returns
This month
0
Books returned

Usage Rate
Books on loan
19%
Of collection

Active Members
Registered users
1
With active membership

Image 18. Main dashboard with information on books and users.


BookwiseUD
Library Management System
Dashboard
Books
Users
Loans
+ Add Book
Search by title, author, ISBN or category...

Book Management

Manage the library catalog

Cien Años de Soledad
Author: Gabriel García Márquez
ISBN: 978-0307474728
Category: Ficción
Available: 5/5 Year: 1967

Don Quijote de la Mancha
Author: Miguel de Cervantes
ISBN: 978-8491050407
Category: Clásicos
Available: 2/3 Year: 1605

El Principito
Author: Antoine de Saint-Exupéry
ISBN: 978-0156012195
Category: Infantil
Available: 6/8 Year: 1943

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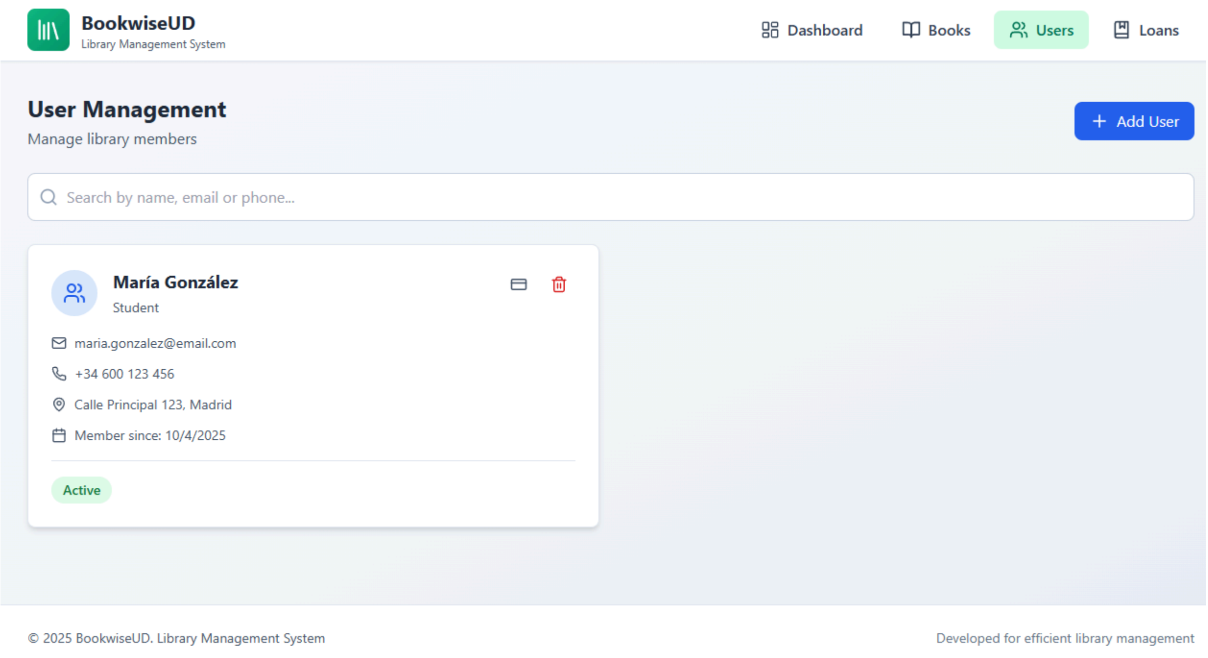
Developed for efficient library management

Image 19. Gallery showing all books and their availability.



User Management

Manage library members

María González

Student

maria.gonzalez@email.com

+34 600 123 456

Calle Principal 123, Madrid

Member since: 10/4/2025

Active

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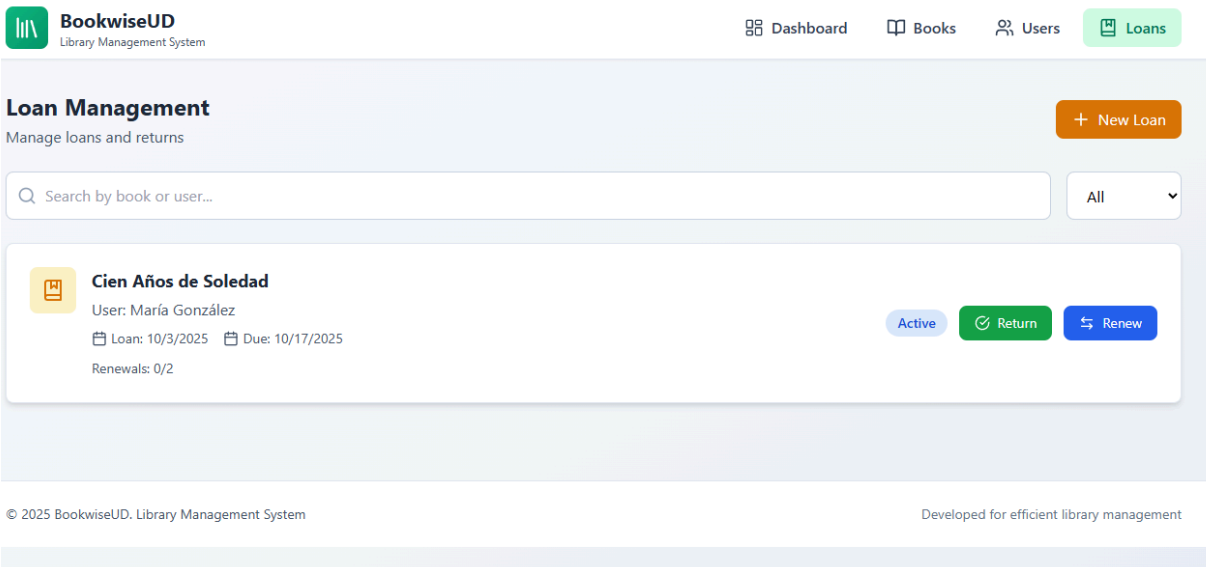
Developed for efficient library management

Image 20. User gallery with contact information.



Loan Management

Manage loans and returns

Cien Años de Soledad

User: María González

Loan: 10/3/2025 Due: 10/17/2025

Renewals: 0/2

Active

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Image 21. Book loan manager for users.

Conclusions

The BookWiseUD system successfully establishes a robust and scalable library management solution. Its multi-layered architecture, featuring a React frontend and separate Java and Python backend services, ensures modularity and clear separation of concerns. The implementation of core use cases, from user and book management to loan processing, demonstrates a well-structured domain model. The use of modern technologies like Docker and CI/CD pipelines facilitates efficient deployment and maintenance, providing a solid technical foundation for the application's functionality and future growth.

The project effectively addresses key operational needs through its intuitive user interface, which allows librarians and users to manage catalogues, loans, and accounts seamlessly. Processes for critical actions like loan management, returns, and user registration are clearly defined, ensuring data integrity and a smooth user experience. By combining a sound architectural design with comprehensive functional coverage, the system delivers an efficient, reliable, and user-friendly platform for modernizing library operations and services.