Software Requirements and Design Document

for

Librasys: Library Management System

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SCOPE: Library System Enhancement

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Introduction

Purpose

The Library Management System (LMS) project at FAST University aims to address challenges associated with the current outdated and user-unfriendly system. With a focus on User Management, Book Catalogue Management, and Book Loaning, the project seeks to create an intuitive and modern library system. Objectives include improving user profile management, optimizing book catalog processes, and streamlining book loan services. The proposed LMS features an online catalog, user-friendly profiles, and efficient resource management, promising to revolutionize library resource utilization for both students and faculty members.

Product scope

The Library Management System (LMS) we're developing for FAST University is all about bringing our library into the modern world. We want to make the whole library experience smoother and more user-friendly for both students and faculty. With features like easy user registration, a searchable online catalog, and a hassle-free book borrowing system, we're aiming to fix the issues with our current outdated system. The LMS is our way of showing that we're serious about providing a top-notch learning environment, aligning with FAST University's goals for a more modern and efficient academic experience.

Title

Revolutionizing Academic Resources: Implementation of an Advanced Library Management System for Enhanced User Experience at FAST University.

Objectives

1. **Enhance User Experience**: Streamline user interactions through improved registration, login, and profile management for a user-friendly experience.
2. **Modernize Book Catalog**: Upgrade the book catalog with efficient processes for adding new books, updating details, and implementing a user-friendly search system.
3. **Optimize Book Loaning**: Simplify and expedite book loaning, return processes, and reservations to enhance the overall lending experience.
4. **Introduce Online Catalog**: Implement a convenient online catalog for users to search and check book availability from any location.
5. **Improve Resource Management**: Track book loans, manage returns, and handle reservations efficiently for optimal resource utilization.
6. **Facilitate Information Flow**: Establish clear interfaces for each service to promote efficient information flow and interaction within the system.
7. **Enhance Accessibility**: Implement features to improve overall accessibility, making library services convenient for users.
8. **Address System Challenges**: Overcome challenges of the current system, including outdated features, to provide a modern and comprehensive solution.

Problem Statement

We're introducing the Library Management System project for FAST University because the current library setup is falling behind. The system is outdated, making it less user-friendly and causing a decline in its popularity among students and faculty. Manual processes for things like user registration and book management are slowing things down, impacting the overall library experience and resource allocation.

The heart of the issue lies in the system's failure to keep up with modern technology standards. Without a user-friendly online catalog, students and faculty struggle to find what they need, and inefficient book loaning processes just add to the frustration. It's not just a tech upgrade; it's a solution to boost accessibility, enhance user satisfaction, and make sure the university's library resources are making the impact they should.

Overall Description

Product Perspective

The Library Management System (LMS) for FAST University is designed as a standalone, self-contained product aimed at addressing the deficiencies in the existing library management system. It serves as a comprehensive solution to enhance user experience, streamline operations, and modernize resource management within the library context. The LMS is not a replacement for existing systems but a crucial evolution to meet the growing needs of students and faculty in the digital age.

In the context of the overall system, the LMS interacts with the university's broader academic infrastructure, ensuring seamless integration and data flow. It is essential to establish interfaces with related systems such as user authentication services, student databases, and academic resource databases.

Product Functions:

- User Management:
    - User Registration
    - Login Functionality
    - Profile Management
- Book Catalog Management:
    - Insertion of New Books
    - Updating Book Details
    - Swift Book Search
- Book Loaning Services:
    - Book Loaning
    - Return Management
    - Reservation Handling
- Online Catalog:
    - User-Friendly Online Catalog for Book Search and Availability

- Efficient Resource Management:
    - Tracking Book Loans
    - Managing Returns
    - Handling Reservations
- Interface Definition:
    - Unique Interfaces for Each Service

User-centric features of this LMS cover registration, login, and profile management, while book-related functions include efficient catalog management, loaning services, and an accessible online catalog. The system focuses on optimizing resource management, including tracking loans, managing returns, and handling reservations. Each service defines a clear interface to ensure streamlined functionality. Class diagram is provided in this document towards the end.

List of Use Cases

1. Register User Profile
2. Log In
3. Update User Profile
4. Add New Book
5. Update Book Details
6. Search for Books
7. Loan Book
8. Return Book
9. Manage Reservations
10. View Catalog
11. Track Book Loans
12. Generate Reports
13. Receive Book Reservations
14. Set Due Dates
15. Remove Book

Extended Use Cases

Use Case 1: Moiez Asif

a. Use case name: Register User Profile

b. Scope: Library Management System

c. Level: User goal

d. Primary actor: Librarian and patrons

e. Stakeholders and interests:

Librarian: Interested in maintaining user profiles for library management.

Patrons: Interested in accessing library services through their profiles.

f. Preconditions: None

g. Postcondition: User profile is created and stored in the system.

h. Main success scenario:

Actor Action:	**System Responsibility:**
1. A librarian or patron selects the "Register" option.	**2.** The system prompts for necessary user information (e.g., name, contact details).
3. The user provides the required information.	**4.** The system validates the information and creates a user profile.
	5. The system confirms successful registration.

i. Extensions:

If the user provides invalid information during registration (e.g., an invalid email address), the system displays an error message and prompts the user to correct the information.

Use Case 2: Moiez Asif

a. Use case name: Log In

b. Scope: Library Management System

c. Level: User goal

d. Primary actor: Librarian and patrons

e. Stakeholders and interests:

Librarian: Interested in accessing administrative functions.

Patrons: Interested in accessing their account and library services.

f. Preconditions: Registered user profile exists.

g. Postcondition: User is successfully logged into the system.

h. Main success scenario:

Actor Action:	**System Responsibility:**
1. A librarian or patron selects the "Log In" option.	**5.** The user gains access to their respective account.
3. The user provides valid credentials.	**System Responsibility:**
	2. The system prompts for user credentials (e.g., username and password).

4. The system verifies the credentials and grants access.

i. Extensions:

If the user enters incorrect credentials, the system displays an error message and allows the user to retry the login.

If the user repeatedly fails to log in, the account may be temporarily locked for security reasons, and the user may need to reset their password.

Use Case 3: Aasir Farrukh

a. Use case name: Update User Profile

b. Scope: Library Management System

c. Level: User goal

d. Primary actor: Librarian and patrons

e. Stakeholders and interests:

Librarian: Interested in updating user profiles for administrative purposes.

Patrons: Interested in keeping their profiles current.

f. Preconditions: User is logged in.

g. Postcondition: User profile is updated with new information.

h. Main success scenario:

Actor Action:	**System Responsibility:**
1. A librarian or patron selects the "Update Profile" option.	**2.** The system displays the user's current profile information.
3. The user makes changes to the desired information.	**4.** The system updates the profile with the new information.
	5. The system confirms the successful update.

i. Extensions:

If the user tries to update information that violates system rules (e.g., changing their username to an existing one), the system informs the user of the conflict and requests an alternative action.

Use Case 4: Aasir Farrukh

a. Use case name: Add New Book

b. Scope: Library Management System

c. Level: User goal

d. Primary actor: Librarian

e. Stakeholders and interests:

Librarian: Interested in expanding the library catalog with new books.

f. Preconditions: Librarian is logged in.

g. Postcondition: New book is added to the library catalog.

h. Main success scenario:

Actor Action:	**System Responsibility:**
1. Librarian selects the "Add New Book" option.	**2.** The system prompts for book details (e.g., title, author, ISBN).
3. The librarian enters the required information.	**4.** The system validates the data and adds the book to the catalog.
	5. The system confirms the successful addition.

i. Extensions: If the book information provided by the librarian is incomplete or contains errors, the system prompts the librarian to correct the information.

Use Case 5: Aasir Farrukh

a. Use case name: Update Book Details

b. Scope: Library Management System

c. Level: User goal

d. Primary actor: Librarian

e. Stakeholders and interests:

Librarian: Interested in keeping book information accurate and up to date.

f. Preconditions: Librarian is logged in, and the book exists in the catalog.

g. Postcondition: Book details are successfully updated.

h. Main success scenario:

Actor Action:	**System Responsibility:**
1. The librarian selects the "Update Book Details" option.	**2.** The system displays the current book details.
3. The librarian makes changes to the book's information.	

4. The system updates the book details.

5. The system confirms the successful update.

i. Extensions:

If the librarian tries to update book details that would conflict with other books in the catalog (e.g., duplicate ISBN), the system informs the librarian and asks for correction.

Use Case 6: Aasir Farrukh

a. Use case name: Search for Books

b. Scope: Library Management System

c. Level: User goal

d. Primary actor: Patrons

e. Stakeholders and interests:

Patrons: Interested in finding books in the library catalog.

f. Preconditions: Patron is logged in.

g. Postcondition: Patrons receive search results matching their query.

h. Main success scenario:

Actor Action:	**System Responsibility:**
1. Patron selects the "Search for Books" option.	**2.** The system provides a search interface.
3. Patron enters search criteria (e.g., title, author, keywords).	**4.** The system retrieves and displays matching book results.
5. Patron can view book details or check availability.	

i. Extensions:

If no search results match the patron's query, the system should provide alternative suggestions or prompt the patron to refine their search.

Use Case 7: Moiez Asif

a. Use case name: Loan Book

b. Scope: Library Management System

c. Level: User goal

d. Primary actor: Patrons

e. Stakeholders and interests:

Patrons: Interested in borrowing books from the library.

f. Preconditions: Patron is logged in, and the book is available.

g. Postcondition: Patron successfully borrows the book, and the book's status changes to "on loan."

h. Main success scenario:

Actor Action:	**System Responsibility:**
1. Patron selects the "Loan Book" option.	**2.** The system displays available books.
3. Patron selects a book for loan.	**4.** The system updates the book's status and assigns it to the patron.
5. Patron confirms the loan, and the system records the transaction.	

i. Extensions:

If the book is not available for loan (e.g., already on loan or reserved), the system informs the patron and suggests an alternative action.

Use Case 8: Moiez Asif

a. Use case name: Return Book

b. Scope: Library Management System

c. Level: User goal

d. Primary actor: Patrons

e. Stakeholders and interests:

Patrons: Interested in returning borrowed books to the library.

f. Preconditions: Patron is logged in, and the patron has borrowed books.

g. Postcondition: Book is successfully returned to the library, and the book's status changes to "available."

h. Main success scenario:

Actor Action:	**System Responsibility:**
1. Patron selects the "Return Book" option.	**2.** The system displays the list of borrowed books.
3. Patron selects the book to return.	**4.** The system updates the book's status to "available."
5. Patron confirms the return, and the system records the transaction.	

i. Extensions:

If the patron tries to return a book that has been damaged or is overdue, the system may apply relevant penalties or inform the patron of the issue.

Use Case 9: Moiez Asif

a. Use case name: Manage Reservations

b. Scope: Library Management System

c. Level: User goal

d. Primary actor: Patrons

e. Stakeholders and interests:

Patrons: Interested in reserving books that are currently unavailable.

f. Preconditions: Patron is logged in, and the book is not available.

g. Postcondition: Patron successfully places or cancels a book reservation.

h. Main success scenario:

Actor Action:

1. Patron selects the "Manage Reservations" option.

3. Patron can place a reservation for an unavailable book or cancel an existing reservation.

5. Patron receives confirmation of the reservation or cancellation.

System Responsibility:

2. The system displays a list of reserved books and available books.

4. The system updates reservation information accordingly.

i. Extensions:

If a reserved book becomes available, the system notifies the patron who reserved it and sets a time limit for them to confirm or cancel the reservation.

Use Case 10: Aasir Farrukh

a. Use case name: View Catalog

b. Scope: Library Management System

c. Level: User goal

d. Primary actor: Patrons

e. Stakeholders and interests:

Patrons: Interested in browsing the entire library catalog online.

f. Preconditions: Patron is logged in.

g. Postcondition: Patrons can view the library catalog and book details.

h. Main success scenario:

Actor Action:	**System Responsibility:**
1. Patron selects the "View Catalog" option.	**2.** The system displays the complete library catalog.
3. Patron can browse and search for books.	
4. Patron can view detailed information about each book.	

i. Extensions:

The system may provide advanced search options, filters, or sorting criteria to enhance the patron's catalog viewing experience.

Use Case 11: Moiez Asif

a. Use case name: Track Book Loans

b. Scope: Library Management System

c. Level: User goal

d. Primary actor: Librarian

e. Stakeholders and interests:

Librarian: Interested in monitoring the status of borrowed books.

f. Preconditions: Librarian is logged in.

g. Postcondition: Librarian can view the status of borrowed books.

h. Main success scenario:

Actor Action:	**System Responsibility:**
1. Librarian selects the "Track Book Loans" option.	**2.** The system provides a list of borrowed books and their due dates.
3. Librarian can see which books are checked out and when they are due for return.	

i. Extensions:

The librarian may generate overdue notices and send them to patrons with overdue books.

Use Case 12: Moiez Asif

a. Use case name: Generate Reports

b. Scope: Library Management System

c. Level: User goal

d. Primary actor: Librarian

e. Stakeholders and interests:

Librarian: Interested in obtaining reports on book availability, loans, and user activities.

f. Preconditions: Librarian is logged in.

g. Postcondition: Librarian receives the requested reports.

h. Main success scenario:

Actor Action:	**System Responsibility:**
1. Librarian selects the "Generate Reports" option.	**2.** The system provides options to select the type of report (e.g., book availability, loans, user activity).
3. Librarian specifies the criteria for the report.	**4.** The system generates and presents the report to the librarian.

i. Extensions:

If there are no records to generate a report (e.g., no user activities during a specific period), the system informs the librarian of the lack of data for that report.

Use Case 13: Moiez Asif

a. Use case name: Receive Book Reservations

b. Scope: Library Management System

c. Level: User goal

d. Primary actor: Librarian

e. Stakeholders and interests:

Librarian: Interested in managing book reservations.

f. Preconditions: Librarian is logged in, and a book has been reserved by a patron.

g. Postcondition: Librarian acknowledges and manages book reservations.

h. Main success scenario:

Actor Action:	**System Responsibility:**
1. Librarian receives notifications about new book reservations.	**2.** The system provides a list of reserved books and the patrons who reserved them.
3. Librarian can acknowledge and manage the reservations.	

i. Extensions:

If a librarian cannot make a reservation (e.g., due to a lost book), the system should provide a mechanism for the librarian to communicate with the patron and offer alternatives.

Use Case 14: Aasir Farrukh

a. Use case name: Set Due Dates

b. Scope: Library Management System

c. Level: User goal

d. Primary actor: Librarian

e. Stakeholders and interests:

Librarian: Interested in setting due dates for borrowed books.

f. Preconditions: Librarian is logged in, and a book has been borrowed.

g. Postcondition: Due date for borrowed books is updated.

h. Main success scenario:

Actor Action:	**System Responsibility:**
1. Librarian selects the "Set Due Dates" option.	**2.** The system provides a list of borrowed books and their current due dates.
3. Librarian can modify the due dates as needed.	**4.** The system updates the due dates for the selected books.

i. Extensions:

The system may send due date reminders to patrons as their due dates approach.

Use Case 15: Aasir Farrukh

a. Use case name: Remove Book

b. Scope: Library Management System

c. Level: User goal

d. Primary actor: Librarian

e. Stakeholders and interests:

Librarian: Interested in removing books that are no longer part of the library's collection.

f. Preconditions: Librarian is logged in, and the book exists in the catalog.

g. Postcondition: Book is removed from the library catalog.

h. Main success scenario:

Actor Action:	**System Responsibility:**
1. Librarian selects the “Remove Book” option.	**2.** The system provides a list of books in the catalog.
3. Librarian selects the book to remove.	**4.** The system removes the book from the catalog.

i. Extensions:

Before removing a book from the catalog, the system may prompt the librarian to confirm the action to prevent accidental removal.

Use Case Diagram

Other Non-Functional Requirements

Performance Requirements

1. User Interaction:
   - Response Time: Respond to user actions within 3 seconds for all interactions.
2. System Load Handling:
   - Scalability: Support a significant increase in users and data load without significant performance degradation.
3. Operational Reliability:
   - Uptime: Maintain 100% uptime during standard operational hours.
4. Transaction Security:
   - Encryption Time: Complete encryption/decryption operations for user data quickly.

These requirements ensure a responsive and reliable Library Management System, capable of handling increased user demand while prioritizing data security and operational stability.

Safety Requirements

The safety requirements for the Library Management System are all about ensuring the security and well-being of user data. This involves implementing strong encryption, access controls, and continuous monitoring to prevent unauthorized access and respond to potential threats. An emergency data backup plan is required place for quick recovery in case of system failures. The system also prioritizes compliance with privacy regulations through regular reviews through transparent data usage policies. Overall, these safety measures aim to create a secure and resilient Library Management System that prioritizes the protection of user data.

Security Requirements

Ensuring the security of the Library Management System is top priority, and it consists of a multifaceted approach. Extensive user authentication practices, including multi-factor authentication and regular password updates, guarantee that only authorized users access the system. The use of strong encryption algorithms safeguards sensitive data during storage and transmission, while role-based access controls and a session maintain data integrity and enable effective monitoring of user activities. An incident response plan, routine vulnerability assessments, and meticulous data backup strategies collectively make up the system's security, creating a comprehensive security framework.

Software Requirements

The Library Management System prioritizes several key software quality attributes to ensure a seamless and effective user experience. User satisfaction is emphasized through a usability goal of achieving interactive UI and aiming for an intuitive and user-friendly interface. Reliability is assured with a mean time between failures of at least 30 days, minimizing disruptions to library services. Code maintainability, scored at 90% in static code analysis tools, facilitates ease of software maintenance for developers. The implementation of a modular architecture supports flexibility and adaptability to future changes. Additionally, portability is ensured by compatibility with various operating systems. These attributes collectively contribute to a reliable, adaptable, and user-oriented Library Management System.

Business Rules

In the Library Management System, distinct business rules overlook the interactions and roles of individuals. Librarians have exclusive rights to add, update, and remove books from the catalog, emphasizing their administrative role. Users, both patrons, and librarians, are required to register and log in to access personalized services, ensuring secure and authenticated usage. Only registered patrons can engage in book loan transactions, and reserved books are exclusively managed by patrons. Librarians are responsible for handling book reservations and setting due dates for borrowed books, safeguarding the efficient operation of the lending system. The adherence to these business rules is crucial for maintaining the integrity and security of the library's resources while ensuring a streamlined and controlled user experience.

Operating Environment

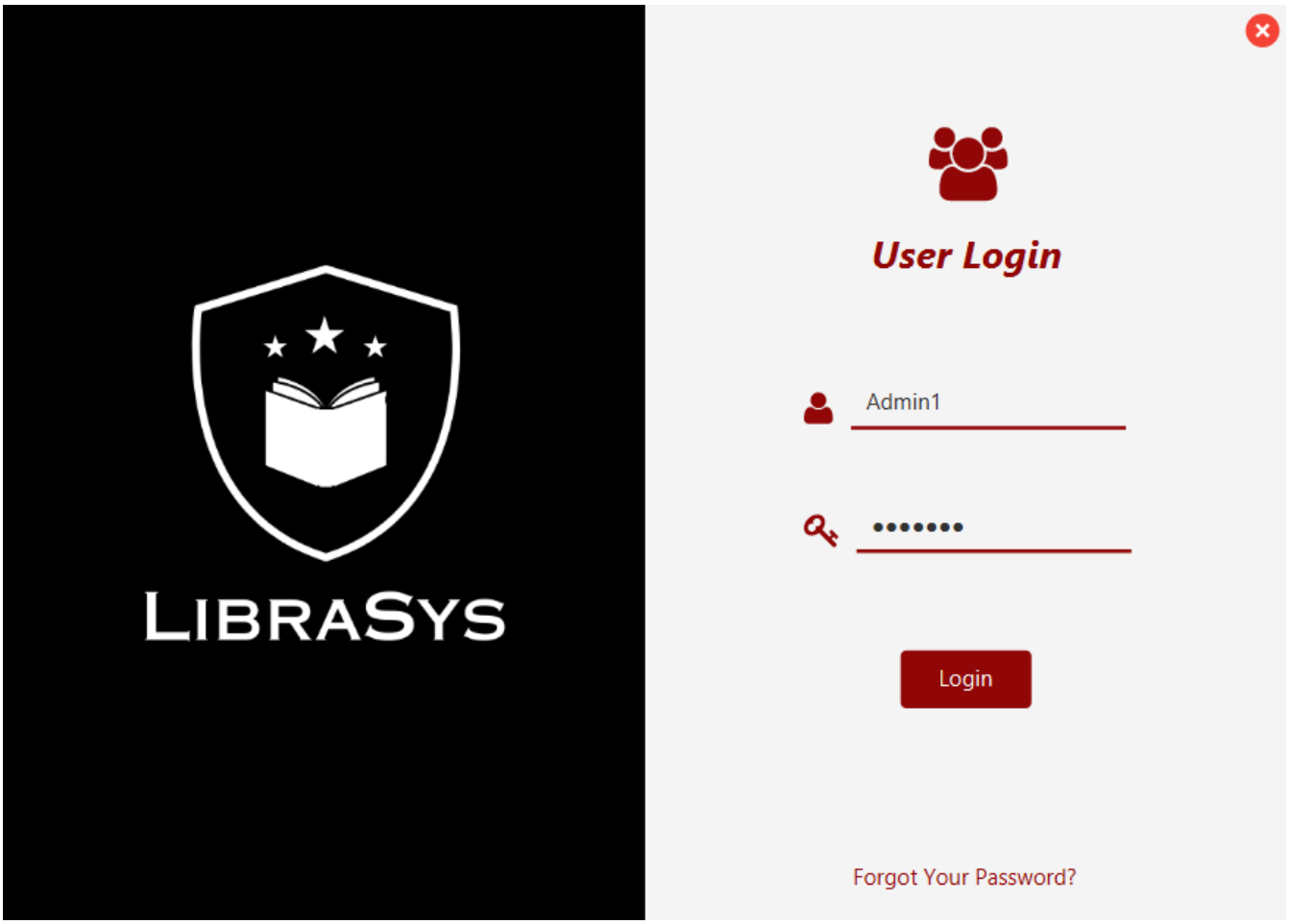
The Library Management System is designed to operate in a diverse computing environment since it is a web app. It is compatible with multiple hardware platforms such as Windows, macOS, and Linux. The system seamlessly integrates with popular web browsers, including Chrome, Firefox, and Safari, ensuring flexibility and accessibility for users with varying preferences. The software is optimized for efficient performance across different operating systems, providing a consistent and reliable experience for librarians and patrons alike. The system utilizes the standard database management systems and network configurations, making interoperability and ease of integration into existing library infrastructure possible.

User Interface

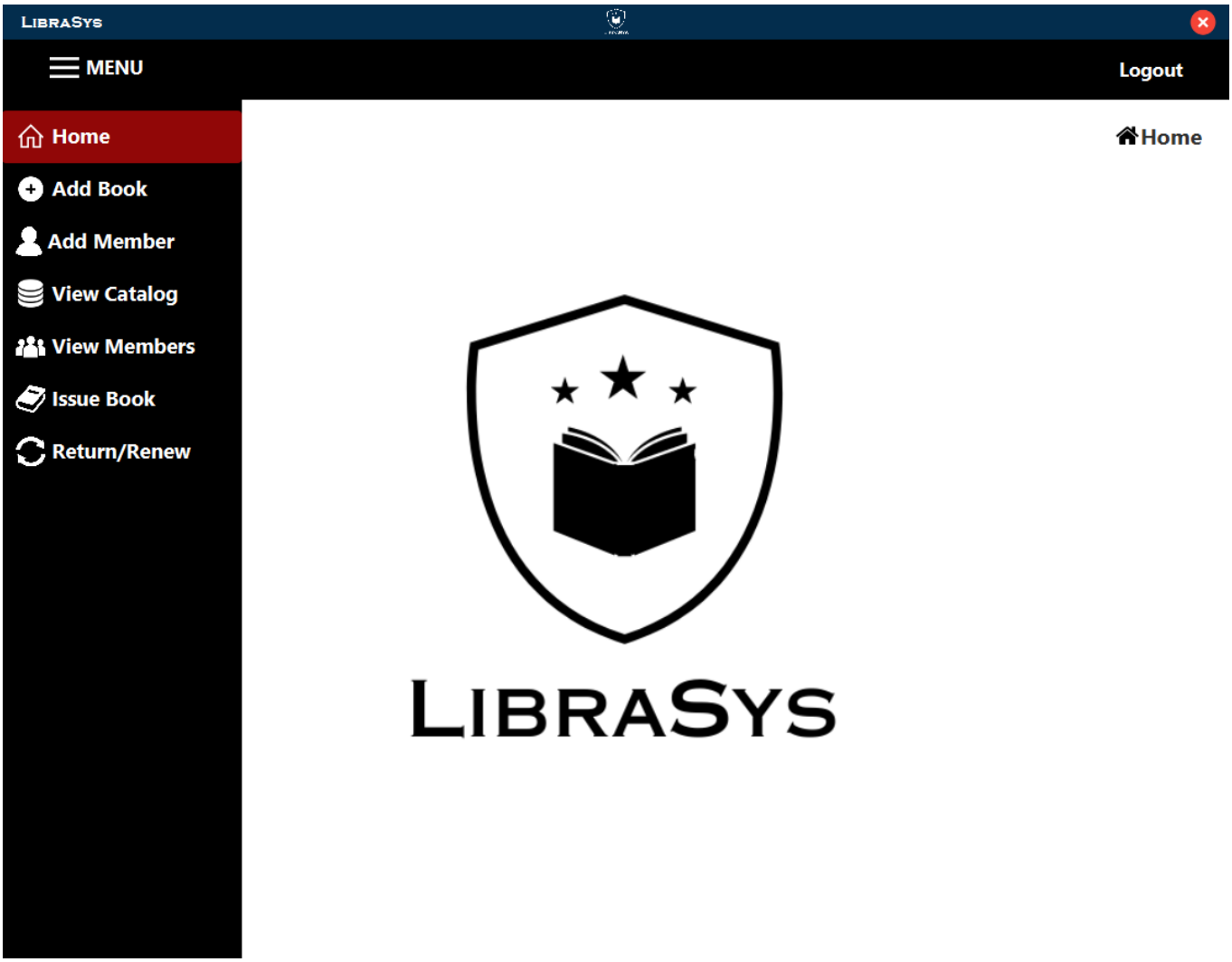
The Library Management System (LMS) encompasses several key screens to facilitate efficient operations. The "Login" screen serves as the gateway, requiring users to input their credentials for access. Once logged in, the "Home" screen provides a central hub, featuring options like "Add Book" and "Add Member" for librarians to seamlessly expand the catalog and manage members.

The "View Catalog" screen offers a comprehensive overview, allowing librarians to browse and update book details. Similarly, the "View Members" screen provides insights into user profiles. For book transactions, librarians can utilize the "Issue Book" screen to manage book loans, ensuring a streamlined process. The "Return/Renew" screen facilitates the return of borrowed books and manages renewals. Each screen adheres to a user-friendly and interactive design, with clear navigation and standard functionalities, contributing to an intuitive and effective Library Management System. Images of the user interface are attached below:

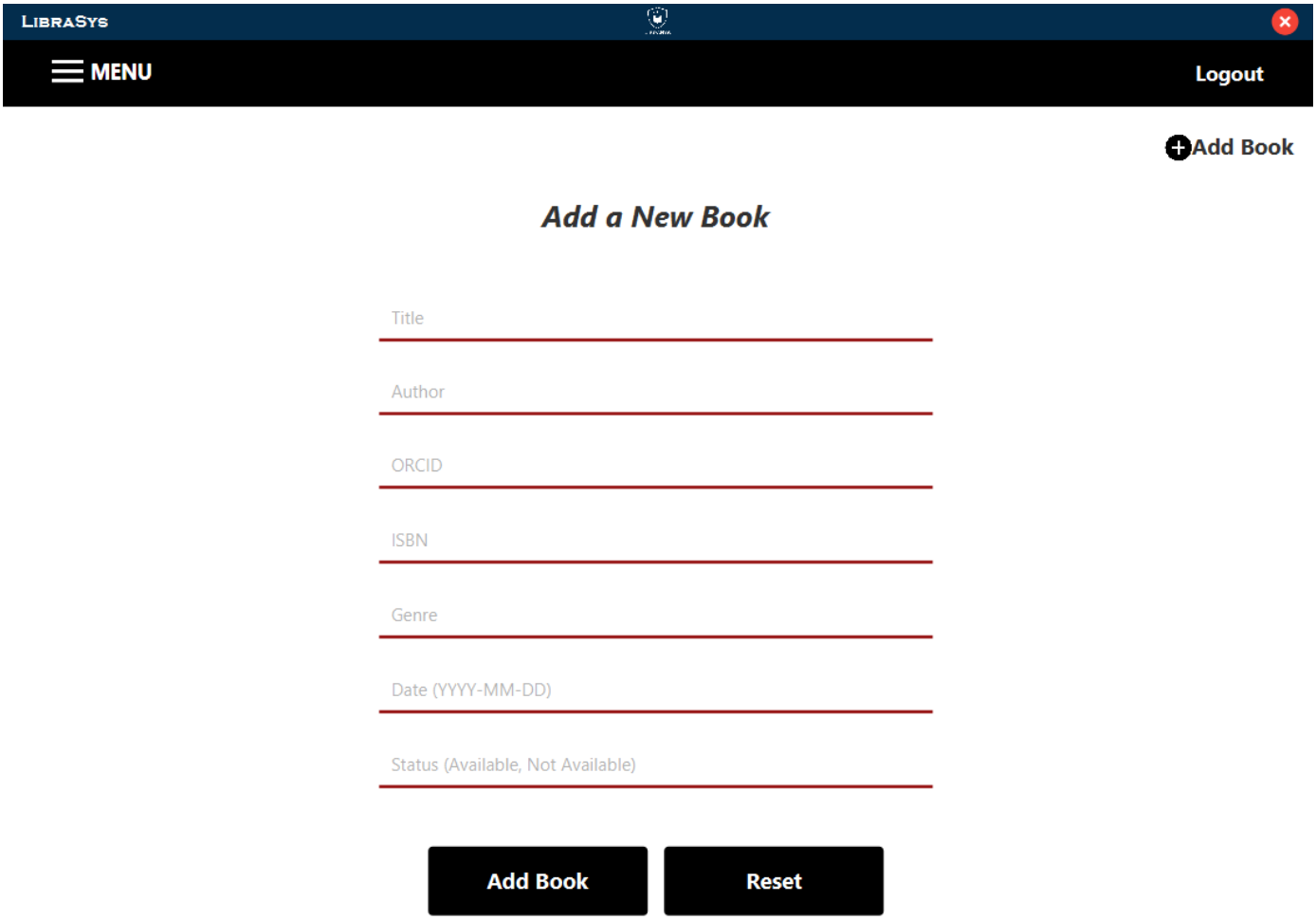
Login UI



Home UI


LIBRASYS
MENU
Logout
Home
Add Book
Add Member
View Catalog
View Members
Issue Book
Return/Renew
Home
LIBRASYS

Add Book UI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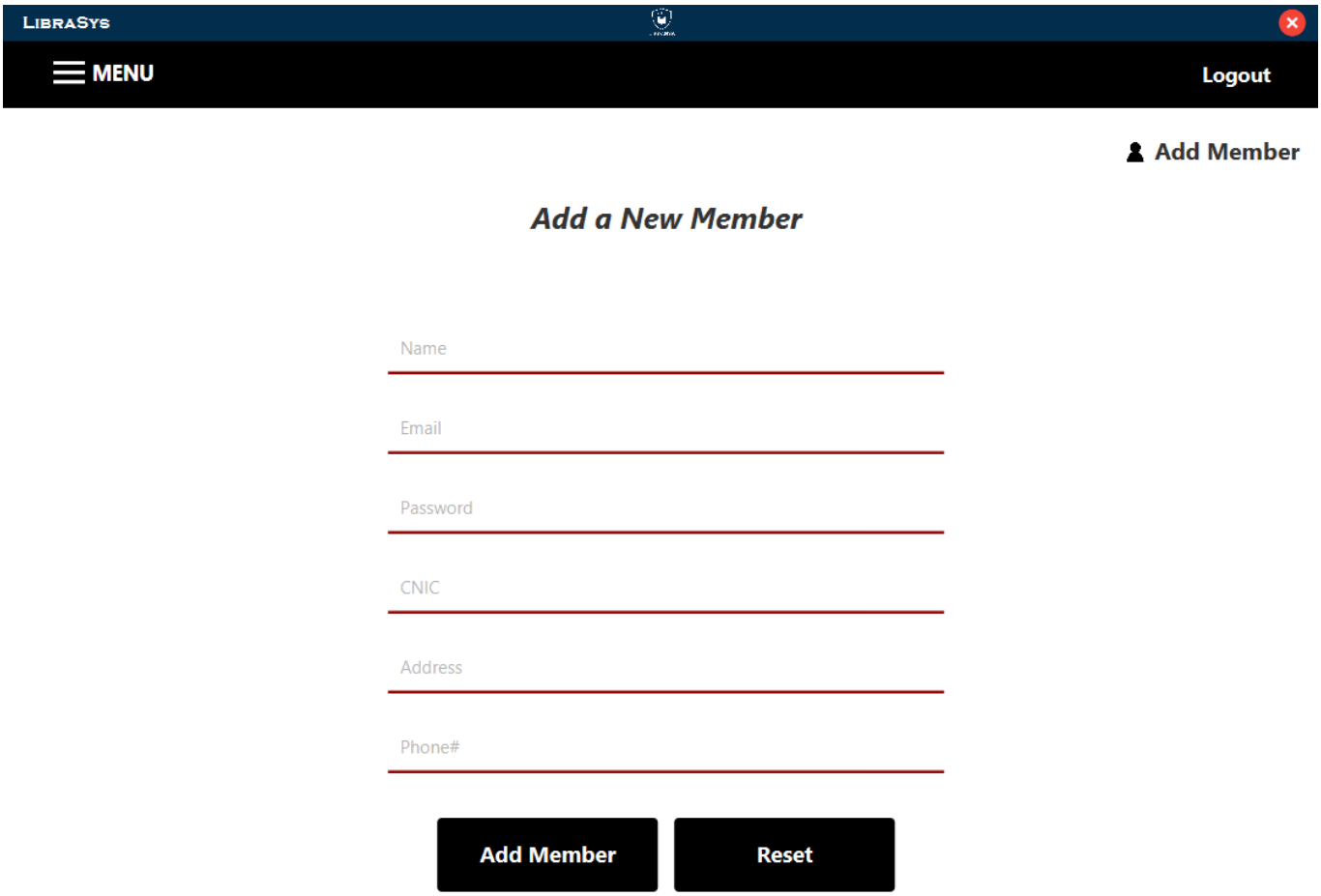
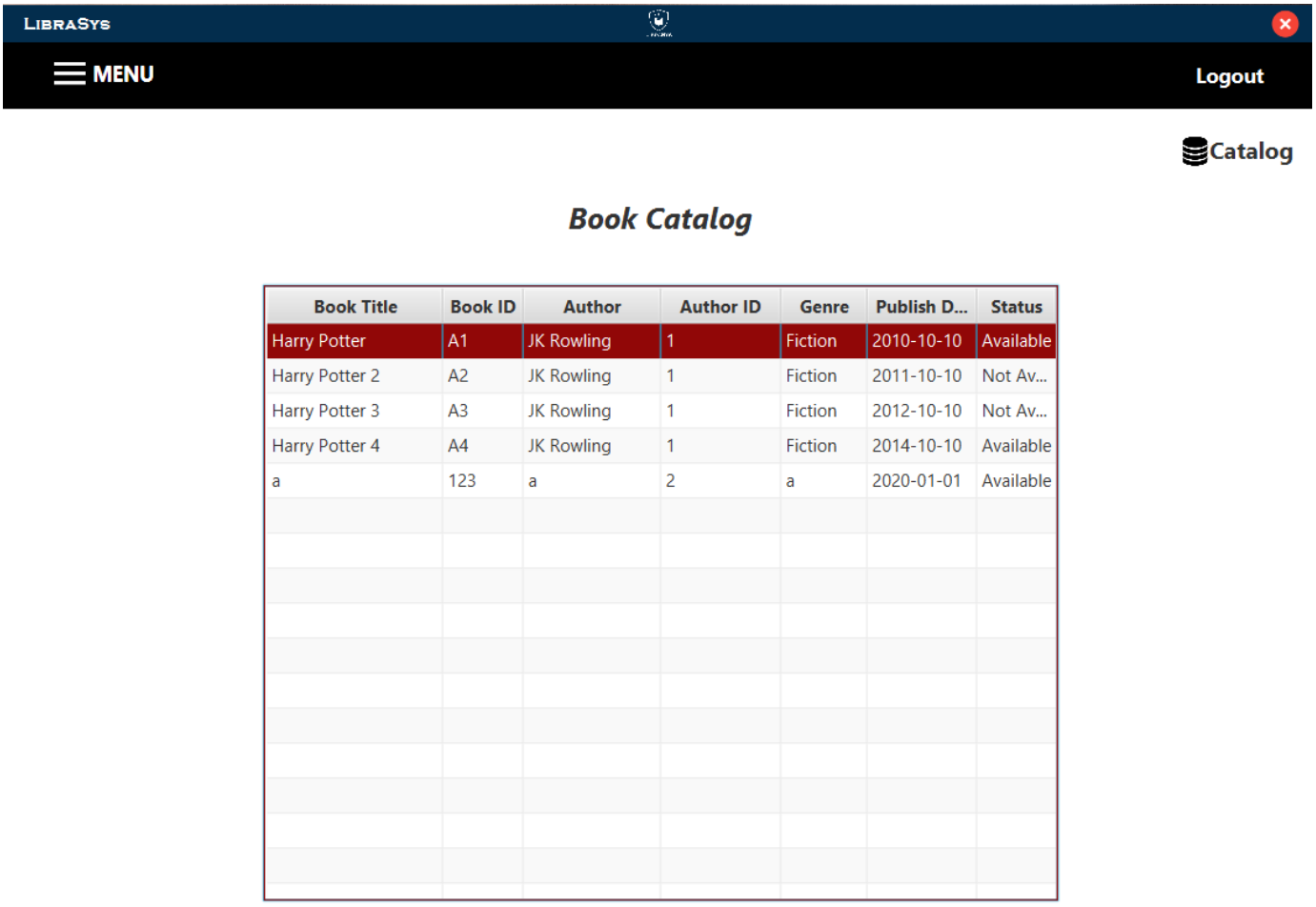
MENU
Logout
Add Book
Add a New Book
Title
Author
ORCID
ISBN
Genre
Date (YYYY-MM-DD)
Status (Available, Not Available)
Add Book
Reset

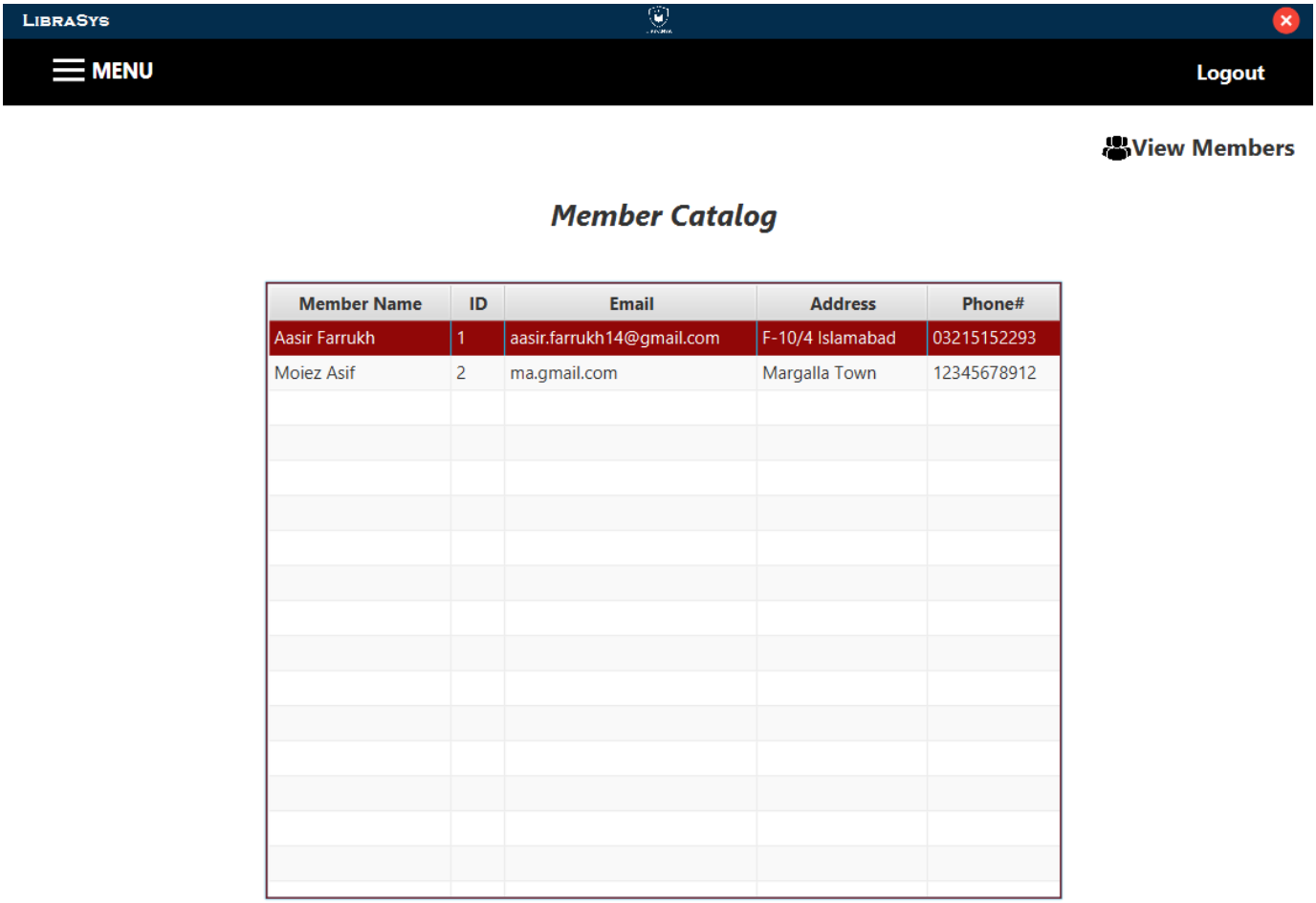
Add Member UI



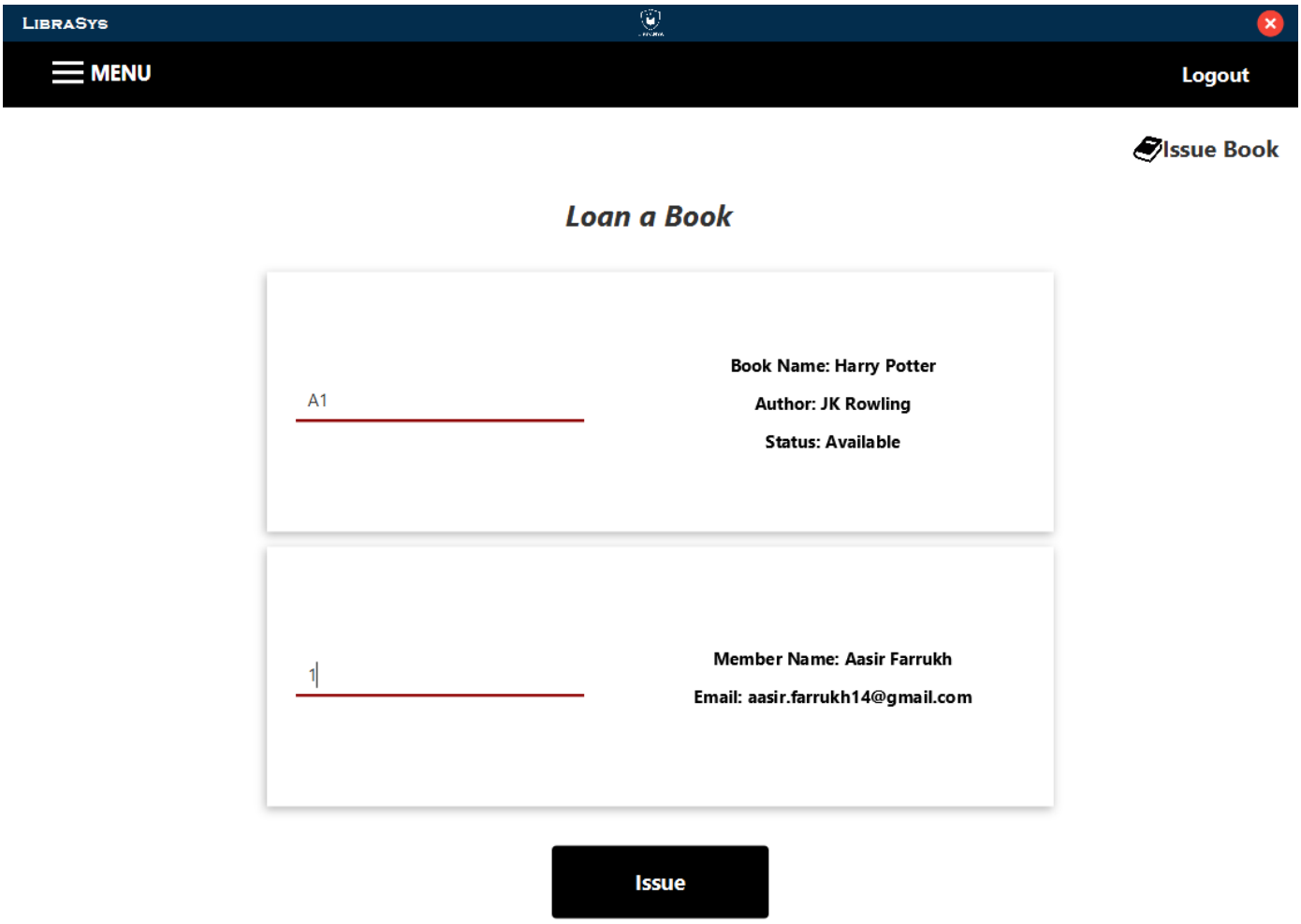
Book Catalog UI



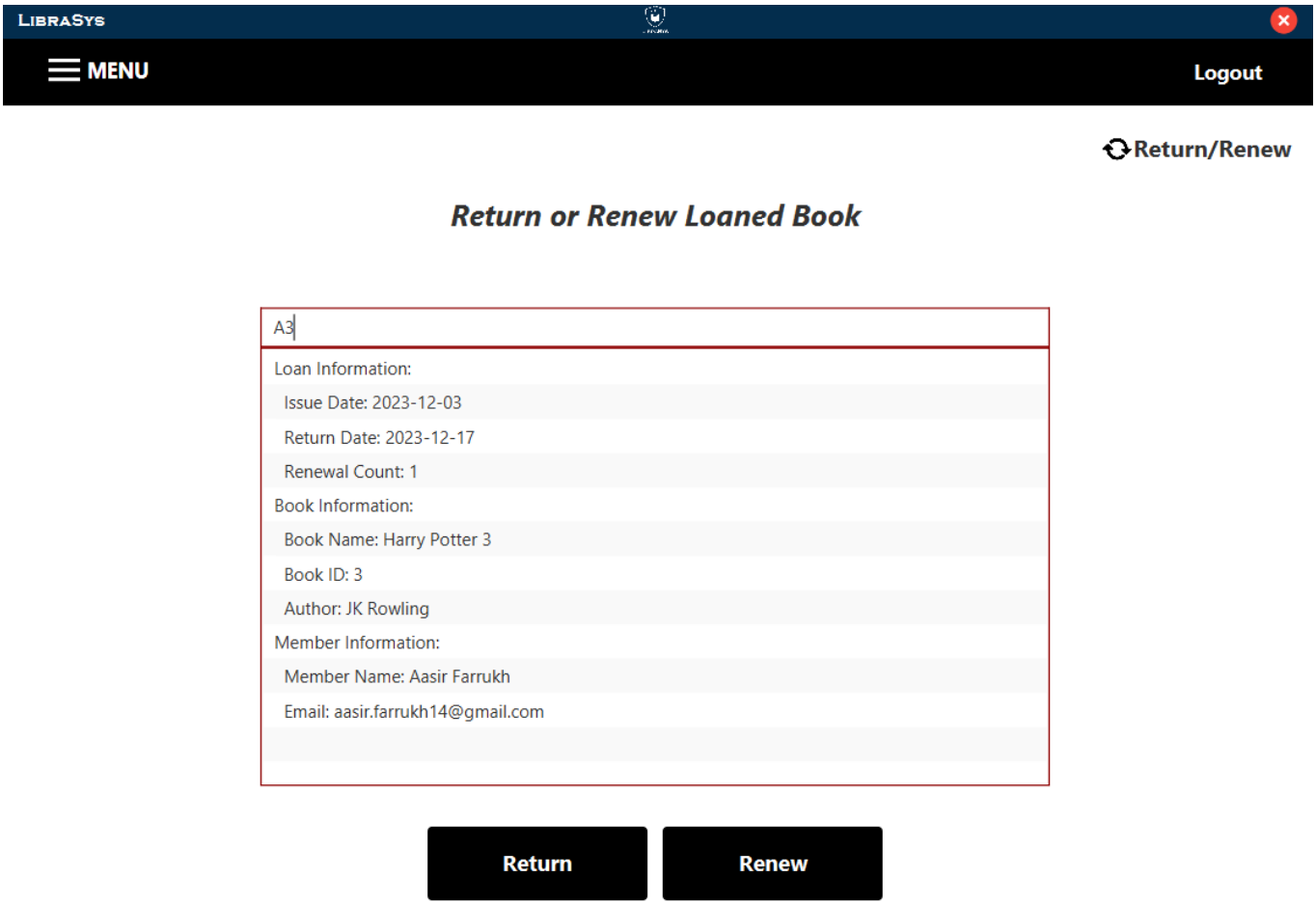
Member Catalog UI



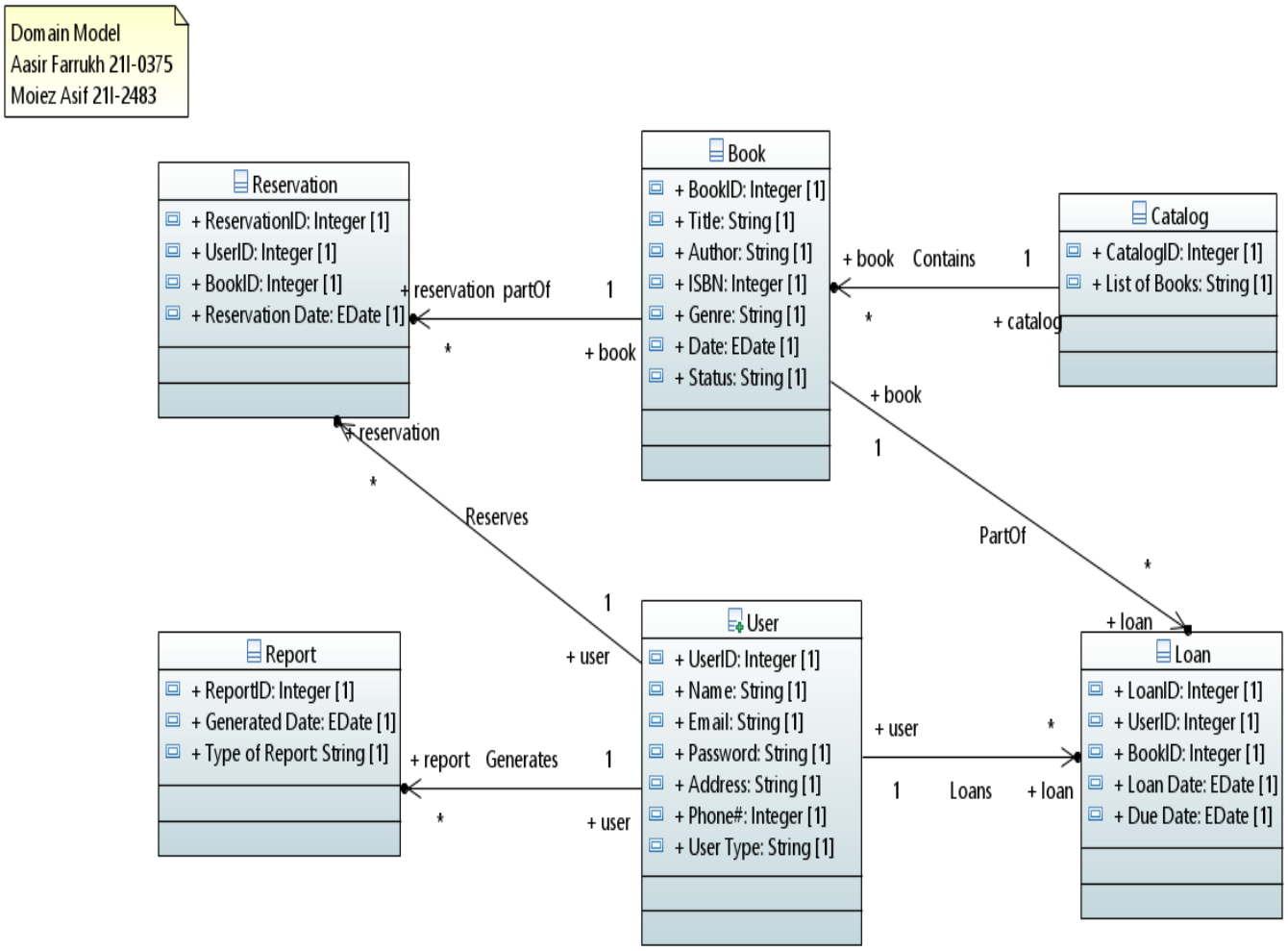
Issue Book UI



Return/Renew UI

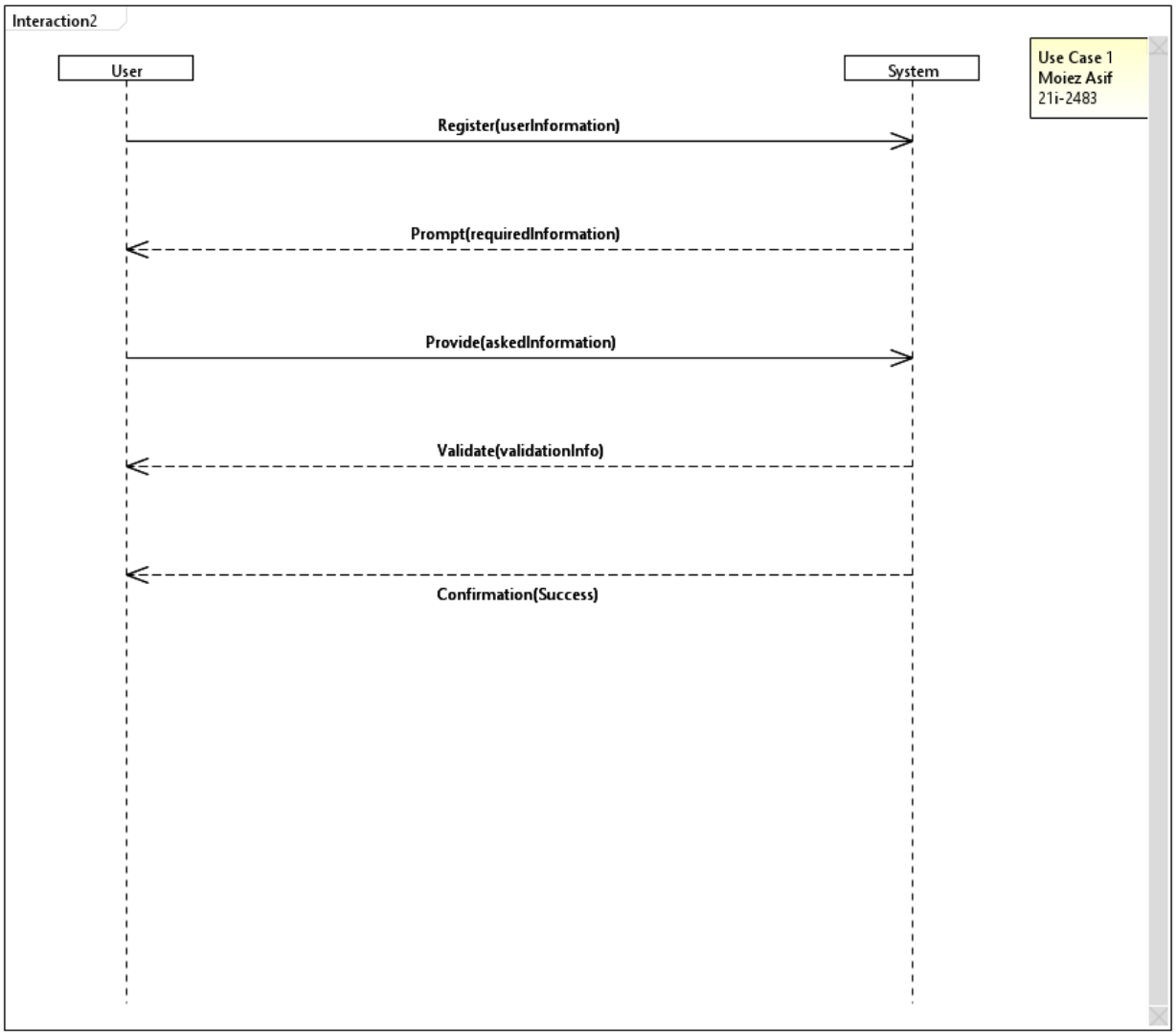


Domain Model



System Sequence Diagrams

SSD Use Case 1:



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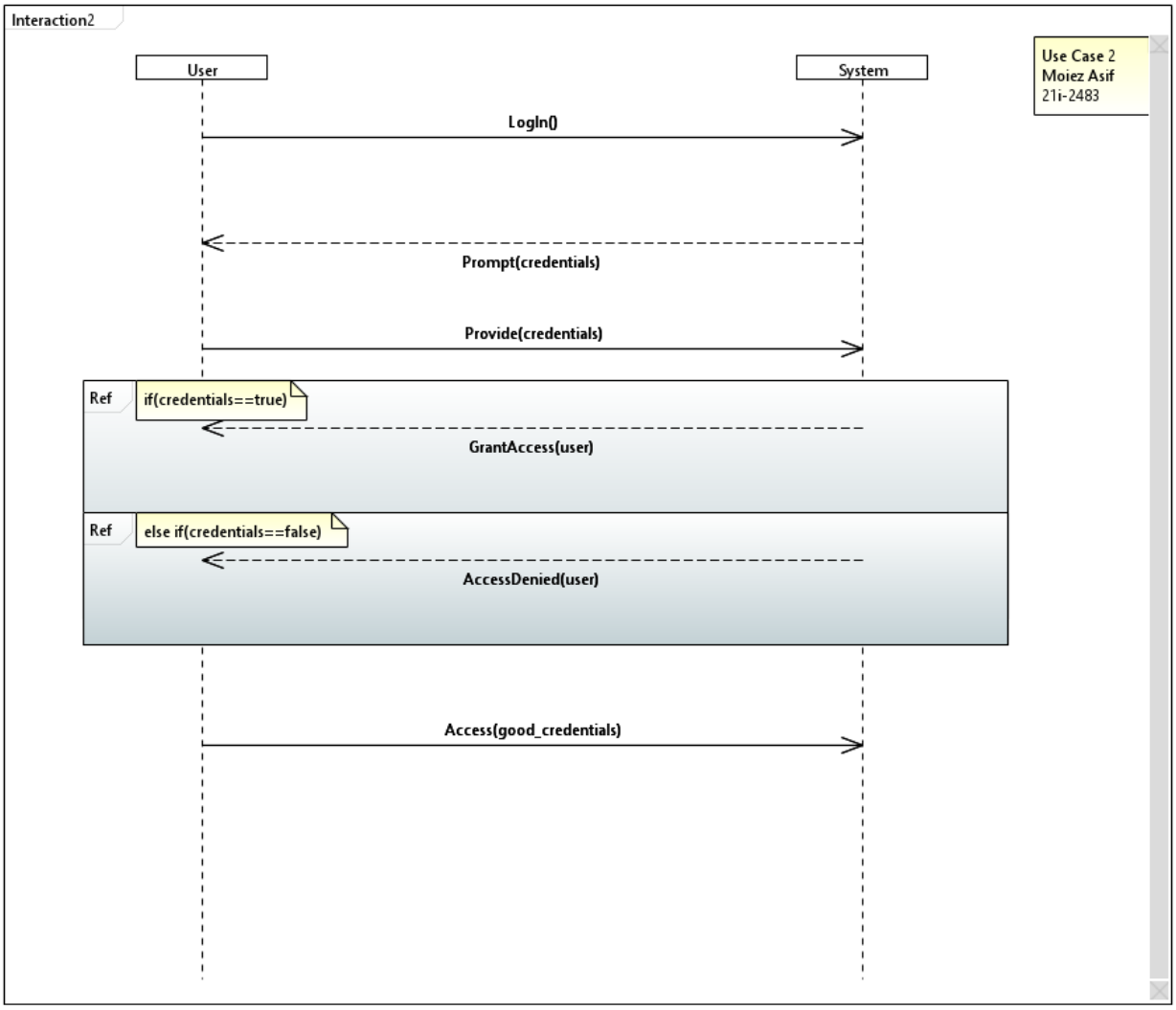

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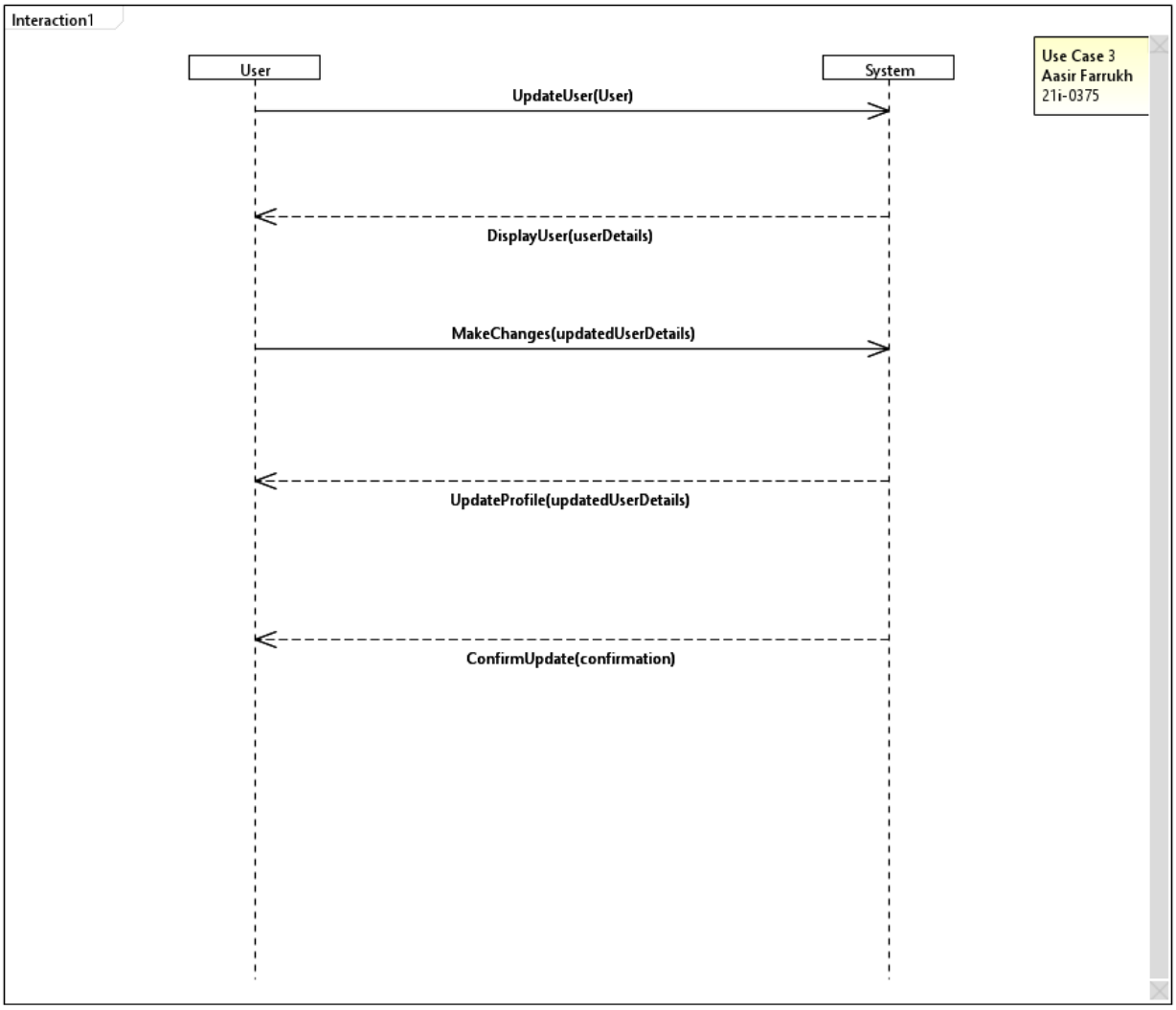

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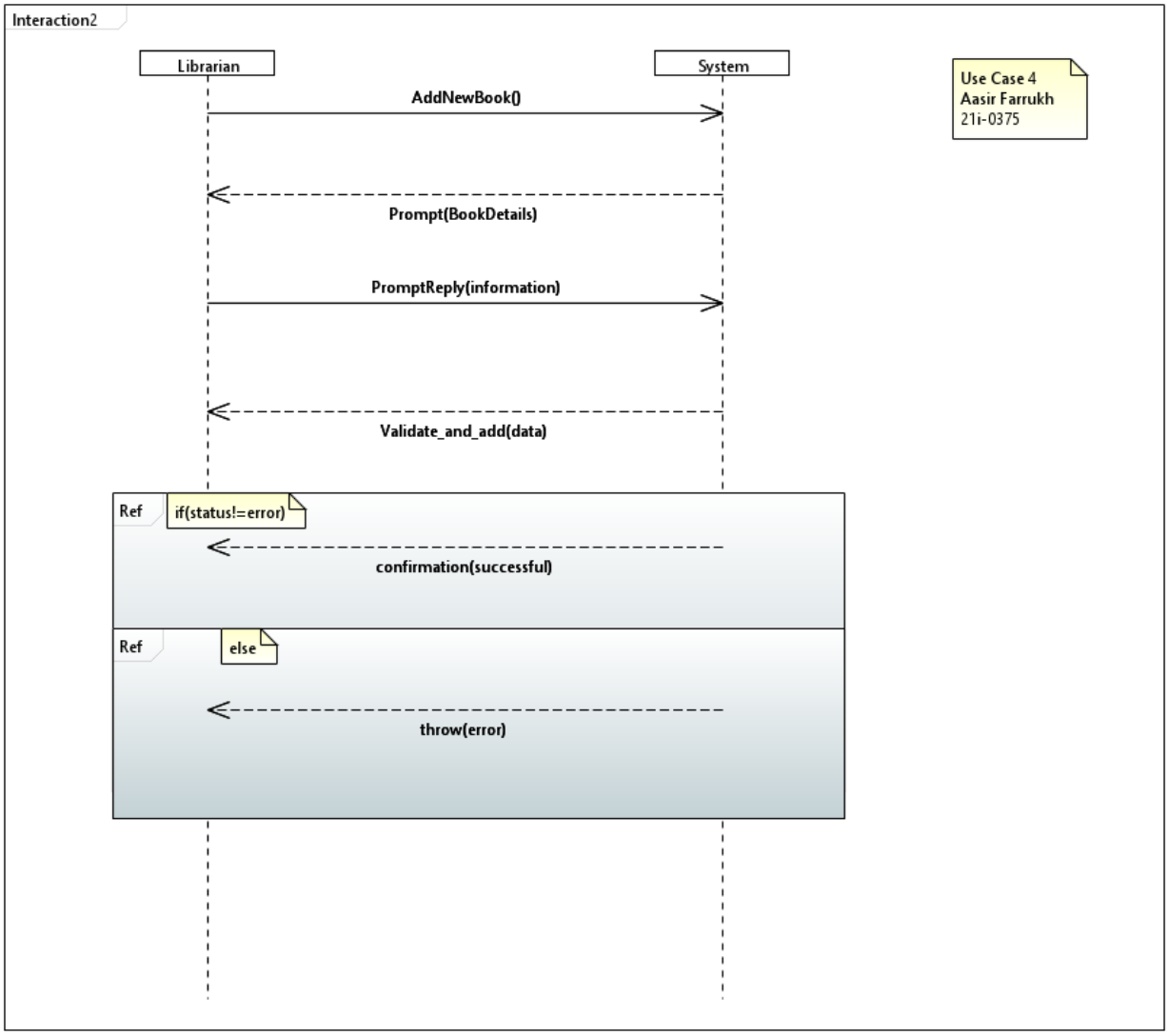

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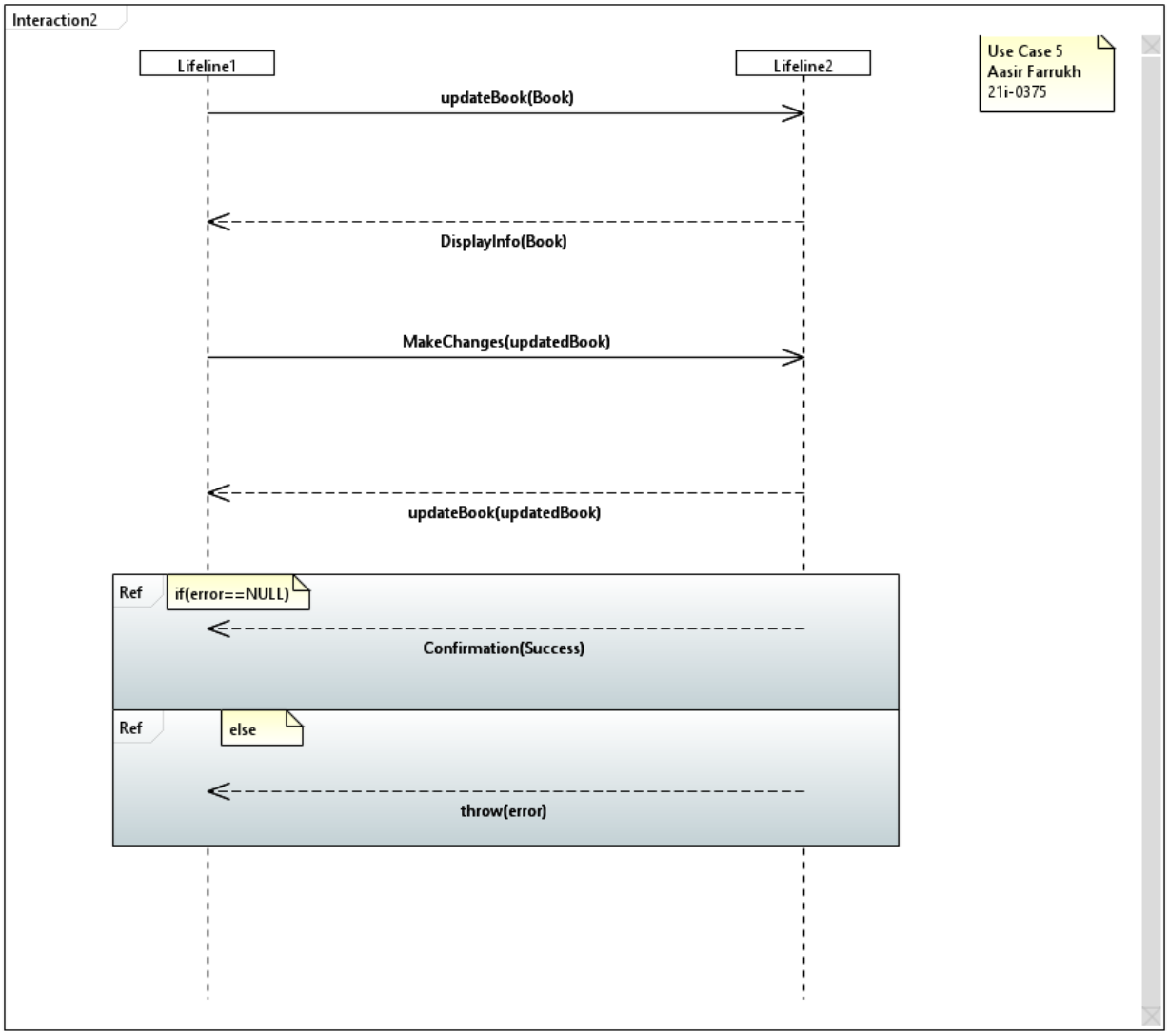
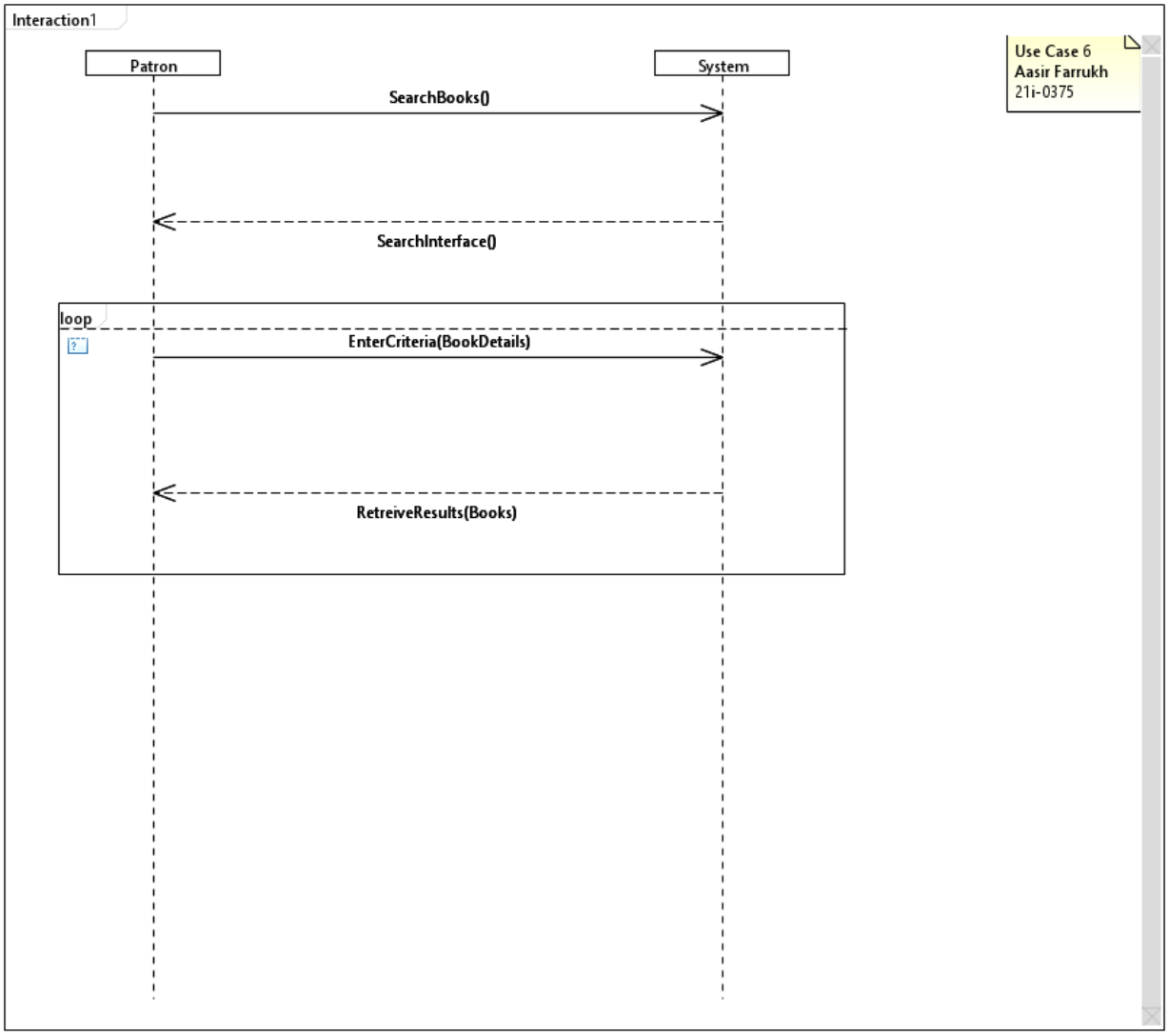
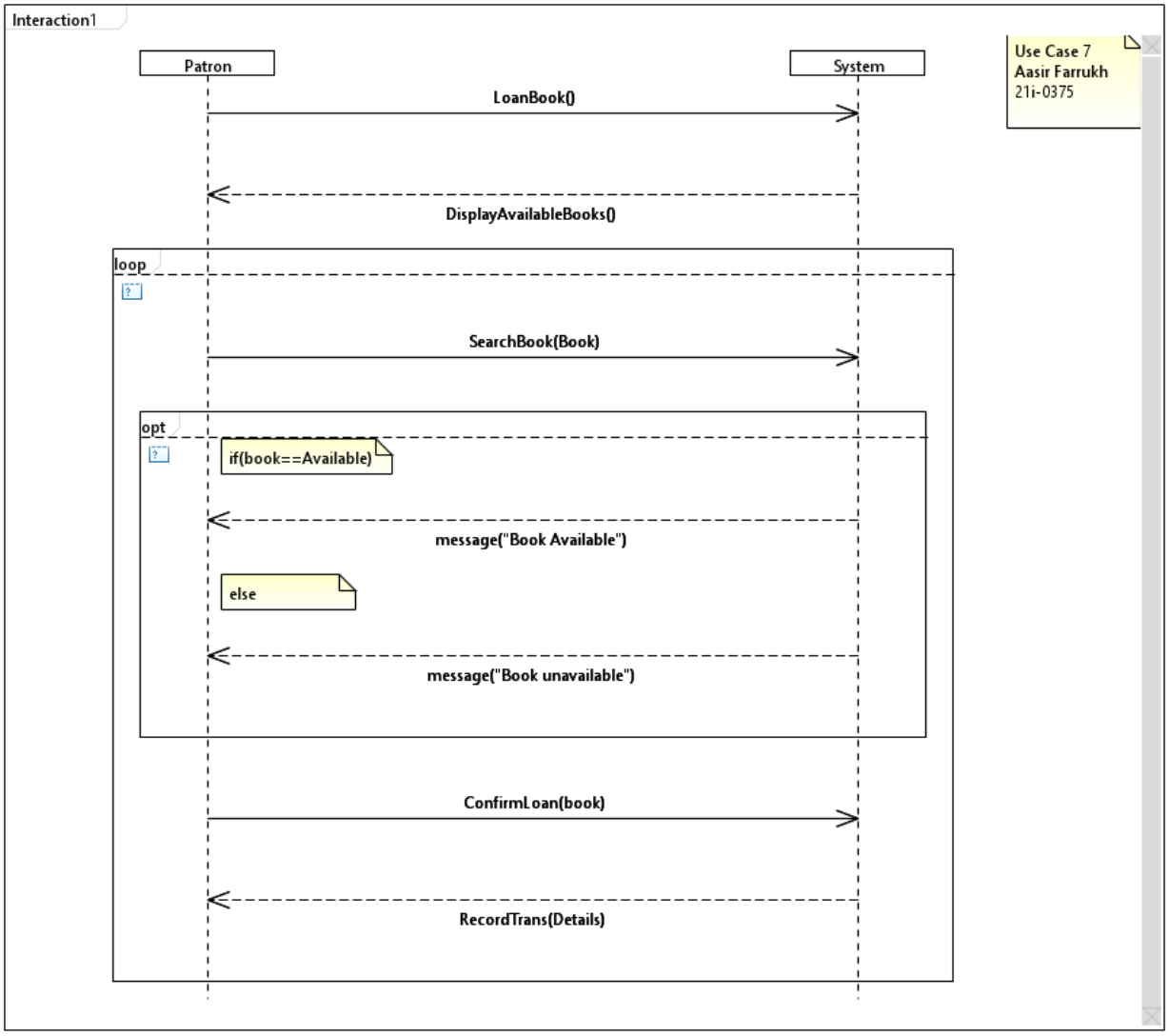


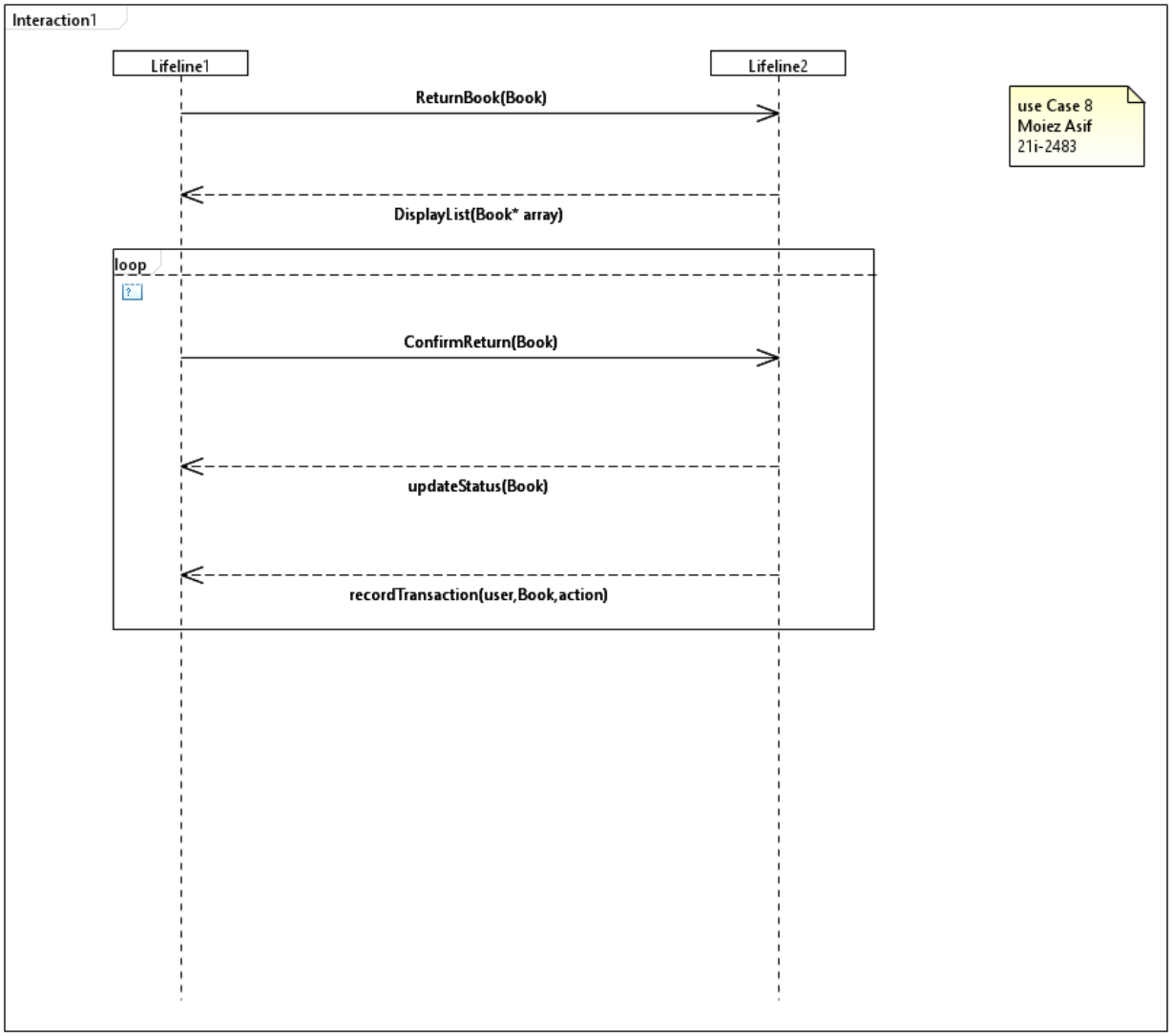
SSD Use Case 6:



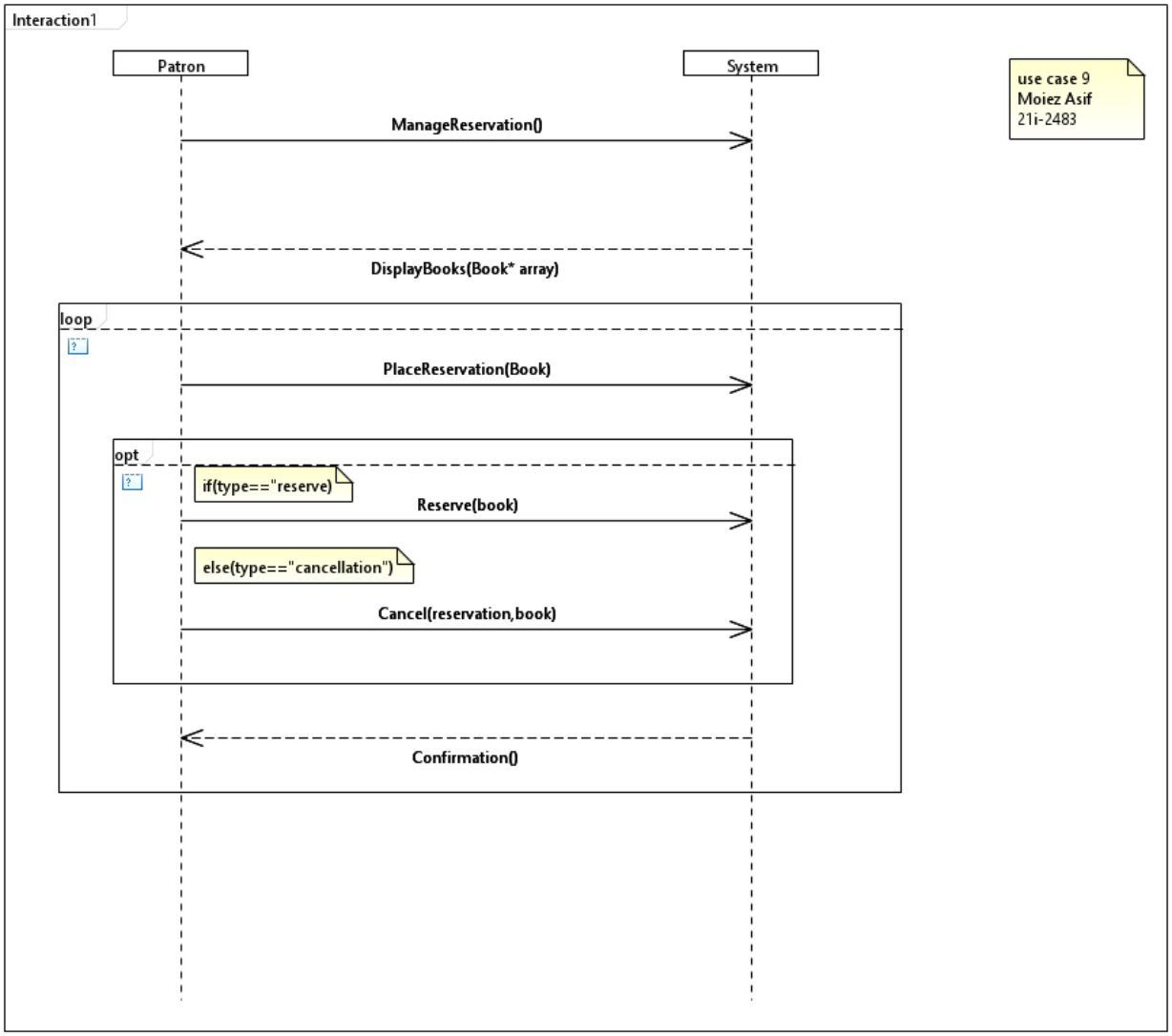
SSD Use Case 7:



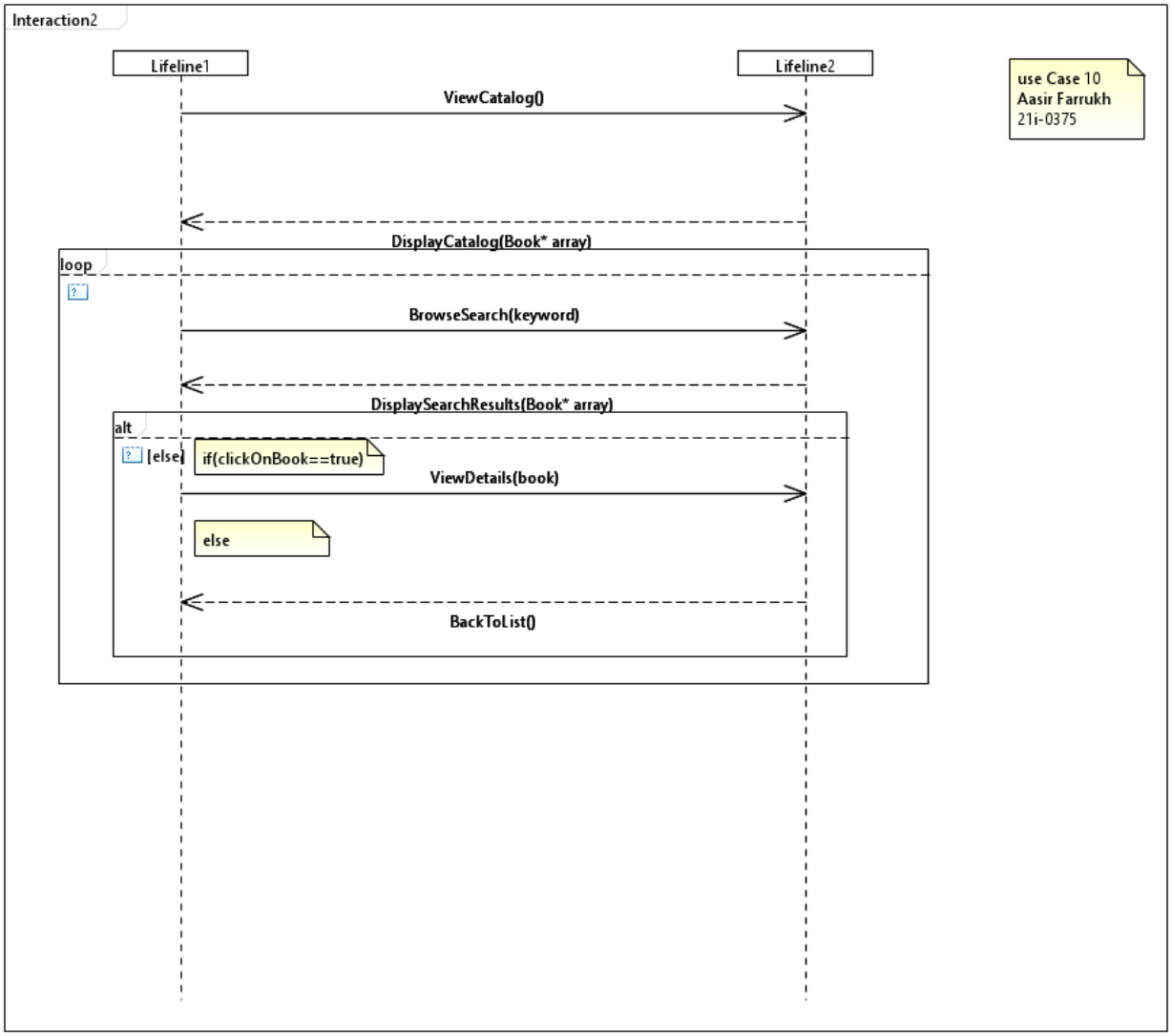
SSD Use Case 8:



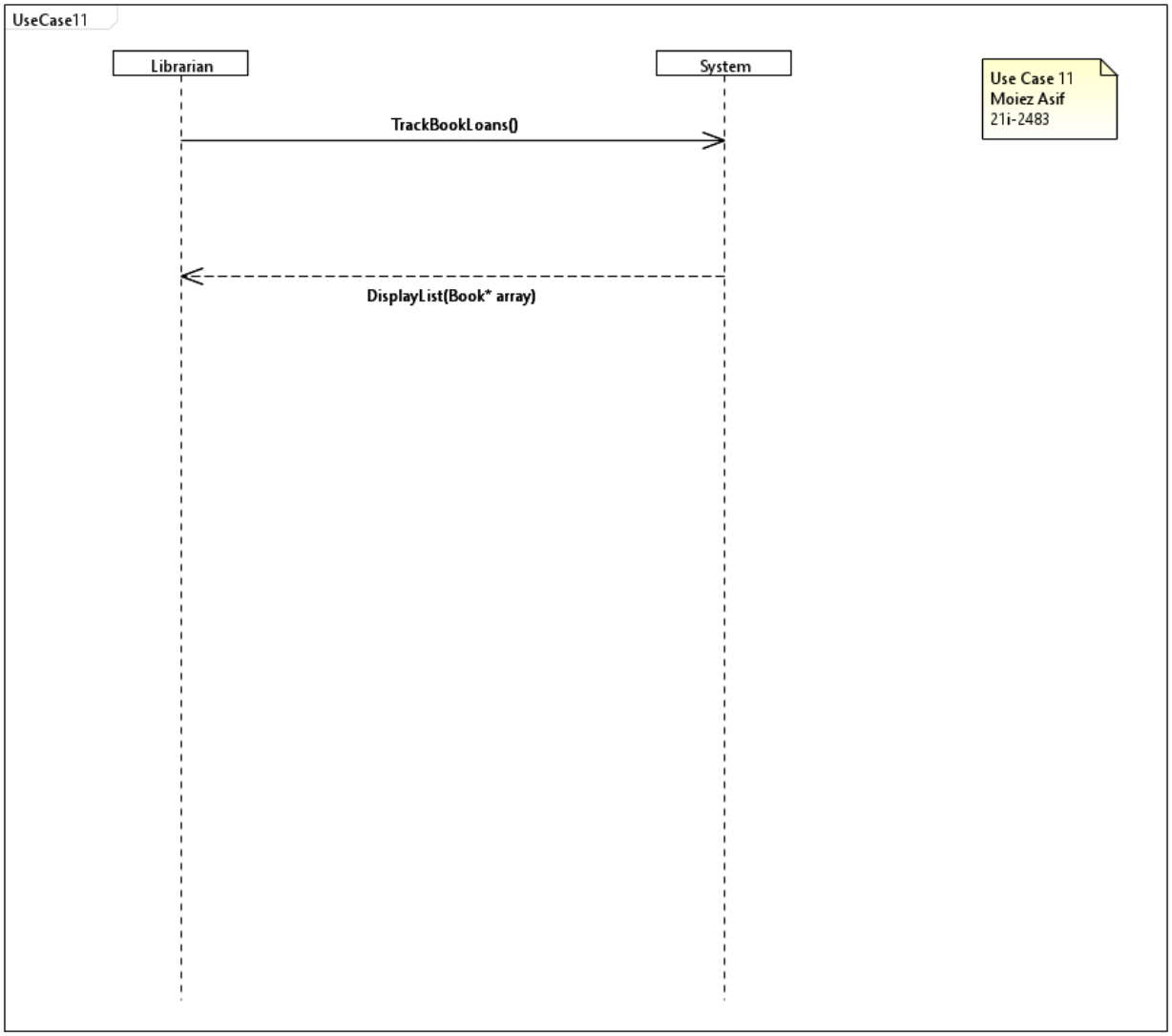
SSD Use Case 9:



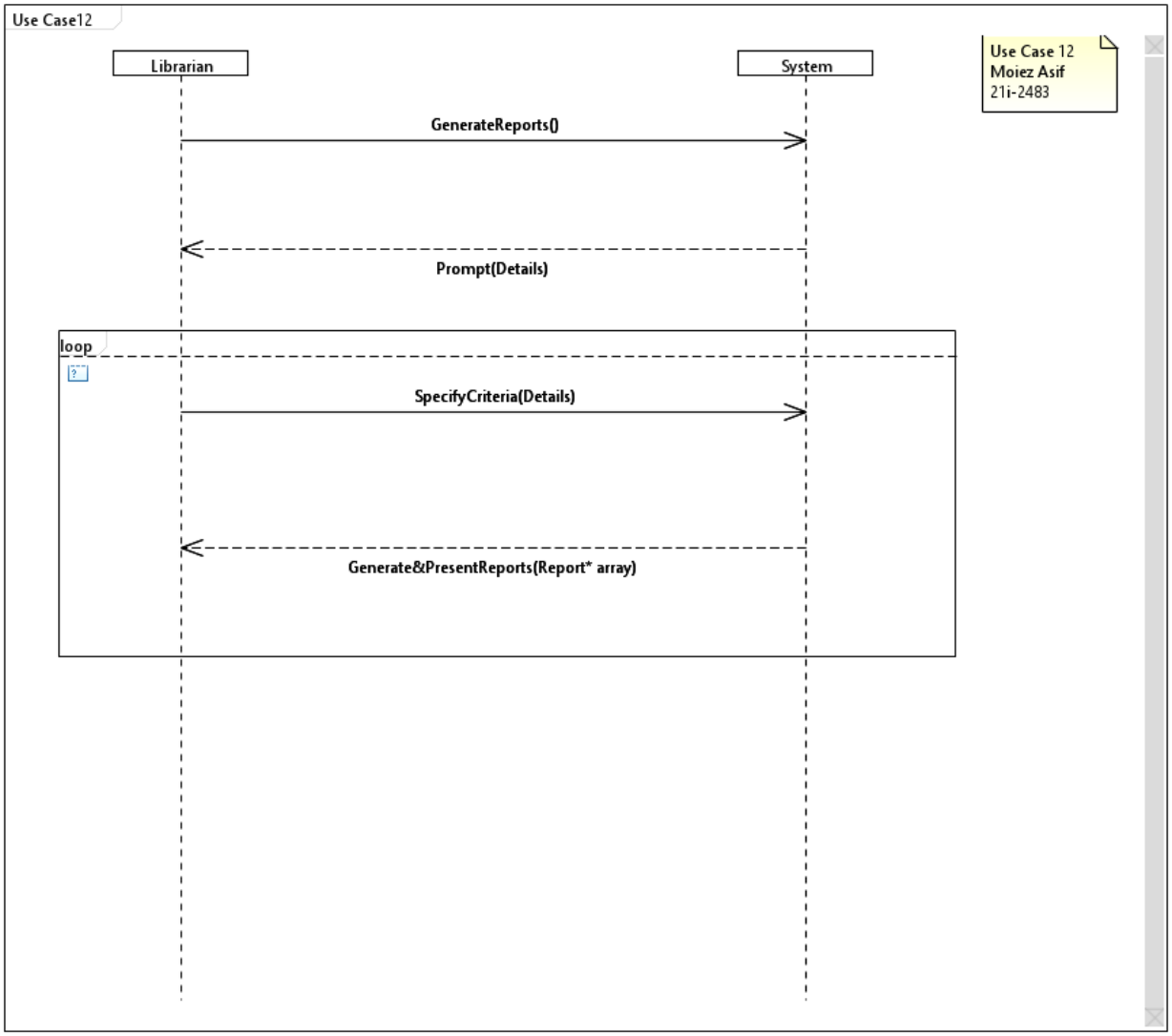
SSD Use Case 10:



SSD Use Case 11:



SSD Use Case 12:



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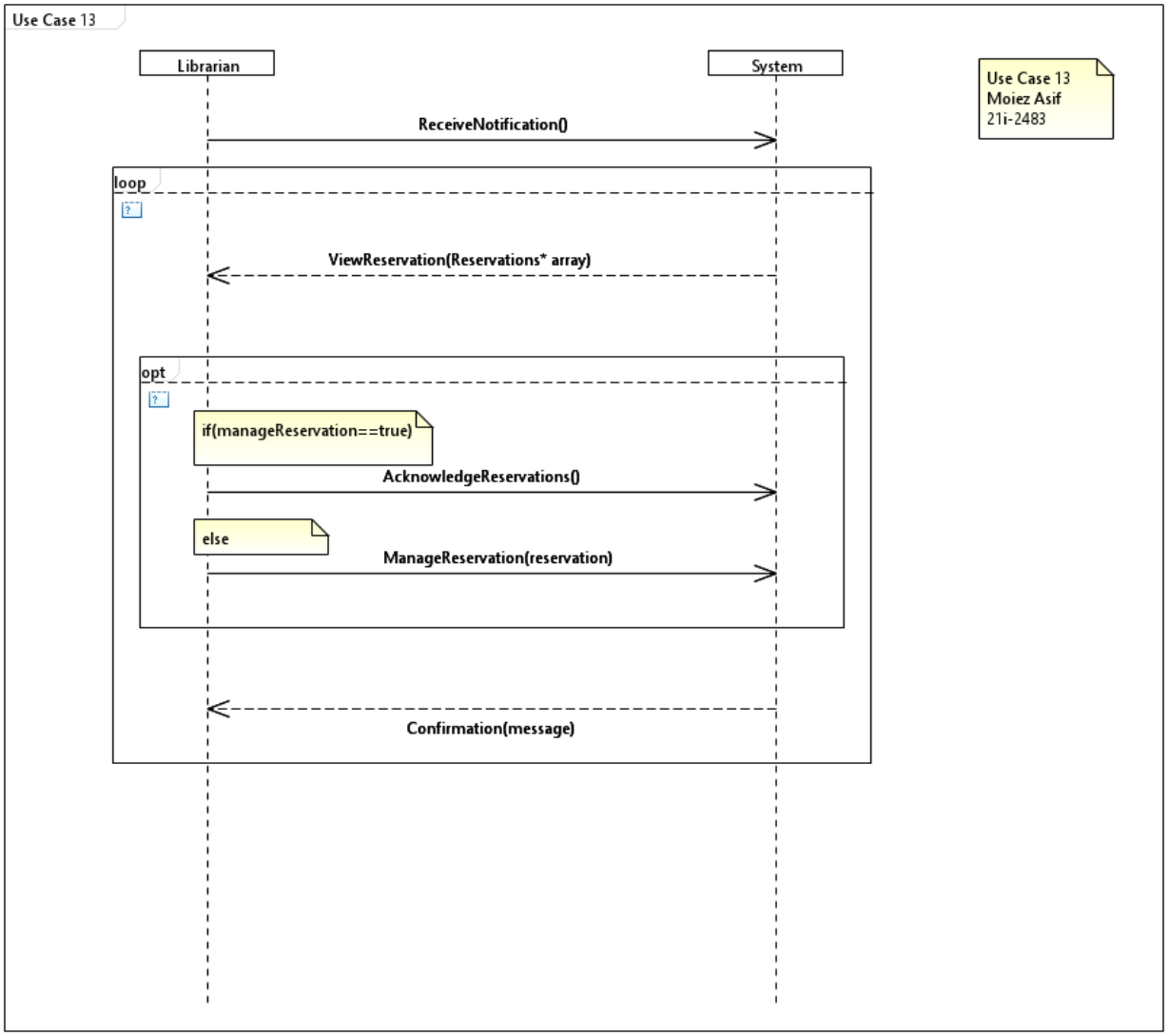
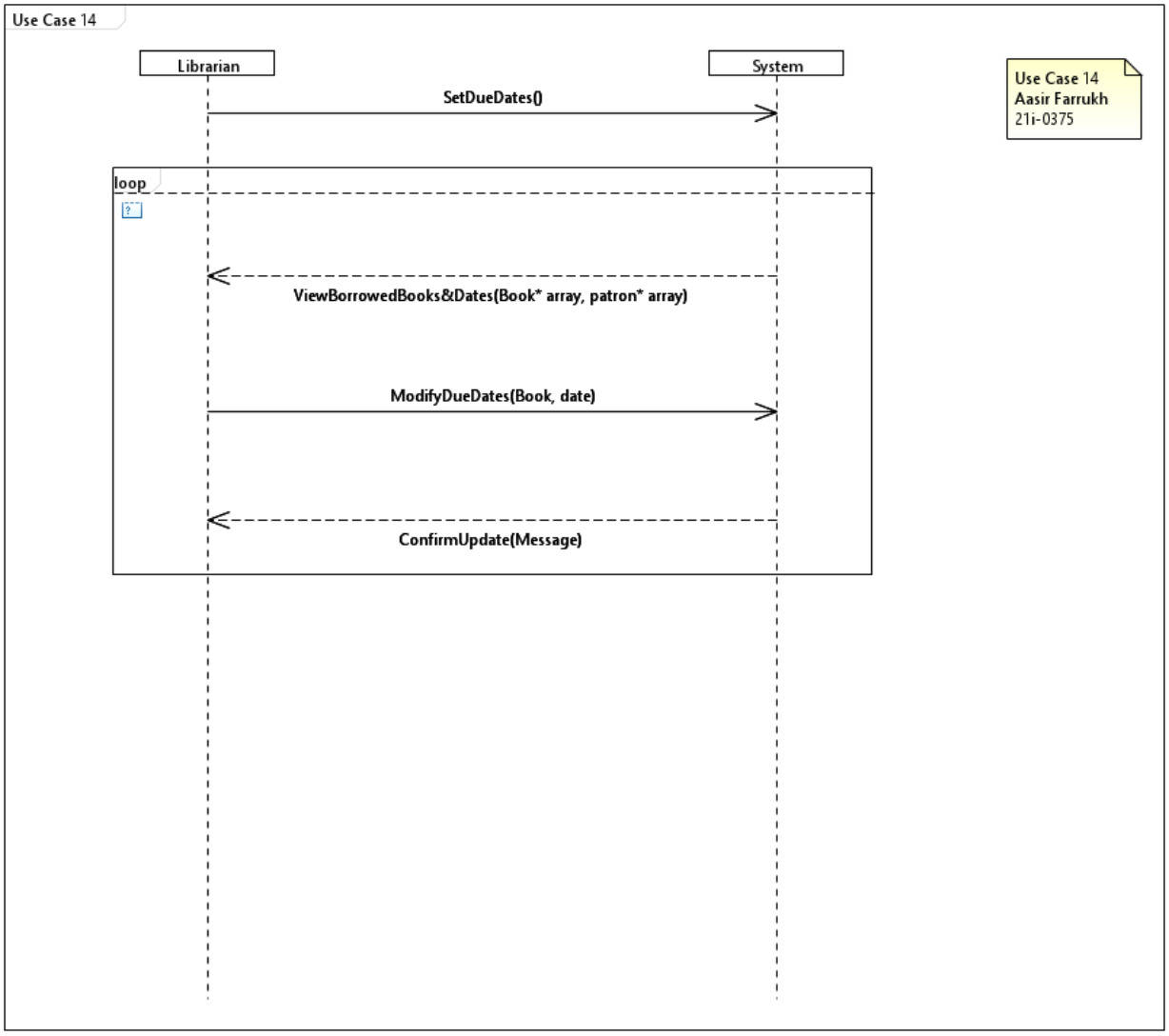
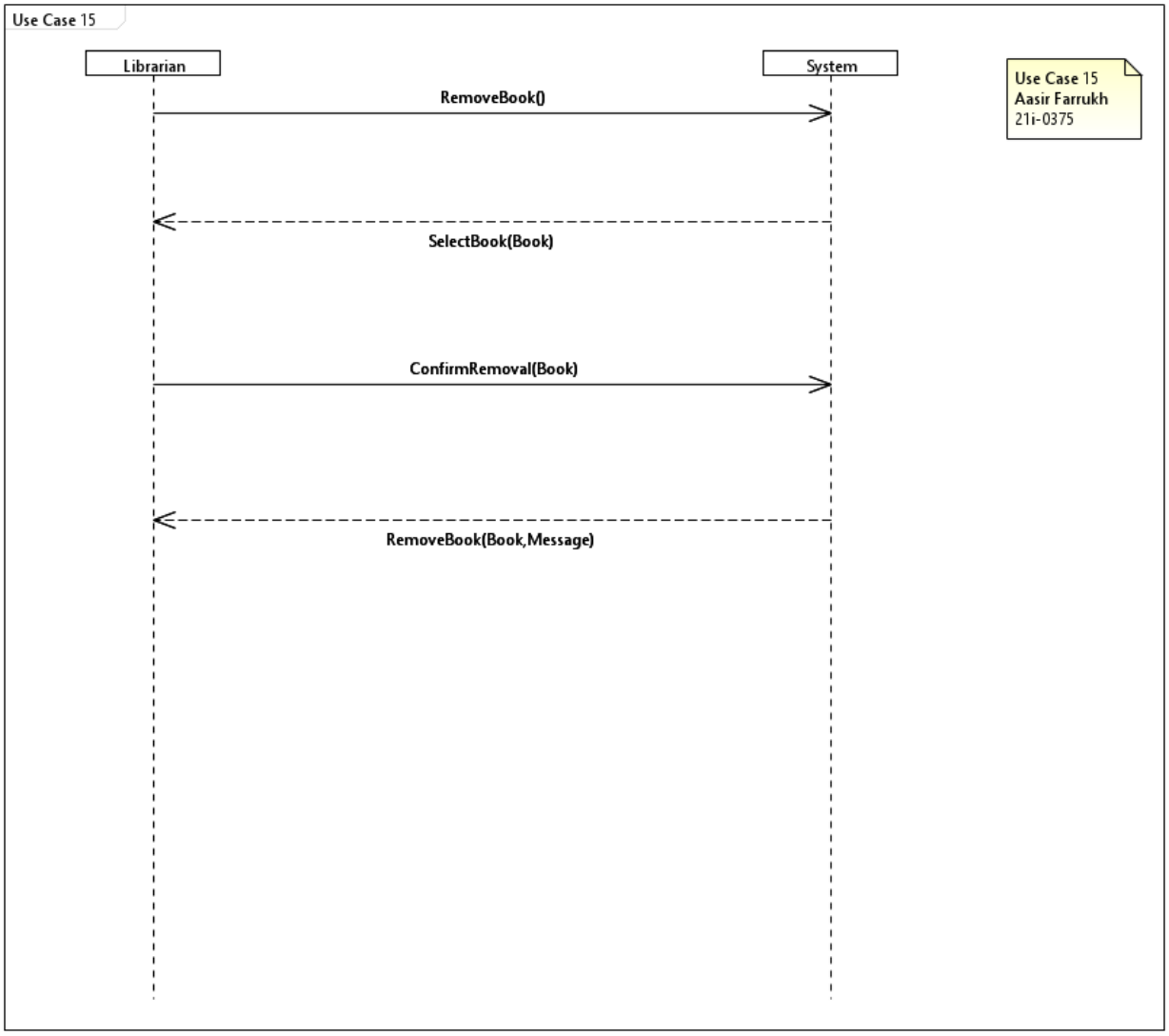


SSD Use Case 14

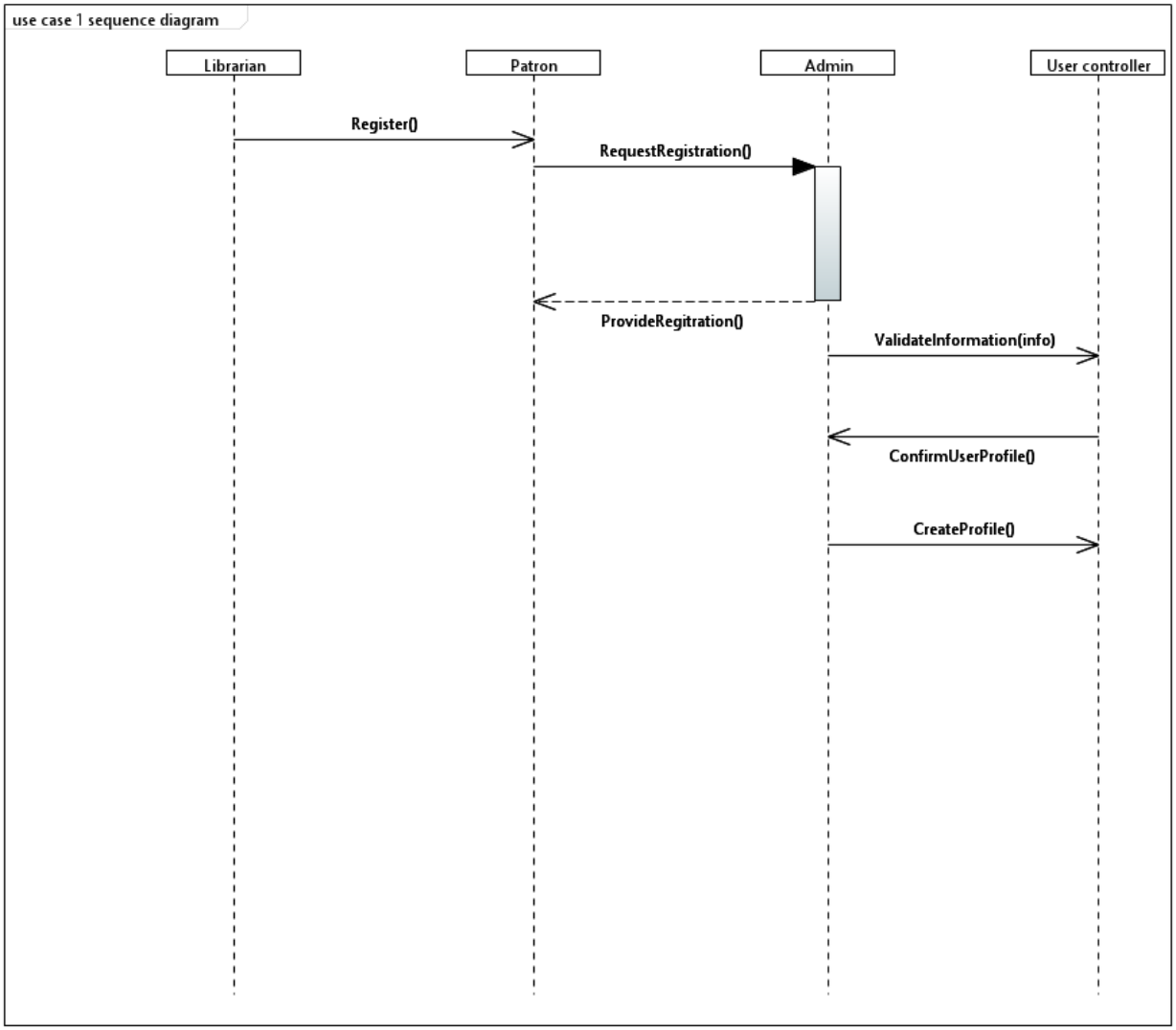


SSD Use Case 15:

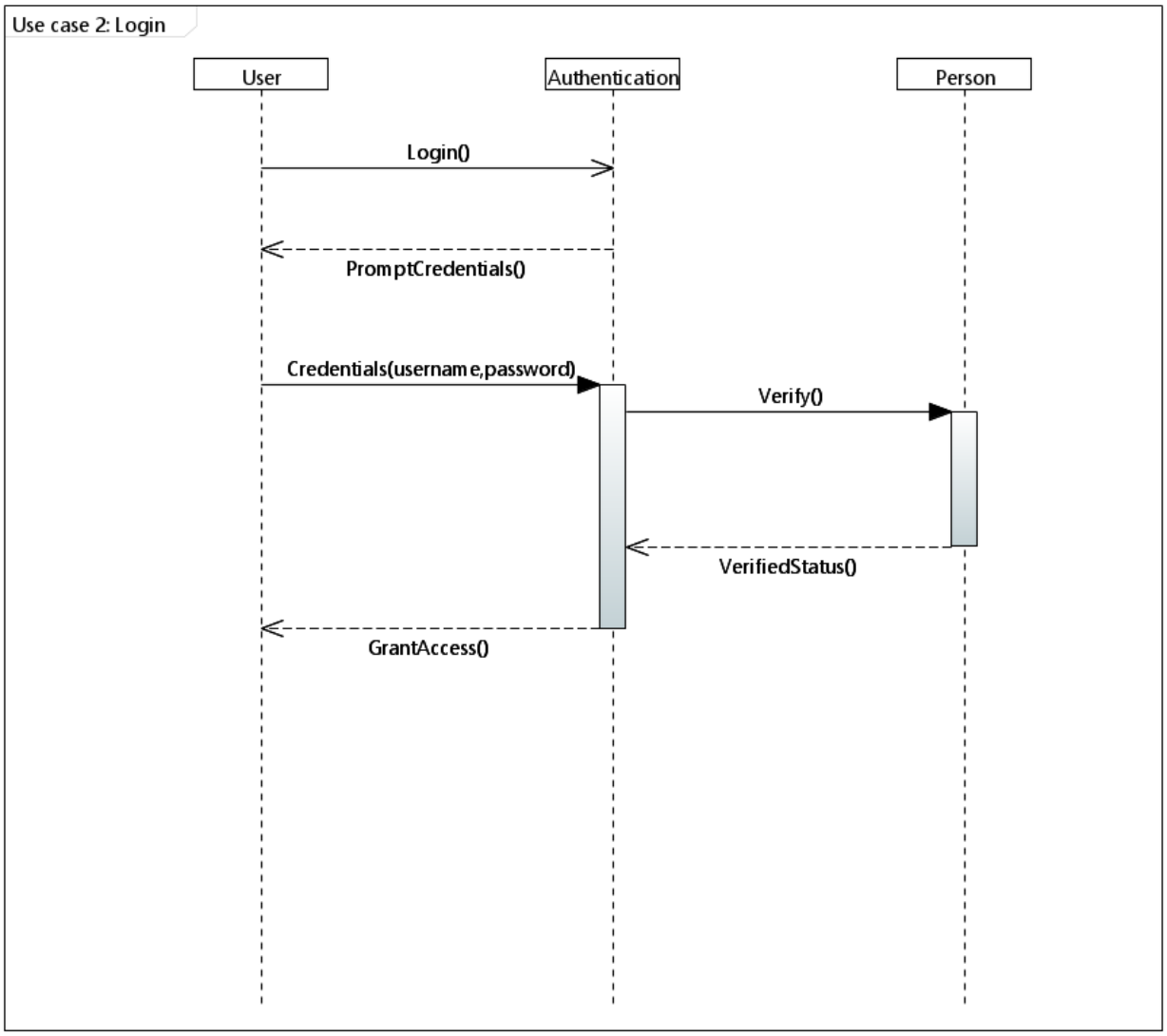


Sequence Diagrams

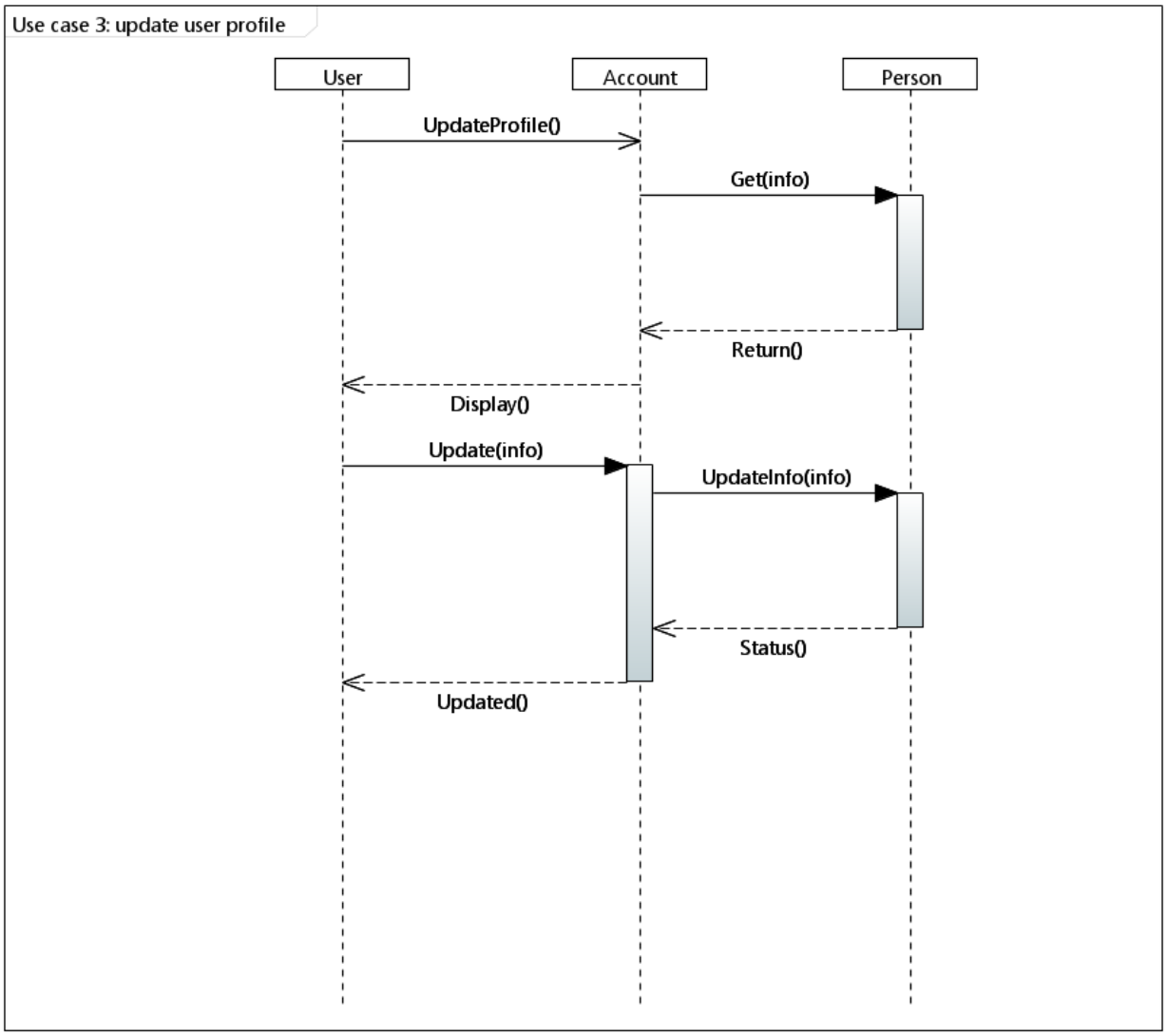
Sequence Diagram of Use Case 1:



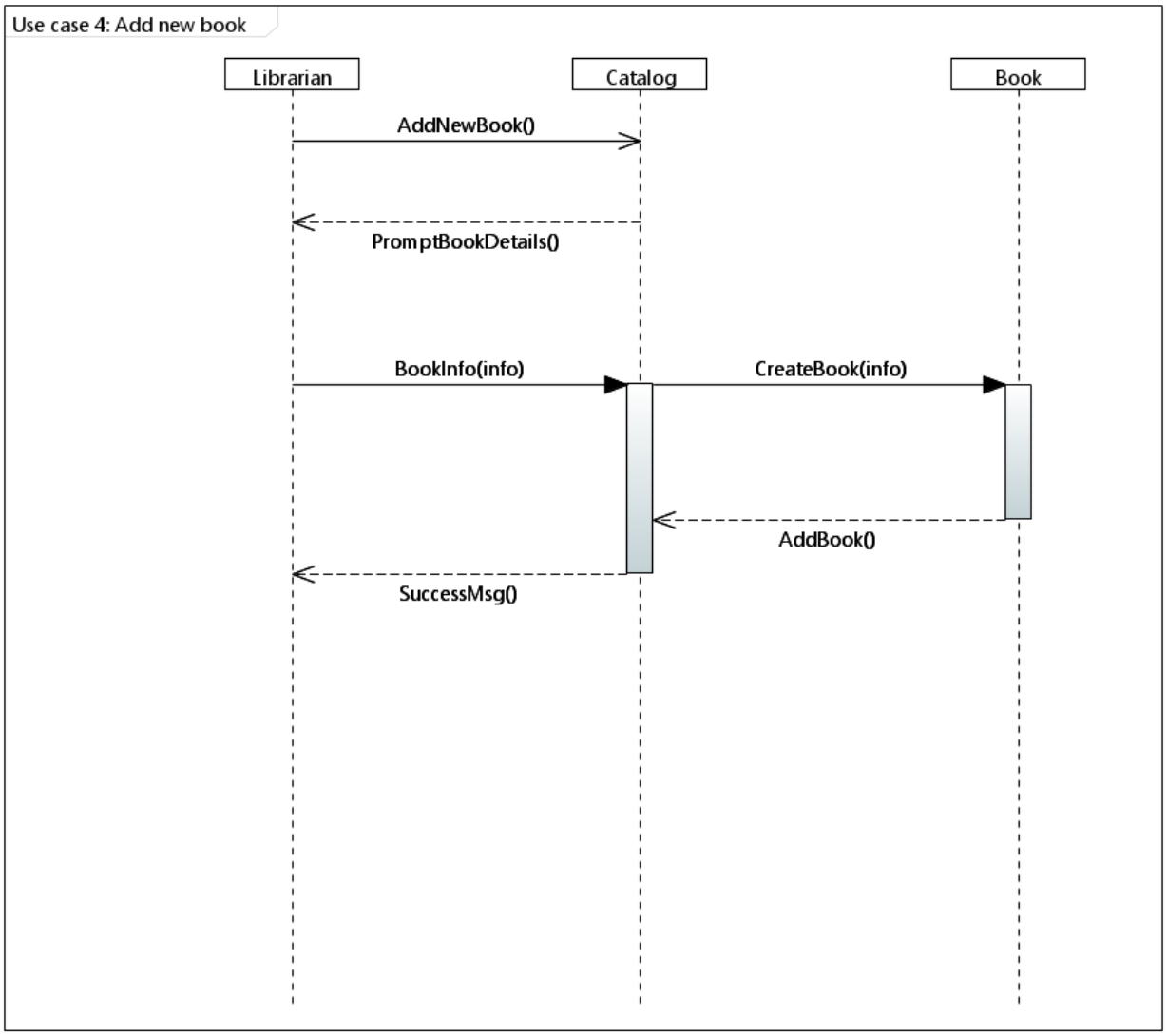
Sequence Diagram of Use Case 2:



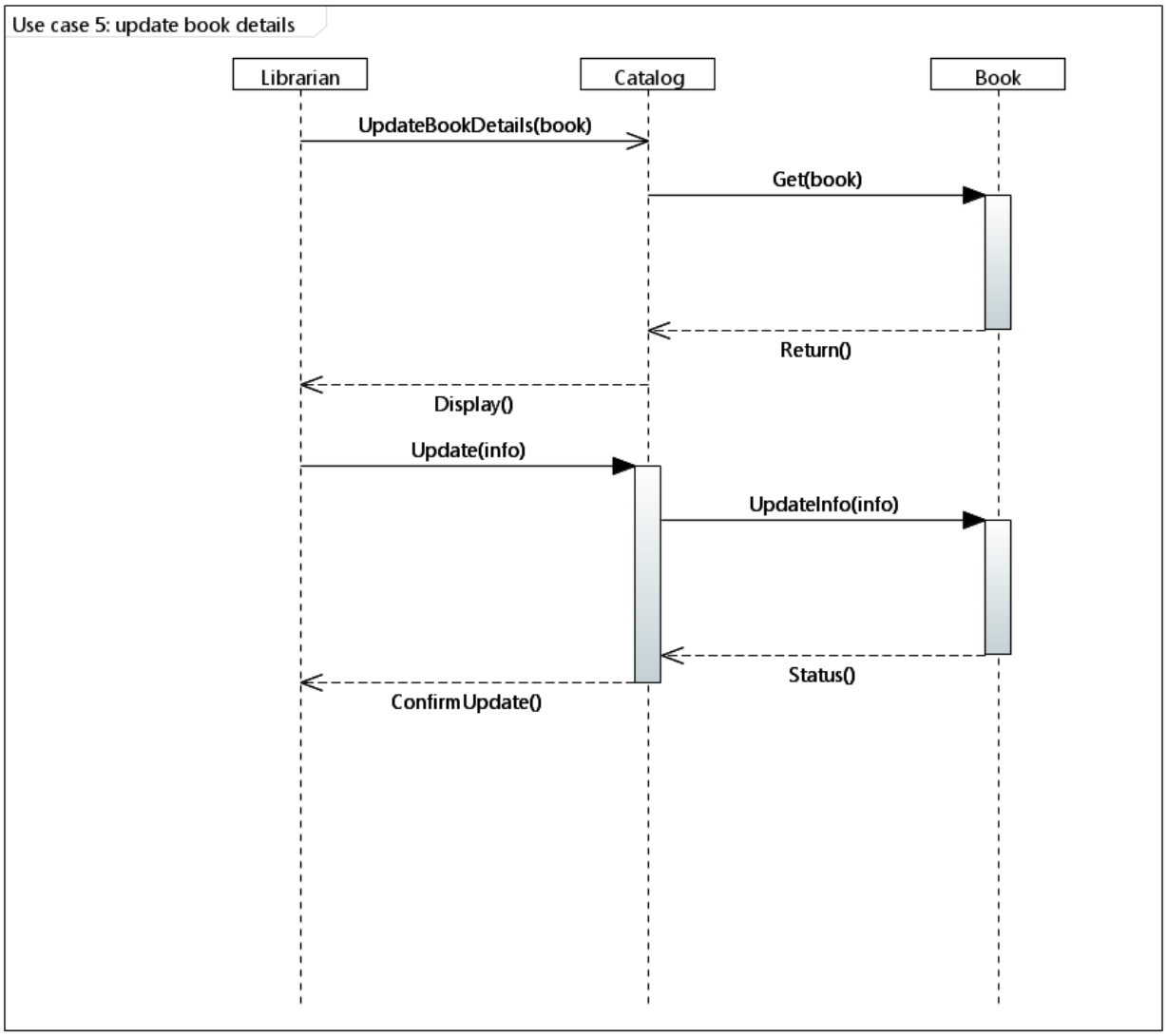
Sequence Diagram of Use Case 3:



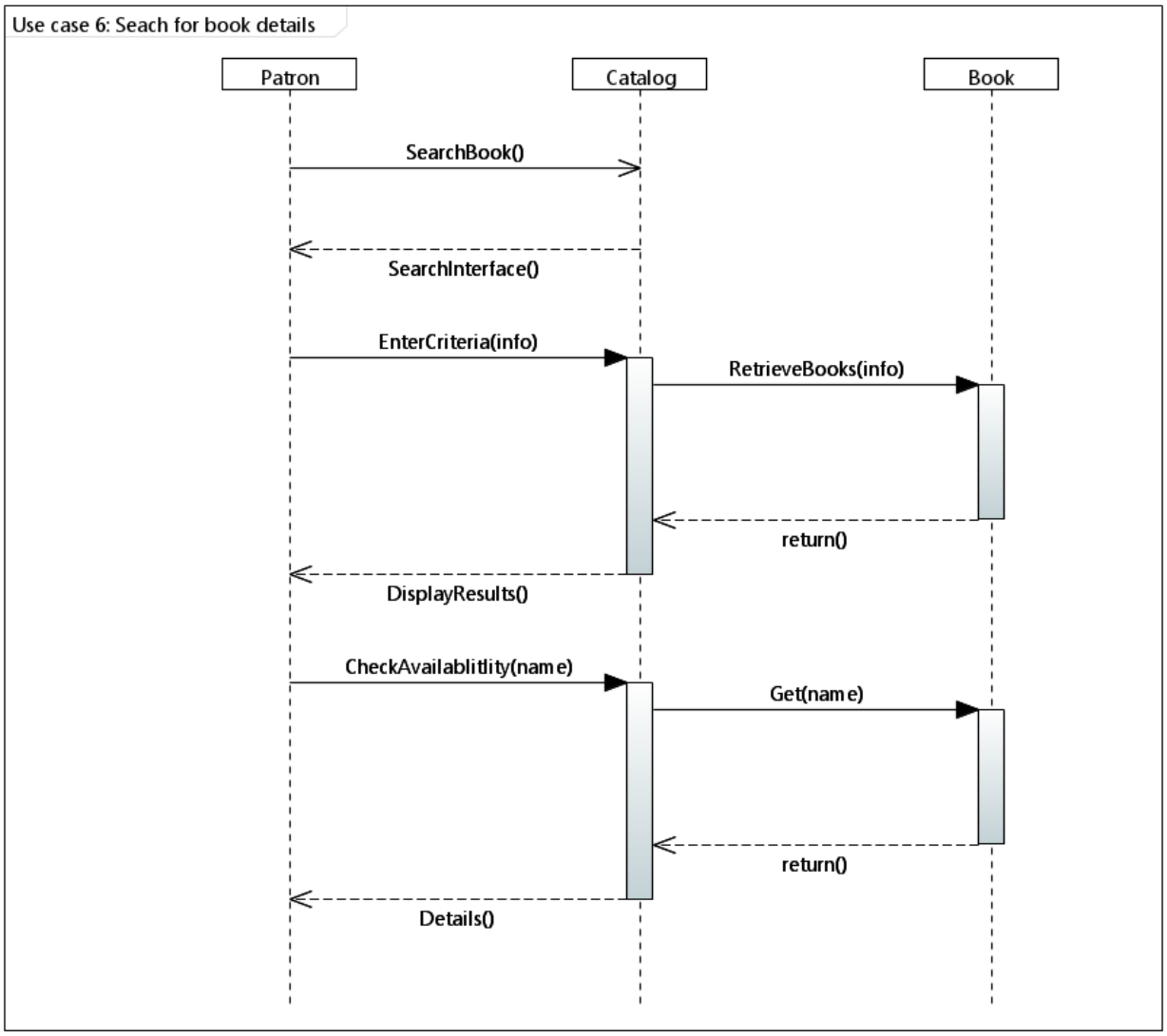
Sequence Diagram of Use Case 4:



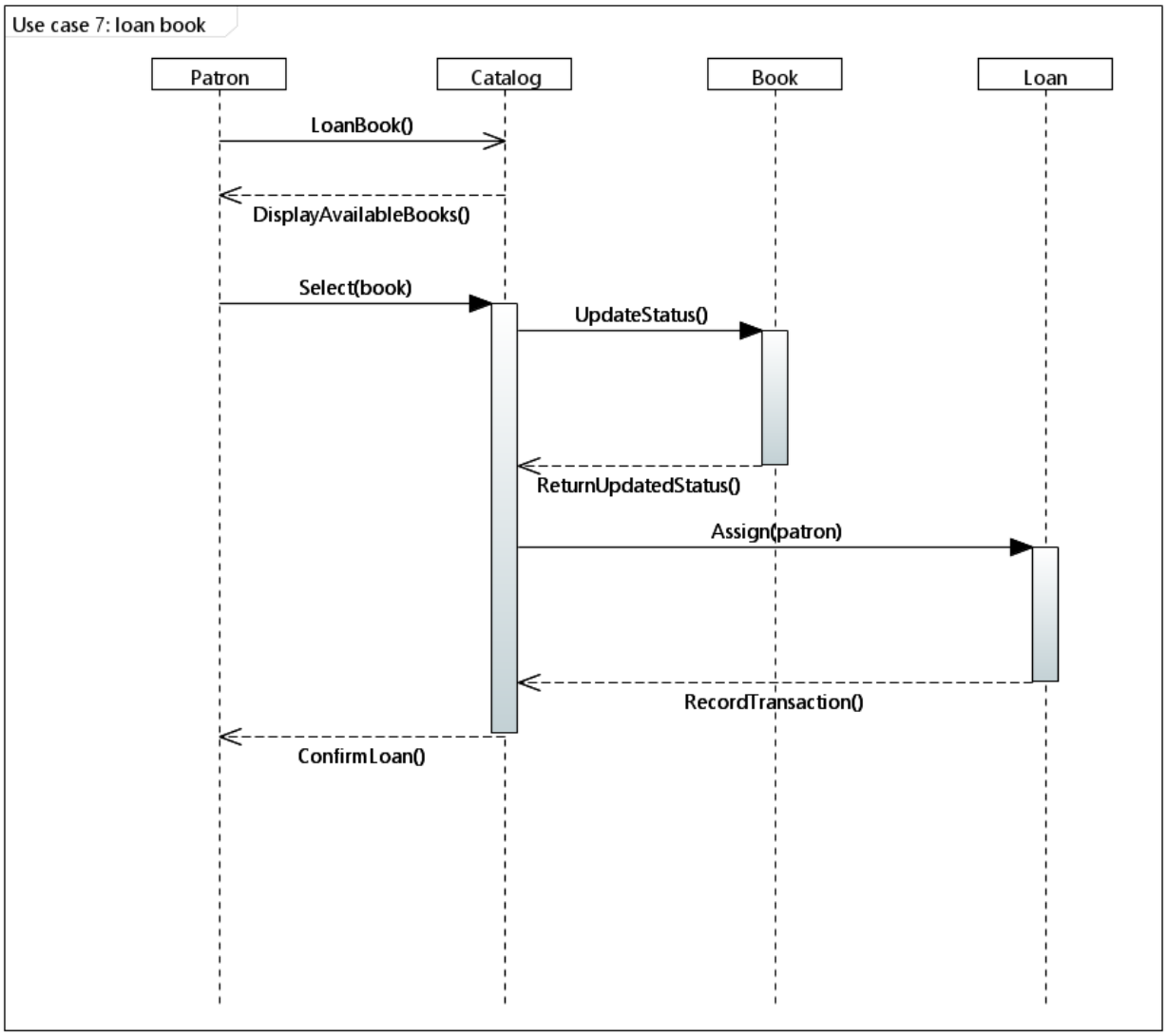
Sequence Diagram of Use Case 5:



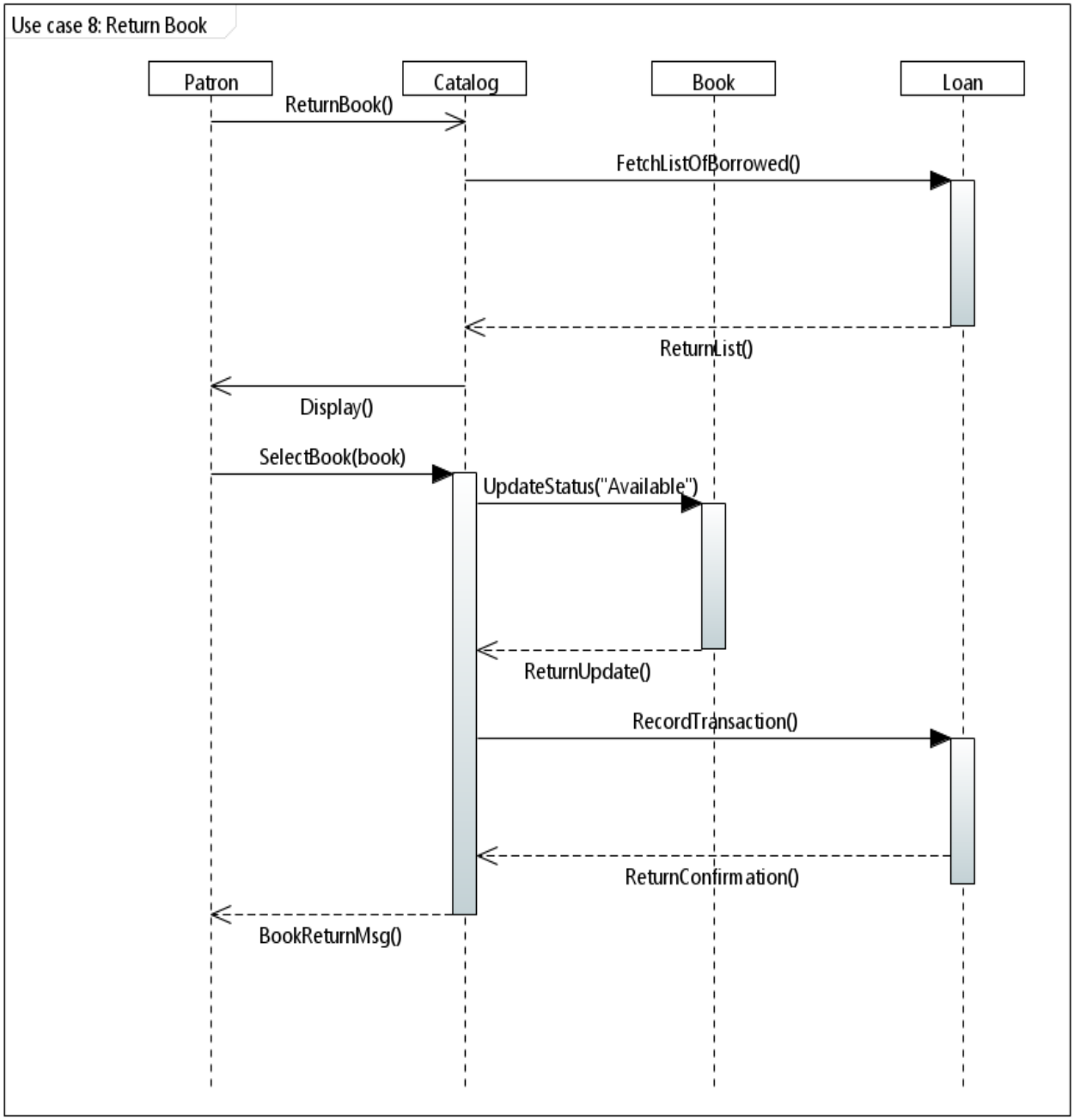
Sequence Diagram of Use Case 6:



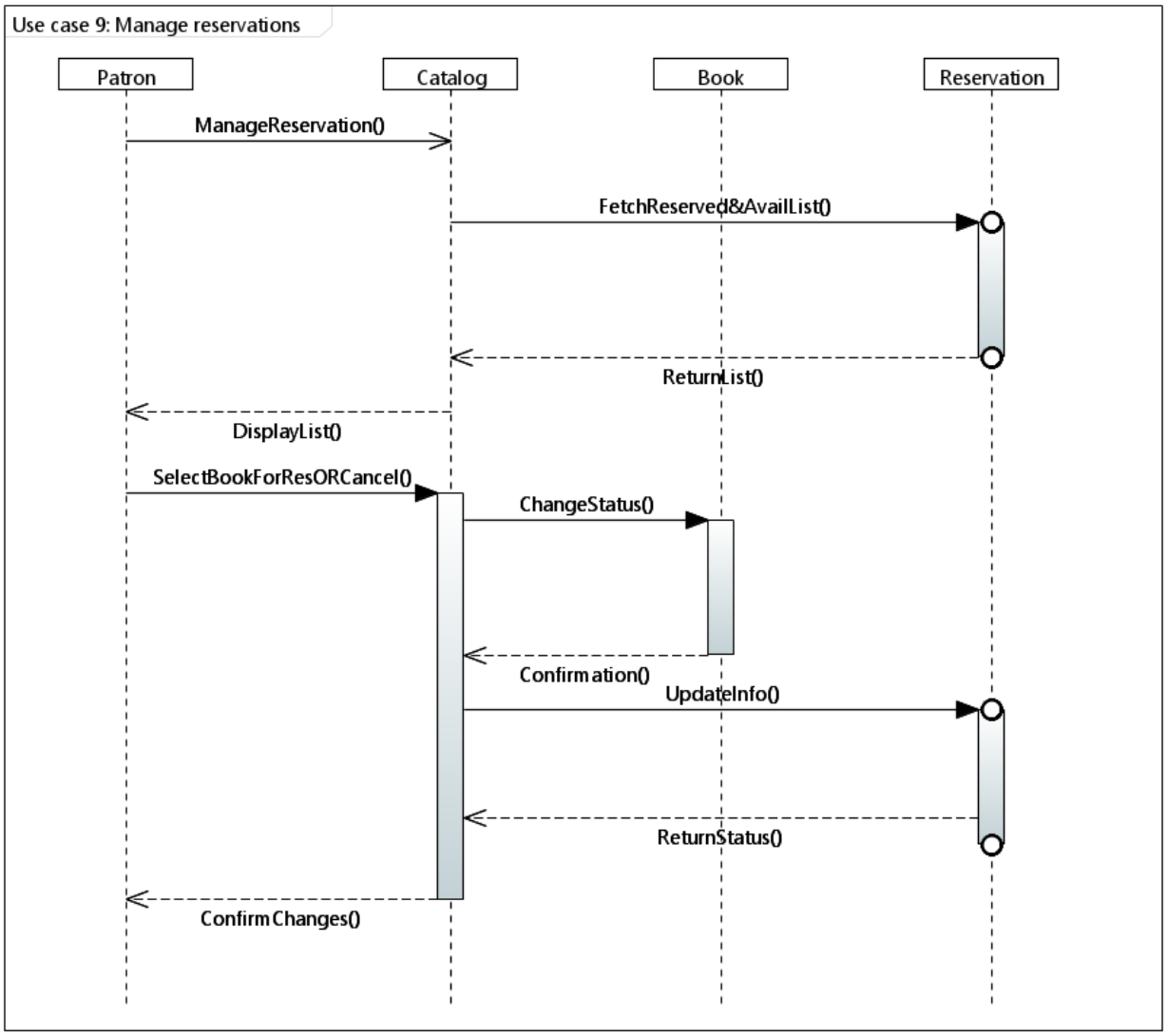
Sequence Diagram of Use Case 7:



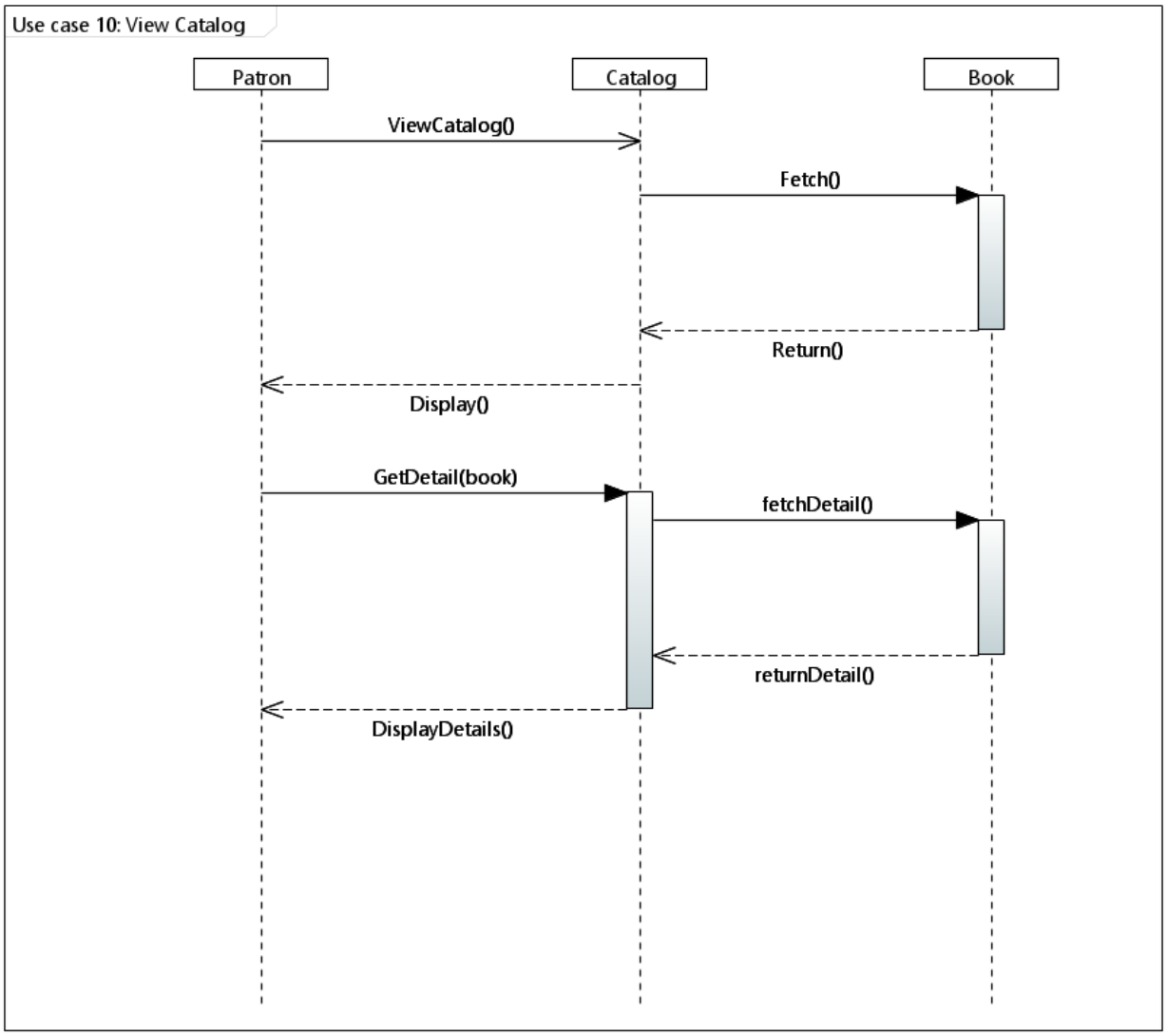
Sequence Diagram of Use Case 8:



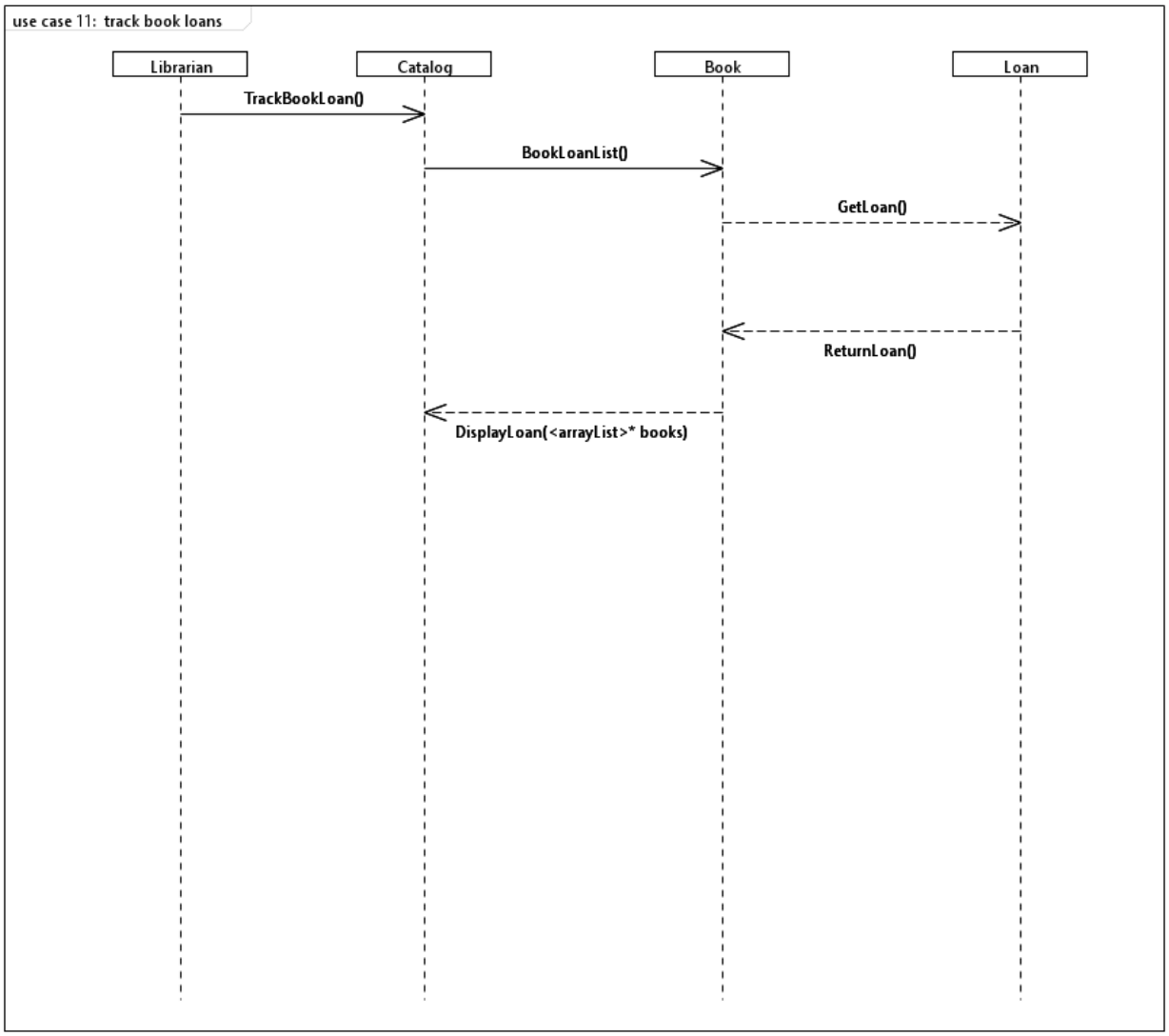
Sequence Diagram of Use Case 9:



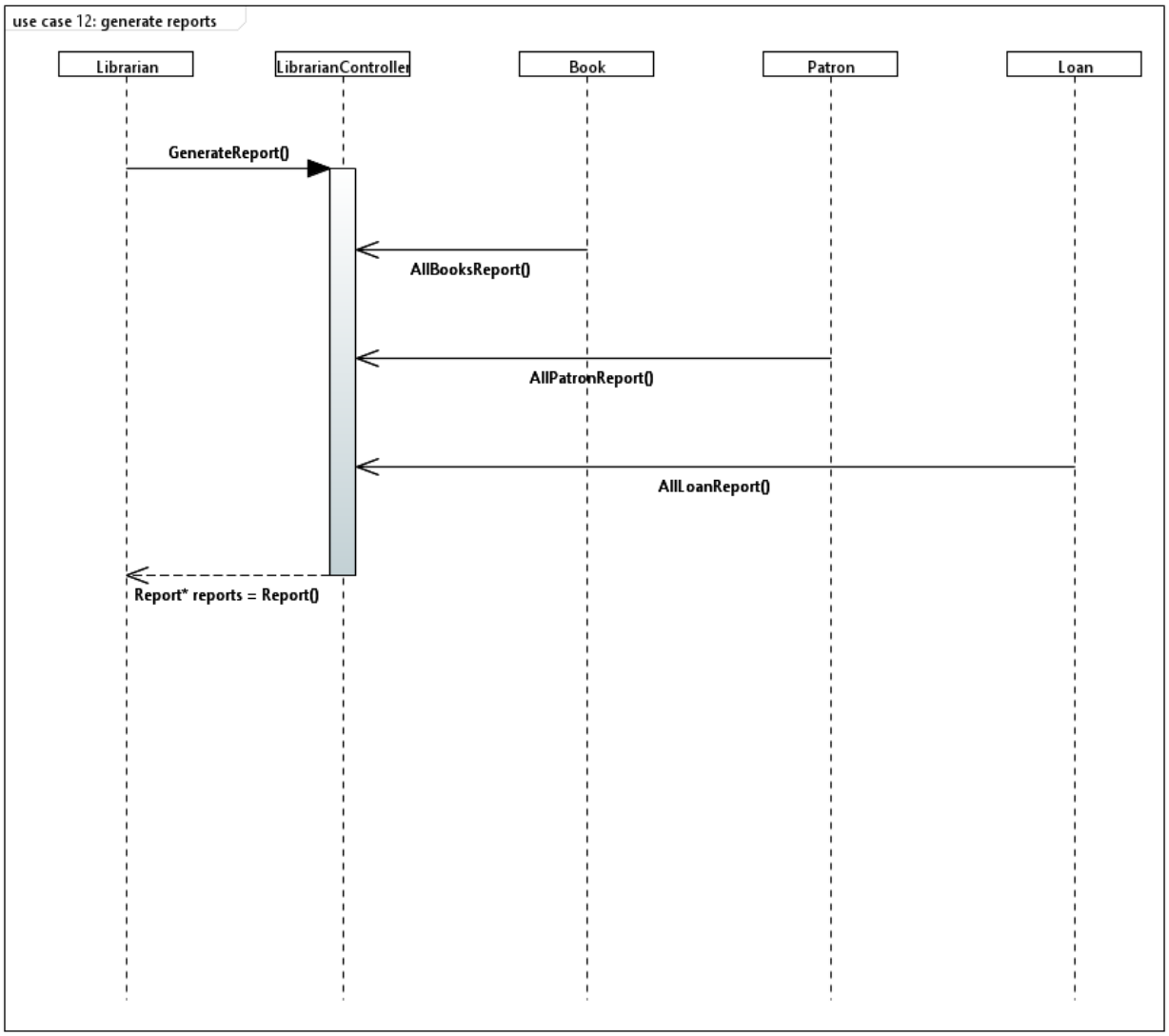
Sequence Diagram of Use Case 10:



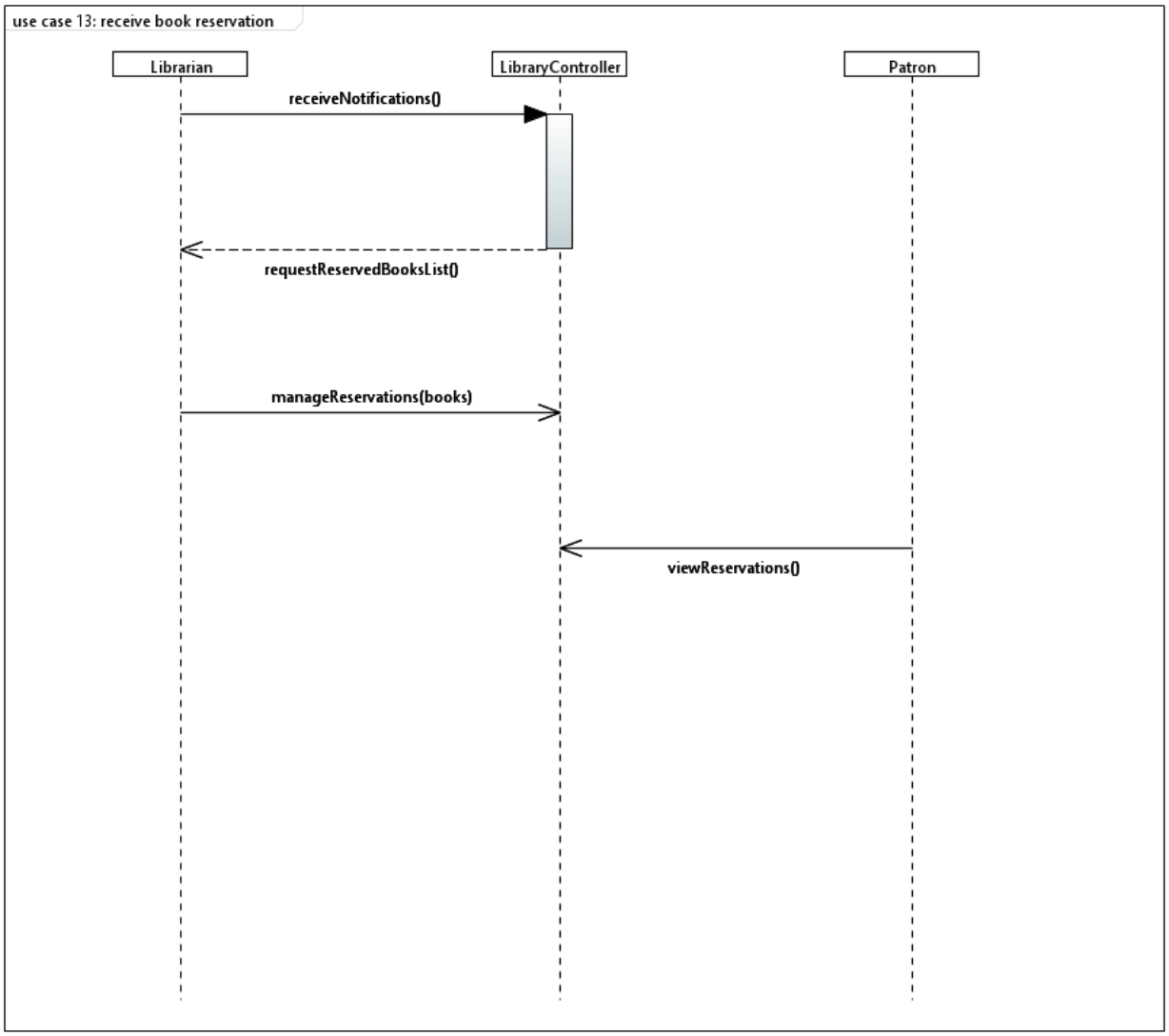
Sequence Diagram of Use Case 11:



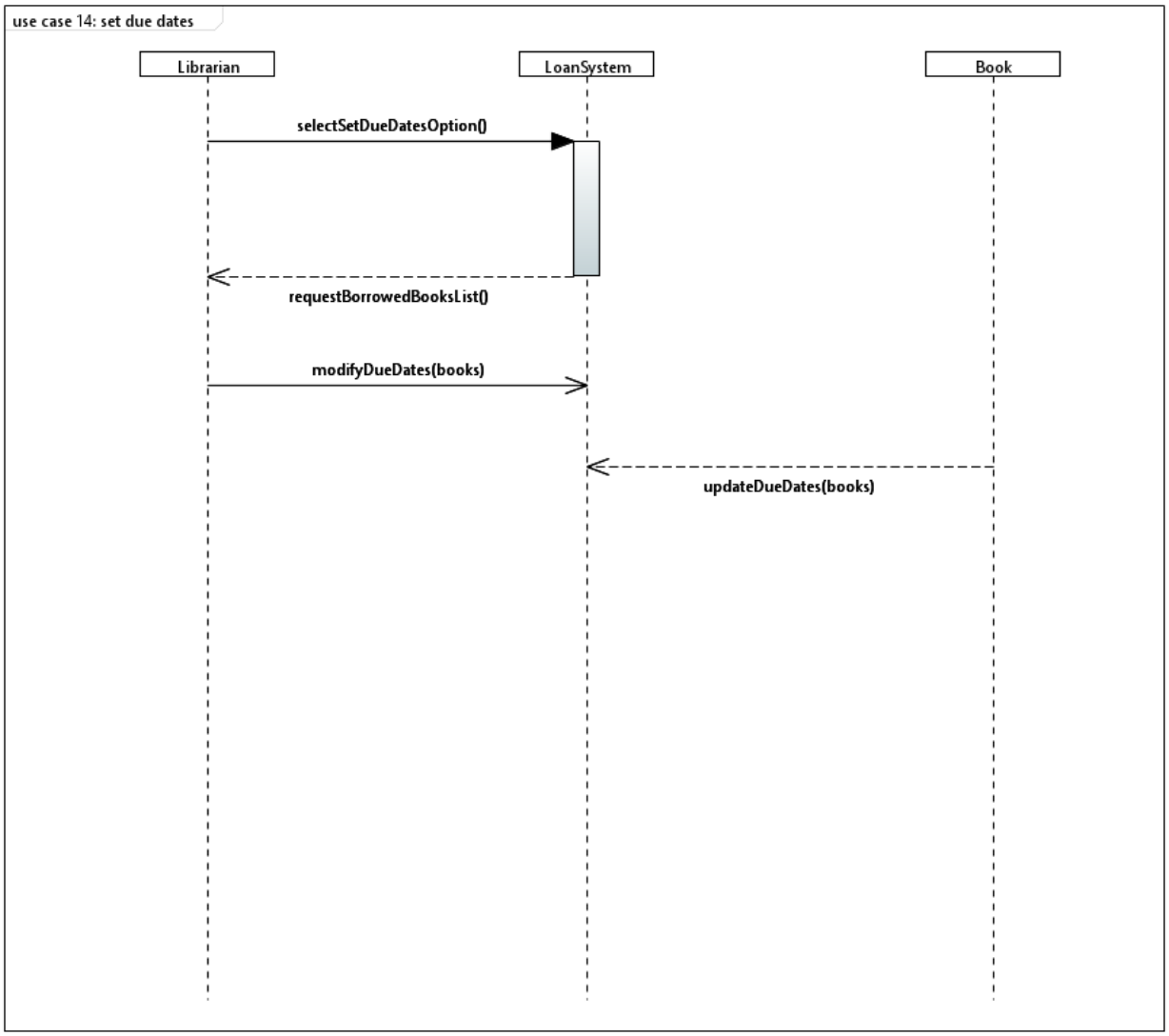
Sequence Diagram of Use Case 12:



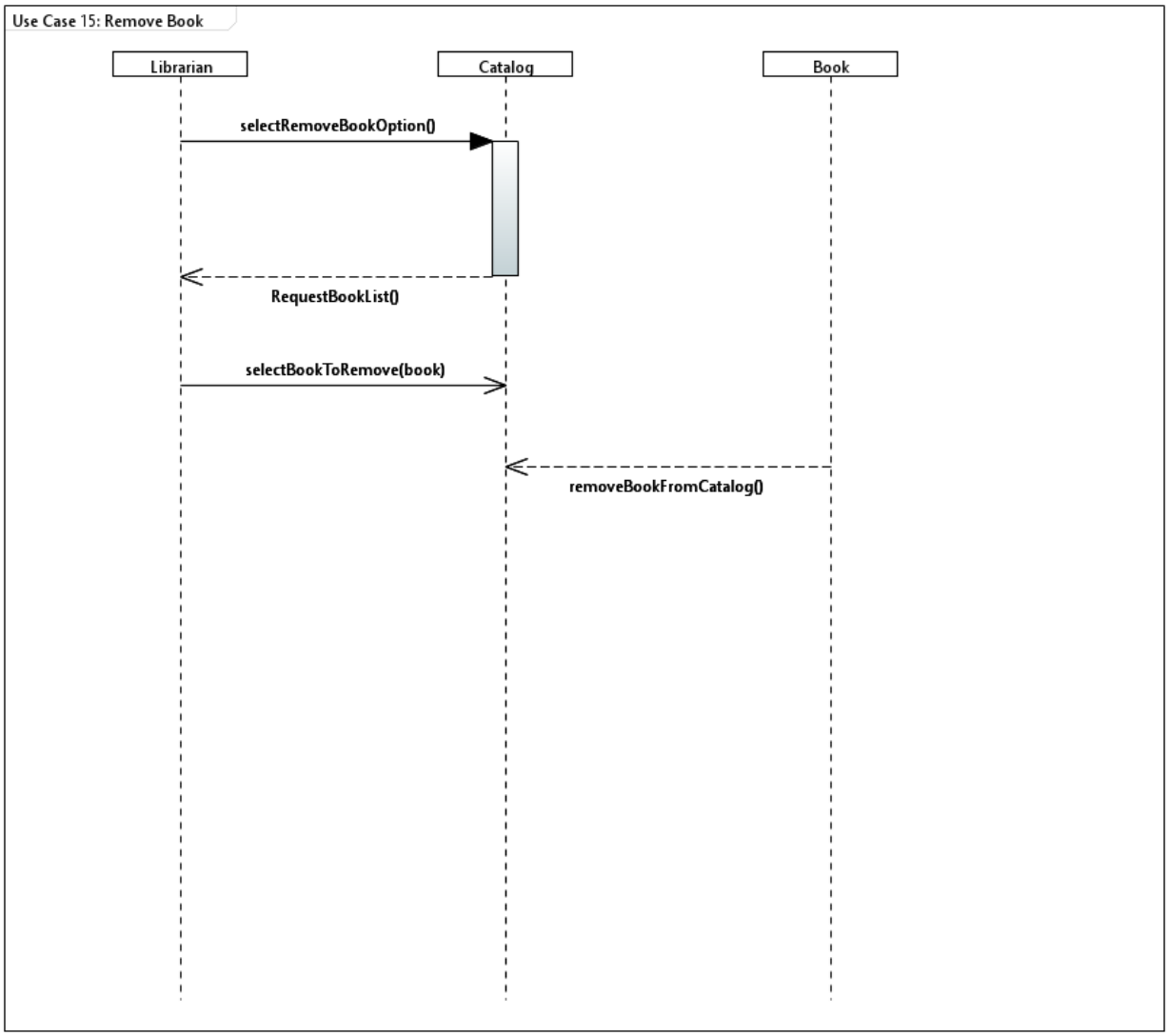
Sequence Diagram of Use Case 13:



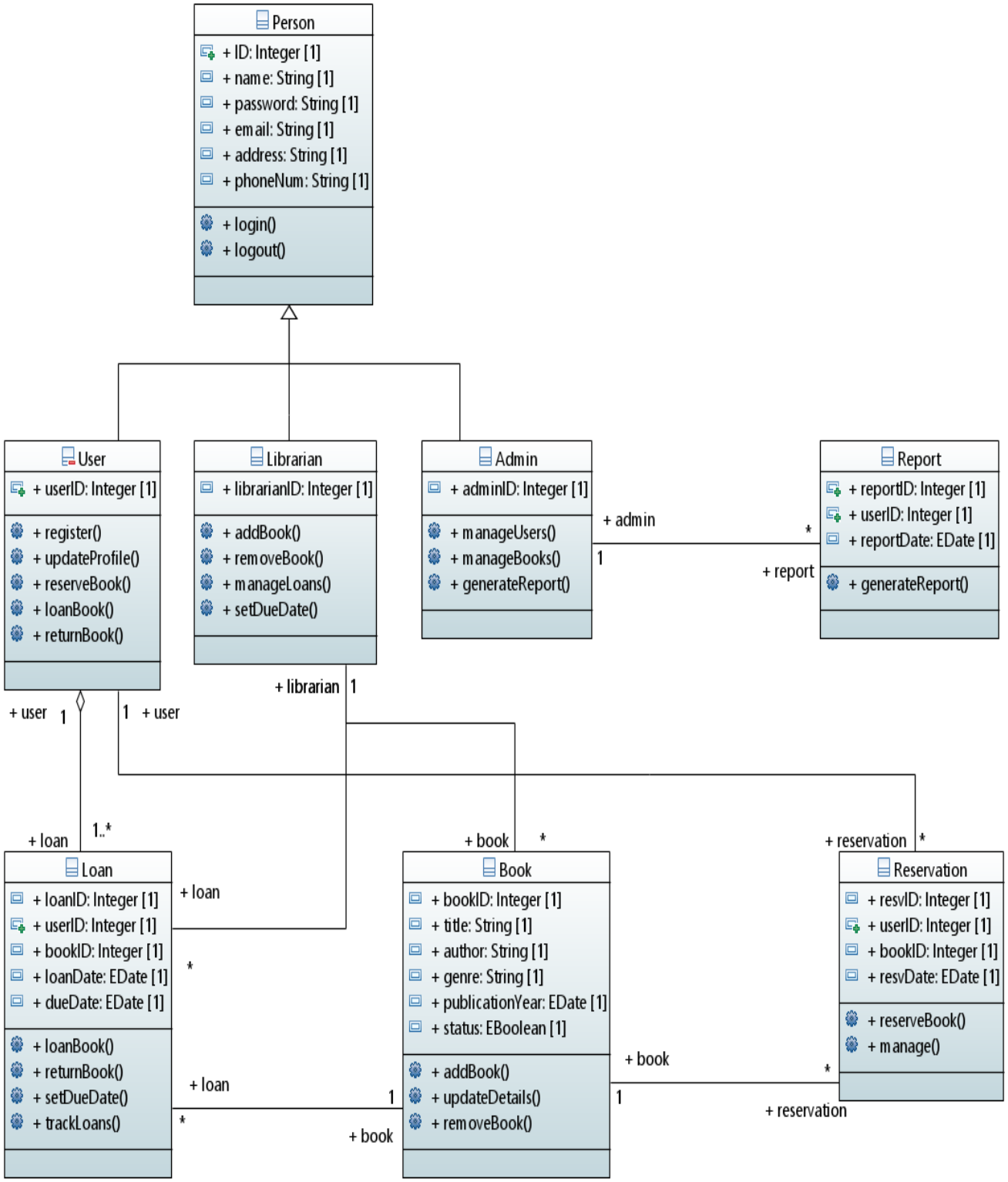
Sequence Diagram of Use Case 14:



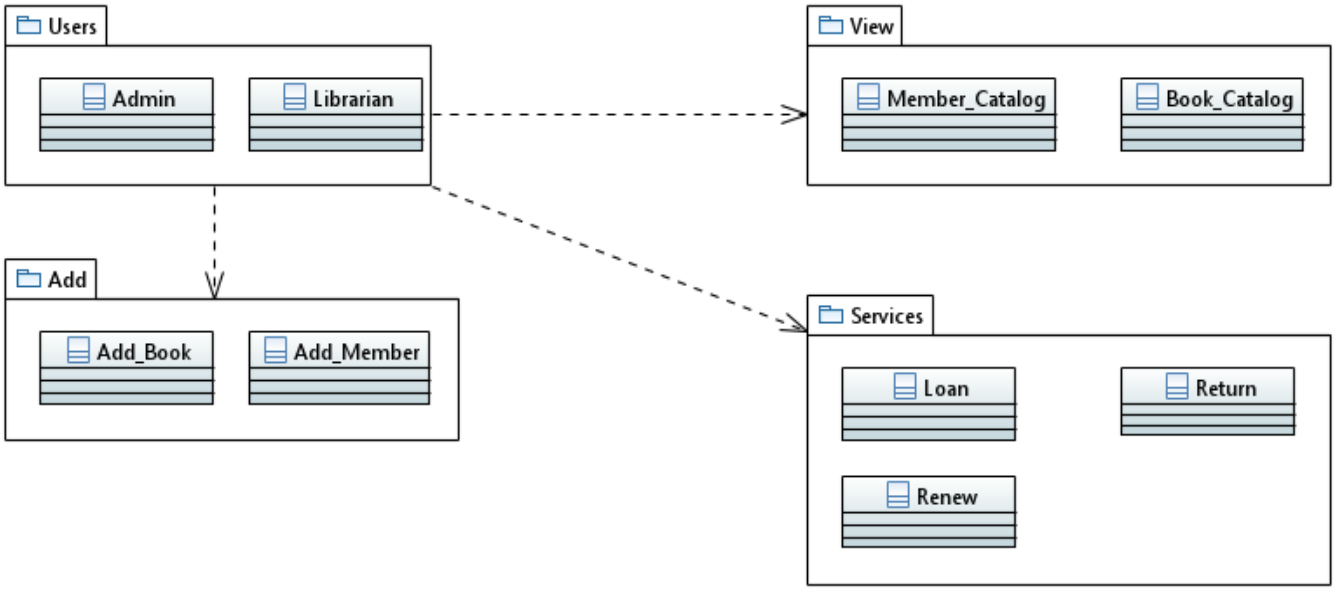
Sequence Diagram of Use Case 15:



Class Diagram



Package Diagram



Deployment Diagram