Software Requirements Specification

for

Online Library Management System

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20.08.2025

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1. Introduction

Background:

Library management systems have evolved significantly from traditional card catalogs and manual record-keeping to sophisticated digital platforms that streamline all aspects of library operations. According to recent studies, digital library management systems can increase operational efficiency by up to 40% and improve resource accessibility by 60% for patrons (Smith, 2023). In educational institutions, libraries serve as critical knowledge hubs where efficient management is crucial for supporting academic activities, research, and self-learning. The transition to online systems addresses numerous challenges associated with manual processes, including time-consuming searches, inefficient borrowing/returning procedures, inventory management difficulties, and limited accessibility to resources after operating hours.

The digital transformation of libraries has become increasingly important in the post-pandemic era, where remote access to resources and services has become an expectation rather than a luxury. Modern library management systems not only automate traditional processes but also provide valuable analytics that help institutions make data-driven decisions about resource allocation, acquisition, and space utilization (Wilson, 2023). These systems have become essential components of educational infrastructure, directly impacting the quality of education and research outcomes.

Motivation:

The increasing demand for efficient information retrieval and resource management in libraries has highlighted the limitations of traditional, manual systems. These legacy approaches often lead to operational inefficiencies, including delays in updating book availability information, difficulties in tracking borrowed items, challenges in managing user accounts, and significant administrative overhead. These inefficiencies ultimately diminish the user experience and reduce library utilization rates.

An online library management system can comprehensively address these challenges by automating critical processes, providing real-time information to both users and administrators, and enhancing the overall library experience through intuitive interfaces and self-service capabilities. The motivation for this project stems from the recognized need to bridge the gap between traditional library services and modern digital expectations, creating a seamless, efficient, and user-centric platform that serves both library staff and patrons effectively.

Furthermore, the shift toward digital solutions in educational environments has accelerated in recent years, with students and faculty expecting anytime, anywhere access to resources. A robust online library management system not only meets these expectations but also provides institutions with valuable insights into usage patterns, popular resources, and areas requiring collection development.

Problem Statement:

Traditional library management systems face numerous significant challenges that hinder their effectiveness in meeting modern user needs. These challenges include inefficient book tracking mechanisms, labor-intensive manual record-keeping processes, delayed availability updates leading to user frustration, difficulties in managing user accounts and borrowing history, inadequate reporting capabilities for administrative decision-making, and limited accessibility outside physical library hours.

These limitations collectively result in a suboptimal user experience, increased administrative burden on library staff, underutilization of valuable library resources, higher rates of lost or overdue materials, and inability to leverage data for strategic collection development. The absence of an integrated digital solution exacerbates these issues, particularly in educational institutions where library resources are critical for academic success.

There is a clear and pressing need for an integrated digital solution that automates library operations, provides real-time information to both users and administrators, streamlines the borrowing/returning process, offers comprehensive reporting capabilities, and extends access to library resources beyond physical constraints. Such a solution would significantly enhance operational efficiency, improve user satisfaction, and maximize the return on investment in library collections.

Objectives:

The primary objective of this project is to develop a comprehensive, web-based Online Library Management System that digitizes and automates all critical library operations, providing an efficient, user-friendly platform for both administrators and library patrons.

Specific objectives include:

- To implement a secure, robust authentication system that distinguishes between administrators and regular users based on ID structure (4-digit for admin, 5-digit for users).
- To develop an intuitive book management system that allows administrators to add, edit, delete, and categorize library resources efficiently.
- To create a comprehensive user management module that enables administrators to manage patron accounts, track borrowing history, and monitor account status.
- To implement a sophisticated borrowing and returning system with automated tracking capabilities, due date management, and renewal features.
- To develop a defaulters tracking system that identifies users with overdue materials and facilitates appropriate follow-up actions.
- To create profile management functionality that allows users to view and update their personal information and borrowing history.
- To implement a configurable settings module that allows administrators to define borrowing rules, fine structures, and library information.
- To design responsive, intuitive user interfaces that provide optimal experiences across different devices and user types.
- To ensure system security through proper authentication, authorization, and data protection mechanisms.

By these objectives, the proposed system aims to transform library operations, enhancing both operational efficiency and user experience while providing valuable data-driven insights for continuous improvement.

2. System Overview

The Online Library Management System is a comprehensive, web-based platform designed to streamline and automate all aspects of library operations in educational institutions, public libraries, and organizational resource centers. The system provides sophisticated role-based access control with distinctly separate interfaces and functionality for administrators and library patrons, ensuring appropriate access levels and capabilities for each user type.

Administrators benefit from a powerful dashboard that provides complete control over library operations, including comprehensive book management (adding new resources, editing existing records, categorizing materials, and managing inventory), patron management (registering new users, updating accounts, tracking borrowing history, and managing privileges), borrowing management (processing loans, returns, and renewals), defaulters tracking (identifying overdue materials and managing follow-up procedures), and system configuration (setting borrowing rules, fine structures, and library policies).

Library users enjoy an intuitive interface that allows them to browse available resources through advanced search and filtering capabilities, manage their borrowing activities (checking out items, viewing due dates, renewing materials), maintain their personal profiles, and access their complete borrowing history. The system incorporates real-time availability information, eliminating the frustration of searching for unavailable resources, and provides automated notifications for due dates, overdue materials, and available holds.

The system is architecturally designed using modern web technologies, including HTML5, CSS3, and JavaScript for the frontend presentation layer, PHP for server-side business logic and processing, and MySQL for robust, efficient data management and storage. This technology stack ensures platform stability, security, and performance while maintaining flexibility for future enhancements and integrations.

The platform offers real-time information synchronization on book availability, current borrowing status, reservation queues, and due dates, significantly improving operational efficiency, resource utilization, and overall user experience. Advanced reporting capabilities provide library administrators with valuable insights into usage patterns, popular resources, and operational metrics, supporting data-driven decision-making for collection development and service improvements.

3. System Life Cycle

3.1 Planning Phase

- Comprehensive requirement gathering through stakeholder interviews, user surveys, and analysis of existing workflows
- Definition of project scope, objectives, deliverables, and success criteria
- Identification of all user roles (Administrator, Library User) and their specific needs and permissions.
- Establishment of project timeline, milestones, and resource allocation
- Risk assessment and mitigation strategy development
- Selection of appropriate technology stack and development tools

3.2 System Analysis Phase

- Detailed analysis of functional requirements for each user role and system module
- Specification of non-functional requirements including performance, security, usability, and scalability
- Documentation of business rules, borrowing policies, and exception handling procedures
- Analysis of data requirements and information flow between system components
- Identification of integration points with existing institutional systems (if applicable)
- Creation of detailed user stories and use cases for all system functionalities

3.3 System Design Phase

- Design of comprehensive database schema supporting all system entities and relationships
- Creation of intuitive user interface designs for both administrator and user portals
- Development of system architecture specifying component interactions and data flow
- Design of authentication and authorization mechanisms ensuring appropriate access control
- Planning of reporting structures and analytics capabilities
- Establishment of design standards, patterns, and consistency guidelines

3.4 Implementation Phase

- Frontend development using HTML5, CSS3, and JavaScript creating responsive, accessible interfaces
- Backend development using PHP implementing business logic, data processing, and API endpoints
- Database implementation using MySQL ensuring efficient data storage and retrieval
- Integration of all system components ensuring seamless data flow and functionality
- Implementation of security measures including input validation, SQL injection prevention, and XSS protection
- Development of administrative tools for system management and monitoring

3.5 Testing Phase

- Comprehensive unit testing of individual components and functions
- Rigorous integration testing verifying component interactions and data consistency
- System testing evaluating end-to-end functionality and performance
- User acceptance testing with representative users from both administrator and patron groups
- Security testing identifying vulnerabilities and ensuring data protection
- Performance testing verifying system responsiveness under various load conditions
- Compatibility testing across different browsers and devices

3.6 Deployment & Maintenance Phase

- System deployment using XAMPP stack for initial implementation
- Data migration from existing systems (if applicable)
- User training for both administrators and library patrons
- Establishment of ongoing maintenance procedures including regular backups and updates
- Monitoring system performance and addressing issues proactively
- Planning for future enhancements based on user feedback and evolving needs
- Documentation of system administration procedures and user guides

4. Functional Requirements

4.1 List of Features with Brief Descriptions

Administrator Features:

User Management: Comprehensive functionality to add, edit, delete, and view all user accounts with appropriate privileges and access levels

Book Management: Complete control over library collection including adding new books, editing existing records, removing obsolete items, and managing inventory levels

Borrowing Management: Oversight of all borrowing activities including viewing current loans, processing returns, handling renewals, and managing reservations

Settings Management: Configuration of system parameters including borrowing rules, fine structures, library information, and operational policies

Notification System: Management of automated communications for due date reminders, overdue notices, and available reservations

Library User Features:

Book Browsing & Search: Intuitive interface for discovering library resources through search, filtering, and categorization features

Borrowing Books: Self-service functionality to check out available materials with clear due date information

Returning Books: Easy process for returning borrowed items with confirmation and history tracking

Profile Management: Access to personal information with ability to update contact details and communication preferences

Borrowing History: Complete record of past and current borrowing activities with status information

Renewal Requests: Ability to request extensions for borrowed materials based on library policies

Reservation System: Functionality to place holds on currently unavailable materials with notification when available

Feature table

ID	Feature	Actors	Description
FR-1	User Authentication	All Users	Secure login system with session management, password encryption, and role-based access control (4-digit ID for admin, 5-digit for users)
FR-2	Role-Based Dashboard	All Users	Distinct, customized dashboards for administrators and users based on login credentials and privileges
FR-3	User Management	Admin	Comprehensive functionality to add, edit, delete, and view user accounts with search, filter, and export capabilities
FR-4	Book Management	Admin	Complete control over library collection including adding new books with full metadata, editing existing records, removing obsolete items, and managing inventory status
FR-5	Borrowing Management	Admin	Oversight of all borrowing activities including viewing current loans, processing returns, handling renewals, managing reservations, and overriding system rules when necessary
FR-6	Settings Management	Admin	Configuration of all system parameters including borrowing rules, fine structures, library information, operational policies, and notification templates
FR-7	Book Borrowing	User	Intuitive interface for discovering library resources through search, filtering, categorization, and recommendation features
FR-8	Book Borrowing	User	Self-service functionality to check out available materials with clear due date information, renewal

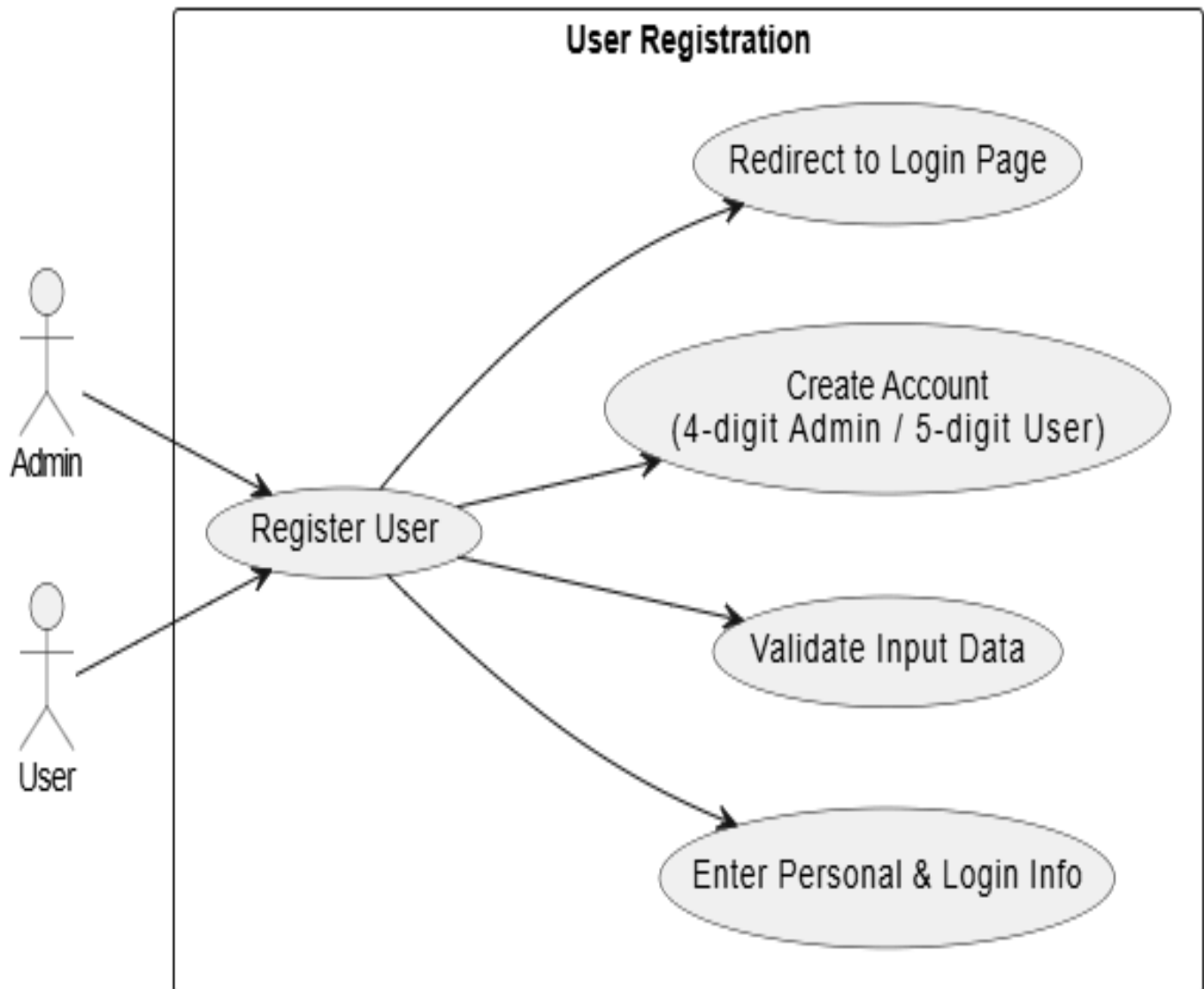|			options, and confirmation
FR-9	Book Returning	User	Simple process for returning borrowed items with confirmation, history tracking, and fine calculation if applicable
FR-10	Profile Management	User	Access to personal information with ability to update contact details, communication preferences, and privacy settings
FR-11	Borrowing History	User	Complete record of past and current borrowing activities with status information, due dates, and renewal history
FR-12	Notification System	All Users	Automated communications for due date reminders, overdue notices, available reservations, and system announcements

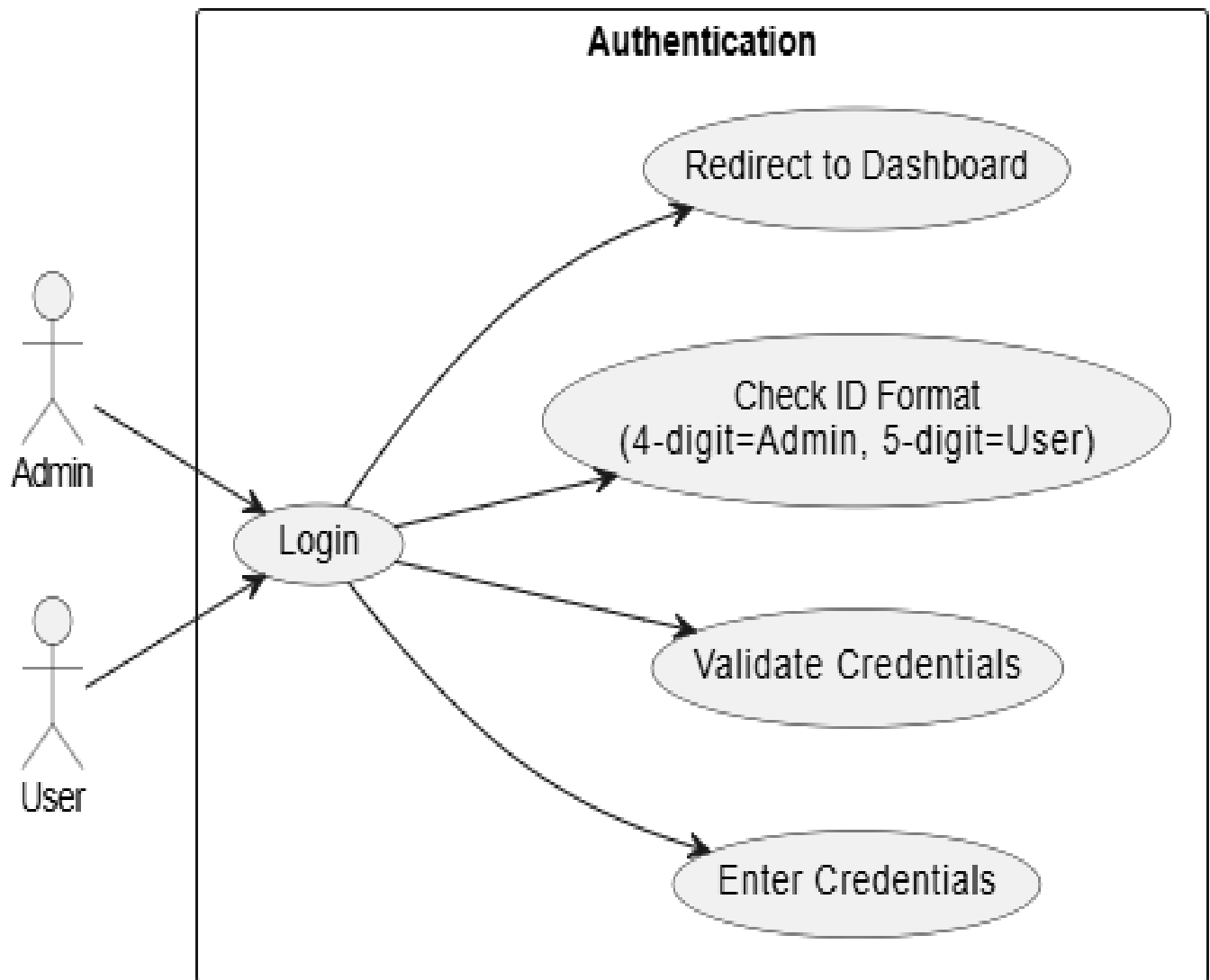# 5. System Specification Diagrams
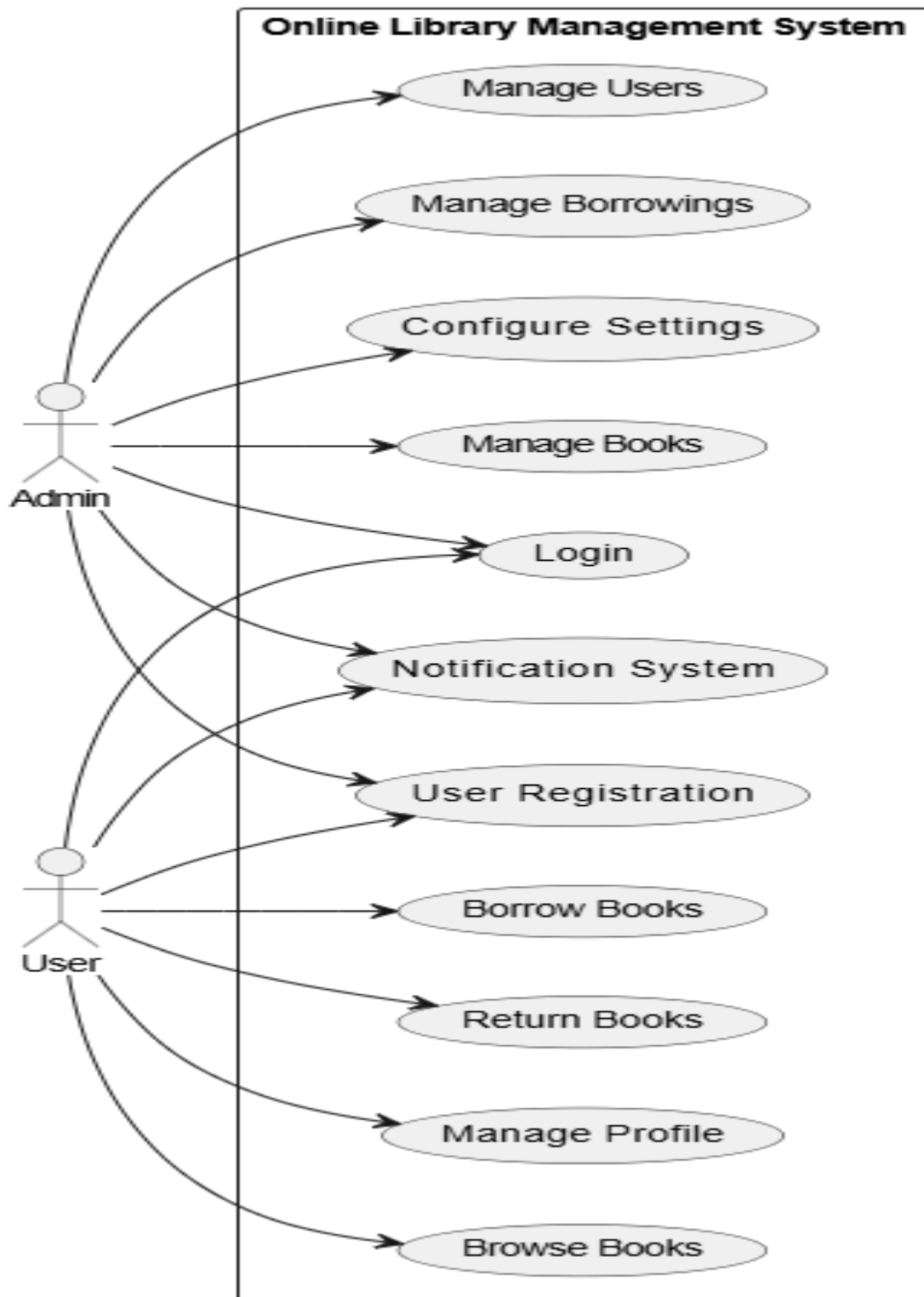
Fig: Use Case Diagram for System

Use Case Diagram: User Registration

Use Case Narration: User Registration

| Use Case Name	User Registration	
Actors	Admin, User	
Description	Allows new users to create an account by entering personal and login details. Admin can also register users.	
Precondition	User must not have an existing account. Admin must be logged in to register users.	
Course of Events	**Actors Action**	**System Response**
	User accesses registration form.	Validates input data.
	Fills out personal and login information.	Creates a new account with appropriate ID (4-digit for admin, 5-digit for user).
		Redirects to login page.
Alternative Course	1. Missing required fields show validation errors. 2. Duplicate email/username displays error message. 3. Invalid data format prompts correction.	
Conclusion	User account is created successfully with appropriate role based on ID format.	

Use Case Diagram: Login

Use case Narration: Login

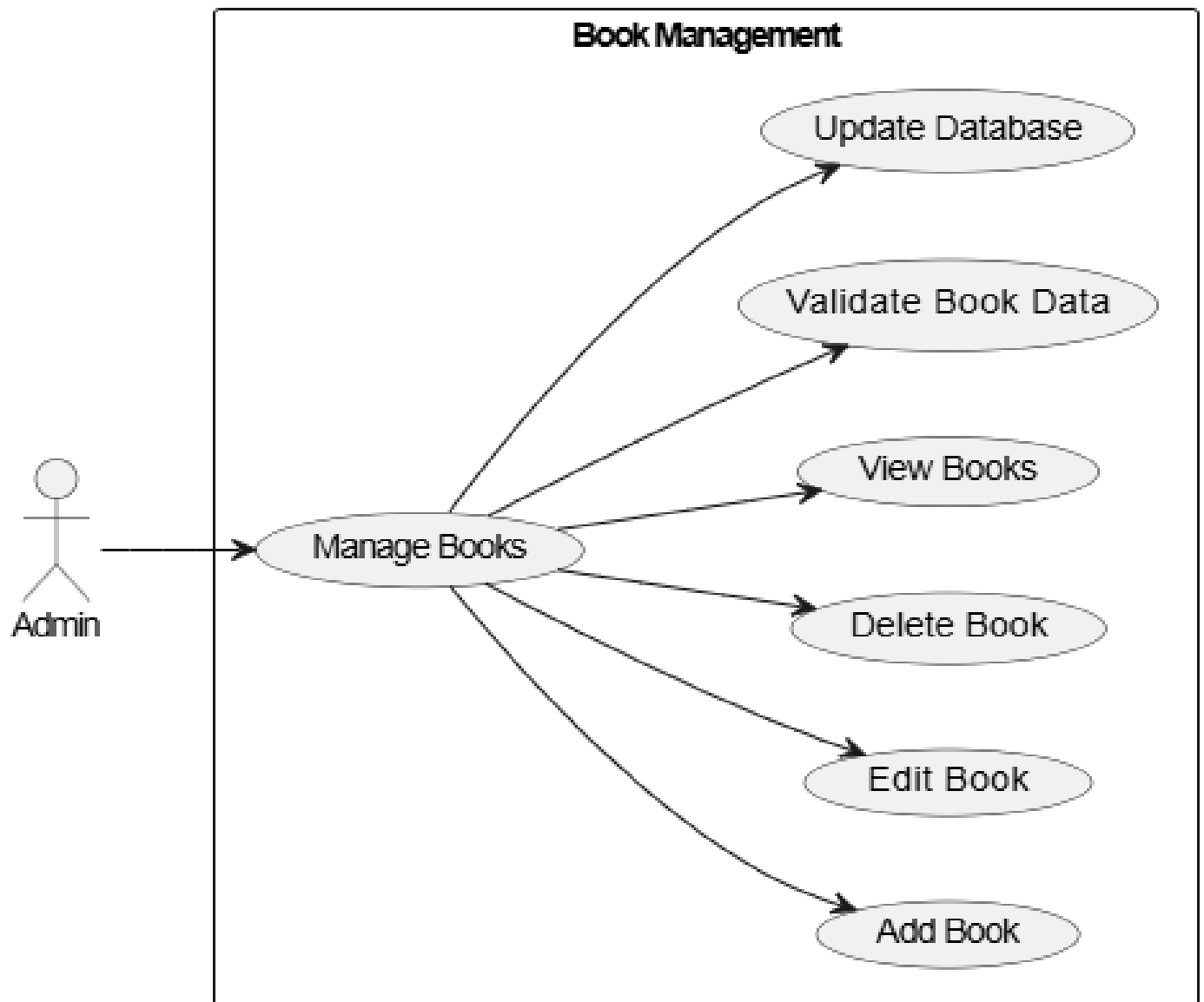| Use Case Name	Login	
Actors	Admin, User	
Description	Allows authenticated users to access the system based on credentials.	
Precondition	User must have a valid account.	
Course of Events	**Actors Action**	**System Response**
	User enters username and password.	Validates credentials.
		Checks ID format to determine role (4-digit = admin, 5-digit = user).
		Redirects to appropriate dashboard.
Alternative Course	1. Invalid credentials display error message. 2. Inactive account shows appropriate message. 3. Multiple failed attempts temporarily lock account.	
Conclusion	User is successfully logged into the system and redirected to appropriate dashboard.	

Use Case Diagram: Manage Profile
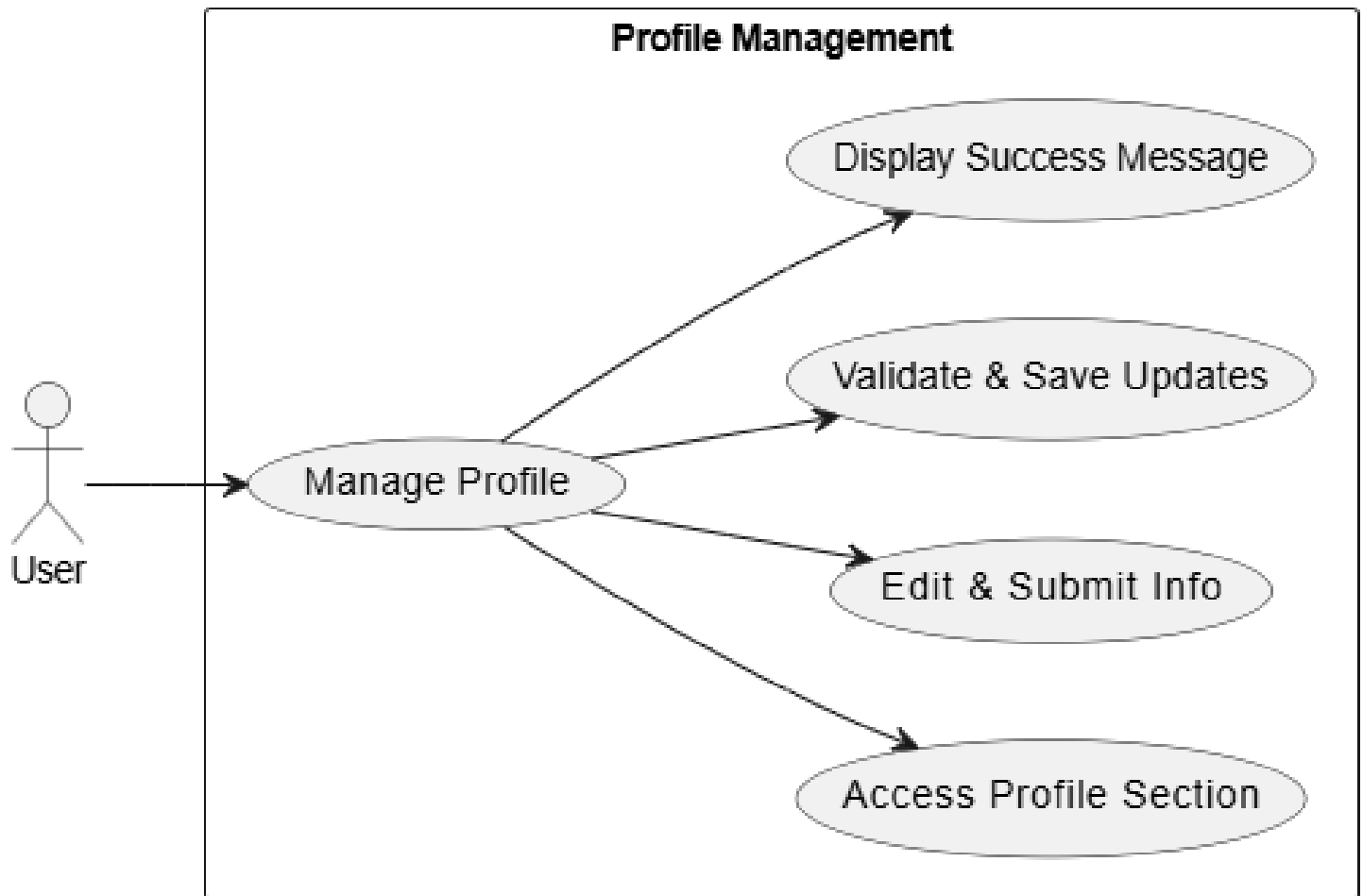
Use Case Narration: **Manage Profile**

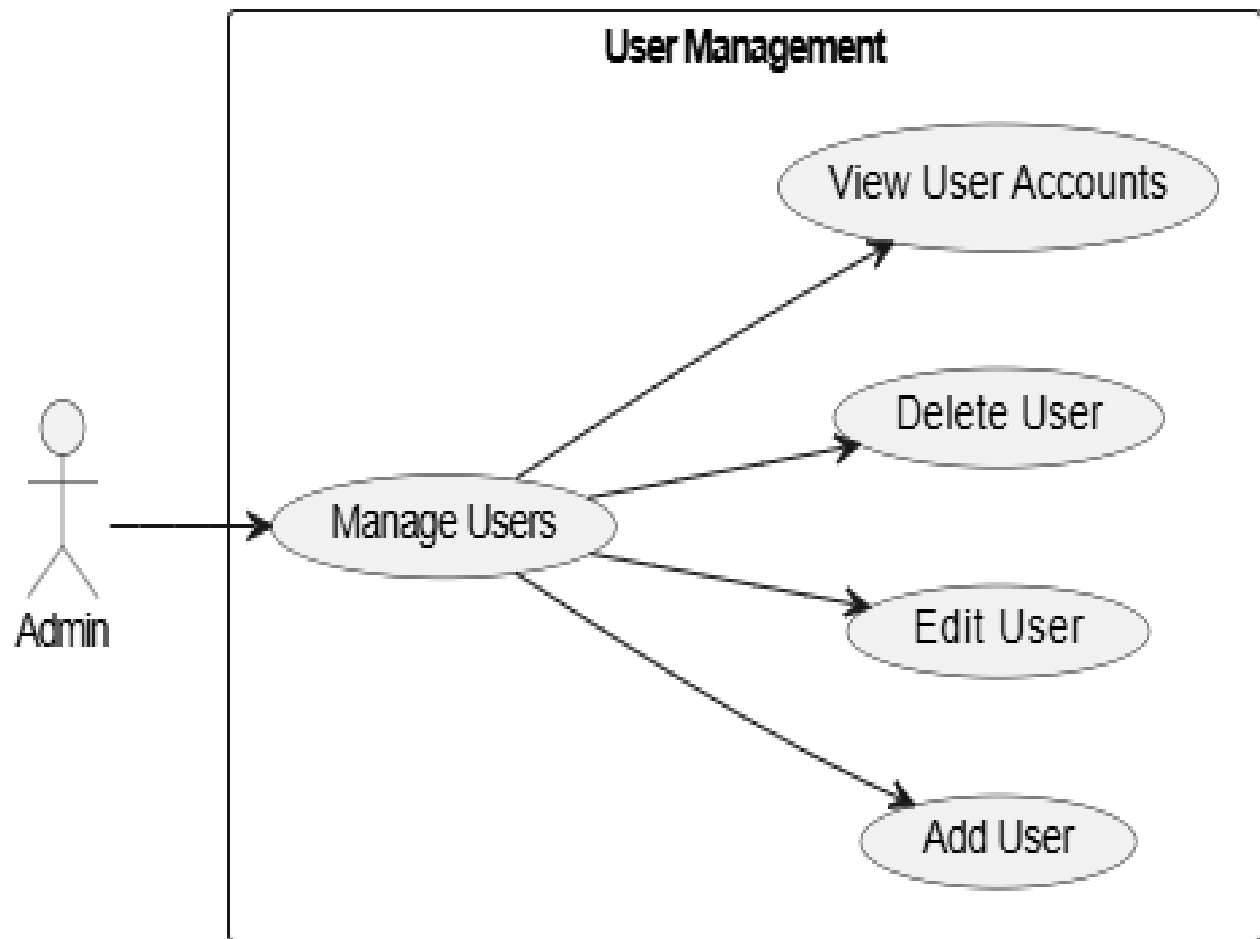| Use Case Name	Manage Profile	
Actors	User	
Description	Allows users to view and update their personal information.	
Precondition	User must be authenticated.	
Course of Events	**Actors Action**	**System Response**
	User accesses profile section.	Validates and saves updates.
	Edits and submits updated information.	Displays success message.
Alternative Course	1. Invalid data prompts validation errors. 2. Failed update triggers retry option.	
Conclusion	User profile is updated successfully.	

Use Case Diagram: Manage Books

Use Case Narration: Manage Books

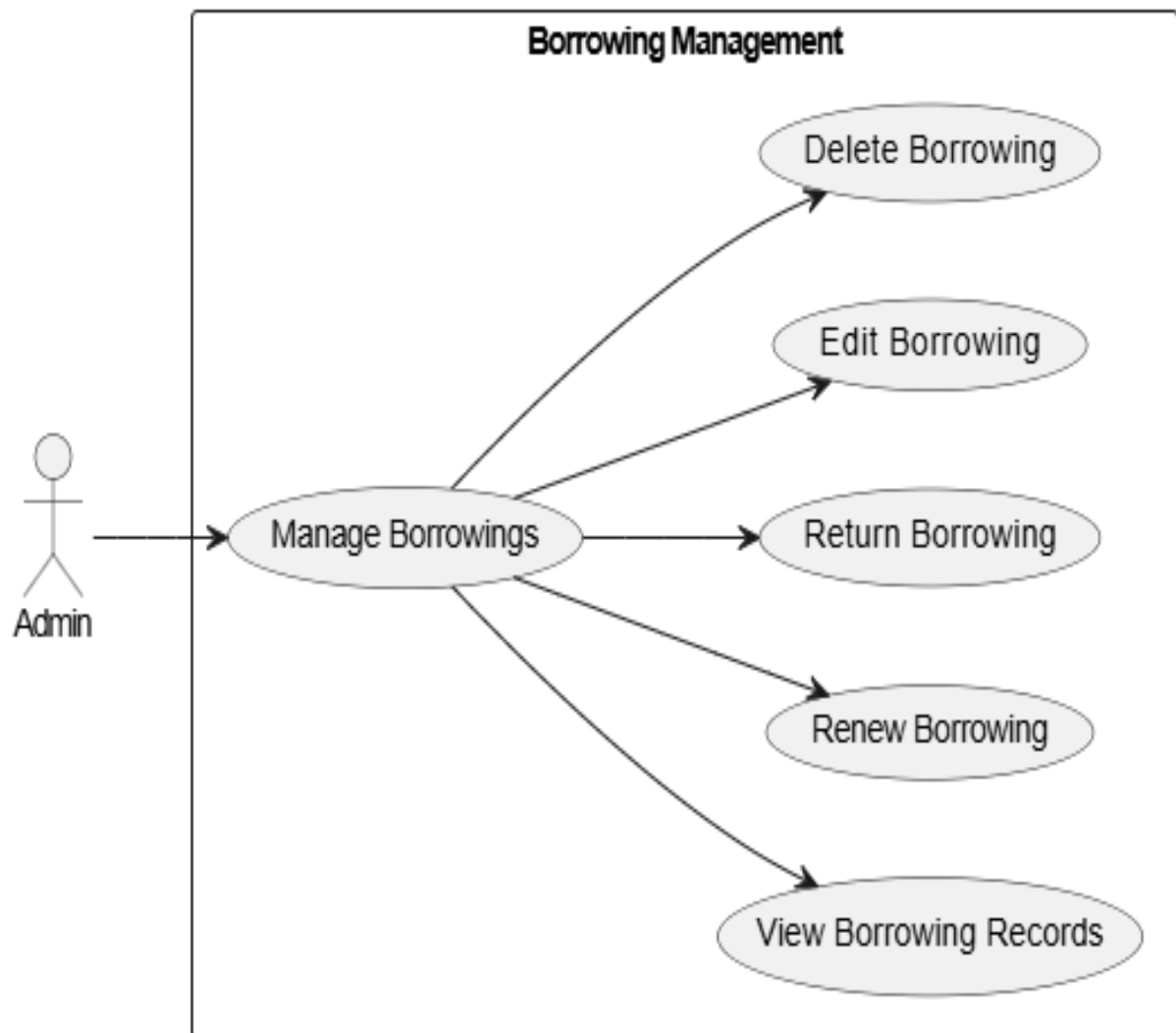| Use Case Name	Manage Books	
Actors	Admin	
Description	Allows administrators to add, edit, delete, and view books in the library.	
Precondition	Admin must be logged in.	
Course of Events	**Actors Action**	**System Response**
	Admin accesses the book management section.	Validates book data.
	Performs add/edit/delete operations on books.	Updates database accordingly.
		Reflects changes in the interface.
Alternative Course	1. Invalid book data shows validation errors. 2. Attempt to delete borrowed book shows warning. 3. Duplicate ISBN displays error message.	
Conclusion	Book database is updated successfully.	

Use Case Diagram: Manage Users

Use Case Narration: Manage Users

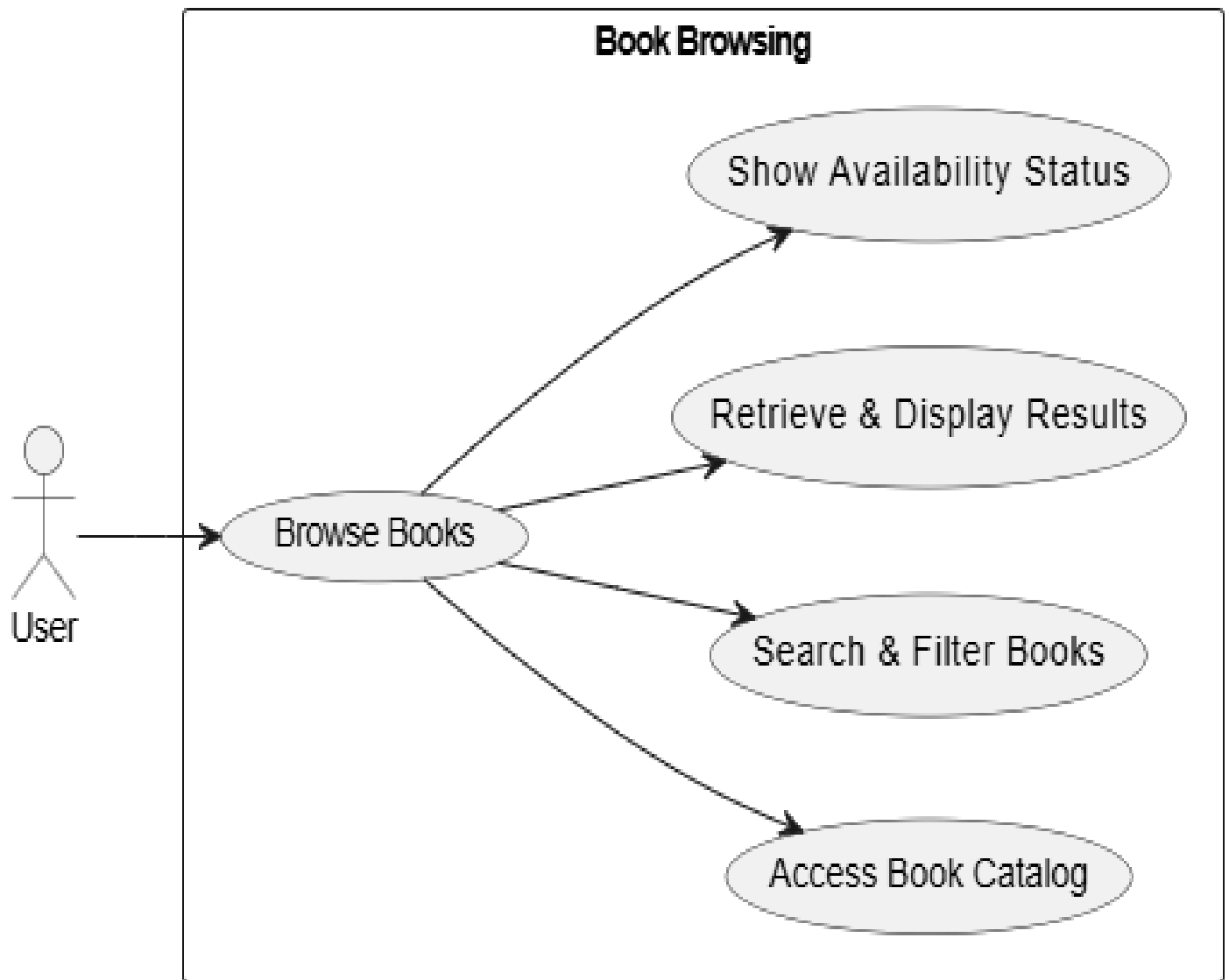| Use Case Name	Manage Users	
Actors	Admin	
Description	Allows administrators to add, edit, delete, and view user accounts.	
Precondition	Admin must be logged in.	
Course of Events	Actors Action	System Response
	Admin accesses the user management section.	Validates user data.
	Performs add/edit/delete operations on users.	Updates database accordingly.
		Reflects changes in the interface.
Alternative Course	1. Invalid user data shows validation errors. 2. Attempt to delete users with active borrowings shows warning. 3. Duplicate username/email displays error message.	
Conclusion	The user database is updated successfully.	

Use Case Diagram: Manage Borrowings

Use Case Narration: Manage Borrowings (Admin)

Use Case Name	Manage Borrowings	
Actors	Admin	
Description	Allows administrators to view, edit, delete, renew, and return borrowings.	
Precondition	Admin must be logged in.	
Course of Events	**Actors Action**	**System Response**
	Admin accesses borrowing management section.	Displays borrowing information.
	Views borrowing records and performs actions.	Processes actions (renew, return, edit, delete).
		Updates database and interface.
Alternative Course	1. Attempt to renew overdue book shows warning. 2. Invalid return date shows validation error. 3. Book not available for renewal shows message.	
Conclusion	Borrowing records are managed successfully.	

Use Case Diagram: Browse Books

Use Case Narration: Browse Books

Use Case Name	Browse Books	
Actors	User	
Description	Allows users to search, filter, and view available books.	
Precondition	User must be authenticated.	
Course of Events	**Actors Action**	**System Response**
	User accesses book catalog.	Retrieves and displays books based on criteria.
	Uses search and filter options.	Shows availability status for each book.
Alternative Course	1. No books found shows appropriate message. 2. Server error displays error message.	
Conclusion	User successfully views available books.	

Use Case Diagram: Borrow Books
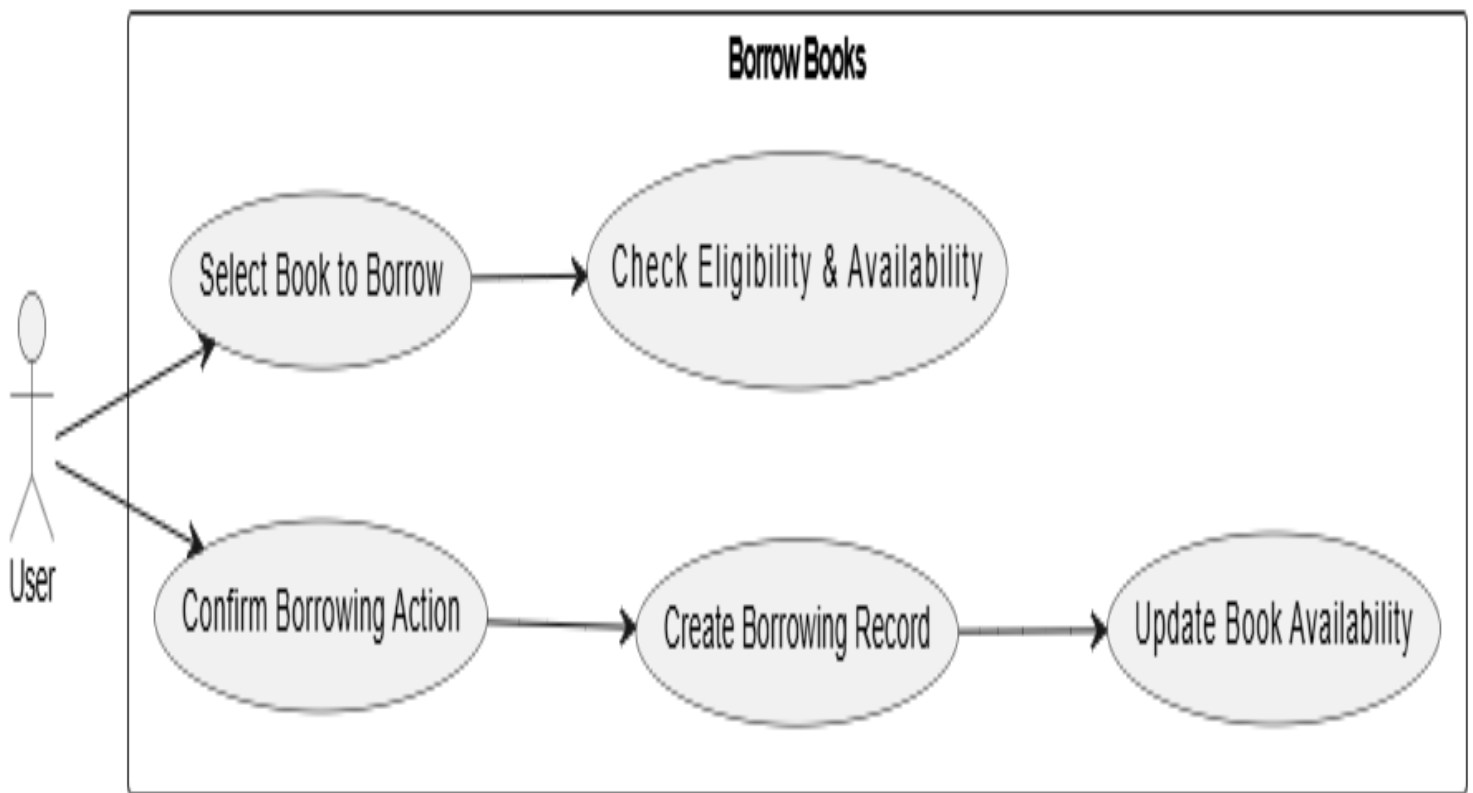
Use Case Narration: Borrow Books

Use Case Name	Borrow Books	
Actors	User	
Description	Allows users to borrow available books from the library.	
Precondition	User must be authenticated and have no overdue books.	
Course of Events	**Actors Action**	**System Response**
	User selects a book to borrow.	Checks user eligibility and book availability.
	Confirms borrowing action.	Creates borrowing record with due date.
		Updates book availability status.
Alternative Course	1. User has overdue books - shows warning. 2. Book not available - shows message. 3. Reached maximum borrowing limit - shows error.	
Conclusion	Book is successfully borrowed by the user.	

Use Case Diagram: Return Books
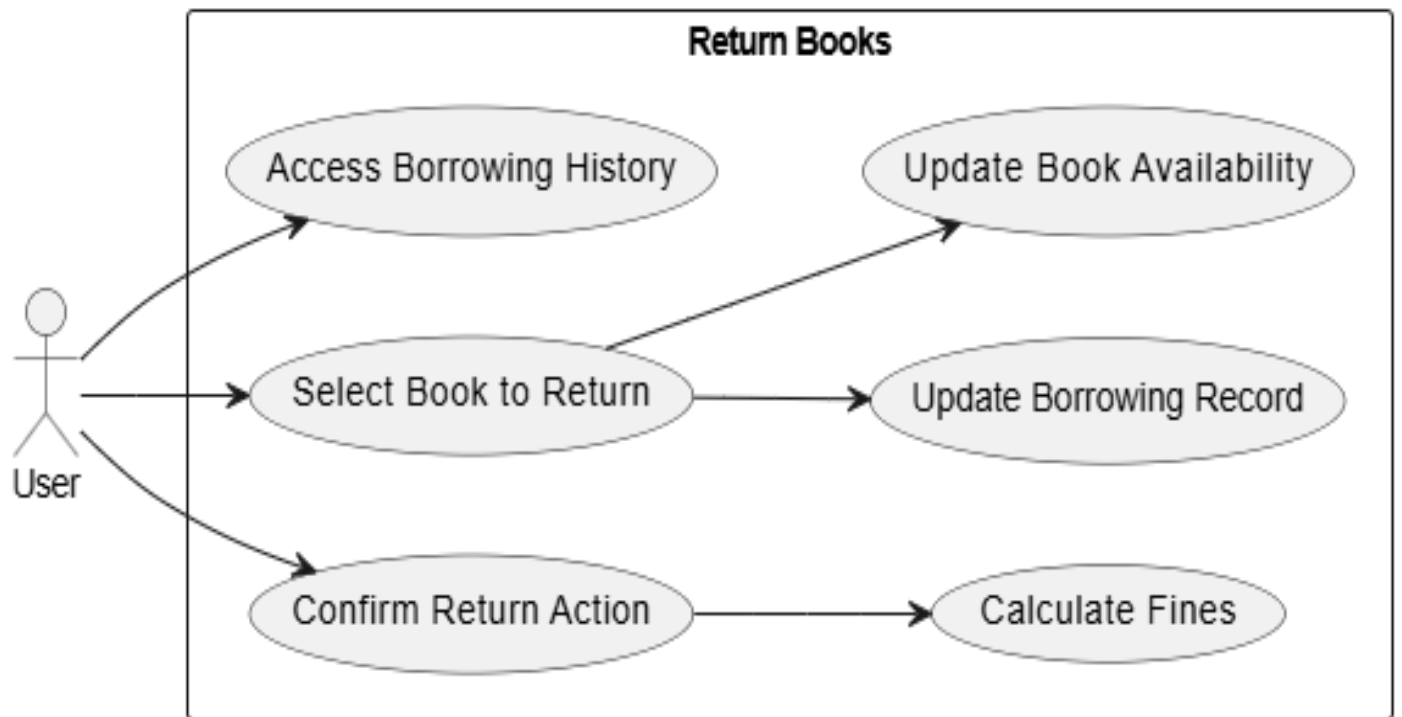
Use Case Narration: Return Books

Use Case Name	Return Books	
Actors	User	
Description	Allows users to return borrowed books.	
Precondition	User must have active borrowings.	
Course of Events	**Actors Action**	**System Response**
	User accesses borrowing history.	Updates borrowing record with return date.
	Selects book to return.	Updates book availability status.
	Confirms return action.	Calculates fines if applicable.
Alternative Course	1. Book already returned shows message. 2. System error during return shows error message.	
Conclusion	Book is successfully returned.	

Use Case Diagram: **Configure Settings**
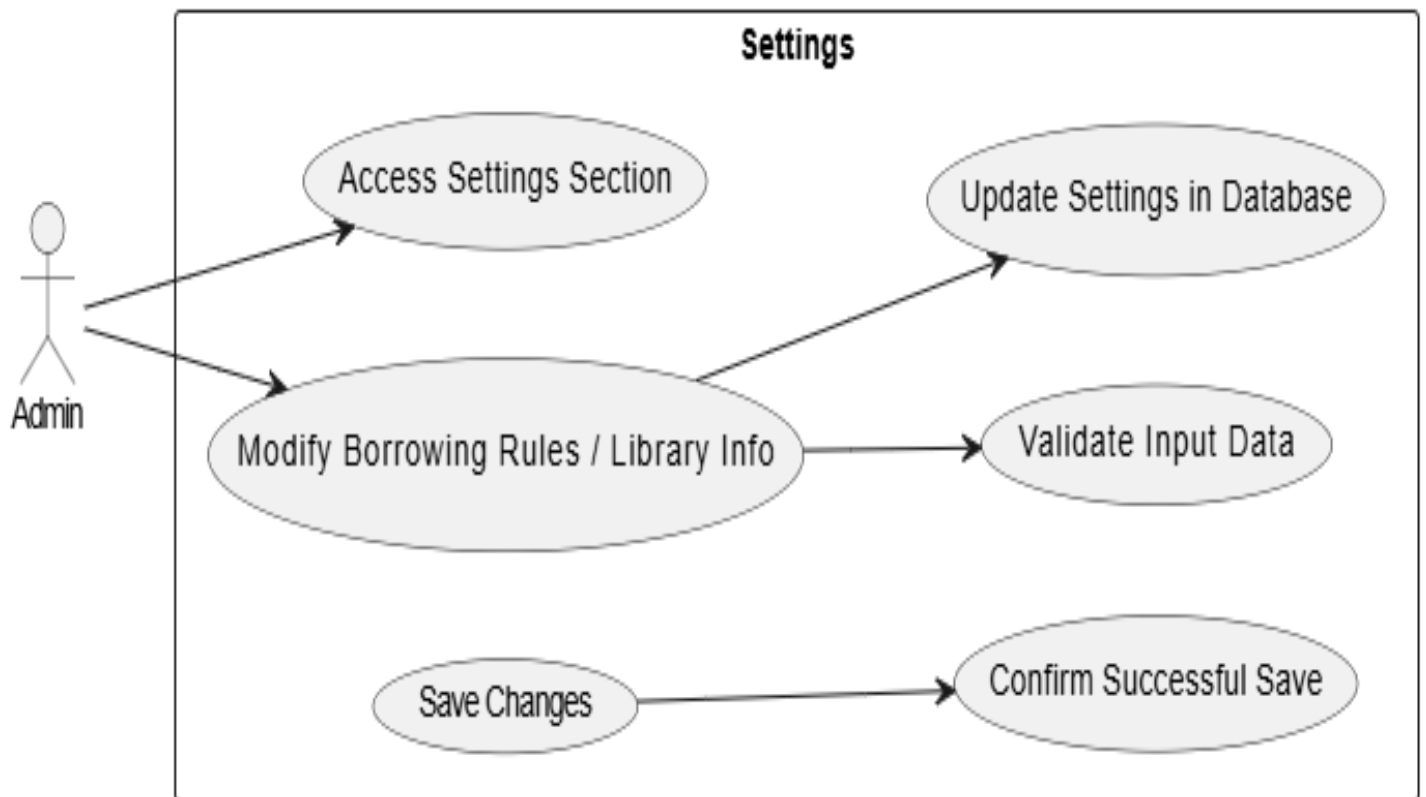
Use Case Narration: Configure Settings

Use Case Name	Configure Settings	
Actors	Admin	
Description	Allows administrators to configure borrowing rules and library information.	
Precondition	Admin must be logged in.	
Course of Events	**Actors Action**	**System Response**
	Admin accesses settings section.	Validates input data.
	Modifies borrowing rules or library info.	Updates settings in database.
	Saves changes.	Confirms successful save.
Alternative Course	1. Invalid values show validation errors. 2. Save failure shows error message.	
Conclusion	System settings are updated successfully.	

Data Flow Diagram (DFD)

Class Diagram

Admin

-int admin_id

-string name

-string email

-string password

+manageUsers()

+manageBooks()

+manageBorrowings()

+configureSettings()

+viewReports()

manages — 1

1 — configures

1

manages

User

-int user_id

-string name

-string email

-string password

-string phone

-string address

-date registration_date

-string status

+login()

+updateProfile()

+viewBorrowingHistory()

+requestRenewal()

Book

-int book_id

-string isbn

-string title

-string author

-string publisher

-int publication_year

-string category

-int total_copies

-int available_copies

-string status

+updateAvailability()

Settings

-int max_borrow_days

-int max_books_per_user

-decimal daily_fine_rate

-int renewal_limit

-string library_name

-string library_address

-string library_contact

+updateSettings()

1 — has — *

* is_borrowed — 1

Borrowing

-int borrowing_id

-int user_id

-int book_id

-date borrow_date

-date due_date

-date return_date

-string status

-decimal fine_amount

+calculateFine()

+renew()

+returnBook()

1 — generates — *

Notification

-int notification_id

-int user_id

-string type

-string message

-date sent_date

-string status

+sendEmail()

+sendSMS()

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6. Non-Functional Requirements

ID	Requirement	Description
NFR-1	Performance	System should respond within 2-3 seconds for most operations, with search results returning in under 5 seconds even with large catalogs
NFR-2	Availability	System should achieve 99.5% uptime during library operating hours, with scheduled maintenance communicated in advance
NFR-3	Security	All user data and passwords must be encrypted; role-based access control; protection against SQL injection, XSS, and CSRF attacks
NFR-4	Usability	Intuitive interface requiring minimal training for both admins and users; consistent navigation; responsive design for various devices
NFR-5	Scalability	System should support up to 1000 concurrent users with graceful performance degradation under peak loads
NFR-6	Maintainability	Code should be well-structured, documented, and follow standard patterns for easy maintenance and future enhancements
NFR-7	Data Integrity	Comprehensive data validation should prevent incorrect data entry; referential integrity enforced at database level
NFR-8	Compatibility	System should work consistently on major browsers (Chrome, Firefox, Safari, Edge) and respond appropriately on mobile devices
NFR-9	Accessibility	Interface should meet WCAG 2.1 Level AA standards to ensure access for users with disabilities
NFR-10	Backup & Recovery	Automated daily backups with ability to restore system to within 24 hours of any failure
NFR-11	Auditability	System should maintain comprehensive logs of all significant actions for security and troubleshooting purposes
NFR-12	Internationalization	Support for multiple languages and date/number formats to accommodate diverse user base

7. Risk Analysis (e.g., SWOT analysis)

Strengths:

- Centralized management of all library resources providing single source of truth
- Real-time information on book availability eliminating search frustrations
- Automated tracking of borrowings and returns reducing administrative overhead
- Self-service capabilities empowering users and reducing staff workload
- Comprehensive reporting providing valuable insights for collection development
- Scalable architecture supporting growth in users and collection size

Weaknesses:

- Dependency on stable internet connectivity for system operation
- Requirement for training administrative staff on system functionality
- Initial setup and data migration requiring significant effort and validation
- Potential resistance to change from staff accustomed to traditional systems
- Ongoing maintenance requirements for software updates and security patches

Opportunities:

- Integration with university/student management systems for seamless user management
- Mobile application development extending access beyond web browsers
- Implementation of RFID technology for automated book tracking and checkout
- Advanced analytics for predicting popular resources and optimizing acquisition budgets
- Expansion to digital resources management including e-books and online journals
- Community features enabling user reviews, recommendations, and reading lists

Threats:

- Cybersecurity risks including data breaches and unauthorized access to user information
- Resistance to technological change from traditional library staff and users
- System downtime affecting library operations and user satisfaction
- Budget constraints limiting implementation of desired features and enhancements

- Competition from commercial library management systems with more resources
- Rapid technological changes requiring continuous updates and adaptations

8. Conclusion

The Online Library Management System represents a comprehensive digital solution to the limitations of traditional library management approaches. By providing an integrated platform that streamlines operations for administrators while significantly enhancing the experience for library patrons, the system addresses critical pain points in modern library operations.

With sophisticated role-based access control, efficient book management capabilities, automated borrowing tracking, and comprehensive reporting features, the system dramatically improves library efficiency, resource utilization, and user satisfaction. The implementation of real-time availability information eliminates frustration for users, while automated notifications reduce overdue materials and improve return rates.

The selected technology stack of HTML5, CSS3, JavaScript, PHP, and MySQL ensures system stability, security, and performance while maintaining flexibility for future enhancements and integrations. The modular architecture supports gradual implementation and scalability as library needs evolve.

While implementation requires initial investment in setup, data migration, and training, the long-term benefits of automation, improved service delivery, and valuable operational insights make this system a valuable investment for any educational institution or library organization. The system not only addresses current operational challenges but also provides a foundation for future innovations in library services and resource management.

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