ADDIS ABABA SCIENCE AND TECHNOLOGY UNIVERSITY

UNIVERSITY FOR INDUSTRY

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SOFTWARE REQUIREMENT SPECIFICATION

FOR

AASTU LIBRARY MANAGEMENT SYSTEM UPDATE

ADDIS ABABA SCIENCE AND TECHNOLOGY UNIVERSITY
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1. Introduction

This chapter serves as the foundation for understanding the context, purpose, and objectives of the Library Management System (LMS) upgrade project for Addis Ababa Science and Technology University (AASTU). By clearly outlining the purpose, scope, and relevant terminologies, this chapter ensures that all stakeholders, including developers, library staff, and university administrators, have a unified understanding of the project's goals and its alignment with institutional needs. The information in this chapter establishes a reference point for all subsequent sections of the Software Requirements Specification (SRS) document.

1.1.Purpose

The purpose of this Software Requirements Specification (SRS) is to formally document the requirements for upgrading the existing library management system at AASTU. The current system is outdated, lacking modern features and operational efficiency, which hinders the library's ability to provide high-quality services to its patrons and staff. This document will:

1. Clearly define the functional and non-functional requirements for the new system.
2. Provide a foundation for the design, development, and implementation phases of the project.
3. Serve as a reference for validation and verification to ensure the final product meets stakeholder expectations.
4. Facilitate effective communication among stakeholders, including developers, testers, library staff, and university administrators.

The upgraded system aims to address key challenges faced by the library by introducing features that enhance operational efficiency, improve user experiences, and support strategic decision-making. It also seeks to ensure compliance with data protection regulations and future scalability to accommodate technological advancements.

1.2.Scope

The LMS Upgrade Project involves the replacement of the existing library system with a modern solution. The scope encompasses:

1. **System Replacement:** The implementation of a new library management system capable of automating workflows such as cataloging, circulation, inventory management, and interlibrary loans.
2. **Advanced Analytics:** Introduction of robust reporting tools to support data-driven decision-making for inventory optimization and resource allocation.
3. **Security and Compliance:** Adoption of secure protocols for user authentication, data protection, and role-based access control (RBAC).
4. **Training and Support:** Comprehensive training programs for library staff to ensure smooth transition and effective utilization of the new system.
5. **Data Migration:** Migration of all existing data, including patron records, catalog information, and transaction history, to the new system with accuracy and integrity.
6. **Post-Implementation Support:** Ongoing support and maintenance to address any issues and ensure system reliability.

The project also aims to minimize disruptions to library services during the transition phase by implementing a phased rollout and maintaining communication with patrons and staff.

1.3.Definitions, Acronyms, and Abbreviations

This section provides definitions and explanations for terms and acronyms used throughout the document to ensure clarity and prevent misinterpretation:

- **LMS**: Library Management System – A software solution designed to manage library operations such as cataloging, user accounts, and inventory.
- **RBAC**: Role-Based Access Control – A security model that restricts system access based on user roles and responsibilities.
- **Encryption**: A security measure involving the encoding of data to prevent unauthorized access.
- **Barcode Scanner**: A hardware device used to scan barcodes on books and IDs to facilitate transactions within the LMS.
- **Concurrent Users**: The number of users simultaneously accessing the system without performance degradation.

1.4.References

The requirements and specifications outlined in this document are informed by the following key references:

- IEEE Std 830-1998: IEEE Recommended Practice for Software Requirements Specifications
- ISO/IEC/IEEE 29148:2018: Systems and software engineering -- Life cycle processes – Requirements engineering 17
- ISO/IEC/IEEE 12207:2017: Systems and software engineering -- Software life cycle processes

1.5.Overview

This SRS document is structured to provide a comprehensive understanding of the LMS upgrade project. Each chapter builds on the information presented in the previous sections, ensuring a logical flow and cohesive narrative. The structure is as follows:

- **Chapter 2:** Provides an overall description of the system, including its product perspective, key features, and constraints.
- **Chapter 3:** Details the specific system features and functionalities to be implemented.
- **Chapter 4:** Outlines the external interface requirements, including user interfaces, hardware interfaces, software interfaces, and communication protocols.
- **Chapter 5:** Specifies the non-functional requirements that the system must fulfill.
- **Chapter 6:** Presents use cases to illustrate how various stakeholders will interact with the system.
- **Chapter 7:** Includes appendices such as a glossary of terms.

This document aims to provide a clear and actionable roadmap for the successful design, development, and deployment of the upgraded Library Management System. By addressing the library's operational needs and aligning with stakeholder expectations, the project seeks to enhance the quality and efficiency of library services at AASTU.

2. Overall Description

This chapter provides a comprehensive description of the Library Management System (LMS) upgrade project for Addis Ababa Science and Technology University (AASTU). It outlines the product's perspective, primary features, intended users, and dependencies, offering an overview of the project's foundational aspects.

2.1.Product Perspective

The LMS upgrade is a replacement for the university's legacy system. The existing system lacks scalability, integration, and modern functionality, limiting the library's ability to serve its users efficiently. The new LMS will:

- Operate as a standalone system to track library activities and transactions.
- Utilize a modular architecture to allow easy enhancements or feature additions in the future.
- Be compatible with AASTU's existing IT infrastructure, minimizing additional hardware costs.
- Improve operational efficiency by automating manual workflows and reducing errors in routine processes.

The product aligns with AASTU's strategic goals of digitization, enhanced user experiences, and data-driven decision-making.

2.2.Product Features

Key features of the upgraded LMS include:

1. **User and Access Management:**
    - Role-based access control (RBAC) for patrons, librarians, and administrators.
    - Integration with the existing student database to verify users using their university ID.
    - Detailed user activity logs to enhance accountability and traceability.
2. **Resource Management and Circulation:**

- Barcode scanning for books and student IDs to facilitate borrowing and returning of books.
- Real-time tracking of borrowed books and returned items to maintain accurate records.
- Logging user entries and exits by scanning IDs at the library door.

3. **Analytics and Reporting:**
    - Dashboards to analyze trends in library usage, such as the number of students entering and books borrowed.
    - Reports to provide insights into library activity for resource planning and decision-making.
4. **Data Security:**
    - Access restrictions to ensure only authorized personnel can view or modify sensitive data.
    - Logging of system activity to monitor usage and maintain system integrity.

2.3.User Characteristics

The LMS will cater to a diverse group of users with varying technical proficiency levels:

- **Students and Faculty:** Primary users who access the library for academic and research purposes. They need a simple, intuitive interface to borrow and return books and record their library visits.
- **Library Staff:** Responsible for managing circulation and monitoring library activity. They need straightforward tools to process book transactions and generate activity reports.
- **University Administrators:** Use the system for generating reports, monitoring library performance, and making strategic decisions. They require basic analytics and reporting features to oversee operations.

2.4.Assumptions and Dependencies

The successful implementation of the LMS depends on several assumptions and external factors:

- **Assumptions:**

- The university's IT infrastructure, including hardware and network, will meet the minimum requirements for the new system.
- Library staff and patrons will actively participate in training and user acceptance testing to ensure smooth adoption of the new system.
- Adequate funding and resources will be available throughout the project lifecycle.
- All stakeholders will provide timely feedback and support during requirement gathering and testing phases.

- **Dependencies:**
  - Availability of barcode scanning devices for integration into the system.
  - Compliance with local data protection regulations to ensure secure handling of user information.
  - Continued support and collaboration from the university's IT department for system maintenance, updates, and troubleshooting.
  - Timely delivery of required hardware or software components to avoid project delays.

3. System Features

This chapter outlines the specific features and functionalities of the Library Management System (LMS) upgrade for Addis Ababa Science and Technology University (AASTU). Each feature is described with its priority, stimulus/response sequences, and functional requirements to ensure a detailed understanding.

3.1.User Entry and Exit Logging

3.1.1. Description

The system shall log the entry and exit of students and faculty by scanning their university ID at designated access points. This feature ensures accurate tracking of library usage by recording timestamps of when users enter and leave the library premises. By integrating with the university ID database, the system maintains a seamless and reliable process for identifying users and

generating usage statistics. This capability provides valuable insights into peak usage hours and overall library traffic patterns, aiding in resource allocation and planning.

3.1.2. Priority

This feature is of **High Priority** as it provides essential data for analyzing library usage patterns and optimizing operational efficiency.

3.1.3. Stimulus/Response Sequences

- **Stimulus:** A student or faculty member scans their university ID at the library entrance or exit.
- **Response:** The system shall validate the ID, log the timestamp, and update the entry/exit records in real time.

3.1.4. Functional Requirements

- **REQ-1.1:** The system shall use the university ID database to verify the authenticity of scanned IDs.
- **REQ-1.2:** The system shall log the timestamp of each entry and exit.
- **REQ-1.3:** The system shall generate daily, weekly, and monthly reports summarizing the number of entries and exits.
- **REQ-1.4:** The system shall provide alerts for duplicate ID scans within a predefined time period.

3.2.Book Borrowing and Returning

3.2.1. Description

The system shall facilitate borrowing and returning of books by scanning the barcode on books and student IDs. This feature streamlines the process of book transactions, ensuring real-time updates to inventory records. Library staff can easily manage the status of books, reducing the likelihood of errors in manual tracking. Additionally, this feature provides students and faculty with a seamless experience while borrowing or returning library materials.

3.2.2. Priority

This feature is of **High Priority** as it directly supports the library's primary operations and ensures the accuracy of inventory records.

3.2.3. Stimulus/Response Sequences

- **Stimulus:** A student or faculty member presents their university ID and the book's barcode for scanning.
- **Response:** The system shall validate the ID and the book's availability, update the inventory, and confirm the transaction.

3.2.4. Functional Requirements

- **REQ-2.1:** The system shall allow library staff to scan book barcodes and student IDs to process transactions.
- **REQ-2.2:** The system shall update the book's status to "issued" or "available" based on the transaction.
- **REQ-2.3:** The system shall notify the user upon successful completion of the transaction.
- **REQ-2.4:** The system shall track the borrowing history of each student and book.
- **REQ-2.5:** The system shall allow library staff to manually override transactions in case of scanning errors.
- **REQ-2.6:** The system shall provide a mechanism to search for borrowed books by book title.

3.3.Book Listing for Borrowing

3.3.1. Description

The system shall provide a list of books to facilitate borrowing processes. This feature allows library staff to add new books to the system, remove outdated records, and update the status of books as "available" or "issued." By providing basic inventory management functionality, the system supports efficient library operations.

3.3.2. Priority

This feature is of **Medium Priority** as it supports the library's operational efficiency and ensures accurate tracking of book transactions.

3.3.3. Stimulus/Response Sequences

- **Stimulus:** A library staff member adds a new book, removes a book record, or updates the status of a book.
- **Response:** The system shall reflect the changes in the book listing and ensure the information is available for borrowing processes.

3.3.4. Functional Requirements

- **REQ-3.1:** The system shall allow library staff to add new book records to the system.
- **REQ-3.2:** The system shall allow library staff to remove outdated or invalid book records.
- **REQ-3.3:** The system shall display the availability status of books as "available" or "issued."
- **REQ-3.4:** The system shall generate a summary report of all books currently available in the library.

3.4.Analytics and Reporting

3.4.1. Description

The system shall provide analytics and reporting capabilities to support data-driven decision-making. By leveraging data on library traffic and book transactions, this feature enables administrators to identify usage trends and optimize library services. Visualizations, such as charts and graphs, further simplify the interpretation of data, making it easier to communicate insights to stakeholders.

3.4.2. Priority

This feature is of **Medium Priority** to assist in optimizing library operations and improving resource planning.

3.4.3. Stimulus/Response Sequences

- **Stimulus:** A library administrator requests a report on specific library usage data within a defined time period.
- **Response:** The system shall generate and display the requested report.

3.4.4. Functional Requirements

- **REQ-4.1:** The system shall generate customizable reports for students entering the library within a specific time period.
- **REQ-4.2:** The system shall generate customizable reports for books borrowed within a specific time period.
- **REQ-4.3:** The system shall generate customizable reports for books not borrowed within a specific time period.

- **REQ-4.4:** The system shall include dashboards for tracking entry statistics and book borrowing trends.
- **REQ-4.5:** The system shall provide visualizations, such as bar charts and pie charts, for key performance metrics.

4. External Interface Requirements

This chapter describes the external interfaces that the Library Management System (LMS) must interact with, including user interfaces, hardware interfaces, software interfaces, and communication protocols. Each interface is essential for ensuring smooth integration and usability of the system.

4.1.User Interfaces

4.1.1. Description

The system shall provide a user-friendly interface accessible to students, faculty, and library staff. The interface must be intuitive, responsive, and compatible with various devices to facilitate ease of use for all stakeholders. The user interface design will ensure that users can navigate the system efficiently, access required features, and complete their tasks with minimal effort.

4.1.2. Interface Requirements

- **UI-1:** The system shall provide a web-based interface accessible through standard browsers such as Chrome, Firefox, and Edge.
- **UI-2:** The user interface shall support both desktop and mobile devices, adapting dynamically to different screen sizes and resolutions.
- **UI-3:** The interface shall include distinct views for library staff and general users (students and faculty), ensuring appropriate access and permissions.
- **UI-4:** The system shall provide a login page for authentication, which integrates with the university's student and staff database.
- **UI-5:** The interface shall include dedicated sections for borrowing books, viewing borrowing history, and generating basic reports for library staff.

4.2.Hardware Interfaces

4.2.1. Description

The system shall interact with various hardware components to enable the scanning of IDs and book barcodes, as well as to support library operations. These interfaces ensure smooth transactions and compatibility with existing library equipment, minimizing the need for additional resources.

4.2.2. Interface Requirements

- **HW-1:** The system shall support integration with barcode scanners for processing book and user ID transactions.
- **HW-2:** The system shall operate on existing library computers with minimal configuration or hardware upgrades.

4.3.Software Interfaces

4.3.1. Description

The system shall integrate with existing university databases and software to ensure seamless access to user data and support operational workflows. This ensures the system's interoperability and its ability to work alongside other tools already in use by the library or the university.

4.3.2. Interface Requirements

- **SW-1:** The system shall integrate with the university's student and staff database for authenticating user identities and retrieving user information.
- **SW-2:** The system shall offer APIs for potential future integrations, such as mobile applications or digital resource platforms, to extend its functionality.

4.4.Communication Interfaces

4.4.1. Description

The system shall support communication protocols that ensure secure and efficient data exchange. These interfaces will guarantee the integrity of user data and facilitate the system's responsiveness to user requests.

4.4.2. Interface Requirements

- **COM-1:** The system shall use HTTPS protocols to ensure secure data transmission between clients and the server.

- **COM-2:** The system shall provide a password recovery mechanism that sends reset links via email to authenticated users.
- **COM-3:** The system shall efficiently handle concurrent user requests to ensure minimal latency and prevent performance degradation.

5. Non-functional Requirements

The non-functional requirements define the overall qualities, constraints, and expectations that the upgraded Library Management System (LMS) must fulfill to ensure optimal performance, security, and usability. These requirements address critical aspects such as system reliability, security, maintainability, and compliance.

5.1.Performance Requirements

- **PR-1:** The system shall be able to support at least 50 concurrent users without performance degradation.
- **PR-2:** Response time for critical operations (e.g., book borrowing, returning, and searching) shall not exceed 3 seconds under normal load conditions.
- **PR-3:** The system shall maintain an uptime of 99.9% to ensure availability during library operating hours.

5.2.Security Requirements

- **SR-1:** The system shall enforce role-based access control (RBAC) to restrict access based on user roles.
- **SR-2:** All data transmissions between clients and the server shall be encrypted using HTTPS.
- **SR-3:** Passwords shall be stored securely using industry-standard hashing algorithms.

5.3.Usability Requirements

- **UR-1:** The system shall provide an intuitive and user-friendly interface that complies with web accessibility standards (WCAG 2.1 Level AA).
- **UR-2:** The system shall provide context-sensitive help and user documentation.

- **UR-3:** Users should be able to complete core functions (e.g., book search and checkout) within three clicks from the home page.

5.4.Maintainability and Support Requirements

- **MR-1:** The system shall be designed using a modular architecture to allow future enhancements without significant rework.
- **MR-2:** System components shall follow coding standards and best practices to facilitate easier troubleshooting and updates.
- **MR-3:** Detailed logging and error reporting mechanisms shall be implemented to assist in debugging and performance monitoring.

5.5.Scalability Requirements

- **SC-1:** The system shall be capable of scaling horizontally to accommodate increased user demand.
- **SC-2:** The database shall support up to 1 million records without significant degradation in performance.
- **SC-3:** The system shall allow for the addition of new modules and features with minimal disruption.

5.6.Compliance Requirements

- **CR-1:** The system shall comply with relevant data protection regulations, such as GDPR, to ensure user data privacy.
- **CR-2:** The system shall meet institutional policies and guidelines related to information security and usage.
- **CR-3:** Audit trails shall be maintained for at least five years in accordance with university policies.

5.7.Reliability Requirements

- **RR-1:** The system shall recover automatically from failures within 10 minutes.
- **RR-2:** In case of a failure, the system shall notify the IT department via email alerts.
- **RR-3:** Redundant systems shall be in place to ensure continuity of operations.

6. Use cases

6.1.Use Case Descriptions

6.1.1. Student Entering Library Use Case

Actors: Student, Librarian

Description: This use case describes the process by which a student enters the library.

Preconditions:

- The student must have a valid university ID.

Flow of Events:

1. The student presents their ID at the entrance.
2. The librarian or system scans the student ID.
3. The system validates the student's eligibility.
4. The system logs the entry timestamp.
5. The student is granted access to the library.

Postconditions:

- The student's entry is recorded.

6.1.2. Book Borrowing Use Case

Actors: Student, Librarian

Description: This use case describes the process by which a student borrows a book from the library.

Preconditions:

- The student must have a valid university ID.
- The book must be available in the library database.

Flow of Events:

1. The student presents their ID to the librarian.
2. The librarian scans the student ID and the book barcode.
3. The system validates the student's eligibility and book availability.
4. The system records the transaction and updates the book's status.
5. The librarian confirms the successful borrowing transaction.

Postconditions:

- The book status is updated to "borrowed".
- The student's borrowing history is updated.

6.1.3. Book Returning Use Case

Actors: Student, Librarian

Description: This use case describes the process by which a student returns a borrowed book.

Preconditions:

- The student must have borrowed the book previously.

Flow of Events:

1. The student presents the borrowed book to the librarian.
2. The librarian scans the book barcode.
3. The system updates the book's status to "available".
4. The system records the return transaction.
5. The librarian confirms the successful return transaction.

Postconditions:

- The book status is updated to "available".
- The student's borrowing history is updated.

6.1.4. Student Leaving Library Use Case

Actors: Student, Librarian

Description: This use case describes the process by which a student leaves the library.

Preconditions:

- The student must have entered the library earlier.

Flow of Events:

1. The student scans their ID at the exit.
2. The system validates the student's ID.
3. The system logs the exit timestamp.
4. The student is allowed to leave the library.

Postconditions:

- The student's exit is recorded.

6.1.5. Generate Reports Use Case

Actors: Librarian

Description: This use case describes how library staff generate reports.

Preconditions:

- The user must have the appropriate permissions.

Flow of Events:

1. The user selects report criteria (date range, book categories, etc.).
2. The system generates the report.
3. The system displays the report in the desired format.

Postconditions:

- The report is available for review and analysis.

6.1.6. Add Book Use Case

Actors: Librarian

Description: This use case describes how a librarian adds a new book to the library system.

Preconditions:

- The librarian must have the appropriate permissions.

Flow of Events:

1. The librarian enters book details into the system.
2. The system validates the book information.
3. The system adds the book to the inventory.
4. The system confirms the addition of the book.

Postconditions:

- The book is available in the library system.

6.1.7. Remove Book Use Case

Actors: Librarian

Description: This use case describes how a librarian removes a book from the library system.

Preconditions:

- The librarian must have the appropriate permissions.

Flow of Events:

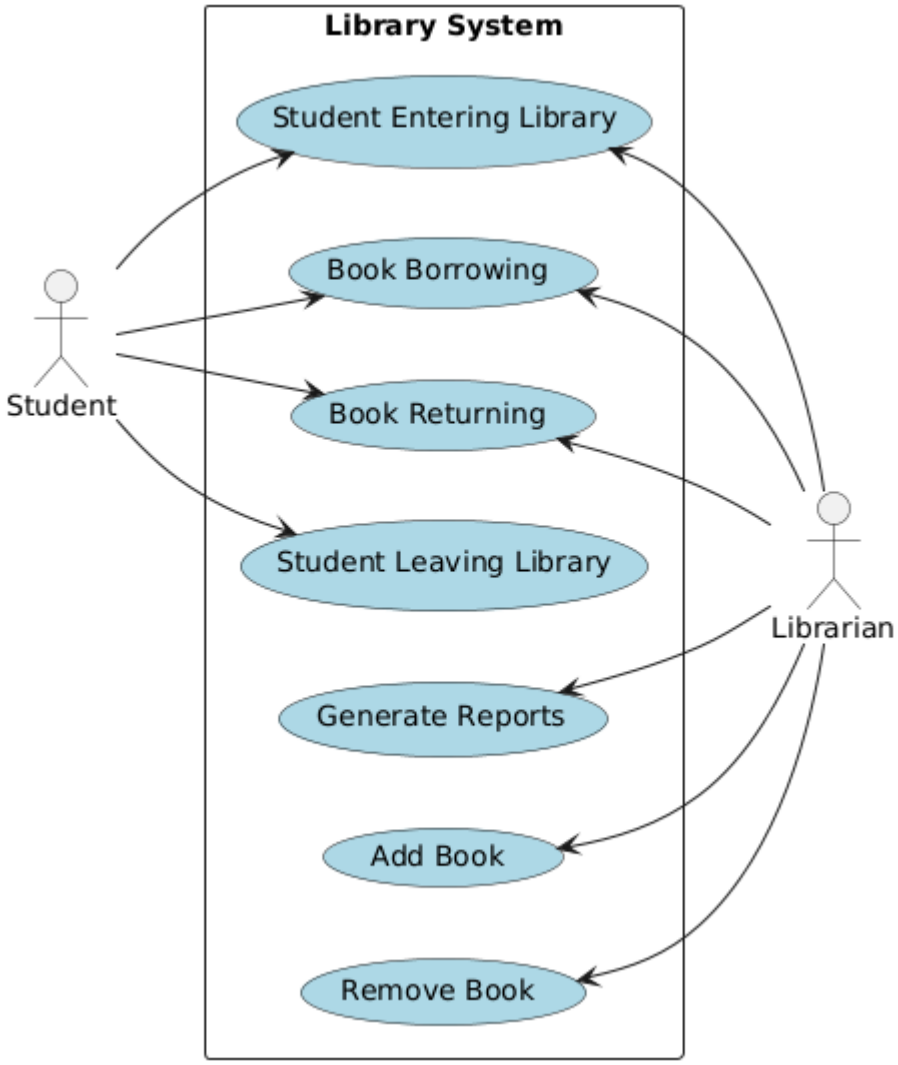
1. The librarian selects the book to be removed.
2. The system verifies the book's current status.

3. The system removes the book from the inventory.
4. The system confirms the removal of the book.

Postconditions:

- The book is no longer available in the library system.

6.2.Use Case Diagram



Appendices

Glossary of Terms

AASTU: Addis Ababa Science and Technology University, the institution for which the LMS upgrade is being developed.

Access Control: A security technique that regulates who or what can view or use resources in a computing environment.

API: Application Programming Interface, a set of tools and protocols that allows different software applications to communicate with each other.

Barcode Scanner: A hardware device used to read barcodes on books and IDs to facilitate transactions in the library system.

Borrowing History: A record of all books borrowed by a user, including transaction dates and durations.

Cataloging: The process of creating and organizing bibliographic records for library resources.

Compliance: Adherence to legal, regulatory, and institutional policies, such as data protection regulations.

Concurrent Users: The number of users actively using the system at the same time.

Dashboard: A visual interface that displays key performance indicators and analytics for library administrators.

Data Migration: The process of transferring existing data, such as patron records and book inventory, from the legacy system to the upgraded LMS.

Data Protection Regulations: Rules and laws designed to safeguard personal data and ensure privacy, such as GDPR.

Encryption: A method of protecting data by converting it into a code that can only be decoded by authorized parties.

Error Logging: The process of recording errors and system issues to facilitate debugging and maintenance.

GDPR: General Data Protection Regulation, a European Union regulation focused on data privacy and protection.

HTTPS: Hypertext Transfer Protocol Secure, a communication protocol used to ensure secure data transmission over the internet.

ID Validation: The process of verifying the authenticity of a user's identification to allow system access or record transactions.

Library Management System (LMS): A software solution designed to manage library operations, including cataloging, circulation, and user accounts.

Logging: Recording system activities, such as user actions and transactions, for monitoring and analysis.

Modular Architecture: A software design approach where a system is divided into smaller, interchangeable modules for easier maintenance and scalability.

Maintenance: The ongoing process of updating and improving the system to ensure it functions optimally.

Non-functional Requirements: System attributes such as performance, reliability, security, and usability that define how the system should operate.

Patron: A user of the library, including students, faculty, and staff.

Performance Degradation: A decrease in the efficiency or responsiveness of the system under high usage or other constraints.

RBAC: Role-Based Access Control, a security model that restricts system access based on user roles and responsibilities.

Redundancy: Backup components or systems to ensure continuity in case of a failure.

Scalability: The system's ability to handle increased usage or expanded functionalities without performance issues.

Stakeholder: Any individual or group with an interest in the project, such as library staff, students, and university administrators.

Timestamp: A record of the date and time when a specific action, such as user entry or book borrowing, occurs.

Usability: The ease with which users can interact with the system to complete tasks.