Library Management System for Stanford University

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Project: Stanford Library Management System (LMS)

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1. Project Foundation & As-Is Analysis

This section establishes the "why" and "who" of the project and documents the current pain points.

1.1. Identifying the Problem Statement

A problem statement is a concise description of the issues that need to be addressed. Based on the case study, the core problem is:

> "The current manual, paper-based system for managing the Stanford University library is operationally inefficient, prone to errors, and incapable of scaling to meet the needs of a 20,000+ student body and a 4+ million book collection. This results in excessive time consumption for both students and staff, high labor

costs, tedious and inaccurate fine calculations, an inability to generate strategic reports, and a poor user experience that is restricted by physical library timings. The lack of automation, tracking, and modern access methods presents a significant barrier to the library's objective of providing efficient and accurate information services."

1.2. Identifying Stakeholders

Stakeholders are any individuals, groups, or entities who may affect, be affected by, or perceive themselves to be affected by a project.

- **Students:** The primary end-users.
- **Library Staff (Librarians, Clerks):** Key users who will operate the LMS daily.
- **Stanford University Management (Client):** The project sponsor.
- **Simplilearn-trained Business Analysts:** The project team responsible for the requirements.
- **Development Team (Java Developers):** The technical team responsible for building the software.
- **System Administrators / IT Staff:** The group responsible for maintaining the system's infrastructure.

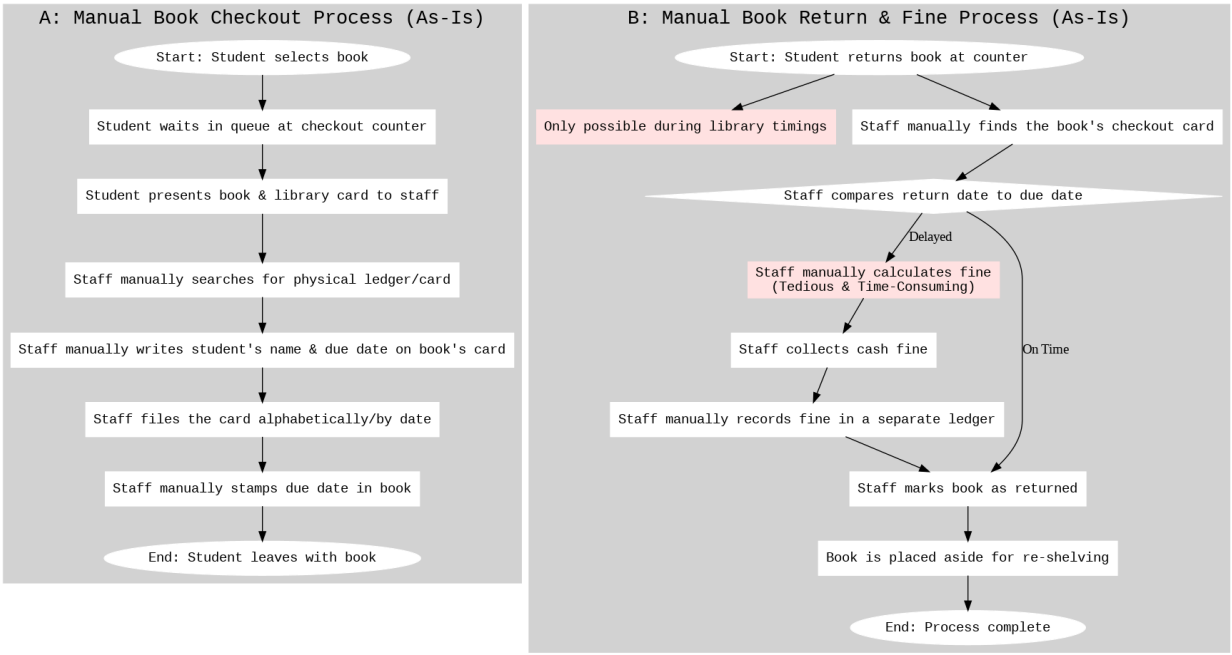
1.3. Identifying Advantages of the new Library Management System

The proposed LMS will provide the following tangible and intangible benefits:

- **Increased Efficiency & Productivity:** Automates core tasks (checkout, check-in, fine calculation).
- **Operational Cost Reduction:** Reduces the need for a large staff to manage manual processes.
- **Improved User Experience & Engagement:** Provides 24/7 access to services like online status checks and the book drop box.
- **Data-Driven Decision Making:** Generates dynamic reports for management insights.
- **Enhanced Accuracy & Record-Keeping:** Creates a centralized, up-to-date cloud database.
- **Improved Security & Asset Management:** Anti-theft RFID gates and better asset tracking.
- **Scalability:** A cloud-based system can easily scale to accommodate future growth.

1.4. As-Is Process Map (Current Manual System)

This flowchart illustrates the current, problematic manual processes.



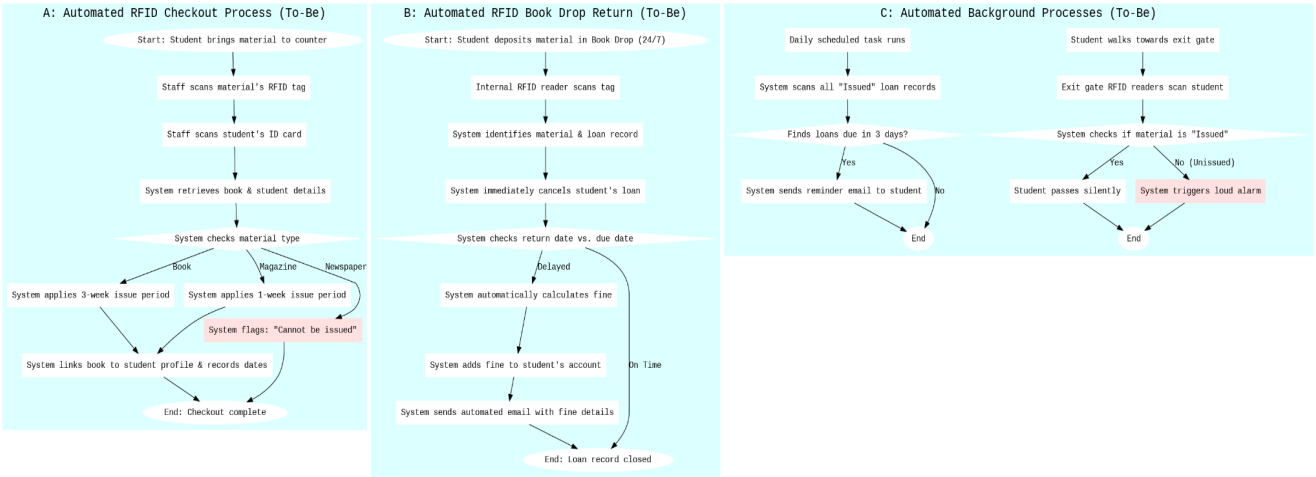
As-Is Process Map: Current Manual Library System

2. Future State & Scope Definition

This section defines the new, improved processes and formally outlines the boundaries of the project.

2.1. Future Process Map (To-Be System)

These flowcharts illustrate the streamlined, automated processes that will be implemented with the new LMS.



To-Be Process Map: New Automated Library System

2.2. Main Features to be Developed

This is a high-level list of the core functionalities (or "epics") that the LMS must provide.

1. **Material Management:** To add, edit, delete, and categorize all library materials.
2. **RFID Integration:** Core integration with RFID hardware (scanners, gates, drop boxes).
3. **Circulation Management:** To handle all checkout and return processes.
4. **Student/Member Management:** A database of all library users.
5. **Fine & Penalties Module:** Automated calculation and logging of fines.
6. **Search & Discovery Portal:** A search engine for staff and a web/mobile interface for students.
7. **Automated Notifications System:** A service to send automated emails.
8. **Digital Resource Access:** A portal for students to access free e-journals and e-books.
9. **Reporting & Analytics Dashboard:** A module for management to generate all required reports.
10. **Anti-Theft & Security:** Software to integrate with gate hardware to trigger alarms.

2.3. In-Scope and Out-of-Scope Items

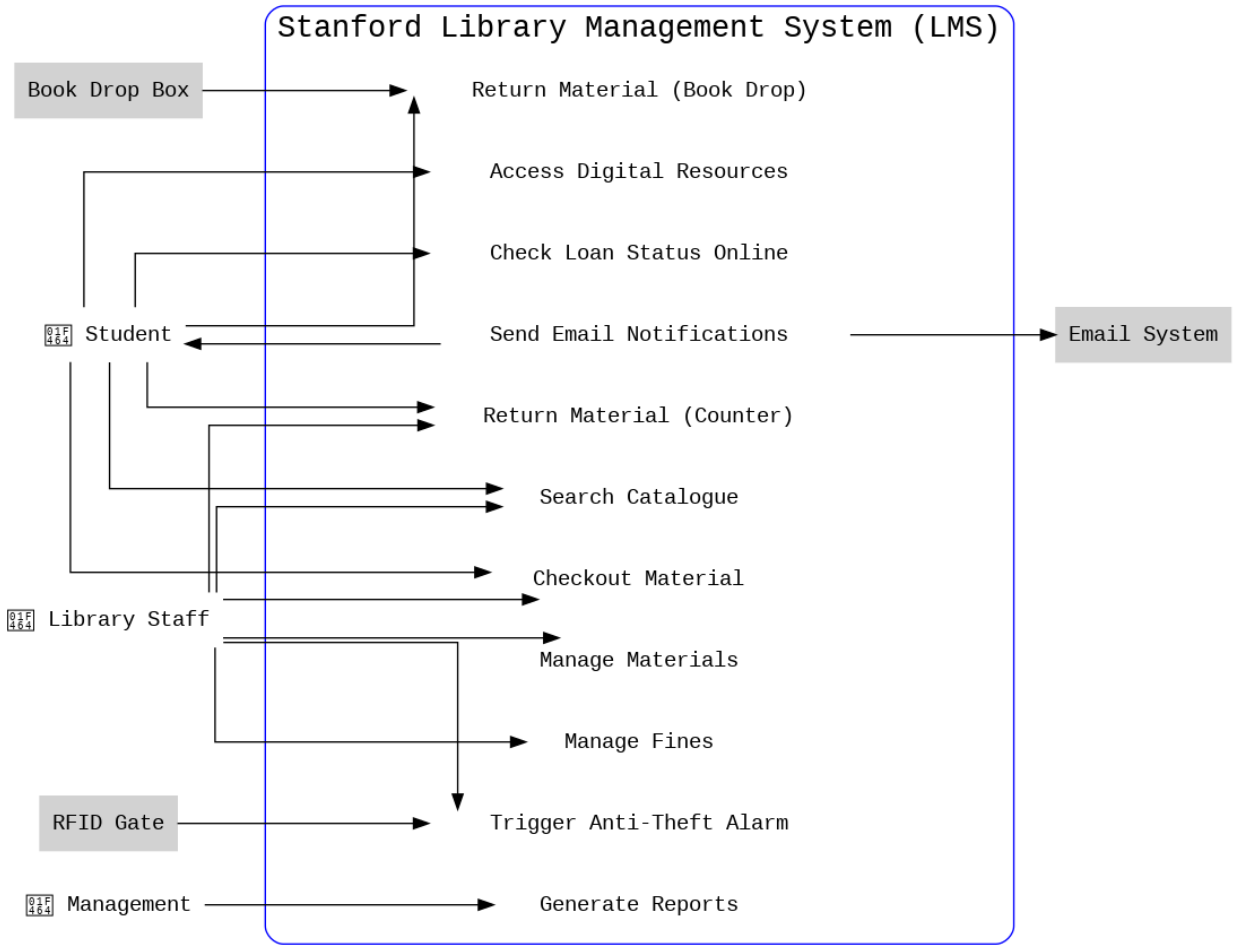
Defining the project's boundaries is critical to prevent "scope creep" and ensure the project stays focused.

In-Scope (What we WILL build)	**Out-of-Scope (What we will NOT build)**
Management of physical library materials (books, magazines, etc.).	Management of university-wide assets (e.g., laptops, projectors).
Integration with RFID hardware (scanners, gates, drop boxes).	The purchase, physical installation, or hardware maintenance of the RFID scanners.
Student-facing portal (Web & Mobile) for checking loan status.	A full-featured e-reader application.
Automated email notifications for reminders and fines.	A general university-wide email system (we will *use* the existing system).
A module to generate the specific management reports listed.	A comprehensive, custom-built data warehouse or advanced BI platform.
User authentication for staff and students.	Management of student course registration or university tuition fees.

Cloud-based data storage for the LMS.	Management of the university's core network infrastructure.

2.4. Scope Diagram (Use Case Diagram)

A Use Case diagram shows the interactions between actors (users) and the system's main functions.



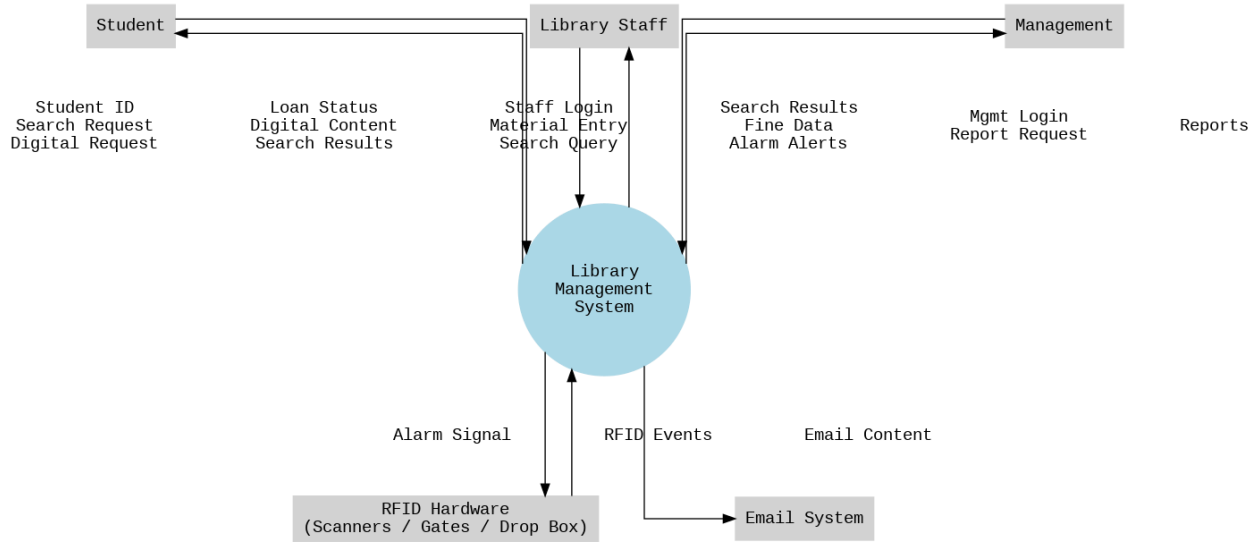
LMS Scope - Use Case Diagram

3. System & Data Modeling

This section details *how data will move* through the new system and *how it will be logically structured*.

3.1. Data Flow Diagram (DFD)

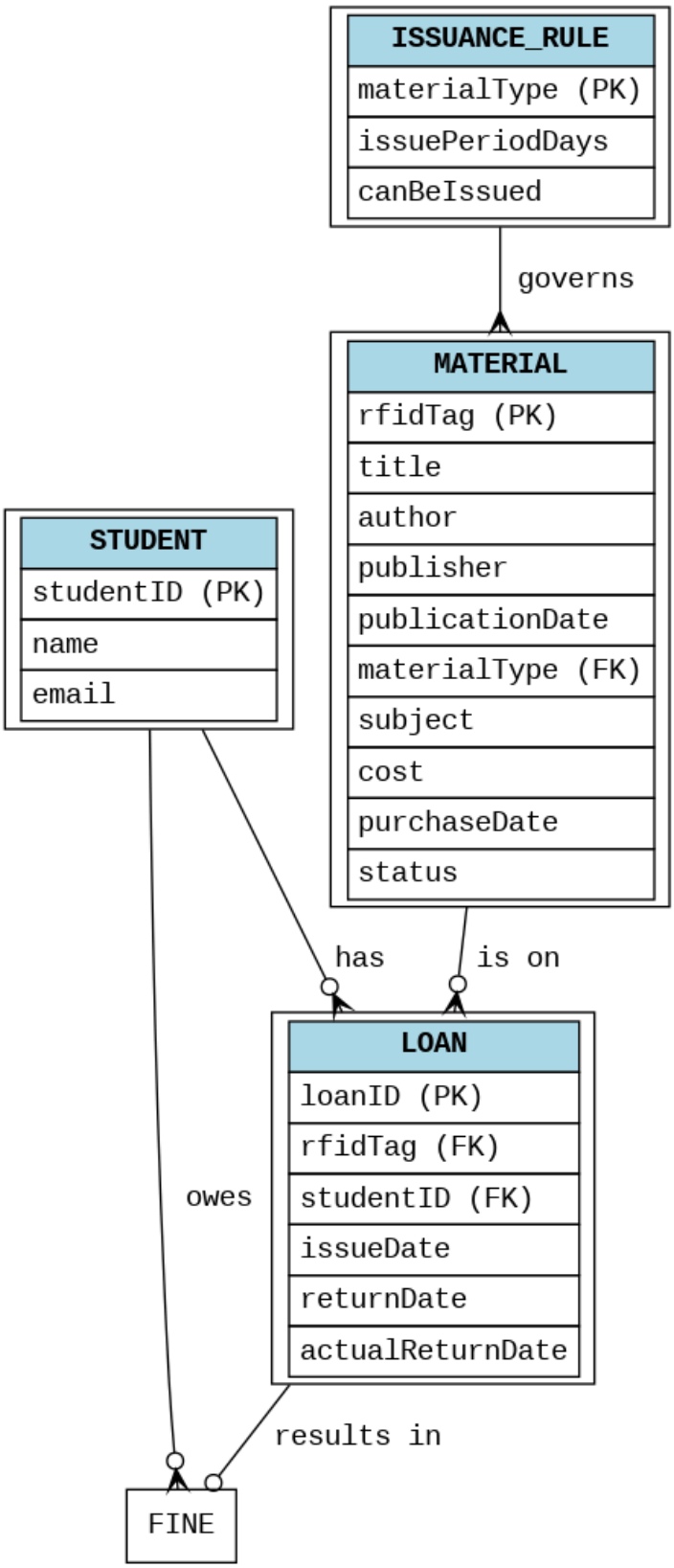
A **Level 0 (Context) Diagram** illustrates the flow of data between the entire system and its external entities.



LMS - Data Flow Diagram (Level 0)

3.2. Entity-Relationship (ER) Diagram

An ERD illustrates the logical structure of the database using "Crow's Foot" notation.



LMS - Entity-Relationship Diagram (Crow's Foot)

Relationship Key:

- **STUDENT ||--o{ LOAN:** One student can have zero or many loans.
- **MATERIAL ||--o{ LOAN:** One material can be on zero or many loans over its lifetime.
- **MATERIAL }|--|| ISSUANCE_RULE:** One issuance rule (e.g., "Book") governs many materials.
- **LOAN ||--o| FINE:** One loan can result in zero or one fine.
- **STUDENT ||--o{ FINE:** One student can have zero or many fines.

4. Detailed Requirements & UI/UX

This phase provides the specific, actionable requirements for the development team and visual mockups.

4.1. Business Requirements

A. Functional Requirements

FR-1: Material Management

- **FR-1.1:** The system shall keep records of different categories of material (books, magazines, journals, etc.).
- **FR-1.2:** The system shall allow library staff to classify books subject-wise.
- **FR-1.3:** The system shall store information for each material (RFID Tag, Author, Title, Publisher, etc.).
- **FR-1.4:** The system shall allow staff to add, modify, and delete material records.

FR-2: Circulation & RFID Management

- **FR-2.1:** The system shall have configurable issuing periods for each category (e.g., Book = 3 weeks).
- **FR-2.2:** The system shall prevent newspapers from being issued for outside use.
- **FR-2.3:** During checkout, the system shall capture material details via an RFID reader.
- **FR-2.4:** The system shall tag the student's ID with the borrowed material.
- **FR-2.5:** The system shall automatically record the issue date and calculate the return date.
- **FR-2.6:** The system shall be compatible with RFID enabled book drop box stations.
- **FR-2.7:** When a book is deposited in the drop box, the system shall immediately cancel the loan.

FR-3: Fine Calculation

- **FR-3.1:** The system shall perform an automatic calculation of fines for delayed returns.
- **FR-3.2:** The fine logic must be configurable by administrators.
- **FR-3.3:** The system shall log all fines against the student's record.

FR-4: Search & Access

- **FR-4.1:** The system shall provide a search interface for staff (by title, author).
- **FR-4.2:** The system shall provide students with online access (web and mobile).
- **FR-4.3:** The student interface shall allow students to know their return dates.
- **FR-4.4:** The system shall provide access to free e-journals and e-books.

FR-5: Notifications

- **FR-5.1:** The system shall automatically send email notifications 3 days before the return date.
- **FR-5.2:** The system shall automatically run the task to check for and send these reminders.

FR-6: Security & Anti-Theft

- **FR-6.1:** The system shall integrate with RFID readers at the exit gates.
- **FR-6.2:** The system shall track materials within a 2-meter range of the gate.
- **FR-6.3:** The system shall trigger a loud alarm if an unissued book passes through the gate.

FR-7: Reporting

- **FR-7.1:** Generate a report on most rented books.
- **FR-7.2:** Generate a report of issued and unissued materials.
- **FR-7.3:** Generate a report on fine collection (filterable by day, week, month).
- **FR-7.4:** Generate a report on the number of lost books.
- **FR-7.5:** Generate an inventory report (total number of books, journals, etc.).
- **FR-7.6:** Generate a report on book age (identifying books > 20 years old).

B. Non-Functional Requirements

NFR-1: System & Platform

- **NFR-1.1:** The LMS shall be usable on Windows and MacOS.
- **NFR-1.2:** The LMS shall be developed in Java.
- **NFR-1.3:** All system data must be stored in the cloud.
- **NFR-1.4:** The system must be RFID ready (NCIP 2.0 HTTP server).

NFR-2: Performance & Reliability

- **NFR-2.1:** The system must be highly reliable with minimal downtime.
- **NFR-2.2:** Search queries shall return results within 3 seconds.
- **NFR-2.3:** RFID checkout/return processes must be near-real-time (< 2 seconds per scan).
- **NFR-2.4:** The system must be highly scalable.

NFR-3: Connectivity

- **NFR-3.1:** Users will require an active internet connection.

NFR-4: Automation

- **NFR-4.1:** The system shall support auto-scheduled tasks (email reminders, database maintenance).

NFR-5: Security

- **NFR-5.1:** The system must be highly secure.
- **NFR-5.2:** Access to staff functions must be restricted by a login system.

NFR-6: Usability

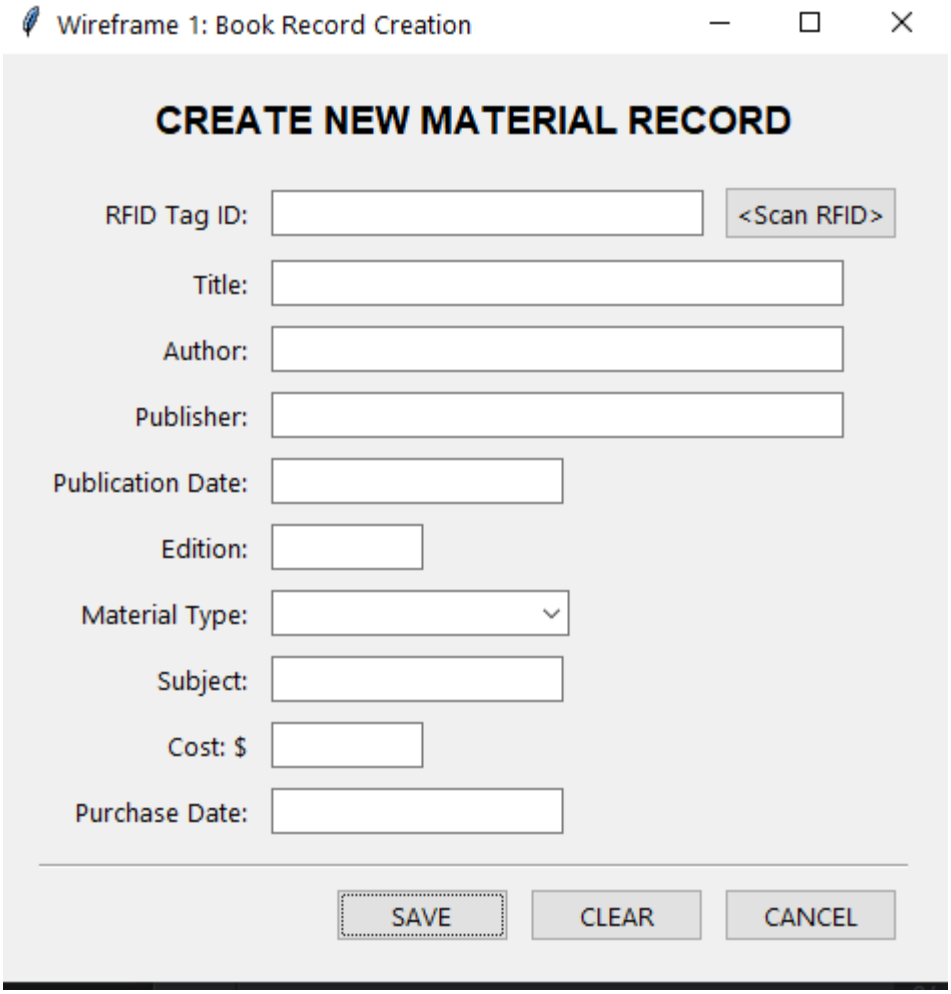
- **NFR-6.1:** All screens must be self-explanatory and very user-friendly.

4.2. Wireframes (Mock-screens)

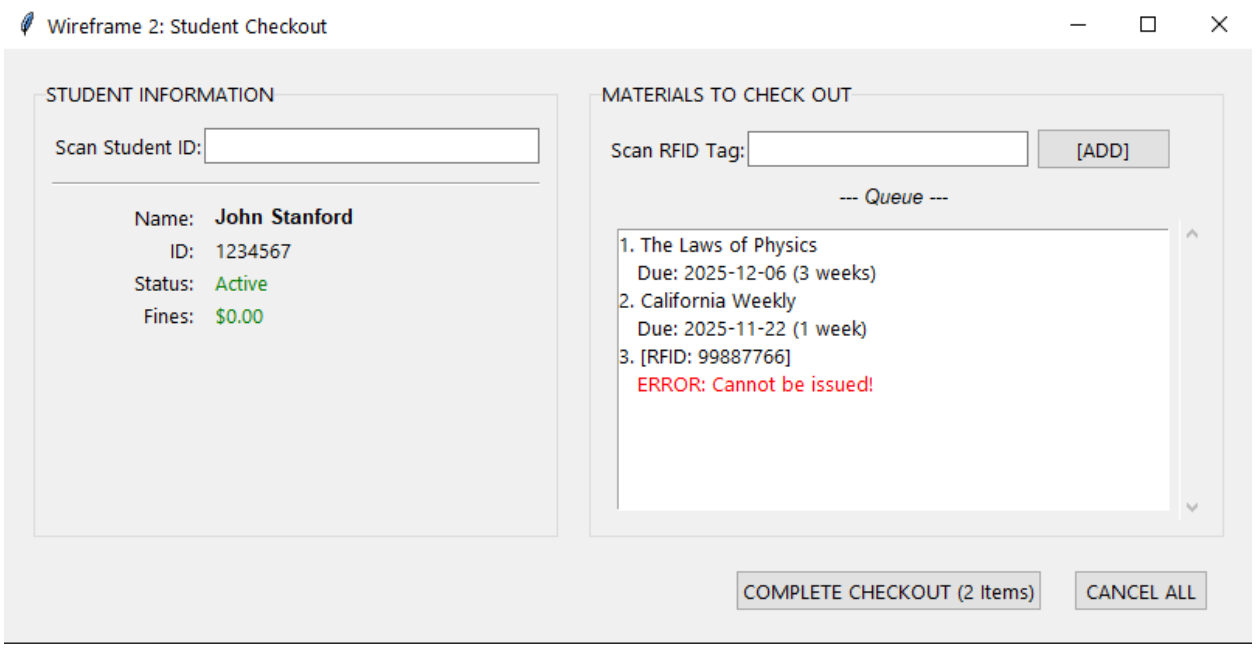
These are text-based, low-fidelity layouts representing the on-screen elements for two key features.

(Note: These text layouts are a standard wireframing technique. Fully functional Python scripts (wireframe_book_record.py and wireframe_checkout.py) have been provided as separate project deliverables to demonstrate a high-fidelity, runnable prototype of these screens.)

A. Wireframe 1: Book Record Creation (Staff-Facing)



B. Wireframe 2: Student Checkout Screen (Staff-Facing)



5. Conclusion

This document provides a comprehensive business analysis for the proposed Stanford Library Management System. It outlines the current problems and details the requirements, scope, data, and processes for a new, automated system. The deliverables herein serve as the foundational blueprint for the technical design and development phases of the project.