

SLMS (Smart Library Management System)

Case Study Definition

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The SLMS case study is defined to demonstrate and evaluate the ITLingoCloud platform, with particular emphasis on its AI Assistant (ITLingo-Chatbot), Specifications (ITLingo-ITOI), and Documents (Document Automation) components. The following text provides an informal description of a fictitious information system used to interactively elicit, specify, validate, and refine its requirements.

Summary

The Smart Library Management System (SLMS) is a digital platform automating academic library operations, replacing manual processes with a streamlined workflow for staff and patrons. It supports three user types: Librarians (managing catalogs, memberships, fines, and reports), Library Members (borrowing, returning, and tracking history), and System Administrators (overseeing settings and security). Key features include member registration with validation, book checkout/return with availability checks, fine calculation (50 cents/day per overdue book, capped at the replacement value), real-time reporting, and explicit entity lifecycles that define state transitions for Books, Members, Borrowings, and Fines. The system enforces rules like 14-day loans (extendable for Faculty) and borrowing limits based on membership type. It prioritizes scalability (100 concurrent users), security (encrypted data), and uptime (99% during library hours), while logging all transactions for auditing.

Introduction

The SLMS (Smart Library Management System) is a digital platform designed to automate the operations of a medium-sized academic library. It replaces the old manual card catalog and paper-based checkout processes with a fully digital workflow that serves both library staff and library patrons. The system handles everything from member registration and book catalog management to borrowing, returning, tracking fines for overdue materials, and generating operational reports for library administration.

Key Users and Functional Requirements

There are three kinds of users who interact with the system: Librarian, Library Member, and System Administrator. The Librarian is a library staff member who manages the book catalog, processes new member registrations, handles book checkouts and returns at the desk, manages fines, and generates reports. Each Librarian has a unique staff ID, a name, an email address, and a role level, which can be Senior, Junior, or Trainee. The Library Member is a registered library user who can browse the catalog, borrow books, return them, and view their borrowing history. Each Member has a unique member ID, name, email, phone number, membership type (Student, Faculty, or External), join date, and a maximum borrowing limit that depends on their membership type. The System Administrator is the person who manages system-wide settings, user accounts, and access permissions, oversees system logs, and can reset passwords or suspend accounts if needed. The Administrator has higher privileges than a Librarian.

The system supports a number of key operations. To start, a Librarian can register a new Member by selecting the option to register, entering the person's details, after which the system validates the data and creates the member record with a unique ID. If someone tries to register with an email address that already exists in the system, an error message appears, and the process reverts, allowing the Librarian to correct the information.

When a Member wants to borrow books, she presents them to the Librarian at the checkout desk; the Librarian scans the Member's library card, and the system displays the Member's information and the number of books she currently has checked out. The Librarian then scans each book's ISBN, and for each

book, the system checks that it is currently available, meaning its status is "Available" and not already borrowed by someone else. If a book is not available, the system alerts the librarian, and that book is removed from the transaction while the rest proceed. The system also checks whether the Member has already reached their maximum borrowing limit; if so, an alert is displayed, and the transaction is canceled. For books that pass these checks, the system calculates a due date, updates each book's status to "Borrowed", records the transaction, and produces a checkout receipt. A Member must not have exceeded their borrowing limit to borrow books.

When a Member returns books, she brings them to the returns desk and the Librarian scans each ISBN. For each book, the system checks the due date against the current date. If the book is returned on or before the due date, the status is simply set back to "Available". If it is overdue, a fine is calculated, and the Librarian is prompted to inform the Member about the fine. If a scanned book has no borrowing record, the system alerts the Librarian that it was not borrowed from the library. Books that are returned on time are marked as available immediately, while overdue books incur fines that must be tracked. Some rare or special collection books may not be borrowable at all, but it is unclear how these are identified in the catalog. The library may optionally also send reminder emails three days before the due date, but this is not mandatory.

When a Member has outstanding fines, she can pay them at the library desk. The Librarian looks up the Member's account, and the system displays the total outstanding fine amount along with a breakdown per book. The Member pays either in cash or by card, the Librarian records the payment, the system marks the fines as paid with the payment date, and a receipt is issued. If the Member pays only part of the total, the remaining balance remains outstanding. A Member whose unpaid fines exceed a certain amount (e.g., 20 euros) is blocked from borrowing new books until the fines are settled. The fine rate is 50 cents per day per overdue book, capped at the book's replacement value.

Librarians can generate several types of operational reports on demand. From the reports menu, they can choose among borrowing history, overdue book lists, most-borrowed book rankings, member activity summaries, and fine collection reports. For each report type, they can optionally apply filters such as a date range or book category, and once generated, the report can be exported.

Other Requirements and Constraints

Beyond these functional aspects, the system must meet several quality requirements. It must support up to one hundred concurrent users. Book search results must appear within two seconds. The system must be available 99% of the time during library hours, which run from 8 AM to 7 PM. All personal data must be stored encrypted at rest. Every transaction (including who performed it, when it was performed, and what action was taken) must be logged for auditing purposes.

A few additional rules govern how the system behaves. The standard loan period is fourteen days for all members, though Faculty members may borrow for up to thirty days. Different membership types have different maximum borrowing limits — Students can borrow up to 5 books at a time, Faculty up to 10, and External members up to 3. The overdue fine is calculated at fifty cents per day per book, but it cannot exceed the book's replacement value. A member whose unpaid fines total more than twenty euros cannot borrow any new books until the balance is paid.

Entity Lifecycles

A book added to the catalog starts as Available and can be checked out by any registered member. When a Librarian scans a member's books and completes checkout, each book becomes Borrowed with a calculated due date. Returning a book on or before the due date brings it back to Available; returning it after the due date also sets it back to Available, but a fine is recorded against the member. If a book is not returned by the due date, it remains Borrowed while overdue, accruing fines daily. Some rare or special collection books are marked as Unavailable and cannot be borrowed, though the criteria for this classification are not specified.

A member begins in Pending Registration while the Librarian enters her details. If the data is validated, the member becomes Active and can borrow books up to their membership limit. If a duplicate email is detected, registration loops back for correction. From Active, unpaid fines exceeding twenty euros move

the member to Borrowing Blocked, preventing further borrowing until the balance falls to or below that threshold. An Administrator may also suspend the account, moving the member to Suspended; only a reinstatement by the Administrator returns the member to Active.

A borrowing transaction begins In Progress when books are checked out with a due date. If all books are returned on time, the borrowing becomes Closed Normal. If the due date passes with any book outstanding, the transaction becomes Overdue; once those overdue books are returned, it becomes Closed Overdue, and fines are calculated. The Librarian may also Cancel an in-progress transaction if, for example, the member has exceeded their borrowing limit.

A fine is Accrued when the system calculates it for an overdue book. Once the Librarian informs the member, the fine becomes Outstanding. The member may pay in full, moving the fine to Paid, or pay in part, moving it to Partially Paid until the remainder is settled. Once Paid, the fine is fully settled, and the payment date and method are recorded.