Introduction

Project Overview

This project is to design a database system for a small library that will allow for improved scalability, item tracking, membership tracking, borrow tracking, and report generation. Our system should provide all of these services with a simple user-friendly UI.

Scope

The system will support efficient cataloging and tracking of loanable items, enforce borrowing rules, and generate insightful reports to aid library management. The library database system will include the following functionalities: item management, membership management, borrowing and returning facilitation, as well as query and report generation. It will do this while maintaining the integrity of the database.

Glossary

- **UI (User Interface)**
  - A User Interface is a high level application that allows an end user to interact with a system.
- **3 Schema**
  - A database design approach that splits data views into external, conceptual and internal layers.
- **Documentation:**
  - An official piece of information that provides internal and external parties information about a topic.
- **Internal Stakeholders**
  - People or groups inside a company that have a direct interest in the success of a project.
- **External Stakeholders**
  - People or groups outside of a company that have an indirect interest in the success of a project.
- **Functional Requirements**

    - Requirements for a system that specify what the system should be able to do. This includes its functions, behaviors, and operations.
- **Data Entities**
    - Data entities are an abstraction away from fully implemented tables. They specify attributes, data-types, and constraints from a high level view.
- **End User**
    - A user that interacts with the top level form of an application. (e.g. a library user interacting with the library database by using a system)

Stakeholders

Internal Stakeholders

- Project team
    - The project team, including the team manager and all members have an interest in the success of the project. Their work directly impacts the system's development and deployment.
- Employees
    - Employees will interact with the database system on a daily basis, meaning that their job performance is directly impacted by how well the system functions.
- Administrators
    - Administrators oversee the management and maintenance of the library system. They must ensure that the library system stays secured and functional, even after development has concluded.

External Stakeholders

- End User
    - All end users (account-based and generic) have an external stake in the success of this project. They will rely on the system to access and manage library resources. Their experience and satisfaction are key indicators of the system's success.
- Local Community
    - The local community will be impacted by the project's success, as their ability to efficiently utilize their community's resources banks on the fact that the system is operational and reliable.
- Investors
    - External investment sources have an internal stake in the overall success of a library management database system. Their financial support is essential for the project's development and sustainability.

Requirements

Functional Requirements:

The library database system must support the following functions:

1.) **User Administration**
   - The library staff can manage client accounts by adding, updating, or removing them
   - Clients may create an account with the library and update their contact information
   - A client will be assigned a membership type based on predefined rules and the system will enforce borrowing regulations based on membership type

2.) **Item Management**
   - Library staff can manage the various forms of media offered by adding, updating, or removing them
   - Clients may borrow and return items with borrowing limits enforced based on membership type

3.) **Data Entry and Management**
   - Staff may check out items to clients, recording the borrow and due dates
   - The system calculates overdue fines and sends notifications for due dates, overdue items, and available reserved items
   - Staff can add new items and update the information of existing items
   - Clients accounts will store history, outstanding fees, and membership details

4.) **Report Generation**

- The system must generate an elaborate report. For example, a collection analysis report which provides a comprehensive analysis of the library's entire book collection. It would examine the distribution of books by the genre, assess the age of the collection, as well as identify acquisition trends. It could potentially analyze borrowing patterns to find under-represented genres or authors.

Data Entities:

I used these references, in addition to the project description when completing this section:
https://www.w3schools.com/sql/sql_datatypes.asp
https://www.geeksforgeeks.org/sql-constraints/

1. **Book:** Represents books in the library system

Attribute	**Data Type**	**Constraints**
book_id	INT	PRIMARY KEY, UNIQUE
title	VARCHAR(500)	NOT NULL
author	VARCHAR(500)	NOT NULL
isbn	VARCHAR(13)* ISBNs are 13 digits long	UNIQUE, NOT NULL
publication_year	YEAR	NOT NULL
genre	VARCHAR(500)* *update with longest genre classification	NOT NULL
avaliability_status	ENUM(Available, CheckedOut, Reserved)	DEFAULT 'Available'
popularity	INT	*tracks amount of times book has been checked out

2. **Media:** Represents digital media in the library system

Attribute	**Data Type**	**Constraints**
media_id	INT	PRIMARY KEY, UNIQUE
title	VARCHAR(500)	NOT NULL
creator	VARCHAR(500)	NOT NULL
media_type	ENUM(‘E-book’, ‘Audiobook’, ‘Video’)	NOT NULL
isbn	VARCHAR(13)* ISBNs are 13 digits long	NOT NULL only if media_type = ‘E-book’ (CHECK)
publication_year	YEAR	NOT NULL
genre	VARCHAR(65535)* *update with longest genre classification	NOT NULL
avaliability_status	ENUM(‘Available’, ‘CheckedOut’, ‘Reserved’)	DEFAULT ‘Available’
popularity	INT	*tracks amount of times item has been checked out

3. **Magazine:** Represents magazines in the library system

Attribute	**Data Type**	**Constraints**
magazine_id	INT	PRIMARY KEY, UNIQUE
title	VARCHAR(500)	NOT NULL
issue_number	VARCHAR(20)	NOT NULL
publication_date	DATE	NOT NULL
avaliability_status	ENUM(‘Available’, ‘CheckedOut’, ‘Reserved’)	DEFAULT ‘Available’
popularity	INT	*tracks amount of times magazine has been checked out

4. **Client:** Represents clients in the library system

Attribute	**Data Type**	**Constraints**
client_id	INT	PRIMARY KEY, UNIQUE
name	VARCHAR(500)	NOT NULL
contact_info	VARCHAR(500)	NOT NULL
membership_type	ENUM(‘Regular’, ‘Student’, ‘Senior’)	FOREIGN KEY REFERENCES Membership_Type(Type), DEFAULT ‘Regular’
account_status	ENUM(‘Active’, ‘Inactive’)	DEFAULT ‘Active’

5. **Membership_Type:** Represents membership types in the library system

Attribute	**Data Type**	**Constraints**
type	ENUM(‘Regular’, ‘Student’, ‘Senior’)	PRIMARY KEY
borrowing_limit	INT	CHECK (borrowing_limit > 0), NOT NULL
daily_late_fee	DECIMAL(5, 2)	CHECK (daily_late_fee >= 0), NOT NULL
extra_fees	DECIMAL(5, 2)	CHECK (extra_fees >= 0), used if book/item is lost or damaged

6. **Loan:** Represents item loans in the library system

Attribute	**Data Type**	**Constraints**
loan_id	INT	PRIMARY KEY, UNIQUE
client_id	INT	FOREIGN KEY REFERENCES Client(client_id), NOT NULL
item_type	ENUM(‘Book’, ‘E-book’, ‘Audiobook’, ‘Video’, ‘Magazine’)	NOT NULL

item_id	INT	FOREIGN KEY REFERENCES Media(media_id)
book_id	INT	FOREIGN KEY REFERENCES Book(book_id)
magazine_id	INT	FOREIGN KEY REFERENCES Magazine(magazine_id)
borrow_date	ENUM(‘Active’, ‘Inactive’)	DEFAULT ‘Active’
due_date	DATE	NOT NULL
return_date	DATE	
fees_accrued	DECIMAL(5, 2)	CHECK(fees_accrued >= 0)

7. **Reservation:** Represents item reservations in the library system

Attribute	**Data Type**	**Constraints**
reservation_id	INT	PRIMARY KEY, UNIQUE
client_id	INT	FOREIGN KEY REFERENCES Client(client_id), NOT NULL
item_type	ENUM(‘Book’, ‘E-book’, ‘Audiobook’, ‘Video’, ‘Magazine’)	NOT NULL
item_id	INT	FOREIGN KEY REFERENCES Media(media_id)
book_id	INT	FOREIGN KEY REFERENCES Book(book_id)
magazine_id	INT	FOREIGN KEY REFERENCES Magazine(magazine_id)
reservation_date	DATE	NOT NULL
status	ENUM(‘Ready for pickup’, ‘In line’, ‘Processing’)	DEFAULT ‘Processing’

place_in_line	INT	NOT NULL

8. **Notification:** Represents notifications in the library system

Attribute	**Data Type**	**Constraints**
notification_id	INT	PRIMARY KEY, UNIQUE
client_id	INT	FOREIGN KEY REFERENCES Client(client_id)
message	TEXT(500)	NOT NULL

Hardware and Software Requirements

In terms of hardware for the database system, you would need things such as a basic CPU, enough storage, RAM, and a Wi-Fi network. These would vary in size depending on the size of the database system being created. For Software, the database system would need both the Windows and MAC servers, MySQL, and a set programming language.
