T25 - Software Systems Architecture - M.EIC010

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Library System Architecture

Automated Library System

Our library system diagram features classes representing entities within the library system such as Media, Users, Inventory and additional classes for representing data in a structured manner and enabling one-to-many or many-to-many interactions. The architectural inspiration for our solution was the Model-View-Controller (MVC) architecture.

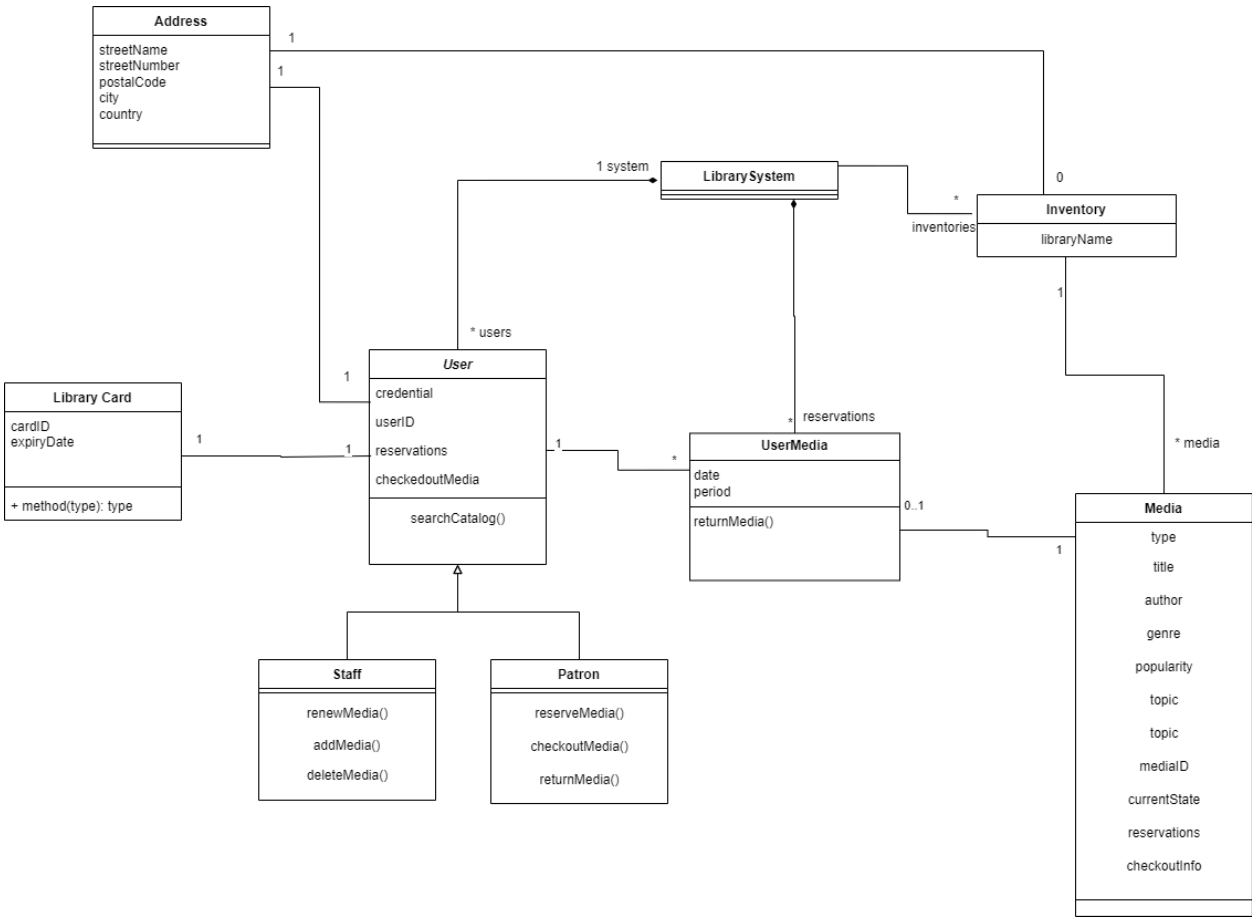

Figure 1. UML diagram of the Library System

The **LibrarySystem** handles user actions, orchestrates the flow of data, and controls the application's behavior by interacting with the data. Since there is a collaboration with other libraries we designed our architecture to enable searching in multiple inventories that could possibly belong to different institutions i.e. libraries. Associations between classes indicate relationships such as a Patron borrowing multiple items of media, etc.

The **Inventory** of a Library can be accessed through the LibrarySystem. Each library has its own inventory, that has its own address. Different libraries possibly have different selections of Media in their inventory. Of course, one specific item can only be present in one inventory, while inventories normally have a great selection of media. This is represented by a one-to-many relationship between the two classes.

Books, CDs, DVDs, etc., which all share some common attributes and behaviors which is why we chose to represent them all with a class called **Media**. Every item has a unique ID in the library, physical objects could have a barcode, QR code or RFID that a Staff member can scan for a Patron or the Patrons could scan it themselves, following the swiping of their library card or entering their credentials at a self-checkout desk.
This is necessary in order to keep track of each individual item, and assign them to Patrons in case of checkouts and reservations. Moreover libraries typically have more than one copy of a book or other types of physical media, consequently it is necessary to distinguish these in order to keep an organized inventory.

Patrons and **Staff** members are both **Users.** Users are identified by their unique IDs and have their personal information (e.g. address) associated with their account. Users are able to search the catalog of the library, check out, reserve and return media. In addition, each user has a library card that they can swipe at checkout desks that is able to log them in by providing their personal information to the system. Moreover staff members have access to the library inventory, and have permission to add and delete items to and from the catalog (inventory).

The **UserMedia** class enables the system to store data describing which book was checked out or reserved by whom, realized by one-to-many and many-to-many interactions. More specifically it allows a Patron to check out or reserve multiple Media items, while making sure that one item can only belong to one Patron at a time. This allows the system to keep track of checked out and reserved items on both the Patron’s and Media’s end.

Typical scenarios

Scenario A: Patron checks out a book
Inside the library, the patron goes to a self-checkout station or to a desk to interact with a staff member. To access their personal user account, including data like the patron's name and address, the patron uses their library card or adds their credentials manually. Now the system can verify the patron’s account and displays the options for checking out books (checkoutMedia). The patron scans the book’s barcode to be borrowed. The system updates the patron's account to reflect the borrowed item and adjusts the inventory accordingly. The patron receives a notification that they checked-out the book successfully and the due date for returning the book.

Scenario B: Patron searches for a book inside the library
The patron searches a book inside the library at a search station or uses their mobile phone to search the library’s catalog. They enter data such as type, title, author, genre and topic. The patron scrolls through the search results and chooses a book they are interested in. They can view additional details about the book such as current reservations and location i.e. which library has an available copy in inventory. If the book is not available, the system may provide an option for placing a hold. The patron receives notifications about the status of their search, including availability of reserved items.