Introduction

Project Overview

This project aims to develop a database system for a small library, enhancing scalability, item management, membership tracking, borrow tracking, and report generation. The system will deliver these features through an intuitive and user-friendly interface.

Scope

The system will enable efficient cataloging and tracking of loanable items, enforce borrowing policies, and generate detailed reports to support library management. Its core functionalities will include item management, membership management, borrowing and returning processes, and query and report generation, all while ensuring database integrity.

Glossary

- **UI (User Interface)**
    - A User Interface is a high level application that allows an end user to interact with a system.
- **3 Schema Architecture**
    - 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.

- **Entity Attributes**

  - A characteristic or trait of an entity type that describes the entity, for example, the Person entity type has the Date of Birth attribute

- **ER (entity-relationship) Diagram**

  - An entity–relationship model which describes interrelated things of interest in a specific domain of knowledge.

- **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)

Relational Schema Mapping

Notification		
<u>notification_ID</u>	client_id(FK)	message

Gets	
<u>Client_id</u>	notification_id

Client				
<u>Client_id</u>	name	contact_info	membership_type(FK)	account_status

Has	
<u>Type</u>	client_id

Membership_Type			
<u>Type</u>	borrowing_limit	daily_late_fee	extra_fees

Takes

Client_id	loan_id

Loan

Loan_id	client_id (FK)	item_type	item_id (FK)	book_id (FK)	magazine_id (FK)	fees_accrued	borrow_date	return_date	due_date

Loaned

loan_id	media_id	magazine_id	book_id

Magazine

magazine_id	title	issue_number	publication_date	availability_status	popularity

Book

book_id	title	author	isbn	publication_year	genre	popularity	availability_status

Media

Media_id	title	creator	isbn	media_type	publication_year	genre	popularity	availability_status

Reserved

book_id	reservation_id	magazine_id	media_id

Reserves

Client_id	reservation_id

Reservation

reservation_id	status	client_id (FK)	place_in_line	magazine_id (FK)	reservation_date	book_id (FK)	item_id(FK)	item_type

Relational Schema Diagram
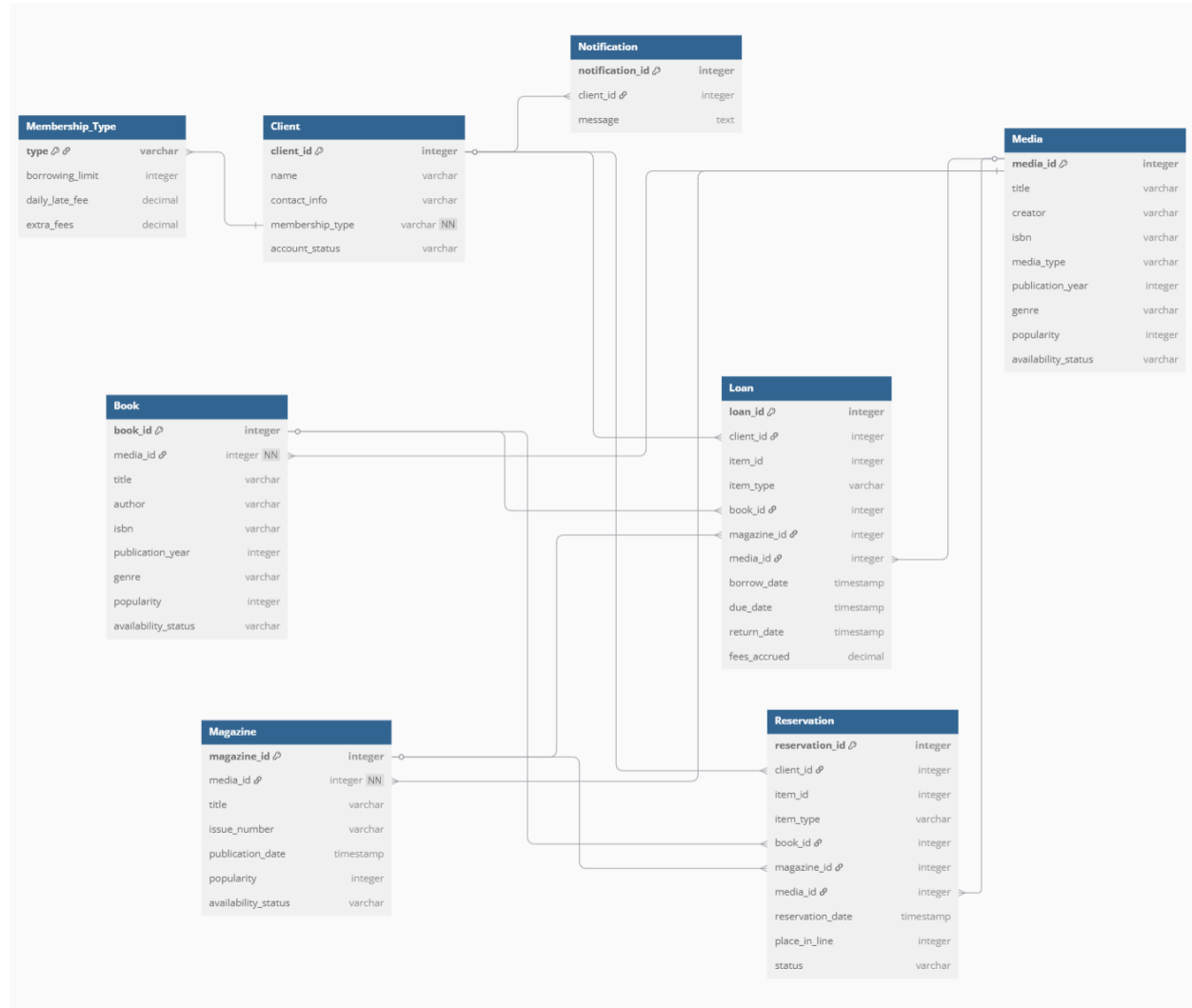
The circle represents the data going out of the table and into the one it is connected to.

Schema Documentation with a Data Dictionary

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

Attribute	Data Type	Constraints	Definition
book_id	INT	PRIMARY KEY, UNIQUE	A unique identifier assigned to each book in the library.

title	VARCHAR(500)	NOT NULL	The full title of the book.
author	VARCHAR(500)	NOT NULL	The name of the author who wrote the book.
isbn	VARCHAR(13)* ISBNs are 13 digits long	UNIQUE, NOT NULL	The 13-digit International Standard Book Number uniquely identifying the book.
publication_year	YEAR	NOT NULL	The year the book was published.
genre	VARCHAR(500)* *update with longest genre classification	NOT NULL	The category or type of literature the book belongs to (e.g., Mystery, Fantasy).
avaliability_status	ENUM('Available', 'CheckedOut', 'Reserved')	DEFAULT 'Available'	This shows if the book is available to be borrowed.
popularity	INT	*tracks amount of times book has been checked out	Shows how many times a book has been checked out.

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

Attribute	Data Type	Constraints	Definition
media_id	INT	PRIMARY KEY, UNIQUE	A unique identifier assigned to each digital media item in the library.
title	VARCHAR(500)	NOT NULL	The title of the digital media item.
creator	VARCHAR(500)	NOT NULL	The individual or organization responsible for creating the media.
media_type	ENUM('E-book', 'Audiobook', 'Video')	NOT NULL	Specifies the format of the media item.

isbn	VARCHAR(13)* ISBNs are 13 digits long	NOT NULL only if media_type = 'E-book' (CHECK)	The 13-digit ISBN, required only for E-books.
publication_year	YEAR	NOT NULL	The year the media item was published or released.
genre	VARCHAR(65535)* *update with longest genre classification	NOT NULL	The classification or category of the media content.
avaliability_status	ENUM('Available', 'CheckedOut', 'Reserved')	DEFAULT 'Available'	Indicates the current availability of the media item.
popularity	INT	*tracks amount of times item has been checked out	Tracks the number of times the media item has been checked out.

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

Attribute	Data Type	Constraints	Definition
magazine_id	INT	PRIMARY KEY, UNIQUE	A unique identifier assigned to each magazine in the library.
title	VARCHAR(500)	NOT NULL	The title of the magazine.
issue_number	VARCHAR(20)	NOT NULL	The issue number of the magazine.
publication_date	DATE	NOT NULL	The date the magazine was published or released.
avaliability_status	ENUM('Available', 'CheckedOut', 'Reserved')	DEFAULT 'Available'	Indicates the current availability of the magazine.
popularity	INT	*tracks amount of times magazine has been checked out	Tracks the number of times the magazine has been checked out.

4. Client: Represents clients in the library system

Attribute	Data Type	Constraints	Definition
client_id	INT	PRIMARY KEY, UNIQUE	A unique identifier for each client registered in the system.
name	VARCHAR(500)	NOT NULL	Full name of the client.
contact_info	VARCHAR(500)	NOT NULL	Contact details of the client.
membership_type	ENUM('Regular', 'Student', 'Senior')	FOREIGN KEY REFERENCES Membership_Type(Type), DEFAULT 'Regular'	Indicates the type of membership the client holds.
account_status	ENUM('Active', 'Inactive')	DEFAULT 'Active'	Indicates whether the client's account is currently active or inactive.

5. Membership_Type: Represents membership types in the library system

Attribute	Data Type	Constraints	Definition
type	ENUM('Regular', 'Student', 'Senior')	PRIMARY KEY	The category of membership a client can hold.
borrowing_limit	INT	CHECK (borrowing_limit > 0), NOT NULL	The maximum number of items a member can borrow at one time.
daily_late_fee	DECIMAL(5, 2)	CHECK (daily_late_fee >= 0), NOT NULL	The fine charged per day for late returns.
extra_fees	DECIMAL(5, 2)	CHECK (extra_fees >= 0), used if book/item is lost or damaged	Additional charges for lost or damaged items.

6. Loan: Represents item loans in the library system

Attribute	Data Type	Constraints	Definition
loan_id	INT	PRIMARY KEY, UNIQUE	A unique identifier for each loan transaction.
client_id	INT	FOREIGN KEY REFERENCES Client(client_id), NOT NULL	The client who borrowed the item.
item_type	ENUM('Book', 'E-book', 'Audiobook', 'Video', 'Magazine')	NOT NULL	Specifies the type of item being loaned.
item_id	INT	FOREIGN KEY REFERENCES Media(media_id)	ID of the media item if it's digital.
book_id	INT	FOREIGN KEY REFERENCES Book(book_id)	ID of the book if it's a physical book.
magazine_id	INT	FOREIGN KEY REFERENCES Magazine(magazine_id)	ID of the magazine if applicable.
borrow_date	ENUM('Active', 'Inactive')	DEFAULT 'Active'	The date the item was borrowed.
due_date	DATE	NOT NULL	The date by which the item must be returned.
return_date	DATE		The actual date the item was returned. Can be NULL if not returned yet.
fees_accrued	DECIMAL(5, 2)	CHECK(fees_accrued >= 0)	Total late or penalty fees incurred on this loan.

7. Reservation: Represents item reservations in the library system

Attribute	Data Type	Constraints	Definition
reservation_id	INT	PRIMARY KEY, UNIQUE	A unique identifier for each reservation made.
client_id	INT	FOREIGN KEY REFERENCES Client(client_id), NOT NULL	The client who placed the reservation.
item_type	ENUM('Book', 'E-book', 'Audiobook', 'Video', 'Magazine')	NOT NULL	Type of item being reserved.
item_id	INT	FOREIGN KEY REFERENCES Media(media_id)	ID of the digital media item (if applicable).
book_id	INT	FOREIGN KEY REFERENCES Book(book_id)	ID of the book (if applicable).
magazine_id	INT	FOREIGN KEY REFERENCES Magazine(magazine_id)	ID of the magazine (if applicable).
reservation_date	DATE	NOT NULL	The date when the reservation was made.
status	ENUM('Ready for pickup', 'In line', 'Processing')	DEFAULT 'Processing'	The current status of the reservation.
place_in_line	INT	NOT NULL	The client's position in the reservation queue for the item.

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

Attribute	Data Type	Constraints	Definition
notification_id	INT	PRIMARY KEY, UNIQUE	A unique identifier for each notification sent to a client.
client_id	INT	FOREIGN KEY REFERENCES Client(client_id)	The ID of the client receiving the message.
message	TEXT(500)	NOT NULL	The content of the message delivered to the client.