Library Management System Documentation

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1 Overall Project Description

The **Library Management System** is a comprehensive software solution designed to optimize library operations by managing resources, user interactions, and administrative tasks efficiently. It enhances user experience through intuitive interfaces for catalog access, borrowing, reservations, and maintains precise transaction records.

2 Requirements Analysis

2.1 Functional Requirements

- **User Registration and Login:** Enable users to create accounts and securely log in.

- **Catalog Search:** Allow searching by title, author, or ISBN.

- **Borrowing and Reserving:** Facilitate borrowing available resources and reserving unavailable ones.

- **Borrowing History:** Provide access to current and past borrowings.

- **Renewals:** Allow users to extend borrowing periods within limits.

- **Profile Management:** Let users update personal information and settings.

- **Administrative Functions:** Enable librarians to manage resources and user accounts.

3 Database and SQL Design

3.1 Database Schema

The system employs a relational database to ensure data integrity and efficient querying. The primary tables include:

- **Users:** Stores user information.

- **Resources:** Details of library materials.

- **Borrowings:** Records of borrowed resources.

3.2 Primary Tables

3.2.1 Users

Field	Description
user_id	Primary key, unique identifier for each user
first_name	User's first name
last_name	User's last name
email	User's email address
password	Hashed password for authentication
role	User role (e.g., Patron, Librarian)
created_at	Timestamp of account creation
updated_at	Timestamp of last account update

Table 1: Users Table Schema

3.2.2 Resources

Field	Description
resource_id	Primary key, unique identifier for each resource
title	Title of the resource
author	Author of the resource
resource_type	Type of resource (e.g., Book, Magazine)
isbn	International Standard Book Number
available_copies	Number of copies available for borrowing
location	Physical location within the library
total_copies	Number of copies
created_at	Timestamp of resource addition
updated_at	Timestamp of last resource update

Table 2: Resources Table Schema

3.2.3 Borrowings

Field	Description
borrowing_id	Primary key, unique identifier for each borrowing record
user_id	Foreign key referencing Users table
resource_id	Foreign key referencing Resources table
borrow_date	Date when the resource was borrowed
due_date	Date when the resource is due for return
return_date	Date when the resource was returned
status	Current status (e.g., Borrowed, Returned)
renewals	Number of times the borrowing has been renewed
created_at	Timestamp of borrowing record creation
updated_at	Timestamp of last update

Table 3: Borrowings Table Schema

4 Front and Back-End Design and Implementation

The **Library Management System** employs a **Model-View-Controller (MVC)** architecture to ensure a clear separation of concerns, enhancing maintainability and scalability. The backend is developed using **Node.js**, interfacing with a **MySQL** database. The frontend utilizes **HTML5**, **CSS3**, and **JavaScript** to create a responsive and interactive user interface.

4.1 Backend Design

4.1.1 Technologies Used

- **Node.js:** JavaScript runtime for building scalable network applications.

- **MySQL:** Relational database management system for data storage.

- **bcryptjs:** Library for hashing passwords.

4.1.2   Key Modules and Routes

Librarian Routes: Manage resources, borrowing, reservations, reports, notifications, and user accounts.

   Patron Routes: Handle catalog search, borrowing, reservations, borrowing history, notifications, and profile updates.

   Authentication Routes: Manage user registration and login processes.

4.1.3   Implementation Details

Requirements	Function/Procedure	Function Introduction
User Registration	registerUser (Frontend)	Captures user input data, validates, and sends registration requests to the backend.
	createUser (Backend)	Processes registration data, hashes passwords, and stores new user information in the database.
User Login	loginUser (Frontend)	Captures user credentials and sends login requests to the backend.
	authenticateUser (Backend)	Verifies user credentials, generates JWT tokens, and manages authentication sessions.
Search Catalog	searchCatalog (Frontend)	Sends search queries to the backend and displays search results to the user.
	searchCatalog (Backend)	Executes SQL queries to fetch resources matching the search criteria.
Borrow Resource	borrowBook (Frontend)	Initiates borrowing requests by sending resource IDs to the backend.
	borrowResource (Backend)	Validates availability, creates borrowing records, and updates resource counts.
View Borrowed Books	fetchBorrowedBooks (Frontend)	Retrieves and displays the list of currently borrowed books.
	getBorrowedBooks (Backend)	Fetches borrowed books data from the database for the authenticated user.
Renew Borrowing	renewBorrowing (Frontend)	Sends renewal requests for borrowed resources to the backend.
	renewBorrowing (Backend)	Validates renewal limits and updates due dates in borrowing records.
Update Profile	updateUserProfile (Frontend)	Captures profile update inputs and sends them to the backend.
	updateProfile (Backend)	Processes profile updates and modifies user information in the database.
Add New Resource	addResource (Backend)	Allows librarians to add new resources to the catalog.
Update Resource	updateResource (Backend)	Enables librarians to update existing resource details.

Requirements	Function/Procedure	Function Introduction
Delete Resource	`deleteResource (Backend)`	Allows librarians to remove resources from the catalog.
Manage User Accounts	`manageUser (Backend)`	Allows librarians to update user roles and account statuses.
Get All Users	`getAllUsers (Backend)`	Retrieves a list of all registered users for administrative purposes.
Delete User Account	`deleteUser (Backend)`	Enables librarians to remove user accounts from the system.
Get Resources	`getResources (Backend)`	Fetches all resources for display in administrative interfaces.
Edit Resource	`editResource (Backend)`	Allows librarians to modify resource details.

4.2   Frontend Design

4.2.1   Technologies Used

- **HTML5:** Markup language for structuring web content.

- **CSS3:** Styling language for designing responsive layouts.

- **JavaScript:** Programming language for interactive functionalities.

- **Fetch API:** For making asynchronous HTTP requests to the backend.

- **Bootstrap:** Frontend framework for responsive design (if applicable).

4.2.2   Key Modules and Functions

The frontend functions correspond to backend routes to ensure seamless user interactions. Below is an overview of the key frontend functionalities:

- **Authentication:** `registerUser` and `loginUser` handle user registration and login processes.

- **Catalog Interaction:** `searchCatalog` enables users to search for resources.

- **Resource Transactions:** `borrowBook` manage borrowing.

- **User Dashboard:** `fetchBorrowedBooks` and display user-specific data.

- **Profile Updates:** `updateUserProfile` allows users to modify their details.

5   How to Use the System

This section provides a step-by-step guide on effectively utilizing the **Library Management System**.

5.1   User Registration and Login

1. **Register a New Account:**

   - Click on the "Register" button.
   - Fill in the required fields: First Name, Last Name, Email, and Password.

- Click "Submit" to create your account.
- A confirmation message will appear upon successful registration.

2. **Login to Your Account:**
   - Click on the "Login" button.
   - Enter your registered username and password.
   - Click "Login" to access your dashboard.

5.2   Searching the Catalog

1. **Perform a Search:**
   - Enter your search query in the search bar. You can search by Title, Author, or ISBN.
   - Click the "Search" button.

2. **View Search Results:**
   - Results will display as cards showing the book cover, title, author, ISBN, type, and availability.
   - Use the "Borrow" buttons to borrow the book.

5.3   Borrowing a Resource

1. **Find the Desired Resource:**
   - Use the search functionality to locate the book you wish to borrow.

2. **Initiate Borrowing:**
   - Click the "Borrow" button on the resource card.
   - A confirmation prompt will appear. Confirm your intent to borrow.

3. **Confirm Borrowing:**
   - Upon successful borrowing, a success message will display with the due date.
   - The available copies count will decrease accordingly.

5.4   Viewing Borrowed Books

1. **Access Borrowed Books Section:**
   - A table listing all currently borrowed books will display, including details like Title, Author, ISBN, Borrow Date, Due Date, Renewals, and Actions.

2. **Renew a Borrowing:**
   - Click the "Renew" button corresponding to the book you wish to extend.
   - Confirm the renewal in the modal that appears.
   - Upon successful renewal, the due date will update, and the renewals count will increment.

5.5   Updating Profile

1. **Access Profile Settings:**

   - Click on the "Profile" tab in the navigation bar.

2. **Edit Information:**

   - Modify your personal details such as Email, Phone, Address, or Password.
   - Click "Update Profile" to save changes.

3. **Confirmation:**

   - A success message will appear upon successful profile update.

6   Using the System as a Librarian

As a **Librarian**, you have access to various tools that help manage library operations efficiently. Here's how to use the key features:

6.1   Manage Library Resources

- **Add New Resources:**

  - Click on the "Manage Resources" tab.
  - Select "Add New Resource".
  - Fill in details like Title, Author, Type (e.g., Book, Magazine), ISBN, and Number of Copies.
  - Click "Submit" to save the new resource.

- **Update Existing Resources:**

  - In "Manage Resources", use the search bar to find the resource by Title or ISBN.
  - Click the "Edit" button next to the resource.
  - Update the necessary information.
  - Click "Save" to apply changes.

- **Delete Resources:**

  - Find the resource in "Manage Resources".
  - Click the "Delete" button next to the resource.
  - Confirm the deletion when prompted.

6.2   Manage User Accounts

- **View Users:**

  - Click on the "Manage Users" tab.
  - Browse the list of registered users.

- **Edit User Information:**

  - Click "Edit" next to a user's name.
  - Update details like Email or Role.

– Click "Save" to update the information.

- **Delete User Accounts:**

  – Click "Delete" next to the user's name.
  – Confirm the deletion when prompted.

7 Conclusion

The **Library Management System** effectively streamlines library operations through its comprehensive features and user-friendly interface. By automating key processes like resource management, borrowing, and user administration, it enhances both user and administrative experiences. Future improvements may include advanced search capabilities, mobile application support, and integration with external databases to further expand its functionality.