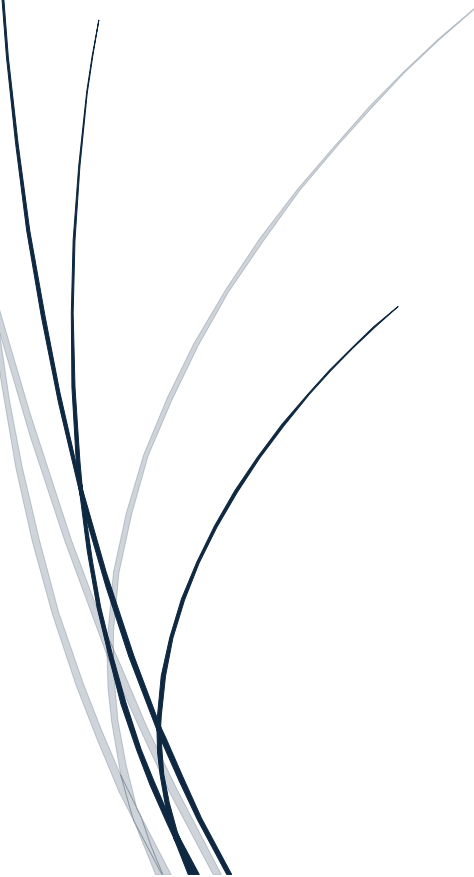


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Library Management System

BookHive



Group 13
EECS 3311

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Library Management System: System Design Document

1. High-Level Architecture

The system is designed as a modular, multi-layered application comprising the following components:

- **Frontend:** HTML templates (base.html, home.html, etc.), CSS, and JavaScript files to handle user interaction.
- **Controllers:** Python modules (auth.py, models.py, views.py) to handle routing, requests, and business logic.
- **Database:** SQLite (database.db) for storing data related to users, admin, and book-related data and borrowing records.
- **Backend Framework:** Flask is used to develop the backend, managing routes, views, and server logic.
- **Email Service:** Flask-Mail is configured for sending automated emails, such as password reset links.

2. CRC Cards

2.1 User Authentication (auth.py)

Class Name: auth.py	
Parent Class: None Subclasses: None	
Responsibilities: <ul style="list-style-type: none">• Authenticate users through login.• Handle user registration, account creation, and password reset.• Manage user logout and session.	Collaborators: <ul style="list-style-type: none">• 'models.py': for user data validation.• 'views.py': for routing authentication-related views.• Flask-Mail: Send password reset emails.

2.2 Models (models.py)

Class Name: models.py
Parent Class: None Subclasses: None

Responsibilities: <ul style="list-style-type: none"> • Manage and query the book inventory. • Store and retrieve user and book borrowing/returning data. • Update book statuses and availability. 	Collaborators: <ul style="list-style-type: none"> • 'auth.py' (to store user account details). • 'database.db' (to handle any database related inquiries).
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2.3 Views (views.py)

Class Name: views.py	
Parent Class: None	
Subclasses: None	
Responsibilities: <ul style="list-style-type: none"> • Render templates and display pages to users. • Handle user requests for book management (add, edit, delete, borrow, return). • Route user actions, such as borrowing books, adding/editing/deleting books, and submitting queries. • Validate user permissions (e.g., admin-only access for specific actions). • Send automated emails for receipts and queries using Flask-Mail. • Handle filters for book lists based on author or genre. 	Collaborators: <ul style="list-style-type: none"> • 'models.py' <ul style="list-style-type: none"> ➤ Queries and updates the database for books, borrowed books, and users. ➤ Retrieves book and user-related data. (for user-specific routing). • 'auth.py': <ul style="list-style-type: none"> ➤ Ensures the user is authenticated. ➤ Validates whether the user is an admin for restricted actions. • 'database.db': <ul style="list-style-type: none"> ➤ Stores books, user data, and borrowed book details. ➤ Provides queried data such as book genres, authors, and borrow records.

2.4 App Initialization (__init__.py)

Class Name: __init__.py	
Parent Class: None	
Subclasses: None	
Responsibilities:	Collaborators: <ul style="list-style-type: none"> • 'auth.py': Registers the authentication blueprint.

<ul style="list-style-type: none"> • Configure and initialize the Flask app. • Set up database connections (SQLAlchemy). • Configure Flask-Mail for email functionality. • Register blueprints for views and auth. • Create database tables if they don't exist. • Configure the login manager for user authentication. 	<ul style="list-style-type: none"> • 'views.py': Registers the views blueprint. • 'database.db': Initializes and creates database tables.
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3. System Interaction with the Environment

- **Programming Language:** Python 3
- **Framework:** Flask
- **Database:** SQLite
- **Frontend Technologies:** HTML, CSS, JavaScript
- **Email Service:** Flask-Mail for sending emails.
- **Operating System:** Platform-independent (Windows, macOS, Linux)

Dependencies:

- **Flask** for backend logic.
- **SQLAlchemy** for database interaction.
- **Flask-Mail** for email functionality.
- **Flask-Login** for session management.

4. System Decomposition

1) User Management:

- Handles user authentication, registration, and role management (admin or regular user).
- Includes password reset functionality.

2) **Book Management:**

- Tracks book inventory, borrowing status, and returns.

3) **Borrow Management:**

- Links users with borrowed books and tracks due dates.

4) **Error Handling:**

- Validates input on both frontend (JavaScript) and backend (Flask).
- Provides clear error messages for invalid credentials, unregistered users, or unavailable books.

5. Error Handling Strategy:

The system ensures robust error handling by validating inputs, managing user feedback, and handling exceptions gracefully.

Invalid Input:

- Validate data in forms before submission.
- Display error messages for incorrect email or password formats.
- Display flash message if the password is less than 7 characters.

Books errors:

- Display error messages for users if the user tried to borrow a book that is out of stock
- Display error messages for users if the user tried to borrow a book that they already borrowed.
- Display error messages for users if the user tried to borrow more than 5 books.