

# **Library Management System**

Done by :

Kholod Fathy Elhmamsy

Ahmed Khaled Erfan

Nada Ahmed Shahat

Mahmoud Amr Amin

Rahma Hesham Helal

# Overview

The **Library Management System** is an online platform that enables users to browse and borrow books, manage their accounts, and leave comments on books. It keeps track of book availability, user checkouts, and enforces penalties for late returns, ensuring efficient management of library resources and user accountability.

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## Models

### 1. Book

The `Book` model represents the library's book collection.

- **Attributes:**

- `BookId` (Int): The unique identifier for the book.
- `Name` (String): The title of the book.
- `Author` (String): The author of the book.
- `Quantity` (Int): Number of copies available.
- `CategoryId` (Int): Foreign key linking the book to a specific category.
- `Description` (String): Detailed description of the book.

- **Relationships:**

- Belongs to one `Category` .
  - Can have multiple `Comments` .
  - Can have multiple `Checkouts` .
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## 2. Category

The `Category` model categorizes books.

- **Attributes:**

- `CategoryId` (Int): Unique identifier for the category.
- `Name` (String): Category name (e.g., Fiction, Science).

- **Relationships:**

- Can have multiple `Books` .
- 

## 3. User

The `User` model represents individuals who can interact with the library system.

- **Attributes:**

- `UserId` (Int): Unique identifier for the user.
- `Name` (String): User's name.
- `Email` (String): User's email address.
- `Phone` (String): User's phone number.
- `Password` (String): Account password.

- **Relationships:**

- Can have multiple `Checkouts` .
- Can leave multiple `Comments` .
- Can have multiple `Roles` (via `UserRole` ).

## 4. Role

The `Role` model defines various roles that users can have within the system.

- **Attributes:**

- `RoleId` (Int): Unique identifier for the role.
- `RoleName` (String): Name of the role (e.g., User, Admin).

- **Relationships:**

- Can be assigned to multiple `Users` (via `UserRole`).
- 

## 6. Checkout

The `Checkout` model tracks book borrowings by users. This includes managing return deadlines and late penalties.

- **Attributes:**

- `CheckoutId` (Int): Unique identifier for the checkout record.
- `UserId` (Int): Foreign key referencing the user checking out the book.
- `BookId` (Int): Foreign key referencing the book being checked out.
- `CheckoutDate` (DateTime): Date when the book was checked out.
- `DueDate` (DateTime): Date by which the book should be returned.

- `ReturnDate` (`DateTime`): Actual return date of the book (if applicable).
- `ActiveFlag` (`Bool`): Flag indicating whether the checkout is active.
- `Penalty` (`Decimal`): Fee charged if the book is returned late.

- **Relationships:**

- A `Checkout` references one `User`.
  - A `Checkout` references one `Book`.
- 

## 7. Comment

The `Comment` model allows users to leave feedback on books.

- **Attributes:**

- `CommentId` (`Int`): Unique identifier for the comment.
- `UserId` (`Int`): Foreign key referencing the user leaving the comment.
- `BookId` (`Int`): Foreign key referencing the book.
- `Description` (`String`): Text content of the comment.

- **Relationships:**

- A `Comment` references one `User`.
  - A `Comment` references one `Book`.
-

# Entity Relationships Summary

1. **Book - Category:** A Category can have multiple Books , but each Book belongs to one Category .
  2. **User - Checkout:** A User can have multiple Checkouts , but each Checkout is linked to one User .
  3. **Book - Checkout:** A Book can be involved in multiple Checkouts , but each Checkout is for one Book .
  4. **User - Comment:** A User can leave multiple Comments , but each Comment belongs to one User .
  5. **Book - Comment:** A Book can have multiple Comments , but each Comment is for one Book .
  6. **User - Book:** A User can borrow multiple Books through checkouts, and a Book can be borrowed and returned by multiple Users over time.
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## Data Flow Diagram (DFD)

### Level 0: Context Diagram

- The system consists of three main actors:
  1. **User:** Interacts with the system to browse, checkout books, and leave comments.
  2. **Admin:** Manages the book catalog, users, and checkout penalties.

3. **System:** Handles requests for book management, user authentication, checkouts, and comments.

## Level 1: Detailed Data Flow

### 1. User Registration/Login:

**Data Flow:** User → [Input credentials] → System → [Validate credentials] → Database → [User information returned]

### 2. Book Browsing:

- **Data Flow:** User → [Request book catalog] → System → [Fetch books] → Database → [Books returned] → User

### 3. Checkout Process:

- **Data Flow:** User → [Request to checkout book] → System → [Validate availability] → Database → [Update book quantity, create checkout record] → User

### 4. Return and Penalty Calculation:

- **Data Flow:** User → [Return book] → System → [Check return date] → Database → [Calculate penalty, update checkout record] → User
-

# Constraints

## 1. Data Integrity

- Users cannot check out a book if the quantity is 0.
- Users cannot have multiple active checkouts for the same book.

## 2. Validation

- Emails must follow proper format ([user@example.com](mailto:user@example.com)).
- Phone numbers must be in a valid format.

## 3. Penalty Calculation

- The penalty is calculated as a flat fee per day of lateness, to be configurable by the admin (\$1 per day).

# Assumptions

- Users are responsible for returning books on time.
  - The system does not handle physical book deliveries, assuming users check out and return books in person.
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# Risks

## 1. Data Breach:

- **Mitigation:** Use encryption for sensitive data, including SSL for data transmission.

## 2. System Downtime:

- **Mitigation:** Implement automated backups and redundancy in the server architecture.
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# Testing

## 1. Unit Testing:

- Each individual component (e.g., book checkout logic) will be tested to ensure it functions correctly in isolation.

## 2. Integration Testing:

- Test interactions between system components, such as book checkouts and penalty calculations.

## 3. User Acceptance Testing (UAT):

- Conduct UAT to verify that the system meets user needs in real-world scenarios, including user registration, browsing, checkouts, and returns.

# System Requirements

## Functional Requirements

### 1. User Registration and Authentication

- Users should be able to register with their email, name, phone number, and password.
- Users should be able to log in using their email and password.

### 2. Book Browsing

- Users should be able to browse the library catalog.
- Users should be able to filter books by category, author, and availability.

### 3. Book Checkout

- Registered users should be able to check out available books.
- The system must record the checkout date, due date, and track the return date.
- Users can only check out books if they have an active account and there are available copies of the book.

### 4. Book Return

- Users should be able to mark a book as returned once they bring it back.
- The system should update the book's availability and remove the checkout flag.

## **5. Penalty Calculation for Late Returns**

- If a book is returned after the due date, a penalty should be applied to the user's account.
- The penalty should be based on the number of days the book is overdue.

## **6. Commenting System**

- Registered users should be able to leave comments on books they have read.
- The comments should include feedback and ratings (optional).

## **7. Role Management**

- Admins should be able to assign and remove roles from users.
- The system should allow users to have multiple roles.

## **8. Category Management**

- Admins should be able to add, edit, or remove book categories.

# Non-Functional Requirements

## 1. Performance

- The system should respond to user requests within 2 seconds under normal load.

## 2. Security

- User passwords must be securely hashed and stored.
- Sensitive data should be encrypted during transmission.

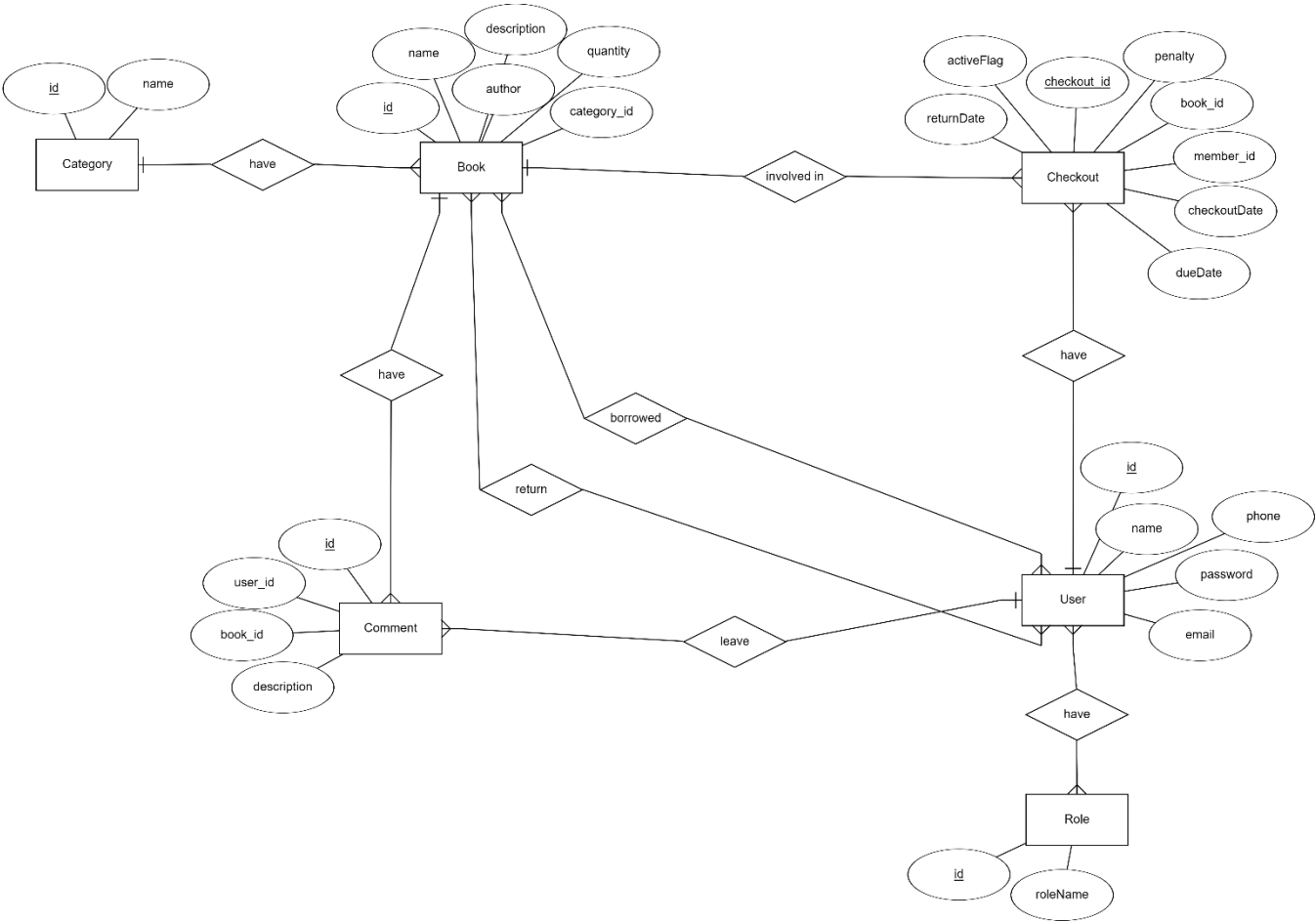
## 3. Usability

- The interface should be user-friendly and accessible.

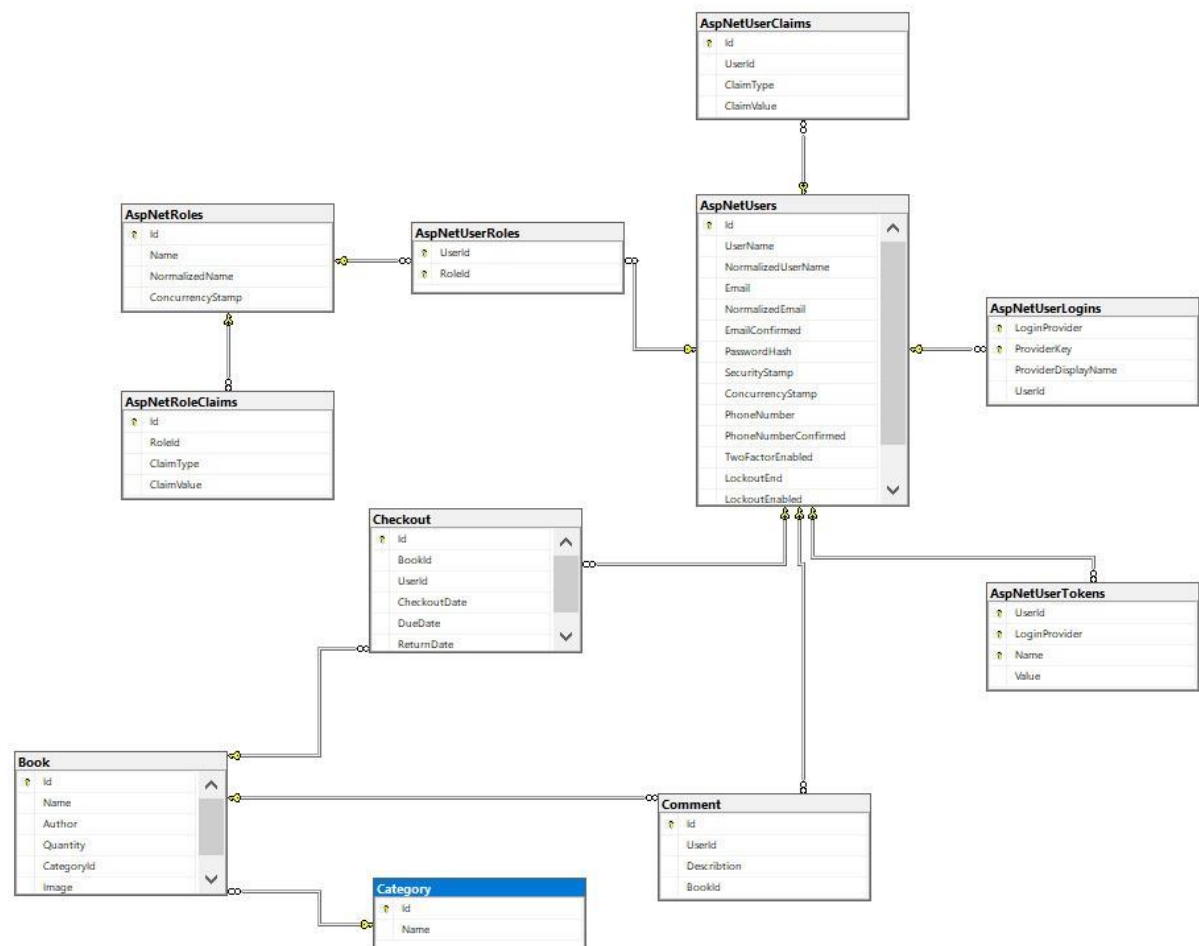
## 4. Scalability

- The system should support an increasing number of users and books without degradation in performance.
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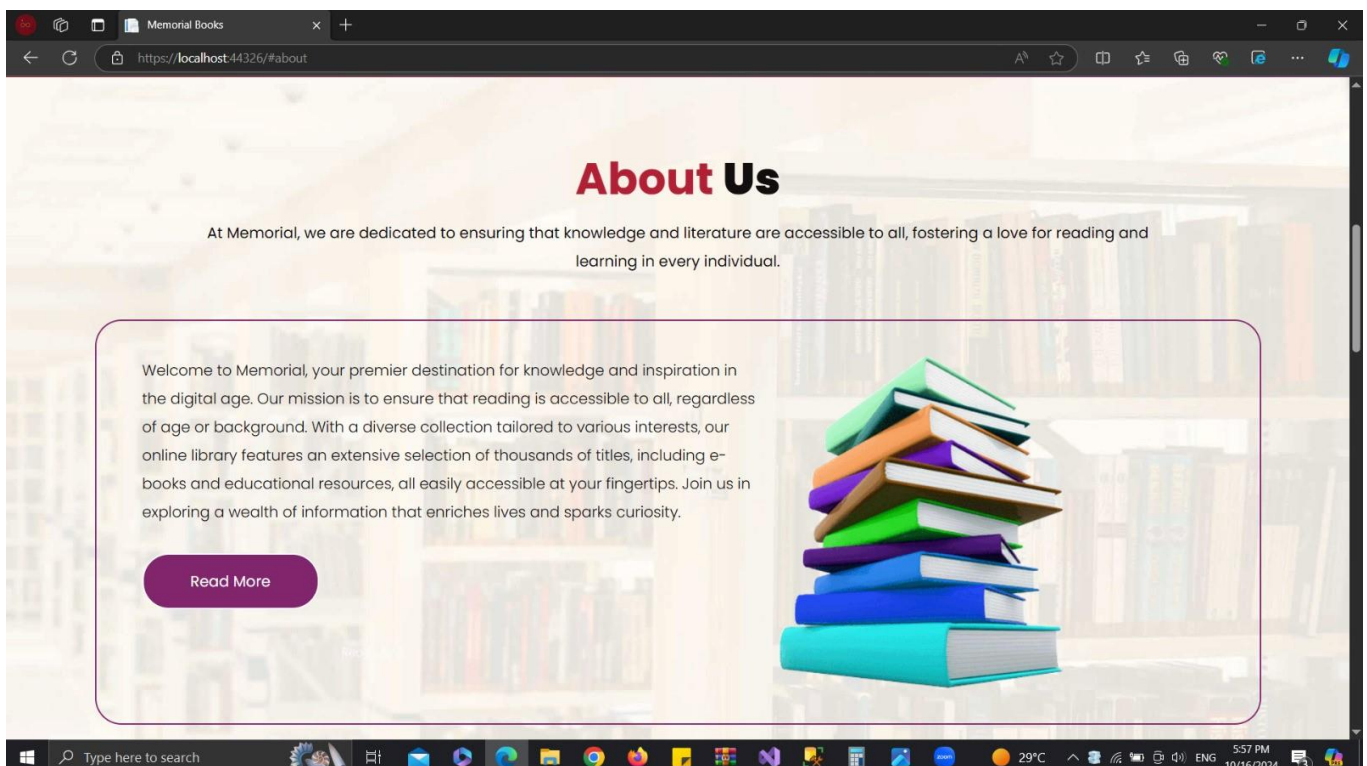
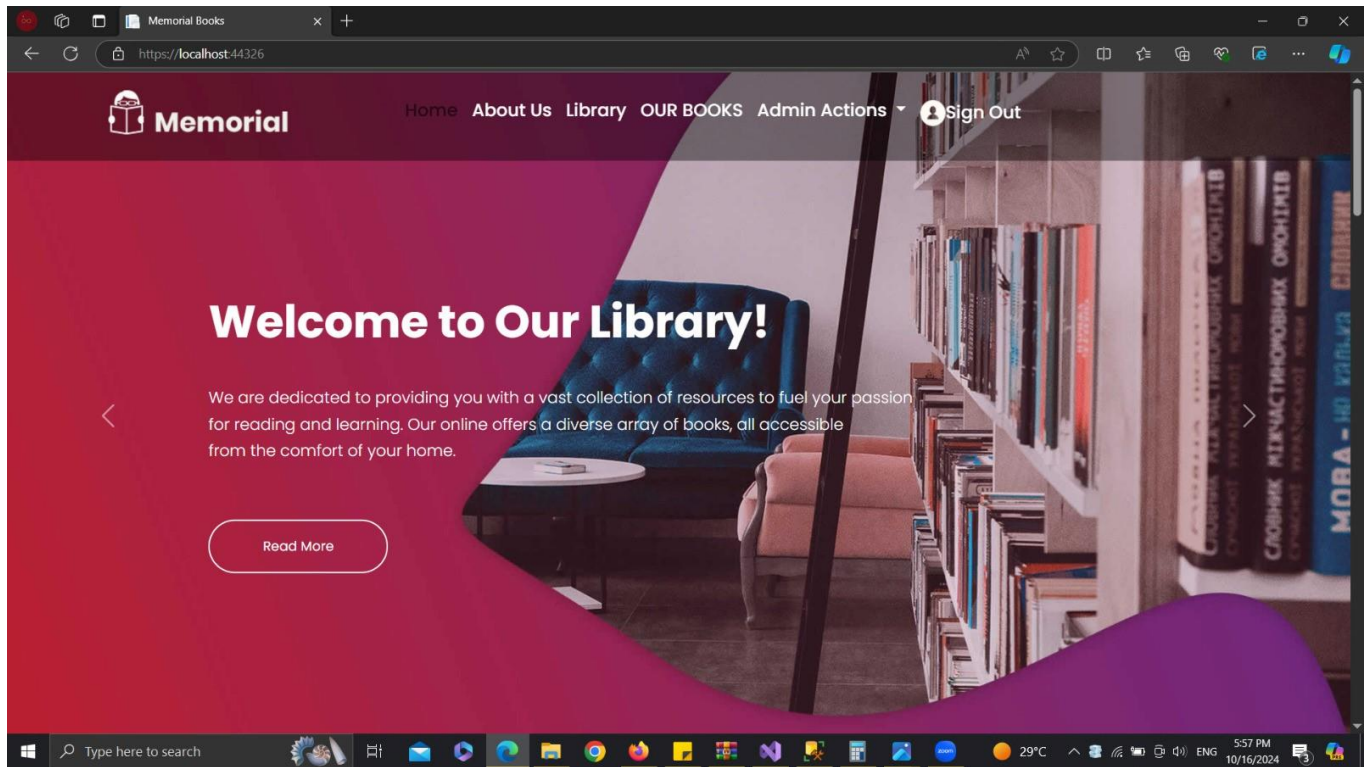
# Entity Relationship Diagram (ERD)

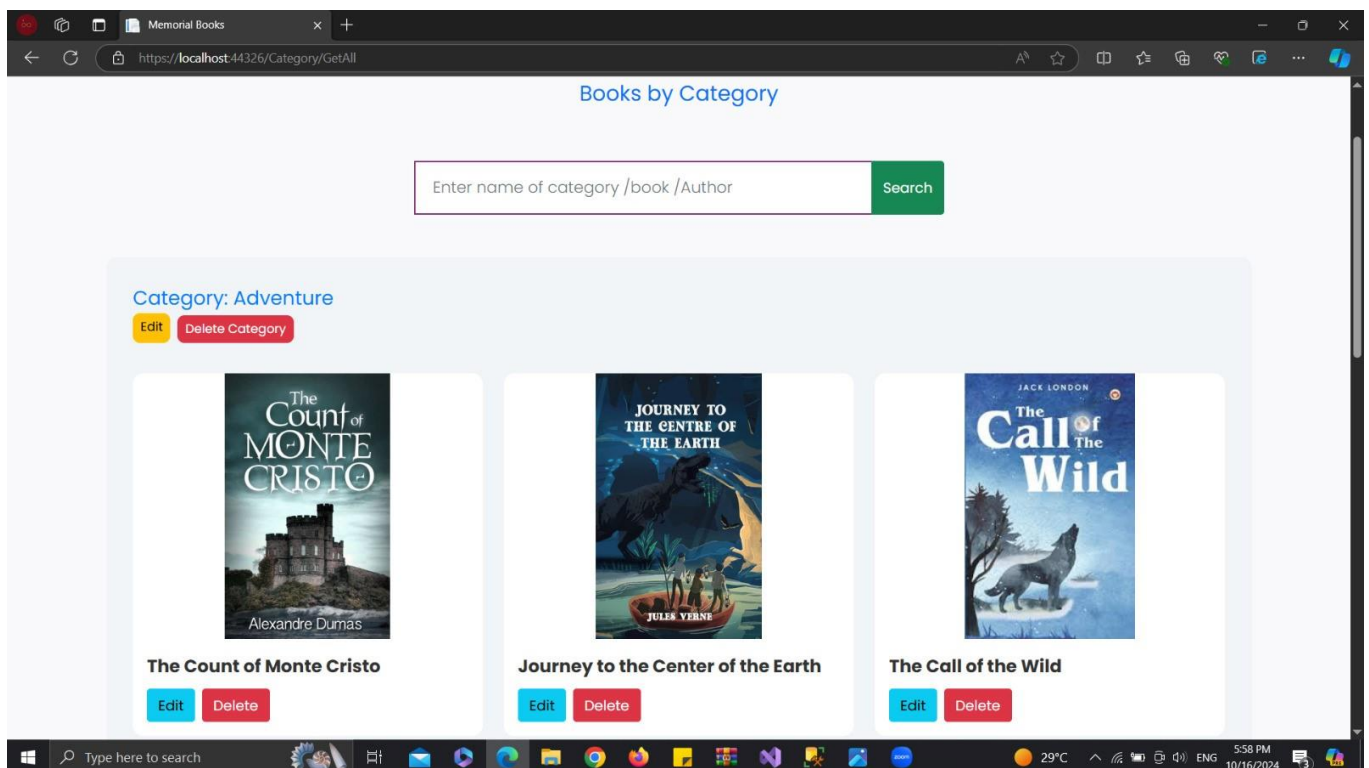
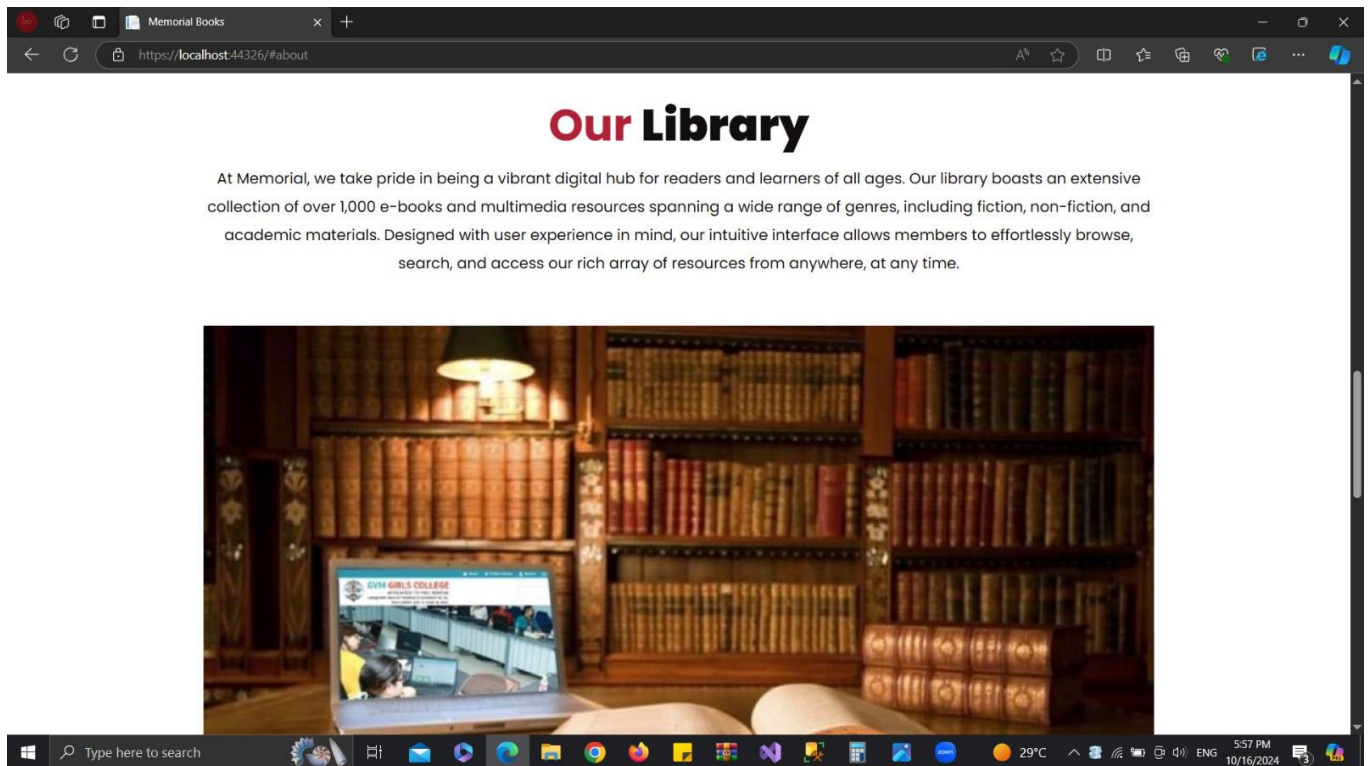


# Class Diagram



# These webpages is designated for administrative access







Memorial Books x +

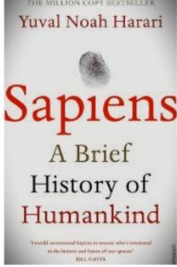
https://localhost:44326/Category/Search

Books by Category

science Search

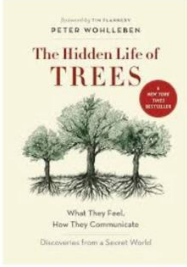
Category: Science

Edit Delete Category



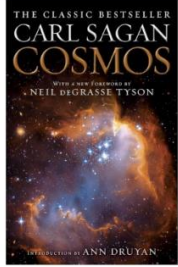
**Sapiens: A Brief History of Humankind**

Edit Delete



**The Hidden Life of Trees**

Edit Delete



**Cosmos**

Edit Delete


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Memorial Books x +

https://localhost:44326/Category/Search


Category: Science Fiction

Edit Delete Category



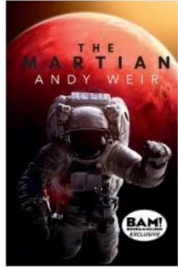
**Dune**

Edit Delete



**Neuromancer**

Edit Delete



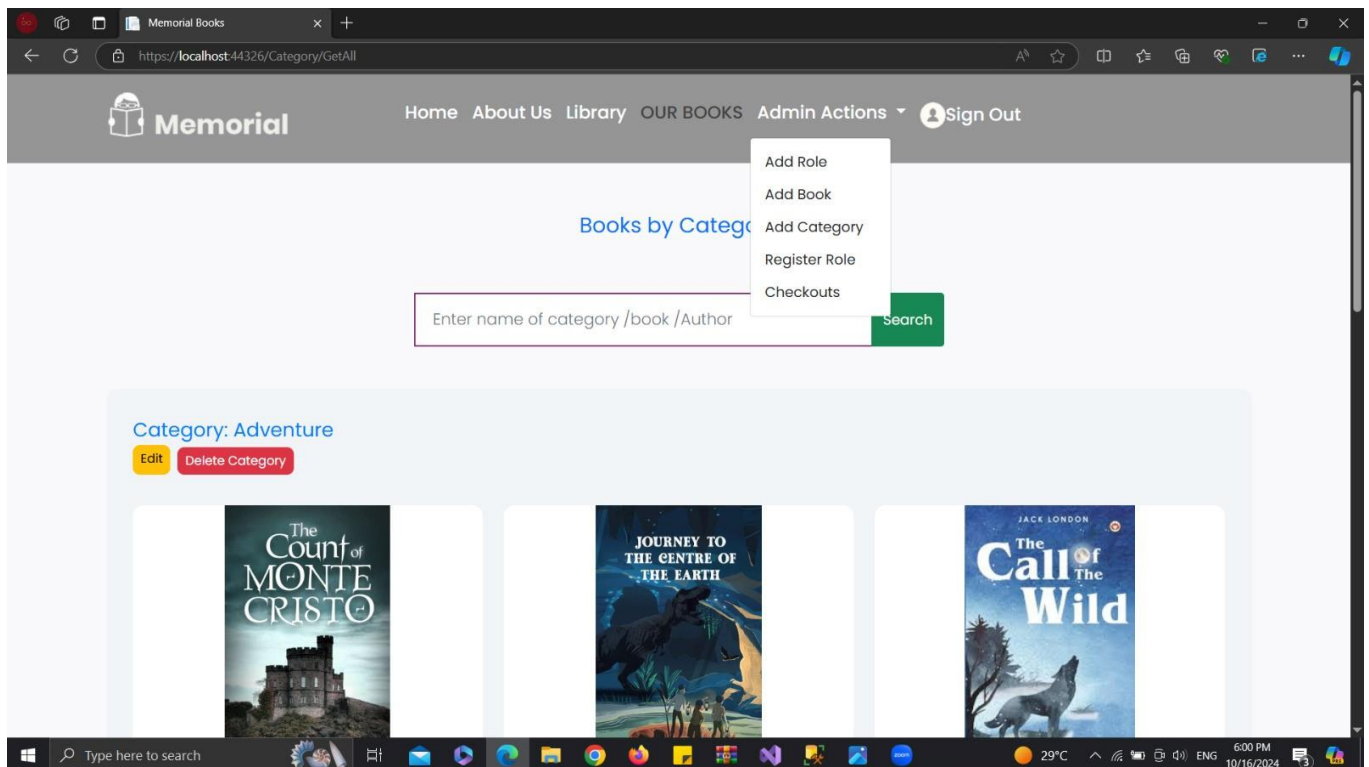
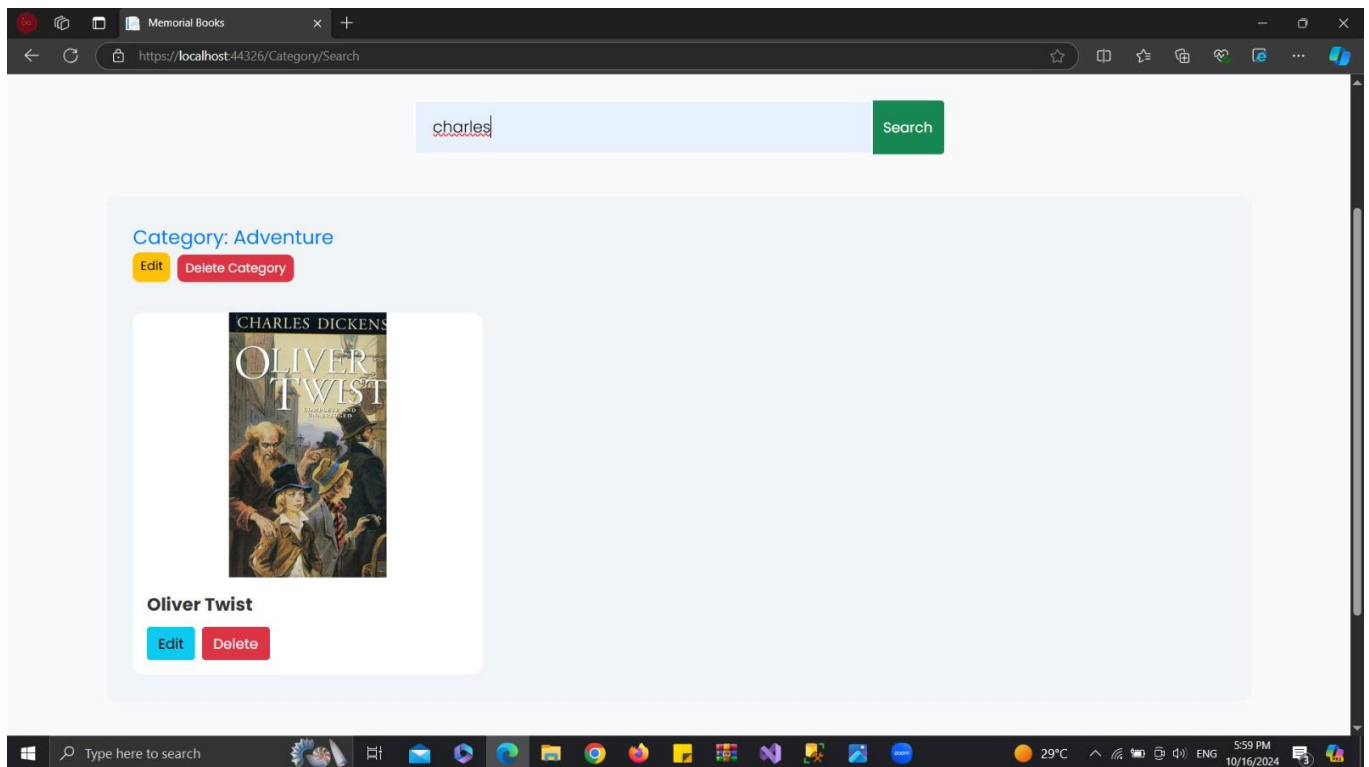
**The Martian**

Edit Delete

Previous 1 Next

Back to Categories

Type here to search 29°C 5:59 PM 10/16/2024



Memorial Books

https://localhost:44326/Book/Add

Add New Book

Book Details

Name

Enter book name

Author

Enter author name

Quantity

Enter quantity

Image

Choose File

No file chosen

Description

Enter book description

Type here to search

29°C

6:00 PM

10/16/2024

Memorial Books

https://localhost:44326/Category/Add

Memorial

Home About Us Library OUR BOOKS Admin Actions Sign Out

Add Category

Add Category

Name

Enter category name

Add

Back to Books

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29°C

6:00 PM

10/16/2024

CheckoutsAdmin

Checkout ID	User Name	Book Name	Book Id	Checkout Date	Due Date	Penalty	Active Flag
1031	mahmoud	Harry Potter	1008	10/10/2024 10:39:22 PM	10/11/2024 10:39:22 PM	0	Valid
1055	Ahmed22	Harry Potter	1008	10/11/2024 2:50:47 AM	10/12/2024 2:50:47 AM	0	Invalid
1060	hassan23	Harry Potter	1008	10/8/2024 8:00:30 PM	10/10/2024 8:00:30 PM	0	Invalid
1064	mohamed21	Harry Potter	1008	10/12/2024 2:19:55 AM	10/13/2024 2:19:55 AM	0	Invalid
1065	wael	Harry Potter	1008	10/12/2024 8:14:17 PM	10/13/2024 8:14:17 PM	0	Valid
1069	nadal12	Harry Potter	1008	10/13/2024 1:02:36 AM	10/14/2024 1:02:36 AM	0	Valid
1071	nour	Harry Potter	1008	10/16/2024 2:28:17 AM	10/17/2024 2:28:17 AM	0	Valid
1073	Mostafa3Ahmed	The Count of Monte Cristo	2017	10/16/2024 5:31:24 PM	10/17/2024 5:31:24 PM	0	Invalid
1074	Mostafa3Ahmed	Journey to the Center of the Earth	2018	10/16/2024 5:32:22 PM	10/17/2024 5:32:22 PM	0	Invalid

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Memorial Books

https://localhost:44326/Account/RoleRegister

Register New User

User Registration

UserName

Enter username

Password

Enter password

Confirm Password

Confirm password

Email

Enter email

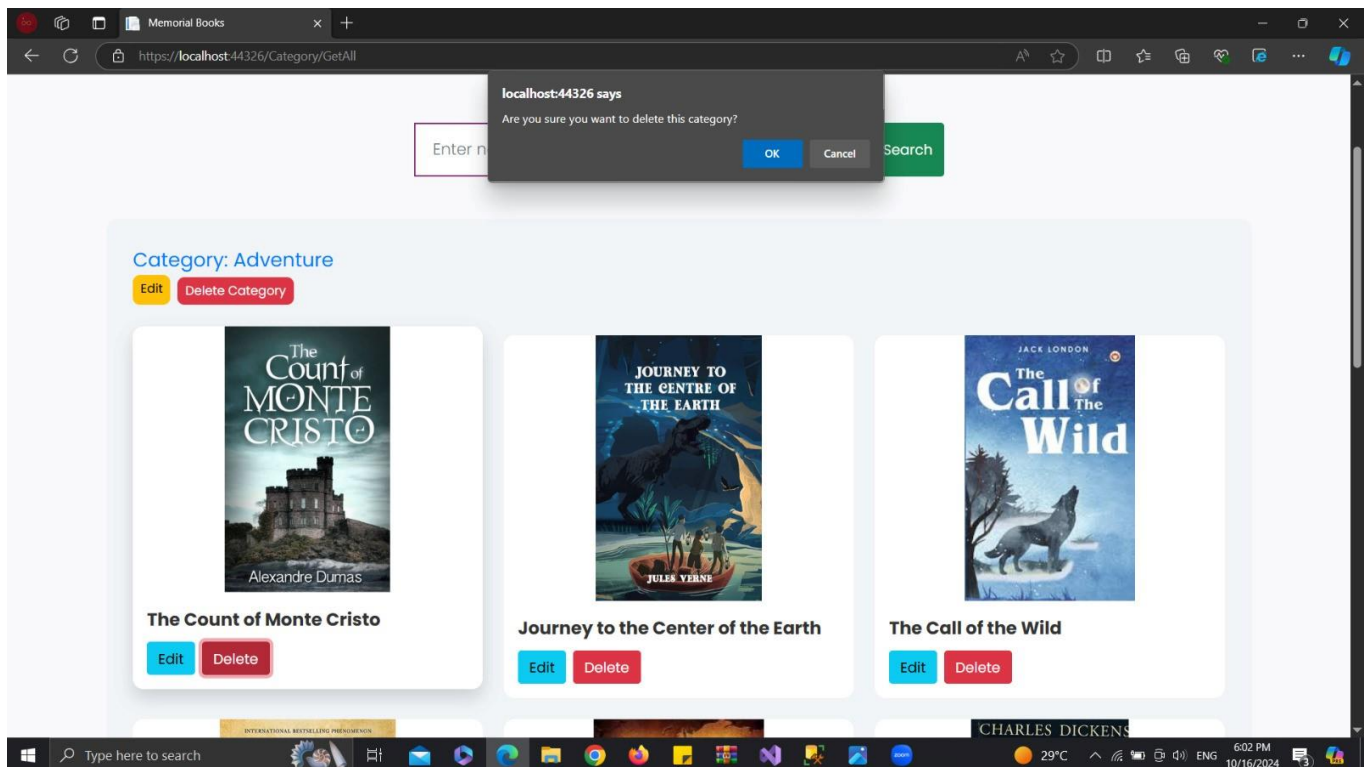
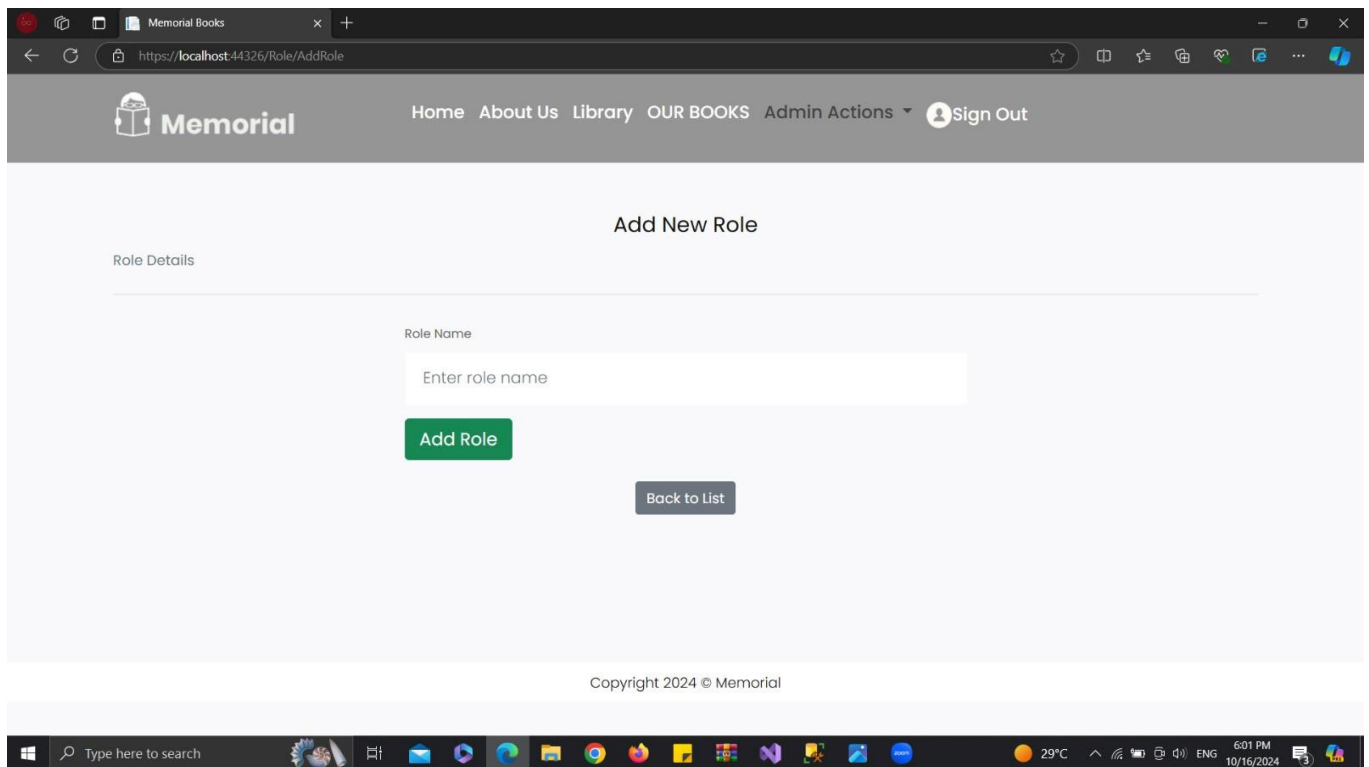
PhoneNumber

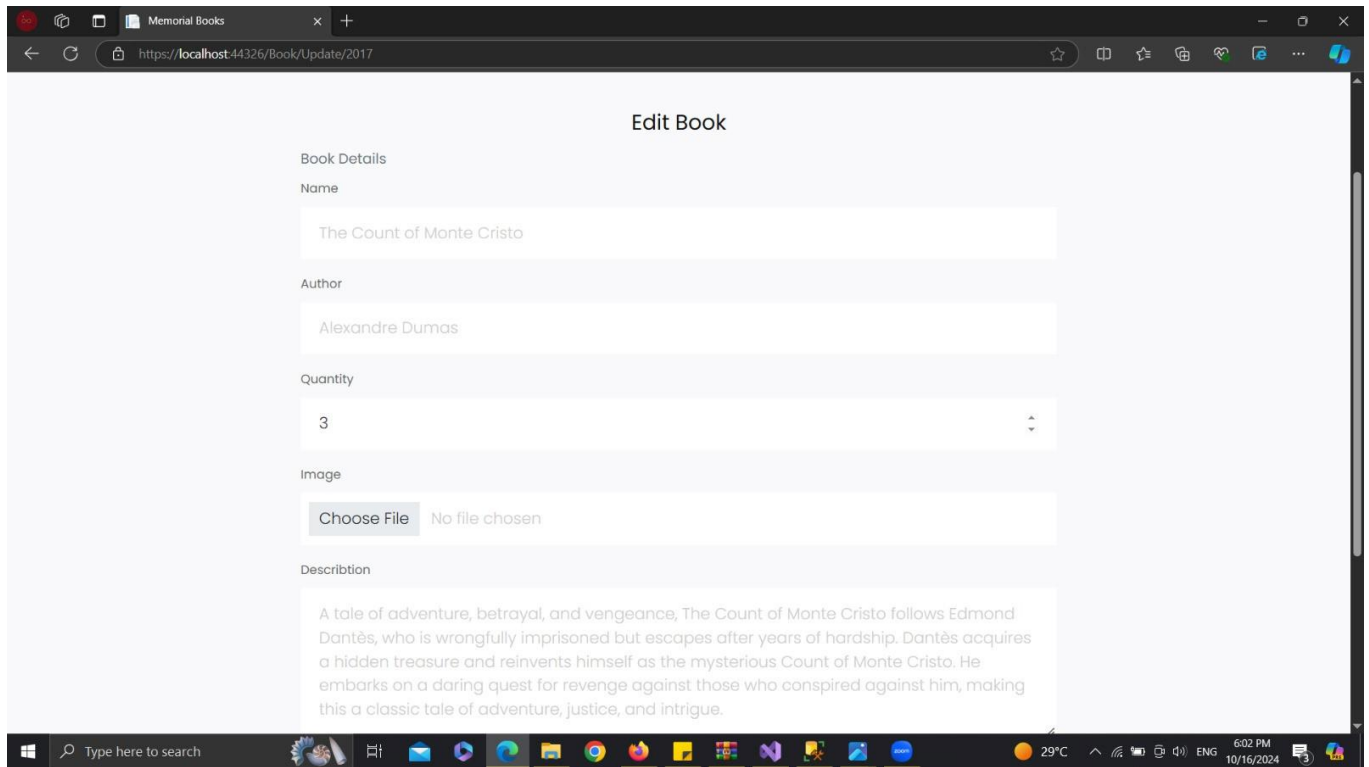
Enter phone number

Create

Type here to search

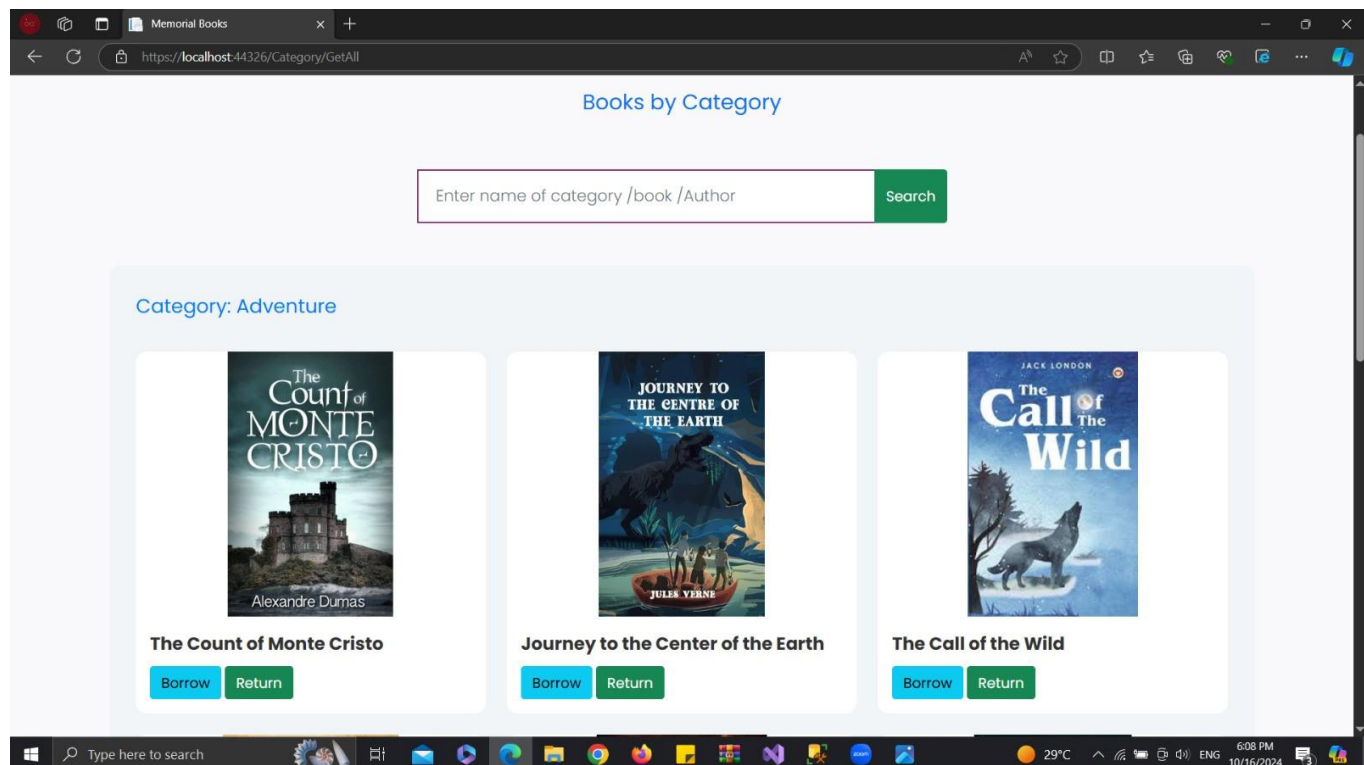
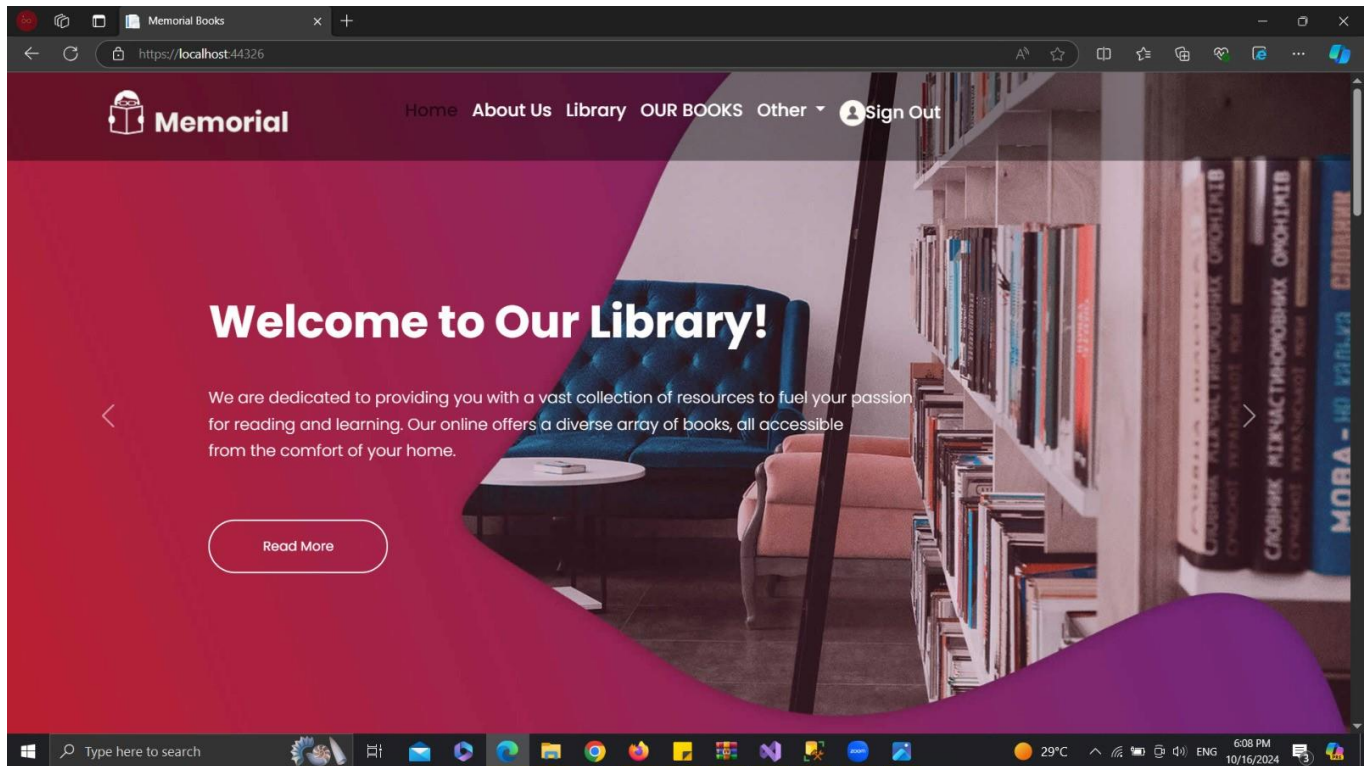
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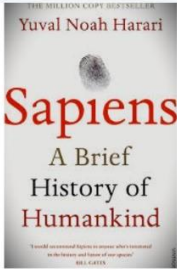


Memorial Books x +

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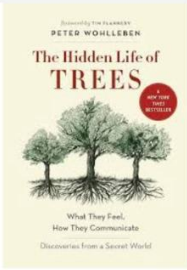
science Search

Category: Science



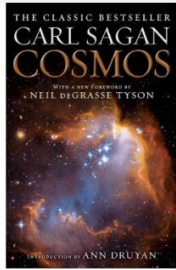
**Sapiens: A Brief History of Humankind**

Borrow Return



**The Hidden Life of Trees**

Borrow Return



**Cosmos**

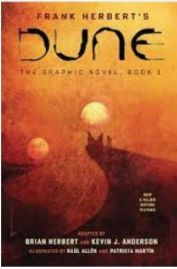
Borrow Return

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Memorial Books x +


https://localhost:44326/Category/Search

Category: Science Fiction



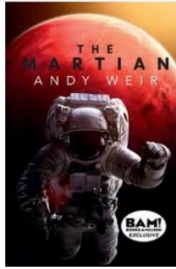
**Dune**

Borrow Return



**Neuromancer**

Borrow Return



**The Martian**

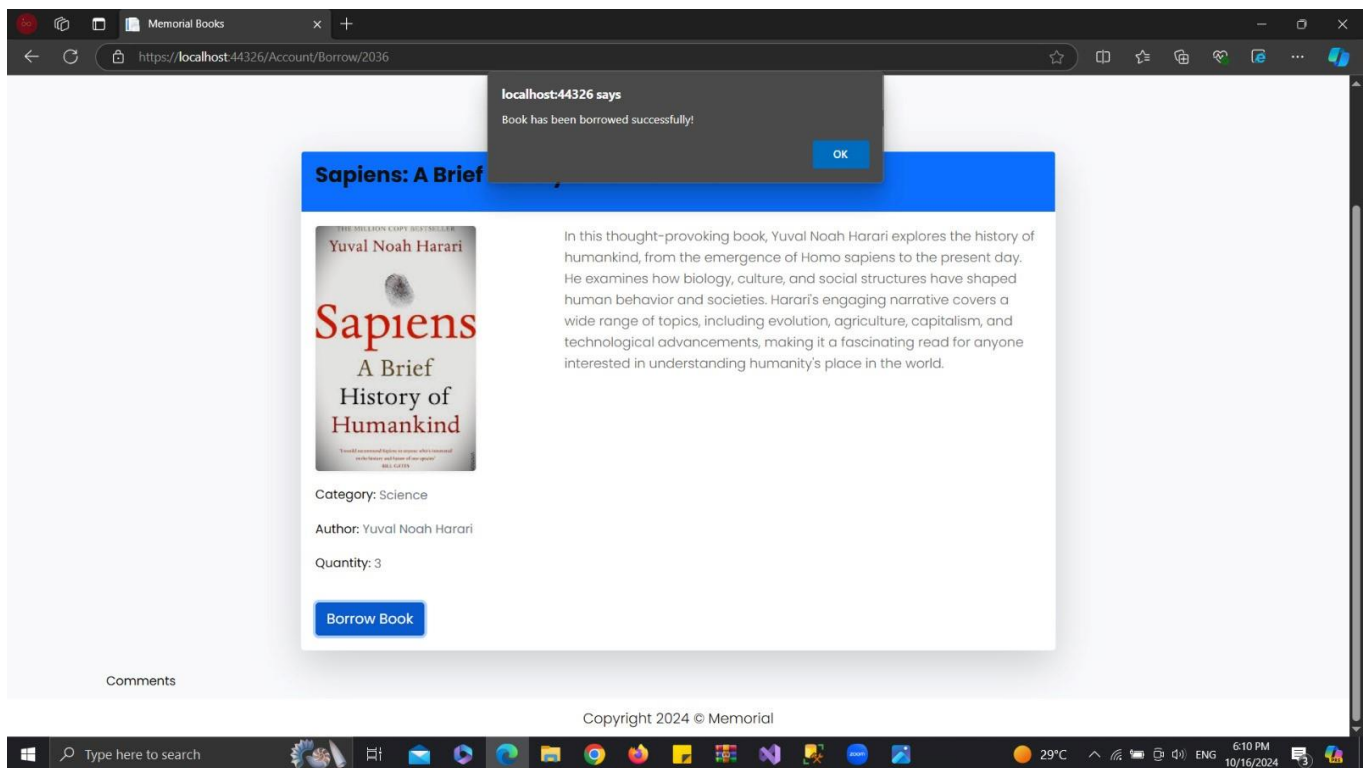
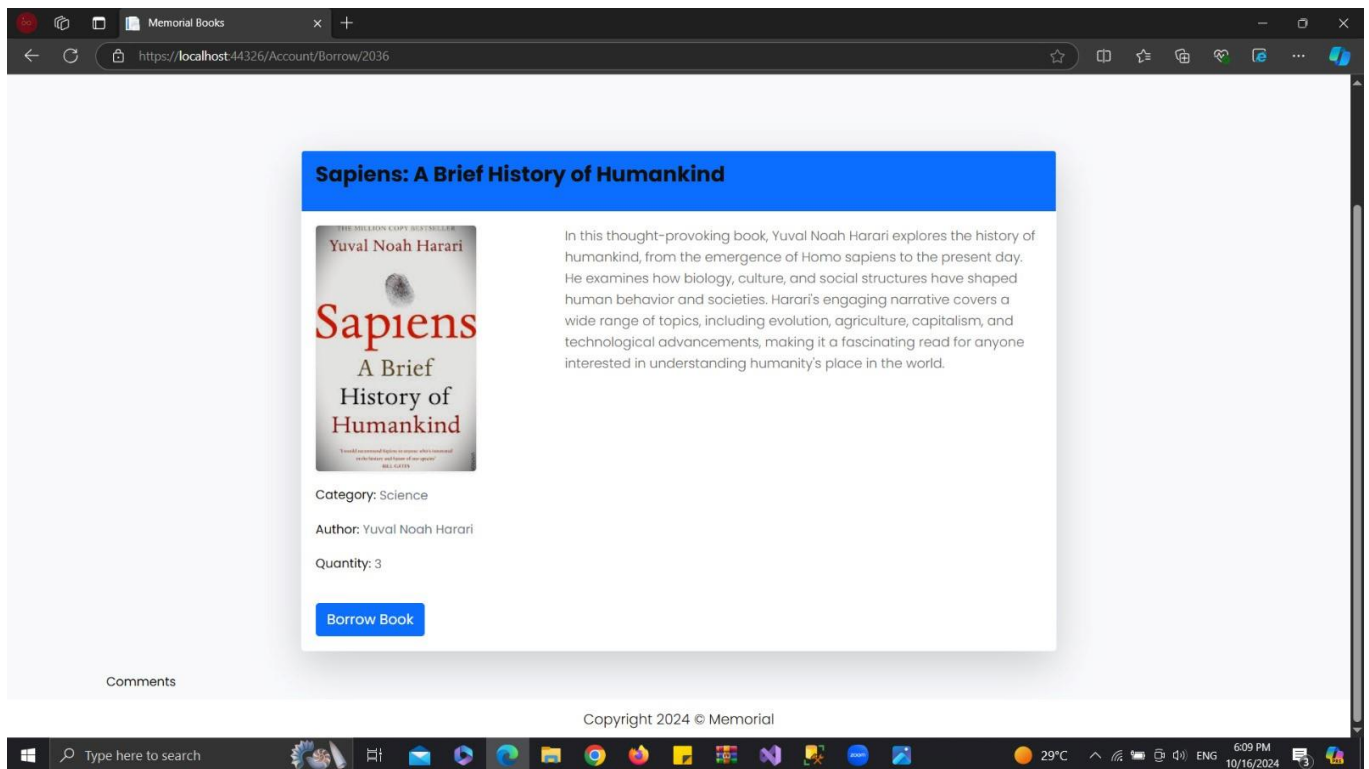
Borrow Return

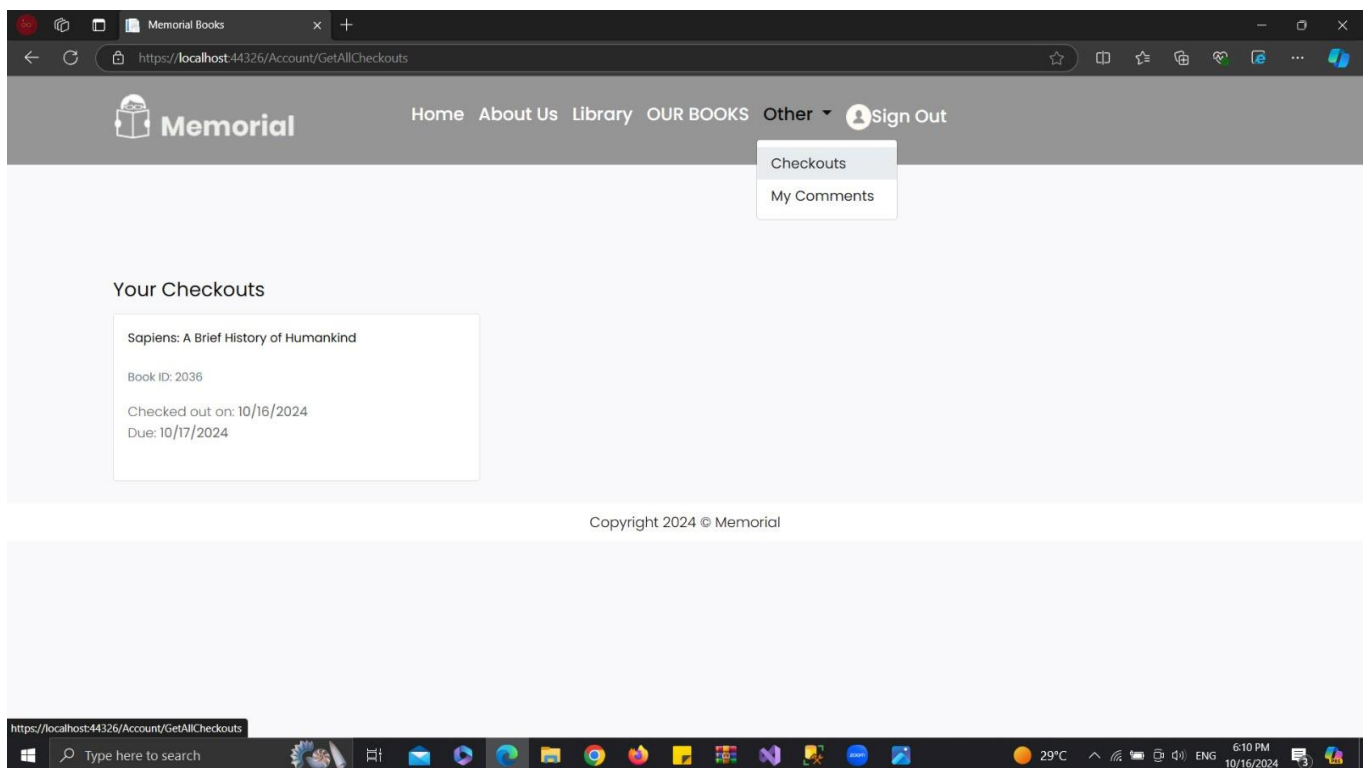
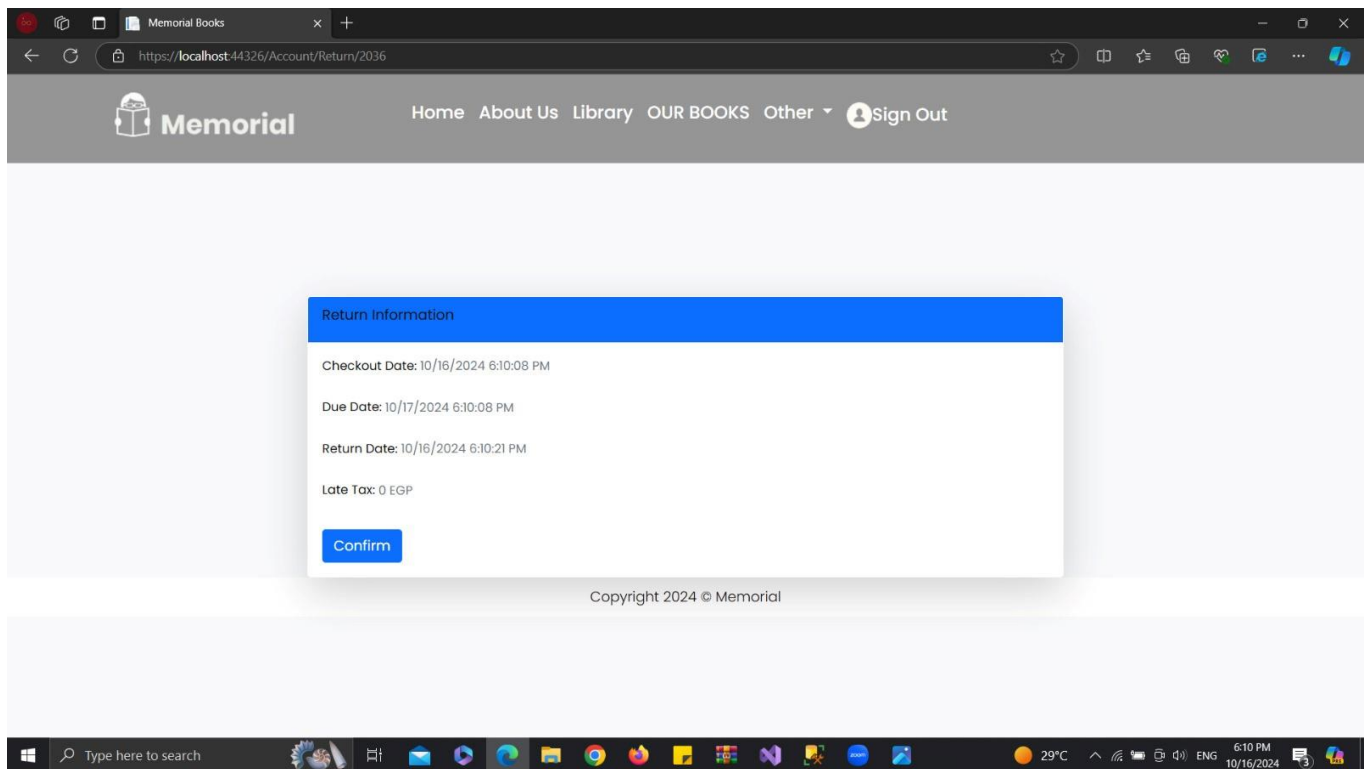
Previous 1 Next

Back to Categories

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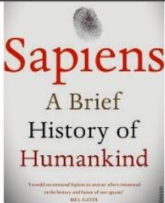






Memorial Books

https://localhost:44326/Account/Borrow/2036



**Sapiens**  
A Brief History of Humankind

Category: Science

Author: Yuval Noah Harari

Quantity: 2

Borrowed

**\*\*You have borrowed this book\*\***

He examines how biology, culture, and social structures have shaped human behavior and societies. Harari's engaging narrative covers a wide range of topics, including evolution, agriculture, capitalism, and technological advancements, making it a fascinating read for anyone interested in understanding humanity's place in the world.

Comments

Comments


this is a good book

Submit

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https://localhost:44326/Comment/GetComments

 **Memorial**

Home About Us Library OUR BOOKS Other 

Sign Out

Checkouts

My Comments

Your Comments

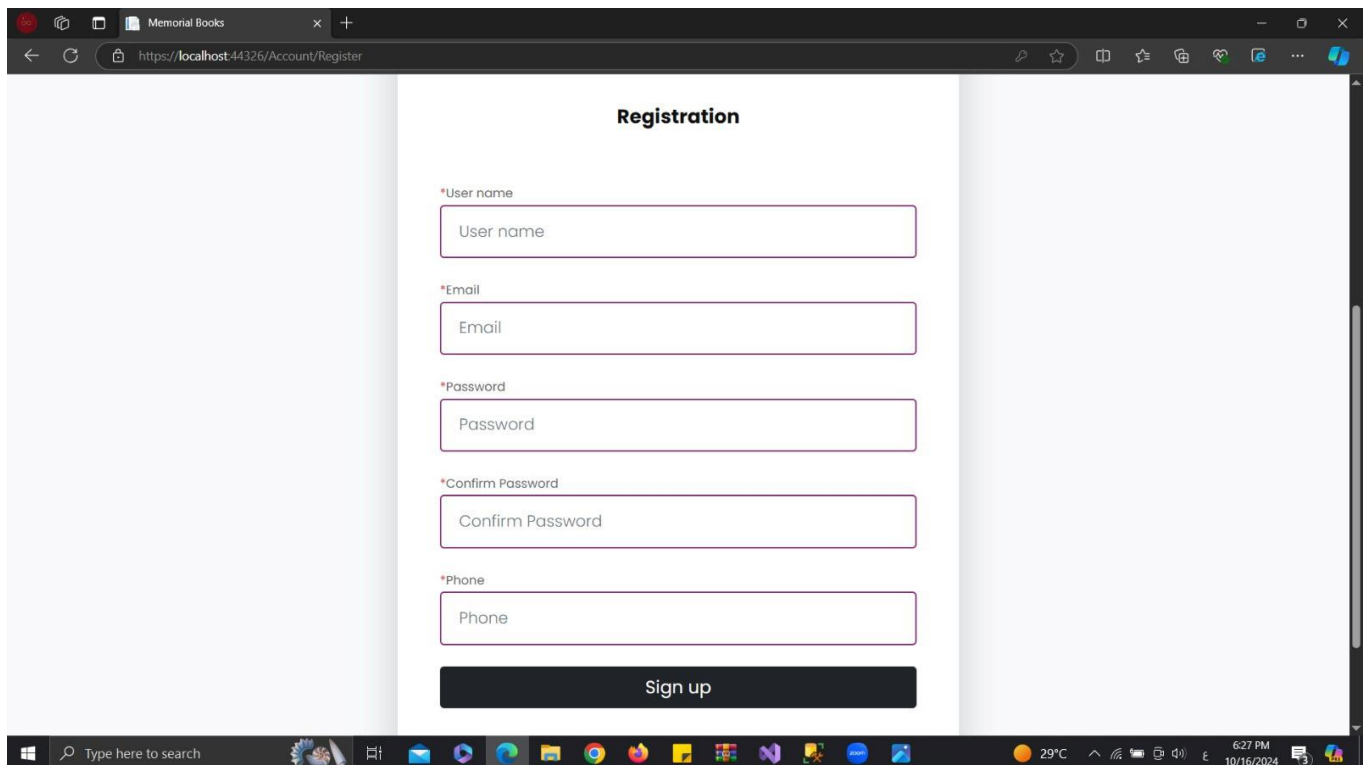
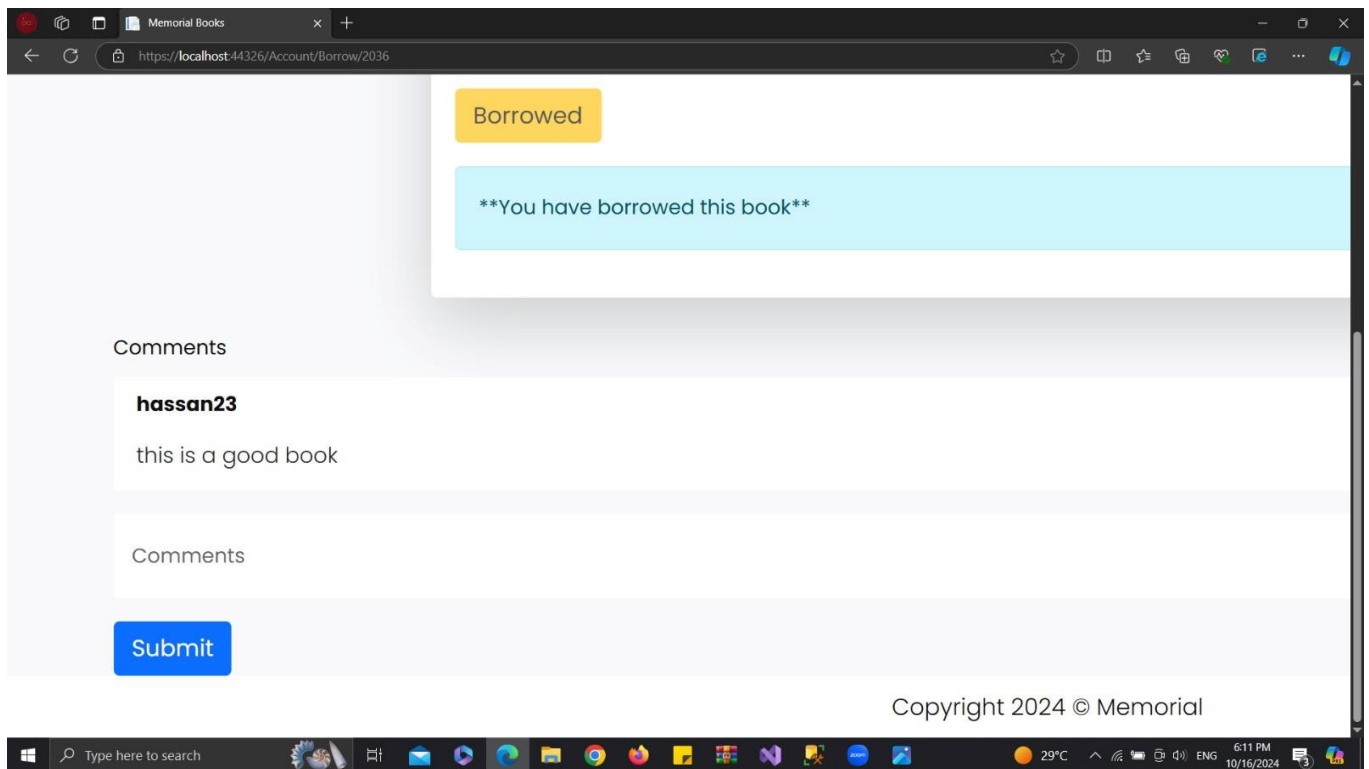
Sapiens: A Brief History of Humankind

this is a good book

Created at:10/16/2024 6:11:16 PM


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https://localhost:44326/Comment/GetComments



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https://localhost:44326/Account/Register



Read with us!

## Registration

\*User name

\*Email


\*Password

Type here to search

29°C 6:27 PM 10/16/2024

Memorial Books

https://localhost:44326/Account/Login



Welcome back you've been missed!

## Sign in

Username

Password

☐ Remember Me!

Login

Do not have an account? [Sign Up](#)

Type here to search

29°C 6:28 PM 10/16/2024

# Conclusion

The Library Management System aims to provide a seamless experience for users to interact with library resources. By incorporating roles and user management effectively, it ensures security, usability, and efficient management of library operations. The outlined architecture, models, and requirements set a solid foundation for the development and deployment of the system.

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