

Library Management System

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.

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`.
-

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.
-

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).
- 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.
-

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.

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.

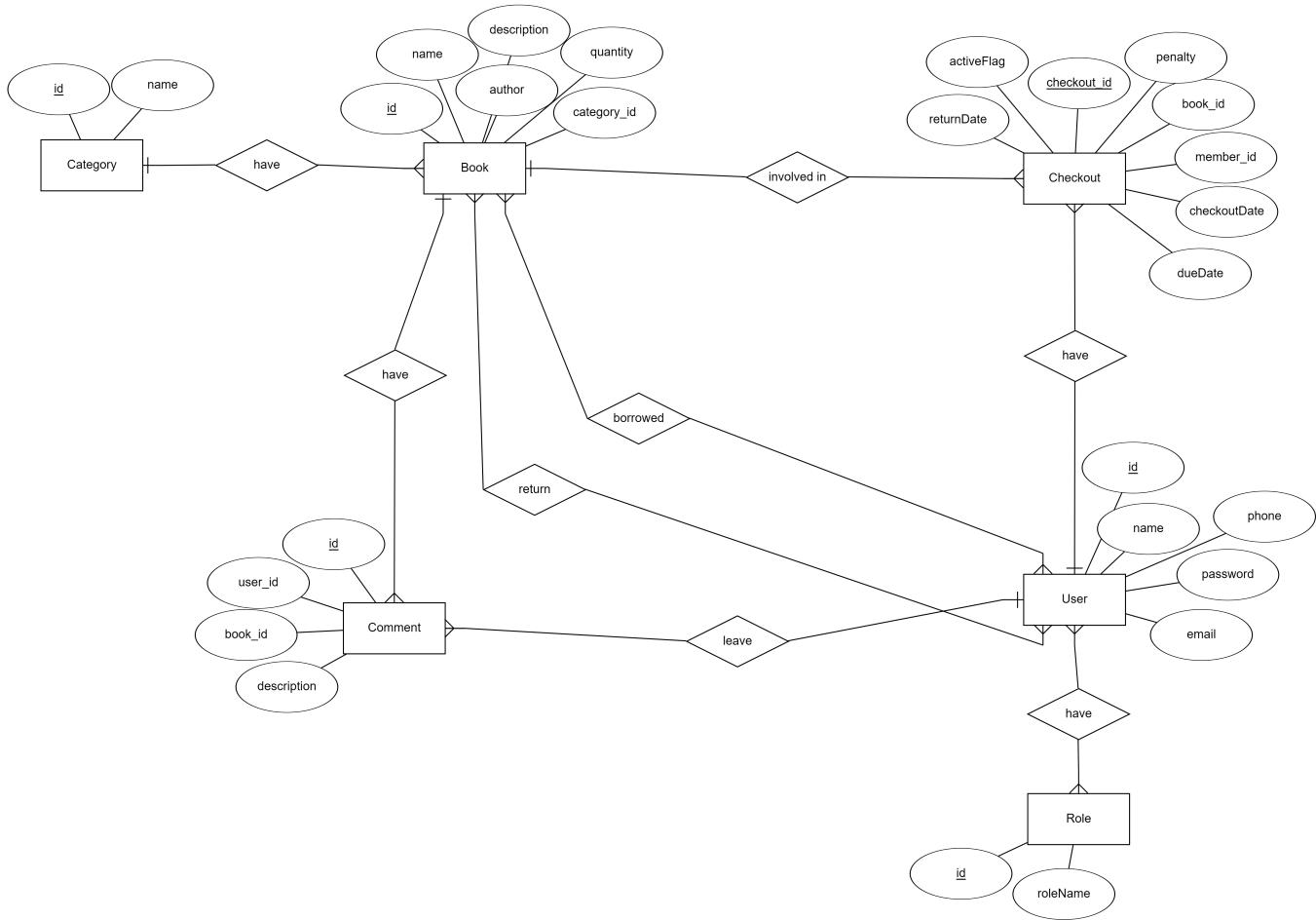
3. Usability

- The interface should be user-friendly and accessible.

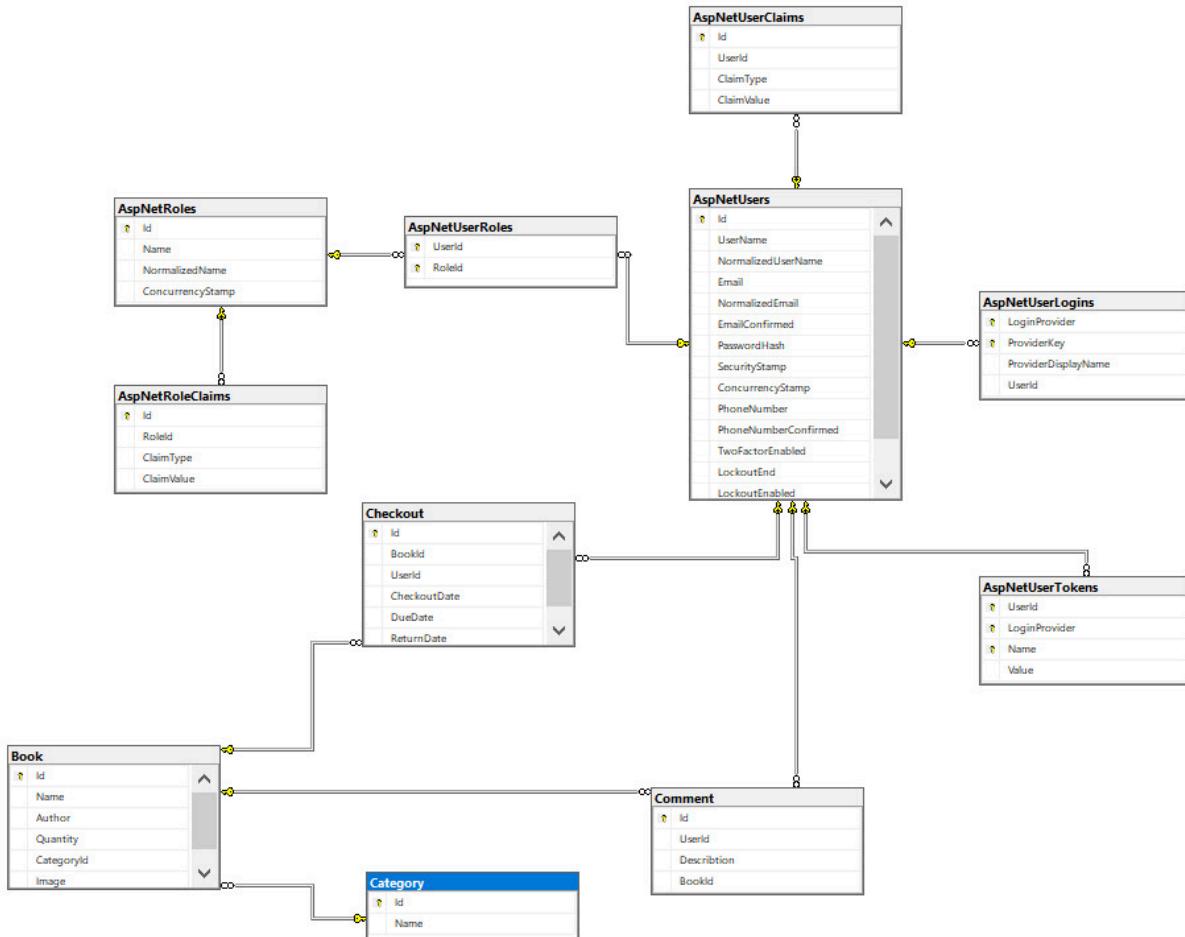
4. Scalability

- The system should support an increasing number of users and books without degradation in performance.
-

Entity Relationship Diagram (ERD)



Class Diagram



These webpages is designated for administrative access

A screenshot of a library website's homepage. The header features a dark purple navigation bar with a logo on the left, followed by menu items: Home, About Us, Library, OUR BOOKS, Admin Actions, and a Sign Out button. Below the header is a large red banner with white text that reads "Welcome to Our Library!". To the right of the banner is a photograph of a cozy reading room with a blue tufted sofa, a pink armchair, and a bookshelf filled with books. At the bottom of the page is a search bar with placeholder text "Type here to search" and a Windows taskbar at the very bottom.

The screenshot shows a Microsoft Edge browser window with the title bar "Memorial Books". The address bar displays the URL "https://localhost:44326/#about". The main content area has a light beige background with a faint image of bookshelves. At the top center, the word "About Us" is written in a large, bold, red sans-serif font. Below it, a centered text block reads: "At Memorial, we are dedicated to ensuring that knowledge and literature are accessible to all, fostering a love for reading and learning in every individual." A thin purple rectangular border encloses the left side of the content area. Inside this border, there is a paragraph of text: "Welcome to Memorial, your premier destination for knowledge and inspiration in the digital age. Our mission is to ensure that reading is accessible to all, regardless of age or background. With a diverse collection tailored to various interests, our online library features an extensive selection of thousands of titles, including e-books and educational resources, all easily accessible at your fingertips. Join us in exploring a wealth of information that enriches lives and sparks curiosity." Below this paragraph is a purple rounded rectangle containing the white text "Read More". To the right of the text block is a 3D rendering of a stack of colorful books (green, orange, purple, blue, teal) of various thicknesses, positioned in front of a blurred background of bookshelves.

Memorial Books

https://localhost:44326/#about

Our Library

At Memorial, we take pride in being a vibrant digital hub for readers and learners of all ages. Our library boasts an extensive collection of over 1,000 e-books and multimedia resources spanning a wide range of genres, including fiction, non-fiction, and academic materials. Designed with user experience in mind, our intuitive interface allows members to effortlessly browse, search, and access our rich array of resources from anywhere, at any time.



Type here to search

GVH Girls College

Books by Category

Category: Adventure

The Count of Monte Cristo

Journey to the Center of the Earth

The Call of the Wild

Enter name of category /book /Author

Search

29°C 5:57 PM ENG 10/16/2024

29°C 5:58 PM ENG 10/16/2024

Memorial Books

https://localhost:44326/Category/Search

Books by Category

science

Search

Category: Science

Edit Delete Category

Sapiens: A Brief History of Humankind

The Hidden Life of Trees

Cosmos

29°C 5:58 PM 10/16/2024

Memorial Books

https://localhost:44326/Category/Search

Books by Category

Category: Science Fiction

Edit Delete Category

Dune

Neuromancer

The Martian

Previous 1 Next

Back to Categories

29°C 5:59 PM 10/16/2024

Memorial Books

charles

Search

Category: Adventure

Edit Delete Category

CHARLES DICKENS
OLIVER TWIST

Oliver Twist

Edit Delete

Memorial Books

Type here to search

https://localhost:44326/Category/GetAll

29°C 5:59 PM ENG 10/16/2024

Home About Us Library OUR BOOKS Admin Actions Sign Out

Add Role
Add Book
Add Category
Register Role
Checkouts

Books by Category

Enter name of category /book /Author

Search

Category: Adventure

Edit Delete Category

The Count of MONTE CRISTO

JOURNEY TO THE CENTRE OF THE EARTH

The Call of The Wild

Memorial Books

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 ENG 10/16/2024

Memorial Books

https://localhost:44326/Category/Add

Home About Us Library OUR BOOKS Admin Actions Sign Out

Add Category

Add Category

Name

Enter category name

Add

Back to Books

Copyright 2024 © Memorial

Type here to search

29°C 6:00 PM ENG 10/16/2024

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	nadal2	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

Copyright 2024 © Memorial

Register New User

User Registration

UserName

Password

Confirm Password

Email

PhoneNumber

Create

Memorial Books

https://localhost:44326/Role/AddRole

Memorial

Home About Us Library OUR BOOKS Admin Actions Sign Out

Add New Role

Role Details

Role Name

Enter role name

Add Role

Back to List

Copyright 2024 © Memorial

Type here to search

localhost:44326 says

Are you sure you want to delete this category?

OK Cancel Search

Category: Adventure

The Count of Monte Cristo

Journey to the Center of the Earth

The Call of the Wild

CHARLES DICKENS

Memorial Books

https://localhost:44326/Book/Update/2017

Edit Book

Book Details

Name

Author

Quantity

Image

Choose File No file chosen

Description

A tale of adventure, betrayal, and vengeance, The Count of Monte Cristo follows Edmond Dantès, who is wrongfully imprisoned but escapes after years of hardship. Dantès acquires a hidden treasure and reinvents himself as the mysterious Count of Monte Cristo. He embarks on a daring quest for revenge against those who conspired against him, making this a classic tale of adventure, justice, and intrigue.



These webpages is intended for users

Memorial Books

https://localhost:44326

Welcome to Our Library!

We are dedicated to providing you with a vast collection of resources to fuel your passion for reading and learning. Our online offers a diverse array of books, all accessible from the comfort of your home.

Read More

29°C 6:08 PM ENG 10/16/2024

Memorial Books

Books by Category

Enter name of category /book /Author

Search

Category: Adventure

The Count of MONTE CRISTO
Alexandre Dumas

The Count of Monte Cristo

Borrow Return

JOURNEY TO THE CENTRE OF THE EARTH
JULES VERNE

Journey to the Center of the Earth

Borrow Return

JACK LONDON
The Call of The Wild

The Call of the Wild

Borrow Return

Type here to search 29°C 6:08 PM 10/16/2024

Memorial Books

https://localhost:44326/Category/Search

science

Search

Category: Science

THE MILLION COPY BESTSELLER
Yuval Noah Harari

Sapiens
A Brief History of Humankind

"You will never again see a movie after you've read this book and have a new perspective!" BILL GATES

Sapiens: A Brief History of Humankind

Borrow Return

Peter Wohlleben

The Hidden Life of TREES
What They Feel, How They Communicate
Discoveries from a Secret World

The Hidden Life of Trees

Borrow Return

THE CLASSIC BESTSELLER
CARL SAGAN
COSMOS
With a new foreword by NEIL DEGRASSE TYSON
A Personal Voyage
DIRECTED BY ANN DRUYAN

Cosmos

Borrow Return

Type here to search 29°C 6:09 PM 10/16/2024

Category: Science Fiction

Dune

Borrow Return

Neuromancer

Borrow Return

The Martian

Borrow Return

Previous 1 Next

[Back to Categories](#)

Sapiens: A Brief History of Humankind

THE MILLION COPY BESTSELLER
Yuval Noah Harari

In this thought-provoking book, Yuval Noah Harari explores the history of humankind, from the emergence of Homo sapiens to the present day. 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.

Category: Science

Author: Yuval Noah Harari

Quantity: 3

[Borrow Book](#)

Comments

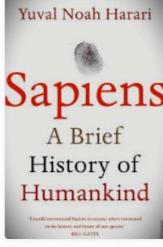
Copyright 2024 © Memorial

Memorial Books

localhost:44326 says
Book has been borrowed successfully!

OK

Sapiens: A Brief History of Humankind



THE MILLION COPY BESTSELLER
Yuval Noah Harari

In this thought-provoking book, Yuval Noah Harari explores the history of humankind, from the emergence of Homo sapiens to the present day. 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.

Category: Science

Author: Yuval Noah Harari

Quantity: 3

Borrow Book

Comments

Copyright 2024 © Memorial

29°C 6:10 PM 10/16/2024

Memorial Books

localhost:44326 Account/Return/2036

Home About Us Library OUR BOOKS Other Sign Out

Return Information

Checkout Date: 10/16/2024 6:10:08 PM

Due Date: 10/17/2024 6:10:08 PM

Return Date: 10/16/2024 6:10:21 PM

Late Tax: 0 EGP

Confirm

Copyright 2024 © Memorial

29°C 6:10 PM 10/16/2024

Memorial Books

https://localhost:44326/Account/GetAllCheckouts

Memorial

Home About Us Library OUR BOOKS Other Sign Out

Checkouts

Your Checkouts

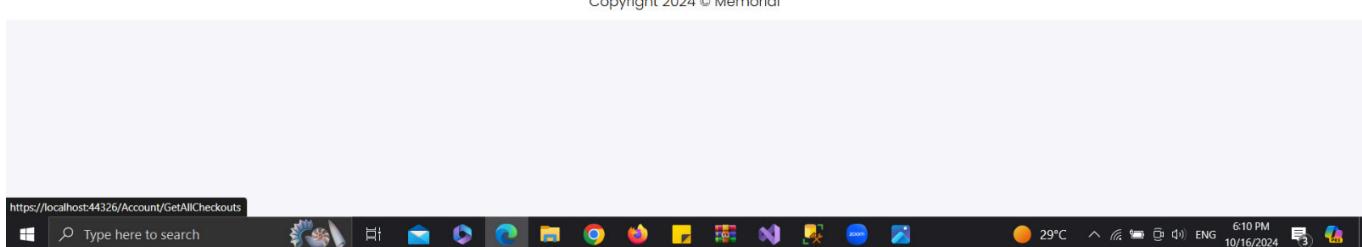
Sapiens: A Brief History of Humankind

Book ID: 2036

Checked out on: 10/16/2024

Due: 10/17/2024

Copyright 2024 © Memorial



https://localhost:44326/Account/GetAllCheckouts

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

The book cover for "Sapiens: A Brief History of Humankind" by Yuval Noah Harari. The cover features the title in large red letters, followed by "A Brief History of Humankind" in smaller black letters, and a quote from Bill Gates at the bottom.

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.

Category: Science

Author: Yuval Noah Harari

Quantity: 2

Borrowed

You have borrowed this book

Comments

Comments
this is a good book

Submit

Copyright 2024 © Memorial

Windows taskbar showing various pinned and running applications.

Memorial Books

https://localhost:44326/Comment/GetComments

Memorial

Home About Us Library OUR BOOKS Other Sign Out

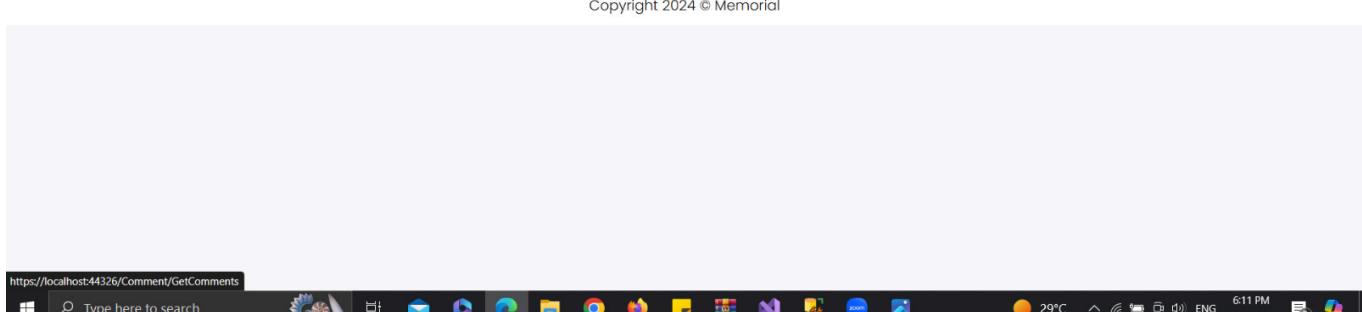
Checkouts
My Comments

Your Comments

Sapiens: A Brief History of Humankind
this is a good book

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

Copyright 2024 © Memorial



Memorial Books

https://localhost:44326/Comment/GetComments

Borrowed

You have borrowed this book

Comments

hassan23

this is a good book

Comments

Submit

Copyright 2024 © Memorial



Memorial Books

https://localhost:44326/Account/Register

Registration

*User name

Email

*Password

*Confirm Password

*Phone

Sign up

29°C 6:27 PM 10/16/2024

Memorial Books

https://localhost:44326/Account/Register



Read with us!

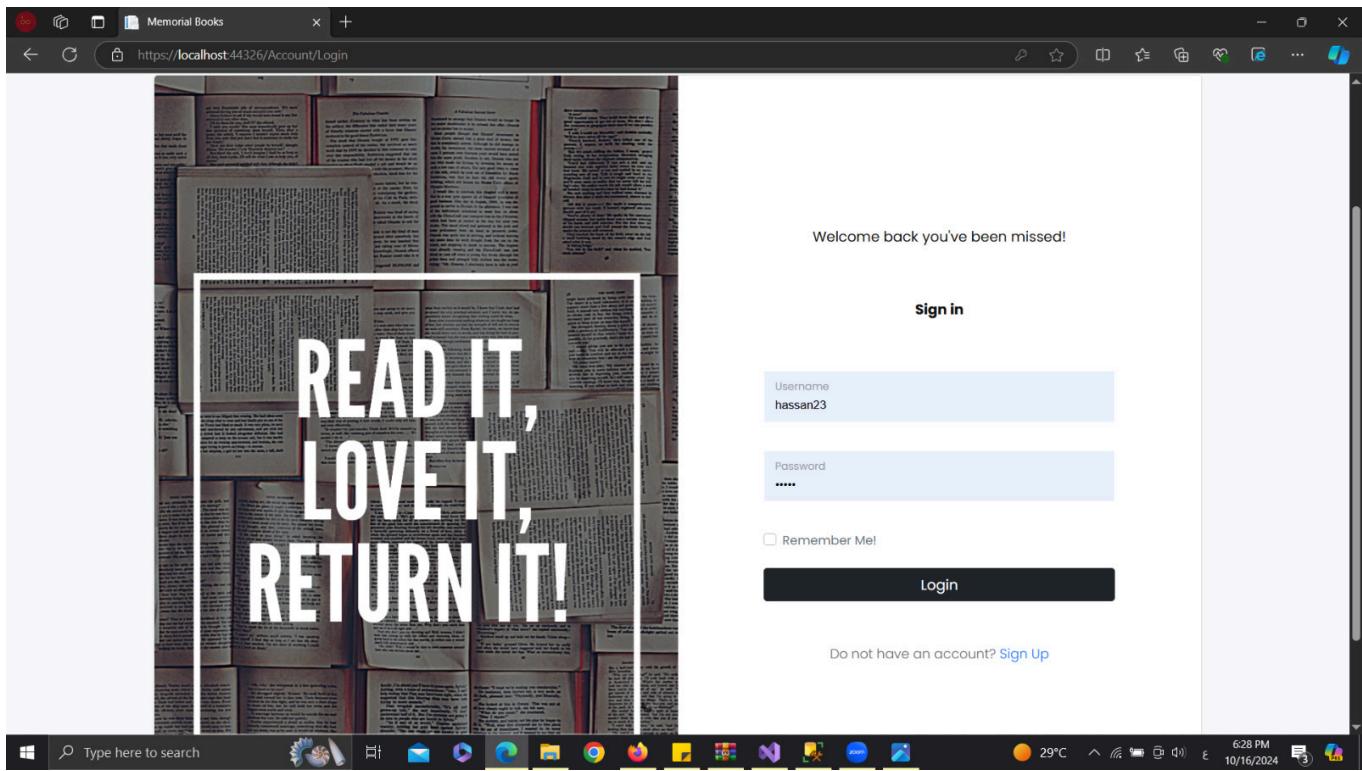
Registration

*User name

Email

*Password

29°C 6:27 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.