MALTEPE UNIVERSITY

Faculty of Engineering and Natural Sciences Software Engineering Department

SE 342 – SOFTWARE VALIDATION AND TESTING MIDTERM PROJECT ANALYSIS DOCUMENT

Library Borrowing and Reservation System

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Table of Contents:

Introduction:

This document stands for the analysis and requirement specifications for the "Library Borrowing and Reservation System," which is developed for the Software Testing & Validation course midterm project. Our objective of the project is to design a structured, well-defined system model before the implementation and testing phases. In this file, functional and non-functional requirements are specified, system workflows are clarified, and key diagrams are prepared in order to reflect the operational logic of the system.

The system aims to allow library members with the ability to search, borrow, and reserve books, while allowing librarians to manage approvals and maintain book availability. By establishing a clear set of requirements and visual presentations, In this report we ensure that the project is aligned with software engineering principles and ready for upcoming testing and validation steps.

FUNCTIONAL REQUIREMENTS

FR-1: Book Search:
The system need to let the library members search books in different ways, for example by typing the title, the writers name or choosing a specific category. This helps to users to find the books they are looking for without wasting too much time. The search function should work in a simple and understandable way, because not every user is very experienced with online systems.

FR-2: Viewing Book Availability:
Before making any borrow or reservation requests, members should be able to check if the book is free to take or it is already borrowed by someone else. Also if the book is in a reserved status, this must be shown. This makes the whole borrowing process more clear and prevents confusion about the book's status.

FR-3: Borrow Request:
When the system shows the book as available, the member should have the option to request it for borrowing. The borrow request should be sent directly to the librarian system so that they can handle it. The process should not be complicated and users should understand easily what they are doing.

FR-4: Reservation Request:
If a book is not currently available (borrowed by another person), the system can give the option to place a reservation. This allow the member "save" their turn for later time. Even whether the book is not in the library at the moment, the member will still be sure that they will get it after the other person returns it.

FR-5: Preventing Double Borrowing:
The system must make sure the same copy of the book cannot be borrowed by two different people at the same time. There should be a proper check before confirming the request. This avoids mistakes and keeps the library records more healthy.

FR-6: Librarian Approval:
All borrow and reservation requests should right go to the librarian panel. Librarians need to approve or reject these requests according to the rules of the library or the condition of the book. The system should support this work flow, and after the librarian decides, the member must be informed about the result.

FR-7: Automatic Status Update:
After a request is approved, the system needs to update the current status of the book automatically. For example, if a book is borrowed, it should switch to "borrowed" state, and if returned later, it should again go back to "available". This avoids wrong information and keeps the system consistent.

FR-8: Viewing Borrowing History:
Members should can view not only their current borrowings or reservations but also the books they borrowed in the past. This history page helps them keep track of their reading activity, due dates and any details about previous transactions. It also improves transparenct for the user.

NON-FUNCTIONAL REQUIREMENTS

NFR-1: Performance
The system should respond to users in a reasonable time. Idealy it should load pages or search results under the 3 seconds, but small delays may happen depending on internet or server. But Still, the system must give a smooth experience over all, because slow systems usually make users uncomfortable.

NFR-2: Security
All login information, passwords and similar sensitive data must be protected. The system should use proper authentication and authorization methods to avoid unauthorized access. Since this system includes personal borrowing data, the library has to make sure nobody else can see it without permission. Basic security steps like hashing passwords should also be applied.

NFR-3: Usability
The interface should be clear enough so both librarians and members can use it without special training. Buttons, menus and messages need to be simple, not too complex. If the user can understand what to do in the first seconds, then the design is successful. The system should help the user, not confuse them.

NFR-4: Compatibility
The web system should work fine on common browsers such as Chrome, Firefox, Safari and similar. Some users may access the system from different

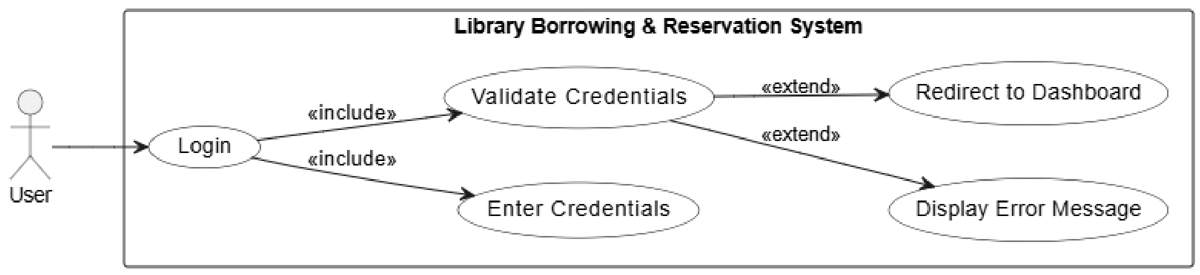
devices, so it should not break or behave strange on different screen sizes or browsers. Basic cross-browser support is important for accessibility.

NFR-5: Data Integrity
All the information stored in the system (book status, borrowings, reservations, etc.) must stay correct and consistent. Even if two users try to perform actions at exactly the same time, the system should keep the rules and avoid conflicting situations. This helps the library maintain clean and reliable data.

USE CASE DIAGRAMS:

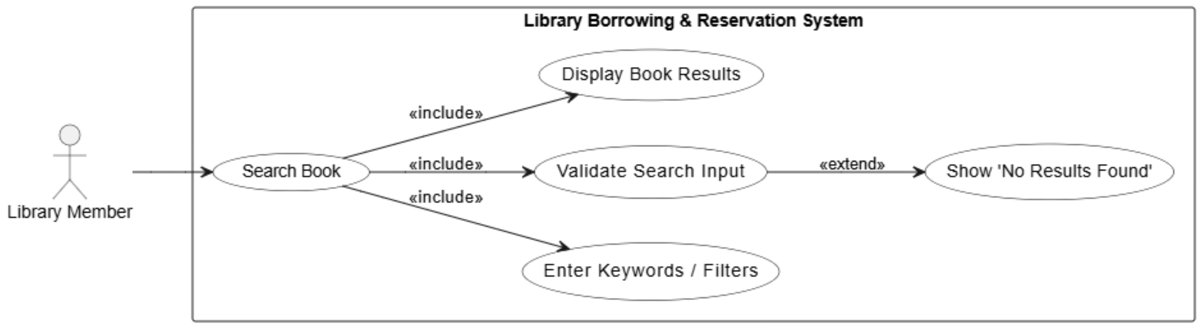
UC-1: Login:

The Login use case describe how a user tries to enter the system by writing their email and password on the login page. This step is important because only people that already have an account should be able to go inside and use the system. When the user types their information, the system checks if the email and password are correct. If the sending data is wrong, the system shows a simple error message and asks the user to try again. If the login is successful, the user gets directed to their own dashboard page depending on their role. The main idea of this use case is keeping the system safe and letting only authorized users access the rest of the features.



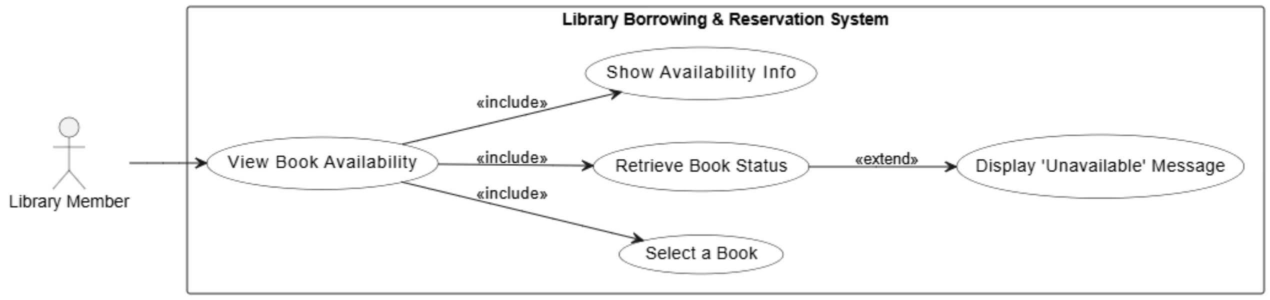
UC-2: Search Book:

This use case shows how a library member tries to find a book in the system by typing some keywords or choosing a filter like author or category. When the user starts a search, the system checks the input and tries to match it with the books stored in the database. If the input is valid and books are found, the system displays the results on the screen. If there is no match, the system shows a “no results found” message. The goal of this use case is helping the user to quickly find the book they want without getting confused.



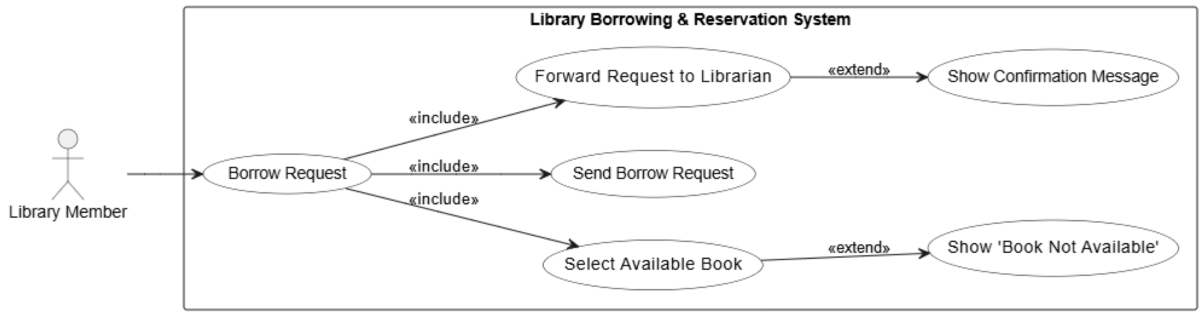
UC-3: View Book Availability:

This use case shows how a library member checks if a book is available or not. The user usually clicks on a book from the search results, and then the system loads the current status like available, borrowed or maybe reserved. If the book is not free at the moment, the system shows a small info message so the user understands why they can’t take it right now. The idea of this use case is helping the user to know the situation of a book before making any borrow or reservation request.



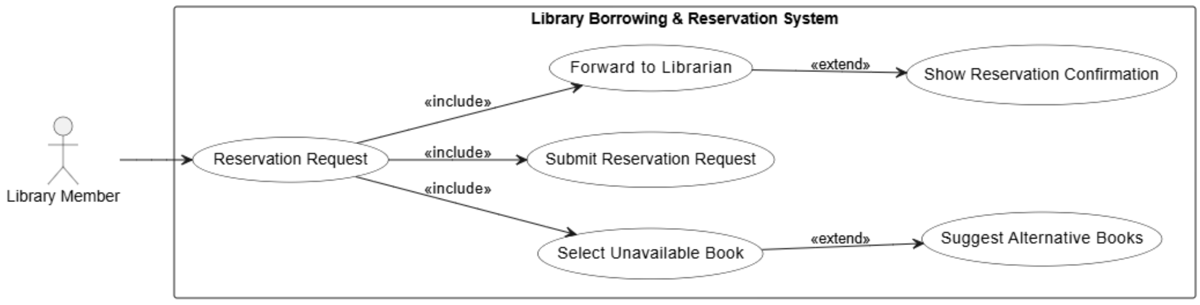
UC-4: Borrow Request:

This use case explains how a library member asks to borrow a book that is available in the system. First, the user chooses a book that is shown as available. After selecting it, the user sends a borrow request through the system. The request is then forwarded to the librarian, who will later approve or reject it. If the book is not available, the system shows a simple message to inform the user. When the request goes through successfully, a confirmation message appears. The goal of this use case is helping members borrow books in an easy and clear way.


Library Borrowing & Reservation System
Library Member
Borrow Request
«include»
Forward Request to Librarian
«extend»
Show Confirmation Message
«include»
Send Borrow Request
«include»
Select Available Book
«extend»
Show 'Book Not Available'

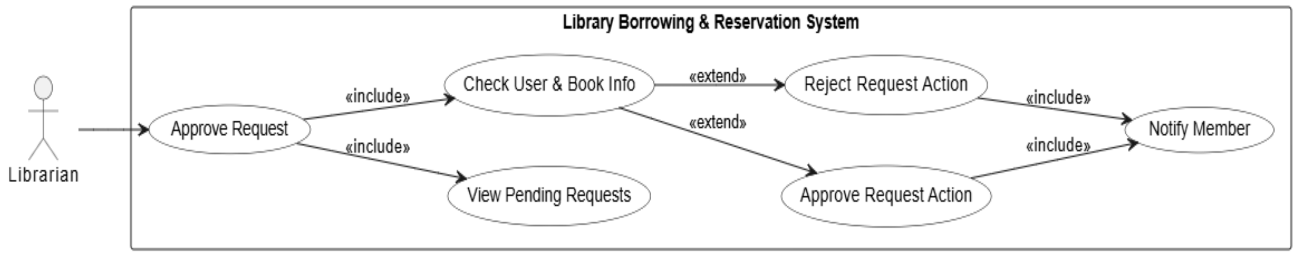
UC-5: Reservation Request:

This use case explains how a library member tries to reserve a book that is not available at the moment. If a book is borrowed or already reserved by someone else, the user can still choose it and send a reservation request. The system takes this request and forwards it to the librarian. Sometimes the system may also suggest alternative similar books if the selected one is not free. When everything goes fine, a reservation confirmation message is shown to the user. The goal of this use case is helping members save their place for a book and get it when it becomes available again.



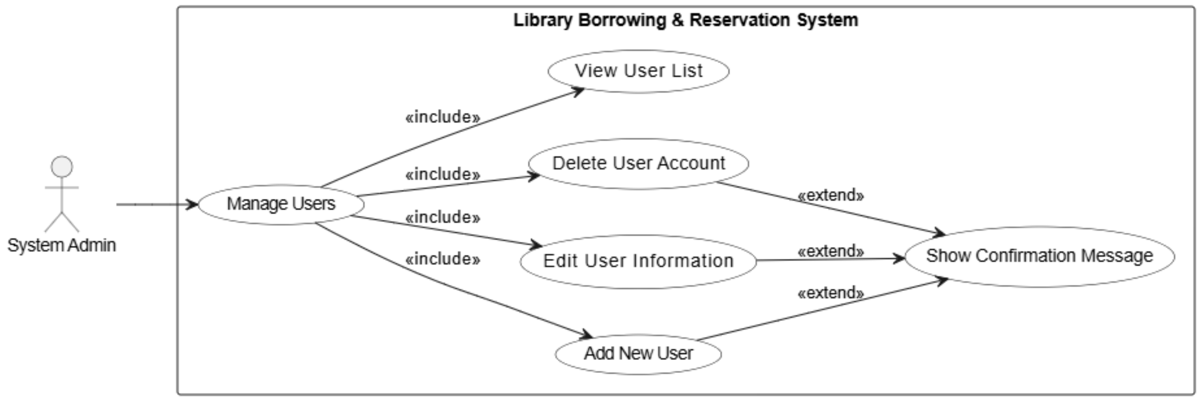
UC-6: Approve Request:

This use case explains how the librarian reviews incoming borrow or reservation requests from members. First, the librarian checks the list of pending requests and then opens one to see the details about the user and the book. After looking at the information, the librarian decides to approve or reject the request. When a decision is made, the system sends a small notification to the member. The goal of this use case is to manage all requests in a controlled and correct way.



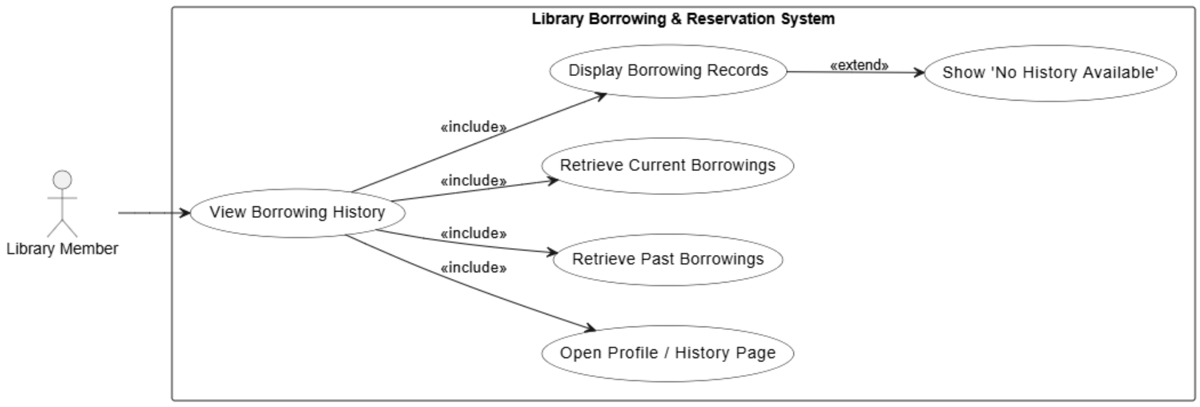
UC-7: Manage Users:

This use case shows how the system admin manages all users inside the library system. The admin can see the full list of users, add new accounts, edit existing information or delete users when needed. After doing one of these actions, the system usually shows a small confirmation message to let the admin know that the process is completed. The purpose of this use case is to keep user information organized and updated in the system.



UC-8: View Borrowing History:

This use case explains how a library member checks the books they borrowed before or the ones they still have. The user opens the history page, and the system loads both past and current borrowings from the database. All the records are shown together in a clear list. If the member has never borrowed a book before, the system shows a simple message saying that there is no history yet. The idea of this use case is to help users keep track of what they read and what they still need to return.


Library Borrowing & Reservation System
Library Member
View Borrowing History
«include»
«include»
«include»
«include»
Display Borrowing Records
Retrieve Current Borrowings
Retrieve Past Borrowings
Open Profile / History Page
«extend»
Show 'No History Available'

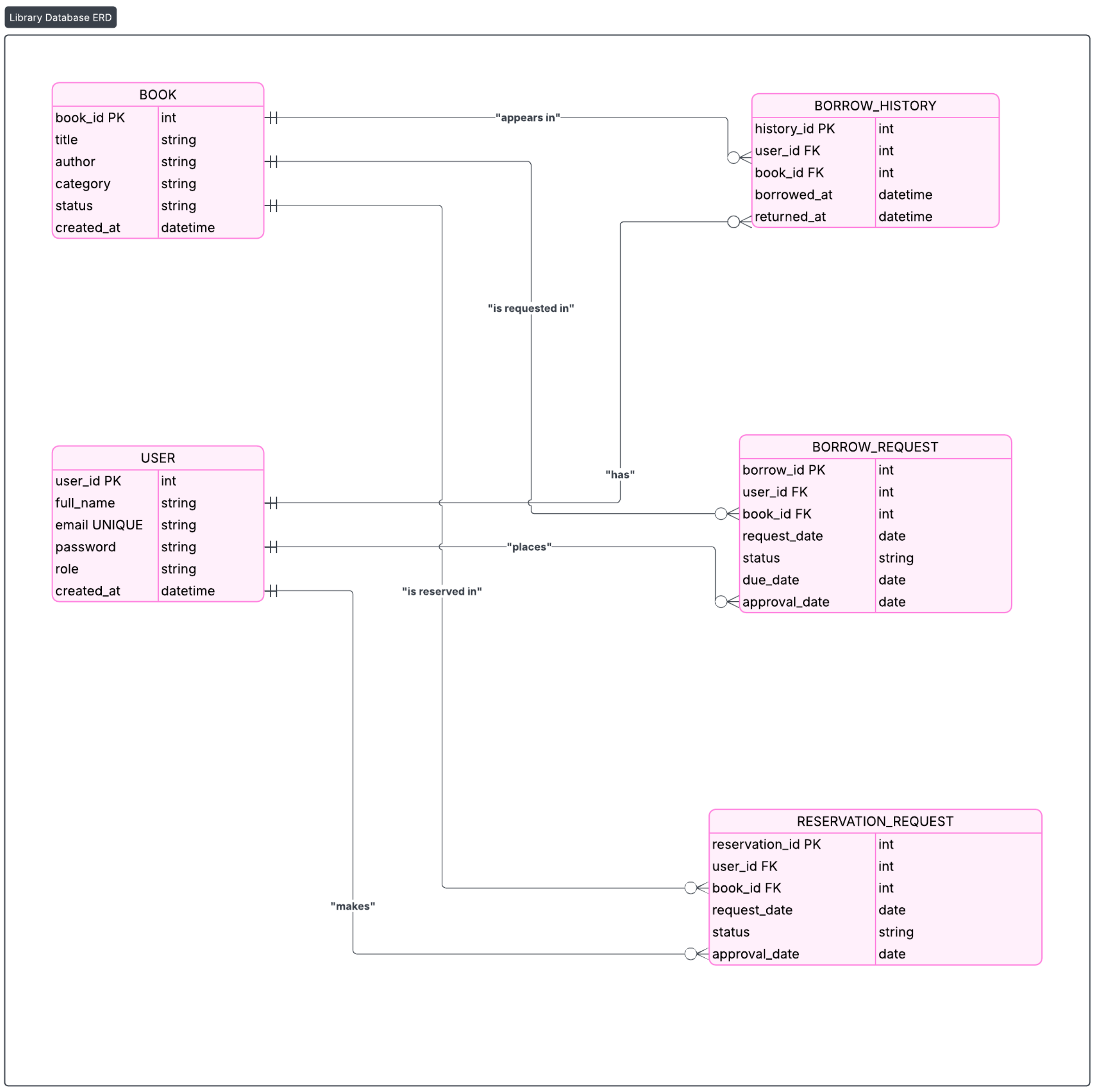
ENTITY RELATIONSHIP DIAGRAM (ERD):

The Entity-Relationship Diagram (ERD) shows the main data structure of the Library Borrowing and Reservation System. It explains how the tables in the database are connected to each other and what kind of information the system needs to store during the borrowing and reservation processes. The ERD is designed in a simple and organized way, so it becomes easy to understand how users, books and different request types interact inside the system.

In the diagram, the **users** table keeps information about all types of users such as members, librarians and the admin. The **books** table stores the details of each book. Both of these tables are directly connected with the request tables because every request must belong to a user and also a specific book.

The **borrow_requests** table is used when a member wants to borrow a book, and the librarian later approves or rejects that request. The **reservation_requests** table works in a similar way but it is only created when the book is not available at that moment. The ERD also includes a **borrow_history** table, which stores both past and current borrow activities of the members. This table helps the system show the borrowing history in the member interface.

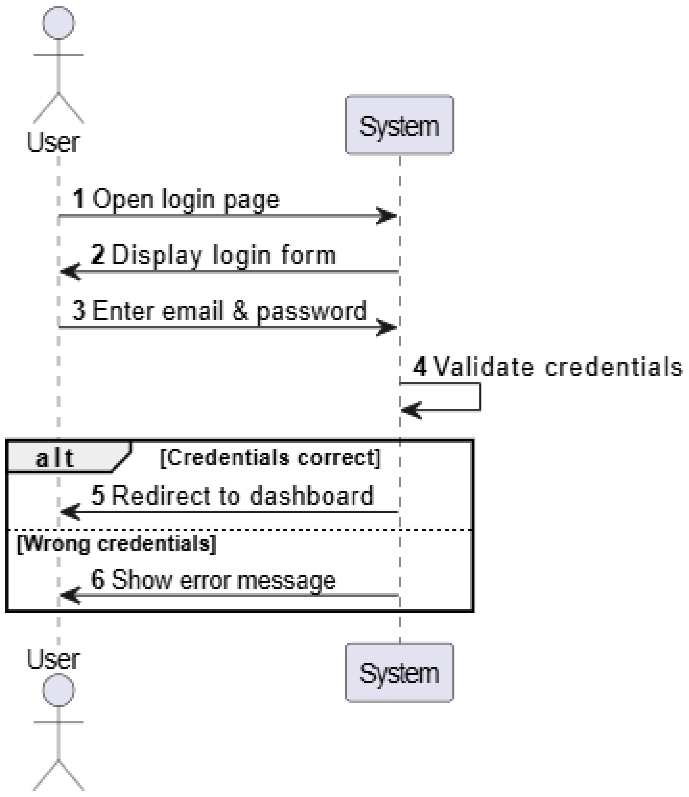
Each connection in the ERD is one-to-many, meaning one user or one book can appear in many different request or history records. This reflects the real life structure of a library system. Overall, the ERD gives a clear overview of the data flow and helps to understand how the rest of the system will work with these relationships.



SEQUENCE DIAGRAMS:

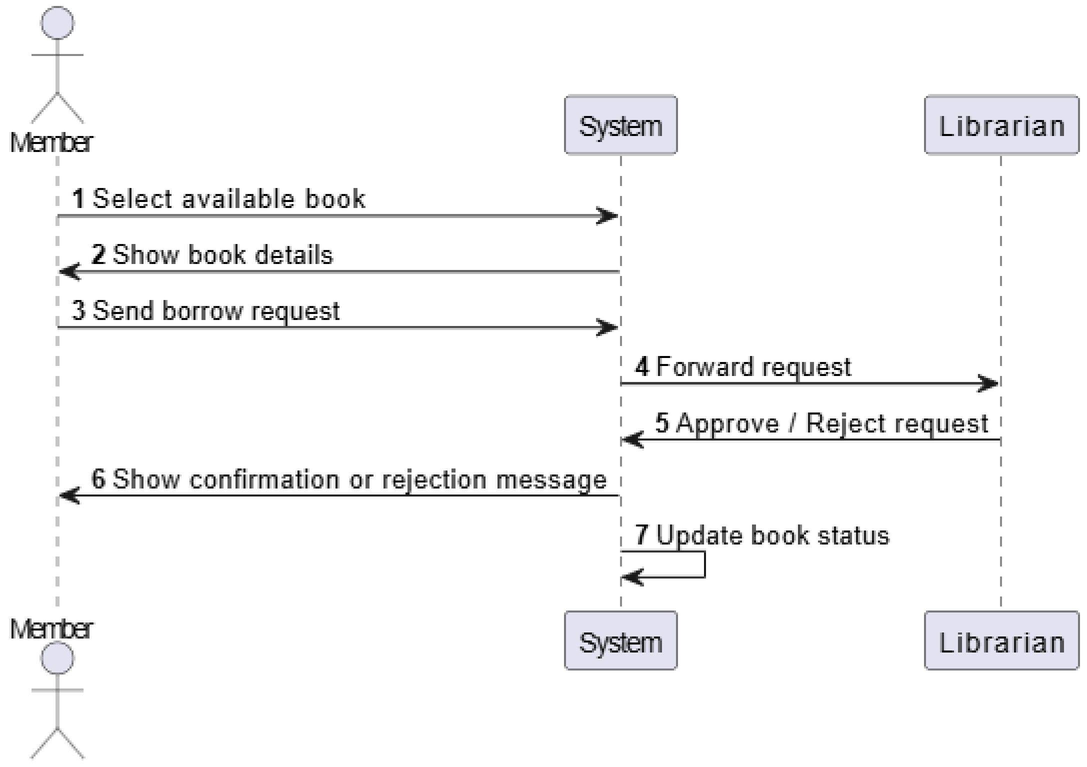
SD1 – Login Workflow:

This sequence diagram explains how the login process works in the system. First, the user opens the login page and the system shows the form. After that, the user types their email and password. The system checks if the information is correct or not. If the login is successful, the user gets redirected to their dashboard page. But when the information is wrong, the system shows a simple error message and asks the user to try again. This diagram shows the basic communication between the user and the system during the login step.



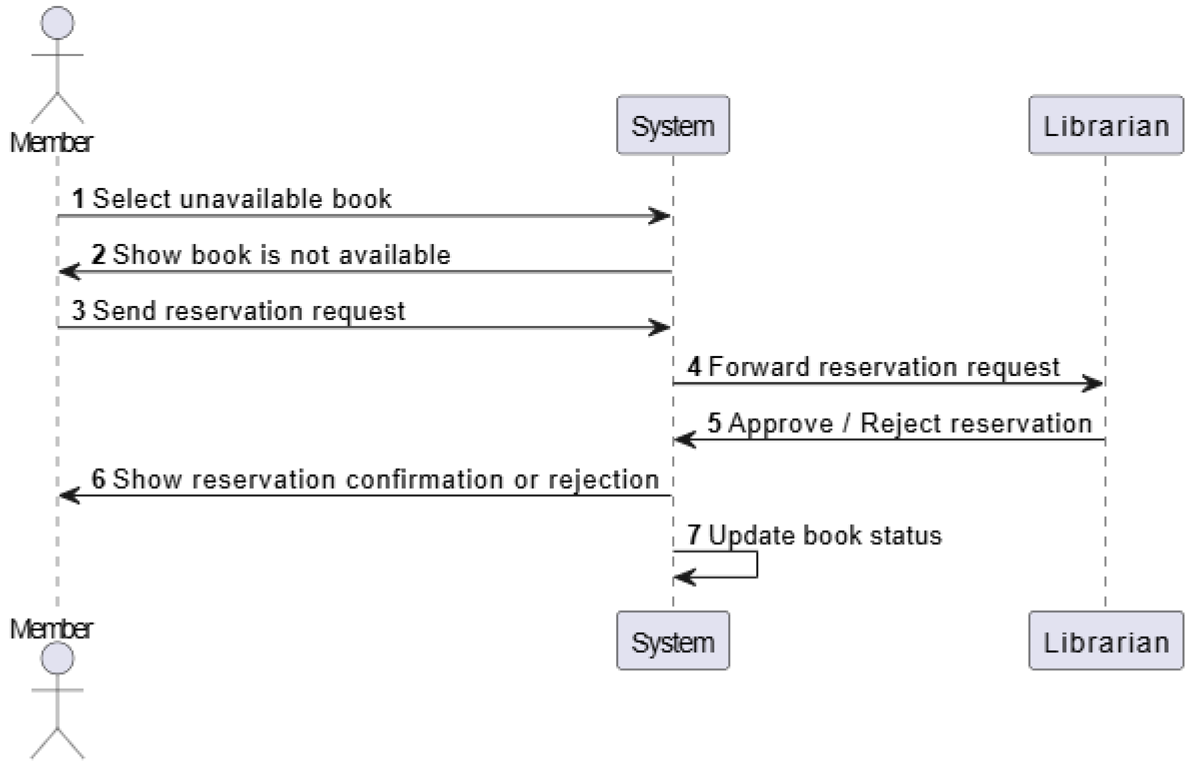
SD2 – Borrow Sequence:

This sequence diagram shows how the borrow request process works inside the system. First, the member selects a book that is available and the system shows the details. Then the member sends a borrow request. The system forwards this request to the librarian, who checks the information and decides to approve or reject it. After the decision, the system updates the book status and sends a message back to the member. This diagram helps to understand the full communication flow between the user, the system and the librarian.



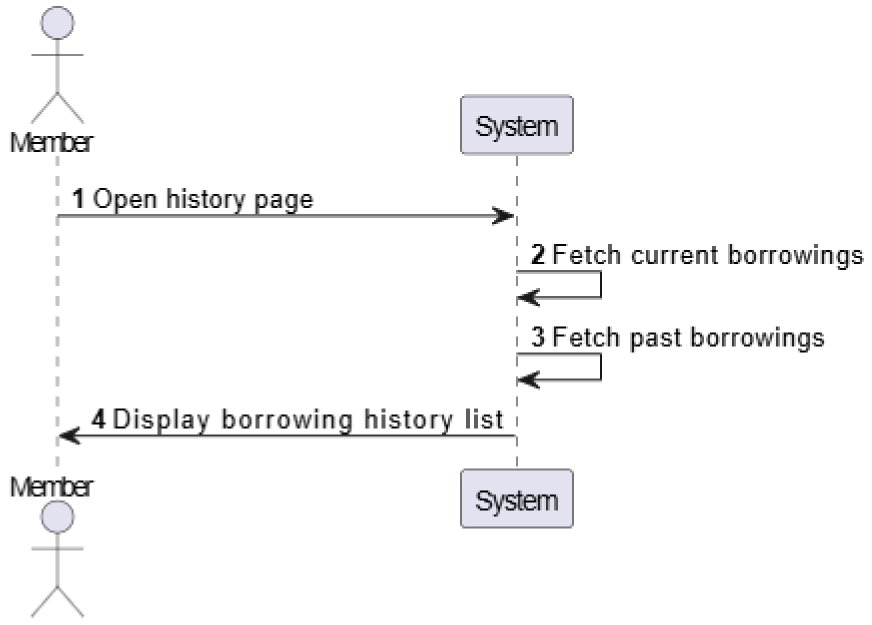
SD3 — Reservation Request Sequence:

This sequence diagram shows what happens when a member tries to reserve a book that is not available right now. First, the user picks a book that is already borrowed or maybe reserved by someone else, and the system tells them that the book cannot be taken at the moment. After that, the member decides to send a reservation request. The system sends this request to the librarian, who checks it and chooses to approve it or reject it. When the decision is made, the system updates the book's situation and sends a simple message back to the member. This diagram mainly helps to understand how the member, the system and the librarian talk to each other during the reservation process.


Member
System
Librarian
1 Select unavailable book
2 Show book is not available
3 Send reservation request
4 Forward reservation request
5 Approve / Reject reservation
6 Show reservation confirmation or rejection
7 Update book status
Member
System
Librarian

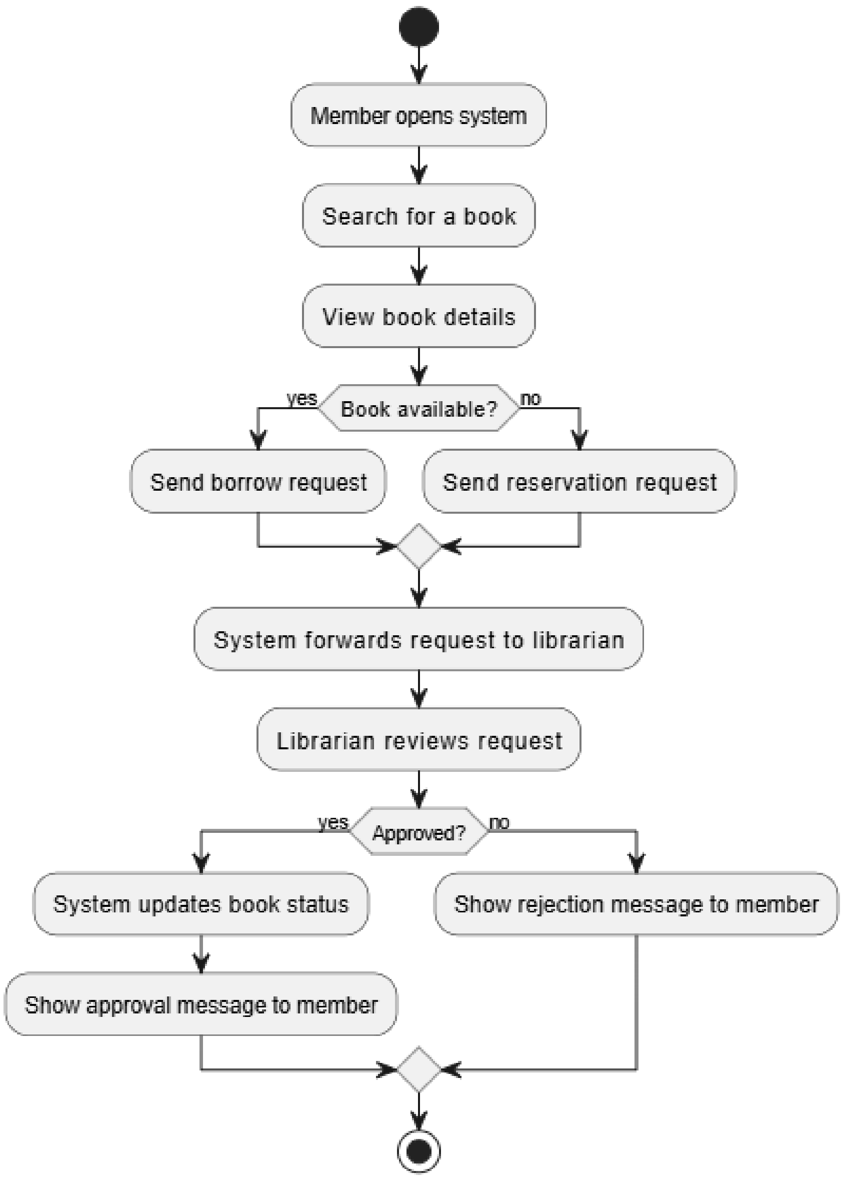
SD4 — View Borrowing History Sequence:

This sequence diagram shows how a member checks their borrowing history in the system. The process starts when the user opens the history page from their account. After that, the system looks for the books the member is currently holding and also the ones they borrowed in the past. When all the information is collected, the system shows it on the screen in a simple list. This diagram basically helps to understand how the system gets the data and sends it back to the user in a clear way.



ACTIVITY DIAGRAM:

This activity diagram indicates general flow of actions when a member interacts with the library system. Firstly, the user searches for a book and checks its details. If the book is available, the user sends a borrow request, but if it isn’t available at that time, they send a reservation request instead of this. After this step, the system forwards the request to the librarian, who decides to approve it or not. When the decision is made, the system updates the book status and shows a short message to the member. This diagram helps to understand the whole process from the start until the end in a clear and simple way.


Member opens system
Search for a book
View book details
Book available?
yes
no
Send borrow request
Send reservation request
System forwards request to librarian
Librarian reviews request
Approved?
yes
no
System updates book status
Show rejection message to member
Show approval message to member

FIGMA DESIGNS:

The interface of the Library Management System was designed using Figma, and different screens were created to show the main user interactions. Each design focuses on clarity, simplicity and a smooth user experience. Below are the descriptions of the screens together with the links to their Figma files.

1. Login Screen

Figma link:
https://www.figma.com/make/qGx1CO0ap3ZOIBaRClmUCw/Library-Management-System-Login-Screen?node-id=0-1&p=f&t=069gdEwKyRfzwALi-0&fullscreen=1

This page lets the user enter the system by typing their e-mail and password. It includes language and theme switching options, and the layout is kept very simple so users can log in without confusion.

2. Search Books (Light Theme)

Figma link:
https://www.figma.com/make/ROxZ69pKYgySaRkopegUjs/Library-Management-System-Dashboard-Light-Theme?node-id=0-1&p=f&t=zyHn6S9mBWUuE0pc-0&fullscreen=1

This screen includes a search bar, filtering tools and book cards. Users can borrow or reserve books directly from here. It is the main page for exploring the library collection.

3. Search Books (Dark Theme)

Figma link:
https://www.figma.com/make/9Aig9AC8o3ofvUD7ZIiaYs/Library-Management-System-Dashboard-Dark-theme?node-id=0-1&p=f&t=DchBICIHyKADXAvZ-0&fullscreen=1

The same content as the light theme but in a dark visual style. It offers a softer look for night use and a modern feel.

4. My Books Screen

Figma link:
https://www.figma.com/make/OGU81uorhQaDayfRmsi5BF/Library-Management-System-My-Books

This page displays borrowed and reserved books of the user. Borrowed books can be returned and reservations can be canceled. It keeps the user updated about their current items.

5. Librarian Dashboard

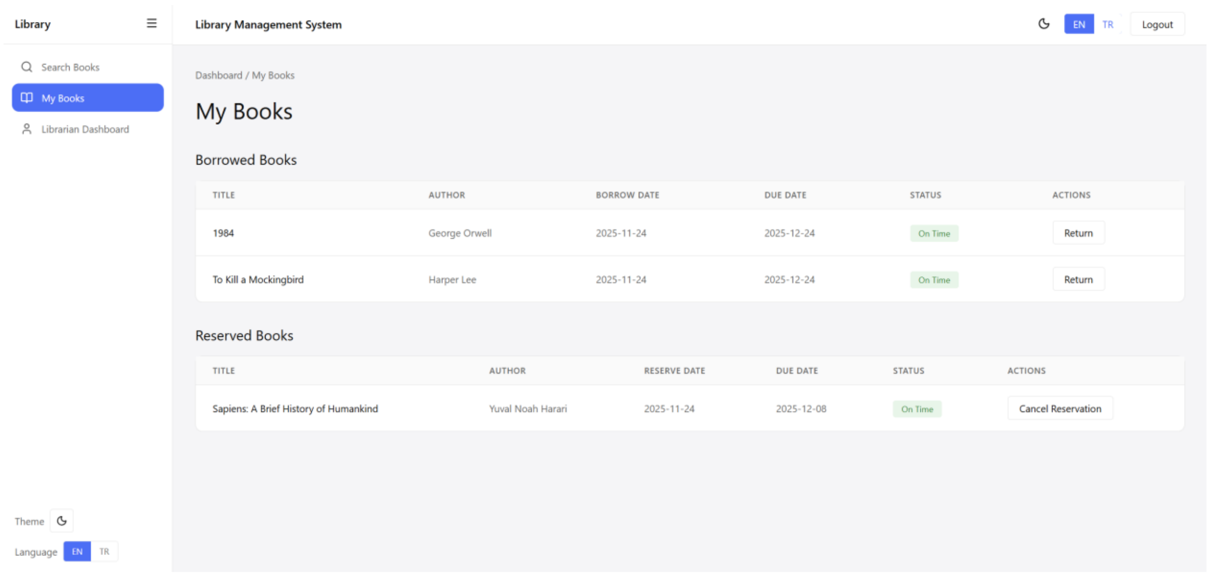
Figma link:

https://www.figma.com/make/gPZPjp3kwcLFdEEmidag0O/Library-Management-System-Librarian-Dashboard?node-id=0-1&p=f&t=NVLxoUtF8HCfswaM-0&fullscreen=1
This screen is for librarians to manage borrow and reservation requests. Each request can be approved or rejected directly, and the table is clear and organized.

6. Navigation Dashboard

Figma link:
https://www.figma.com/make/ROxZ69pKYgySaRkopegUjs/Library-Management-System-Dashboard-Light-Theme?node-id=0-1&p=f&t=zyHn6S9mBWUuE0pc-0&fullscreen=1
A simple navigation area that guides the user to Search Books, My Books or Librarian Dashboard. It provides a clean start after logging in.

Across all designs, users can switch between light/dark mode and English/Turkish language. These features help create a friendly and comfortable user experience.



Library

Search Books

My Books

Librarian Dashboard

Theme

Language EN TR

Library Management System

EN TR Logout

Dashboard / My Books

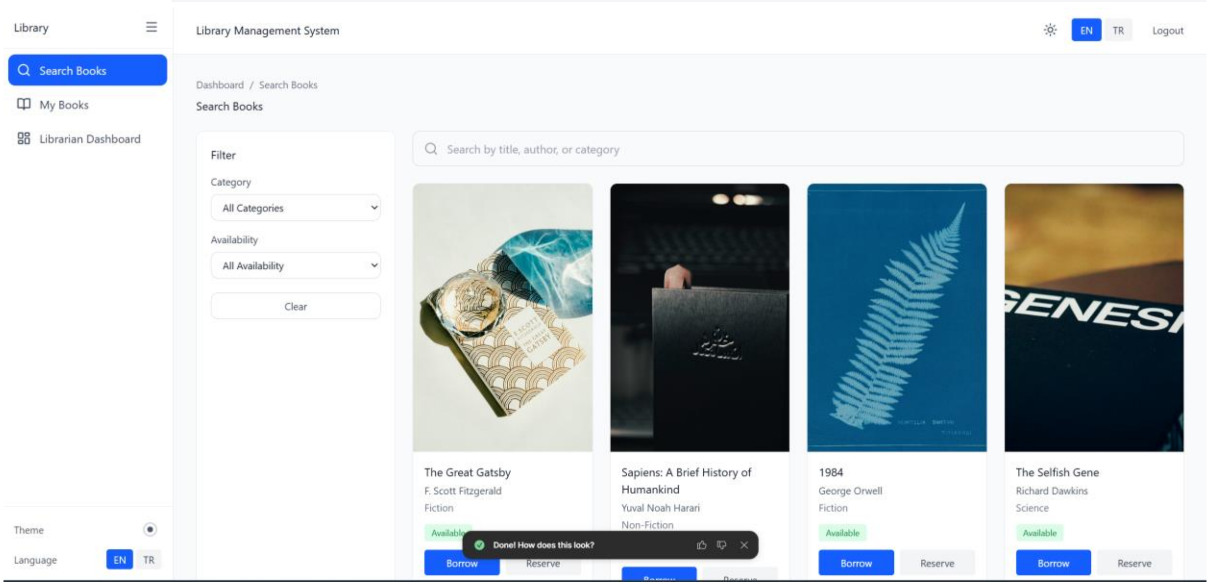
My Books

Borrowed Books

TITLE	AUTHOR	BORROW DATE	DUE DATE	STATUS	ACTIONS
1984	George Orwell	2025-11-24	2025-12-24	On Time	Return
To Kill a Mockingbird	Harper Lee	2025-11-24	2025-12-24	On Time	Return

Reserved Books

TITLE	AUTHOR	RESERVE DATE	DUE DATE	STATUS	ACTIONS
Sapiens: A Brief History of Humankind	Yuval Noah Harari	2025-11-24	2025-12-08	On Time	Cancel Reservation



Library

Search Books

My Books

Librarian Dashboard

Theme

Language EN TR

Library Management System

EN TR Logout

Dashboard / Search Books

Search Books

Filter

Category: All Categories

Availability: All Availability

Clear

Search by title, author, or category

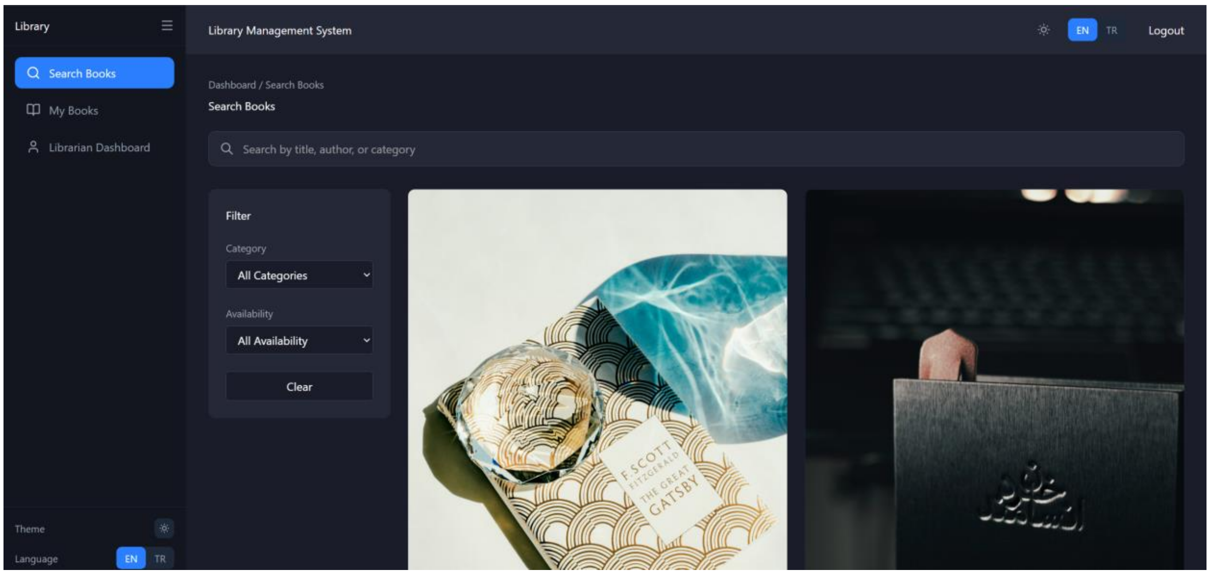
The Great Gatsby
F. Scott Fitzgerald
Fiction
Available
Borrow Reserve

Sapiens: A Brief History of Humankind
Yuval Noah Harari
Non-Fiction
Borrow Reserve

1984
George Orwell
Fiction
Available
Borrow Reserve

The Selfish Gene
Richard Dawkins
Science
Available
Borrow Reserve

Done! How does this look?



Library

Search Books

My Books

Librarian Dashboard

Theme

Language EN TR

Library Management System

EN TR Logout

Dashboard / Search Books

Search Books

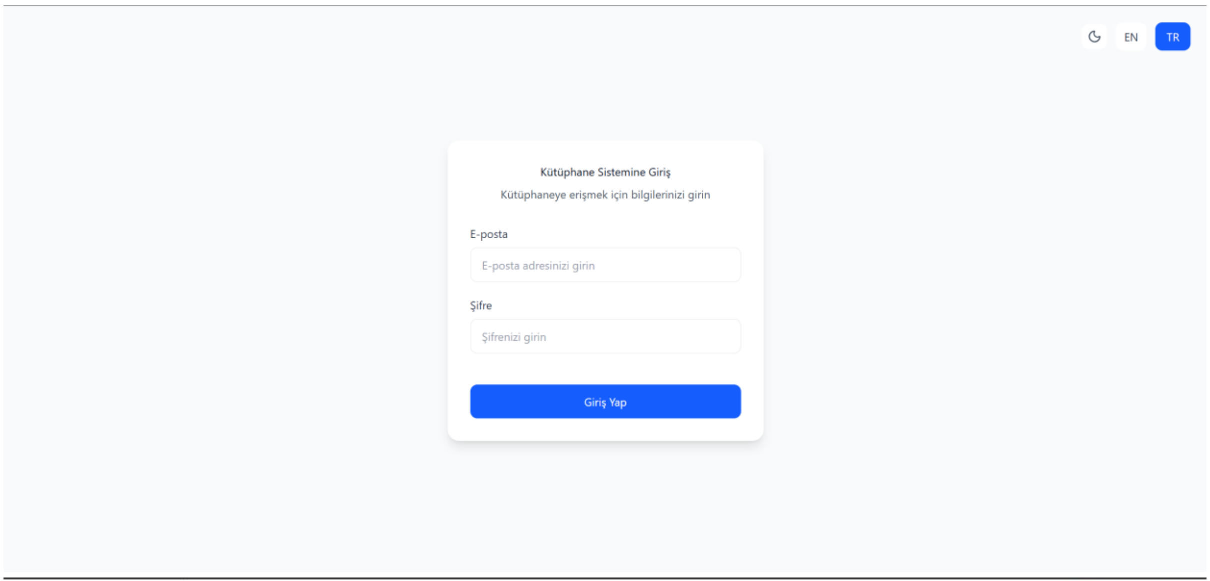
Search by title, author, or category

Filter

Category: All Categories

Availability: All Availability

Clear



EN TR

Kütüphane Sistemine Giriş

Kütüphaneye erişmek için bilgilerinizi girin

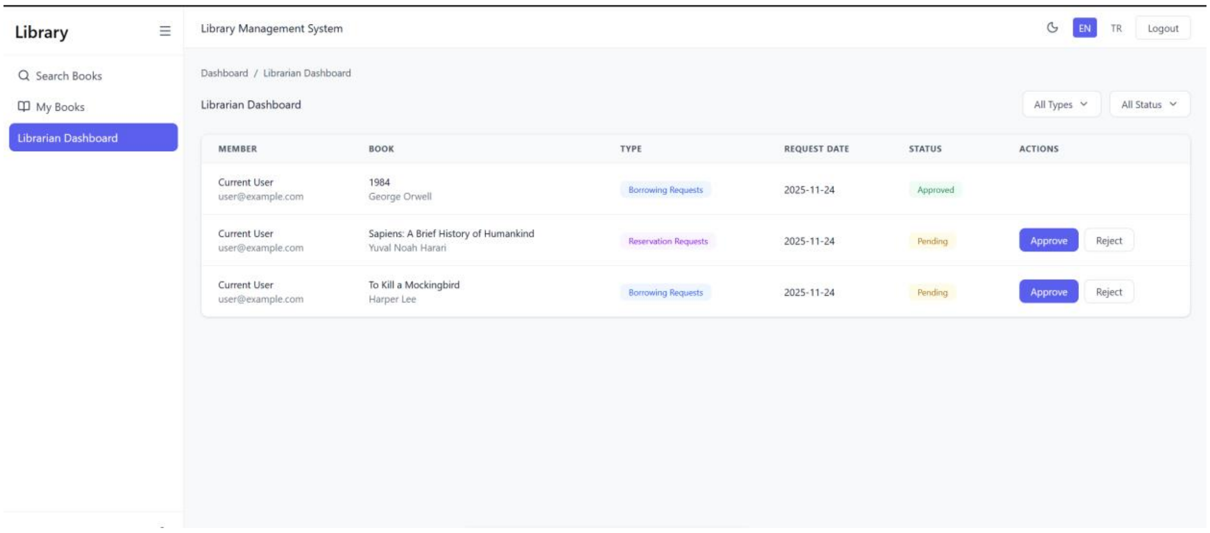
E-posta

E-posta adresinizi girin

Şifre

Şifrenizi girin

Giriş Yap



Library

Search Books

My Books

Librarian Dashboard

Library Management System

EN TR Logout

Dashboard / Librarian Dashboard

Librarian Dashboard

All Types | All Status

MEMBER	BOOK	TYPE	REQUEST DATE	STATUS	ACTIONS
Current User user@example.com	1984 George Orwell	Borrowing Requests	2025-11-24	Approved	
Current User user@example.com	Sapiens: A Brief History of Humankind Yuval Noah Harari	Reservation Requests	2025-11-24	Pending	Approve Reject
Current User user@example.com	To Kill a Mockingbird Harper Lee	Borrowing Requests	2025-11-24	Pending	Approve Reject

Github Link: https://github.com/hasan4adnan/LibraryManagement