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Focus (profile): Software Engineering and Computer Science

Project “Digital Library”

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Glossary

- Book – main library's object including:
 - Author
 - Cover
 - Title
 - Genre
 - Table of contents
 - PDF file
- Book fields – fields in a dataset describing book's attributes.
- Digital library – web application for searching and downloading PDF books. Includes frontend web interface, backend and database with books.
- Books indexing – defining index for every book by its content

Functional requirements

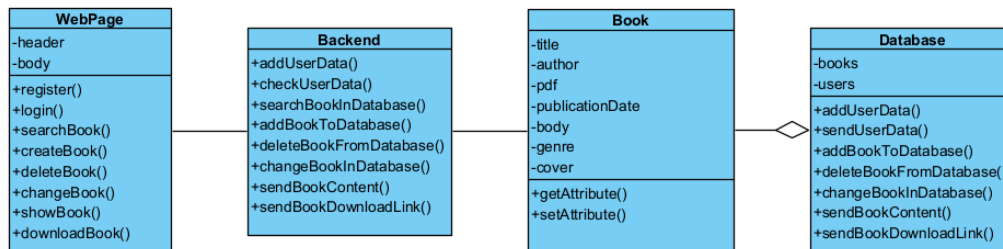
1. Books operations
 - a. User permissions checking for books operations
 - b. Create book
 - c. Delete book
 - d. Get book's attributes
 - e. Change book
 - f. Download book's PDF
2. Books indexing
3. Books search by any text parameter
4. Semantic search
5. User registration
6. Optional functional requirements:
 - a. Creating books' list using JSON or smth else
 - i. Maybe parsing books from [this site](#)
 - b. User profile showing
 - c. Add generative AI for getting book's description

Nonfunctional requirements

1. Comfortable UI
2. Adaptive UI
3. Fast books downloading
 - a. Minimal speed – 0.5 MB/s
4. Accurate semantic search

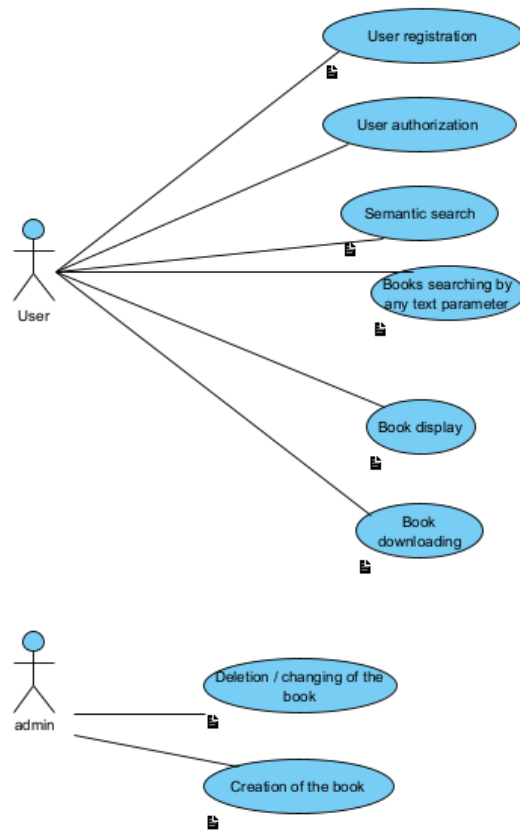
5. Resistance to the basic hacker attacks
6. Storing up to 100 000 books

Class diagram



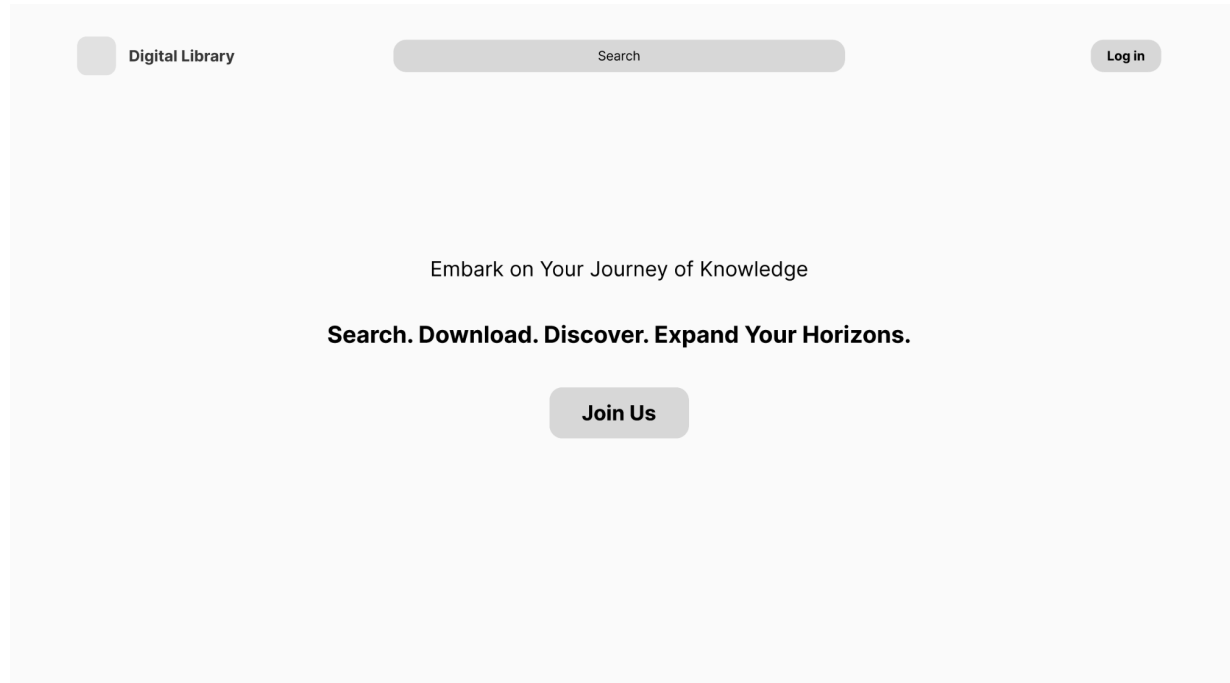
Use cases

Use Case Diagram



Design template

Design components above will be replaced with hello message on this template



AR01: User registration

Level: User-goal

Actor: User

Preconditions: The user is on the registration page, which they may have reached after clicking the "Register" button on the main application page.

Postconditions: The user's data was successfully saved. The user received permissions to create, delete and edit books. After that, the user was redirected to the main page of the application.

AR01-N: Main success scenario

1. The user enters a unique login (e.g., username or email) into the field for login.
2. The user enters a password that meets the system's strength requirements (e.g., length, character variety, etc.) into the password field.
3. The system validates the login to ensure it is unique by checking against existing user data in the database.
4. The system validates the password to ensure it meets security criteria (e.g., length, character variety, etc.).

5. The system saves the new user's data, including the login and hashed password, to the database.
6. The user is automatically logged in after successful registration.
7. The system redirects the user to the main page of the site.

AR01-A1: The user enters a login that already exists in the system

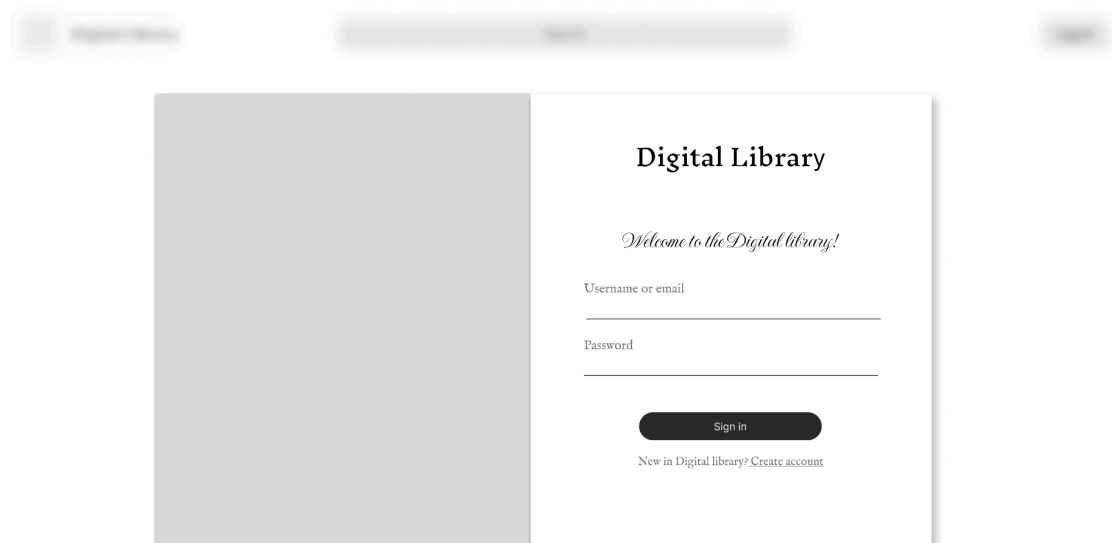
1. The system displays an error message: "This login is already taken. Please choose a different one."
2. The user re-enters a unique login and proceeds with the registration process.

AR01-A2: The user enters a password that does not meet the system's security criteria

1. The system displays an error message: "Your password is too weak. Please create a stronger password (e.g., minimum 8 characters, mix of letters, numbers, and symbols)."
2. The user re-enters a stronger password and proceeds with the registration process.

Frequency of Occurrence: Rare action. A particular person signs up once.

Design



AR02: User authorization

Level: User-goal

Actor: User

Preconditions: The user has already registered an account. The user is on the login page of the web application.

Postconditions: The user has been identified. The user received permissions to create, delete and edit books. The user was redirected to the main page of the application.

AR02-N: Main success scenario

1. The user enters their registered login (e.g., username or email) into the login field.
2. The user enters their password into the password field.
3. The system performs basic client-side validation (e.g., checks that the fields are not empty).
4. The system sends the login credentials to the backend for verification.
5. The backend checks the credentials against the stored user data (e.g., compares the entered password with the hashed password in the database).
6. The system authenticates the visitor as a user with book operations permissions.
7. The system redirects the user to the main page of the site.

AR02-A1: The user enters an incorrect login or password

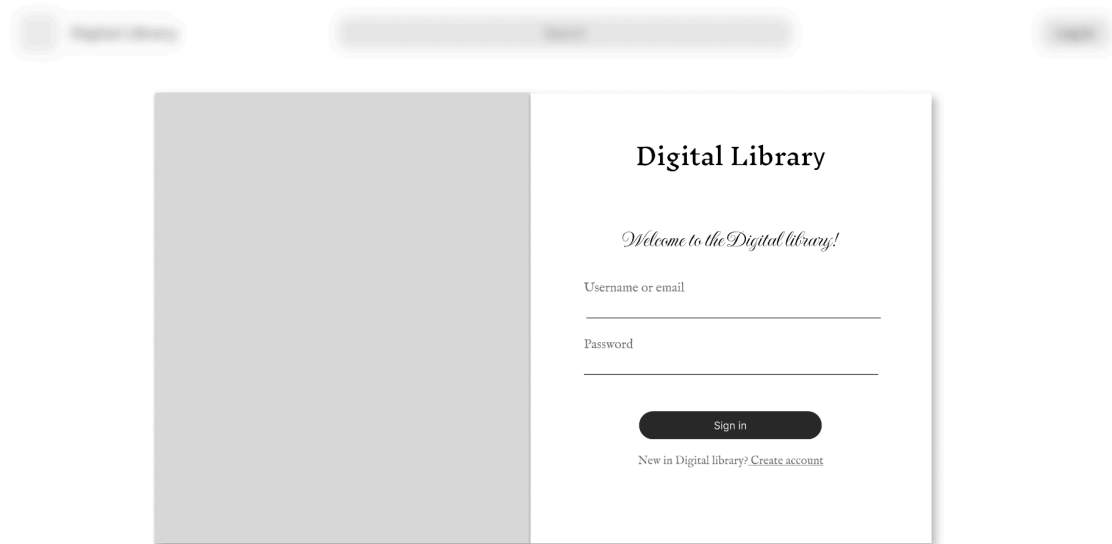
1. The system displays an error message: "Invalid login or password. Please try again."
2. The user is prompted to re-enter their credentials.

AR02-A2: The user forgot his password

1. The system displays a message offering to create a new account: "We cannot offer you to recover your password right now. However, you can register again in the Digital Library"
2. The user clicks the "Register" button on the login page.
3. The system redirects the user to the registration page, where they can create a new account.

Frequency of Occurrence: An ordinary action. Occurs once every active session.

Design



AR03: Semantic search

Level: User-goal

Primary Actor: User

Stakeholders and Interests:

- User: Wants to find a book whose title and author he doesn't know. He partially knows what it contains. He has only a very small piece of information.
- Wikidata service: Wants to receive digital queries to search for related concepts in the correct format. Wants to send a response that expands the context of the source data from the user.

Preconditions: The user is on the main page of the application.

Postconditions: The system shows the user a ranked list of books that semantically match the user's query.

AR03-N: Main success scenario

1. The user enters a query into the search bar, describing in natural language the content, meaning, or details of the desired book.
2. The system preprocesses the user request and breaks it down into separate concepts.
3. The system sends a request to the Wikidata service to search for related concepts and expand the context.

4. The system searches the database of books that semantically correspond to the extended query after receiving a response from the service.
5. The system ranks the found books based on the frequency and significance of the use of the desired concepts.
6. The system displays a ranked list of found books.

AR03-A1a: Wikidata service did not send a response or an error occurred when sending the request

1. The system tries to send a request to the Wikidata service again.

AR03-A1b: Wikidata service is unavailable for connection

1. The system tries to search the database of books that semantically correspond to the source separated concepts.

AR03-A2: Server error during the database searching

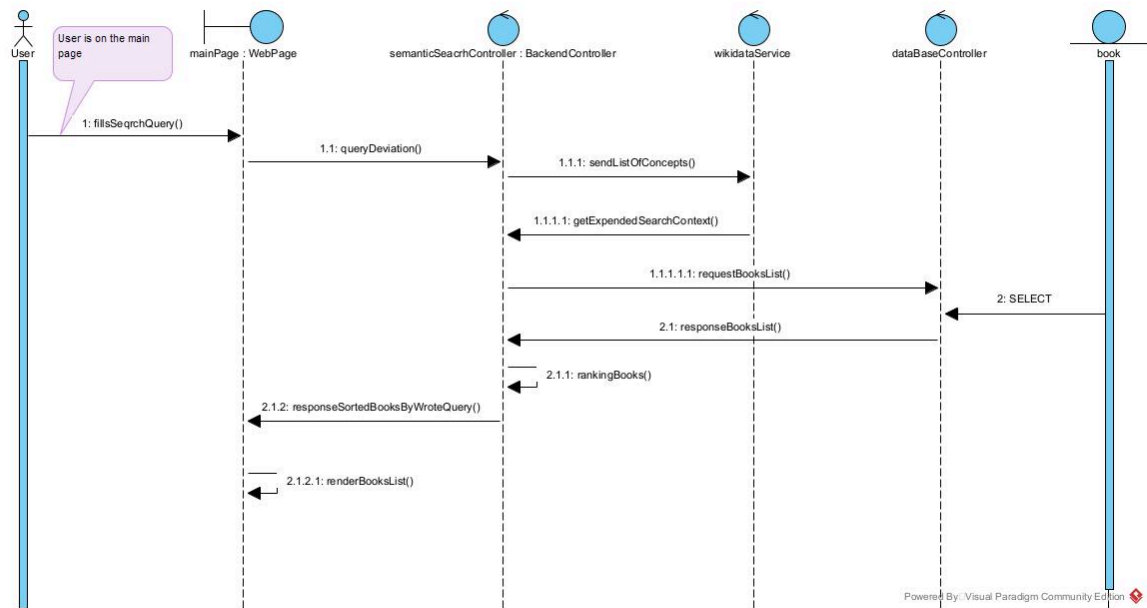
1. The system displays an error message: "An unexpected error occurred. Please try again later."
2. The user can retry the action or navigate to other parts of the application.

AR03-A3: No books semantically match the query

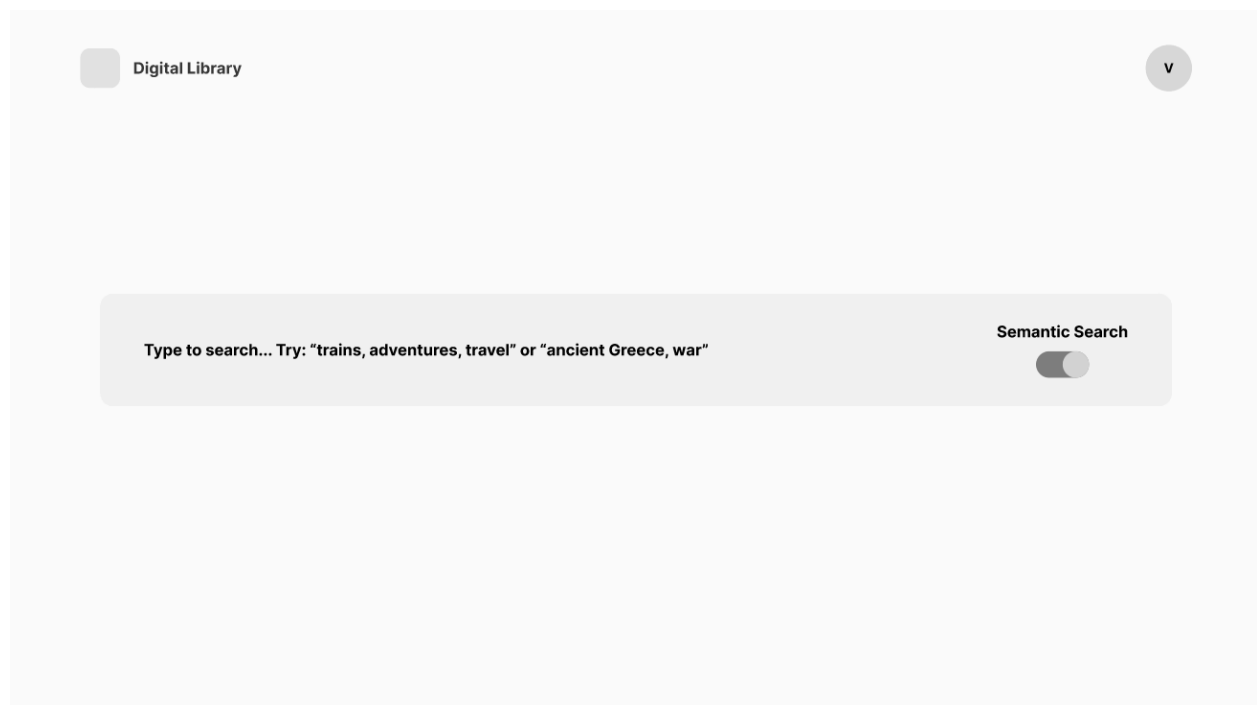
1. The system displays a "No results found" message and suggests alternative search terms.
2. The user tries to reformulate his query and sends a new request.

Frequency of Occurrence: Could be nearly continuous.

UML diagram



Design



AR04: Creation of the book

Level: User-goal

Actor: User

Preconditions: The user is authenticated in the application and has permissions for book creation. The user goes to the book creation page after clicking the "Create Book" button in the application.

Postconditions: The new book's data has been successfully saved to the database. The user is redirected to the newly created book's page, and the system has assigned a unique ID to the book.

AR04-N: Main success scenario

1. The user fills all required fields for the new book (e.g., title, author, publication date, etc.). Fields are defined in the glossary.
2. The user submits the form by clicking "Submit."
3. The system performs client-side validation of the form, ensuring that: 1) all required fields are filled; 2) the data corresponds to the defined format (e.g., correct date format, non-empty title).
4. The backend performs server-side validation, checking that all data conforms to database constraints (e.g., no duplicate titles, valid authors).
5. The system generates a unique unsigned integer ID for the book and saves the book in the database.
6. The system confirms the successful creation and redirects the user to the newly created book's page.

AR04-A1: User doesn't have permissions to create a book

1. The system detects that the user lacks the necessary permissions.
2. An error message is displayed: "You do not have permission to create a new book."
3. The user is redirected back to the main page.

AR04-A2: Simple errors in the form

1. The system highlights the incorrect fields and provides error messages (e.g., "Title is required" or "Invalid date format").
2. The user corrects the errors and resubmits the form.

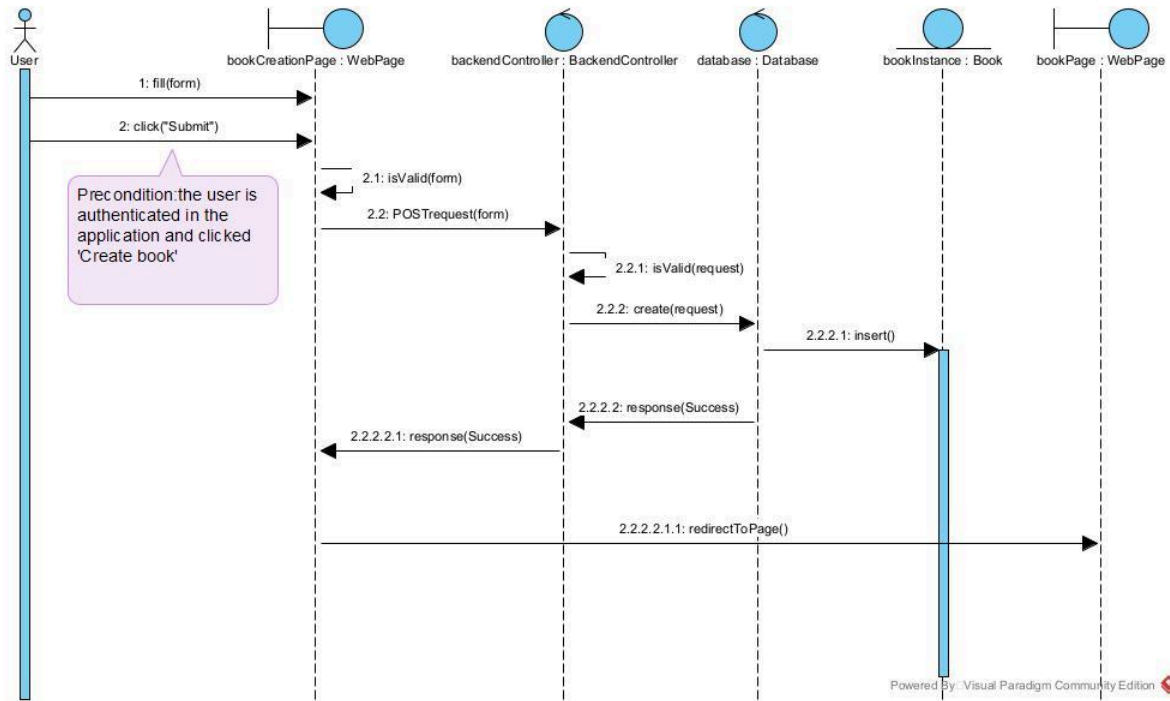
AR04-A3: Server error during book creation

3. The backend encounters an issue while processing the request (e.g., database failure, network issue).
4. The system displays an error message: "An unexpected error occurred. Please try again later."
5. The user can retry the action or navigate to other parts of the application.

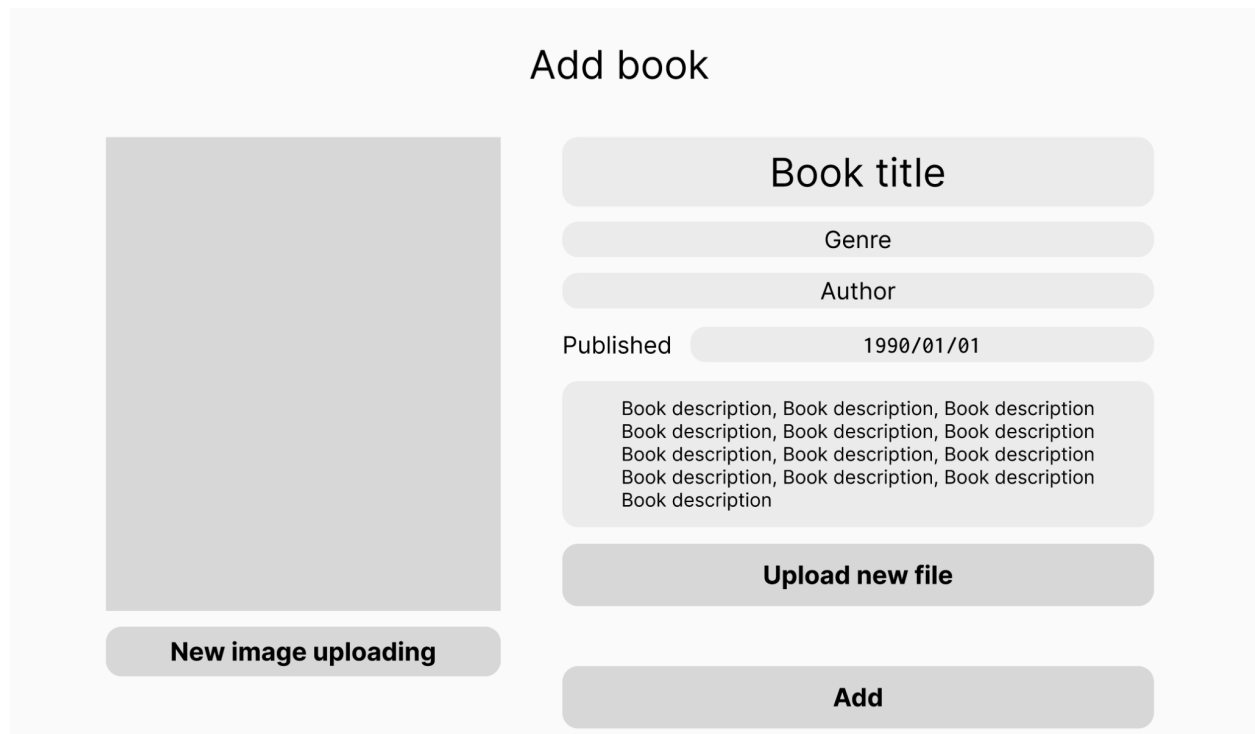
Frequency of Occurrence: It doesn't happen often for a specific user.

Related Use Cases: AR06: User Checking Permissions

UML Diagram



Design



The image shows a user interface for adding a new book. It features a large gray square placeholder for a book cover on the left. To the right of the cover is a form with several input fields: 'Book title', 'Genre', 'Author', and 'Published' (with a date '1990/01/01' entered). Below these fields is a text area containing multiple lines of 'Book description'. At the bottom of the form is a large 'Add' button. Below the cover placeholder is a button labeled 'New image uploading'.

Add book

Book title

Genre

Author

Published 1990/01/01

Book description, Book description, Book description
Book description, Book description, Book description
Book description, Book description, Book description
Book description, Book description, Book description
Book description

Upload new file

Add

New image uploading

AR05: Books searching by any text parameter

Level: User-goal

Actor: User

Preconditions: The user is on the special book search page with additional filters, such as the book title, author's name, or genre, into the search bar.

Postconditions: The system shows the user a list of books that match the entered parameters

AR05-N: Main success scenario

1. The user enters terms into the corresponding search fields, which may be a book title, author's name, genre, or any other relevant text parameters.
2. The system validates the input to ensure it's in an acceptable format (e.g., non-empty string).
3. The system queries the database for books that match the entered search term.
4. The system displays a list of books that match the search term, including book details such as title, author, genre, and a brief description.
5. The user selects a book from the list for further actions (e.g., view details, download).

AR05-A1: The user enters search terms that don't match any records in the database.

1. The system displays a message to the user: "No results found. Please try searching with different terms."
2. The user can modify the search term and try again.

Frequency of Occurrence: Could be nearly continuous.

Design

The image shows a wireframe of a search interface for a 'Digital Library'. The interface is contained within a light gray rectangular area. At the top left, there is a small square icon followed by the text 'Digital Library'. At the top right, there is a circular icon containing the letter 'v'. Below these, there is a search form. The form has four input fields, each preceded by a label: 'Title:', 'Author:', 'Genre:', and 'Year Of Publication:'. To the right of the 'Title:' field, there is a 'Semantic Search' label and a toggle switch. The toggle switch is currently in the 'off' position.

AR06: Deletion / changing of the book

Level: User-goal

Actor: User

Preconditions: The user is authenticated in the application and has permissions for book deletion / changing. The user is on the book's details page.

Postconditions: The book is either updated with new information or completely removed from the system. The system's database reflects the changes accurately. Other users can see the updated information or can no longer access the deleted book.

AR06-N: Main success scenario

1. The user clicks the "Edit" button on the book's details page.
2. The system displays the book's edition page with options to update parameters or delete the book.
3. The user makes the desired changes to the book's parameters or selects the delete option.
4. The user confirms the action.
5. The system sends the appropriate request to the backend.
6. The backend processes the request and updates the database accordingly.
7. The system provides a success message to the user.
8. The system redirects the user:
 - a. To the main page if the book was deleted.
 - b. To the updated book's details page if the book was changed.

AR06-A1: User lacks necessary permissions

1. The system does not display the "Edit" button on the book's details page.
2. If the user attempts to access the edit page directly, the system displays an error message with a link back to the book's details page.

AR06-A2: Form validation errors

1. The user submits the form with invalid data.
2. The system highlights the fields with errors and provides specific error messages.
3. The user corrects the errors and resubmits the form.
4. The system processes the corrected form and continues from step 5 of the main scenario.

AR06-A3: Server-side error

1. The system encounters an error while processing the request.
2. The system displays an error message to the user with an error code and brief description.
3. The user is prompted to try again later or contact support.

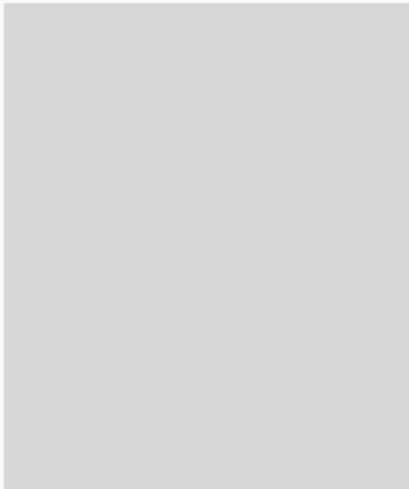
Frequency of Occurrence: Moderate, depends on the size and activity of the library.

Related Use Cases:

- AR04: Creation of the Book
- AR09: User Checking Permissions

Design

Edit book



New image uploading

Book title

Genre

Author

Published1990/01/01

Book description, Book description, Book description
Book description, Book description, Book description
Book description, Book description, Book description
Book description, Book description, Book description
Book description

Upload new file

Save

AR07: Book display

Level: User-goal

Actor: User

Preconditions: The book exists in the library's database. The user navigates to a specific book's page through search results, browsing, or a direct link.

Postconditions: The user is shown complete and reliable information about the requested book.

AR07-N: Main success scenario

1. The user clicks on the book field to get detailed information about this book.
2. The system queries the database for the book's data.
3. The database returns the complete book information.
4. The system processes the data and prepares it for display.
5. The system renders the page with the following information: Book title, Author(s), Publication date, Genre(s), Description/Summary, Cover image (if available), Download button (if applicable)
6. The system displays the fully loaded book page to the user.

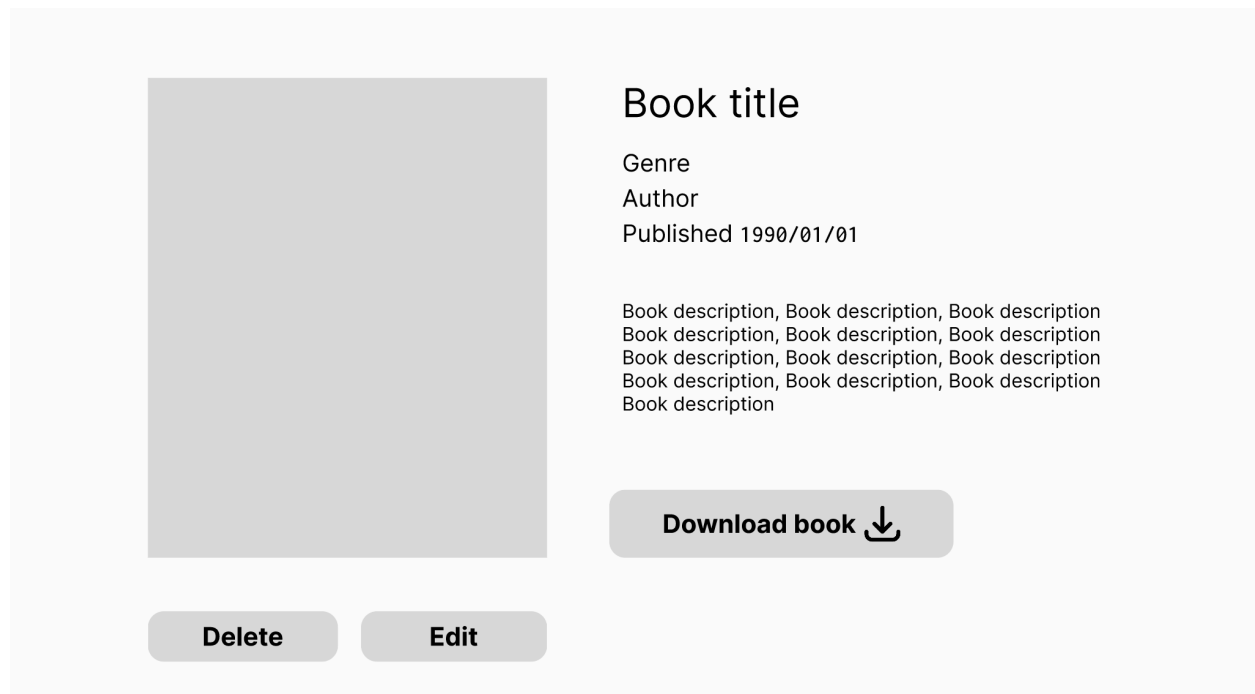
AR07-A1: Server error during processing book's data

1. The system displays an error message: "An unexpected error occurred. Please try again later."
2. The user can retry the action or navigate to other parts of the application.

Frequency of Occurrence: Very high, one of the most common operations

Related Use Cases: AR03: Semantic search (for finding the book)

Design



AR08: Book downloading

Level: User-goal

Primary Actor: User

Preconditions: The user is on the book's details page. The book has an associated PDF file available for download.

Postconditions: The user has successfully downloaded the book's PDF file.

AR08-N: Main success scenario

1. The user clicks the download button on the book's page.
2. The system initiates the download process.
3. The system retrieves the PDF file from the storage.

4. The system begins streaming the PDF file to the user's device.
5. The user's browser receives the file and initiates the download.
6. The system displays a success message to the user.

AR08-A1: File not found or corrupted

1. The system is unable to retrieve the PDF file from storage.
2. The system displays an error message to the user/visitor.
3. The system offers alternative actions (e.g., try again, contact support).

AR08-A2: Download interrupted

1. The download process is interrupted (e.g., due to network issues).
2. The system offers the user the option to resume the download.
3. If resumed, the system continues the download from the point of interruption.

Frequency of Occurrence: High, one of the primary functions of the Digital Library.

Related Use Cases:

- AR07: Book display (as the download typically initiates from the book's page)
- AR09: User checking permissions (if download permissions need to be verified)

AR09: User checking permissions

Level: Subfunction

Primary Actor: Digital Library System

Stakeholders and Interests:

- User: Wants to perform operations on books in the Digital Library with minimal interruption.
- Digital Library System: Wants to ensure that operations are performed only by users with appropriate permissions.

Preconditions: The user is on any page of the Digital Library web application where book operations are available.

Postconditions: The system either allows the operation to proceed or denies it based on the user's permissions.

AR09-N: Main success scenario

1. The user initiates an operation on a book (e.g., view, download, edit, delete).
2. The system identifies the type of operation requested.
3. The system checks the user's authentication status.
4. If the operation doesn't require changes to the library, the system allows the operation to proceed.
5. If the operation can change the library, the system verifies the user's specific permissions for that operation.
6. The system allows the operation to proceed if the user has sufficient permissions.
7. The operation completes successfully.

AR09-A1: User is not authenticated for a change operation

1. The system prompts the user to log in.
2. The user logs in successfully.
3. The system rechecks permissions and continues from step 5 of the main scenario.

AR09-A2: User lacks permissions for the requested operation

1. The system displays a notification that the user doesn't have sufficient permissions.
2. The system cancels the operation.
3. The system logs the attempted unauthorized access.

AR09-A3: System error during permission check

1. The system displays an error message: "Unable to verify permissions at this time. Please try again later."
2. The operation is canceled.

Frequency of Occurrence: Very high, occurs with nearly every user interaction with books in the library.

Related Use Cases:

- AR01: User Registration
- AR02: User Authorization