

Barkin Library Management Tool (BarkinLibTool)

Technical Documentation

Summary

This project presents a Python-based desktop application for managing library books using the PyQt framework and MySQL database. It includes essential features such as user registration, login, book search and filtering, and loan request handling. Staff members can manage loan requests through a separate interface. The application is developed using object-oriented programming and designed with UML and ER diagrams offering a practical solution for basic library operations.

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PERSONAL GAINS

At the initial stage of the project, I focused on defining the system requirements and creating UML diagrams to visualize the overall architecture. The project involved developing a Library Book Management System using the Qt Framework, where I learned to implement GUI-based desktop applications with Python and PyQt.

During the development process, I used Qt Designer to design and customize the user interface, which helped me gain a solid understanding of different approaches to building frontends in Qt.

For the backend, I set up the database using MySQL and handled database operations with mysql-connector-python

The application is developed using an object-oriented programming (OOP) approach. By effectively coordinating the frontend and backend components, I successfully developed a fully functional application.

This project provided me with valuable experience in desktop app development, database integration, and GUI design, while also deepening my understanding of Python and SQL.

KEY TAGS: SQL, Python, QT, MySQL and mysql-connector-python

1. Introduction

Libraries use various software solutions to manage and control physical books more efficiently. These solutions help track books, organize lending and return processes, and facilitate effective inventory management. In this project, the goal is to support library book management processes by developing a simple, Python-based desktop application.

2. Technical Design

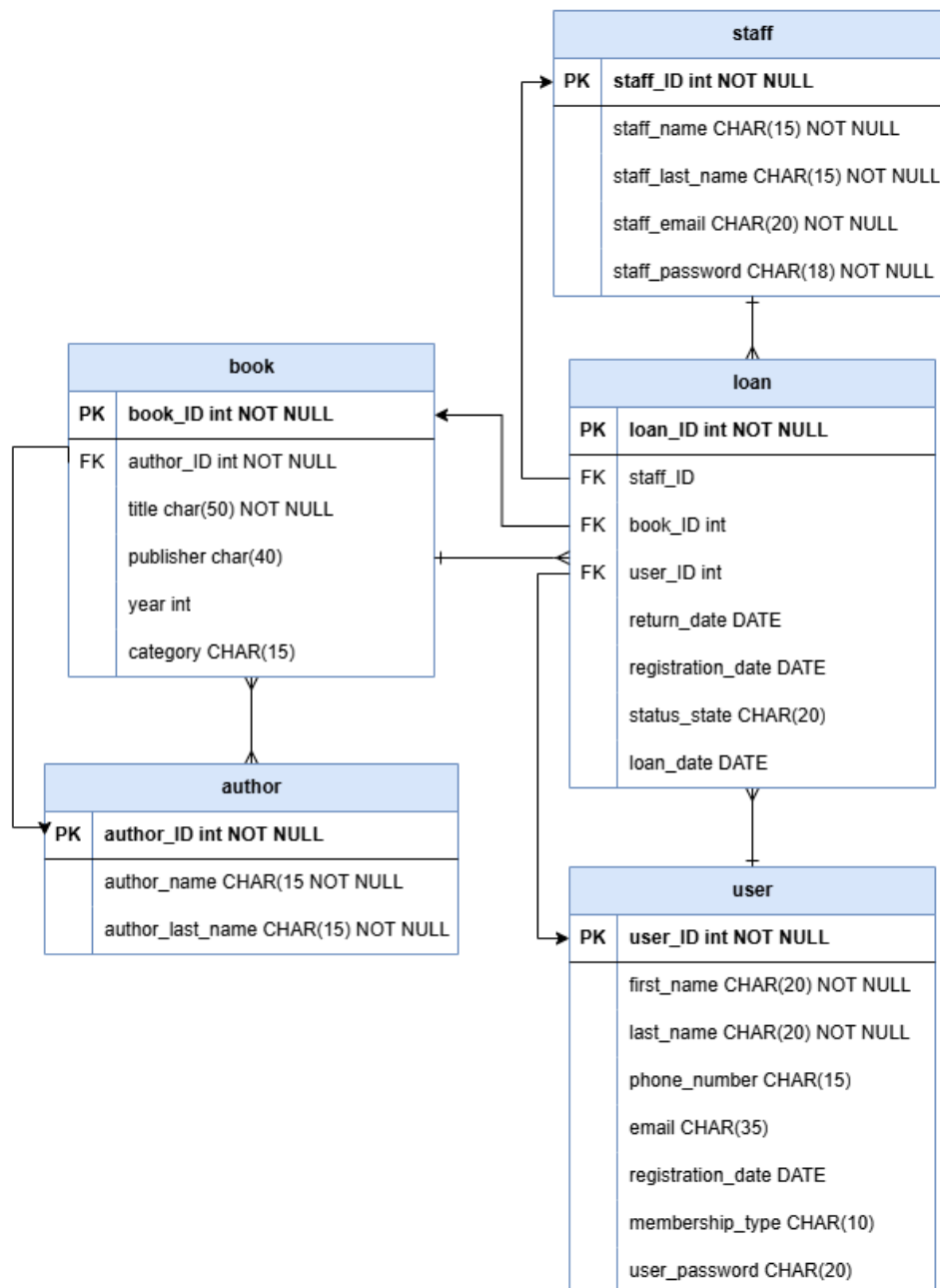


Figure 1. ER relationship of the tables.

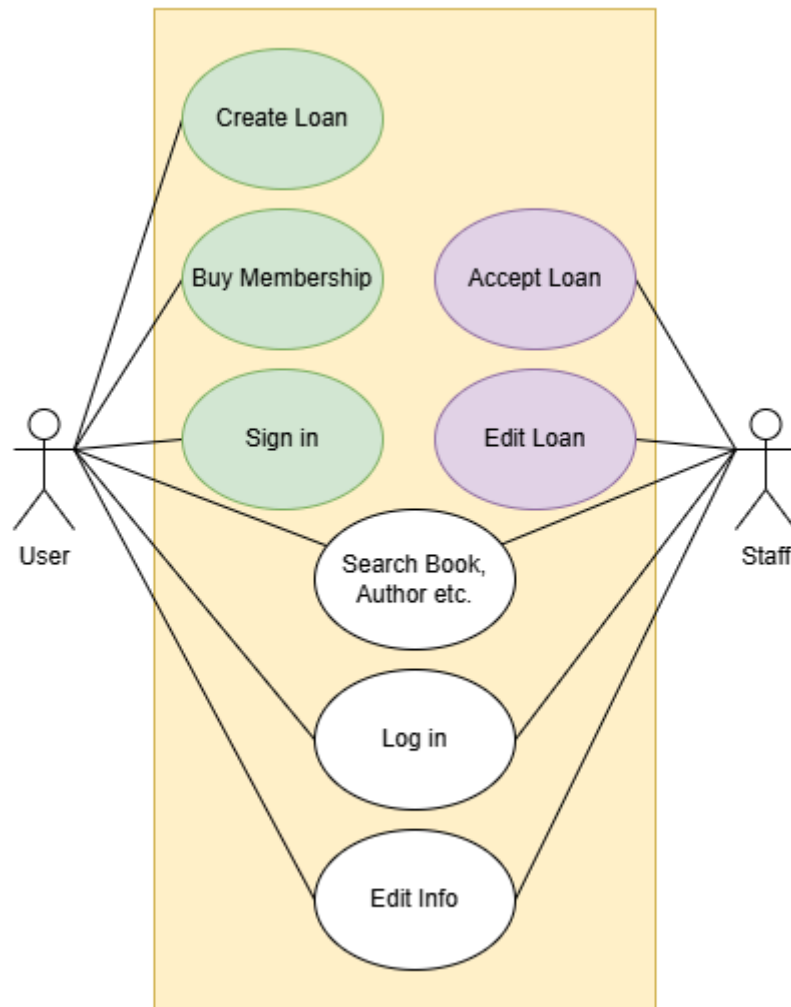


Figure 2. UML diagram of tool.

The relationship between the main entities in the database, such as books, members, and borrowing records is shown in Figure 1. This ER diagram defines how the tables are structured and linked, enabling efficient data organization for the library management system.

The overall system interactions and user roles within the application are shown in Figure 2. This UML use case diagram illustrates the functionalities available to two main actors: User and Staff. Users can perform actions such as signing in, buying a membership, creating a loan request, searching for books or authors, logging in, and editing their personal information. Staff members, on the other hand, are responsible for actions such as accepting loan requests and editing loan details, alongside shared functions like search, login, and editing information. This diagram provides a clear overview of how different roles interact with the system's core features.

3. Application Screenshots

3.1. Main Menu

When the application is launched, a login screen appears as shown in Figure 3. Users are required to enter their email and password to access the system. If incorrect credentials are entered, an error message is displayed, as illustrated in Figure 4. The email and password inputs are validated by checking the corresponding records in the database. Moreover, if the staff wants to log in, he/she must select the Staff box.

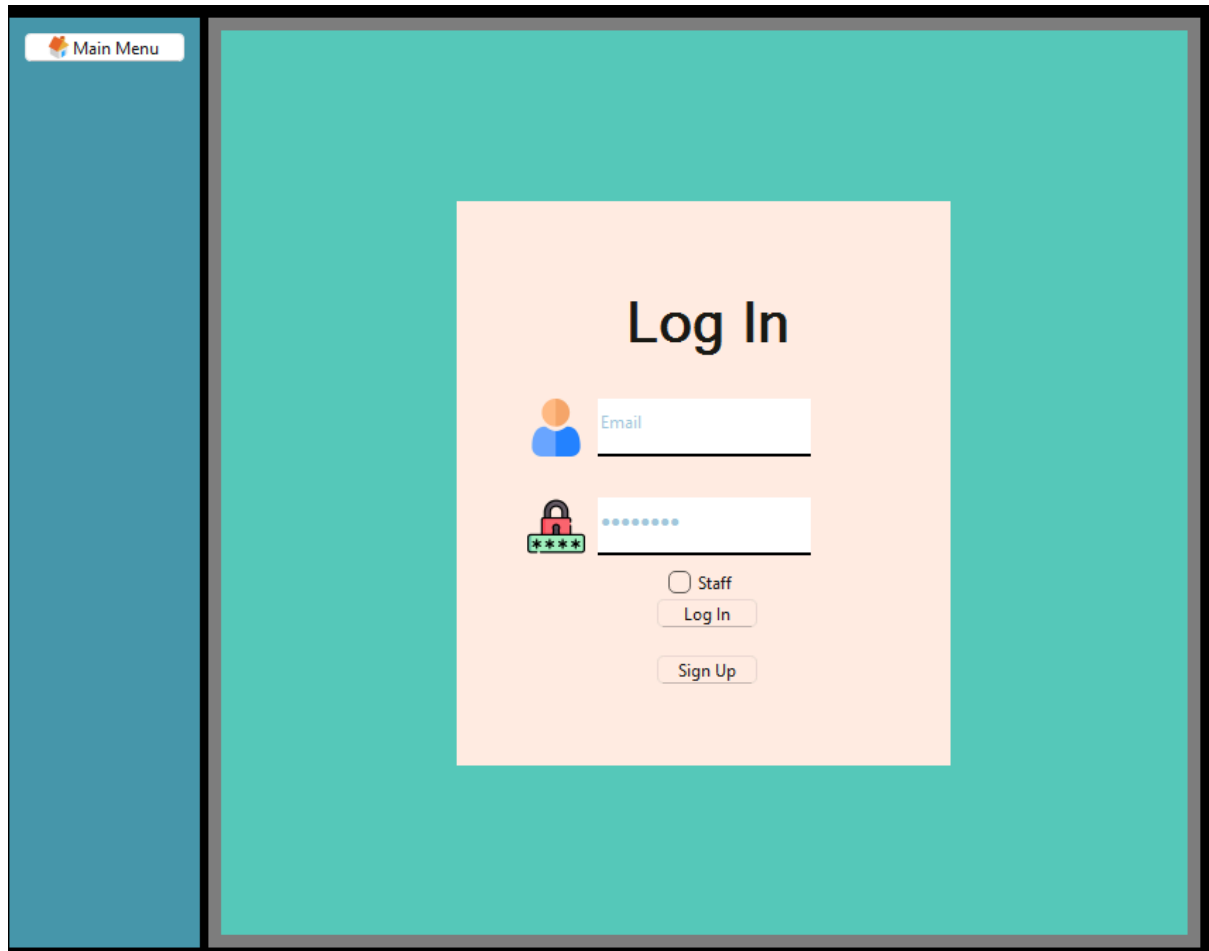


Figure 3. The login screen of the application.

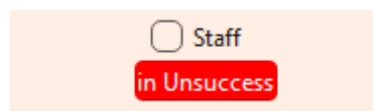
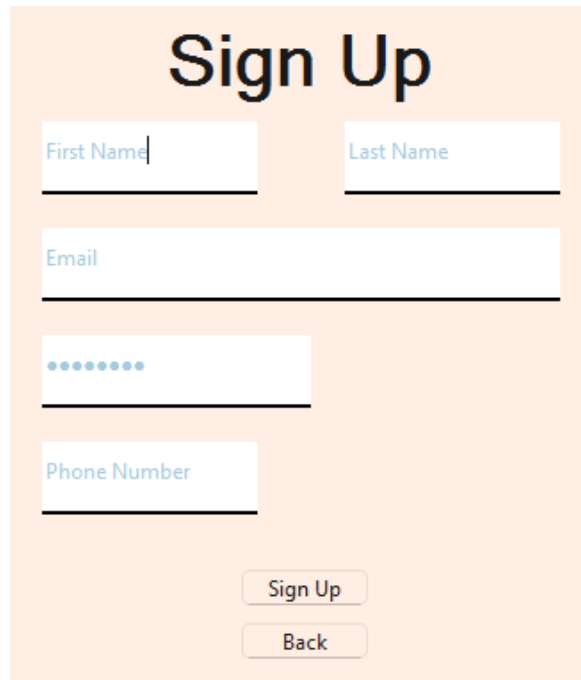


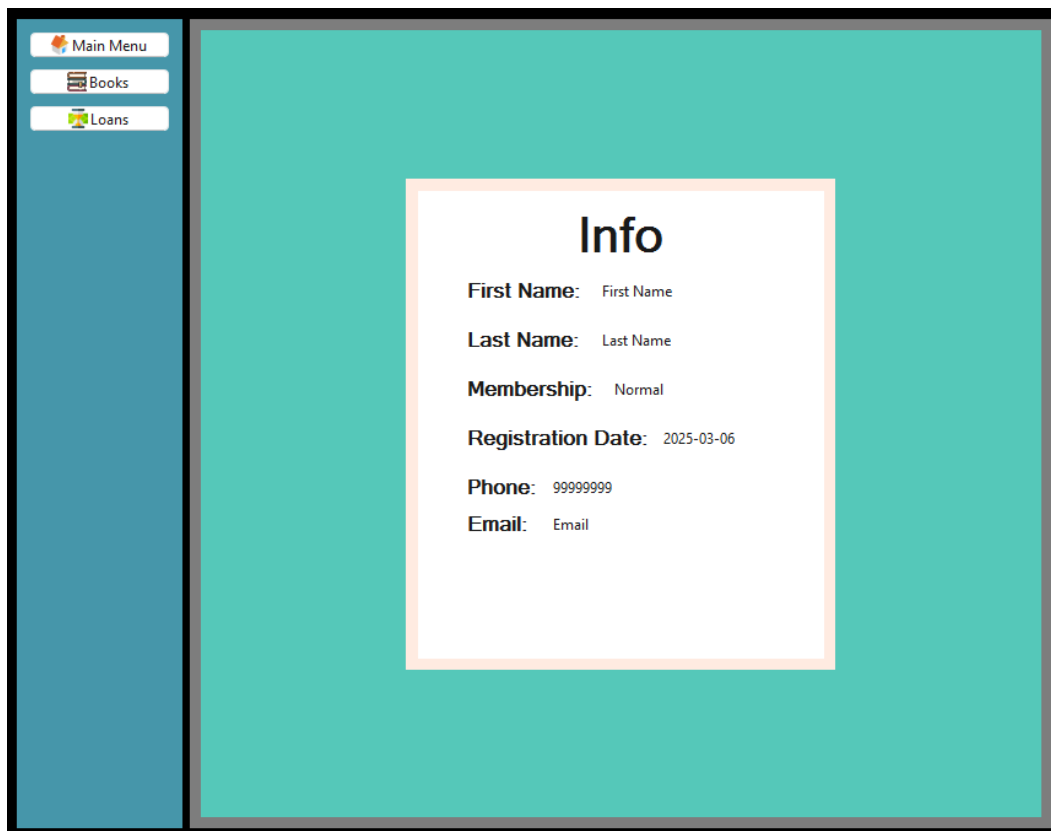
Figure 4. Unsuccess error message of log in.

Users can sign up by clicking the Sign Up button. After that, the registration page will be displayed, where users can enter their information to create a new account as shown in Figure 5. After the success login users can see their info in the Main Menu.



The Sign Up form is displayed on a light orange background. It features a title "Sign Up" at the top. Below the title are four input fields: "First Name", "Last Name", "Email", and "Phone Number". The "Email" field is wider than the others. Below the input fields are two buttons: "Sign Up" and "Back".

Figure 5. Sign up page of the application.



The User/Staff Information page is displayed on a teal background. It features a title "Info" at the top. Below the title are six rows of information: "First Name: First Name", "Last Name: Last Name", "Membership: Normal", "Registration Date: 2025-03-06", "Phone: 99999999", and "Email: Email".

Figure 6. User/staff information of the application.

3.2. Books Menu

Users can search for books using the Books menu located on the left side of the application, as shown in Figure 7. On this page, users are able to search and filter books based on different criteria. If a user wants to search for a specific book by name or a part of the name, they can enter the title and click the Search button. Alternatively, users can leave the search field empty to display all available books. Additionally, they can search for books by a specific author. These cases are demonstrated in Figures 7, 8, and 9.

Moreover, users can filter the book list by categories such as Romance, Horror, Fantasy, and others. They also have the option to search for books published within a specific time range. These filtering options are shown in Figures 10 and 11.

The screenshot displays the 'Books' menu of an application. On the left, a sidebar contains 'Main Menu', 'Books', and 'Loans' buttons. The main area features search fields for 'Book Name' and 'Author Name', a 'Search' button, and a 'Category' filter with radio buttons for Romance, Horror, Fantasy, Travel, Short Story, History, Science Fiction, and Adventure. Below the category filter is a 'Year' filter with a 'Between' range (1755 to 2026) and a 'Filter' button. The central table lists books with columns for Title, Book ID, Author Name, Last Name, Year, and Category. The table contains 19 rows of data, including titles like 'Pride and Prejudice', 'Sense and Sensibility', 'Emma', 'The Shining', 'It', 'Carrie', 'Dracula', 'Frankenstein', 'The Hobbit', 'The Lord of the Rings', 'Harry Potter and the Sorcerer's Stone', 'The Great Railway Bazaar', 'Dark Star Safari', 'The Tell-Tale Heart', 'The Black Cat', 'The Lottery', 'Sapiens', 'Homo Deus', and 'Guns, Germs, and Steel'.

	Title	Book ID	Author Name	Last Name	Year	Category
1	Pride and Prejudice	1	Jane	Austen	1813	Romance
2	Sense and Sensibility	2	Jane	Austen	1811	Romance
3	Emma	3	Jane	Austen	1815	Romance
4	The Shining	4	Stephen	King	1977	Horror
5	It	5	Stephen	King	1986	Horror
6	Carrie	6	Stephen	King	1974	Horror
7	Dracula	7	Bram	Stoker	1897	Horror
8	Frankenstein	8	Mary	Shelley	1818	Horror
9	The Hobbit	9	J.R.R.	Tolkien	1937	Fantasy
10	The Lord of the Rings	10	J.R.R.	Tolkien	1954	Fantasy
11	Harry Potter and the Sorcerer's Stone	11	J.R.R.	Tolkien	1997	Fantasy
12	The Great Railway Bazaar	12	Paul	Theroux	1975	Travel
13	Dark Star Safari	13	Paul	Theroux	2002	Travel
14	The Tell-Tale Heart	14	Edgar	Poe	1843	Short Story
15	The Black Cat	15	Edgar	Poe	1843	Short Story
16	The Lottery	16	Edgar	Poe	1948	Short Story
17	Sapiens	17	Yuval	Harari	2011	History
18	Homo Deus	18	Yuval	Harari	2016	History
19	Guns, Germs, and Steel	19	Yuval	Harari	1997	History

Figure 7. Books menu of application.

Book Name: Author Name:

Category

☐ Romance

☐ Horror

☐ Fantasy

☐ Travel

☐ Short Story

☐ History

☐ Science Fiction

☐ Adventure

Year

Between

	Title	Book ID	Author Name	Last Name	Year	Category
1	The Shining	4	Stephen	King	1977	Horror
2	The Hobbit	9	J.R.R.	Tolkien	1937	Fantasy
3	The Lord of the Rings	10	J.R.R.	Tolkien	1954	Fantasy
4	Harry Potter and the Sorcerer's Stone	11	J.R.R.	Tolkien	1997	Fantasy
5	The Great Railway Bazaar	12	Paul	Theroux	1975	Travel
6	The Tell-Tale Heart	14	Edgar	Poe	1843	Short Story
7	The Black Cat	15	Edgar	Poe	1843	Short Story
8	The Lottery	16	Edgar	Poe	1948	Short Story
9	The War of the Worlds	22	H.G.	Wells	1898	Science Fiction
10	Around the World in 80 Days	25	Jules	Verne	1873	Adventure
11	Twenty Thousand Leagues Under the Sea	26	Jules	Verne	1870	Adventure
12	The Odyssey	27	Homer		-700	Adventure
13	The Old Man and the Sea	28	Ernest	Hemingway	1952	Adventure

Figure 8. Filtered search of the books menu with a book name.

Book Name: Author Name:

Category

☐ Romance

☐ Horror

	Title	Book ID	Author Name	Last Name	Year	Category
1	The Hobbit	9	J.R.R.	Tolkien	1937	Fantasy
2	The Lord of the Rings	10	J.R.R.	Tolkien	1954	Fantasy
3	Harry Potter and the Sorcerer's Stone	11	J.R.R.	Tolkien	1997	Fantasy

Figure 9. Filtered search of the books menu with an author name.

Category

☒ Romance

☐ Horror

☒ Fantasy

☒ Travel

☐ Short Story

☐ History

☐ Science Fiction

☐ Adventure

	Title	Book ID	Author Name	Last Name	Year	Category
1	Pride and Prejudice	1	Jane	Austen	1813	Romance
2	Sense and Sensibility	2	Jane	Austen	1811	Romance
3	Emma	3	Jane	Austen	1815	Romance
4	The Hobbit	9	J.R.R.	Tolkien	1937	Fantasy
5	The Lord of the Rings	10	J.R.R.	Tolkien	1954	Fantasy
6	Harry Potter and the Sorcerer's Stone	11	J.R.R.	Tolkien	1997	Fantasy
7	The Great Railway Bazaar	12	Paul	Theroux	1975	Travel
8	Dark Star Safari	13	Paul	Theroux	2002	Travel

Figure 10. Filtered search of the books menu with a category filtered.

Category

☒ Romance
 ☐ Horror
 ☒ Fantasy
 ☒ Travel
 ☐ Short Story
 ☐ History
 ☐ Science Fiction
 ☐ Adventure

Year

Between

	Title	Book ID	Author Name	Last Name	Year	Category
1	The Hobbit	9	J.R.R.	Tolkien	1937	Fantasy
2	The Lord of the Rings	10	J.R.R.	Tolkien	1954	Fantasy
3	Harry Potter and the Sorcerer's Stone	11	J.R.R.	Tolkien	1997	Fantasy
4	The Great Railway Bazaar	12	Paul	Theroux	1975	Travel
5	Dark Star Safari	13	Paul	Theroux	2002	Travel

Figure 11. Filtered search of the books menu with category and time filtered.

3.3. Loans Menu

In the Loans menu, users can send loan requests for books, cancel existing loan requests, or view all of their current requests, as shown in Figure 12. To request a book loan, the user enters the Book ID of the desired book and submits the request. Afterward, by clicking the Show All Loans button, the user can check the status of their loan requests.

The loan information displayed includes the Loan ID, Book ID, Book Title, Loan Date, and Loan Status. As illustrated in Figure 13, the user sends a loan request for a book with Book ID 11, and in Figure 14, they query and view this request along with previous loan records.

To delete an existing loan request, users can use the Loan ID. In Figure 15, the user deletes the loan request with Loan ID 3, and in Figure 16, they perform a query to view their updated list of loan requests.

Main Menu
Books
Loans

Loan Create

Book ID:

Create

Loan Remove

Loan ID:

Remove

Loans

Show All Loans

Figure 12. Loan page of the application.

Loan Create

Book ID:

Create

Loan Remove

Loan ID:

Remove

Loans

Show All Loans

Figure 13. A loan request made for a book with Book ID 11.

Loan Create

Book ID:

Create

Loan Remove

Loan ID:

Remove

Loans

Show All Loans

	Loan ID	Book ID	Title	Loan Date	Status
1	1	2	Sense and Sensibility	2025-04-19	Accepted
2	3	9	The Hobbit	2025-04-19	Waiting
3	4	11	Harry Potter and the Sorcerer's Stone	2025-04-19	Waiting

Figure 14. List of all loan requests including the newly created one.

Loan Create

Book ID:

Create

Loan Remove

Loan ID:

Remove

Loans

Show All Loans

	Loan ID	Book ID	Title	Loan Date	Status
1	1	2	Sense and Sensibility	2025-04-19	Accepted
2	3	9	The Hobbit	2025-04-19	Waiting
3	4	11	Harry Potter and the Sorcerer's Stone	2025-04-19	Waiting

Figure 15. Deleting a loan request using Loan ID 3.

Loan Create

Book ID:

Create

Loan Remove

Loan ID:

Remove

Loans

Show All Loans

	Loan ID	Book ID	Title	Loan Date	Status
1	1	2	Sense and Sensibility	2025-04-19	Accepted
2	4	11	Harry Potter and the Sorcerer's Stone	2025-04-19	Waiting

Figure 16. Updated list of active loan requests after deletion.

3.4. Staff Menu

If a staff member logs into the application, a Staff menu appears on the left side of the interface. Through this menu, staff members can view all loan requests, as shown in Figure 17. They are able to manage pending loan requests by entering the corresponding Loan ID and updating the status accordingly. An example of a rejected loan request is shown in Figure 18.

Main Menu

Books

Loans

Staff

Loan Edit

Loan ID:

Status:

Edit

Loans

Show All Loans

	Loan ID	Book ID	Title	Loan Date	User ID	Status	Staff ID	Return Date
1	1	2	Sense and Sensibility	2025-04-19	2	Accepted	None	None
2	4	11	Harry Potter and the Sorcerer's Stone	2025-04-19	2	Waiting	None	None

Figure 17. Staff interface displaying all loan requests in the system.

Loan Edit

Loan ID: 4

Status: Rejected

Edit

Loans

Show All Loans

	Loan ID	Book ID	Title	Loan Date	User ID	Status	Staff ID	Return Date
1	1	2	Sense and Sensibility	2025-04-19	2	Accepted	None	None
2	4	11	Harry Potter and the Sorcerer's Stone	2025-04-19	2	Rejected	None	None

Figure 18. Example of a loan request that has been rejected by a staff member.

4. Conclusion

In this project, a simple yet functional desktop application was developed to support library book management processes. By using Python in combination with the PyQt framework, a graphical user interface was designed to enable users and staff members to interact with the system efficiently. The integration of a MySQL database allowed for reliable data storage and retrieval, including user information, book records, and loan transactions.

The application offers core features such as user registration, login authentication, book search and filtering, and loan request management. Role-based functionality was also implemented, allowing staff members to review and manage user loan requests through a dedicated interface.

Throughout the development process, UML and ER diagrams were used to design and plan the system architecture. Qt Designer was utilized to create the user interface visually, streamlining the frontend development process. Object-oriented programming principles were applied to maintain a clean, modular code structure.

Overall, the project provided valuable experience in software design, UI development, database integration, and full-stack desktop application development using Python technologies.

Additional Information

This project was developed using the Qt framework with the PySide6 library for Python.

The icons and logos used in the application interface were sourced from [Flaticon](#) and are credited to the user Freepik.