



**Mukesh Patel School of Technology
Management and Engineering, Mumbai**

Department of Computer Engineering

Course - Database Management Systems

Library Management System



Faculty – Ishani Saha

Submitted by –
B029 – Aryann Dhir
B037 – Parth Jalan
(Class - B Tech CS
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Sem - IV)

Table of Contents

Content		Pg. No.
	Abstract	1
1	Introduction to the system	2
1.1	Introduction	2
1.2	Problem Statement	2
1.3	Functional requirements	3
1.4	Users of the system	4
2	System Design and Constraints	5
2.1	ER Model	5
2.2	Reduction of ER model to Relational Model	5
2.3	Schema Diagram	5
2.4	Constraints	7
2.5	Normalization	7
3	Implementation	9
3.1	Hardware and Software details	9
3.2	Tools and Libraries used	9
3.3	Screenshots and Description	10
3.4	Database structure	16
4	Conclusion and Future work	17

Abstract

Libraries rely on library management systems to manage asset collections as well as relationships with their members. Library management systems help libraries keep track of the books and their checkouts, as well as members' subscriptions and profiles. It also involves maintaining the database for entering new books and recording books that have been borrowed with their respective due dates.

Through this project we aim to build a Library Management System to handle the primary housekeeping functions of a library like maintaining a record of the books issued and their respective due dates.

Fines will also be calculated in case a book is returned late. The user has three different options to search books which are based on: title of the book, author and genre. Another useful feature provided by our system is of recommending books to users based on their individual borrowing history.

Chapter 1: Introduction to the system

1.1 Introduction

A library is a curated collection of sources of information and similar resources, selected by experts and made accessible to a defined community for reference or borrowing, often in a quiet environment conducive to study. It provides physical or digital access to material, and may be a physical location or a virtual space, or both. A library's collection can include books, periodicals, newspapers, manuscripts, films, maps, prints, documents, microform, CDs, cassettes, videotapes, DVDs, Blu-ray Discs, e-books, audiobooks, databases, and other formats. The main aim of this system is to develop a new programmed system that will convey ever lasting solution to the manual base operations and to make available a channel through which staff can maintain the records easily and customers can access information about the books and their past purchases.

Library Management System allows the user to store the book details and the customer details. The system is strong enough to withstand regressive yearly operations under conditions where the database is maintained and cleared over a certain span of time. The implementation of this system will considerably reduce data entry time. The system contains a database where all the information will be stored safely.

1.2 Problem Statement

The problem occurred before having computerized system includes:

- File lost: When computerized system is not implemented file is always lost because of human environment. Sometimes due to some human error there may be a loss of records.
- File damaged: When a computerized system is not there file is always lost due to some accident like spilling of water by some member on file accidentally. Besides some natural disaster like floods or fires may also damage the files.
- Difficult to search record: When there is no computerized system there is always a difficulty in searching of records if the records are large in number.

- Space consuming: After the number of records become large the space for physical storage of file and records also increases if no computerized system is implemented.
- Cost consuming: As there is no computerized system to add each record, paper will be needed, which will increase the cost for the management of library.

1.3 Functional Requirements

1.3.1 USER LOGIN

Description: This feature used by the user to login into the system. They are required to enter user id and password before they are allowed to enter the system. The user id and password will be verified and if invalid id is there user won't be given access.

Functional requirements:

- User ID is provided when they register.
- The system must only allow user with valid id and password to enter the system.
- The user must be able to logout after they finished using system.

1.3.2 REGISTER NEW USER

Description: This feature can be performed by all users to register new user to create account.

Functional requirements:

- System must be able to verify information to see if the username already exists.

1.3.3 SEARCH BOOK

Description: This feature is found in book issuing part. We can search a book based on its name or by any author or search any available genre.

Functional requirements:

- System must be able to search the database based on select search type.
- System must be able to filter book based on keyword entered.
- System must be able to show the filtered book in table view.

1.3.4 ISSUE BOOKS AND RETURN BOOKS

Description: This feature allows to issue and return books and also displays any fine for a book.

Functional requirements:

- System must be able to enter issue information in database.
- System must be able to update number of books of issued.
- System must be able to search if book is available or not before issuing books.
- System should be able to enter issue and return date information.

1.3.5 RECOMMEND BOOKS

Description: This feature is found in book issuing part. The system recommends a list of available books based on the user's history of books issued.

Functional requirements:

- System must be able to search the issued books database based on the username.
- System must be able to filter book based on genre and author.
- System must be able to show the filtered book in table view.

1.4 Users of the System

The system considers the user to be a member of the library where he can use the system just like how a library is used in real life.

Chapter 2: System Design and Constraints

Entities:

Book:

This table consists of details of all the books in the system. The information stored in this table includes ISBN, Title, Author, Genre, Publisher and Issued.

Member:

This table consists of details of all the member of the library. The information stored in this table includes Username and Password.

IssuedBooks:

This table consists of details of all the books issued from the library. The information stored in this table includes Username, ISBN, IssueDate, ReturnDate and Returned.

2.1, 2.2 & 2.3 ER Model, Reduction of ER Model to Relational Model & Schema Diagram

E-R Diagram:

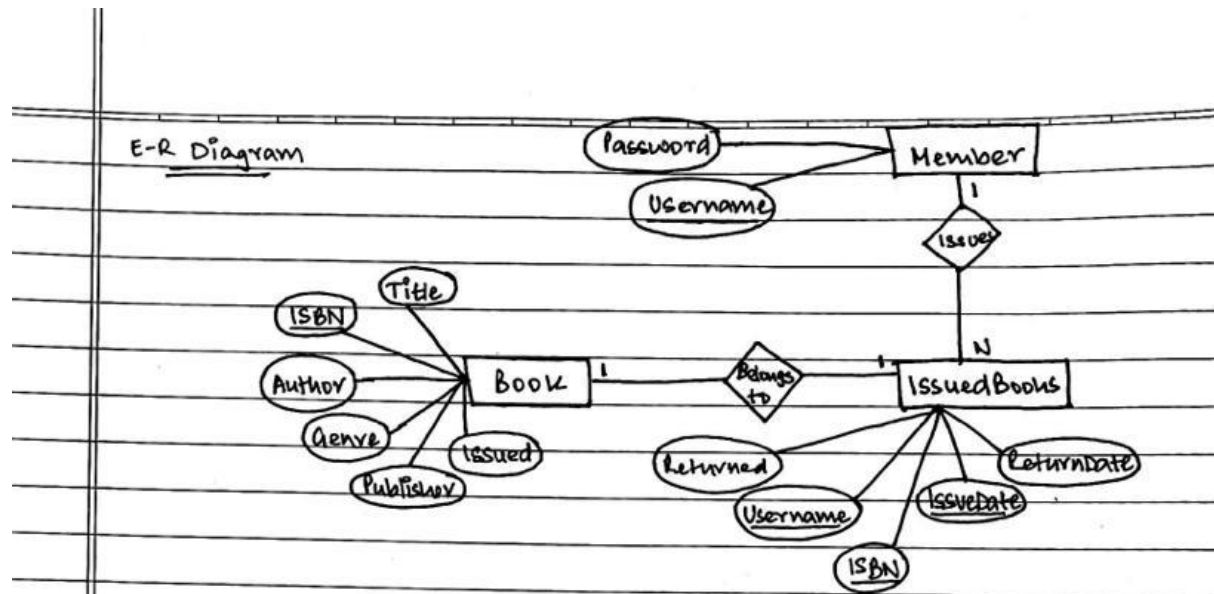
Entity Relationship Diagram is used in modern database software engineering to illustrate logical structure of database. It is a relational schema database modelling method used to Model a system and approach. This approach commonly used in database design. The diagram created using this method is called ER-diagram.

The ER-diagram depicts the various relationships among entities, considering each object as entity. Entity is represented as rectangle shape and relationship represented as diamond shape. It depicts the relationship between data object. The ER-diagram is the notation that is used to conduct the data modelling activity.

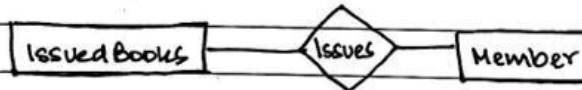
Schema Diagram:

A schema is the structure behind data organization. It is a visual representation of how different table relationships enable the schema's underlying mission

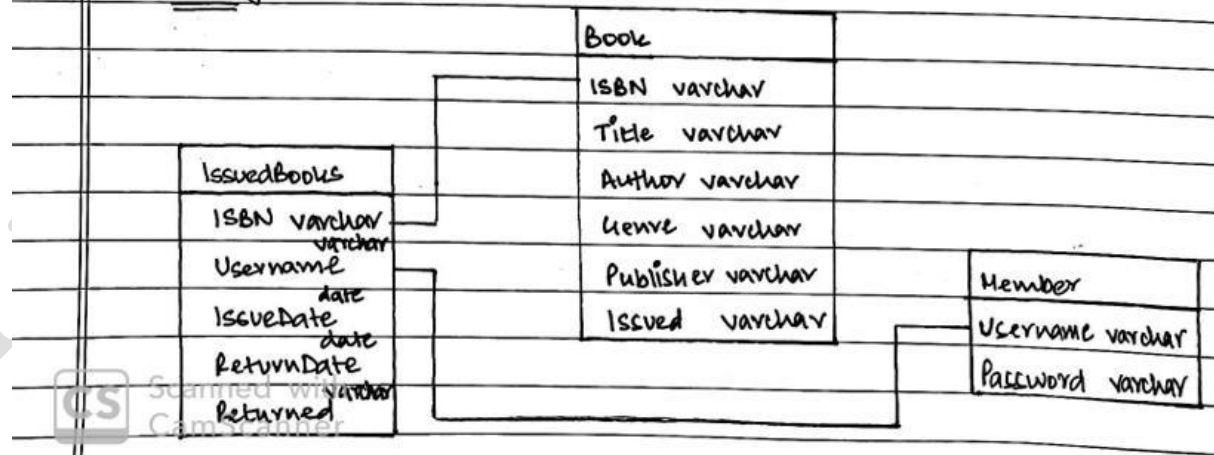
business rules for which the database is created. Database schema defines its entities and the relationship among them.



Reduction of ER Model to Relational Model



Schema Diagram



2.4 Constraints

1. Book:

ISBN should also exist in IssuedBooks table and it should be unique. *Issued* can only be “Y” or “N”.

2. Member:

Username should also exist in IssuedBooks table and it should be unique.

3. IssuedBooks:

ISBN should be unique. *Returned* can only be “Y” or “N”. *ReturnDate* value cannot be before *IssueDate*.

2.5 Normalization

Design view

The library has the following tables in its database:

1. Member (Username, Password)
2. Book (ISBN, Title, Author, Genre, Publisher, Issued)
3. IssuedBooks (ISBN, Username, IssueDate, ReturnDate, Returned)

Normalization of table

1st Normal Form

All three relations are in first normal form since there are no multi-value or composite attributes.

2nd Normal Form

The relations Member and Book are in second normal form since there are no partial dependencies. In the relation IssuedBooks there does exist a partial dependency:

IssueDate \rightarrow ReturnDate

ISBN, Username, IssueDate \rightarrow Returned

To eliminate this, we form two new relations in place of IssuedBooks:

$R_{31}(\underline{\text{IssueDate}}, \text{ReturnDate})$

$R_{32}(\text{ISBN}, \text{Username}, \text{IssueDate}, \text{Returned})$

3rd Normal Form

All four relations are in third normal form since there are no transitive dependencies.

Boyce-Codd Normal Form

All four relations are in Boyce-Codd normal form since for all the non-trivial functional dependencies in a relation, the determinant is the super/candidate key of the relation.

Chapter 3: Implementation

3.1 Hardware and Software details

SOFTWARE REQUIREMENTS

- Operating system – Windows 10 is used as the operating system as it is stable and supports more features and is more user friendly.
- Database Management System – MongoDB, a NoSQL database, is used as it is easy to maintain and retrieve records by simple queries which are in English language. The queries are easy to understand and to write. MongoDB also offers high speed, high availability, and high scalability.
- Development tools and Programming language – Python is used to write the whole code and Python Tkinter is used for designing and styling of front end.

HARDWARE REQUIREMENTS

- Intel core i7 8th generation is used as a processor because it is faster than other processors and is also reliable and stable. By using this processor we can keep on developing our project without any worries.
- 8 GB RAM is used as it will provide fast reading and writing capabilities and will in turn support the processing.

3.2 Tools and Libraries used

Tools

- PyCharm IDE is used for writing the code and developing the system.
- MongoDB Compass Community is used for analysing and understanding the contents of the database.

Libraries

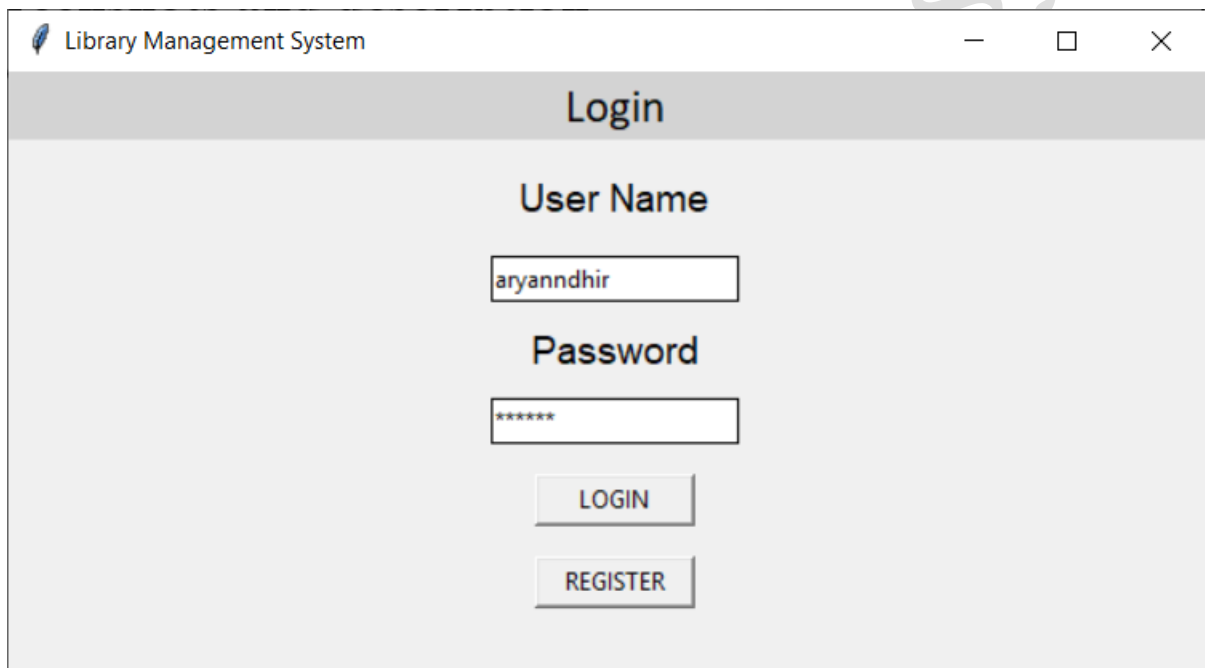
The following python libraries have been used:

- tkinter – Tkinter is the standard GUI (Graphic User Interface) library for Python. Tkinter provides a fast and easy way to create GUI applications.
- ttkthemes - The ttkthemes package contains many different themes created by many different authors to use along with Tkinter.

- pymongo – PyMongo is the official driver published by the Mongo developers to connect python with MongoDB.
- dns – The translation of domain names to IP address is managed by the python module dns.
- datetime – Datetime module supplies classes to work with date and time. These classes provide a number of functions to deal with dates, times and time intervals.

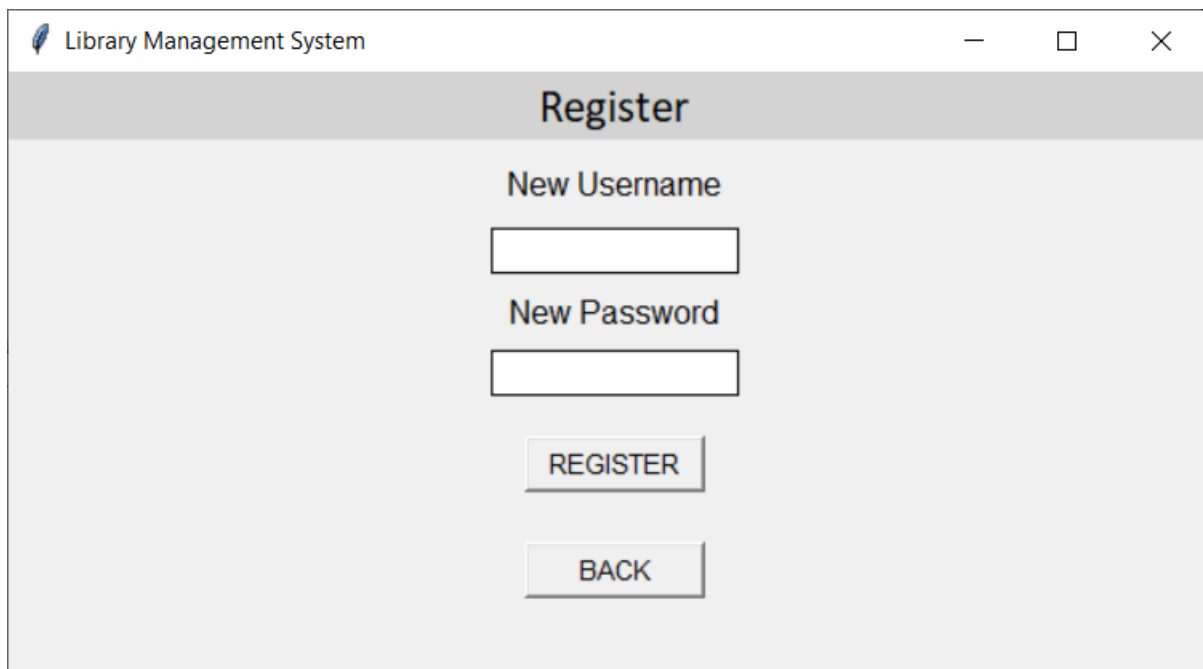
3.3 Screenshots and description

Login: Registered Users can login



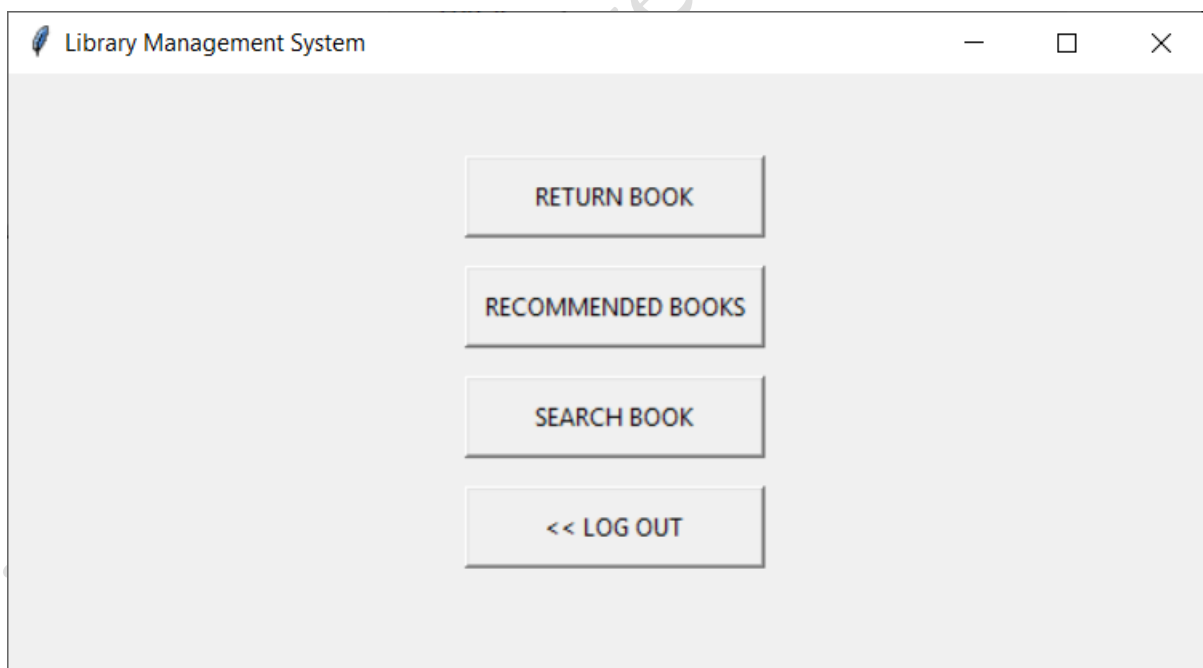
The screenshot shows a web application window titled "Library Management System". The window has a standard Windows-style title bar with minimize, maximize, and close buttons. The main content area has a light gray background. At the top, there is a dark gray header bar with the word "Login" in white text. Below the header, the text "User Name" is displayed in a bold, black font. Underneath, there is a text input field containing the username "aryanndhir". Below the username field, the text "Password" is displayed in a bold, black font. Underneath, there is a password input field filled with six asterisks "*****". At the bottom of the form, there are two buttons: "LOGIN" and "REGISTER", both in a light gray box with a thin black border and black text.

Register: New users can create an account



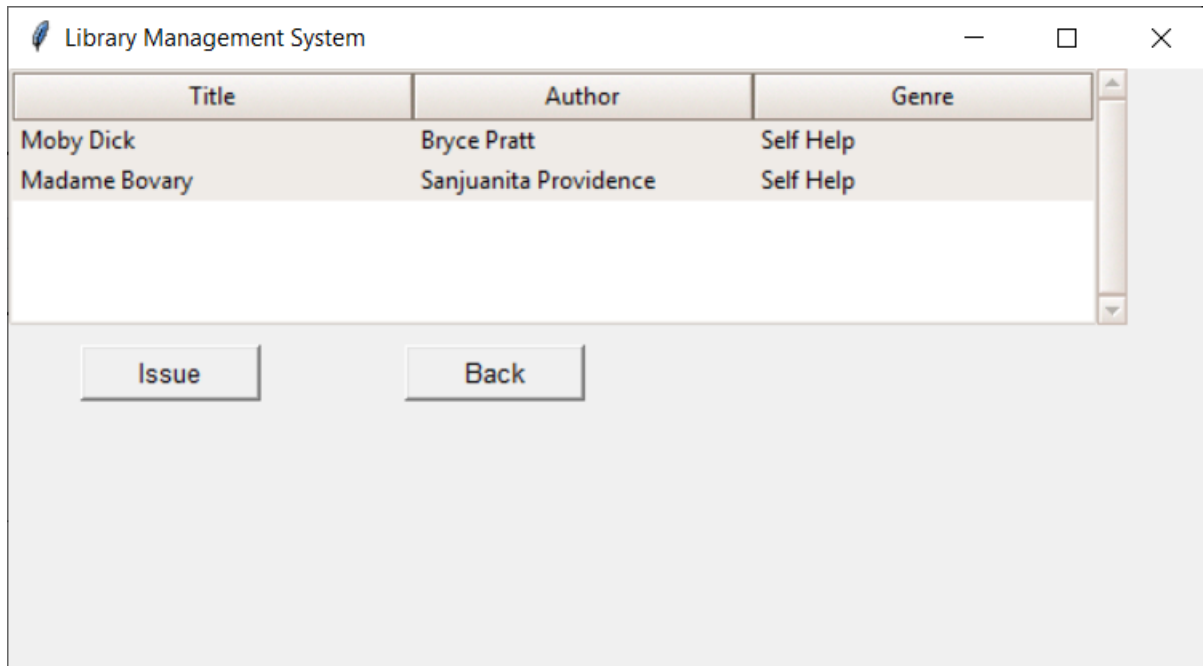
The screenshot shows a window titled "Library Management System" with a "Register" header. Below the header, there are two input fields: "New Username" and "New Password". Below these fields are two buttons: "REGISTER" and "BACK".

Home Page: The user can select any of the main functionalities

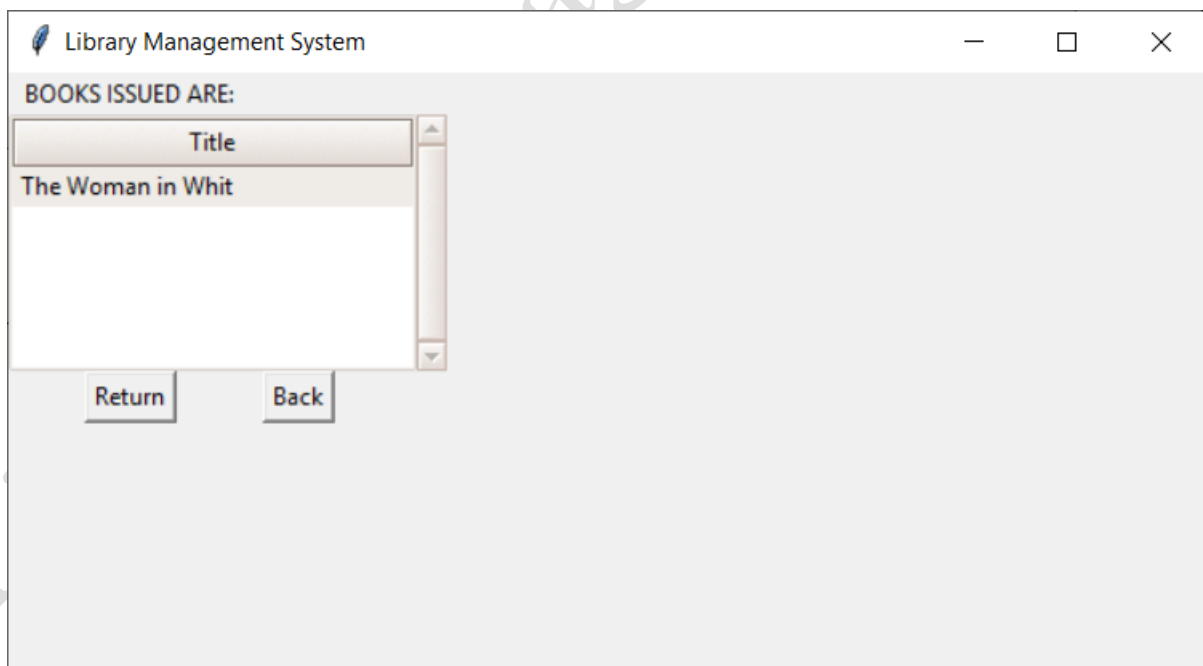


The screenshot shows a window titled "Library Management System" with a home page layout. Below the header, there are four buttons arranged vertically: "RETURN BOOK", "RECOMMENDED BOOKS", "SEARCH BOOK", and "<< LOG OUT".

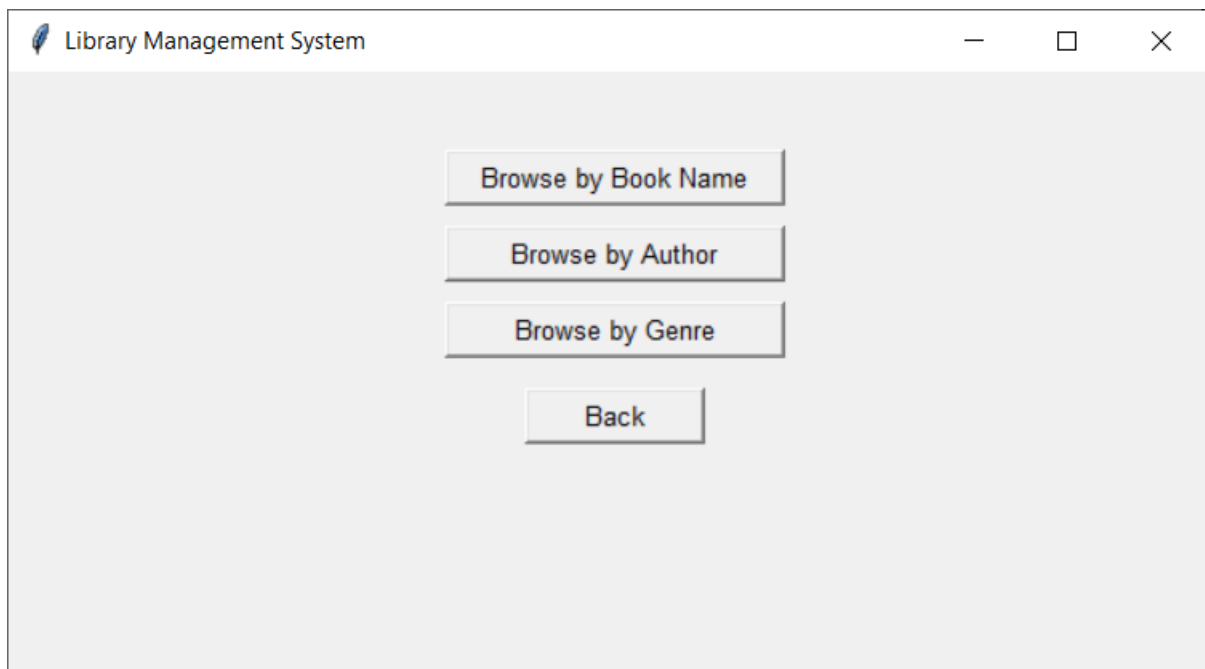
Recommended: Set of recommended books is displayed for the user to select. If the user is new then the most popular books are displayed



Return Book: The user can returned any issued book and see the fine if applicable

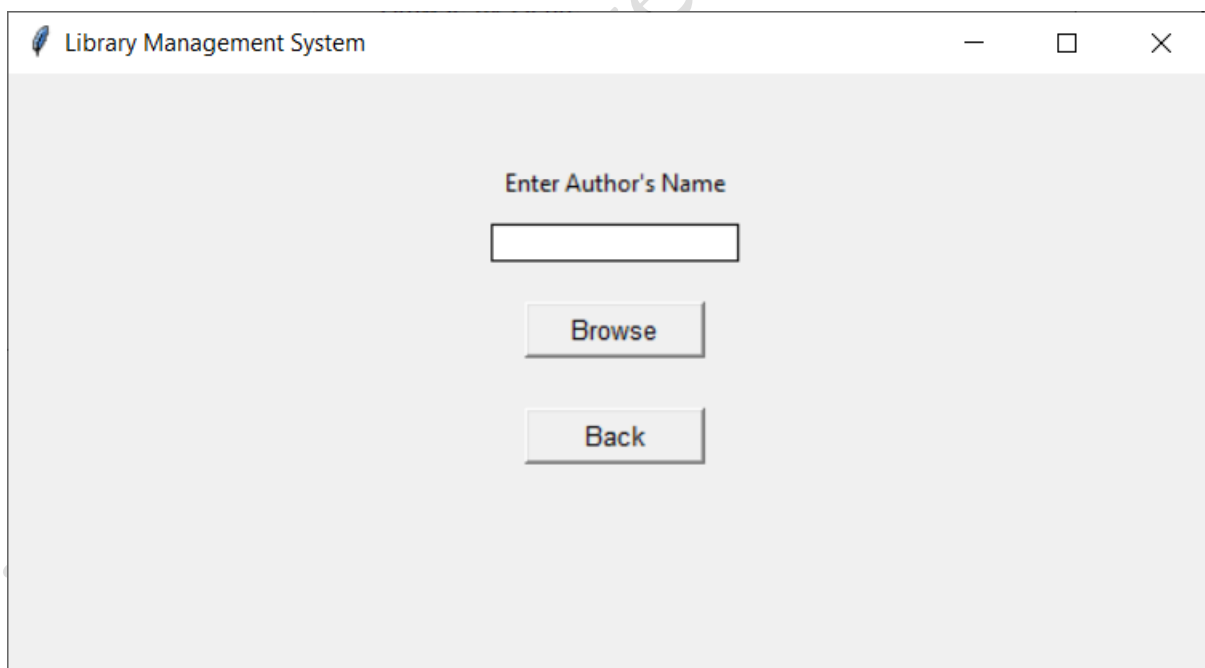


Search Books: The user can search for a book based on author/genre/title

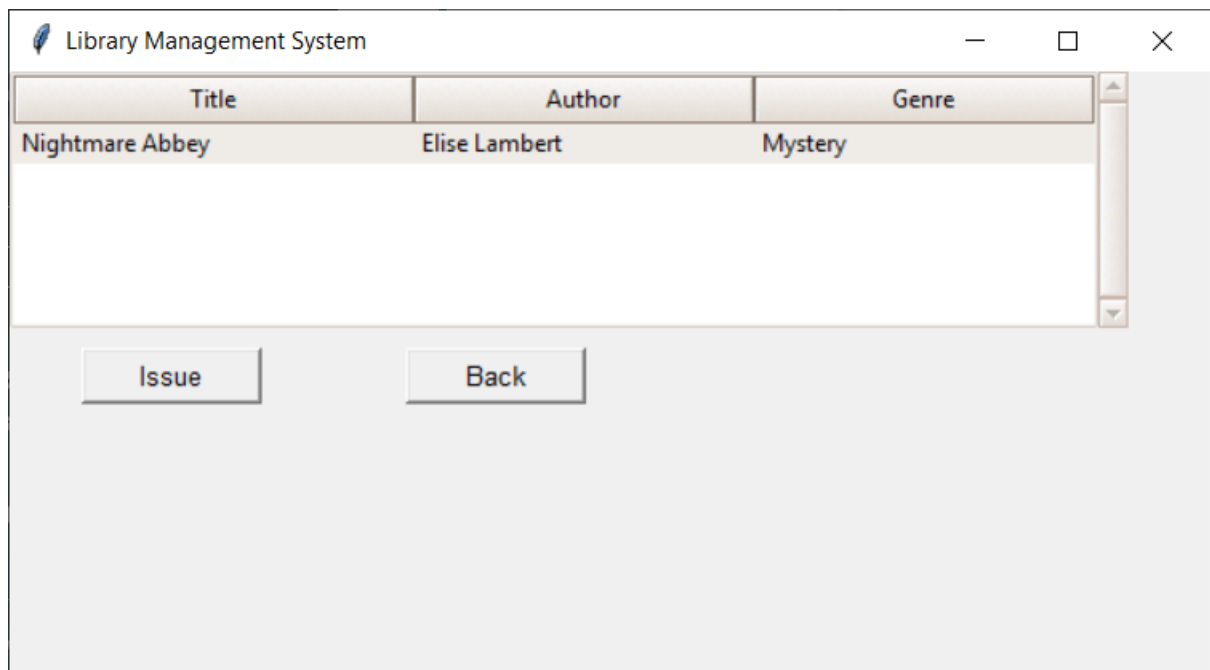


A screenshot of a software window titled "Library Management System". The window has a light gray background and contains four buttons stacked vertically in the center. The buttons are labeled "Browse by Book Name", "Browse by Author", "Browse by Genre", and "Back". Each button has a thin black border and a slight shadow effect.

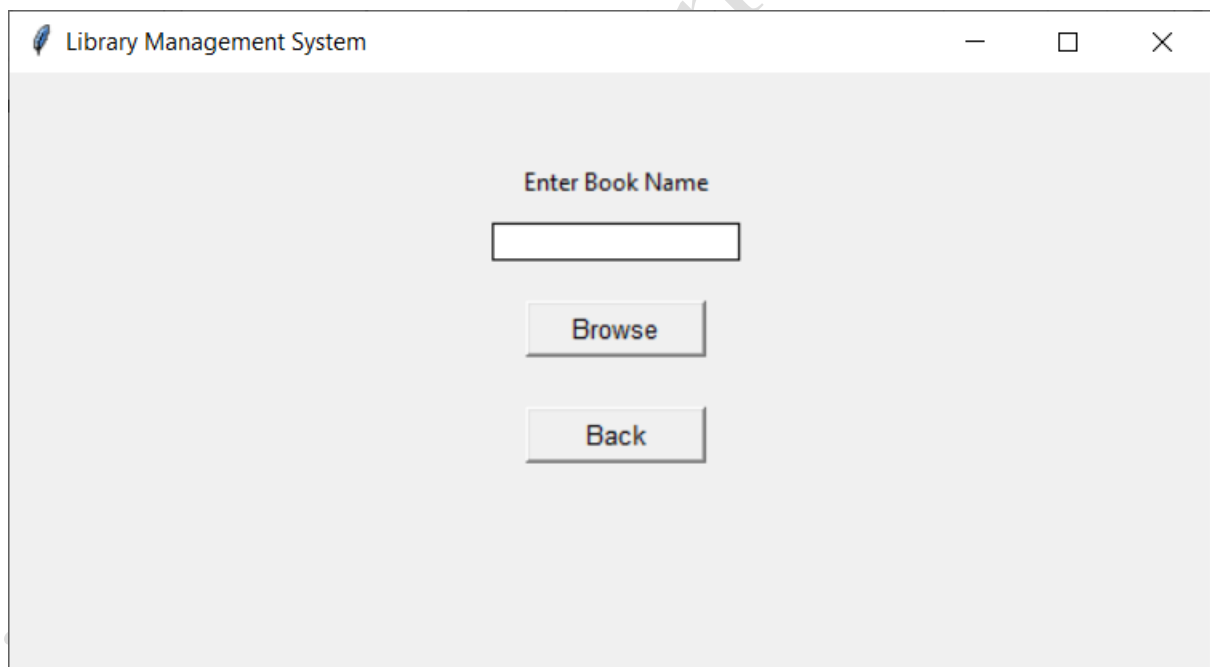
Search By Author: Searches based on Author's Name

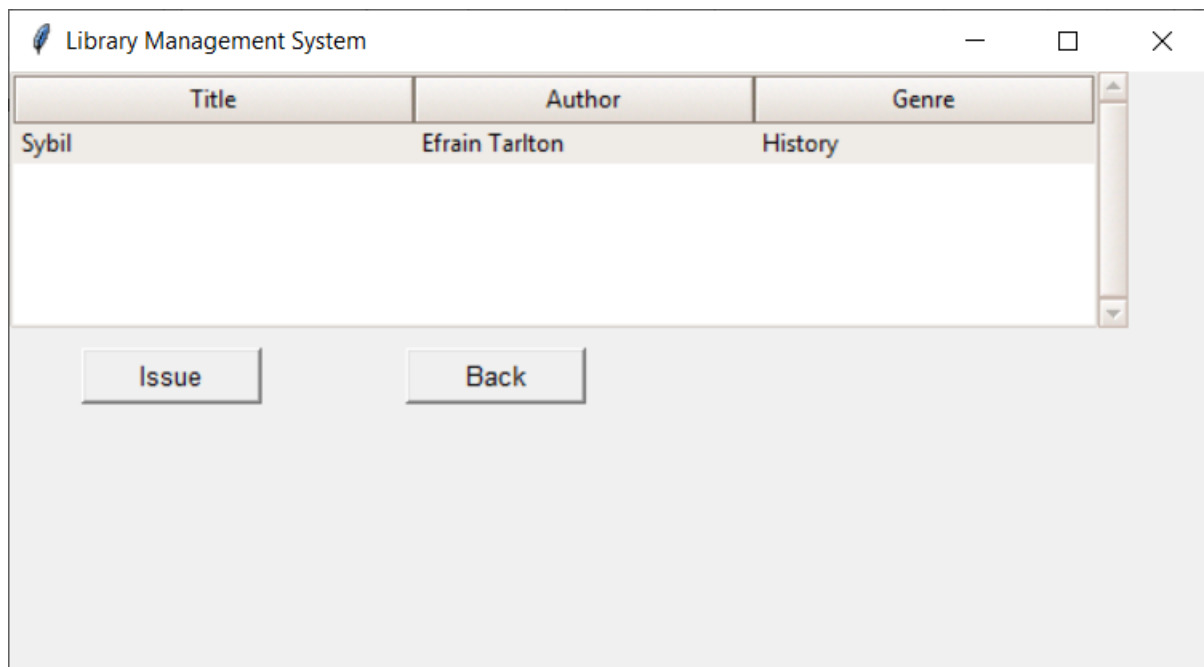


A screenshot of a software window titled "Library Management System". The window has a light gray background and contains a text input field and two buttons. The text input field is labeled "Enter Author's Name" and is empty. Below the input field are two buttons labeled "Browse" and "Back", stacked vertically. Each button has a thin black border and a slight shadow effect.

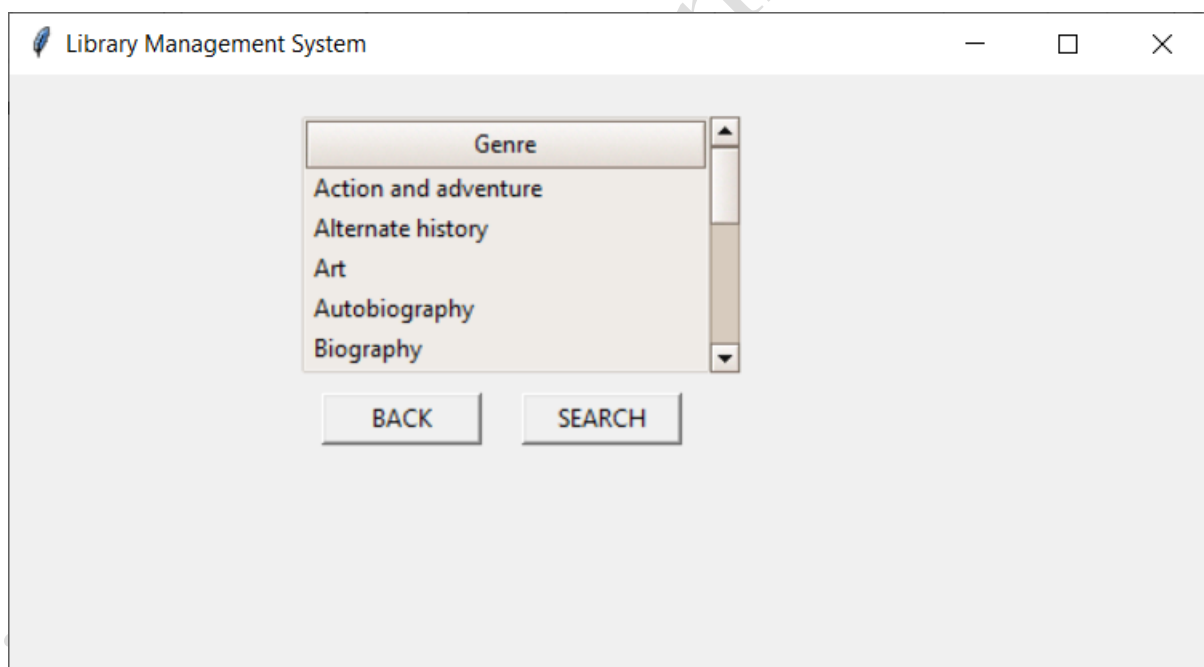


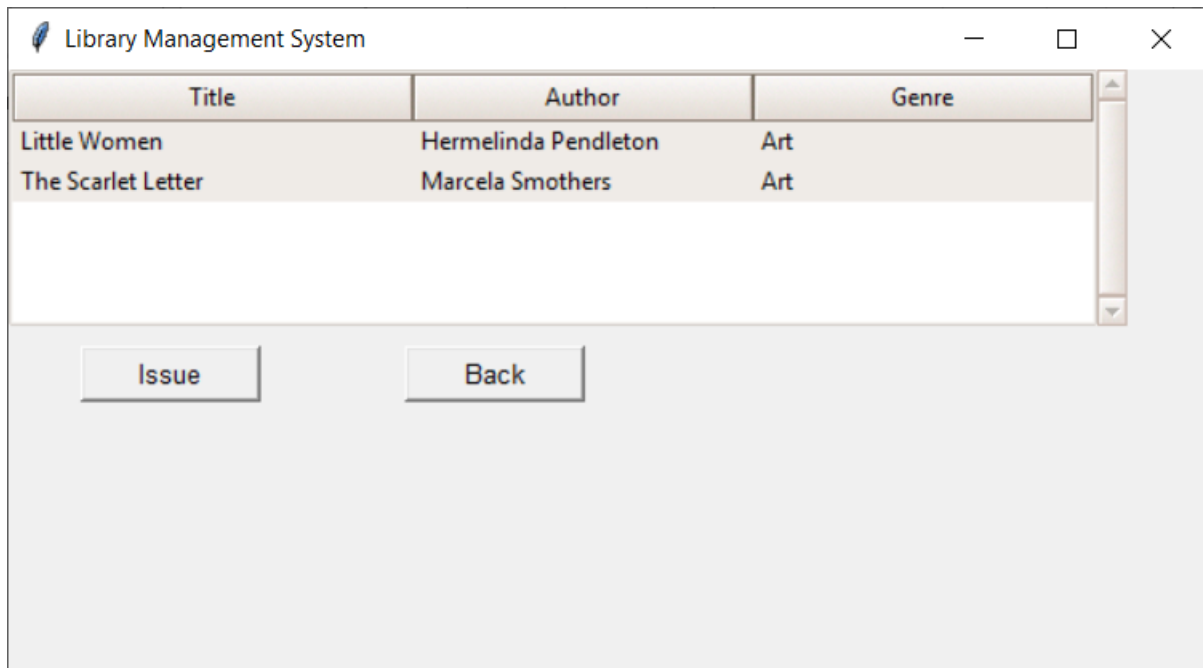
Search By Title: Searches based on Title





Search By Genre: List of all genres is displayed for the user to select





3.4 Database structure

1. Book

ISBN : "0 1763 9957 7 "	String
Title : "Don Quixote "	String
Author : "Natalya Gauthier "	String
Genre : "Action and adventure "	String
Publisher : "Penguin Random House "	String
Issued : "Y "	String

2. IssuedBooks

Username : "parthjalan "	String
ISBN : "0 7493 7480 2 "	String
Issue date : "2020-03-07 "	String
Return date : "2020-03-14 "	String
Returned : "N "	String

3.Member

Username : "aryannndhir "	String
Password : "hidean "	String

Chapter 4: Conclusion and Future Scope

This project provides a computerized version of library management system which will benefit the users as well as the staff of the library.

It makes entire process very simple where students can search and issue books, and the staff can maintain a record of the book transactions. It also has a facility for user login where one can login and can see the status of a book whether it is available or not. The user can also browse for books or ask for some recommendations.

There is a future scope to add the feature of book purchases. Apart from issuing of books a feature for issuing newspapers, magazines, DVDs, video lectures etc. can also be added.

A feature of group chat or discussion forum can also be added where people share their thoughts and views on a particular author, book series, current world issues etc. This will make it more interactive, more user friendly and ensure that the needs of the users is fulfilled in the best way possible.