Smart Library Management System using Custom Data Structures

BY:

Abhinav Saini (152405)

Sanskar Dwivedi (152452)

B.Tech(1st year)

Cluster Innovation Center

University of Delhi

Contents

1.Introduction

The Smart Library Management System is a C-based application that efficiently manages library operations using fundamental data structures such as Hash Tables, Linked Lists, Queues, Stacks, and Binary Search Trees (BST). The system provides functionalities for book inventory management, user management, searching, book issuing/returning, and report generation.

2. Project Components & Data Structures Used

Functionality	Data Structure Used	Purpose
Book Inventory Management	Hash Table (with Chaining)	Efficient storage & retrieval of book details
User Management	Array of Structures	Maintain user records & borrowed books
Search Functionality	Binary Search Tree (BST)	Fast searching by title
Book Issue & Return	Queue (FIFO)	Manage book requests in order
Report Generation	Frequency Counter	Track most borrowed books

3. Program Execution & Screenshots

3.1 Menu-Driven Interface

The program provides an interactive menu with the following options:
1. Add a Book
2. Add a User
3. Issue a Book
4. Return a Book
5. Search by ISBN
6. Search by Title
7. Show Borrowed Books
8. Most Borrowed Book
9. Exit

3.2 Screenshots

Adding Books

```
PS C:\Users\Abhinav Saini> cd "c:\Users\Abhinav Saini\Desktop\"

Welcome to Smart Library Management System!
Please start by adding books and registering users.

====================================================
        SMART LIBRARY MANAGEMENT SYSTEM
====================================================
1. Add Book
2. Register User
3. Search Books
4. Issue Book
5. Return Book
6. Generate Reports
7. Initialize Sample Data (Optional)
8. Exit
----------------------------------------------------
Enter your choice: 1

--- Add New Book ---
Enter ISBN: 23
Enter Title: Iron Man
Enter Author: Stan Lee
Enter Genre: Fiction
Book added successfully!
```

Adding a user

```
==================================================
        SMART LIBRARY MANAGEMENT SYSTEM
==================================================
1. Add Book
2. Register User
3. Search Books
4. Issue Book
5. Return Book
6. Generate Reports
7. Initialize Sample Data (Optional)
8. Exit
--------------------------------------------------
Enter your choice: 2

--- Register New User ---
Enter Name: Abhinav Saini
Enter Email: abhinavsaini1076@gmail.com
User registered successfully! User ID: 1
```

Issue books

```
==================================================
        SMART LIBRARY MANAGEMENT SYSTEM
==================================================
1. Add Book
2. Register User
3. Search Books
4. Issue Book
5. Return Book
6. Generate Reports
7. Initialize Sample Data (Optional)
8. Exit
--------------------------------------------------
Enter your choice: 4

--- Issue Book ---
Enter User ID: 1
Enter Book ISBN: 23
Issue request added to queue.
Book 'Iron Man' issued to Sanskar Dwivedi successfully!
```

Return book

```
==================================================
        SMART LIBRARY MANAGEMENT SYSTEM
==================================================
1. Add Book
2. Register User
3. Search Books
4. Issue Book
5. Return Book
6. Generate Reports
7. Initialize Sample Data (Optional)
8. Exit
--------------------------------------------------
Enter your choice: 5

--- Return Book ---
Enter User ID: 1
Enter Book ISBN: 23
Return request added to queue.
Book 'Iron Man' returned by Sanskar Dwivedi successfully!
```

Search by ISBN

```
====================================================
        SMART LIBRARY MANAGEMENT SYSTEM
====================================================
1. Add Book
2. Register User
3. Search Books
4. Issue Book
5. Return Book
6. Generate Reports
7. Initialize Sample Data (Optional)
8. Exit
----------------------------------------------------
Enter your choice: 3

--- Search Books ---
1. Search by ISBN
2. Search by Title
3. Search by Author
4. Display all books
Enter choice: 1
Enter ISBN: 23

Book Found:
ISBN: 23
Title: Iron Man
Author: Stan Lee
Genre: Sci-Fi
Available: Yes
Borrow Count: 1
```

Search by Title

```
=================================================
        SMART LIBRARY MANAGEMENT SYSTEM
=================================================
1. Add Book
2. Register User
3. Search Books
4. Issue Book
5. Return Book
6. Generate Reports
7. Initialize Sample Data (Optional)
8. Exit
-------------------------------------------------
Enter your choice: 3

--- Search Books ---
1. Search by ISBN
2. Search by Title
3. Search by Author
4. Display all books
Enter choice: 2
Enter Title: The Blue Umbrella

Book Found:
ISBN: 79
Title: The Blue Umbrella
Author: Ruskin Bond
Genre: Humorous
Available: Yes
Borrow Count: 0
```

Active Users (Users with borrowed books)

```
================================================
       SMART LIBRARY MANAGEMENT SYSTEM
================================================
1. Add Book
2. Register User
3. Search Books
4. Issue Book
5. Return Book
6. Generate Reports
7. Initialize Sample Data (Optional)
8. Exit
--------------------------------------------------
Enter your choice: 6

--- Reports ---
1. Currently Borrowed Books
2. Most Borrowed Books
3. Active Users
4. All Users Summary
Enter choice: 3

--- Active Users (Users with borrowed books) ---
User ID: 2
Name: Abhinav Saini.
Email: abhinavsaini1076@gmail.com
Books Borrowed: 2
Borrowed Books: The Blue Umbrella; Iron Man;
------------------------------
```

Most borrowed Books

```
================================================
       SMART LIBRARY MANAGEMENT SYSTEM
================================================
1. Add Book
2. Register User
3. Search Books
4. Issue Book
5. Return Book
6. Generate Reports
7. Initialize Sample Data (Optional)
8. Exit
--------------------------------------------------
Enter your choice: 6

--- Reports ---
1. Currently Borrowed Books
2. Most Borrowed Books
3. Active Users
4. All Users Summary
Enter choice: 2

--- Most Borrowed Books ---
ISBN              Count      Title
--------------------------------------------------
23                2          Iron Man
79                1          The Blue Umbrella
```