

**Sri Sivasubramaniya Nadar College of Engineering, Kalavakkam – 603  
110 (An Autonomous Institution, Affiliated to Anna University, Chennai)**

**Department of Computer Science and Engineering II Year M.Tech Integrated CSE (III  
Semester)**

**Java Programming lab – MINI PROJECT REPORT**

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**Library Management System**

**PROBLEM STATEMENT:**

In academic institutions, public libraries, and community centers, the effective management of books and members is critical to fostering an environment of learning and information accessibility. However, many libraries continue to rely on outdated manual processes or simplistic digital systems that fail to adequately address the complexities of modern library operations. This leads to several significant challenges:

- 1. Inefficient Record Management:** Libraries often rely on manual or outdated systems for tracking books and member information, leading to errors and difficulties in managing inventory.
- 2. Limited Member Access:** Current systems may not provide easy access for members to search for books or manage their accounts, resulting in reduced engagement and satisfaction.
- 3. Cumbersome Inventory Control:** Maintaining accurate records of book availability and tracking issued books can be challenging, impacting decision-making for acquisitions and removals.
- 4. Overwhelmed Staff:** High volumes of book transactions (issues and returns) require a streamlined process to avoid long wait times for library patrons.
- 5. Inadequate Fines Management:** Many libraries lack an efficient method for tracking overdue fines, which can lead to lost revenue and challenges in member accountability.

The Library Management System aims to automate these processes, and providing reliable record-keeping.

## **MOTIVATION OF THE PROBLEM:**

1. **Enhanced User Experience:** A well-structured library management system improves user experience by allowing members to easily search for books, manage their accounts, and access library services online.
2. **Operational Efficiency:** Automating the management of books and member records reduces the time and effort required by library staff, allowing them to focus on more valuable tasks such as community engagement and programming.
3. **Accurate Record-Keeping:** Implementing a digital solution ensures accurate tracking of books, members, and transactions, minimizing human errors and improving data integrity for better decision-making.
4. **Adaptation to Digital Trends:** As libraries evolve into community hubs, leveraging technology to modernize operations aligns with broader societal trends toward digital transformation and enhances the library's role in the community.

## **SCOPE AND LIMITATIONS:**

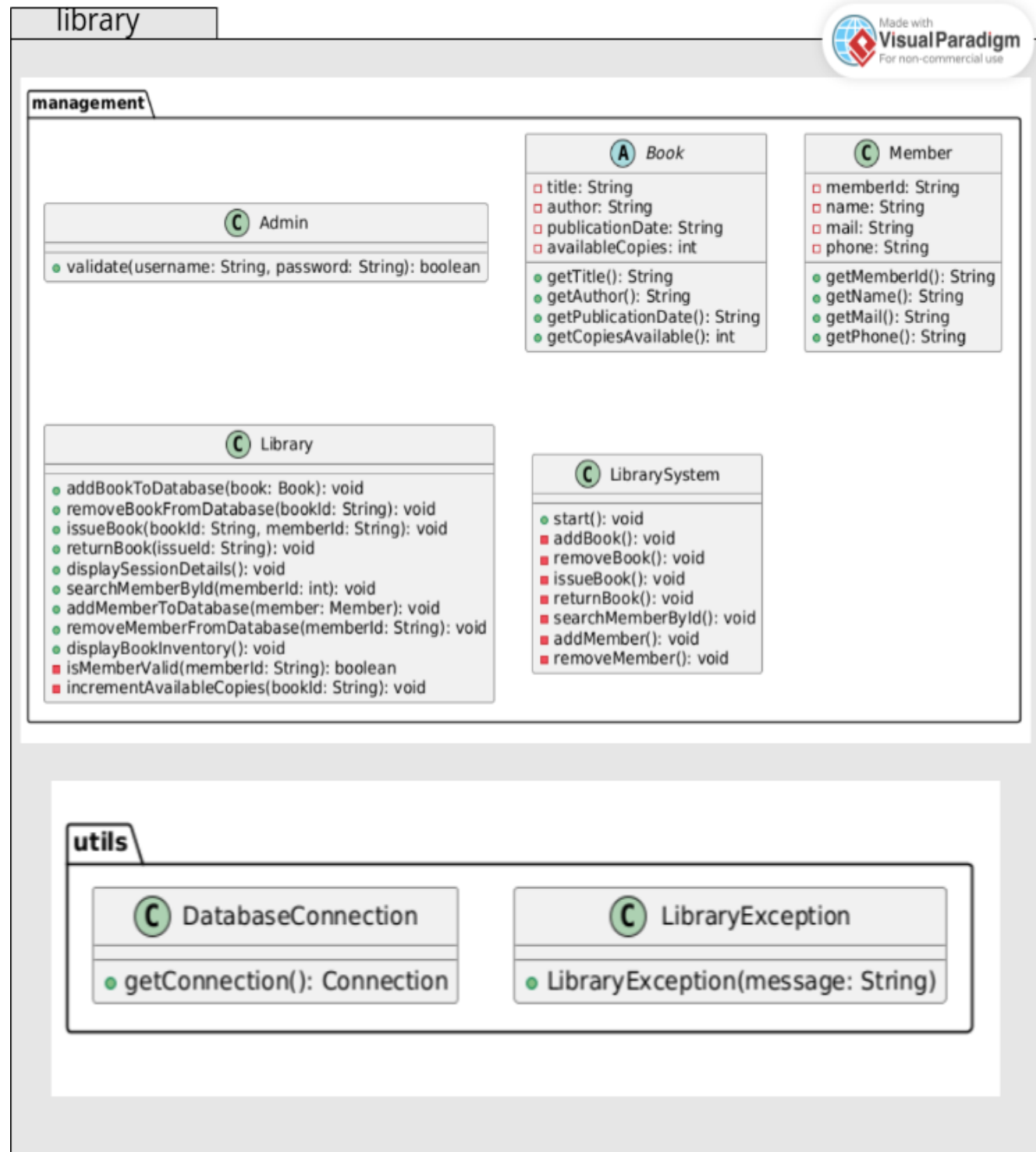
### **Scope:**

- The system is designed for managing books and members in a library setting.
- Features include adding/removing books, issuing/returning books, searching for members, and displaying inventory.
- The system is implemented in Java, utilizing JDBC for database operations.

### **Limitations:**

- **User Authentication:** The current system relies solely on username and password for authentication, which may not be secure against common attacks like brute force or phishing.
- **Limited Book Management:** The system primarily supports basic operations such as adding, removing, issuing, and returning books. It lacks advanced features like categorization, tagging, or searching for books by different criteria (e.g., genre, publication year).
- **No Reporting Features:** The system does not generate reports on library usage, such as the most issued books, late returns, or member activity, which could help in managing the library more effectively.

## CLASS DIAGRAM:



## MODULES SPLIT-UP

### 1. Book Management Module:

- Responsible for adding, removing, and managing the status of books in the library inventory.

### 2. Member Management Module:

- Manages member details and interactions, including member registration and validation.

### 3. Transaction Management Module:

- Tracks book issuance, returns, and overdue fines, providing essential functionalities for managing library transactions.

### 4. Session Management Module:

- Maintains records of operations performed during the session, allowing for detailed reporting.

## IMPLEMENTATION

The implementation leverages Java's object-oriented features to encapsulate data and behaviors. Key components of the implementation include:

- Database Operations: Use of JDBC for database connectivity and operations, handling SQL exceptions effectively.
- Error Handling: Custom exception handling using the LibraryException class to manage application-specific errors.
- Encapsulation: Classes such as Book, Member, and Library encapsulate data and provide public methods for interaction, promoting data hiding.
- The library management system integrates with a Microsoft Azure SQL Database to store and manage data related to books and members efficiently. This cloud-based database ensures high availability, scalability, and security for the application. The system establishes a connection to the database using JDBC (Java Database Connectivity), allowing seamless execution of SQL queries for operations such as adding, removing, and retrieving books and member information. Utilizing Azure's capabilities, the application can handle multiple concurrent users and large datasets without performance degradation. Additionally, the database structure supports efficient data retrieval, ensuring quick access to library records.

## OUTPUT SCREENSHOTS:

```
--- Library Management Menu ---
1. Add Book
2. Remove Book
3. Issue Book
4. Return Book
5. Search Member by ID
6. Add Member
7. Remove Member
8. Current Session Details
9. Display Book Inventory
10. Exit
Choose an option: 1
Enter Book Title: Vinland Saga
Enter Author: Ishida
Enter Publication Date (YYYY-MM-DD): 2011-08-22
Enter Number of Copies: 8
Book added successfully.
Regular Book - Title: Vinland Saga, Author: Ishida, Published: 2011-08-22, Copies Available: 8
```

```
--- Library Management Menu ---
1. Add Book
2. Remove Book
3. Issue Book
4. Return Book
5. Search Member by ID
6. Add Member
7. Remove Member
8. Current Session Details
9. Display Book Inventory
10. Exit
Choose an option: 2
Enter Book ID to remove: 32
Book removed successfully.
```

The book Vinland Saga has been added to the database and then removed using its unique id

```
--- Library Management Menu ---
1. Add Book
2. Remove Book
3. Issue Book
4. Return Book
5. Search Member by ID
6. Add Member
7. Remove Member
8. Current Session Details
9.Display Book Inventory
10. Exit
Choose an option: 3
Enter Member ID: 5
Enter Book ID to issue: 20
Book issued successfully with a due date of 2024-11-10
Book issued successfully.
```

```
--- Library Management Menu ---
1. Add Book
2. Remove Book
3. Issue Book
4. Return Book
5. Search Member by ID
6. Add Member
7. Remove Member
8. Current Session Details
9.Display Book Inventory
10. Exit
Choose an option: 4
Enter Issue ID to return: 5
Book returned successfully.

--- Library Management Menu ---
1. Add Book
2. Remove Book
3. Issue Book
4. Return Book
5. Search Member by ID
6. Add Member
7. Remove Member
8. Current Session Details
9.Display Book Inventory
10. Exit
Choose an option: 5
Enter Member ID to search: 7
ID: 7, Name: David Black, Email: david.black@example.com, Phone: 3334445555
```

Choose an option: 9

--- Book Inventory ---

ID: 1, Title: The Great Gatsby, Author: F. Scott Fitzgerald, Publication Date: 1925-04-10, Available Copies: 4  
ID: 2, Title: 1984, Author: George Orwell, Publication Date: 1949-06-08, Available Copies: 10  
ID: 3, Title: To Kill a Mockingbird, Author: Harper Lee, Publication Date: 1960-07-11, Available Copies: 8  
ID: 4, Title: Pride and Prejudice, Author: Jane Austen, Publication Date: 1813-01-28, Available Copies: 12  
ID: 5, Title: Moby-Dick, Author: Herman Melville, Publication Date: 1851-10-18, Available Copies: 4  
ID: 6, Title: War and Peace, Author: Leo Tolstoy, Publication Date: 1869-01-01, Available Copies: 6  
ID: 7, Title: The Catcher in the Rye, Author: J.D. Salinger, Publication Date: 1951-07-16, Available Copies: 7  
ID: 8, Title: The Lord of the Rings, Author: J.R.R. Tolkien, Publication Date: 1954-07-29, Available Copies: 3  
ID: 9, Title: The Hobbit, Author: J.R.R. Tolkien, Publication Date: 1937-09-21, Available Copies: 9  
ID: 10, Title: The Hobbit, Author: J.R.R. Tolkien, Publication Date: 1937-09-21, Available Copies: 9  
ID: 11, Title: Crime and Punishment, Author: Fyodor Dostoevsky, Publication Date: 1866-01-01, Available Copies: 6  
ID: 12, Title: The Brothers Karamazov, Author: Fyodor Dostoevsky, Publication Date: 1880-01-01, Available Copies: 4  
ID: 13, Title: The Divine Comedy, Author: Dante Alighieri, Publication Date: 1320-01-01, Available Copies: 5  
ID: 14, Title: Ulysses, Author: James Joyce, Publication Date: 1922-02-02, Available Copies: 3  
ID: 15, Title: Don Quixote, Author: Miguel de Cervantes, Publication Date: 1605-01-16, Available Copies: 7  
ID: 16, Title: The Odyssey, Author: Homer, Publication Date: 0800-01-01, Available Copies: 10  
ID: 17, Title: The Iliad, Author: Homer, Publication Date: 0762-01-01, Available Copies: 8  
ID: 18, Title: One Hundred Years of Solitude, Author: Gabriel Garcia Marquez, Publication Date: 1967-05-30, Available Copies: 12  
ID: 19, Title: Brave New World, Author: Aldous Huxley, Publication Date: 1932-01-01, Available Copies: 10  
ID: 20, Title: The Stranger, Author: Albert Camus, Publication Date: 1942-01-01, Available Copies: 3  
ID: 21, Title: One piece, Author: Oda, Publication Date: 1991-01-10, Available Copies: 3  
ID: 23, Title: Bleach, Author: abcd, Publication Date: 1990-09-20, Available Copies: 10  
ID: 26, Title: Berserk, Author: GUTS, Publication Date: 1991-06-21, Available Copies: 5

--- Library Management Menu ---

1. Add Book
2. Remove Book
3. Issue Book
4. Return Book
5. Search Member by ID
6. Add Member
7. Remove Member
8. Current Session Details
9. Display Book Inventory
10. Exit

Choose an option: 8

--- Current Session Details ---

Books Added:

Title: Vinland Saga ,Author:Ishida

Books Removed:

ID: 32, Title: Vinland Saga

Books Issued:

Book ID: 20 to Member ID: 5

## **OBJECT-ORIENTED FEATURES USED**

1. Encapsulation: Data fields in classes are private, and public methods are provided to interact with the data, ensuring controlled access.
2. Inheritance: The Book class can be extended to create specific types of books in the future (e.g., EBook, PrintedBook).
3. Abstraction: The Library and LibrarySystem classes abstract the complexity of library operations, providing a simplified interface for users.
4. Exception Handling: Custom exceptions are used to manage errors and provide meaningful feedback to users.
5. Collections: ArrayLists are used to keep track of current session's details like books added, removed, and issued.

## **INFERENCE AND FUTURE EXTENSION**

The Library Management System provides a solid foundation for managing library operations. Inference from the current implementation highlights the importance of automation in improving efficiency and accuracy in library management.

### **Future Extensions**

- Multi-Branch Support: Expand the system to support multiple library branches, allowing centralized management.
- Advanced Reporting: Implement reporting features that provide insights into borrowing trends, member activity, and inventory analytics.
- Mobile Access: Develop a mobile application for members to manage their accounts and search the library catalog on the go.
- Integration with External Systems: Explore integration with online book retailers and local educational institutions to expand the library's offerings.