



Vivekanand Education Society's Institute Of Technology
Department Of Information Technology

DSA miniProject
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Title:
Sustainability Goal :

Domain:

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THE GLOBAL GOALS

For Sustainable Development





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Introduction to Project

The Library Fine Calculator is a system designed to automate the management of library books, members, and fines.

It simplifies issuing and returning books, automatically calculates due dates and fines, and predicts potential late returns using historical data.

The system improves library efficiency, reduces manual errors, and enhances member experience.

Enhanced Features:

- Automatic 14-day due date calculation for issued books
- AI-inspired fine prediction feature based on member history
- Persistent storage using binary files



Problem Statement

Design and implement a library management module that:

- Maintains records of books and members,
- Issues and returns books,
- Calculates fines based on overdue days,
- Stores data persistently,
- Uses appropriate data structures and displays time/space complexity.



Objectives of the project

- Manage books and member details efficiently
- Automate book issue and return processes
- Calculate fines based on delayed returns
- Store data permanently using file handling
- Predict member behavior using AI-inspired fine prediction
- Apply DSA concepts (arrays, structures, date algorithms) effectively



Requirements of the system (Hardware, software)

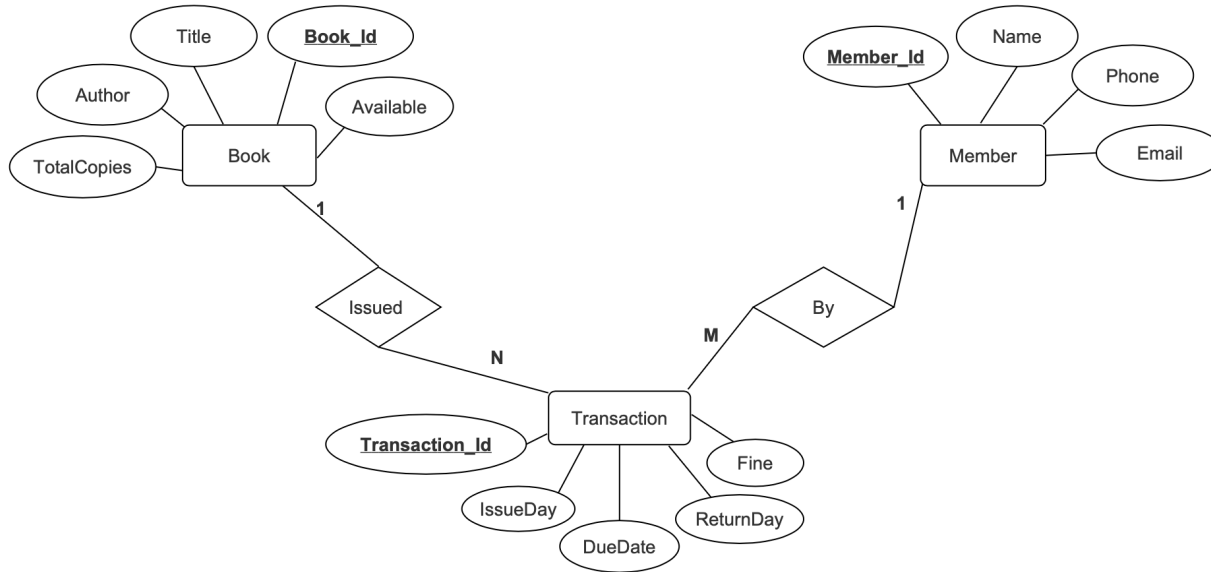
Hardware:

- Intel i3 (or higher) processor
- 2 GB RAM
- 200 MB disk space
- Standard keyboard and mouse

Software:

- Language: C
- Operating System: Windows / macOS / Linux
- Compiler: GCC / Turbo C / Code::Blocks

ER diagram of the proposed system





Data Structures & Concepts Used

- Structure (struct) – for Book, Member, and Transaction entities
- Array of Structures – to manage multiple records
- File Handling – for persistent data storage (binary files)
- Date Handling Algorithms – for due date calculation and fine computation
- Conditional Logic – for AI-based fine prediction
- Functions & Modular Programming – for reusability and clarity



Algorithm Explanation

Book Issue:

1. Input Book ID and Member ID
2. Record issue date
3. Auto-set due date = issue date + 14 days
4. Decrease available copies
5. Save transaction in file

Book Return:

1. Input Book ID and Member ID
2. Record return date
3. Calculate delay = (return date – due date)
4. Fine = delay \times ₹2 (if late)
5. Mark transaction as returned

AI Prediction:

1. Fetch member's fine history
2. Calculate average fine
3. Predict if member is likely to return late



Time and Space Complexity

Time Complexity:

- Add/Search Book $\rightarrow O(n)$
- Issue Book $\rightarrow O(1)$
- Return Book $\rightarrow O(1)$
- Fine Calculation $\rightarrow O(1)$
- AI Prediction $\rightarrow O(n)$

Space Complexity:

- Books Array $\rightarrow O(b)$
- Members Array $\rightarrow O(m)$
- Transactions Array $\rightarrow O(t)$
- Total $\rightarrow O(b + m + t)$

Where:

b = number of books, m = number of members, t = number of transactions



Front End

- Console-based, menu-driven system
- Provides easy text-based interaction for the user
- Displays clear options for all inventory operations
- Designed for simplicity, accuracy, and efficient use of DSA concepts

--- Library Fine Calculator ---

1. Add Book
2. View Books
3. Add Member
4. View Members
5. Issue Book
6. Return Book
7. View Transactions
8. Predict Late Return (AI Feature)
9. Exit

Enter choice:



GUI Integration

Library Ledger – [Link](#)

Library
Fine Calculator

NAVIGATION

- Dashboard
- Books
- Members
- Transactions
- Analytics

Library Dashboard

Welcome back! Here's your library overview

Total Books
21
19 available

Members
5
Active members

Active Loans
0
0 overdue

Total Fines
\$90.00
Collected fines

Recent Transactions

The Great Gatsby
John Smith

Due: Oct 01, 2025

The Great Gatsby
John Smith

Due: Oct 01, 2025

Pride and Prejudice
aditya

Due: Nov 07, 2025

To Kill a Mockingbird
anushka

Due: Oct 15, 2025

To Kill a Mockingbird
anushka

Due: Oct 15, 2025

Overdue Books

No overdue books! 🎉

Library
Fine Calculator

NAVIGATION

- Dashboard
- Books
- Members
- Transactions
- Analytics

Smart Analytics

AI-powered predictions and member insights

Late Return Prediction

Select Member to Analyze

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Total Borrows
2

Total Fines
\$18.00

Average Fine
\$9.00

On-Time Returns
1

Late Returns
1

AI Prediction

High Risk of Late Return

Member has an average fine of \$9.00 per transaction

Prediction: Late Return Likely ⚠️



Output

Fine Calculator

--- Library Fine Calculator ---

1. Add Book
 2. View Books
 3. Add Member
 4. View Members
 5. Issue Book (Auto 14-day Due Date)
 6. Return Book
 7. View Transactions
 8. Predict Late Return (AI Feature)
 9. Exit
- Enter choice: 7

TID	BookID	MemberID	Issue	Due	Return	Fine
1	1	1	07/10/2025	21/10/2025	21/10/2025	0
2	2	1	12/09/2025	26/09/2025	30/09/2025	8
3	2	3	23/09/2025	07/10/2025	23/10/2025	32
4	1	3	15/09/2025	29/09/2025	30/09/2025	2
5	5	1	13/09/2025	27/09/2025	30/09/2025	6

Ai Predictor

--- Library Fine Calculator ---

1. Add Book
 2. View Books
 3. Add Member
 4. View Members
 5. Issue Book (Auto 14-day Due Date)
 6. Return Book
 7. View Transactions
 8. Predict Late Return (AI Feature)
 9. Exit
- Enter choice: 8

--- Smart Fine Prediction ---

Enter Member ID: 3
Average Fine: 17.00
Prediction: LIKELY late return ⚠

--- Library Fine Calculator ---

1. Add Book
 2. View Books
 3. Add Member
 4. View Members
 5. Issue Book (Auto 14-day Due Date)
 6. Return Book
 7. View Transactions
 8. Predict Late Return (AI Feature)
 9. Exit
- Enter choice: 8

--- Smart Fine Prediction ---

Enter Member ID: 4
Member has no fine history. Prediction: On-time return ✅



Future Scope

- Integration with MySQL database for scalability
- Graphical User Interface (GUI) with Tkinter or web interface
- Auto email/SMS notification for due dates
- Integration with barcode scanning for book management



Conclusion

This project demonstrates practical use of C and basic DSA concepts to implement a Library Fine Calculator.

It covers real-world concerns — record-keeping, fine computation, persistence — while remaining a compact educational project that can be expanded with improved data structures and UI.



References

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[Link](#)