Project Report: Library Fine Calculator in C++

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1. Introduction

The **Library Fine Calculator** is an automated tool designed to address the challenges faced by libraries in India, such as manual calculation errors and administrative overhead during peak hours. By utilizing an **Object-Oriented Programming (OOP)** approach, this system provides a transparent and efficient way to manage overdue book returns and ensure students receive accurate, instant fine calculations.

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2. Problem Statement

Manual fine management is often time-consuming and prone to human error. Librarians frequently struggle with:

- Maintaining accurate records for multiple books simultaneously.
- Applying complex fine structures consistently.
- Resolving disputes with students over calculated amounts.

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3. Objectives

The primary goals of this project are:

- **Accept Book Details:** Provide a user-friendly interface to capture titles and overdue duration.
- **Automated Calculation:** Apply conditional logic to determine fines based on predefined rules.
- **Generate Receipts:** Produce professional, formatted documentation for every transaction.

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4. Technical Architecture

The application is built using **C++** and follows a modular class-based design.

Core Concepts Used

- **Classes & Objects:** Used as a blueprint to model the library's real-world entities.
- **Encapsulation:** Protects data by keeping members like `totalFine` private and accessible only through controlled methods.
- **Conditional Logic:** Implements the tiered fine structure through nested `if-else` statements.

Class Structure: `LibraryFineCalculator`

- **Data Members:** Includes `memberName`, `bookTitle`, `daysOverdue`, and `totalFine`.
- **Member Functions:**
  - `inputDetails()`: Collects user data via console.
  - `calculateFine()`: Computes the penalty based on duration.
  - `displayReceipt()`: Outputs the final transaction details.

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5. Fine Structure & Logic

The system applies the following rules to calculate the total penalty:

Overdue Duration	**Fine Rate (Rupees)**
0 Days	No Fine
1–5 Days	₹5 per day
6–10 Days	₹10 per day
Above 10 Days	₹20 per day

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6. Implementation Flow

The program execution follows a linear, three-phase flow:

1. **Input Phase:** Prompts for the member's name, book title, and overdue days.
2. **Logic Phase:** Uses the rates above to determine the amount (e.g., 8 days results in a ₹80 fine).
3. **Output Phase:** Displays a formatted "Fine Receipt" with all details for transparency.

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7. Conclusion and Future Scope

The **Library Fine Calculator** project successfully demonstrates how **Object-Oriented Programming** can be applied to solve real-world administrative challenges. By automating a previously manual process, the system ensures higher accuracy, saves significant time during peak hours, and provides a transparent record that builds trust between the library staff and students.

Beyond its immediate utility, the program serves as a robust educational resource for understanding core C++ principles like **encapsulation** and **modular design**.

Future Scope

To further enhance the system and move toward a comprehensive library management solution, the following features are planned:

- **Database Integration:** Connecting the application to **MySQL** or **PostgreSQL** to maintain permanent historical records for data analysis and reporting.
- **Student Account System:** Implementing a login portal where students can view their borrowing history linked to their unique identification numbers.
- **Multi-Book Support:** Extending the class logic to handle multiple book returns in a single transaction using **arrays** or **vectors**.
- **Web/GUI Development:** Transitioning from a command-line interface to a **web-based application** to allow access from any device across the university campus.