

Library Management System (LMS)

Project Overview

The Library Management System (LMS) is a robust MySQL-based project designed to efficiently manage library resources, including books, members, borrowing records, and staff details. It incorporates relational database concepts, DML/DDL operations, and advanced SQL features such as views, stored procedures, triggers, and transactions to ensure seamless operations and data integrity.

Features

Database Design

- Well-structured, normalized schema for optimized performance.
- Tables for books, members, staff, borrow records, and book categories.

Data Integrity & Constraints

- FOREIGN KEY, CHECK, UNIQUE constraints for data consistency.
- Triggers to automate updates (e.g., decrement book stock on borrowing).

CRUD Operations

- Full support for Create, Read, Update, and Delete (CRUD) operations on books, members, and borrowing records.

Advanced SQL Features

- Stored procedures for automated and reusable tasks.
- Views for easy data retrieval and reporting.
- Transactions ensuring atomicity and rollback capabilities for borrowing and returning books.

Reporting & Analytics

- Most Borrowed Books Report
- Overdue Fines Calculation & Report
- Member Borrowing Insights

Project Structure

- **Library-Management-System**

- **Database_scripts**
 - schema.sql - Database schema definition
 - sample_data.sql - Sample data for testing
 - stored_procedures.sql - Stored procedures for various operations
 - triggers.sql - Triggers for maintaining data consistency
 - views.sql - Views for reporting
 - transactions.sql - Transactions to ensure data integrity
- README.md - Project documentation (this file)
- queries.sql - Example queries for common operations

Key SQL Features

Stored Procedures

- `sp_add_book()` - Adds a new book to the inventory.
- `sp_update_member()` - Updates member details.
- `sp_borrow_book()` - Handles book borrowing logic.
- `sp_return_book()` - Handles book return logic.

Views

- `vw_borrowed_books` - Simplified reporting on borrowed books.
- `vw_member_activity` - Tracks member borrowing activity.

Triggers

- `tr_decrement_stock` - Automatically updates stock when a book is borrowed.
- `tr_increment_stock` - Automatically updates stock when a book is returned.

Transactions

- Ensures atomic operations for borrowing and returning books.
- Uses `BEGIN TRANSACTION`, `COMMIT`, and `ROLLBACK` for data consistency.

Example Queries

Borrowing and Returning Records

```
select books.bookid, title, author ,stock ,members.MemberID , name ,email,membertype ,phone ,
borrowingrecords.RecordID , BorrowDate,returndate , members.MemberID , name
,email,membertype ,phone from books inner join members on books.BookID=
members.MemberID inner join borrowingrecords on books.BookID=borrowingrecords.RecordID ;
```

Result Grid										
Filter Rows:		Export:		Wrap Cell Content:						
title	author	stock	MemberID	name	email	membertype	phone	RecordID	BorrowDate	returndate
Wings of Fire	A.P.J. Abdul Kalam	64	1	arav gupta	aravgupta18@gmail.com	Student	789451689	1	2024-12-01 00:00:00	2024-12-15 00:00:00
The Alchemist	Paulo Coelho	8	2	Riya Sharma	riya.sharma@example.com	Student	9890459945	2	2024-12-02 00:00:00	2024-12-16 00:00:00
Sapiens	Yuval Noah Harari	12	3	Vikram Singh	vikram.singh@example.com	Staff	9890459945	3	2024-12-03 00:00:00	2024-12-17 00:00:00
Brief History of Time	Stephen Hawking	7	4	achary chankya	achary.chankya.78@gmail.com	Student	249461649	4	2024-12-04 00:00:00	2024-12-18 00:00:00
Ramayana	Valmiki	98	5	Rahul Mehta	rahul.mehta@example.com	Staff	9890459945	5	2024-12-05 00:00:00	2024-12-19 00:00:00
The Great Indian Novel	Shashi Tharoor	698	6	Diya Patel	diya.patel@example.com	Student	9890459945	6	2024-12-06 00:00:00	2024-12-20 00:00:00
India After Gandhi	Ramachandra Guha	6	7	Arjun Nair	arjun.nair@example.com	Staff	9890459945	7	2024-12-07 00:00:00	2024-12-21 00:00:00
Think and Grow Rich	Napoleon Hill	7000	8	Neha Desai	neha.desai@example.com	Student	9890459945	8	2024-12-08 00:00:00	2024-12-22 00:00:00
The Art of War	Sun Tzu	10	9	Rohan Joshi	rohan.joshi@example.com	Staff	9890459945	9	2024-12-09 00:00:00	2024-12-23 00:00:00
Rich Dad Poor Dad	Robert Kiyosaki	8	10	Meera Reddy	meera.reddy@example.com	Student	9890459945	10	2024-12-10 00:00:00	2024-12-24 00:00:00
The Monk Who Sold His	Robin Sharma	11	11	Ishaan Malhotra	ishaan.malhotra@example.com	Student	9890459945	11	2024-12-11 00:00:00	2024-12-25 00:00:00
You Can Win	Shiv Khara	13	12	Vaishali Shivane	vaishalishivane.18@gmail.com	Student	189451689	12	2024-12-12 00:00:00	2024-12-26 00:00:00
Cooking for Beginners	Tarla Dalal	5	13	Aman Choudhary	aman.choudhary@example.com	Staff	9890459945	13	2024-12-13 00:00:00	2024-12-27 00:00:00
The Blue Umbrella	Ruskin Bond	20	14	Anushka Jain	anushka.jain@example.com	Student	9890459945	14	2025-02-28 00:00:00	2025-03-15 00:00:00
A Suitable Boy	Vikram Seth	7	15	Harsh Bansal	harsh.bansal@example.com	Staff	9890459945	15	2025-02-28 00:00:00	2025-03-15 00:00:00
Mahabharata	Vyasa	9	16	Priya Saxena	priya.saxena@example.com	Student	9890459945	16	2025-03-15 00:00:00	2025-02-28 14:37:35
Panchatantra	Vishnu Sharma	8	17	Karan Verma	karan.verma@example.com	Staff	9890459945	17	2025-02-28 14:47:05	2025-03-15 00:00:00
A Journey to the Cent...	Jules Verne	6	18	Sneha Bhatt	sneha.bhatt@example.com	Student	9890459945	18	2025-03-15 00:00:00	2025-02-28 14:47:50

Generating a report of most borrowed books:

```
SELECT Books.Title, COUNT(BorrowingRecords.BookID) AS BorrowCount
FROM BorrowingRecords
JOIN Books ON BorrowingRecords.BookID = Books.BookID
GROUP BY Books.Title
ORDER BY BorrowCount DESC
LIMIT 5;
```

	Title	BorrowCount
▶	Ramayana	8
	The Great Indian Novel	5
	Wings of Fire	3
	You Can Win	1
	Cooking for Beginners	1

Calculating overdue fines:

```
SELECT Members.Name, Books.Title,  
DATEDIFF(CURDATE(), ReturnDate) AS OverdueDays,  
(DATEDIFF(CURDATE(), ReturnDate) * 5) AS FineAmount  
FROM BorrowingRecords  
JOIN Members ON BorrowingRecords.MemberID = Members.MemberID  
JOIN Books ON BorrowingRecords.BookID = Books.BookID  
WHERE ReturnDate < CURDATE();
```

Result Grid				
Filter Rows:		Export:	Wrap Cell Content:	
Name	Title	OverdueDays	FineAmount	
arav gupta	Wings of Fire	80	400	
Riya Sharma	The Alchemist	79	395	
Vikram Singh	Sapiens	78	390	
achary chanakya	Brief History of Time	77	385	
Rahul Mehta	Ramayana	76	380	
Diya Patel	The Great Indian Novel	75	375	
Arjun Nair	India After Gandhi	74	370	
Neha Desai	Think and Grow Rich	73	365	
Rohan Joshi	The Art of War	72	360	
Meera Reddy	Rich Dad Poor Dad	71	355	
Ishaan Malhotra	The Monk Who Sold Hi...	70	350	
vaishali shivane	You Can Win	69	345	
Aman Choudhary	Cooking for Beginners	68	340	
Rahul Mehta	Ramayana	5	25	
arav gupta	Wings of Fire	5	25	
Rahul Mehta	Ramayana	5	25	
Diya Patel	The Great Indian Novel	5	25	
Vikram Singh	The Great Indian Novel	5	25	
Riya Sharma	Ramayana	5	25	

EER Diagram :-

