Practical 5

System Analysis and Design for the Selected System

Aim: Perform system analysis on selected system. 1)Systems analysis (what the system should do) 2) Systems design (how to accomplish the objective of the system.)

5. System Analysis and Design

The Book Management System (BMS) is a software solution designed to facilitate the management of a book rental or library business by automating various operations, including book cataloguing, user management, borrowing, returns, and payment or fine processing. The system improves efficiency, reduces manual errors, and enhances the user experience.

5.1 System Analysis

The **Book Management System** aims to achieve the following objectives:

- **Efficient Book Management**: Maintain an up-to-date and organized catalogue of books, ensuring easy accessibility and tracking.
- **Automated Transactions**: Reduce manual intervention in book borrowing and return processes, ensuring timely updates on book availability.
- **User Authentication and Role-Based Access**: Provide a secure access mechanism for different users (members, librarians, administrators) with appropriate privileges.
- **Payment and Fine Management**: Automate the calculation and tracking of rental or borrowing fees, overdue fines, and payment transactions, ensuring transparency.
- **Reporting and Analytics**: Generate detailed reports on book borrowings, overdue returns, and fee collections, aiding in better decision-making.
- **Scalability**: Support an increasing number of users and book collections over time, ensuring long-term sustainability and growth

5.1.1 Gather System Requirements

Functional Requirements:
The system includes a User Management Module, allowing administrators to create, update, and delete user accounts. Users have different roles such as Admin, Librarian, and Member, each with distinct privileges.
The Book Management Module enables librarians to add, update, and remove book records while categorizing books based on genre, author, publisher, and availability.
The Book Search and Borrowing Module allows users to search for books using filters like genre, author, title, and availability.
The Borrowing and Return Module automates the lending process with predefined borrowing durations, ensuring real-time updates to book availability.
The Payment and Fine Processing Module tracks borrowing fees (if applicable), calculates overdue fines, and notifies users of any pending dues.

The Reservation Module allows members to reserve currently unavailable books and notifies them when the books become available.
The Report Generation Module generates reports on book borrowings, overdue returns, and fine collections, supporting effective library management.
Lastly, the system incorporates Security and Authentication measures such as encryption-based secure login and session-based access control to protect user data and ensure secure operations.

Non-Functional Requirements
The system must ensure high performance by providing fast response times for book searches and borrowing transactions. Scalability is crucial to efficiently handle an increasing number of users and expanding book collections.
The user interface should be intuitive and user-friendly, ensuring easy navigation and accessibility for all user roles. Security is a top priority, with sensitive data encrypted and strict controls in place to prevent unauthorized access.
Maintainability is also essential, allowing for easy updates, bug fixes, and feature enhancements over time. Finally, the system must be highly reliable, ensuring continuous and fault-free operation to support daily library activities without interruptions.

5.1.2 Analyze the Current System

Existing Issues
The current manual record-keeping system is prone to errors and inconsistencies, making book availability tracking difficult. Overdue fine calculations lack automation, leading to discrepancies. Without automated reporting, data analysis and library performance tracking become cumbersome. Additionally, the absence of real-time notifications means that users are not promptly informed about book availability or overdue returns and fines.

Gaps Identified
To improve efficiency, a centralized database is required for managing book and user records effectively. Book borrowing and return transactions should be automated to reduce manual workload and minimize errors. Security measures need to be enhanced to protect sensitive user and transaction data. A reporting system is essential for tracking key performance indicators, such as borrow/return rates and overdue fines, to support informed decision-making and library management.

5.2 System Design

System Design is the process of defining the architecture, modules, interfaces, and data for a system to satisfy specified requirements. It involves creating a blueprint for the Book Management System (BMS) that ensures efficiency, scalability, and security. The design phase transforms the functional requirements into a structured solution that dictates how the various system components interact to support library operations effectively.

5.2.1 Architectural Design

The Book Management System follows a three-tier architecture to ensure efficient functionality:

1. Presentation Layer: A web-based user interface that allows users (members, librarians, administrators) to interact with the system and perform tasks such as searching for books, borrowing, and returning items.
2. Business Logic Layer: Handles core functionalities such as book transactions, user authentication, fine calculations, and payment processing.
3. Database Layer: Stores all essential records, including user details, book catalogue, borrowing history, overdue fines, and payment transactions.

5.2.2 User Interface Design

The user interface (UI) is designed to be intuitive, visually appealing, and easy to navigate. The system provides different dashboards for users based on their roles (Admin, Librarian, and Member). Key UI components include:

- Login Page: A secure login screen with role-based authentication for different user types.
- Admin Dashboard: Displays system statistics, user management tools, and report generation options.
- Librarian Dashboard: Includes options for book management, borrow/return transactions, and fine tracking.
- Member Dashboard: Allows users to search for books, view borrowing history, and manage their transactions.
- Book Search Interface: A search bar with filters such as book genre, author, title, and availability status.
- Borrowing and Return Screen: Displays book details, borrowing duration, and fine information.
- Payment Processing Screen: Provides details of borrowing fees, overdue fines, and payment options.
- Notification System: Pop-up and email notifications for book reservations, overdue returns, and payment reminders.

5.2.3 Module Description

User Management Module
This module facilitates user registration, login, and role-based access control. It implements authentication and authorization mechanisms to ensure secure access. User profiles and activity logs are maintained to track system usage, including borrowing history and overdue transactions.

Book Management Module
Librarians can use this module to add, modify, and remove book records. It maintains a structured database of books and their metadata, ensuring books are categorized properly for easy retrieval based on genre, author, or availability.

Book Search and Borrowing Module
This module enables users to search for books using various filters such as genre, author, title, and availability. It provides a detailed catalogue view with book descriptions, borrowing options, and availability status.

Borrowing and Return Module
This module automates the borrowing process, ensuring that book availability updates in real time. It tracks borrowing history, return dates, and overdue fines, managing extensions and renewals when necessary.

Payment and Fine Processing Module
The system automatically calculates borrowing charges based on book duration and overdue fines. It maintains a record of payments, overdue fines, and pending dues while sending automated notifications to users with outstanding balances.

Reservation Module
Users can reserve books that are currently unavailable through this module. Notifications are sent when reserved books become available, and a queue system manages reservation priority.

Report Generation Module
This module generates reports on book borrowings, overdue returns, and fine collections. It provides analytical insights into borrowing trends and includes visual representations of key library metrics such as popular genres, overdue statistics, and revenue from fines.

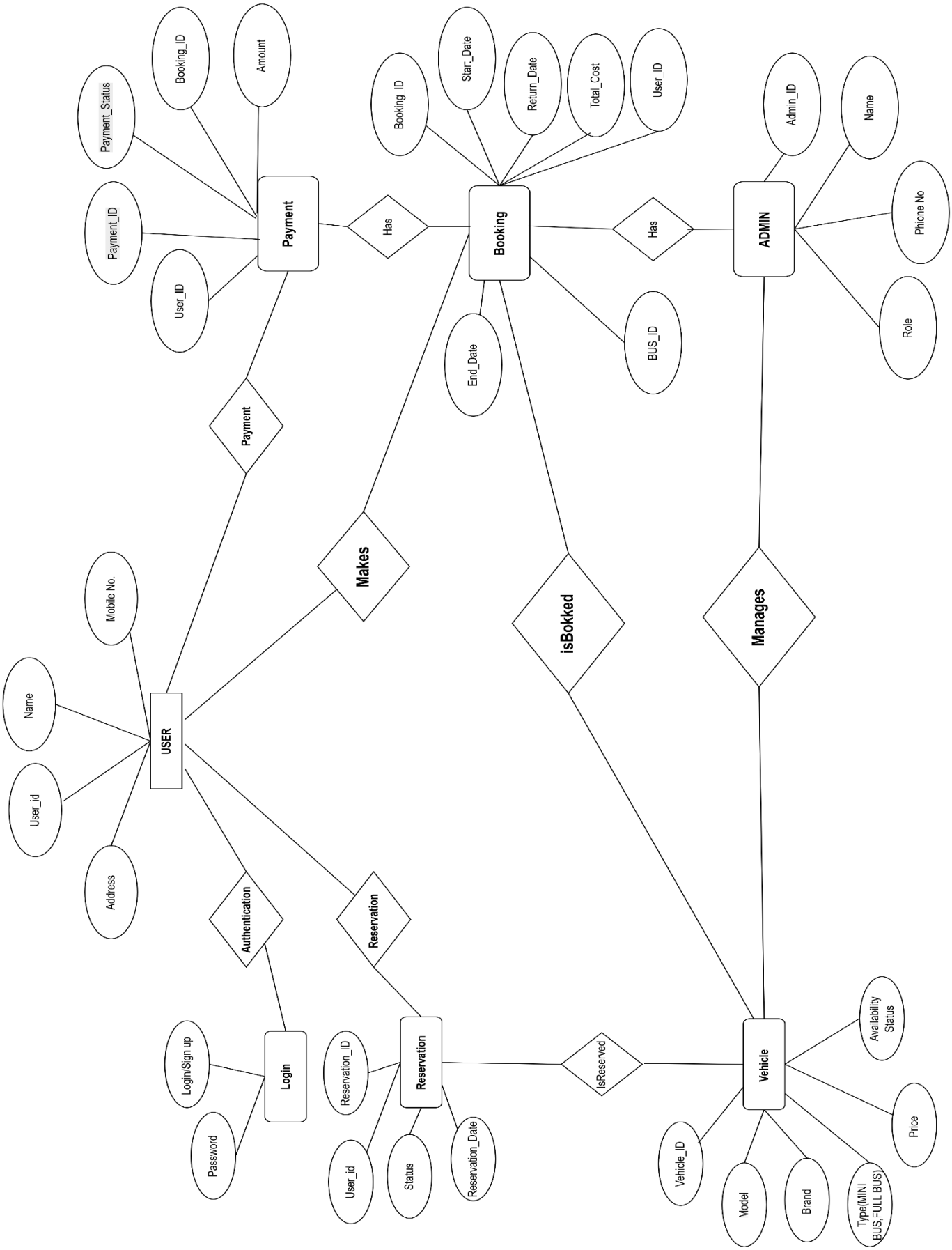
5.2.4 Database Design and ER diagram

The database design of the Book Management System (BMS) is structured to efficiently store and manage information related to books, users, transactions, reservations, and fines. It ensures data integrity, consistency, and fast retrieval of information. The database follows a relational model, with multiple interconnected tables representing different entities and their relationships.
The ER Diagram (Entity-Relationship Diagram) visually represents how different entities in the system interact with each other. Below are the key entities and their relationships:

Entities and Relationships

1. USER (User_ID, Name, Mobile No, Address, Role, Number of Books Borrowed) → A user can borrow multiple books.
2. BOOK (Book_ID, Title, Author, Genre, Availability Status, ISBN) → A book can be borrowed by multiple users (over time).
3. ADMIN (Admin_ID, Name, Phone No, Role) → Manages book inventory, user accounts, and borrowing transactions.
4. BORROWING (Transaction_ID, User_ID, Book_ID, Borrow_Date, Due_Date, Return_Status, Fine_Amount) → Links users and books, tracking borrowing transactions.
5. RESERVATION (Reservation_ID, User_ID, Book_ID, Reservation_Date, Status) → Users can reserve books that are unavailable.
6. PAYMENT (Payment_ID, User_ID, Amount, Payment_Status) → Tracks borrowing fees, overdue fines, and payment status.
7. LOGIN (Login_ID, Password, Role) → Ensures secure authentication for users (members) and admins.

ER Diagram: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Model
Brand
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