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.)

(Hint: Flowcharts/ER diagrams)

5. System Analysis and Design

The Train Booking System (TBS) is a software solution designed to facilitate the booking of train tickets, including user registration, schedule management, booking, and ticket cancellation. The system automates operations improves customer experience, and enhances operational efficiency.

5.1 System Analysis

The Train Booking System aims to achieve the following objectives:

- **Efficient Ticket Management:** Maintain an organized, up-to-date catalog of available train schedules and seats, ensuring easy accessibility for users.
- **Automated Booking and Cancellation:** Reduce manual intervention in the booking and cancellation processes, ensuring timely updates to seat availability.
- **User Authentication and Role-Based Access:** Provide secure login and role-based access for different users (admin, train staff, passengers) with appropriate privileges.
- **Payment Integration:** Automate the payment process for ticket booking and cancellation, including integration with third-party payment gateways.
- **Reporting and Analytics:** Generate detailed reports on booking history, cancellations, and revenue collection, aiding in better decision-making.
- **Scalability:** Support increasing numbers of users, train routes, and booking transactions as the system grows over time.

5.1.1Gather System Requirements

Functional Requirements : The **Train Booking System** consists of several modules to ensure smooth operations. The **User Management Module** allows admins to manage user accounts, assigning roles like Admin, Train Staff, and Passenger with appropriate privileges. The **Train Schedule Management Module** enables admins and staff to add, update, and remove train schedules based on route and seat availability.

The **Booking and Cancellation Module** allows passengers to book and cancel tickets, updating seat availability in real time. The **Payment Gateway Integration Module** handles secure transactions, allowing passengers to pay through various methods like credit/debit cards and digital

wallets. The **Ticket Confirmation and Reservation Module** generates booking confirmations and manages seat reservations for fully booked trains, sending notifications when seats become available.The **Reporting Module** provides admins with reports on bookings, cancellations, revenue, and occupancy. Finally, the **Security and Authentication Module** ensures secure logins, with role-based access to sensitive data and administrative features.

Non Functional Requirements: The system must ensure high performance by providing fast response times for train schedule searches, bookings, and cancellations. Scalability is crucial to handle an increasing number of users and transactions efficiently. The user interface should be intuitive and easy to use, ensuring seamless navigation for passengers. Security is a top priority, with encrypted sensitive data, secure transactions, and restricted access to unauthorized users. Maintainability is important, allowing for easy updates and improvements to the system. Finally, the system must be highly reliable, ensuring continuous operation without disruptions, even during high traffic periods.

5.1.2 Analyze the Current System

Existing Issues

The current manual train booking system is prone to errors and inefficiencies, especially in tracking seat availability and train schedules. Booking and cancellation processes are time-consuming, often requiring manual updates and leading to delays. There is a lack of automation in fare calculations, which causes discrepancies in ticket pricing. Without automated reporting, monitoring of bookings, revenue, and cancellations becomes cumbersome. Additionally, there is no real-time notification system to inform passengers of booking status, cancellations, or train delays.

Gaps Identified

To enhance efficiency, a centralized database is required to manage train schedules, bookings, and passenger information. The booking and cancellation processes should be automated to reduce manual workload and ensure accurate real-time updates. The system must include an automated fare calculation mechanism to avoid errors and inconsistencies. Security measures need improvement to protect sensitive passenger data, especially payment information. A reporting system is essential for monitoring key metrics such as bookings, revenue, and cancellations, providing better insights for decision-making. Furthermore, a notification system should be implemented to provide real-time updates on bookings, cancellations, and any changes to train schedules.

5.2 System Design

System Design involves defining the architecture, modules, interfaces, and data of the system to meet the specified requirements. It creates a blueprint for the Train Booking System (TBS) that ensures efficiency, scalability, and security. The design phase converts the functional requirements into a structured solution that outlines how the system components will interact.

5.2.1 Architectural Design

The **Train Booking System** follows a three-tier architecture to ensure smooth and efficient operations:

1. **PresentationLayer:**
   This layer includes the user interface where passengers, train staff, and admins interact with the system. It is a web-based platform accessible from desktops, tablets, and mobile devices. This layer provides various views such as train schedules, booking details, and user dashboards.

2. **BusinessLogicLayer:**
   This layer contains the core functionality of the system, handling essential processes like train schedule management, ticket booking, fare calculations, payment processing, cancellations, and user authentication. It processes requests from the user interface and communicates with the database to fetch or update relevant information.

3. **DatabaseLayer:**
   The database layer stores all critical data, including train schedules, booking details, passenger information, payment history, and seat availability. It ensures efficient storage, retrieval, and updating of data for fast access and processing.

5.2.2 User Interface Design

The user interface (UI) of the **Train Booking System** is designed to be intuitive, visually appealing, and easy to navigate. The system provides different dashboards for users based on their roles (Admin, Train Staff, and Passenger). Key UI components include:

- **Login Page:** A secure login screen with role-based authentication, allowing users to access the system based on their assigned roles.
- **Admin Dashboard:** Displays system statistics, train schedule management options, user management features, and report generation tools for monitoring bookings and revenue.
- **Train Staff Dashboard:** Provides options for managing train schedules, seat availability, booking transactions, and cancellations.
- **Passenger Dashboard:** Allows passengers to search for available trains, view booking history, and check ticket status.
- **Train Search Interface:** A search bar with filters such as train number, route, departure time, and seat availability, allowing passengers to find suitable trains.
- **Ticket Booking and Cancellation Screen:** Displays train details, passenger information, and booking options. It also shows the option to cancel a booking and update seat availability.
- **Payment Screen:** Displays payment options, ticket prices, and the payment gateway for booking confirmation. It also includes an option to view transaction history.
- **Notification System:** Real-time pop-up and email notifications for booking confirmations, cancellations, train delays, and seat availability updates.

5.2.3 Module Description

User Management Module

This module handles user registration, login, and role-based access control. It ensures secure access by implementing authentication and authorization mechanisms. Passengers, train staff, and admins are assigned roles with specific privileges to access the system. User profiles, login session data, and activity logs are maintained for monitoring and security.

Train Schedule Management Module

Train staff and admins use this module to add, update, and remove train schedules. It maintains a structured database of train schedules, including details such as train number, route, departure time, and seat availability. The module ensures real-time updates whenever changes are made to train timings or seat statuses.

Booking and Cancellation Module

This module automates the process of ticket booking and cancellations for passengers. It checks seat availability, calculates fares, and processes bookings in real-time. It also handles ticket cancellations and updates seat availability accordingly. Passengers receive confirmation and cancellation notifications through this module.

Fare Calculation Module

This module calculates ticket prices based on factors such as the train's route, class, and passenger type (e.g., adult, child, senior citizen). It ensures accurate fare calculations and integrates with the Booking and Cancellation Module to update prices at the time of booking.

Payment Gateway Integration Module

This module integrates with external payment gateways to securely process transactions. It supports various payment methods, such as credit/debit cards, mobile wallets, and bank transfers. The module generates payment receipts and stores transaction history for later reference, ensuring secure and smooth payment processing.

Ticket Confirmation and Reservation Module

Once a booking is confirmed, this module generates digital tickets containing details like the train number, route, departure time, seat number, and passenger details. For fully booked trains, this module manages seat reservations and places passengers on a waitlist, notifying them once a seat becomes available.

Reporting Module

This module generates detailed reports on ticket bookings, cancellations, revenue, and occupancy rates. It provides valuable insights for admins and staff, helping with performance analysis and decision-making. Reports can be exported in various formats, such as PDF or CSV, for further use.

Security and Authentication Module

The system ensures the protection of sensitive data through encryption and secure storage. This module handles user authentication, session management, and role-based access control. It ensures that only authorized users can access specific features of the system, safeguarding data integrity and confidentiality.

5.2.4 Database Design and ER diagram

The database design of the **Train Booking System** is structured to efficiently store and manage information related to users, train schedules, bookings, payments, and reservations. It ensures data integrity, consistency, and fast retrieval of information. The system uses a relational model, with multiple interconnected tables representing different entities and their relationships.

The **ER Diagram** visually represents how different entities in the system interact with each other. Below are the key entities and their relationships:

Entities and Relationships:

• **User (User_ID, Name, Email, Role, Password, Contact_Number)**:A user can book multiple tickets and can have multiple bookings over time. The roles can be Passenger, Admin, or Train Staff.

• **Train (Train_ID, Train_Number, Route, Departure_Time, Arrival_Time, Seat_Availability)**:A train can be part of multiple bookings and can have multiple scheduled journeys across different routes.

• **Booking (Booking_ID, User_ID, Train_ID, Booking_Date, Departure_Date, Seat_Number, Payment_Status)**:Links users and trains, tracking ticket bookings, including booking dates, seat numbers, and payment status.

• **Payment (Payment_ID, Booking_ID, Amount, Payment_Method, Payment_Date, Payment_Status)**:Tracks payments made for ticket bookings, linking each payment to a specific booking.

• **Reservation (Reservation_ID, User_ID, Train_ID, Reservation_Date, Status)**:Allows users to reserve tickets for fully booked trains and keeps track of reservation statuses (e.g., pending, confirmed).

• **Ticket (Ticket_ID, Booking_ID, Ticket_Number, Passenger_Name, Train_ID, Seat_Number, Status)**:Represents the final ticket generated after booking, including ticket details such as train number, seat, and passenger name.

• **Train_Schedule (Schedule_ID, Train_ID, Date, Available_Seats)**:Stores information about specific train schedules for each date, linking trains with seat availability on that particular date.

The **ER Diagram** for the **Train Booking System** would depict the above entities and their relationships. Key relationships would include:

- A **User** can have multiple **Bookings**.
- A **Booking** is linked to a **Train** and contains a **Payment**.
- A **Train** can be part of multiple **Bookings** and **Reservations**.
- A **Reservation** is linked to a **Train** and a **User**, and tracks the reservation status.
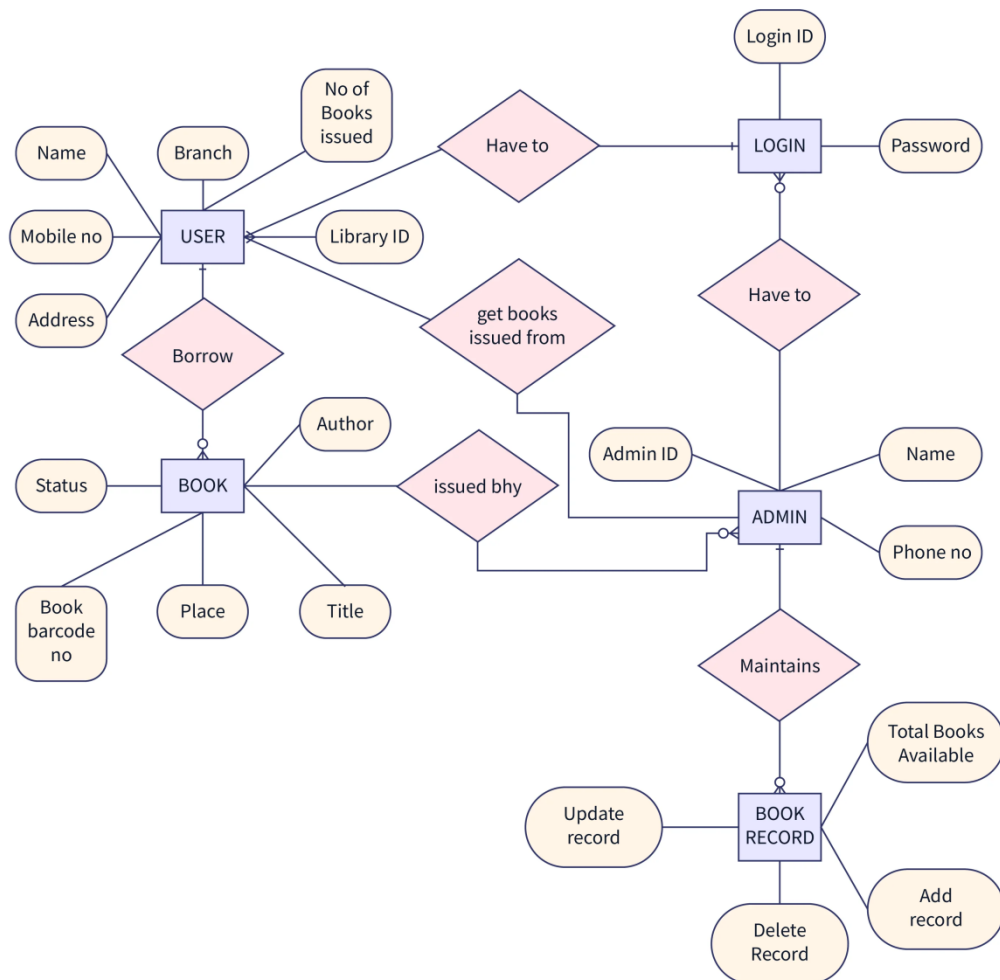- **Ticket** is linked to a **Booking** and contains details such as seat number and status.

Figure 5.1 ER Diagram

(SAMPLE ER DIAGRAM)

Note: As a part of System design and analysis can include flow charts , system architecture diagram etc. Depend upon the project definitions.

Include ER diagram in data base design part