Database Design Document

Description of Business Problems being addressed

The business problems being addressed by railway management system are asfollows:

- **Efficient Train Management**: The primary aim of the railway management system is to efficiently manage trains within the railway network. This includes scheduling trains, tracking their current status, managing routes, andensuring smooth operations.

- **Employee Management**: The system addresses the need for managing employees involved in various roles within the railway system. This includes assigning tasks, tracking employee information such as department, login credentials, and handling employee schedules.

- **Passenger Management**: Another crucial aspect is managing passengersusing the railway services. This involves tracking passenger information,frequency of travel, managing transactions such as ticket purchases, and providing services like Charlie cards for fare payment.

- **Data Analysis and Optimization**: By collecting and analyzing data related to train schedules, passenger frequency, and other factors, the system aims to optimize operations. This includes identifying busy routes, adjusting schedules to meet demand, and improving overall efficiency.

- **Security and Authentication**: Ensuring secure access to the system for bothemployees and passengers is essential. Implementing robust authentication mechanisms, managing login credentials securely, and monitoring system access are key aspects addressed by the system.

- **Revenue Management**: The system also plays a role in revenue managementby tracking transactions, managing fare payments, and analyzing revenue streams. This helps in optimizing pricing strategies and maximizing revenue generation.

- Overall, the railway management system aims to address the complex challenges involved in managing a railway network efficiently, ensuring smooth operations, enhancing passenger experience, and optimizingresources.

Entities List

- We have designed 11 entities for Railway Management System and the list ofentities are as follows:

- **mbta_traininfo**: Represents information about trains, including train ID,schedule, current status, and type.

- **mbta_schedule**: Stores train schedules, including departure and arrival times.

- **mbta_trainCurrentStatus**: Tracks the current status of trains, such asrunning on time, delayed, or canceled.

- **employee**: Contains information about employees working within therailway system.

- **mbta_routeinfo**: Stores information about train routes, including stops anddistances.

- **mbta_types**: Represents different types of trains, such as express, local, etc.

- **mbta_station**: Contains information about railway stations, including location and facilities.

- **mbta_passengerfrequency**: Tracks the frequency of passenger travel onspecific routes.

- **mbta_charlie**: Represents a payment card used by passengers for farepayment.

- **passenger**: Contains information about passengers, including personaldetails.

- **mbta_transaction**: A weak entity representing transactions made by passengers.

Relationships between entities

1)person – passenger/employee (Total participation & overlapping):

Relationship: A person can be a passenger and employee both.

2)Employee – employee_train_assignment(Mandatory One-to-Mandatory Many):

Relationship: An employee operates many train assignments and each train is assigned to only one employee.

3)mbta_traininfo - mbta_schedule (Mandatory One-to-Optional Many):

Relationship: Each train can have multiple schedules, and each schedule should be associated with only one train.

4)mbta_traininfo - mbta_trainCurrentStatus (Mandatory One-to-Optional Many):

Relationship: Each train can have one or more than one status, and each status is associated with only one train.

5)mbta_passenger_frequency - mbta_station (Mandatory One-to-Optional Many):

Relationship: Each station can have one or many record indicating passengerfrequency, while passenger frequency records may be none or many for stations.

6)Passenger - mbta_charlie(Mandatory One-to-Mandatory Many):

Relationship: One passenger can have many Charlie cards and each Charlie card has one or none passenger.

7)mbta_charlie - mbta_transaction (Mandatory One-to-Mandatory Many):

Relationship: Each Charlie card may have multiple transactions, and eachtransaction may be associated with one Charlie card or none.

8)mbta_route_info - mbta_types (Mandatory One-to-Mandatory Many):

Relationship: Each route may fall under multiple types, and each type can be associated with multiple routes.

Key Design Decisions:

- Charlie card and transaction entities are optional to accommodate varying passenger behaviors.
- Enforce a one-to-one relationship between user accounts and logins for data consistency.
- Utilize weak entities for dependent relationships, such as employee logins.
- Define mandatory and optional relationships between entities based on business requirements.
- Implement data security measures like encryption and access control to protect sensitive information.
- Enforce data integrity constraints such as primary and foreign keys to maintain data consistency.
- Establish relationships between entities based on business requirements and data interactions within the railway system.
- Incorporate optional entities and relationships to accommodate varying scenarios and user behaviors within the railway system.
- Ensure that each user is limited to one login account to simplify authentication processes and prevent misuse of multiple accounts.
- Use encryption and access controls to safeguard sensitive data and protect data confidentiality and integrity.
- Manage many-to-many relationships using junction tables for entities like schedules and routes.
- Establish many-to-many relationship between route information and stations.