Freight Train Management System (FTMS)

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1. Requirements Analysis:

For Administrators:

- *Optimized Scheduling*: Enhances train utilization by optimizing schedules based on cargo availability, ensuring no train runs empty.
- *Real-time Monitoring:* Offers live tracking of trains, enabling quick decisions on rerouting or schedule adjustments in case of delays.
- *Profit Maximization*: Facilitates profit tracking and identifies profitable routes and cargo types.
- *Customer Satisfaction*: Improves service reliability and communication with customers regarding cargo status, boosting customer trust and retention.

For Users (Customers):

- *Easy Booking and Tracking*: Provides a user-friendly interface for cargo booking and real-time tracking of cargo status and train location.
- *Flexible Scheduling*: Allows customers to select preferred shipping dates and track estimated arrival times, enhancing convenience.
- *Transparent Pricing*: Offers insights into pricing models based on cargo type, weight, and distance, ensuring transparency.

2. Features of the System:

- *Cargo Booking*: Interface for customers to book cargo shipment, including type, weight, and destination.
- *Dynamic Train Scheduling*: Automated scheduling system that optimizes train routes and timings based on cargo availability and destination.
- *Real-Time Tracking*: Live updates on train location and cargo status for both customers and administrators.
- *Profit and Performance Analytics*: Dashboards displaying profit margins, train efficiency, and route profitability.

3. Setup and Collected Parameters

Setup Parameters:

- *Station Details*: Name, Location, Capacity.
- *Train Details*: ID, Type (Gas, Liquid, Solid), Capacity.
- *User Accounts*: Customer and Administrator profiles, including access rights and preferences.

Collected Parameters:

- *Cargo Information*: Booking ID, Customer ID, Cargo Type, Weight, Booking Date, Destination.
- *Scheduling Data*: Train assignments, route optimizations, departure and arrival times.
- *Operational Metrics*: Train location, delay instances, and causes.
- *Financial Metrics*: Revenue by route, cost of operations, profit margins.

4. Data Analytics Dashboards and Quantifiable Metrics

Dashboards:

- *Operational Efficiency*: Visualization of train schedules, utilization rates, and delay frequencies.
- *Financial Performance*: Comprehensive views of revenue, costs, and profits by route, train type, and cargo type.
- *Customer Engagement*: Analytics on booking trends, customer feedback scores.

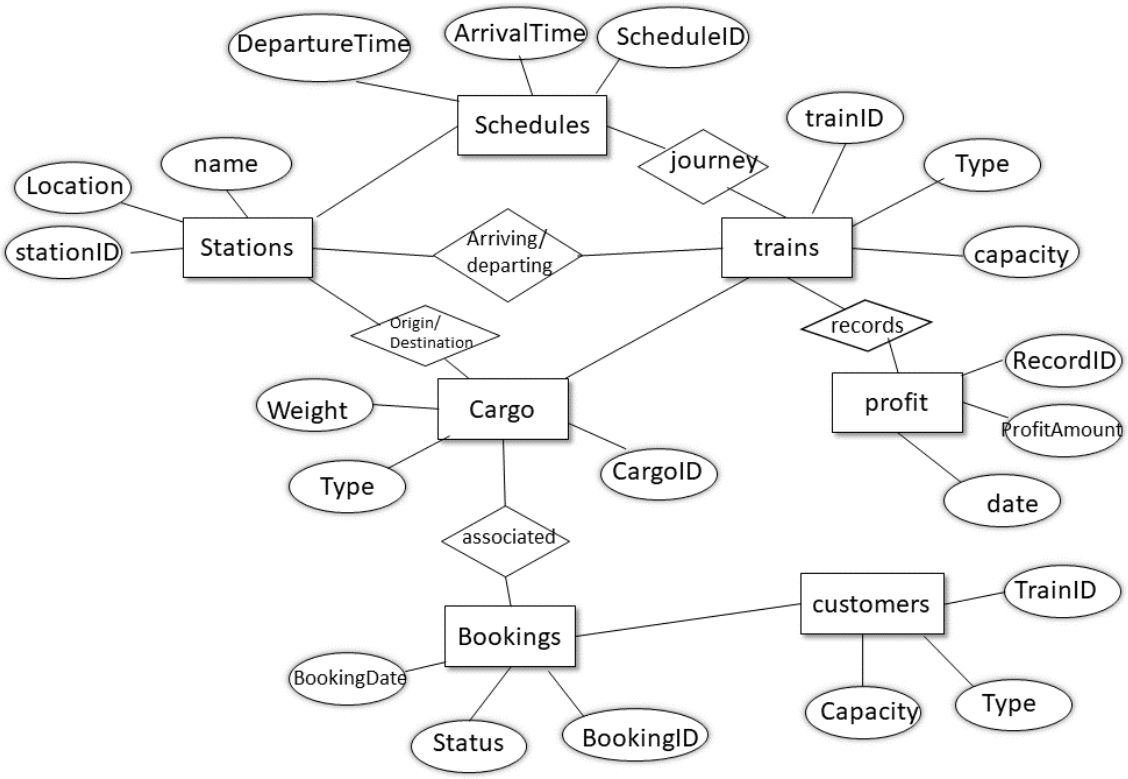
Quantifiable Metrics:

- *Load Factor*: Percentage of train capacity utilized.
- *On-time Arrival Rate*: Percentage of trains arriving on time.
- *Profit Margin*: Net profit as a percentage of revenue.
- *Customer Satisfaction Index:* Based on feedback and repeat bookings.

5. Relational Tables:

- ***Stations***: StationID ***(PK),*** Name, Location.
- ***Trains***: TrainID ***(PK),*** Type, Capacity.
- ***Cargo***: CargoID ***(PK),*** Type, Weight, TrainID (FK), BookingID (FK).
- ***Schedules***: ScheduleID ***(PK),*** TrainID (FK), DepartureStationID (FK), ArrivalStationID (FK), DepartureTime, ArrivalTime.
- ***Customers***: CustomerID ***(PK),*** Name, ContactInfo.
- ***Bookings***: BookingID ***(PK),*** CustomerID (FK), CargoID (FK), BookingDate, Status.
- ***Profits:*** RecordID ***(PK),*** TrainID (FK), ProfitAmount.

6. ER Diagram:



ER Diagram for FTMS