City Tram Conveyance Management System

Overview:

We plan to design a data model, implement a database and manage the data for a city's tram service firm. This centralized database will help store, organize, manage and maintain all the data attributed to the trams. It will include information related to the tram routes, passengers, tickets and drivers associated with the tram.

Business Problems Addressed:

Through this database system we aim to address the following business problems:

- Integrate all tram-related information in one place, making it easy for staff as well as passengers to find and interpret the respective requirements.
- Provide both past and present data to derive significant insights related to customer usage, tram performance as well as staff reviews.
- Assist tram staff to be on time as well as at the right place and the structure of user engagement to be easily understandable to users thus enhancing the commuters' experience.
- Keep things digital and well strategized to implement automated paperless billing and mediate value-for-money rides from passengers as well as company's perspective.
- Protection of user and travel associated data.
- Form an adaptable system according to the changing dynamics of the city to support the tram company's growth and future altercations.

Entities:

Sr No.	Entities	Description
1	Tram	The Tram entity contains information on the Tram's unique identification number (primary key), manufacturer, seating capacity, maximum speed and fuel efficiency.
2	Route	The Route entity contains route id (primary key), the distance, hours, tram stops, start locality and end locality.
3	Driver	The Driver entity contains the driver id (primary key), driver name, driver address, driver phone number and license number. It also uses information of route id and tram id (foreign keys).
4	Locality	The Locality entity contains information on locality id (primary key), locality name and locality zip code.
5	Maintenance	The Maintenance entity contains maintenance id (primary key), date and remarks. It also uses information of tram id (foreign key).
6	Accident	The Accident entity contains information on accident id (primary key), location, date-time and accident type. It also has information on the tram id.
7	Tracking	The Tracking associative entity contains information about tracking id (primary key) and date. It also has tram id and route id (foreign keys).
8	Feedback	The feedback entity contains the reference id (primary key), comment and rating. It also has info on ticket id (foreign key).
9	Ticket	The Ticket entity contains ticket id (primary key), seat number, price, date, time and mode of payment. It also has info on passenger id and route id (foreign keys).
10	Passenger	The Passenger entity has information about passenger id (primary key), passenger name, passenger address, phone, email, date of birth, gender, username and password.
11	Booking Detail	The Booking Detail entity contains information on reference number (primary key), payment status and date. It also has information on ticket id (foreign key).
12	Schedule	This entity contains the data about the departure and arrival

		time of the tram on a specific route as planned, the status of the service provided by adapting route id and tram id as the foreign keys.

Cardinalities:

From	To	Cardinality
Tram	**Route**	Many to Many (M:N)
Tram	**Driver**	Many to One (M:1)
Tram	**Schedule**	One to Many (1:M)
Tram	**Maintenance**	One to Many (1:M)
Tram	**Accident**	One to Many (1:M)
Route	**Schedule**	One to Many (1:M)
Route	**Locality**	Many to Many (M:N)
Route	**Ticket**	One to Many (1:M)
Ticket	**Feedback**	One to One (1:1)
Ticket	**Booking Detail**	One to One (1:1)
Ticket	**Passenger**	One to Many (1:M)

Business Rules:

- A locality is associated with multiple routes and one route can pass through multiple localities.
- A tram can provide services through multiple routes and a distinct route can have multiple trams traveling through it.
- A driver can be assigned to drive multiple trams and a distinct tram can be driven by only one driver.
- A tram undergoes multiple maintenance checks, but a distinct maintenance check is associated with only one tram.
- A tram can be involved in multiple accidents, but a distinct accident can be associated with only one tram.
- A tram can have multiple schedules, but a distinct schedule is always associated with one tram only.
- A passenger can purchase multiple tickets, but a unique ticket is assigned to only one passenger.

- A ticket is always assigned one feedback from the passenger travelling on it and any unique feedback is associated with only one ticket.
- A ticket has one booking detail and one distinct booking reference is associated with only one ticket.
- A route can have multiple schedules, but a distinct schedule is associated with only one route.
- A route can have multiple tickets brought by passengers, but a ticket is bought only for one specific route.

Design Decisions:

Following are the entities mentioned in the ER diagram, the details, their relations and the reason of inclusion in our system:

- **Locality:** This entity signifies different geographical areas or zones. The decision to incorporate this is to provide a systematic method to represent the start and end points of routes, thus adding clarity to the route of a distinct tram. Furthermore, by differentiating localities, the system can adapt to changing routes or the addition of new routes considering the future aspects.

- **Route:** Routes serve as the lifelines of the entire tram system. Each route provides critical information about how different localities connect, the distance between them, and the transit time. Routes are related to tickets because passengers buy a ticket when they have a specific route to follow. Routes in turn have their own assigned schedules about the time there will be services provided by the tram throughout the day.

- **Driver:** Every tram in operation requires a driver. By creating a separate entity for drivers, the database design allows for a clear understanding of which driver operates is assigned to which tram, their contact details, and license information. This separation also adds flexibility, considering drivers might rotate between different trams.

- **Tram:** At the heart of this database system is the Tram entity. The inclusion of this entity ensures that the system can track each tram's specific schedule, accident data, maintenance history and their routes.

- **Passenger:** Tracking the passengers using the tram services is paramount for ticketing, feedback, and potential communication. The attributes like email and

phone numbers provide multiple channels for interaction. Passengers are connected to tickets directly as they decide to enroute from one locality to another and a buy a ticket for the same. Passengers are the end users for whom the system is maintained.

- **Booking Details & Feedback:** These entities streamline the passenger's journey. Booking Detail ensures each ticket transaction is recorded with its payment status. Feedback, on the other hand, is a crucial entity for service improvement. By associating feedback with tickets, it ensures feedback is tied to a distinct trip, associated to a passenger only with that ticket thus making it easier to identify and rectify service issues and avoid fake feedback at the same time.

- **Ticket:** Ticket is a strong entity related to both passengers and a route because it is distinct for both the related entities. Passenger buys a ticket only when he has a route in mind and every route has a distinctly identified ticket. This entity can help track a journey of the passenger, the feedback about the journey and the monetary side of the business.

- **Maintenance & Accident:** The safety and operational efficiency of trams are paramount. Including the Maintenance entity ensures that regular checks and repairs of trams are logged. The Accident entity, while we hope it remains sparse, is a necessity to record any mishaps, ensuring accountability and future prevention.

- **Schedule:** Effective management of time is essential for a smooth operation. The Schedule entity provides departure and arrival times and is linked to the tram and the route entity since every tram has a decided schedule to provide services over a certain route at a certain given time of the day.

- **Tracking:** Tracking provides real-time details about the tram's journey. It is associated to the route and the tram as to know where the tram is exactly travelling at an instantaneous time.