University Transportation System

Database Management Systems

Semester Project

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Abstract

University Transportation system is used to manage the data of different entities involved in the system i.e., passengers (students, faculty, and staff members), employees (drivers and bus conductors), buses and routes. We have designed a system that manages the data of entities in an efficient manner. The key aspects of database design include:

Buses and Routes:

- Each bus is uniquely identified by a route number and a license plate number.
- The route is characterized by the bus route number, accompanied by additional route details.

Employees:

- Employees are distinguished by attributes like EmployeeID, employee name, and employee CNIC.
- Two distinct types of employees exist: drivers and conductors. Drivers possess an additional attribute, namely the license number.

Passengers:

- Passengers are classified by attributes such as PassengerID, name, phone, CNIC, pickup point, and email.
- Each passenger is associated with a specific role—student, faculty, or staff member—with additional attributes like semester for students, job status for faculty, and rank for staff.

Bus-Related Constraints:

- Each bus is assigned only one specific route.
- A bus accommodates precisely two employees—one driver and one conductor.
- Multiple passengers can be assigned to a bus, but each passenger can only be associated with one bus.

Passenger Categories:

- Passengers are categorized into distinct roles—students, faculty, or staff—each having unique attributes specific to their role.

This project strives to provide a coherent database system, incorporating essential business rules to ensure the effective management of university transportation entities.

Entities

The following entities are involved in university transportation system.

1. Bus (Strong entity)
2. Route (Weak Entity)
3. Employee (Strong entity, Supertype)
4. Driver (Strong entity, Subtype)
5. Conductor (Strong entity, Subtype)
6. Passenger (Strong entity, Supertype)
7. Student (Strong entity, Subtype)
8. Faculty (Strong entity, Subtype)
9. Staff (Strong entity, Subtype)

1. **Bus:**
   The bus has a unique identifier i.e., Bus Route Number and an additional attribute Bus license plate.
2. **Route:**
   The route is a weak entity as it does not have any unique identifier and is dependent on the bus route number of the bus to identify its records.
3. **Employee:**
   Employee is the supertype of driver and conductor entity. There exists a total specialization and disjoint constraint. Attributes of employee include employeeID, employee name, employee phone and employee CNIC.
4. **Driver:**
   The driver is the subtype of employee and has an additional attribute of Driver license number.
5. **Conductor:**
   Just like the driver, conductor is also the subtype of employee, but it does not have any additional attributes.
6. **Passenger:**
   Passenger is a strong entity with PassengerID as its unique identifier, other attributes of the passenger include passenger name, passenger phone, passenger CNIC, passenger pickup stop and passenger email address.
   Passenger is the supertype and has total specialization and disjoint constraint.
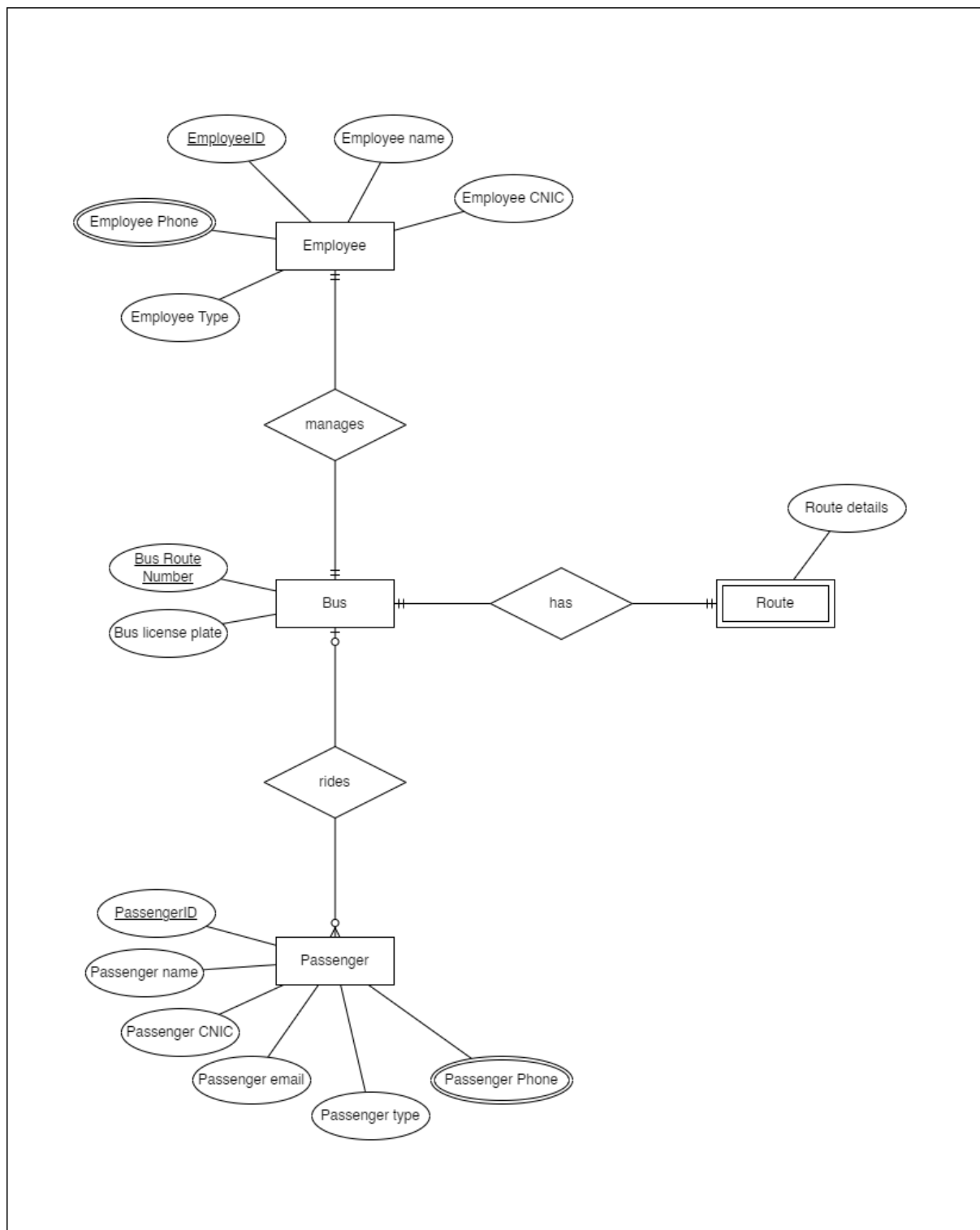7. **Student:**
   Student is the subtype of the passenger with additional attribute of semester.
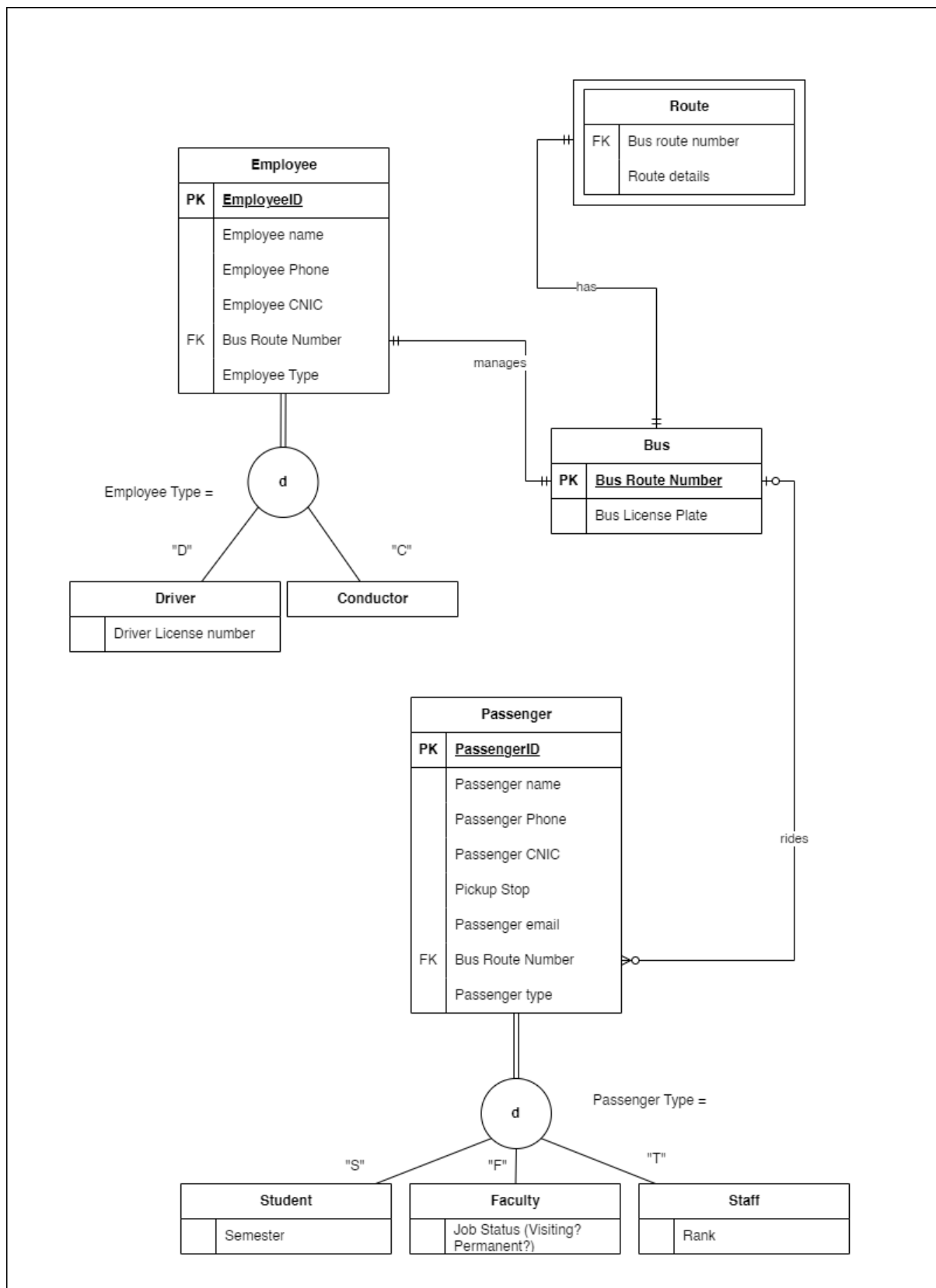8. **Faculty:**
   Faculty is the subtype of the passenger with additional attribute of job status.
9. **Staff:**
   Staff is the subtype of the passenger with additional attribute of rank.

Entity Relationship Diagram (ERD)

Enhanced Entity Relationship Diagram (EERD)

Relational Model

Bus Table:

Bus Route Number	Bus License Plate

Route Table:

Bus Route Number	Route Details

Employee Table:

EmployeeID	Employee Name	Employee Phone	Employee CNIC	Bus Route Number	Employee Type

Driver Table:

EmployeeID	License Number

Passenger Table:

PassengerID	Passenger Name	Passenger Phone	Passenger CNIC	Bus Route Number	Email	Pickup stop	Passenger Type

Staff Table:

PassengerID	Rank

Faculty Table:

PassengerID	Job Status

Student Table:

PassengerID	Semester