

Introduction to Database Systems

Railway Management System

ER Diagram Report

Team Number: 15

Team Members:

Ahmed Mohamed Ismail Nabeel	1180501
Moaaz Mohamed ElSherbini	1180528
Mostafa Ashraf Ahmed Kamal	1180406
Nader Youhanna Adib Khalil	1180477

Contact Info:

Ahmed	ahmedmoh123@hotmail.com
Moaaz	moaz5657@gmail.com
Mostafa	moustafa.achraf@hotmail.com
Nader	naderyouhanna@gmail.com

Problem Definition:

The system we intend to implement is a railway management system. It provides users with functionalities that maintain a safe and well scheduled trip. Such system is expected to be used by passengers whose requirement is to deal with a user-friendly system that provides all necessary information. It is also used by employees, which includes managers and maintenance employees.

Our system allows passengers to search, book, cancel and edit trips. They can also write and send out feedbacks to the railway company. It allows managers to hire, promote and fire employees they supervise. It also allows maintenance employees to send out requests of needed spare parts, which the managers have the authority to approve or reject.

Users:

1. Passengers
2. Maintenance employees
3. Managers

Privileges:

Passengers

1. Book a trip between two stations
2. Cancel a booked trip
3. Change a booked trip
4. View booked trips information
5. View previous trips
6. View available trips
7. Search for a specific trip
8. View train information
9. Feedback a trip

Maintenance employees

1. View available spare parts in inventory
2. Decrease the quantity of spare parts in inventory
3. Request more spare parts from managers
4. View maintenance date of trains from train table
5. Change maintenance date of trains from train table

Managers

1. Add/remove a trip between two stations
2. Hire/fire employees/managers
3. Update employee's data
4. Change train's stations
5. View trains schedule
6. Add/remove suppliers
7. Approve/reject spare part orders
8. Get detailed statistical reports for the railway company
 - a) Total number of trips a certain passenger has ever booked
 - b) Total number of trips a certain train has ever made
 - c) Total income coming from a certain trip
 - d) Average number of passengers booking in a certain trip
 - e) Number of employees working in a certain station
 - f) Average salary of employees working in a certain station
 - g) Total number of spare parts bought from a supplier
 - h) Total income/loss in a given period of time (monthly/yearly profit etc...)

Entities:

1. Employees

Contains the employees working in the railway stations and the information of each of them. They are divided into maintenance employees and managers.

2. Passengers

Contains the clients of the railway company and the information of each of them.

3. Stations

Contains the different stations that form the railway and their locations.

4. Trains

Contains each train's information such as the number of available seats and the date of its maintenance. Each train's seats are divided into economic and business class.

5. Trips Timetable

Contains each trip's information such as the departure and arrival time and stations without specifying the date, which means the same trip can take place more than once on different dates.

6. Spare Parts

This table contains the different parts required for the maintenance of the railway to ensure its functionality. Each station contains an inventory that has some of the parts.

This entity is a weak entity since it has no keys. Its identifying owner is the entity *Stations*.

7. Suppliers

Contains the different supplier companies and manufacturers of spare parts that the railway company deals with. Requests are sent from managers to the suppliers for spare parts deals.

8. Feedback

Contains the comments and complaints of the passengers regarding different trips.

This entity is a weak entity since it has no keys. Its identifying owner is the entity *Passengers*.

Relationships:

1. Bookings (Binary)

Relates each passenger to the trip he/she booked.

This is a many-to-many relationship since a passenger can book more than a trip. A trip can be booked by more than a passenger as well. Participation in this relationship is optional for both participating entities.

2. Requests (Ternary)

This relationship contains all requests coming from maintenance employees to the managers. Managers have access to the requests and can approve or reject them, therefore sending to suppliers or deleting the request.

This relationship is a many-to-many relationship since a maintenance employee can issue more than a request. The same manager can also approve/reject more than a request.

Participation in this relationship is optional for both participating entities.

3. Supervision (Binary)

Relates each employee to the manager who supervises him/her.

This relationship is a one-to-many relationship since each employee has at most one manager but a manager supervises more than an employee.

Participation in this relationship is optional for both participating entities.

4. Manages (Binary)

Relates each manager to the station he/she manages.

This relationship is a one-to-one relationship since each manager manages at most one station while each station is managed by only one manager.

Participation in this relationship is optional for employees since not all employees are managers but is mandatory for stations since each station must have a manager.

5. Works_at (Binary)

Relates each employee to the station he/she works at.

This relationship is a one-to-many relationship since each employee works at at most one station. However, a station has many employees working at it.

Participation in this relationship is mandatory for both participating entities since each employee must be working in a station and a station must have employees to run it.

6. Location (Binary)

Relates each spare part to the station it is located at.

This relationship is a many-to-one relationship since each part with its quantity can exist at only one station while each station contains many parts.

Participation in this relationship is mandatory for spare parts since each part must exist in a station. It is optional for stations since a station can have an empty inventory.

This is an identifying relationship since spare parts is a weak entity.

Spare Parts' primary key is composed of the Part Number and the Station.

7. Feedbacks_of (Binary)

Relates each feedback (comment/complaint etc..) to the passenger who wrote it.

This relationship is a many-to-one relationship since each passenger can write more than a feedback while each feedback can be written by only one passenger.

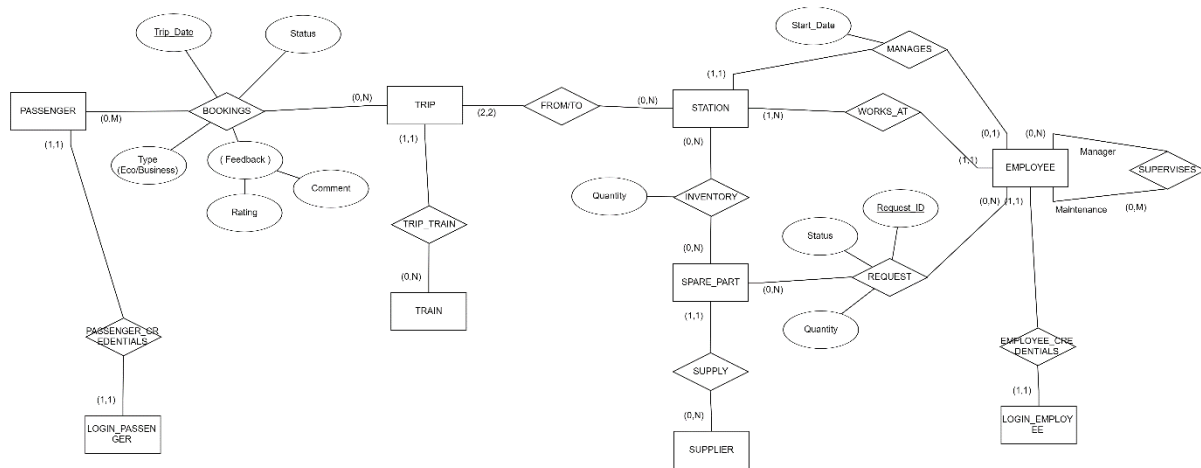
Participation in this relationship is optional for passengers since a passenger can choose not to write any feedbacks, while it is mandatory for feedbacks since each feedback must have a writer.

This is an identifying relationship since *Feedback* is a weak entity.

Feedback's primary key is composed of the Passenger's SSN, the trip number and the feedback's date (the same passenger can write feedbacks for the same trip but at different dates).

ER Diagram:

a) Entities and Relationships:



b) Attributes of each entity:

