Railway System Database

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Milestone/Version	Date
M1V1	02/19/2021

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Section I: Project Description

This project is a database system for a railway system. A company shall be able to hire employees and sell tickets. Where these employees are conductors, station managers, and railway police. Conductors will be able to drive trains which contain passengers. Customers are able to create accounts and book tickets for themselves. Once they have a ticket they will become a passenger. Once tickets are booked they are sent to the customer's email or EasyTrips account. Where they can access their tickets on their smartphones instead of having to print paper copies. If the customer wishes to, they may also purchase tickets at kiosks that are within the train stations. Once the passengers have their tickets, they are able to board their respective trains.

Section II: Use Cases

1. Sam is a customer who decides one day that he wants to go on a trip with his family. He decides to order his tickets online through the company's website. Through the website he books 4 coach class seats for his family. The tickets are then sent to his email, where he can choose to print them out.
2. Bobby wanted to go visit his friend who is far away and the only way to travel there is with the railway. He goes online to book a ticket for himself but runs into a problem. The site asks him to enter his birth date and after entering he is alerted with an issue. It turns out that Bobby is under the age of 16 which makes him a minor. This requires him to be accompanied with an adult if he wants to travel using this railway.
3. After Bobby sees the issue that popped up, he still decides that he really wants to visit his friend. So he puts a fake birth date in and is able to purchase the ticket. He gets to the station and boards the train. The conductor goes through the train checking everyone’s tickets. By chance the conductor noticed that Bobby looked young and asked him to show his I.D. to prove his age. Bobby refused and was then asked by the conductor to get off the train. He also refused to do this, which then led to the railway police to get involved and escort him off the train.
4. John wants to go on a trip on his own and he has a bit of extra money to spend. He decides to book a first class train ticket. While booking the ticket he notices that the route he wanted to take had the first class seats filled already. There was still room for coach class seats but he instead chose to book a first class seat with a train that departs later.
5. 10 minutes before the train departs the conductor goes through the train. The conductor checks the tickets of each individual. If someone is caught without a ticket they would be asked to leave. If the individual refuses to leave then the railway police will be called to escort the individual off the train.
6. One day an accident occurs on the railway tracks. This causes a huge delay in departure and arrival times for all trains. The station manager has to alert other station managers of the delay so they can update the arrival and departure times to make up for the delay.

Section III: Business Rules

1. Company
    1.1. A company shall own at least one train.
    1.2. A company hires at least one employee.
    1.3. A company sells at most one ticket.
2. Employee
    2.1. An employee shall work for only one company.
3. Station Manager
    3.1. A station manager shall have one unique employee id.
    3.2. A station manager shall manage at least one station.
4. Conductor
    4.1. A conductor shall drive one train.
5. Railway Police
    5.1. Railway police shall work at, at least one station.
6. Train
    6.1. A train shall have many seats.
    6.2. A train shall have at least one route.
    6.3. A train shall arrive at, at least one station.
    6.4. A train shall depart at, at least one station.
7. Coach Class Seat
    7.1. A coach class seat shall only be seated by a coach class passenger.
8. First Class Seat
    8.1. A first class seat shall only be seated by a first class passenger.
9. Station
    9.1. A station shall hold at least one train.
    9.2. A station will have only one inbound.
    9.3. A station will have only one outbound.
10. Kiosk
    10.1. A kiosk shall belong to only one station.
    10.2. A kiosk shall print only one purchased ticket.
11. Route
    11.1. A route shall have one departure station.
    11.2. A route shall have one arrival station.
    11.3. A route shall have one departure time.
    11.4. A route shall have one arrival time.
    11.5. A route shall have one departure date.
    11.6. A route shall have one arrival date.
    11.7. A route shall be updated by at least one station manager.
12. Customer

12.1. A customer can create only one EasyTrips account.
12.2. A customer shall book at least one ticket.
12.3. A customer shall be able to cancel at least one ticket.
12.4. A customer can purchase one ticket from a kiosk.
12.5. A customer shall create only one EasyTrips account using a unique email.
12.6. A passenger shall have at least one ticket.
12.7. A passenger shall board only one train.
12.8. A passenger with a coach class ticket shall be seated only in the coach class area.
12.9. A passenger with a first class ticket shall be seated only in the first class area.
12.10. A passenger shall be able to upgrade to a first class ticket.
12.11. A passenger shall be able to downgrade to a coach class ticket.

13. Ticket
    13.1. Tickets shall be sent to the customer's unique email.
    13.2. Tickets shall be sent to the customer's EasyTrips account.
    13.3. A ticket shall have only one route.
14. Payment Type
    14.1. A payment type can be Credit Card or Debit Card.
    14.2. A payment type shall have one billing address.
    14.3. A payment type shall have one city.
    14.4. A payment type shall have one state.
    14.5. A payment type shall have one zip code.
    14.6. A payment type shall have one country.
15. EasyTrips Account
    15.1. An EasyTrips Account can only be created by one Customer.
    15.2. An EasyTrips Account shall have only one user logged in.
16. Phone App
    16.1. A phone app shall have zero or more tickets.

Section IV: Detailed List of Main Entities, Attributes, Keys

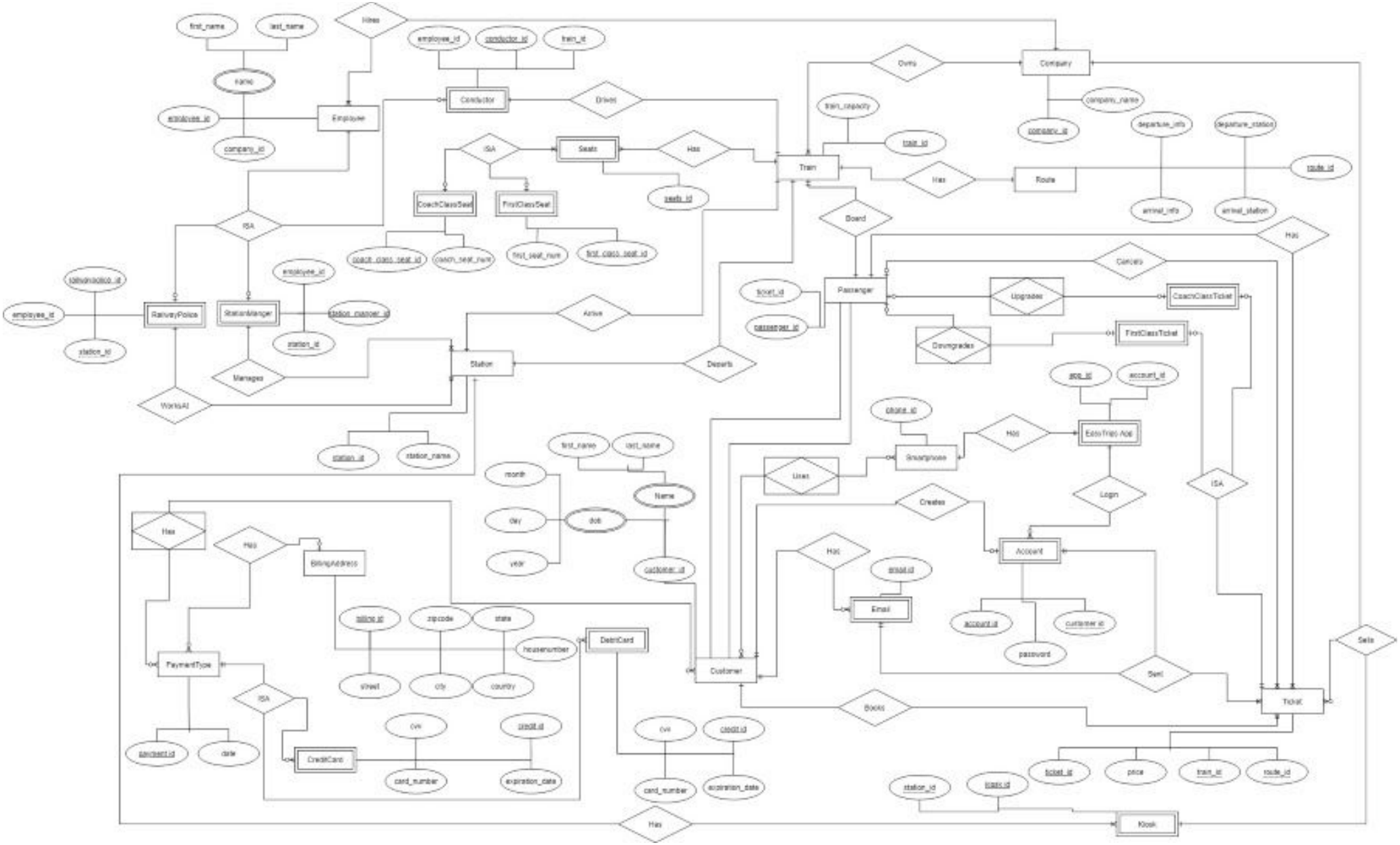
1. Company (Strong)
    - company_id: key, numeric
    - company_name: alphanumeric
2. Employee (Strong)
    - employee_id: key, numeric
    - name: composite
        i. first_name: alphanumeric
        ii. last_name: alphanumeric
    - company_id: weak key, numeric
3. Station Manager (Weak)
    - station_manger_id: key, numeric
    - employee_id: weak key, numeric
    - station_id: weak key, numeric
4. Conductor(Weak)
    - conductor_id: key, numeric
    - employee_id: weak key, numeric
    - train_id: weak keym numeric
5. Railway Police(Weak)
    - railwaypolice_id: key, numeric
    - employee_id: weak key, numeric
    - station_id: weak key, numeric
6. Train(Strong)
    - train_id: key, numeric
    - train_capacity: numeric
7. Seats(Weak)
    - seats_id: key, numeric
8. First Class Seat(Weak)
    - first_class_seat_id: key, numeric
    - first_seat_num: numeric
9. Coach Class Seat(Weak)
    - coach_class_seat_id: key, numeric
    - coach_seat_num: numeric
10. Station(Strong)
    - station_id: key, numeric
    - station_name: multivalue alphanumeric
    -
11. Kiosk(Weak)
    - kiosk_id: key, numeric

    - station_id: weak key, numeric
12. Route(Strong)
    - route_id: key, numeric
    - departure_info: alphanumeric, timestamp
    - arrival_info: alphanumeric, timestamp
    - departurel_station: alphanumeric
    - arrival_station: alphanumeric
13. Customer(Strong)
    - customer_id: key, numeric
    - name
        i. first_name: alphanumeric
        ii. last_name: alphanumeric
    - dob: composite, alphanumeric
        i. month: numeric
        ii. day: numeric
        iii. year: numeric
14. Passenger(Strong)
    - passenger_id: key, numeric
    - ticket_id: weak key, numeric
15. Ticket(Ticket)
    - ticket_id: key, numeric
    - train_id: weak key, numeric
    - route_id: weak key, numeric
    - price: numeric
16. Payment Type(Strong)
    - payment_id: key, numeric
    - date: timestamp
17. Credit Card(Weak)
    - credit_id: key, numeric
    - card_number: numeric
    - cvv: numeric
    - expiration_date: composite, alphanumeric
        i. month: numeric
        ii. year: numeric
18. Debit Card(Weak)
    - debit_id: key, numeric
    - card_number: numeric
    - cvv: numeric
    - expiration_date: composite, alphanumeric
        i. month: numeric

    ii. year: numeric

19. Billing Address(Strong)
    - billing_id: key, numeric
    - street: alphanumeric
    - zipcode: numeric
    - city: alphanumeric
    - state: alphanumeric
    - country: alphanumeric
    - house_number: numeric
20. Account(Weak)
    - account_id: key, numeric
    - customer_id: weak key, numeric
    - password: alphanumeric
21. Smartphone(Strong)
    - phone_id: key, numeric
22. EasyTrips App(Weak)
    - app_id: key, numeric
    - account_id: weak key, numeric

Section V: Entity Relationship Diagram (ERD)



Section VI: Testing Table

Rule	Entity A	Relation	Entity B	Cardinality	P/F	Error Description
1	Company	Own	Train	1-to-M	P	
2	Company	Hires	Employee	1-to-M	P	
3	Company	Sells	Ticket	1-to-M	F	It is possible for a company to make 0 to many ticket sales
4	Employee	Work	Company	1-to-1	P	
5	Station Manager	Manage	Station	1-to-Only 1	F	A station manager should be able to work at, at least one station. It cannot work only at a single station.
6	Conductor	Drives	Train	1-to-1	P	
7	Railway Police	WorksAt	Station	M-to-Only 1	F	One Railway Police shall work at, at least one station. They should not be locked to working at only one station.
8	Trains	Has	Seats	1-to-M	P	
9	Train	Has	Route	1-to-1	P	
10	Train	Arrives	Station	1-to-M	F	A train should arrive at one station.
11	Train	Departs	Station	1-to-M	F	A train should

						depart from one station.
12	Seats	IS-A	Coach Class Seat	M-to-1	P	
13	Seats	IS-A	First Class Seat	M-to-1	P	
14	Station	Has	Kiosk	1-to-M	P	
15	Customer	Books	Ticket	1-to-M	P	
16	Customer	Creates	Account	1-to-M	F	Customers should only be able to create zero or one account
17	Customer	Has	Email	1-to-M	P	
18	Customer	Has	Payment Type	M-to-N	P	
19	Customer	Uses	Smartphone	M-to-N	P	
20	Payment Type	IS-A	Credit Card	1-to-M	P	
21	Payment Type	IS-A	Debit Card	1-to-M	P	
22	Payment Type	Has	Billing Address	M-to-1	P	
23	Passenger	Has	Ticket	1-to-M	P	
24	Passenger	Cancels	Ticket	M-to-N	P	
25	Passenger	Upgrades	Ticket	M-to-N	F	Passenger should only be allowed to upgrade one ticket at a time
26	Passenger	Downgrades	Ticket	M-to-N	F	Passenger should only be

						allowed to downgrade one ticket at a time
27	Passenger	Boards	Train	1-to-Only 1	P	
28	Ticket	Sent	Account	M-to-Only 1	P	
29	Ticket	Sent	Email	M-to-Only 1	P	