**ER Diagram and DBMS Project on Indian Transport Station**

The Indian Transport Station Management System is a database designed to manage and streamline the operations at transport stations, such as bus depots, train stations, and metro hubs. The system focuses on efficiently managing details related to stations, vehicles, drivers, schedules, and ticket bookings, enabling the station administrators to monitor and operate vehicles, assign drivers, and keep track of daily schedules and ticket sales.

The system ensures data integrity and accuracy, manages relationships between entities (like vehicles and drivers), and implements various SQL operations to support station management tasks such as scheduling, assigning drivers to vehicles, booking tickets, and tracking vehicle information.

**ER Diagram**

Entities (Tables in your database):

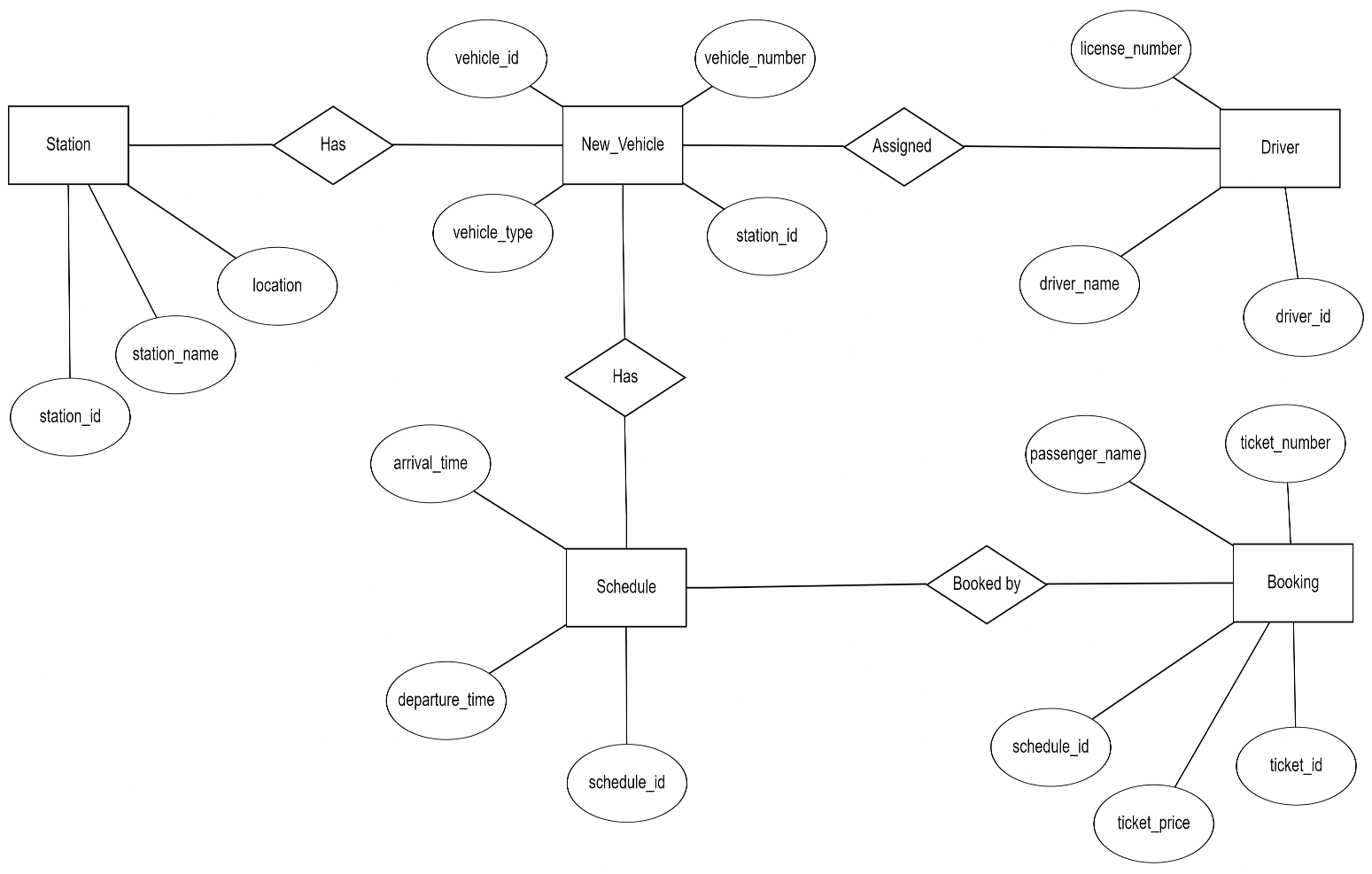
* Shape: Use rectangles to represent entities.
* Entities in your case: Station, New\_Vehicle, Driver, Schedule, Ticket.

Relationships:

* Shape: Use diamonds to represent relationships between entities.
* Relationships in your case:
  + Station-Vehicle (Has)
  + New\_Vehicle-Driver (Assigned )
  + New\_Vehicle-Schedule (Has)
  + Schedule-Booking (Booked by)

Attributes (Entity fields):

* Shape: Used ovals to represent attributes.
* Example Attributes:
  + For Station: station\_id, station\_name, location
  + For New\_Vehicle: vehicle\_id, vehicle\_number, vehicle\_type, station\_id
  + **For Driver: driver\_id, driver\_name, license\_number**
  + **For Schedule: schedule\_id, departure\_time, arrival\_time**
  + **For Booking: ticket\_id, ticket\_number, passenger\_name, schedule\_id, ticket\_price**

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**Program 1**: Basic Table Operations

CREATE DATABASE IndianTransport;

USE IndianTransport;

CREATE TABLE Station (

station\_id INT AUTO\_INCREMENT PRIMARY KEY,

station\_name VARCHAR(100) NOT NULL,

location VARCHAR(100) NOT NULL

);

CREATE TABLE Vehicle (

vehicle\_id INT AUTO\_INCREMENT PRIMARY KEY,

vehicle\_number VARCHAR(20) NOT NULL UNIQUE,

vehicle\_type VARCHAR(50) NOT NULL,

station\_id INT,

FOREIGN KEY (station\_id) REFERENCES Station(station\_id)

);

CREATE TABLE Driver (

driver\_id INT AUTO\_INCREMENT PRIMARY KEY,

driver\_name VARCHAR(100) NOT NULL,

license\_number VARCHAR(50) NOT NULL

);

INSERT INTO Station (station\_name, location)

VALUES ('Mumbai Central', 'Mumbai'),

('Howrah Junction', 'Kolkata'),

('Delhi Junction', 'Delhi');

INSERT INTO Vehicle (vehicle\_number, vehicle\_type, station\_id)

VALUES ('MH01X1234', 'Bus', 1),

('WB12X5678', 'Train', 2),

('DL01B6543', 'Metro', 3);

INSERT INTO Driver (driver\_name, license\_number)

VALUES ('John Doe', 'L1234567'),

('Jane Doe', 'L7654321'),

('Michael Smith', 'L5647382');

TRUNCATE TABLE Driver;

DROP TABLE Vehicle;

select \* from Station;

select \* from Vehicle;

select \* from Driver;

**Output:**

+------------+-----------------+----------+

| station\_id | station\_name | location |

+------------+-----------------+----------+

| 1 | Mumbai Central | Mumbai |

| 2 | Howrah Junction | Kolkata |

| 3 | Delhi Junction | Delhi |

+------------+-----------------+----------+

ERROR 1146 (42S02) at line 37: Table ' IndianTransport.vehicle' doesn't exist

**Program 2**: Child Table and Referential Integrity

CREATE TABLE Vehicle (

vehicle\_id INT AUTO\_INCREMENT PRIMARY KEY,

vehicle\_number VARCHAR(20) NOT NULL UNIQUE,

vehicle\_type VARCHAR(50) NOT NULL,

station\_id INT,

FOREIGN KEY (station\_id) REFERENCES Station(station\_id)

);

CREATE TABLE Schedule (

schedule\_id INT AUTO\_INCREMENT PRIMARY KEY,

departure\_time TIME NOT NULL,

arrival\_time TIME NOT NULL,

vehicle\_id INT,

FOREIGN KEY (vehicle\_id) REFERENCES Vehicle(vehicle\_id)

);

ALTER TABLE Schedule RENAME TO VehicleSchedule;

INSERT INTO Vehicle (vehicle\_number, vehicle\_type, station\_id)

VALUES ('MH01X1234', 'Bus', 1),

('WB12X5678', 'Train', 2),

('DL01B6543', 'Metro', 3);

INSERT INTO VehicleSchedule (departure\_time, arrival\_time, vehicle\_id)

VALUES ('08:00:00', '12:00:00', 1),

('09:00:00', '13:00:00', 2)

('10:30:00', '12:00:00', 3);

UPDATE VehicleSchedule SET vehicle\_id = 2 WHERE schedule\_id = 1;

ALTER TABLE VehicleSchedule ADD CONSTRAINT fk\_vehicle FOREIGN KEY (vehicle\_id) REFERENCES Vehicle(vehicle\_id);

CREATE TABLE Ticket (

ticket\_id INT AUTO\_INCREMENT PRIMARY KEY,

ticket\_number VARCHAR(20) NOT NULL,

passenger\_name VARCHAR(100) NOT NULL,

schedule\_id INT NOT NULL,

ticket\_price DECIMAL(10, 2) NOT NULL,

FOREIGN KEY (schedule\_id) REFERENCES VehicleSchedule(schedule\_id)

);

INSERT INTO Ticket (ticket\_number, passenger\_name, schedule\_id, ticket\_price)

VALUES

('TK1001', 'John Doe', 1, 150.00),

('TK1002', 'Jane Smith', 2, 200.50),

('TK1003', 'Alice Johnson', 3, 180.75),

('TK1004', 'Bob Brown', 1, 150.00),

('TK1005', 'Charlie Davis', 2, 200.50),

('TK1006', 'Diana Evans', 3, 180.75),

('TK1007', 'Ethan Foster', 1, 150.00),

('TK1008', 'Fiona Green', 2, 200.50),

('TK1009', 'George Hall', 3, 180.75),

('TK1010', 'Hannah Ives', 1, 150.00);

DELETE FROM Ticket WHERE schedule\_id = 1;

ALTER TABLE Ticket RENAME TO Booking;

select \* from Vehicle;

select \* from VehicleSchedule;

**Output:**

+------------+----------------+--------------+------------+

| vehicle\_id | vehicle\_number | vehicle\_type | station\_id |

+------------+----------------+--------------+------------+

| 1 | MH01X1234 | Bus | 1 |

| 2 | WB12X5678 | Train | 2 |

| 3 | DL01B6543 | Metro | 3 |

+------------+----------------+--------------+------------+

+-------------+----------------+--------------+------------+

| schedule\_id | departure\_time | arrival\_time | vehicle\_id |

+-------------+----------------+--------------+------------+

| 1 | 08:00:00 | 12:00:00 | 2 |

| 2 | 09:00:00 | 13:00:00 | 2 |

+-------------+----------------+--------------+------------+

**Program 3**: SQL Constraints

CREATE TABLE New\_Vehicle (

vehicle\_id INT AUTO\_INCREMENT PRIMARY KEY,

vehicle\_number VARCHAR(20) UNIQUE NOT NULL,

vehicle\_type VARCHAR(50) NOT NULL,

station\_id INT NOT NULL,

FOREIGN KEY (station\_id) REFERENCES Station(station\_id),

CHECK (vehicle\_type IN ('Bus', 'Train', 'Metro'))

);

INSERT INTO New\_Vehicle (vehicle\_number, vehicle\_type, station\_id)

VALUES

('MH01X1234', 'Bus', 1),

('WB12X5678', 'Train', 2),

('DL01B6543', 'Metro', 3),

('TN02Y4567', 'Bus', 1),

('KA03Z8910', 'Train', 2),

('UP04A1112', 'Metro', 3),

('GJ05B1314', 'Bus', 1),

('RJ06C1516', 'Train', 2),

('HR07D1718', 'Metro', 3),

('PB08E1920', 'Bus', 1),

('BR09F2122', 'Train', 2),

('JK10G2324', 'Metro', 3),

('MH11H2526', 'Bus', 1),

('WB12I2728', 'Train', 2),

('DL13J2930', 'Metro', 3);

ALTER TABLE New\_Vehicle MODIFY vehicle\_type VARCHAR(50) NULL;

select \* from New\_Vehicle;

**Output:**

+------------+----------------+--------------+------------+

| vehicle\_id | vehicle\_number | vehicle\_type | station\_id |

+------------+----------------+--------------+------------+

| 1 | MH01X1234 | Bus | 1 |

| 2 | WB12X5678 | Train | 2 |

| 3 | DL01B6543 | Metro | 3 |

| 4 | TN02Y4567 | Bus | 1 |

| 5 | KA03Z8910 | Train | 2 |

| 6 | UP04A1112 | Metro | 3 |

| 7 | GJ05B1314 | Bus | 1 |

| 8 | RJ06C1516 | Train | 2 |

| 9 | HR07D1718 | Metro | 3 |

| 10 | PB08E1920 | Bus | 1 |

| 11 | BR09F2122 | Train | 2 |

| 12 | JK10G2324 | Metro | 3 |

| 13 | MH11H2526 | Bus | 1 |

| 14 | WB12I2728 | Train | 2 |

| 15 | DL13J2930 | Metro | 3 |

+------------+----------------+--------------+------------+

**Program 4**: SQL Queries with WHERE, GROUP BY, HAVING, ORDER BY, DISTINCT, and LIMIT

SELECT \* FROM New\_Vehicle WHERE vehicle\_type = 'Bus';

SELECT station\_id, COUNT(vehicle\_id) AS VehicleCount

FROM New\_Vehicle

GROUP BY station\_id

HAVING VehicleCount > 1;

SELECT \* FROM New\_Vehicle ORDER BY vehicle\_type ASC;

SELECT DISTINCT vehicle\_type FROM New\_Vehicle LIMIT 5;

**Output:**

+------------+----------------+--------------+------------+

| vehicle\_id | vehicle\_number | vehicle\_type | station\_id |

+------------+----------------+--------------+------------+

| 1 | MH01X1234 | Bus | 1 |

| 4 | TN02Y4567 | Bus | 1 |

| 7 | GJ05B1314 | Bus | 1 |

| 10 | PB08E1920 | Bus | 1 |

| 13 | MH11H2526 | Bus | 1 |

+------------+----------------+--------------+------------+

+------------+--------------+

| station\_id | VehicleCount |

+------------+--------------+

| 1 | 5 |

| 2 | 5 |

| 3 | 5 |

+------------+--------------+

+------------+----------------+--------------+------------+

| vehicle\_id | vehicle\_number | vehicle\_type | station\_id |

+------------+----------------+--------------+------------+

| 1 | MH01X1234 | Bus | 1 |

| 4 | TN02Y4567 | Bus | 1 |

| 7 | GJ05B1314 | Bus | 1 |

| 10 | PB08E1920 | Bus | 1 |

| 13 | MH11H2526 | Bus | 1 |

| 3 | DL01B6543 | Metro | 3 |

| 6 | UP04A1112 | Metro | 3 |

| 9 | HR07D1718 | Metro | 3 |

| 12 | JK10G2324 | Metro | 3 |

| 15 | DL13J2930 | Metro | 3 |

| 2 | WB12X5678 | Train | 2 |

| 5 | KA03Z8910 | Train | 2 |

| 8 | RJ06C1516 | Train | 2 |

| 11 | BR09F2122 | Train | 2 |

| 14 | WB12I2728 | Train | 2 |

+------------+----------------+--------------+------------+

+--------------+

| vehicle\_type |

+--------------+

| Bus |

| Train |

| Metro |

+--------------+

**Program 5**: Joins

SELECT Station.station\_name, Vehicle.vehicle\_number

FROM Station

LEFT JOIN Vehicle ON Station.station\_id = Vehicle.station\_id;

SELECT Station.station\_name, Vehicle.vehicle\_number

FROM Station

RIGHT JOIN Vehicle ON Station.station\_id = Vehicle.station\_id;

SELECT Station.station\_name, Vehicle.vehicle\_number

FROM Station

INNER JOIN Vehicle ON Station.station\_id = Vehicle.station\_id;

SELECT Station.station\_name, Vehicle.vehicle\_number

FROM Station

LEFT JOIN Vehicle ON Station.station\_id = Vehicle.station\_id

UNION

SELECT Station.station\_name, Vehicle.vehicle\_number

FROM Station

RIGHT JOIN Vehicle ON Station.station\_id = Vehicle.station\_id;

**Output:**

+-----------------+----------------+

| station\_name | vehicle\_number |

+-----------------+----------------+

| Mumbai Central | MH01X1234 |

| Howrah Junction | WB12X5678 |

| Delhi Junction | DL01B6543 |

+-----------------+----------------+

+-----------------+----------------+

| station\_name | vehicle\_number |

+-----------------+----------------+

| Mumbai Central | MH01X1234 |

| Howrah Junction | WB12X5678 |

| Delhi Junction | DL01B6543 |

+-----------------+----------------+

+-----------------+----------------+

| station\_name | vehicle\_number |

+-----------------+----------------+

| Mumbai Central | MH01X1234 |

| Howrah Junction | WB12X5678 |

| Delhi Junction | DL01B6543 |

+-----------------+----------------+

+-----------------+----------------+

| station\_name | vehicle\_number |

+-----------------+----------------+

| Mumbai Central | MH01X1234 |

| Howrah Junction | WB12X5678 |

| Delhi Junction | DL01B6543 |

+-----------------+----------------+

**Program 6**: String, Numeric, and Date-Time Functions

SELECT CONCAT(driver\_name, ' (', license\_number, ')') AS DriverInfo FROM Driver;

SELECT ROUND(AVG(ticket\_price), 2) AS AverageTicketPrice FROM Booking;

SELECT NOW() AS CurrentDateTime;

**Output:**

+--------------------------+

| DriverInfo |

+--------------------------+

| John Doe (L1234567) |

| Jane Doe (L7654321) |

| Michael Smith (L5647382) |

+--------------------------+

+--------------------+

| AverageTicketPrice |

+--------------------+

| 190.63 |

+--------------------+

+---------------------+

| CurrentDateTime |

+---------------------+

| 2024-10-16 10:39:47 |

+---------------------+

**Program 7**: Subqueries and Set Functions

SELECT station\_name FROM Station WHERE station\_id IN (SELECT station\_id FROM Vehicle WHERE vehicle\_type = 'Bus');

SELECT vehicle\_number FROM Vehicle

WHERE station\_id = (SELECT station\_id FROM Station WHERE station\_name = 'Mumbai Central');

SELECT \* FROM Booking WHERE schedule\_id IN (SELECT schedule\_id FROM VehicleSchedule WHERE vehicle\_id = 1);

SELECT vehicle\_number FROM Vehicle

WHERE station\_id = ANY (SELECT station\_id FROM Station WHERE location LIKE 'Mumbai%');

**Output:**

+----------------+

| station\_name |

+----------------+

| Mumbai Central |

+----------------+

+----------------+

| vehicle\_number |

+----------------+

| MH01X1234 |

+----------------+

+----------------+

| vehicle\_number |

+----------------+

| MH01X1234 |

+----------------+

**Program 8**: Relational Algebra Operations (Cartesian Product, Division, Rename)

SELECT \* FROM Vehicle, Driver;

SELECT station\_id FROM Vehicle V

WHERE NOT EXISTS (SELECT \* FROM VehicleSchedule VS WHERE VS.vehicle\_id = V.vehicle\_id);

SELECT station\_name AS 'StationName', location AS 'City' FROM Station;

Output:

+------------+----------------+--------------+------------+-----------+---------------+----------------+

| vehicle\_id | vehicle\_number | vehicle\_type | station\_id | driver\_id | driver\_name | license\_number |

+------------+----------------+--------------+------------+-----------+---------------+----------------+

| 3 | DL01B6543 | Metro | 3 | 1 | John Doe | L1234567 |

| 2 | WB12X5678 | Train | 2 | 1 | John Doe | L1234567 |

| 1 | MH01X1234 | Bus | 1 | 1 | John Doe | L1234567 |

| 3 | DL01B6543 | Metro | 3 | 2 | Jane Doe | L7654321 |

| 2 | WB12X5678 | Train | 2 | 2 | Jane Doe | L7654321 |

| 1 | MH01X1234 | Bus | 1 | 2 | Jane Doe | L7654321 |

| 3 | DL01B6543 | Metro | 3 | 3 | Michael Smith | L5647382 |

| 2 | WB12X5678 | Train | 2 | 3 | Michael Smith | L5647382 |

| 1 | MH01X1234 | Bus | 1 | 3 | Michael Smith | L5647382 |

+------------+----------------+--------------+------------+-----------+---------------+----------------+

+------------+

| station\_id |

+------------+

| 1 |

+------------+

+-----------------+---------+

| StationName | City |

+-----------------+---------+

| Mumbai Central | Mumbai |

| Howrah Junction | Kolkata |

| Delhi Junction | Delhi |

+-----------------+---------+

**Program 9**: Transaction Control Commands

START TRANSACTION;

INSERT INTO Station (station\_name, location) VALUES ('New Delhi', 'Delhi');

COMMIT;

ROLLBACK;

START TRANSACTION;

SAVEPOINT savepoint1;

INSERT INTO Vehicle (vehicle\_number, vehicle\_type, station\_id) VALUES ('MH01B9090', 'Metro', 3);

ROLLBACK TO savepoint1;

**Program 10**: Views

CREATE VIEW StationDetails AS

SELECT \* FROM Station;

CREATE VIEW MetroStations AS

SELECT station\_name FROM Station

WHERE location = 'Delhi';

CREATE VIEW VehicleInMumbai AS

SELECT vehicle\_number

FROM New\_Vehicle

WHERE station\_id = (SELECT station\_id FROM Station WHERE station\_name = 'Mumbai Central');

CREATE VIEW VehicleScheduleView AS

SELECT V.vehicle\_number, S.departure\_time, S.arrival\_time

FROM New\_Vehicle V

INNER JOIN VehicleSchedule S ON V.vehicle\_id = S.vehicle\_id;

UPDATE MetroStations SET station\_name = 'New Delhi' WHERE station\_name = 'Delhi Junction';

SELECT \* from MetroStations;

SELECT \* from StationDetails;

SELECT \* from VehicleInMumbai;

SELECT \* from VehicleScheduleView;

Output:

+--------------+

| station\_name |

+--------------+

| New Delhi |

| New Delhi |

+--------------+

+------------+-----------------+----------+

| station\_id | station\_name | location |

+------------+-----------------+----------+

| 1 | Mumbai Central | Mumbai |

| 2 | Howrah Junction | Kolkata |

| 3 | New Delhi | Delhi |

| 4 | New Delhi | Delhi |

+------------+-----------------+----------+

+----------------+

| vehicle\_number |

+----------------+

| MH01X1234 |

| TN02Y4567 |

| GJ05B1314 |

| PB08E1920 |

| MH11H2526 |

+----------------+

+----------------+----------------+--------------+

| vehicle\_number | departure\_time | arrival\_time |

+----------------+----------------+--------------+

| WB12X5678 | 08:00:00 | 12:00:00 |

| WB12X5678 | 09:00:00 | 13:00:00 |

| DL01B6543 | 10:30:00 | 12:00:00 |

+----------------+----------------+--------------+

**Conclusion:**

This DBMS project demonstrates a well-rounded understanding of relational databases, SQL concepts, and the management of real-world transport station operations. It showcases essential operations like creating relationships, managing transactions, querying data, and enforcing integrity constraints to ensure accurate and consistent data across the system.