AMERICAN INTERNATIONAL UNIVERSITY–BANGLADESH (AIUB)

FACULTY OF SCIENCE & TECHNOLOGY

Advance Database Management System

Final Term Project Documentation

Project Name - Metro Rail Management System

Section: A

Supervised By

Juena Ahmed Noshin

Submitted By

Name	Id	Contribution
Afsana Jahan Onu	21-45708-3	25% User Interface, Database Connection
Asir Foysal Al Mukit	21-45696-3	25% Project Proposal, Schema Diagram, Use Case Diagram
Umme Jannatul Fariha	21-45718-3	25% Class Diagram, Query Writing
Md. Amir Hossain Alif	21-45446-3	25% Activity Diagram, Relational Algebra

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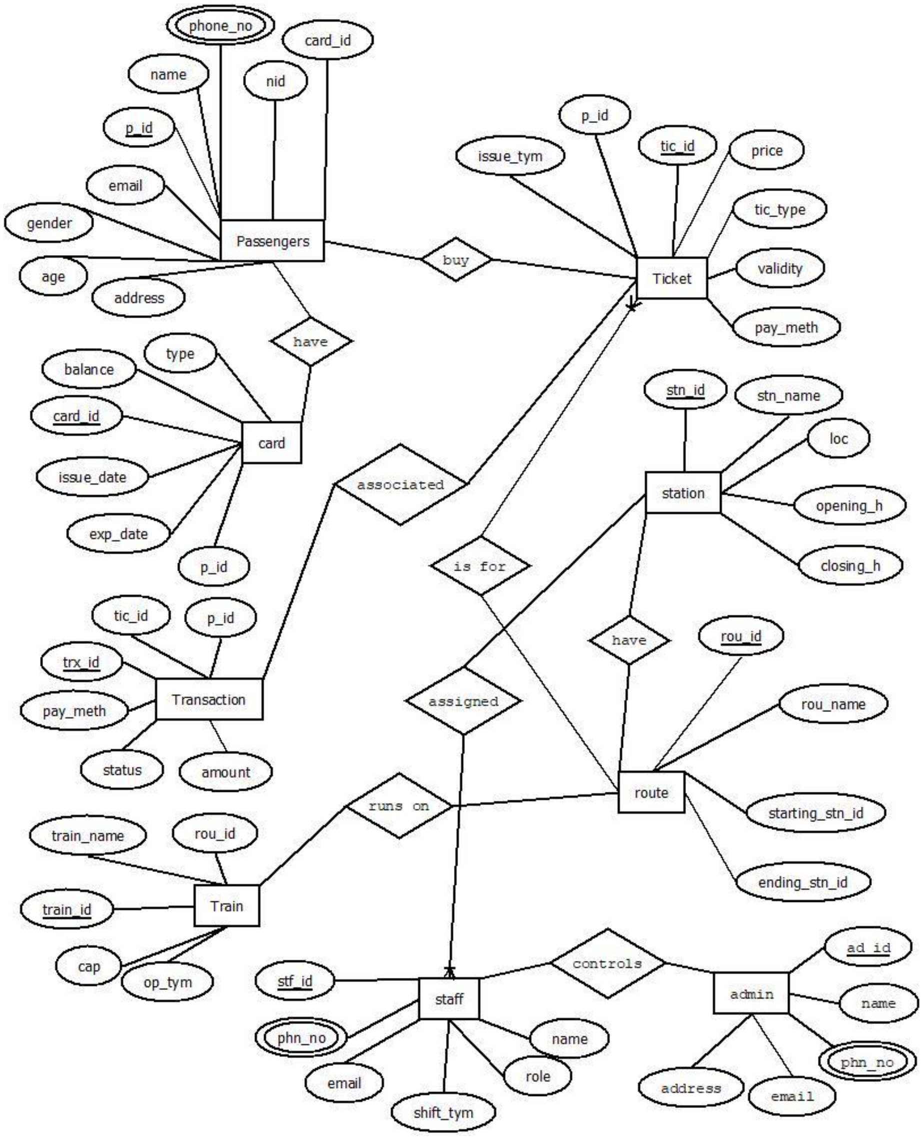
Project Update:

ER Diagram:



Scenario:

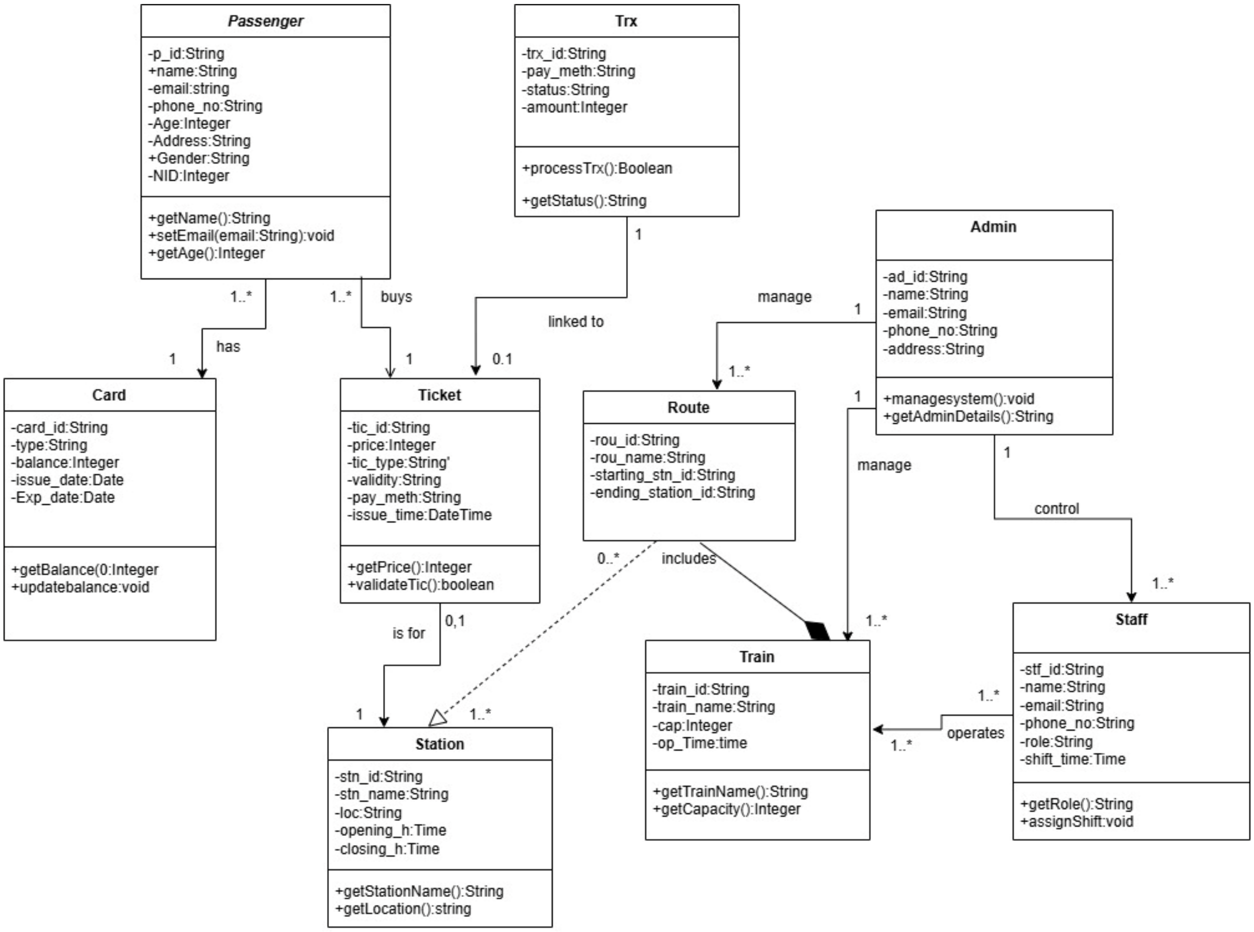
The metro rail management system efficiently manages passenger ticketing, train operations, and station staffing. Passengers can register in the system with a unique passenger ID and provide details such as name, contact information, address, age, gender, and national identification. Each passenger is issued a single metro card containing a card ID, type, balance, issue date, and expiration date, which can be used for purchasing tickets. Tickets, identified by a unique ticket ID, include details such as type, issue time, validity, and payment method. Passengers can buy multiple tickets, with each ticket linked to a specific transaction. Transactions, identified by transaction ID, record the passenger ID, ticket ID, payment method, status, and amount. Tickets are associated with predefined routes, comprising a route ID, name, starting station, and ending station. Trains operate on these routes and are defined by train ID, name, route ID, capacity, and operating hours. Each route encompasses multiple stations, which are identified by station ID, name, location, and operational hours. The system is managed by admins who assign staff to stations, ensuring efficient operations. Admins are identified by admin ID and maintain their contact information and address. Stations are staffed by personnel with specific roles and shift times, with each staff member assigned to one station. This integrated system ensures seamless ticketing, route management, and operational efficiency for passengers and administrators alike.

Project Proposal:

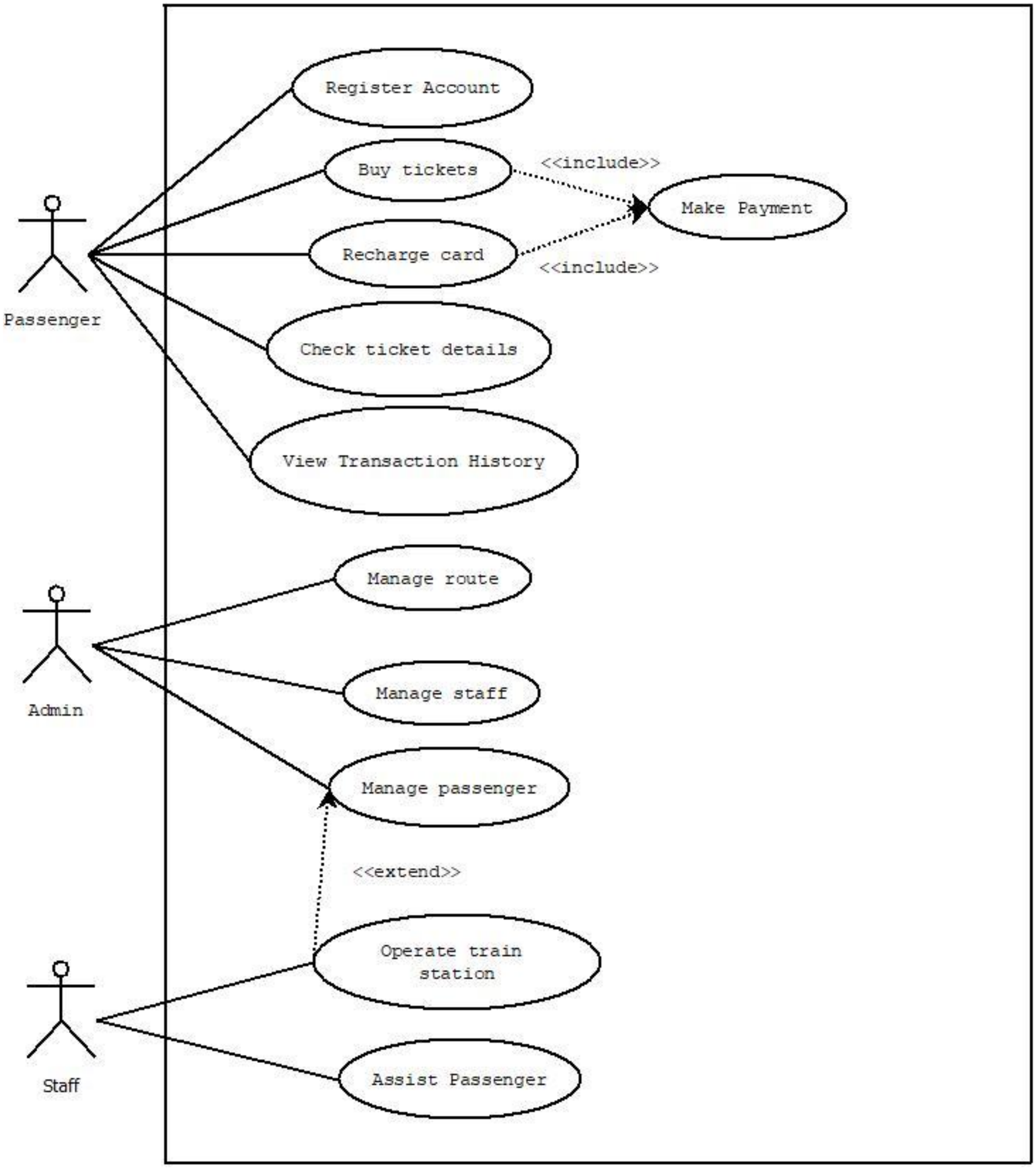
Metro Rail Management System is a digital solution for the betterment of railway operations by enabling passengers to purchase tickets online, maintain their travel cards, and manage transactions efficiently. The system features include passenger registration, secure ticket purchase, smart card integration, and automated financial transaction processing. It also includes train and route management, and administrative control for staff and operators. The system is focused on digitalizing railway ticketing, reducing manual workload, and enhancing passenger experience by using C# for both frontend and backend, and Oracle for the database. This project ensures a fast, seamless, and secure railway management system, hence guaranteeing efficiency, security, and user satisfaction with secure payment gateways and automated processes.

<u>Class diagram, Use Case Diagram and Activity Diagram:</u>

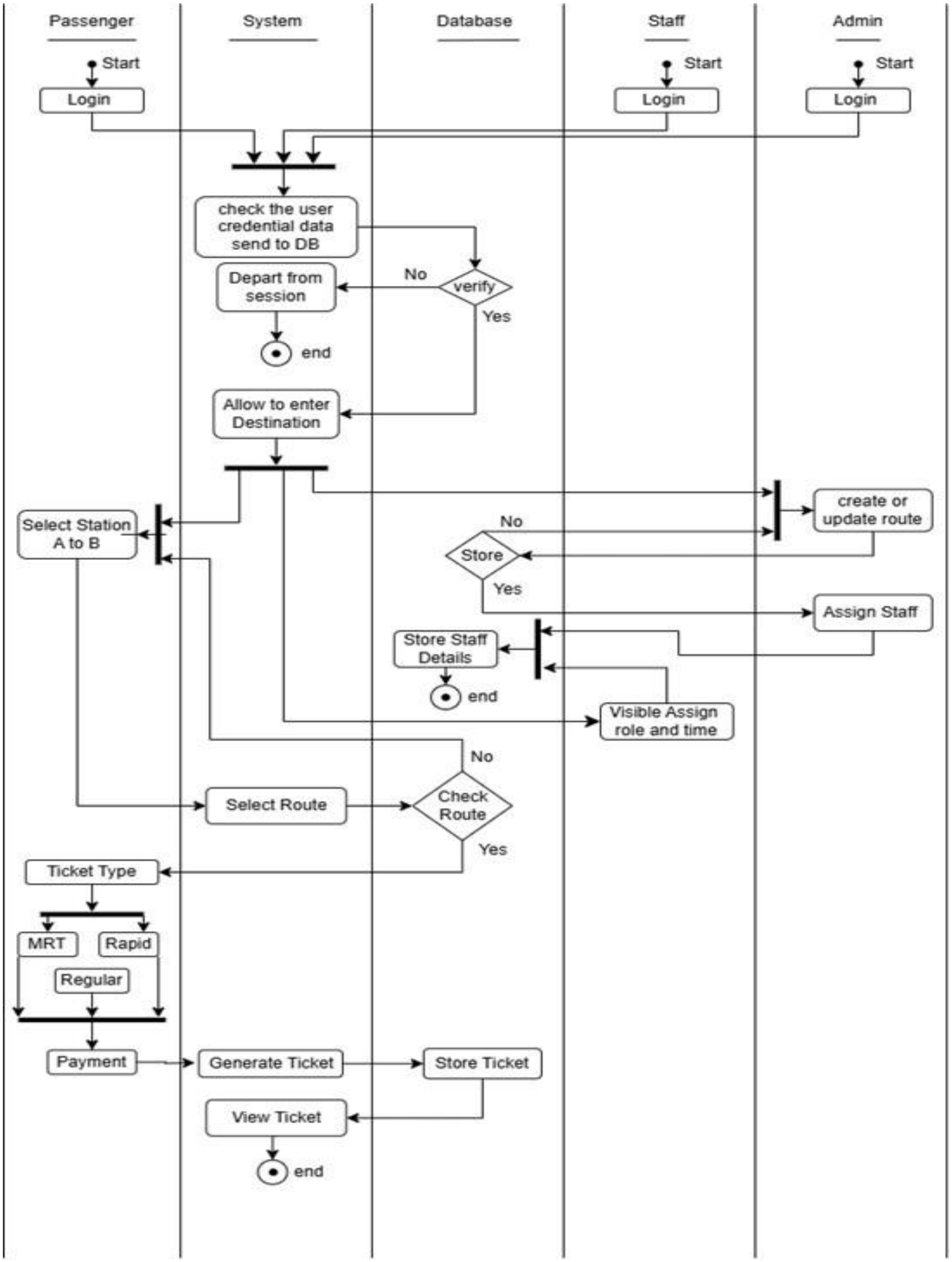
Class Diagram:



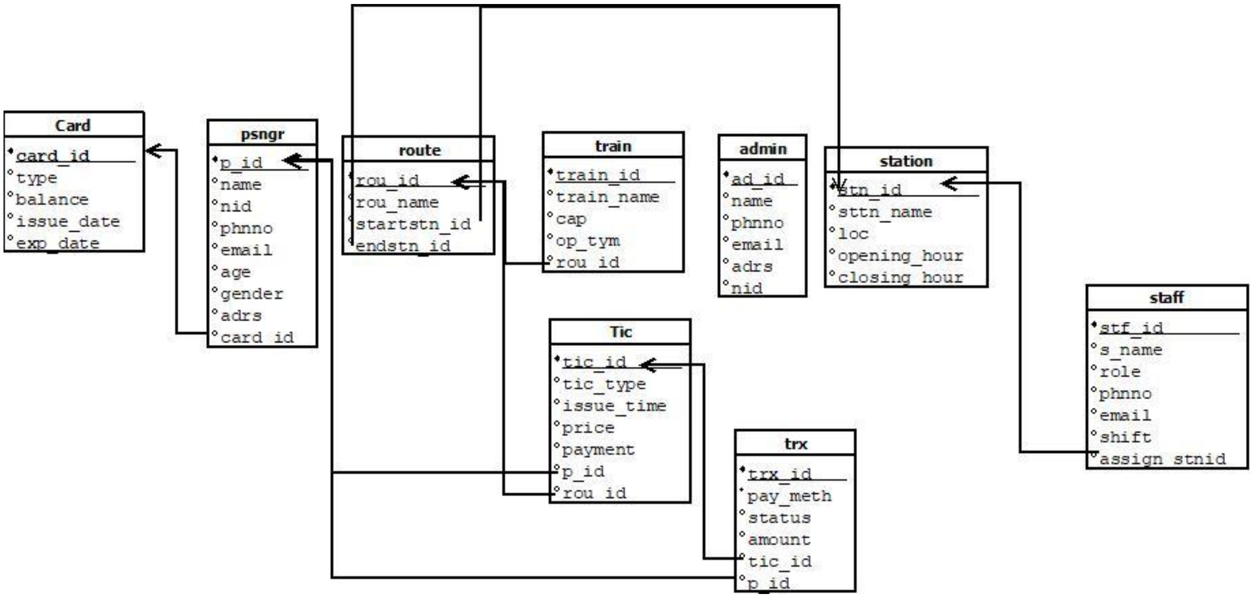
Use Case Diagram:



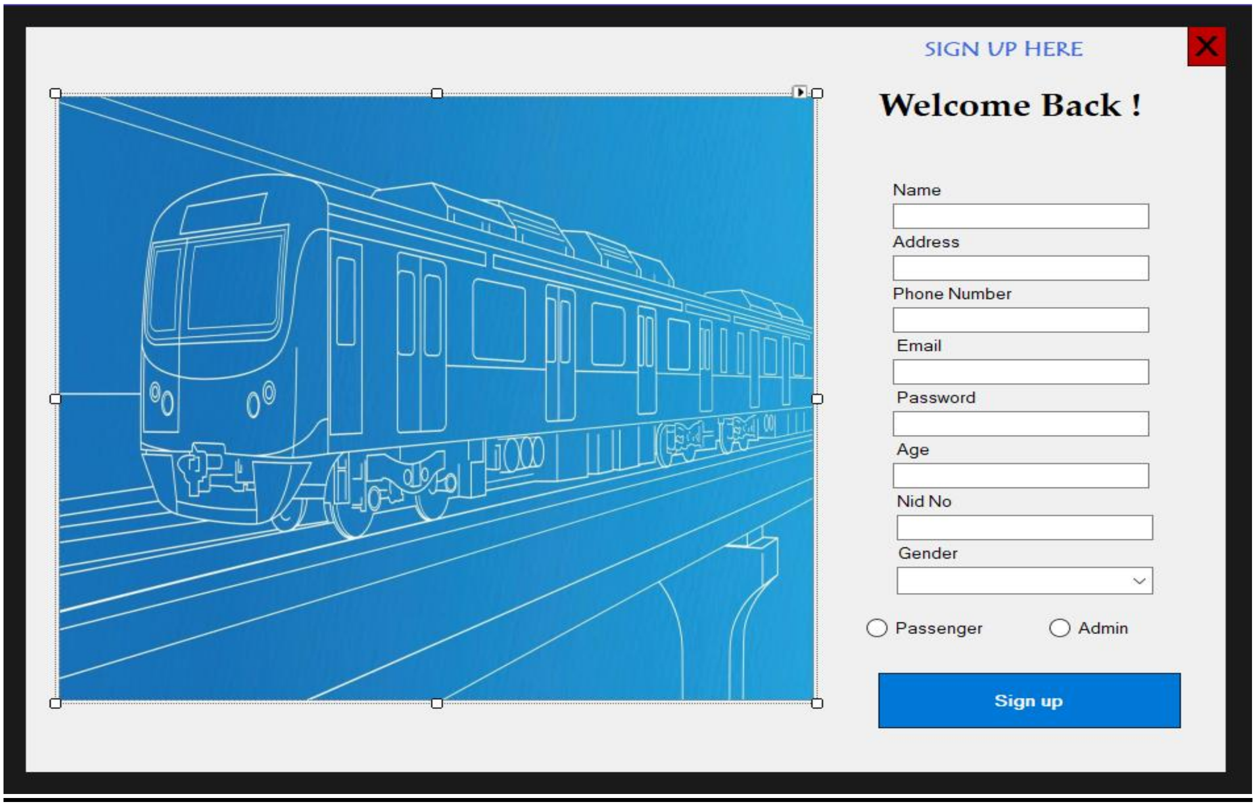
Activity Diagram:

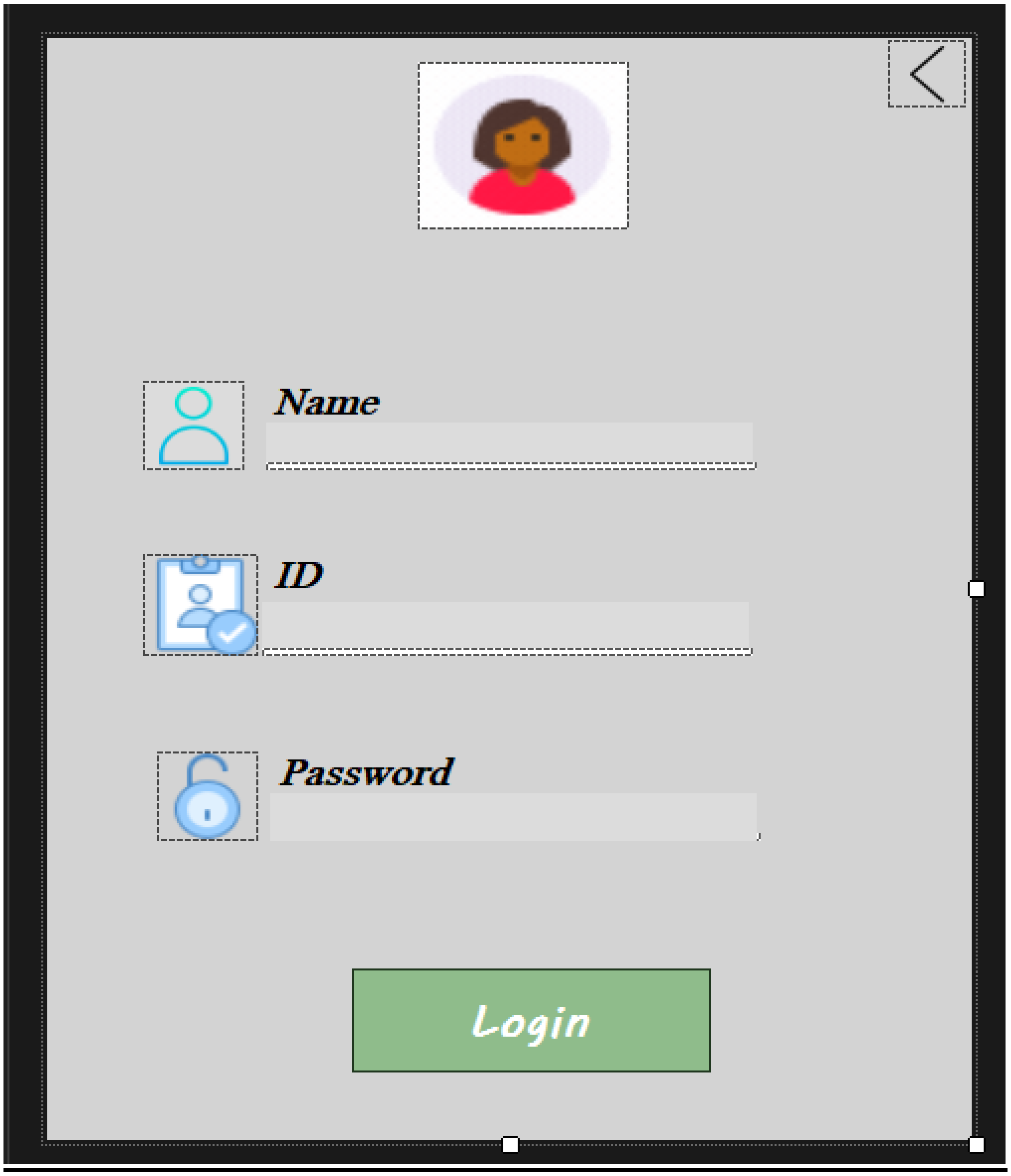


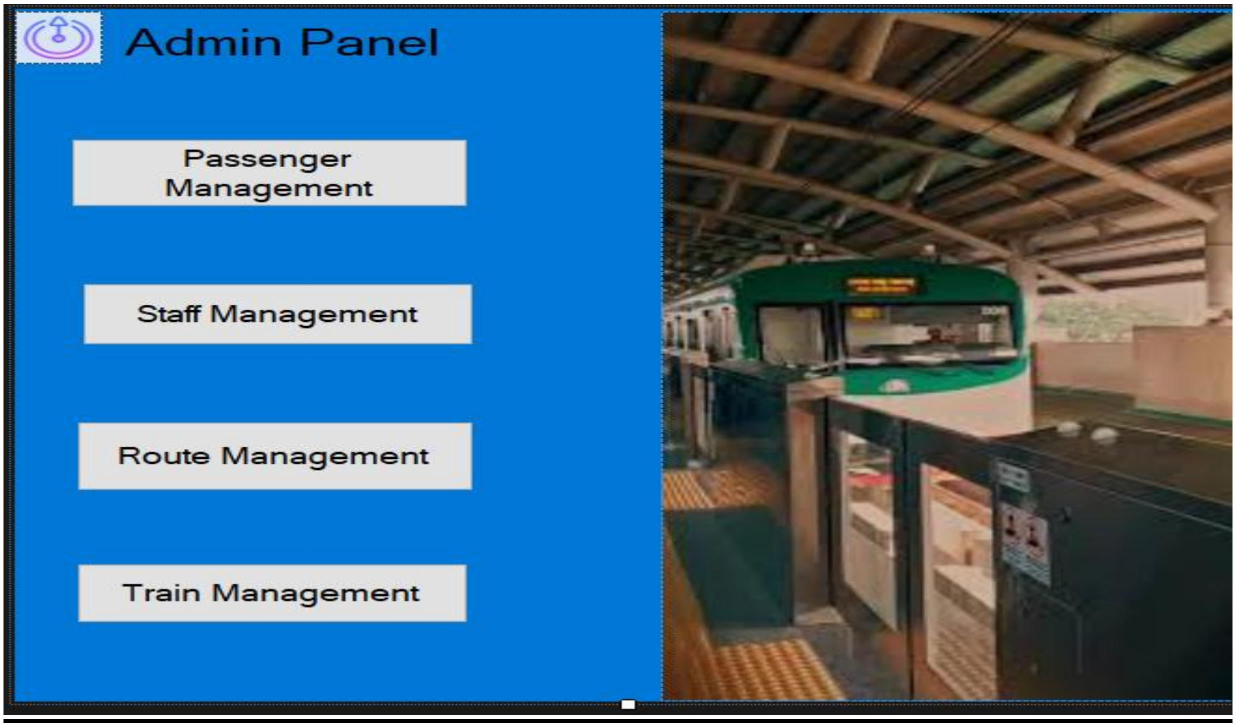
Schema Diagram:

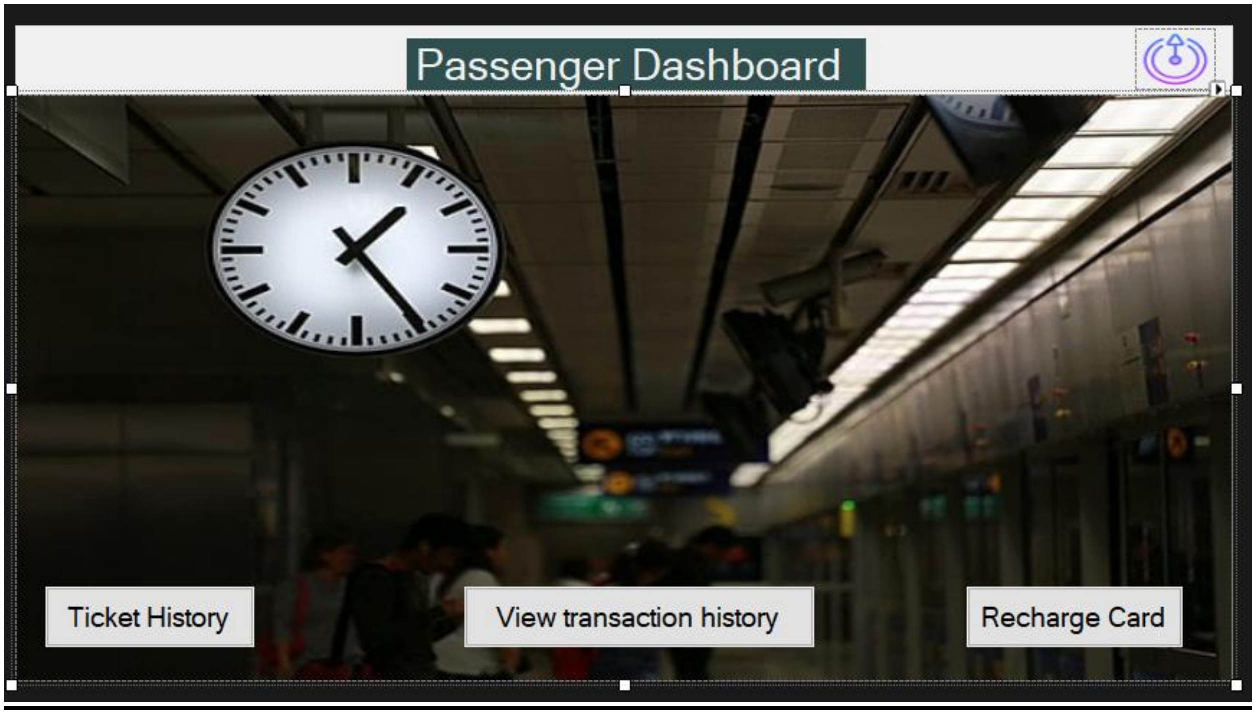


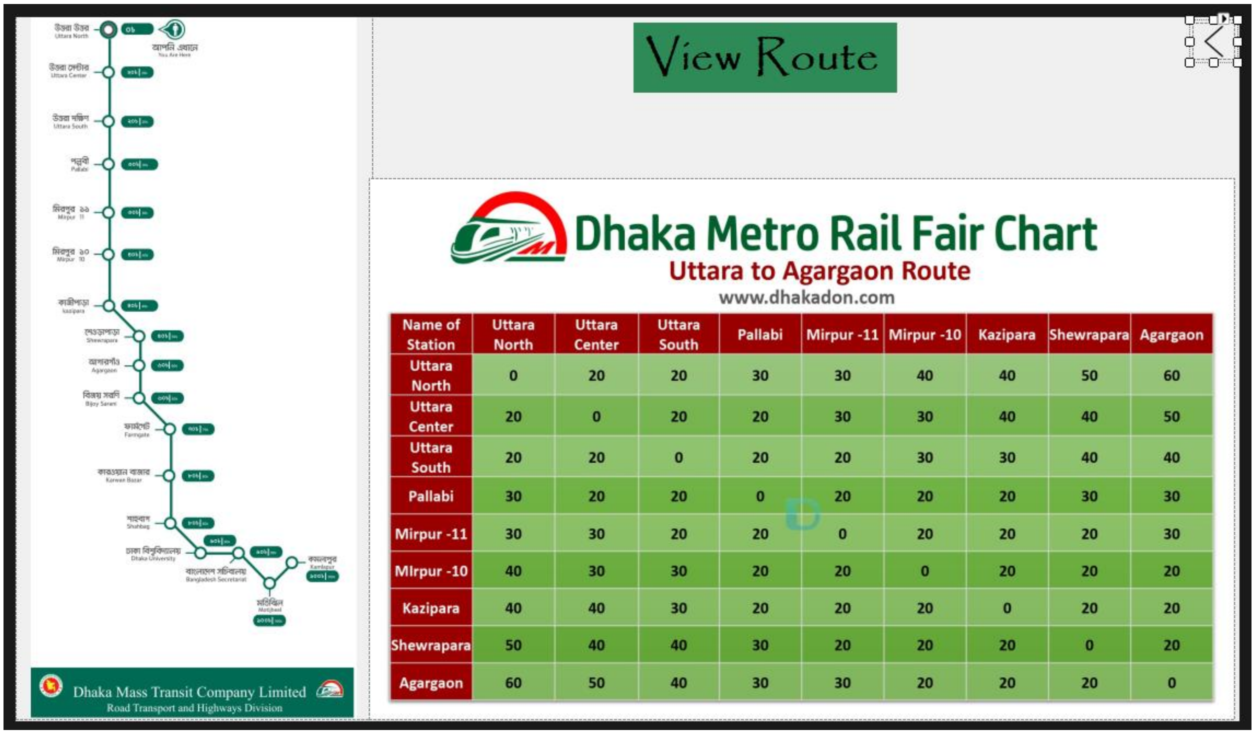
User Interface:




Name
ID
Password
Login


Admin Panel
Passenger Management
Staff Management
Route Management
Train Management


Passenger Dashboard
Ticket History
View transaction history
Recharge Card



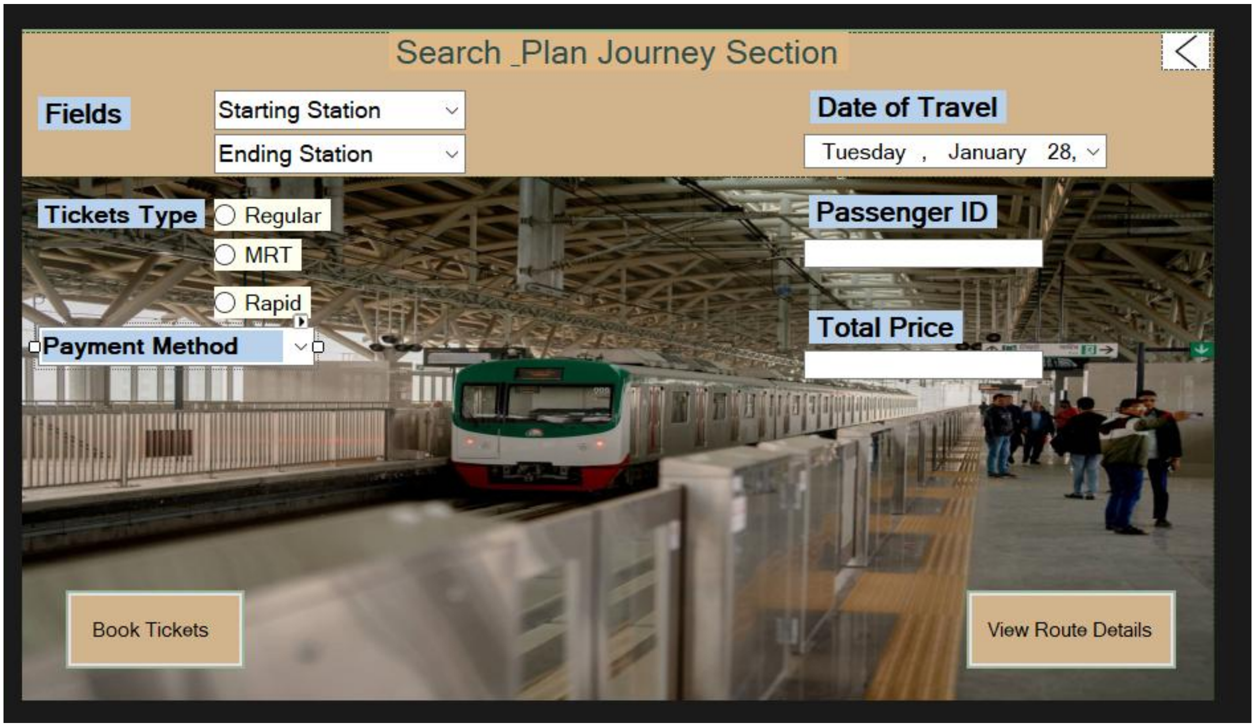
View Route

Dhaka Metro Rail Fair Chart

Uttara to Agargaon Route

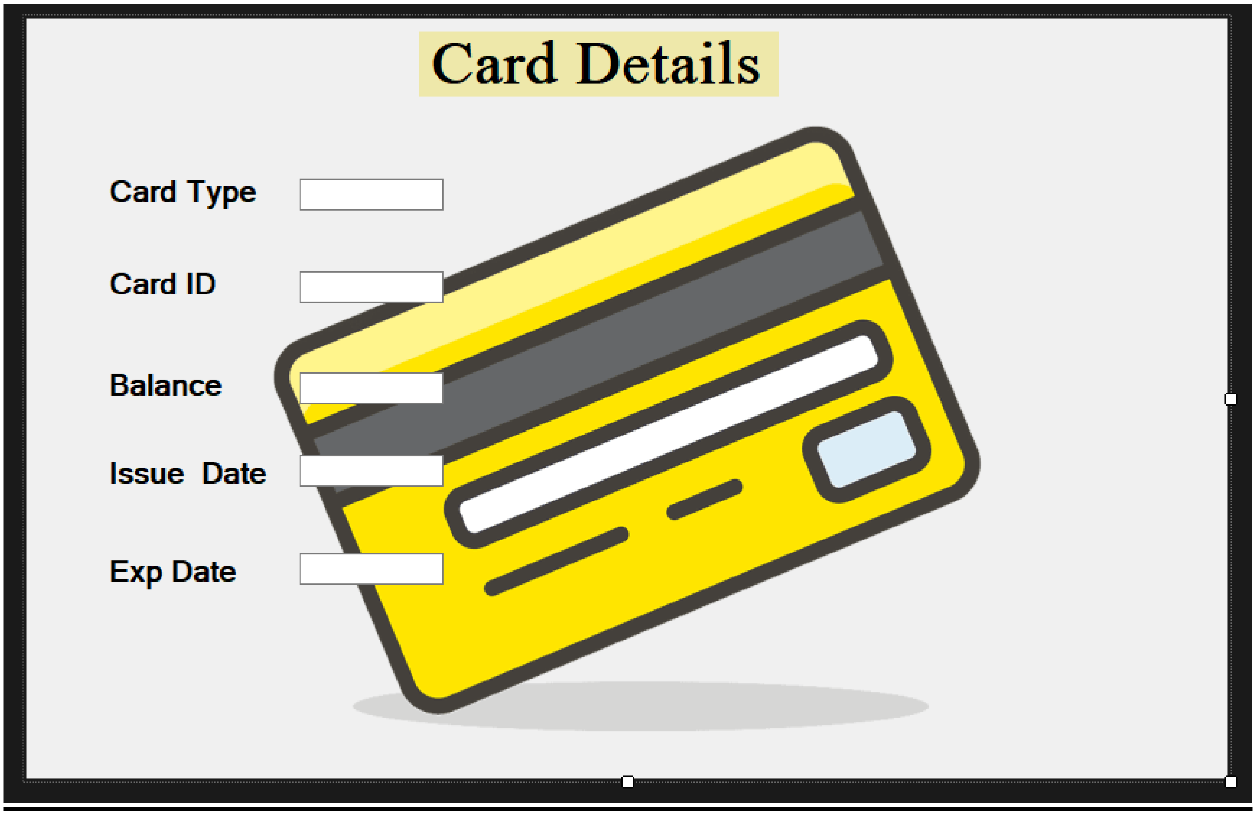
www.dhakadon.com

Name of Station	Uttara North	Uttara Center	Uttara South	Pallabi	Mirpur -11	Mirpur -10	Kazipara	Shewrapara	Agargaon
Uttara North	0	20	20	30	30	40	40	50	60
Uttara Center	20	0	20	20	30	30	40	40	50
Uttara South	20	20	0	20	20	30	30	40	40
Pallabi	30	20	20	0	20	20	20	30	30
Mirpur -11	30	30	20	20	0	20	20	20	30
MIrpur -10	40	30	30	20	20	0	20	20	20
Kazipara	40	40	30	20	20	20	0	20	20
Shewrapara	50	40	40	30	20	20	20	0	20
Agargaon	60	50	40	30	30	20	20	20	0



Search _Plan Journey Section

Fields	Starting Station ⌄	Date of Travel	
	Ending Station ⌄	Tuesday , January 28, ⌄	
Tickets Type	○ Regular	Passenger ID	
	○ MRT		
	○ Rapid	Total Price	
Payment Method ⌄			



Card Details

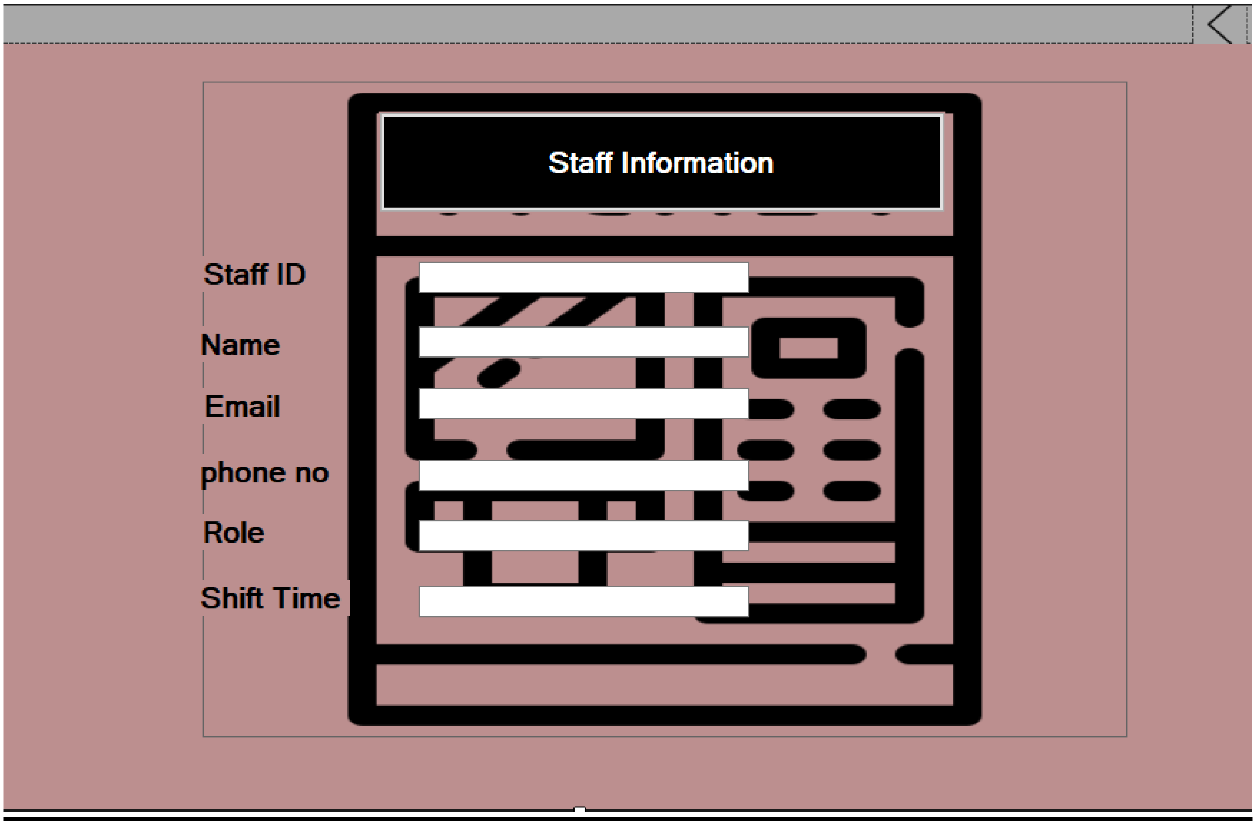
Card Type

Card ID

Balance

Issue Date

Exp Date



Staff Information

Staff ID

Name

Email

phone no

Role

Shift Time

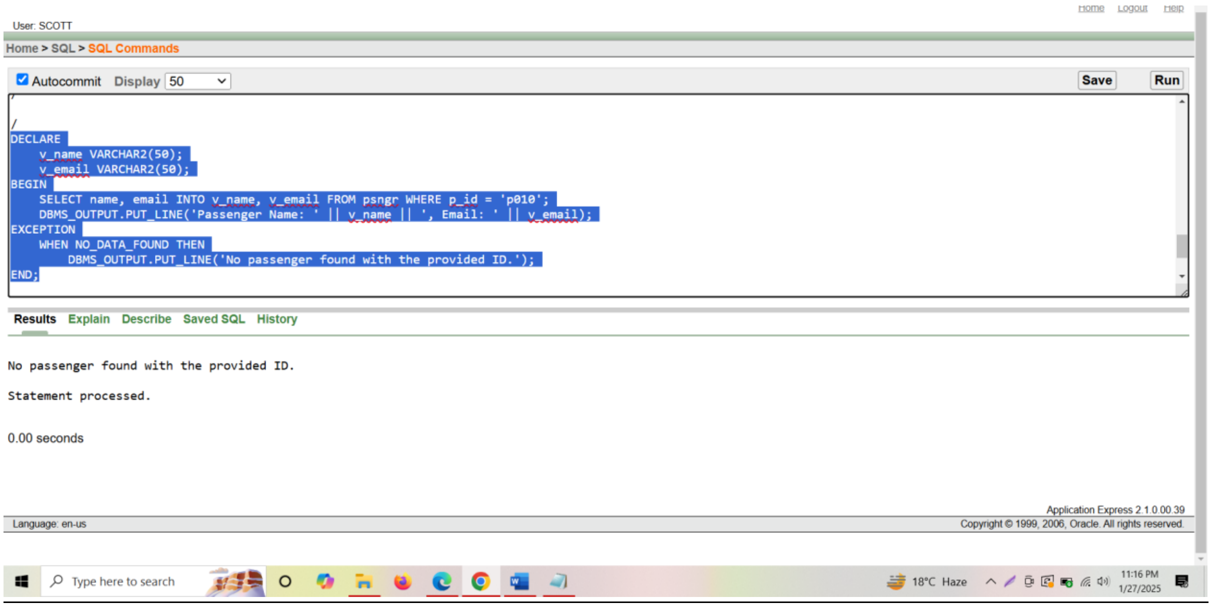
Query Writing:

Exception handling

1.How can you handle a situation where a query retrieves no rows (e.g., no passenger is found with a specific (p_id) and display an appropriate message?

Ans:

```
DECLARE
    v_name VARCHAR2(50);
    v_email VARCHAR2(50);
BEGIN
    SELECT name, email INTO v_name, v_email FROM psngr WHERE p_id = 'p010';
    DBMS_OUTPUT.PUT_LINE('Passenger Name: ' || v_name || ', Email: ' || v_email);
EXCEPTION
    WHEN NO_DATA_FOUND THEN
        DBMS_OUTPUT.PUT_LINE('No passenger found with the provided ID.');
END;
```



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Results Explain Describe Saved SQL History
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Language: en-us
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11:16 PM
1/27/2025

```
/
DECLARE
    v_name VARCHAR2(50);
    v_email VARCHAR2(50);
BEGIN
    SELECT name, email INTO v_name, v_email FROM psngr WHERE p_id = 'p010';
    DBMS_OUTPUT.PUT_LINE('Passenger Name: ' || v_name || ', Email: ' || v_email);
EXCEPTION
    WHEN NO_DATA_FOUND THEN
        DBMS_OUTPUT.PUT_LINE('No passenger found with the provided ID.');
END;
```

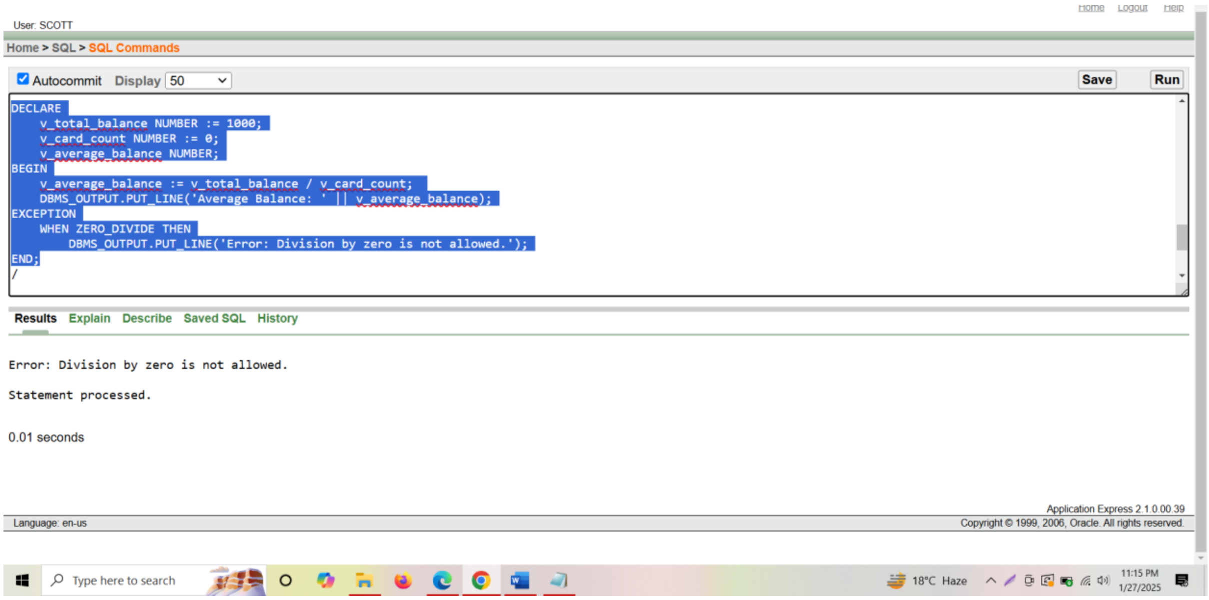
```
No passenger found with the provided ID.

Statement processed.
```

0.00 seconds

2. How can you handle a divide-by-zero error when calculating an average balance in a scenario where the total number of cards might be zero?

Ans:

```
DECLARE
   v_total_balance NUMBER := 1000;
   v_card_count NUMBER := 0;
   v_average_balance NUMBER;
BEGIN
   v_average_balance := v_total_balance / v_card_count;
   DBMS_OUTPUT.PUT_LINE('Average Balance: ' || v_average_balance);
EXCEPTION
   WHEN ZERO_DIVIDE THEN
      DBMS_OUTPUT.PUT_LINE('Error: Division by zero is not allowed.');
END;
```



```
DECLARE
    v_total_balance NUMBER := 1000;
    v_card_count NUMBER := 0;
    v_average_balance NUMBER;
BEGIN
    v_average_balance := v_total_balance / v_card_count;
    DBMS_OUTPUT.PUT_LINE('Average Balance: ' || v_average_balance);
EXCEPTION
    WHEN ZERO_DIVIDE THEN
        DBMS_OUTPUT.PUT_LINE('Error: Division by zero is not allowed.');
END;
/
```

```
Error: Division by zero is not allowed.

Statement processed.

0.01 seconds
```

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Implicit Locking:

1.How can you lock specific rows in the station table to prevent other users from updating or deleting them while ensuring you can update them?

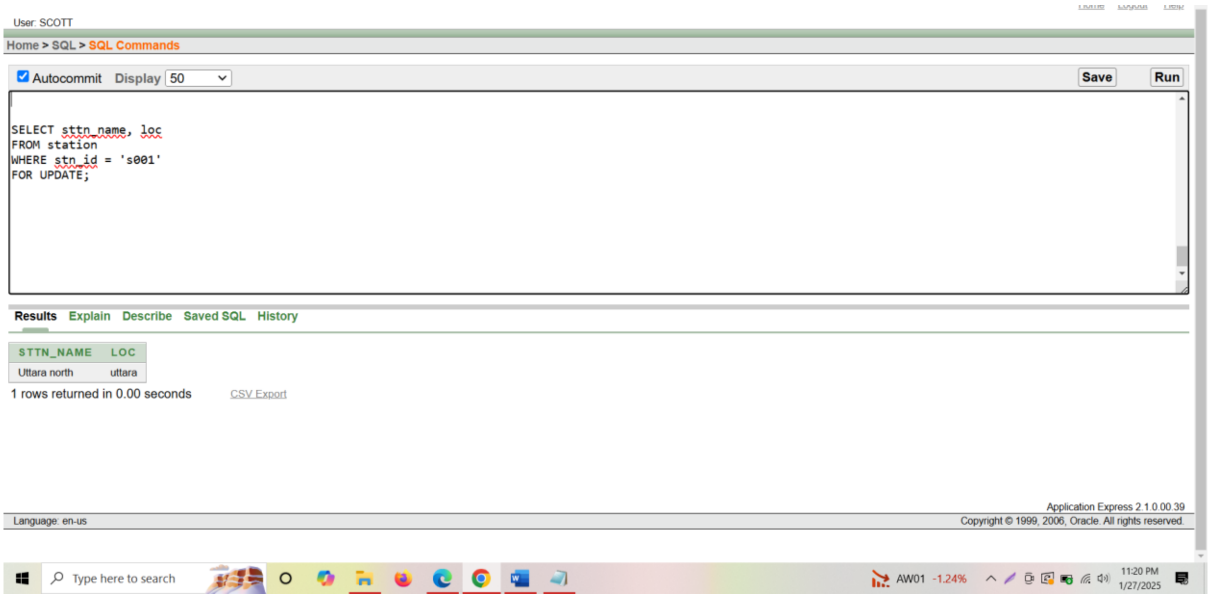
Ans:

SELECT sttn_name, loc

FROM station

WHERE stn_id = 's001'

FOR UPDATE;



```
SELECT sttn_name, loc
FROM station
WHERE stn_id = 's001'
FOR UPDATE;
```

STTN_NAME	LOC
Uttara north	uttara

1 rows returned in 0.00 seconds

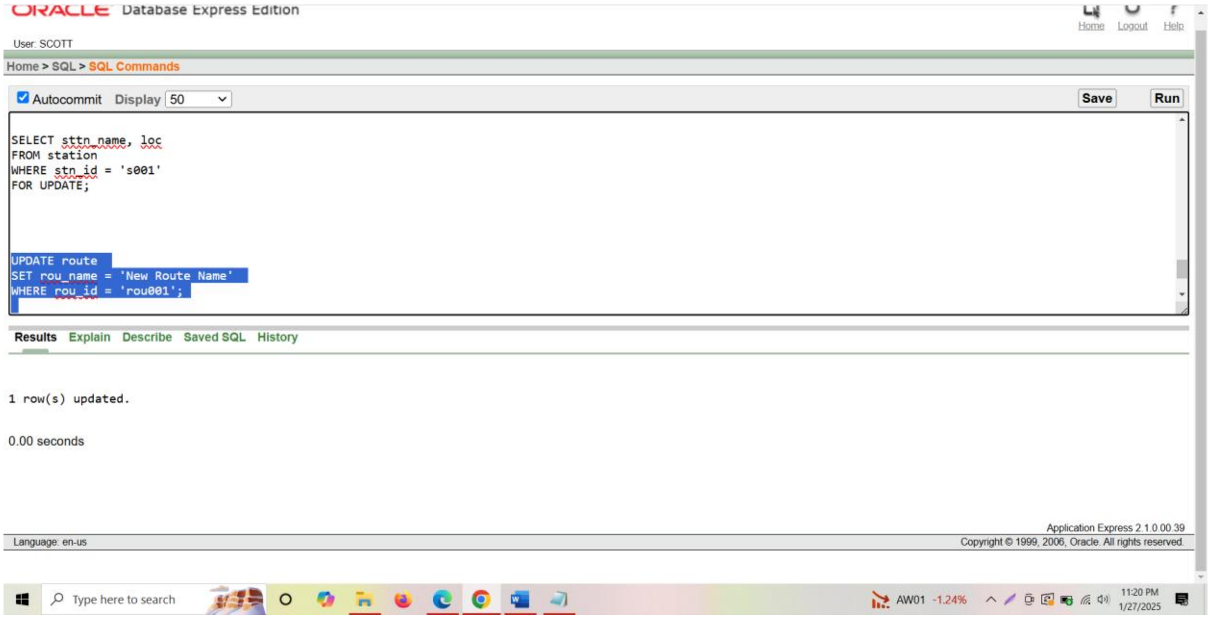
2. How can you ensure no other user modifies a specific route while updating its name in the route table?

Ans:

UPDATE route

SET rou_name = 'New Route Name'

WHERE rou_id = 'rou001';



```
SELECT sttn_name, loc
FROM station
WHERE stn_id = 's001'
FOR UPDATE;


UPDATE route
SET rou_name = 'New Route Name'
WHERE rou_id = 'rou001';
```

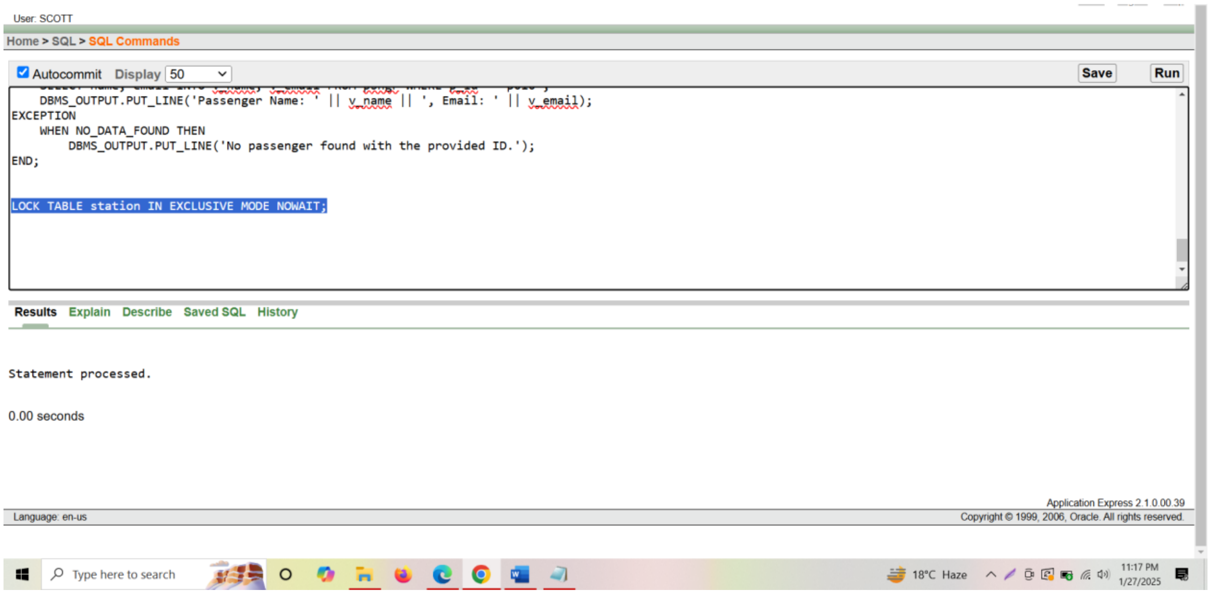
```
1 row(s) updated.

0.00 seconds
```

Explicit Locking

1: How can you lock the entire station table to prevent all modifications, allowing only SELECT operations?

Ans:

LOCK TABLE station IN EXCLUSIVE MODE NOWAIT;



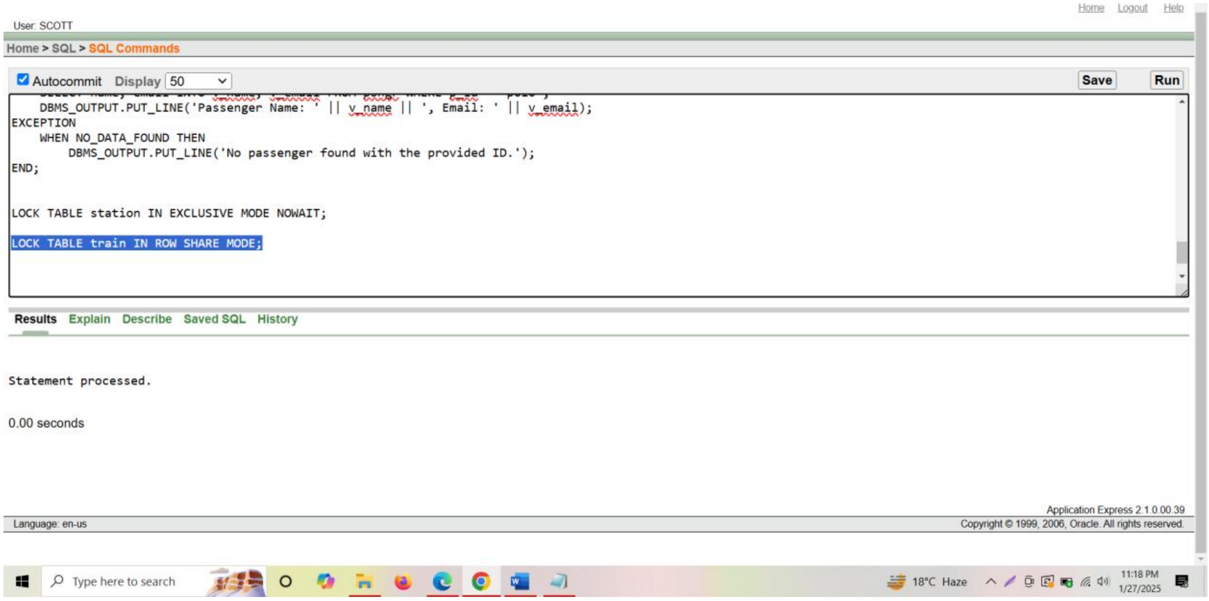
```
    DBMS_OUTPUT.PUT_LINE('Passenger Name: ' || v_name || ', Email: ' || v_email);
EXCEPTION
    WHEN NO_DATA_FOUND THEN
        DBMS_OUTPUT.PUT_LINE('No passenger found with the provided ID.');
END;


LOCK TABLE station IN EXCLUSIVE MODE NOWAIT;
```

```
Statement processed.

0.00 seconds
```

2: How can you allow multiple users to read or update rows in the train table while preventing others from locking the table exclusively?

Ans:

LOCK TABLE train IN ROW SHARE MODE;



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Home > SQL > SQL Commands
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Run
Results Explain Describe Saved SQL History

```
    DBMS_OUTPUT.PUT_LINE('Passenger Name: ' || v_name || ', Email: ' || v_email);
EXCEPTION
    WHEN NO_DATA_FOUND THEN
        DBMS_OUTPUT.PUT_LINE('No passenger found with the provided ID.');
END;


LOCK TABLE station IN EXCLUSIVE MODE NOWAIT;

LOCK TABLE train IN ROW SHARE MODE;
```

```
Statement processed.

0.00 seconds
```

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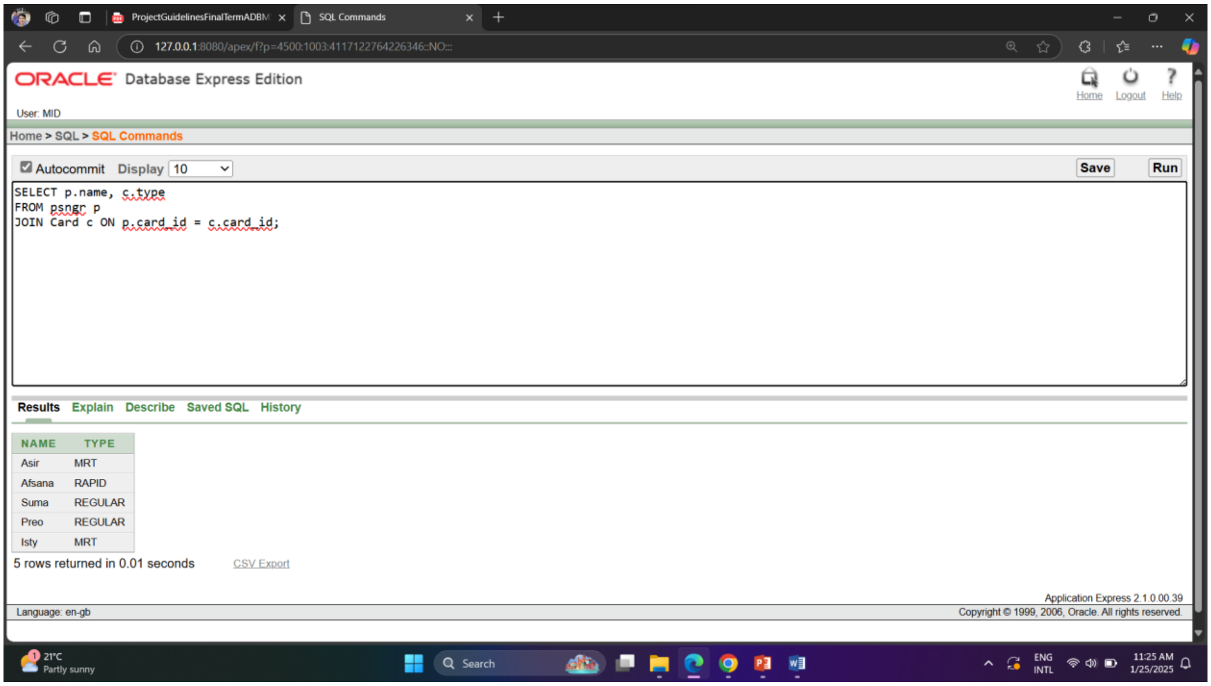
Relational Algebra:

1. Retrieve all passenger names and the card type associated with them.

Relational Algebra: $\pi_{\text{name, type}}(\text{psngr} \bowtie \text{Card})$

Query: SELECT p.name, c.type FROM psngr p JOIN Card c ON p.card_id = c.card_id;



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```
SELECT p.name, c.type
FROM psngr p
JOIN Card c ON p.card_id = c.card_id;
```

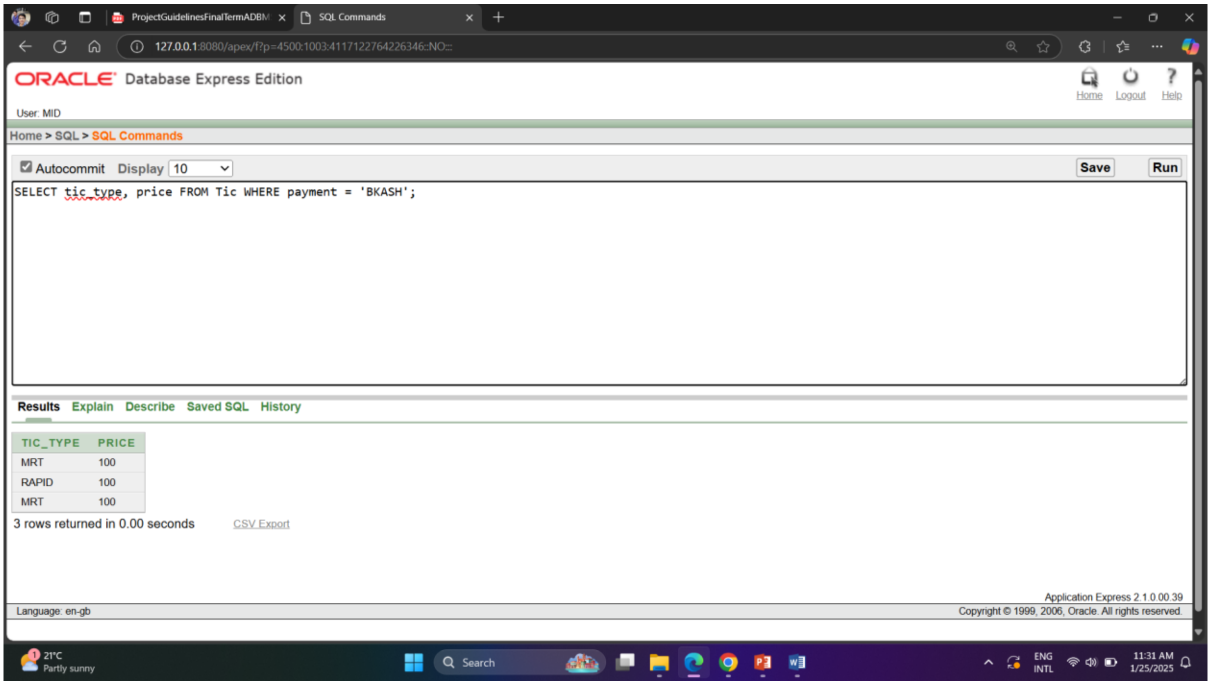
NAME	TYPE
Asir	MRT
Afsana	RAPID
Suma	REGULAR
Preo	REGULAR
Isty	MRT

5 rows returned in 0.01 seconds

2. Find the ticket type and price for all tickets purchased via 'BKASH'.

Relational Algebra: $\pi_{\text{tic\_type, price}}(\ \sigma_{\text{payment='BKASH'}}\ (\text{Tic}))$

Query: SELECT tic_type, price FROM Tic WHERE payment = 'BKASH';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Home > SQL > SQL Commands
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Run
Results Explain Describe Saved SQL History

```
SELECT tic_type, price FROM Tic WHERE payment = 'BKASH';
```

TIC_TYPE	PRICE
MRT	100
RAPID	100
MRT	100

3 rows returned in 0.00 seconds

CSV Export
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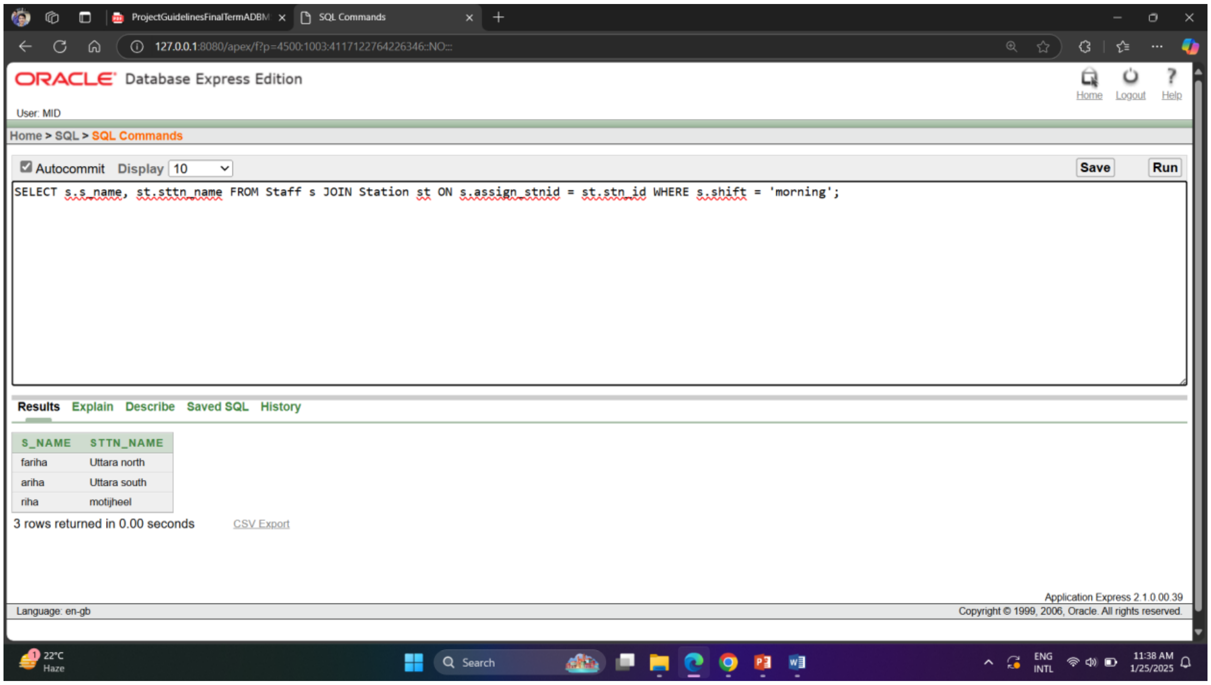
3. List all staff members who work in the 'morning' shift along with their assigned station names.

Relational Algebra: $\pi_{s\_name,\, sttn\_name}(\ \sigma_{shift='morning'}\ (Staff \bowtie Station))$

Query: SELECT s.s_name, st.sttn_name FROM Staff s JOIN Station st ON s.assign_stnid = st.stn_id WHERE s.shift = 'morning';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```
SELECT s.s_name, st.sttn_name FROM Staff s JOIN Station st ON s.assign_stnid = st.stn_id WHERE s.shift = 'morning';
```

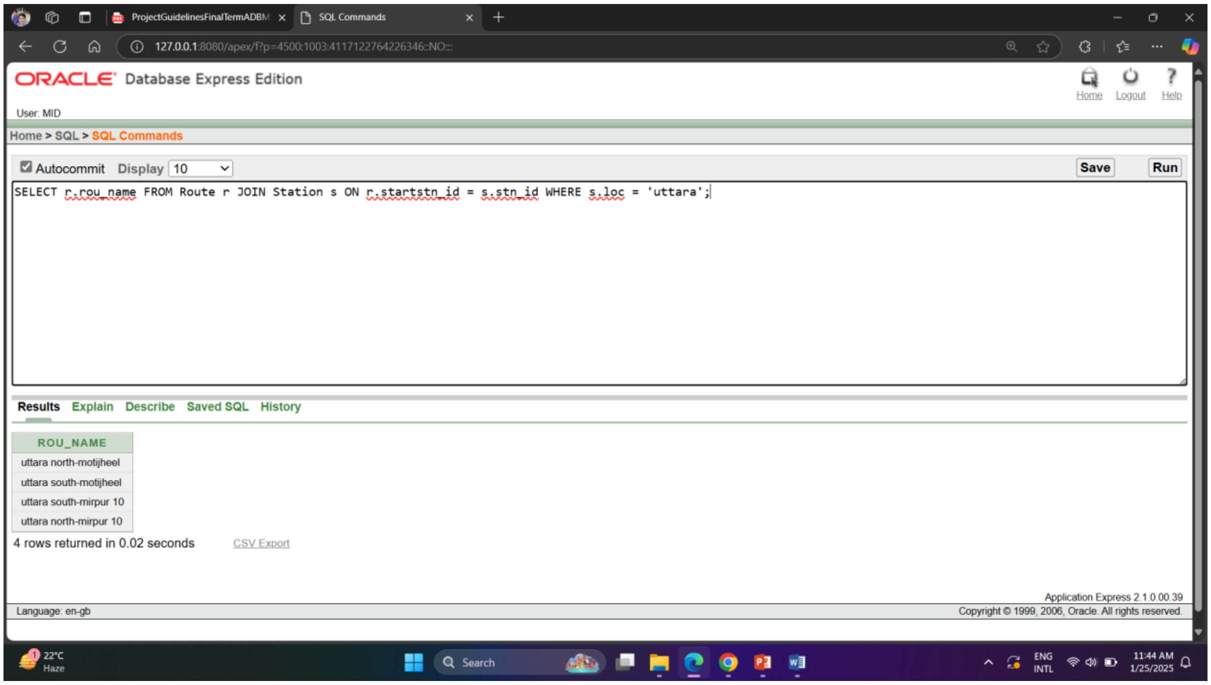
S_NAME	STTN_NAME
fariha	Uttara north
ariha	Uttara south
riha	motijheel

3 rows returned in 0.00 seconds

4. Retrieve the names of routes that start from stations in 'uttara'.

Relational Algebra: $\pi_{rou\_name}(\sigma_{loc='uttara'} (Station) \bowtie Route)$

Query: SELECT r.rou_name FROM Route r JOIN Station s ON r.startstn_id = s.stn_id WHERE s.loc = 'uttara';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```
SELECT r.rou_name FROM Route r JOIN Station s ON r.startstn_id = s.stn_id WHERE s.loc = 'uttara';
```

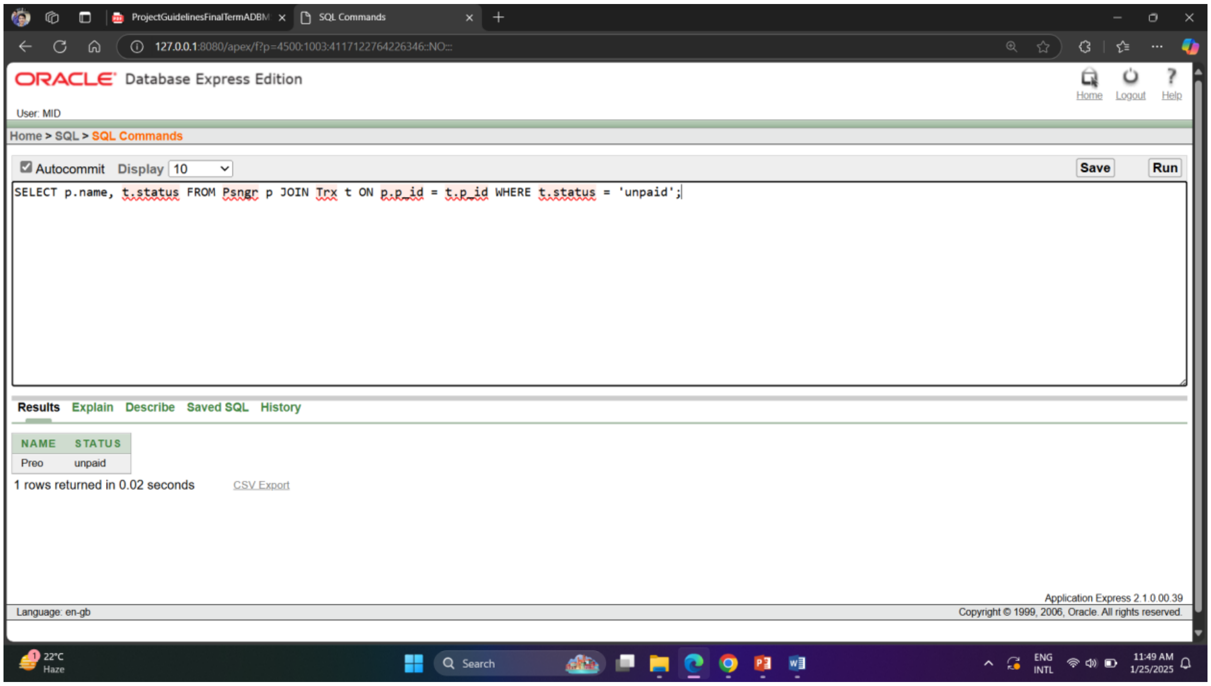
ROU_NAME
uttara north-motijheel
uttara south-motijheel
uttara south-mirpur 10
uttara north-mirpur 10

4 rows returned in 0.02 seconds

5. Find the passengers who have unpaid transactions.

Relational Algebra: $\pi_{\text{name, status}}(\ \sigma_{\text{status='unpaid'}}\ (\text{Trx} \bowtie \text{Psngr}))$

Query: SELECT p.name, t.status FROM Psngr p JOIN Trx t ON p.p_id = t.p_id WHERE t.status = 'unpaid';



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```
SELECT p.name, t.status FROM Psngr p JOIN Trx t ON p.p_id = t.p_id WHERE t.status = 'unpaid';
```

NAME	STATUS
Preo	unpaid

1 rows returned in 0.02 seconds