Traffic Management System :

The Traffic Management System is designed to efficiently manage road traffic by tracking vehicles, managing traffic lights, recording traffic violations, and generating insightful reports. The system includes functionalities for administrators, traffic officers, and vehicle owners, with a focus on ensuring smooth traffic flow and regulatory compliance.

Class Descriptions

1. **Account**
    - **Purpose: Manages user accounts, including authentication and unique identification.**
    - **Role in System: Handles user information such as ID, email, name, and contact details. It also manages password-related functionality.**
    - **Access: Works with various classes to ensure secure access and proper identification of users across the system.**
1. **Admin**
    - **Purpose: Manages administrative tasks within the system, including adding and managing traffic officers, owners, and zones.**
    - **Role in System: Acts as the backbone for maintaining the system's operations and user management.**
    - **Access: Has access to TrafficOfficer, Owner, and Zone classes for performing its functions.**
1. **Owner**
    - **Purpose: Represents vehicle owners, managing their vehicles and notifications.**
    - **Role in System: Keeps track of vehicle ownership and related notifications.**
    - **Access: Interacts with Vehicle, Notification, and Traffic_Violation classes to manage owner-related data.**
1. **TrafficOfficer**
    - **Purpose: Represents traffic officers responsible for monitoring zones and recording traffic violations.**
    - **Role in System: Ensures traffic regulations are followed and violations are recorded.**
    - **Access: Interacts with Zone, Traffic_Violation, and Owner classes to manage violations and assigned zones.**

1. **Traffic_Violation**
    - **Purpose: Records and manages details about traffic violations.**
    - **Role in System: Essential for tracking and managing violations to maintain traffic discipline.**
    - **Access: Interacts with TrafficOfficer, Vehicle, Owner, and Notification classes for comprehensive violation management.**
1. **Vehicle**
    - **Purpose: Manages vehicle-related information, including type, owner, and associated violations.**
    - **Role in System: Tracks and organizes data related to each vehicle in the system.**
    - **Access: Works with Owner and Traffic_Violation classes to manage vehicle data.**
1. **Zone**
    - **Purpose: Represents specific traffic areas and manages traffic lights within those zones.**
    - **Role in System: Crucial for organizing traffic control and monitoring areas.**
    - **Access: Works with Traffic_Lights class to handle traffic light data.**
1. **Traffic_Lights**
    - **Purpose: Manages details and operations of traffic lights.**
    - **Role in System: Ensures the proper functioning of traffic signals within zones.**
    - **Access: Collaborates with Zone class for traffic light management.**

1. **Notification**
    - **Purpose: Handles creation and management of notifications related to traffic violations and other events.**
    - **Role in System: Keeps users informed about relevant updates and violations.**
    - **Access: Utilizes data from Traffic_Violation class to generate notifications.**
1. **TrafficReport**
    - **Purpose: Generates various types of traffic reports based on different criteria such as zones and time periods.**
    - **Role in System: Central to creating insightful reports for traffic management.**
    - **Access: Interacts with Zone and Traffic_Violation classes to gather necessary data for report generation.**

Relationships

Inheritance:

- **Admin, TrafficOfficer, and Owner inherit common attributes and methods from Account.**

Associations:

- **Admin manages TrafficOfficer, Zone, and Traffic Lights.**
- **Owner has multiple Vehicles and receives Notifications.**
- **TrafficOfficer handles Traffic_Violations in a specific Zone.**
- **Vehicles can have Traffic_Violations.**

Aggregation:

- **Zone contains multiple Traffic_Lights.**
- **Owner aggregates a list of Vehicles.**
- **TrafficReport interacts with Traffic_Violation and Zone for report generation.**

Detailed Relationships:

1. **Inheritance:**
    - **Admin, TrafficOfficer, and Owner inherit from Account.**
        - **Purpose: To share common attributes and methods such as ID, contact information, and authentication features across different user types within the system.**
        - **Explanation: By inheriting from Account, these classes can leverage common functionalities and maintain consistency in user data management.**
1. **Associations:**
    - **Admin manages TrafficOfficer, Zone, and Traffic Lights.**
        - **Purpose: To facilitate administrative control and oversight of traffic officers, zones, and traffic light configurations.**
        - **Explanation: The Admin class includes methods for adding, updating, and deleting traffic officers, zones, and traffic lights, ensuring efficient traffic management.**
    - **Owner has multiple Vehicles and receives Notifications.**
        - **Purpose: To manage vehicle ownership and ensure owners are informed about relevant updates and violations.**
        - **Explanation: The Owner class maintains a list of owned vehicles and a list of notifications, providing a comprehensive view of the owner's assets and notifications.**
    - **TrafficOfficer handles Traffic_Violations in a specific Zone.**
        - **Purpose: To enforce traffic regulations and record violations within assigned zones.**
        - **Explanation: The TrafficOfficer class records violations and interacts with the Zone class to track where violations occur.**

- **Vehicles can have Traffic_Violations.**
  - **Purpose: To associate traffic violations with specific vehicles for accurate tracking and management.**
  - **Explanation: The Vehicle class maintains a list of traffic violations, allowing for a clear record of each vehicle's infractions.**

1. **Aggregation:**
   - **Zone contains multiple Traffic_Lights.**
     - **Purpose: To organize and manage traffic light systems within specific areas.**
     - **Explanation: The Zone class aggregates multiple traffic lights, ensuring each zone's traffic control systems are efficiently managed and monitored.**
   - **Owner aggregates a list of Vehicles.**
     - **Purpose: To maintain an organized record of all vehicles owned by an individual.**
     - **Explanation: The Owner class contains a list of Vehicle objects, representing the vehicles under the owner's name.**
   - **TrafficReport interacts with Traffic_Violation and Zone for report generation.**
     - **Purpose: To generate comprehensive traffic reports based on violations and zone data.**
     - **Explanation: The TrafficReport class accesses data from Traffic_Violation and Zone classes to produce reports that help in analyzing traffic patterns and issues.**

System Overview

The system is well-organized using object-oriented principles:

- **Admin oversees the system configuration.**
- **Traffic Officers record violations.**
- **Owners manage their vehicles and notifications.**
- **Zones control traffic lights and track violations.**
- **Vehicles are central to the system as they are tracked for violations.**
- **Reports provide insights into congestion and high-density areas.**

Conclusion

This document provides a clear and professional overview of the Traffic Management System, detailing the roles and interactions of each class within the system. Every member of the team collaborated on this document, with each member responsible for their respective classes, ensuring a professional and comprehensive overview of the system.

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Input and Output Scenarios for Traffic Management System

1. First Page (Sign Up / Login / Exit):

Input:

- The user is prompted to choose an action from the following options:
    - **1- Sign up**
    - **2- Login**
    - **3- Exit**

Scenario 1: Signing Up

- Input: 1 (Sign up option)
- Output: The user is guided to fill out the registration details (e.g., username, password, contact info).

Scenario 2: Logging In

- Input: 2 (Login option)
- Output: The system asks for:
    - **Username**
    - **Password**

Scenario 3: Exit

- Input: 3 (Exit option)
- Output: The system exits, and the program ends

1.Sign-Up as User

Input:

1. **Enter ID:**
2. **Enter Email:**
3. **Enter Password:**
4. **Enter Name:**
5. **Enter Contact:**

Output (Successful Sign-Up):

- **"Account created successfully!"**
- Prompt to create another account:
  "Do you want to create another account? (y/n):"

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2. Login as User (Post Login)

Input:

- After a successful login, the user is shown:
  - **Username**
  - **Password**

Output:

- If the login is successful:
  - Welcome message with the username (e.g., **"Welcome,(user_name !"**)
  - Unseen notifications count (e.g., **"You have 0 unseen notifications."**)
  - Menu options for the user:
    1. View Profile
    2. View Your Notifications
    3. View Your Vehicles
    4. Add Vehicle

5. Change Password
6. Log Out

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3. Login as Admin (Post Login)

Input:

- After logging in as an Admin, the system will show:
    - **Username**
    - **Password**

Output:

- If the login is successful:
    - Welcome message (e.g., **"Welcome (Admin) !"**)
    - The Admin menu options:
        1. View existing zones
        2. Add traffic lights
        3. Update traffic lights
        4. Delete traffic lights
        5. Add zone
        6. View violations by vehicle or by zone
        7. Generate traffic reports
        8. Add new Admin
        9. Change my password
        10. Add new Traffic Officer
        11. View your information
        12. Details about the number of users
        13. Calculate and Display Averages
        14. Logout

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4. Login as Officer (Post Login)

Input:

- After logging in as an Officer, system will ask for:
    - **Username**
    - **Password**

Output:

- If the login is successful:
    - Welcome message (e.g., **"Welcome (officer)!"**)
    - The Officer menu options:
        1. View the violations you added
        2. Search violations added by you
        3. Record violation
        4. Change password
        5. Logout

<u>Example Flow for Each Role(Sample Run):</u>

Example: User Registration and Login

Sign-Up Process

1. **First Page (Sign Up)**
   Input:
    - Enter choice: 1 (Sign up)
2. **Input Sequence:**
    - Enter ID: OW-14
    - Enter Email: owner@gmail.com
    - Enter Password: OW
    - Enter Name: owner

- Enter Contact: 12345

3. **Output:**
    - "Account created successfully!"
    - "Do you want to create another account? (y/n):"

User Login

1. **First Page (Login)**

   Input:
    - Enter choice: 2 (Login)
2. **Input Sequence:**
    - Enter Username: owner
    - Enter Password: OW
3. **Output (Successful Login):**
    - Welcome message:

      "Welcome, owner!"
    - Unseen notifications count:

      "You have 0 unseen notifications."
4. **Menu Options for the User:**

1. View Profile:
    - input:1
    - output:
    - Owner Name: owner
    - Contact Number: 12345
    - Email: owner@gmail.com

7. View Your Notifications:
    - input:2
    - output:

- Owner Name: owner
- Contact Number: 12345
- Email: owner@gmail.com

13. View Your Vehicles:
    - input:3
    - output:
    - You have no vehicles.

17. Add Vehicle:
    - input:4
    - output:
    - 1- Bike
    - 2- Car
    - 3- Truck
    - Enter vehicle type: 1
    - Enter license plate:1-a
    - Vehicle added: 1-a
    - Do you want to add another vehicle? (y/n):

27. Change Password:
    - input:5
    - output:
    - Enter your current password: 12345
    - Enter your new password: 123456
    - Password changed successfully!

33. Log Out:
    - input:6
    - output:

- Logging out...

Example: Admin Login and Menu Interaction

1. **Login as Admin**

   Input:

   - **Enter Username: youssif**
   - **Enter Password: 170714**

     Output:
   - Welcome youssif!
   - 1- View exist zones.
   - 2- Add traffic lights.
   - 3- Update traffic lights.
   - 4- Delete traffic lights.
   - 5- Add zone.
   - 6- View violations by vehicle or by zone.
   - 7- Generate traffic reports.
   - 8- Add new Admin.
   - 9- Change my password.
   - 10- Add new Traffic Officer.
   - 11- View your information.
   - 12- Details about the number of users.
   - 13- Calculate and Display Averages
   - 14- Logout.

2. **Admin Menu**

   Input: 1 (View existing zones)

   Output:

   - 1- Zone1

- 2- Zone2
- 3- Zone3
- Enter Number assigned zone: 1(sub-input)
- Zone ID: Z-001
- Zone Name: Zone1
- Zone Location: Location1
- Do you want to view Traffic Lights? (y to view):
- y(sub-input)
- ID: TL-01
- Location: Location1-1
- Status: Red
- Duration: 25
- ID: TL-07
- Location: Location1-2
- Status: Red
- Duration: 25
- ID: TL-08
- Location: Location1-3
- Status: Red
- Duration: 25

3. **Add Traffic Light**

   Input:

   2 (Add traffic lights)

   Output:

   - 1- Zone1
   - 2- Zone2
   - 3- Zone3

- Enter Number assigned zone: 1(sub-input)
- Enter temp Duration for first time(greater than 1):
- 10(sub-input)
- 1-Red
- 2-Yellow
- 3-Green
- Enter Status:
- 2(sub-input)
- Traffic Light added successfully!
- Zone ID: Z-001
- Zone Name: Zone1
- Zone Location: Location1
- Do you want to view Traffic Lights? (y to view):
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4. **Update traffic lights.(following the same functionality)**
5. **Delete traffic lights.(following the same functionality)**
6. **Add zone**

- **input:**
- Enter your choice: 5
- Enter the name of the zone: zone4
- Enter the Location of the zone: cairo
- **output:**
- Zone ID: Z-004,added successfully!

13. **View violations by vehicle or by zone**

- **input:**
- Do you want view violations by Zone or vechicle?

- 1-Zone
- 2-Vehicle
- Enter your choice: 2
- Enter Vehicle plate: Car|221
- **output**
- TracksViolationID: TV-02
- Vehicle ID: Car|221
- Violation Type: Parking
- Date: 18/12-03:03
- Fine Amount: 150.0

26. **Generate traffic reports**

- **input:**
- 1. High-Density Zones Report based on Time
- 2. Most Violated Zone
- 3. Most Frequent Violation Type
- **Choose the type of report you want: 2**
- **output:**
- Most Violated Zone Report:
- Zone2 | Violations: 5
- Zone3 | Violations: 2
- **(sub-input):**
- Do you want to continue generate report (y/n): y
- 1. High-Density Zones Report based on Time
- 2. Most Violated Zone
- 3. Most Frequent Violation Type
- Choose the type of report you want: 3

- **(output):**
- Frequent Violations Report: 6
- Speeding: 1
- Parking: 1
- Running Red Light: 2
- No License Plate: 0
- No Registration: 1
- No Helmet: 1

50. Change my password.(following the same functionality)
51. Add new Traffic Officer.(following the same functionality)
52. View your information.(following the same functionality)
53. **Details about the number of users**

- **input:**
- you can show how many users include admins officers owners
- 1- Admins
- 2- Officers
- 3- Users
- 4- Count for all
- **Enter your choice: 1**
- output: 4 (admins)

62. **Calculate and Display Averages**
    input:

- Note that this is not the exact price; it is an approximate range.
- 1- for all
- 2- for each type
- 3- specific type

- **Enter your choice: 1**
  output:
- Frequent Violations Report: 6
- Average of total violations = 16550
- Do you want to continue (y/n):

71. 14- Logout(the same functionality)

Example: Officer Login and Menu Interaction

1. **Login as Officer**
   Input:2
   - Enter Username: youssif El-Sayed
   - Enter Password: 2023
     Output:
     "Welcome youssif El-Sayed!"
2. **View the violations you added**

- **input:1**
  output:
- Violation found:
- TracksViolationID: TV-03
- Vehicle ID: Car|221
- Violation Type: No Registration
- Date: 18/12-03:03
- Fine Amount: 15000.0 $

10. **Search Violations added you**

- **input:**
- **Choose Violation Type**
- 1- Speeding

- 2- Parking
- 3- Running Red Light
- 4- No License Plate
- 5- No Registration
- **Enter your choice: 2**
  output:
- ===== Searching for Violations of Type: Parking =====
- TracksViolationID: TV-02
- Vehicle ID: Car|221
- Violation Type: Parking
- Date: 18/12-03:03
- Fine Amount: 150.0 $
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26. **Record Violation**
    input:

- **Enter Vehicle plate:**
- Car|221
- Choose Violation Type
- 1- Speeding
- 2- Parking
- 3- Running Red Light
- 4- No License Plate
- 5- No Registration
- **Enter your choice: 1**
  output:
- Violation recorded successfully by officer: youssif El-Sayed
- Violation added to Vehicle with License Plate: Car|221