Sustainable Transportation Tracking Database

I.   Overview and Proposal

Problem

In many urban areas, transportation contributes significantly to pollution, congestion, and carbon emissions. While there's a growing interest in sustainable transportation options such as cycling, walking, and public transit, tracking the usage and impact of these alternatives can be challenging without proper tools.

Objective

To develop a database that allows the tracking, management, and promotion of sustainable transportation options within communities. The database would help to collect data on usage patterns, emissions reductions, and user feedback, informing transportation planning and policy decisions.

Tables

Transportation_Mode
- mode_id (PK)
- mode_name
- description
- carbon_emission_rate_per_mile

User
- user_id (PK)
- username
- email
- password
- location
- preferred_transportation_mode

Trip
- trip_id (PK)
- user_id (FK)
- mode_id (FK)
- start_location
- end_location
- distance_traveled
- trip_purpose
- trip_duration
- carbon_emission_saved

Emissions_Data
- emissions_id (PK)
- mode_id (FK)
- date
- total_emissions_saved

Feedback
- feedback_id (PK)
- user_id (FK)
- date
- feedback_text
- satisfaction_rating

Community Event
- event_id (PK)
- event_name
- location
- date_time
- description
- organizer

II.   Business Requirements

Sustainable Transportation Tracking Database Requirements:

Rules

- <mark>Users</mark> can <mark>register</mark> with the system using a unique username, email, and password.
- <mark>Users</mark> <mark>provide</mark> their location and preferred transportation mode during registration.
- <mark>Users</mark> can <mark>log</mark> their <mark>trips</mark>, including start and end locations, distance traveled, purpose, and duration.
- The system <mark>calculates</mark> carbon emissions saved for each trip based on the <mark>transportation mode</mark> chosen.
- <mark>Emissions data</mark> is <mark>aggregated</mark> to <mark>track</mark> total emissions saved over time.
- <mark>Users</mark> can <mark>provide</mark> <mark>feedback</mark> on their transportation experiences, including text <mark>feedback</mark> and satisfaction ratings.
- <mark>Community events</mark> promoting sustainable transportation habits are <mark>organized</mark>, including car-free days, bike-to-work campaigns, and walking tours.
- <mark>Users</mark> can <mark>participate</mark> in <mark>community events</mark>, <mark>track</mark> their participation, and <mark>provide feedback</mark>.
- Incentive programs <mark>reward</mark> users for choosing sustainable transportation options.
- <mark>Rewards</mark> earned by users are <mark>managed</mark> within the system.
- <mark>Visualizations</mark> and <mark>reports</mark> can be <mark>generated</mark> from the database to <mark>illustrate</mark> usage patterns, emissions reductions, user feedback, and community event participation.
- The database system <mark>prioritizes</mark> <mark>security</mark> and <mark>privacy</mark>, <mark>encrypting</mark> sensitive user information and adhering to data protection regulations.
- The <mark>system</mark> is designed to handle large volumes of data and <mark>support</mark> a growing user base.

<mark>Possible Nouns</mark>

Denoted by yellow highlights in Rules listed above.

- Users
- Transportation Modes
- Trips
- Emissions Data
- Feedback
- Community Events

- Incentive Programs
- Rewards
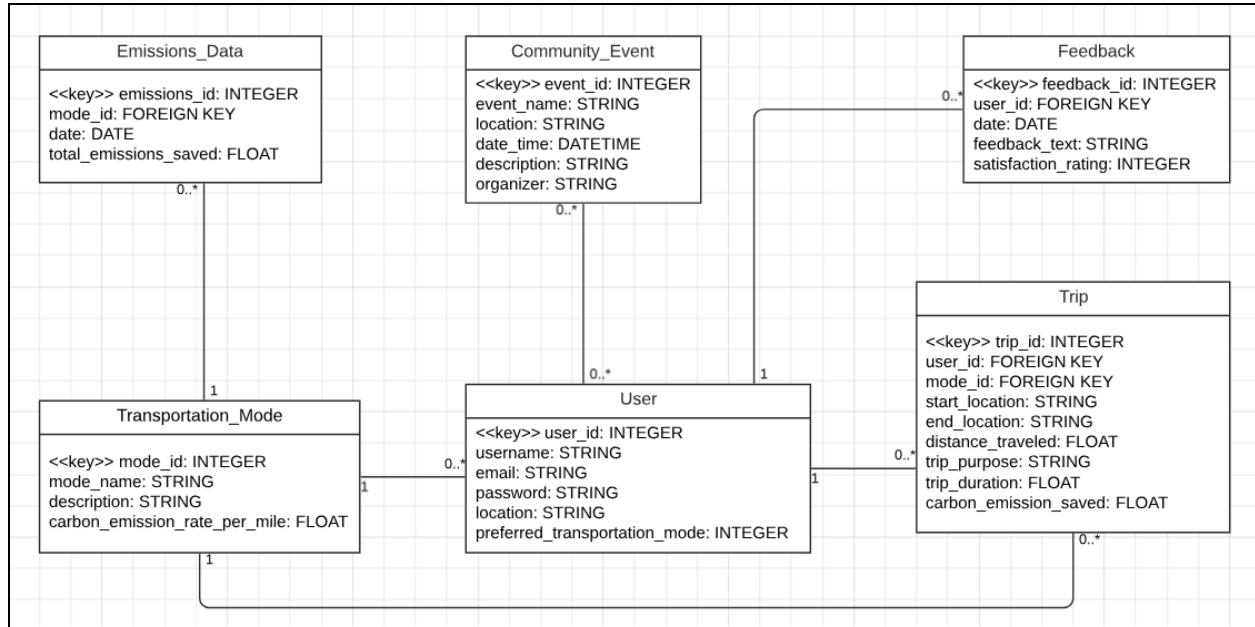- Visualizations
- Reports
- Security
- Privacy
- System

Possible Actions

Denoted by green highlights in Rules listed above.

- Register
- Log
- Calculate
- Aggregate
- Provide
- Organize
- Participate
- Track
- Manage
- Generate
- Illustrate
- Prioritize
- Encrypt
- Support

III.   UML Class Diagram

Resued from Project 1.

URL:

Explanation of Multiplicities

1. User to Transportation_Mode
   - **Type**: Many-to-One
   - **Multiplicity**: Many Users (0..*) to One Transportation_Mode (1)
   - **Description**: Each user may have one preferred transportation mode, but each transportation mode can be preferred by many users.

2. User to Trip
   - **Type**: One-to-Many
   - **Multiplicity**: One User (1) to Many Trips (0..*)
   - **Description**: Each user can log multiple trips, but each trip is logged by exactly one user.

3. Trip to Transportation_Mode
   - **Type**: Many-to-One
   - **Multiplicity**: Many Trips (0..*) to One Transportation_Mode (1)
   - **Description**: Each trip is associated with one transportation mode, while each transportation mode can be used for many trips.

4. User to Feedback
   - **Type**: One-to-Many

- **Multiplicity**: One User (1) to Many Feedback entries (0..*)
- **Description**: Each user can provide multiple feedback entries, but each feedback entry is provided by exactly one user.

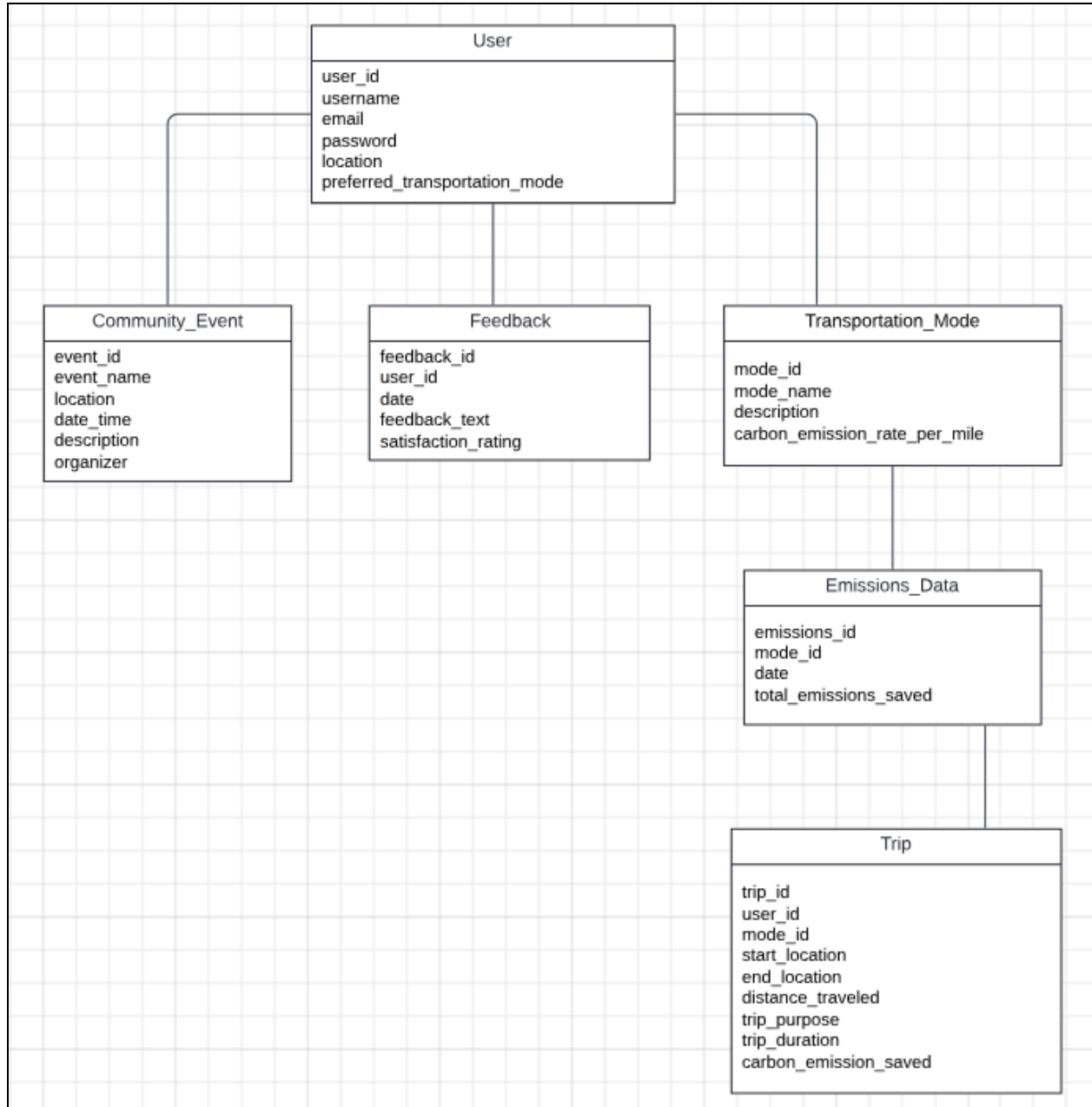5. Transportation_Mode to Emissions_Data
   - **Type**: One-to-Many
   - **Multiplicity**: One Transportation_Mode (1) to Many Emissions_Data entries (0..*)
   - **Description**: Each transportation mode can have multiple emissions data entries, but each entry is associated with exactly one transportation mode.

6. User to Community_Event
   - **Type**: Many-to-Many
   - **Multiplicity**: Many Users (0..*) to Many Community_Events (0..*)
   - **Description**: Users can attend multiple community events, and each community event can have multiple attendees.

IV.   ER Diagram (Logical Model)

Derived from the UML class diagram depicted above and adapted to fit a document database.

User
- user_id
- username
- email
- password
- location
- preferred_transportation_mode

Community_Event
- event_id
- event_name
- location
- date_time
- description
- organizer

Feedback
- feedback_id
- user_id
- date
- feedback_text
- satisfaction_rating

Transportation_Mode
- mode_id
- mode_name
- description
- carbon_emission_rate_per_mile

Emissions_Data
- emissions_id
- mode_id
- date
- total_emissions_saved

Trip
- trip_id
- user_id
- mode_id
- start_location
- end_location
- distance_traveled
- trip_purpose
- trip_duration
- carbon_emission_saved

URL:
https://lucid.app/lucidchart/b164c01e-8368-4d0f-83b9-ef3cde5ce34f/edit?viewport_loc=-2161%2C-486%2C3565%2C1412%2C0_0&invitationId=inv_f1d1878c-934a-4844-b132-bd91533cabc5

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