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CSC 315 - 01/ MGT/BUS 385 - 03

March 8, 2023

<div align="center">Phase III</div>

<u>Narrative</u>

   A relational database centers around the correlation between data items. Within a relational database, different data items are stored into rows and columns to form a table. The columns consist of headings called attributes, and the rows are called tuples. Each tuple holds a unique identifier; this can either be a primary key or a foreign key. Primary keys allow each tuple in a table to be unique, and foreign keys allow for a connection to be made from one table to another table through primary keys. Within a relational database, multiple tables are used to connect information. The relationship between different tables is important for exploring the use of different types of data. Different data items can be used for different purposes, and relational databases are an easy way to store all necessary information in one place. For example, a company can have a database that stores all their departments' information. One table can be used to store the names of all the departments and their corresponding numbers. Another table can store a list of all the employees and the department number that they work for. The two tables can be related through the department number to accumulate the sum of all employees for a given department. Using a relational database makes this process more efficient.

   In our UML Use Case diagram, there are three people icons. The leftmost one represents the User, who is the actor in our database. The User is responsible for

selecting what the application provides in the dropdown list: first, the counties in New Jersey, then the municipalities. The Server person icon represents the storage for what the User chooses and provides the data that the Database icon holds. In other words, the Server acts as a middleman between the User and the Database. After the User selects a county and a municipality, the Server takes the data from the Database to display the information about the total vehicle mileage and the total resulting greenhouse gas emissions. The <<extend>> keyword is used to show that the actions of the Server can be broken into smaller steps for the User.

The elements of our UML diagram, more specifically the information revealed by the Server, can further be described by our Entity-Relationship diagram. The two entities used are Vehicle Miles Traveled (VMT) and Greenhouse Gas Emissions (GHG_EMISSIONS). The correlation between the two entities is that the total greenhouse gasses emitted are increased by the total vehicle miles traveled. Our relationship on the ER diagram is INCREASES; it has a 1:1 cardinality ratio. VMT and GHG_EMISSIONS share similar attributes, such as Location and Year. Municipality and Year serve as the primary keys for both entities because they give unique values to their represented entities.

We designed our database to show that the total greenhouse gas emissions from vehicles depend on the total number of vehicle miles traveled. Users are able to select their municipality, which then shows the total number of miles traveled and GHG emissions from vehicles based on the area they selected. By displaying this data, users can become more aware of their own contributions towards this issue. They can take action in order to decrease the amount of GHG emissions New Jersey is responsible

for. Our solution to make this more sustainable was to have the highest-contributing municipalities cut down the use of individual vehicles. One way to achieve this can be to have individuals use other means of transportation, such as public transportation, biking, or walking.

Use Case

Program offers a list of NJ counties.

User selects a county.

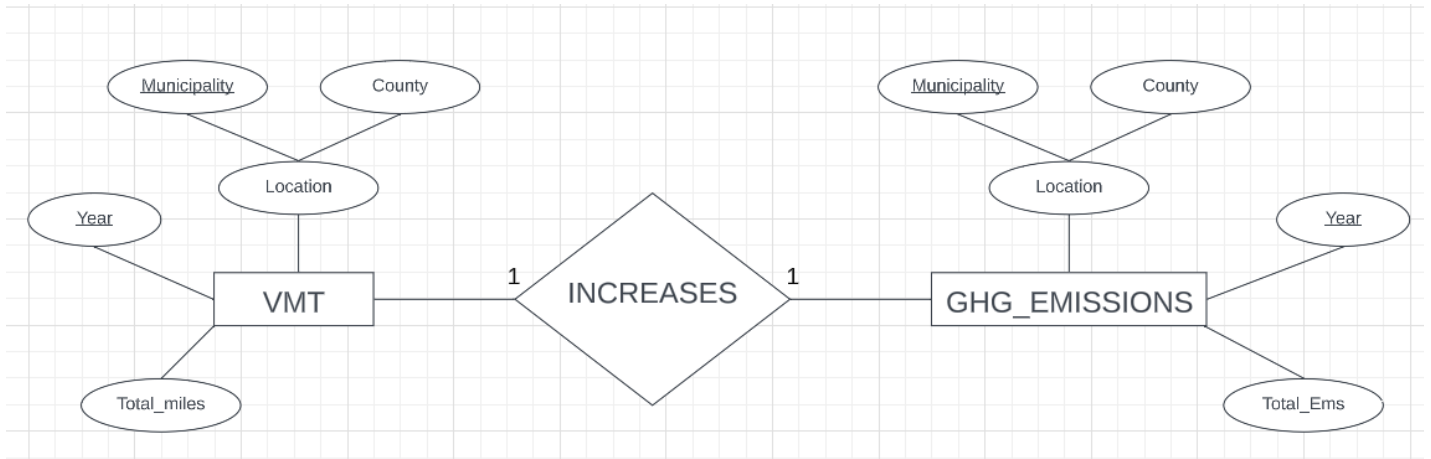Program offers a list of municipalities in selected county.

User selects a municipality.

Program displays total vehicle miles traveled and natural gas emissions for the selected municipality based on given years.

Data sets used from Sustainable Jersey:
- Vehicle Miles Traveled (VMT) Data
- GHG Emissions by Vehicle Type (Metric tons Carbon Dioxide Equivalent)

ER Diagram:

UML Use Case Diagram: