Phase 3: The Database Model Explained

A relational database is a type of database that stores and provides access to data points that are related to one another. Relational databases are used on the relational model, an intuitive, straightforward way of representing data in tables.

Data is arranged into tables with rows and columns in relational databases, and the relationships between the tables are defined by unique keys. Users can insert, update, and delete data using SQL (Structured Query Language), which is used to manage and change the data kept in these tables. Regardless of the particular database management system used, this standard language offers a consistent way to interface with the database. (“What is a relational database?”, n.d.).

The capacity of relational databases to guarantee data security and integrity is one of their main advantages. This is done by enforcing the data type, field length, and referential integrity through the application of constraints and rules established in the database structure. This ensures that data is input accurately and consistently, helping to prevent errors and discrepancies. (“What is a relational database?”, n.d.).

In a variety of settings, including financial systems, e-commerce websites, scientific research, and healthcare, relational databases are very adaptable and useful. They offer a high degree of flexibility in terms of how data may be assessed and analyzed while also enabling the efficient, strong retrieval of enormous volumes of data. In conclusion, relational databases are a useful tool for managing and analyzing data and provide a dependable and safe method for storing, organizing, and manipulating massive volumes of data (“What is a Relational Database, 2019).

Our ER diagram models our electric vehicles impact on green house gas emissions database. The model contains four entities and three relationships between the entities. The four entities are greenhouse gases, electric vehicles, fuel vehicles, and community profile. There is an ownership relationship between the electric vehicles entity and the community profile entity, an emissions relationship between the greenhouse gas and fuel vehicles entity, and a produces relationship between the greenhouse gas and community profile entity. Each entity has it's own attributes that are used to describe the entity. Each entity has a composite primary key composed of the municipalities, county, and year attributes used to uniquely identify each relation.

The attributes of the community profile entity describe the size and population characteristics of each municipality, and has a relationship with the greenhouse gas entity, which contains attributes that describe the total emissions from each municipality. The electric vehicles entity has attributes that reveal the ownership and number of electric vehicles in each municipality. The fuel vehicles entity has attributes that show the miles traveled, used for transportation, and emissions from fuel vehicles in each municipality. The relationships between each entity reveal how fuel vehicles contribute to greenhouse gas emissions, and the impact that electric vehicles can have on reducing the emissions of greenhouse gases. It also reveals the ownership of electric vehicles and the emissions produced in each municipality based on the population characteristics of each municipality.

Given the design of the database model, the goal is to differentiate the use of greenhouse gas emissions from electric vehicles and fuel vehicles. Looking at the greenhouse gas emissions table of data, we see the elements shown by our model.

Which include the county, municipality, type of passenger vehicle emissions, metric tons of Carbon dioxide equivalent, and the year. In each of these categories, we are looking to see if greenhouse gas emissions are lowered through the use of electric vehicles. Our model shows a relationship between the variables n and m which is the relationship between greenhouse gas emissions and fuel vehicles. There is also a relationship between 1 and N– which shows the relationship between Community profile and greenhouse gasses. This shows how certain parameters of a community like population, median household income, population, and percent of people in poverty relate to the number of greenhouse gasses emitted by different communities. 1 to N also shows the relationship between community profile and electric vehicle use.

There is an assumption that each community/municipality is unique and can have many eclectic vehicles. This relation also shows how population characteristics impact the ownership of electric vehicles. This model will help us answer the question: "Do electric vehicles lower greenhouse gas emissions in each municipality?" The relationships illustrated can help us find specific data that will help answer this question and achieve our goal of finding the impact of electric vehicles of fuel vehicles and different municipalities.

<u>Use Case: Locate Information</u>

Primary Actor: User

Description: The user locates information present in the database

Scenario:

1. User will navigate to the database webpage

2. System will prompt user to search begin search
3. User will presented with names of municipalities
4. User will select one or more municipalities they wish to view the data of
5. User will be presented with data grouped by specific municipality
6. User can further narrow search by selecting data of entity

Use Case: Select

Primary Actor: User

Description: The user selects information they wish to view

Scenario:

System will present user with data of entities

User will be given option to select data from specific entity

User will further refine selection of data (ex. Filter by EV ownership, total GHG emissions, etc.)

User will select multiple columns of data from each entity data table

User will be shown specified or filtered selection of data from tables

User can compare columns of data selected

Use Case: View

Primary Actor: User

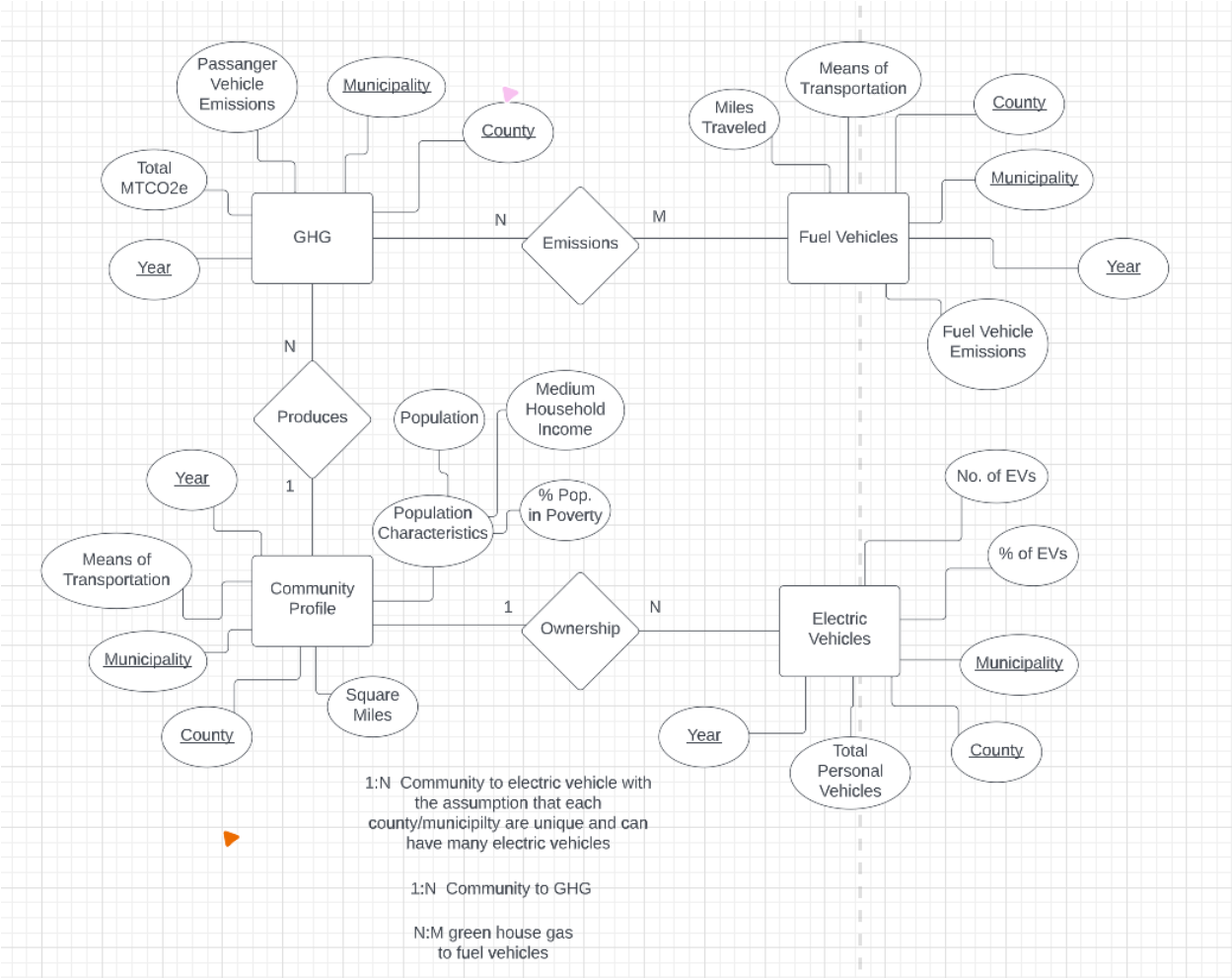
Description: The user views the information they have selected

Scenario:

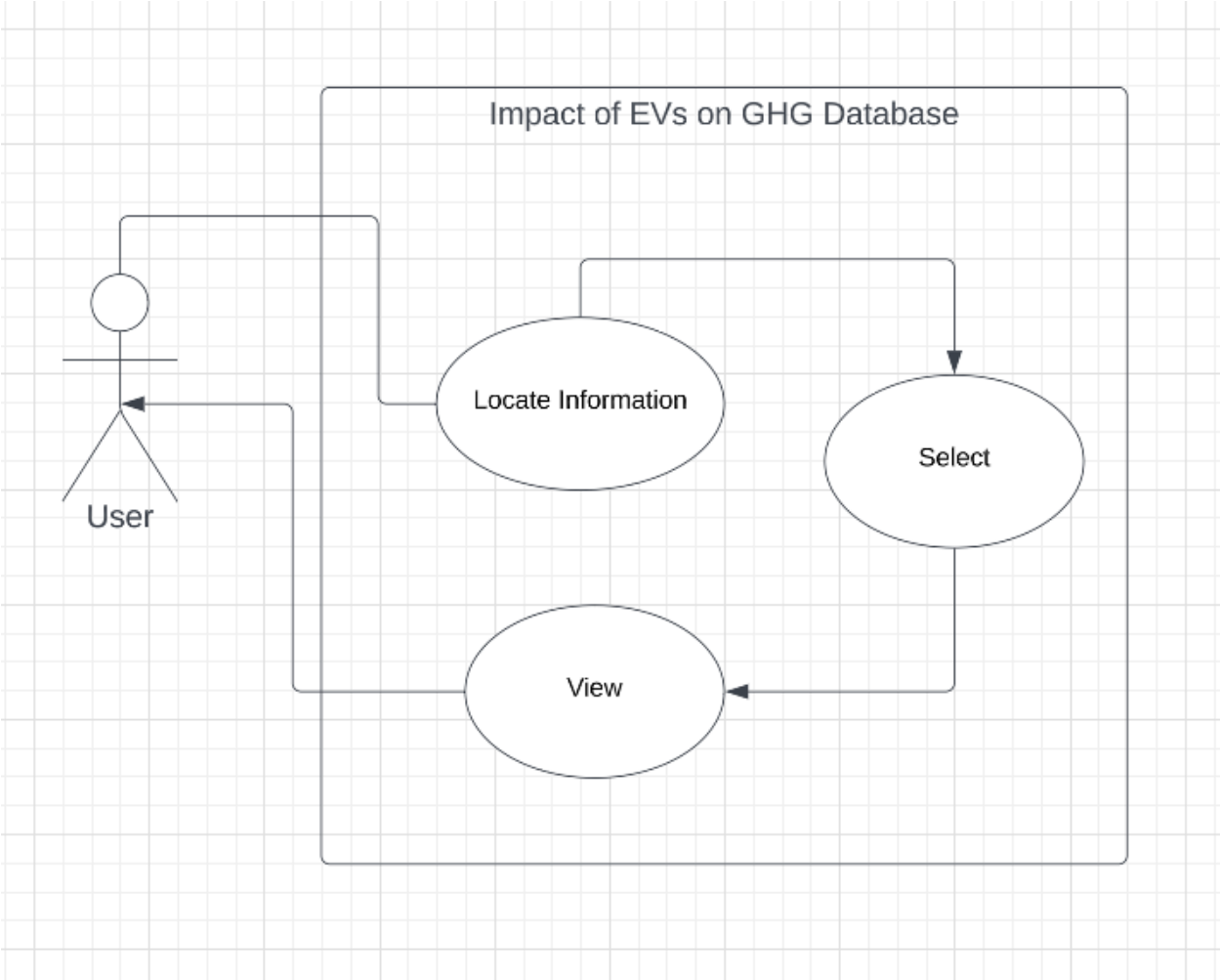
1. System will present the user with selected data

2. User can select entries they wish to view
3. User can view specific ownership of EVs in each municipality
4. User can view total emissions produced by passenger vehicles in selected municipality
5. User can compare EV ownership and total passenger vehicle emissions by municipality
6. User will be presented with the data they have selected

ER/EER Diagram:



UML Use Case Diagram:



References

Relational databases explained - examples, use cases & more. Fauna. (n.d.). Retrieved March 8, 2023, from https://fauna.com/blog/relational-database

What is a relational database? IBM. (n.d.). Retrieved March 8, 2023, from https://www.ibm.com/topics/relational-databases#:~:text=A%20relational%20database%20organizes%20data,key%20or%20a%20foreign%20key.

What is a relational database? Oracle. (n.d.). Retrieved March 8, 2023, from https://www.oracle.com/database/what-is-a-relational-database/