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Our project consists of using various different sources of data, in which we portrayed this data using different types of diagrams, including an ER diagram, a UML diagram, and an EER diagram.

The entity relation diagram (ER diagram) demonstrates how the data will be presented under tables, in which we call ‘relations’. The diamond demonstrates the type of relationship the entities have with each other. These types of diagrams help us create a proper format as to how we can display data to the user. It also helps describe how to access other pieces of data using underlined keys, which are used to pinpoint to a specific entity, or another entity using foreign keys, borrowed from other entities.

The ER diagram itself helps isolate data by year, as years could depend on organization in which sampled the data for the vehicle data. Populations gets its own separate entity due to the conflict of sampled data in years. The vehicle entity describes the emissions of GHG and miles traveled under vehicle types, not explicitly noting EVs, while the population entity describes GHG emissions, number of EVs, along with the difference means of transportation, including passenger vehicles. This helps solve the issue of inconsistent data due to not containing sampled data in 2015 or 2020. There is also another issue involving the municipality. Due to the data demonstrating a municipality with different counties, in order to create isolated data without duplicates and no conflicts, each municipality can be identified by both its name and county. We could have gone with a county based entity, but instead we went with a municipality as we believe it is a better way to demonstrate the emissions produced within each

municipality to isolate where most emissions come from. If the user wishes to more simply view data on the basis of county, queries can be used, which are commands to help isolate specific pieces of data in the relation, we can simply count up the data by municipality and present it by county.

The EER diagram enhances the ER diagram, which describes the relationships and specifies how each entity can access each other. This specification is presented through foreign keys, which are underlined. The foreign keys help create connections between entities, as these attributes are derived from each other in order to directly or indirectly access one relation to another. Within our EER diagram, we have four relations, three of which are connected to the municipality relation using the municipality name as the foreign key. Other than municipality, the other relations also have their own superkey to access its own individual data.

The UML diagram demonstrates how the user will access the data through an interface, either access it through the basis of municipality, or the overall state. The user will then be given an overview of data collected in 2015 and 2020. Under municipality data, the user can see comparisons based on vehicle miles traveled, a means of transportation, population, and percentage of EV ownership. Along with those pieces of data, it will also extend to the comparison of greenhouse gas emissions (GHG) in different years as a way to try and demonstrate how the increase in EV ownership could also help decrease the rate of GHG emissions. Under state data, it is just a more simplified version of the municipality data, only comparing between greenhouse gas emissions, and means of transportation in 2015 and 2020. Outside of those presented

data, both will include the list of municipalities, vehicle emissions, and the means of transportation to work.

The proposed graphical user interface will be a dropdown that allows selecting by municipality, with an option to view statewide data instead. For the municipality data, users will be presented with three views that allow viewing all means of transportation to work in a municipality, the makeup of vehicle miles traveled in a municipality, and the EV ownership relative to the total personal vehicle ownership and population. The user is also presented with options to switch these views between two different years, to see trends.

For statewide data, the user can compare greenhouse gasses across the state, as well as compare two selected means of transportation to work. Ideally, this would be presented using a heatmap, but if that proves too difficult, a sorted bar graph would do. These views also allow selecting between years.