Phase IV: Final Report

CSC315 & BUS/MGT385 Collaborative Project

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Team Members:

Jianna Nieves, Benjamin Fryc, Charles Mcbride, Collin Meakem, and Morgan Petrino

I. Phase I: Initial Video Proposal Video Link

In our initial video proposal we presented the data sets we were going to use, how these data sets could be linked together, and how the links would be valuable. The data sets that we chose to work with were the aggregated community-scale utility energy data, electric vehicle ownership data, energy efficiency program and solar installation data. Using these data sets we hope to see correlations between the use of EVs and solar effect power consumption on the grid. Some of the issues we take aim at with this data is to see if the reduction of emissions from ICE vehicles is replaced with increased emissions from the use of fossil fuel power plants.

II. Phase II: Proposal

A. Data being used in Database

The datasets being used in our collaborative project are all from the Sustainable New Jersey website. They include: Aggregated Community-Scale Utility Energy Data, Electric Vehicle Ownership Data, Solar Installation Data, Energy Efficiency Program Participation Data, and Municipalities of New Jersey.

The first dataset, Aggregated Community-Scale Utility Energy Data, shows the total amount of electricity and natural gas purchased in a municipality by sector from 2015 through 2021. The electricity purchased is displayed in kWh and the natural gas purchased is divided up in terms of residential, commercial, industrial, and street lighting sectors. Sustainable New Jersey uses this data to calculate GHG emissions from electricity and natural gas.

The second dataset, Electric Vehicle Ownership Data, shows the estimated total number of personal vehicles and electric vehicles in every New Jersey municipality for 2015 and 2020. It was prepared using the US Census ACS data and the New Jersey Department of Environmental Protection's (NJDEP's) Alternative Fueled Vehicles (AFV) Report data. This can be used to track community Electric Vehicle adoption.

The third dataset being used in our database is the Solar Installation Data, which shows all solar installations in New Jersey from 2000 to 2020. The data includes: information about every installation, the total number of installations by year, total number of installations by customer type, and the total MW

installed in each municipality for 2015 and 2020. The data was derived from New Jersey's Clean Energy Program Solar Activity Report "Installation Data".

The final dataset used in our project was the Municipalities of New Jersey dataset. This dataset contained standard information on New Jersey's municipalities, such as which county they belong to, as well as their municipality code.

B. Questions the data will explore

Utilizing the existing attributes in available datasets will allow users to combine information from various sources to conduct accurate research on this topic. One example for using all the available data would be to ensure the power companies can sustain the increasing number of electric vehicles as they become more and more mainstream. Some relevant data points from the data sets are: residential electricity and natural gas consumption, total number of vehicles vs. number of EVs owned, number of residential solar installations.

C. How the data could help identify sustainability problems, and opportunities to propose positive change

The datasets mentioned above will be combined to make our database. This will allow us to run queries in order to see if there is a correlation between the municipalities with the most eclectic vehicle ownership and the municipalities with the most amount of solar installations. Another correlation we can make is comparing the amount of electricity and natural gas that is

purchased by those municipalities that have the most EV or the most solar installations.

By running these tests and queries, our goal is to identify areas/municipalities who have increased their solar energy production and EV use and if the energy needed to charge EVs is being supplemented by increased solar usage.

D. Overview of the sustainability issue

1. Background of the problem

Are areas that use more electric vehicles drawing more power, and if they are whether or not these areas are trying to offset this increased electrical demand with more solar.

2. Various stakeholders affected by the problem

Stakeholders include private citizens, energy producers, fossil fuel companies, auto manufacturers. Private citizens are stakeholders as they bear the weight of harm caused by pollutants. Energy producers and fossil fuel companies are heavily invested in fossil fuels, as well as auto manufacturers.

3. Ethical Issues

Some of the ethical issues include resource acquisition for things like batteries, job loss or gain, and environmental impact. Areas that demand more energy also produce more solar energy.

E. Detailed Textual Use Cases

1. Use Case 1

2. System prompts user to select first data set to retrieve
3. User selects data set
4. System prompts user to select second data set
5. User selects second data set
6. System prompts user on how to view data correlations
7. User selects data view type
8. System generates graphical correlation data

F. Use Case 2

1. System prompts user to select data set
2. User selects data set
3. System displays data
4. System analyzes data for outlier data
5. System displays areas that could use improvement
6. System prompts user to highlight areas that could use improvement
7. User highlights displayed areas that could use improvement
8. System displays detailed information regarding the highlighted data set

G. Appendix : Changes

The data being used has changed the datasets we have used for our project: Aggregated Community-Scale Utility Energy Data, Electric Vehicle Ownership Data, and Solar Installation Data.

H. Detailed Textual Use Cases

I. Use Case 1

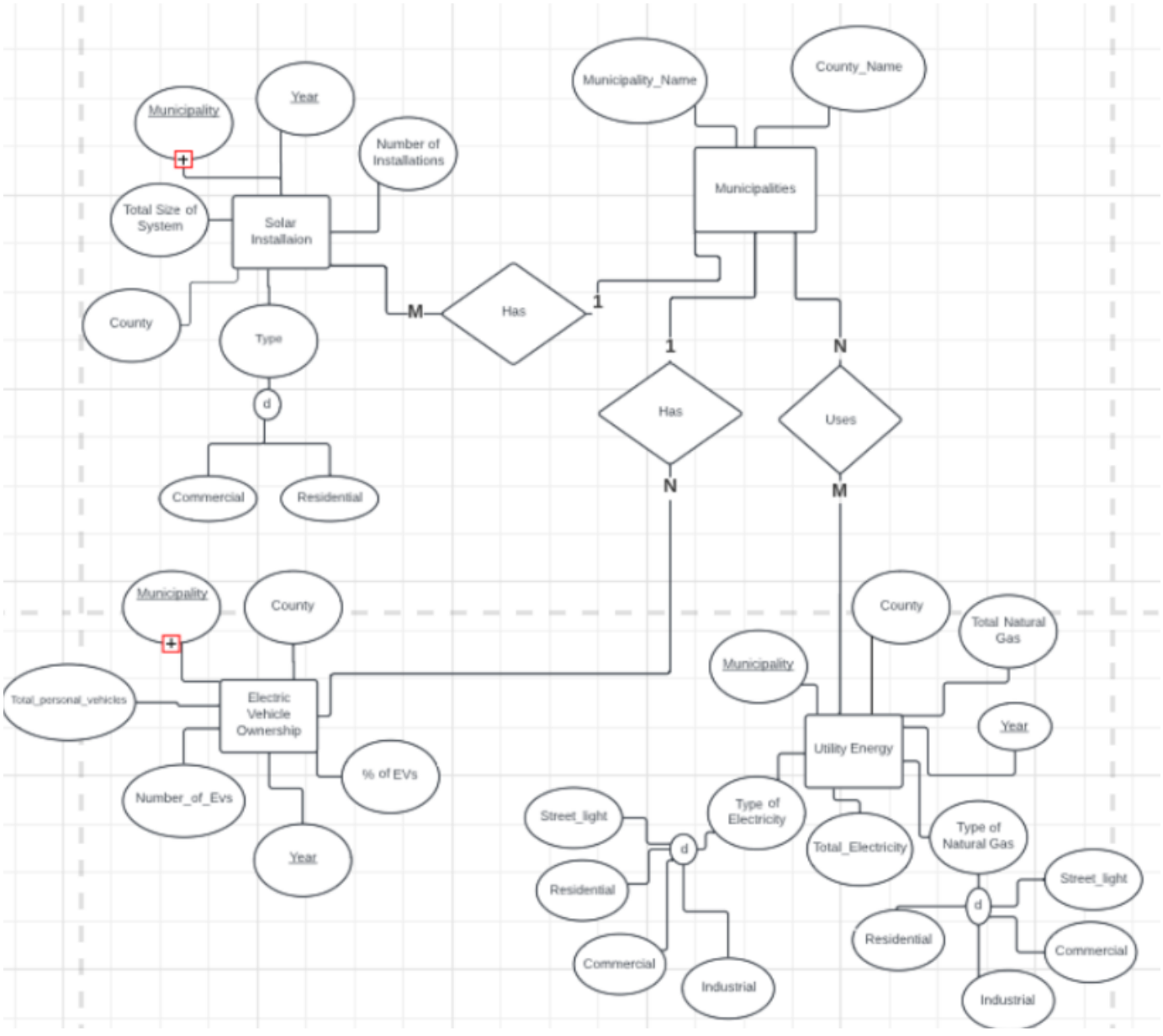
1. System prompts user to select county
2. User selects county
3. System prompts user to select municipality
4. User selects municipality
5. System shows the solar installations, energy, and electric vehicles data for that specify county & municipality.

J. Use Case 2

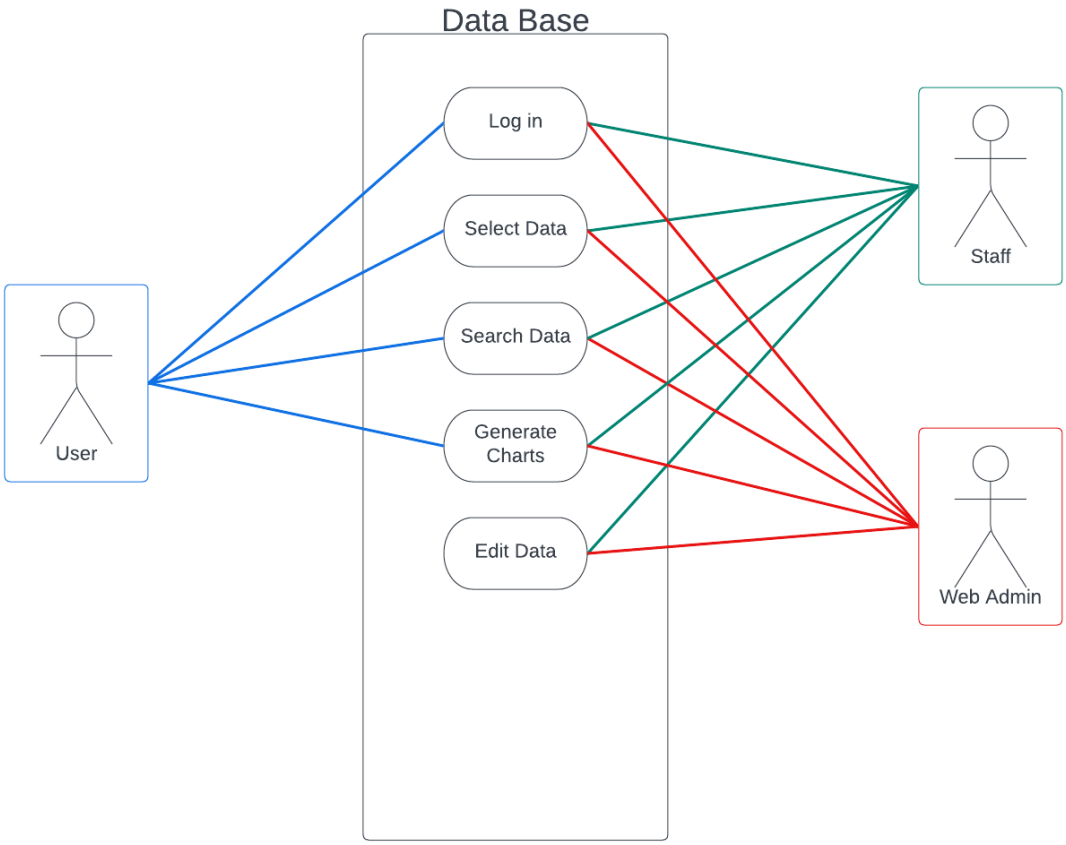
1. System prompts user to select a interesting query to view
2. User selects query
3. System displays data

III. Phase III: Entity Relationship Diagram

A. ER Diagram



B. Use Case Diagram



1. Summarize the details of your system's users (actors) and their interactions with your system.

   The three actors in our use case are: User, Web Admin, and Staff. The only interaction that not every actor can access is editing the data. Web admin is the only one who can edit data in the database. Other actions that all actors can access include: log in, select data, search data, and generate charts.

2. Describe the scope of your system.

Our system's scope includes running a set amount of queries that can help users generate charts and see the correlation between our datasets. It also should be used to encourage municipalities to be more energy efficient and give them examples on how to do so.

C. Narrative Explained

1. A general description of how relational databases work and why they are valuable.

Relational databases are used to manage a large amount of structured data. They provide an intuitive way to show data and allow easy access to the related data points. They are valuable because they are flexible due to the fact that it is easy to add, update, or delete tables and relationships. It is also easy to run complex queries using SQL. Lastly, multiple people can access and use the data simultaneously, which is very valuable since this is a group project.

D. The various elements of your diagram and what they reveal about your database model.

1. Entities

    a) Electric Vehicle Ownership

    b) Solar Installation

    c) Municipalities

    d) Utility Energy

2. Relationships
    a) Municipalities uses utility energy
    b) Municipalities have solar installation
    c) Municipalities have electric vehicle ownership

E. The reasoning behind your database design given the goals for the sustainability project.

The reasoning for our database design is to encourage municipalities to join in on sustainability projects. Our main goal is to be able to view data correlations and generate graphical correlations. These correlations can encourage and show municipalities who are looking to become more sustainable, ways they can. It can also prove how sustainable acts can affect the environment and specifically help New Jersey become more sustainable.

F. Detailed Textual Use Cases - Use Case 1
    1. System prompts user to select first data set to retrieve
    2. User selects data set
    3. System prompts user to select second data set
    4. User selects second data set
    5. System prompts user on how to view data correlations
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IV. Phase IV: Video

A. Click here to view our final video

V. Phase IV: Written report

A. Proposal to improve municipal sustainability based on the data analyzed

The purpose of our website is to help improve municipal sustainability by showing interesting correlation queries with datasets from Sustainable Jersey. The datasets we chose to use for our database are: Electric Vehicles data, Solar Installation data, Energy data, and Municipality data. Using these datasets, we hope municipalities can see how having solar installations and electric vehicles in their municipality can affect their energy usage. By showing these types of correlations, county officials and residents can get a better understanding of how solar installations and electric vehicles can have a big impact on sustainability when implemented.

B. How the proposal could be implemented in detail

This proposal could be used to better understand the balance between electrical consumption, the amount of EVs in a community, and the amount of solar production in that same community. Further advancements in the database could include interactive maps and graphs that include trendlines. We have implemented a row and column method in order to display the data from our database. We use a dropdown menu

system that the user can navigate through to find statistics from their desired county and municipality. Our main goal is for users to get a better idea of the effects of certain sustainability projects that their communities can get involved in.

C. Positive and negative ethical implications of your proposal

This proposal calls to mind a few positive ethical implications. For example, the proposal demonstrates which municipalities have been pushing to make the change from gas powered energy to renewable energy. Municipalities with a high percentage of Electric Vehicles show that residents of that county are opting for a county run on clean energy. Our site highlights counties and municipalities who have made an effort to become more sustainable. On the other hand, it also shows which counties and municipalities have not.

D. How the solution will affect various stakeholders

One of the stakeholders is the residents of the community. They may be affected by the presentation of this data by showing positive correlations in Electric Vehicle use, solar installations, and energy consumption. Another stakeholder would be Sustainable New Jersey, the effect on them could be better outreach and greater clarity in data trends and patterns. Lastly, another stakeholder would also be utilities companies. The best effect on utilities companies would be showing if they need to increase

their power production at their power plants to keep up with additional demand from rising numbers of Electric Vehicles.

E. Any unintended risks or ethical concerns that your proposal raises

An unintended risk could be data manipulation. If an unauthorized or malicious user were to gain access to the data they could change entries, which would lead to improper or false relations to be shown. These false relations could lead users to form false opinions on the relations shown in the database.

F. How they might be addressed

These concerns would be addressed using strong security measures to protect the data. By implementing things such as discretionary security mechanisms, privileged commands, and user log in, the data would be well protected and would continue to display accurate and up to date information.

G. Why your proposal is nonetheless worth pursuing despite these concerns.

Despite the potential for data to be misrepresented or altered, we believe that the presentation of this data would prove beneficial to the general public in increasing their understanding of the impacts of solar and electric vehicles. We also believe county officials can come to our site to see the benefits of joining Sustainable Jerseys energy efficiency programs.

This can be done by using examples of counties who already participate in the programs and have had great success in bringing down their environmental footprint on both the world and New Jersey.