Problem Statement

The College of New Jersey has a goal of becoming Net Zero by 2040 and it is our goal to alter the fleet vehicle management in order to help the college get closer to its goal. To become Net Zero, the college must completely negate the amount of greenhouse gasses produced. While 2040 may seem a long way out, in reality if TCNJ would like to achieve their goals of becoming Net Zero in 2040, actions must be taken soon. The College of New Jersey has over 100 fleet vehicles in operation that are used around campus to support its staff. Some of the uses of the vehicles include maintenance vehicles for the TCNJ maintenance crew, police cars, vans for athletic teams, as well as golf carts that are used by different organizations and events on campus. Since most of these vehicles are engine powered and are fueled by gasoline, this can add up to a lot of money being spent on operating these vehicles. Not only that, but these vehicles are contributing to TCNJ's greenhouse gas emissions. Our proposal to change this is to retire certain fleet vehicles which will reduce the number of fleet vehicles on campus.

Objective

There are three main objectives our module would like to provide solutions for. The first objective is to help TCNJ achieve its goal of becoming Net Zero by 2040. The second goal of the module is to reduce the number of vehicles used by the school. The third objective is to determine the most optimal and efficient way to bring about these changes without causing too much disruption at the college. Our first objective is to reduce the total amount of greenhouse gas emitted by The College of New Jersey. One way we can do this is to cut down on the amount of fleet vehicles used by the college. When looking at the current fleet vehicles, there are 96 vehicles in use, and they are almost entirely gas powered cars. Of these 96 cars, 30 are from 2006 or earlier and it is our proposal to retire these vehicles initially. By retiring the older vehicles first, we can decrease the cost of maintaining the fleet since older vehicles are more likely to have mechanic issues. By reducing the total number of vehicles we will save the school money as well as help The College of New Jersey reach its goal of becoming Net Zero. The third objective of determining the most optimal and efficient way of implementing these changes is the most challenging aspect of the plan. We need to determine the amount of vehicles to retire as well as alternatives we can offer to substitute the absence of the vehicles. Our module will look to provide solutions for all these objectives.

Desired End Product

TCNJ currently has almost 100 vehicles in their fleet. Many of these vehicles are over 15 years old. This number of vehicles is a bit extreme for a campus that is only 0.45 square miles. By getting rid of every vehicle made in 2006 or earlier, the college would lose about 30 vehicles, all of which require a great deal of maintenance. The vehicles also release a great deal of carbon dioxide into the air. Though the college would lose a decent number of vehicles, they still would have over 65 vehicles in their fleet to help around campus, which should be more than enough.

As stated previously, TCNJ would save a good deal of money by cutting down on the number of vehicles in their fleet. That money could be used in other places around the campus, whether it be making improvements to classrooms or being put towards athletics or the arts. The earth will also be a much cleaner place. Old vehicles emit over 4.35 tons of carbon dioxide per year. This can cause significant risks for people's health, especially those who live on campus. By cutting 30 vehicles, there will be over 130 tons less carbon monoxide in the air per year.

Research and Data

Being able to look at the entire workings of TCNJ's Fleet Vehicle Management System would've been the best option to make decisions for TCNJ's fleet. However, with the data we've been given, we can make informed decisions as well. The research we plan to conduct involves, primarily, the Vehicle Fleet CAB spreadsheet as that is where our base information on TCNJ's fleet comes from. Researching this topic and possible improvements will lead to us asking questions such as: What vehicles are currently in the fleet, what fuel source do said vehicles use and how costly is it, financially and environmentally. Also, the chance of looking at any previously proposed and trying to integrate any relevant information and suggestions.

As for the Data we will be including, it sits along the same lines of our research questions. Taken into account will be several factors like the initial cost of purchasing the vehicle and the maintenance costs for repairs, tires, battery, transmission, and the like. Perhaps one of the most significant data entries will be the fuel type, usage, cost, and effects.

Other Similar Systems / Approaches That Exist

Colleges use many similar systems and there are other approaches that exist that are similar to ours. One method that some colleges use is a sort of GPS fleet tracking system. Fleet management software such as this ensures that vehicles are where they are supposed to be and serve their correct purpose. This is similar to our idea because we want to only use vehicles that are helping our campus and decrease the amount of money spent on maintenance. This idea prioritizes that vehicles are doing what they were purchased to do; however, our idea focuses more on reducing the number of fleet vehicles by retiring vehicles that were purchased before 2006.

Many college campuses have on site maintenance facilities to keep their fleet vehicles running properly. Smart maintenance is something that is becoming more popular. Features such as Zubie Smart Maintenance allow fleet managers to track vehicles, schedule maintenance, and pay for maintenance and vehicle expenses. This helps keep track of each vehicle's service requirements. There already is an existing system for fleet vehicle management at TCNJ. They have started to utilize golf carts more and the fleet vehicle excel illustrates that TCNJ has future plans to buy more electric vehicles. Our module will add to this by retiring vehicles that were purchased prior to 2006 and overall reducing the number of fleet vehicles at TCNJ.

Possible Alternate Applications

While it is ideal to have a lesser amount of fleet vehicles, it may be difficult to implement given the extensive usage of each one. However, this does not mean that older vehicles, which produce a great amount of carbon emissions and require a considerable amount of maintenance, should be here to stay for the long run. With that said, an alternative application to the situation at hand would be to retire the older vehicles and purchase electric vehicles. This would include cars, trucks, and even golf carts. It is believed that while there may be an initial cost at hand, this would lead to cost-efficiency and more sustainability in the future.

Performance

By retiring all fleet vehicles from 2006 and older, we are greatly reducing TCNJ's carbon footprint as well as annual vehicle costs. Newer vehicles are more technologically advanced and produce less emissions. The money saved by this reduction could help out other

school projects, or go back into fleet management. Reducing the amount of fleet vehicles overall is better than simply replacing fleet vehicles with electric vehicles because electric vehicles still have a carbon footprint. If more cars are needed by TCNJ after the reduction, adding electric vehicles is an option.

Security

In terms of security, repositories created on GitHub will be restricted to private instead of public visibility. Making a repository private eliminates an open source project, where the source code cannot be modified and changed by anyone for any other purpose. Since the repositories will be in private visibility, all the files related to the project will only be accessed by the group members and all the modifications and updates of the source code will only be viewed by the shared members, which makes it safe and secure.

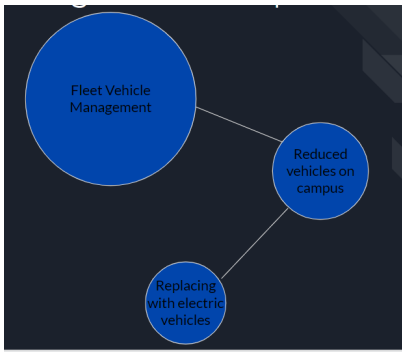
Backup and Recovery

For each portion of our project, we will be uploading our information to the open-source application known as GitHub. In the case that our information is damaged or destroyed, it is important for there to be a backup in order to recover whatever is lost. Therefore, we also plan on uploading all of our codes and overall information to alternative open source platforms. Examples of these include GitLab and Google Cloud Source Repositories. This would allow for the group to recover any lost information without having to start entirely over from the beginning of the process.

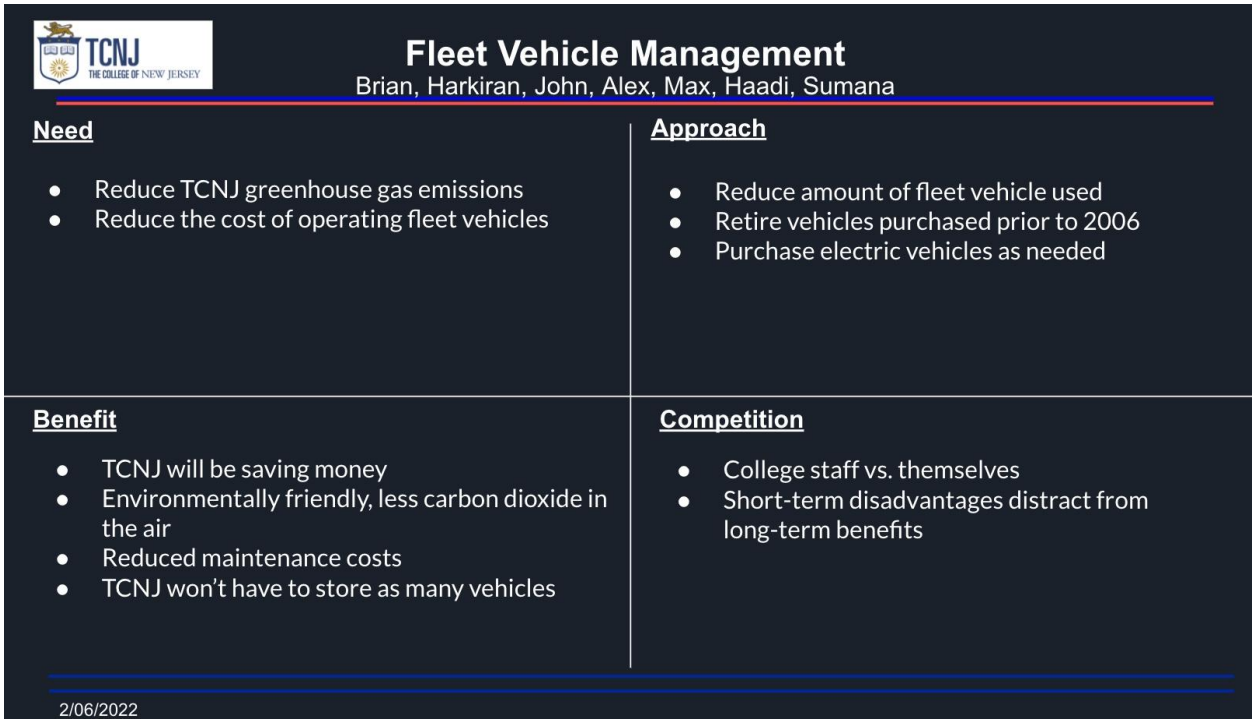
Technology and Concepts:

For the Fleet Vehicle Management project, some of the database concepts that will be used are Entity-Relationship diagrams. An ER diagram is a visual representation that displays the relationships between several entities, also known as tables, in the database. Each entity has specific characteristics, known as attributes, that will store the information about a particular entity. For instance, in our project, a vehicle is an entity; the attributes are color, license number, manufacturing date, etc., An ERD diagram tool- Lucidchart, will be used to construct the ER diagrams to showcase the design of our database application. Also, PostgreSQL database will serve as a platform to write SQL queries. With the use of these queries, data stored in the database can be accessed and manipulated with the use of SQL commands as per the requirements. As for the implementation of the web-based interface, the Python programming language will be used to integrate all the SQL queries into user-interface. As the sample Flask code is already being provided, we will use it as a sample to write the Python programming language to develop the web application.

Diagrammatic Representation



Quad Chart


TCNJ
THE COLLEGE OF NEW JERSEY
Fleet Vehicle Management
Brian, Harkiran, John, Alex, Max, Haadi, Sumana
Need
Reduce TCNJ greenhouse gas emissions
Reduce the cost of operating fleet vehicles
Approach
Reduce amount of fleet vehicle used
Retire vehicles purchased prior to 2006
Purchase electric vehicles as needed
Benefit
TCNJ will be saving money
Environmentally friendly, less carbon dioxide in the air
Reduced maintenance costs
TCNJ won't have to store as many vehicles
Competition
College staff vs. themselves
Short-term disadvantages distract from long-term benefits
2/06/2022