

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 build a model that allows the user to compare and contrast the differences between vehicles in the model to determine what the overall effects of the change would have on the fleet vehicles.

Objective

The objective of our model is to build a user-friendly interface that gives the user control to execute commands that bring up a vehicle of his own wishes that would then provide the user with information regarding the vehicle's cost and emission data. This model would allow administrators to have complete control of the different vehicles and could compare on the database. For example, the user could request to compare the cost and emission data of one of TCNJ's Ford F450's with a Ram 1500, easily comparing side by side the different expected costs and the effects on the environment. The database will be able to store thousands of vehicle information, allowing the user to find the most optimal group of vehicles to make up the fleet vehicle management at TCNJ.

Desired End Product

The desired end product is a database that uses the FIFO method to replace the old vehicles with new vehicles. The database will also allow for the admin to manually choose a specific vehicle to replace if they would like to. The database will have specific dropdowns where the admin can select the year, make, and model of vehicles. Once a certain vehicle is selected, the admin will then be able to access numerous data about the vehicle, such as how many miles per gallon the vehicle gets, how much emissions it releases, the life expectancy, etc. This is important because the admin will be able to see if the vehicle is environmentally friendly as well as when it is time for a vehicle to be retired, and what type of vehicle would be the best replacement. Obviously, different departments will need different vehicles to complete their tasks, so this database will help find the best replacement. Non admins will be able to access the database as well, and view important statistics regarding the vehicle fleet's impact on the environment.

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 environmental 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

With our approach, it is suggested that when it is time to replace vehicles, it is done so by 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. The creation of this database will allow for TCNJ to use the same techniques when trying to determine what else at the college needs to be replaced. This could range from a variety of items such as technology, buildings, classroom materials, etc.

Performance

The database will contain the records of every fleet vehicle used by TCNJ. The GUI will have boxes to fill out the year, make, and model of the new vehicle being added to the fleet. The database will suggest the oldest vehicle on file to be replaced, but the user will be able to choose any other vehicle in the fleet if need be. The database will also display statistics such as the percentage of electric vehicles in the fleet, as well as any other attributes found useful for improving TCNJ's carbon footprint. Overall, the database will serve as easy access to information regarding the college's fleet vehicles and how they affect the environment.

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. After the project is completed and departed from Github to the TCNJ facilities, we will ensure that the user interface (software) is restricted to TCNJ users only. If restriction is possible to implement through database queries, then we will proceed with this proposal. Otherwise, we have to restrict access through the source code we develop. Therefore, no unauthorized users can access the database or retrieve the information.

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

Admin Access

New Vehicle:

Year	Make	Model
<input type="text"/>	<input type="text"/>	<input type="text"/>

Recommended Replacement:

Year	Make	Model
<input type="text"/>	<input type="text"/>	<input type="text"/>

Vehicle Removal:

Year	Make	Model
<input type="text"/>	<input type="text"/>	<input type="text"/>

User Access

- Emissions statistics
- Percentage of electric vehicles
- Oldest vehicle
- Newest vehicle
- Any other statistics relevant to the fleet and its affect on the environment



Electric vs Combustion

Vehicle Lookup:

Year	Make	Model
<input type="text"/>	<input type="text"/>	<input type="text"/>

- Statistics regarding individual vehicle
- The impact of removing the vehicle
- The impact of replacing the vehicle

Quad Chart



Fleet Vehicle Management

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Need

- Reduce TCNJ greenhouse gas emissions
- Reduce the cost of operating fleet vehicles

Approach

- Replace fleet vehicles with electric vehicles as needed
- Possibly retire vehicles purchased prior to 2006

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

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