Functional Specification

Background

The surge of alternative fuels in vehicles has given rise to the consumption of electric models, hydrogen-fuel cell models, and hybrid models. As good as these changes are for the environment, the cost of the infrastructure to make these new environmentally-friendly vehicle models sustainable needs to be considered as well. A host of electrical charging stations, hydrogen filling stations, and ports are being invested in by numerous companies and governments spanning the nation which has given incentive for car companies to put more resources into building more efficient models. This in turn has inspired people, who are now more inclined than ever, to buy these vehicles as well. This is where a two-fold problem area rises:

1) For a user who has never purchased an alternatively-fueled vehicle, how are they supposed to know which one is the best one?
2) How can they be certain that, in the state they live in, there is enough infrastructural support for this new model and that overall this purchase will be worthwhile for them?

The support that these new vehicles get to succeed is just as important as them existing in the first place. Our project plans to tap into these problem areas and provide support and guidance to a new user of an alternatively-fueled vehicle as early as possible, so these environmentally-friendly vehicles will catch on at a quicker rate for a wide range of people.

User profile

We are targeting non-technical users who are looking to buy an electric vehicle. Using our analysis tool will not require the user to have any knowledge of coding in a certain programming language. The user will simply be required to answer a few questions about their preferences about a car in order for our classification model/recommendation system to recommend a car that would best fit their preferences. Aside from that however, our tool will require that our user have a basic understanding of electric vehicles and of the different types of charging stations such as Electric Level 1, Electric Level 2, Electric DC fast, Hydrogen Retail, Hydrogen Non-Retail, Propane Primary, Propane Secondary etc. We do expect the users to have seen and understood some of the nuances of these alternatively-fueled vehicles and have an idea of what preferences they might have in the purchasing process.

Data Sources

The first data source we used was the electric car attributes dataset which is the ElectricCarData.csv file. It includes the following columns: brand, model, acceleration, top speed, range, efficiency, fast charge, rapid charge, power train, plug type, body style, segment, number of seats and its price in euros. This dataset didn't require any restructuring since a clean version was already provided on Kaggle: https://www.kaggle.com/geoffnel/evs-one-electric-vehicle-dataset?select=ElectricCarData_Clean.csv

Our second data source is the StationsByState.csv file that includes states, their codes, and a breakdown of the number of different alternative fuel charging/filling stations in that state. This file was cleaned by splitting evethe data into into individual columns after a many of the columns have been grouped together

Our final data source is the EV registration dataset for 15 different states in the US. It consists of 15 csv files; one for each of the following states: New York, New Jersey, Oregon, Texas, Vermont, Virginia, Washington, Wisconsin, Florida, California, Colorado, Connecticut, Montana, Michigan and Minnesota. These csv files contain the registration details for each of the vehicles registered in each of the states such as zip code, registration valid date, registration expiration date, make, model and model year. We joined these datasets on the columns they had in common. The final combined dataset contains rows that either have a geoID or a zip code. In addition, some rows contain either a 'Vehicle Name' column or "Make", "Model", and "Model Year" columns. We split the "Vehicle Name" column into "Make" and "Model" columns for consistency purposes. The links to each of the individual state datasets can be found here: https://www.atlasevhub.com/materials/state-ev-registration-data/#data

Use Cases

Case 1:

OBJECTIVE: Person A moves to the Silicon Valley and wants to trade in a gas guzzler in order to get a new alternatively fueled vehicle to keep up with the rising cost of gasoline in the Valley and be able to efficiently make it to work everyday by using the carpool lane

INTERACTION: Our system will help the user decide if they should switch to Electric Vehicles and if it will be effective monetarily in the long run, depending on their car usage and the fuel price.

Case 2:

OBJECTIVE: Person B is confused about whether or not to get a Tesla or a Toyota Mirai and unsure about which attributes makes an electric/hydrogen vehicle better than the other (how our interface helps them and what it does in the backend to come up with that solution

INTERACTION: Our user interface will ask some specific questions to the user to understand their requirements like car specifications like acceleration, top speed, range in kilometers, fast charge, number of seats, budget, etc. and make a recommendation depending on that.

Case 3:

OBJECTIVE: Person C wants to decide which Electric car to buy depending on the cars preferred in a particular state along with the availability of the charging stations along with the type of charging in the area.

INTERACTION: Our user interface will ask the user for their address and will give them an insight about the most bought Electric cars in their region and the availability of charging stations along with the plug types in that state.