Gabrielius Kudirka

CS 6630: Visualization for Data Science

Project Proposal

Basic Info:

Title: Seed2Soil Visualization

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GitHub: https://github.com/gabekudirka/Seed2SoilVis

Background and Motivation:

For this project I will be pursuing my current research in transportation visualization under Dr. Bei Wang Phillips and Dr. Cathy Liu. Last fall I took Dr. Bei Wang Phillips' advanced data visualization course where I created a transportation visualization tool for a class project. I found the work to be very interesting and was happy with what I was able to produce. Dr. Bei Wang Phillips liked my design as well and with her help along with Dr. Cathy Liu, we extended the project after the class was finished and included it in a paper that we submitted over the summer. Because of this experience and my interest in transportation visualization, I joined onto this project which is called Seed2Soil and is aimed at analyzing and optimizing performance of the University of Utah's fleet of service vehicles. By using this research as my project for this class, I hope to get more time to produce a high-quality visualization tool.

Project Objectives:

The aim of this project is to provide a visualization tool for performance analysis of service fleet vehicles at the University of Utah. This visualization tool will primarily use telematic data to allow for analysis of the performance of fleet operation and allow for the development of strategic solutions for effective fleet service management. The primary questions that I would like to answer with this visualization are:

How can we optimize the utilization of vehicles between departments to consolidate our fleet?

Can we reduce the number of trips taken by vehicles by consolidating similar routes?

Can we reduce vehicle idle time?

Can we increase driving efficiency by analyzing driver behavior?

By answering these questions we hope that we will be able to reduce costs and emissions from fleet vehicles at the University of Utah.

Data:

The University of Utah currently keeps data for vehicles on a platform called GeoTab. From this platform we can download data about each vehicle (department, mpg, model, etc.) as well as data about the trips that each vehicle takes which includes the vehicle running time, idle time, as well as the addresses of each stop that the vehicle makes. We have been told that there is more fine grain trajectory data for the vehicle trips which includes vehicle GPS coordinates, acceleration, etc. at 5-20 second intervals along each trip. However, this fine grain trajectory data is not available to us yet and it is unclear when it will be so I will plan on using the data directly from GeoTab for the purposes of this project. Access to this data requires authorization so I am unable to include a link to it here.

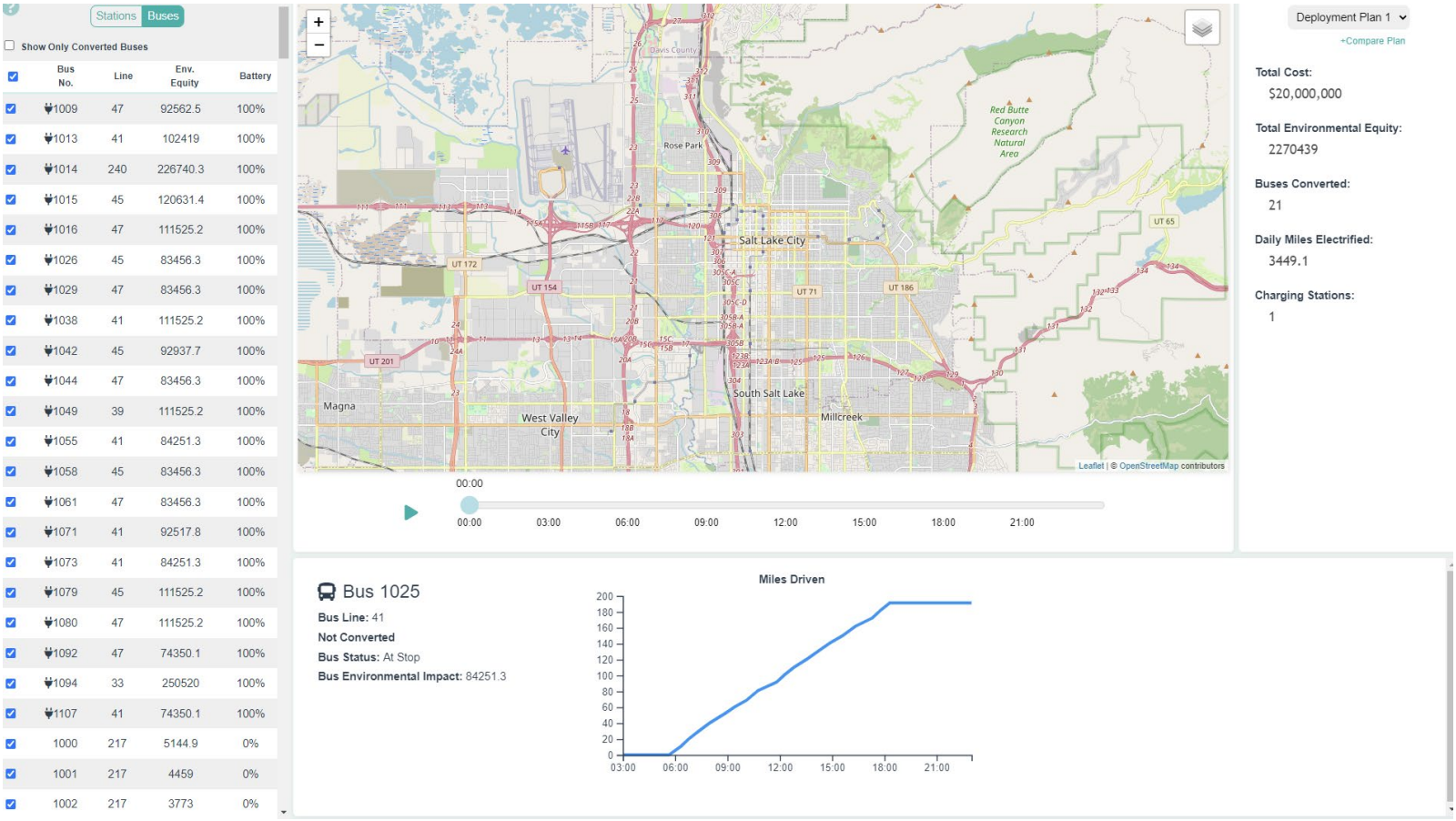
Data Processing:

The data taken from GeoTab requires a significant amount of preprocessing as the different data of interest must be downloaded separately. After processing there will be three central objects that the visualizations will be based around, vehicles, trips, and departments. Each vehicle will be associated with its specific corresponding data points such as make and model, efficiency, and ID. Vehicles will also be associated with a specific department and will have an array of trips that they have taken. Department objects will contain specific data points about the department and contain a list of the vehicles associated with that department. Trips objects currently require the most preprocessing because in it's current form, the data only contains the addresses of stop locations and not coordinates. This will require using the ArcGIS API to convert these addresses into coordinates that can be plotted. In addition to the coordinates of stops trip objects will also contain information on idle time during the trip, when the trip took place, and the vehicle associated with the trip. If we gain access to the finer grain trajectory data trips will also contain the coordinates for the exact route in GeoJson format. This data processing will be done using python.

Visualization Design:

Because this project is already underway, we already have chosen a final design. On the left side bar is where you will be able to select vehicles. By selecting a vehicle it's trip information for a specified

time period will appear on the map and more visualizations will appear on the bottom panel. On the left panel information about each vehicle will be displayed. On the left panel users will be able to select optimization plans developed by other participants in the research panel which will update the visualizations accordingly. I aim to make the visualizations on the bottom panel interactive. I will also add a way to select range of dates rather than just time of day underneath the map. The following is a design which we intend to base the future work off of.



Must Have Features:

- The ability to display trip information for selected vehicles on the map
- The ability to select ranges of time, both dates and time of day
- Provide visualization for vehicle usage in the selected amount of time in the bottom panel
- The ability to select specific busses for visualization specific to that bus
- Add the ability to compare multiple busses on the map
- Add the ability to compare multiple busses usage
- Add visualizations for idle time and departments on the bottom panel

Optional features:

- Draw vehicle routes on the map
- Allow users to compare vehicle routes
- Provide metrics for route similarity for consolidation
- Allow users to switch away from the map view for a more in depth comparison between vehicles/departments
- Add visualizations for driving behavior like acceleration, stopping, etc.
- Add an overlay to the map displaying where stops are most often
- Add an overlay to the map displaying where idle time is most frequent
- Provide cost analysis for busses over set periods of time
- Visualize cost analysis for busses over set periods of time

Many of these optional features are dependent on the work of other members of the project and the data we are able to collect.

Project Schedule:

1. Vehicles along with information on the vehicle list – After week 1
2. Display trip information for vehicles on the map - After week 2
3. Provide the ability to users to vary the time window they are analyzing - After week 2
4. Add the ability to add multiple busses to the map - After week 2
5. Provide visualizations for selected buss's usage on the bottom panel - After week 3
6. Add visualizations for idle time on the bottom panel - After week 3
7. Allow users to compare usage of multiple vehicles on the bottom panel - After week 4
8. Add visualizations for departments – After week 5

Following this schedule should leave me with at least a week before the due date to complete more optional features.