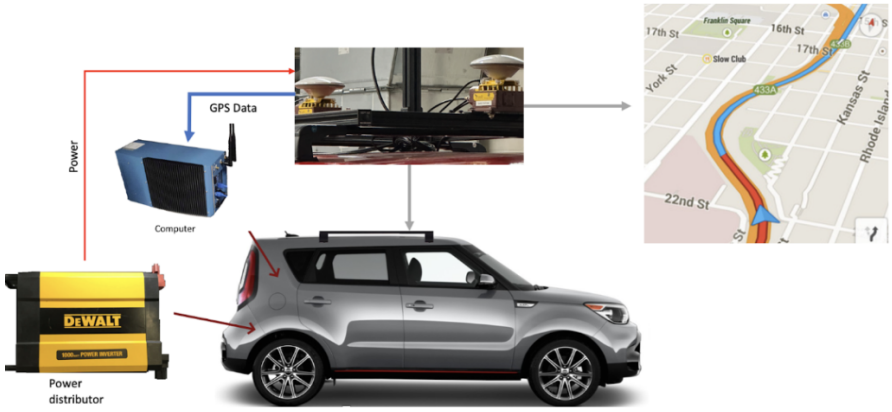
Report 6 - Nihal Afsal

Localization using GPS, IMU, and Map Data

Note: Homework must be uploaded as a **single pdf file**, not a zip file. If a problem solution requires a video, add it as a hyperlink in the pdf. The hyperlink should open the video file which is stored on your Google Drive. Any problem that requires Python code must show the entire code as well as a description of how the code works. Duplicate code submissions will result in a zero.

1. During class we recorded a rosbag using the GPS/IMU mounted on our autonomous vehicle development platform. Document the set-up of the GPS/IMU on the vehicle by splitting the following tasks with your group. You can all turn in the same thing or have each student turn in their contribution. (*15 pts)*

a. Create a wiring diagram



b. Document with photos how and where the GPS/IMU is connected

Fig. 1

Figure 1 roof mounted GPS

Figure 2 trunk computer

Figure 3 spare tire compartment inverter

Fig. 2

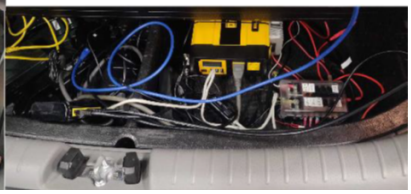


Fig. 3

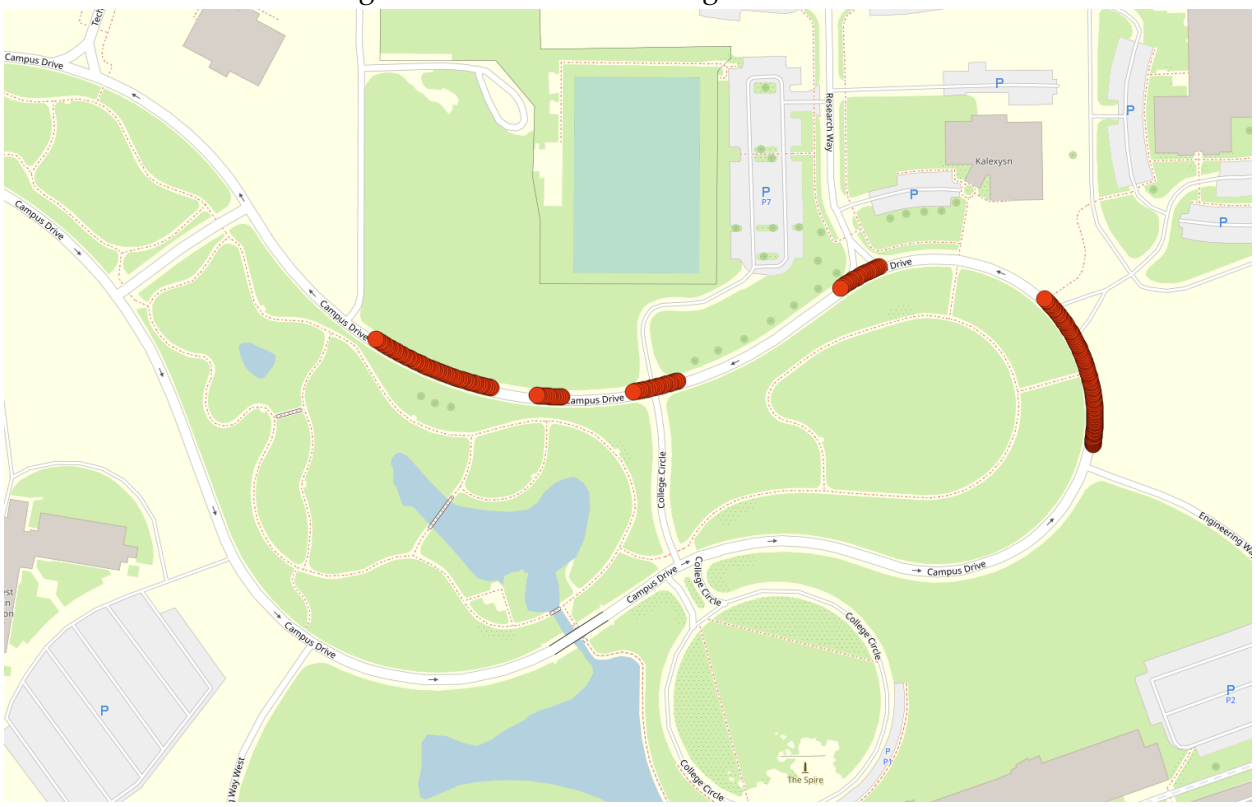
- In our Autonomous Vehicle, the two GPS/IMU sensors are mounted on top of the vehicle's centerline. The wiring runs from the roof-mounted sensor rack into the vehicle's rear cargo area. The power was connected to the power distribution, and the data were transmitted through ethernet cables connected through a switch to the high-performance computer.

c. Document and describe how the GPS/IMU data was collected

- In most cases, sensors mounted on the autonomous vehicle are used to collect GPS/IMU data. The GPS receives signals from satellites orbiting the earth and uses them to determine the exact location of the moving object. The GPS/IMU sensors are linked to a central computer, which continuously gathers and analyzes the sensor data. The information can be used to determine the location and heading of the vehicle as well as its speed and acceleration, among other things.

2. Using the hd_maps.bag file from Elearning, create a high quality plot of the following. You should collaborate with your group, but each individual must turn in a slightly different plot. (*30 pts)*

d. The latitude and longitude of the vehicle during the whole route

- 

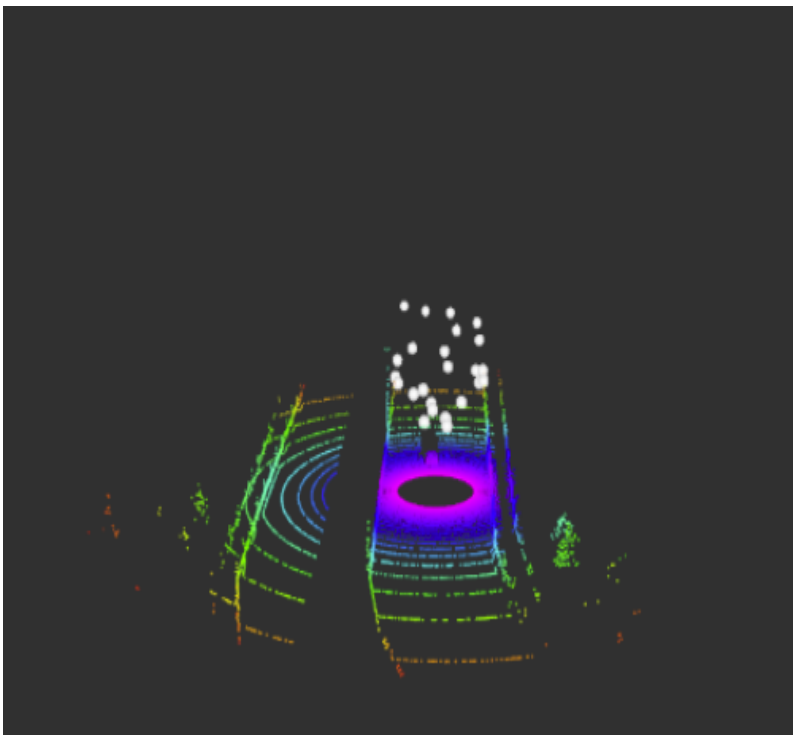
The Matplotlib method was inefficient when plotting the coordinates and manually adding a map behind the background, so I chose not to use it. Instead, I decided to plot the points on a map using a Python library called Folium. I used several Folium functions in my Python code to plot the points and output the data on an HTML live map.

Code:

```
import folium
import pandas as pd

# Load GPS data from CSV file
data = pd.read_csv('gps_points.csv')

# Create a folium map centered on the mean latitude and
longitude
```

```
m = folium.Map(location=[data['latitude'].mean(),
data['longitude'].mean()], zoom_start=25,
tiles='OpenStreetMap')

# Add a circle marker for each GPS coordinate to the folium map
for lat, lon in zip(data['latitude'], data['longitude']):
    folium.CircleMarker(location=[lat, lon], radius=10,
color='black', fill=True, fill_color='red', fill_opacity=1,
weight=0.5).add_to(m)

# Save the folium map to an HTML file
m.save('gps_map.html')
```

e. One instance of a lidar point cloud



Can you identify the location where this rosbag was recorded?

- From the generated map, it looks like the rosbag was recorded in front of Parkview Campus!

3. Complete the Group Norm Check-In document in the Projects folder on Elearning. Each member of the team should turn in the same thing. *(10 pts)*

- https://docs.google.com/document/d/14-1_CRprBqsfu1e93_yeWpkt7ZELrw7H/edit?usp=sharing&ouid=101253656479036943106&rtpof=true&sd=true