EECE 5554 Robotics Sensing and Navigation

Lab 1 Report

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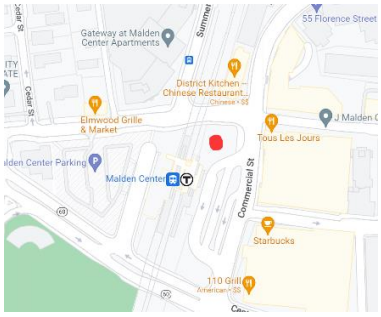
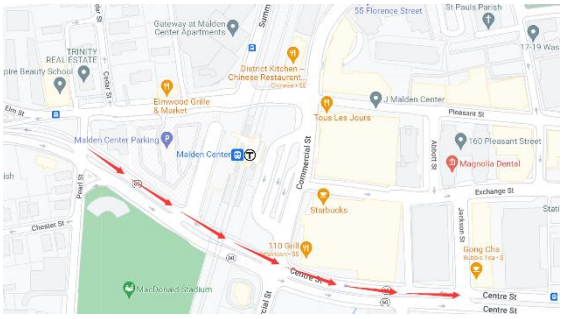
Introduction

The data for this lab is collected at Malden, Massachusetts. The stationary data has been collected next to the Malden Center transportation station. The walking data has been collected by walking down the Centre Street. The figure below is a better way to indicate how data has been collected.

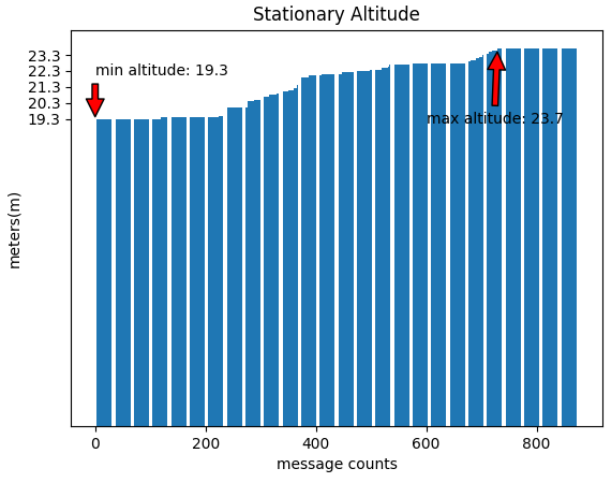




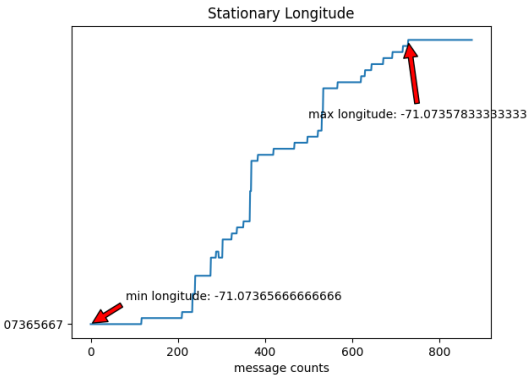
Data Processing and Analysis

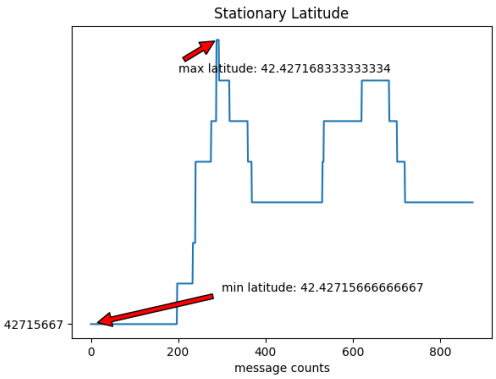
For this lab, all data are collected via ROSBAG feature, after recording, the bag file has been converted into yaml file. By using python reading the yaml file, all data could be process and plot into plausible visualizations.

For the stationary data, the examiner held the GPS sensor and standing next to the Malden Center for 10 minutes.

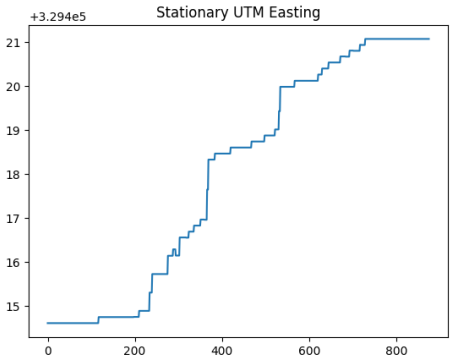


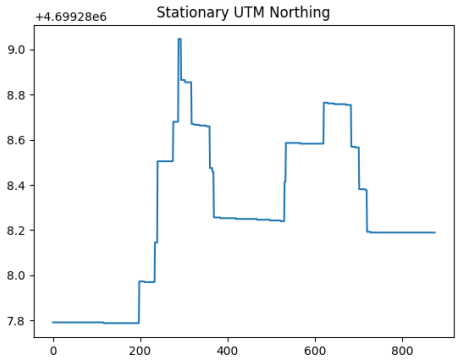
The stationary altitude figure is showed above. The minimum stationary altitude is 19.3 meters and maximum stationary altitude is 23.7 meters.



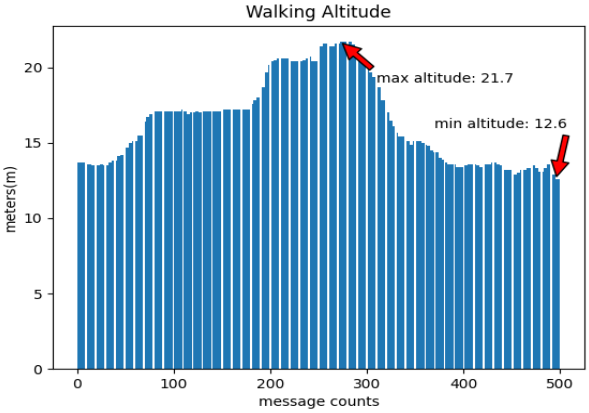


The above two figures are stationary longitude and stationary latitude. The minimum stationary longitude is -71.0736566, the maximum stationary longitude is -71.07357833, the minimum stationary latitude is 42.4271566, the maximum stationary latitude is 42.42715833.

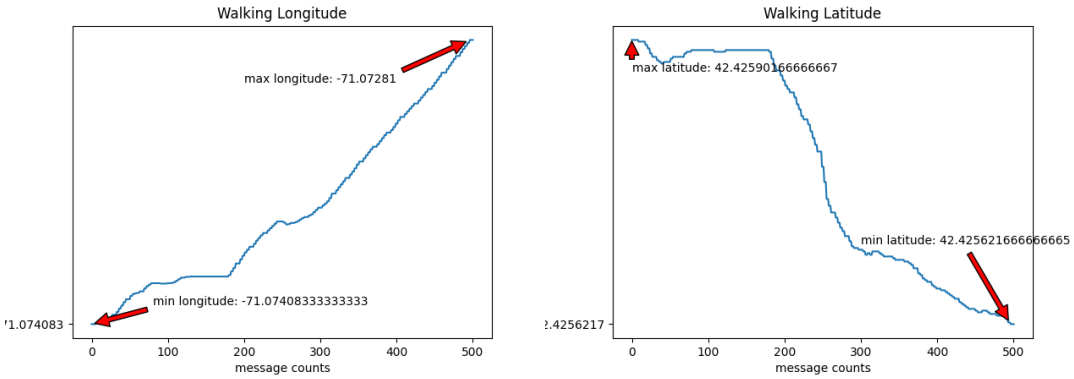




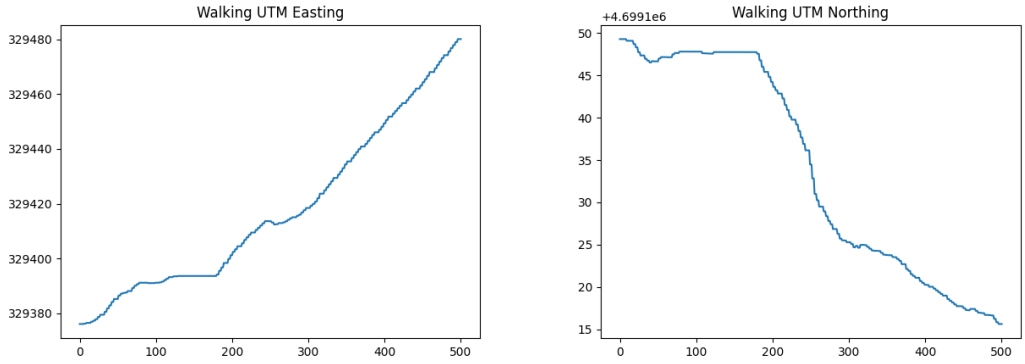
The above two figures are stationary UTM easting and stationery UTM northing. The stationary UTM easting plot is similar to stationary longitude plot. The stationary UTM northing plot is similar to the stationary latitude plot.



The figure above is the walking altitude. The maximum walking altitude is 21.7 meters, and the minimum walking altitude is 12.6 meters.



The figure above shows the walking longitude and walking latitude. The minimum walking longitude is -71.0740833, the maximum walking longitude is -71.07281. The minimum walking latitude is 42.42590166, the minimum walking latitude is 42.42562166. From the walking data plot, it is not hard to see a trend that walking longitude is increasing along the time, and the walking latitude is decreasing along the time.



Here are two figures for walking UTM easting and walking UTM northing. The walking UTM easting plot is similar to walking longitude plot, the walking UTM northing plot is similar to walking latitude plot.

Errors/Uncertainties Analysis and Improvements

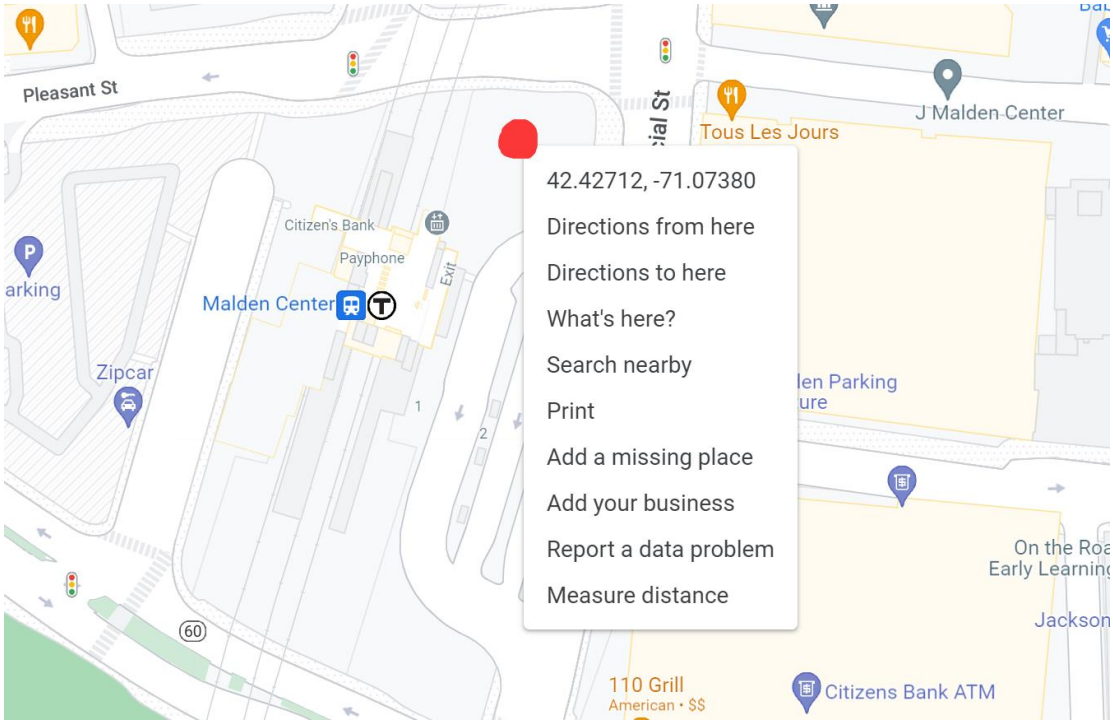
For the stationary data, since the position of GPS sensor is fixed. Therefore, the plot from stationary data should be a straight line with some noises. In other words, if a position is fixed on the map, the longitude value and latitude value measured should

closed to that fixed coordinate. In our lab data, there are many data recorded as outliers. Because of the GPS is held by an examiner. Therefore, the data recorded by the GPS sensor should have more noise than place a GPS sensor on a table or some flat, steady locations. Therefore, human interaction for causing this error is significant. A way to improve in the future experiment is while recording the data outside, place the GPS sensor on a bench in the park and keep it steady. By doing that, the human causation of error will reduce significantly.

For walking data errors. The walking altitude error may be caused by human moving and shaking. A potential improvement is driving a vehicle while recording the data. By driving a vehicle slowly, the vehicle has the suspension which can reduce the shaking and some unwanted vibration.

Conclusion

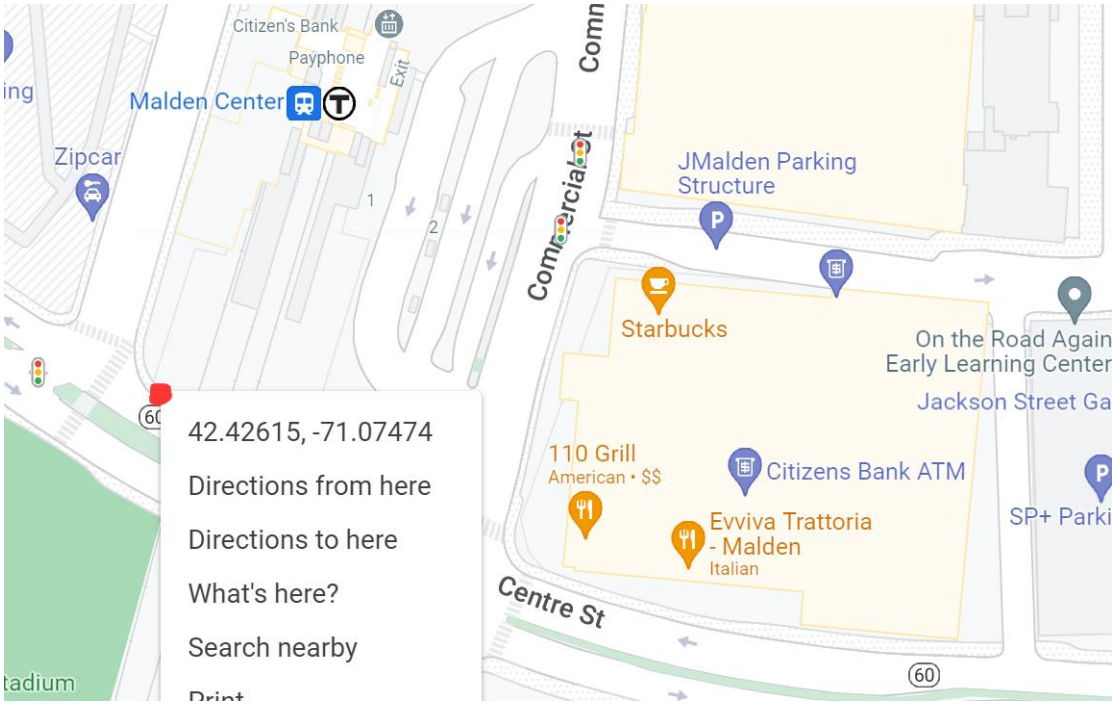
This lab is a good practice of ROS using and data gathering, processing and visualizing. An interesting thing is, after this lab, by right clicking on the Google map the position where we collected stationary data. The result is showed below.



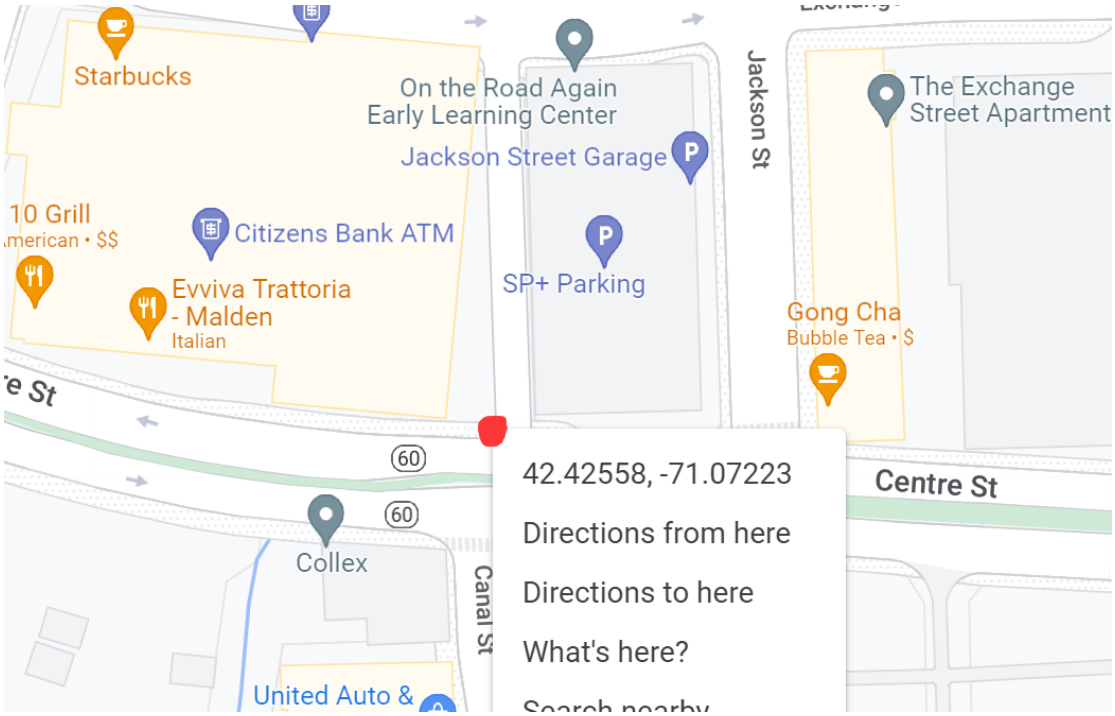
The coordinates on the Google map that is very close to our stationary latitude and longitude.

Also watch the walking data.

The starting point of walking data.



The end point of walking data.



It is all very close to our lab data. One thing needs to be improved in the future is, to see the data change for walking, we need to increase the sample size. The examiner should walk not only for few hundred meters but walk like 1 to 2 miles if possible. That way, the longitude and latitude will change a lot.