EECE 5554 Robotics Sensing and Navigation
Lab-1 Report

Introduction:

This lab mostly focused on writing the driver for the GPS puck using ROS and analysing the obtained data .The NMEA data obtained is parsed and converted into decimal form which is then changed to UTM form to obtain the letter and the zone. The first part of the lab was to write a driver and then collect the raw data and segregate the data having GPGGA format publish it on to the " /gps " rostopic. Once the driver is written, a launch file was also created for the gps driver.The second part of the lab is analysing the obtained data by plotting it and understanding the errors .

Collection of data :

Once the launch file is created ,gps device is connected and the data is collected using a rosbag which is then converted intp csv format .

There are three types of data collection :

1.Stationary data in open area : Data is collected in the centennial common by placing the puck on the lawn chairs .It was later verified by checking the coordinates on Google Earth

2.Stationary data in occluded area : data is collected near the Ryder hall benches.

3.Moving data : Data is collected while walking from Ryder hall parking lot to West Village A by following an almost straight line .

Data Analysis:

After collection of data in rosbag files , they are later plotted using pyplot . Scatter plots with northing vs easting data , altitude vs time data are plotted for the three different types of data collection . After subtraction from a known value the distribution is plotted using Histogram .

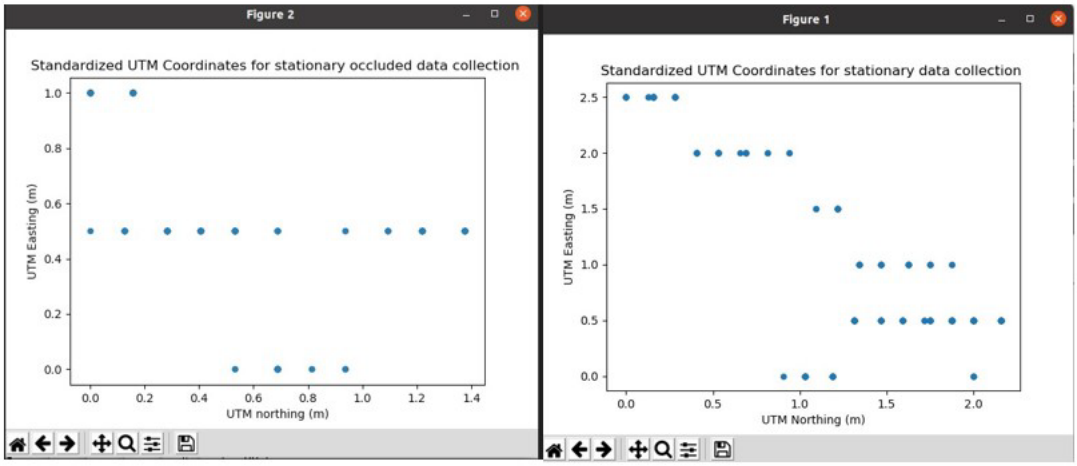

Fig 1 : UTM Northing vs Easting data for Stationary and Occluded data collection

The UTM northing defines the distance from the equator and the UTM easting defines the distance from the prime meridian. As observable from the plot, instead of showing a single point, the data seems to be scattered which could be due to loss of gps signals as there are trees ,buildings and other obstructions.

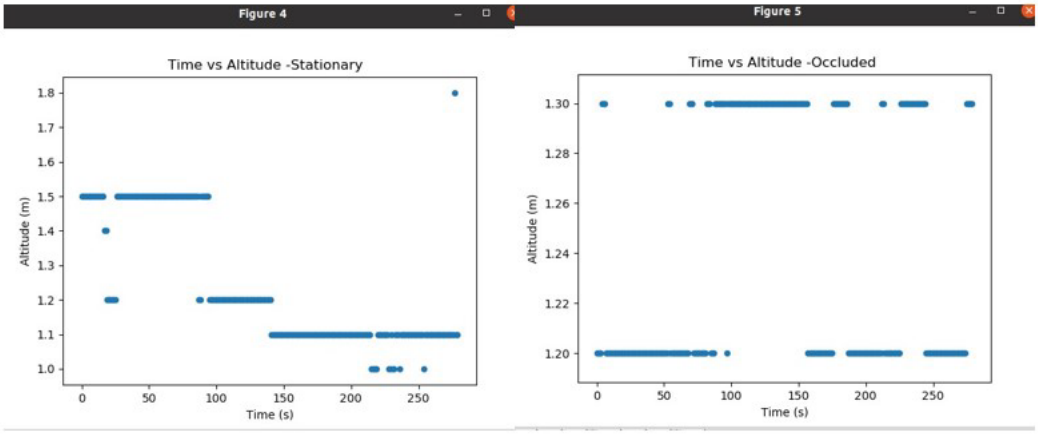

Fig 2 : Altitude vs Time for Stationary and Stationary Occluded

Even though there shouldn't be any changes in the height of the gps puck ,we are able to see some changes. In Occluded plot the data is more scattered .This could be due to reflection of gps signals from the buildings .

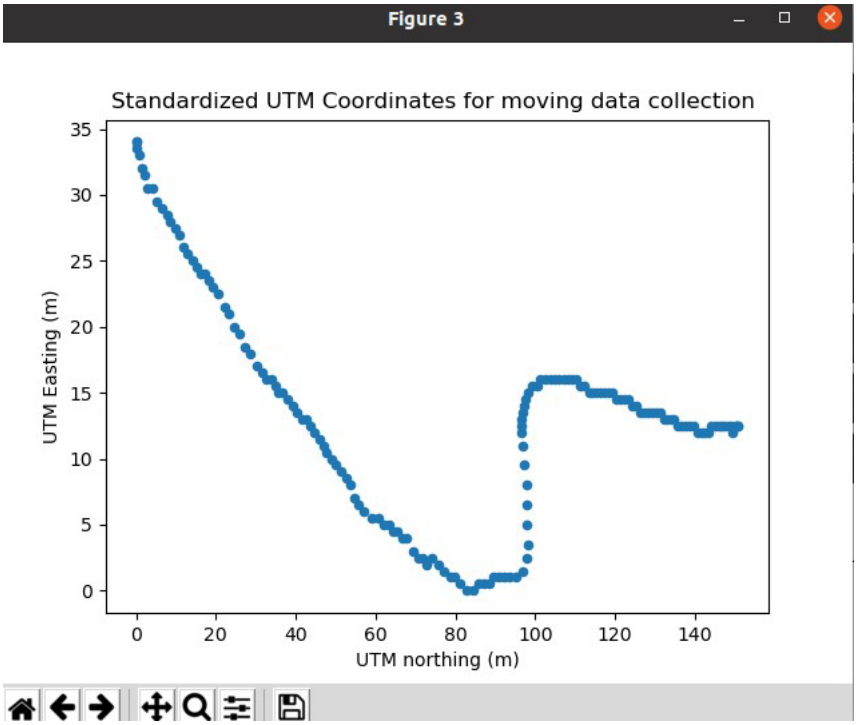

Fig 3 : UTM Northing vs Easting data for Moving data collection

The plot with solid points depicts the data collected in open areas shows an important observation that the UTM data seems to be more scattered in case of stationary data but not while walking. There is a minimal deviation from the path taken .

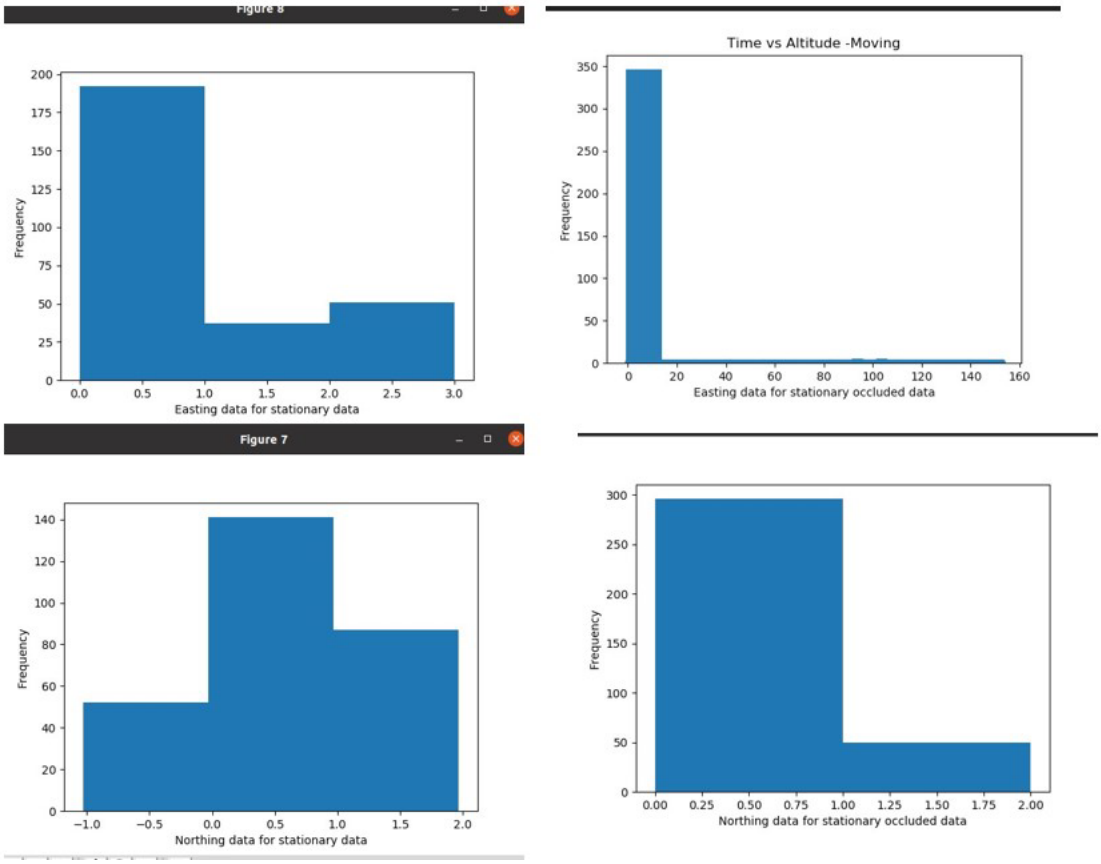

Fig 4 : Histogram for UTM Northing and Easting for Stationary and Stationary Occluded

For stationary data, the distribution is calculated by subtracting the known value (last value of the csv file is selected as the gps puck would give accurate values as time passes) from the given values and the difference is plotted against the frequency .

Fig 5 : UTM Easting and Northing histogram for moving data

For moving data ,the errors are calculated using Residual sum of squares method :

RSS = Σ(observed_value – known_value)^2

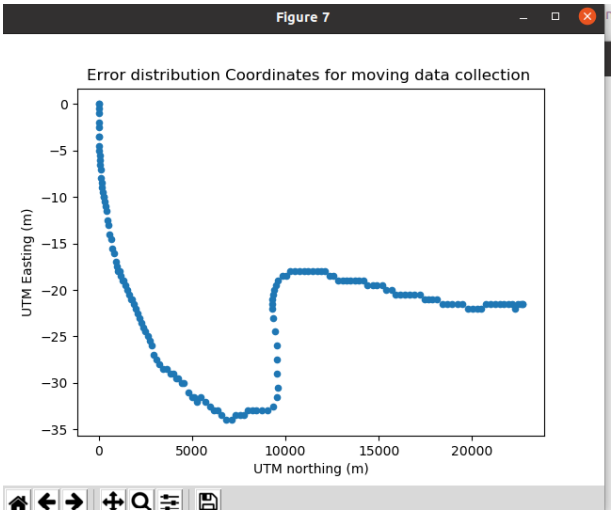

Fig 5 : Error distribution for moving data

RSS of UTM Northing data is taken and then plotted against Easting value. The residual is the difference between the observed value and the predicted value(known value) for each data point.This gives the best fit of the line.

Conclusion :

It can be concluded that impact of noise and disturbances is more in case of stationary data collection when compared to moving data collection .This is expected as gps combines the data of the receiver's previous points and velocities with the incoming data