LAB 2 : ROBOT SENSING AND NAVIGATION

Note: As our team was unable to collect the values due to power issues in the ports of our laptop we took the TA's advice to take the rosbag files from group 1 .We tested our drivers using the serial emulator by adding GNGGA values . For the moving open area data collection, Group 1 followed an elliptical and for occluded area moving data, the straight line at the bottom is acceptable as a part to be analyzed .The rest of the plot can be ignored as told by the Prof.

Introduction:

LAB 2 of RSN uses Real time Kinematics GPS receiver from EMLID .It uses differential GPS correction based on carrier phase measurement to apply corrections.The accuracy of this method of data collection is 1-3 cm compared to 1m in LAB 1 . For the setup we use EMLID flow app in our phones (base) to get NTRIP correction values and connect it to the rover (EMLID receiver) via WiFi .The rover is connected to the laptop via USB .

Data was collected in two locations : Centennial common for open area and Berakhis for occluded area . At each location , 10 minutes of data was collected with the rover in stationary position and another set of data with rover moving in a fixed path and returning to the same point.Similar to LAB1 , driver code for gps is used and the data collected is stored in rosbag files .For this lab ,I have used the deviation by taking my last observation as the known position.To differentiate between the fix and float data points ,I have assigned green for fix and red for float by accessing the fix quality value.

Data Analysis for Stationary Open area :

One important takeaway from the Northing vs Easting plots is that the range of values for Northing and Easting is in centimetres unlike LAB1 where the values were in metres .RMSE for northing for stationary GPS data: 0.32847 m.RMSE for easting for stationary GPS data: 0.56896 m.The values are comparatively very less when compared to LAB 1 .As seen from the Altitude vs Time plot ,the gps after collecting data for a while turns into fix mode and gives us the correct results

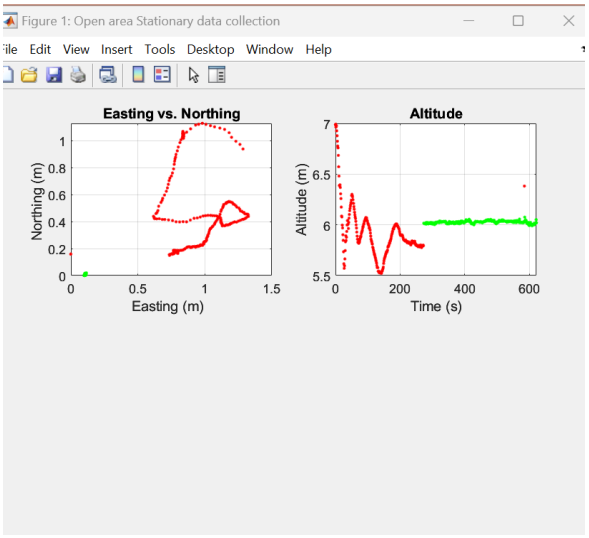

Figure 1 : Data analysis for Stationary open area

Data Analysis for Stationary Occluded area :

The stationary data for occluded area was collected near Berakhis building .The RMSE values are higher when compared to open area data and even after the error corrections it can be seen that the precision is in metres instead of centimeters unlike the stationary open area data .

RMSE for northing for occluded stationary GPS data: 0.82468 m
RMSE for easting for occluded stationary GPS data: 0.68806 m

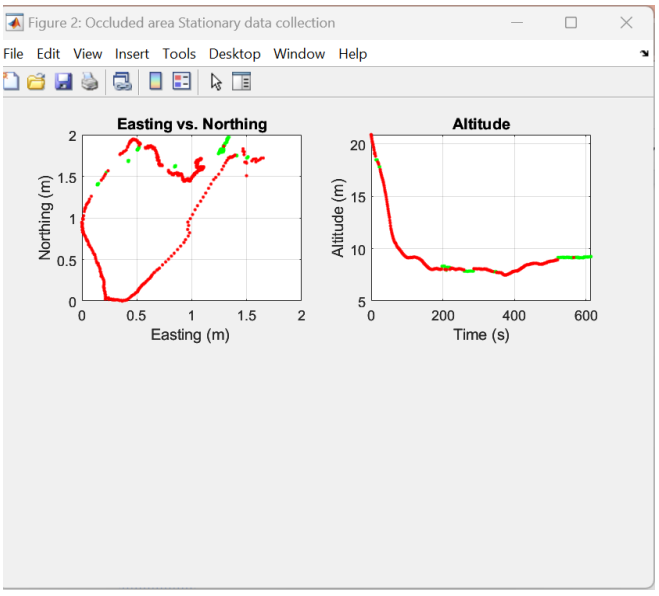

Figure 2: Data analysis for Stationary occluded area

Data Analysis for Moving Occluded area :

For the Northing vs Easting plot , the data collected was not exactly in a rectangular path . To perform linear regression ,after talking to the Prof , we considered the straight line path and ignored the rest of the path .Later RMSE value is calculated using polyval.To calculate the

root mean square error (RMSE) from the best fit plot, residuals are computed between the observed data and the fitted line. The RMSE is then the square root of the mean of the squared residuals. It can be seen that the precision for range of values is in metres and the altitude values are also scattered.The best fit line is plotted using linear regression
RMSE for Occluded moving data: 1.1789 m

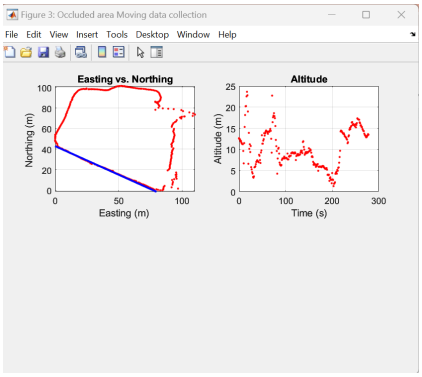

Figure 3 : Data analysis for Moving occluded area

Data Analysis for Moving Open area :

For the Northing vs Easting plot , the data was collected in an elliptical path .For the best fit plot , we used fit_ellipse function from Matlab . It is worth noting that the range is in metres instead of centimeters . The data seemed more precise and accurate in the stationary open area data collection compared to moving open area .Root mean square error for Open area moving data: 1.7906 m .

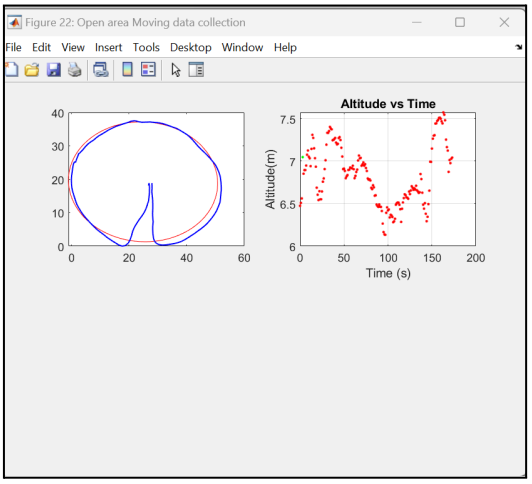

Figure 4 : Data analysis for Moving open area

Conclusion :

To conclude ,using RTK GPS helped us attain more precise and accurate data when compared to normal GPS data .RTK GPS helped reduce the noise from ionosphere interference,multipath effects and other sources of signal disturbances