Lab_1 Report

EECE 5554 Robotics Sensing and Navigation – Professor Singh

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1. Short description on driver and gps_msg

In Lab_1, I receive a GPS puck for measuring the GPS data. The puck is publishing the raw data in many formats, we choose to convert the GPGGA format to the common format(degree, minute, second) and utm format by writing a driver in ros, publishing the ros message to the topic called /gps. The message then is recorded by rosbag and analyzed in Matlab. The driver node and the rosbag is in the folder, this report is mainly focused on the data analysis.

2. The data testing

The data is collected in two ways, collecting in one spot for 10 minutes and for 10-minutes straight walk. In each data analysis, I will show three plots: the altitude change with time, the trajectory change shown by latitude, longitude and the utm_northing and utm_easting.

a. Stationary data

As shown in the plot below, the altitude changes significantly at first and after 200 seconds, it will be more stable than before. The same trend appears in the location change in both latitude, longitude and the utm plot: the location will first move up and then goes down(not goes down in the real world, I mean the line in the chart) and become stable. It appears to me that when measuring in

one pot, the gps will be unstable for the first few seconds, but it will be more precise finally.

Error estimate: the probable reason for the unstable period at first my be that

i) The gps only receive limited satellite signals(maybe one or two). After few minutes it will receive all 4 satellite signal and the location goes stable.

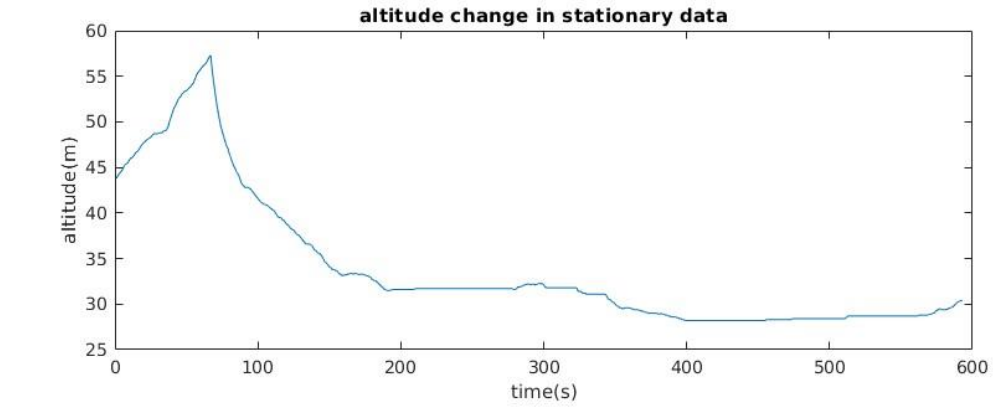
ii) The gps is not used recently, so it will take more time to get the location correctly(it was first used in campus by my teammate but I take it to home), like warming up.

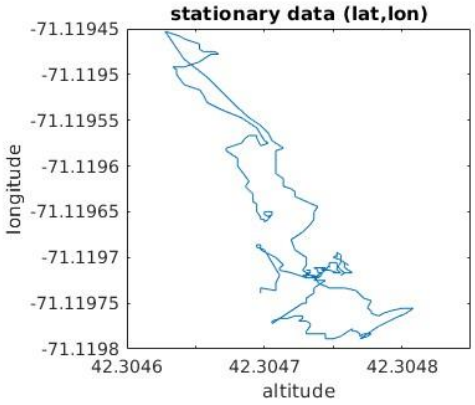
iii) In my driver code, the accuracy of the latitude and longitude is 0.001. so in the chart, the data in the chart has error and it may not change so significantly actually.

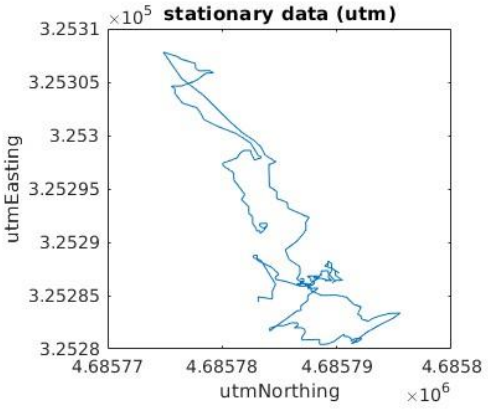
iv) My home is close to subway station so it will shake a little bit when there is a subway goes by, which may cause error.

The good error estimate is that it will consider both the error in hardware and software, the environment and the users.

We can put bounds to some of the errors: like adding some algorithms to reduce the error caused by measurement, like input the data when the raw data is stable, and apply the filter to make the data seems smooth.







b. Walking data

The walking data seems more accurate comparing to the stationary data. The altitude goes down because when I walk on the street, it was downhill at first and then it was a flat road. (The Whashington st.) The walking trajectory shows almost a straight line, which is perfect.

Error estimate:

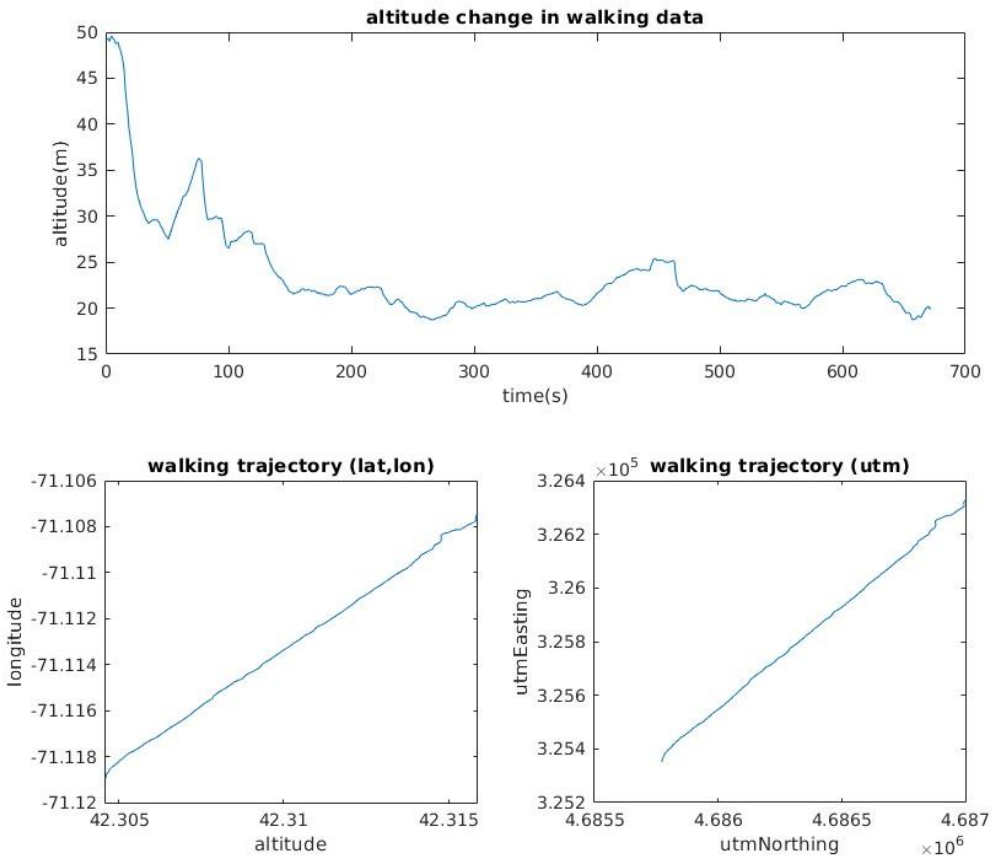
When walking, the environment will change and bring more error comparing to the stationary data. But the walk is a little bit long I move faster than the error scale in the stationary data, so the error seems not so significant comparing to the stationary data.

But the are some new distributions of noise:

i) The environment change (e.g. the tall buildings will reflect the gps signal)

ii) The loss and regain of the gps signal, which will cause blank in the plot

iii) The faster rate of collecting the data when moving will accumulate error faster.



3. Conclusion

The lab_1 gives me an overview on how gps works in a robot. The gps messages are very important in building the robot,

especially the mobile robots. I also learned how to write a driver node in ros, and it is a good practice to costom my own ros message for recording and analyze.