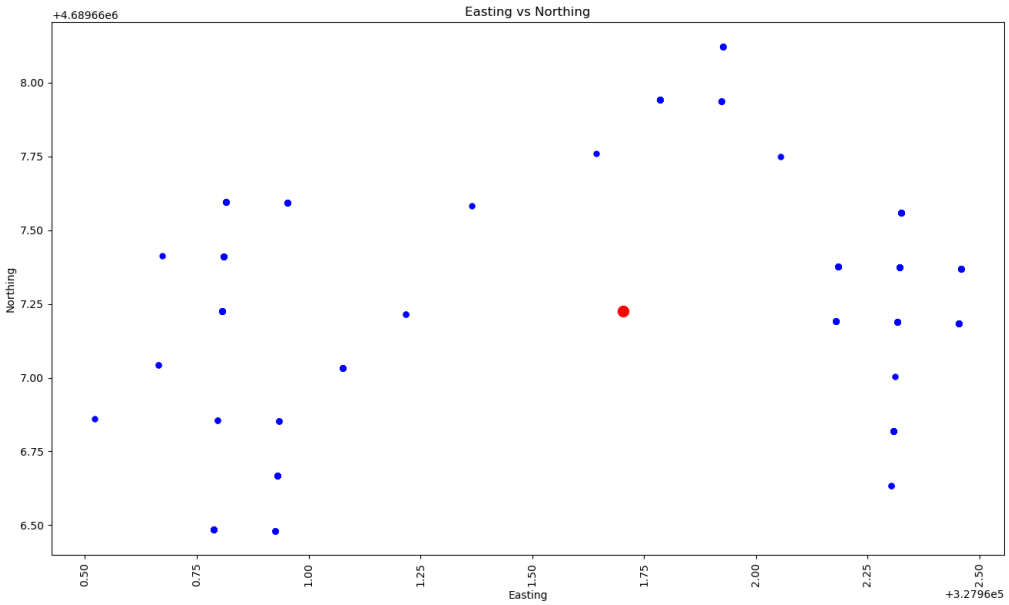
Analysis of stationary data

The data size plotted is for 700 values, the blue markers represent the collected values over time and the red marker is the mean of those values. The standard deviation for the values is 0.04176 which defines the range of error of the easting northing values. This reading tells us that our mean position is accurate to about 5 centimeters. This range of accuracy varies based on the amount of data we analyze.

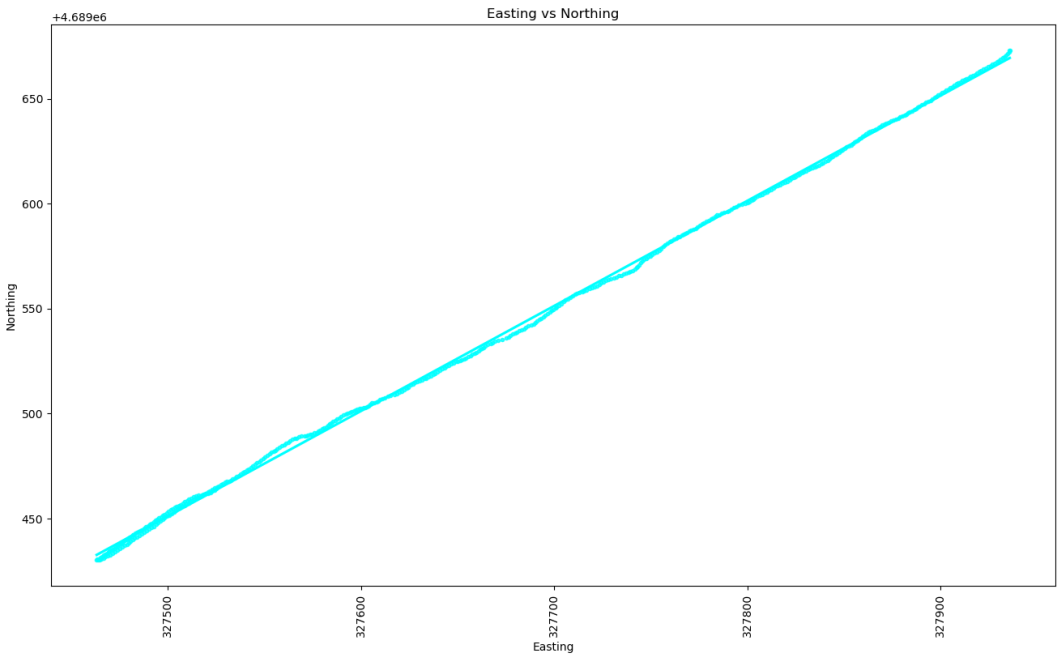


The maximum range can be up to 3 meters as it is the range of the values that we collected is about 2.5 meters. So considering these values and other atmospheric conditions, we can say that the range can be around 5 cm to 3 meters in ideal conditions, and this estimate is strictly subjected to many factors. We cannot put a definite bounds on these error estimates as the signal is dependent on weather conditions, calculation and rounding errors, ephemeris data errors. multipath effects, objects around the gps receiver, dilution of precision, satellite and receiver clocks etc.

Based on the above analysis, we cannot completely rely on gps for navigation as we need accuracy upto a centimeter in autonomous driving.

Analysis of straight line walk data

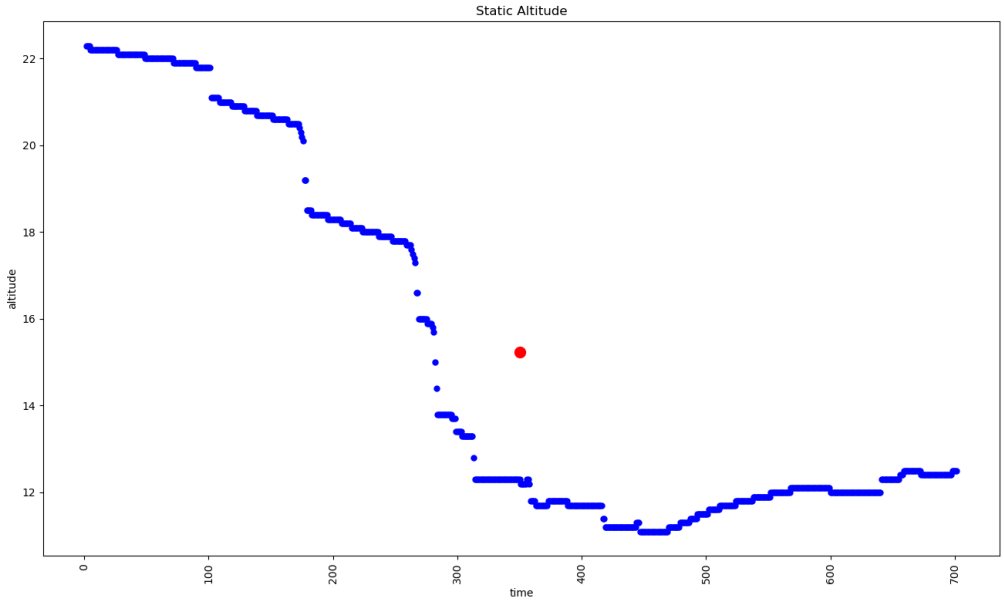
The data set is plotted on 500 values which were recorded while walking in a straight line of about 300 meters. The standard deviation of the first 100 values is around 12m. This is a very large value and imagine using gps only while navigating we will end up in situations shown in the image(source: Google) below.

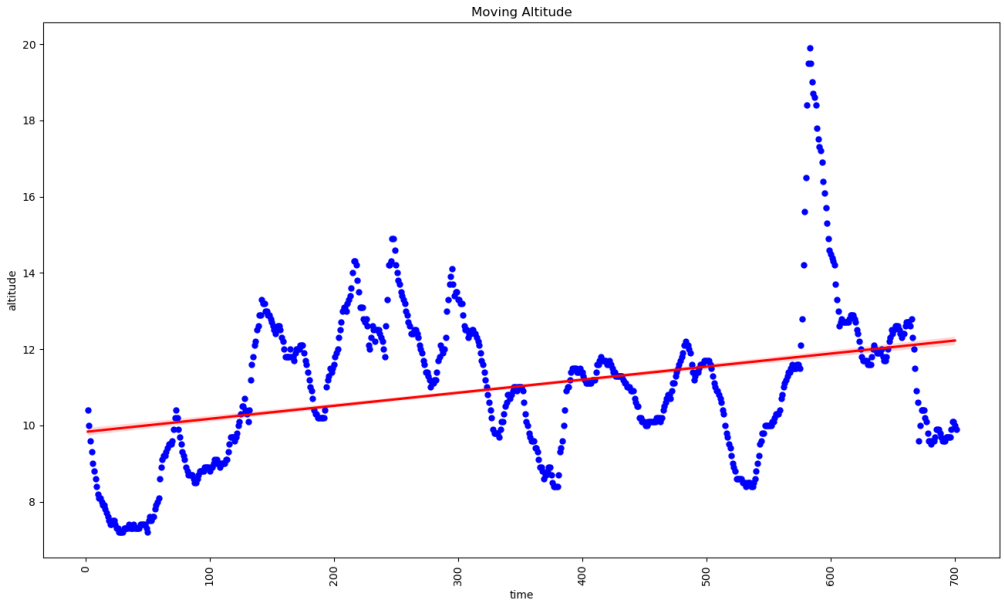


The error estimate changes drastically as opposed to stay in a spot in the order of 4-5 times.

Anlaysis of Static Altitude

The altitude while in static measurement either decreases or increases with respect to time and the average standard deviation is about 0.15 meters, where as in the moving condition the altitude fluctuates like a messed up sine wave. Generally, It is estimated that the altitude error is about 1.5 times the horizontal error. The estimate of the altitude error while moving is around 20-25m . The GPS measures the altitude from the center of the satellite vehicle orbits. Since the earth is not a perfect sphere, the values vary and while gps tries to correct these values. That is why the value fluctuates while moving.


Static Altitude
altitude
time
22
20
18
16
14
12
0
100
200
300
400
500
600
700


Moving Altitude
altitude
time
20
18
16
14
12
10
8
0
100
200
300
400
500
600
700