EECE5554 Lab2 Report

1. Collection data from completely clear

A． Analysis of stationary data

a. Data collection

This lab data collection was mainly collected at the MacDonald Stadium near the Malden Center subway station (Figure 1). Considering this area is open and wide, no building block is very beneficial to GPS signal data collection. When we collected the stationary data, we firstly put the RTK Base and Rover on the audience platform at same time. In addition, considering that the twisting of the USB cable will cause errors, I have been trying to straighten the data cable to avoid twisting. While in open area, the GNSS fix quality maintain as 5, which indicates RTK float ambiguities

Figure 1 Stationary GPS Data Positon

b. Data Analysis

The following figures were generated from the stationary dataset. Figure 2 represents the altitude of the GPS sensor. We can observe the fluctuations int the data, but after a period, the altitude, UTM easting and UTM northing data does not change and remain at the same altitude (11.3 m), UTM northing (4699141.791516657),

UTM easting (329206.3094940667), which convert from 42°25'32.9"N 71°04'34.1"W, and which signed on Figure 1. Based on this situation, we can intuitively feel the error caused by the eddy current generated by the coil to the GPS detector. And after removing this kind of error, we can collect very stable and accurate GPS data from the RTK Base and Rover detector. As shown in

Figure 5, the final generated intermediate point is the position determined by GPS.

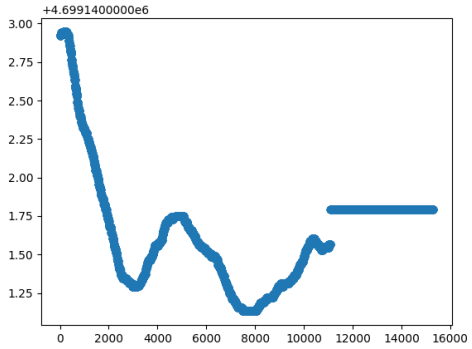

Figure 2 UTM_Northing from GPS

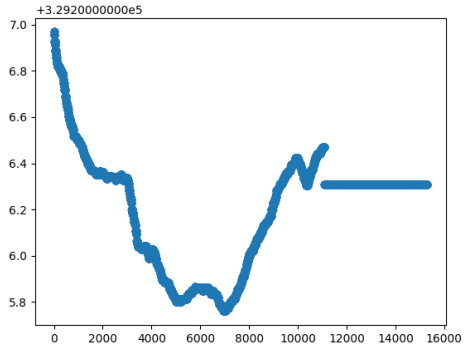

Figure 3 UTM_Easting from GPS

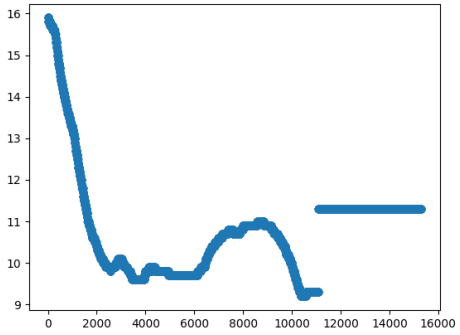

Figure 4 Altitude from GPS

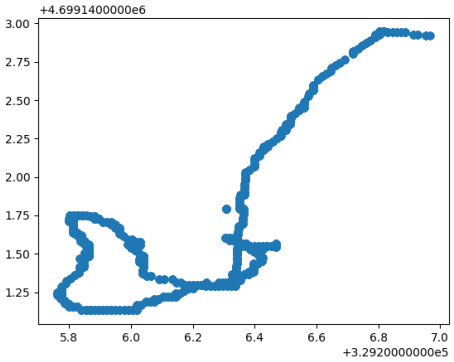

Figure 5 UTM Position from GPS

B. Analysis of walk data

a. Data collection

About walking GPS data in open area, we collected it with RTK rover on the track in the MacDonald Stadium as Figure 6 shown. And we put the RTK base on the audience platform at beginning.

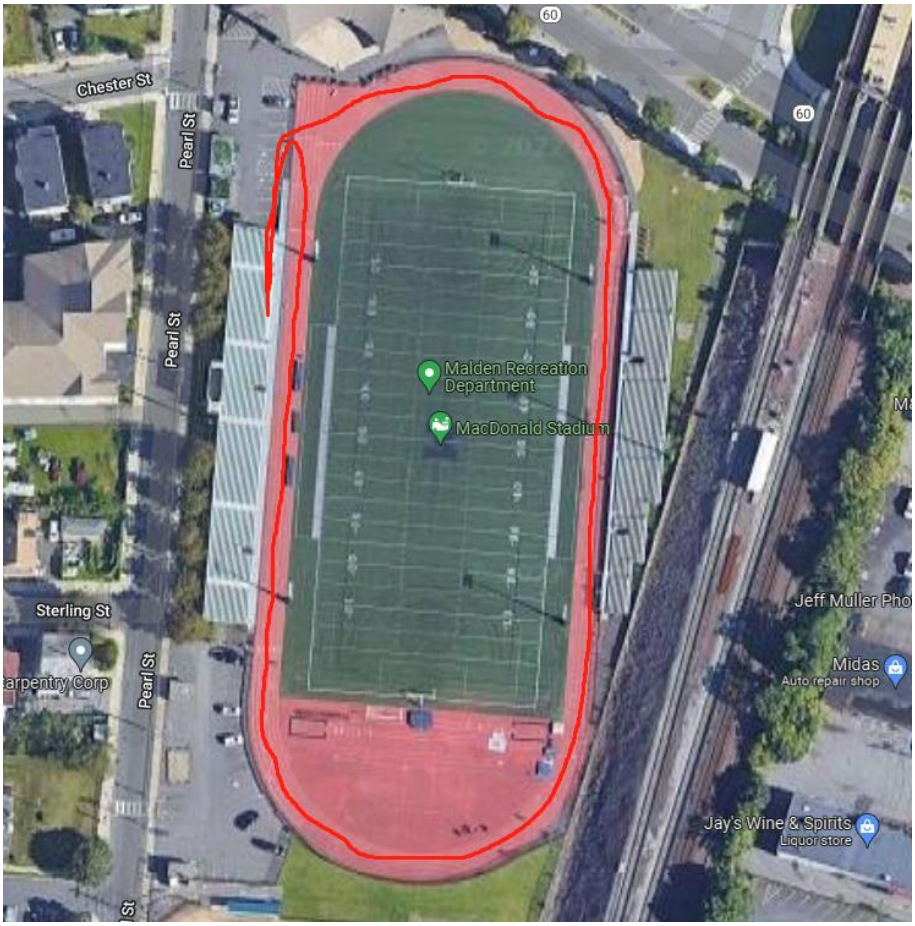

Figure 6 Walking Track in RTK Rover

b. Data analysis

The following figures are representative figures for walking GPS data. Figure 7 recorded the RTK rover altitude data, as in reality, we got off the audience stage and entered the track, and then went back to the audience stage after a circle around the track. The altitude change in Figure 7 just reflects this series of action. Figure 8, which shows the RTK base position, as we expected, it has been in a fixed position without moving. As for Figure 9, 10 are RTK rover position track draw by 2D/3D scatter plot. In the 2d view, we can see that it is basically the same as our trajectory. In the 3D view, although there is a certain altitude offset, this may be caused by passers-by nearby and the vibration generated by the coil when going up and down the steps.

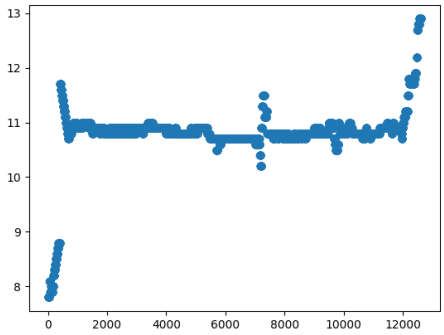

Figure 7 Walking Rover Altitude

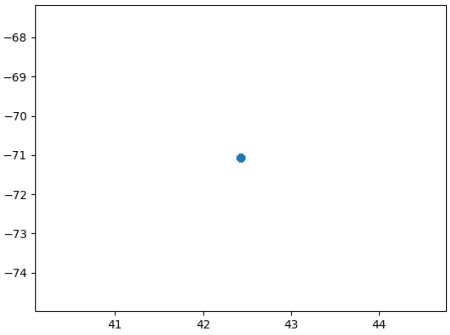

Figure 8 Walking Base Position

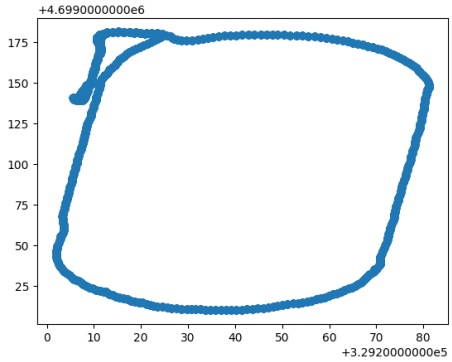

Figure 9 Walking Rover 2D Scatter Plot

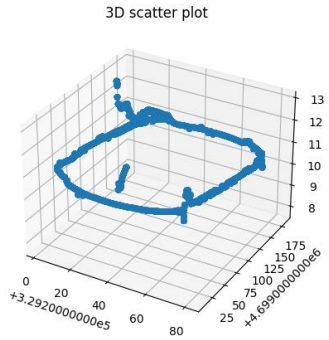

Figure 10 Walking Rover 3D Scatter Plot

2. Collection data from partial occlusion and reflection nearby
   A. Analysis of stationary data
   a. Data Collection

   This stationary data collection we conducted in front of the school's Kariotis Hall. It is surrounded by buildings and trees that meet the conditions for this data collection.

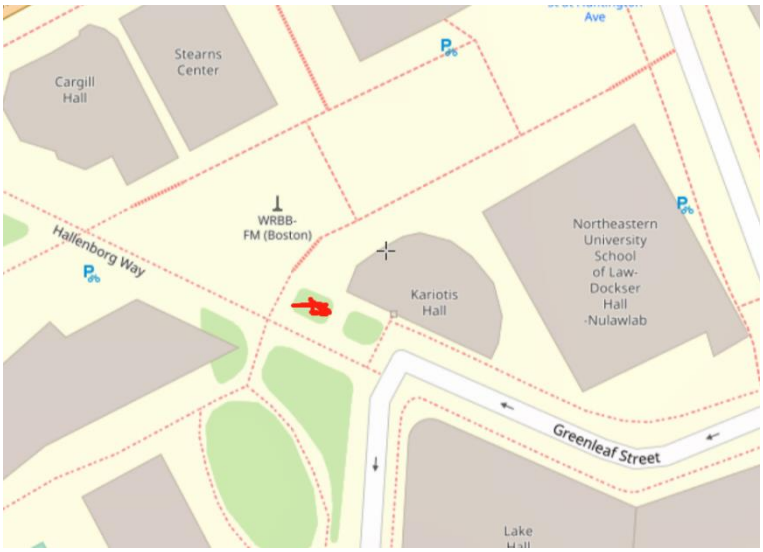

Figure 11 Stationary GPS Data Position

b. Data analysis

The following figures are generated based on the stationary dataset. Compared with the open and clear area, this time the GPS data collected this time fluctuates greatly. During the ten-minute data collection time, we kept the detector as stable as possible, however from the figure below we can see that both utm_easting (Figure 13) and utm_northing（Figure 12）are constantly changing.

Besides the altitude also fluctuates up and down in a certain range, which due to the Fix quality is 1 almost.

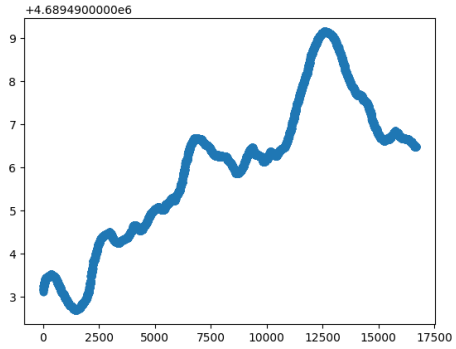

Figure 12 UTM_Northing from GPS

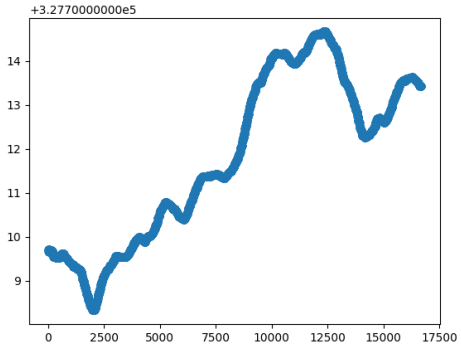

Figure 13 UTM_Easting from GPS

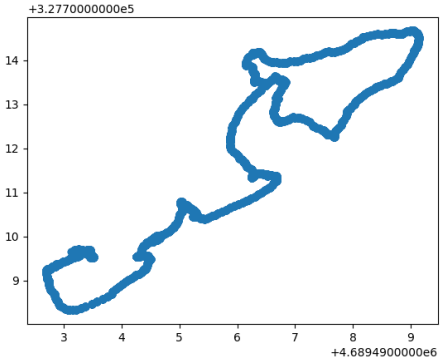

Figure 14 Altitude from GPS

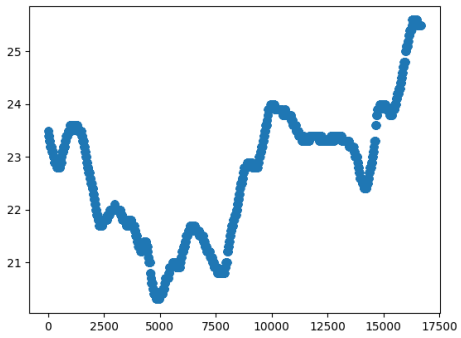

Figure 15 UTM Position from GPS

B. Analysis of walk data

a. Data collection

About this walking data in reflections nearby, we walked around the school's west village building shows on Figure 16. This area is surrounded by trees and buildings, which is satisfied with the reflection conditions of the GPS signal.

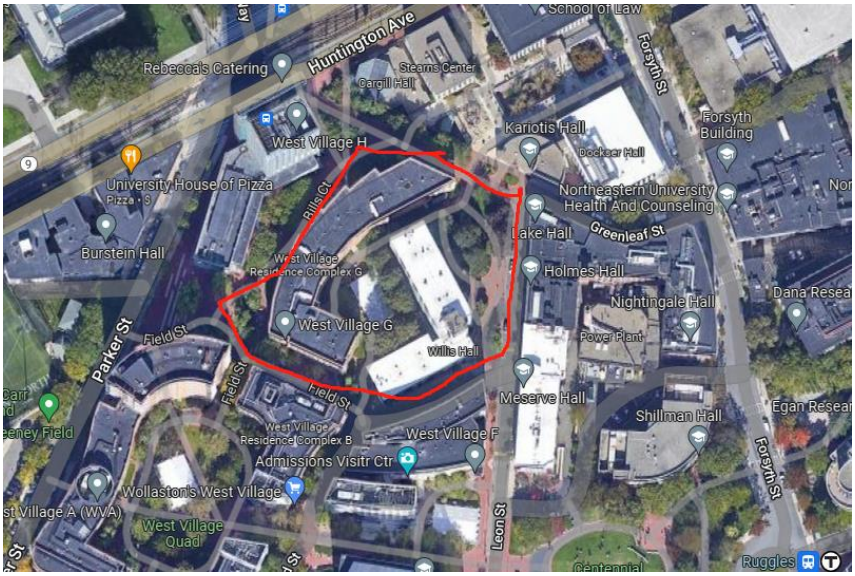

Figure 16 Walking Track in RTK Rover

b. Data analysis

An interesting accident happened during this data walk collection. When walking to the back of the West Village G building, the signal transmission between RTK rover and RTK base was interrupted. Then we found that the altitude data changed drastically. From the normal altitude of about 17 meters, it rose sharply to 40 meters above sea level, and then dropped to about 5 meters. When the Rover and the base were reconnected, the collection of altitude data gradually returned to normal. While utm-easting and utm-northing values converted from longitude and latitude can be recorded better and more accurately.

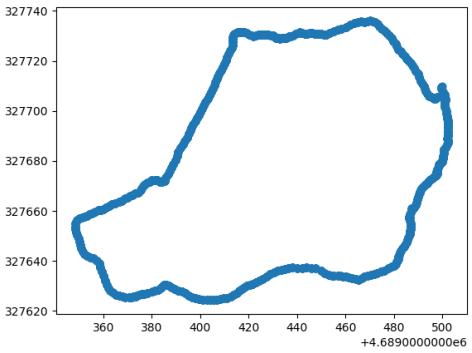

Figure 17 Walking Rover 2D Scatter Plot

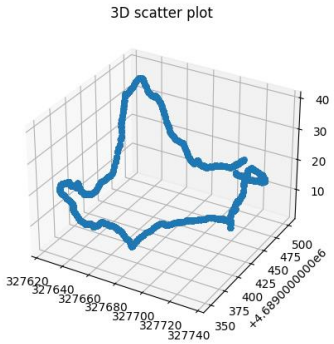

Figure 18 Walking Rover 3D Scatter Plot

3. Conclusion

In this lab, we collected and analyzed the GPS data from RTK Base and Rover. Compared with the GPGGA data we collected in lab1, due to the existence of the RTK Base in this test, the data collected is more accurate in open area. However, in some environments with reflections around buildings or trees, the detector can be greatly affected, especially at altitude data, also if we lost signal transmission between RTK Rover and Base. In addition, stationary GPS data received more reflections impact from environments than walk data.