LAB2 report

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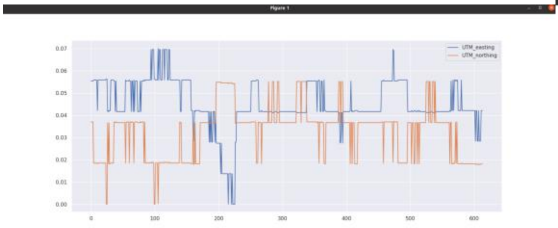
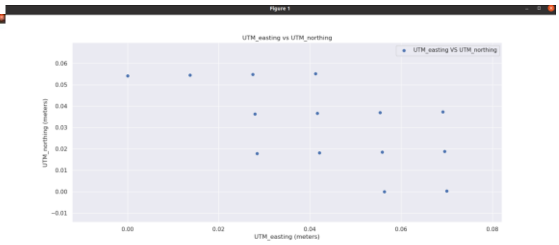
Claim: Our group met some hardware difficulties and had to borrow the data from Group 8 and we acquired consent from them and the TA.

Data and plots:

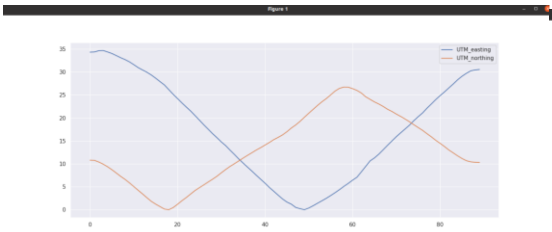
Occluded Space

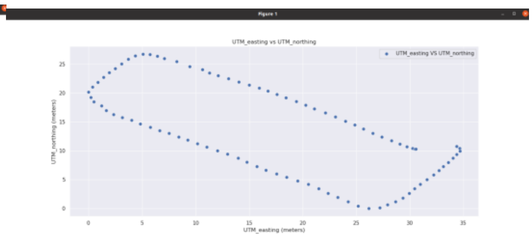
Stationary_Data:





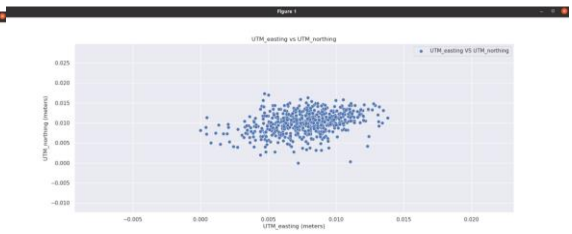
Walking_Data:



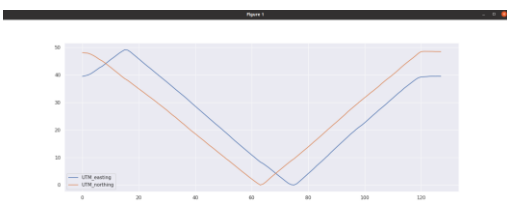


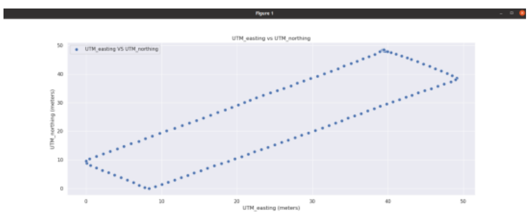
Open Space

Stationary_Data:



Walking_Data:





I'll be using the above plots to strengthen my answers to the following questions.

RTK GNSS intro:

RTK GNSS (Real-Time Kinematic Global Navigation Satellite System) is a technique used to enhance the accuracy of GPS (Global Positioning System) positioning. In traditional GPS, the position is determined by receiving signals from at least four satellites, which are used to calculate the distance between the receiver and each satellite. However, this method can be affected by several sources of error, such as atmospheric conditions, satellite geometry, and signal interference. As a result, the accuracy of traditional GPS can vary from several meters to tens of meters.

RTK GNSS uses a differential technique to achieve centimeter-level accuracy in real time. In RTK GNSS, a fixed base station with a known location receives the same satellite signals as the mobile receiver. The base station calculates the difference between the actual and the measured positions and transmits this information to the mobile receiver in real time. The mobile receiver then applies this correction to its own position calculation, resulting in significantly higher accuracy.

Overall, RTK GNSS is a powerful technology that can significantly improve the accuracy and reliability of GPS positioning in real time. Its applications are diverse, and it has the potential to revolutionize industries that rely on precise positioning data.

Question (a)

The key difference between RTK GNSS and regular GNSS is the level of accuracy that can be achieved. In the data collected, compared to the ones without RTK, it's clear that the RTK GNSS has much more accuracy than the ones without. In RTK GNSS, a fixed base station with a known location receives the same satellite signals as the mobile receiver. The base station calculates the difference between the actual and the measured positions and transmits this information to the mobile receiver in real time. The error would occur the same way as GNSS but with the base station correcting the results. It will give a much more accurate result.

Question (b)

We can look at the graphs for stationary data for noise data as the walking data is not a good representation of noise. It can easily be seen that open space data is random but more concentrated, while the occluded space data is following a certain pattern that forms a certain shape. My understanding of this situation of noise scattering is that in occluded space the noise is fixed by the base station but due to the reflection of the buildings, the fix has a normalized pattern since there are limited angles the signal can reach. There is no such limitation in open space, so the fix is more accurate, which shows on the graph to be random but concentrated dots.

Question (c)

The difference in distribution is most likely due to the difference in data collection procedures. The algorithm is almost the same so that would not cause any difference. The noise distribution can most likely be influenced by the hardware differences in LAB1 and LAB2. With RTK GNSS there is a base station that sends the fix to the rover, while in LAB1 there is only one device. The different device has different calibration and different ways of processing the data and algorithms passed into them.

Question (d)

Looking at the graph we can see that:

1. The data for open space is more linear than the occluded space one, which is more curvilinear and jagged.
2. The data for open space is more accurate than the occluded space as it shows a sharper angle which indicates the turn made during the data collection.
3. The data for open space has less noise than the occluded space one.

All of the above influence has something to do with the quality of the GNSS fix value, it is an important step taken to ensure the accuracy of data collection. With fewer available satellites in occluded space, the fix is not as accurate, resulting in a drop in accuracy when compared to open-space data.

Question (e)

For stationary data, it’s basically the same only that the stationary data has less dependency on the satellite because if the base and rover is not moving so it can have some constant satellite signal (for a while).
In the graphs, the open-space data is more zig-zag shaped which means that it has more chances to fix its value and constantly update its location while this process is clearly slower in occluded space.