EECE5554 Robotic Sensing & Navigation

February 14th, 2025

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Lab 1

Stationary data was recorded in two separate locations, one on an open field, and another in an area obstructed by nearby buildings. These datasets were plotted in MATLAB on the same plot, with the open data adjusted to lie in the same region as the occluded data, to better visualize the differences in variation between two datasets. The plotted data is shown in the figure below.

**A graph with blue and red dots

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**Figure 1: Easting vs Northing plot stationary datasets**

The occluded data can be seen “walking” around the origin, despite the GPS puck laying stationary during the data recording. This is indicative of nearby buildings creating noise between the puck and satellite communications.

To quantify the positional error of each dataset, the positional data is compared to the known location and visualized on a histogram based on the distance deviation. This data is displayed in the two figures below, one for the open dataset, and another for the occluded dataset.

**A graph of a graph

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Figure 2: Positional error histogram for open dataset**

**A graph of blue rectangular bars

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Figure 3: Positional error histogram for occluded dataset**

The positional measurement in the open dataset typically deviates no more than one meter from the known measurement location. While the occluded dataset error histogram may appear to have a similar spread, the error scale reaches instances of 4 meter positional error, due to signal noise.

Altitudes for each dataset were also plotted on the same graph over time, shown in the figure below.

A graph of an altitude

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**Figure 4: Altitude over time for both occluded and open data**

The altitude of the open dataset deviates no more than ±1m, which is a reasonable amount of variation. However, the altitude from the occluded data exhibits a seemingly exponential downward trend. While satellite interference from the nearby buildings is certainly present, the nearly 10 meter difference in data is still strange.

During the process of recording the moving dataset, the data is collected while attempting to walk as straight as possible. There was a hitch in the positional data, visible in the graph due to an obstruction on the path, but the path was fairly straight otherwise. This data is plotted in the figure below.

A graph with blue lines

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**Figure 5: Easting vs northing data, moving data**

To estimate this path as a straight line, this dataset is plotted alongside a linear fit line. The resulting R2 value comes to 0.942, which indicates a fairly reasonable linear fit to the motion data, especially considering the physical obstacles and that real world walking would not be a perfectly linear path. This linear line of best fit over the moving data is shown in the figure below.

A graph with blue lines and red lines

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**Figure 6: Line of best fit over moving positional data**

Just as strange as the occluded stationary altitude data over time, the moving altitude over time data exhibits a 40 meter variation in vertical position. While a variation in vertical position would be more expected while on the move, the data was recorded over a flat region, which had no more than a meter of incline. Contrary to the stationary dataset, this altitude over time exhibits an upward trend, but could also be fit to an increasing exponential regression. This altitude over time is shown in the figure below.

A graph with blue lines

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**Figure 7: Altitude over time for moving dataset**