MPC-MAP Assignment No. 1 - Report

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Task 2

In this task, I used the MATLAB function std() to determine the standard deviation (sigma). The stored values are then printed onto the console and saved to a .csv file. Then I plotted histograms for each channel to a figure. The standard deviation is not entirely consistent across LIDAR channels and GNSS X and Y axis.

LIDAR								GNSS	
Ch1	Ch2	Ch3	Ch4	Ch5	Ch6	Ch7	Ch8	X	Y
0.047643	0.047084	0.052441	0.047132	0.054669	0.048171	0.050804	0.04886	0.493923	0.547294

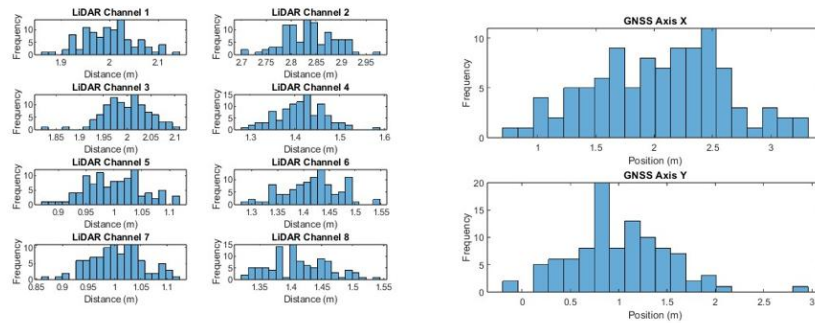*Table 1 - Standard deviation of LIDAR and GNSS sensors*

Figure 1 - LIDAR and GNSS stds histogram

Task 3

The values in the LiDAR covariance matrix are very small, close to zero, indicating that the LiDAR sensor provides measurements with low noise and high precision. In contrast, the GNSS covariance matrix contains larger values, suggesting that GNSS measurements have more noise and are less precise.

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LiDAR Covariance matrix (8x8):
    0.0019    0.0002   -0.0003    0.0000   -0.0004   -0.0001   -0.0001   -0.0001
    0.0002    0.0030   -0.0004    0.0001    0.0001    0.0007    0.0001   -0.0005
   -0.0003   -0.0004    0.0020    0.0002   -0.0001    0.0001    0.0001    0.0000
    0.0000    0.0001    0.0002    0.0025   -0.0006   -0.0000   -0.0000   -0.0001
   -0.0004    0.0001   -0.0001   -0.0006    0.0021    0.0000   -0.0001    0.0001
   -0.0001    0.0007    0.0001   -0.0000    0.0000    0.0026    0.0003   -0.0002
   -0.0001    0.0001    0.0001   -0.0000   -0.0001    0.0003    0.0022    0.0003
   -0.0001   -0.0005    0.0000   -0.0001    0.0001   -0.0002    0.0003    0.0022

GNSS Covariance matrix (2x2):
    0.2633    0.0175
    0.0175    0.3069
```

Figure 2 - Covariance matrices for LIDAR and GNSS

Task 4

In the figure its visible that LIDAR has less noise and is more precise than GNSS which has more noise, but it could be improved if we use it with Kalman filter.
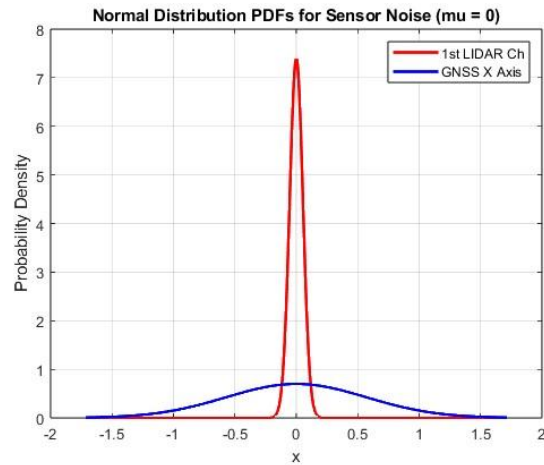
Figure 3 - No distribution PDFs for Sensor Noise (mu = 0)

Task 5

In the last task, I used a finite state machine to reach the goal. Of course, I didn't succeed on the first try because it depended on factors like which wheel took the first step, etc. However, after a few attempts, I managed to achieve it.
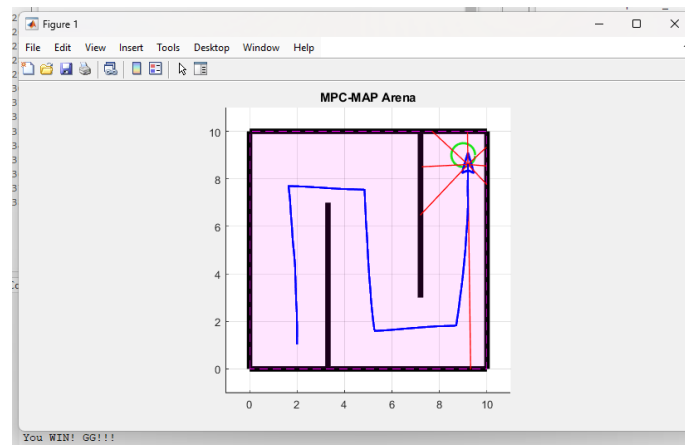

Figure 4 - Finite State Machine