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Localization Lab

MEASUREMENT NOISE VARIANCE

First, we put all noises and the Mahalanobis threshold to zero in the file "DefineVariances.m" and we changed the frequency value to 20 Hz in the file "RobotAndSensorDefinition.m"

We chose to run the program "MagnetLoc.m" using a straight trajectory, for example "diagonal45degrees.txt", after setting the correct initial position to [0 0 pi/4]. We have plotted the results using "PlotResults.m".

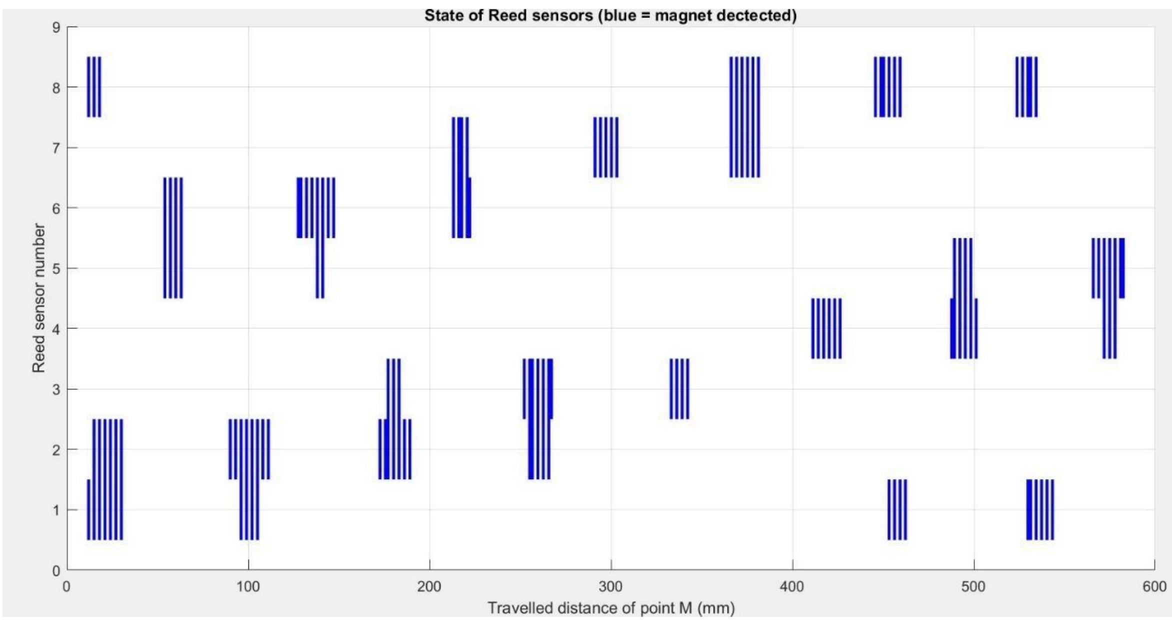

Figure 1

In order to evaluate the measurement noise variance, we used Figure 8. We observe that the travel distance may change. This behavior is correct because it shows that the reed sensors may cross the magnet along the diameter (in this case the travel distance is larger) or on its side (in this case the travel distance is smaller)

In order to evaluate the variance, we can follow two strategies:

1. We could consider all measurements and calculate the real variance
2. We could use a "worst case analysis", which means we can take the measurement having the largest travel distance

We decided to follow the second strategy.

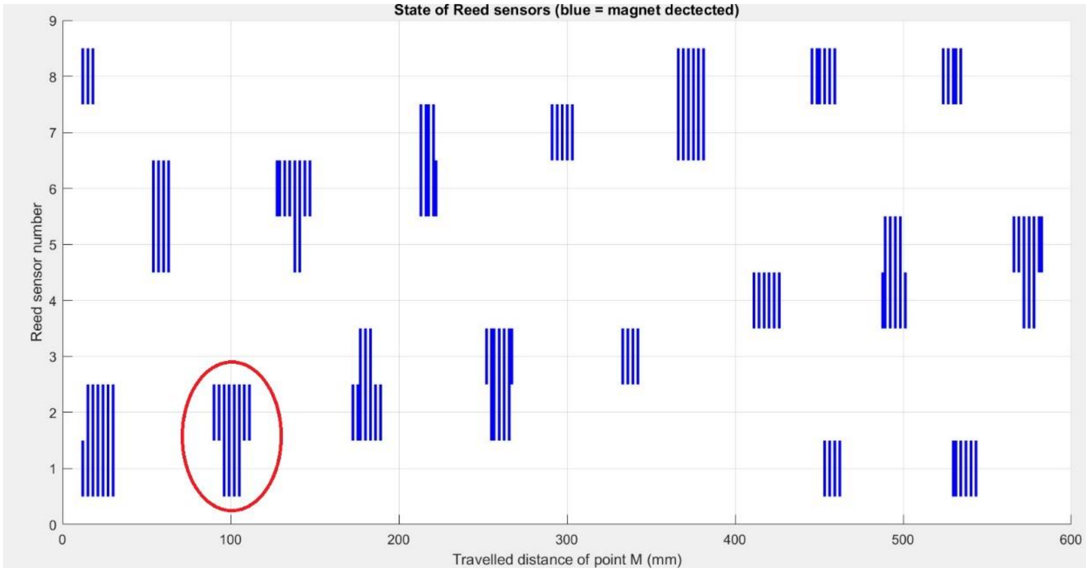

Figure 2

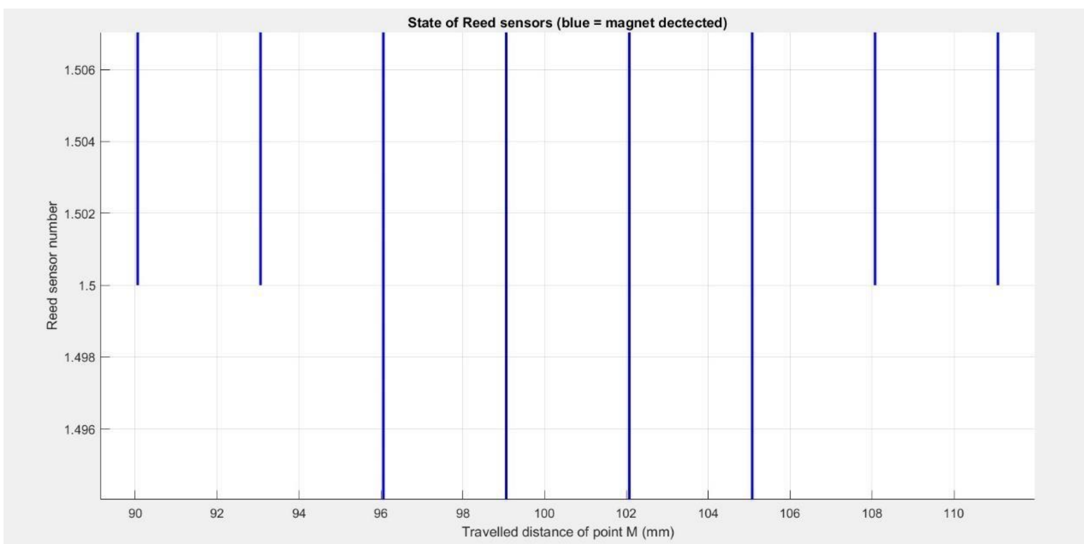

Figure 3

To evaluate our Y variance, we need to look at the robot geometry. Each sensor detect a magnet in the range [-5 , +5] mm, since our reed sensor are located each at a distance of 10mm. The measurement has a uniform distribution and its variance is given by (b-a)^2/12. The result is then given by 10^2/12.

To evaluate our X variance, we suppose the correct measurement to be in the middle of the plot in Figure 3, when the sensor is right above the magnet. We observed that the measurement has a uniform distribution and its variance is given by (b-a)^2/12, where (b-a) is the interval in which the sensor detects the same magnet.

If we take the measurement in Figure 3, we obtain a variance of about 40.33