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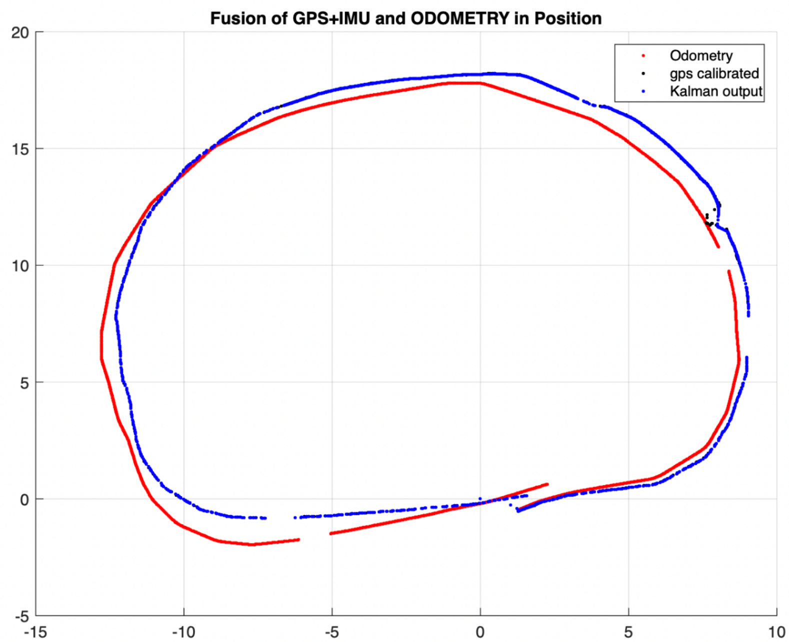
CPE 470

Project 1

A.
The Kalman Filter output that combines all the three individual sensors provides a smoother and accurate prediction of the position of the robot. Using the output from the other sensors, the KF provides a more accurate and better at handling noise than the individual sensors on the position of the robot. The Kalman Filter would also be more accurate when the GPS of the robot is not working properly because of signal issues. For example, if the robot is under a tree, the result of the GPS will not be accurate which is why we can use the KF to produce more accurate results.
B.



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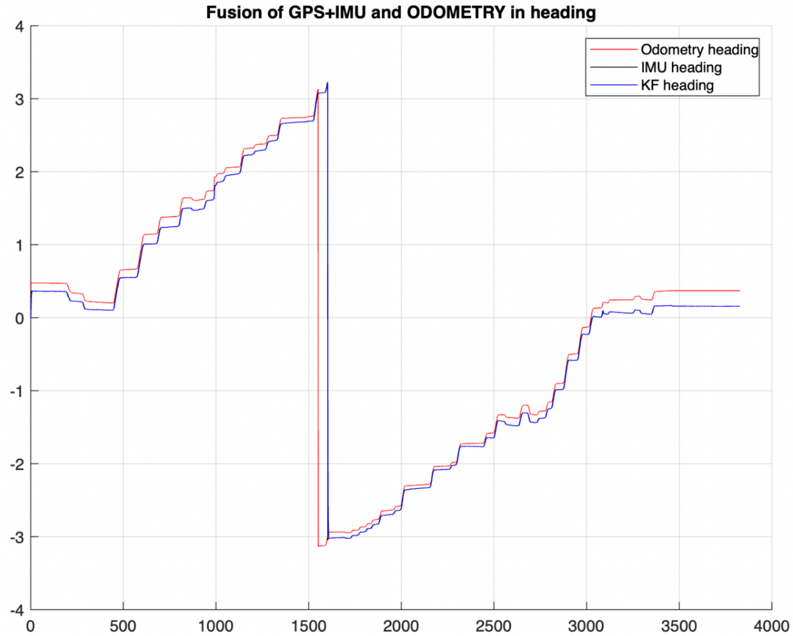
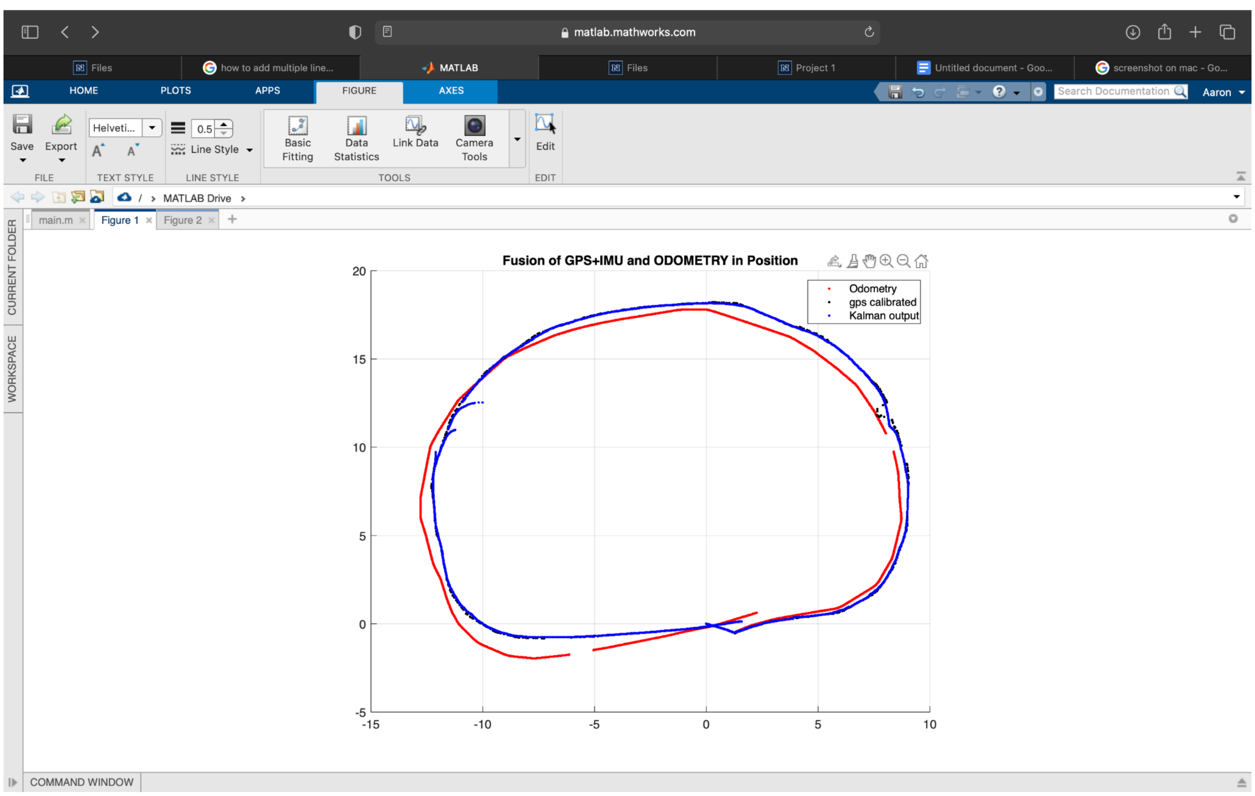


These Images show that the Kalman Filter output heading is very close to the actual data collected by the GPS, IMU, and the Encoder with some corrections.

C.



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I added a .15 noise standard deviation to the data with a .5 noise mean to the gps covariance of all the data. With the noise added to the GPS covariance, the results of the GPS are closer to the Kalman Output. This shows that the KF is much better with handling data with noise than the GPS.

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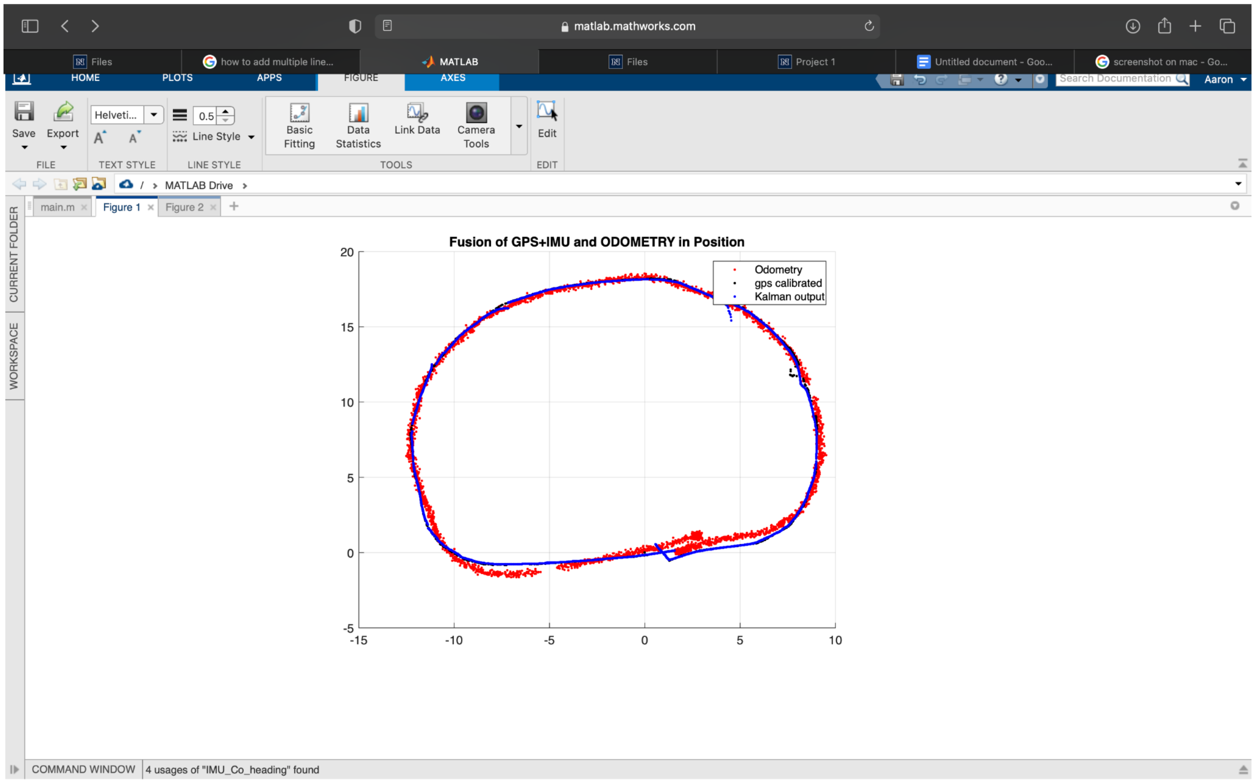
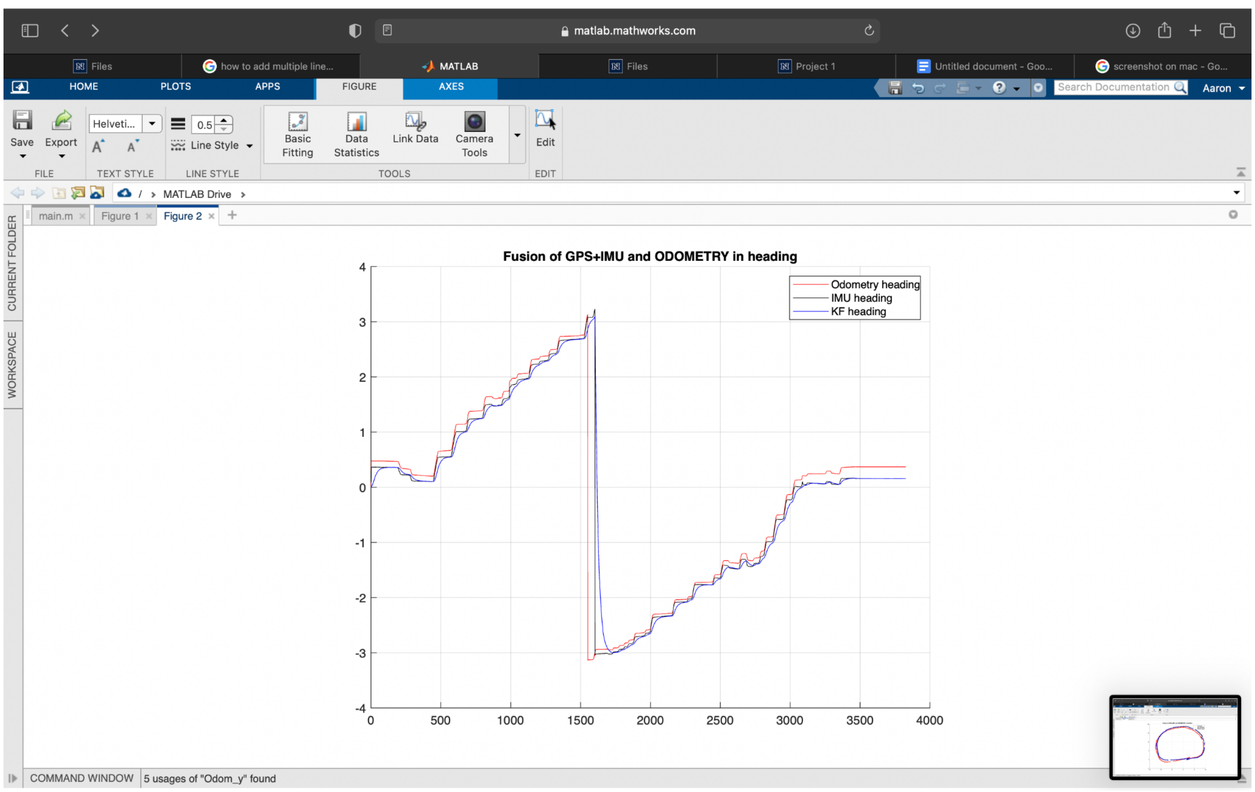
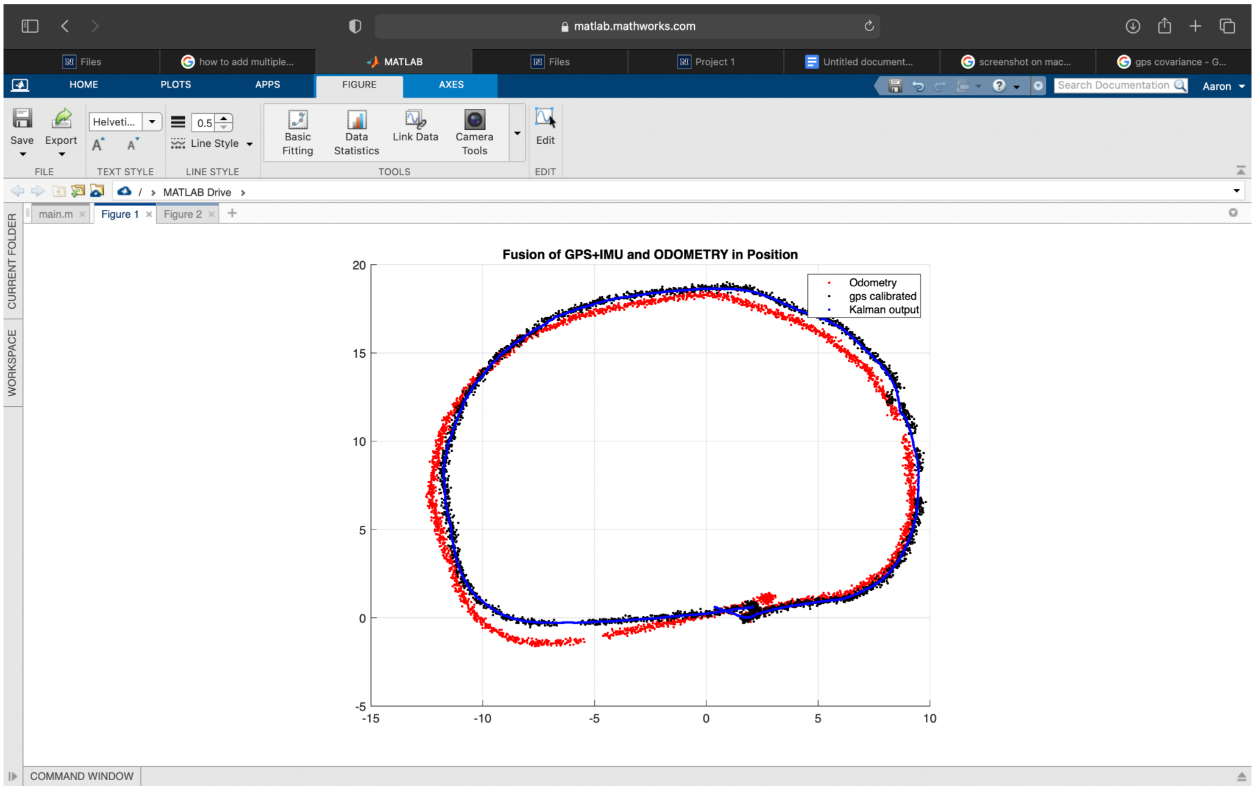




After adding noise to the IMU covariance data and the Odometry data, the graph shows that the output of the IMU is also closer to the output of the Kalman Filter. This means that the IMU data with noise reacts the same way with the GPS data with noise and proves that the KF data is more accurate with dealing with noise in datasets. I added a .1 noise standard deviation with a mean of .5 to all the IMU data and the Odometry Data.

E.



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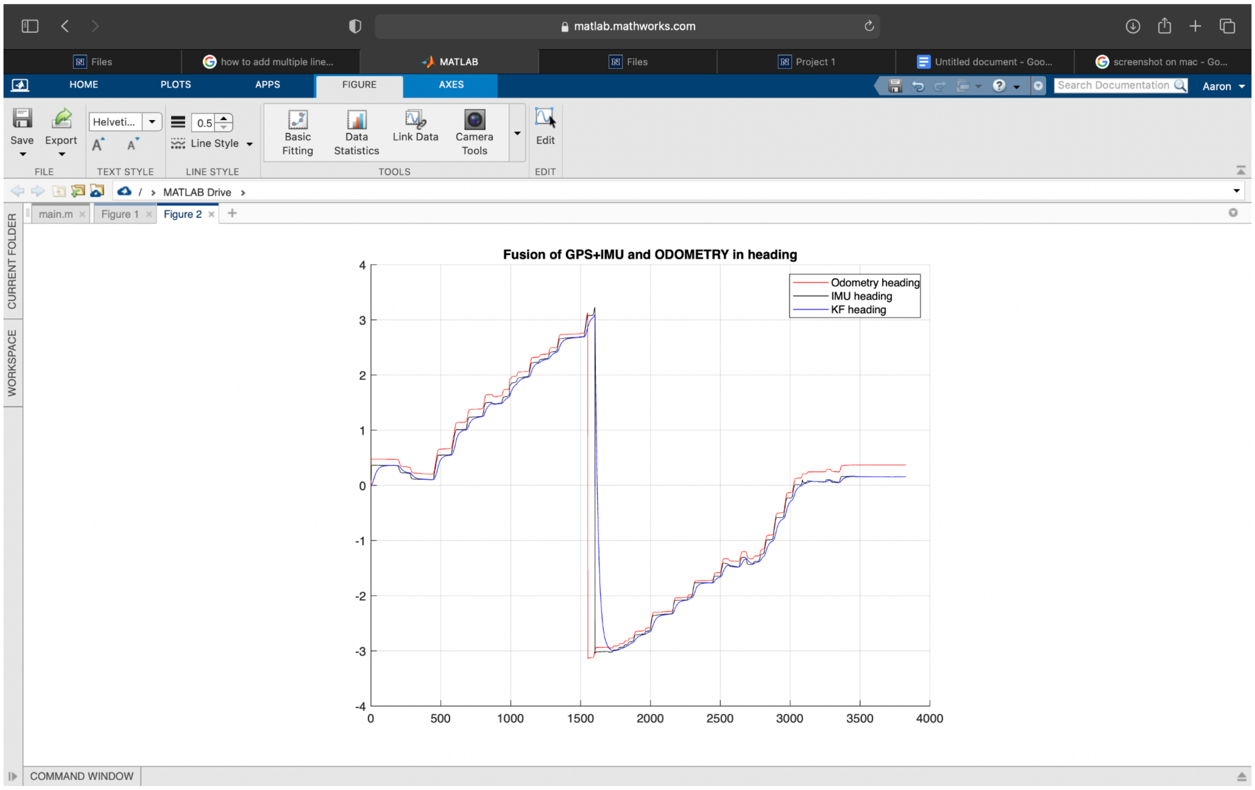

After adding the GPS noise of a mean of .5 and .1 to the entire data set, The output of the GPS with noise closely resembles the KF output even more which proves that the KF outperforms individual sensors in regards to handling data especially ones with noise.