Rob521 - Assignment 2
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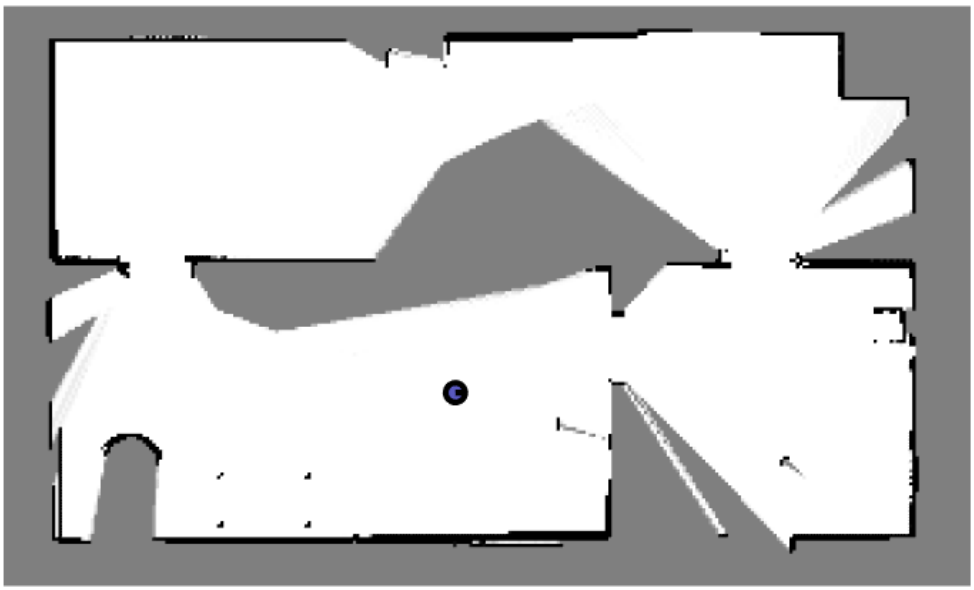
Question #1 -build an occupancy grid map
In this part, we had to implement an occupancy grip mapping algorithm that builds the map from perfect ground-truth localization.This is completely identical to the ROB521 Lab3 mapping that we had to complete and thus I implemented the method that my team used in that lab.

By iterating through all of the lidar scans, and proceeding if the lidar measurement is within the laser range limits (r_min and r_max) and if it wasn't a nan value. We converted the robot pose and the lidar end position to the map frame. Ray traced to see where the lidar did not find an obstacle with the end of the lidar scan being an obstacle. We then updated the log map with the beta and alpha values for free and occupied space (0.5 for beta and 3 for alpha). And then put that through the log-odds to recover the map at that time frame. Do that for all time frames.

In the below map, black is occupied (alpha) and white is free (beta), while grey are unknown.

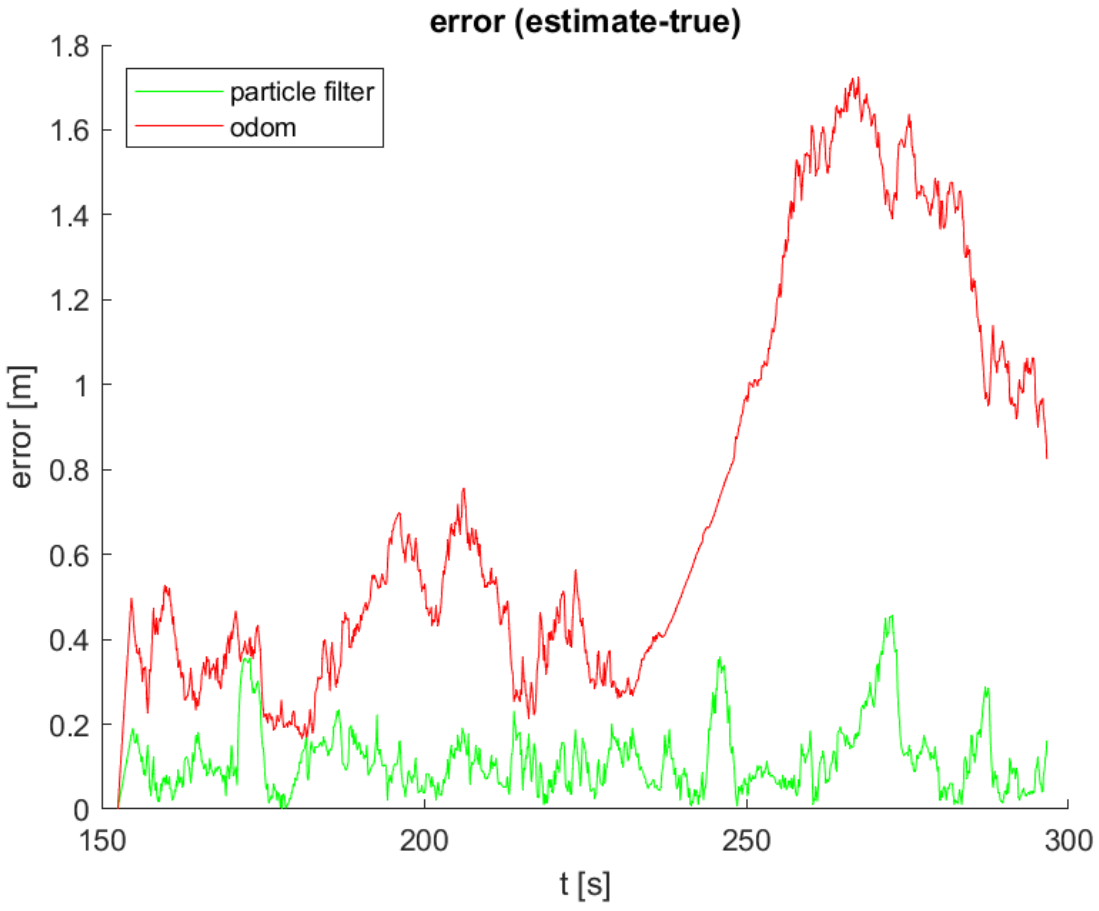


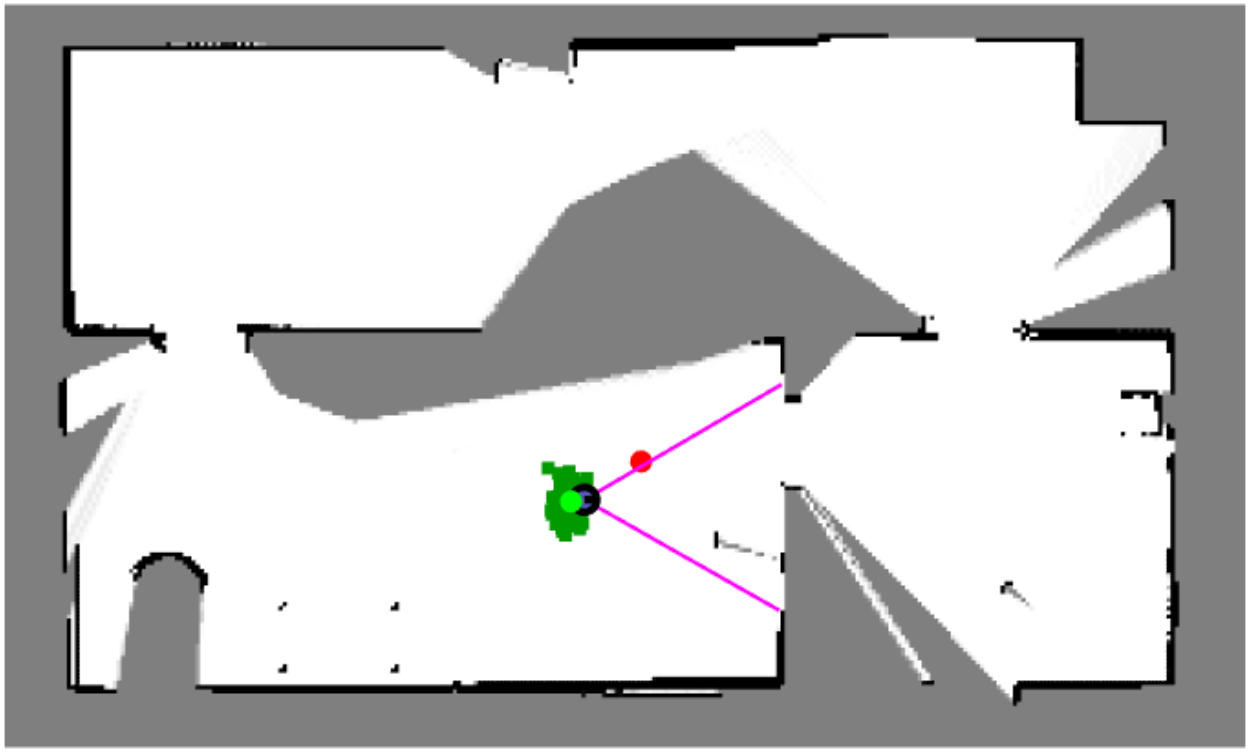
Question #2 - localization from an occupancy grid map using particle filter

In this part, we had to implement a particle filter localization algorithm to localize the robot. We only used two scans as this was outlined in the doc and was sufficient to localize. Noise was added to the wheel odometry and to the laser scan. We first estimated the y_laser given the particle pose and information on the laser and occupancy map. To do so we just propagated and found the first occupied cell from the ray.

The next thing was to calculate the weight of the particle given a normal distribution with the mean of the predicted and a given variance. This was done using normpdf.

The below graph shows the error of the particle filter and error of odom.





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