Lab 5: Searching for Objects

Spiros Mavroidakos, David Ugo

Lab Report

Data/Analysis

Fig. 1	Number of false positives		
Trial #	Styrofoam False Positives	Wood Block False Positives	
1	0	0	
2	0	0	
3	0	0	
4	0	0	
5	0	0	
6	0	0	
7	0	0	
8	0	0	
9	0	0	
10	0	0	
Fig. 2	Number of false negatives		
Trial #	Styrofoam False Negative	Wood Block False Negatives	
1	0	0	
2	0	0	
3	0	0	
4	0	0	
5	0	0	
6	0	0	
7	0	0	
8	0	0	
9	0	0	
10	0	0	
Fig. 3	Localization Analysis		
Trial #	Localization Time (seconds)	Localization error (angle)	Localization error (Distance cm)
1	32	2	0.3
2	35	3	0.2
3	33	1	0.2
4	32	2	0.3
5	34	2	0.2
Fig. 4	Trial Time and Error		
Trial #	Trial Time (Seconds)	Destination distance error(cm)	
1	150	1.00	
2	167	0.95	
3	162	0.90	
4	172	1.00	
5	156	0.97	

Observations and Conclusions

1. What differences, if any, did you observe in the behavior/performance of your earlier code (i.e. localization, odometry, navigation) when combined in a larger system? Explain any discrepancies. If it turns out that things worked out pretty much as expected, explain how the design of your code contributed.

   Some of the methods in the navigation class needed to be updated because during testing, it was discovered that the turnTo() method could not deal with input angles that were greater than 360°. This error caused the robot to oscillate in place. The travelTo() method also had to be tweaked in order to deal with the inaccuracy of the odometer readings caused by slipping. This meant that the inputted coordinates had to be increased in order to make it go tot the desired location.

   Surprisingly, the odometer performed well enough when used as a means to determine whether or not the robot was going out of bounds or not. The x and y readings were accurate enough to not greatly affect this detection part of the algorithm.

   Localization needed to be reworked because the light sensor could not be used as it was in the previous lab. A new approach was developed. After the original Ultrasonic localization, the robot would then turn to face the wall in the y direction completely perpendicular and take a distance reading and then do the same in the x direction. These were then used to determine the distance that the robot was away from the origin and then the robot would travel that distance and finished the localization

2. How reliable was your object detection? What factors influence the reliability of object detection? Where would you expect your code to break down? What steps can you take to make detection more robust?

The object detection was more reliable when tweaked to reach acceptable if not optimal values. As the robot got closer to the object, accuracy of detection improved. Initially the robot got within 10 cm but this yielded on occasion some false positives and therefore the distance was refined and found to be optimal at 8 cm.

The constant lighting in the lab helped with the accuracy of the results because changing light conditions affect the light sensor's accuracy. The distance from the object also affected the accuracy of the light sensor. The code is expected to break down if there is a change in the light conditions since the code was made to work based on the lab's lighting and no external lighting was considered.

The detection would be more accurate if other lighting conditions were taken into account since that is the major part of the detection algorithm. The distance from the object was found to be optimal at 8 cm so distance would not change in other situations.

3. What aspect of this lab did you find most difficult? What aspect of this lab did you find most surprising or unexpected?

The most difficult aspect of the lab was coming up with an effective algorithm to search for blocks. Several algorithm designs were tested but the most optimal was to turn at a specified angle when going out of bounds or when a wooden block or wall was detected. The detection portion was not as difficult because the demo conditions were known and in a controlled environment with similar lighting to that if the lab. The most unexpecting part of this lab was the

difficulty in tweaking the localization portion. The robot performed the US localization perfect in the previous lab but it was not working in this portion so an offset angle had to be implemented to make up for the discrepancy. The amount of code refactoring that had to be done was also surprising because we had assumed that it would be fine to leave it as is since they worked fine in the previous lab.