TESTING – US Localization Testing V2.0

Project: Design an Autonomous Robot

Task: To design an autonomous robot that is capable of navigating to a predetermined position while avoiding obstacles and firing objects at two targets. This is to be done in the shortest time possible.

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Software Version: Localization V2.5

Hardware Version: 2.0

Goal: To determine which method the robot should use to find its coordinate

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# PURPOSE

The purpose of the test is to know which method is better in determining the location of the robot. (Finding minimum or rising edge). This information is important as it will help to better locate the robot in the competition. This test is also made to know the accuracy of the better method, so that it might be improved if there is a big range of error.

This test will be done with the hardware version 2.0 and localization V2.5 of the code that can be found in the “Localization V2.5” folder. It is also available in the “code” folder.

# OBJECTIVES

The objective of the test is to know which localization methods will work better.

This test is a simulation of the localization part of the competition. Since the competition will be held at an indoor place, there will not be any factors that affect the measured distance of the US. Therefore, it is correct to assume that doing the test in the lab room can represent the real situation.

# PROCEDURE

1. Place the robot at random position in the starting area
2. Run default file and press left button (use the new method)
3. After the robot stops, measure actual X and Y using a ruler
4. Measure actual angle using a ruler
5. Record odometer X, Y and angle
6. Repeat step 1 -5 fifteen times

# EXPECTED RESULTS

The expected result is that both methods will be really close in terms of precision. Precision (Standard deviation) is more important than accuracy (mean) because mean can be manual adjusted by adding a value into the equation used to calculate coordinate. The best case of the test is that the standard deviation of the one of the methods is small. The worst case is that standard deviations from both methods are really large.

# CALCULATIONS

The mean value is obtained using the AVERAGE method in Microsoft Office Excel. The averages for rising edge are obtained from Localization Test V1.1.

For finding minimum: For rising edge:

X mean: -0.72 X mean: -4.829

Y mean: 1.638 Y mean: -0.791

Theta mean: 17.4 Theta mean: 4.1

The standard deviation is obtained using the STDEV method in Microsoft Office Excel. The standard deviations for rising edge are obtained from Localization Test V1.0.

For finding minimum For rising edge:

X standard deviation = 1.74 X standard deviation: 0.84

Y standard deviation = 1.85 Y standard deviation: 2.14

Theta standard deviation: 7.21 Theta standard deviation: 2.89

# TEST REPORT

The collected results show rising edge beats out finding minimum in two of the three standard deviations. The data for finding minimum can be found in Test Data while the data for rising edge can be found in Localization Test V1.0 and Localization Test V1.1.

# CONCLUSION

The data shows that rising edge is the better of the two methods in determining the location of the robot. However, one thing to note is that the finding minimum method takes significantly less time than rising edge. Also, even though X and Y standard deviations in finding minimum are almost twice as large as the ones in rising edge. It is a mere 1cm more. Theta difference between the two methods is only 5 degrees. . Furthermore, USLocalizer is not designed to be super accurate as there is light localizer to back it up. As a result, it is hard to determine a clear winner in this test.

# ACTION

This test report should be keep within the software team. The software team will discuss which method to use depending on the time consumption and accuracy. Adjustment will be made to finding minimum method to manually correct the error.

# DISTRIBUTION

This testing belongs to the software development.

# GLOSSARY

US = ultrasonic sensor