TESTING – US Localization Testing V2.1

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 V3.1

Hardware Version: 4.0

Goal: To find the mean of the error and manually decrease the error

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# Purpose

The purpose of the test is to know the mean of the error. Although there are tests done on this previously, the robot hardware design has gone through multiple revisions and thus the test needs to be performed again. This information is important as it will help to better locate the robot in the competition. By finding the mean, an adjustment can be done on the calculation for coordinate and angle.

This test will be done with the hardware version 4.0 and localization V3.1 of the code that can be found in the “Localization V3.1” folder in the “Code” folder.

# Objectives

The objective of the test is to manually correct the error in XY coordinate and angle.

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. Also, the placements of the robot will be in all four squares of the starting area. 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 facing random orientation in the upper right square
2. Run default file
3. After the robot stops, measure actual X and Y and measure actual angle
4. Repeat step 1 - 4 three times
5. Place the robot at random position facing random orientation in the upper left square
6. Run default file
7. After the robot stops, measure actual X and Y and measure actual angle
8. Record odometer X, Y and angle
9. Repeat step 6 - 9 three times
10. Place the robot at random position facing random orientation in the lower left square
11. Run default file
12. After the robot stops, measure actual X and Y and measure actual angle
13. Record odometer X, Y and angle
14. Repeat step 11 - 14 three times
15. Place the robot at random position facing random orientation in the lower right square
16. Run default file
17. After the robot stops, measure actual X and Y and measure actual angle
18. Record odometer X, Y and angle
19. Repeat step 15 - 18 three times

# Expected Results

The expected result is that the mean of error will be really small. Precision is less important than accuracy because the accuracy of the robot can only be corrected from determining the mean. Standard deviation is not expected to change much even though the hardware has gone through multiple revisions. The best case of the test is that the standard deviation remains the same as before. The worst case is that standard deviation changes a lot.

# Calculations

The mean value is obtained using the AVERAGE method in Microsoft Office Excel.

Currently Previously

X mean: -1.05 -0.72

Y mean: -0.07 1.64

Theta mean: 15.54 17.40

The standard deviation is obtained using the STDEV method in Microsoft Office Excel.

Currently Previously

X standard deviation: 1.82 1.73

Y standard deviation: 1.36 1.85

Theta standard deviation: 10.51 7.21

# Test Report

The test was performed 12 times in total (3 at each square) following the protocol described in the “procedure” section. The completed results can be seen in the spreadsheet “Test Data.xlsx” in the same folder as this report.

# Conclusion

The collected results show that the standard deviations have not changed much. On the other hand because of multiple hardware revisions, the mean has shifted since previous test. As a result, adjustments will be done.

# Action

This test report should be keep within the software team. As for adjustments, the calculated mean will be added onto the calculations for the coordinate and the angle.

# Distribution

This testing belongs to the software development.

# Glossary

US = ultrasonic sensor