TESTING – US Localization (Coordinate) Testing V1.1

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 V2.3

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. (Rising edge or falling 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 V2.3 of the code that can be found in the “Localization V2.3” 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 arbitrary positions in the start area
2. Start the robot’s rising-edge method
3. After the robot determines its coordinate, record the measured coordinate (x and y) and actual coordinate (x and y) using a ruler
4. Repeat step 1 and 3 ten times
5. Repeat step 1 and 3 ten times with rising edge method

# EXPECTED RESULTS

The expected result is that both methods will be really close in terms of precision. Because tuning still needs to be done to determine wheel radius and width, precision is more important accuracy. Also accuracy 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 deviations of the both methods are 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

For falling: For rising edge:

X mean: -1.796 X mean: -4.829

Y mean: -1.219 Y mean: -0.791

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

For falling edge: For rising edge:

X standard deviation = 4.31 X standard deviation: 0.84

Y standard deviation = 3.75 Y standard deviation: 2.14

# TEST REPORT

The collected results show that rising edge performs better than falling edge in terms of precision in coordinate. The data can be found in Test Data.xlsx.

# CONCLUSION

With standard deviations of 0.84 and 2.14 in X and Y respectively, rising edge is clearly better in precision than falling edge, which has standard deviations of 4.31 and 3.753 in X and Y respectively. Mean value shouldn’t be taken into consideration because adjustments can be made on the distance calculation to mediate the mean.

# ACTION

This test report should be keep within the software team in order to bring adjustments to the localization in the future. Rising edge will be used in terms of US localization. Adjustments will be done on the calculation that is used to determine coordinate.

# DISTRIBUTION

This testing belongs to the software development.

# GLOSSARY

US = ultrasonic sensor