TESTING – Odometer and Correction

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.

Document Version Number: 2.0

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Software Version: 2.0

Hardware Version: 2.0

Goal: The goal of this test is to know the accuracy of the odometer and its correction.

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# PURPOSE

Explain briefly the overall process. Include: Design version number, limitations on the scope of the test.

**The purpose of the test is to know how accurate the odometer reading is comparing to the measured coordinates while the odometer correction is on. This is the most essential part as there are many other codes such as Navigation and Obstacle Avoidance will use odometer as the base.**

**This test will be done with the hardware version 2.0 and a testing code that can be found in the “Code/Merged Version 2.0” folder.**

# OBJECTIVES

Detail exactly what is desired from the test.

Why are we testing that part (how does it tie to our final design)? What if it doesn’t work? Why is this test necessary? Make sure you talk about what is the worst case and why. What decision will the test validate? Which potentially weak spot of the design are we testing and using what methods? Why does it cause problems? What are you measuring (x, y, theta, light senor values, US sensor values, etc.)? Attention should be paid to the variables to be controlled or monitored. Make sure the worst case is described and it is tested. Describe the testing environment! For example, if it’s light sensor, then talk about the ambient lighting, the time of day, weather (cloudy, rainy, sunny, etc.). Reminder: Don’t forget the extremes (worst case and best case) and why.

**The objective of the test is to know if the odometer can work properly and display the right information on X/Y coordinates. The objective of the test on odometer correction is to investigate on how well the correction code can reduce the error when the correction mode is turned on.**

# PROCEDURE

1. **Place the robot at a position (0, 0) (i.e.: at an intersection of the grids).**
2. **Run the odometer code, and the robot will run in a designated path, from (0,0) to (30,60) then to (75,75)**
3. **Repeat step 2) 5 times, and measure change in the X and Y components after the robot stops.**
4. **Repeat 2) and 3), but this time let the robot travel from rom (0,0) to (60,30) then to (75,75) instead.**

# EXPECTED RESULTS

What results are we expecting? Why? What does this imply about our design? Good or bad for us?

Talk about the best case and worst case, what do you expect?

[Insert Data Sheet of Predictions]

If you don’t know roughly what should happen, then how do you know if it’s wrong?

**The expected result is that the odometer reading will read about (60,75) once it goes around the designated path. We want to make sure that the odometer does not display numbers that deviate too much from x & y coordinates measured. The best case of the test is that the odometer will go back to the origin and display (60,75)after going around the square. The worst case scenario of the test is that the odometer reading is way off from the actual x & y reading (ex: read (63,72) but the actual coordinates are (59,70)).**

# FORMAT OF OUTPUT REQUIRED

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | (30,60) to (60,75) | | | | |  |
|  | Odometer Values (cm) | | Actual Values (cm) | | Error (cm) | |
| Observation | X | Y | X | Y | X | Y |
| 1 | 74.43 | 74.82 | 74.8 | 75.8 | 0.37 | 0.98 |
| 2 | 74.92 | 75.6 | 76.8 | 75.6 | 1.88 | 0.00 |
| 3 | 73.89 | 74.98 | 75.8 | 75.9 | 1.91 | 0.92 |
| 4 | 73.76 | 75.44 | 75 | 76.2 | 1.24 | 0.76 |
| 5 | 74.66 | 75.94 | 75.5 | 75.5 | 0.84 | -0.44 |
| Mean | 74.332 | 75.356 | 75.58 | 75.8 | 1.248 | 0.444 |
| Standard Deviation | 0.49636 | 0.45725 | 0.78867 | 0.78867 | 0.52009 | 0.63094 |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | (60,30) to (60,75) | | | | |  |
|  | Odometer Values (cm) | | Actual Values (cm) | | Error (cm) | |
| Observation | X | Y | X | Y | X | Y |
| 1 | 75.7 | 74 | 76.5 | 75.5 | 0.08 | 1.5 |
| 2 | 75.01 | 74.35 | 76.9 | 75.6 | 1.89 | 1.25 |
| 3 | 75.09 | 74.02 | 76.9 | 75.6 | 1.81 | 1.58 |
| 4 | 74.87 | 74.17 | 76 | 76.2 | 1.13 | 2.03 |
| 5 | 75.09 | 74.4 | 76.3 | 75.6 | 1.21 | 1.2 |
| Mean | 75.152 | 74.188 | 76.52 | 75.7 | 1.224 | 1.512 |
| Standard Deviation | 0.31925 | 0.31925 | 0.31925 | 0.31925 | 0.72538 | 0.33132 |

# SAMPLE CALCULATIONS

The mean value can be obtained by the following formula:

For the mean of error of X with odometer correction, cm

In this test, the mean values for error of x and y are 1.246 and 0.982 cm, respectively.

The standard deviation can be obtained as

In this test, the standard deviation for x-axis and y-axis are respectively 0.52009 and 0.63094 cm**.**

# TEST REPORT

What are our results? What do they mean in general + our design? (Remember to say why and justify with data from the chart).

Ex from lectures: “The test was performed 12 times following the protocol described above. The complete results can be seen in the spreadsheet (Obstacle\_Avoid\_Test\_11Feb.xls)”

**The collected results are acceptable because the error of x and y is within 2 cm off, and the standard deviation values are lowin the in the first path, 0.52009 and 0.63094 cm for each axis respectively.**

# CONCLUSION

Pass/Fail of the tested part of the project.

Were the results the same as prediction? What are the results in general and what does that imply to our design (basically a “tl;dr” version of the test). Actions to be done? Is this a weak or strong point in our design? Do we need to improve on the design to fix anything? Keep everything the same?

**This testing is considered “passed” as the error between the odmeter reading and the actual distance are negligible. The measurements are only around 1 to 2 cm off, which can be considered accurate.**

# ACTION

What needs to be done due to this test?

Ex: This test report should be sent to the software team to review the obstacle avoidance process. The Gantt chart should be updated to show the revised tasks

**The codes for both odometer and odometer correction are working the way as we expected; therefore, the odometer codes are usable in order to make other codes function.**

# DISTRIBUTION

Which part of the project does this belong in?

Ex: “Software development, project management”

**This testing belongs to the software development.**