Ultrasonic Localization

**Test 1**

**Date :** 2021/3/22

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**Hardware version:** 1.2 (in Part 2.5 of [Hardware Document](https://docs.google.com/document/d/11jkA_S_xBqyCbcn2NyMuM-OMDEybDfRy/edit#))

**Software version:** 1.1 (in Part 7.0 of [Software Document](https://docs.google.com/document/d/19JaY5629aUu4Y4rjoQJ-jWyeQLqNSAcr/edit))

**Test Purpose:**

Determine whether the ultrasonic localizer can help the red team robot to turn to the desired angle with limited errors.

**Test Procedure:**

We will place the robot at the upper left corner on the 45° line with the random initial angle. We expect the robot can finally turn to 180° according to the ultrasonic sensor feedback.

1. The robot is placed at coordinate (0.5, 8.5), that is (0.1524, 2.5908) in meters, which is on the 45° line of the upper left corner of the world.
2. Depending on the input angle, the robot will be set to orient to the angle.
3. Start the odometer. Initializing the odometer with value (0.1524, 2.5908, input θ).
4. Run the ultrasonic localizer with ultrasonic sensor running at a sample rate of 25Hz and use the filter methods to deal with samples.
5. When the ultrasonic localizer stops running, stop the program .
6. Print the final angle value indicated by the webot.
7. Print the final angle value indicated by the odometer.

**Test Data:**

|  |  |
| --- | --- |
| Trial# | Initial Angle |
| 1 | 0.0 |
| 2 | 20.0 |
| 3 | 55.0 |
| 4 | 82.0 |
| 5 | 120.0 |
| 6 | 165.0 |
| 7 | 200.0 |
| 8 | 280.0 |
| 9 | 330.0 |

**Expected Result:**

|  |  |  |
| --- | --- | --- |
| Trial# | Final Angle (Webot) | Final Angle (Odometer) |
| 1 | 180.0 | 180.0 |
| 2 | 180.0 | 180.0 |
| 3 | 180.0 | 180.0 |
| 4 | 180.0 | 180.0 |
| 5 | 180.0 | 180.0 |
| 6 | 180.0 | 180.0 |
| 7 | 180.0 | 180.0 |
| 8 | 180.0 | 180.0 |
| 9 | 180.0 | 180.0 |

**Test Results:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Trial# | Final Angle (Webot)/deg | Final Angle (Odometer)/deg | Error (Webot)/deg | Error (Odometer)/deg |
| 1 | 178.1 | 180.0 | 1.9 | 1.9 |
| 2 | 177.3 | 180.0 | 2.7 | 2.7 |
| 3 | 178.5 | 180.0 | 1.5 | 1.5 |
| 4 | 178.2 | 180.0 | 1.8 | 1.8 |
| 5 | 177.7 | 180.0 | 2.3 | 2.3 |
| 6 | 178.4 | 180.0 | 1.6 | 1.6 |
| 7 | 179.2 | 180.0 | 0.8 | 0.8 |
| 8 | 178.6 | 180.0 | 1.4 | 1.4 |
| 9 | 177.9 | 180.0 | 2.1 | 2.1 |

**Test Report:**

The test is performed 9 times for different input initial angles. The pass rate is 100%. We expect the robot to turn to 180° and the error is expected to be within 1 degree. From the tested output, we can see that the ultrasonic localizer generates maximum error 2.7 deg and minimum error 0.8 deg. We can also observe that the odometer generates some inaccuracy here. Overall, some errors are larger than our expectation, but they are within 5 degrees requirements. The upcoming light localization can reduce the inaccuracy dramatically.

**Conclusion:** Pass

**Action:** None

**Distribution:** software development