Light Localization

**Descirption**

The test mainly checks whether the Light Localizer can help the robot localize to the point we expect (the start point at beginning or the nearest point during the process of navigation).

For the test, we will test whether the light localizer can help to localize the nearest point while navigating. We will just let the robot move from a random start point to a random endpoint on the island. At the end of moving, we will let the robot use Light Localizer to localize to the endpoint. The final coordinate of the robot after localization will be recorded for the error analysis.

**Test 1**

**Date:** 2021/3/21

**Tester:** Junjian Chen

**Author:** Junjian Chen

**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))

**Purpose:** Evaluate the error of when localizing the robot to a nearest point while navigation in normal cases

**Procedure:** 1. Place the robot to (4,3)

2. Use the method in Navigation Class directTravelTo() (light localization is used in this method) to make the robot travel to 8 different points.

3. Record the actual position of the robot after localization

4. Calculate the error by Euclidean error distance

Test Data:

|  |  |  |
| --- | --- | --- |
| Trial# | Starting point  /(x,y) | End point  /(x,y) |
| 1 | (4,3) | (4,5) |
| 2 | (4,3) | (4,1) |
| 3 | (4,3) | (2,3) |
| 4 | (4,3) | (6,3) |
| 5 | (4,3) | (2,5) |
| 6 | (4,3) | (5,5) |
| 7 | (4,3) | (6,1) |
| 8 | (4,3) | (1,1) |

**Expected Results:**

|  |  |
| --- | --- |
| Trial# | Expected End point  /(x,y) |
| 1 | (4,5) |
| 2 | (4,1) |
| 3 | (2,3) |
| 4 | (6,3) |
| 5 | (2,5) |
| 6 | (5,5) |
| 7 | (6,1) |
| 8 | (1,1) |

**Test Results:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Trial# | Starting point  /(x,y) | Expected End point  /(x,y) | Actual End point  /(x,y) | Error distance  /feet |
| 1 | (4,3) | (4,5) | (4.00,4.99) | 0.01 |
| 2 | (4,3) | (4,1) | (3.98,1.12) | 0.03 |
| 3 | (4,3) | (2,3) | (2.01,3.00) | 0.01 |
| 4 | (4,3) | (6,3) | (5.98,3.01) | 0.02 |
| 5 | (4,3) | (2,5) | (1.99,4.99) | 0.01 |
| 6 | (4,3) | (5,5) | (4.99,4.99) | 0.01 |
| 7 | (4,3) | (6,1) | (6.01,1.01) | 0.01 |
| 8 | (4,3) | (1,1) | (0.99,1.01) | 0.01 |

**Test Report:**

Average Error: 0.014

Pass Rate:100%

The error of the light localizer is very low, most of the errors are between 0.01 and 0.02 feet, with only one trial at 0.03. So the performance of the light localization is good.

**Conclusion:** Pass

**Action:** None

**Distribution:** software development

**Test 2**

**Date:** 2021/3/21

**Tester:** Junjian Chen

**Author:** Junjian Chen

**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))

**Purpose:** Evaluate the error of when localizing the robot to a nearest point in edge cases

**Procedure:** 1. Place the robot to (1,4)

2. Use the method in Navigation Class directTravelTo() (light localization is used in this method) to make the robot travel to 4 different points.

3. Record the actual position of the robot after localization

4. Calculate the error by Euclidean error distance

**Test Data:**

|  |  |  |
| --- | --- | --- |
| Trial# | Starting point  /(x,y) | End point  /(x,y) |
| 1 | (1,4) | (4,5) |
| 2 | (1,4) | (4,3) |
| 3 | (1,4) | (2,1) |
| 4 | (1,4) | (6,5) |

**Expected Results:**

|  |  |
| --- | --- |
| Trial# | Expected End point  /(x,y) |
| 1 | (4,5) |
| 2 | (4,3) |
| 3 | (2,1) |
| 4 | (6,5) |

**Test Results:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Trial# | Starting point  /(x,y) | Expected End point  /(x,y) | Actual End point  /(x,y) | Error distance  /feet |
| 1 | (1,4) | (4,5) | (3.98,4.98) | 0.03 |
| 2 | (1,4) | (4,3) | (3.98,3.01) | 0.02 |
| 3 | (1,4) | (2,1) | (1.98,1.01) | 0.02 |
| 4 | (1,4) | (6,5) | (4.99,5.45) | 1.11 |

**Test Report:**

Average Error: 0.295

The error of trial 1,2 and 3 is small and they pass the test. However, trial 4 fails because in the first step of the localization, the light sensor is already above the black line, causing the robot to turn to a wrong direction.

**Conclusion:** Conditional Pass

Action: Start light localization earlier, i.e at a point further from the waypoint, when the minimal angle between the two waypoints is small.

**Distribution:** Software Development