Return Back From Island

**Test 1**

**Date :** 2021/3/23

**Tester:** Shichang Zhang

**Author:** Shichang Zhang

**Hardware version:** 1.3 (in Part 2.5 of [Hardware Document](https://docs.google.com/document/d/11jkA_S_xBqyCbcn2NyMuM-OMDEybDfRy/edit#))

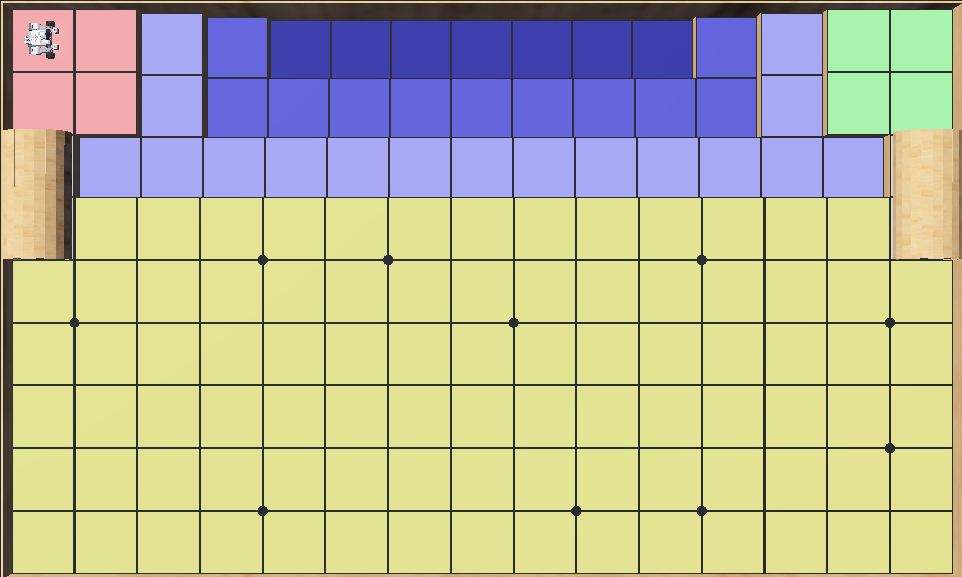
**Software version:** 1.5 (in Part 7.0 of [Software Document](https://docs.google.com/document/d/19JaY5629aUu4Y4rjoQJ-jWyeQLqNSAcr/edit))

**Test Purpose:**

Determine whether the robot can go back to the red team start point from the island.

**Test Procedure:**

The map:



We will place the robot at the input waypoint before going back to the start point with the input angle. We expect the robot to navigate to the bridge and go across the bridge and return to the start point (1,8) with limited error.

1. Bridge is localized at (0,5) to (1,7)
2. The robot is placed at input coordinate, which is the waypoint before travelling back.
3. The robot is set to be oriented to the input angle.
4. Set the forward speed of the robot to be 500, rotate speed to be 200.
5. Pass the parameters related to the start region to the robot (i.e. RED\_LL, RED\_UR).
6. Start the odometer.
7. Set the odometer parameters according to the input coordinates and angle.
8. Start the program.
9. Record whether the robot hits the bridge.
10. Record whether the robot successfully stops at the start point (1,8), (0.3048,2.4384) in meters.
11. Stop the program. Record the final translation value indicated by the webot.

**Test Data:**

|  |  |  |
| --- | --- | --- |
| Trial# | Waypoint (ft,ft) | Angle (deg) |
| 1 | (1,4) | 0 |
| 2 | (1,4) | 90 |
| 3 | (1,4) | 240 |
| 4 | (2,4) | 30 |
| 5 | (2,4) | 90 |
| 6 | (2,4) | 225 |
| 7 | (2,2) | 60 |
| 8 | (2,2) | 145 |
| 9 | (2,2) | 330 |
| 10 | (4,1) | 75 |
| 11 | (4,1) | 195 |
| 12 | (4,1) | 270 |

**Expected Result:**

|  |  |  |  |
| --- | --- | --- | --- |
| Trial# | Hit Bridge | Stop at Waypoint | Translation (m,m) |
| 1 | No | Yes | (0.3048,2.4384) |
| 2 | No | Yes | (0.3048,2.4384) |
| 3 | No | Yes | (0.3048,2.4384) |
| 4 | No | Yes | (0.3048,2.4384) |
| 5 | No | Yes | (0.3048,2.4384) |
| 6 | No | Yes | (0.3048,2.4384) |
| 7 | No | Yes | (0.3048,2.4384) |
| 8 | No | Yes | (0.3048,2.4384) |
| 9 | No | Yes | (0.3048,2.4384) |
| 10 | No | Yes | (0.3048,2.4384) |
| 11 | No | Yes | (0.3048,2.4384) |
| 12 | No | Yes | (0.3048,2.4384) |

**Test Results:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Trial# | Hit Bridge | Stop at Waypoint | Translation (m,m) | Error (m,m) |
| 1 | Yes | No | (0.2560,1.5606) | (0.488,0.8778) |
| 2 | Yes | No | (0.2477,1.5850) | (0.0501,0.8534) |
| 3 | Yes | No | (0.2498,1.5941) | (0.0550,0.8443) |
| 4 | Yes | No | (0.2388,1.5631) | (0.0660,0.8753) |
| 5 | Yes | No | (0.2443,1.5842) | (0.0605,0.8542) |
| 6 | Yes | No | (0.2578,1.5705) | (0.0470,0.8679) |
| 7 | Yes | Yes | (0.2926,2.3957) | (0.0122,0.0427) |
| 8 | Yes | Yes | (0.3444,2.3927) | (0.0396,0.0457) |
| 9 | Yes | Yes | (0.3596,2.3804) | (0.0548,0.0580) |
| 10 | Yes | No | (0.5761,2.2647) | (0.2713,0.1737) |
| 11 | Yes | No | (0.2560,2.1702) | (0.0488,0.2682) |
| 12 | Yes | No | (0.5029,2.2982) | (0.1981,0.1402) |

**Test Report:**

The test is performed 12 times for different input waypoints and angles. The pass rate is 0%. We expect the robot to go through the bridge and then return back to the start point with limited error. From the tested output, we can see that the robot failed to go through the bridge. The robot usually hits the bridge when it is trying to travel to the entry of the bridge and then it gets stuck at the bridge entry or its moving state is influenced considerably. Overall, the robot failed to return back to the start point of the red team.

**Conclusion:** Fail

**Action:** Add some correction algorithms to the bridge passer.

**Distribution:** software development

**Test 2**

**Date :** 2021/3/23

**Tester:** Shichang Zhang

**Author:** Shichang Zhang

**Hardware version:** 1.3 (in Part 2.5 of [Hardware Document](https://docs.google.com/document/d/11jkA_S_xBqyCbcn2NyMuM-OMDEybDfRy/edit#))

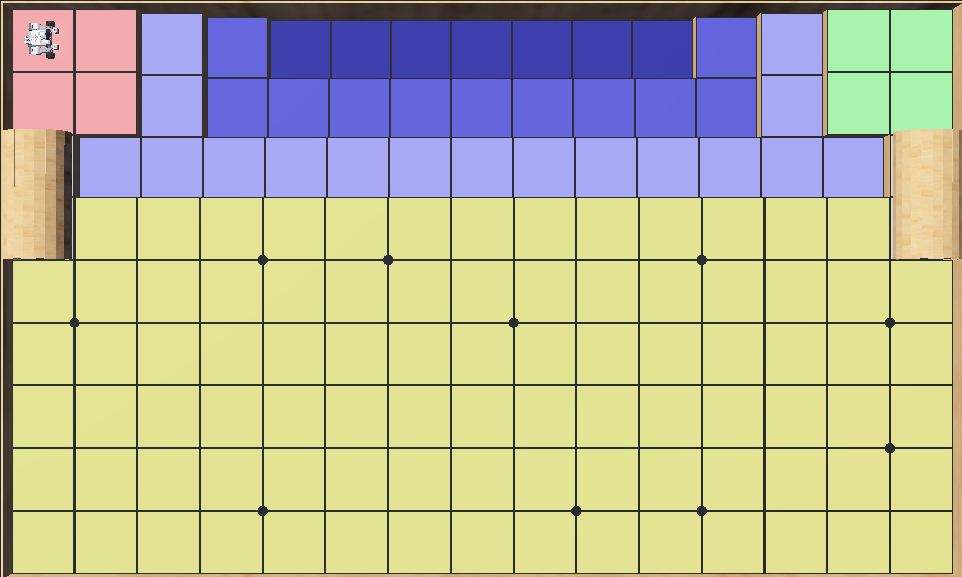
**Software version:** 1.6 (in Part 7.0 of [Software Document](https://docs.google.com/document/d/19JaY5629aUu4Y4rjoQJ-jWyeQLqNSAcr/edit))

**Test Purpose:**

Determine whether the robot can go back to the red team start point from the island.

**Test Procedure:**

The map:



We will place the robot at the input waypoint before going back to the start point with the input angle. We expect the robot to navigate to the bridge and go across the bridge and return to the start point (1,8) with limited error.

1. Bridge is localized at (0,5) to (1,7)
2. The robot is placed at input coordinate, which is the waypoint before travelling back.
3. The robot is set to be oriented to the input angle.
4. Set the forward speed of the robot to be 500, rotate speed to be 200.
5. Pass the parameters related to the start region to the robot (i.e. RED\_LL, RED\_UR).
6. Start the odometer.
7. Set the odometer parameters according to the input coordinates and angle.
8. Start the program.
9. Record whether the robot hits the bridge.
10. Record whether the robot successfully stops at the start point (1,8), (0.3048,2.4384) in meters.
11. Stop the program. Record the final translation value indicated by the webot.

**Test Data:**

|  |  |  |
| --- | --- | --- |
| Trial# | Waypoint (ft,ft) | Angle (deg) |
| 1 | (1,4) | 0 |
| 2 | (1,4) | 90 |
| 3 | (1,4) | 240 |
| 4 | (2,4) | 30 |
| 5 | (2,4) | 90 |
| 6 | (2,4) | 225 |
| 7 | (2,2) | 60 |
| 8 | (2,2) | 135 |
| 9 | (2,2) | 330 |
| 10 | (4,1) | 75 |
| 11 | (4,1) | 195 |
| 12 | (4,1) | 270 |

**Expected Result:**

|  |  |  |  |
| --- | --- | --- | --- |
| Trial# | Hit Bridge | Stop at Waypoint | Translation (m,m) |
| 1 | No | Yes | (0.3048,2.4384) |
| 2 | No | Yes | (0.3048,2.4384) |
| 3 | No | Yes | (0.3048,2.4384) |
| 4 | No | Yes | (0.3048,2.4384) |
| 5 | No | Yes | (0.3048,2.4384) |
| 6 | No | Yes | (0.3048,2.4384) |
| 7 | No | Yes | (0.3048,2.4384) |
| 8 | No | Yes | (0.3048,2.4384) |
| 9 | No | Yes | (0.3048,2.4384) |
| 10 | No | Yes | (0.3048,2.4384) |
| 11 | No | Yes | (0.3048,2.4384) |
| 12 | No | Yes | (0.3048,2.4384) |

**Test Results:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Trial# | Hit Bridge | Stop at Waypoint | Translation (m,m) | Error (m,m) |
| 1 | No | Yes | (0.3112,2.4389) | (0.0064,0.0005) |
| 2 | No | Yes | (0.3022,2.4419) | (0.0026,0.0035) |
| 3 | No | Yes | (0.3084,2.4423) | (0.0036,0.0039) |
| 4 | No | Yes | (0.3047,2.4410) | (0.0001,0.0026) |
| 5 | No | Yes | (0.3056,2.4389) | (0.0008,0.0005) |
| 6 | No | Yes | (0.3032,2.4378) | (0.0016,0.0006) |
| 7 | No | Yes | (0.3080,2.4396) | (0.0032,0.0012) |
| 8 | No | Yes | (0.3090,2.4430) | (0.0042,0.0046) |
| 9 | No | Yes | (0.3055,2.4413) | (0.0007,0.0029) |
| 10 | No | Yes | (0.3126,2.4481) | (0.0078,0.0097) |
| 11 | No | Yes | (0.3170,2.4495) | (0.0122,0.0111) |
| 12 | No | Yes | (0.3164,2.4478) | (0.0116,0.0094) |

**Test Report:**

The test is performed 12 times for different input waypoints and angles. The pass rate is 100%. We expect the robot to go through the bridge and then return back to the start point with limited error. From the tested output, we can see that the robot succeeds going through the bridge. We also found that if the start waypoint is far from the bridge (e.x. waypoint (4,1)), the final translation error will increase. But the errors are still in the tolerable range. Overall, the robot performs favorably when returning back to the start point of the red team.

**Conclusion:** Pass

**Action:** None

**Distribution:** software development

**Test 3**

**Date :** 2021/3/24

**Tester:** Shichang Zhang

**Author:** Shichang Zhang

**Hardware version:** 1.3 (in Part 2.5 of [Hardware Document](https://docs.google.com/document/d/11jkA_S_xBqyCbcn2NyMuM-OMDEybDfRy/edit#))

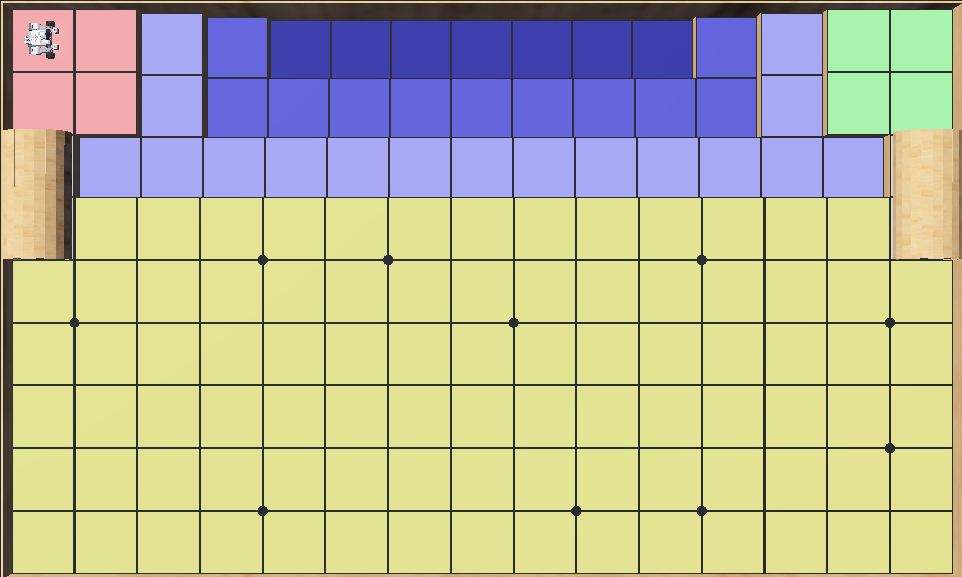
**Software version:** 1.6 (in Part 7.0 of [Software Document](https://docs.google.com/document/d/19JaY5629aUu4Y4rjoQJ-jWyeQLqNSAcr/edit))

**Test Purpose:**

Determine whether the robot can go back to the green team start point from the island.

**Test Procedure:**

Test map:



We will place the robot at the input waypoint before going back to the start point with the input angle. We expect the robot to navigate to the bridge and go across the bridge and return to the start point (14,8) with limited error.

1. Bridge is localized at (14,5) to (15,7)
2. The robot is placed at input coordinate, which is the waypoint before travelling back.
3. The robot is set to be oriented to the input angle.
4. Set the forward speed of the robot to be 500, rotate speed to be 200.
5. Pass the parameters related to the start region to the robot (i.e. GREEN\_LL, GREEN\_UR).
6. Start the odometer.
7. Set the odometer parameters according to the input coordinates and angle.
8. Start the program.
9. Record whether the robot hits the bridge.
10. Record whether the robot successfully stops at the start point (14,8), (4.2672,2.4384) in meters.
11. Stop the program. Record the final translation value indicated by the webot.

**Test Data:**

|  |  |  |
| --- | --- | --- |
| Trial# | Waypoint (ft,ft) | Angle (deg) |
| 1 | (14,4) | 90 |
| 2 | (14,4) | 135 |
| 3 | (14,4) | 180 |
| 4 | (13,4) | 30 |
| 5 | (13,4) | 135 |
| 6 | (13,4) | 225 |
| 7 | (13,2) | 60 |
| 8 | (13,2) | 135 |
| 9 | (13,2) | 330 |
| 10 | (11,1) | 75 |
| 11 | (11,1) | 270 |
| 12 | (11,1) | 315 |

**Expected Result:**

|  |  |  |  |
| --- | --- | --- | --- |
| Trial# | Hit Bridge | Stop at Waypoint | Translation (m,m) |
| 1 | No | Yes | (4.2672,2.4384) |
| 2 | No | Yes | (4.2672,2.4384) |
| 3 | No | Yes | (4.2672,2.4384) |
| 4 | No | Yes | (4.2672,2.4384) |
| 5 | No | Yes | (4.2672,2.4384) |
| 6 | No | Yes | (4.2672,2.4384) |
| 7 | No | Yes | (4.2672,2.4384) |
| 8 | No | Yes | (4.2672,2.4384) |
| 9 | No | Yes | (4.2672,2.4384) |
| 10 | No | Yes | (4.2672,2.4384) |
| 11 | No | Yes | (4.2672,2.4384) |
| 12 | No | Yes | (4.2672,2.4384) |

**Test Results:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Trial# | Hit Bridge | Stop at Waypoint | Translation (m,m) | Error (m,m) |
| 1 | No | Yes | (4.2740,2.4381) | (0.0068,-0.0003) |
| 2 | No | Yes | (4.2731,2.4380) | (0.0059,-0.0004) |
| 3 | No | Yes | (4.2791,2.4376) | (0.0119,-0.0008) |
| 4 | No | Yes | (4.2783,2.4347) | (0.0111-,0.0037) |
| 5 | No | Yes | (4.2661,2.4402) | (0.0011,0.0018) |
| 6 | No | Yes | (4.2704,2.4389) | (0.0032,0.0005) |
| 7 | No | Yes | (4.2745,2.4373) | (0.0073,0.0011) |
| 8 | No | Yes | (4.2713,2.4357) | (0.0041,0.0027) |
| 9 | No | Yes | (4.2733,2.4366) | (0.0061,0.0018) |
| 10 | Yes | Yes | (4.1432,2.4231) | (-0.0124,-0.0153) |
| 11 | No | Yes | (4.2737,2.4405) | (0.0065,0.0021) |
| 12 | No | Yes | (4.2600,2.4387) | (0.0072,0.0003) |

**Test Report:**

The test is performed 12 times for different input waypoints and angles. The pass rate is 91.6%. We expect the robot to go through the bridge and then return back to the start point with limited error. From the tested output, we can see that most times the robot succeeds going through the bridge. However, there is one trial failed. In this trial, the robot’s tail hits the wall when trying to localize to the nearest point after passing the tunnel. But finally the robot still returns to the start point. Moreover, compared to returning to the red team region, we found that returning to the green team will produce larger translation errors. But the errors are still in the tolerable range. Overall, the robot performs favorably when returning back to the start point of the green team.

**Conclusion:** Fail

**Action:** Decrease the length of the hardware model.

**Distribution:** software development

**Test 4**

**Date :** 2021/3/24

**Tester:** Shichang Zhang

**Author:** Shichang Zhang

**Hardware version:** 1.5 (in Part 2.5 of [Hardware Document](https://docs.google.com/document/d/11jkA_S_xBqyCbcn2NyMuM-OMDEybDfRy/edit#))

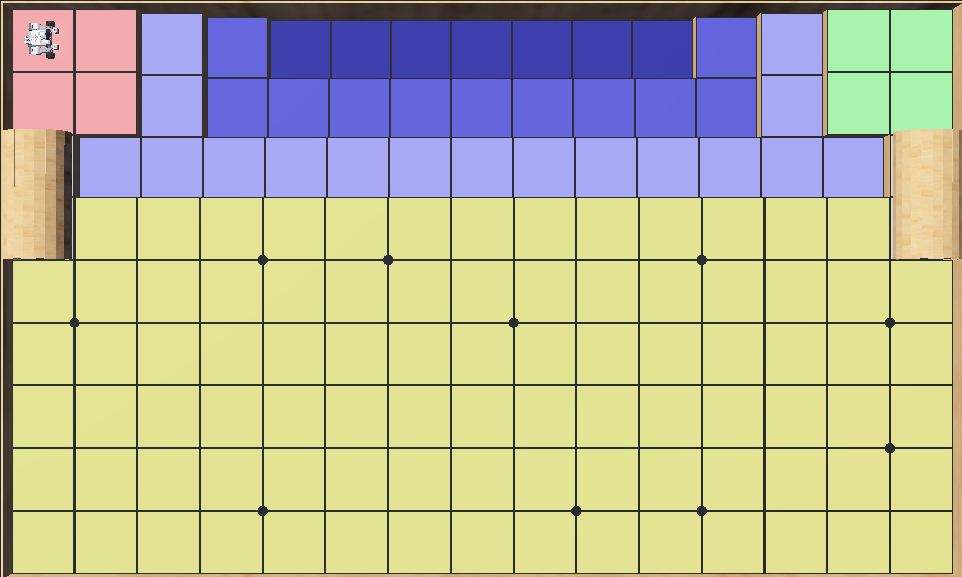
**Software version:** 1.6 (in Part 7.0 of [Software Document](https://docs.google.com/document/d/19JaY5629aUu4Y4rjoQJ-jWyeQLqNSAcr/edit))

**Test Purpose:**

Determine whether the robot can go back to the green team start point from the island.

**Test Procedure:**

Test map:



We will place the robot at the input waypoint before going back to the start point with the input angle. We expect the robot to navigate to the bridge and go across the bridge and return to the start point (14,8) with limited error.

1. Bridge is localized at (14,5) to (15,7)
2. The robot is placed at input coordinate, which is the waypoint before travelling back.
3. The robot is set to be oriented to the input angle.
4. Set the forward speed of the robot to be 500, rotate speed to be 200.
5. Pass the parameters related to the start region to the robot (i.e. GREEN\_LL, GREEN\_UR).
6. Start the odometer.
7. Set the odometer parameters according to the input coordinates and angle.
8. Start the program.
9. Record whether the robot hits the bridge.
10. Record whether the robot successfully stops at the start point (14,8), (4.2672,2.4384) in meters.
11. Stop the program. Record the final translation value indicated by the webot.

**Test Data:**

|  |  |  |
| --- | --- | --- |
| Trial# | Waypoint (ft,ft) | Angle (deg) |
| 1 | (14,4) | 0 |
| 2 | (14,4) | 90 |
| 3 | (14,4) | 240 |
| 4 | (13,4) | 30 |
| 5 | (13,4) | 90 |
| 6 | (13,4) | 225 |
| 7 | (13,2) | 60 |
| 8 | (13,2) | 135 |
| 9 | (13,2) | 330 |
| 10 | (11,1) | 75 |
| 11 | (11,1) | 195 |
| 12 | (11,1) | 270 |

**Expected Result:**

|  |  |  |  |
| --- | --- | --- | --- |
| Trial# | Hit Bridge | Stop at Waypoint | Translation (m,m) |
| 1 | No | Yes | (4.2672,2.4384) |
| 2 | No | Yes | (4.2672,2.4384) |
| 3 | No | Yes | (4.2672,2.4384) |
| 4 | No | Yes | (4.2672,2.4384) |
| 5 | No | Yes | (4.2672,2.4384) |
| 6 | No | Yes | (4.2672,2.4384) |
| 7 | No | Yes | (4.2672,2.4384) |
| 8 | No | Yes | (4.2672,2.4384) |
| 9 | No | Yes | (4.2672,2.4384) |
| 10 | No | Yes | (4.2672,2.4384) |
| 11 | No | Yes | (4.2672,2.4384) |
| 12 | No | Yes | (4.2672,2.4384) |

**Test Results:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Trial# | Hit Bridge | Stop at Waypoint | Translation (m,m) | Error (m,m) |
| 1 | No | Yes | (4.2706,2.4427) | (0.0034,0.0043) |
| 2 | No | Yes | (4.2731,2.4352) | (0.0059,-0.0032) |
| 3 | No | Yes | (4.2761,2.4398) | (0.0089,0.0014) |
| 4 | No | Yes | (4.2715,2.4421) | (0.0043,0.0037) |
| 5 | No | Yes | (4.2745,2.4369) | (0.0073,-0.0015) |
| 6 | No | Yes | (4.2756,2.4418) | (0.0084,0.0034) |
| 7 | No | Yes | (4.2774,2.4374) | (0.0102,-0.0010) |
| 8 | No | Yes | (4.2762,2.4381) | (0.0091,-0.0003) |
| 9 | No | Yes | (4.2759,2.4409) | (0.0087,0.0025) |
| 10 | No | Yes | (4.2735,2.4397) | (0.0063,0.0013) |
| 11 | No | Yes | (4.2753,2.4393) | (0.0081,0.0009) |
| 12 | No | Yes | (4.2721,2.4402) | (0.0049,0.0018) |

**Test Report:**

The test is performed 12 times for different input waypoints and angles. The pass rate is 100%. We expect the robot to go through the bridge and then return back to the start point with limited error. From the tested output, we can see that most times the robot succeeds returning back to the start point. Also, the final translation error is tolerable, the euclidean distance errors are within 3cm range. Overall, the robot performs favorably when returning back to the start point of the green team.

**Conclusion:** Pass

**Action:** None

**Distribution:** Software Development