Go Under Overpass

**Test 1**

**Date :** 2021/3/21

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

**Test Purpose:**

Determine whether the robot can correctly go through the bottom of the overpass when using hard code.

**Test Procedure:**

We will place the robot at (8,4), the waypoint that before going through the bottom of the overpass. We expect the robot to go through the bottom of the overpass without hitting the overpass and travel to the input next waypoint.

1. The robot is placed at coordinate (8,4), that is (2.4384,1.2192) in meters, which is the waypoint before travelling through the overpass bottom.
2. The start point of overpass is (5,4), the end point is (9,2)
3. Set the forward speed of the robot to be 500, rotate speed to be 200.
4. Pass the parameters related to the overpass to the robot (i.e. OP\_A, OP\_B).
5. Pass the next waypoint as input data. The input data should ask the robot to go through the bottom of the overpass.
6. Call the travelTo() method to travel to the next waypoint.
7. Record whether the robot hits the overpass.
8. Record whether the robot successfully stops at the input waypoint.
9. Stop the program.
10. Print the final translation value indicated by the webot.

**Test Data:**

|  |  |
| --- | --- |
| Trial# | Next Waypoint (ft,ft) |
| 1 | (4,1) |
| 2 | (4,1) |
| 3 | (6,2) |
| 4 | (5,2) |
| 5 | (4,2) |

**Expected Result:**

|  |  |  |  |
| --- | --- | --- | --- |
| Trial# | Hit Overpass | Stop at Waypoint | Translation (m,m) |
| 1 | No | Yes | (1.2192,0.3048) |
| 2 | No | Yes | (1.2192,0.3048) |
| 3 | No | Yes | (1.8288,0.6096) |
| 4 | No | Yes | (1.5240,0.6096) |
| 5 | No | Yes | (1.2192,0.6096) |

**Test Results:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Trial# | Hit Overpass | Stop at Waypoint | Translation (m,m) | Error (m,m) |
| 1 | Yes | No | (2.3470,0.9754) | (1.1278,0.6706) |
| 2 | Yes | No | (2.3274,0.9601) | (1.1082,0.6533) |
| 3 | Yes | No | (2.0574,0.8534) | (0.2286,0.2438) |
| 4 | Yes | No | (2.0437,0.8412) | (0.5197,0.2316) |
| 5 | Yes | No | (2.0506,0.8322) | (0.8314,0.2226) |

**Test Report:**

The test is performed 5 times for different input waypoints. We expect the robot to go through the bottom of the overpass and travel to the waypoint with limited error. From the tested output, we can see that the robot failed to go through the overpass. The robot always hit the overpass when it travelled through the overpass bottom. Overall, the robot failed to travel from a waypoint from right of the overpass to the left of the overpass when it is required to go through the bottom of the overpass.

**Conclusion:** Fail

**Action:** Design a special software algorithm for this requirement.

**Distribution:** software development

**Test 2**

**Date :** 2021/3/22

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

**Test Purpose:**

Determine whether the robot can correctly go through the bottom of the overpass when using hard code.

**Test Procedure:**

We will place the robot at (8,4), the waypoint that before going through the bottom of the overpass. We expect the robot to go through the bottom of the overpass without hitting the overpass and travel to the input next waypoint.

1. The robot is placed at coordinate (8,4), that is (2.4384,1.2192) in meters, which is the waypoint before travelling through the overpass bottom.
2. The start point of overpass is (5,4), the end point is (9,2)
3. Set the forward speed of the robot to be 500, rotate speed to be 200.
4. Pass the parameters related to the overpass to the robot (i.e. OP\_A, OP\_B).
5. Pass the next waypoint as input data. The input data should ask the robot to go through the bottom of the overpass.
6. Call the travelTo() method to travel to the next waypoint.
7. Record whether the robot hits the overpass.
8. Record whether the robot successfully stops at the input waypoint.
9. Stop the program.
10. Print the final translation value indicated by the webot.

**Test Data:**

|  |  |
| --- | --- |
| Trial# | Next Waypoint (ft,ft) |
| 1 | (4,1) |
| 2 | (4,1) |
| 3 | (6,2) |
| 4 | (5,2) |
| 5 | (4,2) |

**Expected Result:**

|  |  |  |  |
| --- | --- | --- | --- |
| Trial# | Hit Overpass | Stop at Waypoint | Translation (m,m) |
| 1 | No | Yes | (1.2192,0.3048) |
| 2 | No | Yes | (1.2192,0.3048) |
| 3 | No | Yes | (1.8288,0.6096) |
| 4 | No | Yes | (1.5240,0.6096) |
| 5 | No | Yes | (1.2192,0.6096) |

**Test Results:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Trial# | Hit Overpass | Stop at Waypoint | Translation (m,m) | Error (m,m) |
| 1 | No | Yes | (1.2276,0.3084) | (0.0084,0.0036) |
| 2 | No | Yes | (1.2224,0.3089) | (0.0032,0.0041) |
| 3 | No | Yes | (1.8286,0.6122) | (-0.0002,0.0026) |
| 4 | No | Yes | (1.5207,0.6107) | (-0.0033,0.0011) |
| 5 | No | Yes | (1.2215,0.6082) | (0.0023,-0.0014) |

**Test Report:**

The test is performed 5 times for different input waypoints. We expect the robot to go through the bottom of the overpass and travel to the waypoint with limited error. From the tested output, we can see that the robot successfully went through the overpass and travelled to the waypoint. Furthermore, we asserted waypoints that are far from the overpass bottom (i.e. waypoint (4,1)) and we observed that the final errors are very small. The robot can reach the waypoint with small euclidean distance errors and angle errors. Overall, the robot performs favorably when it travels from a waypoint from right of the overpass to the left of the overpass when it is required to go through the bottom of the overpass.

**Conclusion:** Pass

**Action:** The algorithm is hard code. Need to develop a general algorithm for this function.

**Distribution:** software development

**Test 3**

**Date :** 2021/3/22

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

**Test Purpose:**

Determine whether the robot can correctly go through the bottom of the overpass when using hard code.

**Test Procedure:**

We will place the robot at (4,1), the waypoint that before going through the bottom of the overpass. We expect the robot to go through the bottom of the overpass without hitting the overpass and travel to the input next waypoint.

1. The robot is placed at coordinate (4,1), that is (1.2192,0.3048) in meters, which is the waypoint before travelling through the overpass bottom.
2. The start point of overpass is (5,4), the end point is (9,2)
3. Set the forward speed of the robot to be 500, rotate speed to be 200.
4. Pass the parameters related to the overpass to the robot (i.e. OP\_A, OP\_B).
5. Pass the next waypoint as input data. The input data should ask the robot to go through the bottom of the overpass.
6. Call the travelTo() method to travel to the next waypoint.
7. Record whether the robot hits the overpass.
8. Record whether the robot successfully stops at the input waypoint.
9. Stop the program.
10. Print the final translation value indicated by the webot.

**Test Data:**

|  |  |
| --- | --- |
| Trial# | Next Waypoint (ft,ft) |
| 1 | (8,4) |
| 2 | (8,4) |
| 3 | (8,5) |
| 4 | (9,4) |
| 5 | (9,5) |

**Expected Result:**

|  |  |  |  |
| --- | --- | --- | --- |
| Trial# | Hit Overpass | Stop at Waypoint | Translation (m,m) |
| 1 | No | Yes | (2.4384,1.2192) |
| 2 | No | Yes | (2.4384,1.2192) |
| 3 | No | Yes | (2.4384,1.524) |
| 4 | No | Yes | (2.7432,1.2192) |
| 5 | No | Yes | (2.7432,1.524) |

**Test Results:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Trial# | Hit Overpass | Stop at Waypoint | Translation (m,m) | Error (m,m) |
| 1 | No | Yes | (2.4406,1.2148) | (0.0022,-0.0044) |
| 2 | No | Yes | (2.4353,1.2188) | (-0.0031,-0.0004) |
| 3 | No | Yes | (2.432,1.5256) | (-0.0064,0.0016) |
| 4 | No | Yes | (2.7497,1.2197) | (0.0065,0.0005) |
| 5 | No | Yes | (2.7473,1.5204) | (0.0041,-0.0036) |

**Test Report:**

The test is performed 5 times for different input waypoints. We expect the robot to go through the bottom of the overpass and travel to the waypoint with limited error. From the tested output, we can see that the robot successfully went through the overpass and travelled to the waypoint. Furthermore, we observed that the final errors are very small. Overall, the robot performs favorably when it travels from a waypoint from left of the overpass to the right of the overpass when it is required to go through the bottom of the overpass.

**Conclusion:** Pass

**Action:** The algorithm is hard code. Need to develop a general algorithm for this function.

**Distribution:** software development

**Test 4**

**Date :** 2021/4/4

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

**Test Purpose:**

Determine whether the robot can correctly go through the bottom of the overpass.

**Test Procedure:**

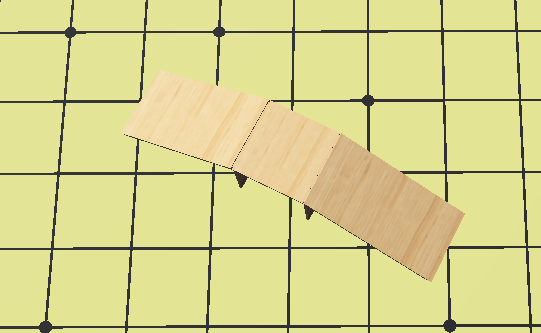


Figure 4.1 The overpass position

The bridge’s two endpoints are (5,4) and (9,2).

We will place the robot at (8,4), the waypoint that before going through the bottom of the overpass. We expect the robot to go through the bottom of the overpass without hitting the overpass and travel to the input next waypoint.

1. The robot is placed at coordinate (8,4), that is (2.4384,1.2192) in meters, which is the waypoint before travelling through the overpass bottom.
2. The start point of overpass is (5,4), the end point is (9,2)
3. Set the forward speed of the robot to be 500, rotate speed to be 200.
4. Pass the parameters related to the overpass to the robot (i.e. OP\_A, OP\_B).
5. Pass the next waypoint as input data. The input data should ask the robot to go through the bottom of the overpass.
6. Call the travelTo() method to travel to the next waypoint.
7. Record whether the robot hits the overpass.
8. Record whether the robot successfully stops at the input waypoint.
9. Stop the program.
10. Print the final translation value indicated by the webot.

**Test Data:**

|  |  |
| --- | --- |
| Trial# | Next Waypoint (ft,ft) |
| 1 | (4,1) |
| 2 | (4,1) |
| 3 | (6,2) |
| 4 | (5,2) |
| 5 | (4,2) |

**Expected Result:**

|  |  |  |  |
| --- | --- | --- | --- |
| Trial# | Hit Overpass | Stop at Waypoint | Translation (m,m) |
| 1 | No | Yes | (1.2192,0.3048) |
| 2 | No | Yes | (1.2192,0.3048) |
| 3 | No | Yes | (1.8288,0.6096) |
| 4 | No | Yes | (1.5240,0.6096) |
| 5 | No | Yes | (1.2192,0.6096) |

**Test Results:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Trial# | Hit Overpass | Stop at Waypoint | Translation (m,m) | Error (m,m) |
| 1 | No | Yes | (1.2224,0.3071) | (0.0032,0.0023) |
| 2 | No | Yes | (1.2234,0.3109) | (0.0042,0.0061) |
| 3 | No | Yes | (1.8294,0.6128) | (0.0006,0.0032) |
| 4 | No | Yes | (1.5281,0.6122) | (0.0041,0.0026) |
| 5 | No | Yes | (1.2256,0.6140) | (0.0064,-0.0044) |

**Test Report:**

The test is performed 5 times for different input waypoints. We expect the robot to go through the bottom of the overpass and travel to the waypoint with limited error. The pass rate is 100.0%. From the tested output, we can see that the robot successfully went through the overpass and travelled to the waypoint. Overall, the robot performs favorably when it travels from a waypoint from right of the overpass to the left of the overpass when it is required to go through the bottom of the overpass.

**Conclusion:** Pass

**Action:** None

**Distribution:** software development

**Test 5**

**Date :** 2021/4/4

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

**Test Purpose:**

Determine whether the robot can correctly go through the bottom of the overpass.

**Test Procedure:**

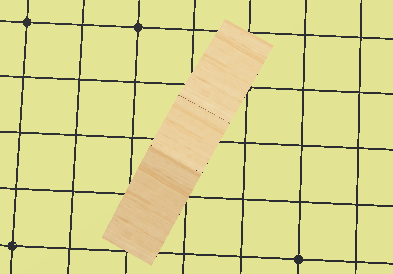


Figure 4.1 The overpass position

The bridge’s two endpoints are (6,1) and (8,5).

We will place the robot at (8,4), the waypoint that before going through the bottom of the overpass. We expect the robot to go through the bottom of the overpass without hitting the overpass and travel to the input next waypoint.

1. The robot is placed at coordinate (8,4), that is (2.4384,1.2192) in meters, which is the waypoint before travelling through the overpass bottom.
2. The start point of overpass is (6,1), the end point is (8,5)
3. Set the forward speed of the robot to be 500, rotate speed to be 200.
4. Pass the parameters related to the overpass to the robot (i.e. OP\_A, OP\_B).
5. Pass the next waypoint as input data. The input data should ask the robot to go through the bottom of the overpass.
6. Call the travelTo() method to travel to the next waypoint.
7. Record whether the robot hits the overpass.
8. Record whether the robot successfully stops at the input waypoint.
9. Stop the program.
10. Print the final translation value indicated by the webot.

**Test Data:**

|  |  |
| --- | --- |
| Trial# | Next Waypoint (ft,ft) |
| 1 | (9,1) |
| 2 | (9,2) |
| 3 | (9,3) |
| 4 | (11,2) |
| 5 | (11,1) |

**Expected Result:**

|  |  |  |  |
| --- | --- | --- | --- |
| Trial# | Hit Overpass | Stop at Waypoint | Translation (m,m) |
| 1 | No | Yes | (2.7432,0.3048) |
| 2 | No | Yes | (2.7432,0.6096) |
| 3 | No | Yes | (2.7432,0.9144) |
| 4 | No | Yes | (3.3528,0.6096) |
| 5 | No | Yes | (3.2528,0.3048) |

**Test Results:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Trial# | Hit Overpass | Stop at Waypoint | Translation (m,m) | Error (m,m) |
| 1 | Yes | No | (1.8898,0.9022) | (0.8534,0.5974) |
| 2 | Yes | No | (1.8692,0.9003) | (0.8740,0.2907) |
| 3 | Yes | No | (2.0014,0.7830) | (0.7418,0.1314) |
| 4 | Yes | No | (1.8801,0.8943) | (1.4727,0.2847) |
| 5 | Yes | No | (2.2387,0.7646) | (1.1141,0.4598) |

**Test Report:**

The test is performed 5 times for different input waypoints. We expect the robot to go through the bottom of the overpass and travel to the waypoint with limited error. The pass rate is 0%. From the tested output, we can see that the robot hit the overpass every time and failed to go through the bottom of the overpass. Actually, each time the robot fails to acknowledge that there is an overpass and it should have some actions to handle the condition. It is due to the path manager’s failure. Overall, the robot fails to travel from a waypoint from left of the overpass to the right of the overpass when it is required to go through the bottom of the overpass.

**Conclusion:** Fail

**Action:** Improve the path manager.

**Distribution:** software development

**Test 6**

**Date :** 2021/4/5

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

**Test Purpose:**

Determine whether the robot can correctly go through the bottom of the overpass.(red team)

**Test Procedure:**

We expect the robot to go through the bottom of the overpass without hitting the overpass and travel to the input next waypoint.

1. The robot is placed at input current waypoint, which is the waypoint before travelling through the overpass bottom.
2. The overpass is placed according to the input overpass endpoints.
3. Set the forward speed of the robot to be 500, rotate speed to be 200.
4. Pass the parameters related to the overpass to the robot (i.e. OP\_A, OP\_B).
5. Pass the next waypoint as input data. The input data should ask the robot to go through the bottom of the overpass.
6. Call the travelTo() method to travel to the next waypoint.
7. Record whether the robot hits the overpass.
8. Record whether the robot successfully stops at the input waypoint.
9. Stop the program.
10. Print the final translation value indicated by the webot.

**Test Data:**

|  |  |  |  |
| --- | --- | --- | --- |
| Trial# | Current Waypoint (ft,ft) | Next Waypoint (ft,ft) | Overpass endpoints (ft,ft) |
| 1 | (8,4) | (4,1) | (5,4),(9,2) |
| Figure 6.1 The navigation path on the island of trial 1 | | |
| 2 | (5,5) | (9,1) | (6,1),(8,5) |
| Figure 6.2 The navigation path on the island of trial 2 | | |
| 3 | (8,4) | (11,1) | (10,1),(12,5) |
| Figure 6.3 The navigation path on the island of trial 3 | | |
| 4 | (11,5) | (11,1) | (7.5,3),(12,3) |
| Figure 6.4 The navigation path on the island of trial 4 | | |
| 5 | (6,5) | (10,4) | (8,1.5),(8,5.5) |
| Figure 6.5 The navigation path on the island of trial 5 | | |

**Expected Result:**

|  |  |  |  |
| --- | --- | --- | --- |
| Trial# | Hit Overpass | Stop at Next Waypoint | Translation (m,m) |
| 1 | No | Yes | (1.2192,0.3048) |
| 2 | No | Yes | (2.7432,0.3048) |
| 3 | No | Yes | (3.3528,0.3048) |
| 4 | No | Yes | (3.3528,0.3048) |
| 5 | No | Yes | (3.0480,1.2192) |

**Test Results:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Trial# | Hit Overpass | Stop at Next Waypoint | Translation (m,m) | Error (m,m) |
| 1 | No | Yes | (1.2267,0.3093) | (0.0075,0.0045) |
| 2 | No | Yes | (2.7469,0.3076) | (0.0037,0.0028) |
| 3 | No | Yes | (3.3557,0.3090) | (0.0029,0.0042) |
| 4 | No | Yes | (3.3569,0.3104) | (0.0041,0.0056) |
| 5 | No | Yes | (3.0522,1.2246) | (0.0042,0.0054) |

**Test Report:**

The test is performed 5 times for different input waypoints. The pass rate is 100.0%. We expect the robot to go through the bottom of the overpass and travel to the waypoint with limited error. From the tested output, we can see that the robot now can confirm that it should go underpass at some points. And then the robot will call the corresponding methods to handle the condition. Finally, the robot goes through the bottom of the overpass successfully. Overall, the robot is able to travel through the bottom of the overpass.

**Conclusion:** Pass

**Action:** Test green team condition

**Distribution:** software development

**Test 7**

**Date :** 2021/4/5

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

**Test Purpose:**

Determine whether the robot can correctly go through the bottom of the overpass.(green team)

**Test Procedure:**

We expect the robot to go through the bottom of the overpass without hitting the overpass and travel to the input next waypoint.

1. The robot is placed at input current waypoint, which is the waypoint before travelling through the overpass bottom.
2. The overpass is placed according to the input overpass endpoints.
3. Set the forward speed of the robot to be 500, rotate speed to be 200.
4. Pass the parameters related to the overpass to the robot (i.e. OP\_A, OP\_B).
5. Pass the next waypoint as input data. The input data should ask the robot to go through the bottom of the overpass.
6. Call the travelTo() method to travel to the next waypoint.
7. Record whether the robot hits the overpass.
8. Record whether the robot successfully stops at the input waypoint.
9. Stop the program.
10. Print the final translation value indicated by the webot.

**Test Data:**

|  |  |  |  |
| --- | --- | --- | --- |
| Trial# | Current Waypoint (ft,ft) | Next Waypoint (ft,ft) | Overpass endpoints (ft,ft) |
| 1 | (8,4) | (4,1) | (5,4),(9,2) |
| Figure 7.1 The navigation path on the island of trial 1 | | |
| 2 | (6,5) | (9,1) | (5,2),(9,4) |
| Figure 7.2 The navigation path on the island of trial 2 | | |
| 3 | (6,4) | (9,1) | (6,1),(8,5) |
| Figure 7.3 The navigation path on the island of trial 3 | | |
| 4 | (8,4) | (9,1) | (5,3),(10,3) |
| Figure 7.4 The navigation path on the island of trial 4 | | |
| 5 | (7,4) | (11,3) | (8,2),(8,5) |
| Figure 7.5 The navigation path on the island of trial 5 | | |

**Expected Result:**

|  |  |  |  |
| --- | --- | --- | --- |
| Trial# | Hit Overpass | Stop at Next Waypoint | Translation (m,m) |
| 1 | No | Yes | (1.2192,0.3048) |
| 2 | No | Yes | (2.7432,0.3048) |
| 3 | No | Yes | (2.7432,0.3048) |
| 4 | No | Yes | (2.7432,0.3048) |
| 5 | No | Yes | (3.3528,0.9144) |

**Test Results:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Trial# | Hit Overpass | Stop at Next Waypoint | Translation (m,m) | Error (m,m) |
| 1 | No | Yes | (1.2213,0.3080) | (0.0021,0.0032) |
| 2 | No | Yes | (2.7488,0.3095) | (0.0056,0.0047) |
| 3 | No | Yes | (2.7448,0.3069) | (0.0016,0.0021) |
| 4 | No | Yes | (2.7484,0.3090) | (0.0052,0.0042) |
| 5 | No | Yes | (3.3567,0.9192) | (0.0039,0.0048) |

**Test Report:**

The test is performed 5 times for different input waypoints. The pass rate is 100.0%. We expect the robot to go through the bottom of the overpass and travel to the waypoint with limited error. From the tested output, we can see that the robot is also able to calculate the points that need to perform underpass action according to the new arranging points for the green team. Overall, the robot is able to go through the bottom of the overpass.

**Conclusion:** Pass

**Action:** Test green team condition

**Distribution:** software development