

Test Document

Project: LIBERTY

Task: Dismounting Test

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1.0 TEST

Test: Dismounting from the Zip-line

Date: 18/11/2017

Tester: Xijun Liu

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- 1) The purpose of this test is to determine whether the robot can dismount from the zip-line successfully.
- 2) One objective of this test is to determine whether the robot can dismount from the zip-line.
- 3) First, place the robot on the start-side of the zip-line. Then, run the test code. After the robot finish traversing, record the final result.
- 4) The expected result is that the robot should be able to dismount from the zip-line successfully.
- 5) Results:

Trial	starting point (60.96cm, 152.40cm)		
	Successful or not		
1	yes		
2	yes		
3	yes		
4	yes		
5	yes		
6	yes		
7	yes		
8	yes		
9	yes		
10	yes		

Figure 1: Testing Result of dismounting from the zip-line

- 6) From **Figure 1**, it can be observed that all of the trials can dismount from the zip-line successfully, which is perfectly under estimation.
- 7) As the actual results meet with the estimated results, should not make changes.

Test: Localization after Dismounting from the Zip-line

Date: 19/11/2017

Tester: Xijun Liu

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- 1) The purpose of this test is to determine whether the robot can localize itself accurately after dismounting from the zip-line.
- 2) One objective of this test is to determine whether the robot can localize successfully can travel to point (182.88cm, 152.40cm) with final direction angle 90 degrees.
- 3) First, place the robot on the start-side of the zip-line. Then, run the zip-line code. After the robot finish traversing, record the final result. Next, run the localization code. Record the final position of the robot and calculate the differences between x-position, y-position and angle theta with 182.88cm, 152.40 cm and 90 degrees respectively.
- 4) The absolute value of the differences between the actual results and the estimated results of x-axis, y-axis and theta should be within 3cm, 3cm and 5 degrees, respectively.
- 5) Results:

Trial	starting point (60.96cm, 152.40cm)			
	Successful or not	x(+/-1cm)	y(+/-1cm)	theta(+/-1deg)
1	yes	183.58	153.40	94.80
2	yes	183.18	152.60	93.4
3	yes	182.78	152.80	96.5
4	yes	183.88	153.60	94.2
5	yes	184.98	152.80	87.1
6	yes	183.78	153.70	93.8
7	yes	184.38	153.10	94.7
8	yes	182.48	152.90	94.4
9	yes	183.58	152.80	93.9
10	yes	183.48	153.2	87.4

Figure 2: Testing Result of localization after Dismounting from the Zip-line

Trial	Offset		
	x(+/-1cm)	y(+/-1cm)	theta(+/-1deg)
1	0.7	1	4.8
2	0.3	0.2	3.4
3	0.1	0.4	6.5
4	1.0	1.2	4.2
5	2.1	0.4	2.9
6	0.9	0.3	3.8
7	1.5	0.7	4.7
8	0.4	0.5	4.4
9	0.7	0.4	3.9
10	0.6	0.8	2.6
average	0.83	0.59	4.12
standard deviation	0.596	0.325	1.106

Figure 3: Position and Theta differences between Actual Position and (182.88cm, 152.40cm)

- 6) The data in **Figure 2** shows the final position and the angle theta of the robot after localization. Meanwhile the differences between the actual position and the expected position are shown in **Figure 3**. It can be obtained that the averages of the differences of x-position, y-position and theta are all within the tolerance.
- 7) The overall results are ideal. However, if one of the color sensor detects the robot immediately after dismounting off the zip-line, the localization might fail.

The average (AM) was calculated by using the following formula

$$Average = \frac{1}{n} \sum_{i=1}^n a_i = \frac{1}{n} (a_1 + a_2 + \dots + a_n)$$

We use the sample standard deviation formula (see below) to calculate the sample standard deviation.

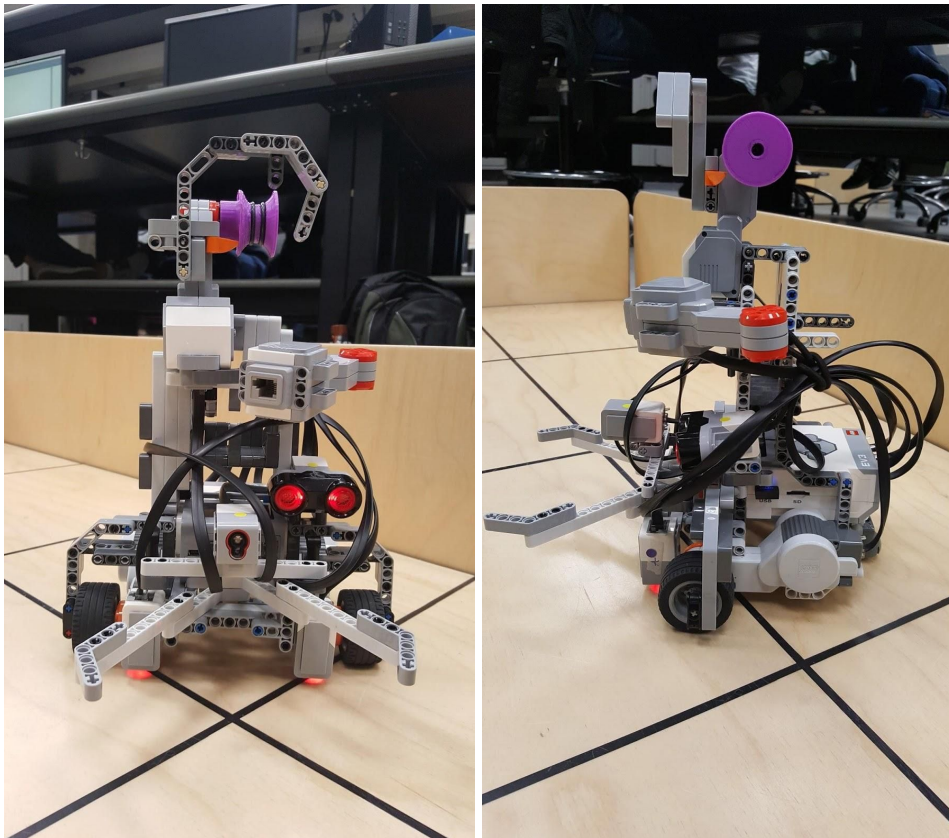
$$s = \sqrt{\frac{1}{N-1} \sum_{i=1}^N (x_i - \bar{x})^2}$$

\bar{x} = Mean

N = Sample size

$x_i = \text{Sample at } i$

2.0 HARDWARE



See *HARDWARE - 2.0*

3. Source Code used

See github group repository at commit: 941f1c2c2ba3f6c1ed7a9073f08fd72fd2747e2e