Week 7- Speed testing

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Software Version: V3.1

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Goal: Searching potential factors that can effect the speed of the robot

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PURPOSE

To ensure the robot can drive at a desired speed.

OBJECTIVES

The speed of the robot ideally is expected to be the same as the calculated values. However, there are always factors that will effect the performance of the motors. This test is about searching possibilities that may cause a impact on the speed of the robot, such as the battery level, the friction between the wheels and the ground, etc. In the meantime, come up potential solutions to reduce errors as much as possible.

PROCEDURE

1. Set the wheel radius to 2.0cm

2. Set the speed to 300 deg/s

3. Drive the robot for 10 seconds with fully charged batteries

4. Measure the distance, compare the actual distance with the calculated distance

5 . Set the speed to 250deg/s

1. Repeat step 3,4

7. Set the speed to 200deg/s

8. Repeat step 3,4

9 Set the speed to 150deg/s

10 . Repeat step 3,4

11. Repeat all steps with low level batteries

EXPECTED RESULTS

With fulled charged batteries, robot is expected to drive as the desired speed. However, consider the force of friction and also the weight of the robot. The actual speed might be lower.

The level of battery is a crucial factor that effect the performance of the robot. With low level battery the robot is expected to travel a shorter distance with the same speed.

FORMAT OF OUTPUT REQUIRED

Fulled charged batteries

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Distance traveled (cm )  Speed(degree/s) | 300 | 250 | 200 | 150 |
| 1 | 93.4 | 80.2 | 58.3 | 43.3 |
| 2 | 95.7 | 78.3 | 59.6 | 42.8 |
| 3 | 96.3 | 78.7 | 59.2 | 42.7 |
| 4 | 96.7 | 78.2 | 59.1 | 43.1 |
| 5 | 96.4 | 78.4 | 59.7 | 42.8 |

10 percent charged batteries

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Distance traveled (cm )  Speed (degree/s) | 300 | 250 | 200 | 150 |
| 1 | 80.2 | 66.2 | 43.5 | 33.2 |
| 2 | 83.1 | 68.6 | 43.8 | 31.4 |
| 3 | 80.1 | 65.4 | 44.2 | 30.6 |
| 4 | 78.6 | 64.2 | 44.7 | 30.8 |
| 5 | 79.4 | 67.7 | 43.7 | 33.4 |

Fulled charged battery

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Speed(deg/s)  Theo D- Act D(cm) | 1 | 2 | 3 | 4 | 5 |
| 300 | 11.3 | 9.0 | 8.4 | 8.0 | 8.3 |
| 250 | 7.1 | 9.0 | 8.6 | 9.1 | 8.9 |
| 200 | 11.5 | 10.2 | 10.6 | 10.7 | 10.1 |
| 150 | 9.1 | 9.6 | 9.7 | 9.3 | 9.6 |

20 percent charged battery

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Speed(deg/s)  Theo D- Act D(cm) | 1 | 2 | 3 | 4 | 5 |
| 300 | 24.5 | 21.6 | 24.6 | 26.1 | 25.3 |
| 250 | 21.1 | 18.7 | 21.9 | 23.1 | 19.6 |
| 200 | 26.3 | 26.0 | 25.6 | 25.1 | 26.1 |
| 150 | 19.2 | 21.0 | 21.8 | 21.6 | 19.0 |

SAMPLE CALCULATIONS

Distance=Rotational Speed\*2\*pi\*Radius\*time

Ex. (300/360)rad/s\*2\*pi\*2\*10sec=104.7

Difference= Theoretical Distance - Measured Distance

Ex. When speed is 300rad/s Difference=104.7-93.4=11.3

Mean value=

|  |  |  |
| --- | --- | --- |
| Fulled charged | Average difference | Standard Deviation |
| 300 | 9.0 | 1.33604 |
| 250 | 8.54 | 0.82644 |
| 200 | 10.62 | 0.55408 |
| 150 | 9.46 | 0.251 |

|  |  |  |
| --- | --- | --- |
| 20 percent charged | Average difference | Standard Deviation |
| 300 | 24.42 | 1.70206 |
| 250 | 20.88 | 1.76125 |
| 200 | 25.82 | 0.47645 |
| 150 | 20.52 | 1.33116 |

TEST REPORT

With different speed, the actual distance is always shorter than the theoretical values. To achieve a desired speed the theoretical speed need to be higher than the actual value. From the calculation, it is obvious to see the robot will not function properly under a low battery level. In addition, driving a long path can not reduce the errors on speed caused by mechanical design.

CONCLUSION

Make the robot drive faster will not reduce the impact of the friction.

The actual distance is always shorter than the desired distance is caused by the outside environment , and mechanical design, such as the weight of the robot, the friction between the robot and the floor and etc. In the future testings, always test the robot under the same environment, ensure the floor is clean, the wheels are tight enough.

When the batteries die out, it has a significant impact on the performance of the robot. Therefore, never test the robot with low level batteries. Refer to Battery vs Performance Test under Tests in Week 6 for more information.

ACTION

1. Running the robot with high level batteries in the future testings
2. Use fully charged battery in the final competition to achieve the best performance

3. Retest all numerical values when there is an adjustment on hardware

DISTRIBUTION

Further improvement on software, numerical analysis