

WHEELS TEST 2

GROUP 4

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Version 2

Abstract

This test further checked which wheel design works best. We are planning to test tireless rims and large gears. Rear wheel drive improved robot's movement/navigation and it helped crossing the discontinuities. The large gear with tape design performed best.

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1 BACKGROUND

1.1 Edit History

Mamoun Benchekroun, Richie Piyasirisilp: 2016-11-05, Initial set up and completion

Jake Zhu: 2016-11-15, Added abstract

Quentin Norris: 2016-12-01, Updated conclusion, procedure, and results to better reflect the tests being done.

Mamoun Benchekroun: 2016-12-01, Updated Procedure, Expected Results

1.2 Test Information

Tester: Mamoun Benchekroun, Richie Piyasirisilp

Author: Mamoun Benchekroun, Richie Piyasirisilp

Hardware Version: Wheel testing design 2

Software Version: SquareDriver.java 7b23256

2 GOAL

Find wheel design that will allow robot to drive over discontinuities in arena without deviating from original path. Design must also allow robot's wheels to rotate properly without error in odometry.

3 PROCEDURE

Setup:

1. Build a simple robot design with no sensors and interchangeable wheels. Switch wheels up
2. Attach different types of wheels to a rear wheel drive design - wheel designs specifically tireless rims without tape over the wheel, and with tape, and large gear.

Test:

1. Place the robot facing the discontinuities at an angle of 90 degrees
2. Attach a tireless rim as third wheel
3. Run SquareDriver.java

4. Replace the robot at an angle of 10 degrees less than the previous one
5. Repeat steps 1-4 until the starting angle facing the discontinuities is 0 degrees
6. Repeat steps 1-5 with taped tireless rims, large gear and taped large gear as third wheel
7. Repeat steps 1-5 with the best performing design with 3 EV3 bricks worth of weight

4 EXPECTED RESULT

The rear wheel drive design was expected to perform the same way as the front wheel drive designs. We expected that the tireless rims would provide more grip and cross discontinuities properly with no error. The structure of the large gear let us think that it would catch the discontinuities with its teeth and cross them easier. Furthermore, the tape cover was added in order to add more grip to the wheel without sacrificing turning accuracy for the gear and the tireless rim.

5 TEST REPORT

5.1 Rear wheel drive - Tireless rims as third wheel

1. Without tape on front wheel

The robot drove straight with no significant problems and turning did not require correction. It performed better than the other front wheel drive designs but still failed to overcome the discontinuities completely at angles ranging from 1 to 35 degrees.

2. With tape on front wheel

Driving was possible but turning was very difficult due to the increased friction exerted by the third wheel with tape on it. Rotations of 90 degrees became rotations of 60 degrees while offering no significant improvements at the discontinuities.

5.2 Rear wheel drive - Large gear as third wheel

1. Without tape on front gear

Performed very similarly to the first design without tape. No real improvements observed.

2. With tape on front gear

The increased friction made turning slightly inaccurate, turning at an angle of 70 degrees instead of 90 degrees. However, it overcame the discontinuities at all angles except at the 0 to 10 degrees range.

3. With tape on front gear and three EV3 bricks worth of weight

With the increased weight, the robot made 55 degree turns instead of the previous 70 degrees. The range of angles where it could not cross the discontinuities increased to 0 to 15 degrees. In the 12 to 15 range, the robot can cross the discontinuities but the error would progressively increase as the angle got closer to 12 degrees.

6 CONCLUSION

The switch to rear wheel drive improved all the different wheel designs in terms of crossing the discontinuities compared to their front wheel drive counterpart. Even though it is not perfect, the gear with tape design performed the best overall.

7 ACTION

7.1 Hardware

Since there is only one thin gear at the front of the vehicle, it would be beneficial for the final design to hold more weight at the back where there are two wheels supporting the lifting/pulling/aligning mechanisms.

7.2 Software

Due to the extra friction caused by the tape (to overcome discontinuities) the rotations are offset by approximately 35 degrees for a 90 degree turn so turning methods will have to account for this error.

8 DISTRIBUTION

Hardware team, software team