INITIAL WHEELS TEST

GROUP 4

2nd December 2016
Version 1

Abstract

The initial wheels test was designed to check which wheel design works best. The three designs in question are (i) the metal sphere (ii) the gear wheels (iii) the treads. The metal sphere is unreliable when crossing discontinuities because it can only overcome them at specific angles. Gear wheels are also unreliable but the range of angles at which it clips is quite smaller. The treads cause too much friction and inhibit the robot from turning properly and effectively, reaching the destination. Given these results, the best option so far is the gear wheels.

Contents

1 BACKGROUND

1.1 Edit History

Jake Zhu: Initial set up 28 Oct

Mamoun Benchekroun and Jake Zhu: Wrote out this document

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

1.2 Test Information

Tester: Richie and Mamoun

Author: Mamoun and Jake

Hardware Version: Locomotion with Different Types of Wheels

Software Version: SquareDriver.java 7b23256

2 GOAL

To see whether it is better to use treads, gears or wheels.

3 PROCEDURE

Setup:

1. Built a simple robot design with no sensors and interchangeable wheels
2. Attach different types of wheels: metal sphere, gear wheel or treads.
3. Place the robot at various angles facing the discontinuity gap.
4. Run SquareDriver.java

Tests:

1. Tested on the smaller boards in the labs to see if the robot would run
2. Ran SquareDriver.java on the big board in TR0090.

4 EXPECTED RESULT

We expected the metal sphere and the gear wheel to get stuck for a few milliseconds and therefore would slightly affect the odometer. For the treads, we expected that the robot would run smoother on the discontinuities but general locomotion would be less precise.

5 TEST REPORT

5.1 Metal Sphere

Any bumps or discrepancies in the arena do not halt the robots movement completely as long as it comes at an angle of 45 to 90 degrees to the discontinuity. The robot does take time (1/2 sec in the worst case) to overcome these and may potentially cause errors with the odometer. We originally did not know about this issue since SquareDriver.java always comes at an angle of 90 degrees to the discontinuities.

5.2 Gear Wheel

Comparatively, this design had the same accuracy for the odometer as the metal sphere. However, the range of angles at which it didn't clip was greater, being 25-90 degrees instead of 45-90 degrees.

5.3 Treads

1. Without tension bars
   - with normal rotation angles, it didnt perform properly. This is probably due to the difference in wheel design and structure. It turned about 70 degrees instead of 90.
   - the friction with the addition of the back wheel inhibited the robot from reaching the destination by approximately a 10x10cm square. **NOTE**: Not consistent because not tense enough, varying radius on same rotation therefore rotations differ at times
2. With tension bars
   - Extending the wheels distance b/n each other cause the tension bars to bend
3. Triangular
   - Doesnt physically work because the treads exert too much tension on the three wheels.

6 CONCLUSION

In conclusion, we decided that both the metal sphere and treads were not viable choices for the design due to their inaccuracies and unreliable perfermances. We concluded the optimal design so far is the gear wheel, however this requires several issues to be addressed such as crossing the discontinuity at smaller angles of around 0 degrees (parallel to discontinuity) to 25 degrees. The gear design seems to be the most promising.

7 ACTION

7.1 Metal Sphere

We cannot improve this design to overcome the discontinuities.

7.2 Gear Wheels

We could add rubber bands on the edge of the gears and cover them with rubber in order to increase the grip and possibly overcome discontinuities. There would be a trade off with the turning of the robot because of the increased grip.

7.3 Treads

We could increase the turning angle to offset the error. The only issue with that is the angle will be inaccurate on the odometer. We would have to compensate for this error in the odometer code. We could also increase the distance to travel in order to make up for error caused by the lack of friction between the treads and the wheel.

8 DISTRIBUTION

Software Team, Hardware Team