LOCALIZATION TEST

GROUP 4

2nd December 2016
Version 2

Abstract

This test verifies which of the bumper designs to use in the final hardware design to work best for localization. relies on several bumper designs. The tests for the designs showed us that the technique to use a flat bumper, spinning 360 degrees, bumping into the wall after getting the shortest distance, turning 90 degrees and bumping into the wall again worked best.

Contents

1 BACKGROUND

1.1 Edit History

Jake Zhu: 2016-10-28, Initial set up

Alexis Giguere-Joannette: 2016-11-06, work on conclusion, action and distribution sections

Alexis Giguere-Joannette: 2016-11-07, work on test report section

Kareem Halabi: 2016-11-20, Minor grammatical edits

Jake Zhu: 2016-11-24, Edited Procedure, Test Report, Conclusion and Action. Added abstract.

1.2 Test Information

Testers: Tristan and Alexis

Author: Tristan and Alexis

Hardware Version: Multiple Bumper Designs

Software Version: c95ffa1

2 GOAL

Our goal is to find a localization algorithm that is precise, fast and reliable.

3 PROCEDURE

Setup/Assumptions:

1. Assume there all the robots for the individual designs have been completed.
2. Assume that there is code written finish localization with each corresponding hardware design.

Test:

1. Place the robot at a 45 degree angle to see if any of the designs requires the robot to be at this location. **NOTE**: This is not applicable during the final demonstration because our robot can put put at any position inside the corner tile.
2. Upload the code onto the robot using WiFi or USB.

3. Click a button to tell it to start localizing
4. Time it to make sure that it is within the 30 second requirement
5. Record the final position of the robot
6. Repeat steps 1-5 9 times at the 45 degree angle
7. Repeat steps 1-5 10 times at any position in the corner tile to make sure that it can work under any circumstances.

4 EXPECTED RESULT

We expect all routines to be able to localize. We expect the two routines involving bumpers to perform best because it is less dependent of the environment of the map. In other words, we expect the falling edge and rising edge routine to fail when blocks are placed close to the localization corner. We expect all routines to localize under 30 seconds. The triangular bumper routine is expected to perform the best as it performs only one correction.

5 TEST REPORT

To test the following routines, we built a mini robot composed of 2 wheels, a light sensor, an ultrasonic sensor and a custom bumper depending on the localization routine. The machine is not representative of the final design but it was good enough to see how the localization algorithms were performing. The following parts describe qualitatively the test conduct by the software team on the localization routines. We will not conduct quantitative analysis of the localization until we have the final robot design.

5.1 Flat bumper

- The robot rotates 360 degrees and stores every distance seen by the ultrasonic sensor and the angle at which the distance was seen.
- Based off that, the robot backs into the wall, goes forward and then repeats the process in order to localize on the other wall in the corner.
- This algorithm never took more than 25 seconds to complete.
- It was simple, accurate and fast.
- The time taken to accomplish the localization is almost always the same as it needs to turn 360 degrees each time and bump into 2 walls.

5.2 Triangular bumper

- The triangular bumper would succeed only when the initial position of the robot was on or close to the 45 degrees
- If it was not on the 45 degree angle, the robot would get stuck on one of the walls or the bumper would not fit perfectly in the corner.

5.3 Rising Edge and Falling Edge

- The light localization should always take the same amount of time as it always scans four lines from a point.
- The time taken by the ultrasonic part of these routines varies depending on the initial position and orientation of the robot.
- The time taken by the ultrasonic part of these routines varies depending on the initial position and orientation of the robot. The ultrasonic part may take up to more than 20 seconds, which is two thirds of the time we have to localize.

6 CONCLUSION

- Flat bumper localization routine is the most precise and reliable routine of all four routines tested. This is due to the fact that it knows the location of the wall.
- The triangular bumper was the fastest localization routine, but was not a reliable routine during the test since it was based on being on the 45 degree angle. We would have to write an algorithm to get there.

7 ACTION

- Communicate with the hardware team to incorporate a bumper in the design of the robot.
- Improve the bumper localization code and test it to find optimal speeds to localize faster but still be reliable.
- Analyze the data fetched from the ultrasonic sensor to implement a filter according to the errors observed (false positive and false negative).

8 DISTRIBUTION

Hardware Team, Software Team