

Lab 2: Sense and Avoid (or Follow)

Out: Tuesday, 6 February 2018

Due: Tuesday, 13 February 2018

Overview: In this lab, you will program your robot to avoid obstacles by backing up and turning when one of the bump sensors is hit. Then you will modify your robot to include an IR sensor (the “top hat” sensor) so that your robot can follow a black line.

What to do in this lab:

0. Connect to your Wallaby

See the course website for the slides on how to connect to your Wallaby.

1. Obstacle Avoidance

For this lab, you’ll need to modify your robot car to include a bumper, if you didn’t already build one on the robot in Lab 1. A good design is to have touch sensors on either side of the front of your robot, then have a piece of Lego, plastic or other object connecting the two; this design allows for your robot to sense if it hits an object anywhere on the front of your robot, not just on one of the corners where your touch sensors are.

After modifying your car to include a bumper, write a program to make your robot move forward. Then modify it so that if your robot hits an obstacle on either side of the bumper, it will back up and then turn towards the open direction (i.e., if it hits on the right, it will back up and turn to the left, and vice versa). Be sure to comment your code appropriately.

2. Line Following

Now you will create a robot that will follow a black line on a white background. For this part of the lab, you will need to use the “top hat” sensors, which plug into the analog ports.

1. Experiment with the top hat sensors to determine what they read when placed over white paper and what they read over black lines. Is there a difference between shiny and flat surfaces? Choose ranges that would indicate black readings and white readings. Note: you may wish to have some dead zone between the two colors, depending upon your findings. Run the same tests in the line course that you’ll be using in this lab.
2. If you are trying to follow a black line on a white background, discuss algorithmic differences between using one top hat sensor and using two top hat sensors.
3. Now you will write the program that will allow your robot to follow a line. You may choose whether to use one top hat or two. Please discuss in your lab report why you chose the number you did. Choose good mount locations for your sensor(s)

and attach them to the robot, using a fairly temporary mounting method such as double sided tape. Write the code to follow a black line. Turn in your commented code.

4. Was your robot able to traverse the entire course? If not, what part did it fail on? Why?

What needs to be turned in and demonstrated:

Lab Report: For your lab report, print out your code for both parts and attach answers to each of the questions raised above. Each team only needs to submit one lab report; however, I strongly encourage you to write the report together so that both members of the team participate in all aspects of the lab. Your lab report is due at the start of class on Tuesday, 13 February – printed out. Print it at home, print it in a computer lab on campus – just do it before class starts.

Demonstration: Demonstrate your line following robot for me and the class at the start of class on Tuesday, 13 February (or during class on Tuesday, 6 February, if you're done on the first day of the lab).