COMP 4500, Mobile Robotics I
Spring 2018, Prof. Yanco

Lab 3: Braitenberg Vehicles, Emergence, Meta-Sensing and Randomness

Out: Tuesday, 13 February 2018
Due: Tuesday, 27 February 2018, at the start of class

The questions in Part I should be answered individually and turned in with your lab report next Thursday. Each team will turn in one lab report (written jointly) that has each person's individual answers to the questions in Part I attached.

Part I: Individual Questions

Question 1:
Describe your line following robot from Lab 2 as a Braitenberg vehicle, based upon your reading of Chapters 1-4 of Braitenberg's Vehicles book.

Question 2:
Do you think that Braitenberg's method really can describe complicated robot behaviors? Why or why not? (No more than 1-2 paragraphs is needed to answer this question for this assignment, although one could write much more on the topic.)

Part II: Lab

In Lab 2, you designed code that would avoid obstacles and follow lines. Now you will be creating robots that are attracted to light.

For this lab, you may use the robot you built for Lab 1 and 2 or you may choose to redesign the robot with a different drive train. (Section 4.5 of Fred's book has a nice presentation of how to build with Lego. I highly recommend that you read it. I also handed out his Art of Lego article in class a few weeks ago.) However, all exercises can be completed with your existing robot. I leave this choice to you.

You only need to write one lab report for your group. I would prefer that your work in lab and your lab reports be collaborative work. One partner should not be writing the programs or the lab report alone. All of the questions below should be answered in your lab report.

For any exercises that ask you to write code, please turn in the code with your lab report. Please comment your code appropriately.

A. Light sensors

Write a short program that prints the value of two light sensors (to be distributed in class), which you should mount to either side of the front of your robot. Experiment with how the sensor values change as you move your robot around the room.

Answer the following questions in your lab report (from Martin 2.4.5):

1. How do the light sensor readings change as the amount of light increases?
2. Do the two light sensors typically give the same reading, or do they vary by the angle toward the nearest light source?
3. What are the maximum and minimum readings you can obtain? What are typical readings from the ambient light sources in the room?
4. Do both sensors seem to provide the same reading for the same amount of light, or are the readings from one shifted with respect to the other?

B. Shielding light sensors

Light sensors will be much more directional if you shield them using a small piece of tubing or some electrical tape, which will help you to find and approach a light source. Design shields fo the two light sensors on your robot. With your new shielding, what are the readings when the sensor is pointed directly at a light? How do the readings change as it turns away from the light source (10°, 20°, 45°, 90°)?

C. Normalizing light readings to motor commands

In order for your robot to function like a Braitenberg vehicle, you will write a program that uses the signals from the light sensors to control the robot's motors. To make your robot seek out a light, you will need to convert your light sensors' readings to a value where the darkest value makes the motor stop and the lightest makes it turn quickly. Write and test the function. Turn in the code.

D. Light-seeking

Using your normalizing function, write a program that turns your robot into a light-seeing Braitenberg vehicle. Test it. Does it work? If not, what could be done to improve it?

Rewrite your program to avoid sources of light. Describe its behavior in different situations.

E. Light and touch sensitivity

Add your bumper behaviors from Lab 2 to the light-seeking robot code. Your robot should now seek out light while it will back up and turn if it hits something with its bump sensors.

Does the bump sensor code accomplish the goal of getting your robot to work its way around obstacles? Explain why or why not. If not, improve your code so that your robot does a better job of avoiding obstacles while it is seeking out light.

This lab is modified from Fred Martin's Robotic Explorations book.