

91.450, Robotics I  
Fall 2001  
Prof. Yanco

## Lab 2

Out: Thursday, 20 September 2001

Due: Thursday, 27 September 2001

**Overview:** In this lab, we will program the Handy Bug to avoid obstacles by backing up and turning when one of the bump sensors is hit. Then we will modify the Handy Bug to include a light sensor so that it can follow a black line.

### What to do in this lab:

1. If you haven't already read Martin, Section 2.1, do so now. You should also read Appendix E, which is the IC (Interactive C) manual.
2. Now go to Section 2.3, which describes the first program that you'll write in IC. First, you'll need to attach the two button touch sensors to the 1x2 bricks that are behind the wheels on the bumper. For today, we'll be using either putty or double-sided tape for a temporary mount. As we begin to work on projects, we'll use more permanent mountings.
3. Answer the four questions in Section 2.3.3. You will turn in answers to these questions with your lab report. For Question 3, turn in a copy of your code (which will be beautifully commented, I'm sure). For Question 4, I have put a weasel ball in the lab so that you can compare its performance to that of your Handy Bug.
4. Now move on to Section 2.3.4. Do the two exercises in Section 2.3.5. For Question 2, turn in your code (again, with useful comments).

In Steps 1-4, you've created a robot that will go forward. If it 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).

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.

5. 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.
6. 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.

7. Now you will write the program that will allow your Handy Bug 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. You may use putty or double sided tape for a temporary mount. Write the code to follow a black line. Turn in your code (need I mention comments again?).
8. Was your robot able to traverse the entire course? If not, what part did it fail on? Why?

**Lab report:**

Print out your code for the different 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 by 2pm on Thursday, 27 September 2001.

In addition to the lab report, please demonstrate your line following robot for me before Thursday, 27 September at 2pm. You can show me your robot during staffed lab hours (Tuesday 12:30-2, Wednesday 11-2 or Thursday 12:20-2). If you can not make any of those hours, please set up an appointment with me. We'll be videotaping your demonstrations for posterity.