91.450, Robotics I
Fall 2003
Prof. F. Martin

Lab 2

<u>Out:</u>   Friday, 12 September 2002
<u>Due:</u>   Friday, 19 September 2002

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. You will need to install touch sensors in your robot. The best way is to use the LEGO touch sensors as illustrated in the book (see me for parts for building adapter cables). Otherwise, you can use double-side tape to attach the two button touch sensors to the 1x2 bricks that are behind the wheels on the bumpers.

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 will try to 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 reflective IR sensors, which plug into the analog ports.

5. Experiment with the reflective IR 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 reflective IR sensor and using two reflective IR 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 reflective IR 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. The best way is to hot-glue one or two LEGO pices to the sensor (thereby, "LEGOizing" it) and then using the LEGO properties to attach to your chassis. Otherwise, you may use 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 at the beginning of class (1:30 pm) on Friday, 19 September 2003.**

In addition to the lab report, you will demonstrate your line following robot during class on Friday, 19 September.