Mobile Robot Base Lab

Due: Week of 2/8/99

Your first assignment is to build a mobile robot base using the kit that you were given in your lab session. It should have space for the microprocessor board and batteries and space for mounting the sensors that you'll get in later labs.

In order to test your robot base, you should use the motor test board (small PC board with 4 switches) included in your kit. Plug your motors and batteries into that board and you can use it as a simple manual controller. **You will not be using the microcontroller board or the sensors for this lab!**

You are allowed to add your own parts (Lego or otherwise) to the pieces in the kit, **if they are necessary**. Until you get a working base, try to think of function before form. Once it's doing the right thing, then you can add the go-faster stripes. Rubber bands tend to be very useful. There are only two things that are forbidden. Don't mutilate the Legos and absolutely **no glue**.

The major goal for this lab is to build a base that meets the following criteria.

- Robust. The robot can run around the floor without falling to bits. To test for robustness, you should be able to drive your base around for about half an hour and sustain repeated mild collisions with walls without serious disintegration. When you pick it up, the base should feel solid, not flexible.
- Straight driving. The robot should be able to drive in something approaching a straight line. This is not as easy as it might sound, since you'll have to deal with uneven friction in the gear trains, slightly different motors and a host of other factors.
- General purpose. Although there are points for straight driving, a robot that is unable to turn isn't much use. Robots that achieve the straight driving criteria by being unable to turn get no credit for this lab (yes, someone did that once).

To achieve robustness, follow some of the hints in the Lego building handout. The traditional Lego building technique of bricks atop bricks doesn't make a very robust structure. Be sure to cross-brace your structures. To achieve straight driving, make sure that the drive wheels are even with each other and that the axles are well supported (so that they don't splay out). Be sure that your gear assemblies don't have too much (or too little) play in them. You should probably gear these motors down some to get a good balance between speed and torque. The speed you get with the motor plugged into the test board will be somewhat faster than the maximum speed available from the micro-controller. Faster robots are more exciting, harder to control and able to apply less force.

You are required to demonstrate the finished robot in your lab section. The grading scheme is as follows.

- 25% Straight driving
- 25% Physical robustness
- 30% Structural design (Is the processor safe? Is the battery pack accessible?)

- 20% Lab report.

In addition to demonstrating your robot, you are required to turn in a lab report. The report is due at 9am on the day after your lab section, in the handin bin. The reason for this is to give you time after the section to change the report in light of your TA's comments.

The lab report should contain things like

- A description of the physical design of the robot. Things like dimensions, gear ratios, wheel configuration, how the structure is reinforced, *etc.*
- Justifications for your design decisions. Why did you gear the motors down 1000:1? Why does it have a bumper on top?
- Remember a picture is worth a thousand words. If something is more easily described with a diagram, then put one in.

If you typeset your report (with a word processor, or LaTeX), then it would make your TA very happy. As would taking a second and using a spell-checker. We're not expecting impeccable grammar, but any reports that are judged unreadable will be returned for rewriting (and start gather late penalties).