UNIVERSITY OF CALIFORNIA, SANTA CRUZ
BOARD OF STUDIES IN COMPUTER ENGINEERING

CMPE118L: INTRODUCTION TO MECHATRONICS

LABORATORY ASSIGNMENT NUMBER 2 FOR CMPE 118

Due by 5:00pm on Friday, January 29, 2010

Pre-Lab Due by **the start of your lab** on Wednesday or Thursday (January 20 or 21, 2010)

Purpose:

This lab is intended to acquaint you with:

- Using SolidWorks as a visualization tool.
- Developing parts in SolidWorks/CorelDraw
- Cutting parts using the Laser Cutter
- Working with Foamcore and MDF
- Correct use of lab equipment and tools
- Assembling a working filter

Minimum Parts Required:

There is a selection of motors set out in the lab that you may use as the motors to develop your motor mounts. The motors are just for use as props in this lab—we want them back. For constructing your platform prototype you'll need foamcore, MDF, hot-glue guns, hot-glue sticks, hobby knifes (with lots of blades).

For building your circuit, you'll need a small perf board and soldering station.

You are responsible for providing you own materials. In order to save on material costs, the TAs will arrange a group buy-in for MDF and foamcore.

Warning: razor blades are very sharp and will cut through your skin quite easily, hot glue won't do permanent damage, but it is very painful on the skin. BE CAREFUL.

Pre-Lab:

You will encounter many tools in this class. Some as simple as a knife or a file—that you think you already know how to use—and some you may not have used. This is a chance for us to see how familiar you are with tools we'll be placing in the lab.

☐ 0.1) For each of the tools in this list provide a brief description of what the tool is used for, what materials you can use it with, and any special safety considerations you should (and will!) take.

a. Hot glue gun (and the glue itself)
b. Hobby knife (and the blades themselves!)
c. Soldering iron (and the solder itself!!)
d. Hacksaw (and the—you get the picture…)
e. Drill press
f. Jigsaw

☐ 0.2) Your pre-lab will be completed during a live SolidWorks tutorial during your Wednesday or Thursday lab time, and the result of this will be added to Part 0.1 to be turned in during lab.

In the report:

Include your discussion of the tools and a dimensioned three-view and shaded printout of the part from the tutorial in 0.2.

Part 1 Designing A Simple Motorized Platform

Reading: Fabulous Foamcore (on the website), CKO Ch. 26

Assignment: You are to design, capture the design, and assemble a simple motorized platform. The platform should have a flat base made from one layer of MDF and it should carry two Applied Motion stepper motors (in a cardboard box in lab) and an H-Bridge Module (a sample is in lab). The motors should be mounted to the base using motor mounts constructed of MDF. The mounts should attach to the base using tab-and-slot construction. The motor mounts should provide more robust support than the simple planar design shown in class and the H-Bridge Module should be attached to the top of the base near the motors. Also mounted to the platform should be a circular column constructed of foamcore and sitting above which should be a smaller platform, also made of foamcore. The platform should have the shape of a square box of suitable depth and size to carry your sensor circuit built in Part 3. Make sure your circuit board can be securely mounted 10" above the ground.

☐ 1.0) Take the time to plan out all the parts required: the base, wheels, motors, motor mounts, driver board, sensor board, column, and platform. Make sure to consider how all these parts will connect and that when assembled everything will be strong enough to support itself.

☐ 1.1) Using SolidWorks (or any other similar CAD program) to construct 3-D parts to represent all the parts required. Carefully design these parts so they can be securely fit together. Create an assembly of these parts to make sure everything will, in fact, fit together as planned.

- The finished base should be roughly circular with recessed cutouts to provide room for wheels to be mounted on the motors.
- The wheels will need to be at least three layers of foamcore or two layers of MDF.

Note: We have 10 licensed copies of SolidWorks off the FlexLM server, so do not leave it running when you are not using it. We are also sharing these licenses with senior design groups, but we have reserved the licenses from 10am-6pm every day, so if you find that you're unable to launch SolidWorks during this time be courteous when you ask someone in BE113 or BE111 to stop using the program.

☐ 1.2) Using the Fabulous Foamcore handout as your guide, use a sharp hobby knife (be careful!) to build the foamcore box that will sit atop the platform. Use lap joints at the edges. Just because you're working with foam core by hand does not mean this can't be as neat and tidy as it looks in SolidWorks.

☐ 1.3) As above, build the foamcore column. Use a lap joint to close the column.

In the report: Include a printout of the assembled model as well as the individual parts from 1.1.

Part 2 Constructing A Simple Motorized Platform

Reading: CMPE-118 LaserCutter Handout

Assignment: Take the design that you created in Part 1 and construct a prototype of the platform.

☐ 2.1) Prepare your SolidWorks designs for cutting using the laser cutter. (Note that the laser cutter is driven from CorelDraw, so you will need to get your parts into that program).

No Etching Allowed. Aside from markings in order to help you assemble parts, there is no etching allowed on your designs. Remember that you will have to baby-sit your design while it is being cut out, and that means you will have to wait.

IT IS ABSOLUTELY UNACCEPTABLE TO LEAVE THE LASER CUTTER UNATTENDED

☐ 2.2) Have your output files reviewed by the instructor, tutors, or TA.

☐ 2.3) Cut the parts from MDF, using the Laser Cutter. Because you've cleverly designed these using a variable in your assembly, it's no hassle to measure the material and rebuild in SolidWorks before cutting. Always review rebuilt models visually and with interference detection.

☐ 2.4) Assemble the parts of the platform. Do not glue. Demonstrate it to the instructor, tutors, or TA.

☐ 2.5) Glue the parts together (NOT the motors). Demonstrate it to the instructor, tutors, or TA.

In the report: Include printouts of the SolidWorks/CorelDraw files that you created to help you cut out the foamcore/MDF.

Part 3 Building Your Detector Circuit

Reading: None.

Assignment: Take the design that you created in Lab 1 and build a working version that you will use on your final project. Only attempt this once you've practiced elsewhere and are confident your prototyping abilities.

☐ 3.1) Make sure you use a circuit that actually works well. If you're unhappy with your results from Lab 1 talk to your classmates about their designs and see if you can improve yours. Make sure to verify any changes or additions to your circuit before making them permanent.

☐ 3.2) Have your design reviewed by the instructor, tutors, or TA. Make sure that your design includes an LED to indicate when the beacon is detected. This will help with debugging later. Also include a power supply capable of powering your circuit from a roach battery.

☐ 3.3) Do NOT disassemble your working circuit from your protoboard. Instead, replicate the design on the perf board, and solder or wirewrap the parts together.

☐ 3.4) Test your assembly and make sure it works. If not, debug. Again, incremental development here; build a little, test a little, build a little more, test a little more, until the whole thing functions reliably. Test front to back and back to front in stages. Make sure there is an indicator LED that helps to debug the circuit.

☐ 3.5) Demonstrate it to the instructor, tutors, or TA.

In the report: Include a schematic of the final circuit you built, and if you can, add in a digital picture of the final board, top and bottom, to show off how neat and tidy it is. If you did a simulation of the circuit, include that too.

Lab #2

Time Summary

Be sure to turn this in with your lab report

This information is being gathered solely to produce statistical information to help improve the lab assignments.

Pre-Lab	Preparing Outside of the lab _____	In the lab working this part_____
Part 1	Preparing Outside of the lab _____	In the lab working this part_____
Part 2	Preparing Outside of the lab _____	In the lab working this part_____
Part 3	Preparing Outside of the lab _____	In the lab working this part_____
Report	Preparing the Lab Report _____	