



LABORATORY ASSIGNMENT NUMBER 2 FOR CMPE 118/218

Due by 5:00pm on Wednesday, February 01, 2012

Pre-Lab Due by **6:00pm** on Thursday, January 26, 2011

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 in Foamcore
- 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, unharmed and unaltered. Do **NOT** glue them in! Foamcore, 3/16" MDF, hot-glue guns, hot-glue sticks, eXacto knives, lots of blades.

For the circuit part, a small perf board (from BELS) and soldering station (provided) and/or wire-wrap tools. Check with the TAs for the knives, glue guns and glue sticks.

Note: In order to save on material costs, you should team up with AT LEAST one other person on this lab (in order to get to know you classmates, team up with someone you have not worked with before). You are responsible for providing you own materials.

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:

Complete the following exercises AFTER you have read through the lab assignment and BEFORE starting to work on the parts of the lab.



- 0.1) Set yourself up at any workstation that has SolidWorks installed (all the machines in BE115 do) and follow the SolidWorks "getting started" tutorial included with the program under HELP->SolidWorks Tutorials->Getting Started.

Note that we have 12 licensed copies of SolidWorks off the FlexLM server, 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.



- 0.2) Look through the attached pages with the dimensions and drawings for a simple gearbox assembly (there will be a physical one of these down in the lab). Watch the SolidWorks tutorial lecture posted on the class website:

<http://classes.soe.ucsc.edu/cmpe118/Winter12/#videos>

These tutorials will walk you through the process of making the parts in SolidWorks, and assembling them together. There are a few mistakes in the tutorial (see if you can find them). The parts and drawings are also on the website under Lab 2.

In the report:

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

Part 1 Designing A Simple Motorized Platform

Reading:

CKO Ch. 29, Fabulous Foamcore (on the website)

Assignment:

You are to design, capture the design and assemble a simple motorized platform. The platform should have a flat base made from two layers of Foamcore and it should carry two DC gear-motors and an H-Bridge Module (2.5" x 2.3" electronic part). The motors should be mounted to the base using motor mounts constructed of Foamcore. The mounts should attach to the base using 'Tab in Slot' construction. The motor mounts should provide more robust support than the simple planar design shown in class. The H-Bridge Module should be attached to the top of the base near the motors. Also mounted to the platform should be a 4.5" diameter 6" tall circular column, constructed of foamcore and centered on the base. Sitting atop the column should be a smaller platform, also made of foamcore. The platform should have the shape of a square box of about 1" depth and be centered on the platform.



- 1.1) Use SolidWorks to construct simple 3-D shapes to represent the base, motors, motor driver board, column and platform. Create an assembly of these parts to explore how they will fit together.



- 1.2) Using the Fabulous Foamcore handout, and a sharp eXacto knife (be careful!), 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.



- 1.4) Figure out how you are going to attach the column to the base and to the platform. You may want to do this **BEFORE** you actually build them.



- 1.5) Using SolidWorks, create the parts necessary to assemble the motor mounts that you designed and mount them to the base. The finished base should be roughly circular with recessed cutouts to provide room for 3" wheels to be mounted on the motors. You will need to move the 2D shapes to CorelDraw for part 2 of this lab.



- 1.6) Using SolidWorks, create 3" wheels to be mounted on the motor shafts. These will need to be at least three layers of foamcore, or two layers of MDF. You will need to move the 2D shapes to CorelDraw for part 2 of this lab.

In the report:

Include a printout of the model from part 1.1 and the individual parts from parts 1.5 and 1.6.

Part 2 Implementing A Simple Motorized Platform

Reading:

CMPE-118 LaserCutter Handout

Assignment:

Take the design that you created in Part 1 and implement a prototype of the platform.



- 2.1) Using the laser cutter handout (on the website), to be distributed later, and your printouts from the above drafting part, to prepare your part 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).

NOTE: 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.

WARNING: IT IS ABSOLUTELY UNACCEPTABLE TO LEAVE THE LASER CUTTER UNATTENDED. Every single episode of laser cutter fires resulted from unattended operation.

- ☐ 2.2) Have your output files reviewed by the instructor, tutors, or TA.
- ☐ 2.3) Cut the parts from 3/16" MDF (Medium Density Fiberboard), using the Laser Cutter.
- ☐ 2.4) Assemble the parts of the platform. Do not glue them, but rather do a test fit. Demonstrate it to the instructor, tutors, or TA.
- ☐ 2.5) Fit/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. Include a digital photo of your assembled bot.

Part 3 Building Your Detector Circuit
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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. Note that as you should be working with someone other than you worked with on your previous 2 labs, you should have two separate designs. Use the one that works better. 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 (talk to your classmates about this, see whose design really worked well from Lab 2, and try to make one like it). 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. That is, make a functioning protoboard version **BEFORE** you solder.
- ☐ 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.
- ☐ 3.3) Do NOT disassemble your working one off of 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. 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 _____	

Lab #2**Partner Evaluation**

Email the Professor (only) at <mailto:elkaim@soe.ucsc.edu> with a subject line of:
"CMPE118 Lab 2 Partner Evaluation" and include:

(1) Partner's name:

Rate them on a scale of 1 (bad) to 5 (excellent) on the following areas:

(2) Knowledge:

(3) Prep:

(4) Work:

(5) Neatness/Cleanup:

This will be used to help us match partners for the project, and is extremely important. Failing to send this in will result in a 20% penalty on your lab grade.