

Physics 335, Spring Quarter 2013

Final Project for labs 28-31 May and 4-7 June

INTRODUCTION

Your final assignment for the last two labs is to use your PIC microcontroller expertise for one of the projects described below or a project of your own imagination. The final project requires adding hardware to your system and writing the control software.

Once you have designed this final project, download the template for homework #7 and complete that assignment. You can't proceed with the final project without passing homework #7.

You and your lab partner will work together on the same final project. Meet with your partner and decide on your final project and how to divide up the labor. Ensure you have a fully worked-out circuit diagram for the hardware additions to microcontroller.

IDEAS FOR THE FINAL PROJECT

Below are some sample projects to start you thinking. You certainly aren't restricted to the projects listed below, but these projects are those for which we have the necessary hardware components and which can sensibly be completed in the few remaining lab sections.

(1) X-Y plotter: With two DACs (a variant of a prior lab), you can connect the outputs of the DACs to the X and Y inputs of the oscilloscope in X-Y mode. By creating X and Y values in memory and looping through the table, you can draw letters, figures, etc on the 'scope (start with simple shapes!).

You would need two AD588 DACs. A simple RC filter on the DAC outputs makes the lines smoother.

(2) Sound recorder/playback: We have amplifier boxes that connect to microphones and speakers. You can have your ADC digitize a sound, for example, and then play it back to the speakers. You can also modify the recorded signal before playing it back, for example, by stretching the frequency, averaging (running filter) points, rectifying, inverting, etc. You can also play back the recording on the oscilloscope.

For this you could use the AD7569 ADC/DAC. You may need a divider network to put the microphone signal within range of the ADC. Reasonable voice fidelity needs to digitize at least at a few kHz, which means voice will fill up memory almost instantly. You could add another memory chip, but this is a fair amount of wiring.

(3) Stepper motor driver: We have a few stepper motors that can be turned by digital signals on 4 lines, labeled S1 – S4. To turn the motor counter clockwise (CCW), send a sequence

	S1	S2	S3	S4
1	1	0	1	0
2	1	0	0	1
3	0	1	0	1
4	0	1	1	0
1	repeat sequence			

Each input must be stable for at least 2 msec and turns the shaft by 0.01 turns. To turn CW, cycle through the sequence in reverse order, i.e., 4, 3, 2, 1, 4, ...

You'll need the stepper motor control box and output pins for four lines. You might consider having switch control of the turning direction or speed. You could wrap a string around the shaft and lift a weight.

Think of variants of these projects. Or think of other projects; check with your instructor to ensure the necessary hardware is available.

A word of caution: Think big and small. You'll need to finish something; ensure that even if you can't finish your big idea, there's a smaller project on the way there. Things take longer and are harder than you think.

HOW THIS IS GRADED

Homework #7 is your proposal for the final project. You need to submit and pass homework #7 before you can proceed with this final project lab. For the lab, you and your lab partner need to demonstrate operability of your final project to your TA. You are responsible for debugging your code, so code carefully and have a code-development plan.

You and your lab partner together submit a final-project lab writeup; both your names are on the writeup. For your writeup, include the as-built circuit diagram and brief description of how your circuit and software works. Also include a printout of your assembly code. The TA will quickly look at this printout and see if it's a mess, or understandable on its own. The TA may grant an incentive of 10% for particularly tidy and readable code, or subtract 10% for particularly obscure and unreadable code. Full credit is given only to fully functional circuits.

Finally, you should have the circuit drawn and the software blocked out before you come into lab. Otherwise, you're unlikely to finish.

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