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**ELTN 117 – Survey of Digital Logic and Microcontrollers**

**Final Laboratory Project: Photo-Deflector Rotary Encoder**

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# Introduction

The purpose of this project was to create an inexpensive and effective rotary encoder system that could be mounted on wheeled robots for more accurate linear movement.

Example:

*Simple explanation of hardware*

**The project was mounted on a laser cut 11 X 14 piece of plywood, and includes a power supply, X and Y galvanometers, and circuit board for the 328 microcontroller and analog circuitry. Since this project will be used for educational purposes it was decided not to put it in a traditional enclosure, but one that could be covered with acrylic so students could see the circuitry used.**

*Simple explanation of software*

**The main software comes from a laser light show implemented for clubs and other animated displays. The program was modified to take the user input and create the various mathematical functions. More details will be explained in the software section. The programs were created using an Arduino UNO, and then downloaded to the 328 microcontroller on the board.**

# Schedule / Gantt Chart

The following figure is the Gantt chart used to manage the project timeline:

## Gantt Chart

CHART HERE

Figure 1. Gantt chart of project

## Actual Schedule

*Don’t go into a long explanation about problems, setbacks, etc…save that for the conclusion!*

When comparing the original schedule to the final schedule there were several modifications that were required, including procurement…

The final schedule looked like this:

# Hardware Description

The block diagram below shows the basic subsystems used in the system:

*You can use a number of programs to create a simple block diagram – From Eagle to Microsoft Visio (which is great – IMO) or even Word. The idea is to show the main parts of your circuit without showing individual components like a schematic. Below the diagram you want to list the basic parts, especially ones that are specific to your project.*

# Software

*Include a basic top-down diagram of your project. Include any summaries of special functions or libraries you have used with your project. DO NOT include the entire code listing here – save that for the appendix.*

[TOP DOWN HERE]

Figure 2. Top Down diagram of program

## Libraries / Functions

The following libraries were from the OLSD website. They include basic functions to send the data from the main program to the DAC’s.

#include <OLSD.h>

#include <standard.h>

OLSD dac;

This important function plots points “a” out based on the sin and cos functions. The phase variable adds a phase shift so that the circle rotates:

for (a = 0.0; a <= (2.0 \* PI); a += 0.1)

{

// Calculate x and y using our angle in radians

// Include a phase shift so the circle rotates

x = sin(a + phase);

y = cos(a);

// Change the +/-1.0 numbers into unsigned integers

x = x \* 32760.0 + 32760.0;

y = y \* 32760.0 + 32760.0;

// Output the point

dac.OutputPoint((unsigned int)x, (unsigned int)y, 255, 255, 255);

}

Figure 3 – Code segment for displaying laser points

The entire code is shown in appendix A.

# Budget / BOM

*Include your budget and Bill of Materials (BOM) here. Using Excel and copying groups of cells works well for this.*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Line item | Quantity | Description | Part number | Cost | Extended Cost |
|  |  |  |  |  |  |
| 1 | 1 | Power Supply | GX-24-24 | $18 | $18 |
| 2 | 2 | Galvonometers | G-1200-24X | $15 | $30 |
| 3 | 1 | PCB | N/A | $14 | $14 |
| 4 | 2 | Amplifiers | G-1357-44 | $8 | $16 |
| 5 | 1 | Base Material | 10" X 14" 3/16 plywood | $5 | $5 |
| 6 | 1 | Acrylic Cover | 3/8" Lexan | $15 | $15 |
|  |  |  |  |  |  |
|  |  |  | Total |  | $98 |

Figure 4: Bill of Materials w/ costs

# What was learned / Conclusion

*In this section include what you learned in the process. Try to remember back to before you started this class, and what you know now. Some general areas:*

*Arduino*

*Project management*

*Programming / functions / Approach to programming*

*Issues / successes*

*Improvements you would like to make*

*What you would have done differently*

*Etc….*