16.480/16.552 Laboratory #2 Due: October 25, 2006

Data Acquisition

1. Introduction

The purpose of these laboratory assignments is for you to design the circuits and system components required to implement a lighting measurement system interfaced to a laboratory PC. The specific objective of this laboratory assignment is for you to create circuits and systems needed to acquire lighting data.

2. Laboratory Procedure - Hardware

1. The ADC you will use is the AD670 8-bit Analog to Digital Converter. The ADC will reside at address $FE000_{16}$ in physical memory. Design a circuit that allows the 8088 to poll the ADC's 8-bit digital output using the appropriate 74LS138 output. Make sure you understand how the ADC works, how each signal and control line is used, how data capture is initiated, and how analog voltages are represented as digital values. Set up the ADC such that 1 Volt corresponds to maximum brightness and 4 Volts corresponds to dim lighting.
   Based on the minimum and maximum voltage values, what is the resolution of the ADC in terms of volts/bit?
2. Based on the transfer characteristics of the provided Advanced Photonix, Inc. PDV-P5003-ND Photoconductive Cell, a photoresistor, create a circuit that will result in an output voltage value ranging between 1 Volt (maximum brightness) and 4 Volts (dim), corresponding to the voltage input range of the ADC. Connect this voltage output to the input of the ADC.
   Based on the resolution of the ADC, what is the resolution of the photoresistor circuit in Lux/bit?
3. We will control the light bulb by software commands that either turn it on or off. The light bulb will reside at address $F8000_{16}$ in physical memory. We will use a solid-state MOS power switch to control the light bulb. The specific device we will use for driving the light bulb is the Elantec EL7202C Power Driver. Your lamp interface should be based on the 74LS138 output bit driving the A or B input to this device (ground the unused input). The light bulb should connect between the output of the driver and ground. Use +5 volts to power the device. Design a circuit that allows the 8088 to turn the light bulb on and off using the appropriate 74LS138 output. Make sure the light bulb is located very close to the photoresistor and construct a covering for the system so that no extraneous light may enter while the light bulb is turned on.

3. Laboratory Procedure - Software

1. Modify your assembly language code from laboratory one to turn on the light bulb for one second and then turn the light bulb off.
   Demonstrate the operation of this program to your course instructor, TA, or LA.
2. Further modify your assembly language code such that while the light bulb is on, the value from the ADC coming from the photoresistor circuit is read. Write this 8-bit value to the address of the FIFO. Attach a logic analyzer to D_7-D_0 of the data

bus and record the data values.

To what lighting value does the stable output voltage correspond?

Demonstrate the operation of this program to your course instructor, TA, or LA.

4. Laboratory Report and Grading

Grading will be on:

- Hardware implementation and demonstration
- Circuit wiring neatness
- Software and software documentation
- Laboratory write-up

Include the following items in your laboratory report:

- Cover page with names and email addresses.
- Authorship page (who did what).
- Introduction detailing what the laboratory is trying to accomplish.
- A discussion of your circuits and programs.
- Clean-copy schematics for your hardware design.
- A discussion of your software implementation.
- Well commented program listings including the assembler map for the EEPROM.
- Conclusions regarding the laboratory.