16.480/16.552 Laboratory #4 Due: December 15, 2006

Data Display

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 allow a host computer to read and display the lighting data collected by the embedded system.

2. Laboratory Procedure - Hardware

1. The FIFO will reside at I/O address $031C_{16}$ in the host computer's I/O address space. Design a circuit that allows the FIFO to be read by the host computer when an I/O read operation is performed at address $031C_{16}$. Make sure you understand how the FIFO works, how each signal and control line is used, and how data is accessed. Make sure you maintain the FIFO read interface independent from the FIFO write interface.
   Demonstrate the operation of this program to your course instructor, TA, or LA.
2. The command register will reside at I/O address $031B_{16}$ in the host computer's I/O address space. Design a circuit that allows the command register to be written to by the host computer when an I/O write operation is performed at address $031B_{16}$. Note that this is the same command register located at address $FC000_{16}$ in the embedded system (see step 2.2 in Laboratory #3).
   Demonstrate the operation of this program to your course instructor, TA, or LA.

3. Laboratory Procedure - Software

1. Write an assembly language code routine to be run on an 80386DX host computer to issue the command word 34_{16} at I/O address $031B_{16}$ when the "R" key is pressed.
   Demonstrate the operation of this program to your course instructor, TA, or LA.
2. Modify your assembly language code routine to wait two seconds after issuing the "R" command and then read the FIFO sixteen times at I/O address $031C_{16}$. Calculate the equivalent lighting value in Lux for the 8-bit voltage values read from the FIFO. You should be able to calculate the closest equivalent voltage value for this lighting value using the transfer characteristics of the photoresistor. Be sure to maintain the precision of the incoming data when performing the conversion.
   What does your software do to avoid floating point calculations?
   What is the data rate for read operations from the FIFO?
   Comparing the read data rate from the FIFO with the write data rate to the FIFO calculated in laboratory three, will your system work?
   Demonstrate the operation of this program to your course instructor, TA, or LA.

1. Modify your assembly language code to display the sixteen lighting values in Lux.
   What is the precision for the displaying of data on the screen?
   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.
- Sign-off sheet.