ECE 395 – Microprocessor Laboratory Course Outline

Spring of 2007

Course Supervisor – Dr. S. Rosenstark

- Prerequisites: ECE 291 and ECE 252 Co-requisite: None
- Textbook(s)/Materials Required: S. Rosenstark, *Experiments with a Single Board Computer (SBC), ECE 395 Microprocessor Laboratory Manual*, Version 1.41.
- Hardware: One single board computer. See below for source.
- Development Tools used for Assembly and Emulation:
    1. Either the DOS oriented ASM68K and EMU68k of Antonakos.
    2. Or the windows oriented, freely distributed and open, EASy68K.

Course Objective

It is the objective of this laboratory to give the students the opportunity to acquire some hands-on experience with microprocessors. To this end the students are required to purchase a Single Board Computer (SBC) kit as explained in the ECE 395 Microprocessor Laboratory Manual. See below for the source of the SBC kit.

The Choice of Assembler and Emulator

The assembler and emulator that is offered by Antonakos is a perfectly workable development system. The assembler ASM68K and the emulator EMU68K have to be executed in DOS. Most students have difficulty mastering the intricacies of the DOS operating system. Accordingly it is recommended that students download the freely distributed and open EASy68K

Table 1: The features available in the Sim68K simulator and on the SBC. Put the task number in D0.B and use TRAP #15 for all the tasks.

Task	The function and its requirements.
0	Display string at (A1), D1.W long (max 255) with CR, LF.
1	Display string at (A1), D1.W long (max 255) without CR, LF.
2	Read string from keyboard and store at (A1), length in D1.W (max 80).
4	Read a number from the keyboard into D1.L.
5	Read single character from the keyboard into D1.B.
6	Display the character in D1.B on the screen.
7	Set D1.B to 1 if keyboard input is pending, otherwise clear it. Use task 5 to read it.
9	Terminate the program gracefully.
12	Controls keyboard echo. D1.B = 0 to turn it off, D1.B $\neq$ 0 to turn it on. Echo is restored on 'Reset' or when a new file is loaded.
13	Display a null terminated string at (A1) with CR, LF.
14	Display a null terminated string at (A1) without CR, LF.

Development System. This system is windows oriented and it should be easy to become familiar with it.

The emulator in this system has a number of functions built in. I've taken the trouble to build many of these functions into the monitor program MON300. Table 1 shows all the functions of Sim68K that the single board computer will execute.

Experiment 1 - Acquiring and Completing the SBC

Each student is required to obtain a microprocessor based computer kit. The task of acquiring and finishing the board should be performed immediately so that performing of experiments can commence by the second week. To assure success the *students should get the kits without any delay* and finish adding the few simple items in the shortest possible time. Foot dragging will not lead to success in this course.

The class should be informed that they can get the microprocessor kit from ACL Equipment Corporation in Livingston, New Jersey, by simply calling and stopping by there. Their telephone number is 1-973-740-9800.

The best choice for a communication program to interface with the SBC is the public domain TTermPro (a.k.a. TeraTermPro). It has no shortcomings, but should it prove troublesome in ASCII HEX file transfer then just go to **SETUP**, then **SERIAL PORT** and specify a 30 msec/line time delay. It won't affect the transfer rate noticeably, but will make the file transfer reliable.

This course outline as well as the course manual can be found on the website http://web.njit.edu/ rosensta/. Antonakos's latest assembler, emulator, and the latest MONITOR program for the SBC can be found on the same website as well.

In the following experiments the students must give a demonstration of whatever is required. The demonstration should be accompanied with a printout of the source code. This latter should be simple and to the point. Convoluted (spaghetti) code should be given a reduced grade.

Experiment 2 - Developing Software for the SBC

This should take two lab sessions to perform.

Experiment 3 — An Event Driven Annunciator System

This should take two lab sessions to perform.

Experiment 4 — Testing and Simulating Some ICs

This should take two lab sessions to perform.

Experiment 5 — Testing the Serial Port

This should take two lab session to perform.

Experiment 6 — DAC Interface with the SBC

This should take two lab sessions to perform.

The stockroom has kits containing the DAC0808 D/A converter and a few other chips. Each student can draw one kit from the stockroom. The students are responsible for having the foresight to obtain any other chips and components they think they will need during the course of the semester.

Experiment 7 — The Logic Analyzer

This should take two lab sessions to perform.

Requirements and Grading Policy

- The only documentation required of the students will be an individual final essay style report in the form of a critique. The students can discuss what was learned, what additional work could have been done and what improvements could be made in the course.
- The final grade should be based on the number and quality of the experiments completed. Good code accompanied by good demonstrations should lead to good grades. A final exam can be given at the instructor's discretion.