ECE-395: Microprocessor Lab (2 credits, 3.75 hours, required course)

Instructor: Azeez Bhavnagarwala

Course Materials:
ECE-395 Lab Manual: The course lab manual is available on the course web page. The manual describes the hardware used in the course, highlights the key features of the processor that are relevant to the course and outlines the required experiments.

Course Description: In this laboratory, students get the opportunity to apply the theoretical knowledge they acquired in their previous microprocessor courses to real hardware and software. The course uses a Coldfire (68k based) microcontroller demo board as a development platform and commercial development tools so students can experience modern design techniques. Some of the labs focus strictly on software while others deal with the problems of operating and interfacing microprocessor hardware. The students write code in assembly language to develop a strong understanding of microprocessor fundamental operations.

Prerequisites: ECE 252, ECE 291

Specific Course Learning Outcomes (CLO): The students are able to

1. understand and apply the fundamentals of assembly level programming of microprocessors;
2. work with standard microprocessor interfaces including GPIO, serial ports, digital-to-analog converters and analog-to-digital converters;
3. troubleshoot interactions between software and hardware;
4. analyze abstract problems and apply a combination of hardware and software to address the problem;
5. use standard test and measurement equipment to evaluate digital interfaces.

Relevant Student Outcomes:

(a) an ability to apply knowledge of mathematics, science, and engineering (1,2,3,4,5)
(b) an ability to design and conduct experiments, as well as to analyze and interpret data (3, 4, 5)
(e) an ability to identify, formulate, and solve engineering problems (3, 4, 5)
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice (1, 2, 5)

Experiments:

Exp. 1 – Get Acquainted with the Project Kit (No lab report)
- Learn to operate board used in the class
- Learn to assemble and execute code

Exp. 2 – Developing Software for the SBC (No lab report)
- Part 1: Find ‘X’ program
- Part 2: Move a string in RAM program
- Part 3: Adding numbers entered from the keyboard

Exp. 3 – An Event Driven Annunciator System (Lab report required for 3-person group)
- Demonstrate annunciator state machine program specified by lab manual
Exp. 4 – Testing and Simulating Some IC’s *(No lab report)*
   Part 1: Quad logic gate (NAND, AND, OR) chip tester
   Part 2: Simulation of D and JK flip-flop in software

Exp. 5 – Testing the Serial Port *(Lab report required)*
   - Clock Tolerance for the UART
   - Observation of the Serial Waveform

Exp. 6 – DAC (Digital to Analog Converter) Interface with the Microprocessor *(Lab report required)*

Exp. 7 – ADC (Analog to Digital Converter) with Accelerometer (Replaces lab 7 in manual)

**Lab Reports:**
Lab reports are required for certain labs as indicated. Each lab report should have a primary author that is responsible for writing the report for the entire group. Each group partner is responsible for one report in the semester. The grade given for the report will count toward the primary author’s grade.

**Grading Policy:**
Exp. 1 – 0 points
Exp. 2 – 10 points
Exp. 3 – 10 points
Exp. 4 – 15 points
Exp. 5 – 10 points
Exp. 6 – 15 points
Exp. 7 – 10 points
Lab reports – 20 points (individual component based on reports primary author)
Attendance – 10 points
Total – 100 points

**Honor Code:** The NJIT Honor Code will be upheld, and any violations will be brought to the immediate attention of the Dean of Students.

As this is a group lab, collaborating (sharing code, results, etc.) within your own group is expected. Using the work of others (e.g., another group or person in or out of this class) is not acceptable and is a direct violation of the honor code.