Term Project

1 INTRODUCTION

You will synthesize what you have learned in ELC 343 and ELC 411 into a useful project

2 PROCEDURE

1) Write a proposal and get approval for your project. Some acceptable projects at:
    a. Neural network based system for classifying an input signal as either sinusoidal or square wave, based on the results of a Fast Fourier Transform.
    b. Multi-user opto-electronic lock system based on notches in cards and opto-interrupters.
    c. DC motor speed control based on feedback controller. Use a disc with notches and opto-interruptor. Use LED blinking at RPM * N Hz, where N is the number of notches, to visualize the adaptation of speed.
    d. Shave-and-a-haircut detector, use piezo into ADC to detect each knock, and open lock after secret code.
    e. Waveform classifier – either sine, triangle or square wave, from 20 Hz to 20 KHz. Display wave shape, and frequency. You decide on the algorithm. Display results on the LCD with real-time update.
    f. Audio FX generator.
    g. Musical instrument tuner.
    h. Keyboard based polyphonic music synthesizer.
    i. Read I2C based temperature/humidity sensor and display results on LCD.
    j. Drive a color LCD display via SPI interface
    k. Capture signals and transfer to PC via serial interface or USB
    l. Impedance meter – drive DC, and sine waves at various frequencies, measure current
    m. Bluetooth remote temperature app and/or heater control
    n. Rock-paper-scissors game – 1 player or 2 player

2) Acceptable projects will combine one or more of the following challenges. You must select at least 100 “points” worth of challenge elements. **Do not over-reach! The vast majority of your grade on this project is based on getting it working fully!**
    a. 80 pts
        i. Bluetooth, using PSoC BLE Pioneer Kit
        ii. Extensive coding in assembly language
    b. 70 pts
        i. USB
        ii. Direct Memory Access (DMA)
        iii. Use of 32L476GDISCOVERY board
        iv. Use of FPGA board
        v. Use of RFID tags and reader
    c. 40 pts
        i. Neural Network
        ii. Some coding in assembly language
        iii. Significant use of fixed point arithmetic
        iv. Multi-time-scale real time processing
        v. I2C
        vi. Serial Peripheral Interface (SPI)
        vii. CapSense
        viii. 8x8 LED dot matrix
        ix. AI – e.g. smart opponent for game
    d. 30 pts
        i. Analog to Digital Converter
        ii. Digital to Analog Converter
        iii. Pulse-width-modulation and/or Timer block
        iv. Stepper motor
        v. Fast Fourier Transform
        vi. Digital Filter (FIR or IIR)
        vii. Serial interface
    e. 20 pts
        i. At least 10 lines (equivalent) of ‘C’ hand coded in assembly language
        ii. Seven-segment display
        iii. Opto-interruptors or other opto-sensors
        iv. Three or more push-buttons
        v. Analog pressure sensor
        vi. 4x4 keypad
        vii. H-bridge power driver, for bi-directional power control
        viii. Appropriate use of interrupt service routine(s)
    f. 10 pts
        i. Power driver circuitry (MOSFETs or Power Darlington)

3 GRADING

Design/Construction (maximum 50%)

50% for fully working

40% for partially working

25% for significant effort, but incomplete

Code (maximum 20%)

20% for well commented, well structured, adhere to all guidelines

10% for working code

Slides and Presentation (maximum 30%)

30% for all relevant measurements taken and included in slides (some detail can be put in Appendix in slides, or in separate .docx files), high quality presentation and fully able to answer questions

15% for most relevant measurements taken and included, fair quality presentation, and some ability to answer questions

4 PREPARE CODE, SLIDES AND PRESENTATION

The report will, minimally, consist of a file with slides (.ppt or .pdf, .ppt preferred) and all of your code in .c and .h files. I expect a full reporting including:

- Title Slide (project title, group members, class, date, etc.)
- Requirements/Goals (what your project is intended to do)
- Hardware and Software Architectures (block diagrams showing top-level blocks and interfaces, plus analysis of computational requirements, interface bandwidths, etc., as appropriate)
    - Your software architecture should identify one-time tasks and periodic tasks, and indicate each separate thread in your code – an interrupt service routine is a separate thread, and each non-blocking task would be a thread.
    - Any equations or other analysis
- Results
    - Your designs and construction
        - Include computer generated schematics for any hardware that you added, no matter how simple. Complex circuit design can be represented at a more abstract level, where appropriate.
        - Explain design choices
    - Your code (walkthrough and review your software patterns – loops, state machines, etc).
    - All relevant measurements, placed in tables and/or figures where appropriate
    - Scope traces and hand-drawn timing diagrams where appropriate

  - Debug experiences
- Conclusions (**what did you learn,** what would you do differently the next time, how could this be developed further, etc).

REPORT NOTES:

- One report per team
- Upload PowerPoint slides and collateral (e.g. code files or other data) to Canvas