EE 2920 - Week 6 Lab: ADC – Part 2

1 dedicated lab period, 2 lab periods to complete

Name:_____

Objectives

- Understand and use the integrated ADC
- Use interrupts
- Use analog sensors

Prelab	**student check off**
• Review ADC class notes	☐
• Review class notes on interrupts	☐
• Review the generic Photo Cell specification	☐
• Review QTR-1A specification	☐
• Solder pins onto your QTR-1A	☐

Assignment

Part 1: a) Using a DMM, characterize the resistance of your photocells in varying light conditions.

b) Design a voltage divider circuit to provide a reasonable range of output values for each sensor (Can you calculate the optimum value for the fixed resistor?)

Part 2: a) Interface two photocells to a pair of analog input pins on the microcontroller.

b) Use the ADC subsystem in repeated sequence to read the analog signals using interrupts.

8 lines for main
2 lines for pin config fn
13 lines for LCD setup fn
9 lines for ADC setup fn
2 lines for calculation fn
4 lines for LCD update fn
6 lines for ISR

c) Display the light intensity on the LCD. The LCD should display light intensity for each sensor in “percent" as follows: Left = 60% Right = 25%

Calibrate the light measurement so that a very bright light source illuminating the photocell (e.g., a phone flash shining directly on the photocell) results in a near “100%" reading and darkness (e.g., an opaque object covering the photocell) results in a near “0%" reading.

Your software must use the ADC interrupt and corresponding ISR.

Part 3: a) Interface an analog line sensor (part number QTR-1A) to a third analog input pin of the microcontroller.

b) Use 3 red LEDs to create a light reflectance meter:

Reflectance Level	Red LEDs
High	All 3 LEDs On
Medium	Two LEDs On
Low	One LED On
None	All 3 LEDs Off

*9 lines for main
4 lines for pin config fn
*13 lines for LCD setup fn
*9 lines for ADC setup fn
*2 lines for calculation fn
*4 lines for LCD update fn
7 lines for LED driver fn
*8 lines for ISR

Use a 2 inch by 2 inch piece of white paper with a 1/2 inch wide black stripe to test your sensor.

c) Calibrate your system so that passing the paper over the sensor at a distance of 1/4 inch exercises the full range of your reflectance meter.

NOTE: The sensor response is extremely sensitive to its position relative to the reflecting surface!

Check Off

You must demonstrate your working design(s) prior to the end of the 2nd lab period

- Demo your Part 1 50% _____
- Demo your Part 2 30% _____

Lab Report (informal)

- Due at 4:00 pm, 1 day after the second lab period – in the box outside my office
- Include this cover sheet
- Include a properly documented informal lab report. 20% _____

Strategy

**** Create a program Flow Diagram for each part ****

** I suggest you create 2 different programs – do not overwrite prog x to make prog y **

Part 2: Wire up the voltage divider and verify operation with a voltmeter. Configure and run the ADC – checking the code values. Convert the code value to voltages.

Part 3: Add the analog sensor to the board. Verify operation with an oscilloscope and define the measurement thresholds. Connect the output to the 3rd adc input and add code to include the new channel in the sequence (pins, adc setup, isr, …) Wire up the 3 LED and create a function to drive them based on the ADC measurements.