COMPE-375: Embedded Systems Programming Lab

Lab-09: A/D Conversion

For this lab assignment, you must use the A/D (analog to digital converter or ADC) to convert analog input signals in the range 0 to the reference voltage. In this case, we will use the power supply voltage as the reference.

This program uses timers and interrupts to make an LED dim and brighten. It also aims to teach us about analog to digital conversion. The program requires setting up of two timers:

i. one to control the LED brightness,
ii. one to start the A/D conversion process.

The task of this lab exercise is to control the brightness of your LED using the potentiometer. The brightness must be proportional to the position of the wiper in the potentiometer.

1. Set up a timer to generate an interrupt every (X+1) ms -- the timer ISR starts the A/D conversion and toggle one GPIO pin
2. Set up the A/D ISR to read the A/D result, scale it as an unsigned fixed-point number in the range 0 to 1, save it in a global short variable, and toggle a second GPIO pin. Note the A/D result is a two-byte variable.
3. Connect the potentiometer to A/D input channel Y%8 (Y modulo 8) to be read by the ISR in #2 above (Follow image in presentation for connection instructions)
4. In the main () loop, use the global A/D result variable and control one of the timers to generate a PWM waveform that varies the brightness of the LED on the board, based on the potentiometer position. The PWM frequency should be (Z+1)*100 Hz.

The X, Y and Z values above are based on the last three digits of your Red ID number as follows:

- Use the last 3 digits of your Red ID as in 812345XYZ
- (X+1) ms Interrupt period to start the A/D (sample rate)
- Potentiometer connected to A/D channel number Y%8
- PWM Frequency is (Z+1)*100 Hz

For demonstration of your output, you must be able to show proper variation in the scale of your LED brightness at various positions of the wiper in the potentiometer.

Checkpoint for the lab:

- Send a character on the Serial I/O port corresponding to the value read by the ADC Pin (ReadValue/MaxValue*100) in percentage, as follows:
  - If 0% to 10 %, Transmit “0”
  - If 10% to 20 %, Transmit “1”
    - :
    - :
  - If 90% - 100%, Transmit “9”
- ADC Conversion to be done by busy wait instead of interrupts