Timed Sensor Sampling

Lab 1

Each student will create a sensor sampling program that will act on a real time trigger, controlled by an internal timer. Each time a trigger event from the timer module is seen, the program will sample from the ADC module and save the sample into a sampling array.

When the sampling array is filled, an average sample will be calculated and displayed. This base program is the starting point of a larger, accumulative program that will comprise the term-long system development. This program will be modified with each following exercise.

Operational Characteristics:

Hardware

1. Use Diptrace to create a unique schematic that has a completed title block, denoting what the schematic is, who has modified it and what exercise it reflects.

   Modify the posted schematic on Fanshawe Online (FoL) to include a chosen (as in choose one, suggest channel 0) ADC channel pin connected to the simulated sensor configuration developed at the end of ELNC-6006-20F. Include an RS-232 serial communication interface. Pushbuttons and LEDs will be added in a later exercise.

   Follow the Program Conventions document posted on FoL. If student work does not conform to the Program Conventions, demonstrations will not be accepted. The Program Conventions are a requirement and not a suggestion.

   Do not consume the serial port pins of the PIC18F45K22.

   Ensure the decoupling capacitors are installed as close to the VCC pins of ICs as possible.

2. Build the circuit on the three panel breadboard.

3. Use your digital multiple meter to test the breadboard and **ENSURE** there are no shorts from VCC (+5V) to Ground (0V).

Software

Create a new folder directory and an MPLab project using the C18 tool suite. Name the project ELNC6007(your initials)Lab1, without the brackets.

Create a new source code file. Download and save the pragmas.h file, posted on Fanshawe Online, to your new project directory.

1. Create a global int array that will hold ADC samples. Define the size of this array to be a size of 30 samples.

2. Initialize the PIC18F45K22
   - **Osc**illator to operate at 4 MHz
   - **Port** Configuration for the appropriate connections, defined on the schematic
   - **Serial** Port 1, on, TX & RX enabled, 9600 baud
   - **ADC**, module on, 12 Tad, 2 µsecond ADCS, selecting the chosen channel from the schematic, reference voltages of internal V_{DD} and Ground (V_{SS})
     - Create a separate function that will sample from the ADC module and returns the result of the ADC sample to the function call
   - **Timer0**, on, appropriate pre-scaler and pre-set count for a 1 second rollover.
     - Create a separate reset function for Timer0 that accepts an input int value and can write that value to the Timer0 count registers.
     - Be prepared to show calculations and define the process of how to set the count for Timer0.
   - Call all of the configuration functions within master configuration function called "initializeSystem", this is the only function that will be called from within the initialization section of your source code's main.
     - Include a terminal message "System Ready…" at the end of this function

3. Within the program's indefinite loop:
   a. When Timer 0 has a rollover event, reset the Timer 0 module to rollover again after 1 second. Use the function written above to do this.
   b. Sample from the ADC module and wait for the result. Save the result of the ADC module's sample into the global sample array. Use the function written to get an ADC sample. DO NOT OVERWRITE another sample unless the array has been filled already with samples. Fill the entire array with samples on this 1 second timed control.
   c. Use a counting or indexing variable to control where the latest ADC sample is saved within the global array.
   d. Perform a "housekeeping" action that allows the next sample to be saved into the next element of the global sample array.
   e. Display the raw ADC sample value to the terminal display.

This exercise will be expanded within Week 2 and 3 for this term. Do not leave your work to the last minute. Keep on top of each exercise as they are deployed. Time is short this term, your dedication to completion is key to your success.