LAB6: DAC COMP OPAMP – ECE433/533/CS456 – Spring 2024

Goals:

- Use the DAC to generate an analog signal
- Use the COMP to compare two analog signals
- Use the OPAMP to precondition analog signals

Setup:

- You will use the linear thermistor IC (MCP9701-E/TO), provided in the previous lab.
- You will use the ADC reading mechanism you developed in Lab5.

Requirements:

- Create a separate program for each of the following applications
- **The DAC application:**
  - Generate a sine waveform that changes between 0V and 3.3V with a 1KHz frequency (cycle = 1msec).
  - The `sin()` function can be found in `math.h` library
  - Use a timer that triggers the DAC to update its value at 100KHz, so that you have 100 steps to generate the 1KHz sinewave.
  - You can use the following line:
    - `int dac_val_12b=(4095/2)*(1+sin(2*3.14*step/99)); // where step is 0 to 99`
  - For testing, hook the DAC output to the ADC input developed in Lab5 to draw it on the PC using its fastest speed.
- **The COMP application:**
  - Set the DAC to a value a little higher than the current reading of the temperature sensor.
  - Connect the DAC to one input of the COMP
  - Connect the temperature sensor to the other input of the comparator
  - On comparator trigger (where temperature > DAC_value), create an interrupt handler to turn on the red LED.
  - For testing, increase the temperature around the sensor (by touching it?) to trip the LED.
- **The OPAMP application:**
  - Use the OPAMP to precondition the temperature sensor signal to scale it using the gain of 2.
  - The output of the OPAMP should be internally connect to the ADC.
  - This will improve the dynamic range of the ADC making it more sensitive to temperature changes.
- Do not use any prebuilt high-level functions but you may use your functions developed in previous labs. Like what you learned in class, write your program in a register level abstraction.
- Add comments to each line in your code.
- Make you code portable since we will add to it on the next lab.
- You can submit separate code for each of the three assignments.