Temperature Sensor(LM35) and LCD

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1 Lab Objective

In this lab, you will interface a 16x2 LCD with the TIVA board and LM35 temperature sensor.

2 Pre-requisite

1. Lab 4 : ADC and UART

2. You may want to read about interfacing working of 16x2 lcd and interfacing it in 4 bit mode.

3 Problem Statement

1. Interface a 16x2 LCD in 4 bit mode with the board. There is an onboard temperature sensor, display the temperature sensed by this sensor on the LCD; use the internal ADC to convert analog readings to digital ones.
   Follow the display format as shown in the figure 1 below:

2. Next, interface an external LM35 temperature sensor with the board and display the temperature on the LCD. Use the switch "sw1" to switch between internal and external temperature readings. The display should show external sensor readings by default and switch to internal when"sw1" is pressed once, on the next press the display should return to default (show external temperature readings). Figure 2 below will clear things out.
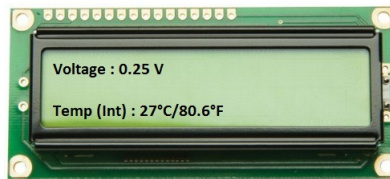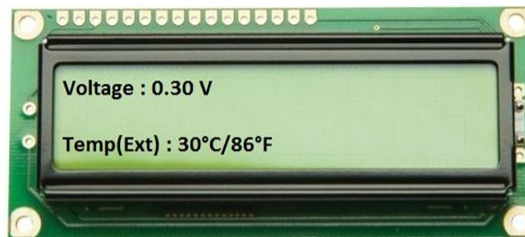
Figure 1: LCD Display Format

sw1 pressed once: External temperature sensor readings

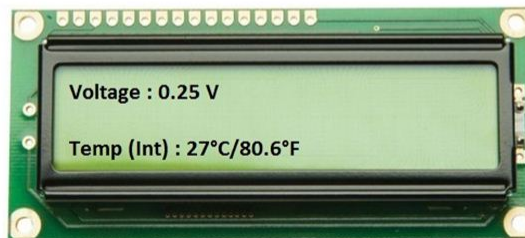sw1 pressed again : Internal temperature sensor readings

Figure 2: Alternating sensor display values

4 Relevant Theory

This lab will use LM35 temperature sensor, you can refer to its datasheet from the following link:**Datasheet**.

You have to interface LCD in 4 bit mode rather than 8 bits. Read up about LCD working and the basic LCD commands to be used for initialization.

The problem statement requires you display decimal values upto two places on the LCD. You can shift the values to the left by appropriate places and then use the ascii value of "." to display decimal values.

Please follow the timings given in the LCD data sheet during initialization.
Make the code modular with header file etc so that you can seamlessly use LCD for other projects as well.

5 Procedure

1. For LCD in 4 bit mode :
   First initialize lcd in 4 bit mode
   Give commands for clear screen,display on and cursor location
   Command mode:
   In command mode rs=0 and rw=0
   Send higher 4 bit
   After sending data to the port;give a enable pulse
   Send lower 4 bit
   After sending data to the port;give a enable pulse
   Give delay of microsecond at end
   Write mode:
   In write mode rs=1 and rw=0
   Send higher 4 bit
   After sending data to the port;give a enable pulse
   Send lower 4 bit
   After sending data to the port;give a enable pulse
   Give delay of microsecond at end

2. For external tenprature conversion:
   Configure adc1 chip
   set ch1 to get analog data
   enable adc1
   wait untill interrupt has occured
   store the data in the variable and convert it into celsius by dividing it with 12.41
   convert the stored data into character and store it in array
   send the character array to lcd screen

3. For internal temprature
   Configure adc0 chip
   set the temprature given on chip
   enable adc0
   wait untill interrupt has occured
   store the data in variable and convert data into celcius
   convert the stored data into character and store it in array
   send the character array to lcd screen

6   Demo and Submissions

You have to shoot two individual videos demonstrating the output of the problem statement.
Your codes for each of the problem statement has to be uploaded in Github repository.