Lab #3
ADC and OLED display Interfacing
CSCE 5612 - Embedded Hardware/Software Design
Fall 2018

100 Points
Due: 11/02/2018, 11:55 PM

Instructions: TA will be available during the office hours or by an appointment to demonstrate your lab as a team. You are most welcome to demonstrate the lab to the TA as a team before the due date. Please don't wait till the last minute to complete the lab as you may not get the required resources like PCs or boards. Make sure you have a printed lab report (one per team) and turn it in when the demonstration starts. Your lab grader will ask you questions during the demonstration. Questions are worth **20 points** and will be graded according to your answer to the questions. After the demonstration is completed, immediately upload the report and the zipped project to Canvas. **Not following the above instructions could result up to 50% deduction from your lab score**. **Late demonstrations and submissions are not allowed.**

Objectives:

This lab introduces ADC and OLED display interfacing using ESP8266 NodeMcu and shows how SPI and I^{2}C bus is used for interfacing.

Requirements: (30 Points)

1. Measure the ambient temperature using TMP 36 temperature sensor
2. Convert the analog voltage from the TMP 36 temperature sensor to a digital value using an MCP3008 ADC
3. Interface the ADC with the ESP8266 NodeMcu using the SPI bus
4. Calibrate the temperature sensor to read the right temperature
5. Interface an 128x64 OLED display with ESP8266 NodeMcu using the I^{2}C bus
6. Display the ambient temperature in Celsius and Fahrenheit on the OLED display.

Procedure:

1. Interface the temperature sensor TMP36 to the MCP3008 ADC using their respective datasheets

      a. https://www.analog.com/media/en/technical-documentation/data-sheets/TMP35_36_37.pdf

      b. http://ww1.microchip.com/downloads/en/DeviceDoc/21295d.pdf

2. Install the MCP3008 libraries in Arduino IDE (Sketch→Include Library→Add .ZIP Library…) from https://github.com/adafruit/Adafruit_MCP3008

3. Interface the 128x64 OLED display with the ESP 8266 NodeMcu using the video https://www.youtube.com/watch?v=RpK7-Ljnpho

4. Using C code, read the MCP3008 ADC for the ambient temperature. Calibrate (using C code) the TMP 36 temperature sensor using a standard mercury thermometer or other calibrated temperature sensor

5. Display the temperature on the OLED display in Celsius and Fahrenheit

6. Arduino IDE reference is available here https://www.arduino.cc/reference/en/

7. Use the example codes and the Arduino reference to meet the requirements and complete the lab

8. Record your observations in the report.

Demonstration: (30 Points)

1. Demonstrate that the ambient temperate is displayed on the OLED display in Celsius and Fahrenheit

2. Demonstrate that the ambient temperature is calibrated, and the calibrated temperature is displayed on the OLED display

3. Demonstrate that the temperature increases (on the OLED display) as the sensor comes in contact with a hot body.

Deliverables: (20 Points)

1. Use the lab template posted on the Canvas page

2. Answer all the questions asked in the lab template

3. Type the lab report and turn in the printout of the lab report when the lab is demonstrated as a team

4. After the demonstration is completed, upload the report (one per team) and the zipped project (one per team) to Canvas.