IOWA STATE UNIVERSITY

Senior Design Weekly Report

Weekly Report 9

Group: May-06

Group member: Chongli Cai, Qiaoya Cui, David Hoffman, Andrew Kom, Ailing Mei

Client: Garmin International

Advisor: Dr. Colin Christy

Period: 10/22/2012-10/28/2012

Date: 10/28/2012

Goals to Meet

This week we wanted to narrow down the list of 4 LCD screens to 2 and order them. This will allow us to start integrating LCD and UI integration in the measurement circuits with the MCU. We also wanted to start testing our current sensor and temperature sensors we got for accuracy. The tests can be seen bellow. In addition to continuing to program the MSP430, we wanted to establish UART communication between the PIC board and a PC's hyper-terminal.

Weekly Progress

We narrowed the list of LCD screens down to 1 we located, and 1 that was recommended by Garmin. An email has been sent out to Steve at Garmin to order those parts. We also were able to test the current and temperature sensors (SEE BELOW). Continued research into the MSP430 ADC and UART communication was also accomplished this week. In addition, we created a simple program to send characters to the hyper-terminal, using the PIC evaluation board. There are some complications though, see below.

Future Planning

This next week, we want to debug our interface with the PIC and hyper-terminal. We also want to start getting hyper-terminal communication with the MSP430, and ADC readings.

Pending Issues

This week, we attempted to get the PIC processor to send a signal through the RS232 port on the evaluation board. We were unsuccessful as no communication was made. We have 2 ideas as to why. First, it is possible that a mistake was made when connecting the pins on the mini-USB spliced 9-pin cable. The other is that using the RS232 to USB converter doesn't work because of connections that don't exist on the evaluation board side (mini-USB port that has RS232 pins). This will debugging will be high priority this coming week.

Individual Contributions

Andrew:
Wrote project report 9
Made purchase request for 2 different types of LCD screens to start testing

Chongli:
Finished and submitted the Design Document
Helped Ailing and Qiaoya in the Temperature sensor and current sensor testing

Ailing, Qiaoya:
Continued to work on programming the MSP430 MCU
Tested the Temperature sensor, obtaining the characteristic equation for temperature
Tested the current sensor we received

David:

Attempted UART communication with the PIC processor and hyper-terminal

Report for Temperature Sensor and Current Sensor Characteristic Testing

Chongli Cai, Ailing Mei, Qiaoya Cui

10/26/2012

- ## Temperature measurement

The temperature is measured by using LM35 temperature sensor from Taxes Instruments Inc. The output voltage is linearly proportionally to the Celsius Temperature.

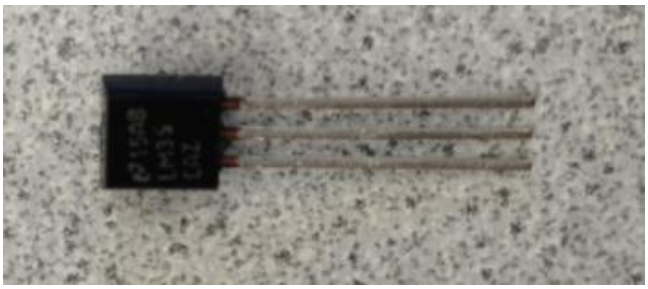
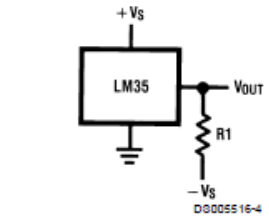


Figure 1: TI LM35 Temperature Sensor



Choose $R_1 = -V_S/50\ \mu A$
V_{OUT}=+1,500 mV at +150°C
= +250 mV at +25°C
= −550 mV at −55°C

Figure 2: Lab Measurement schematic

We test the Temperature Sensor in the Lab and find the linear relation between output voltage and temperature. The Matlab result is shown in the Figure 5.

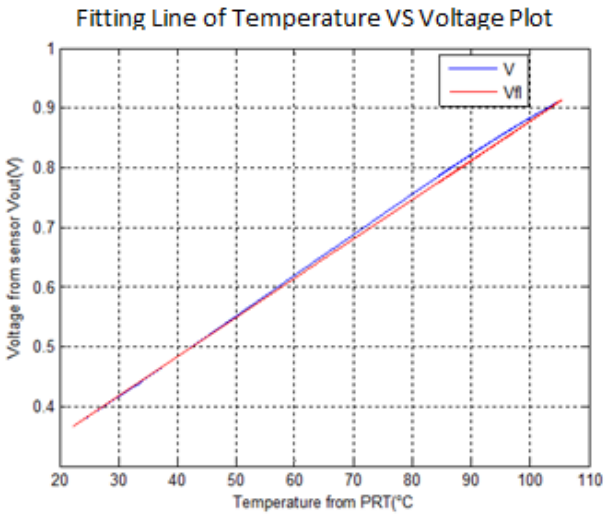


Figure 3: Fitting Line of Temperature VS Voltage Plot

The red line is the measurement result and the blue line is the theoretical result.

- **Current Measurement**

  Current measurement is based on Hall effect-Base Linear Current Sensor. The output of current sensor is followed by an amplifier to arrange the voltage less than 3V. Allegro System Inc. ACS714 Hall Effect-Base Linear Current Sensor is used for current measurement. Since ACS714 includes an instrumentation amplifier, it does not need to follow another one at the output pin.

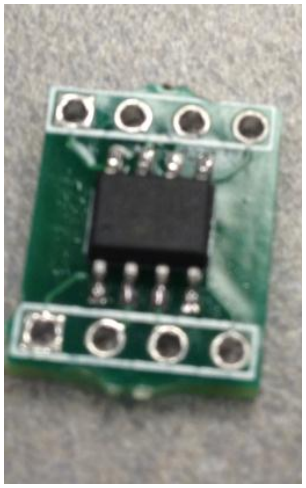


Figure 4: ACS714 Hall-Effect Current Sensor

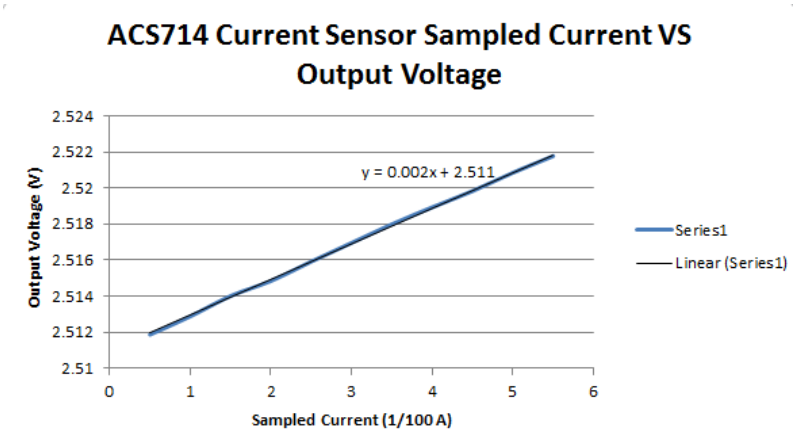


Figure 5: Test Result for ACS714

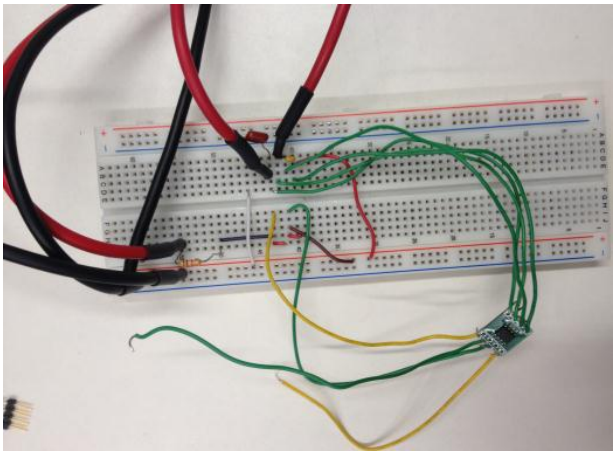


Figure 6: Test Circuit for Current Sensor