

gPod Accessible Blood Glucose Meter

Week 8

March 13- 17

David Price

Work Completed

This week I worked to integrate the glucose circuit to the microprocessor and LCD screen. Early in the week I worked to convert the 8-bit binary number from the A/D converter to a decimal number that would be displayed on the LCD. Initially I tried converting the binary number to a binary coded decimal number and then converting that to an ASCII hex number required by the LCD screen. I later learned that this method is very slow and uses a lot of microprocessor memory. I later found a sample program that explained how to convert the binary number to a decimal number on the LCD.

Using this new code I was able to display decimal numbers on the LCD. The next step of this process was to convert the number to the voltage being read by the A/D converter. This required a simple expression:

$$V_{\text{out}} = (\text{binary count}) * 10 * 5/255$$

The binary count is the number given by the A/D, the 5/255 is the reference voltage divided by the A/D resolution. In this case I was using a reference voltage of 5 volts and only 8 of the 10 bits of the A/D so it has a resolution of 255.

I then worked to improve the glucose circuit. With the current configuration, an average voltage level is approximately 240mV. I would like to increase this level to 2-3 V so that the internal reference voltage of the A/D can be used, simplifying the circuit. It is unclear at the moment whether it is possible to modify the glucose-voltage equation Mike derived to work with this higher voltage level. If we choose to increase the voltage output of the glucose circuit a new glucose curve may need to be obtained.

To take a glucose measurement we poll the A/D for a voltage level to jump over 0.1V. After this increase is detected we delay the measurement for 2 seconds and then read the value at the A/D converter. This value is converted to a voltage and then converting this voltage to the glucose level. The glucose level is then written to the LCD screen.

Initial tests of the code show that the sample detection works and the A/D waits 2 seconds before taking a reading. We have some questions as to the accuracy and repeatability of the system that will be looked at more closely next week. We compared our meter's output to the OneTouch Ultra's. The OneTouch Ultra showed a glucose level of 156 mg/dL and ours showed a value of 89 mg/dL. Another test showed similar discrepancies between the values. We did notice a problem with the signal due to the strip not making good contact with the strip reader. Figure 1 shows the display of our meter and the display of the OneTouch Ultra during a test.

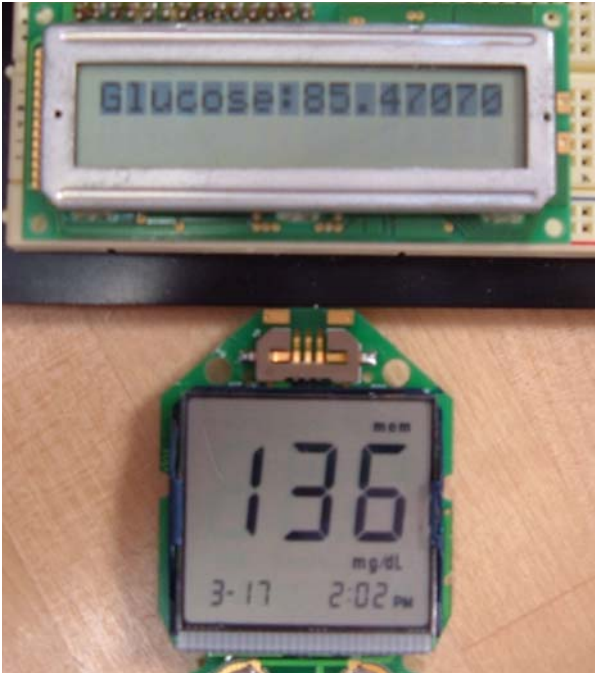


Figure 1, Comparison of gPod to OneTouch Ultra meter.

Future Work

This week will be spent working to finalize the glucose circuit and LCD integration and to integrate the speech module. I will look into the discrepancies of the measurements with Mike and work to increase the accuracy and repeatability. I will also start writing code to use the speech module with the RS232 port on the microprocessor as well as program code to use the predefined phrases. Matt will work on the printed circuit board in ExpressPCB and also order surface mount parts. Mike will work to check the accuracy of the glucose curve and help me improve the accuracy of our meter. Mike will also work with the barcode scanner. By the end of the week I will have the LCD, glucose circuit, and speech module all working with the microprocessor.

Project Review

The progress on the project has been very good this past week. The integration of the LCD screen is complete and integration of the glucose circuit is going very well. Our initial concept of taking glucose measurements was correct and with a few minor adjustments will be able to take accurate blood glucose measurements. The project looks to come together by the end of the next week. Total costs to date are \$895.67.

Hours Worked

Hours spent on the project for Week 8: **22 Hours**