gPod Accessible Blood Glucose Meter

Week 8
March 13-17
Matthew Bularzik

Work Completed

This week was spent on many things. Matt spent most of the week starting to design the PCB board. Dave spent most of the week on integrating the different circuit with the microprocessor. Finally Mike spent most of the week mainly working with the vial scanner.

Matt spent the week compiling the overall circuit for the gPod by drawing each section of the circuit by hand. These sections consisted of the Microprocessor, LCD, SP03 module, Glucose circuit with filtering, and the Max232 circuit. Figure 1 below shows the overall circuit schematic version 1.

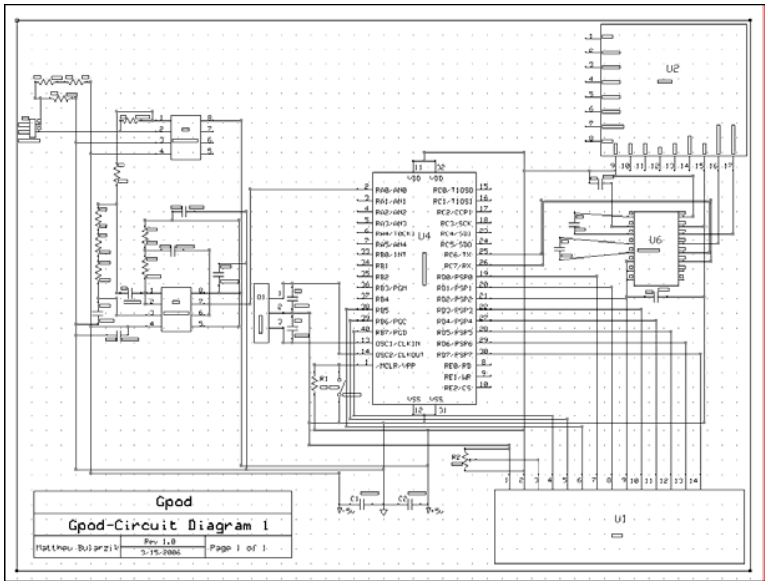

Figure 1: Overall Circuit Schematic

There are possibly more circuit sections to be added if the vial scanner can be developed in time. This would mean that the USB chip circuit would have to be added along with the vial scanner circuit. There are also more connections that have to be made between the microprocessor and the SP03 speech module for the preprogrammed phrases.

Dave spent most of the week integrating the glucose circuit to the microprocessor and LCD screen. Early in the week he worked to convert the 8-bit binary number from the A/D converter to a decimal number that would be displayed on the LCD. He found a sample program that explained how to convert the binary number to a decimal number on the LCD. Using this new code Dave 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_{out} = (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 he 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.

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

Dave and Mike then worked on testing the screens integration with the microprocessor and LCD. Initial tests of the code show that the sample detection works and the A/D will 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. 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.

Mike spent a portion of the week developing the vial scanner. He designed a LabView program that simply prompted the user to scan a barcode, and when scanned, the number on the barcode would show up on the front panel of the program. The present idea for

the vial scanner is that we will take about three barcode numbers of various insulin brands that are sold. The barcodes of insulin have been made standard by the FDA, so the barcode numbers are specific to a certain type. Mike will then use a website to generate barcodes for these numbers, and then print and paste these barcodes to the vials. A database of these numbers will be stored into the code being written that will be able to read in the number and output the type of insulin it is. This output can then be displayed on the screen and essentially we have insulin identification.

The next part that needs to be done for the vial scanner is a USB/Serial circuit. The microprocessor has serial port capabilities that can be directly connected through certain pins. However, the vial scanner is run through a USB connection. Mike have found a datasheet that gives some sample circuits that will make this conversion, as well provide power to the USB and other things.

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 5:	Matt 19 Hours
	Dave 22 Hours
	Mike 14 Hours
	Total 55 Hours