

gPod Accessible Blood Glucose Meter

Week 1

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Matthew Bularzik, David Price, Michael Rivera

Work Completed

During winter break Dave researched details relating to the LCD screen and microprocessor. He obtained many application notes relating to the controlling of a serial LCD display using a PIC16 microprocessor. He also found an appropriate memory module to be used for storage of measurement data and as a frame buffer for the LCD.

The first thing that was done when the spring semester started was to inspect and check on what parts have arrived. All parts that were ordered had arrived though not all were correct. An ordering mistake was found with our LCD screen choice and a second module needed to be ordered. The screen ordered was a smaller size of the version we originally intended to use. In addition to a new LCD screen, we placed an order for a development board to accompany the LCD screen. The development board is an economical way to connect the screen and interface it with either a PC or the microprocessor. It will allow Dave to get a comprehensive understanding of the hardware and software aspects of the display without worrying about incorrectly connecting the display and damaging it. In the long run we feel that the development board will simplify interfacing the LCD to the microprocessor and will provide a safe testing environment.

The bar code scanner currently does not read the bar code on the empty insulin vial that we have and will likely have to be returned. A bar code scanner that will work with our vial will ultimately need to be ordered. This could be caused by the bar code since it runs with the curve of the bottle and not the length of the bottle.

Another Winbond speech chip and DIP adapter had to be ordered since trouble was encountered during soldering of the first set. Both were damaged beyond repair and needed to be reordered. The soldering irons in the lab make soldering 0.8 mm spacing a challenge. Future soldering may take place at Dave's place of work back in Massachusetts to eliminate any further damage. Also, additional memory was ordered and the USB chip that will be needed for our gPod and a computer to talk to each other.

Great progress was made in the area of glucose detection and measurement. Dave and I spent Wednesday trying to piggyback measurements from the OneTouch Ultra meter. Measurements with an oscilloscope or multimeter caused the OneTouch Ultra to enter an error state and not acquire a reading. A number of setups were tried to grab the data from the One Touch Ultra meter and they all failed since the meter just kept going into an error state. We decided to eliminate this problem by constructing our own glucose measurement circuit and taking readings from an oscilloscope. Figure 1 shows the schematic of the test setup while Figure 2 shows a picture of the test setup. A potential of 400 mV was applied between the Reference Electrode and Working 2 and Working 1. A

sample glucose solution of ~114 mg/dL was applied to the test strip connected to the three electrodes. The voltage level was read using a scope and Figure 3 shows the results. Channel 1 (orange) shows the data from Working 1 and Channel 2 (blue) shows Working 2. The data in Figure 3 appears almost exactly as expected from the research from last semester. One difference in our data is it is inverted producing a positive sloping line instead of a negative sloping one. More data analysis and filtering were completed using LabView.

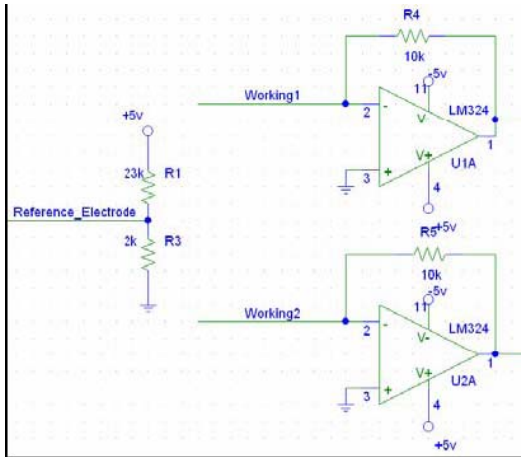


Figure 1: Glucose Circuit

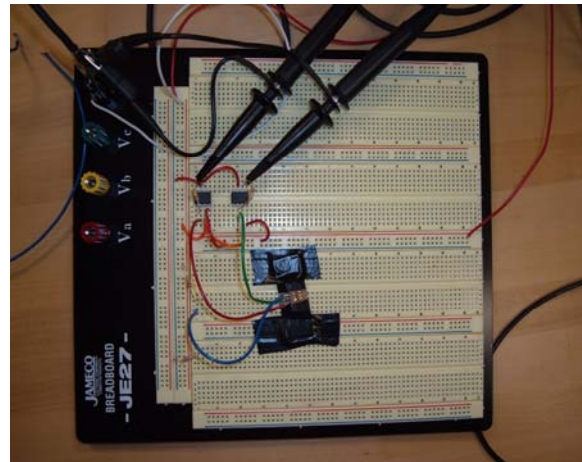


Figure 2: Picture of Glucose Circuit

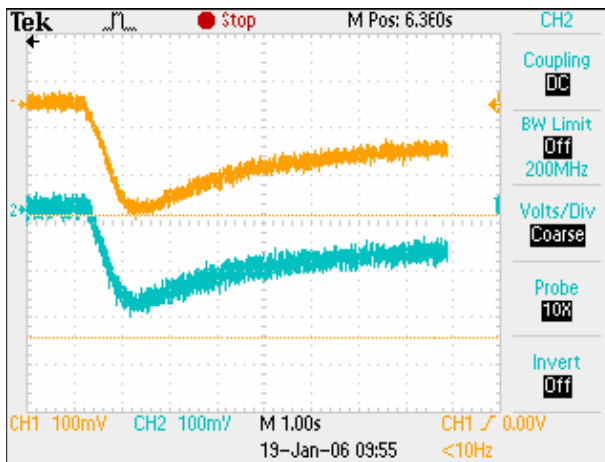


Figure 3: Glucose Measurement Results

Future Work

In the upcoming week, significant testing and analysis needs to be done. Currently, there are a couple issues with our circuit. For one, the output signal we get seems to be inverted, in comparison to those that were found in our research. Why this is happening, and its significance is still unknown. The glucose circuit will be adjusted so that the signal is in the positive range so the microprocessors A/D converters will be able to work with it.

With everything considered, it is still hopeful that by the end of week 2 we will have a relatively accurate and consistent glucose-voltage relationship. Once we have this trend, we can then incorporate the microprocessor and begin coding it to perform the necessary measurements and tasks.

New materials should also be arriving which had been ordered the previous week such as the new Winbond text to speech chip and its DIP adapter. Once Dave successfully solders the Winbond chip to the DIP adapter I will begin to prototype the chip circuitry. I also plan on further research on how to talk/program to the Winbond chip. Hopefully the LCD development board will arrive, if approved, so that work may begin on the LCD prototyping and user interface.

Project Review

The project is progressing in a positive manner. The delay in the work on the LCD and speech chip was offset by the tremendous progress made in the glucose measurement portion of the project. The glucose measurement segment of the project is nearly two weeks ahead of schedule. The speech chip and LCD portions of the project will be back on track as soon as the new parts are received. By the end of the week we hope to have an accurate glucose curve and start writing code to obtain the data using the microcontroller. The project is also staying well under budget. Total costs to date are \$342.24. Additional orders from Week 1 place the projected costs at \$500. After this week no major purchases are scheduled until board layout and assembly occurs.

Hours Worked

Hours spent on the project for Week 1:

Dave: 15

Matt: 15

Mike: 7

Total: 37