Work Completed

During past week Rob and I continued to work on the SP03 module. The SP03.exe program, which is used to program the module, reported no connection from the computer to the module when the module was powered up and connected by a serial cable. When powered, the module would say, “Thanks for” and then cut out and repeat the short phrase again. I spoke with Dave Price (Team 2, Spring 2006, glucose meter) one evening about the difficulty we were having getting the module to connect. He said that when his group used the same module the year before, they also had connection problem.

On his advice, I tried a variety of things. I changed the order in which I connected and powered up the module (power module, connect module to computer, power computer; power computer, power module, connect module to computer; etc), which didn’t solve the problem. Dave also said to make sure that the module was receiving enough current. Increasing the current to the module to 25mA resulted in the module finishing the phrase it would cut out of: “Thanks for purchasing the SP03.” Dave suggested as well that we check our permissions and that we may need administrative access to properly run the program. Working with Bill, we downloaded the SP03.exe program to the administrative account on our computer. This didn’t immediately solve the problem either. However, about an hour after adjusting the program permissions, the computer could connect with the module, and we were able to test the module with sample phrases. The module worked well, but the speaker that came with it was not loud enough. I attached an $8\Omega$, .25W speaker that I found in the closet to the module, and the volume level that was output was much more acceptable. We still do not know exactly why the SP03 module started working.

Work was also done with the thermocouples that were ordered from Omega (they arrived on Friday). I had ordered 36” long, .032 diameter, glass insulated, type J wire thermocouples for use in measuring respiratory rate. Using a multimeter, I found that at room temperature, the voltage across the thermocouple was about .04mV. To quickly test the sensitivity of the thermocouple and verify that it would be appropriate for our purpose, I held the reactive end under my nose and breathed regularly with my mouth closed. The multimeter showed an increase to .28mV on exhale and a decrease back down to .10mV on inhale. The speed of the change corresponded to my rate of respiration. For our use, we only need to see a noticeable in temperature from the thermocouple. Voltage value (so far as it is appropriate for the microprocessor) does not matter.
Table 1. Thermocouple Initial Test Results

<table>
<thead>
<tr>
<th>Action</th>
<th>Voltage (mV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Room temperature, No action</td>
<td>.04</td>
</tr>
<tr>
<td>Inspiration</td>
<td>.10</td>
</tr>
<tr>
<td>Expiration</td>
<td>.28</td>
</tr>
</tbody>
</table>

The thermocouple wire is long, but very rigid. To simply clip it to the nose would be awkward. In making the probe, we will either attach the thermocouple to a headset (Fig. 1), with the adjustable tip under the nose, or cut the tip of the thermocouple off and use wire that can be retracted back into the vital signs monitor (Fig. 2).

Continuing with the thermocouple, to amplify the signal I built a simple amplifier using an op amp, which has a gain of 100 (G=100). Checking the signal with an oscilloscope, I found it very noisy and difficult to see the change in temperature (Fig. 3.). Using FilterPro, I designed a 3rd order Butterworth low pass filter with a cutoff of 40Hz (Fig. 4). I plan to implement the filter later this week, since I suddenly ran into some problems with the amplifier and its output onto the oscilloscope. Despite debugging, the scope reads 5V from the amplifier though the multimeter reads around .5V (correct).
**Future Work**

In the next week, I will debug the amplifier and implement the filter. I went to RadioShack over the weekend, and I picked up some wire to finish the thermometer probe (at least for now), so I’d like to work on that. The pressure sensor for the blood pressure system came in this week, and I’ll start working with it and the blood pressure cuff. Also, I will submit POs for a pump and valve for the blood pressure system and a PO for a fingertip pulse oximeter to integrate into the monitor. Finally, I plan to speak with Bill about wireless chips and making the probes wireless.

**Project Review**

Due to time constraints and that I’ll be traveling to Indiana this weekend, I haven’t gotten as much work done as I would have liked this week. The end of this week and next will probably involve some long hours on my behalf to accomplish the work I want to do. Otherwise, since the SP03 module is working, we have at least one part of our accessibility under control. I’d like to see Mike finish with the scale by the time I return from Indiana, and now that we have MPLab installed on our computer, I expect Rob will take off with the microprocessor. Overall, we’re progressing steadily. With parts received to date, we have spent $495.29.

**Hours Worked**

Hours spent by working on the project, Week 2 (1/31/07-2/6/07): 11 hours