Accessible Home Vital Signs Monitoring System
Week 1 (1/16/07-1/30/07)
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Jenna M. Sullivan

Work Completed

During the first week of class, we received some initial parts (scale, Blackfin, LCD screens, batteries). We had ordered 6 LCD screens, thinking that we would display each of the six vital signs we collect on its own screen, but from research that I did over winter break, I determined that it would be easier and cleaner looking to use just one screen. One LCD screen reduces the amount of power we need to run the device and the number of microprocessors we would need (six, one for each screen). Using only one screen, we plan to scroll or flash the vital signs across the screen, one at a time, in sync with the audio output of the vital signs from the SP03 module. All timing will be controlled by the microprocessor. Also in this first week, more parts were ordered, including the pressure sensor, photodetector, LEDs, and SP03 module.

In the next week of classes, I built the temperature probe for the thermometer. In order to reduce costs and make a recognizable probe, I purchased a digital thermometer from CVS and pulled all of the circuitry out of it, leaving just the casing and the thermistor in the tip (Fig. 1). I then soldered two wires to the thermistor leads in order to test the probe and determine a table of resistances (or resistance curve) that the microprocessor will use to calculate temperature.

Figure 1. Thermometer and Cap
The probe was tested using materials from the BME 217 lab, including a Corning Hot Plate, 600mL Pyrex beaker, glass thermometer (alcohol, ± 1°C), and a Fluke 45 Dual Display Multimeter. I taped the probe to the side of the beaker and filled it up with water past the metal tip of the thermometer, which contains the thermistor. The glass thermometer joined the probe in the beaker, and the beaker was placed on the hot plate. Using alligator clips, I attached the multimeter probes to the thermistor leads and set the multimeter to display resistance. By monitoring the glass thermometer and multimeter, I was able to determine the change in resistance of the thermistor as the temperature of the water increased (Fig. 2). I ran 4 trials over a period of 32-44°C (~90-110°F), allowing at least 5 minutes between each trial for the thermometers to return to room temperature.

The results show that the change in resistance over this temperature period is linear, proving that I did not damage the thermistor when I removed the circuitry from the thermometer. However, the four curves that I received do not overlap, as I hoped they would (Fig. 3). I believe the discrepancies in resistance to be due to the inaccuracy of the glass thermometer. To remedy this, I repeated the experiment using the Fisher Scientific Accumet Research AR50 Dual Channel Ph/Ion/Conductivity Meter from the BME 271 lab, which has a digital thermometer with an accuracy of ±.1°C. This produced much better results (Fig. 4).
Thermometer Probe Resistance Testing

Figure 3. Results from Round 1 of the Thermistor Testing

Thermometer Probe Resistance Testing 2

Figure 4. Results from Round 2 of the Thermistor Testing
Future Work

In the next week, I plan to start work on the circuitry for the pulse oximeter. This week I started playing with the driver circuit that will provide a constant current source to pulse the LEDs, as well as finding an optional method for timing the LED light pulsation. I plan to use the microprocessor to control timing in the finished circuit, but for now I will look into using a function generator or comparator to produce a TTL signal. Also, if the photodiode and LEDs arrive next week, I will begin construction of the pulse oximeter probe. Finally, the thermometer circuit will be completed by the addition of an amplifier and filter, and the probe will be finished once I find wire I’d like to use for the leads.

Project Review

Work on the project is progressing relatively smoothly. We’ve had a few days set back on the microprocessor with getting MPLabs installed on our computer, but since we’re considering switching from the Blackfin to a regular PIC, this gives us time to brush up on working with PIC microprocessors. Also, forward progress with the thermometer has offset some trouble with acquiring some parts (sensor and valve) for the automated blood pressure system. Despite ordering LCD screens that we will not need, we are still well under budget at expenditures at $411.53. Part orders that were placed within the last week will bring us up to about $500 spent. The only major purchase left before the PCB and casing will be the Bluetooth module, which is expected to cost around $100.

Hours Worked

Hours spent by working on the project, Week 1 (1/16/07-1/30/07): 22