For this week, the bulk of my work involved the transfer of the PIC from the Quick-Start board to my protoboard. This task took some time, however it is now complete with one exception. The crystal that is used in the Quick-Start board is a 7.3MHz crystal oscillator, however the crystal that was available to me was a 4MHz crystal. Because the crystal determines the speed of the PIC’s clock, the performance of my code was subsequently changed as well when I used the 4MHz crystal. For example, instead of calling audio in response to frequencies of 45-56Hz and 90-112Hz, (Red and Blue respectively) with a 4MHz crystal, the audio will be called at 24-30Hz and 50-62Hz. Of course I tried decreasing the ranges of timer1 overflows to count between captures, however these would require frequencies of 160-200+Hz. With a 4MHz crystal, this would fall somewhere between 1 and 2 timer1 overflows between captures. When I tried this, I realized that capturing less than 3 timer1 overflows between captures would account for frequency ranges that are so wide, that specificity of frequency would be compromised. On the other hand, since the PIC 16F74 is more commonly used with 4MHz crystals and the Quick-Start board uses a 7.3MHz, I’m uncertain about turning to a crystal of even higher frequency, since I don’t know how this PIC would perform under a faster crystal. However I will order a 7.3MHz crystal to be used in the circuit because, I know it works, and with the senior design clock running out, it would be best for me to stick to what I know will deliver.

Besides transferring the PIC from the Quick-Start to the breadboard, I was able to integrate the PIC circuitry with the SP03 module, by simply linking PortB of the PIC to the parallel port of the SP03. The audio response is prompt, and the frequency dependency is exactly as I would expect it to be for a 4MHz oscillator.

I began working on PC board fabrication this week, by making the diagram and schematic for the circuit. I also went to RadioShack to look for a simple toggling switch for the device, however I learned that those switches are less than ideal for this design.
Upon close inspection of these switches, I learned that they would easily let water in, as they are not designed to be used in wet environments. Water seepage into switches such as these would either short circuit the battery, or let water into the casing, which is clearly unacceptable.

**Future Work**

The next task is to finish PC board fabrication by finishing the schematic in the ExpressSCH program, and then transfer it to ExpressPCB. Once Bill signs off on the board design, then it will be ordered. Along with that order, I will get a 7.3MHz crystal, as well as a waterproof switch. With Kenta’s help, I will even start ordering plastic for the casing. This way we should save a lot of time from having to wait for several small orders to come in to having to wait for one large batch to come in instead.

As far as purchasing plastics for the device casing, I figure we should initially buy thin 12”x12” sheets of 3/16” thick plastic of 2 or 3 different types before buying the thicker sheet for the full casing for three reasons. First, we will need a 3/16” thick sheet anyway for the rear panel and battery compartment cover. Second, they will serve as plastic samples for us, which isn’t a bad idea since we can’t truly tell what a plastic feels and looks like from a website. Other senior design teams have made the mistake of purchasing bulk amounts of plastics they thought they could use, but couldn’t, and purchasing small samples would keep us from making this mistake. Third, 12”x12” sheets of 3/16” thick plastic is relatively inexpensive, averaging about $10 each. To avoid expensive mistakes, no machining of the plastics will be done until all dimensions and layouts are drawn, and until we have shown them to the machine shop personnel.

The circuitry for the device is very close to completion, all that is left to be done is to obtain the 7.3MHz crystal and the simple op-amp circuit to amplify the SP03 audio signal for our waterproof speaker.

**Project Review**
With four weeks remaining, there are only two main tasks left to complete. That is PC board fabrication and device casing, which are the easier, but not necessarily the least time consuming parts of the design. The aim is to have the PC board finished, ordered and on the Team5 table by no later than next week. Two weeks from now, when it comes time to display our design, we will be able to showcase the complete Shampoo-Conditioner ID device from sensor, to SP03 in full action, however the casing will most likely still be in the works. However it is expected to be finished by senior design day.

Hours Worked: 13