1) Backpack Lever Arm System

**Work Completed**

This week, my role was to investigate how to program the PIC16F84A microcontroller, as our project involves developing a program in C to move the servo motors in a sequential manner for precise movements. Essentially, I found pieces of sample code (in C and Assembly), and tried to understand the logic that was being used for Pulse Width Modulation. What is important is, that the Pulse Width Modulation output is a signal that has a time-base (period) and a time that the output stays high (duty cycle). By varying the duty cycle of the PWM signal, it is possible to change the effective power of signal and slow down (or speed up) the motor. I realized that building the program would involve using the Timer features of the PIC to set the PWM period, and cause start/stop motion at certain moments. I have started to look at methods through which I may be able to implement this in C.

Accounting for suggestions from the advisers, the team decided to look into 80/20 materials to build segments of the lever arm system. At the same time, correspondence with the client has kept us informed of updates into dimensions of the new wheelchair, the Quickie P222. However, the client is still unsure about the exact length, width, and depth of the wheelchair's seat, as it will be bought and used in the future. The team has decided to make our design as universal as possible, and adjusted the dimensions of limbs to allow for some customization. The final measurements are: Limb 1 = 22”, Limb 2 = 20”, and Limb 3 = 10”.

![Figure 1: The 3 limbs after cutting the stock material.](image-url)
Lastly, my teammate and I went to the machine shop and cut the 80/20 stock material into the correct dimensions.

**Future Work**
The operation of the PIC16F84A, and development of the C code will be the primary focus. In addition, the group is waiting on delivery of the servo motors, so that we can experiment with alternative locations to mount them. Based on this decision, the team will need to come to a conclusion on whether the 270 degree hinges (ordered) are practical, or if an alternative such as mounting one limb on top of another will be necessary for motion.

If none of the methods prove to be viable ones, it may be necessary to manually develop 270 degree hinges at the machine shop, or further manipulate the 180 degree Pivot, available through 80/20. Design issues still include where to put the power supply, and how to properly insulate the wires/circuitry running within the hollow limbs.

**Project Review**
The team is proceeding according the schedule. As long as the Servo motors arrive (as planned, according to delivery date) next week, we will continue to remain on track.

**Hours Worked: 10**

2) Shampoo-Conditioner Identification Device

**Work Completed**

This week, I looked at different options for a belt which could be customized to fit different bottles sizes. Based on a teammate’s suggestion, I went to Best Buy, and searched in the IPod accessories section. I found an ideal belt, generally used to wrap around one’s arm when exercising. Attached to the belt is a small plastic case, generally used to hold the IPod. I purchased one of these and was successful in tightly packing the voice output circuit inside the casing. With the advisers’ input, the team concluded that this was a good physical design, and should be pursued in making the final product.

After looking at some voice amplification designs, my teammate and I looked for, and acquired four different speakers (of various specifications) to try. After my teammate modified the design (with a new speaker of 1 W, 8Ohms from Diligent Inc.) rather than the .25 W, 8 Ohm speaker that we started with, the sound output was found to be considerably louder. This is exactly what was desired. However, the small batteries provided by the Voice Pad Message Maker were not sufficient (in terms of current output) to
run the new speaker at full volume. Therefore, we tested the system with AA batteries and were successful in achieving full volume.

This week, I also ordered 3-Amp Soft Touch Push Buttons from Radioshack, which can be used to create a large input surface, which the client can press to hear the sound output.

Figure 2: This is a picture of the recording circuit, along with the 1 W Diligent speaker.

**Future Work**
As the belt and casing have been acquired, we will have to look for ways to insulate the circuit within the plastic casing.

The ideal battery will also have to be determined, along with making the best method of convenient replacement possible. This will involve testing the circuit with AA and AAA batteries.

Unfortunately, the Diligent speaker circuit that we used to amplify the sound output of the Voice Pad Message Maker has been discontinued. Therefore, we will either have to build it ourselves or look for another source from which this circuit can be acquired. The benefit of buying it (assembled) is that the compact nature of the circuit can be efficiently maintained, and the team does not have to compromise on volume or weight.

When incorporating the buttons, some insulation should be placed under and around it to prevent water contact with the circuit and damage to the electrical components.
Project Review:
This project is on track, as the voice amplifier has already been constructed, the belt/casing has been ordered, along with the buttons. Once these components are put together, the team will focus on safety issues that are relevant and necessary for a long-lasting product.

Hours Worked: 4