**Project Identity:**

Assistive Robotic Arm  
Week 1  
Asma Ali

**Work completed:**

A microcontroller is used in the electrical design to control the input from the user keypad, process it and as a result, move joints in the desired location. The microcontroller will be responsible for receiving the inputs and then controlling the motors via motor controller chips/motor controller circuitry.

So far, I worked on programming the microcontroller. This programming is done in Assembly language to avoid the complications while compiling the program. Microcontrollers are usually best programmed in assembly language, in which the mnemonic instructions assemble into machine language on a one to one basis. This is because digital control operations require very precise timing and with the PIC, the vast majority of operations execute in a single machine cycle, thus timing is precise and predictable. Higher level languages utilize functions which can be complex subroutines, thus making such timing much more difficult to achieve.

**Figure 1: Flow chart of the program for the microcontroller**
I wrote a standard program that uses the structure that can provide a modular framework for all motor control operations so that over the course of developing the mechanical structure, I can modify the basic structure to create a better motor control system. As depicted in figure 1, the standard program is written by breaking down program into subroutines that are called from the main program loop, or as interrupt subroutines. Over the course of designing the mechanical parts, this interrupt subroutine will be modified that would correspond to the desired functions of the joints.

Figure 2: Photoconductive Cell/Position Sensor:

A position sensor will be added in the design to stop the device in case of an emergency/malfunction. Although mechanical constraints are part of the design for safety but by having these sensors, electrical components will provide added safety to the client. A maximum threshold peak will be programmed in the microcontroller so that upon detecting the light, the power will be cut off and device will stop further movements in that direction. An operational amplifier is added to this sensor to enhance the sensitivity as the resulting output of this sensor is proportional to the light falling on the device.
Future work:

First motor controller subroutine will be implemented in the program. A software based pulse width modulation will be a part of this subroutine to control the timing of the device. The timing is used to control the motor by having a counter that increment periodically and resets at the end of each period of pulse width modulation. The program for microcontroller will be modified on week to week basis as the requirements may change based on mechanical constraints. Also, the circuitry required to run the microcontroller and the force sensors will be implemented on a protoboard. Once, all the circuitry is implemented; it will be tested extensively to ensure safety and eliminate any chances of failure upon installation in the hardware.

Project Review:

Our project is within the expected time frame. The major challenge of programming the microcontroller is under control and developing electrical design is in steady shape as well. Much of the electrical work will depend on the finishing up the mechanical parts and will progress with the development of hardware.

Number of hours worked: 10