Principal Investigator:

John Enderle (860) 486-5521
jenderle@bme.uconn.edu
The Assistive Robotic Arm

Designers: Alon Dagan and Michael Khalil
Client Coordinator: Merriam Kurland, Speech Pathologist, Hampton Elementary School, Hampton, CT 06247
Supervising Professor: Dr. John Enderle
Department of Biomedical Engineering
University of Connecticut
260 Glenbrook Road
Storrs, Connecticut 06269-2247
INTRODUCTION
The assistive robotic arm is a device being developed to aid children with cerebral palsy. Cerebral Palsy is a debilitating disease that affects the portions of the brain necessary for fine motor control and stability. As this illness does not affect mental capacity, children can become quite frustrated with the inability to control their own limbs. The discrepancies between the client’s mental and physical capacity can cause a great deal of anxiety and stress. He has difficulty typing, eating, and interacting with other students. While he has an aide who helps him in class he feels a lack of independence which affects his self esteem. The robotic assistive device will help bridge this gap between physical and mental abilities for the client.

Figure 1. The Assistive Robotic Arm.

SUMMARY OF IMPACT
The assistive robotic device aims to reduce this frustration and provide greater independence for children with cerebral palsy. The assistive robotic arm will act as a third limb for the client, translating his gross motor movements into fine motions. It is hoped that this will reduce some of the frustration in the client’s life and also give him a greater sense of independence.

TECHNICAL DESCRIPTION
The assistive robotic arm is comprised of a three major mechanism which mimic the function of the shoulder, elbow and the wrist. The shoulder movement is emulated using a servo motor base. This motor rotates the entire robot arm 180 degrees and will provide the client with a full range of motion to grab objects off his tray or a neighboring desk.

On top of the shoulder mechanism will be an elevator mechanism which will help elevate the arm. The arm will be capable of increasing 6 inches in its
height so that he will be able to elevate various objects that he might be using in his class and aid in his final goal of gaining independence. The main component of the elevator mechanism is a motor called a linear actuator which will be capable of lifting the elbow portion of the arm to the motors maximum stroke length of 6 inches.

To mimic the elbow of the assistive robotic arm will have a mechanism controlled by a processing unit which is capable of taking x y coordinates and converting it to angular coordinates for the elbow to move in. This way the movement of the 2 segments of the arm attached to the elbow compensate for each other when they move. The processing unit will send a pulse width modulation signal to a servo motor at the elbow, which determines the duty cycle for the servo motor and allow it to move the segments of the arm to a desired length.

The operation of the wrist will rotate the grabber based on an input from the joystick controller by the client. The wrist will be capable of panning and tilting to aid the client in picking up objects regardless of height off of the ground. It will be capable of mimicking the flexion/extension and the abduction/adduction functions of the human wrist.

The gripper mechanism will consist of a vise-like grabbing component connected directly to a motor. These components will work together to allow for a sturdy grip that will not endanger the client or his peers. An end effector called the “Big Gripper” will be purchased as the gripping mechanism for the assistive robotic arm. The gripper’s fingers measure at 3 inches long and open wide enough to grasp a 12 oz tennis ball. The body of the gripper is comprised of a rugged but lightweight PVC plastic.

The cost of parts/material was about $700