# The Engineering and Programing of a Novel Robotic Exoskeletal Joint Enhancement Apparatus

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This experiment was designed to invent a portable biomechatronic joint enhancement apparatus capable of increasing the strength, support, and load bearing capabilities of the human arm for medical rehabilitative application. A motorized apparatus would move in unison with the arm of a user, resulting in assisted motion and increased strength. A resistive analog sensor would be used to sense human movement to be analyzed by software and converted to mechanical output in real-time. Three dimensional models of the apparatus were generated using computer-aided design software. These objects were fabricated from polylactic acid, by the use of three dimensional printing, to produce light-weight and durable components. Analog data from a voltage divider circuit consisting of a fixed resistor and a variable resistive sensor, reflective of the angle formed by the human arm, was retrieved from an analog to digital converter. This data was rectified and used in the execution of a C program, resulting in the rotation of a servo motor. The novel prototype was developed for $750.00, significantly less than comparable available devices. Software on the device was capable of generating data models which could be accessed locally on the device, or retrieved wirelessly upon the receipt of an electronic message. The ability to remotely access motion data from the apparatus would be greatly beneficial to medical personnel in the assessment of patient rehabilitation. Testing showed that the apparatus was capable of operation free from external computers or power supplies for prolonged periods of time, as well as accurately sensing and responding to human arm movement. This resulted in an increase to the strength and load bearing capabilities of the human arm.

**Awards Won:**

Fourth Award of $500