Glove Controlled Robotic Arm

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Motivation

Fifty-three million people in America have a disability and over four-tenths of mobility device users are unable to adequately perform daily tasks. A system that allows those with limited mobility to fully utilize their extremities can potentially improve their daily lives.

Objective

The objective is to design a device that is capable of accurately measuring arm motions, utilizing the captured data as control signals, and applying it to an external system in real time.

Data Acquisition Unit

The printed circuit board (PCB) will house the ATmega1284P microcontroller and creates a troubleshoot friendly interface with the sensors. It receives power from a rechargeable 5V USB battery pack, ensuring the user's mobility and access to multiple power banks. Through rigorous prototyping, the PCB effectively received, calibrated, and transmitted our sensor data.

- **Flex Sensor** – Measures the linear displacement in one direction
- **ADXL345** – Measures the acceleration and angular rotation along the X and Y axis
- **HMC5883L** – Measure's low magnetic fields in reference to Earth's poles
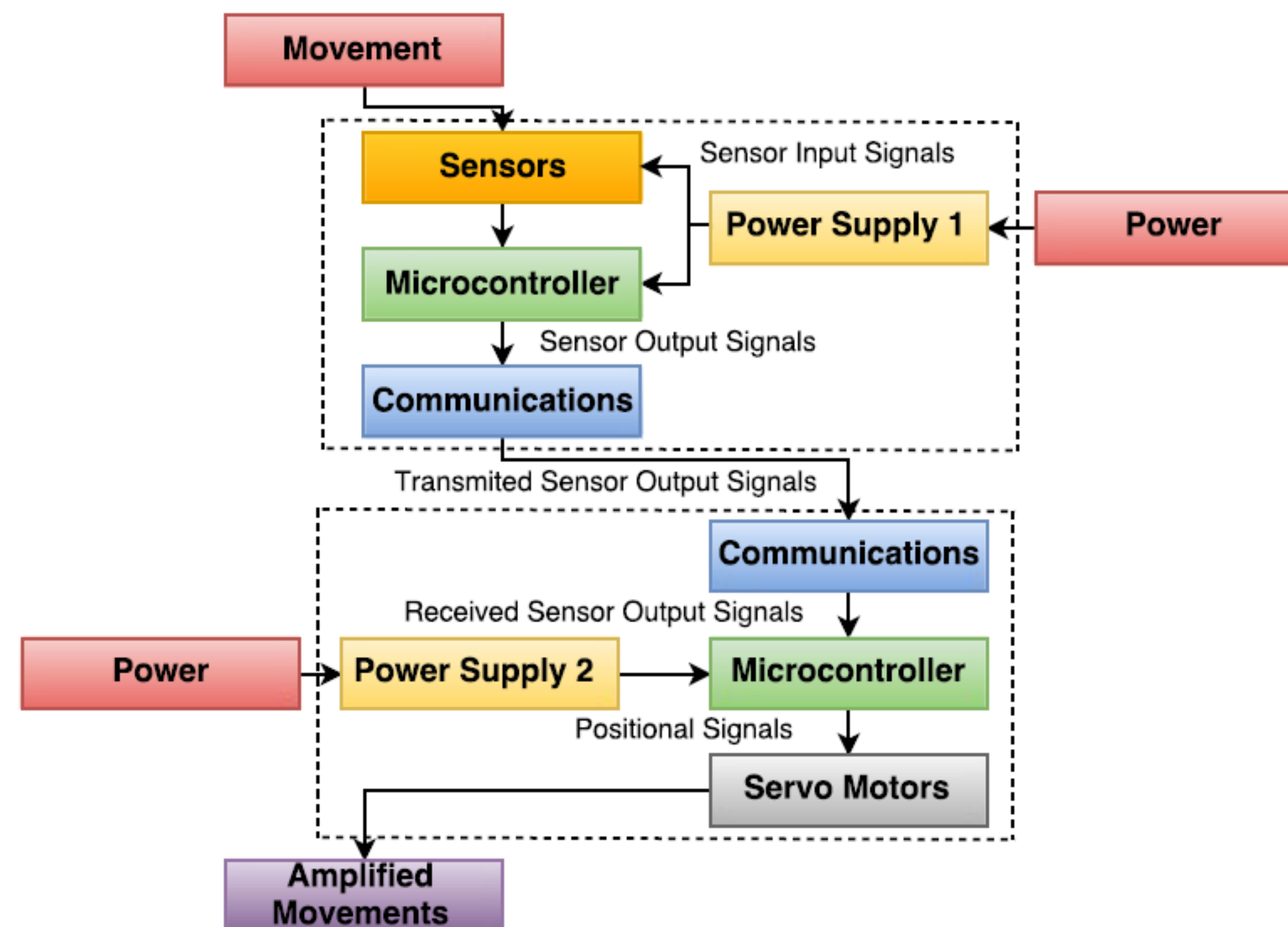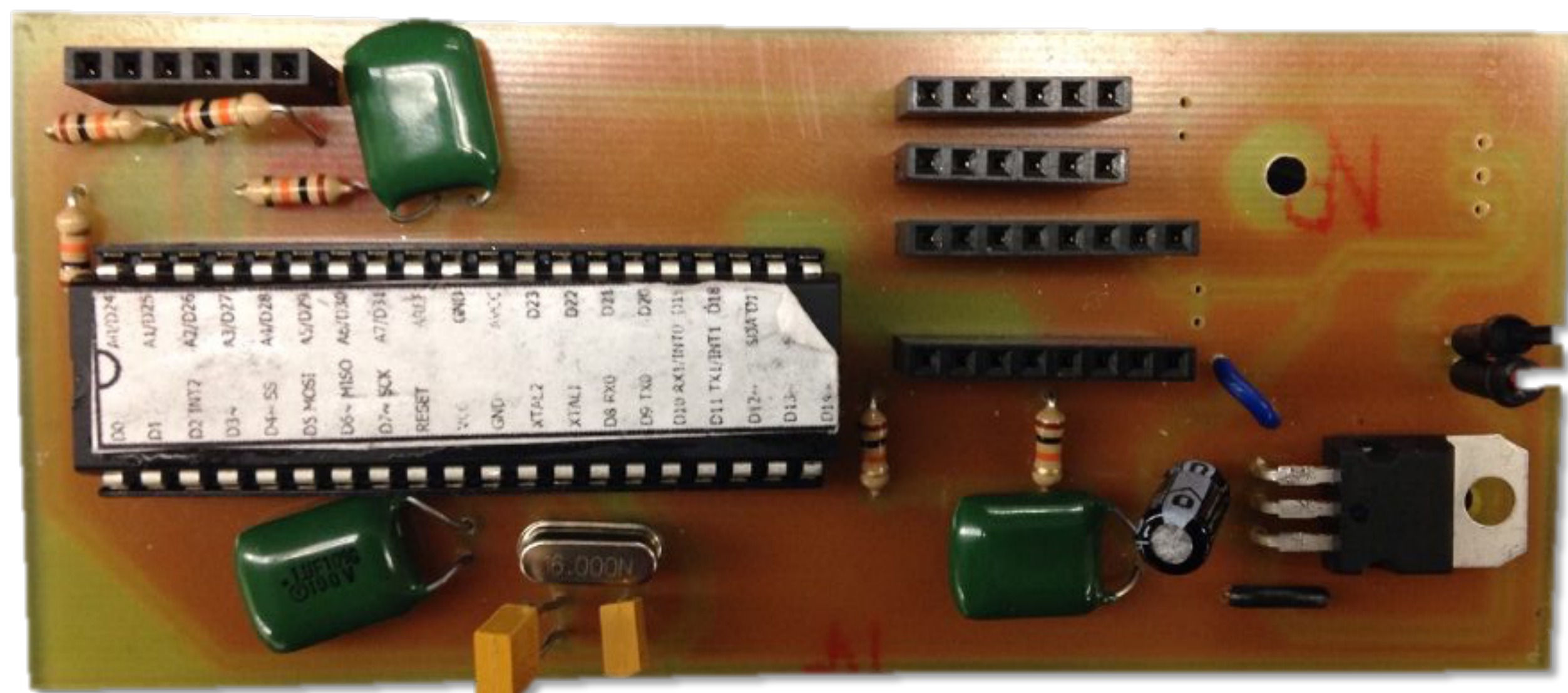

Glove Program

This program loaded onto the ATmega1284P and is responsible for the following:

- ✓ Acquire Sensor Data
- ✓ Run Calibration on User's Movement
- ✓ Calculate Pitch, Roll, and Yaw
- ✓ Convert from User's Angles to Robotic Arm's Angles
- ✓ Filter Degree Range
- ✓ Send Data from PCB to Arduino Mega

Robotic Arm

The robotic arm is used to demonstrate the movements of the arm that are captured by the control device and is oriented on a wooden mount. The arm captures the anatomical movements: shoulder flexion, shoulder rotation, elbow flexion, wrist flexion, wrist rotation, and finger flexion.
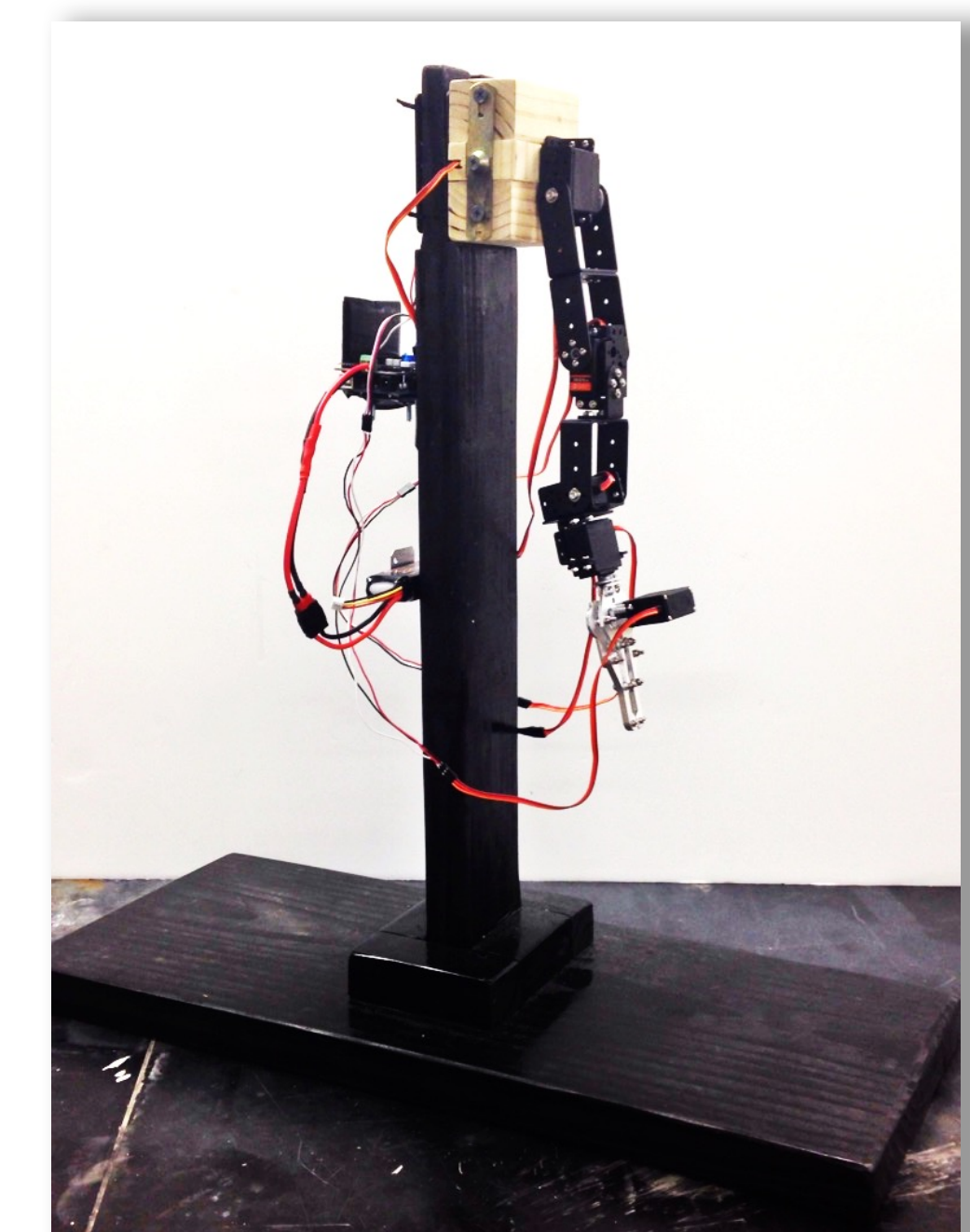
Robotic Arm Program

This program is loaded onto the Arduino Mega and is responsible for the following:

- ✓ Wait for data to be received
- ✓ Converts received data to numbers and characters
- ✓ Assign degree values to corresponding servo motors

Results

- Response time of 21 milliseconds
- Calibrates to user's movement
- Successfully amplifies movement