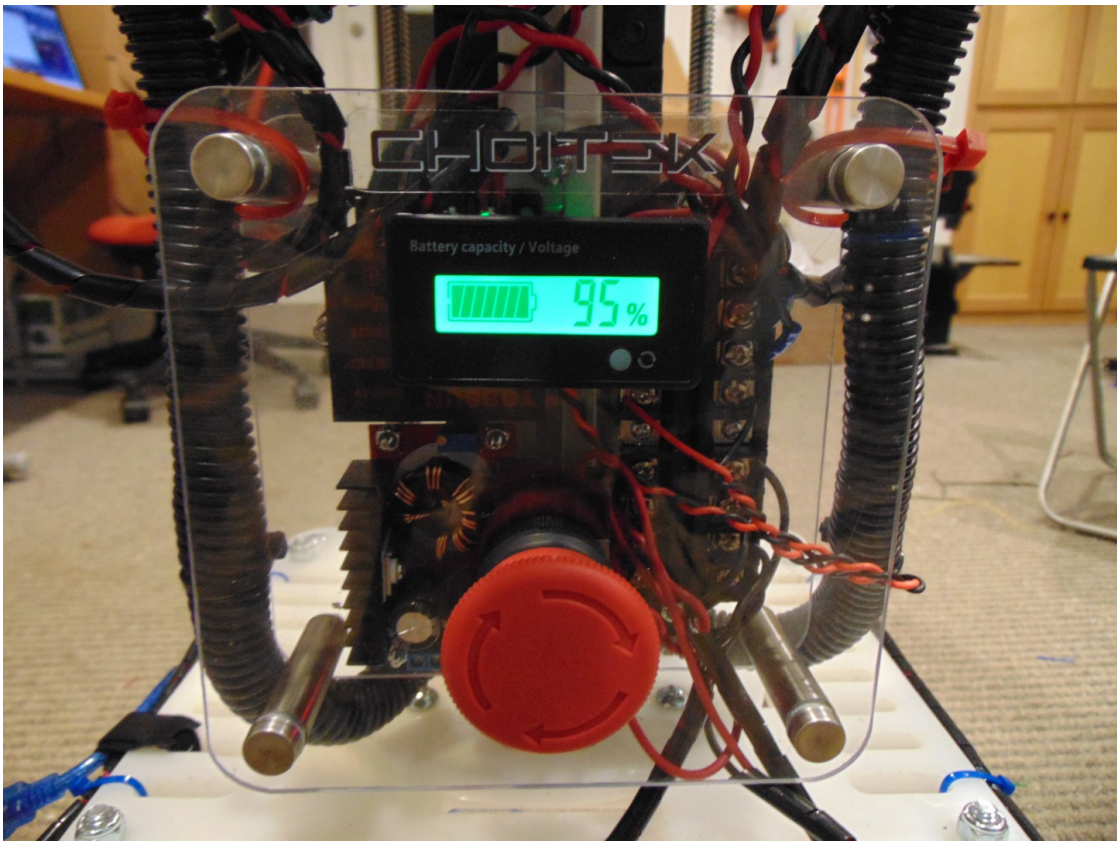
CUSTOM 2-ARM MOBILE MANIPULATOR ROBOT

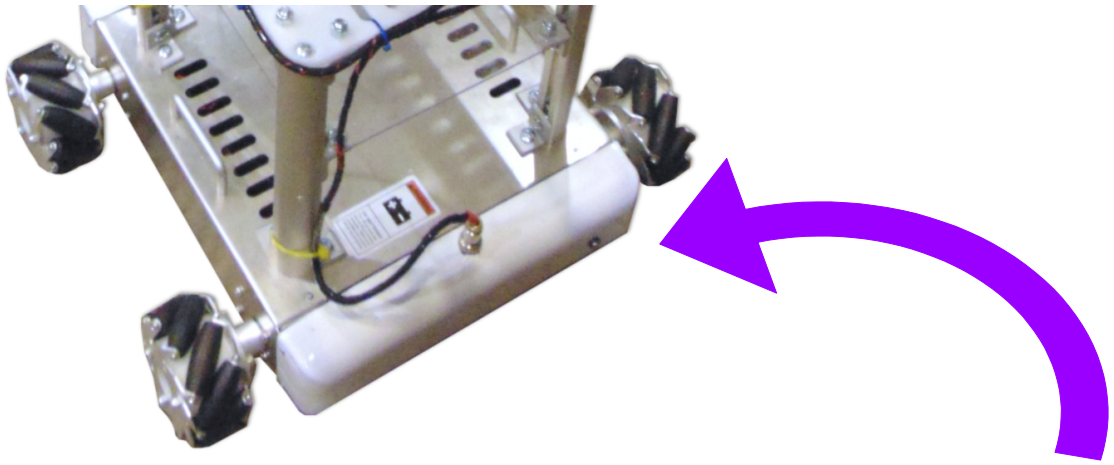
QUICK SETUP GUIDE

Perspective view of Custom 2-armed Mobile Manipulator Robot Platform

POWER MANAGEMENT



The robot is powered by four 12-volt sealed lead acid batteries stored at the base of the robot for an expected runtime of 3–5 hours of continuous operation. **A green LED voltage monitor** shows the current battery life of the entire robot. It shows battery life in either direct voltage or percentage of life (press the small grey button to cycle display modes). **A single big red button** is the on/off switch for the entire system (wheels, motors, arms and all). To turn the robot on, simply twist the button until the voltage monitor LED turns on. To turn the robot off, simply push the red button until the voltage monitor LED turns off. Whenever the robot is not being used, be sure to turn the system off to maximize useful battery life.

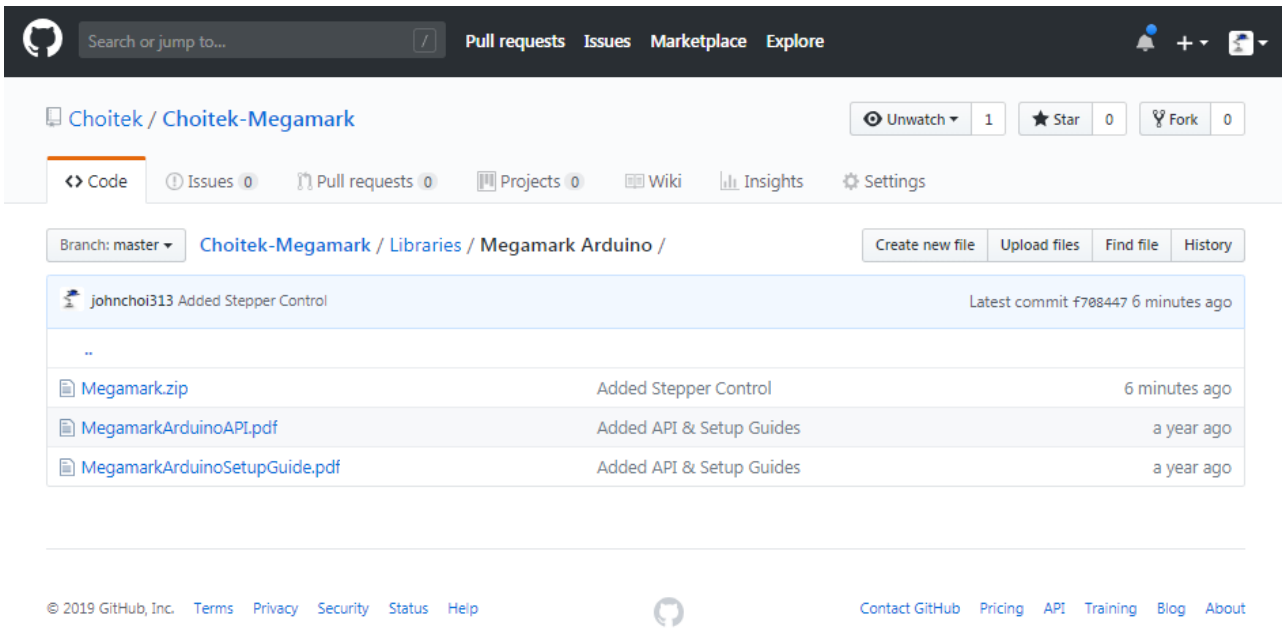


To charge batteries, simply turn system off and plug in charger to ***charging port (on back).***

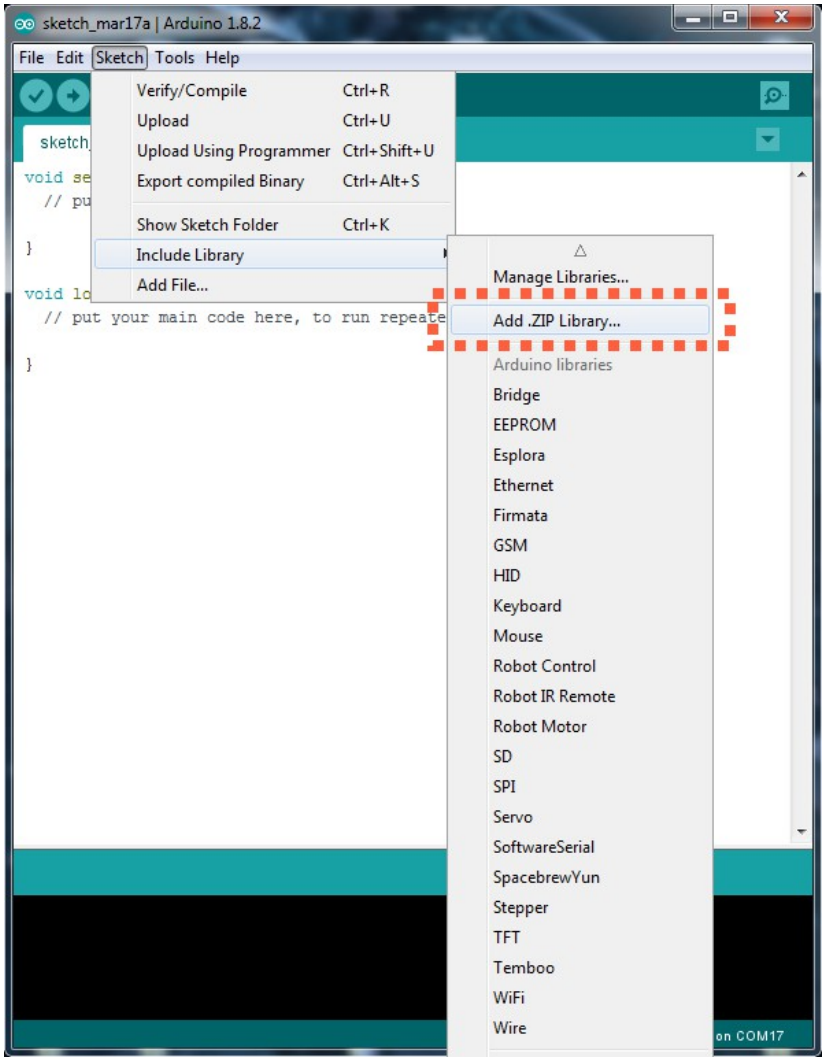
SETTING UP BASIC ARDUINO CODE

0. Download the latest version of Arduino here: https://www.arduino.cc/en/Main/Software

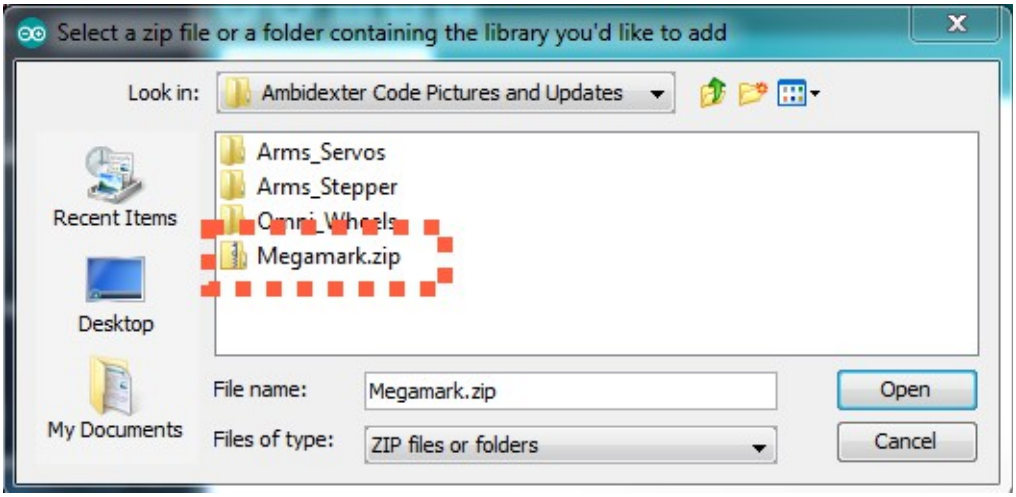
1. Download all of the necessary files. Specifically, download the **Megamark Library** from here: https://github.com/Choitek/Choitek-Megamark/tree/master/Libraries/Megamark%20Arduino. *(This library contains convenient and easy-to-use speed-controlled synchronized wrappers for servomotors, PWM DC motor controllers, stepper motors, and serial communication for Arduino UNO, Arduino Mega, and other Arduino boards.)*



2. Open up Arduino. Click on **Sketch → Include Library → Add .ZIP Library.**



3. Select the **Megamark.zip** library you just downloaded.



Now, with a bit of additional custom code, you should be able to use the basic functionality of the 2-arm mobile manipulator robot. See next steps for more info:

OMNIDIRECTIONAL MECANUM WHEEL BASE

The omnidirectional wheel base is controller by a **single Arduino UNO** (specifically, a KEYESTUDIO Super UNO for it's easy to access servo ports.), and two **Dual DC High Current Motor Drivers.** The Arduino UNO sends direction and PWM speed control signal to both motor drivers, each of which control two high torque 80rpm worm gear motors.

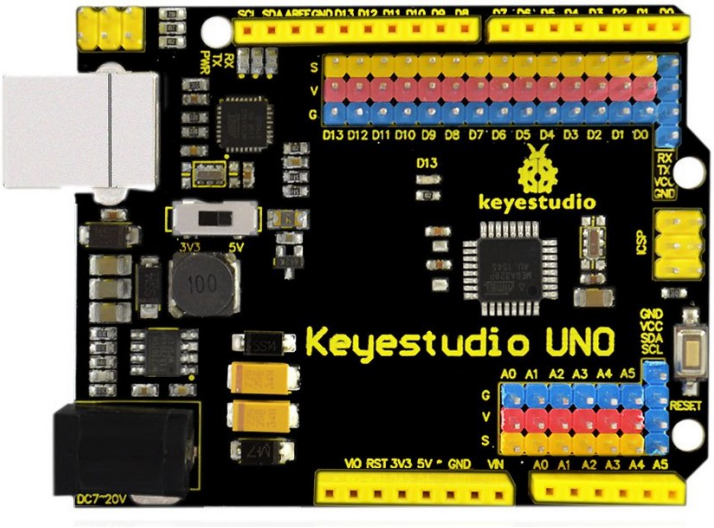
Arduino Pin Mappings:

Pin 12 = Left Front Wheel Speed
Pin 11 = Left Front Wheel Direction

Pin 10 = Left Back Wheel Speed
Pin 9 = Left Back Wheel Direction

Pin 6 = Right Front Wheel Speed
Pin 5 = Right Front Wheel Direction

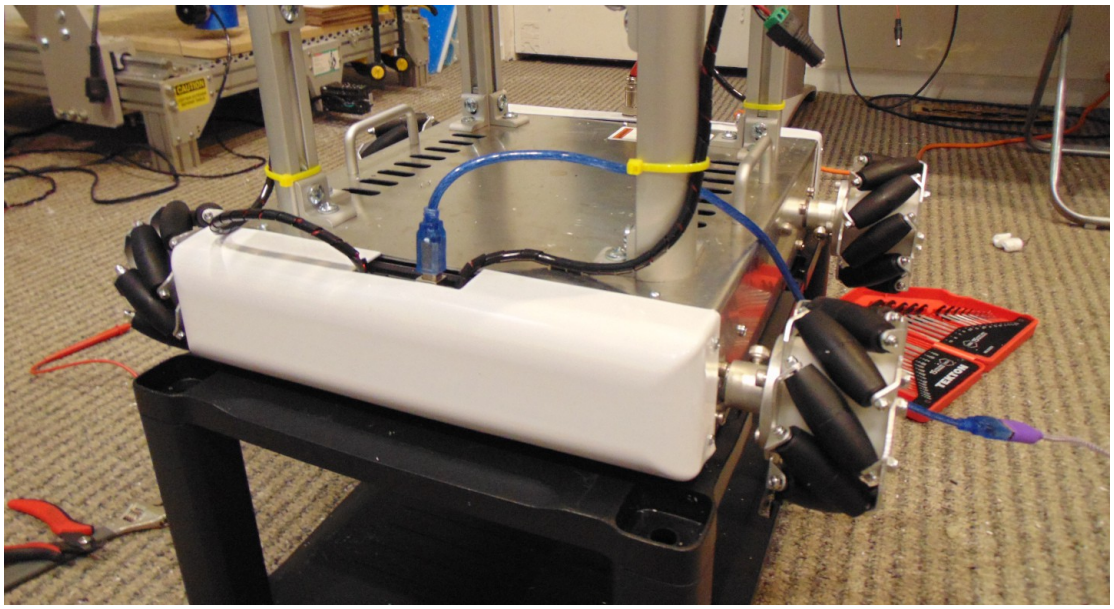
Pin 4 = Right Back Wheel Speed
Pin 3 = Right Back Wheel Direction



KEYESTUDIO Super Uno shown above.

Test the Mecanum Wheel Base with Arduino Software

Load and upload **Omni_Wheels.ino** to the connected Arduino UNO at the base of the robot. This code controls the four wheels and has quick helper functions for moving forwards, backwards, left and right and also turning left and right. *(It is recommended to put the robot on a small stable platform like a block of wood so that it doesn't go anywhere at first. Once You know what to expect, take the platform off and let it roll free!)*

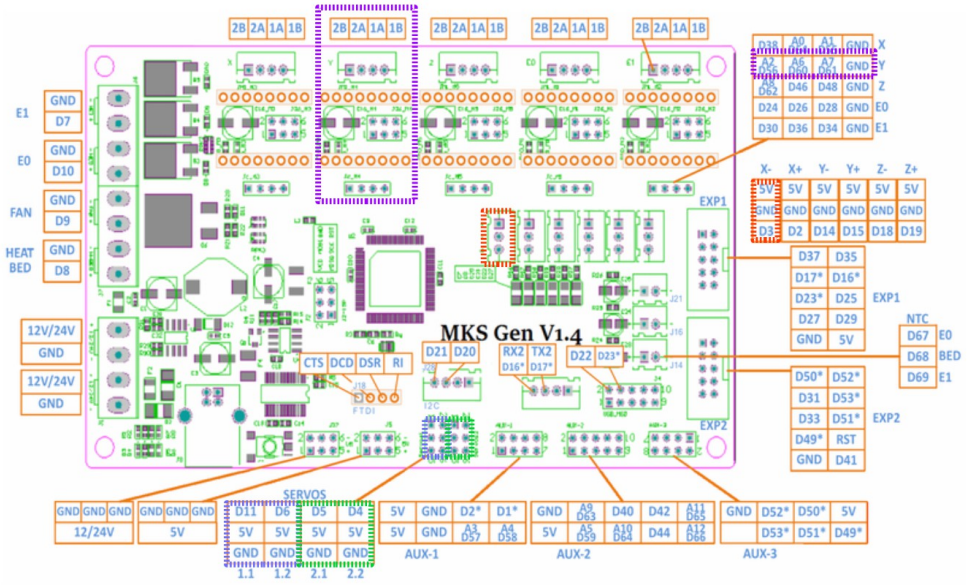


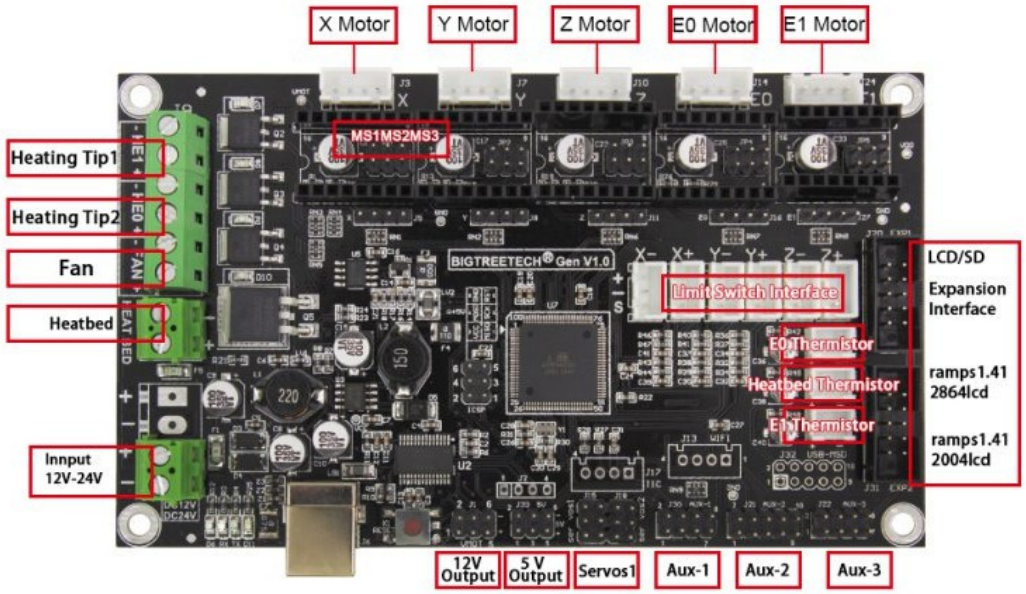
SCARA-STYLE ROBOT ARMS AND ADAPTABLE GRIPPERS

SCARA-style (Selective Compliance Articulated Robot Arm) robot arms are a common form of robotic arms for their simplicity, relatively high-strength, large work area and ease-of-use. This 2-arm mobile manipulator robot has two arms, each of which have the following:

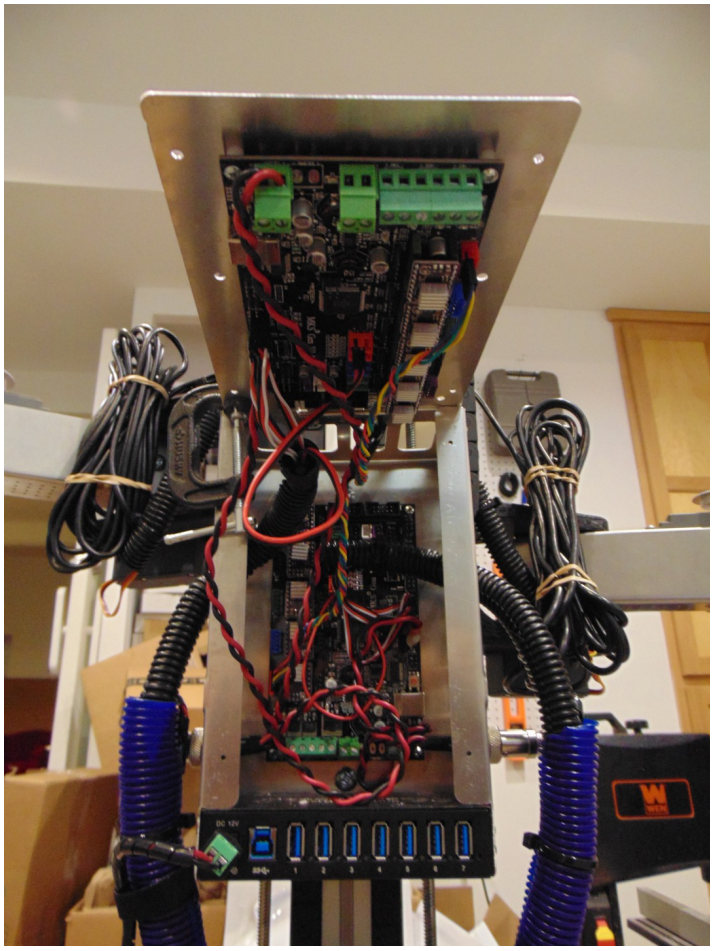
- **500mm stepper motor linear actuator**
- **Limit switch for stepper motor linear actuator**
- **Two heavy duty large servo motors** (one for shoulder and one for elbow)
- **Two standard servo motors for grippers** (the actual gripper is on an adaptable mounting plate, meaning that it can be quickly replaced with other designs.)

The main control board for each arm is an **MKS Gen 1.4**, which is an Arduino-compatible micro-controller with excellent easy plug-and-play pinout mappings for servo motors and stepper motors (it uses the same chip and is interchangeable with an Arduino Mega 2560.)





The MKS Gen 1.4 boards and their pin attachments can be adjusted by opening the back of the robot: (there are two MKS Gen 1.4 boards, one for left arm, and one for right arm:)



Testing the Servo Arms / Claws with Arduino Software

Load and upload **Arms_Servos.ino** to the connected MKS Gen 1.4 at the base of the robot. This code controls the shoulder and elbow servomotors, along with the gripper servo motors. This basic code opens and closes the grippers, but it is fairly straightforward to move the arms and elbows as well.

Testing the Servo Arms / Claws with Arduino Software

Load and upload **Arms_Stepper.ino** to the connected MKS Gen 1.4 at the base of the robot. This code controls the stepper linear actuator with the limit switch endstop for homing position. This basic code homes the stepper motor and moves it up and down in a loop.

(NOTE: To prevent damage during use, whenever the robot is acting funky and about to collide with itself in an ugly, unnatural fashion, ***quickly press the big red emergency stop button to immediately turn off the robot!*** *The robot does not contain safety mechanisms to prevent crashing into itself, so not crashing into itself has to be accounted for in software!)*