



Arduino Workshop

Slides and Code

- <https://github.com/MorganDenes/Arduino>

Open the IDE



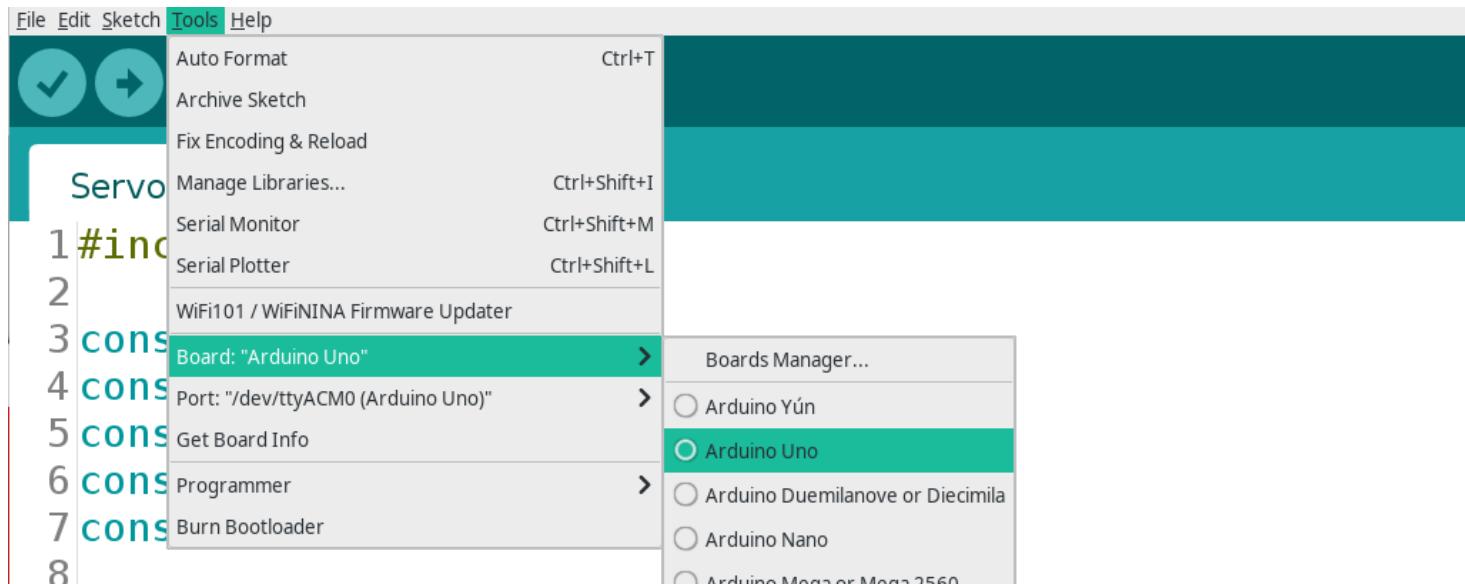
Connect the Arduino

- You know.



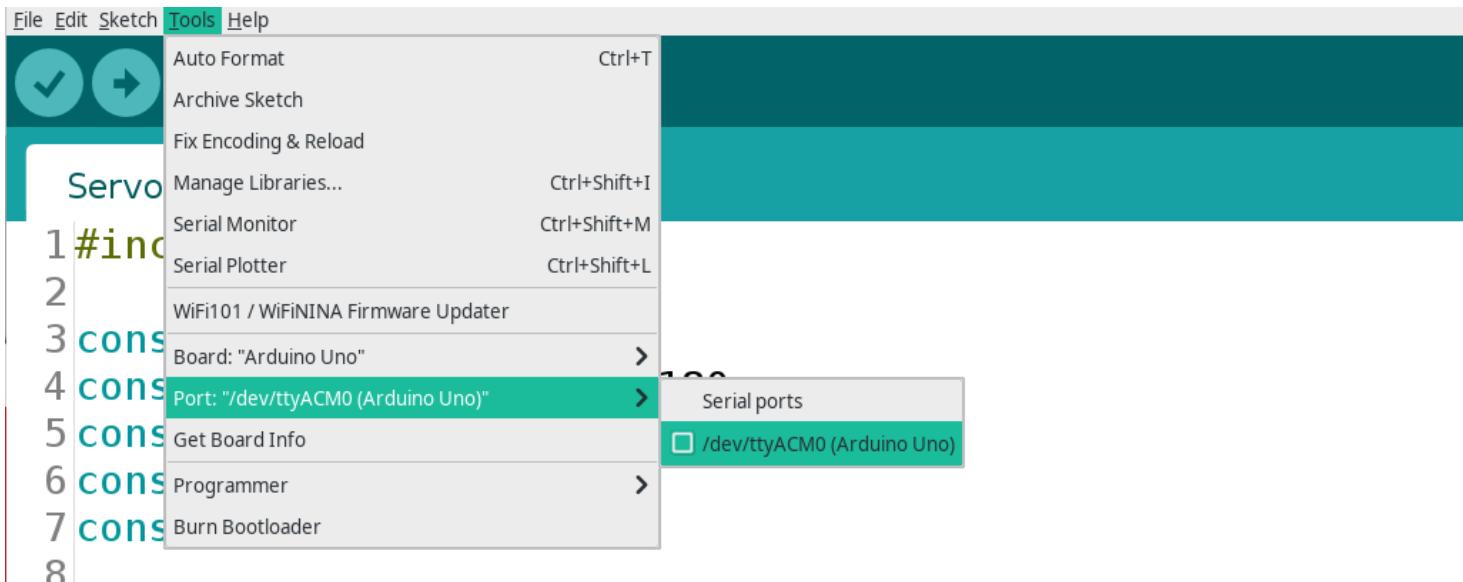
Select Correct Arduino Type

- Tools > Board > Arduino Uno



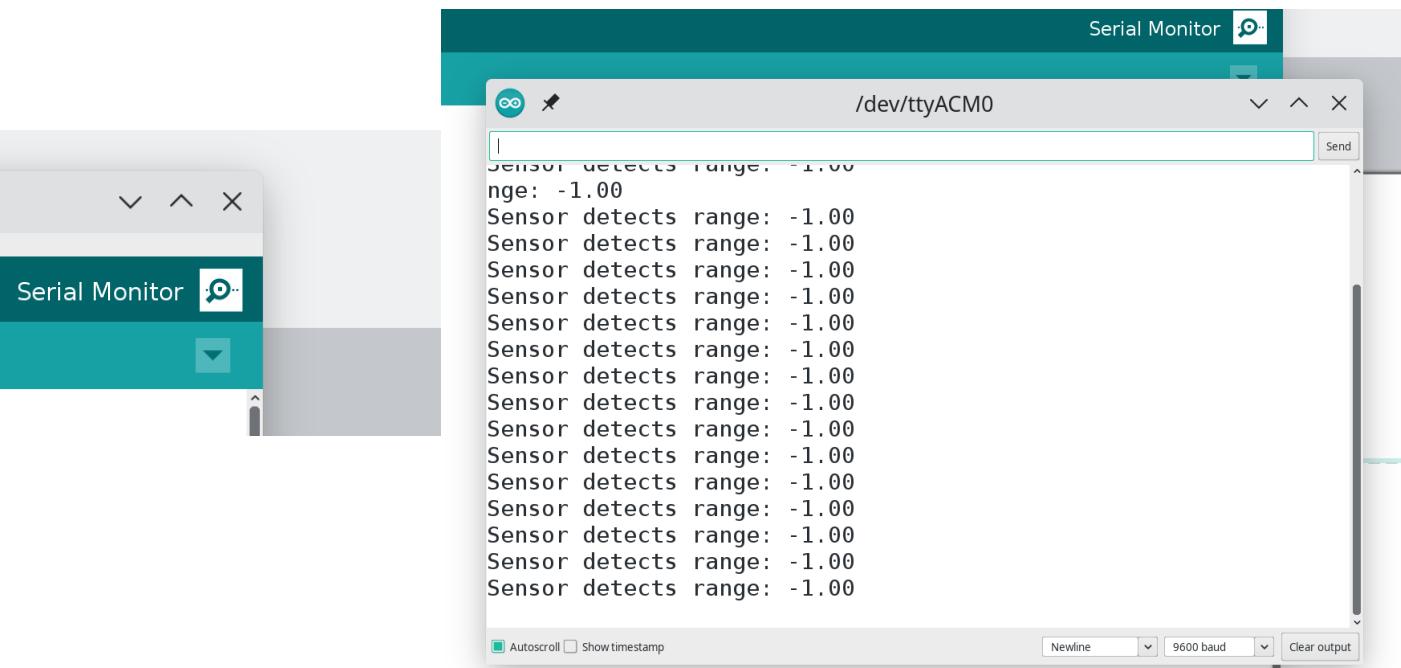
Select Correct Port

- Tools > Port > [Whatever Port]



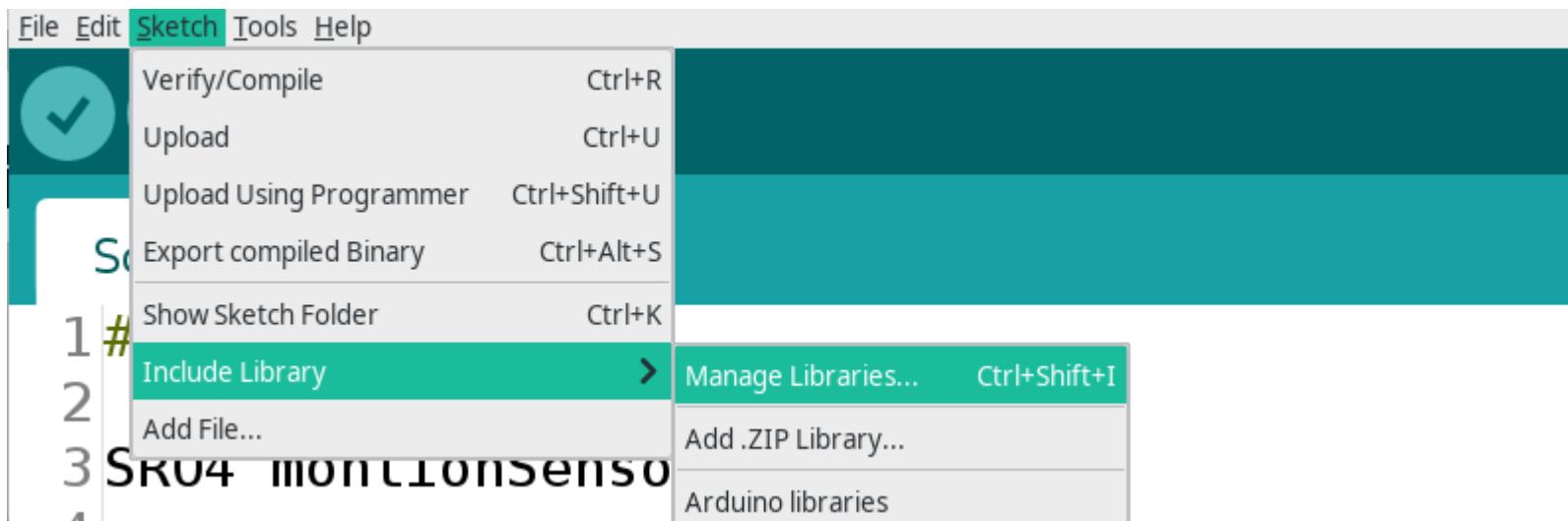
Verify Connection

- Top right of the IDE click the ‘magnifying glass’
- The Serial Monitor will open if the connection is good



Install a Library

- Sketch > Include Libraries > Manage Libraries...



Install a Library

- On the top bar type in the name of the library
- Click install on the desired library

The screenshot shows the Arduino library search interface. At the top, there are two dropdown menus: 'Type' set to 'All' and 'Topic' set to 'All'. A search bar contains the text 'SR04'. Below the search bar, a list of libraries is displayed. The first item is 'utilize one trigger with multiple echoes simultaneously.' followed by a 'More info' link. The second item is 'HCSR04' by 'Martin Sosic'. It is described as a 'Library for HC-SR04 ultrasonic distance sensor. You can measure distance in centimeters.' Below this description are two links: 'More info' and 'Version 2....' followed by an 'Install' button.

Type All Topic All SR04

utilize one trigger with multiple echoes simultaneously.
[More info](#)

HCSR04
by Martin Sosic
Library for HC-SR04 ultrasonic distance sensor. You can measure distance in centimeters.
[More info](#)

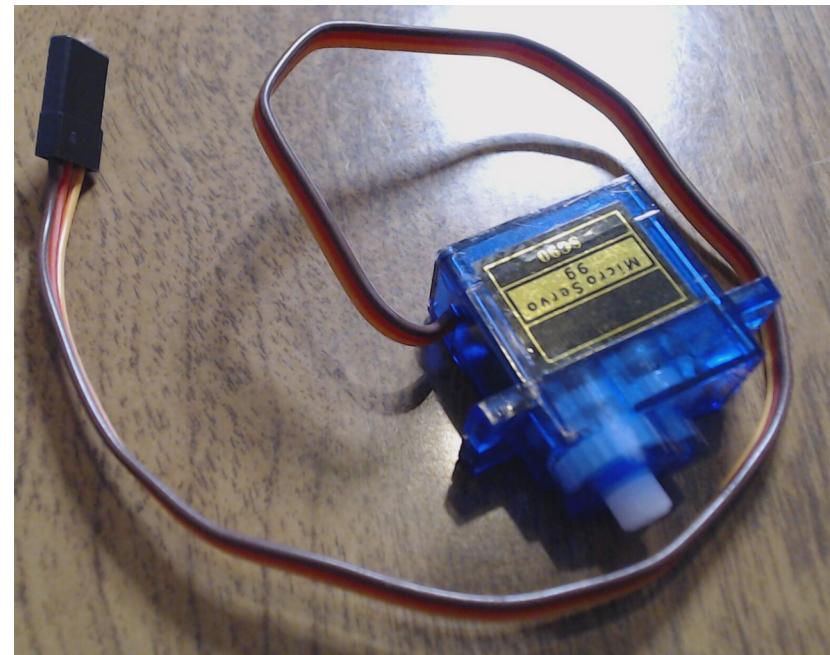
Version 2.... [Install](#)

Libraries to Get

- **Servo** by *Arduino*
- **Stepper** by *Arduino*
- **LiquidCrystal** by *Arduino*
- **HCSR04** by *Martin Sosic*

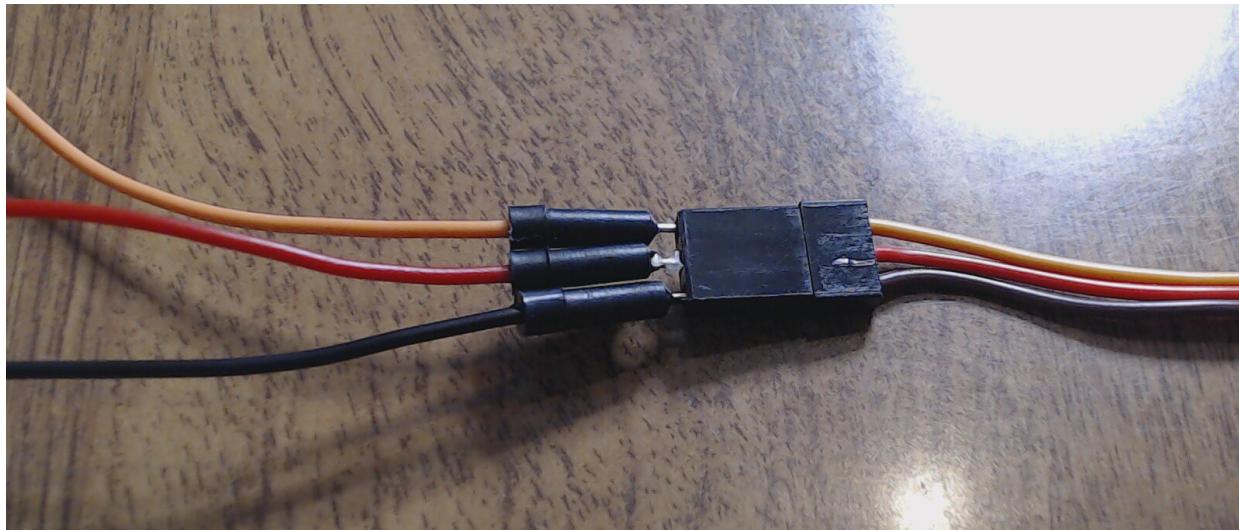
Servo

- Only 180° of rotation
- Control it by setting angle
- Needs to be wired to ~PWM
- Good for hobby work



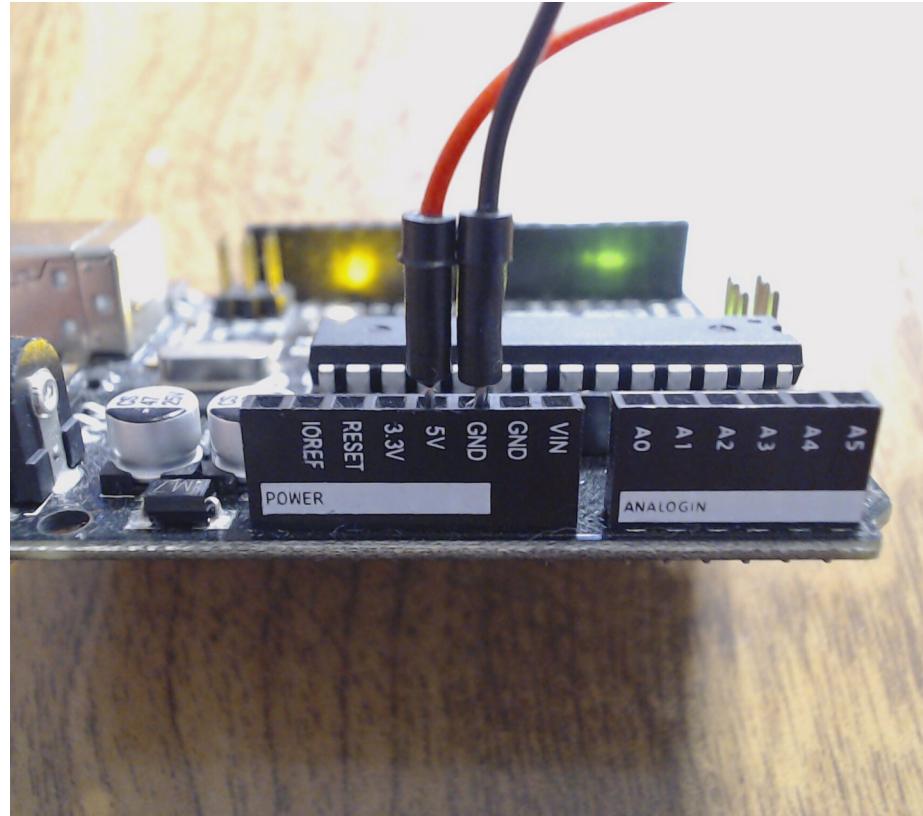
Wire the Servo

- Red to red
- Brown to black
- Orange to orange



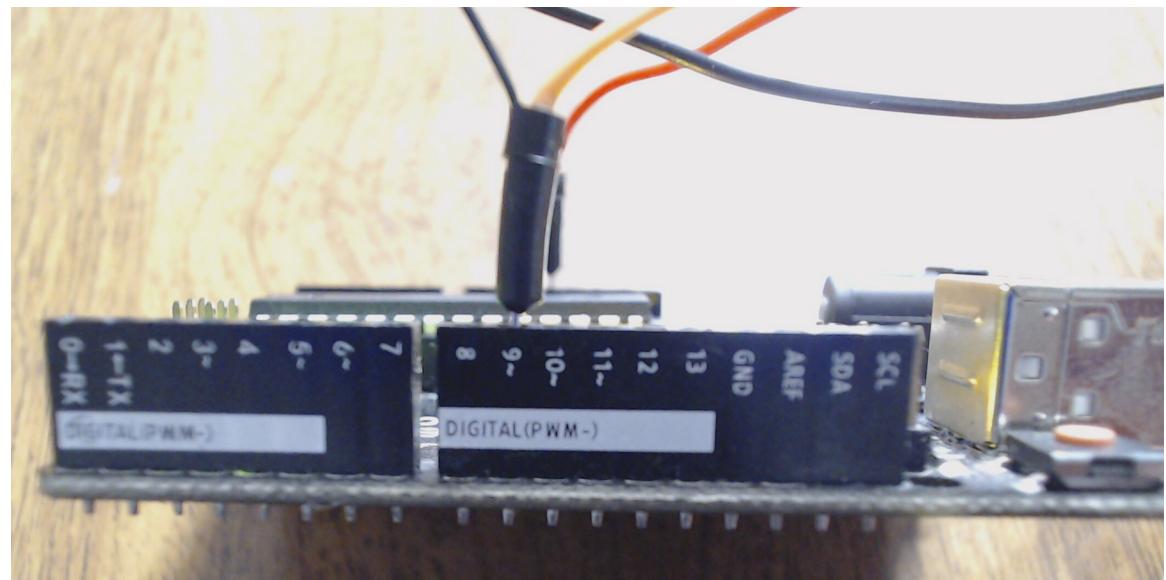
Wire Arduino

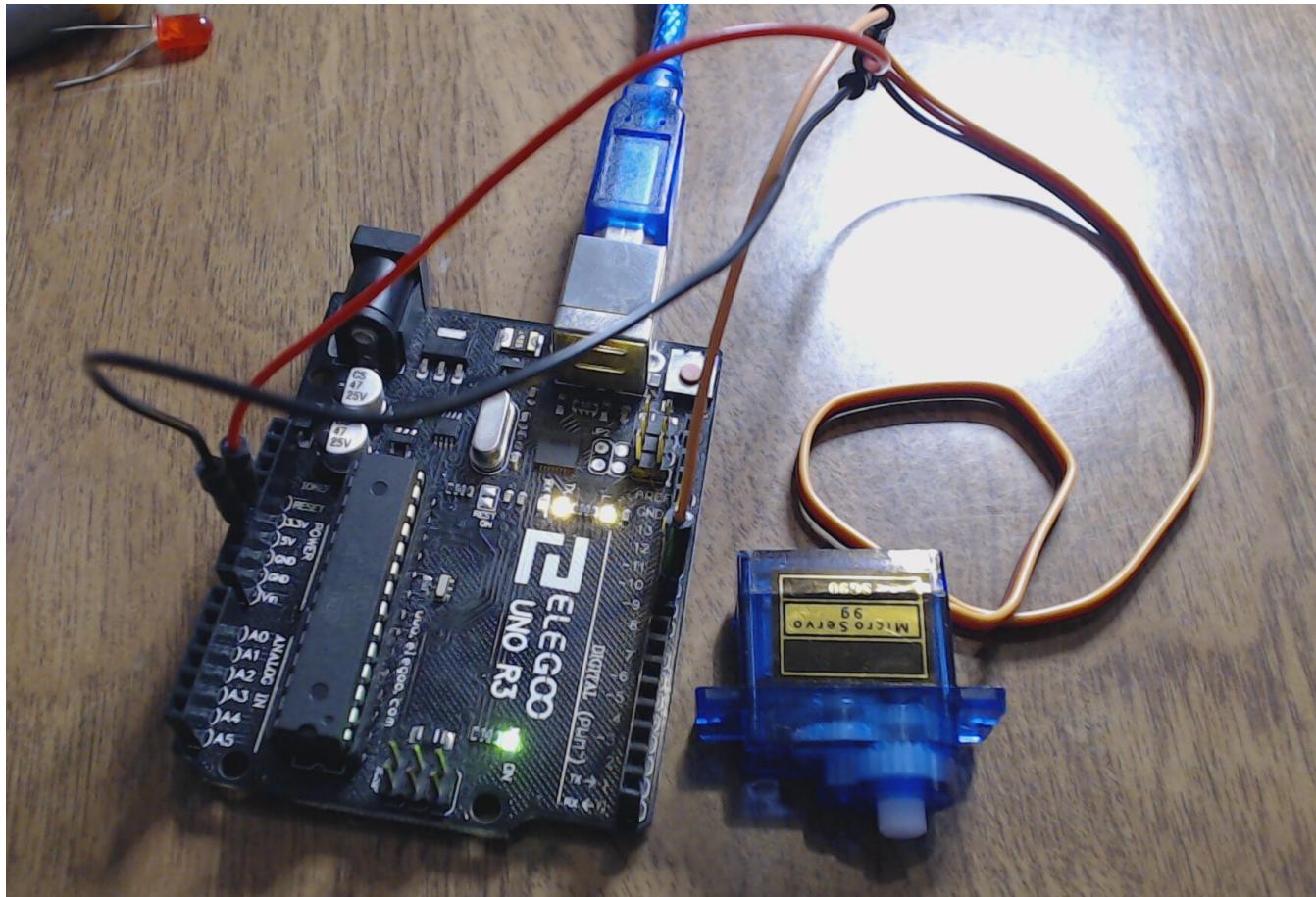
- Red wire to 5V
- Black wire to GND



Wire Arduino

- Orange to digital 9



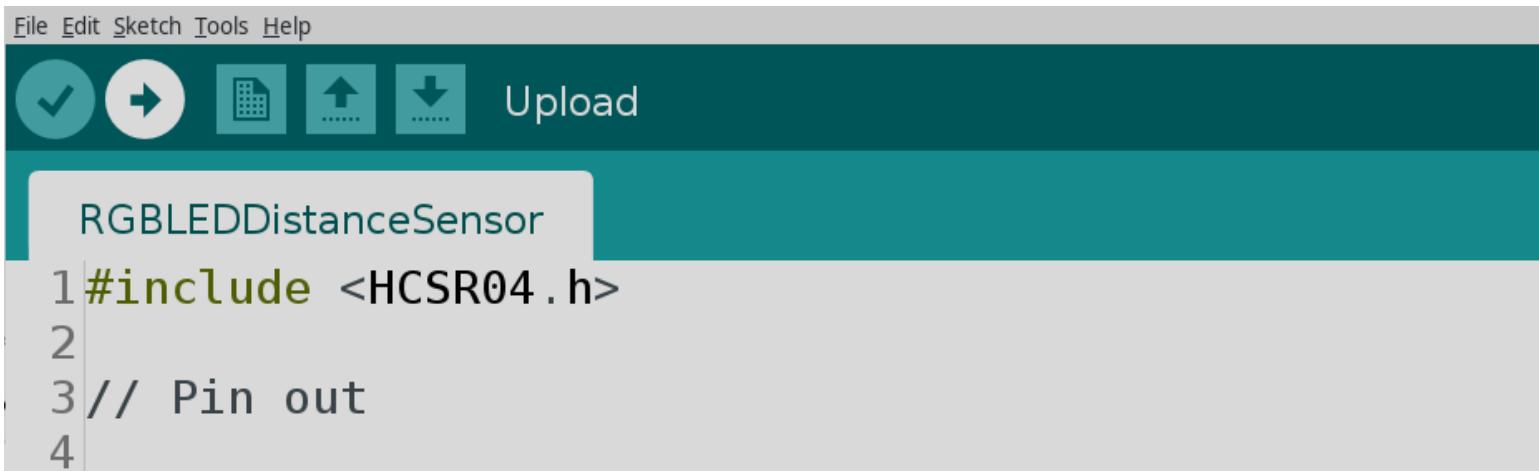


Servo Programs

- ServoSimple
 - A minimum program to demonstrate a servo
- ServoWithVairables
 - Has variables at the top that you can control

Run a Program

- Click the arrow in the top left of the IDE



The screenshot shows the Arduino IDE interface. At the top, there's a menu bar with 'File', 'Edit', 'Sketch', 'Tools', and 'Help'. Below the menu is a toolbar with several icons: a checkmark, a right-pointing arrow, a file folder, an upload icon, a download icon, and an 'Upload' button. The main area is titled 'RGBLEDDistanceSensor'. The code editor contains the following sketch:

```
1 #include <HCSR04.h>
2
3 // Pin out
4
```

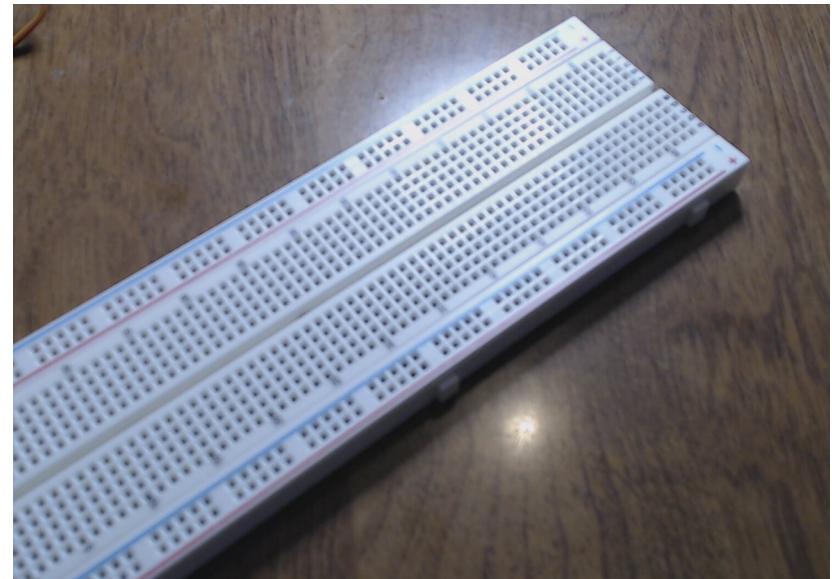
Button

- Opposing legs are already connected
- Clicking in the button connects all legs together
- Lets us control code flow



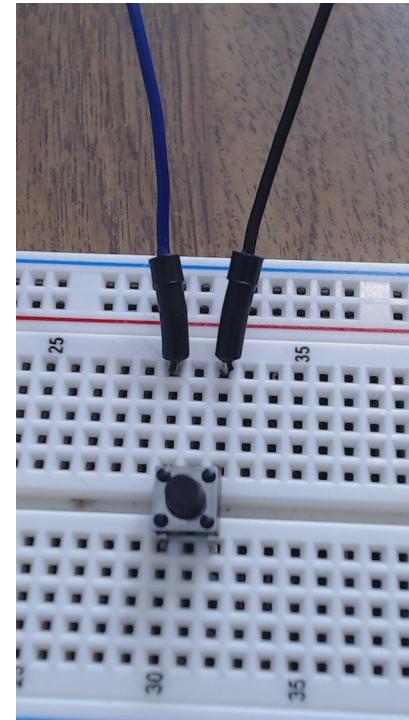
Breadboard

- Ignore the power rails for now
- The pips are connected in sets of 5
 - For each row:
 - A through E are all connected
 - F through J are all connected
- Designed for rapid prototyping
- Plug & Play



Wire the Button

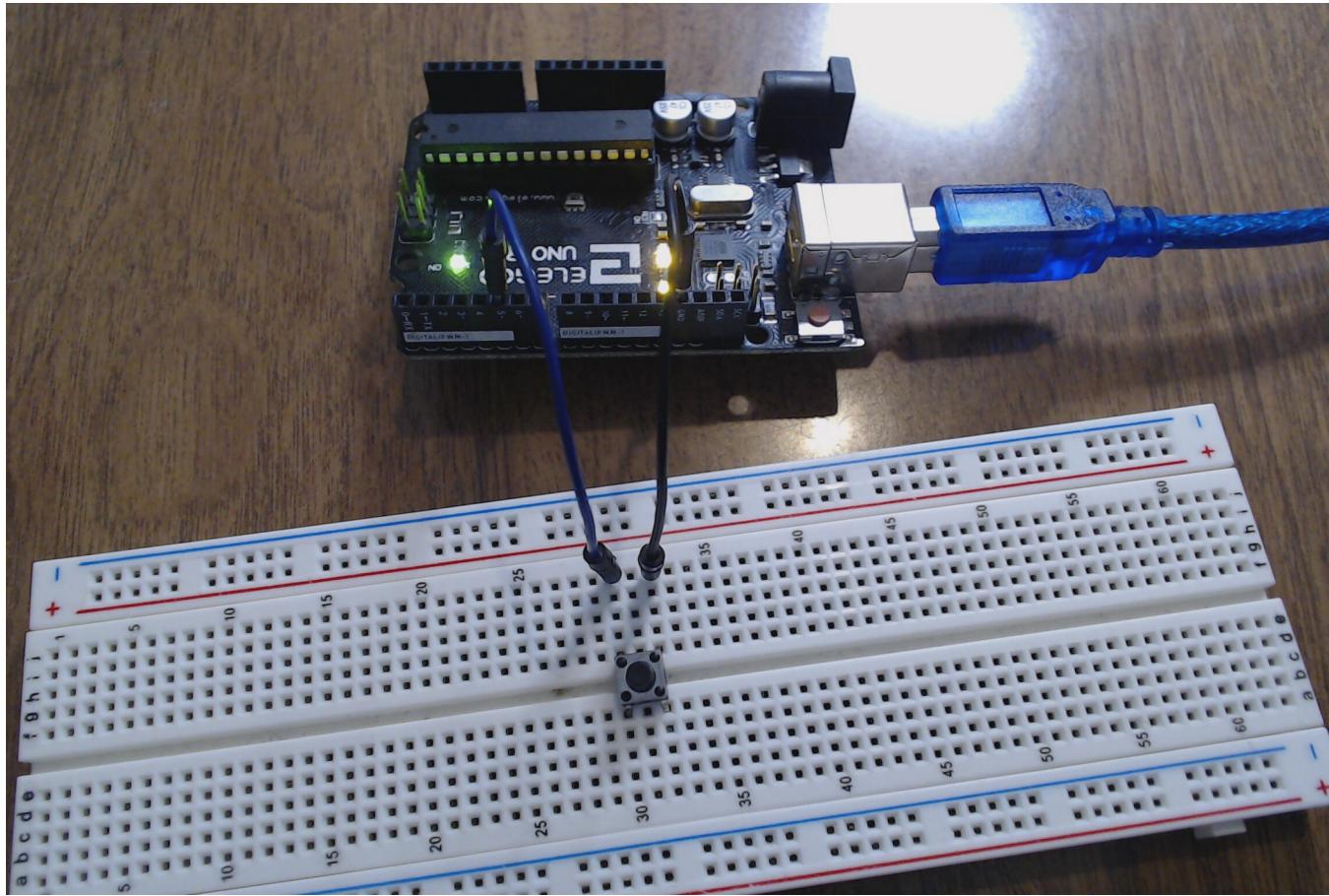
- Put the button over the middle of the breadboard
- Connect one side to black wire
- Connect the other side to blue wire



Wire Arduino

- Blue wire to digital 5
- Black wire to GND



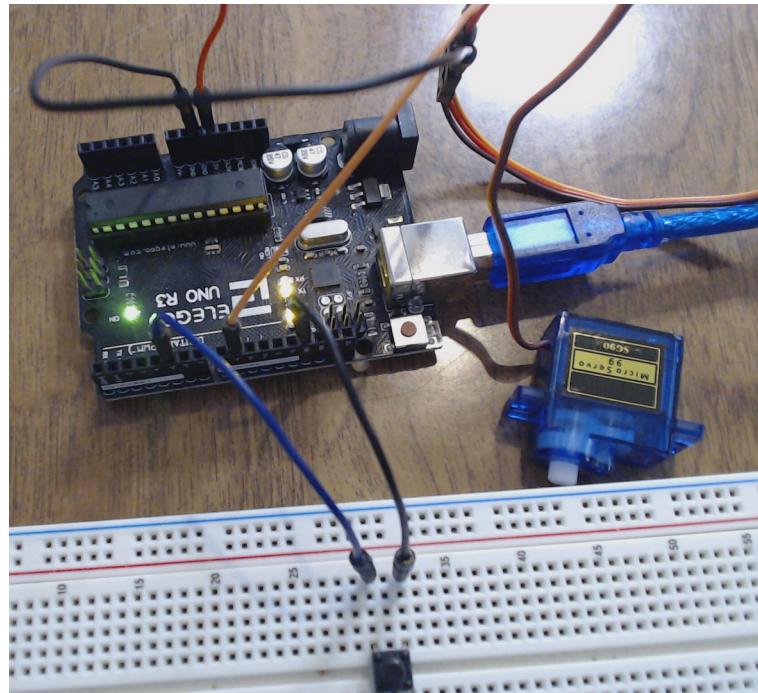


Button Code

- Button
 - Shows that Arduino is able to read the button state

Button and Servo

- Use the button to control the Servo

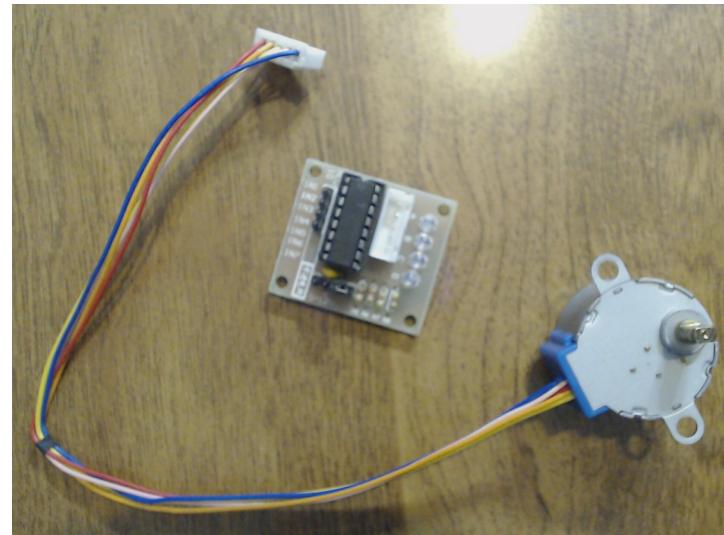


Servo and Button Code

- ServoActiveButton
 - Button must be held to turn servo
- ServoPassiveButton
 - Button is clicked to turn servo
- ServoPassiveButtonWithVariables
 - Same as ServoPassiveButton but with extra variables

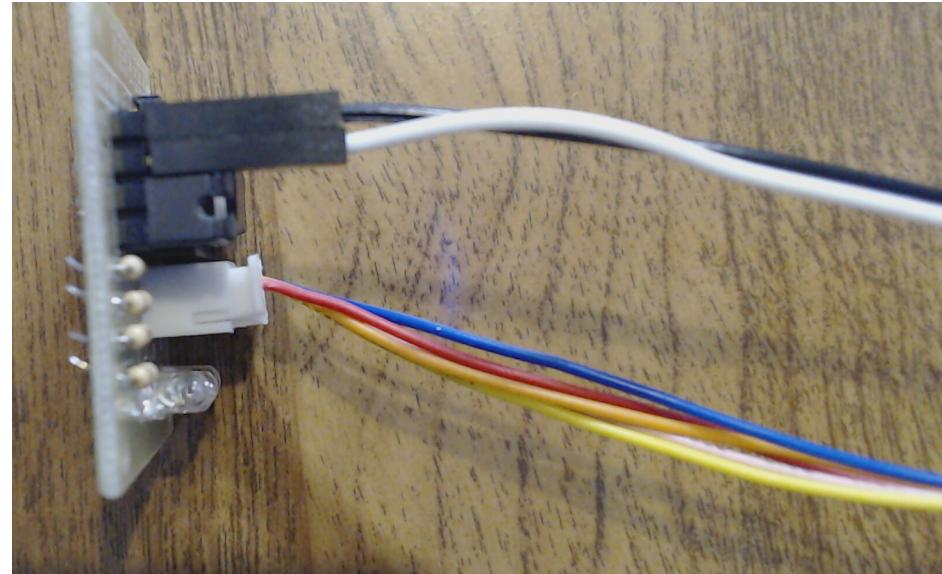
Stepper

- Most complex to wire up
- Control how far it rotates
- 3D printers use them for their accuracy



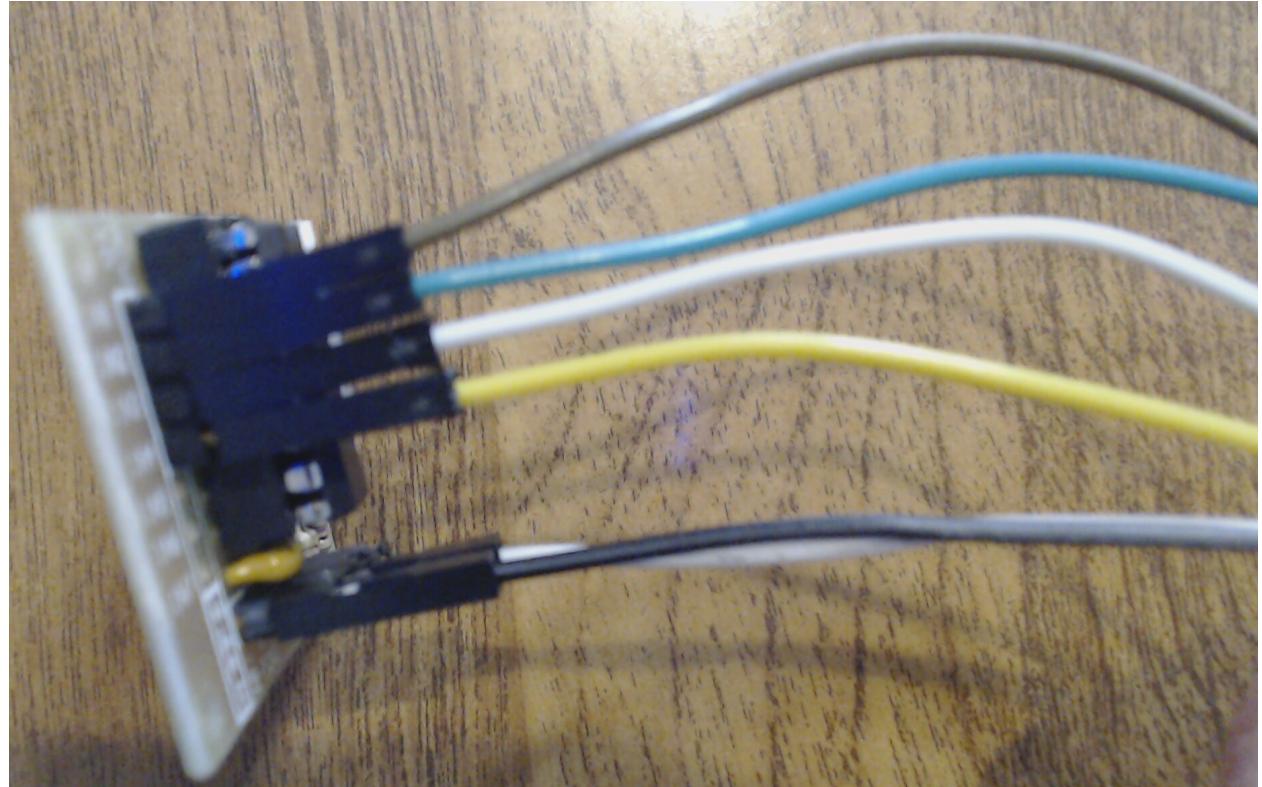
Wire Stepper Motor

- Plug the motor into it's extra board
- Connect 5V '-' to black
- Connect 5V '+' to "red"



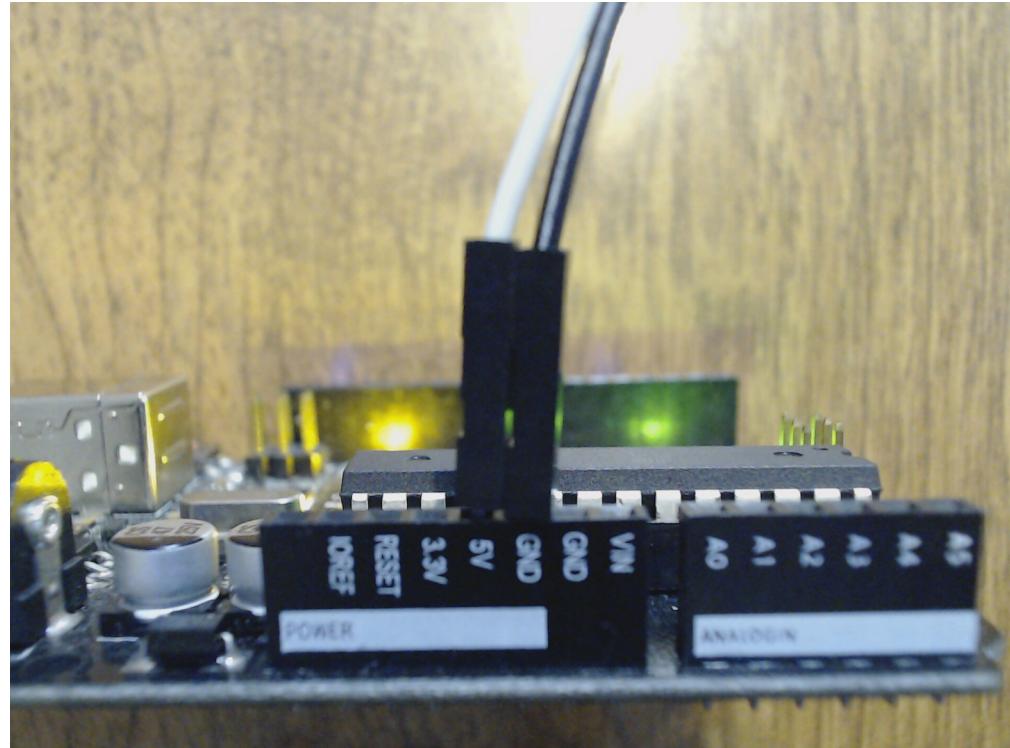
Wire Stepper Motor

- 1N1 to brown
- 1N2 to green
- 1N3 to white
- 1N4 to yellow



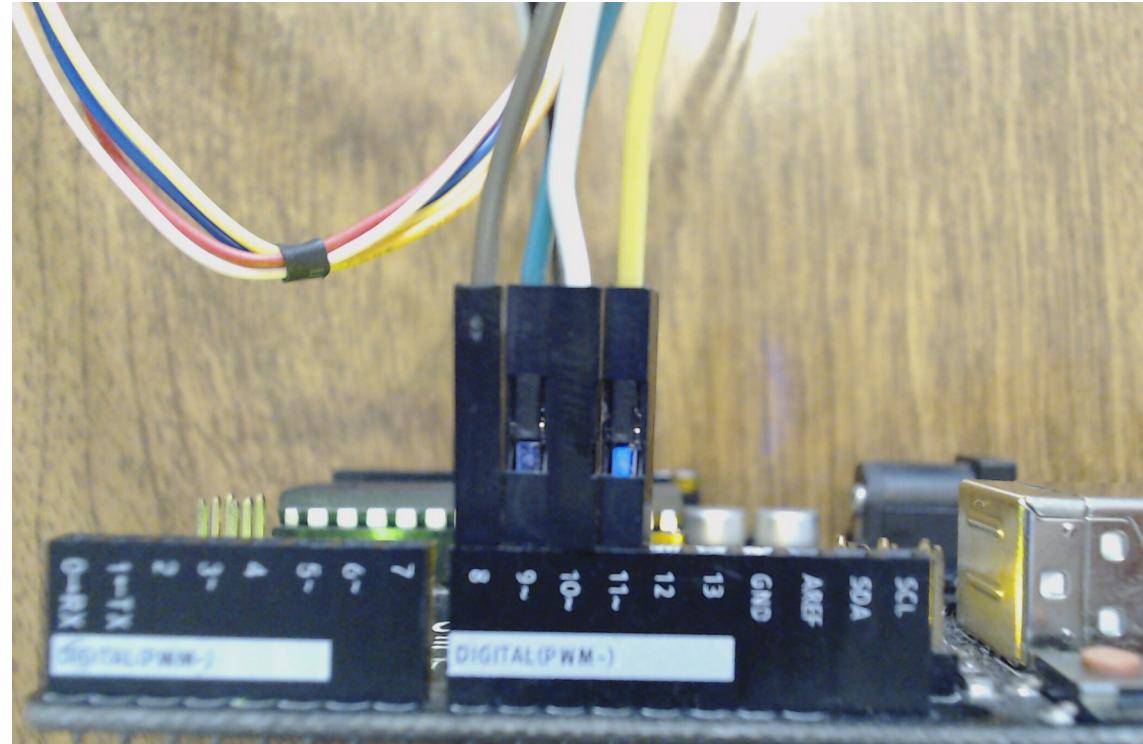
Wire Arduino

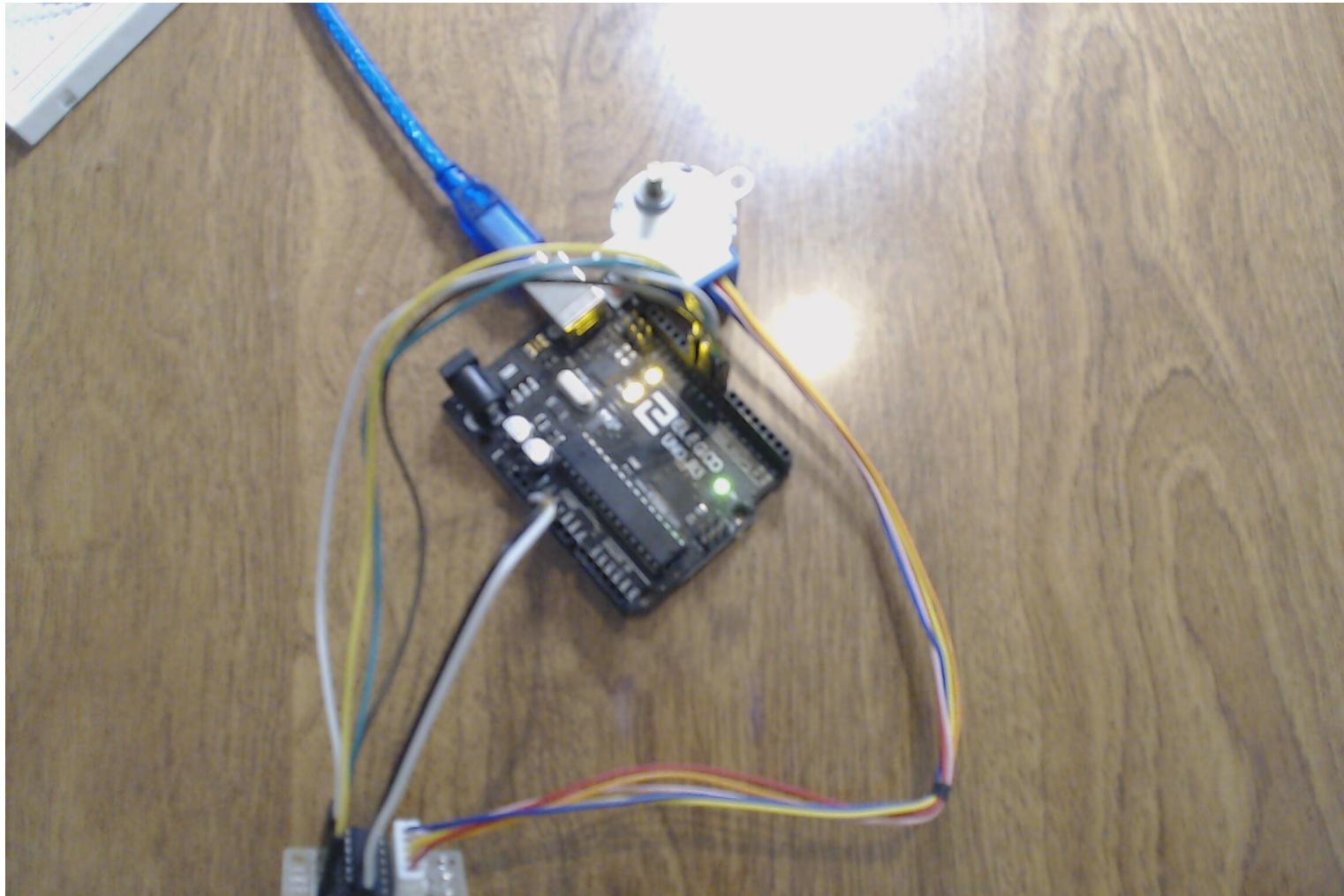
- Black wire to GND
- “Red” wire to 5V



Wire Arduino

- Brown to digital 8
- Green to digital 9
- White to digital 10
- Yellow to digital 11

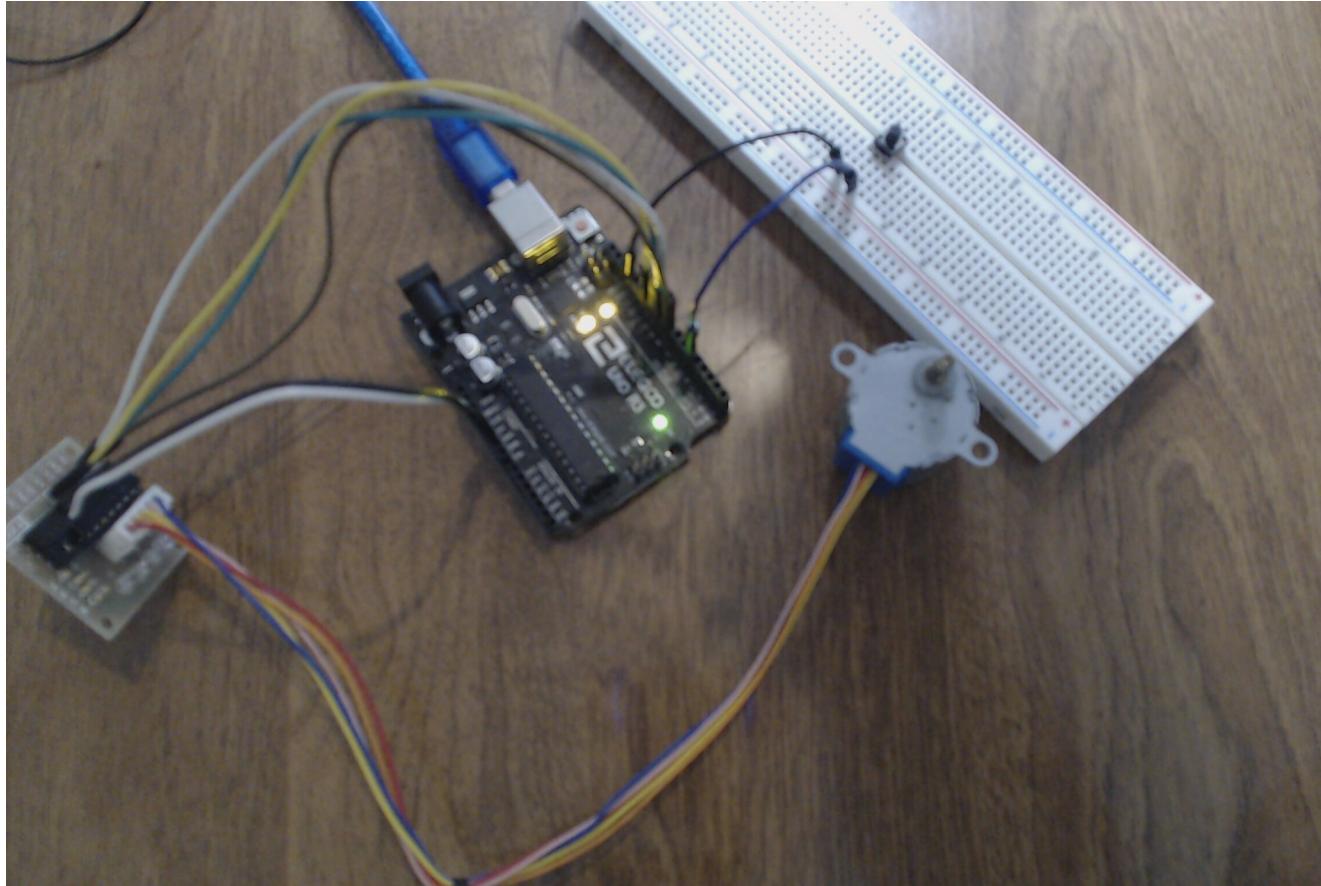




Stepper Code

- StepperSimple
 - Simple example of the Stepper working

Stepper and Button



Stepper and Button Code

- StepperActiveButton
 - Set the rotation direction with the button
- StepperActiveButtonWithVariables
 - Same as StepperActiveButton but with more variables

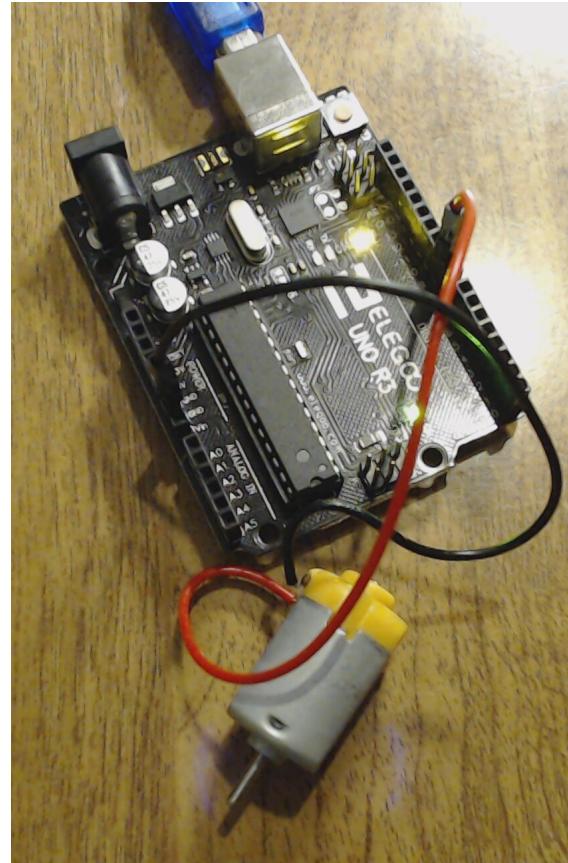
DC

- DC means Direct Current
- Easiest to wire
- Used for Tesla cars, fans, and RC cars



Wire DC to Arduino

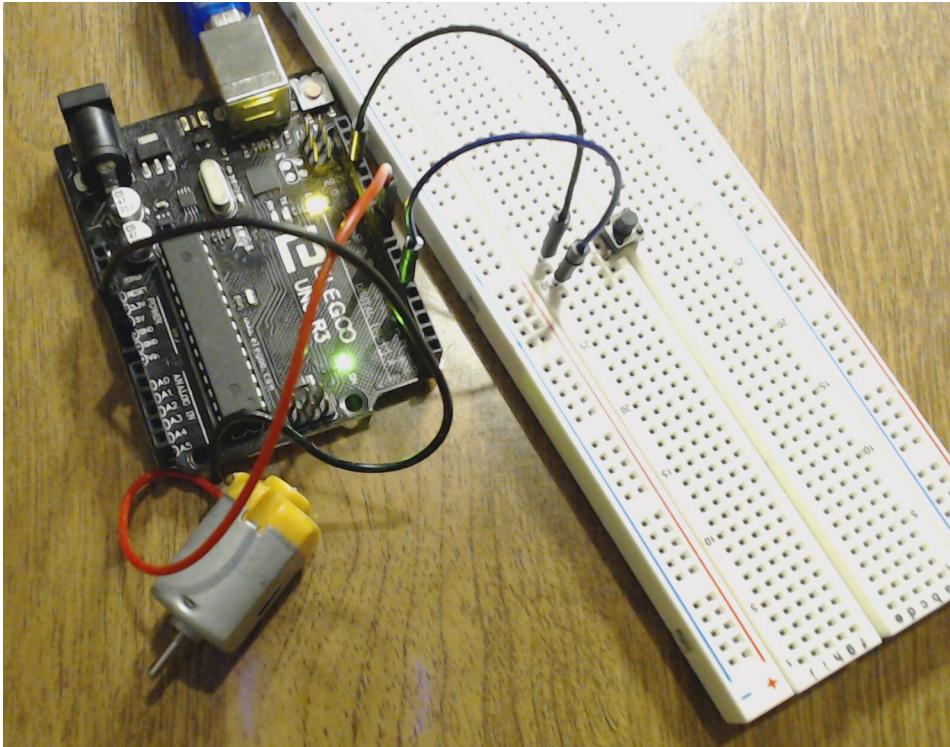
- Red wire to digital 9
- Black wire to GND



DC Code

- DC
 - Simple code for working DC

DC and Button



DC and Button Code

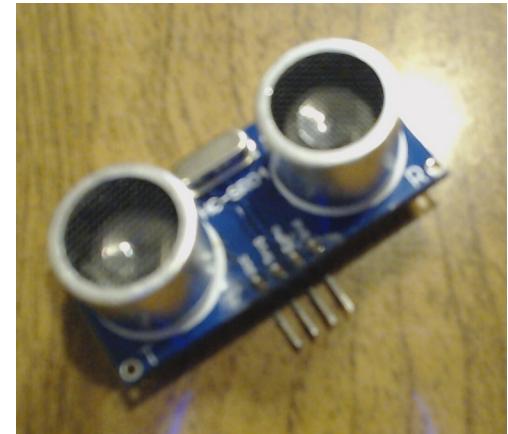
- DCButton
- DCPassiveButton
 - Like ServoPassiveButton but with a DC motor

Footnote on DC

- Can wire DC to spin both ways
 - Not doing it in this workshop

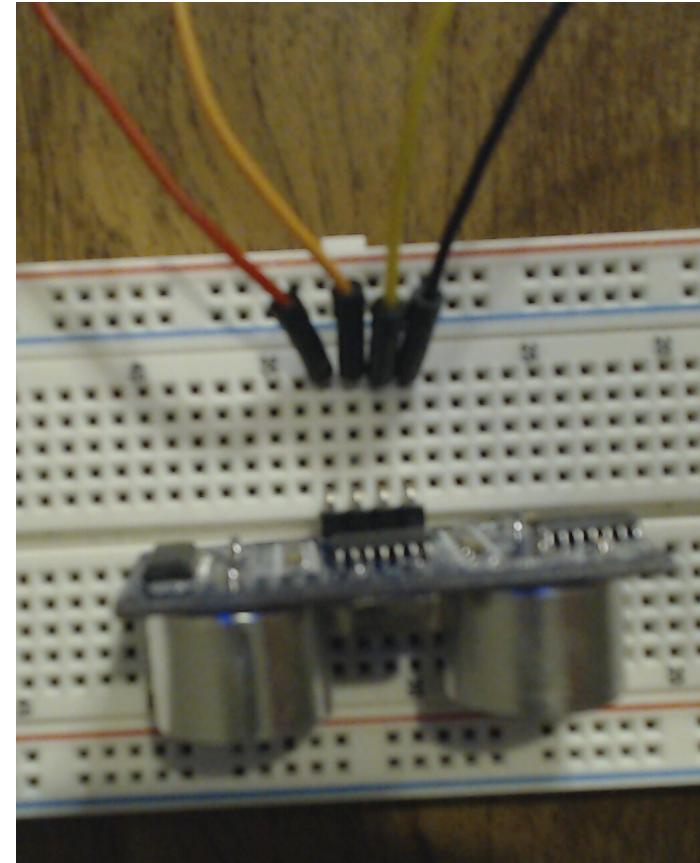
Distance Sensor

- Can estimate the distance from it
- We'll be treating it like a button



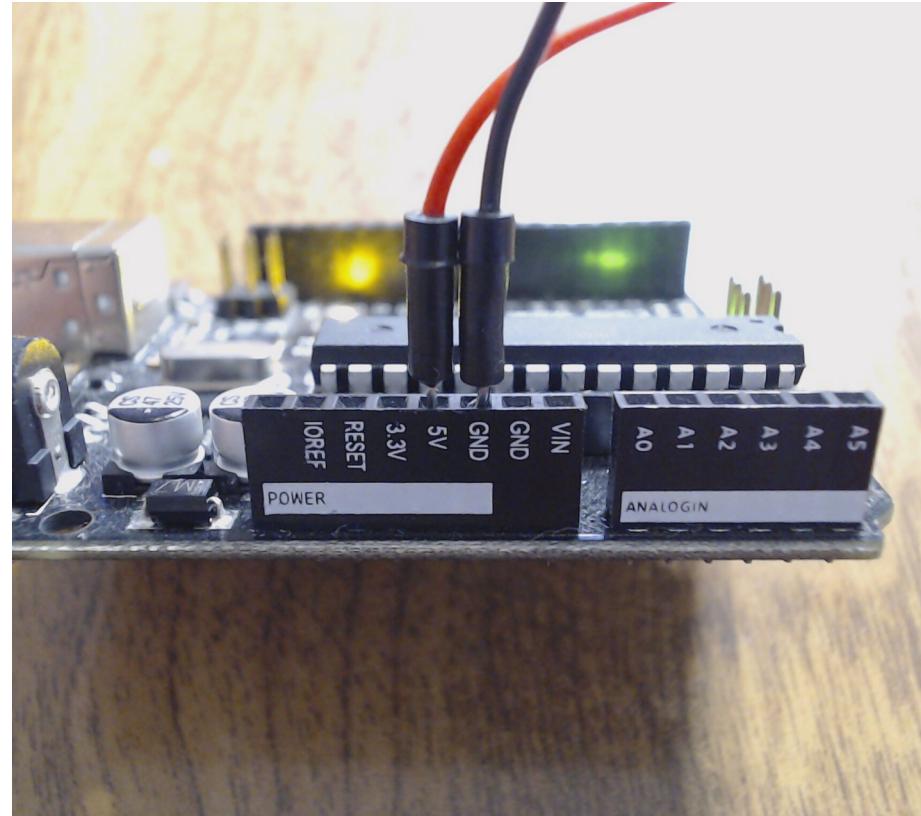
Wire Distance Sensor

- Vcc to Red
- Trig to Orange
- Echo to Yellow
- GND to black



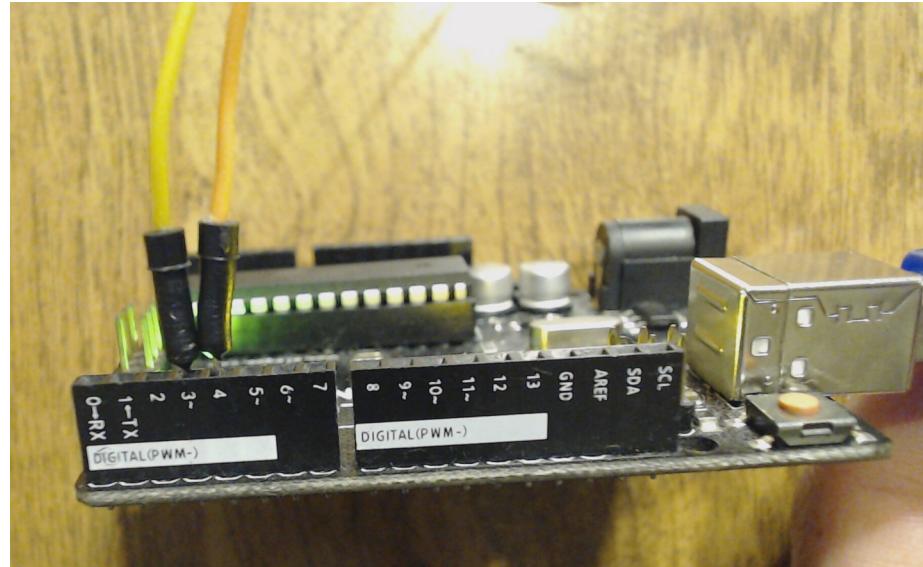
Wire Arduino

- Red to 5V
- Black to GND



Wire Arduino

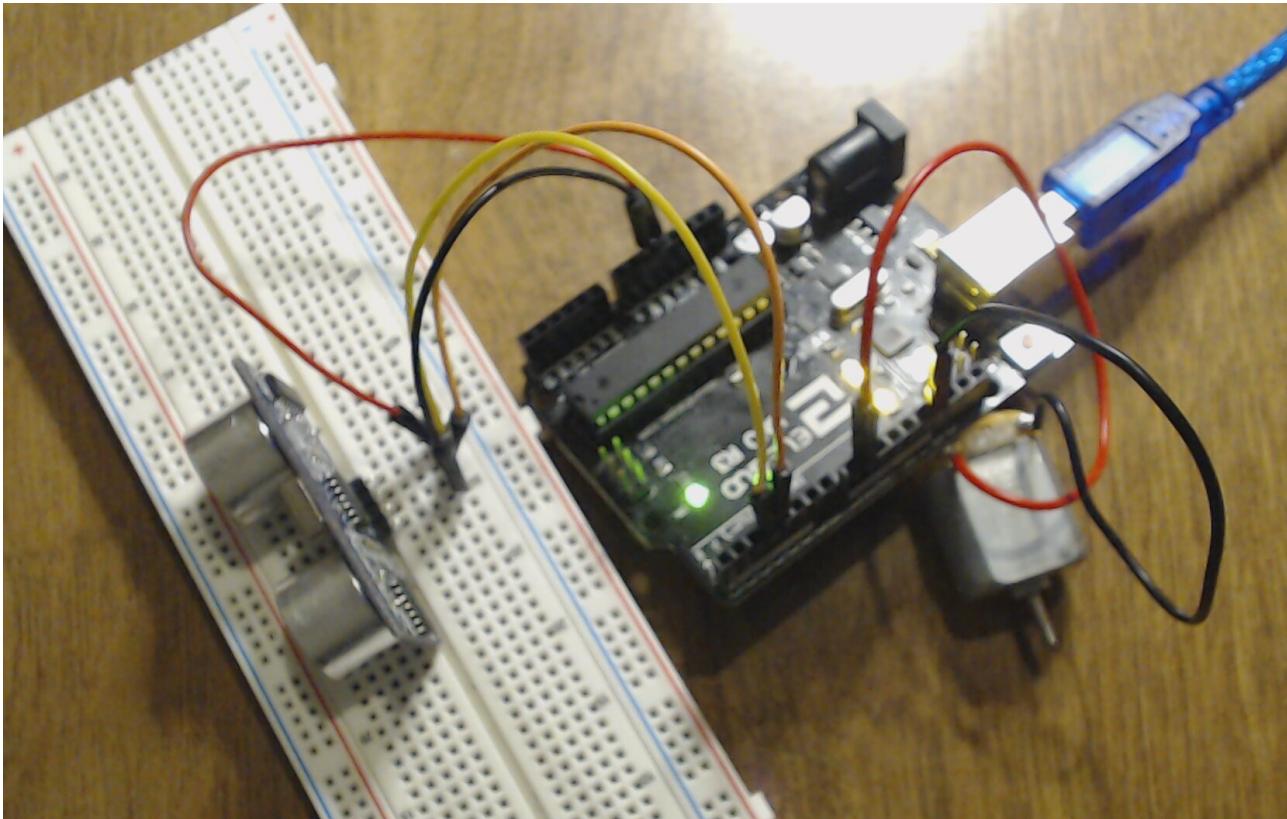
- Orange to digital 4
- Yellow to digital 3



Distance Sensor Code

- DistanceSensor
 - Simple code to use the distance sensor

Distance Sensor and DC



Distance Sensor and DC Code

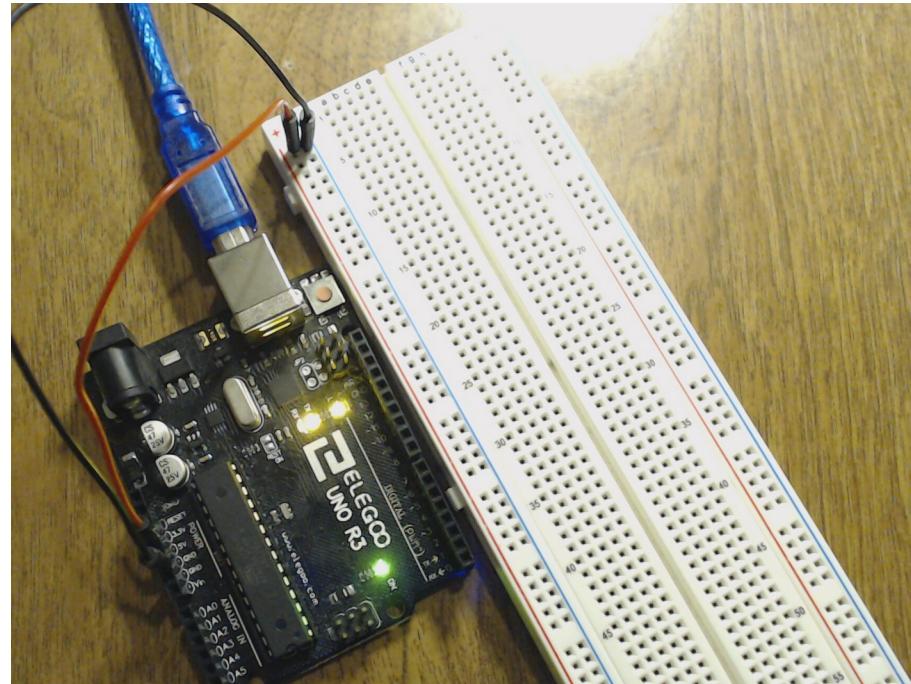
- DCDistanceSensor
 - Control DC motor with Distance Sensor

Breadboard Power Rails

- Two long connections on each side
- Useful since everything needs power and ground

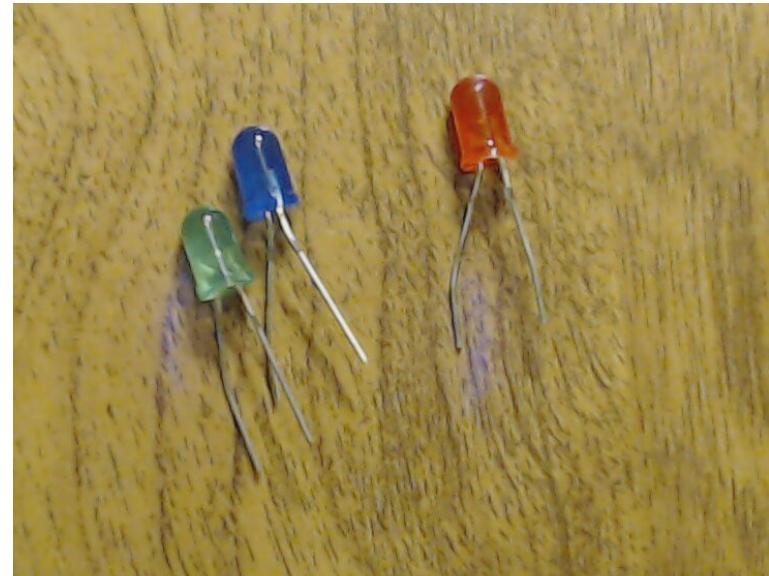
Connect Power Rails and Arduino

- 5V to red rail
- GND to blue rail



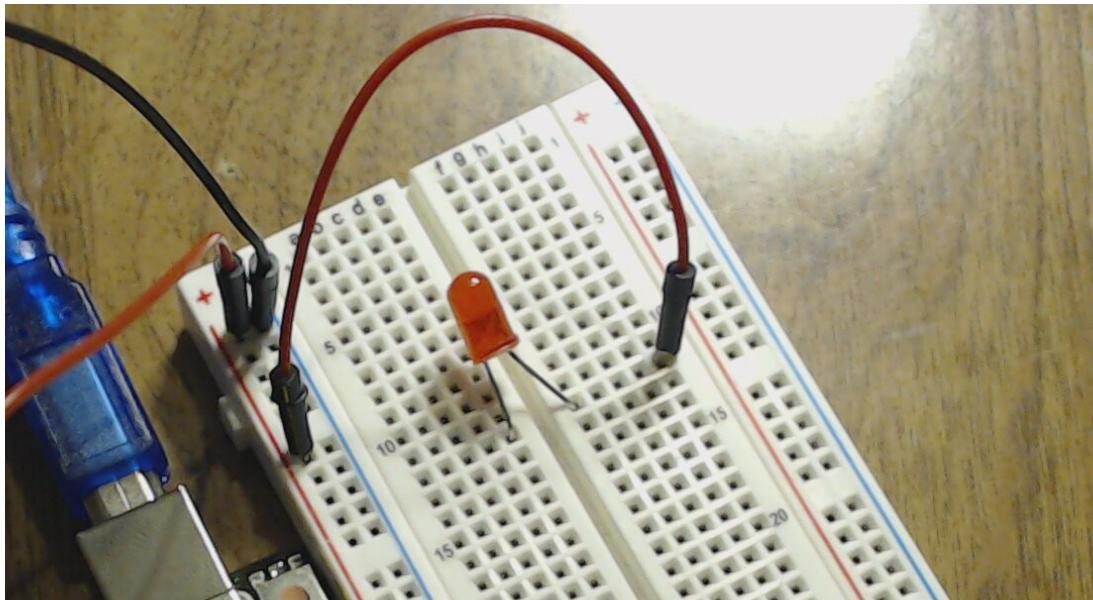
LED

- Light Emitting Diode
- Only let's electricity flow one way
- Long leg is positive



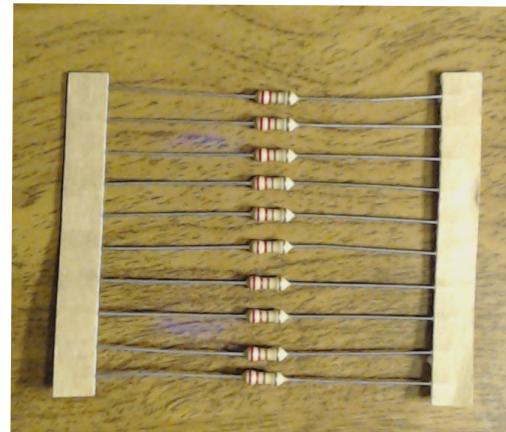
Connect LED

- Run red wire from red power rail to far side of breadboard
- Place LED across center with long leg connected to red wire



Resistor

- Sets resistance
- Necessary to not break the LEDs
- Pick out ones with the following bands
 - RED RED BROWN GOLD



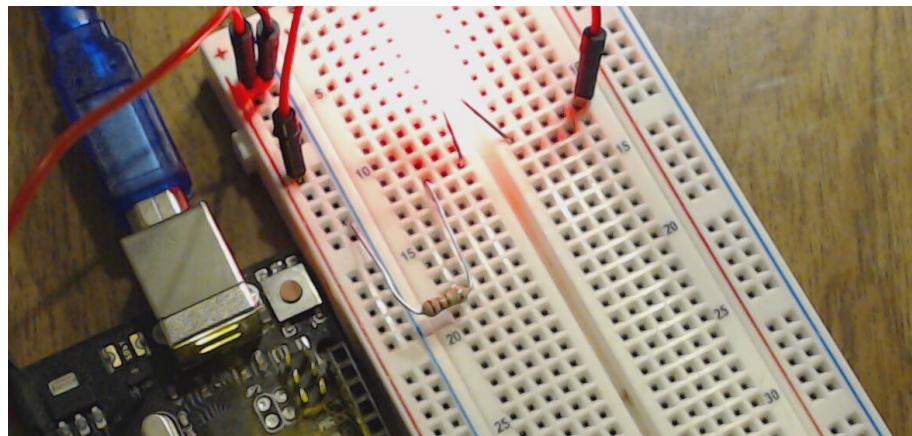
4 Band Resistor

4 Band Resistor			
	First Digit	Second Digit	Multiplier
Black	Nil	0	1
Brown	1	1	10
Red	2	2	100
Orange	3	3	1000
Yellow	4	4	10000
Green	5	5	100000
Blue	6	6	1M
Violet	7	7	10M
Grey	8	8	100M
White	9	9	1G
Gold	Nil	Nil	±10
Silver	Nil	Nil	±10%

www.CircuitsToday.com

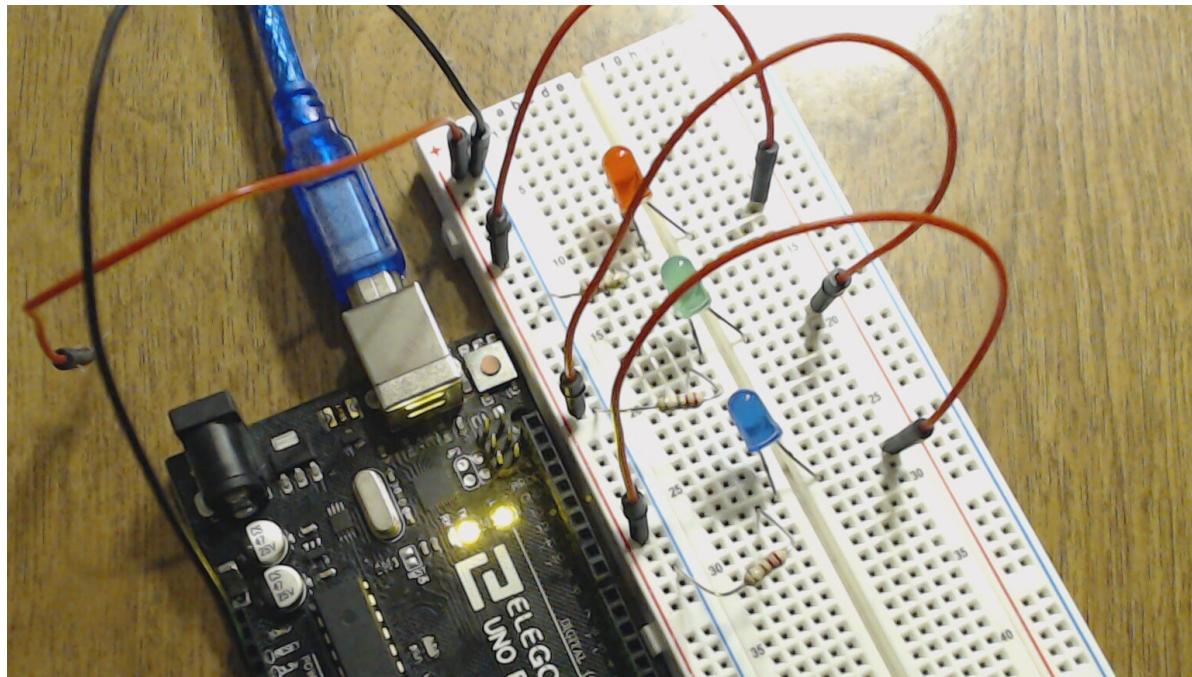
Connect Resistor

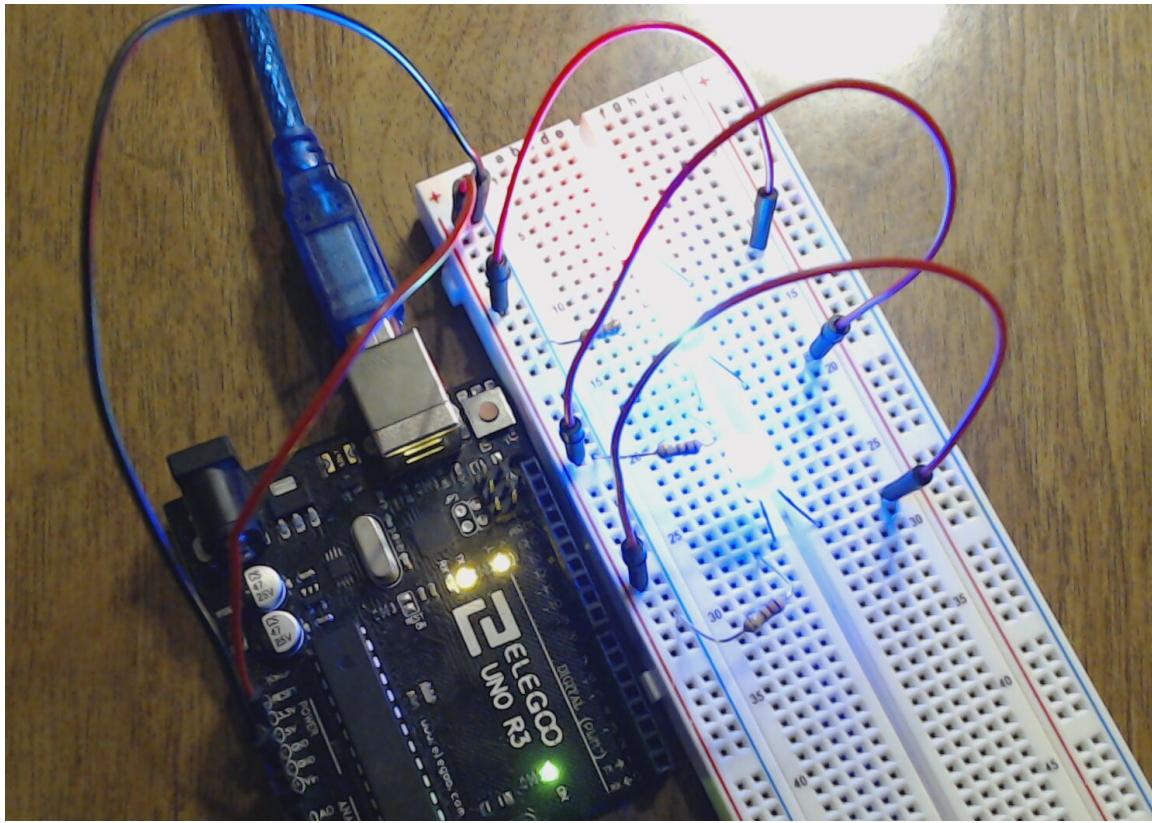
- Connect output of LED to the blue rail
- And there was light



Repeat Twice more

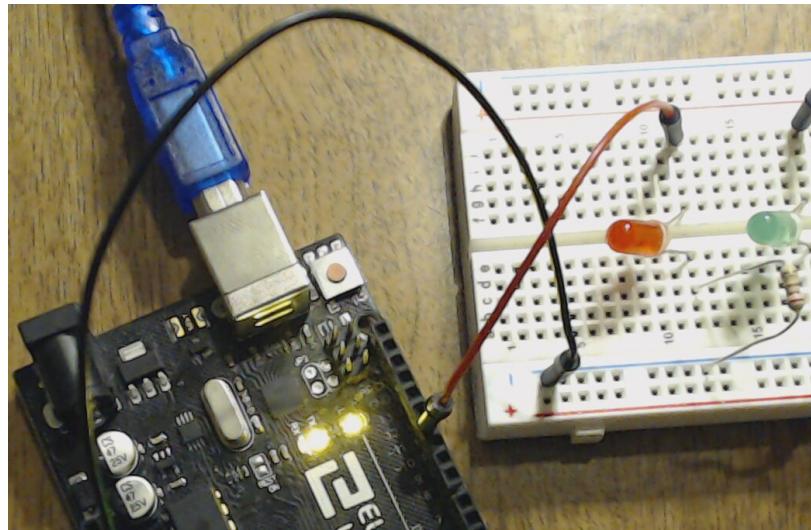
- Use the colors red then green then blue





Move Wires

- Take the wire connecting the red rail and the red LED
 - Move the power rail side over to digital 11

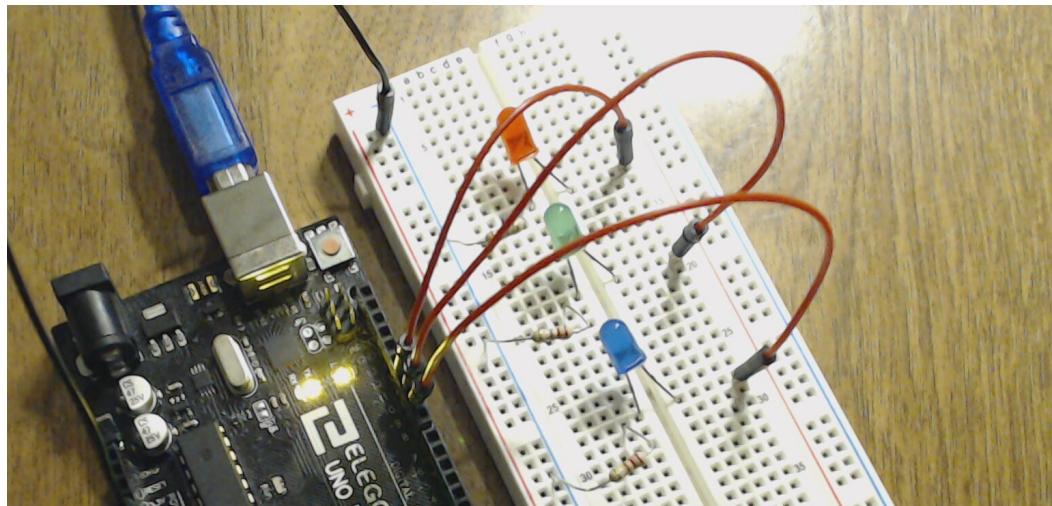


Blink Red Light Code

- BlinkRed
 - Simple example to control an LED
- BlinkRedWithVariables
 - Same as BlinkRed but with variables

Move Wires

- Then do the same for green
 - Use digital 10
- Then do the same for blue
 - Use digital 9



Blink LEDs Code

- RGBLEDs

RGB LED

- Tricolor LED that gives you any color
- Longest leg is GND
- Single leg on right of ground is red
- Shortest leg is blue
- Leg left of ground is green
- BLUE GREEN GND RED



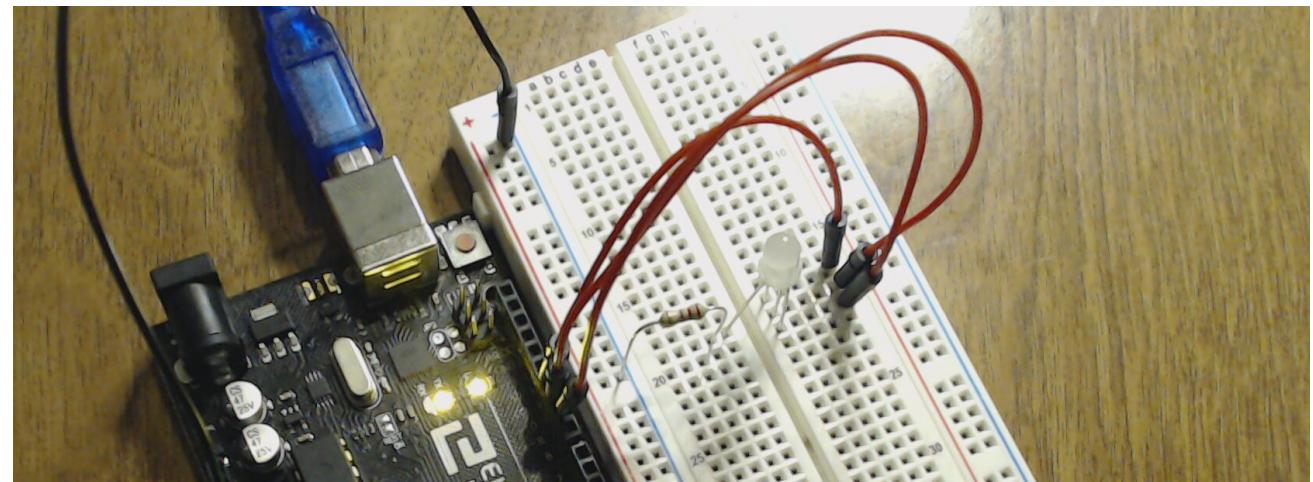
Bend GND Away

- Using the orientation
 - BLUE GREEN GND RED
- Bend GND away from you



Replace all the LEDs

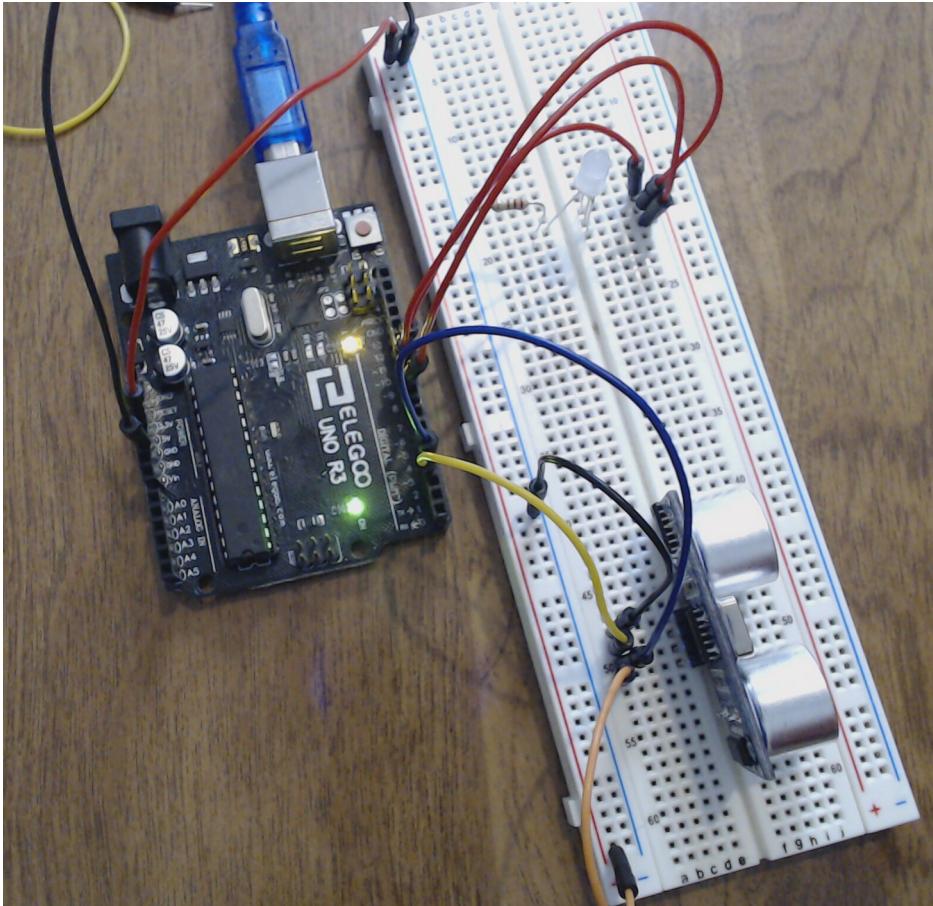
- Replace the green LED with the RGB LED
- GND should plug into the resistor
- Move the digital wires to the RGB LED
 - Red to red
 - Green to green
 - Blue to blue



RGB LED Code

- RGBLEDS
 - This same program will work with the RGB LED

RGB LED and Distance Sensor



RGB LED and Distance Sensor Code

- RGBLEDDistanceSensor
 - Control color based on set distance

Disconnecting the Computer

- Unplug the computer from the Arduino
- Get a 9V battery and the connector
- Plug it into the Arduino

Rotation to Linear







Arduino Reference

- From arduino.cc go to Documentation > Reference
- See all the builtin funtions and constants
- Find section Standard Libraries
- Download Servo and Stepper