Advanced Manufacturing Academy - 2016

ROBOTICS – 5
Input& Sensors

College of Engineering and Technology

East Carolina University

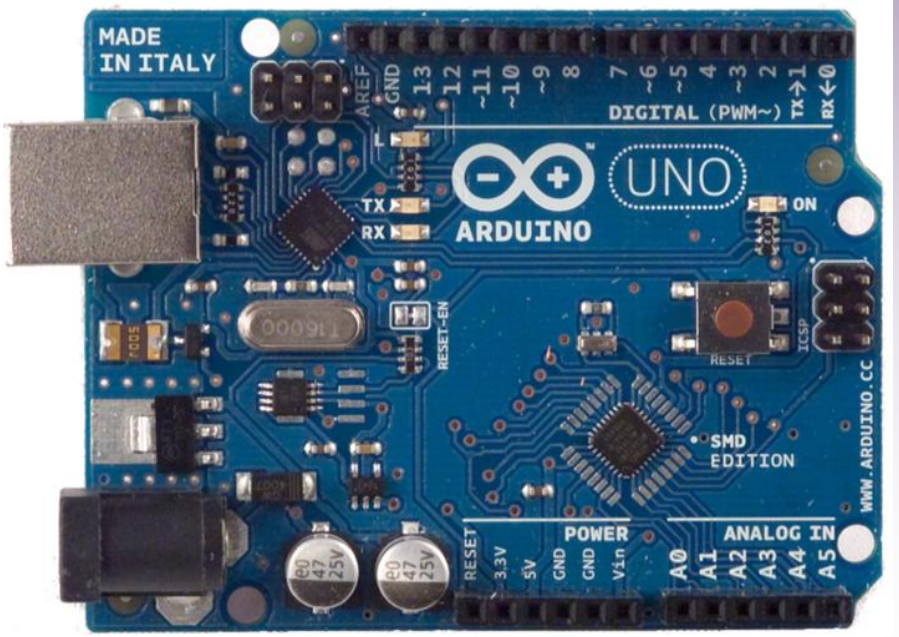
Our Robot – Our Plan

- We have a moving robot
- How do we know when to stop?
- Need some way to get information back to the Arduino about its environment.
- Sensors!
  - Digital inputs
  - Switch/Button
  - Read Voltages – on/off
  - Programming details – Loops/Conditionals

Inputs to the Arduino

- Digital inputs
  - Pins 0-13 will act as digital inputs
  - Some with special functions
- Analog Inputs
  - 6 pins: A0 – A5
  - Read 0 – 5VDC
  - 10 bit Resolution

DIGITAL INPUTS



ANALOG INPUTS

Digital Input – On/Off

- Information to the Arduino by sending
  - 5V = High = True = On
  - 0V = Low = False = Off
- Pick a digital pin – name it
- Set it to be an “input”
  - IE.. If we set pin 2
    - int pin2 = 2; // Set variable pin2 = 2
    - pinMode(pin2, input); // pin2 is an input

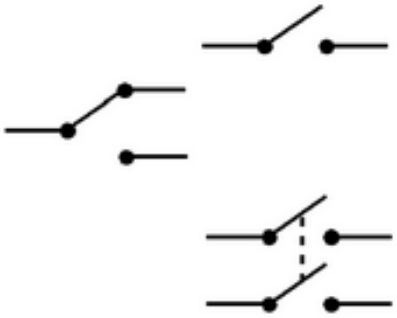
Switches

- Talk about our switch
- Switch opens and closes a circuit
- Lots of different types but same concept
- Two possible states;
  - Open = OFF
  - Closed = ON

http://tex.stackexchange.com/questions/51740/change-make-contact-graphic-in-tikz-circuit-lib-and-add-closed-option

You can stack up switches

- Keep adding Poles and Throws
  - Poles – each “Circuit” through switch
  - Throws – how many ways to connect
    - ✓ Single pole single throw
    - ✓ Single pole double throw
    - ✓ Double pole single throw



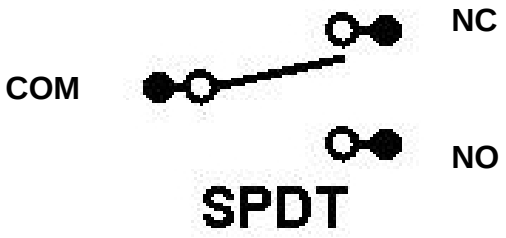
http://www.tb-training.co.uk/MarineE02.html

A massive 4PDT circuit symbol, and an physically massive 4PDT toggle switch.

https://learn.sparkfun.com/tutorials/switch-basics/poles-and-throws-open-and-closed

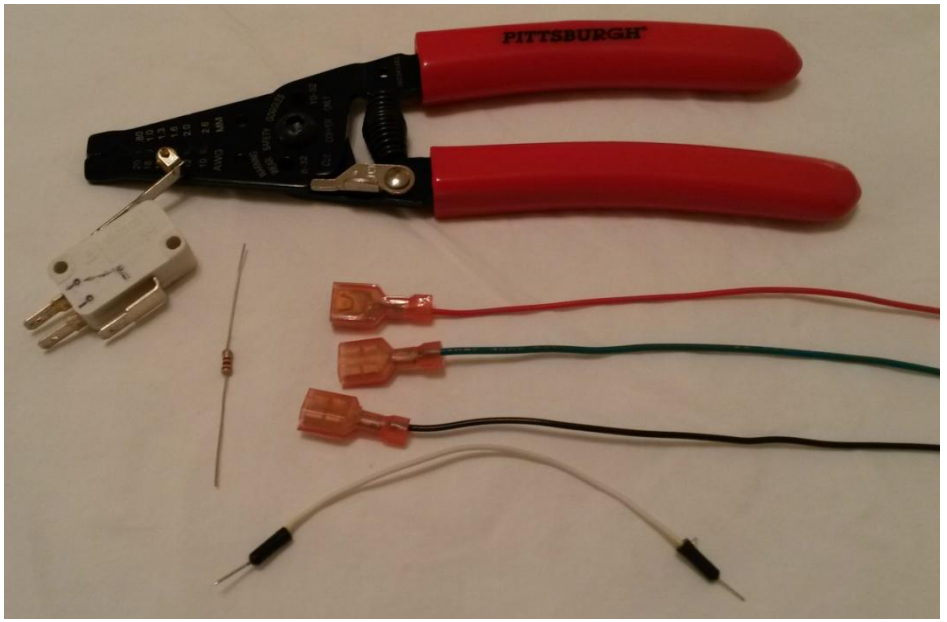
Our Switch – The details

- Our Switch is a SPDT – Single Pole Double throw.
- It has three connections
  - COM, NC and NO?
  - There should also be a picture on the side



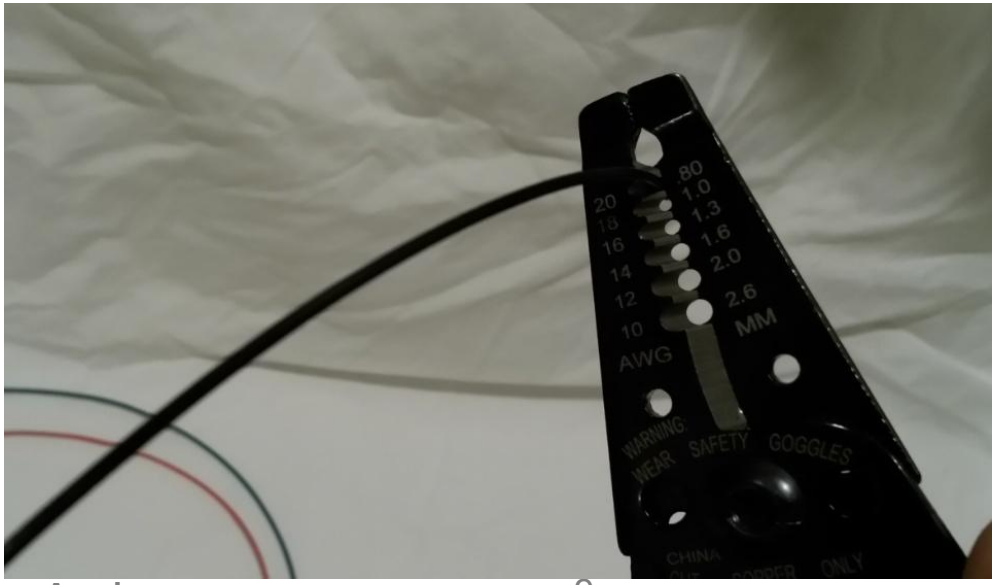
Parts for our “Button” exercise

- Need to prep and understand parts
- You will need:
  - Wire cutter/strippers
  - Wires with female connectors
  - Switch
  - Resistor
  - Jumper



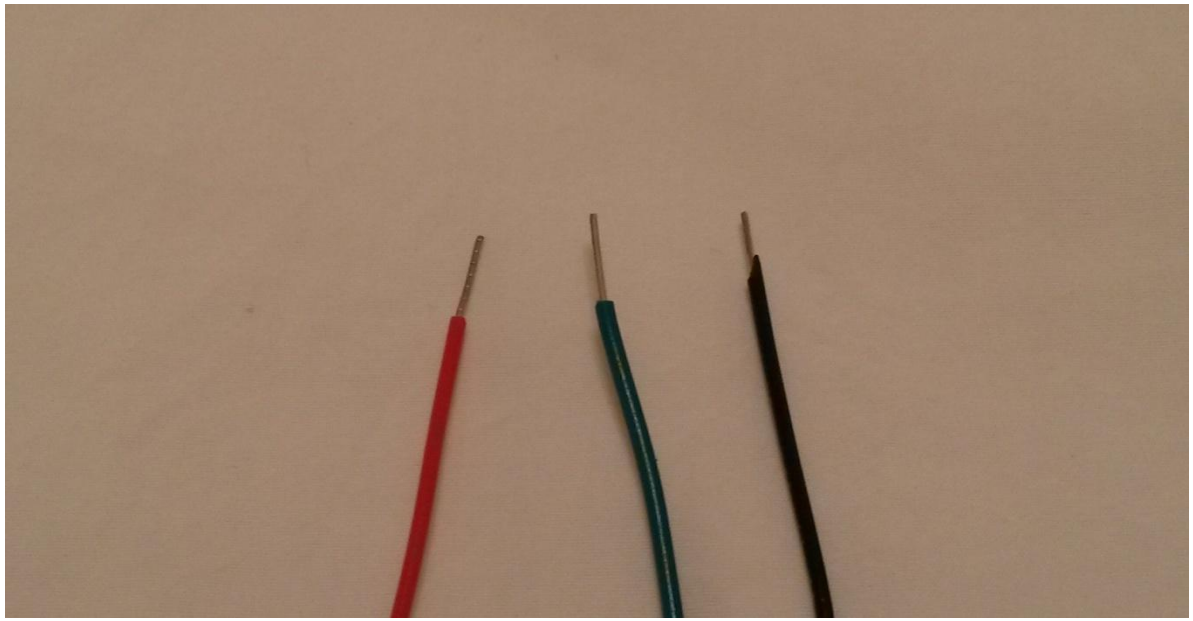
Make Jumpers/Connector

- Need to strip ¼” of insulation off wires
- Strip each end of plain wires
- Strip single end off connector wire
  - Place wire into strippers – Use 20 hole
  - Close pliers and firmly pull wire



Jumpers/Connectors Done

- Wires should look like this….
  - 3 connector wires with stripped end



Let's Try the Button Program

- Load the Button Program from desktop
  - Init section and setup

```
 by Tom Igoe
 This example code is in the public domain.
 http://www.arduino.cc/en/Tutorial/Button
 */

// constants won't change. They're used here to
// set pin numbers:
const int buttonPin = 2;     // the number of the pushbutton pin
const int ledPin =  13;      // the number of the LED pin

// variables will change:
int buttonState = 0;         // variable for reading the pushbutton status

void setup() {
  // initialize the LED pin as an output:
  pinMode(ledPin, OUTPUT);
  // initialize the pushbutton pin as an input:
  pinMode(buttonPin, INPUT);
}
```

Button Program (cont)

- Button Program – void loop section

```
void loop(){
  // read the state of the pushbutton value:
  buttonState = digitalRead(buttonPin);

  // check if the pushbutton is pressed.
  // if it is, the buttonState is HIGH:
  if (buttonState == HIGH) {
    // turn LED on:
    digitalWrite(ledPin, HIGH);
  }
  else {
    // turn LED off:
    digitalWrite(ledPin, LOW);
  }
}
```

IF Command

- IF Command - A conditional statement/test
  - If Something is true, do the following

```
if (someVariable > 50)
        {
        // do something here
        }
```

```
if (x > 120) digitalWrite(LEDpin, HIGH);

if (x > 120)
digitalWrite(LEDpin, HIGH);

if (x > 120){ digitalWrite(LEDpin, HIGH); }

if (x > 120){
  digitalWrite(LEDpin1, HIGH);
  digitalWrite(LEDpin2, HIGH);
}                                    // all are correct
```

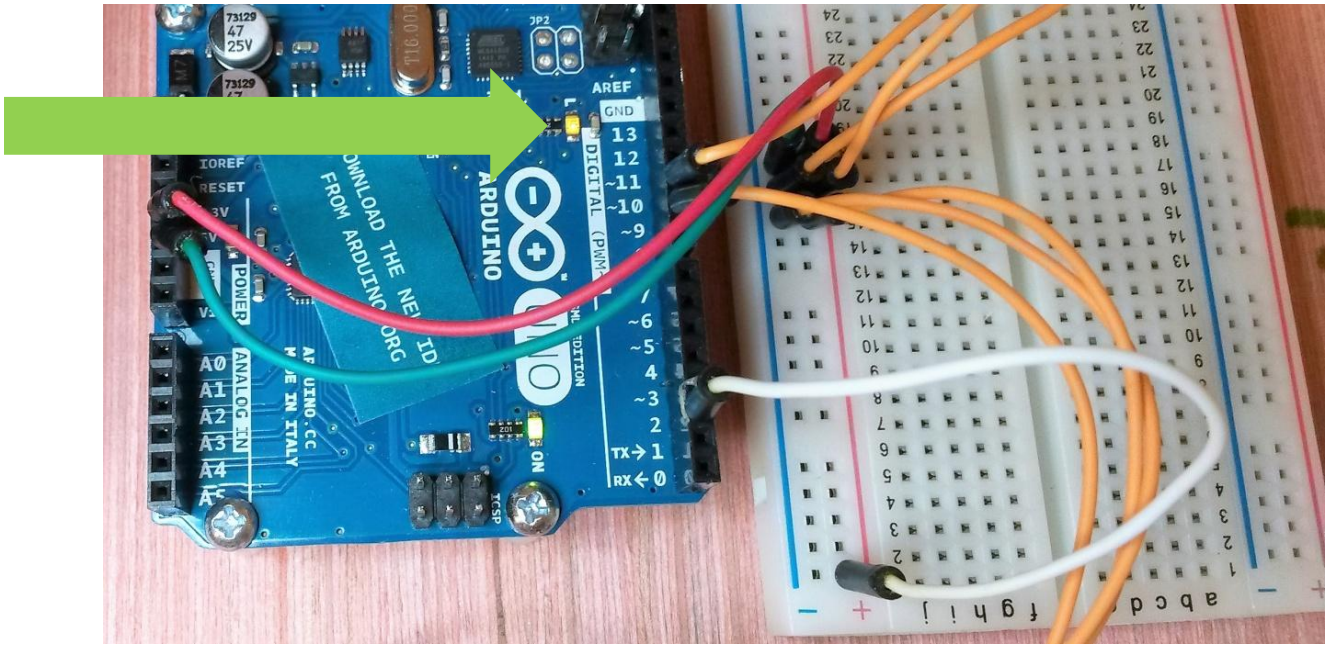
IF - Else Command

- IF – Else – Two option conditional statement/test
  - If Something is true, do the following otherwise do the other

```
if (pinFiveInput < 500)
{
  // action A
}
else
{
  // action B
}
```

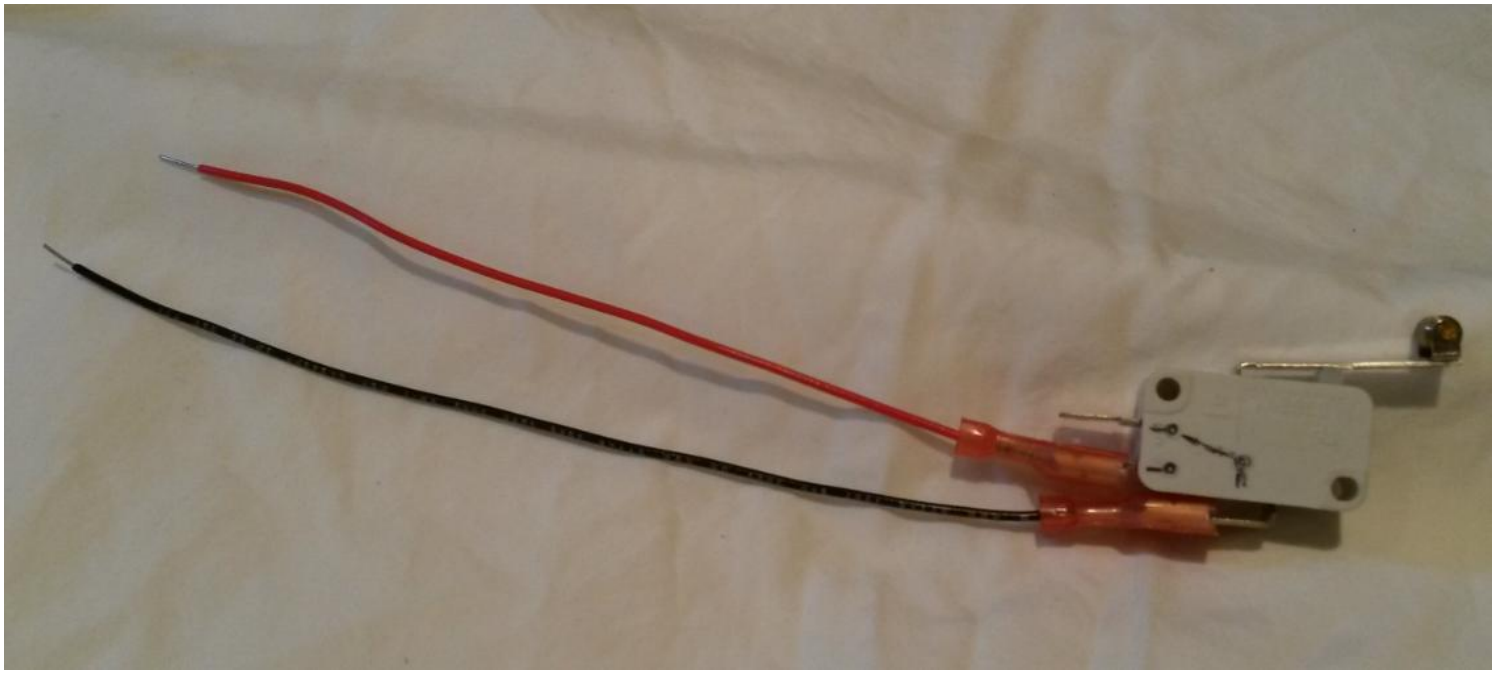
Button Code Test

- NOW – Let's try the code
  - Load Button code to arduino
  - Install jumper in +1 on breadboard
  - Touch wire arduino pin 2
  - Watch built in LED #13 – What happens?



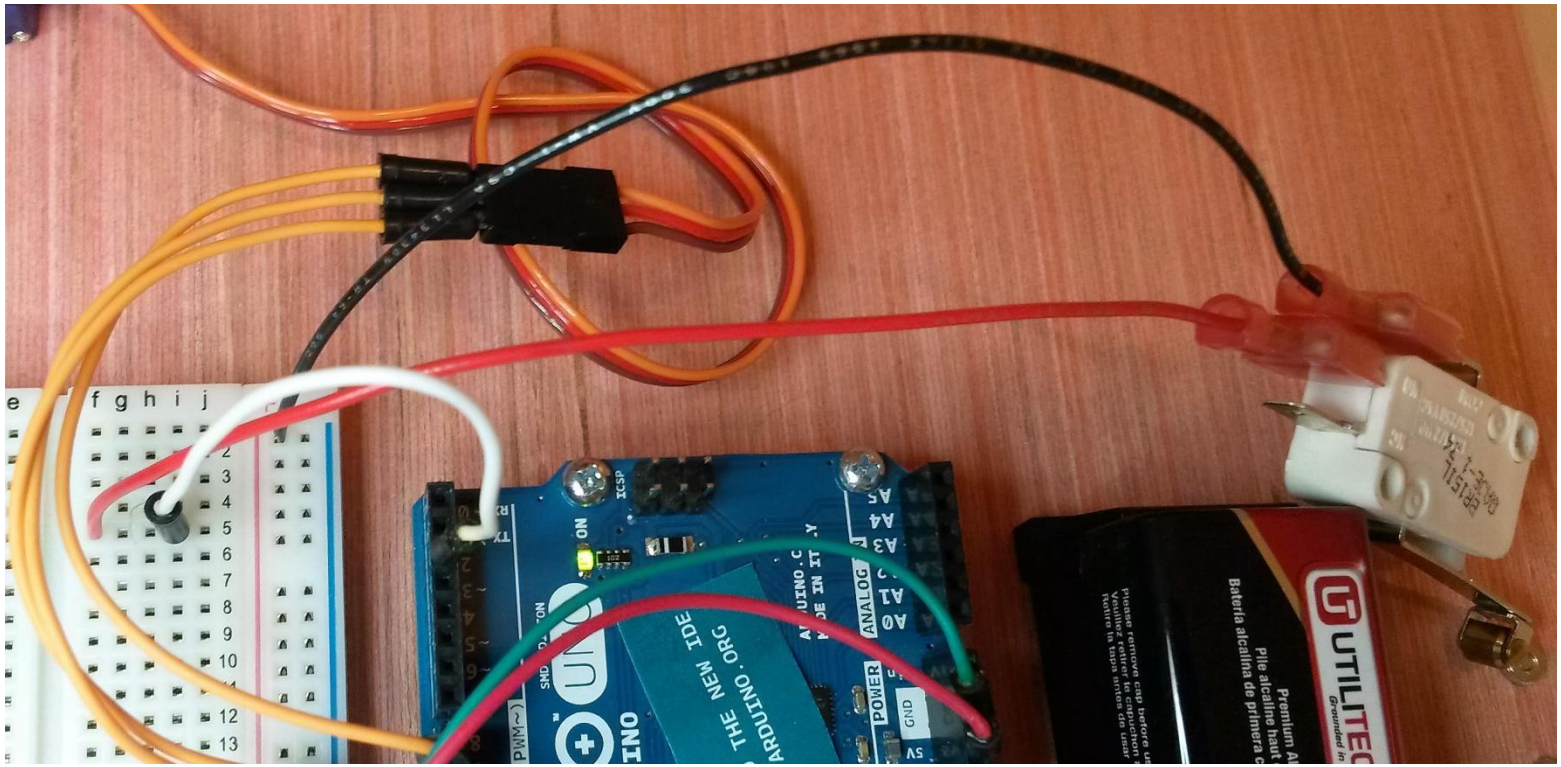
Add The Switch!

- Not a stable way to make connections
- Add switch
  - Install black lead on “Com”
  - Install red lead on “NO”



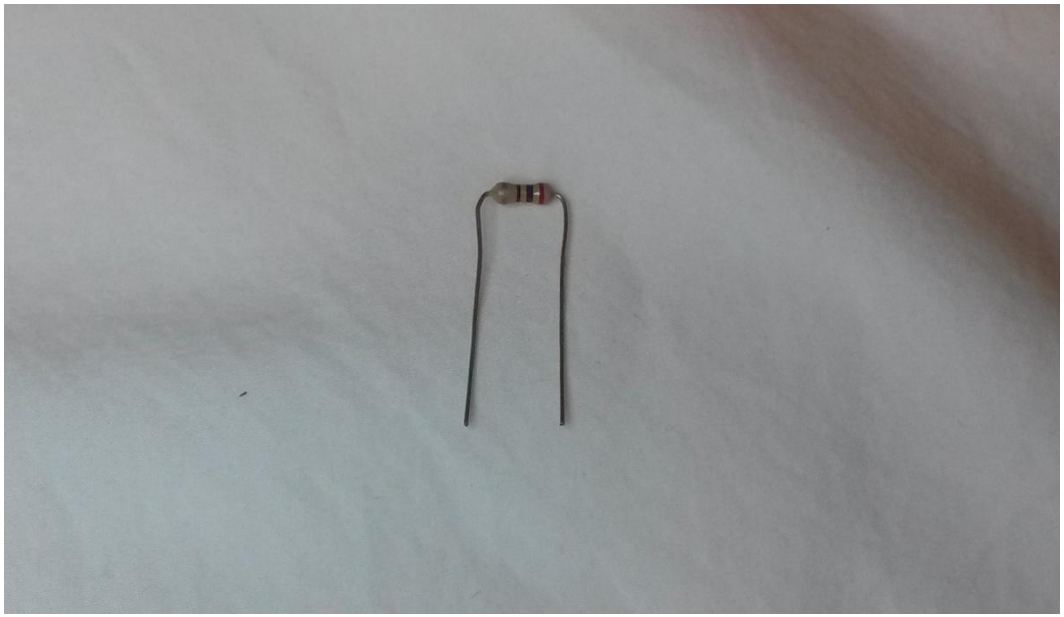
Install Switch in Circuit

- Install black wire in +1
- Install red wire in f5
- Install jumper from i5 to arduino 2



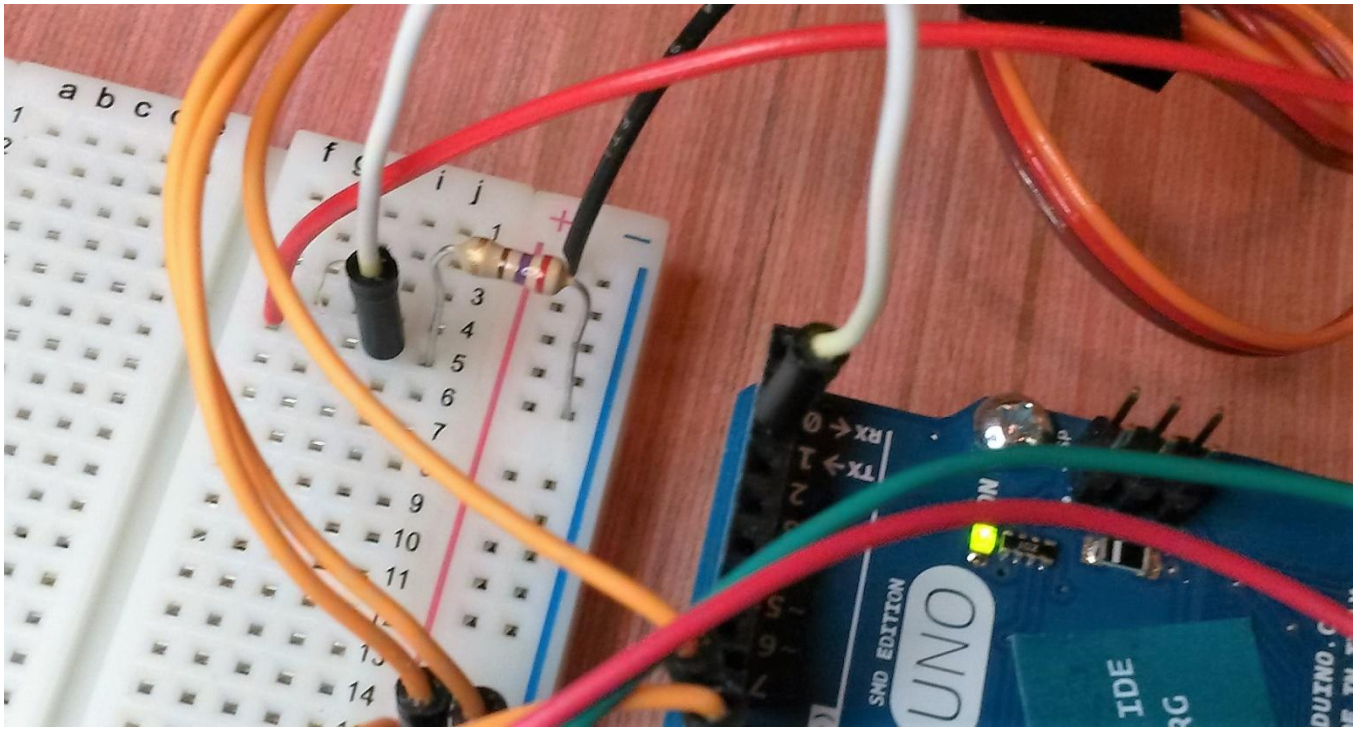
Button Code Bugs?

- Light Comes on and stays on?
- Light comes on and goes out?
- Not stable! Add a resistor!
- Bend resistor as shown



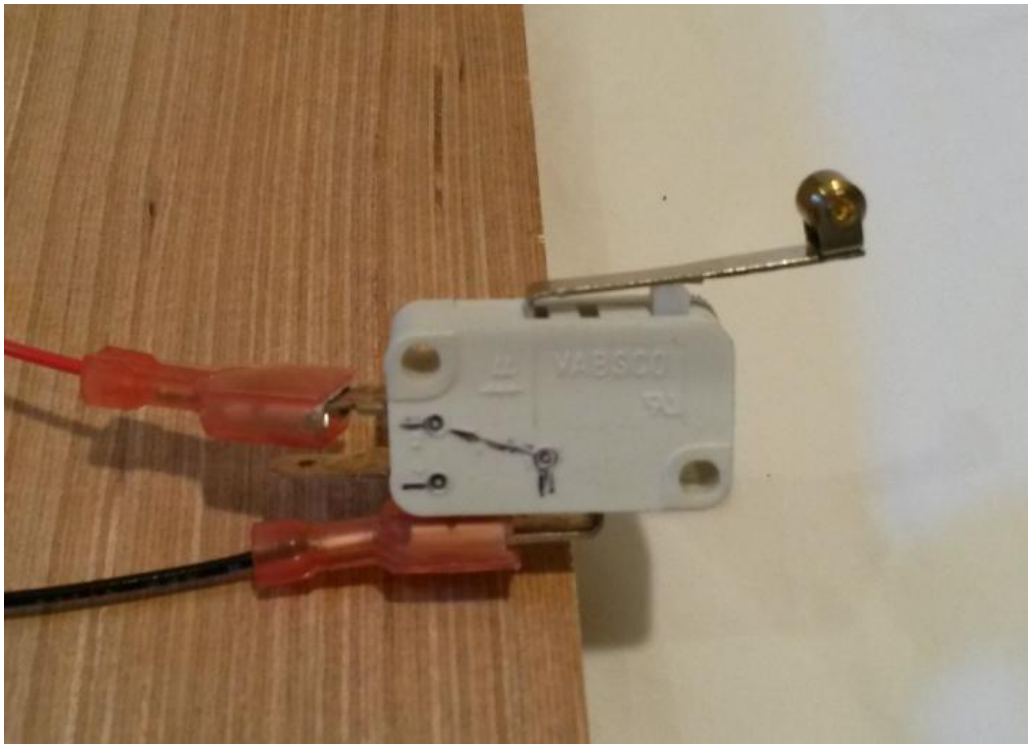
Install Resistor

- Install resistor from j5 to -5 as shown
- Try switch
- Stable? Works?



Try Switch

- What happens if you switch the leads?
- Like this?
- NO vs. NC?



CHALLENGES!

- Use switch Input to stop/start 1 servo?
  - Need servo and if-then functions added to button file…
  - Make sure to include all the parts!
- Make it run continuously?

Build your BOT!

- Build a bot to solve the final Challenge
  - Example provided
- Use all parts provided
- Hot glue and cardboard provided
- **Store files on your jump drive**
- Working time
  - Today 6/24
  - Short time Friday 7/1 before competition
- Competition FRIDAY 7/1!