

# ARDUINO:

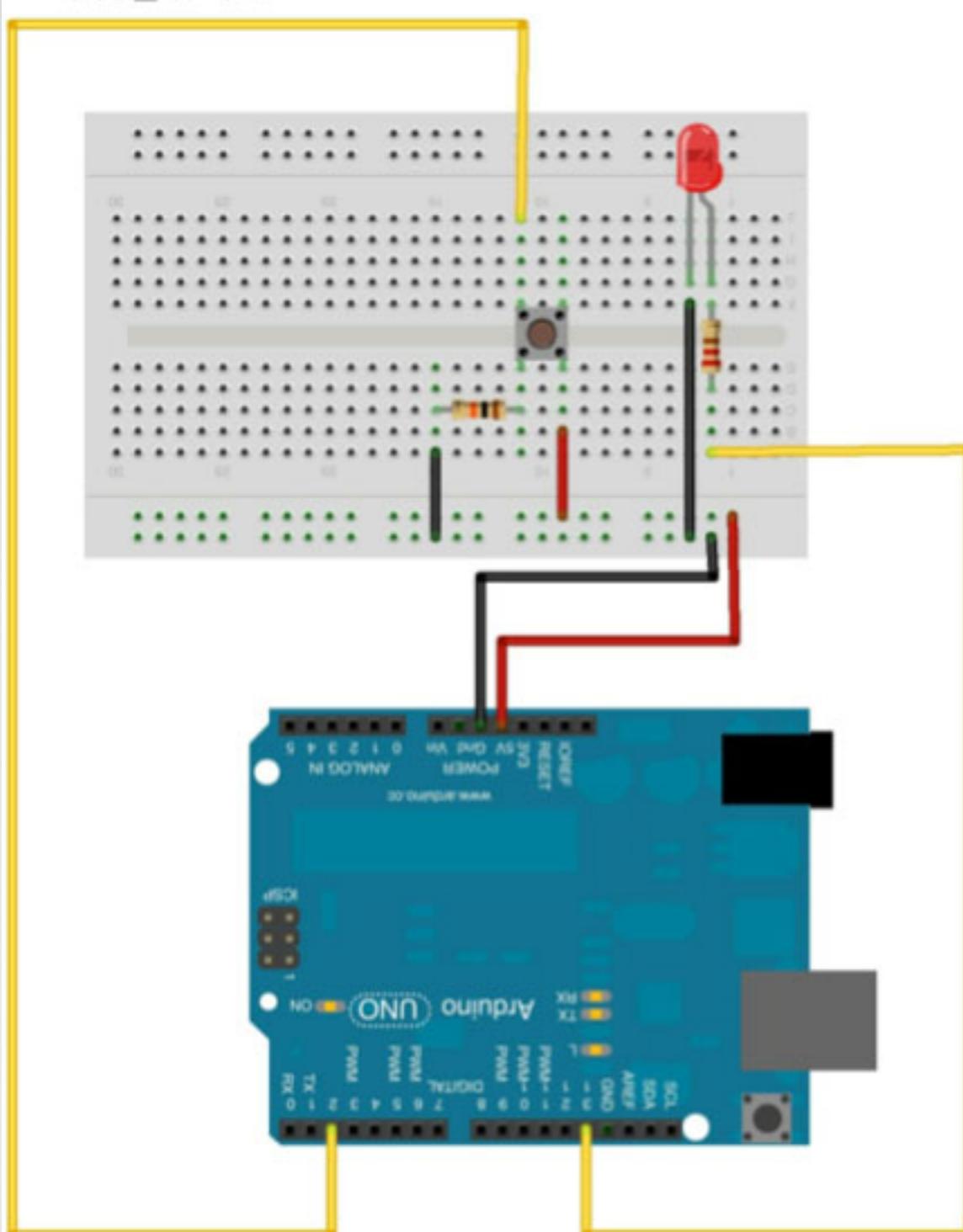
## Intro to Microcontrollers - Day 3

# TODAYS TOPICS

- 1. Introduction to motion with motors**
- 2. Having the Arduino interface with other software(Processing, NodeJS)**

# WHY A RESISTOR WITH A BUTTON?

Made with  Fritzing.org



1. When the button is not pressed pin 2 is being “pulled down” to ground.

This reads as **LOW**

2. When the button is pressed current flows across the Button and takes the path of least resistance to pin 2

This reads as **HIGH**

3. Without the pull down resistor there is potential for signal noise that can result in a false reading of **HIGH**

# ART MADE WITH MOTORS

**Zimoun**

<http://www.zimoun.net/2013-43.html>

**Survival Research Labs**

[https://www.youtube.com/watch?v=Ahj5-zV80c0&index=8&list=PLrG8Ed4\\_R2aAEiQa0xGAdDWBtj6GRiHsz](https://www.youtube.com/watch?v=Ahj5-zV80c0&index=8&list=PLrG8Ed4_R2aAEiQa0xGAdDWBtj6GRiHsz)

# ARDUINO WITH OTHER SOFTWARE

[http://www.creativeapplications.net/  
objects/solar-sinter-objects/](http://www.creativeapplications.net/objects/solar-sinter-objects/)

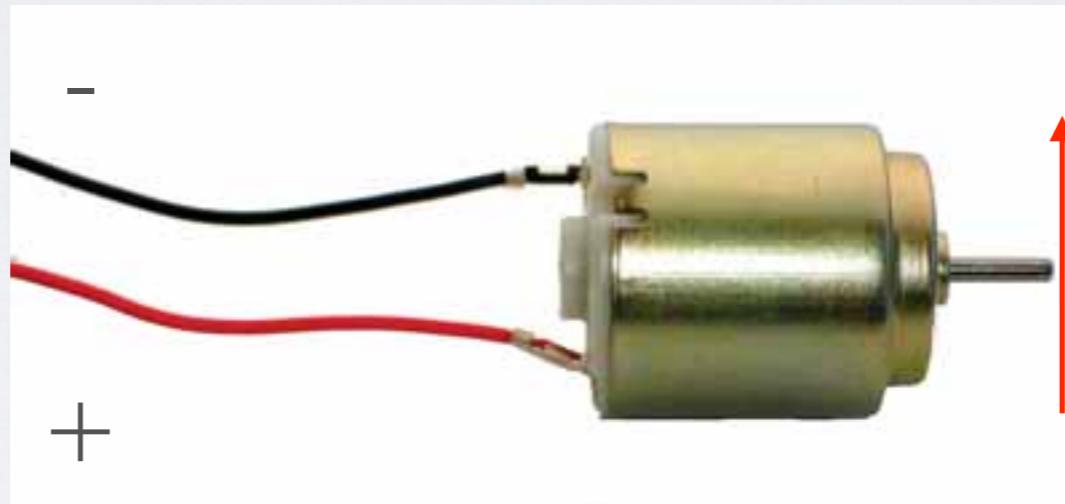
# ARDUINO WITH OTHER SOFTWARE

**“The two most important introductions for art in the past 20 years have been the Arduino and Processing,” Paola Antonelli, senior curator in the Department of Architecture and Design at the Museum of Modern Art.**

[http://www.nytimes.com/2011/03/17/arts/design/arduinoss-provide-interactive-exhibits-for-about-30.html?\\_r=0](http://www.nytimes.com/2011/03/17/arts/design/arduinoss-provide-interactive-exhibits-for-about-30.html?_r=0)

# INTRODUCING MOTION: THE ELECTRIC MOTOR

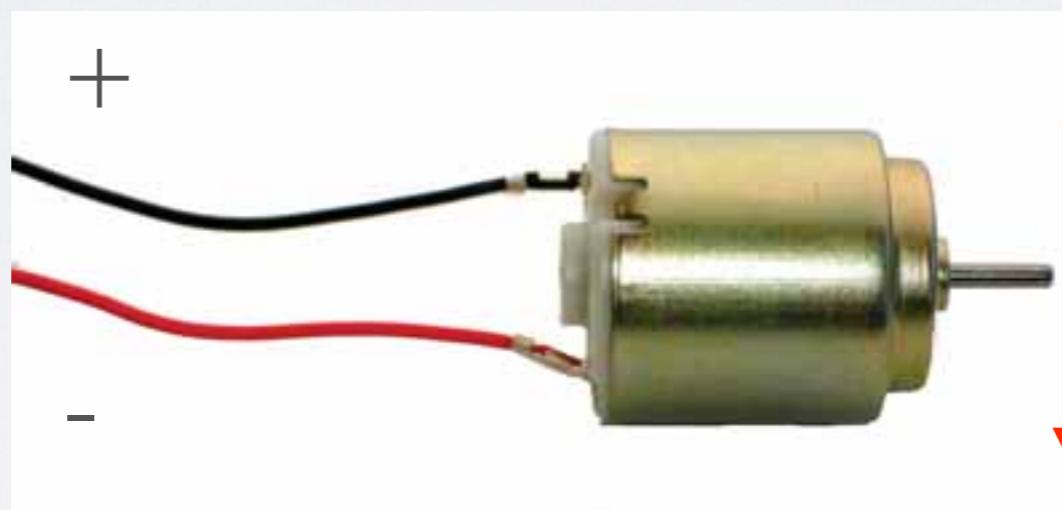
The motor is an electromechanical device with 2 leads.



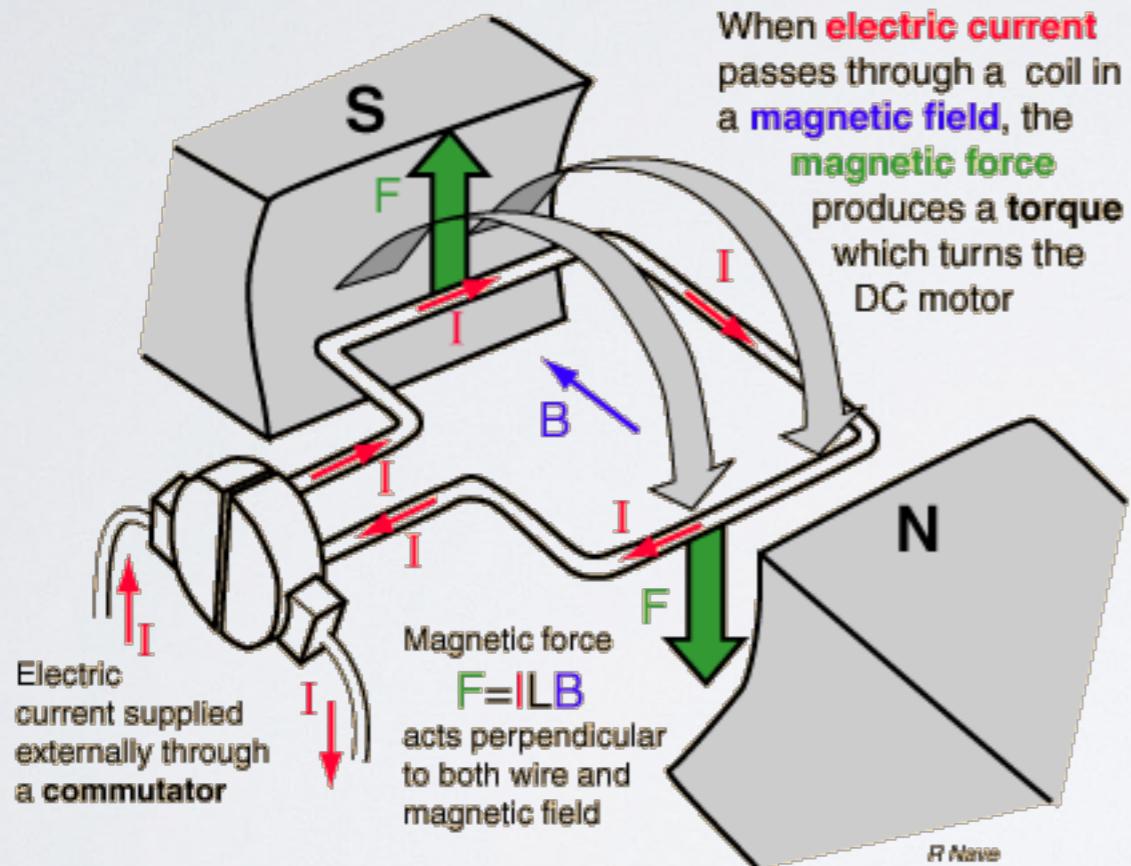
When you apply forward voltage to one lead and ground to the other the shaft of the motor will spin one direction.

# INTRODUCING MOTION: THE ELECTRIC MOTOR

With the motors that we are using today if you swap the forward voltage and ground pins the motor will spin the opposite direction.



# INTRODUCING MOTION: THE ELECTRIC MOTOR



Motors use a switched array of electromagnets to repel the polarity of fixed magnets in order to rotate.

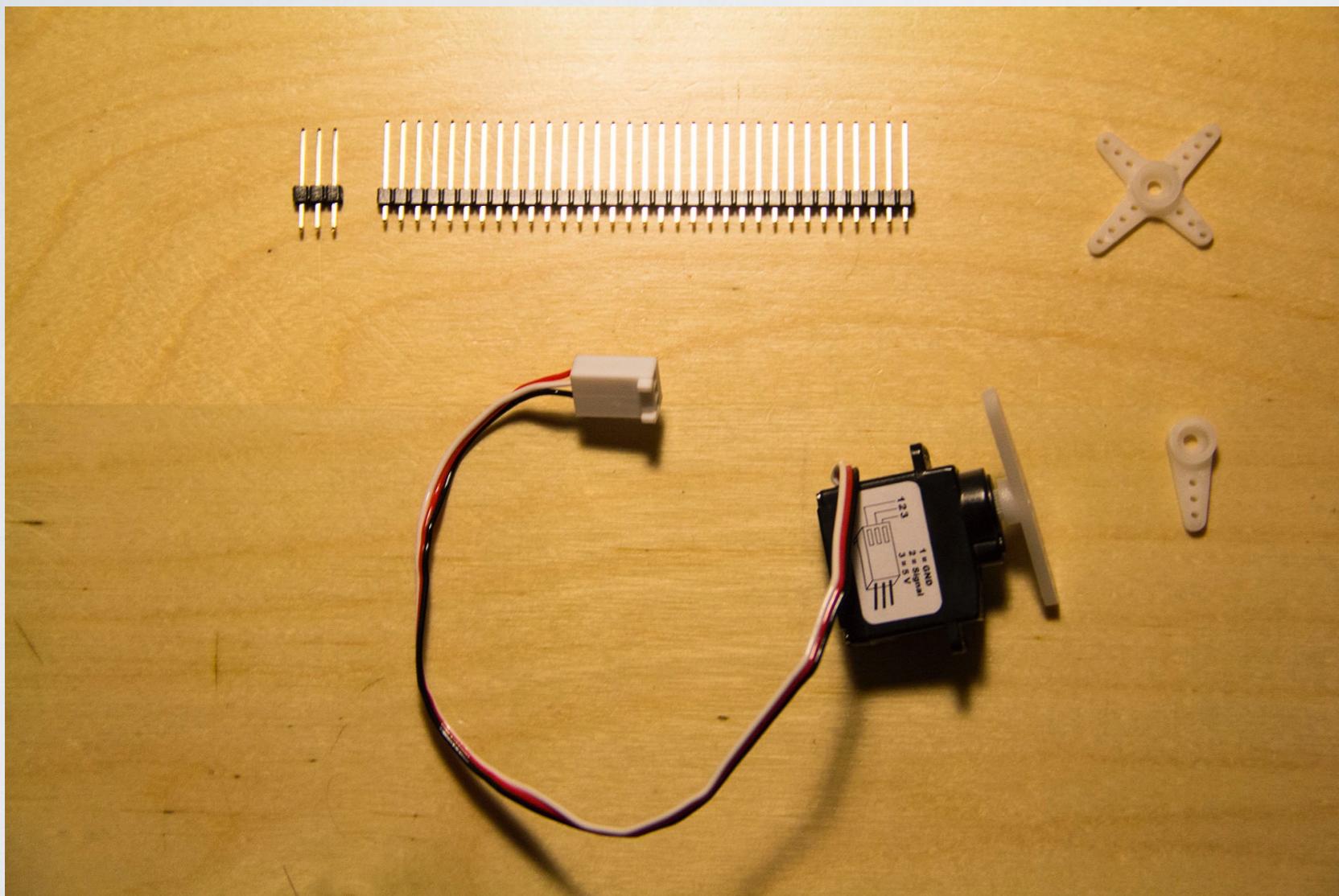
Full explanation here:

<https://community.freescale.com/docs/DOC-1067>

# INTRODUCING MOTION: THE SERVO



# INTRODUCING MOTION: THE SERVO



**Find your servo**

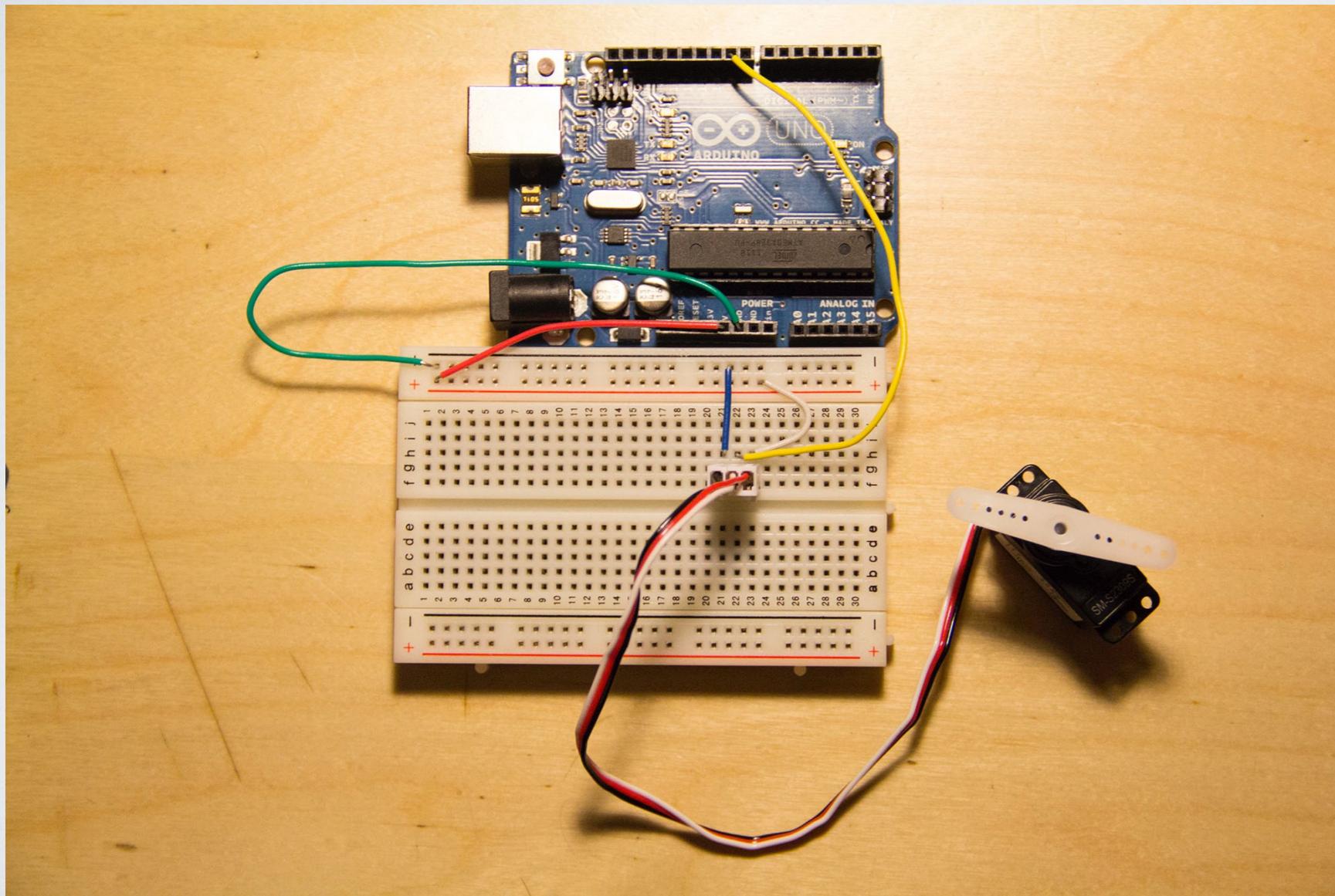
The white plastic things are servo horns - attach one to the shaft

**Find the header pins and break off 3**

Push the plastic spacer down a bit to lengthen the short side

Attach the long pins to the servo connector

# INTRODUCING MOTION: THE SERVO



**Connect 5V and Ground  
to side strips**

**Connect black wire of  
servo to ground**

**Connect Red wire to 5V**

**Connect white wire to  
pin 9**

# INTRODUCING MOTION: THE SERVO

```
#include <Servo.h>
```

```
Servo myservo; // create servo object to control a servo  
// a maximum of eight servo objects can be created
```

```
int pos = 0; // variable to store the servo position
```

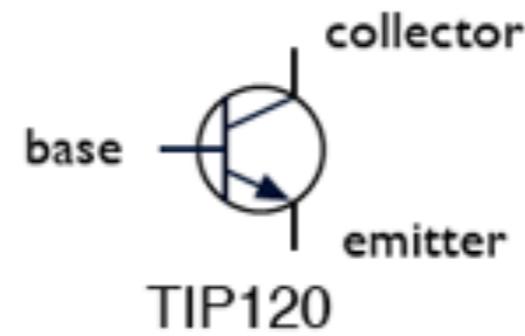
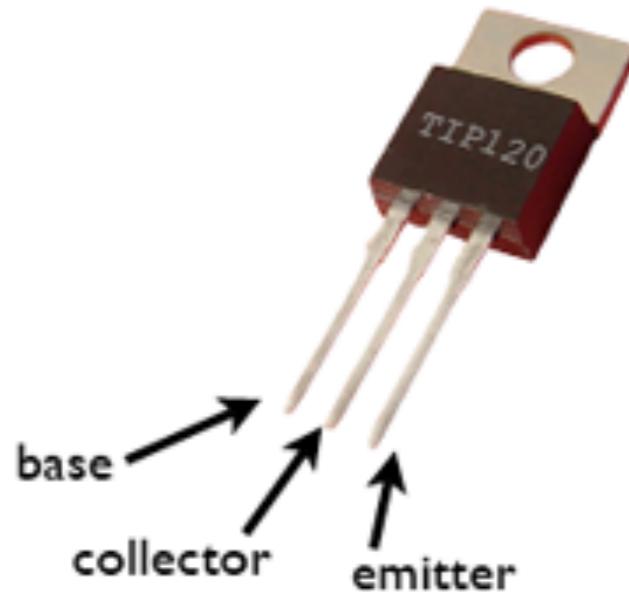
```
void setup()  
{  
    myservo.attach(9); // attaches the servo on pin 9 to the servo object  
}
```

```
void loop()  
{  
    for(pos = 0; pos < 180; pos += 1) // goes from 0 degrees to 180 degrees  
    {  
        // in steps of 1 degree  
        myservo.write(pos); // tell servo to go to position in variable 'pos'  
        delay(15); // waits 15ms for the servo to reach the position  
    }  
    for(pos = 180; pos>=0; pos-=1) // goes from 180 degrees to 0 degrees  
    {  
        myservo.write(pos); // tell servo to go to position in variable 'pos'  
        delay(15); // waits 15ms for the servo to reach the position  
    }  
}
```

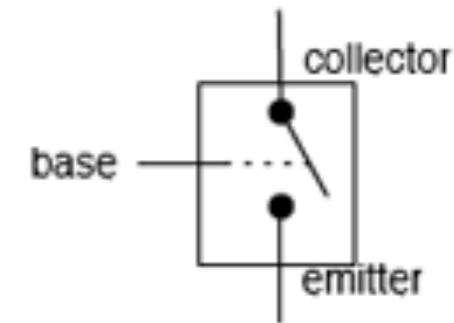
<http://arduino.cc/en/reference/servo>

# INTRODUCING THE TRANSISTOR

Act like switches electricity flicks the switch instead of your finger



schematic symbol

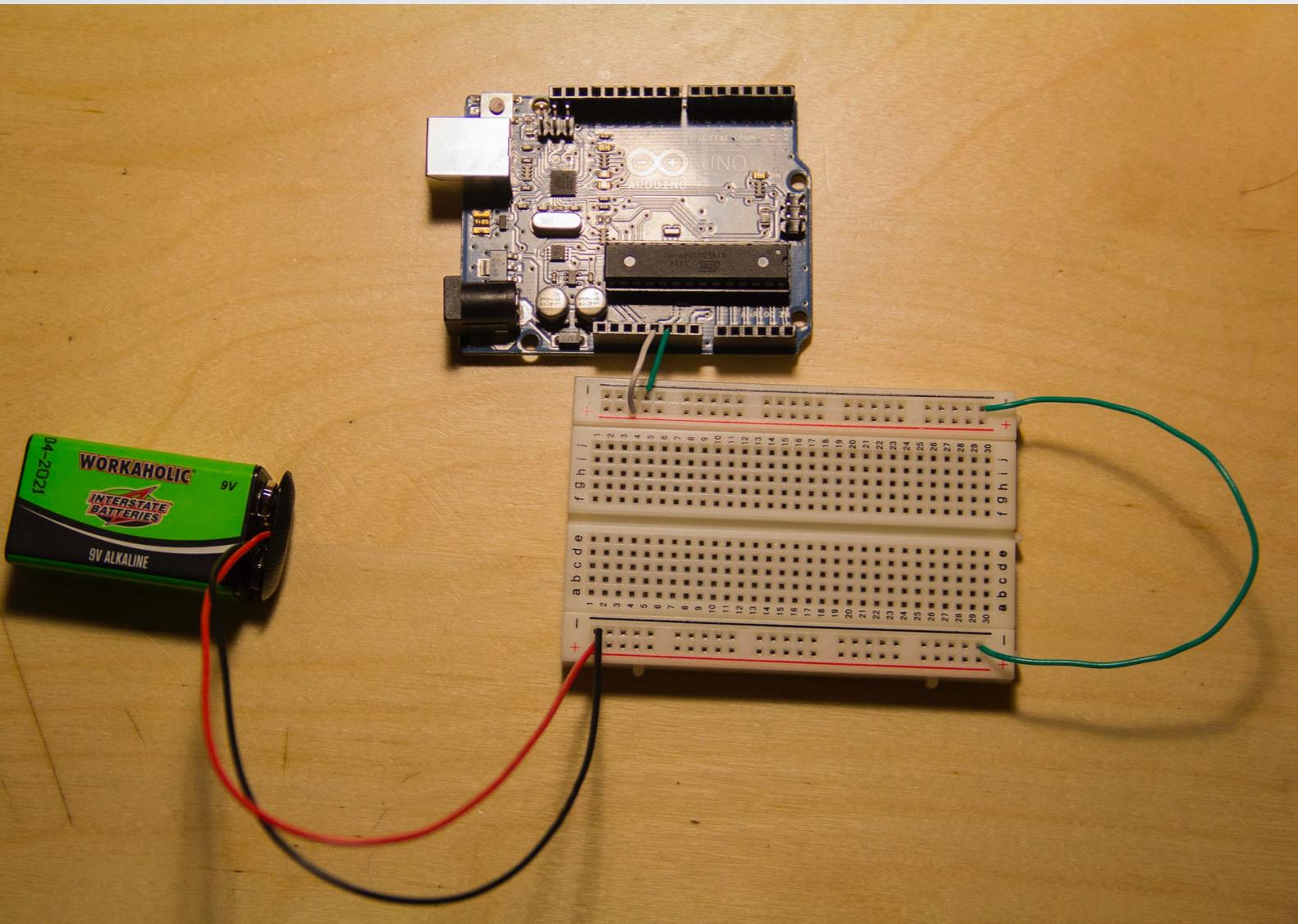


how it kind of works

Turning on the “base” connects the “collector” & “emitter” together

The can drive higher powered devices

# MOTOR CIRCUIT

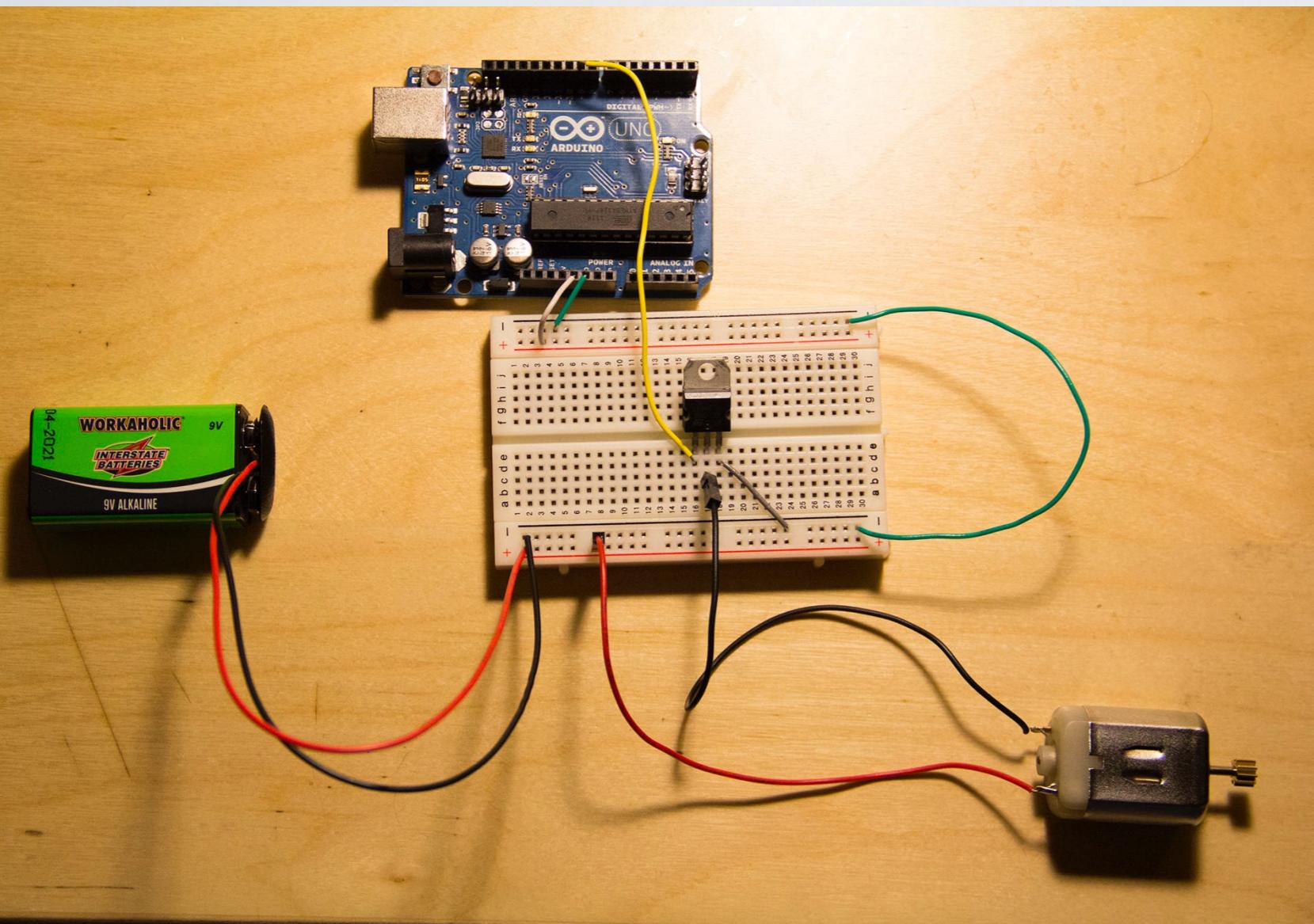


Connect 5V and Ground from Arduino to one side

Connect Red Wire and Black wire of 9 volt Battery to other side

Bridge the two ground side strips to create a 'common ground'

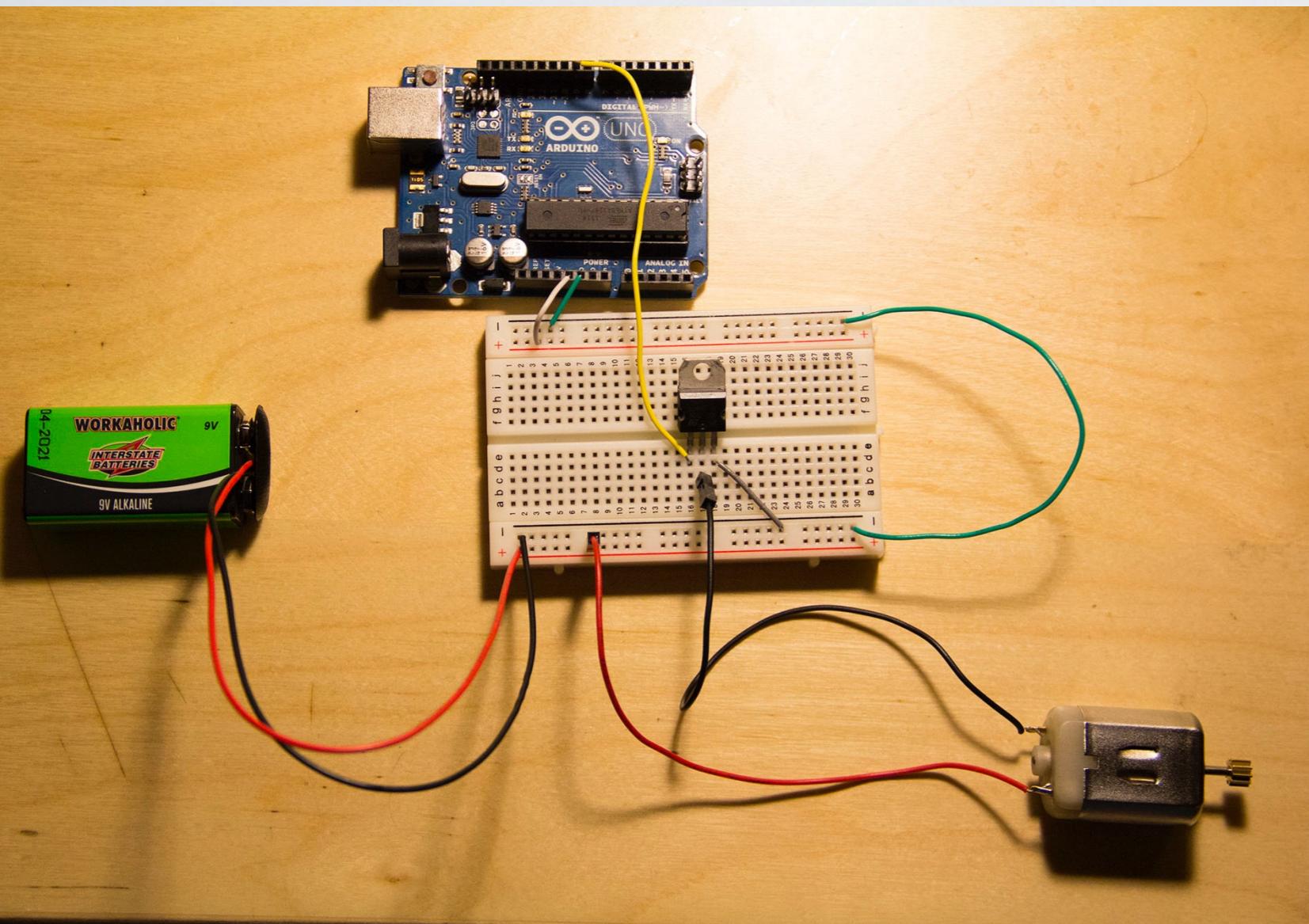
# MOTOR CIRCUIT



Connect Red wire  
of motor to forward  
voltage of battery

Connect black wire  
of motor to center  
pin of transistor

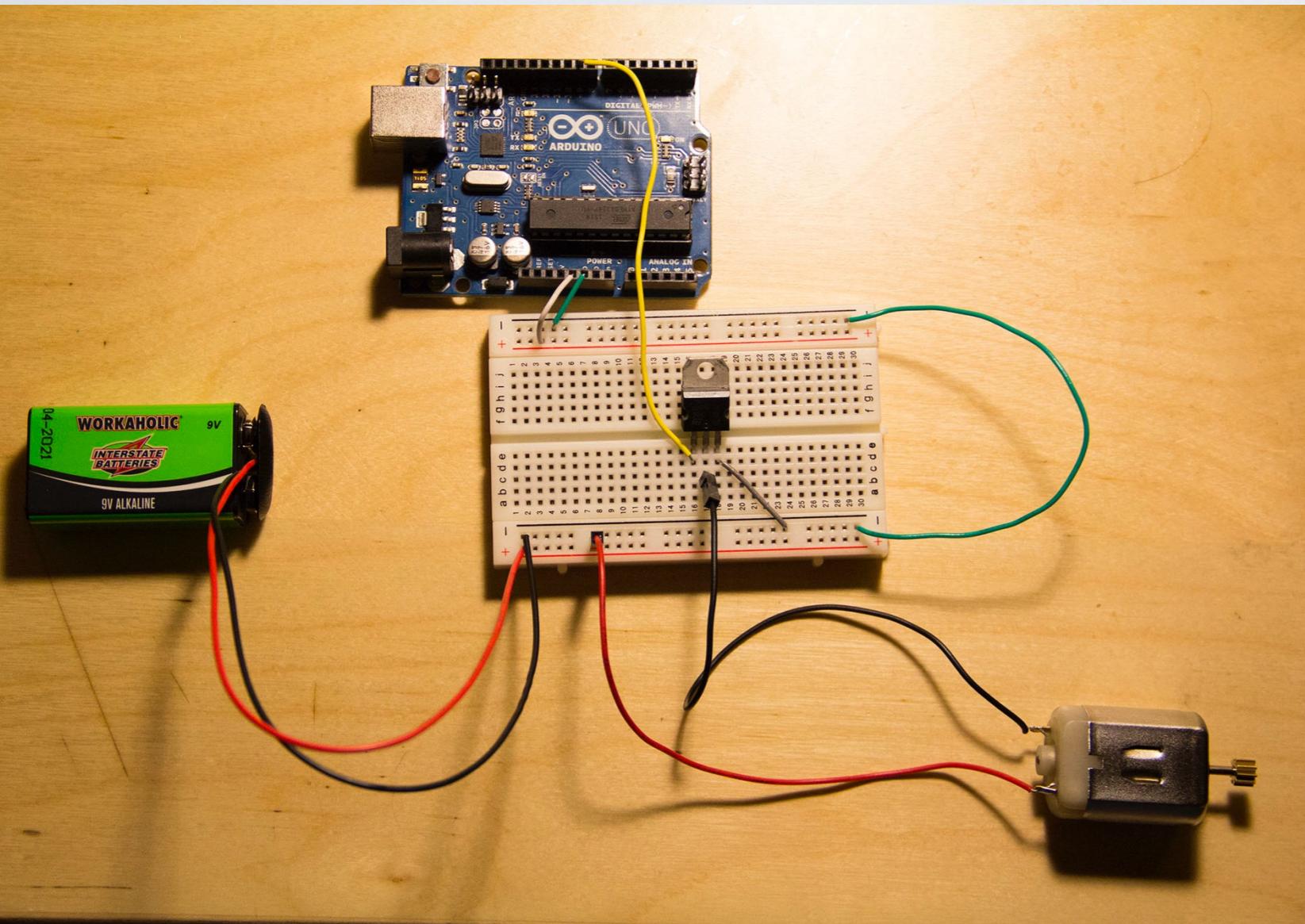
# MOTOR CIRCUIT



Connect the  
leftmost pin of the  
transistor to pin 9  
on the Arduino

Connect the  
rightmost pin of the  
transistor to  
the ground strip

# MOTOR CIRCUIT



Upload MotorFader

Keep circuit intact for  
next exercise

# SERIAL COMMUNICATIONS

## Hello Serial

```
/*
 * Hello World!
 *
 * This is the Hello World! for Arduino.
 * It shows how to send data to the computer
 */

void setup()          // run once, when the sketch starts
{
    Serial.begin(9600); // set up Serial library at 9600 bps

    Serial.println("Hello world!"); // prints hello with ending line break
}

void loop()           // run over and over again
{
    // do nothing!
}
```

# SERIAL COMMUNICATIONS

## SerialMath

```
int a = 5;
int b = 10;
int c = 20;

void setup()          // run once, when the sketch starts
{
    Serial.begin(9600);      // set up Serial library at 9600 bps

    Serial.println("Here is some math:");

    Serial.print("a = ");
    Serial.println(a);
    Serial.print("b = ");
    Serial.println(b);
    Serial.print("c = ");
    Serial.println(c);

    Serial.print("a + b = ");    // add
    Serial.println(a + b);

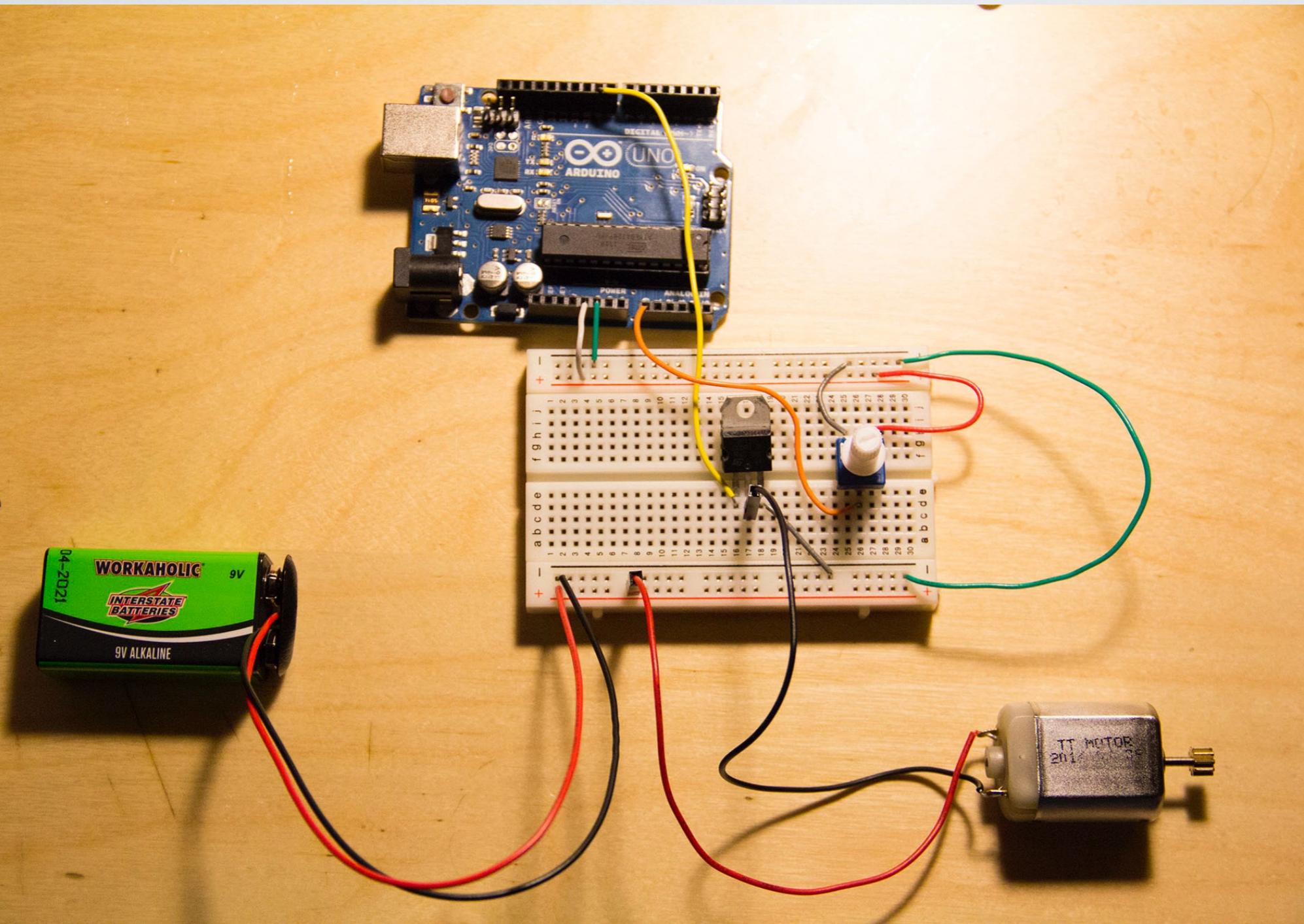
    Serial.print("a * c = ");    // multiply
    Serial.println(a * c);

    Serial.print("c / b = ");    // divide
    Serial.println(c / b);

    Serial.print("b - c = ");    // subtract
    Serial.println(b - c);
}

void loop()           // we need this to be here even though its empty
{
```

# ADD A POTENTIOMETER



Connect  
Middle pin to  
A0

Left Pin to  
Ground

Right Pin to  
+ Forward  
Voltage

# LET'S TALK TO PROCESSING

Open GraphSerialArduino and upload to Arduino

Open GraphSerialProcessing

\*We need to tell the processing program  
the proper serial port

Turn Knob

# LET'S TALK TO PROCESSING

Open FlickrWebCamSerialArduino and upload to Arduino

Open FlickrWebCamSerialProcessing and run

Turn Knob

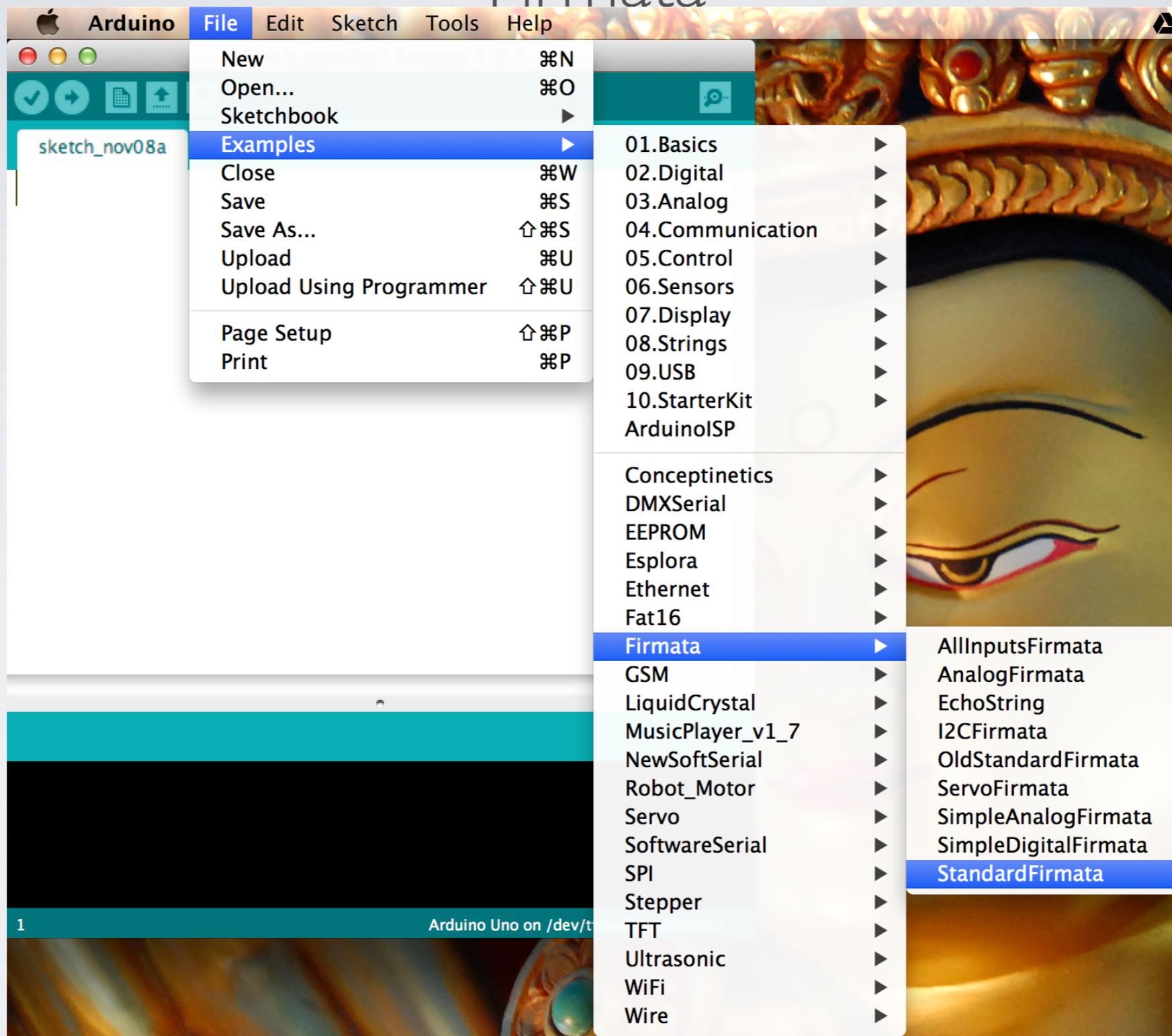
# SERIAL COMMUNICATIONS

## Firmata

This library allows you to control an Arduino board from Processing without writing code for the Arduino. Instead, you upload a standard firmware (program) to the board and communicate with it using the library. The firmware is called Firmata, and is included in the Arduino software. The corresponding Processing library can be downloaded below.

# SERIAL COMMUNICATIONS

## Firmata



Upload Standard Firmata

# SERIAL COMMUNICATIONS

## Firmata

Run arduino\_pwm\_firmata

# SERIAL COMMUNICATIONS

## NodeJS

Simple Example ardserial

Go into the directory

npm install serialport

set serial port in server.js

node server.js

# SERIAL COMMUNICATIONS

## NodeJS Kitchen Sink

arduino-processingjs-socketio

Go into the directory

npm install && bower install

set serial port in app.js

node app.js