ARDUINO:

Intro to Microcontrollers - Day 3

TODAYS TOPICS

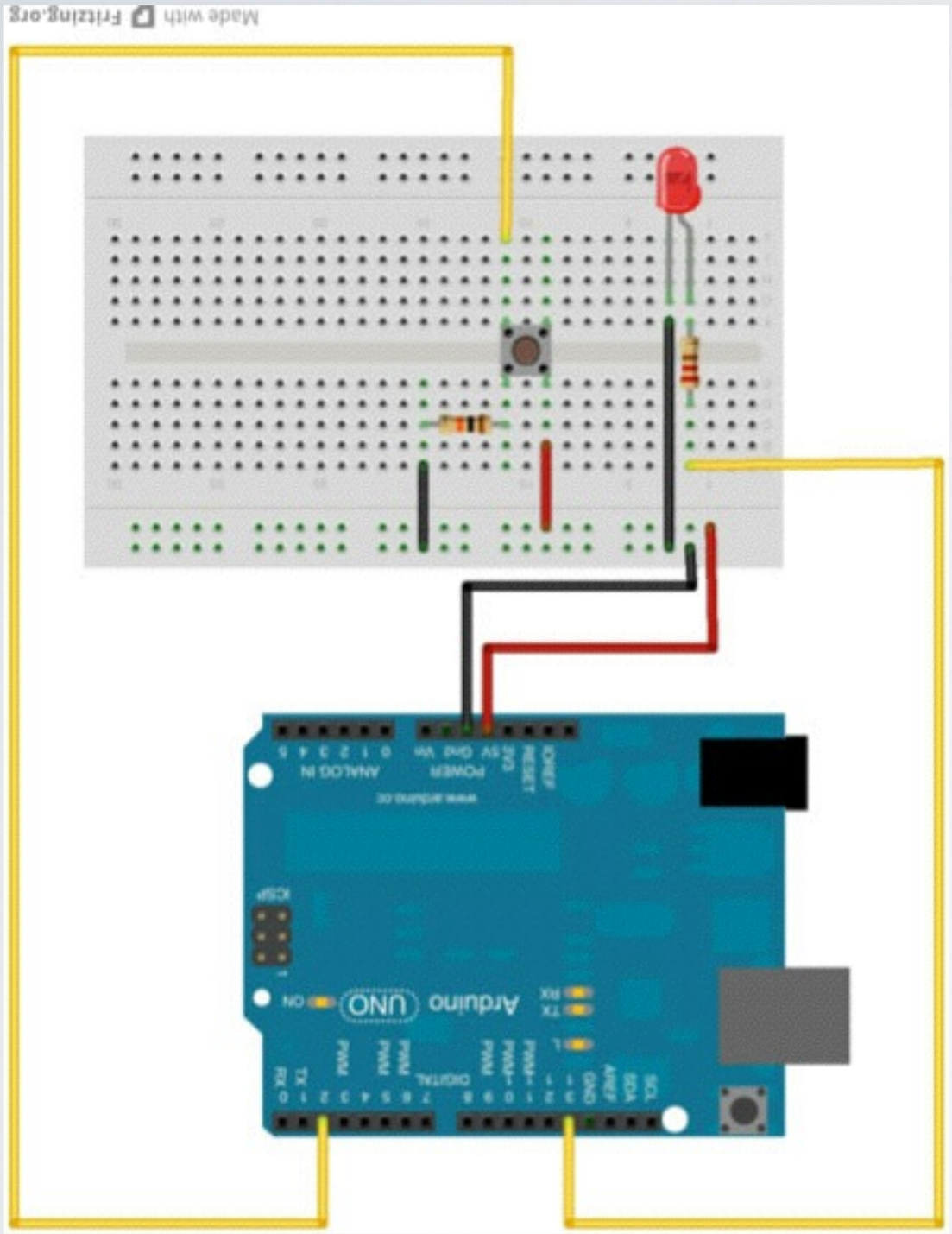
1. **Introduction to motion with motors**

2. **Having the Arduino interface with other software(Processing, NodeJS)**

REAL QUICK!

I wanted to clarify some errata from Thursday

WHY A RESISTOR WITH A BUTTON?



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

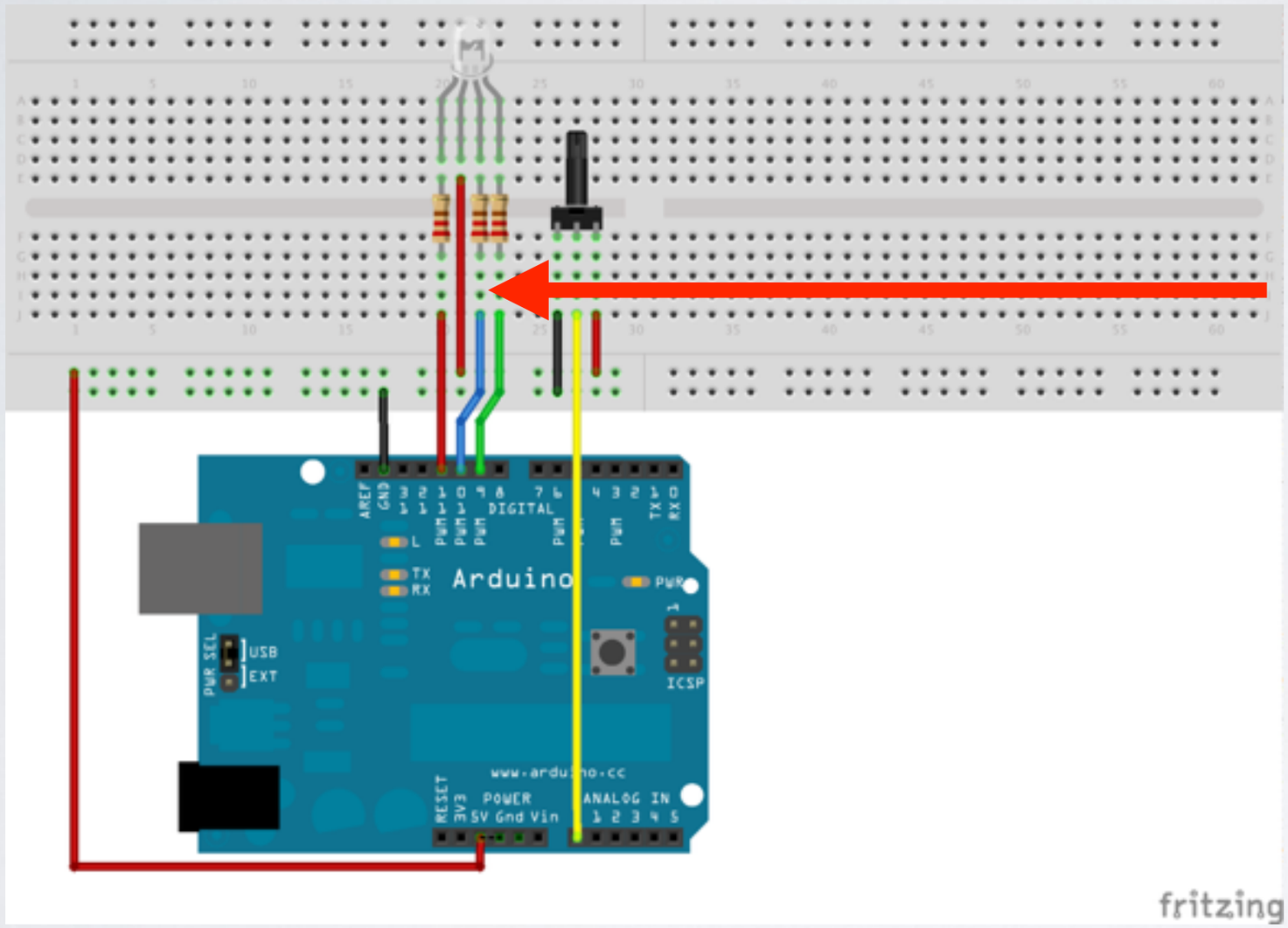
This reads as LOW

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

This reads as HIGH

3. With out the pull down resistor there is potential for signal noise that can result in a false reading of HIGH

CORRECTED CIRCUIT FOR RBG LED



Corrected diagram:
Common Anode
Connects to 5V

PWM EXPLANATION

Short and Concise

http://www.endurance-rc.com/ppmtut.php

Video!

https://www.youtube.com/watch?v=YmPziPfaByw

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

ARDUINO WITH OTHER SOFTWARE

http://www.creativeapplications.net/objects/solar-sinter-objects/

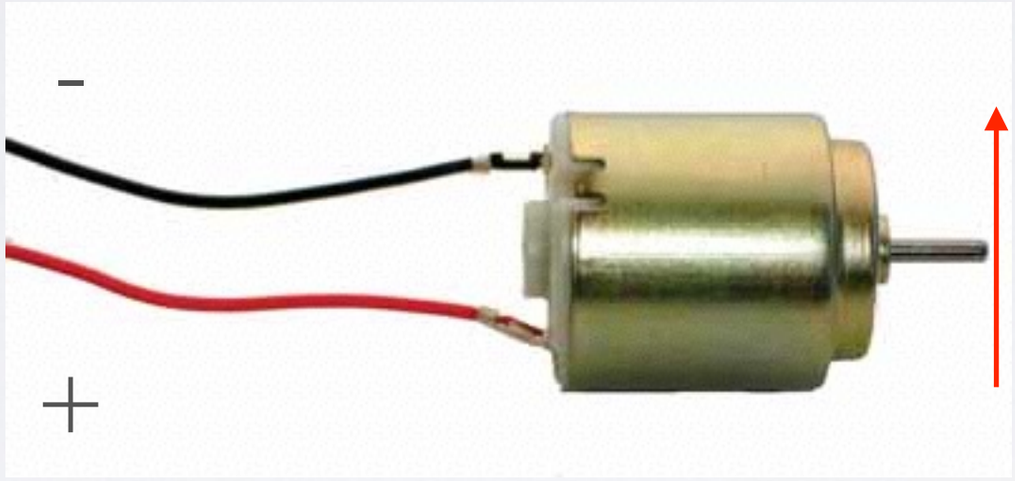
ARDUINO WITH OTHER SOFTWARE

“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/arduinos-provide-interactive-exhibits-for-about-30.html?_r=0

INTRODUCING MOTION: THE ELECTRIC MOTOR

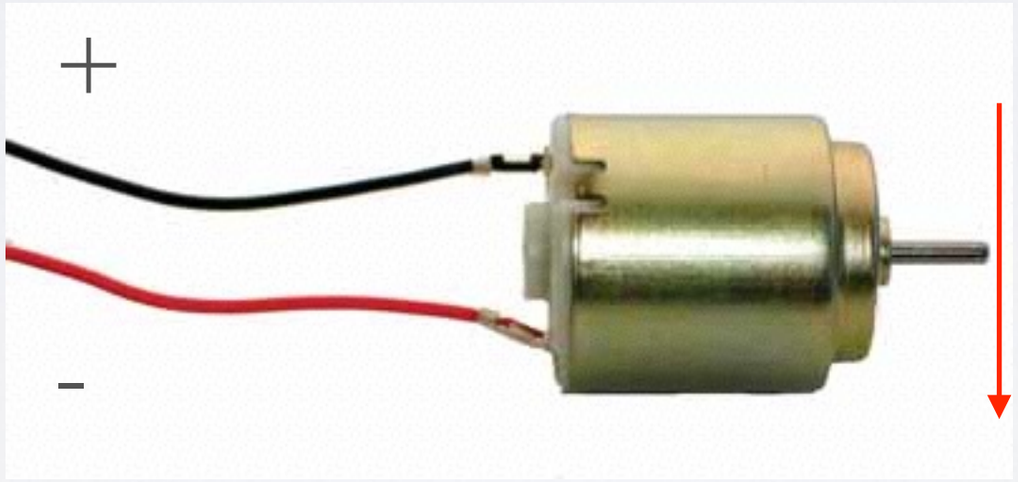
The motor is an electromechanical device with 2 leads.



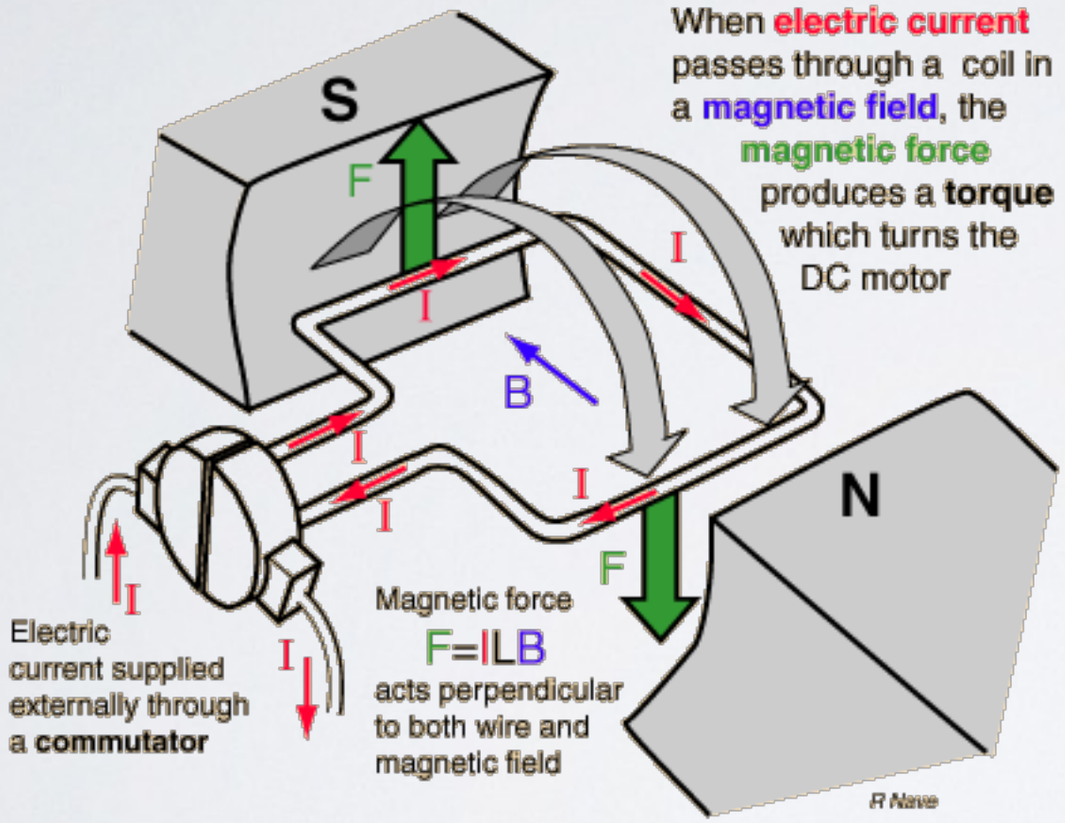
When you apply forward voltage to one lead and ground to the other the shaft of the motor will spin one direction.

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



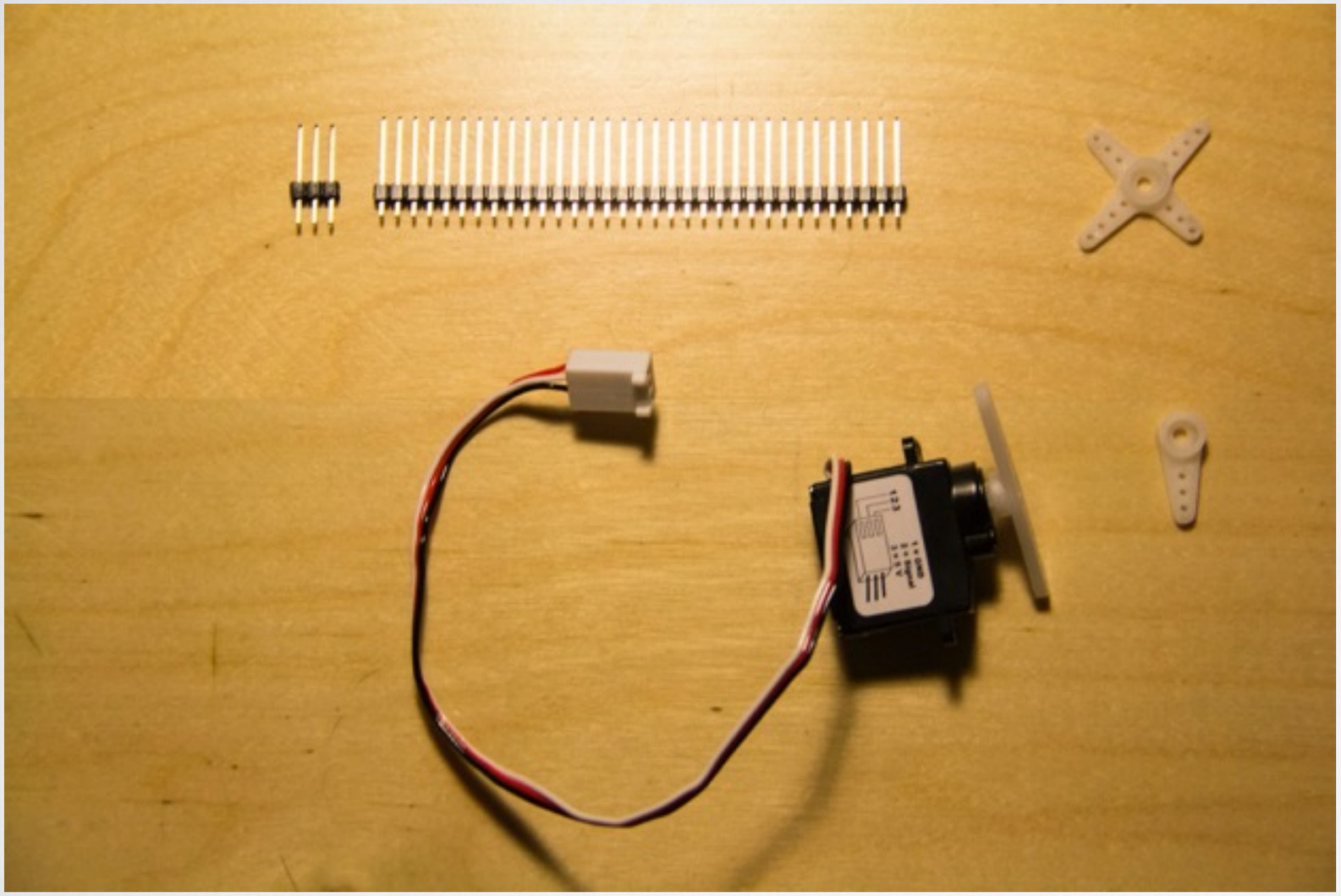
Motors use a switched array of electromagnets to repel the polarity of fixed magnets in order to rotate.

Full explanation here:

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

INTRODUCING MOTION: THE SERVO

INTRODUCING MOTION: THE SERVO



Find your servo

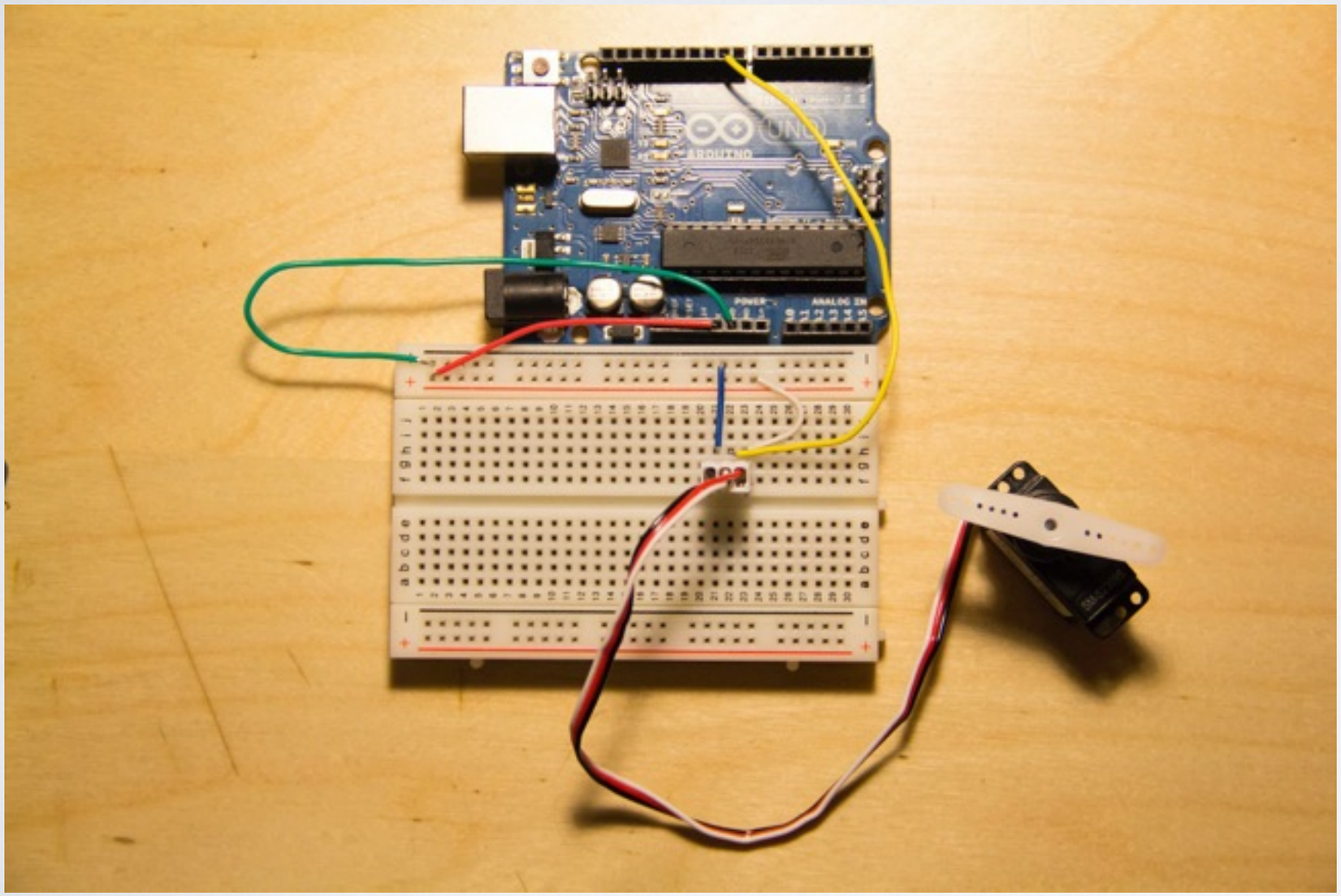
The white plastic things are servo horns - attach one to the shaft

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

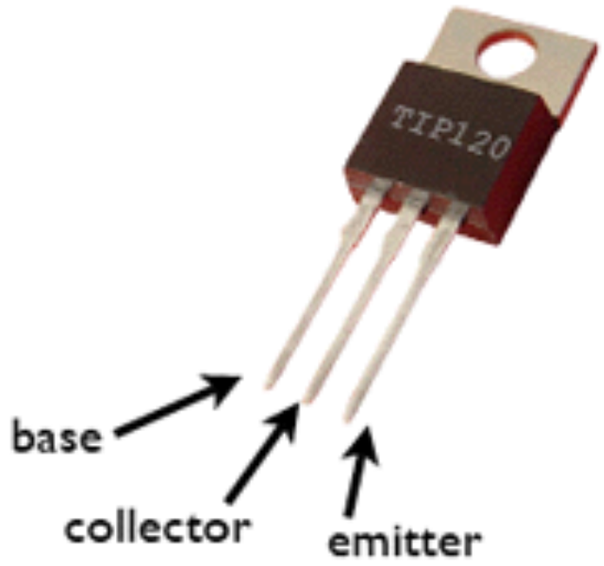
INTRODUCING MOTION: THE SERVO

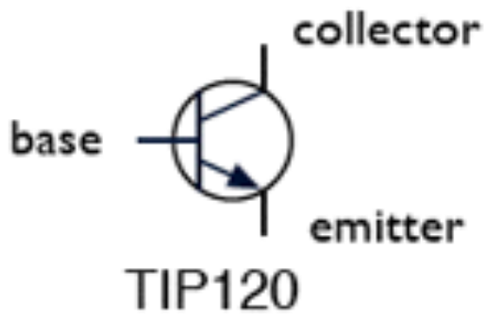
```
#include <Servo.h>

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>=1; 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

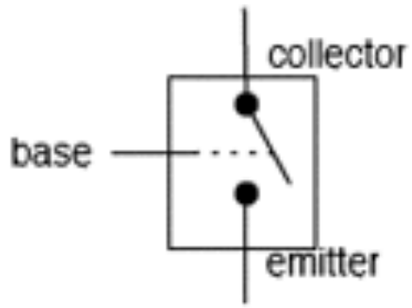
INTRODUCING THE TRANSISTOR

Act like switches electricity flicks the switch instead of your finger





schematic symbol

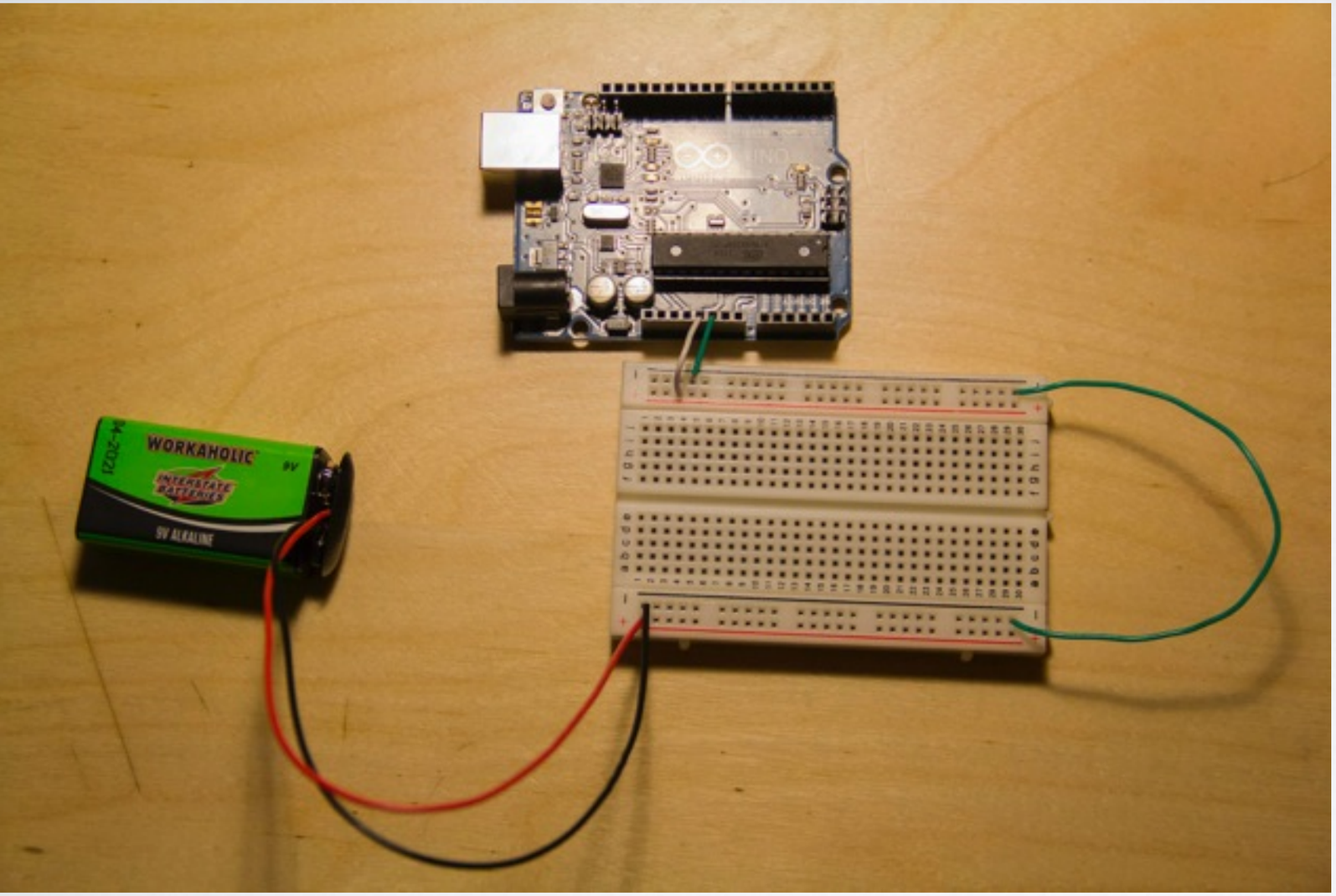


how it kind of works

Turning on the "base" connects the "collector" & "emitter" together

The can drive higher powered devices

MOTOR CIRCUIT

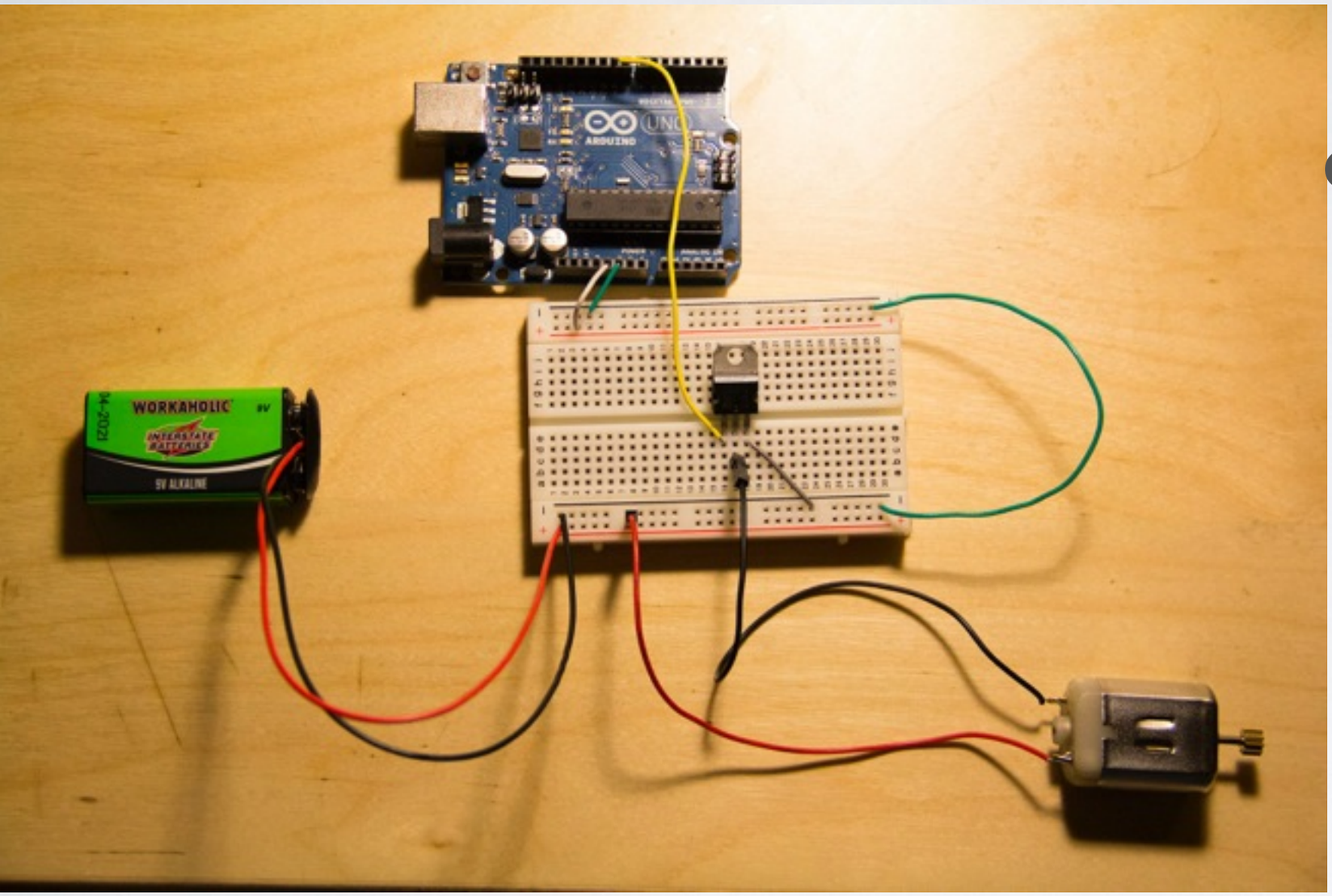


Connect 5V and Ground from Arduino to one side

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

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

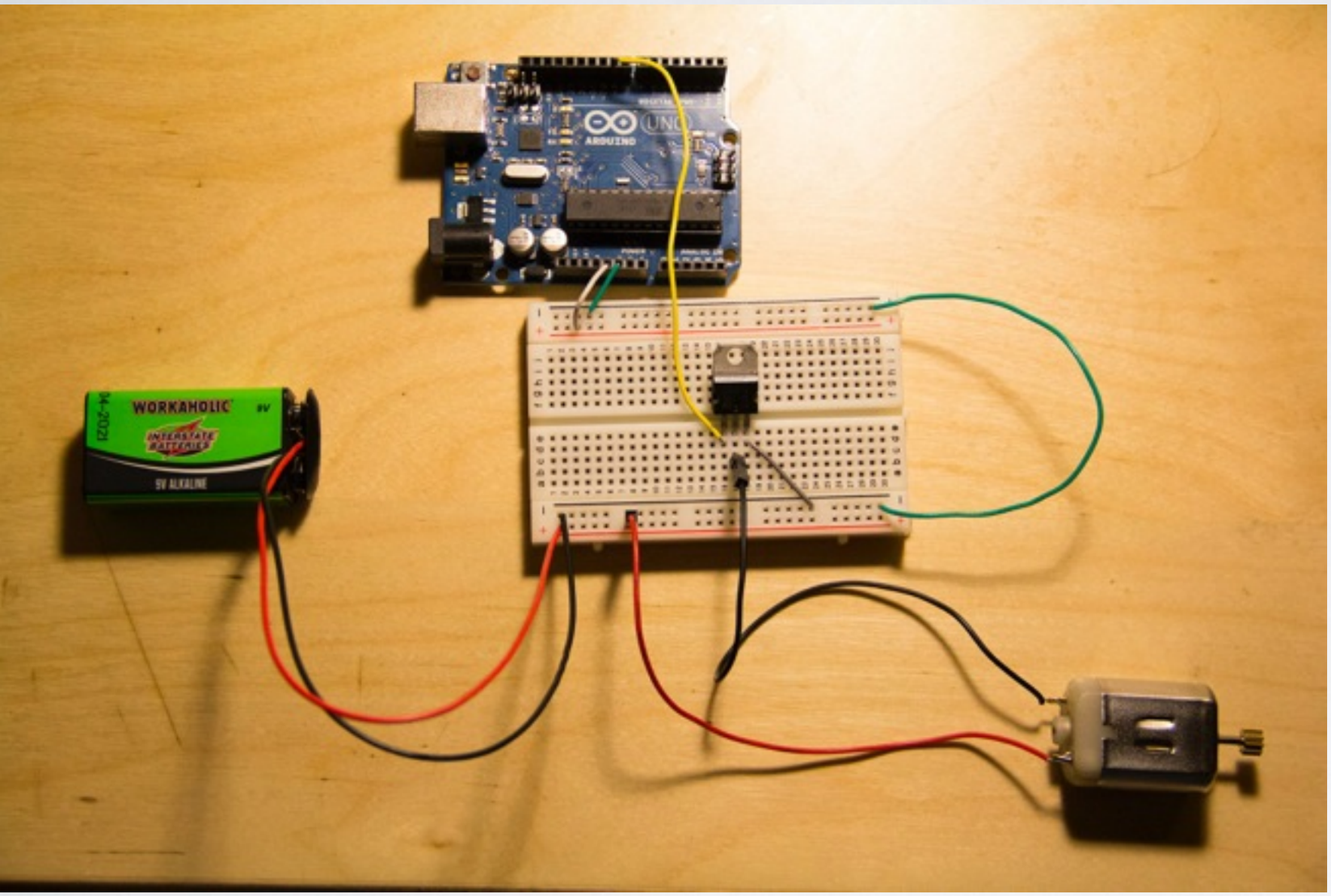
MOTOR CIRCUIT



Connect Red wire of motor to forward voltage of battery

Connect black wire of motor to center pin of transistor

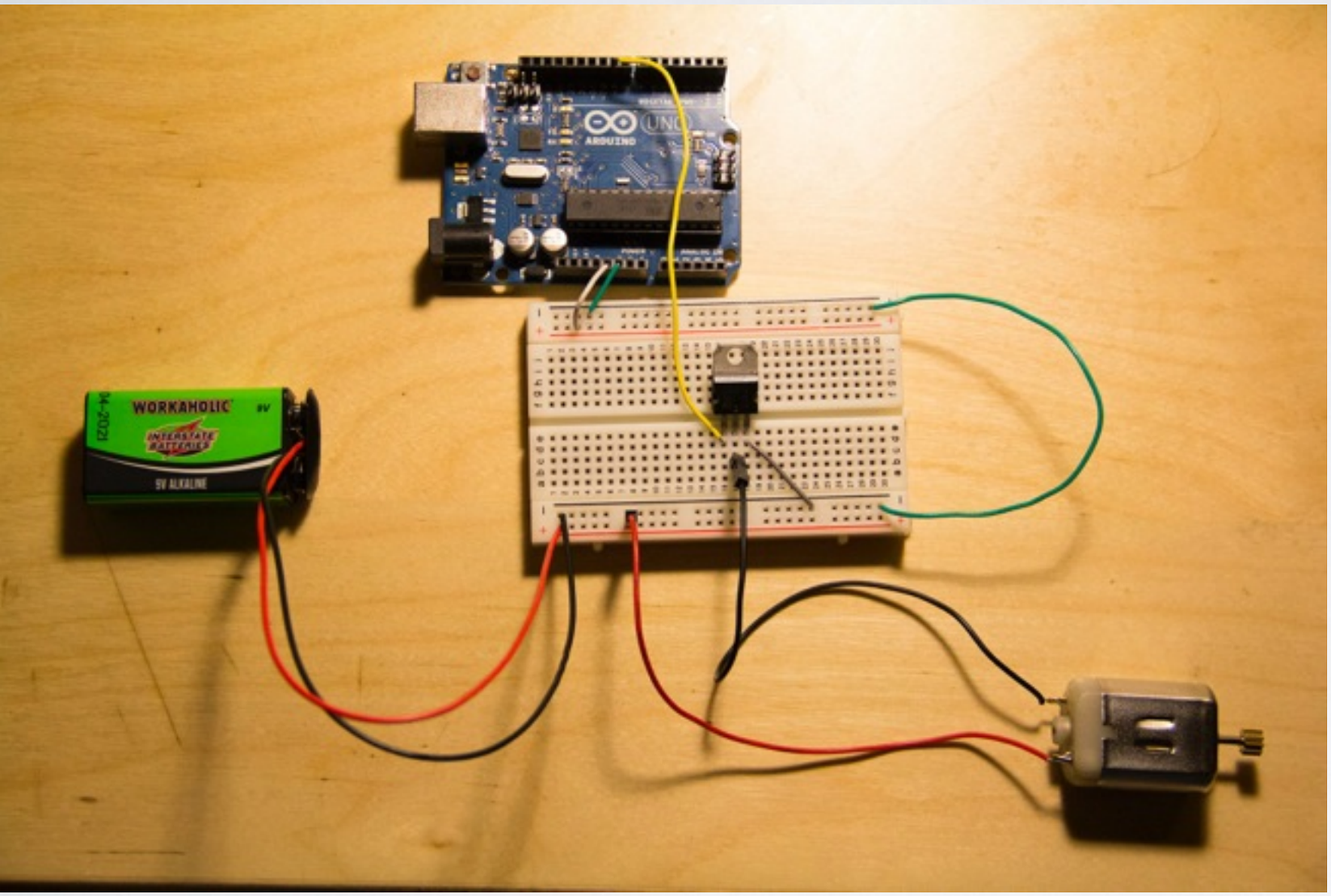
MOTOR CIRCUIT



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

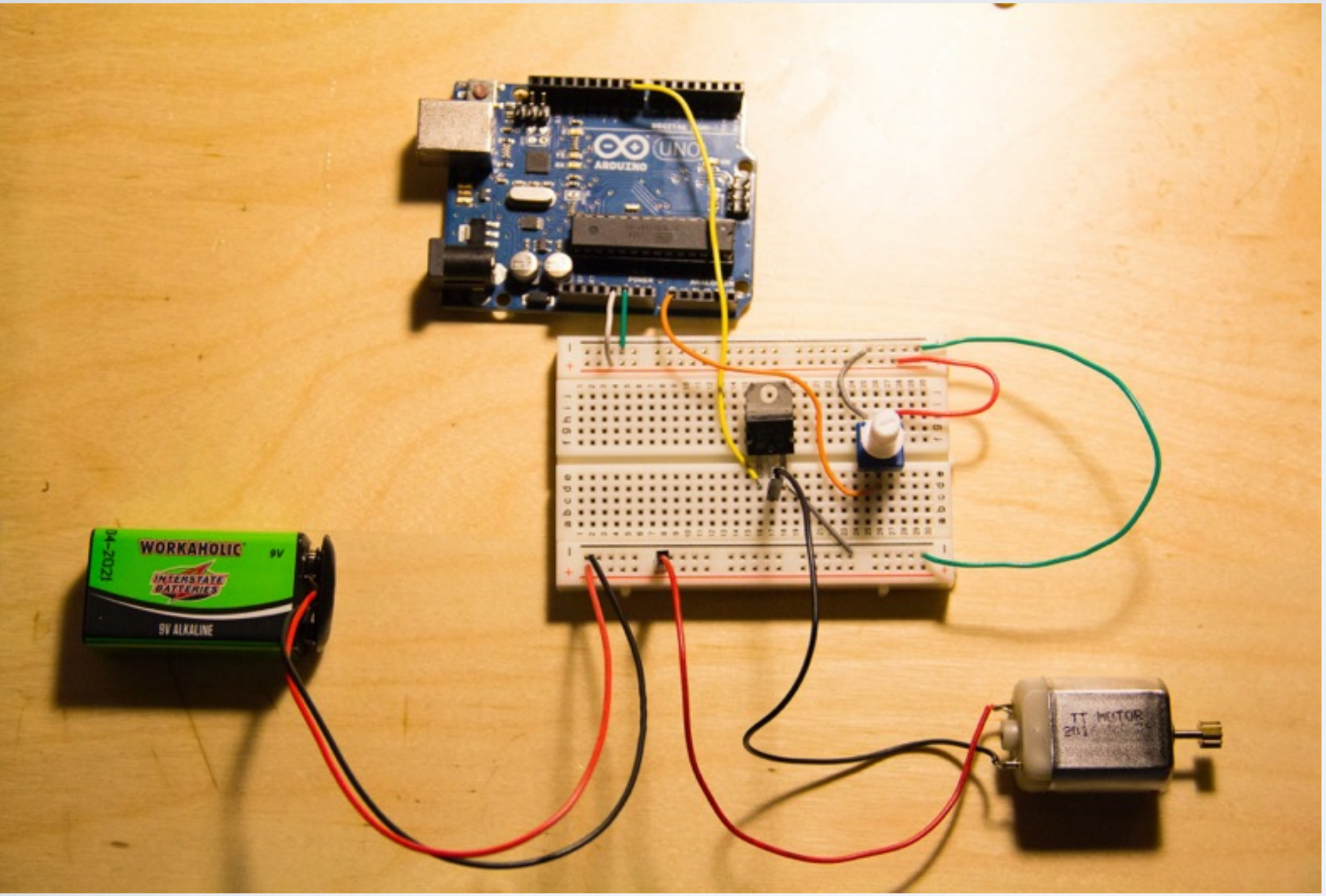
```
/*
 * Hello World!
 *
 * This is the Hello World! for Arduino.
 * It shows how to send data to the computer
 */


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 POTENTIONMETER



Connect Middle pin to A0

Left Pin to Ground

Right Pin to + Forward Voltage

LETS TALK TO PROCESSING

Open GraphSerialArduino and upload to Arduino

Open GraphSerialProcessing

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

Turn Knob

LETS TALK TO PROCESSING

Open FlickrWebCamSerialArduino and upload to Arduino

Open FlickrWebCamSerialProcessing and run

Turn Knob

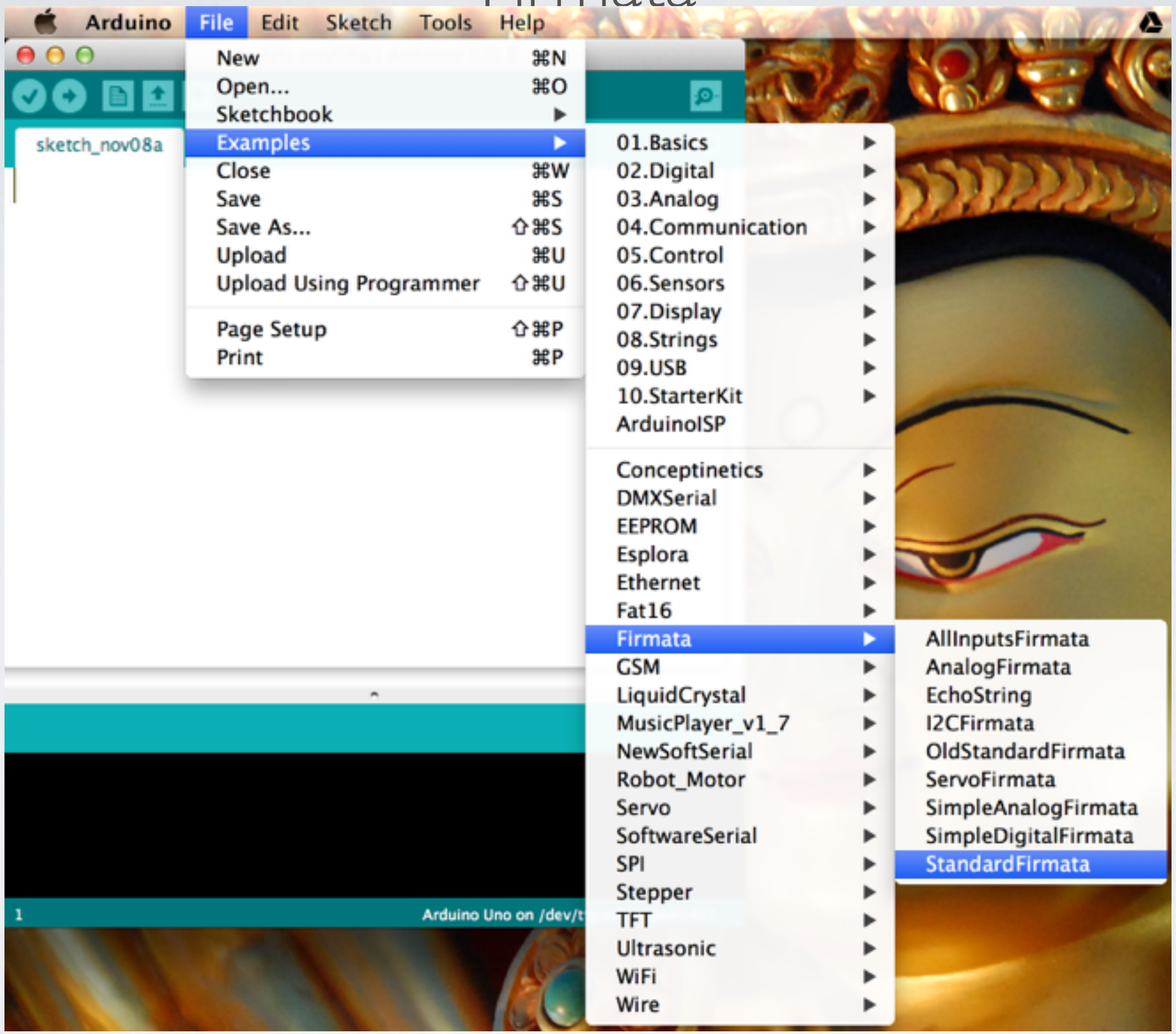
SERIAL COMMUNICATIONS

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 serial port

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