

Physical Computing

Analog Signal & Sensors

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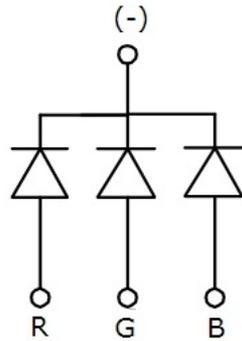
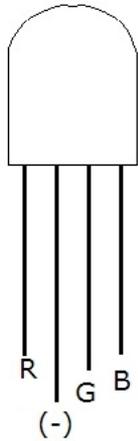


Tutorial

- Introducing dual-color LED
- More sensors
 - Light sensor
 - Vibration sensor

RGB LED with Common Cathode (共負極三色燈)

Common
Cathode (-)



● Red

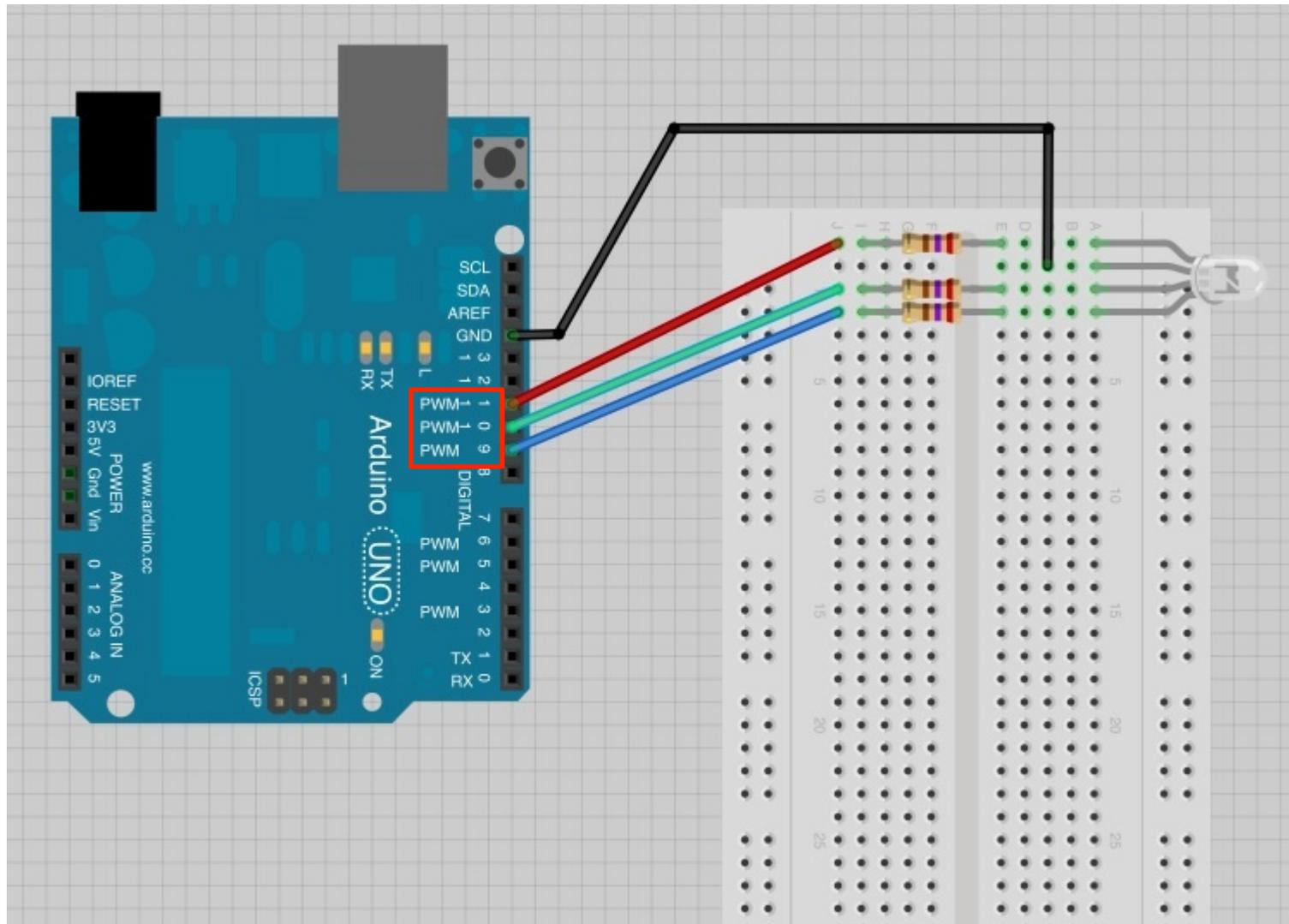
● Green

● Blue



Store No : 102804

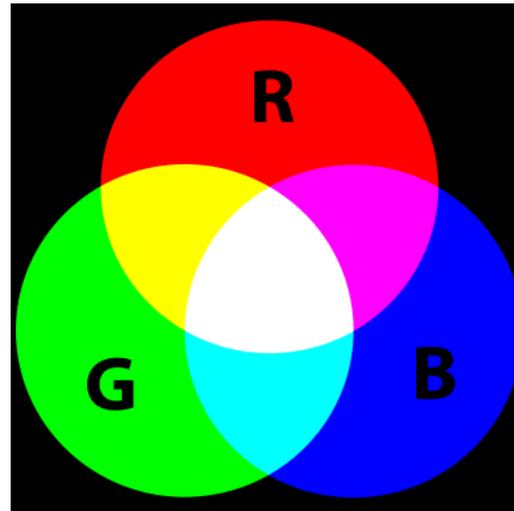
Connection with Arduino



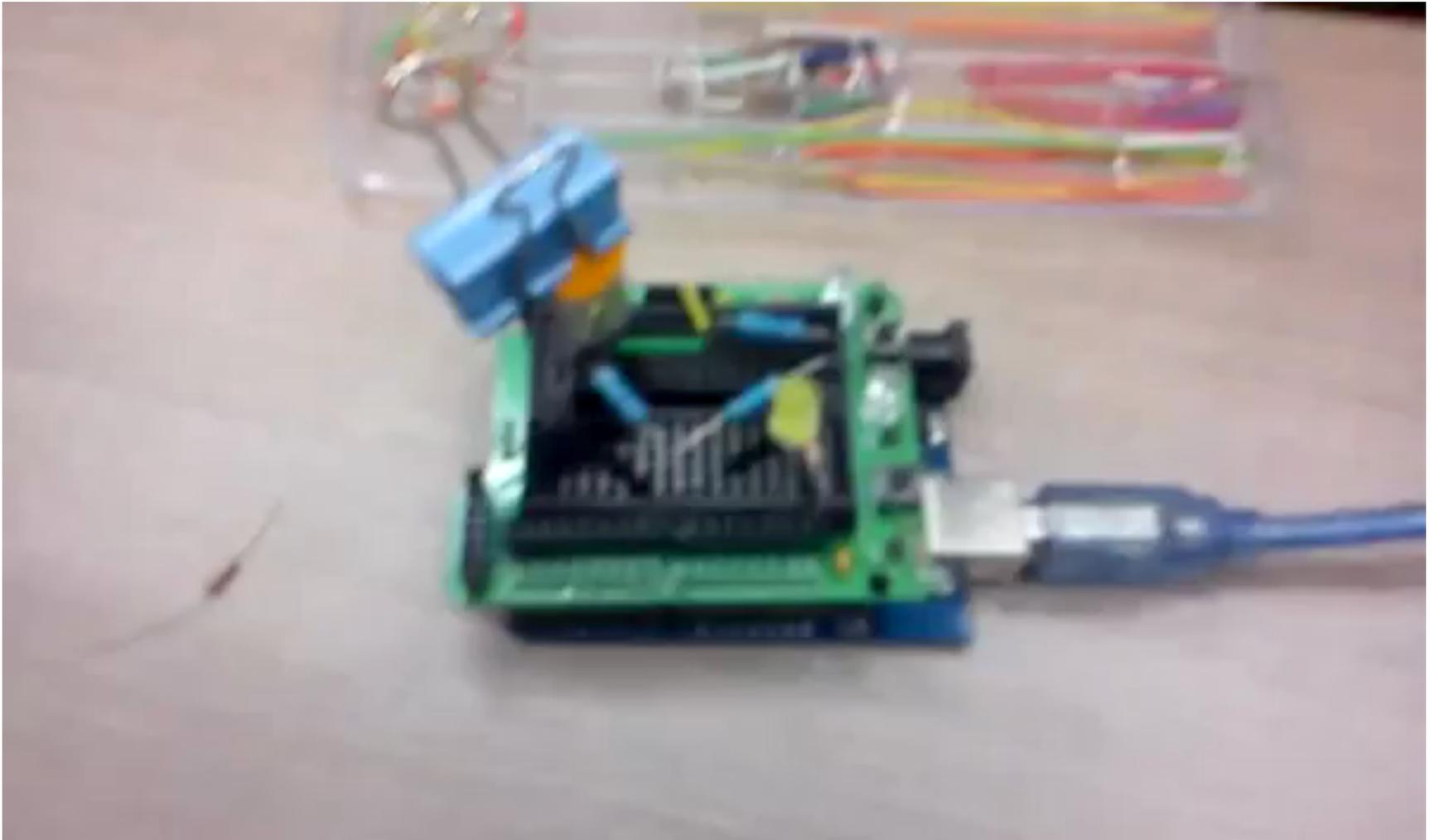
Controlling with Arduino

```
/*  
Adafruit Arduino - Lesson 3. RGB LED  
*/  
  
int redPin = 11;  
int greenPin = 10;  
int bluePin = 9;  

```



Flexible Vibration Sensor



<http://www.youtube.com/watch?v=YSwzngiWZWg>

Flexible Vibration Sensor (Piezo sensor)

- Piezo sensor is very sensitive to vibration and movement, and generate output signal.
- The voltage range of signal that a piezo sensor can produce can be from a few microvolts to thousands volts, so we need a large value resistor to limit current and reduce the voltage through the circuit.

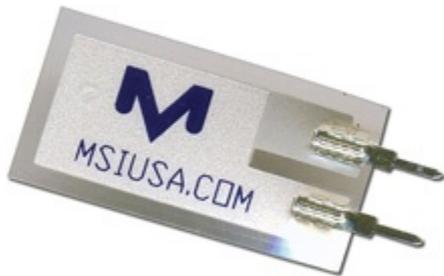
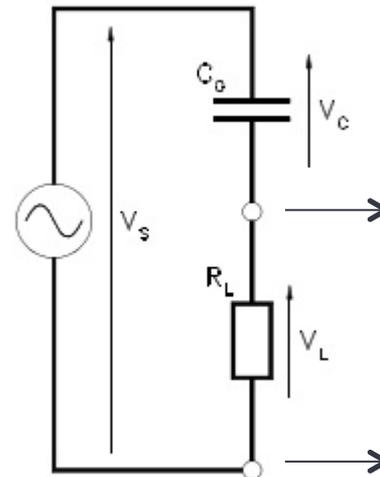
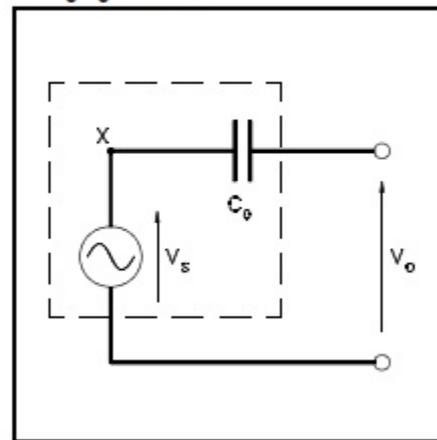


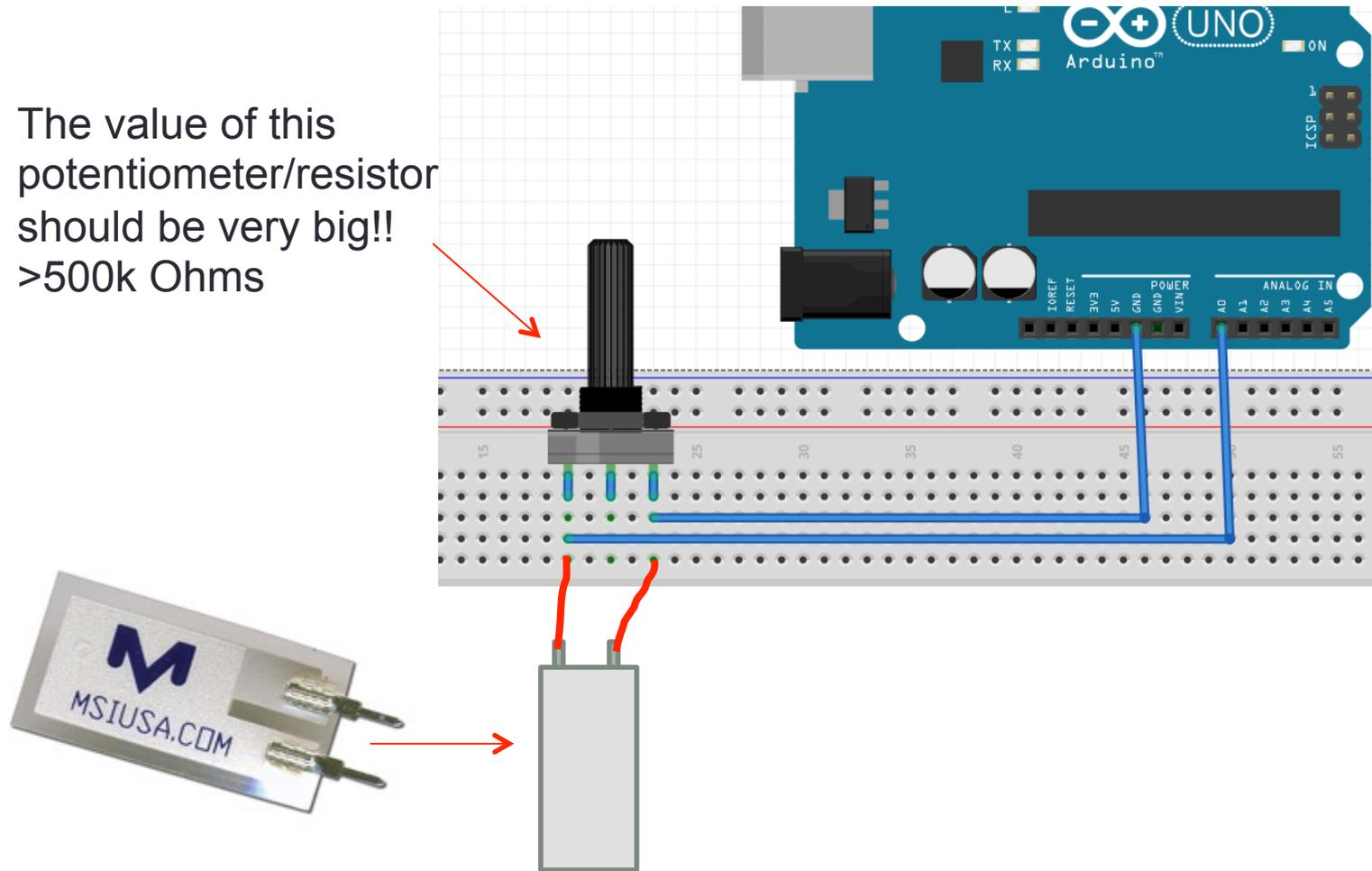
Figure 12. Piezo film element as a simple voltage generator



We get the voltage of these two points for the input to Arduino

Connect the sensor to Arduino

The value of this potentiometer/resistor should be very big!!
>500k Ohms



Code

```
void setup()
{
  Serial.begin(9600);
}

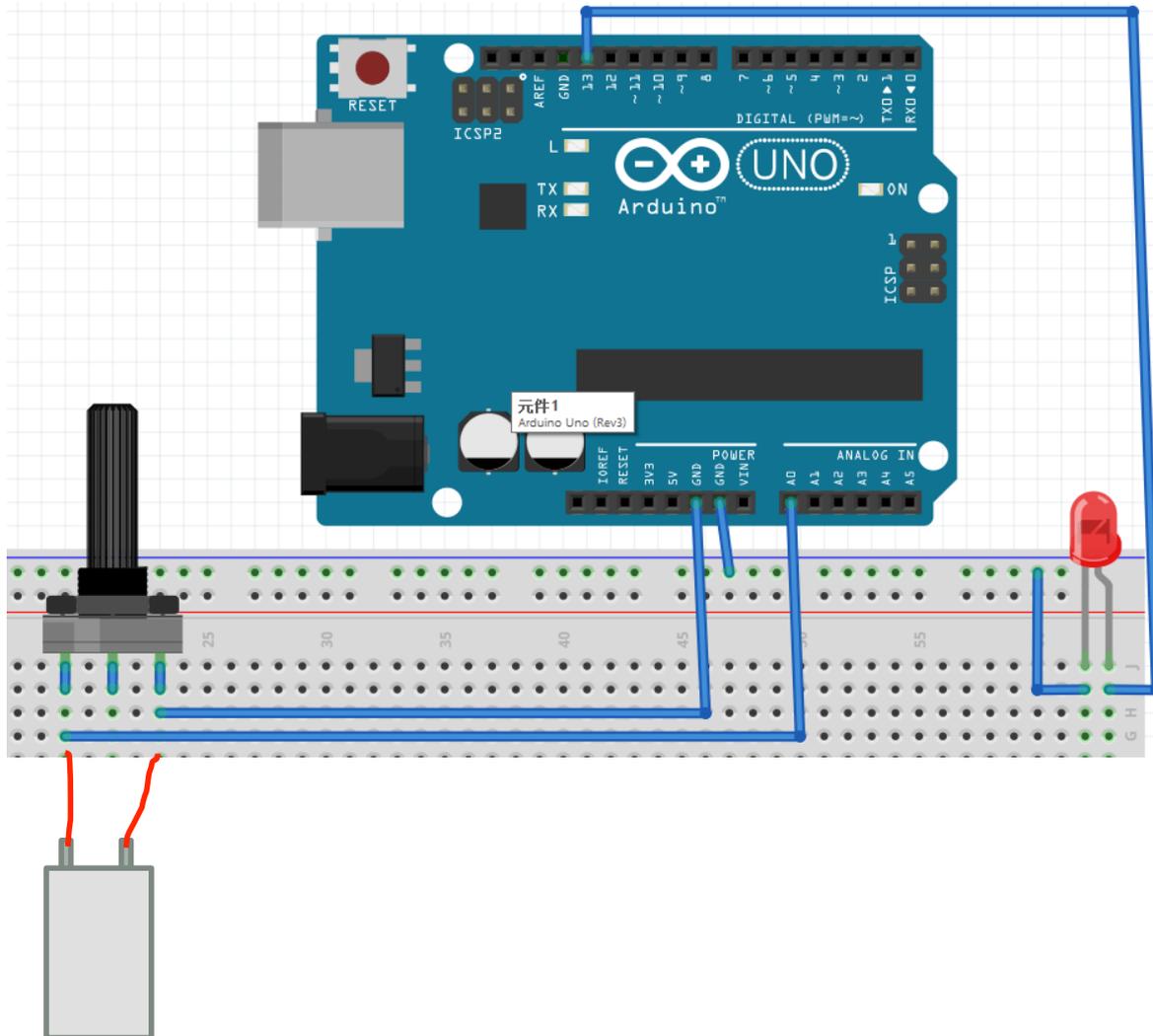
void loop()
{
  int value = analogRead(0);

  Serial.println(value);

  delay(100);
}
```

Open the serial monitor to see the number changing when you shake/flip the film

Vibration sensor to control LED



Code

```
int ledPin = 13;

void setup()
{
  Serial.begin(9600);
  pinMode(ledPin, OUTPUT);
}

void loop()
{
  int value = analogRead(0);

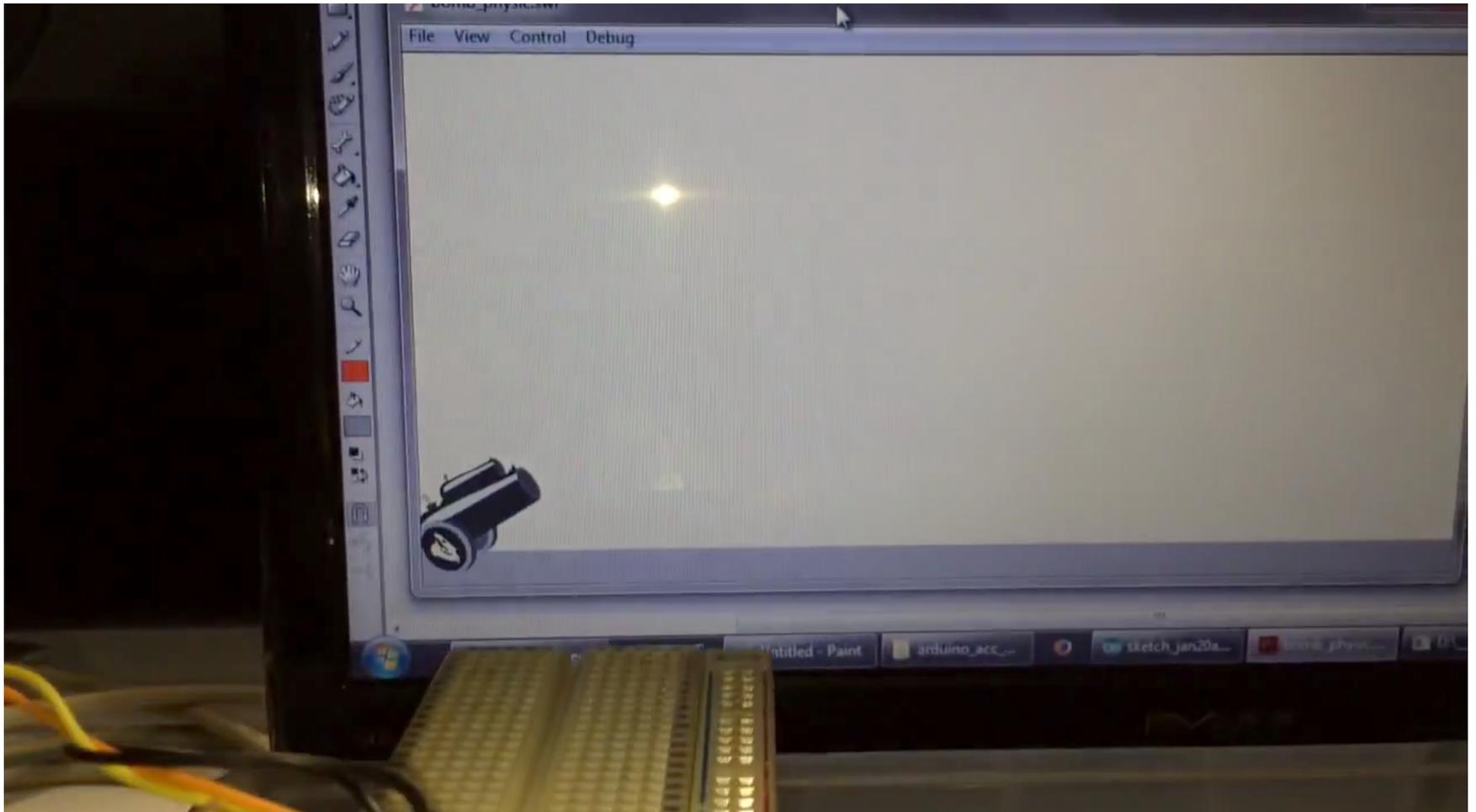
  Serial.println(value);

  digitalWrite(ledPin, LOW);

  if (value > 50) digitalWrite(ledPin, HIGH);

  delay(50);
}
```

Some more interesting examples with vibration sensor



<http://www.youtube.com/watch?v=heyn6Dy2lig>

Some other things with vibration



万王游戏机厂家 youjichangjia.com
18312050050 邹先生 13202508018 唐小姐

Light Dependent Sensor/Photoresistor (Resistance changed by light)

- Photoresistor gives a high resistance in darkness. When it is exposed in light, its resistance drops and become a good conductor.



Light sensor

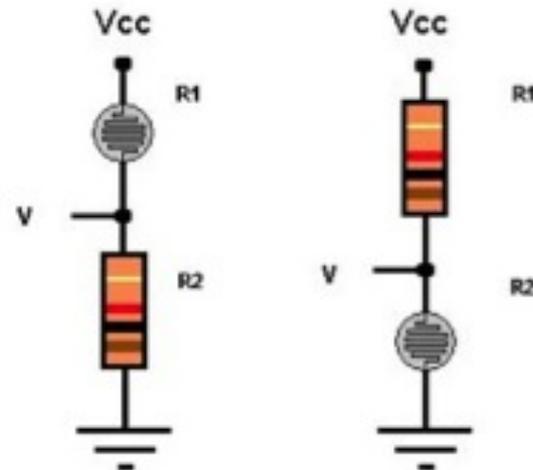
- We can use it as a light-activated switch. The easiest way to do this is with a **voltage divider circuit**.

A voltage divider is just two resistors in **series** connected between a voltage supply and ground. If R1 is connected to the voltage supply and R2 is connected to ground then the voltage at the junction between the two resistors is:

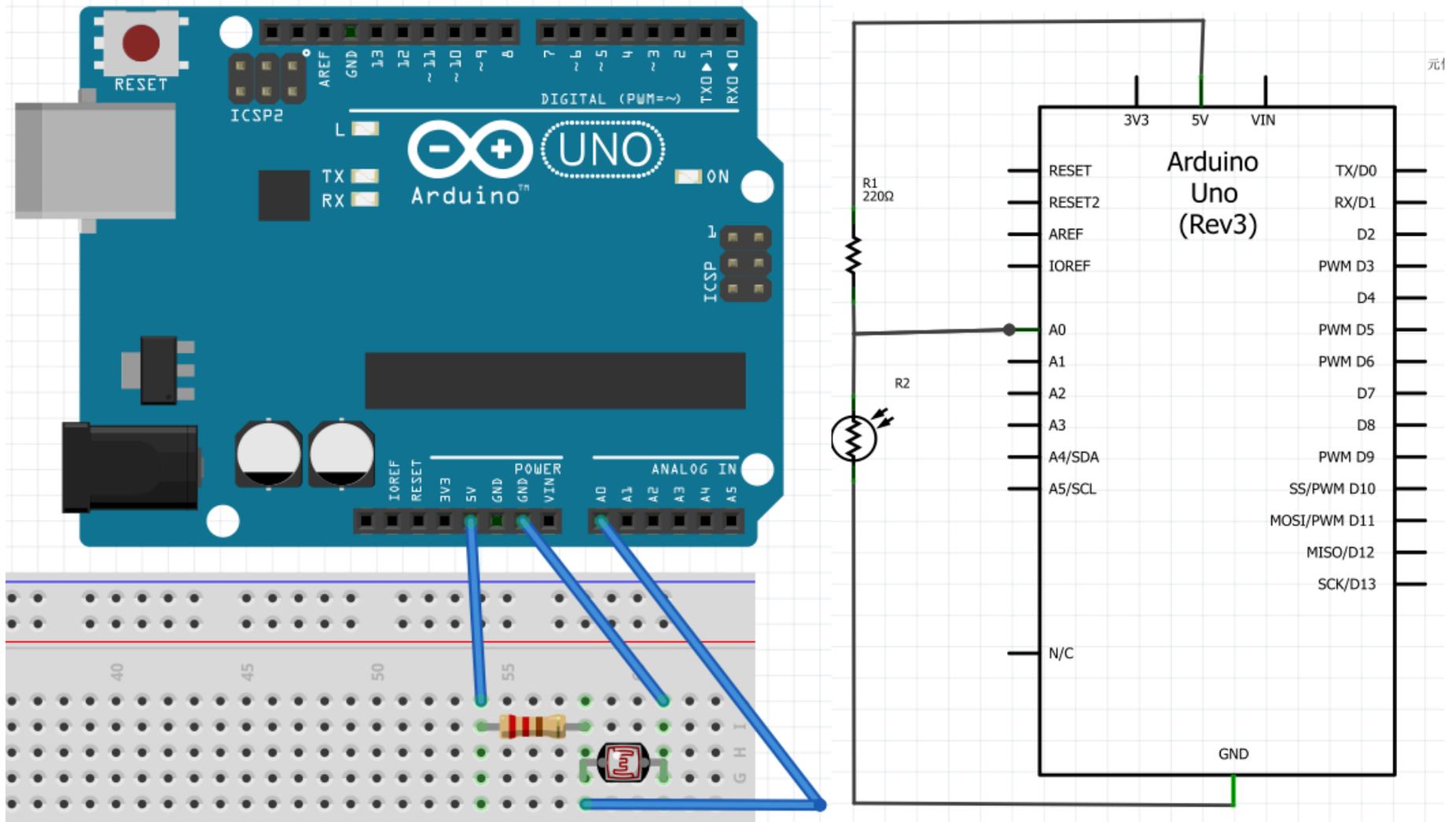
$$V = V_{cc} * (R2 / (R1 + R2))$$

(Left) R1 is photoresistor, voltage reading will increase with increasing light intensity.

(Right) R2 is photoresistor, voltage reading will decrease with increasing light intensity.



Connecting a light sensor to Arduino



Code to watch the input value

```
int analogPin_0 = 0;

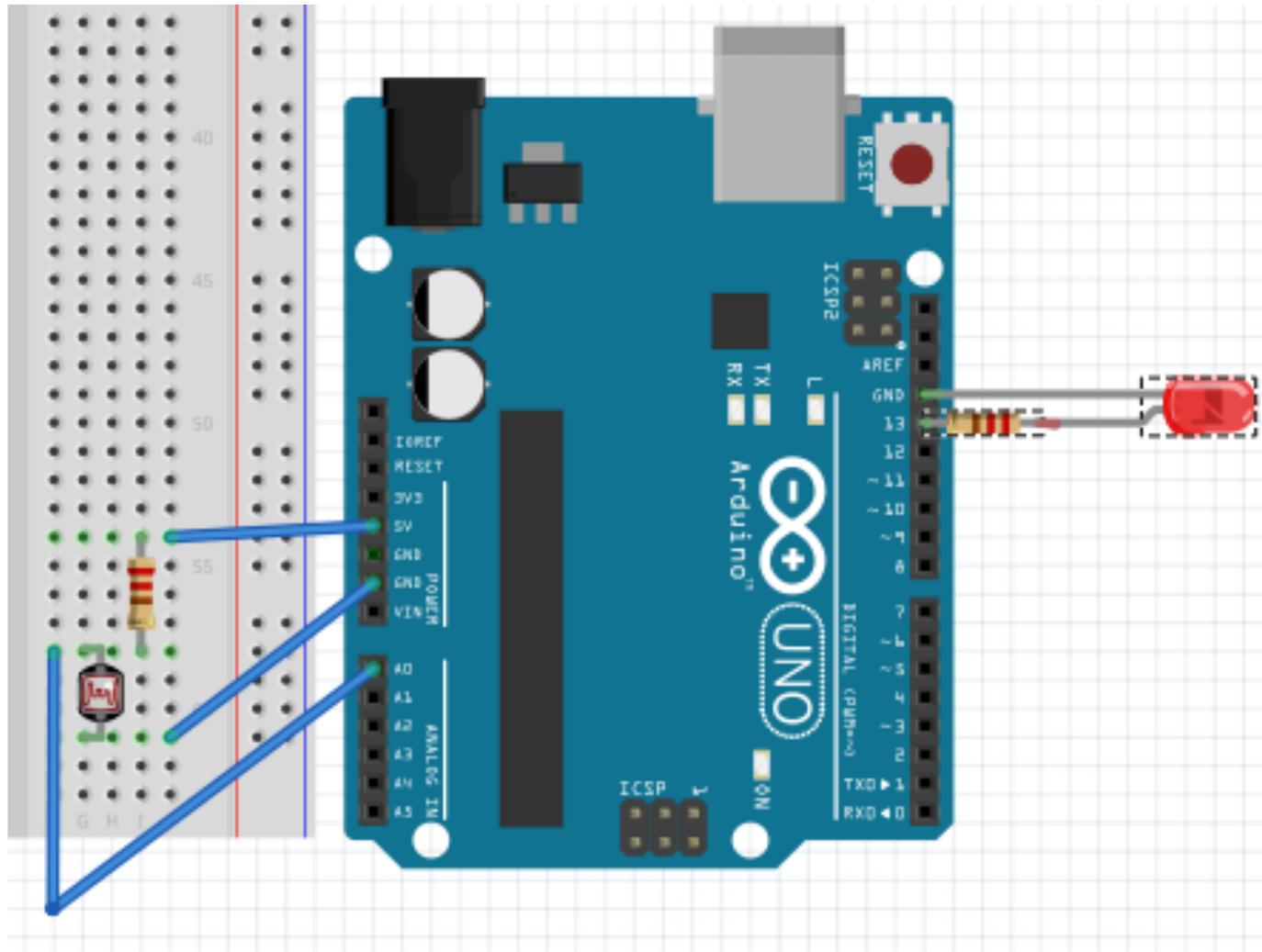
void setup() {
  Serial.begin(9600);
}

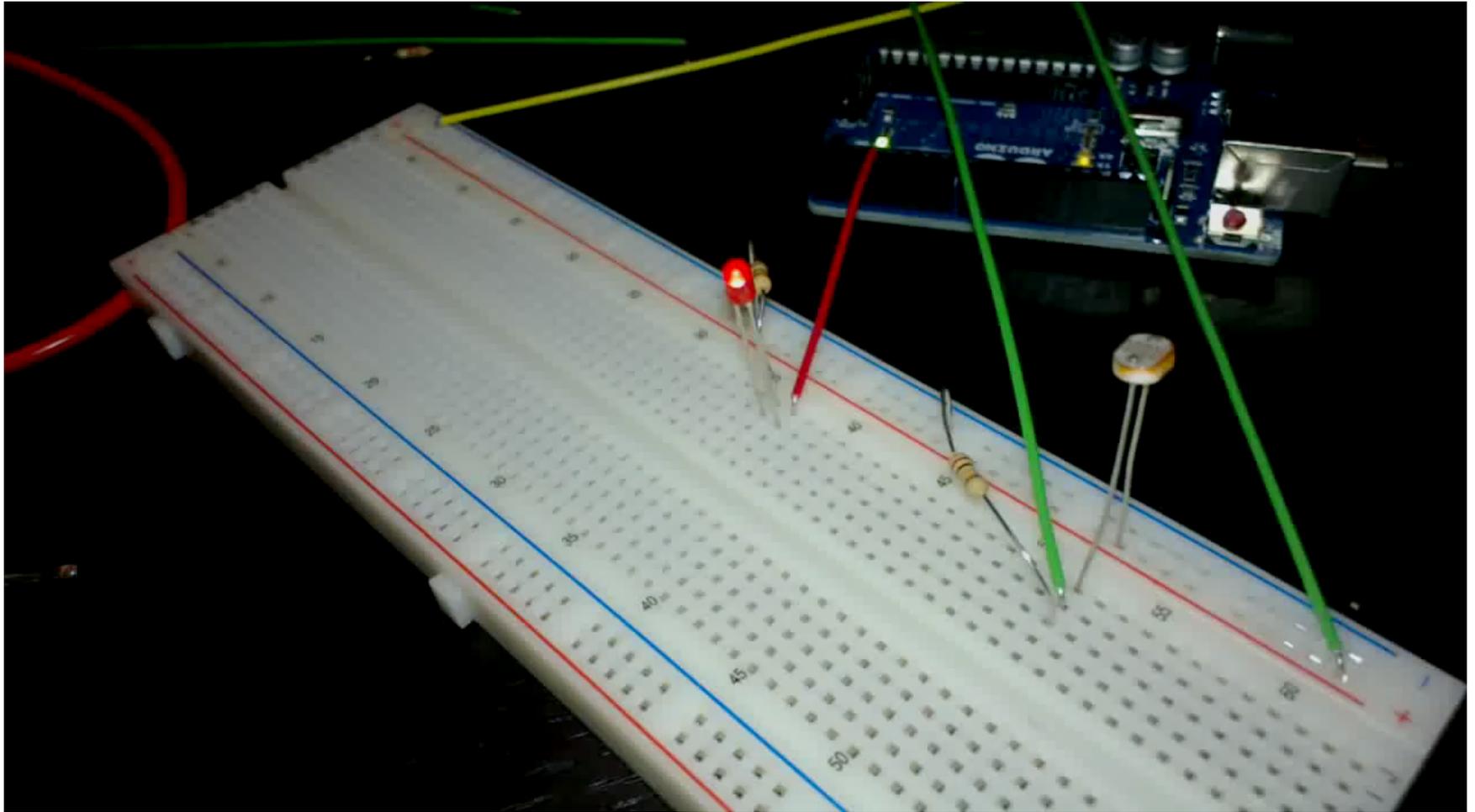
void loop() {
  int value = analogRead(analogPin_0);

  Serial.println(value);

  delay(100);
}
```

You can also use it to dim an LED/ Speaker





<http://www.youtube.com/watch?v=IVX39gFdcq0>

Exercise: Control the tone of the buzzer with light sensor

Video

https://drive.google.com/file/d/0B7GcieK_Yt3HTmV4dW5WYUw2ZjA/view?usp=sharing

- And think about
- Can you use an ultrasonic distance sensor to make the same effect?
- What is the difference?

Meanwhile...

- You can continue this tutorial to be your final assignment in this module
 - Simple interaction using sensors
 - Make it nicer with daily objects, handicraft, etc.
- 2~3 persons in a group
- Demo on week 13 Monday

- Feel free to talk to me if any question.
 - Design
 - What kind of component you need
 - To borrow sensors and other components from production center
 - Or purchase from 華輝電子 (鴨寮街201號)

Next week...

- We will play with motors a little bit
- and control computer with Arduino

