Arduino Workshop

Difficulty Level: ☆☆☆☆☆

In the workshop you will...

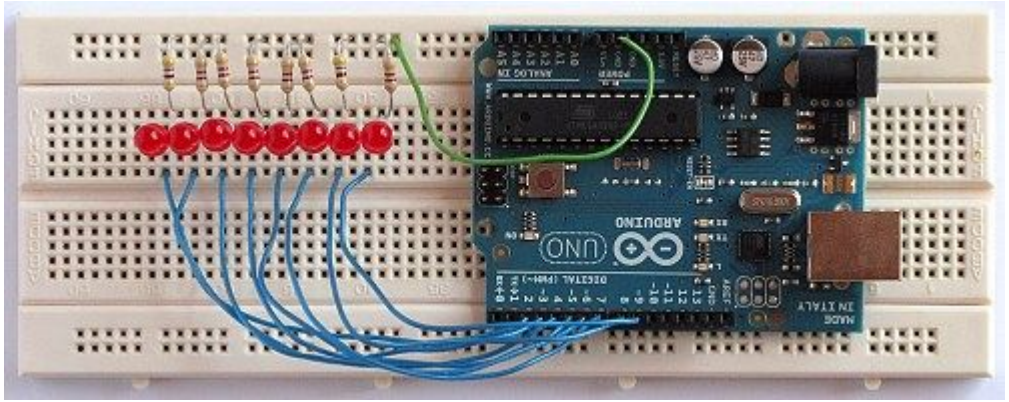
1. Program your Arduino with a bootloader (hopefully you soldered well last week ;))
2. Build a circuit with your arduino and a breadboard
3. Write a small program on your computer in the Arduino IDE
4. Load the program onto your Arduino
5. Watch stuff flash and press buttons
    a. The program you loaded will handle input and do stuff

What is a ‘bootloader’?

- A basic operating system that allows the Arduino to turn on and accept the program that you will load from your computer
- Typically for programming microcontrollers you’ll need external hardware

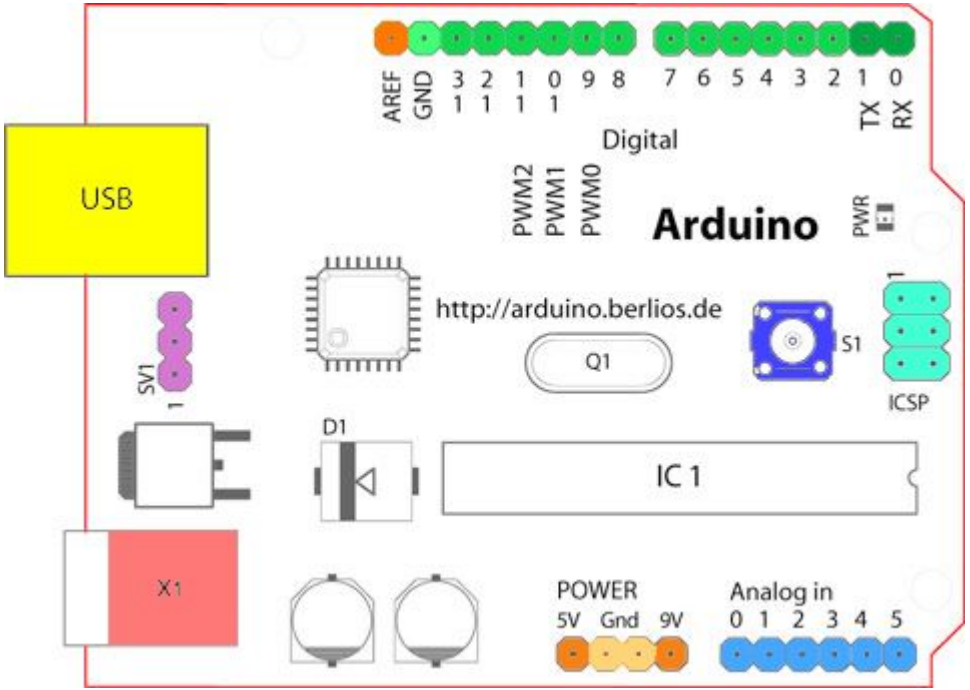
Why do we need a breadboard?

- The Arduino provides power
  Through pins
- Not everything fits
  On the Arduino
- Sometimes you need
  To add a resistor
  To a circuit



Pins

- Pins are the small holes that you attach wires to to power your LEDs, get input from your switches, etc.
- Pins will run a wire to the breadboard first, and the components will go on the breadboard
- Pins are numbered or labeled



Writing code in the IDE

Loading the program onto your Arduino

Traffic Light Workshop

By Alex Choulos and Taylor Mau

LED

\+ = longer wire

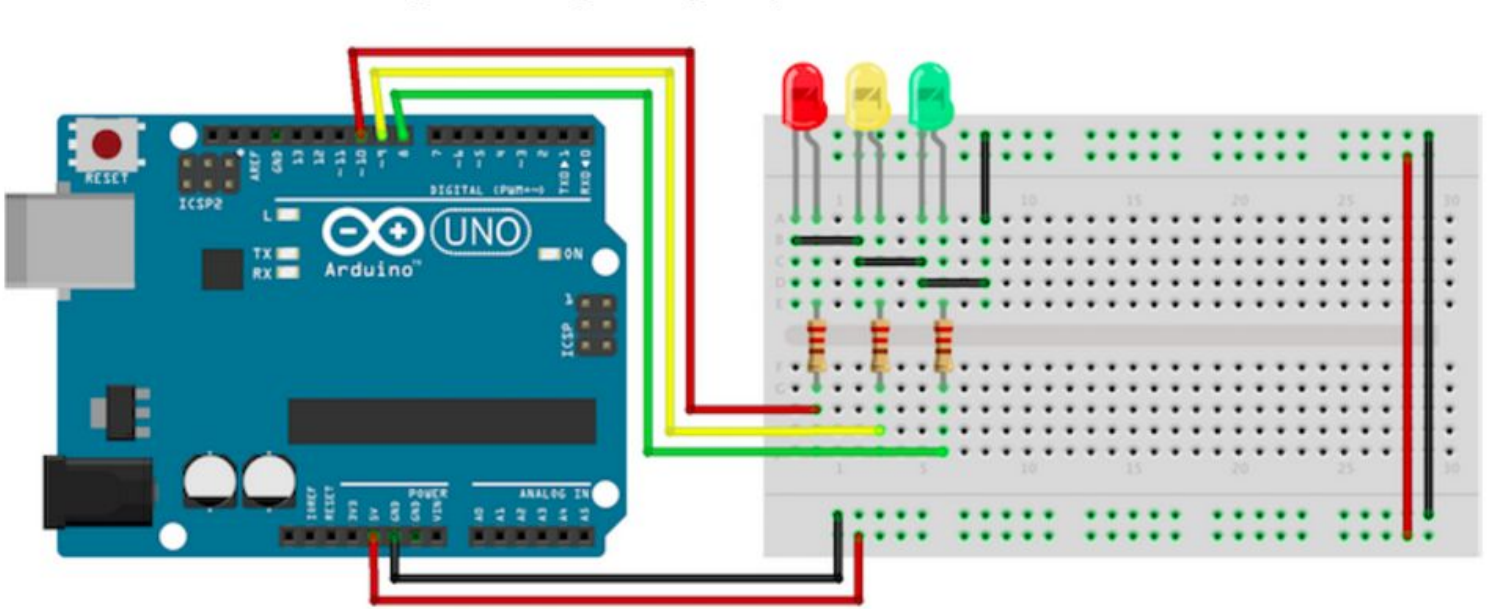
\- = shorter wire

Resistor

Download resistor app
Bands tell you what resistance it is and tolerance

** Must add a resistor or LED will die

Basic Setup Traffic Light



CODE!

```
int red = 7;
int yellow = 6;
int green = 5;
void setup() {
}
```

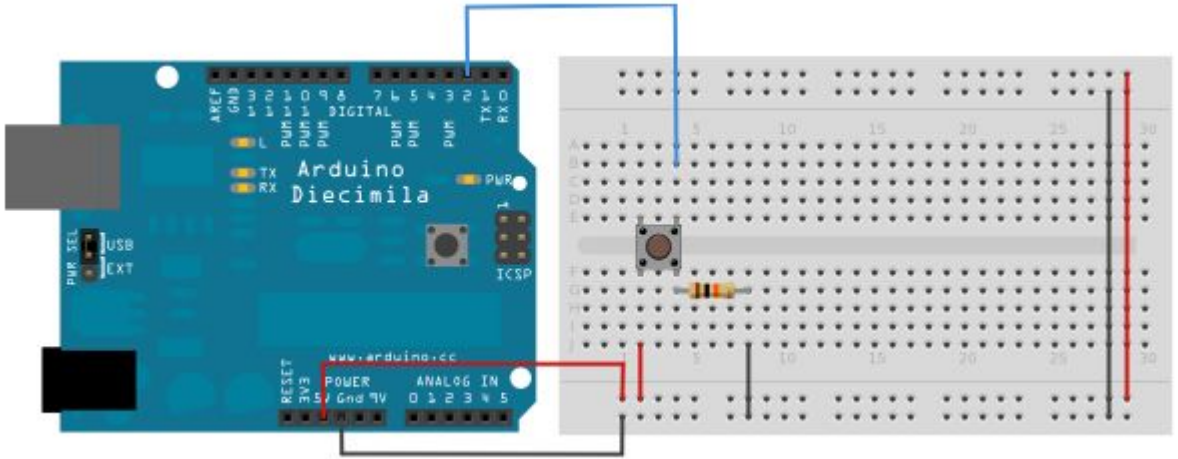
```
void loop(){
    changeLights();
    delay(15000);
}
```

Your Turn!

```
//Tell LED at pin 1 to turn on
digitalWrite(1,HIGH);
//Tell LED at pin 1 to turn off
digitalWrite(1,LOW);
```

```
//Delay for 3 sec
delay(3000);
```

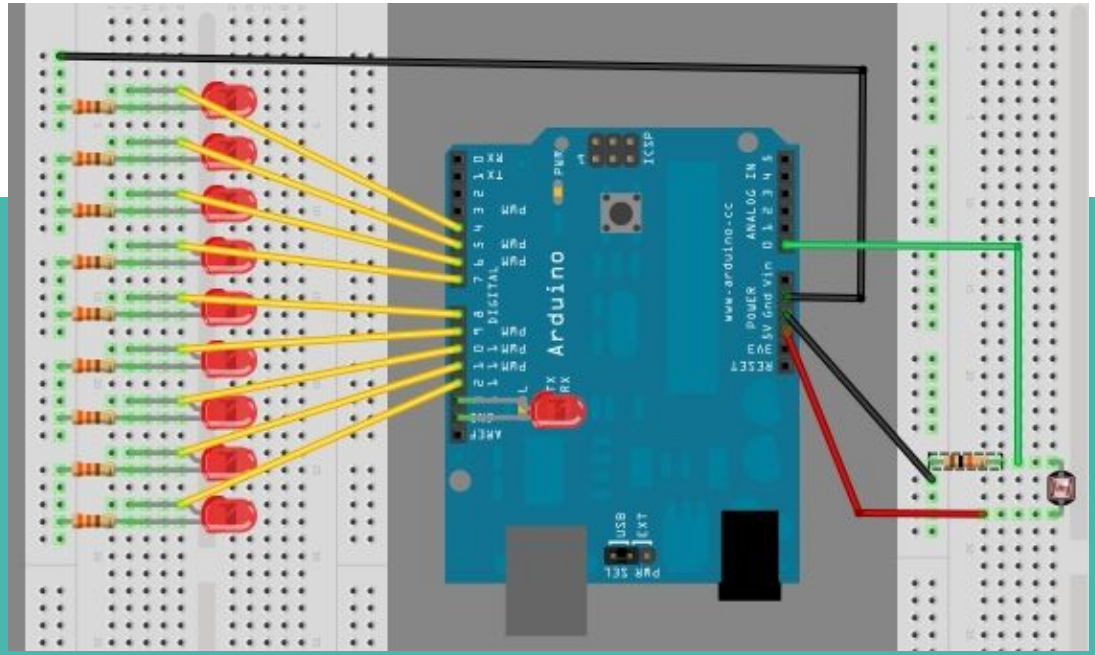
ADD THE BUTTON!



Photoresistor Workshop

By Angela Shao and Paul Ahrens

Basic Setup Photoresitor and LED



LED

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\- = shorter wire

Resistor

Download resistor app
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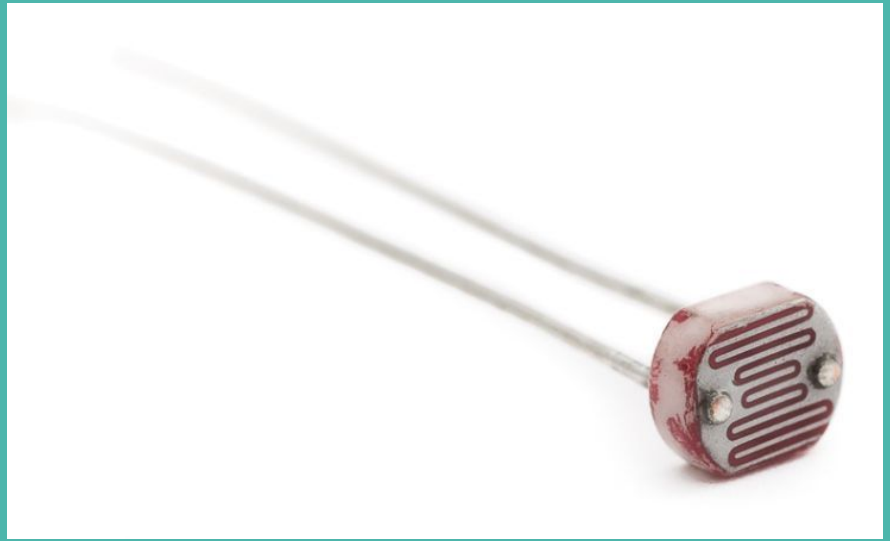
Photoresistor

A photoresistor is a light-controlled variable resistor.

This means that, as the light dims, the photoresistor increases in resistance.



Serial Monitor

Tools > Serial Monitor
(cmd + shift + M)

```
// initialize the serial port
void setup() {
  Serial.begin(9600);
}

// prints some variable x to the
Serial Moniter
  Serial.println( x );
```

CODE!

Functions:

map(pinNum, a, b, x, y):

For all values from pinNum in range [a, b], scales results and maps to range [x, y]. Returns the scaled integer value.

E.g. int x = map(red, 10, 20, 100, 200);

constrain(pinNum, x, y):

Constrains all values from pinNum to range [x, y]. Returns the constrained integer value.

E.g. int y = constrain(x, 100, 200);

```
int photoPin = 0;  //depends on your pin

void setup() {
    for (int i=4; i<7; i++){
        pinMode (i, OUTPUT);
    }
}

void loop(){
    int photoRead = map( analogRead(
photoPin ), 500, 700, 4, 7);

    int ledPin = constrain(photoRead, 4, 7);

    digitalWrite(ledPin, HIGH);
    delay(1);
    digitalWrite(ledPin, LOW);
}
```

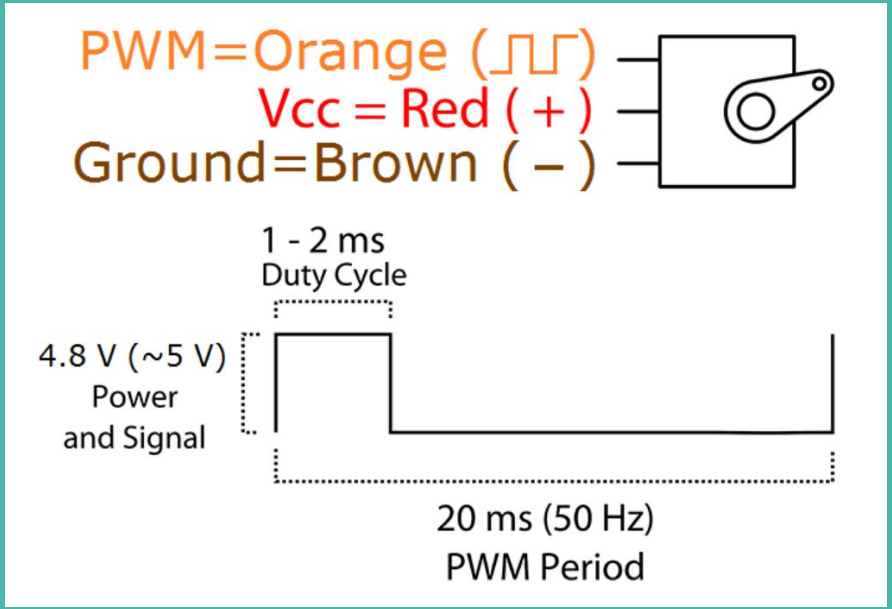
Servos and IR Workshop

Difficulty:☆☆☆

Servos

“Motors” with integrated gears for precise movements

Pinouts

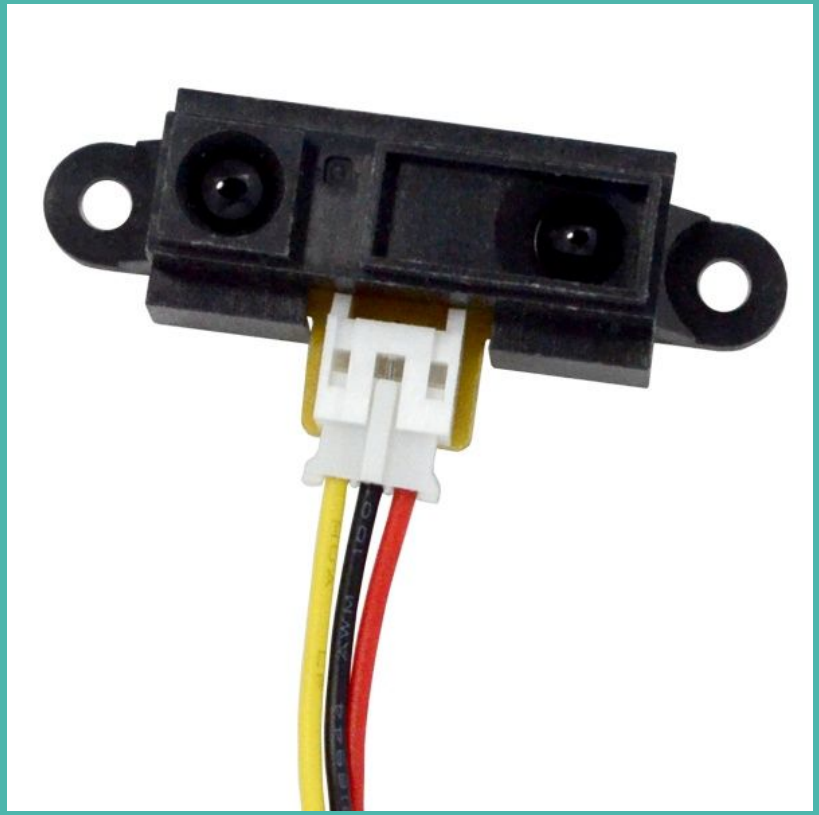

PWM=Orange
Vcc = Red (+)
Ground=Brown (–)
1 - 2 ms
Duty Cycle
4.8 V (~5 V)
Power
and Signal
20 ms (50 Hz)
PWM Period

CODE!

```
#include <Servo.h>
Servo myservo;
int pos = 0;
void setup() {
    myservo.attach(9);
}
void loop() {
    myservo.write(pos);
}
```

IR Sensors

Used to detect range. Usually split into an emitter and receiver



Pinouts

Red - Power

Black - Ground

Yellow - Data

CODE!

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

int val = 0;
```

```
void loop() {
  val = analogRead(0);
  Serial.println(val);
}
```

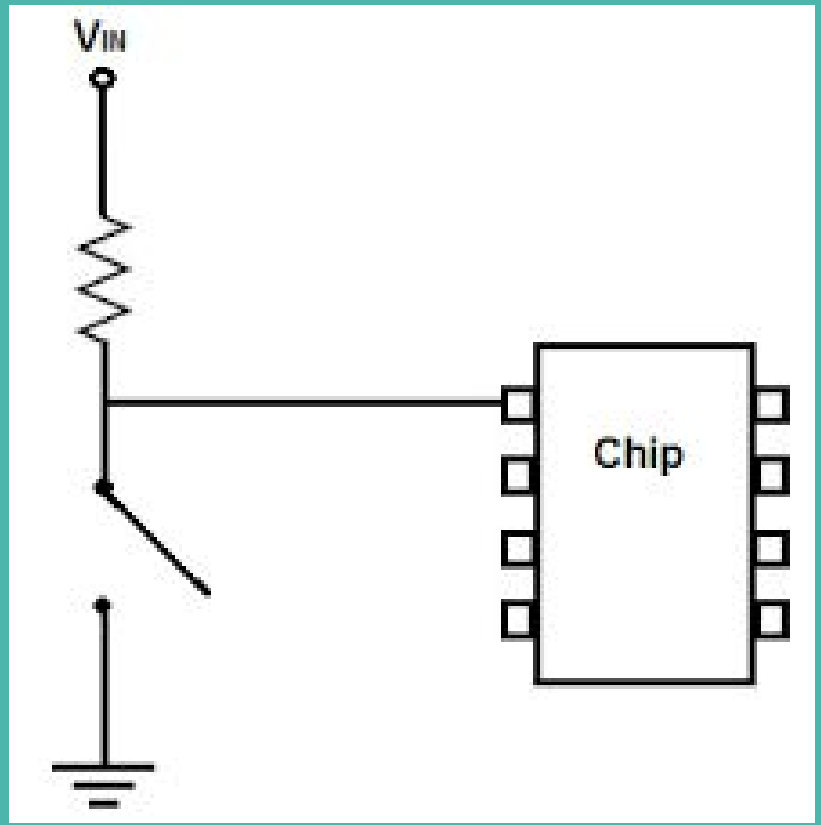
Activity!

Take a tape measure and record down the analog output at 5 cm, 10 cm, 15 cm, and 30 cm!

LED Cube Demo

How does it work?

- All negative ends of the LED’s are connected by level.
- All positive ends of LED’s are connected by columns.
- Levels are connected to pull-up resistors which enable both GND and VCC.



Example Code

```
void setup() {

 for (int i=0;i<11;i++)   { pinMode(i,OUTPUT);    //
PINS0-10 are set as output}

    pinMode(A0,OUTPUT);    //PIN A0 set as output

    pinMode(A1,OUTPUT);   // PIN A1 set as output

    pinMode(A2,OUTPUT);   // PIN A2 set as output

    digitalWrite(A0,HIGH);    //pull up the A0 pin

    digitalWrite(A1,HIGH);   // pull up the A1 pin

    digitalWrite(A2,HIGH);   // pull up the A2 pin

    randomSeed(analogRead(5));

}
```