

# Introduction to Arduino



@DimSumLabs

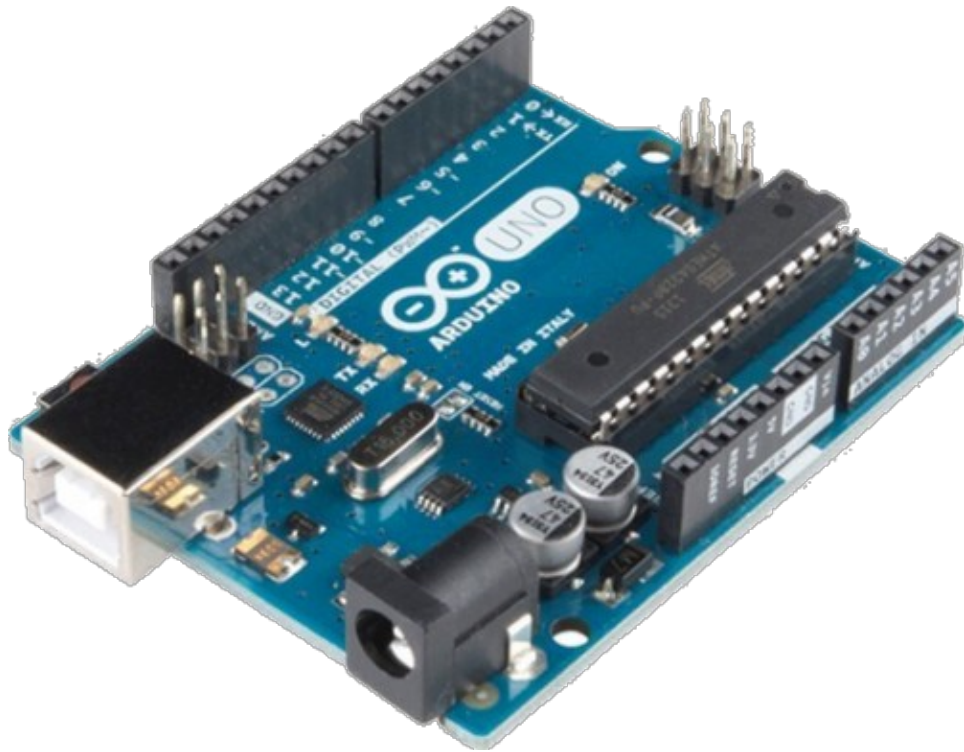
*Version 20190823*

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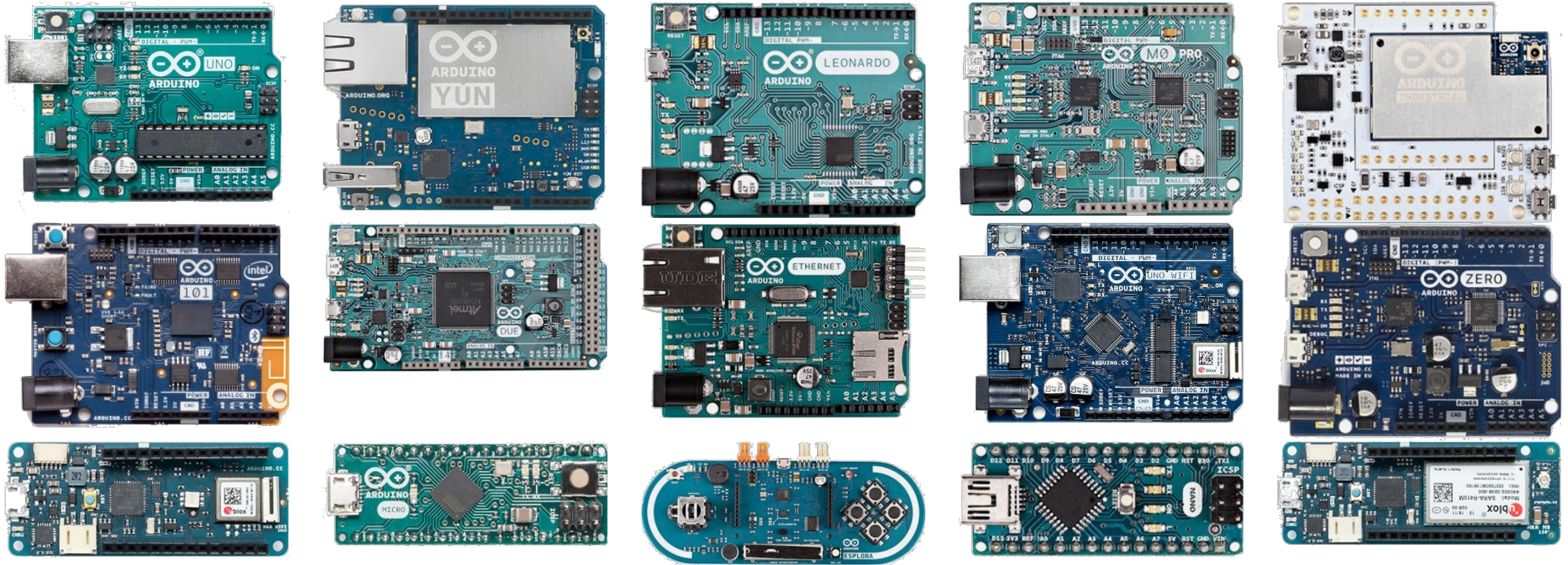


## Micro-Controller / Micro-Processor





## Arduino compatible boards





Many more official ones on: <https://www.arduino.cc/en/Main/Products>



## Connectivity

1. USB – to the computer
2. Power – 5 Volts
3. Input / Output
  1. Digital – True / False – One / Zero
  2. Analog – Zero to 5 Volts
  3. PWM (Pulse Width Modulation) – control of LED strip, DC motor, Servo motor, ...

## Setup of the board

1. Download the Arduino IDE
2. Install
3. Configure
  - board
  - port
4. Open the Blink Sketch
5. Sketch = program you wrote
6. File / Examples / 01.Basics / Blink
7. Click the Verify icon  then the Upload icon  to test the connectivity
8. Explain the Sketch
9. Clean up the Sketch and ReUpload the Sketch

// Initialiase

// the setup function runs once when you press reset or power the board

```
void setup() {  
  pinMode(LED_BUILTIN, OUTPUT);  
}
```

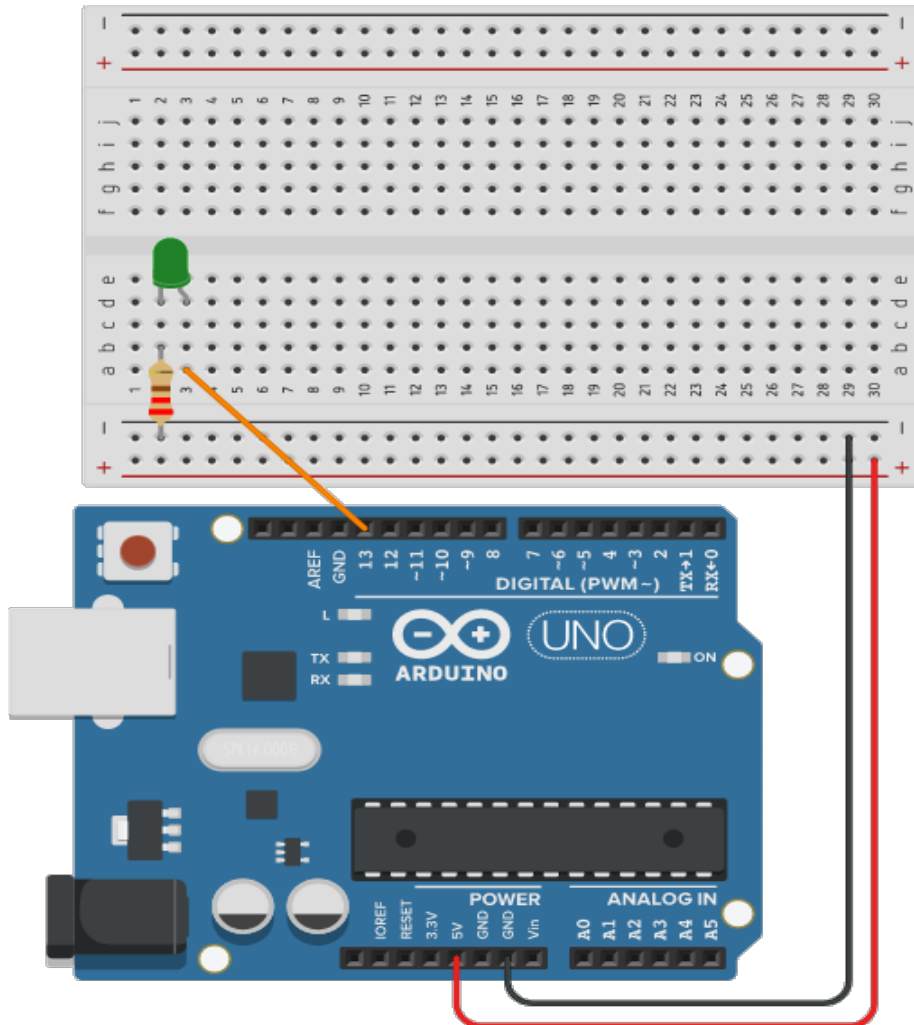
// the loop function runs over and over again forever

```
void loop() {  
  digitalWrite(LED_BUILTIN, HIGH);  
  delay(1000);  
  digitalWrite(LED_BUILTIN, LOW);  
  delay(1000);  
}
```



# Breadboard, LED, Resistor, Cables

## 1 LED



- Connect an LED to pin 13
- Modify the Sketch to light up this LED

// Initialiase

```
int led1pin = 13;
```

// the setup function runs once when you press reset or power the board

```
void setup() {  
  pinMode(led1pin, OUTPUT);  
}
```

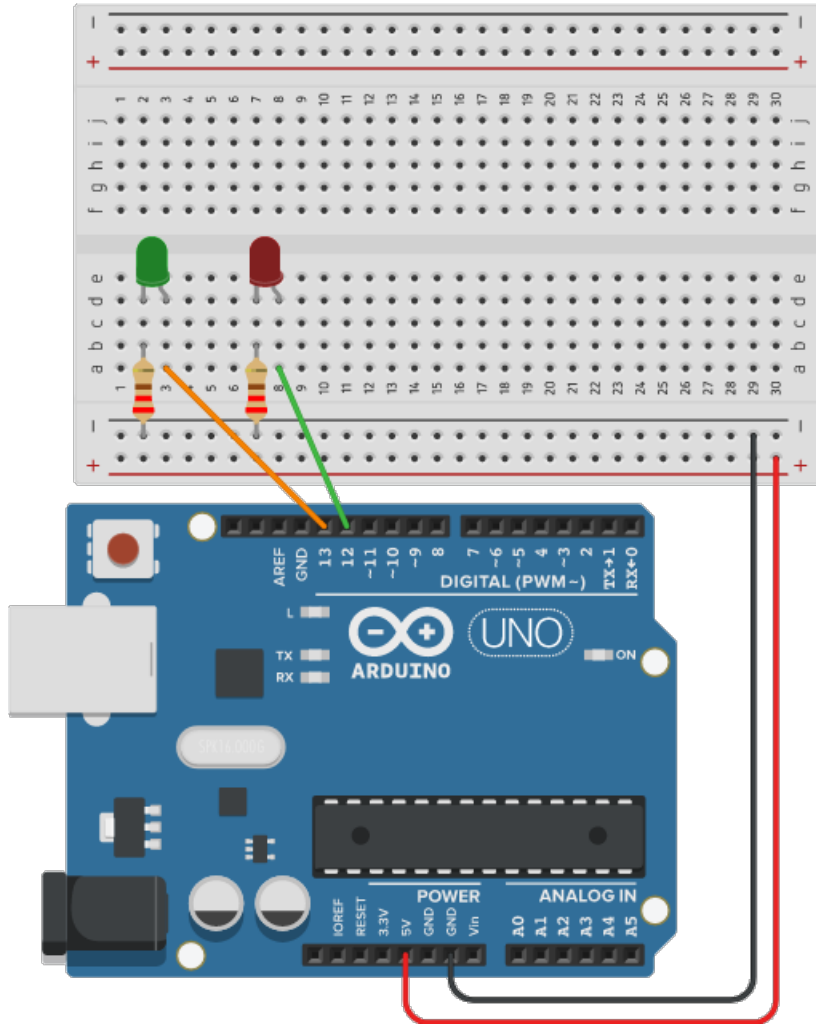
// the loop function runs over and over again forever

```
void loop() {  
  digitalWrite(led1pin, HIGH);  
  delay(1000);  
  digitalWrite(led1pin, LOW);  
  delay(1000);  
}
```

**Exercise: Have 2 LEDs light up alternatively & Manage the delay with a variable called timedelayled**



## 2 LED



**// Initialiase**

```
int led1pin = 13;  
int led2pin = 12;  
int timedelayled = 500;
```

**// the setup function runs once when you press reset or power the board**

```
void setup() {  
    pinMode(led1pin, OUTPUT);  
    pinMode(led2pin, OUTPUT);  
}
```

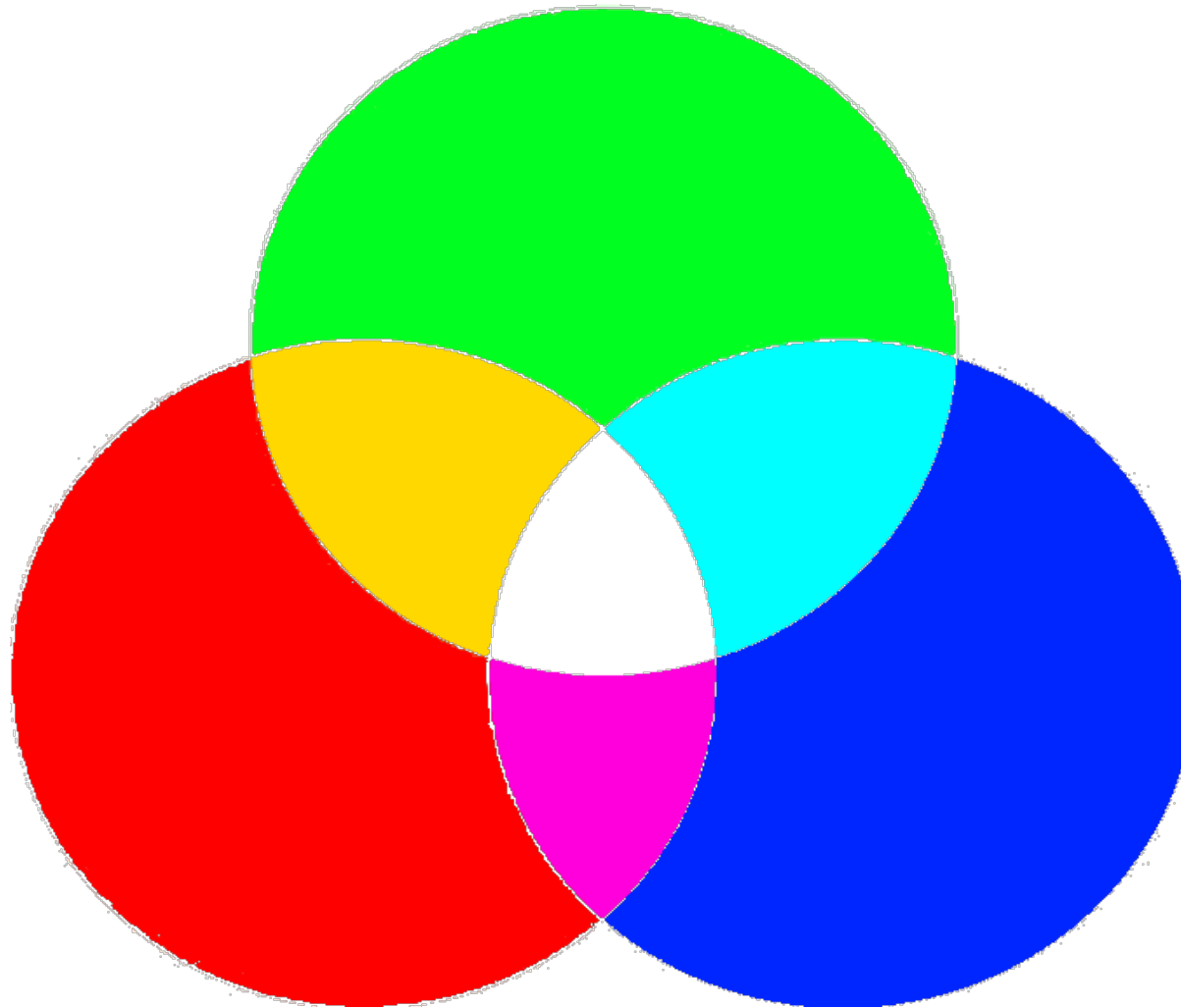
**// the loop function runs over and over again forever**

```
void loop() {  
    digitalWrite(led1pin, HIGH);  
    digitalWrite(led2pin, LOW);  
    delay(timedelayled);  
    digitalWrite(led1pin, LOW);  
    digitalWrite(led2pin, HIGH);  
    delay(timedelayled);  
}
```



## RGB LED, Randomness, Serial monitor

Red Green Blue Colors





## Randomness



Serial Monitor

167  
241  
217  
42  
167  
241  
167  
241

- Get Random value upto 255 (256) into the variable randnumber
- Show the values on the serial monitor

// Initialiase

**long randnumber;**

// the setup function runs once when you press reset or power the board

**void setup() {**

**Serial.begin(9600);**

**}**

// the loop function runs over and over again forever

**void loop() {**

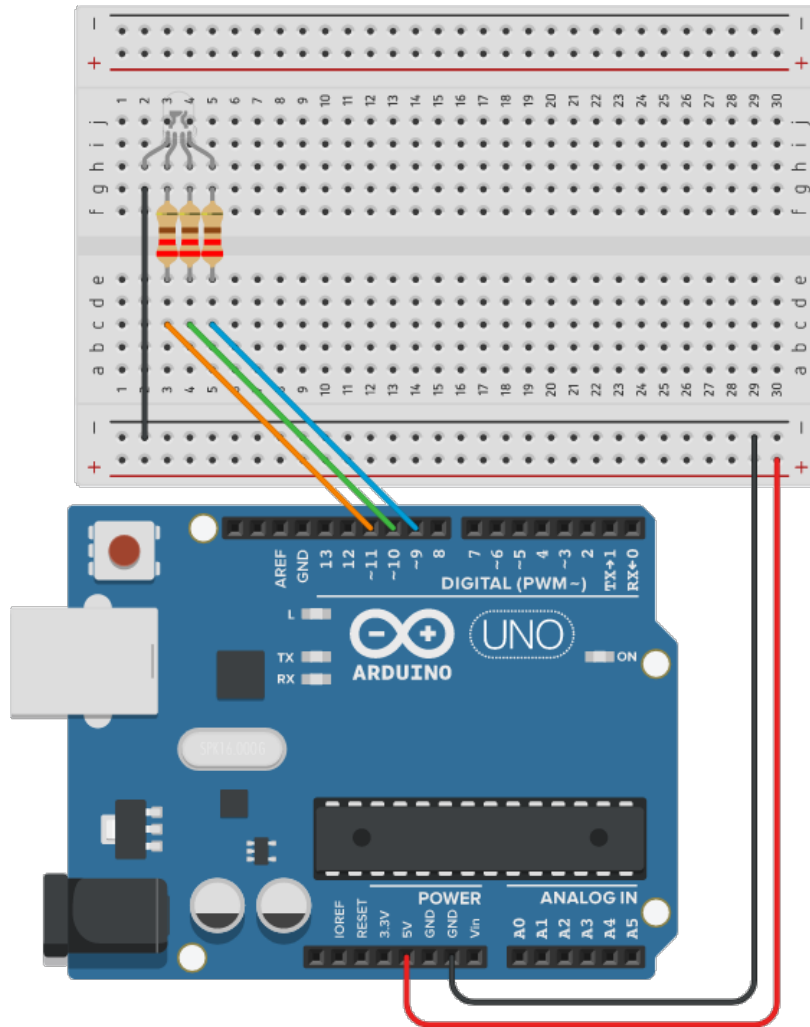
**randnumber = random(256);**

**Serial.println(randnumber);**

**}**



## RGB LED



- Save your Sketch & Create a new one
- Remove the 2 LEDs
- Connect a RGB LED to the breadboard pinned, pingreen, pinblue, as 11, 10, 9
- Assign fix values to the variables redvalue, greenvalue, bluevalue between 0 and 255 as **long** instead of **int**
- light on (your value) and off (white or black) the RGB

// Initialiase

```
int redpin = 11;  
int greenpin = 10;  
int bluepin = 9;  
long redvalue = 0;  
long greenvalue = 255;  
long bluevalue = 0;  
int timedelay = 500;
```

```
void setup() {  
  pinMode(redpin, OUTPUT);  
  pinMode(greenpin, OUTPUT);  
  pinMode(bluepin, OUTPUT);  
}
```

```
void loop() {  
  analogWrite(redpin, redvalue);  
  analogWrite(greenpin, greenvalue);  
  analogWrite(bluepin, bluevalue);  
  delay(timedelay);  
  analogWrite(redpin, 255);  
  analogWrite(greenpin, 255);  
  analogWrite(bluepin, 255);  
  delay(timedelay);  
}
```

**Exercise: Combine randomness and the RGB color values to change the color at each blink**



## Random colors

**// Initialiase pins, values**

**int redpin = 11;**

**int greenpin = 10;**

**int bluepin = 9;**

**long randvalue = 0;**

**int timedelay = 500;**

**// the setup function runs once when you press reset or power the board**

**void setup() {**

**Serial.begin(9600);**

**pinMode(redpin, OUTPUT);**

**pinMode(greenpin, OUTPUT);**

**pinMode(bluepin, OUTPUT);**

**}**

**// the loop function runs over and over again forever**

**void loop() {**

**randvalue = random(256);**

**analogWrite(redpin, randvalue);**

**randvalue = random(256);**

**analogWrite(greenpin, randvalue);**

**randvalue = random(256);**

**analogWrite(bluepin, randvalue);**

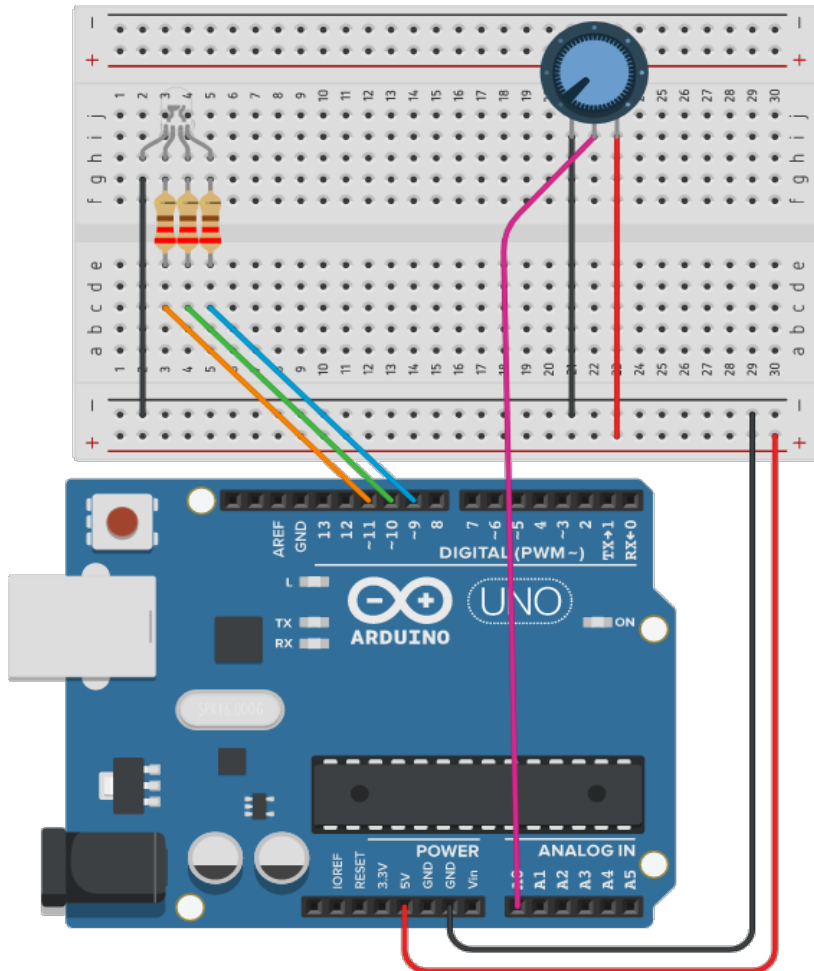
**delay(timedelay);**

**}**



# Potentiometer, Buzzer

## Potentiometer



- Connect the Potentiometer and display the values on the serial monitor

// Initialiase pins, values

```
int potvalue = 0;  
int potpin = A0;
```

// the setup function runs once when you press reset or power the board

```
void setup() {  
  pinMode(potpin, INPUT);  
}
```

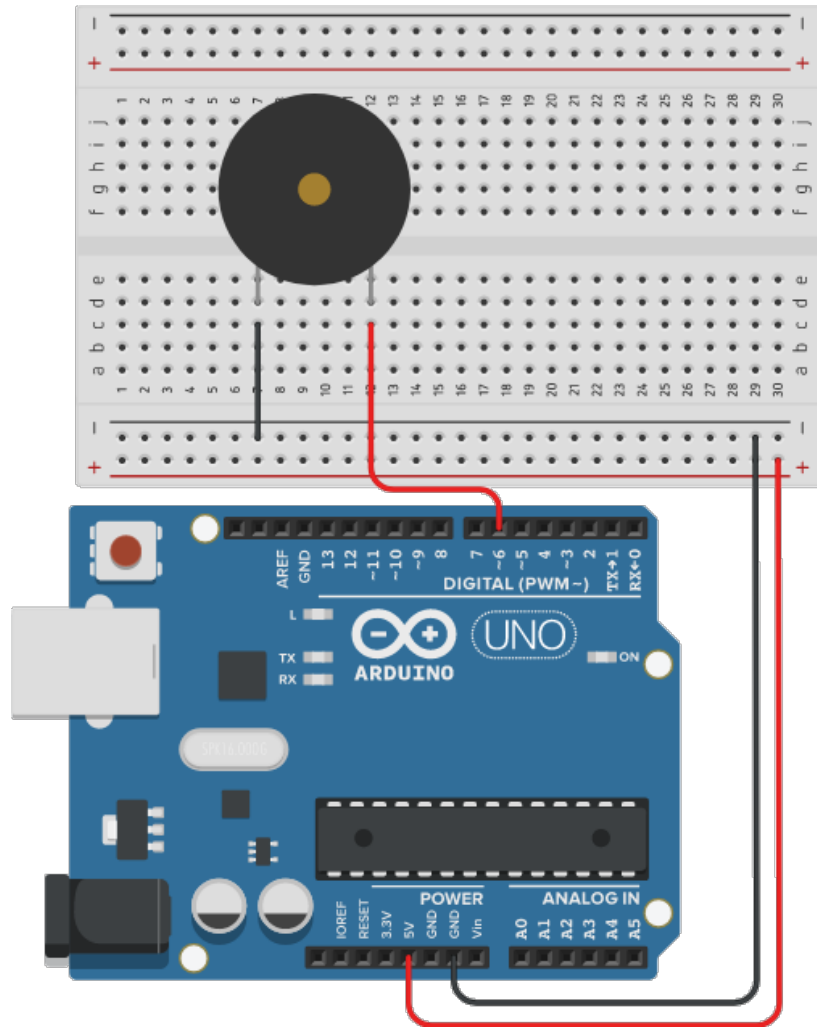
// the loop function runs over and over again forever

```
void loop() {  
  potvalue = analogRead(potpin);  
}
```

**Exercise: Display values of the potentiometer**



## Buzzer



- Connect the buzzer
- Play with tone frequency of 10 to 1000

**// Initialiase**

**int buzpin = 6;**

**int buzvalue = 1000;**

**// the setup function runs once when you press reset or power the board**

**void setup() {**

**pinMode(buzpin, OUTPUT);**

**}**

**// the loop function runs over and over again forever**

**void loop() {**

**tone(buzpin, buzvalue);**

**delay(timedelay);**

**noTone(buzpin);**

**delay(timedelay);**

**}**

**Exercise: The potentiometer control the tone**



## Potentiometer + Buzzer

**// Initialiase**

```
int redpin = 11;
int greenpin = 10;
int bluepin = 9;
int potpin = A0;
int buzpin = 6;
int potvalue = 0;
int buzvalue = 1000;
long randvalue;
int timedelay = 500;
```

**// the setup function runs once when you press reset or power the board**

```
void setup() {
  Serial.begin(9600);
  pinMode(redpin, OUTPUT);
  pinMode(greenpin, OUTPUT);
  pinMode(bluepin, OUTPUT);
  pinMode(buzpin, OUTPUT);
  pinMode(potpin, INPUT);
}
```

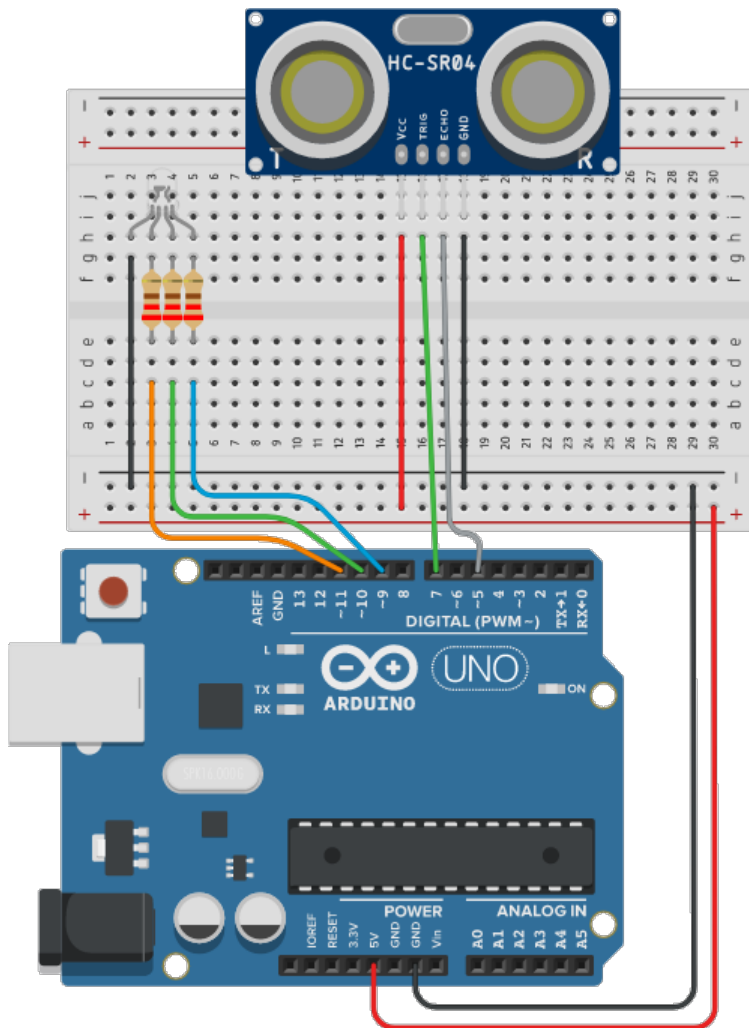
**// the loop function runs over and over again forever**

```
void loop() {
  potvalue = analogRead(potpin);
  randvalue = random(256);
  analogWrite(redpin, randvalue);
  randvalue = random(256);
  analogWrite(greenpin, randvalue);
  randvalue = random(256);
  analogWrite(bluepin, randvalue);
  tone(buzpin, potvalue);
  delay(timedelay);
  noTone(buzpin);
  delay(potvalue);
  Serial.print("Potiometer value: ");
  Serial.println(timedelay);
}
```





## Ultrasonic sensor



- Save your Sketch & Create a new one
- Connect the sensor
- Read the values from the serial monitor

**// Initialiase pins, values**

```
int trigpin = 7;  
int echopin = 5;
```

**// Initialiase the variables**

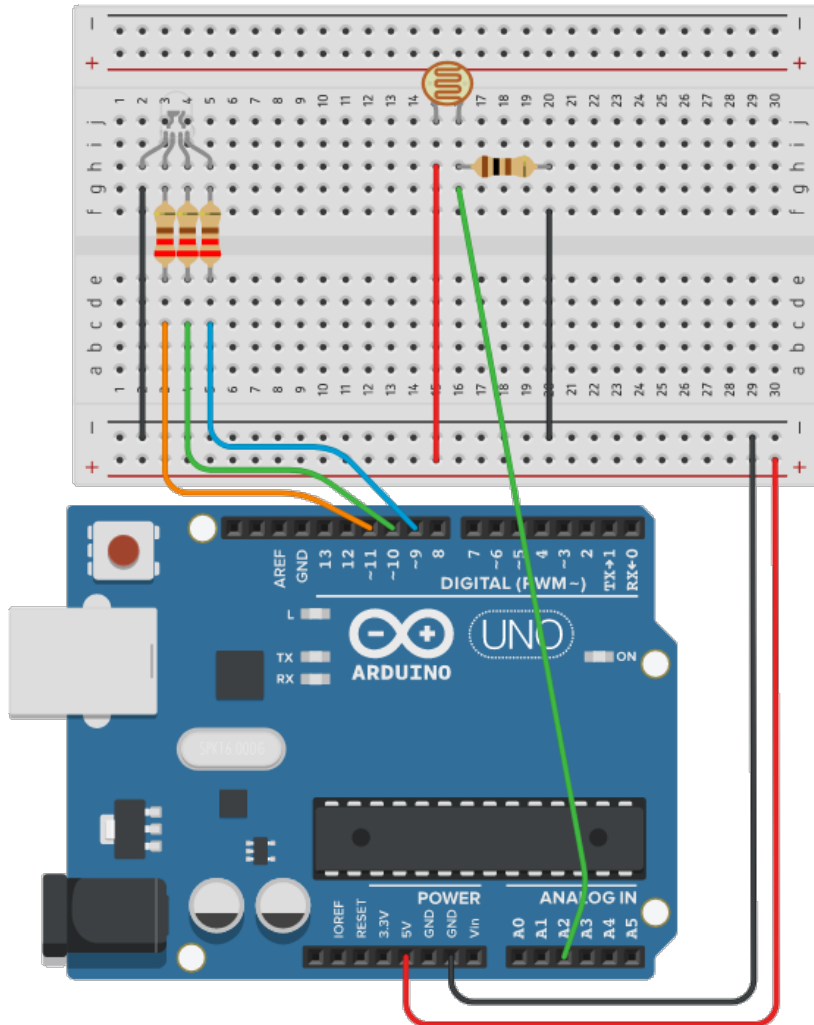
```
int ultradist = 0;  
int centimeters = 0;
```

**// the loop function runs over and over again forever**

```
void loop() {  
  pinMode(trigpin, OUTPUT);  
  digitalWrite(trigpin, LOW);  
  delayMicroseconds(2);  
  digitalWrite(trigpin, HIGH);  
  delayMicroseconds(10);  
  digitalWrite(trigpin, LOW);  
  pinMode(echopin, INPUT);  
  ultradist = pulseIn(echopin, HIGH);  
  centimeters = 0.01723 * ultradist;  
}
```



## Light sensor / LDR / Photoresistor



- Save your Sketch & Create a new one
- Connect the sensor
- Read the values from the serial monitor

// Initialiase pins, values

int ldrpin = A2;

int ldrvalue = 0;

// the setup function runs once when you press reset or power the board

```
void setup() {  
  pinMode(ldrpin, INPUT);  
}
```

// the loop function runs over and over again forever

```
void loop() {  
  ldrvalue = analogRead(ldrpin);  
}
```



# Annexes

## Arduino Libraries

Arduino libraries are pieces of software that someone else has already developed and made available to the public. Certain sensors require very difficult timing and pulsing of digital pins such as a Capacitive Sensor. So in order to use the sensor easily you 'include' that piece of software called a library into your code.

You can add a library manually, or by the menus:

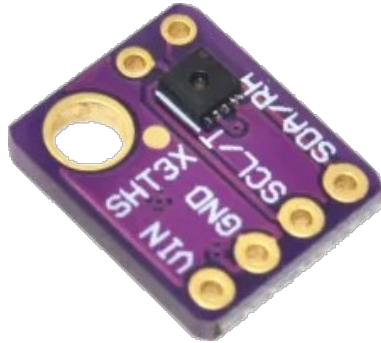
- Sketch / Include library / Manage Libraries...
- Sketch / Include library / Add .ZIP Library...

List of known library verified by Arduino

Only import libraries from trustworthy sources as it will be part of your code

## Sensors

### Temperature + Humidity



#### SHT31

- Often used in industrial environment due to its precision and reliability over time. SHT31 is the low cost version, SHT35 is the high-end model.
- Interface: I<sup>2</sup>C
- Arduino UNO connection:
  - VIN → 5V
  - GND → GND
  - SDA → A4
  - SCL → A5



#### HTU21D

- Low cost, highly accurate and reliable over time
- Interface: I<sup>2</sup>C
- Arduino UNO connection:
  - + → 3.3V
  - - → GND
  - DA → A4
  - CL → A5



## Workshop full sketches

- Comments in the code
- Function name
- Known values in Arduino – you cannot create a variable with such a name

### Blink 1 & 2

```
// Initialiase the variables
```

```
int led1pin = 13;  
int led2pin = 12;  
int timedelayled = 500;
```

```
// the setup function runs once when you press reset or power the board
```

```
void setup() {  
  pinMode(led1pin, OUTPUT);  
  pinMode(led2pin, OUTPUT);  
}
```

```
// the loop function runs over and over again forever
```

```
void loop() {  
  digitalWrite(led1pin, HIGH);  
  digitalWrite(led2pin, LOW);  
  delay(timedelayled);  
  digitalWrite(led1pin, LOW);  
  digitalWrite(led2pin, HIGH);  
  delay(timedelayled);  
}
```



## Randomness, RGB LED, Potentiometer, Buzzer, Ultrasonic sensor, LDR

```
// Initialiase the variables
```

```
// Randomness
```

```
long randnumber;
```

```
// RGB LED
```

```
int redpin = 11;
```

```
int greenpin = 10;
```

```
int bluepin = 9;
```

```
long redvalue = 0;
```

```
long greenvalue = 255;
```

```
long bluevalue = 0;
```

```
int timedelay = 500;
```

```
// Potentiometer
```

```
int potvalue = 0;
```

```
int potpin = A0;
```

```
// Buzzer
```

```
int buzpin = 6;
```

```
int buzvalue = 1000;
```

```
// Ultrasonic sensor
```

```
int trigpin = 7;
```

```
int echopin = 5;
```

```
int ultradist = 0;
```

```
int centimeters = 0;
```

```
// LDR
```

```
int ldrpin = A2;
```

```
int ldrvalue = 0;
```



```

// the setup function runs once when you press reset or power the board
void setup() {
  // Initialize the serial monitor
  Serial.begin(9600);
  // RGB LED
  pinMode(redpin, OUTPUT);
  pinMode(greenpin, OUTPUT);
  pinMode(bluepin, OUTPUT);
  // Potentiometer
  pinMode(potpin, INPUT);
  // Buzzer
  pinMode(buzpin, OUTPUT);
  // LDR
  pinMode(ldrpin, INPUT);
}

// the loop function runs over and over again forever
void loop() {
  // Randomness
  randnumber = random(256);
  // Potentiometer
  potvalue = analogRead(potpin);
  // Ultrasonic sensor
  pinMode(trigpin, OUTPUT);
  digitalWrite(trigpin, LOW);
  delayMicroseconds(2);
  digitalWrite(trigpin, HIGH);
  delayMicroseconds(10);
  digitalWrite(trigpin, LOW);
  pinMode(echopin, INPUT);
  ultradist = pulseIn(echopin, HIGH);
  centimeters = 0.01723 * ultradist;
}

```





```

// LDR
ldrvalue = analogRead(ldrpin);

// Print on the serial monitor a value, here the centimeters value from the Ultrasonic sensor
Serial.print("Distance in centimeters: ");
Serial.println(centimeters);

// Flash loop
// RGB LED
analogWrite(redpin, potpin/4);           // Changing the red value via the potentiometer
analogWrite(greenpin, random(256));      // Changing the green value via randomness
analogWrite(bluepin, ldrvalue/4);        // Changing the blue value via the LDR
// Buzzer
tone(buzpin, potpin);                    // Changing the red value via the potentiometer

delay(timedelay);

// RGB LED
analogWrite(redpin, 0);
analogWrite(greenpin, 0);
analogWrite(bluepin, 0);
// Buzzer
noTone(buzpin);

delay(timedelay);
}

```



## Contact us



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