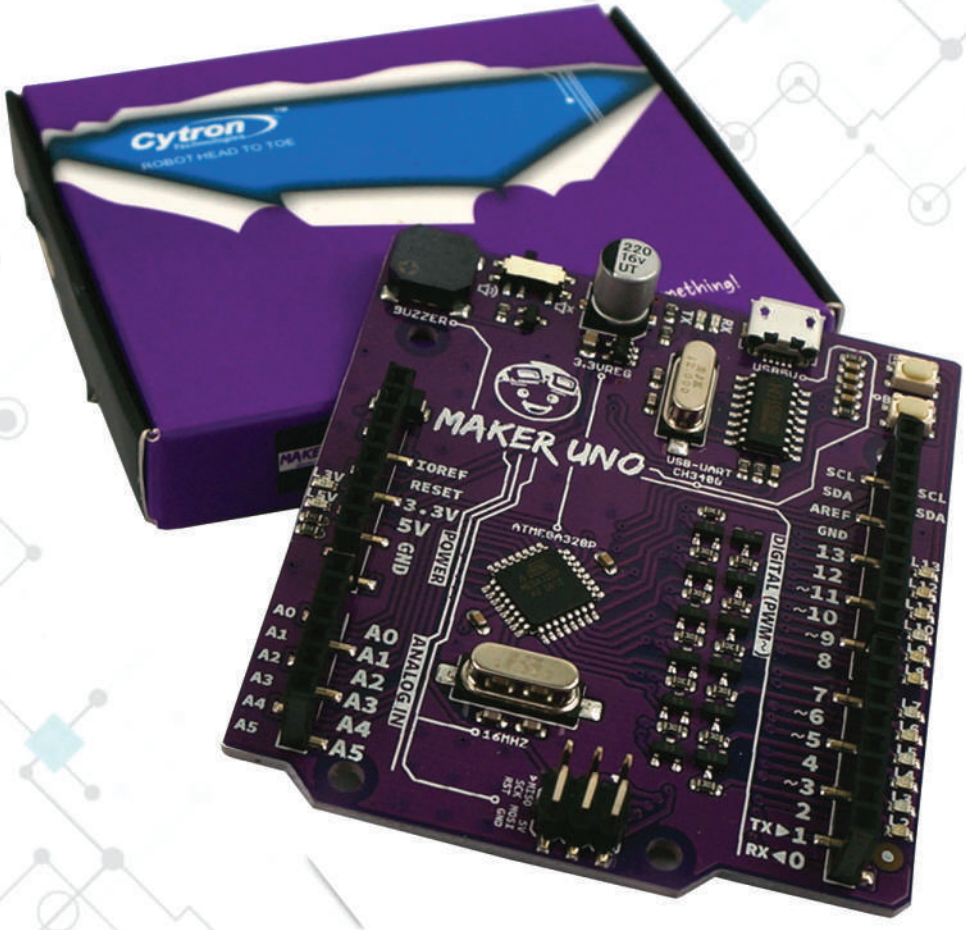
Getting Started with

MAKER UNO

ARDUINO UNO COMPATIBLE

Starter Kit



Cytron Technologies

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Cytron Technologies

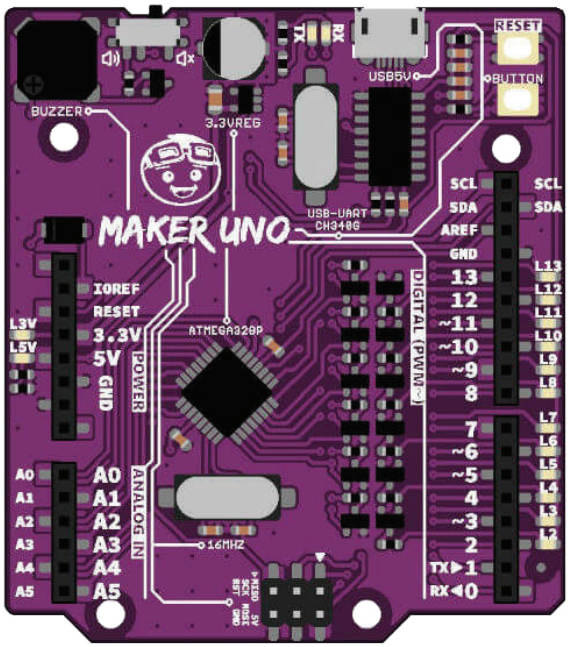
LESSONS

PROJECTS

INTRODUCTION

MAKER-UNO

Maker UNO, an Arduino UNO compatible board designed and developed specially for students to learn coding and microcontroller. We named it Maker UNO to encourage everyone to be a maker by getting started with this amazing board..



MAKER - UNO Features:

- SMD ATmega328P microcontroller(the same microcontroller on Arduino UNO) with Optiboot (UNO) Bootloader.
- USB Programming facilitated by the CH340.
- Input voltage: USB 5V, from computer, power bank or standard USB adapter.
- 500mA (maximum) 3.3V voltage regulator.
- 0-5V outputs with 3.3V compatible inputs.
- 14 Digital I/O Pins (6 PWM outputs).
- 6 Analog Inputs.
- ISP 6-pin Header.
- 32k Flash Memory.
- 16MHz Clock Speed.
- R3 Shield Compatible.
- LED array for 5V, 3.3V, TX, RX and all digital pins.
- On board programmable push button (pin 2, need to configure as INPUT_PULLUP).
- On board piezo buzzer (pin 8).
- Utilize USB Micro-B socket.
- PURPLE PCB!

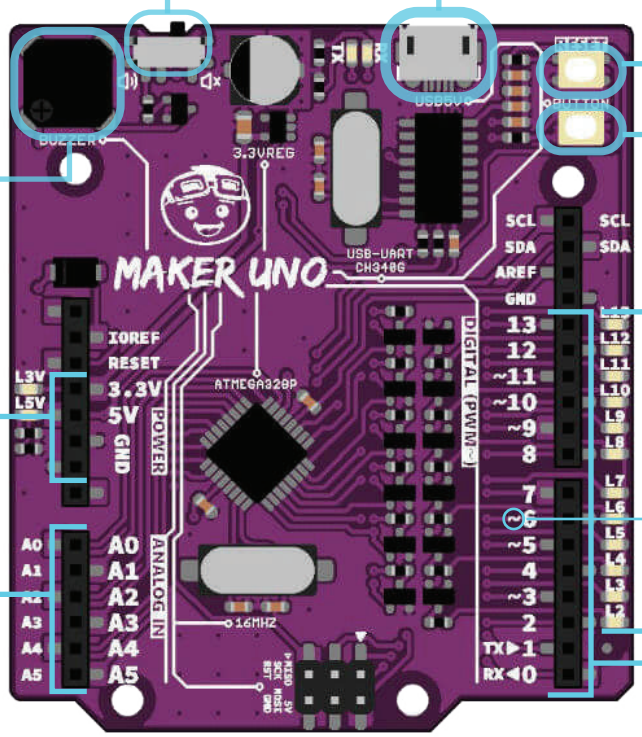
MAKER-UNO BOARD

Piezo Buzzer Slide Switch
Slide switch to connect between pin 8 to piezo buzzer. To use piezo buzzer, slide the switch on and program the buzzer. To use pin 8 for other purpose, slide the switch off.

Piezo Buzzer
Piezo buzzer is connected to pin 8 through slide switch.

Power Pin
GND - Ground Pins
5V - Regulated 5V output
3V3 - Regulated 3.3v supply

Analog Pin
This pin can be used with analogRead(); to read an input in analog form (0-1023)



Micro USB B Type Connector (Female)
Main supply for Maker Uno. Used for program and debug purpose (Serial Monitor) too.

Reset Button
Button to restart Maker UNO program.

Programmable Button
This button is connected to pin 2 and GND. To use it, user need to configure it as INPUT_PULLUP.

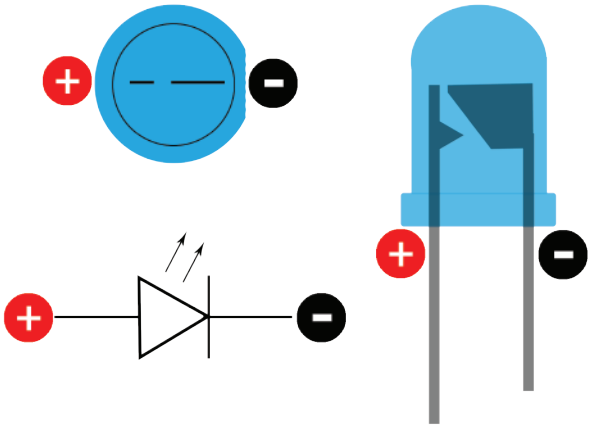
Series of LED for Digital I/O
Every digital IO is equipped with LED, where you can control it or make it as indicator for input.

PWM Pin ~
The digital pin that has this symbol can only use analogWrite(); to control the output. (0-255)

Digital Pin
This pin can be used with :
digitalRead(); as an input
digitalWrite(); as an output

LED

Light Emitting Diode (LED) is electronic component that emits visible light when current passes through it. LED is a basic component used as an indicator in learning robotics. It has polarity which is positive(+) and negative(-). Positive pin must be connected to the power source (eg : 5V), while negative pin must be connected to the ground. LED is considered as an output for electronic components.

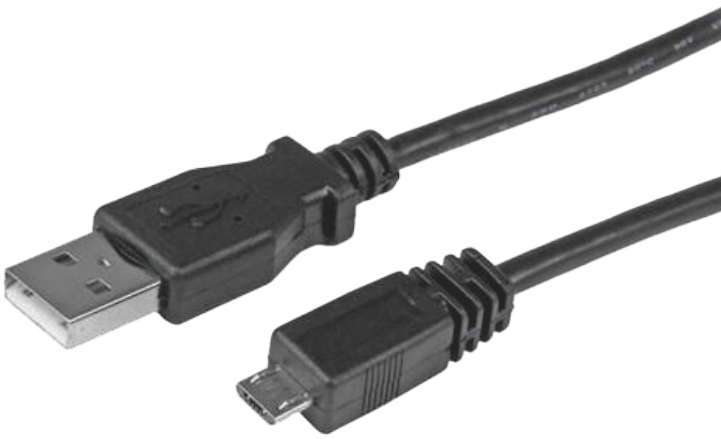


RESISTOR

Resistor is an electronic component that limit the electrical energy in a circuit and will make voltage and current change as a results. Resistor does not have any polarity. The value of the resistor is based on the three stripes.

USB MICRO B

This is USB 2.0 type A to micro USB 5-pin cable. It is a new, smaller connector for USB devices. Micro USB connectors are about half the height of mini USB. Micro USB is found on newer hand held devices like cell phones and portable media devices.

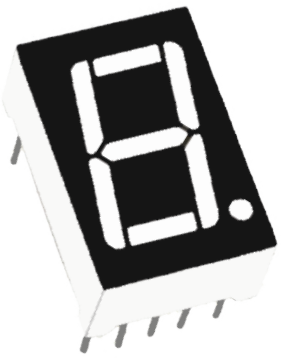


PUSH BUTTON

Push button is a simple switch mechanism that close a circuit when pressed. It's good to detect on and off signals. Push button is an electronic input.

7 SEGMENT DISPLAY

This is a 7 segment display. It's created using seven LEDs. Each of the seven LEDs is called a segment because when illuminated the segment forms part of a numerical digit (both Decimal and Hex) to be displayed.

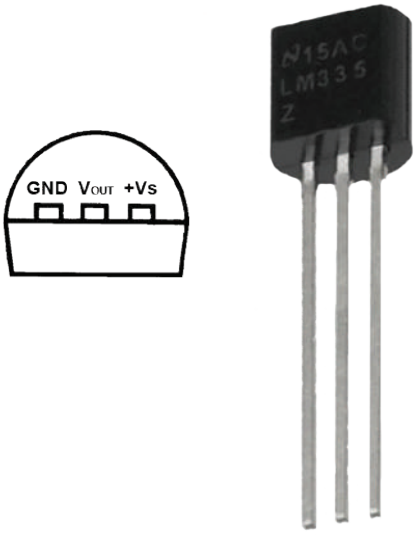


LIGHT DEPENDENT RESISTOR

A photoresistor or light dependent resistor (LDR) is a resistor whose resistance decreases with increasing incident light intensity. It can also be referred to as a photoconductor.

TEMPERATURE SENSOR

Temperature sensor change it's voltage depending on the temperature of the component. If the temperature of the component is high, then the voltage output is high and if the temperature of the component is low, then the voltage output is low.



PIEZO BUZZER

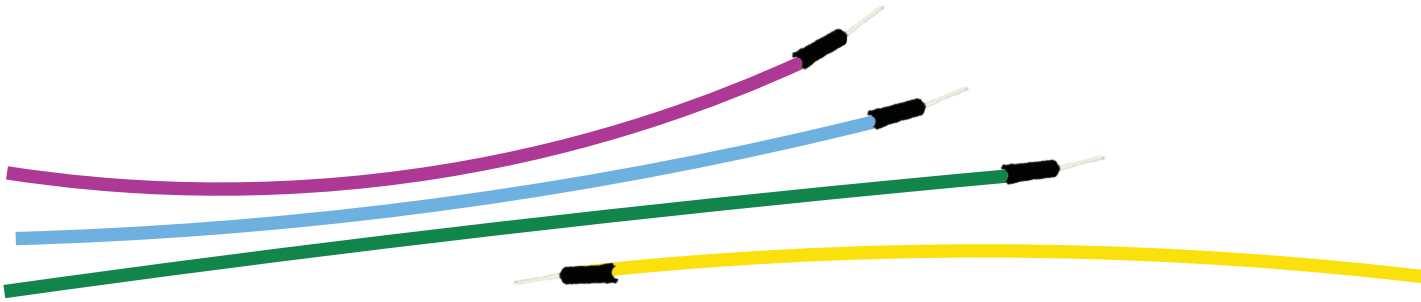
This is an on-board piezo buzzer. It is an electrical component that give out audio signal.

POTENTIOMETER

Potentiometer is a variable resistor with three pins. The variable resistor is easier to be adjusted by turning the knob clockwise or anti-clockwise.

JUMPER WIRE

This jumper wire is used to connect component to each other on the breadborad and to the Maker UNO.



BREADBOARD

The breadborad is a board that can build an electronic circuit on it. It has a rows and columns of holes that connected to each other.

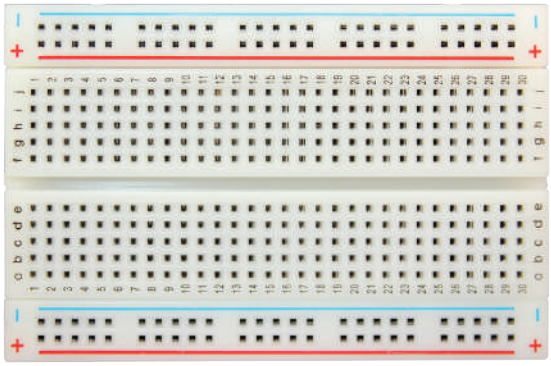


Figure 1 : A small size breadboard.

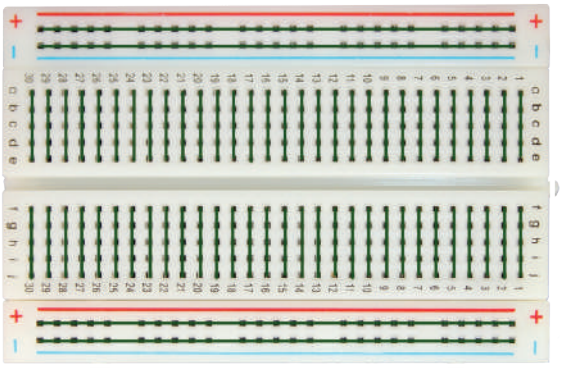


Figure 2 : Connection of breadboard

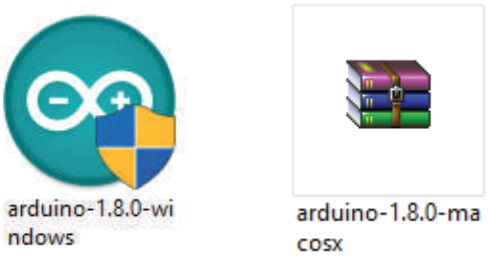
DOWNLOADING ARDUINO IDE

Maker UNO requires Arduino software to run. You can download the software from Arduino website (http://arduino.cc/en/Main/Software) and it is free to use.

Arduino IDE is compatible with Windows, Mac OS X and also Linux. You just need to choose the appropriate operating system installation package for your computer.

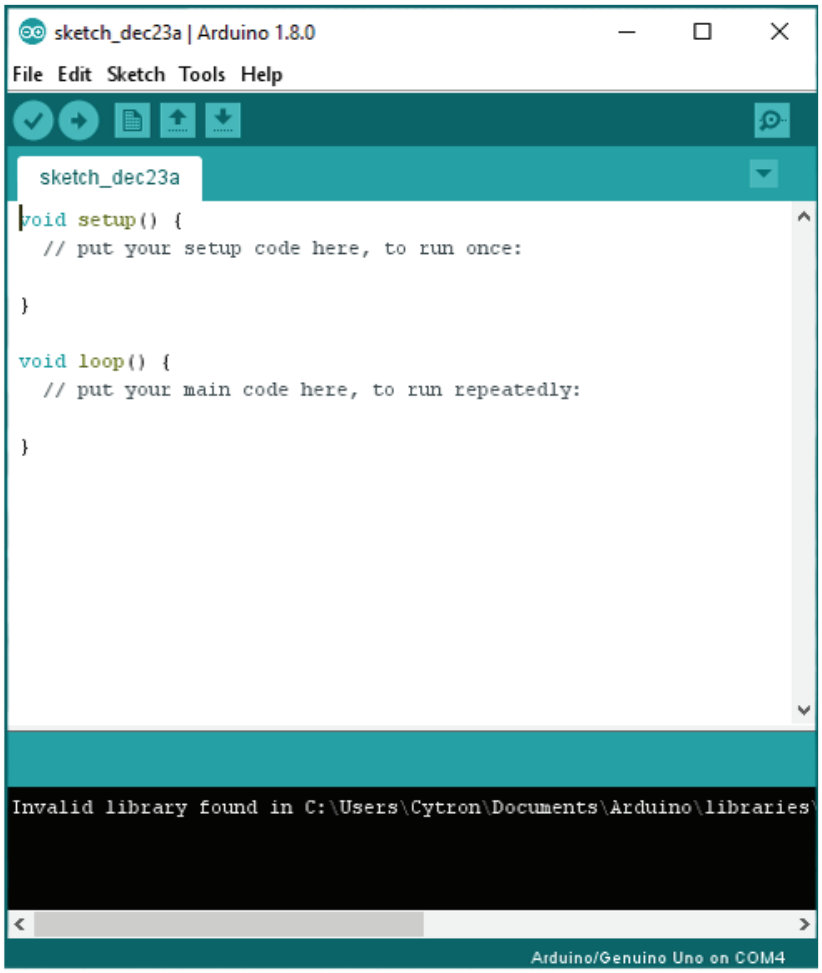
*Note: If you are a Windows user, it is recommended that you choose Windows (installer).

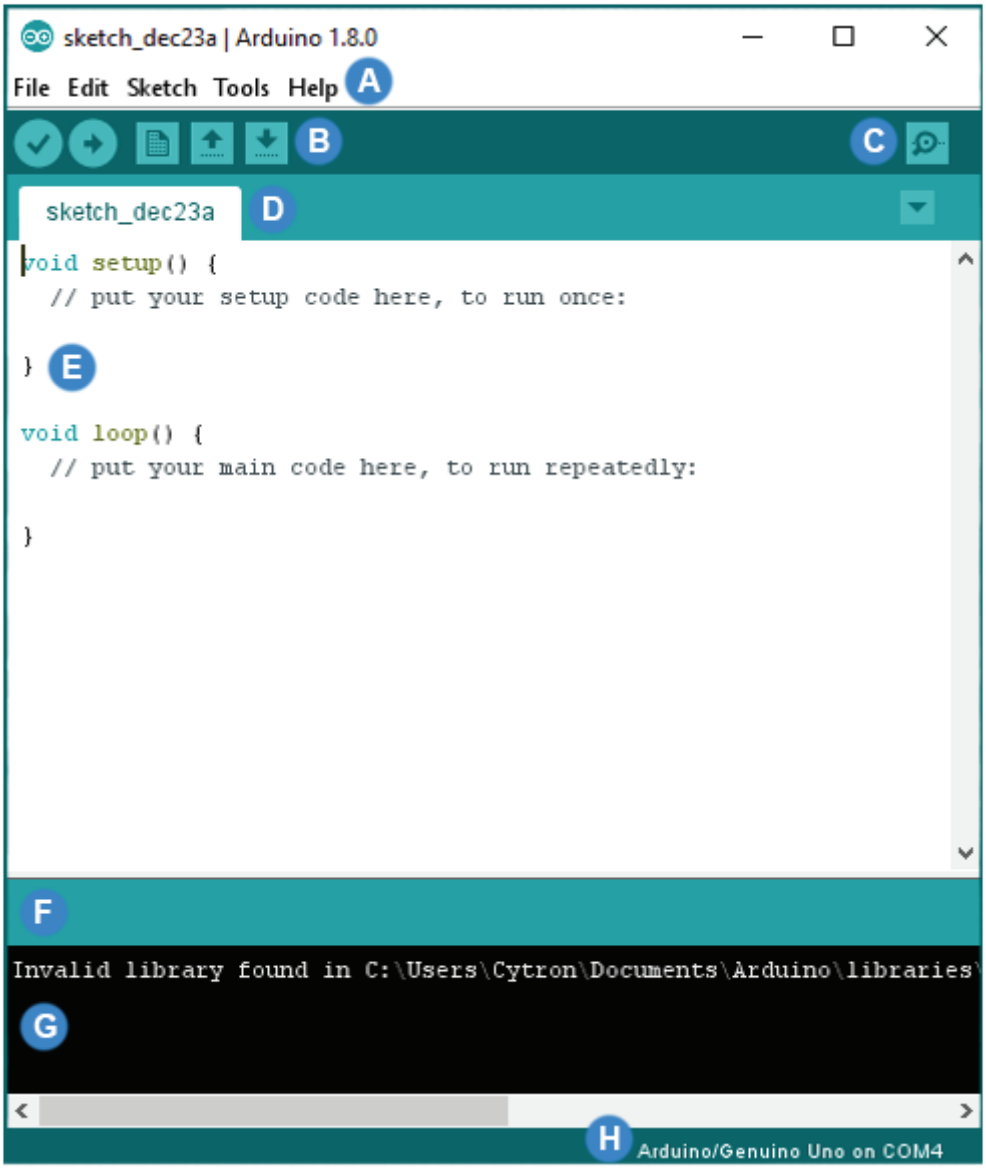
Choose the installer that compatible with your laptop OS and download the Arduino IDE. You will have arduino-1.8.x-windows.exe software after finish downloading for Windows OS user while for Mac OS user, you will get a zip file of arduino-1.8.x-macosx zip file as shown below :



*Note: For latest version of Arduino IDE, go to https://www.arduino.cc/en/Main/Software

Double-click on the icon to install Arduino IDE. Complete the download, proceed with the installation as usual. After finish installing the software, you can start using it by double-click on the icon. Then, you will see this layout of Arduino IDE.

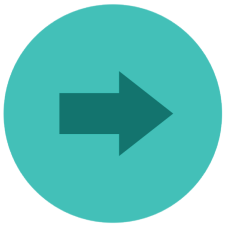




Label	Description	Label	Description
A	Menu Bar	E	Code Area
B	Button Bar	F	Status Bar
C	Serial Monitor	G	IDE Output
D	Sketch Name	H	Board Name and COM Number

Verify

Compiles and approves your code. It will detect errors in syntax (e.g. missing semi colon or parentheses).



Upload

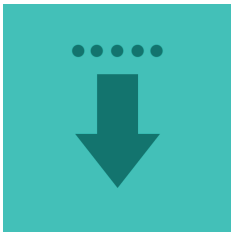
Sends your code to the Maker UNO. When you click it, you should see the lights on your board blink rapidly.

New Sketch

This button opens up a new code window tab.

Open

This button will let you open an existing sketch.



Save

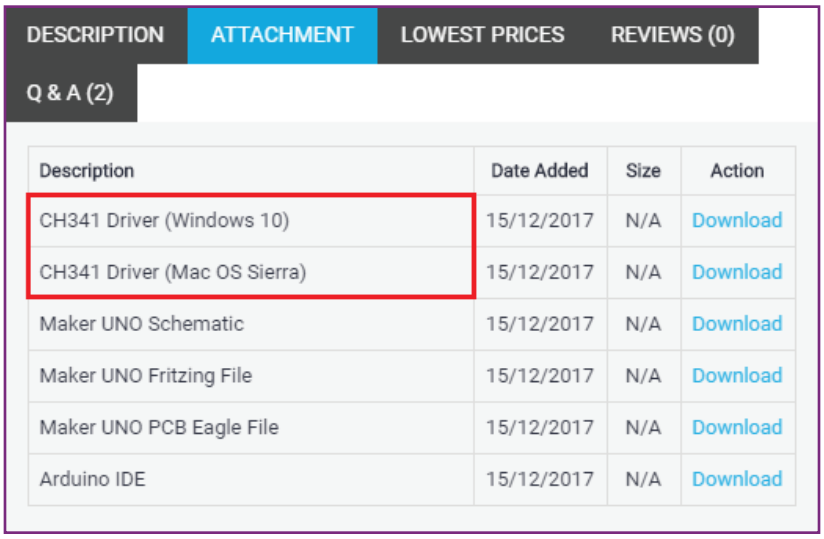
This saves the currently active sketch.

Serial Monitor

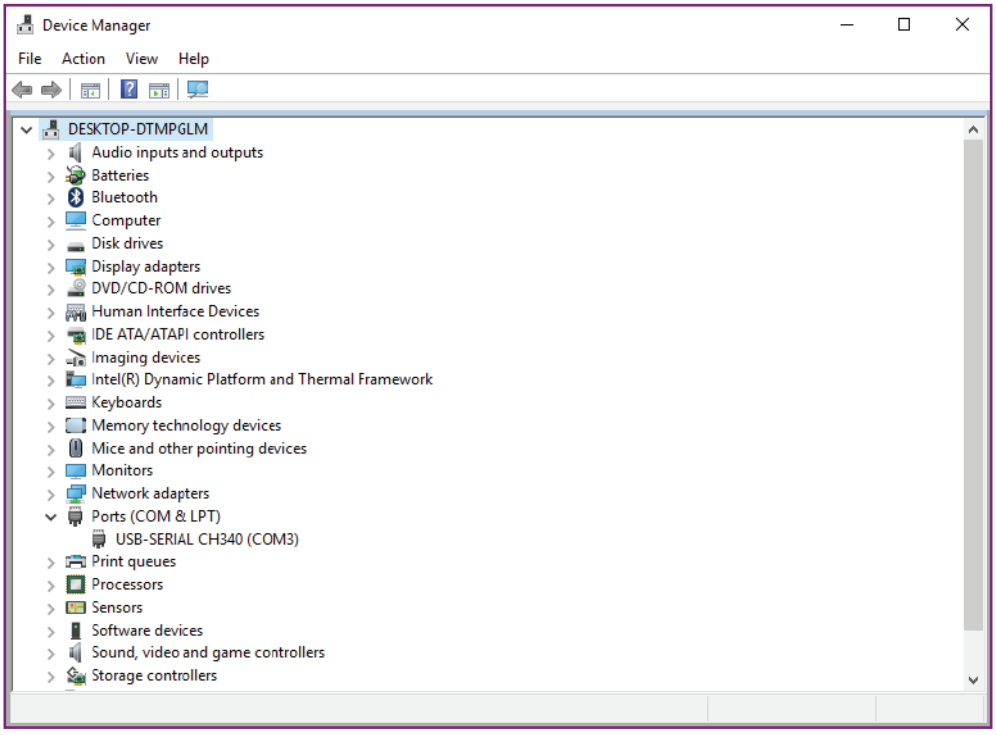
Open Serial Monitor.

INSTALLING MAKER UNO DRIVER

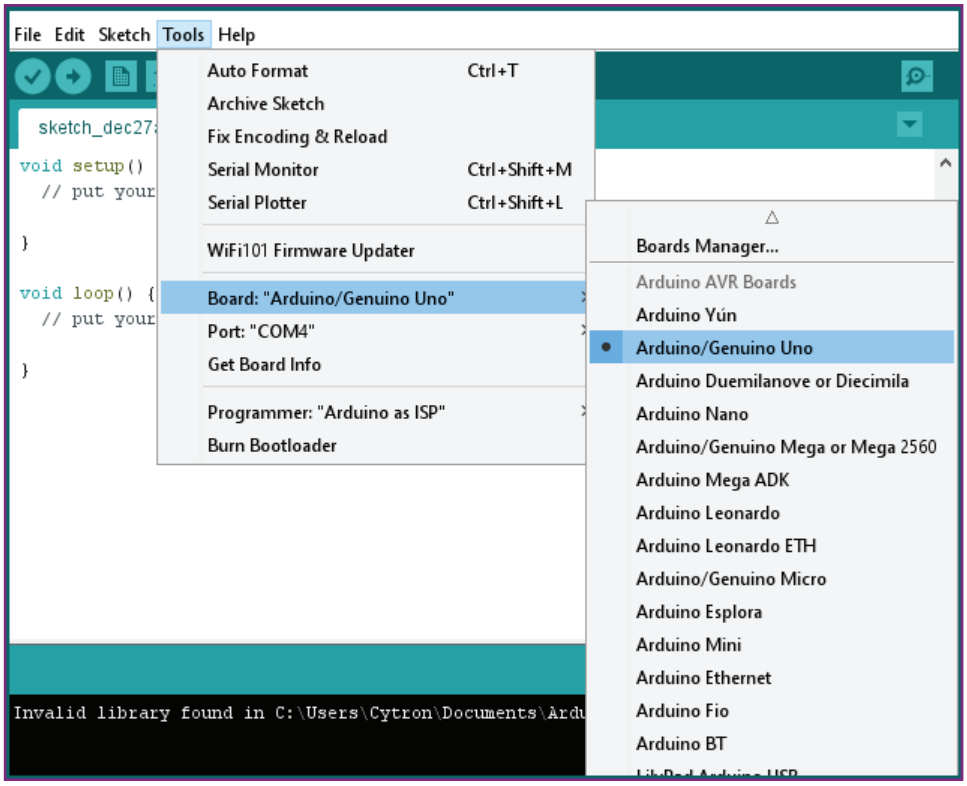
Download Maker UNO driver at Maker Uno product page (under Attachment tab). Please choose appropriate driver depends on your OS. Complete the download, proceed with the installation as usual.



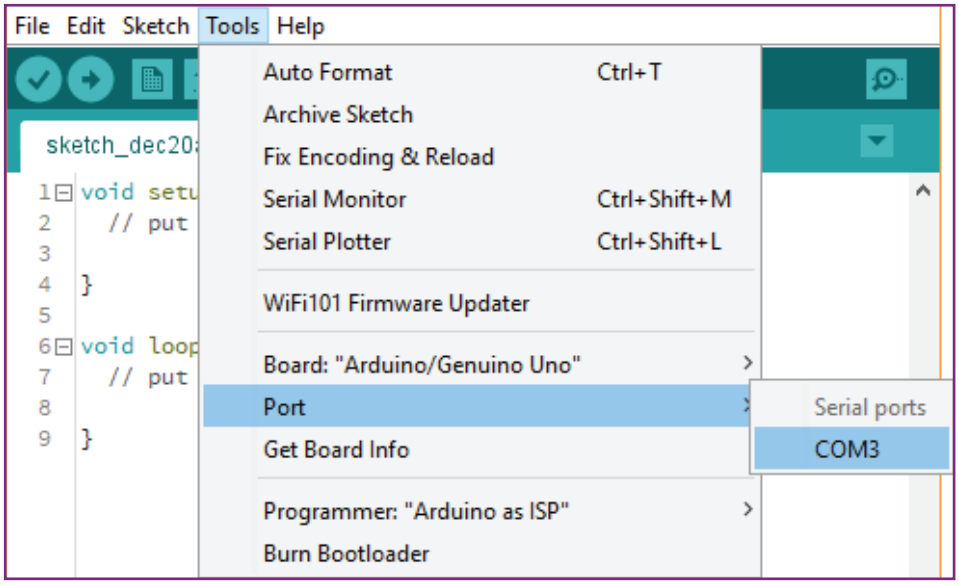
After installation is complete, your Maker UNO port should appears at Device Manager under Ports (COM & LPT) - e.g. USB-SERIAL CH340 (COM3). Please remember the port number.



Select Board :



Select Serial Port :



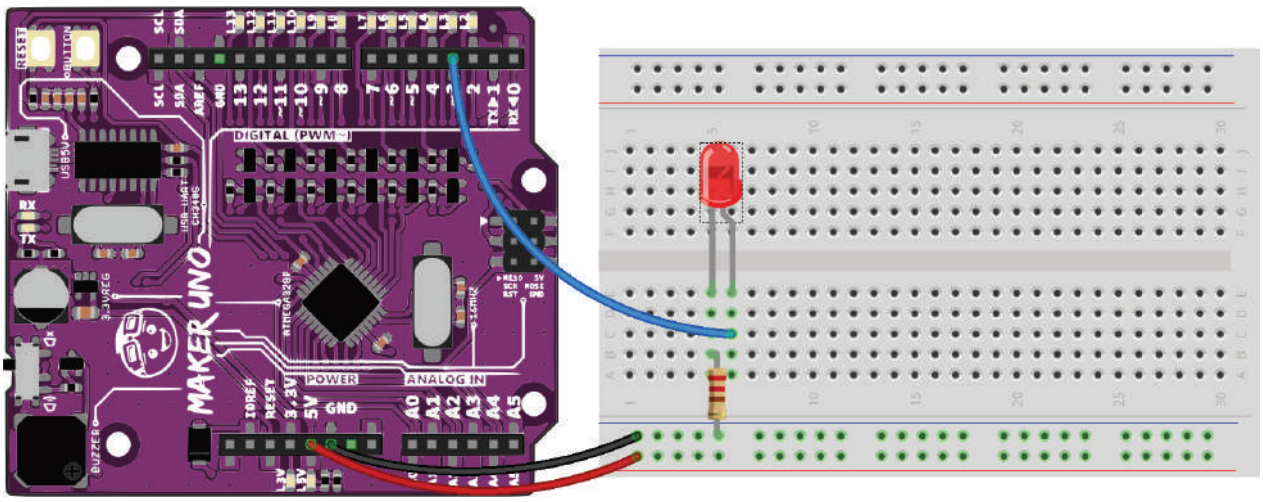
LESSON

LESSON 1
LED BLINKING

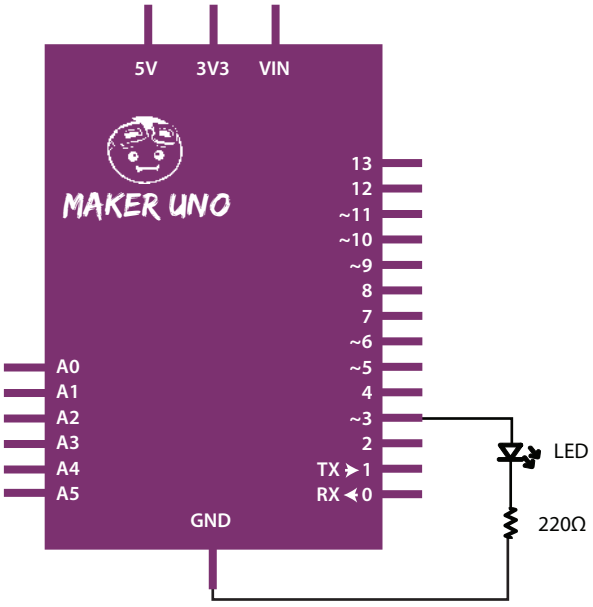
INTRODUCTION

LED is a light emitting diode. It will light up when a proper voltage is applied in correct direction. LED will blink when delay is applied between ON and OFF.

HARDWARE CONNECTION



SCHEMATIC DIAGRAM



ARDUINO CODE

```
void setup()
{
  pinMode(3, OUTPUT);
}

void loop()
{
  digitalWrite(3, HIGH);
  delay(1000);
  digitalWrite(3, LOW);
  delay(1000);
}
```

The **void setup()** runs once when the Maker UNO is powered on. The code in the void setup() usually use to configure the pin as INPUT or OUTPUT using pinMode();

The **digitalWrite(3, HIGH);** digital pin number 3 is set to HIGH which is to turn ON the LED while the **digitalWrite(3, LOW);** digital pin number 3 is set to LOW which is to turn OFF the LED.
The **delay();** is a function to make the Maker UNO from execute anything for the time set in miliseconds. 1000 is equal to 1 second.

RESULT

LED is a light emitting diode. It will light up when a proper voltage is applied in correct direction. LED will blink with a delay of 1 second.

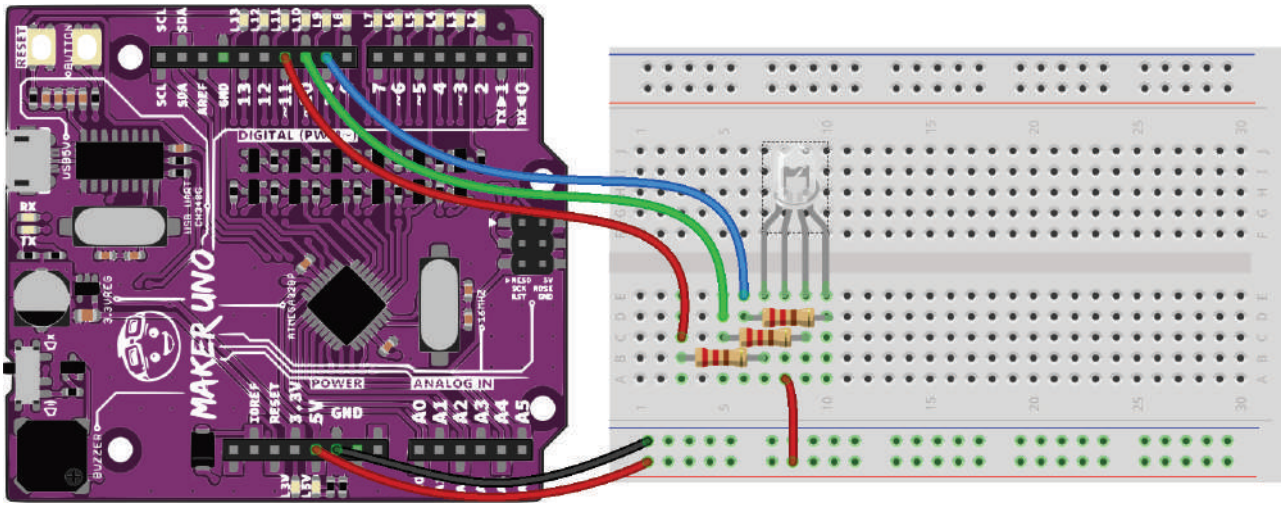
*Note : The built-in LED on pin number 3 will also light up with a delay of 1 second.

LESSON 2
RED GREEN BLUE LED

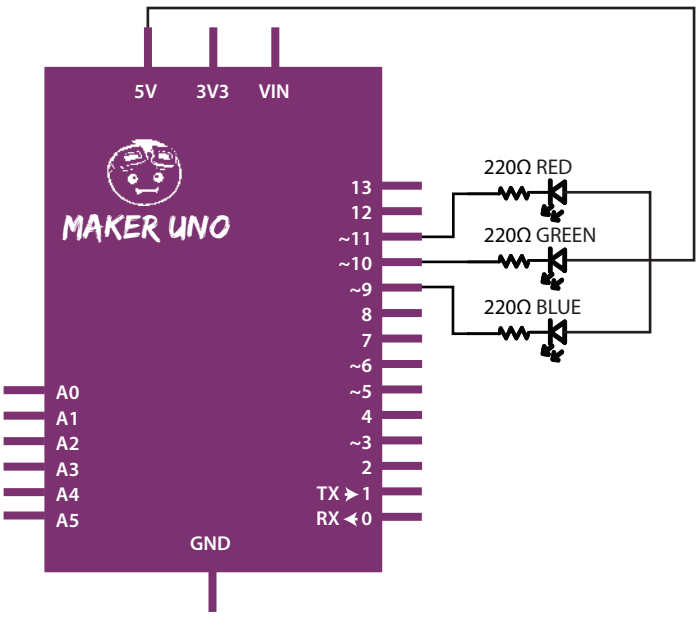
INTRODUCTION

Red Green Blue (RGB) LED is a red, green, blue LED. It is a combination of 3 colors in a single LED.

HARDWARE CONNECTION



SCHEMATIC DIAGRAM



ARDUINO CODE

```
void setup()
{
  pinMode(9, OUTPUT);
  pinMode(10, OUTPUT);
  pinMode(11, OUTPUT);
}

void loop()
{
  // Blue light
  analogWrite(9, 0);
  analogWrite(10, 255);
  analogWrite(11, 255);
  delay(1000);
  // Green light
  analogWrite(9, 255);
  analogWrite(10, 0);
  analogWrite(11, 255);
  delay(1000);
  // Red light
  analogWrite(9, 255);
  analogWrite(10, 255);
  analogWrite(11, 0);
  delay(1000);
}
```

The **analogWrite(9, 0);** set the OUTPUT of the pin number 9's brightness to 0. The value can be from 0 to 255. analogWrite(); works only with PWM pin which has "~ " symbol.

RESULT

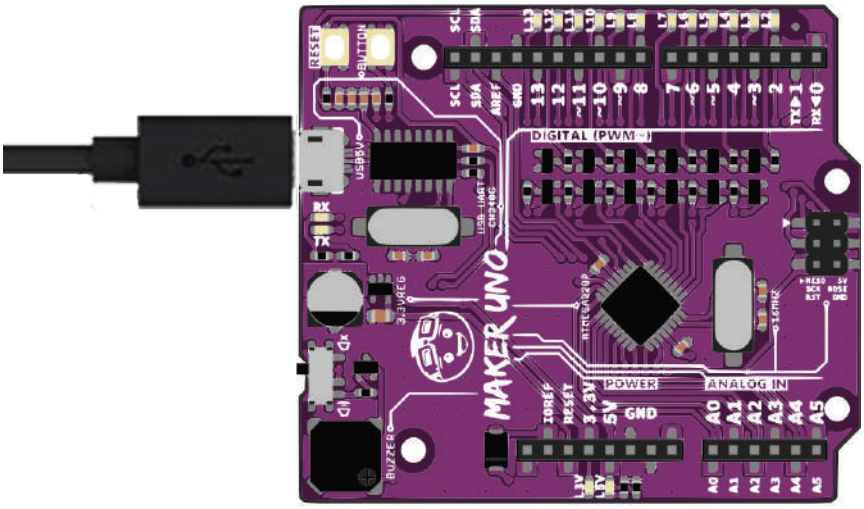
Three colors (blue, green and red) will light up. It will change colour every 1 second.

LESSON 3
CREATE MELODY WITH PIEZO BUZZER

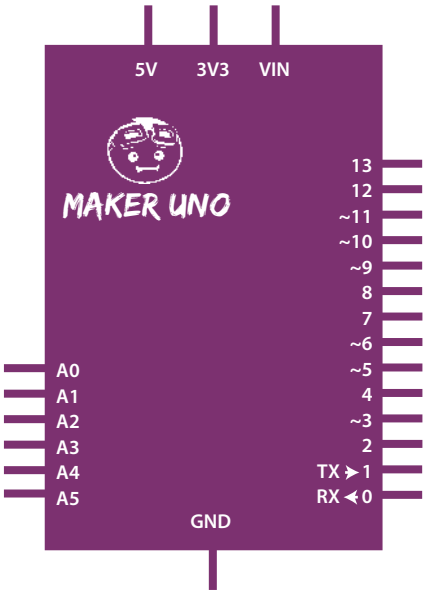
INTRODUCTION

Piezo buzzer can produce different notes by controlling the voltage frequency. Maker UNO has a built-in piezo buzzer on digital pin 8.

HARDWARE CONNECTION



SCHEMATIC DIAGRAM



ARDUINO CODE

```
  #include "pitches.h"

   int melody[] = {
   NOTE_C4, NOTE_G3, NOTE_G3, NOTE_A3, NOTE_G3, 0, NOTE_B3,
NOTE_C4
     };

    int noteDurations[] = {
     4, 8, 8, 4, 4, 4, 4, 4
     };

  void setup()
  {
   for (int thisNote = 0; thisNote < 8; thisNote++)
     {
      int noteDuration = 1000 / noteDurations[thisNote];
      tone(8, melody[thisNote], noteDuration);
      int pauseBetweenNotes = noteDuration * 1.30;
      delay(pauseBetweenNotes);
      noTone(8);
     }

  void loop()
  {
```

RESULT

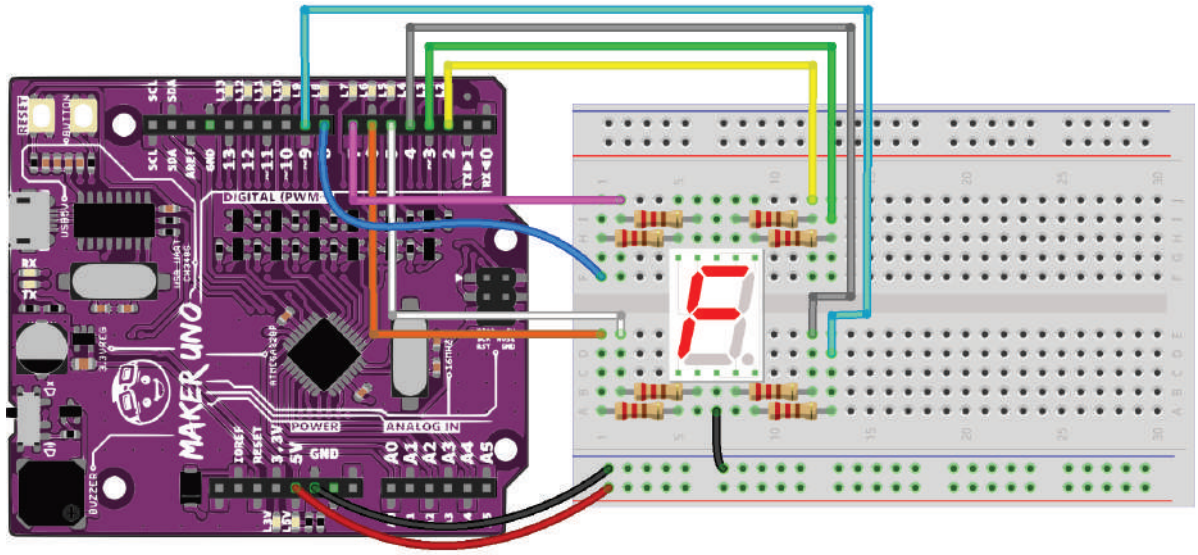
Piezo buzzer generates a melody.

LESSON 4
7 SEGMENT DISPLAY

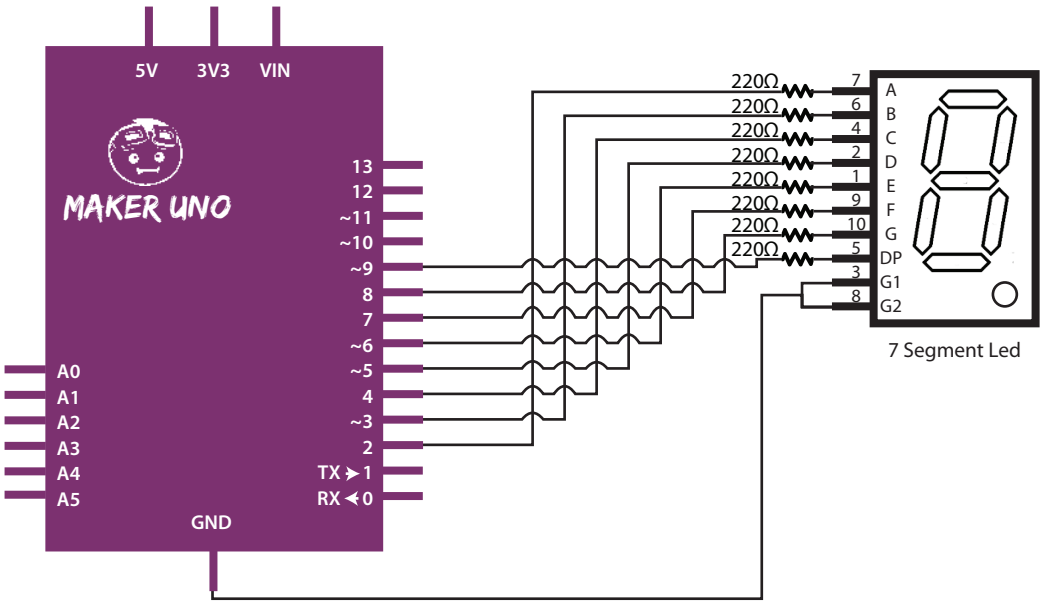
INTRODUCTION

7 segment display is an arrangement of LEDs that able to display decimal numbers.

HARDWARE CONNECTION



SCHEMATIC DIAGRAM



ARDUINO CODE

```
int sevenSegment[5][8] = {
{HIGH, HIGH, HIGH, HIGH, HIGH, HIGH, LOW, LOW}, // 0
{LOW, HIGH, HIGH, LOW, LOW, LOW, LOW, LOW}, // 1
{HIGH, HIGH, LOW, HIGH, HIGH, LOW, HIGH, LOW}, // 2
{HIGH, HIGH, HIGH, HIGH, LOW, LOW, HIGH, LOW}, // 3
{LOW, HIGH, HIGH, LOW, LOW, HIGH, HIGH, LOW}, // 4
};

int pin, number;

void setup()
{
 for(pin = 2; pin < 10; pin++)
    pinMode(pin, OUTPUT);
}

void loop()
{
  for(number = 0; number < 5; number++)
  {
    for(pin = 0; pin < 8; pin++)
    digitalWrite(pin+2, sevenSegment[number][pin]);
    delay(1000);
   }
}
```

RESULT

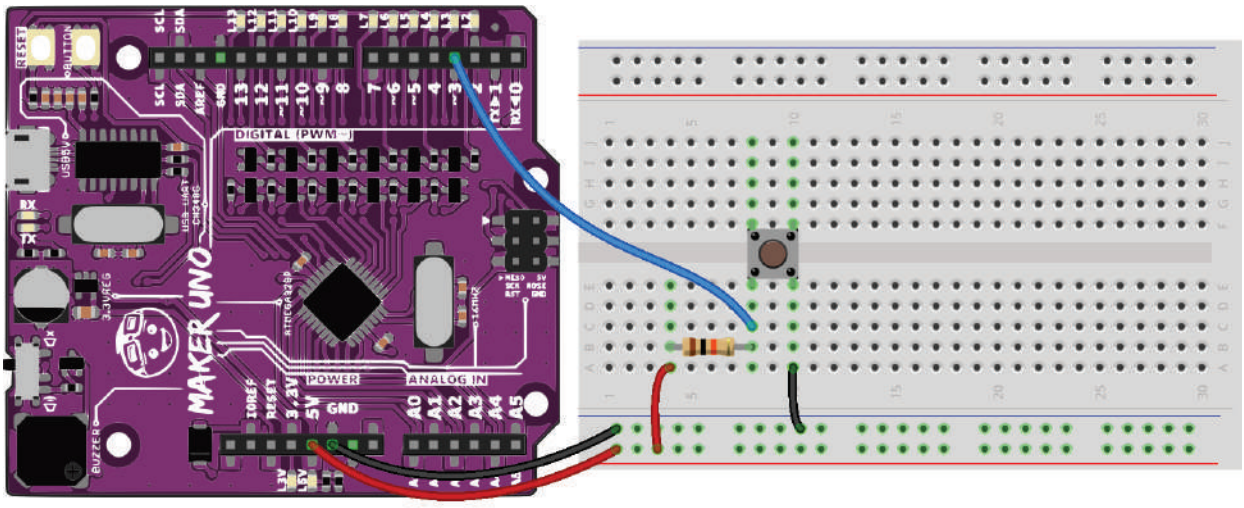
7-segment will display a looping counter from 0 to 4.

LESSON 5
PUSH BUTTON AS DIGITAL INPUT

INTRODUCTION

Push button can act as a digital input device. Maker UNO is able to sense 2 states for digital input, i.e. HIGH and LOW

HARDWARE CONNECTION



SCHEMATIC DIAGRAM

ARDUINO CODE

```
*Open Button example (File - Examples - 02.Digital - Button).

const int buttonPin = 3;
const int ledPin =  13;
int buttonState = 0;

void setup()
{
 pinMode(ledPin, OUTPUT);
 pinMode(buttonPin, INPUT);
}


void loop()
{
  buttonState = digitalRead(buttonPin);
  if(buttonState == LOW) // Push button is pressed
  digitalWrite(ledPin, HIGH);
  else digitalWrite(ledPin, LOW);
}
```

RESULT

If push button is pressed, LED on Maker UNO will turn on and if push button is released, LED will turn off.

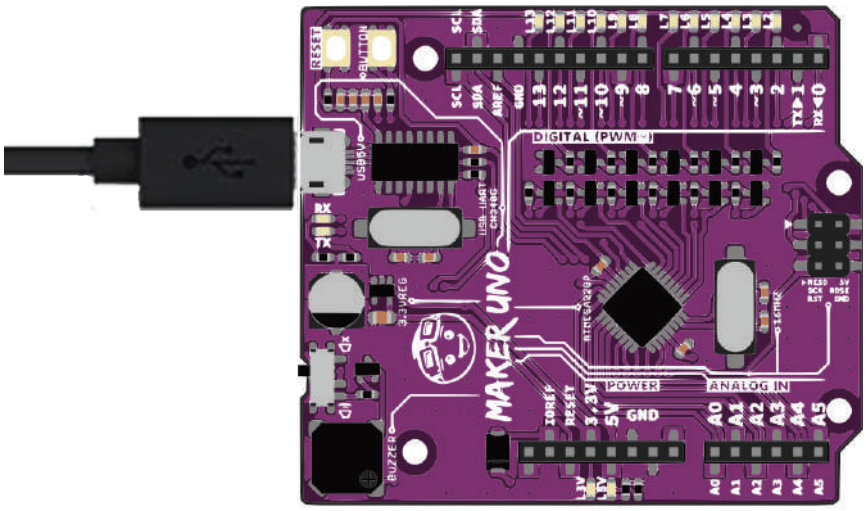
*Note : You may use the built-in push button on pin number 2 by using pinMode(2,INPUT_PULLUP);

LESSON 6
SERIAL DISPLAY ON COMPUTER

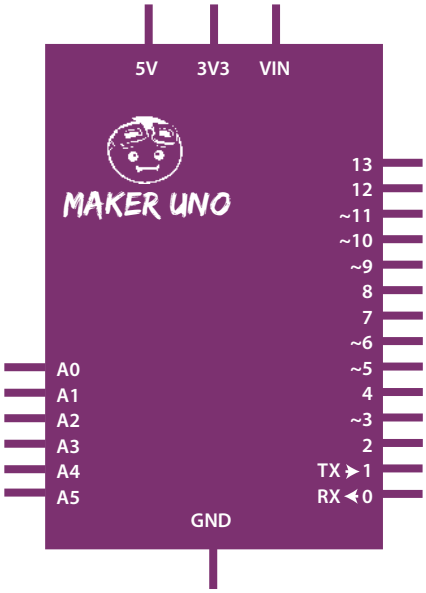
INTRODUCTION

Serial display can display numbers and characters (based on ASCII data) on the Arduino Serial Monitor. Click on the symbol to see the result!

HARDWARE CONNECTION



SCHEMATIC DIAGRAM



ARDUINO CODE

```
int Button = 2;

void setup()
{
 pinMode(2, INPUT_PULLUP);
 Serial.begin(9600);
}

void loop()
{
  if (digitalRead(Button) == LOW)
  {
    Serial.print("Button is PRESS!");
  }
  else if (digitalRead(Button) == HIGH)
  {
    Serial.println("Button is NOT PRESS!");
  }
}
```

The **Serial.begin()** open a serial communication between the MAKER-UNO and the computer. 9600 is the baud rate of the comunication. The serial monitor must use the same baud rate to view the information.

The **Serial.print()** sends information from MAKER-UNO to the connected computer. The information will be in the

RESULT

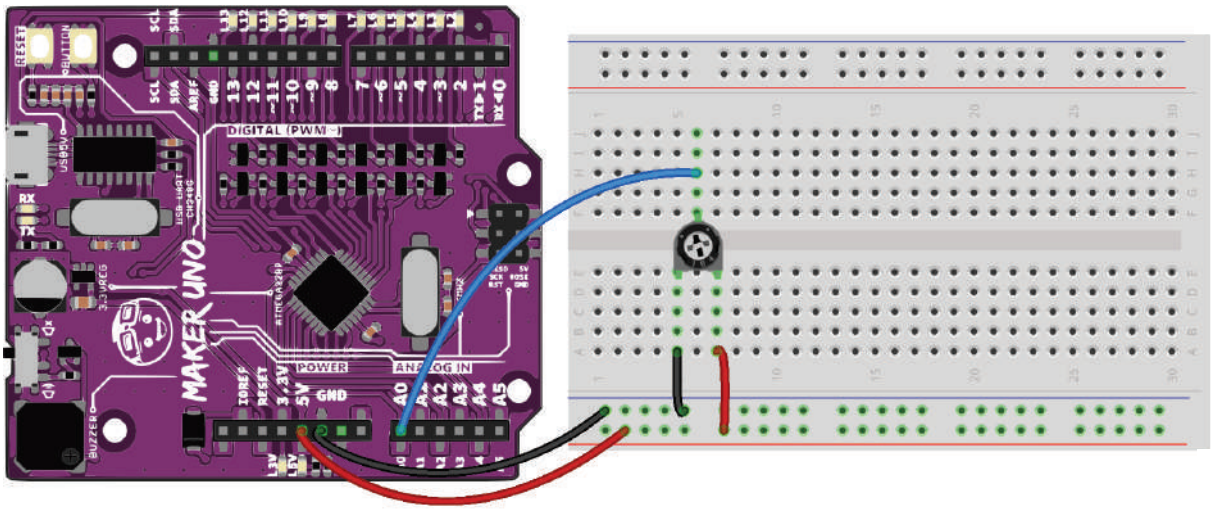
The Serial Monitor will print "Button is PRESS!" when the button is realesed and the Serial Monitor will print "Button is NOT PRESS!" when the button is not pressed.

LESSON 7
POTENTIOMETER AS ANALOG INPUT

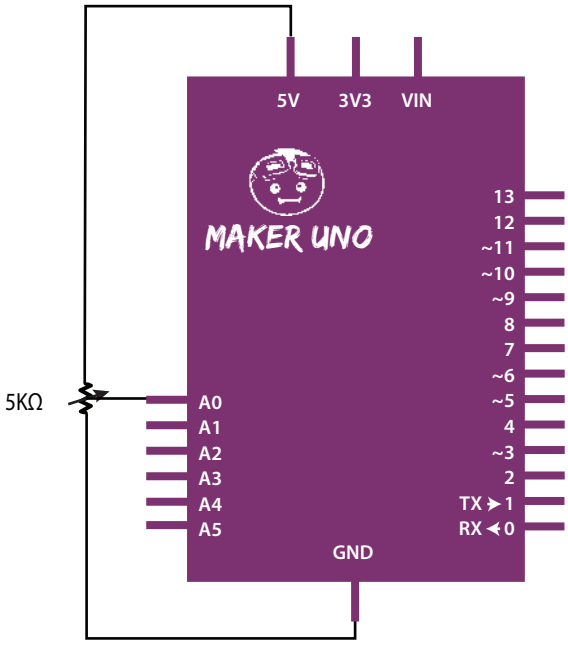
INTRODUCTION

Potentiometer can be an analog input device. Maker UNO is able to read 1024 (10-bits) from 0 - 1023 as analog input.

HARDWARE CONNECTION



SCHEMATIC DIAGRAM



ARDUINO CODE

```
int sensorPin = A0;
int ledPin = 13;
int sensorValue = 0;

void setup()
{
  pinMode(ledPin, OUTPUT);
}


void loop()
{
  sensorValue = analogRead(sensorPin);
  digitalWrite(ledPin, HIGH);
  delay(sensorValue);
  digitalWrite(ledPin, LOW);
  delay(sensorValue);
}
```

RESULT

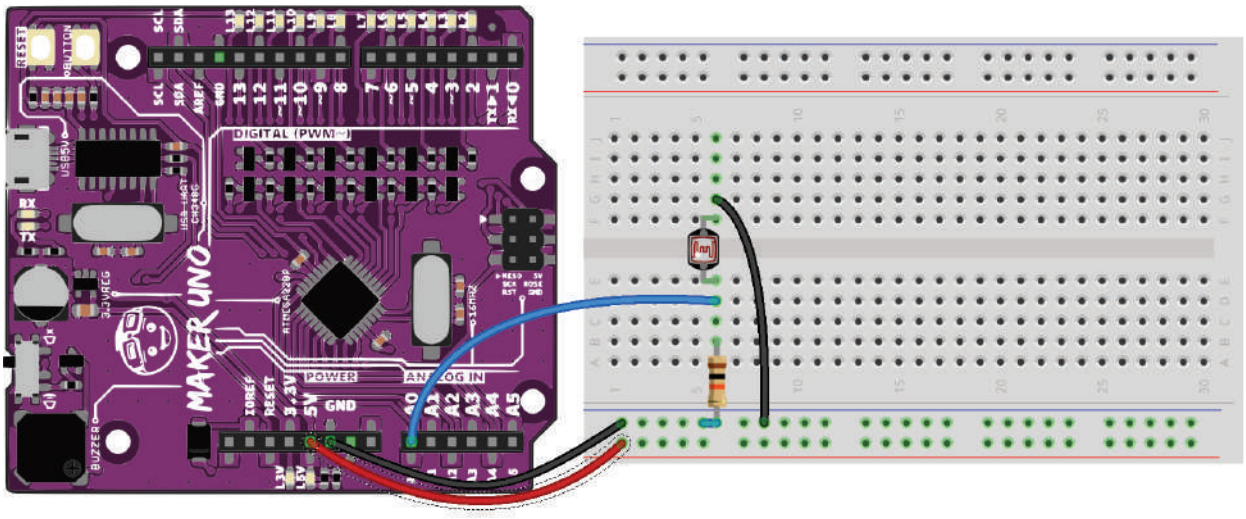
When the potentiometer's value changes, it will affect the LED pin 13 blinking speed.

LESSON 8
LIGHT DEPENDENT RESISTOR AS ANALOG INPUT

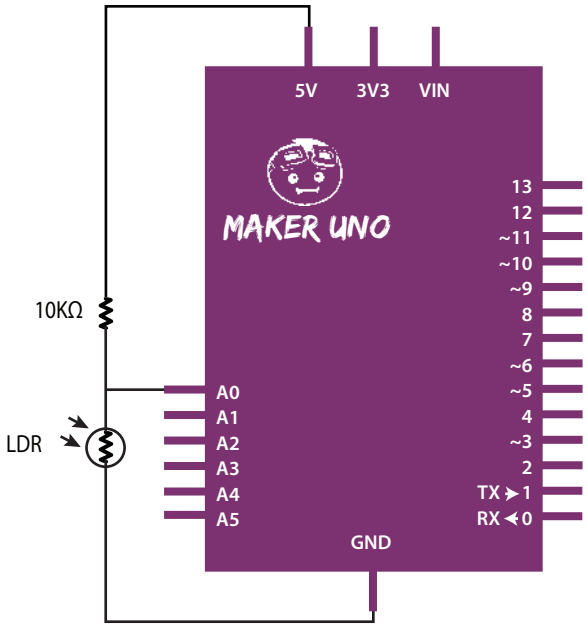
INTRODUCTION

LDR (Light Dependent Resistor) is a sensor that can generate a different resistance value based on the amount of light intensity it receives

HARDWARE CONNECTION



SCHEMATIC DIAGRAM



ARDUINO CODE

```
int sensorPin = A0;
int ledPin = 13;
int sensorValue = 0;

void setup()
{
  pinMode(ledPin, OUTPUT);
}


void loop()
{
  sensorValue = analogRead(sensorPin);
if(sensorValue > 900)
  digitalWrite(ledPin, HIGH);
else
  digitalWrite(ledPin, LOW);
}
```

RESULT

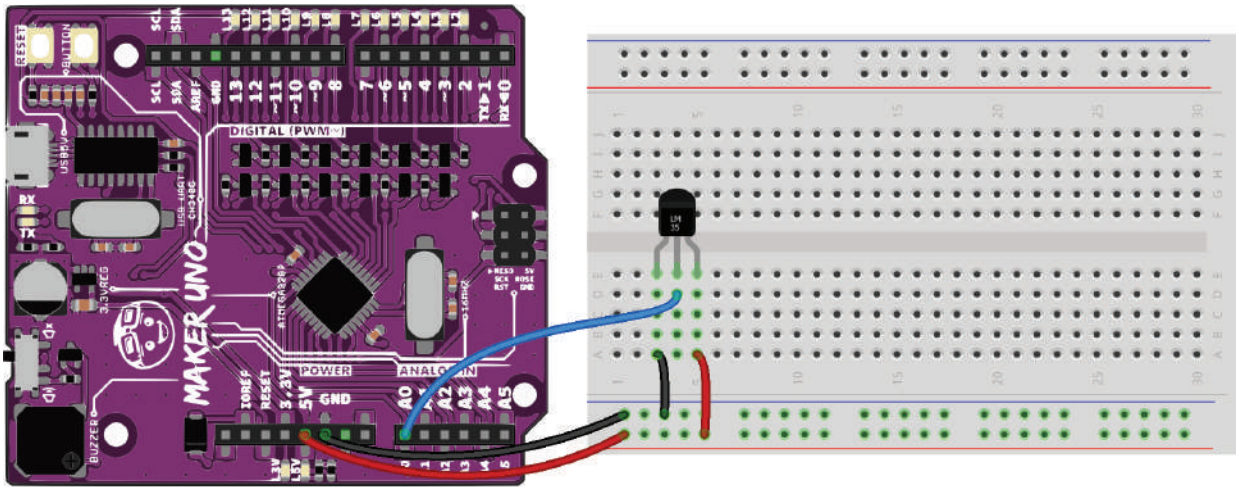
When it is dark, the LED on pin 13 will light up.

LESSON 9
TEMPERATURE SENSOR

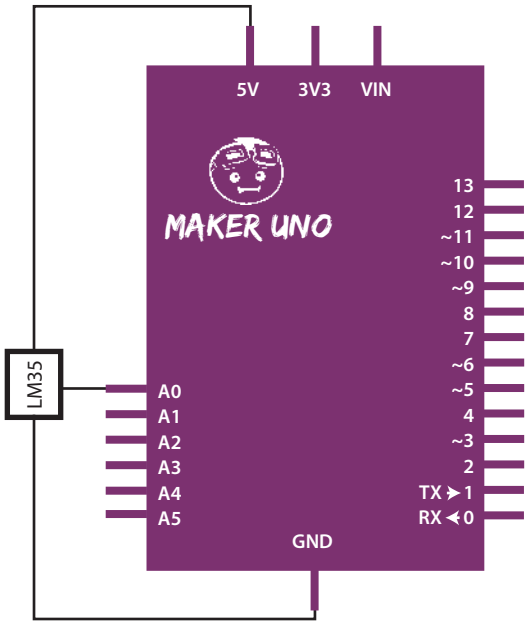
INTRODUCTION

Temperature sensor can be used to measure surrounding temperature. It will produce a voltage proportional to temperature (°C). The voltage output is based on temperature of the component.

HARDWARE CONNECTION



SCHEMATIC DIAGRAM



ARDUINO CODE

```
int sensorPin = A0;
int sensorValue = 0;

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


void loop()
{
  sensorValue = analogRead(sensorPin);
  Serial.print("ADC :");
  Serial.print(sensorValue);
  Serial.print("  Temperature : ");
  Serial.print(sensorValue*0.488); // Convert ADC to Celcius
  Serial.print(186); // ASCII degree symbol
  Serial.println("C");
  delay(100);
}
```

RESULT

ADC and temperature value displays on Arduino Serial Monitor (need to open Arduino Serial Monitor).


PROJECT

PROJECT 1
INTERACTIVE TRAFFIC LIGHT

INTRODUCTION

Interactive Traffic Light is a combination of standard traffic light for vehicles and traffic light for pedestrian.

This project applies knowledge outcome from:
Lesson 1: LED Blinking
Lesson 6: Push Button as Digital Input

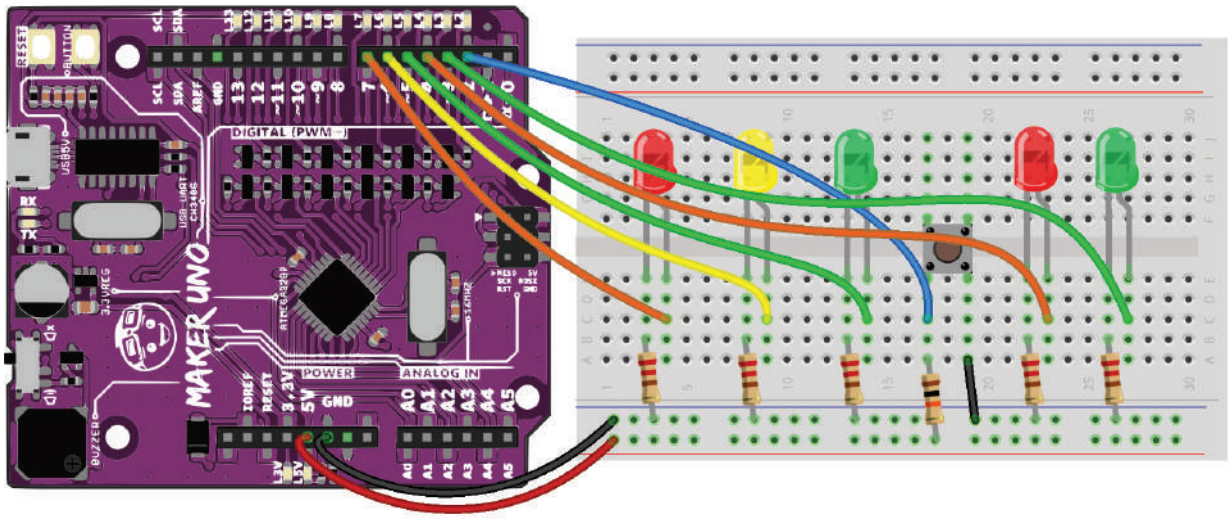
INGREDIENTS

a. Maker UNO - 1x
b. Breadbord - 1x
c. Red LED - 2x
d. Green LED - 2x
e. Yellow LED - 1x
f. Push button - 1x
g. Resistor 220Ω - 5x
h. Resistor 10kΩ - 1x
i. Jumper wires

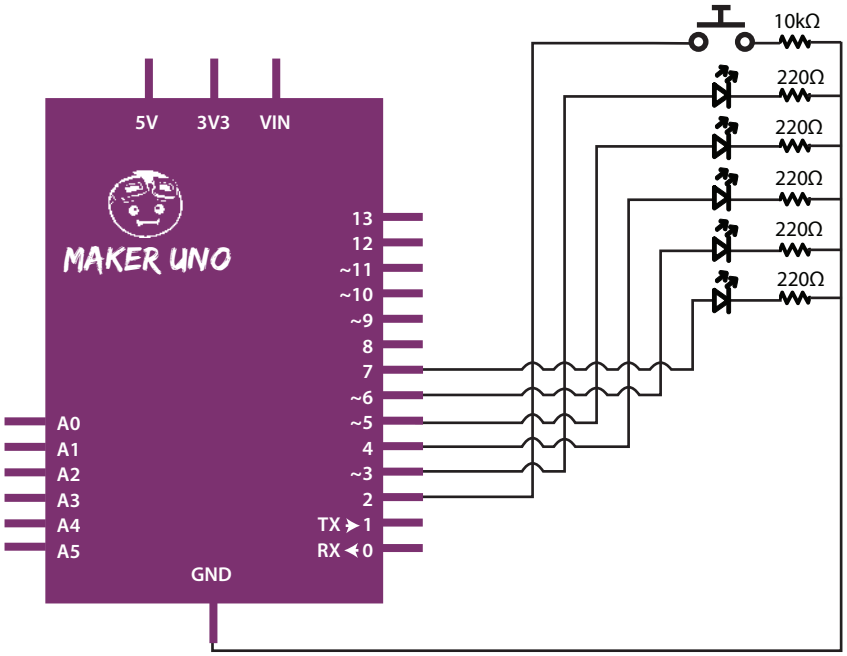
INSTRUCTION

Using all the parts above to create a simple traffic light system for vehicles and pedestrian. At start/normal condition, green LED (vehicle) and red LED (pedestrian) will light up. When push button is pressed, green LED (vehicle) will turn off and yellow LED (vehicle) will turn on for 2 seconds. After that, yellow LED (vehicle) will turn off and red LED (vehicle) will light up. After 1 second, when it is time for pedestrians to cross the road, green LED (pedestrian) will turn on for 5 seconds. Then, green LED (pedestrian) will turn off and red LED (pedestrian) will turn on. After 1 second, it will be back to normal condition.

HARDWARE CONNECTION



SCHEMATIC DIAGRAM



ARDUINO CODE

```
const int greenLedVehicle = 5;
const int yellowLedVehicle = 6;
const int redLedVehicle = 7;
const int greenLedPedestrian = 3;
const int redLedPedestrian = 4;
const int pushButton = 2;

void setup()
{
  pinMode(greenLedVehicle, OUTPUT);
  pinMode(yellowLedVehicle, OUTPUT);
  pinMode(redLedVehicle, OUTPUT);
  pinMode(greenLedPedestrian, OUTPUT);
  pinMode(redLedPedestrian, OUTPUT);
  pinMode(pushButton, INPUT);

  digitalWrite(greenLedVehicle, HIGH);
  digitalWrite(redLedPedestrian, HIGH);
}

void loop()
{
 if(digitalRead(pushButton) == LOW)
  {
    digitalWrite(greenLedVehicle, LOW);
    digitalWrite(yellowLedVehicle, HIGH);
    delay(2000);
    digitalWrite(yellowLedVehicle, LOW);
    digitalWrite(redLedVehicle, HIGH);
    delay(1000);
    digitalWrite(redLedPedestrian, LOW);
    digitalWrite(greenLedPedestrian, HIGH);
    delay(5000);
    digitalWrite(greenLedPedestrian, LOW);
    digitalWrite(redLedPedestrian, HIGH);
    delay(1000);
    digitalWrite(redLedVehicle, LOW);
    digitalWrite(greenLedVehicle, HIGH);
  }
}
```

PROJECT 2
SMART FIRE ALARM SYSTEM

INTRODUCTION

Smart Fire Alarm System is a fire alarm system project that will alert the surrounding if the temperature is above than normal temperature. If the temperature exceeds a certain value, the buzzer will sound and LED will blink.

This project applies knowledge outcome from:
Lesson 1: LED Blinking
Lesson 3: Create Melody with Piezo
Lesson 9: Temperature Sensor

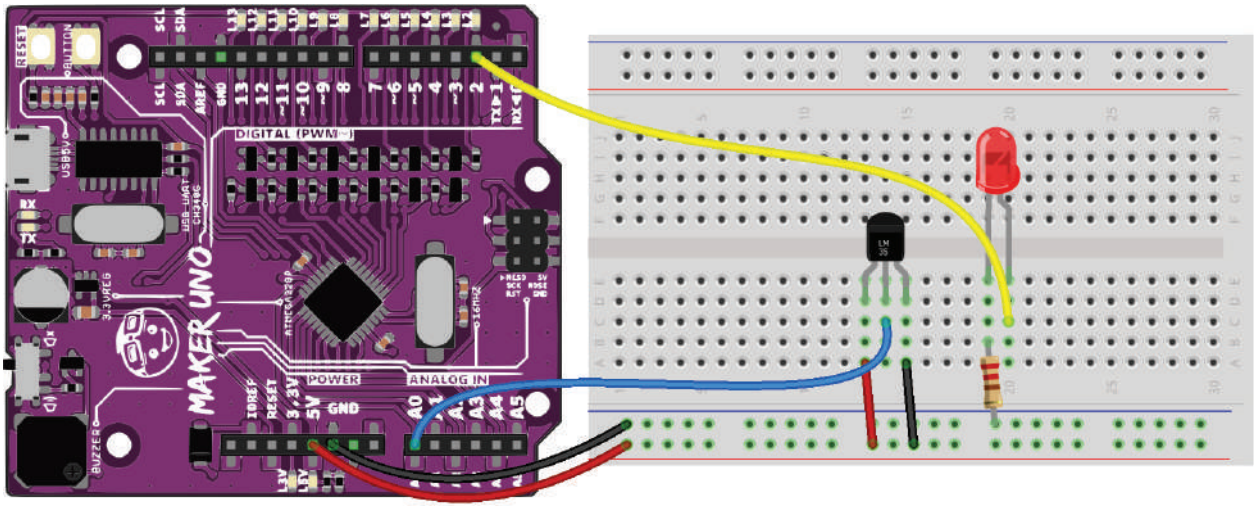
INGREDIENTS

a. Maker UNO - 1x
b. Breadbord - 1x
c. Red LED - 1x
d. Resistor 220Ω - 1x
e. Temperature sensor - 1x
f. Jumper wires

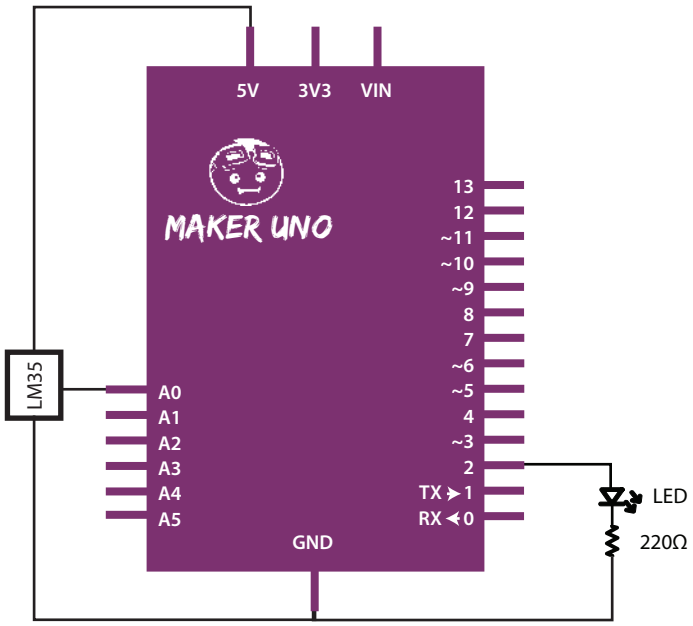
INSTRUCTION

Using all the parts above and create a simple Smart Fire Alarm System. When the temperature (detected by temperature sensor LM35) exceeds 30°C, the buzzer will sound and the LED will blink. When the temperature is less than 30°C, buzzer and LED will turn off.

HARDWARE CONNECTION



SCHEMATIC DIAGRAM



ARDUINO CODE

```
#include "pitches.h"
const int ledPin = 2;
const int piezoPin = 8;
const int sensorPin = A0;
int celsius = 0;

void setup()
{
  pinMode(ledPin, OUTPUT);
  pinMode(piezoPin, OUTPUT);
  pinMode(sensorPin, INPUT);
}

void loop()
{
  celsius = analogRead(sensorPin) * 0.488;

if(celsius > 30) // if temperature > 30 degree celsius
  {
    digitalWrite(ledPin, HIGH);
    tone(piezoPin, NOTE_B4, 500);
    delay(500);
    digitalWrite(ledPin, LOW);
    tone(piezoPin, NOTE_C4, 500);
    delay(500);
    noTone(piezoPin);
  }
}
```

PROJECT 3
LIGHT THEREMIN

INTRODUCTION

A theremin is an instrument that makes sounds based on the movements of a musician's hands around the instrument. This project will use LDR as an input where the amount of light intensity will determine the melody notes.

This project applies knowledge outcome from:
Lesson 3: Create Melody with Piezo
Lesson 8: Light Dependent Resistor

INGREDIENTS

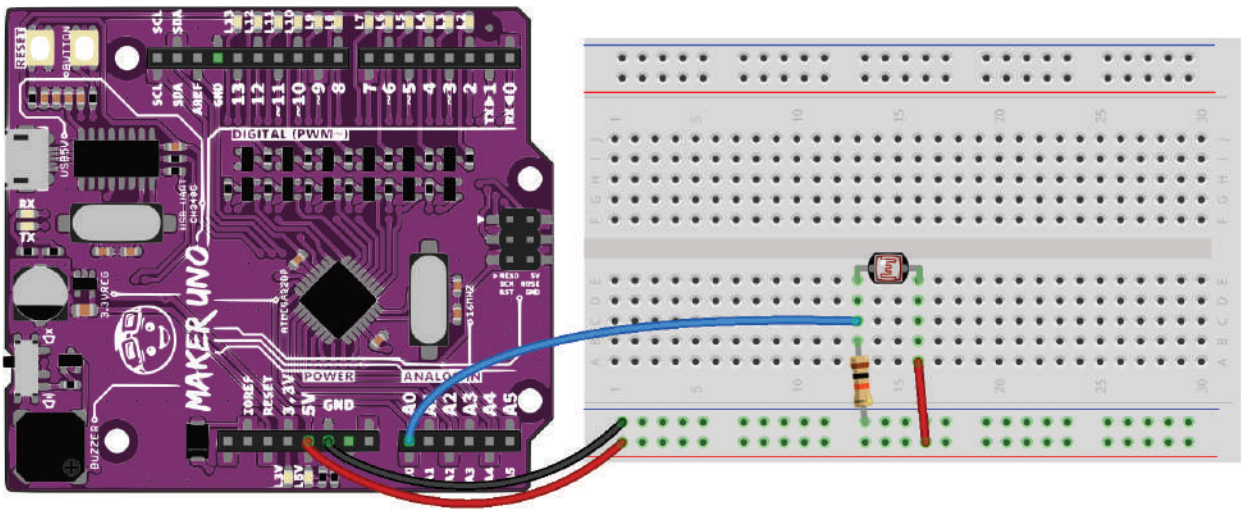
a. Maker UNO - 1x
b. Breadbord - 1x
c. Resistor 10kΩ - 1x
d. LDR - 1x
e. Jumper wires

INSTRUCTION

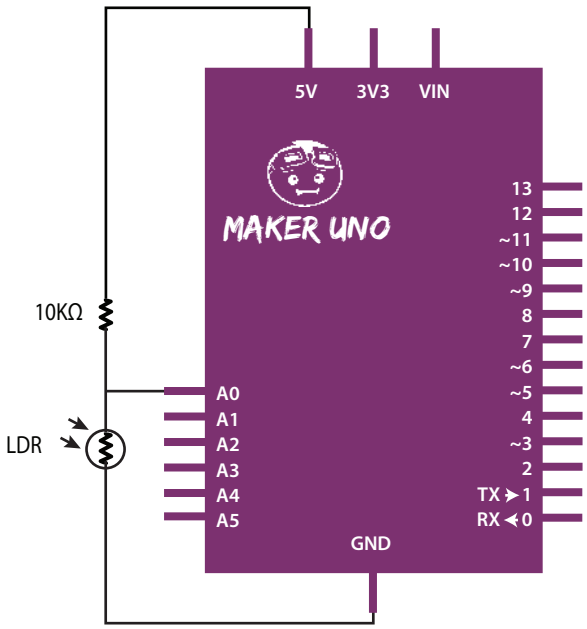
Using all the parts above and create an instrument that creates melody played by piezo depends on your hand position. The closer your hand is to the LDR, the higher the notes that will be produced. When you withdraw your hand, no sound will be generated. So, enjoy the melody you create!

Note: To calibrate the sensor, move your hand up and down over the LDR for 5 seconds to change the amount of light that reaches it. The closer you replicate the motions you expect to use while playing the instrument, the better the calibration will be.

HARDWARE CONNECTION



SCHEMATIC DIAGRAM



ARDUINO CODE

```
#include "pitches.h"
int melody[49] = {
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
NOTE_C2, NOTE_D2, NOTE_E2, NOTE_F2, NOTE_G2, NOTE_A2, NOTE_B2,
NOTE_C3, NOTE_D3, NOTE_E3, NOTE_F3, NOTE_G3, NOTE_A3, NOTE_B3,
NOTE_C4, NOTE_D4, NOTE_E4, NOTE_F4, NOTE_G4, NOTE_A4, NOTE_B4,
NOTE_C5, NOTE_D5, NOTE_E5, NOTE_F5, NOTE_G5, NOTE_A5, NOTE_B5,
NOTE_C6, NOTE_D6, NOTE_E6, NOTE_F6, NOTE_G6, NOTE_A6, NOTE_B6
};
int sensorValue = 0;
int sensorLow = 1023;
int sensorHigh = 0;
const int ledPin = 13;


void setup()
{
  pinMode(ledPin, OUTPUT);
  digitalWrite(ledPin, HIGH);

// Calibrate for the first five seconds after program runs
  while(millis() < 5000)
  {
    sensorValue = analogRead(A0);
    if(sensorValue > sensorHigh)
      sensorHigh = sensorValue;
    if(sensorValue < sensorLow)
      sensorLow = sensorValue;
  }
  digitalWrite(ledPin, LOW);
}
void loop()
{
  sensorValue = analogRead(A0);
  int pitch = map(sensorValue, sensorLow, sensorHigh, 48, 0);
  tone(8, melody[pitch], 50);
  delay(50);
  noTone(8);
  delay(150);
}
```

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