

① Distance Measurement Using Arduino

Every note is ✓.

Ultrasonic Sensor HC-SR04

Why?

Ultrasonic Sensor HC-SR04 is a sensor that can measure distance

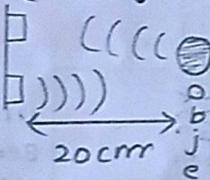
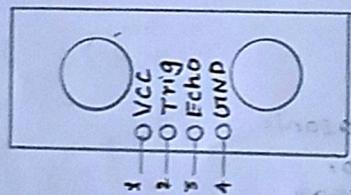
How?

It emits an ultrasound at 40000 Hz (40 kHz) which travels through the air and if there is an object or obstacle on its path It will bounce back to the module.

Considering the travel time and the speed of the sound you can calculate the distance.

Configuration Pin of HC-SR04:

(working)



* Speed of sound :

$$V = 340 \text{ m/s}$$

$$V = 0.034 \text{ m/s}$$

formula

$$\text{Time} = \text{Distance} / \text{speed}$$

$$t = s/v = 20 / 0.034 \\ = 588 \mu\text{s}$$

$$s = t \times 0.034 / 2$$

1	Vcc	Power supply \leftrightarrow 5v pin on the Arduino
2	Trig	trigger the ultrasonic sound pulses
3	Echo	Echo Pin produces a pulse when the reflected signal is received
4	GND	ground pin connect it to GND of Arduino

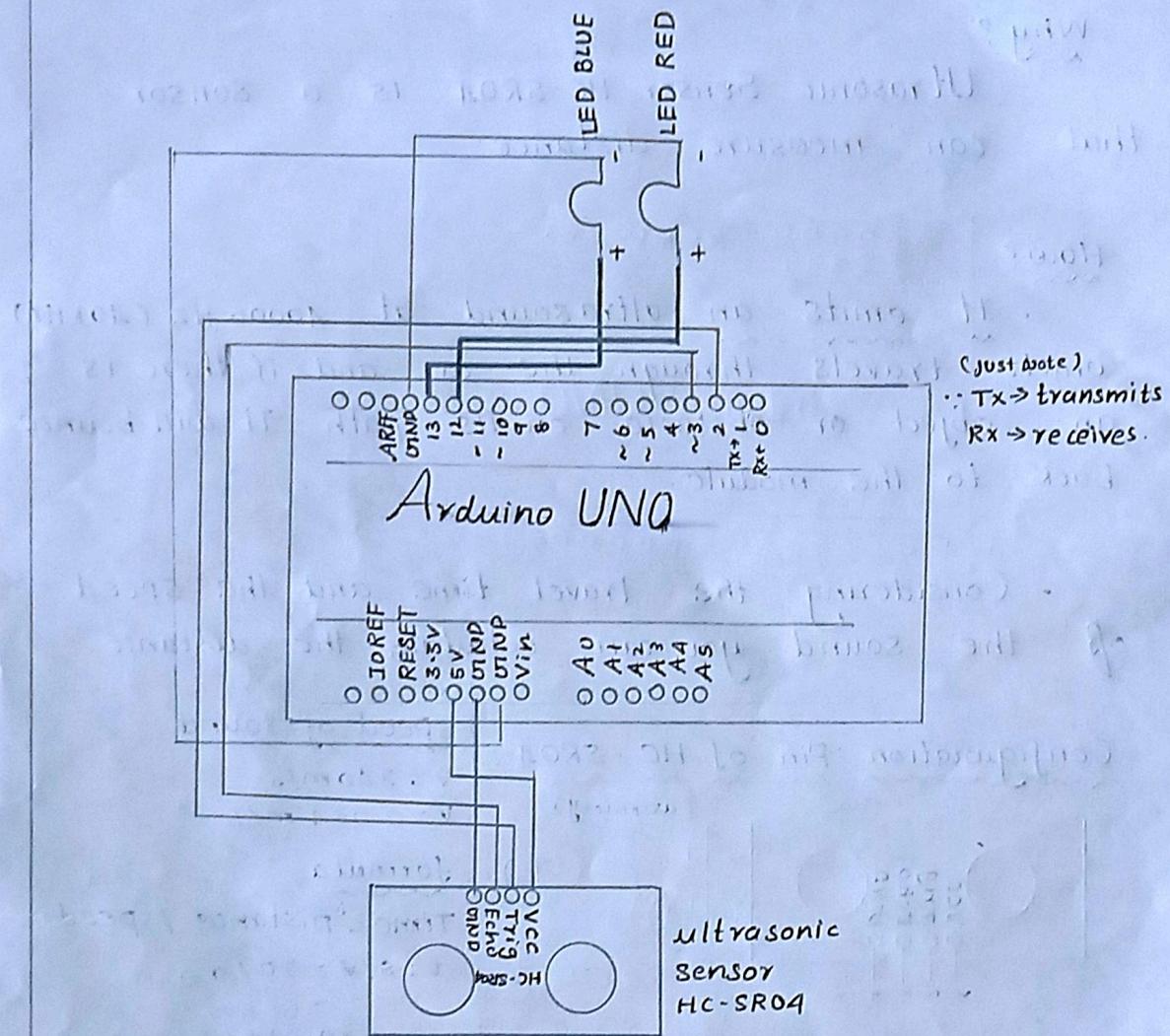
Features:

1. Measure the distance within a wide range of 2cm to 400cm
2. Stable performance
3. Accurate distance measurement
4. High - density
5. Small blind distance.

Distance Measurement Using Arduino

Circuit Diagram:

Note
LED must
be used.



Detection Range → output

(distance ≤ 10) → output → very close (Blue light blink)

(distance $>= 11$ and distance ≤ 50) → output → Near Range (Red light blink)

(distance > 51) → output → Far Range (No light blink)

② Moisture Content In Agricultural Land

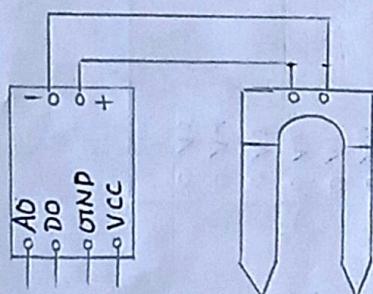
Soil Moisture Sensor:

Why? Soil Moisture sensor measure the volumetric water content in soil.

How?

Soil moisture sensors measure the volumetric water content indirectly by using some other property of the soil, such as electrical resistance, dielectric constant, or interaction with neutrons, as a proxy for the moisture content.

Configuration Pin of Soil Moisture Sensor:



formula:

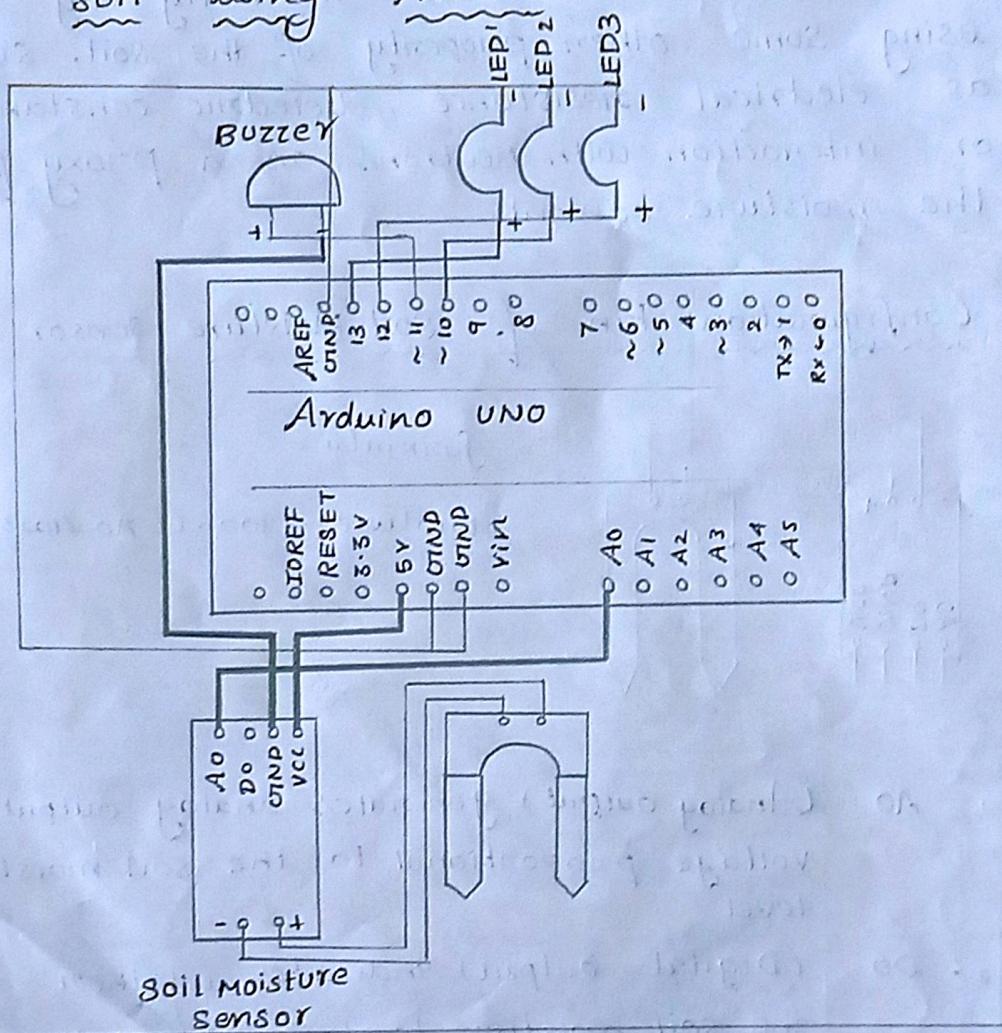
$$\text{Moisture} = (100 - (c \cdot A_0 / 1023.00)) \cdot 100$$

1	A0	(Analog output) generates analog output voltage proportional to the soil moisture level
2	DO	(Digital output) indicates whether the soil moisture level is within the limit.
3	GND	ground pin connected to GND of Arduino
4	VCC	power supply \leftrightarrow 5v pin on the Arduino

Specification :

- The required voltage for working is 5V
- The required current for working is <20mA
- Type of interface is analog
- The required working temperature of this sensor is $10^{\circ}\text{C} \sim 30^{\circ}\text{C}$.

Circuit diagram of moisture content in soil using Arduino



Detection Range x output

- $\text{sensor value (A0)} \geq 1000 \Rightarrow \text{Not in soil or disconnected}$
 $\text{A(A0)} < 1000 \text{ and } (\text{A0}) \geq 600 \Rightarrow \text{Dry soil (LED1 blink)}$
 $(\text{A0}) < 600 \text{ and } (\text{A0}) \geq 370 \Rightarrow \text{Humid soil (LED2 blink)}$
 $(\text{A0}) < 370 \Rightarrow \text{Water soil (LED3 blink)}$

(3) Motion Detection using Arduino

(1) PIR Sensor:

Why?

PIR sensors allow you to sense motion, almost always used to detect whether a human has moved in or out of the sensor's range.

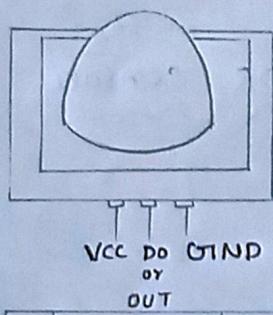
PIR → Passive Infrared

Note: PIR sensor does not generate or radiate any energy for detection purposes.

How?

They detect the infrared radiation emitted or reflected from objects.

Configuration Pin of PIR sensor:



1	VCC	Power supply \leftrightarrow 5V pin on the Arduino
2	DO or OUT	Digital output \leftrightarrow pin 2 on the Arduino
3	GND	Ground pin \leftrightarrow GND of Arduino

(6)

Specification of PIR sensor

- Detection range : between 5m and 12m
- Detection angle : 110 degrees
- operating temperature: -15°C to $+70^{\circ}\text{C}$

(2) LDR sensor (photoresistor)

LDR \rightarrow Light Dependent Resistor.

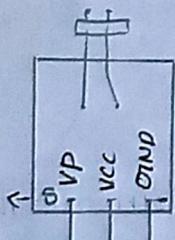
Why?

Light sensitive devices most often used to indicate the presence or absence of light, or to measure the light intensity.

How?

An LDR is a resistor whose resistance changes as the amount of light falling on it changes. The resistance of the LDR decreases with an increase in light intensity, and vice-versa.

Configuration Pin of LDR sensor.



'S' represent the signal

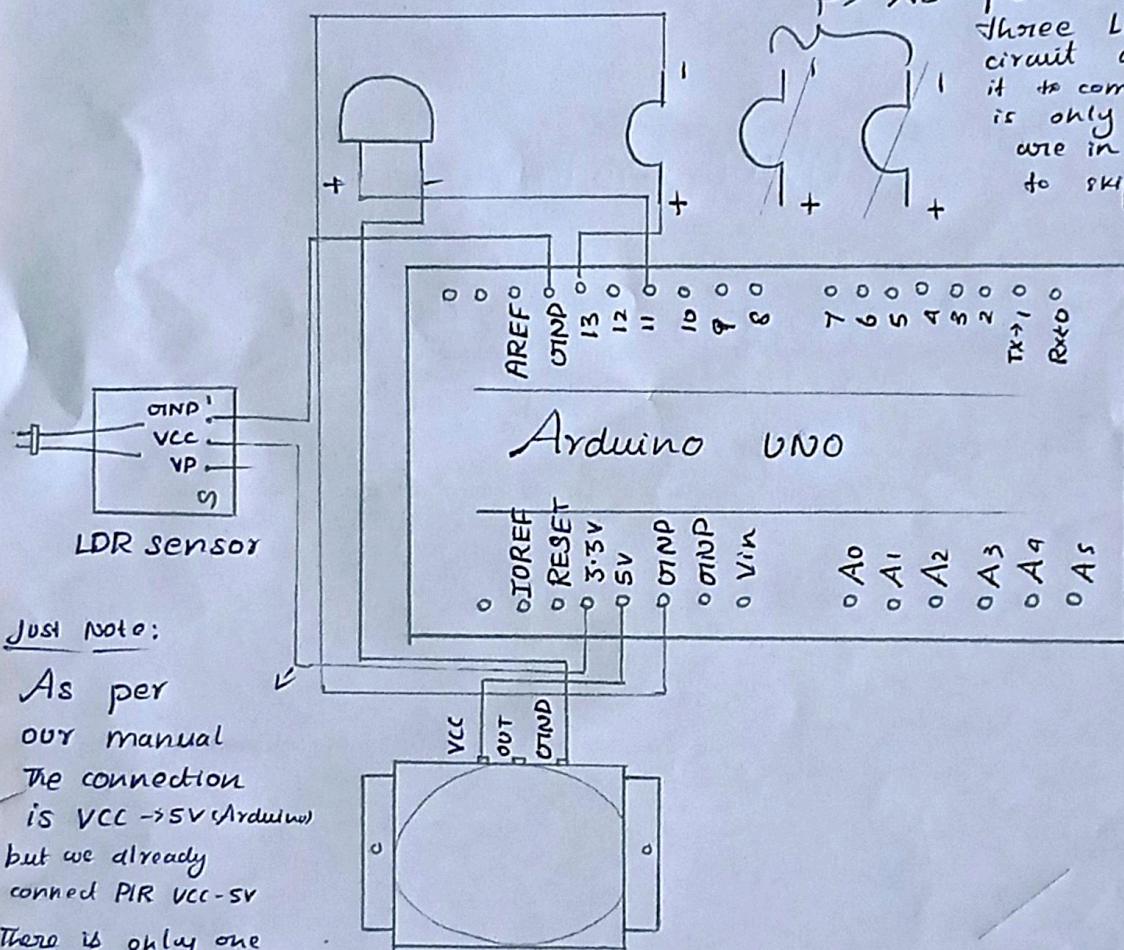
Remember
The '-'ve
represent
that the pin
is GND pin

1	VP	Signal (not for our use in this EXP)
2	VCC	power supply \leftrightarrow 5V on the Arduino
3	GND	From ground pin \leftrightarrow GND on the Arduino.

Specification of LDR sensor:

LDR resistance values range from many megaohms in complete darkness to only a few hundred ohms in strong light

Circuit diagram of motion Detection using Arduino:



→ As per manual; There are three LED lights are in circuit diagram but when it is come to code there is only one LED right are in use so, it is okay to skip 2 LED lights.

(4)

Room temperature and Humidity using Arduino

DHT11 Sensor (Some of the DHT11 sensor are not work well in IOT lab so carefull while choosing it)

DHT → Digital Temperature and Humidity.

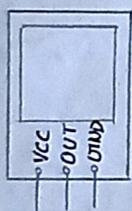
Why?

DHT11 sensor is use for sensing temperature and humidity.

How?

DHT11 sensor comes with a dedicated NTC to measure temperature and an 8-bit microcontroller to output the values of temperature and humidity as serial data.

DHT11 Pin Configuration:

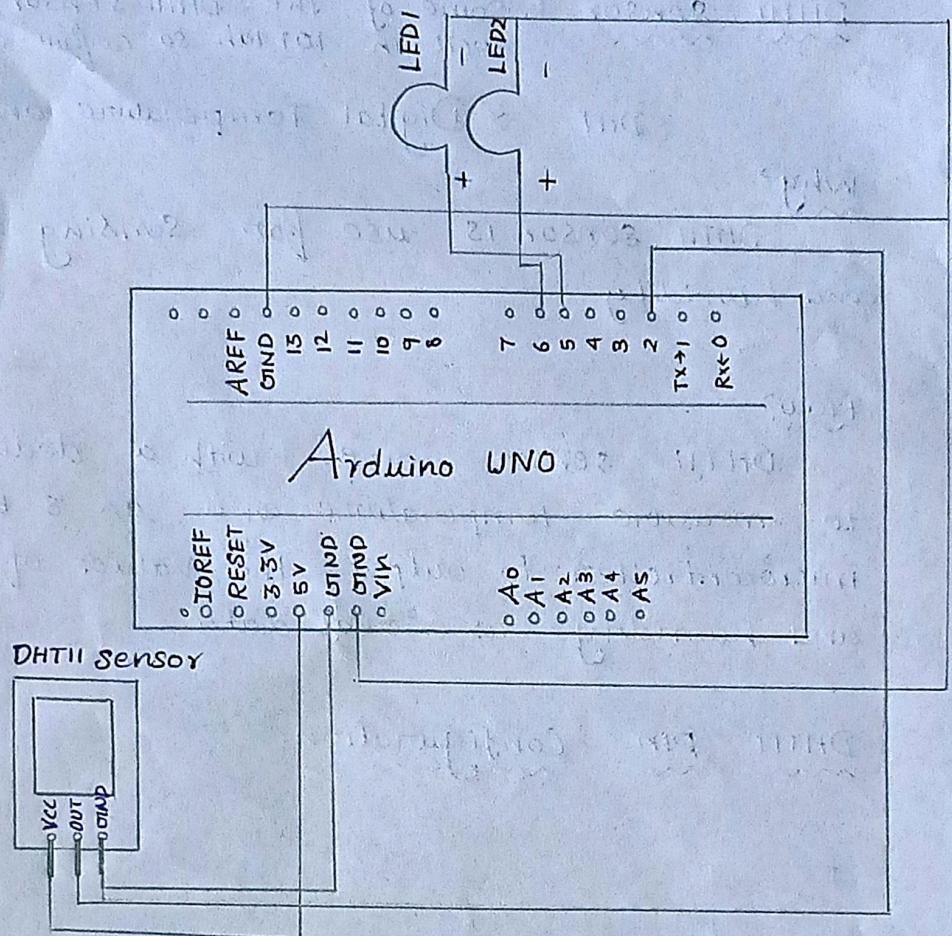


1	VCC	power supply → 5v on the Arduino uno
2	OUT	output both Temperature and Humidity through serial Data
3	GND	Ground pin connected to the ground of the Arduino board.

Specification:

- Temperature Range : 0°C to 50°C
- Humidity Range: 20% to 90%
- Accuracy: $\pm 1^{\circ}\text{C}$ and $\pm 1\%$

Circuit Diagram of Temperature and Humidity measurement using Arduino



(7) Colour Recognition using Arduino.

Colour Recognition or TCS230 color sensor

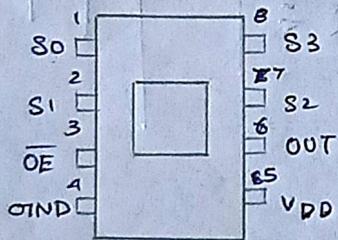
why?

The TCS230 color sensor uses a TAOS TCS3200 RGB sensor chip to detect color.

How?

The TCS3200 has an array of photodiodes with 4 different filters. A photodiode is simply a semiconductor device that converts light into current. By selectively choosing the photodiode filters readings, you're able to detect the intensity of the different colors.

Pin configuration of TCS230 color sensor.

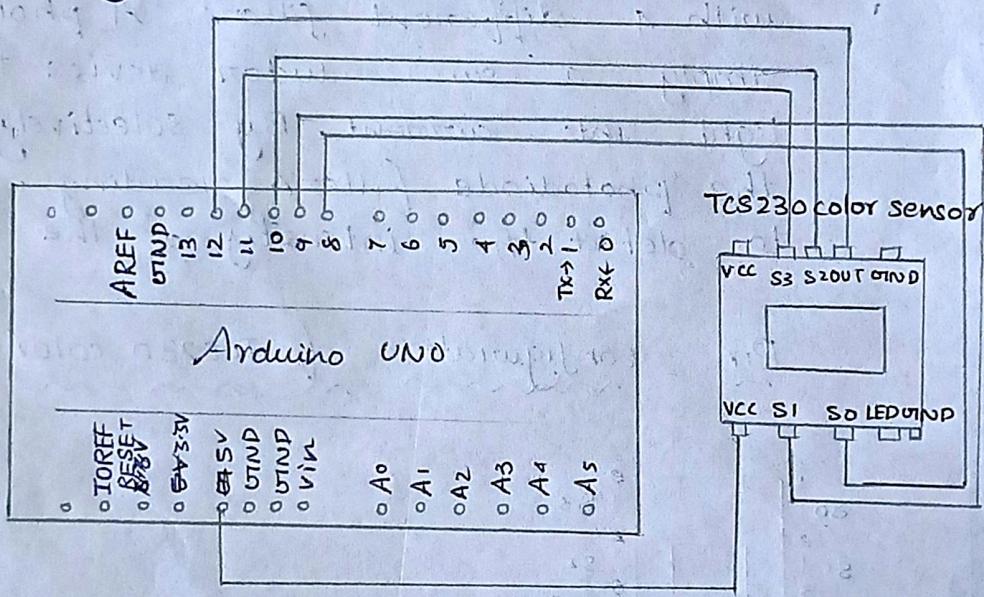


1 2	S0 S1	Output frequency scaling selection input.
3	OE	Enable for output frequency (active low)
4	GND	power supply ground
5	VDD	Voltage supply
6	OUT	out frequency
7 8	S2 S3	photodiode type selection input

Sensor Specification

- Interface: digital TTL
- High-resolution conversion of light intensity to frequency
- programmable color and full-scale output
- communication directly to microcontroller.

Circuit Diagram:



⑧ Fire Alaram using Arduino.

Sensor: Flame sensor

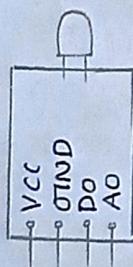
Why?

A flame sensor is one kind of detector which is mainly designed for detecting as well as responding to the occurrence of a fire or flame.

How?

This sensor/detector can be built with an electric circuit using a receiver like electromagnetic radiation. This sensor uses the infrared flame flash method, which allows the sensor to work through a coating of oil, dust, water vapor, otherwise ice.

Configuration of pin of Flame Sensor

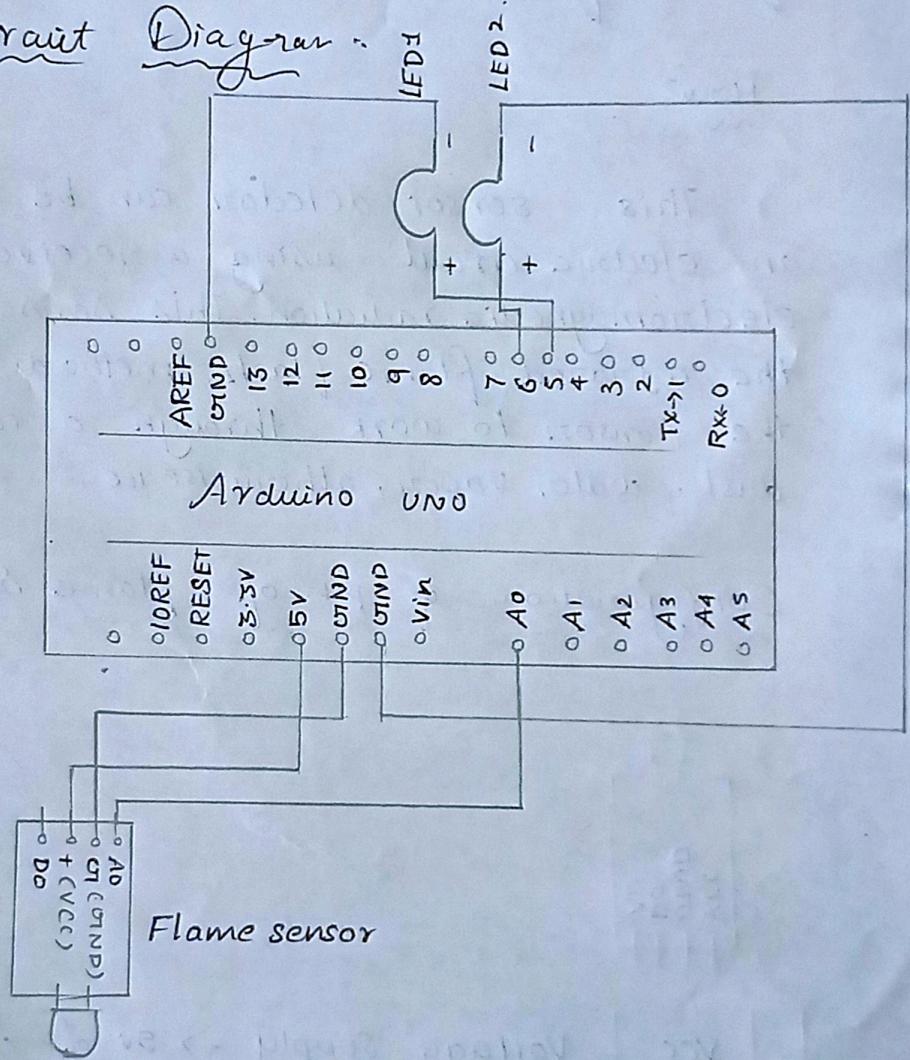


1	VCC	Voltage Supply \rightarrow 5V of Arduino
2	GND	Ground pin \rightarrow GND pin of Arduino
3	D0	Digital output
4	AO	Analog Analog output.

Specification of flame sensor:

- Detection angle is 60°
- if the flame intensity is lighter within 0.8m then the flame test can be activated.
- if the flame intensity is high, then the detection of distance will be improved.

Circuit Diagram:



⑨ Sound Detection using Arduino

Sound sensor:

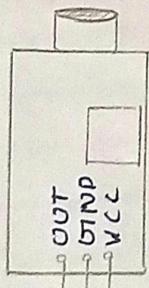
Why?

Sound Sensor used to detect sound

How?

it uses a microphone and the main function of this is, it uses the vibrations and changes into current otherwise voltage. Generally, it includes a diaphragm which is designed with magnets that are twisted with metal wire. When sound signals hit the diaphragm, then magnets within the sensor vibrates & simultaneously current can be stimulated from the coils.

Pin Configuration



VCC = power supply \rightarrow 5V of Arduino

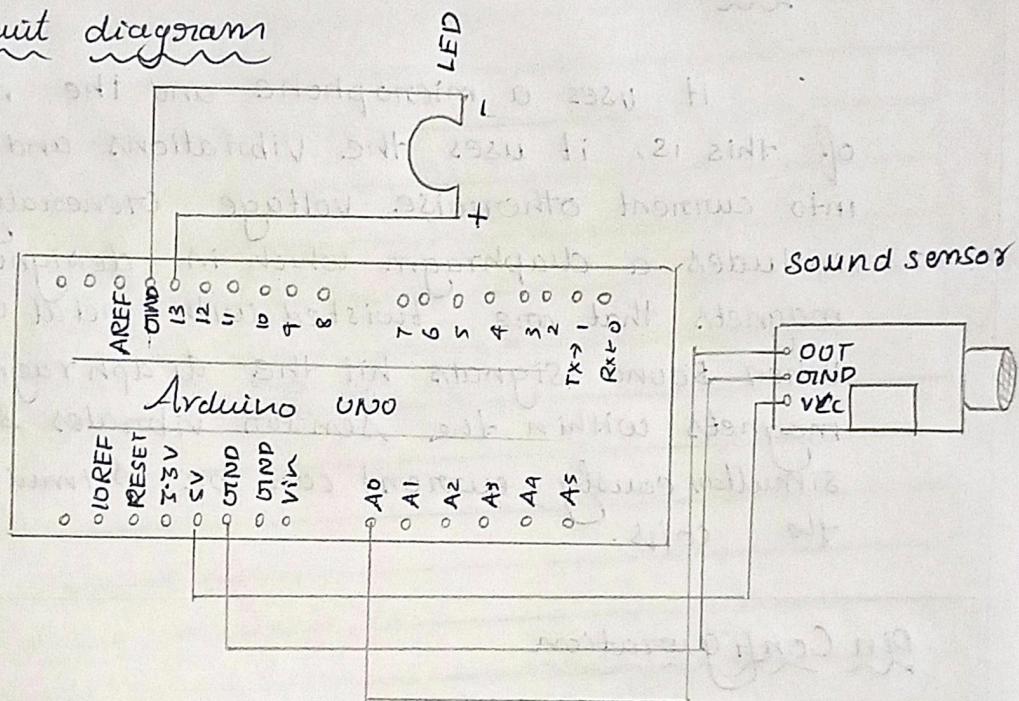
GND = ground pin \rightarrow GND of Arduino

DO = Digital output.

Specification:

- The sensitivity of the microphone (1KHz) is 52 to 48 dB
- The impedance of the microphone is 2.2K. ohm
- The frequency of microphone is 16 to 20 kHz
- The signal to noise ratio is 54 dB

Circuit diagram



(15)

Flex Sensor with Arduino

flex sensor:

why?

A flex sensor is a kind of sensor which is used to measure the amount of deflection otherwise bending.

How?

This sensor works on the bending strip principle which means whenever the strip is twisted then its resistance will be changed.

Pin configuration:



Pin P₁: This pin is generally connected to the +ve terminal of the power source.

Pin P₂: This pin is generally connected to GND pin of the power source.

Specifications :

- The range of bend resistance will range from $45\text{K} - 125\text{K}$ ohms

