Experiment – 2

Aim: Study of the sensor (IR, temperature, pressure, gas) and the actuator (Piezoelectric actuator, pneumatic actuator) using Arduino.

Theory: Sensors: An electronic sensor detects and measures a physical phenomenon, such as temperature, pressure, force, or acceleration, and provides a corresponding output, usually in the form of an electronic signal.

IR sensor:

1. An infrared sensor is an electronic instrument which is used to sense certain characteristics of its surroundings by their emitting and/or detecting infrared radiation.

2. Infrared sensors are also capable of measuring the heat being emitted by an object and detecting motion.

3. Infrared waves are not visible to the human eye. In the electromagnetic spectrum, infrared radiation can be found between the visible and microwave regions.

4. The infrared waves typically have wavelengths between 0.75 and 1000 µm

Actuators:

Actuators convert an electrical signal to the corresponding physical quantity such as movement, force, sound, display etc. The actuator is a part of any machine which is responsible for mechanical rotation or controlling.

Piezoelectric actuators: Piezoelectric actuators are devices that produce a small displacement with a high force capability when voltage is applied. There are many applications where a piezoelectric actuator may be used, such as ultra-precise positioning and in the generation and handling of high forces or pressures in static or dynamic situations. Actuator configuration can vary greatly, depending on application.

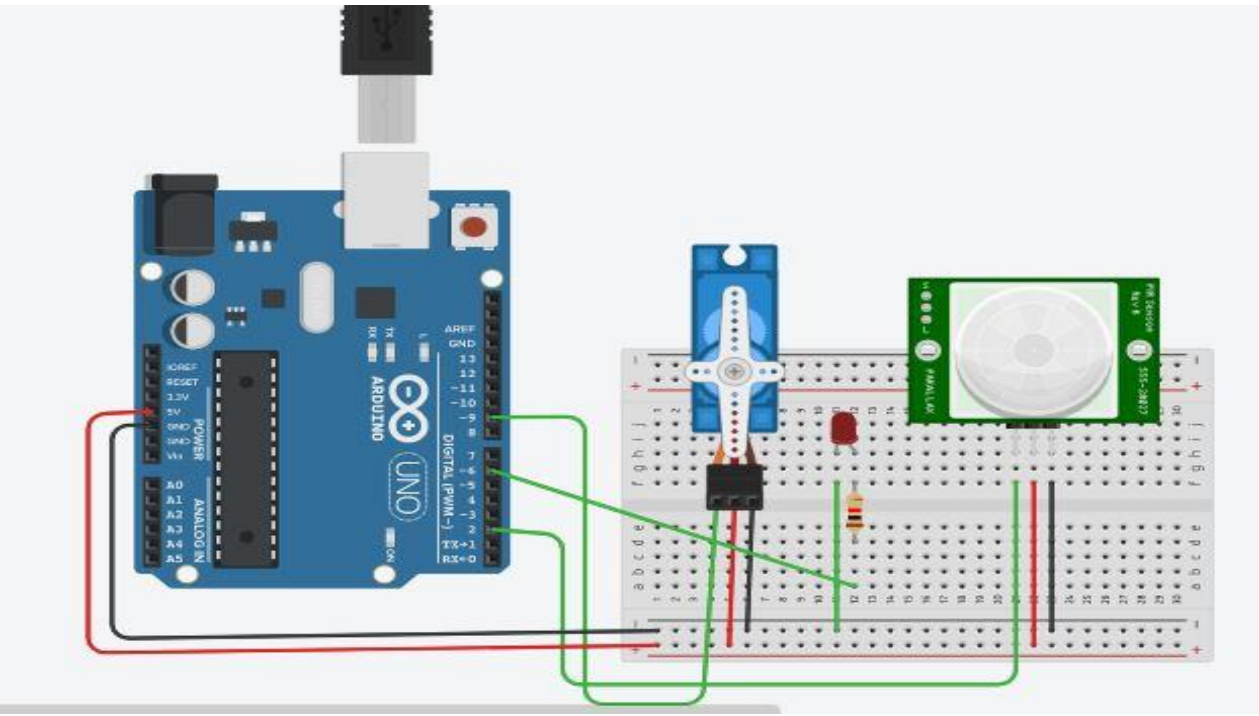
Pneumatic actuators: A pneumatic actuator uses energy formed by vacuum or compressed air at high pressure to convert into either linear or rotary motion. Pneumatic actuators are notable in their use for applications where the opening and closing of valves takes place.

a. IR Sensor& Piezoelectric Actuator

IOT Kit : Arduino

Senor : PIR Sensor

Motor : Micro Serv0

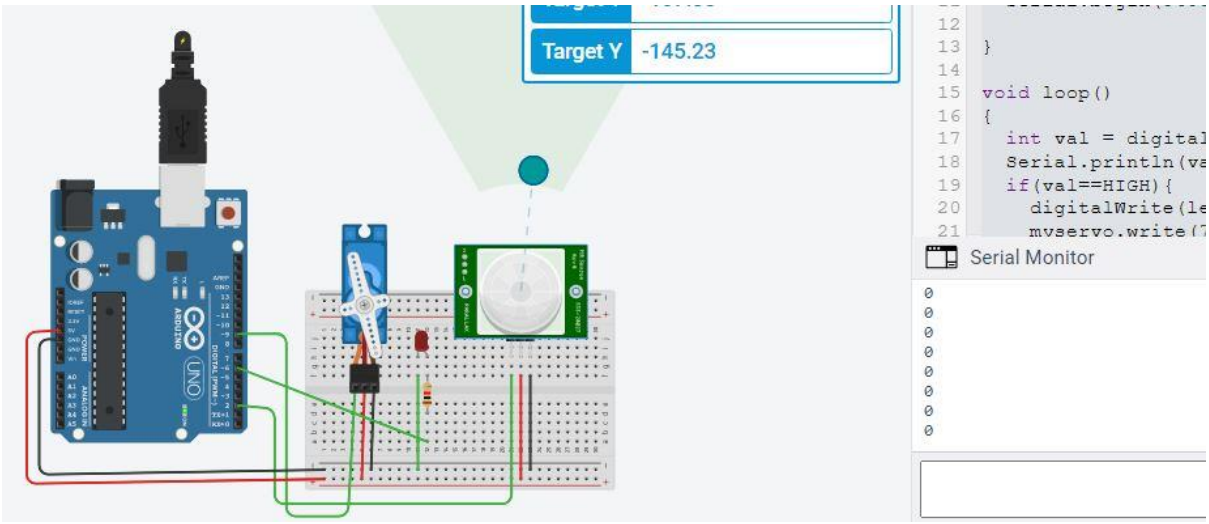


Code :

```
#include <Servo.h>
Servo myservo;
int led=6;
int pir=2;
void setup()
{
  pinMode(pir,INPUT);
  pinMode(led,OUTPUT);
  myservo.attach(9);
  Serial.begin(9600);
}
void loop()
{
  int val = digitalRead(pir);
  Serial.println(val);
  if(val==HIGH){
    digitalWrite(led,HIGH);
    myservo.write(70);
```

```
 }
 else{
   digitalWrite(led,LOW);
   myservo.write(10);
 }
   delay(10);
}
```

OutPut : (PIR Sensor Detected object , Servo Motor Will rotate, Serial Monitor Change from 0 -→1 .. ie object detected using sensor)



b. Temperature Sensor

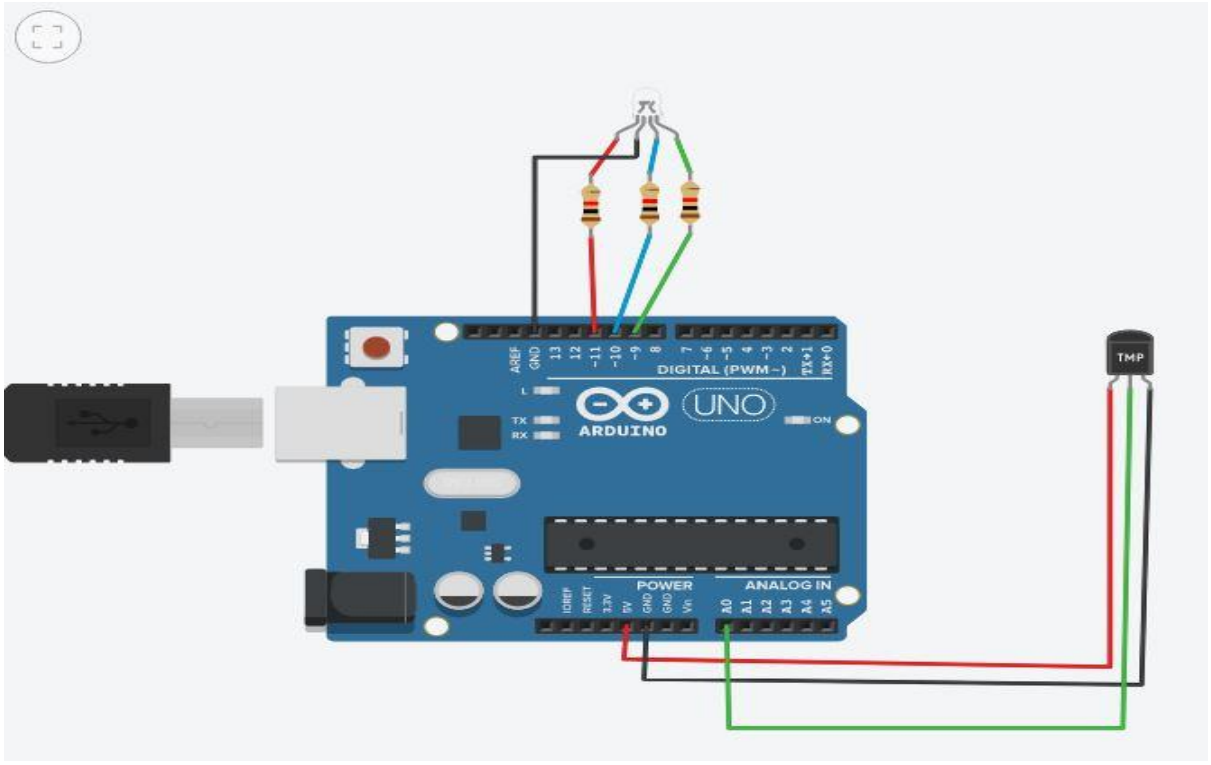
LM 35 temperature sensor:

1.BMP 280 pressure sensor module is an Arduino compatible tool used for atmospheric pressure measurement in environments. Such measurements mainly allow for forecasting of short term changes in the weather.

2. The LM 35 temperature sensor is a nice little module that provides the digital temperate. It is really easy to set up and only requires one wire for the data signal.

3. These sensors are frequently used in remote weather stations, home environment control systems.

Sensor : Temperature sensor

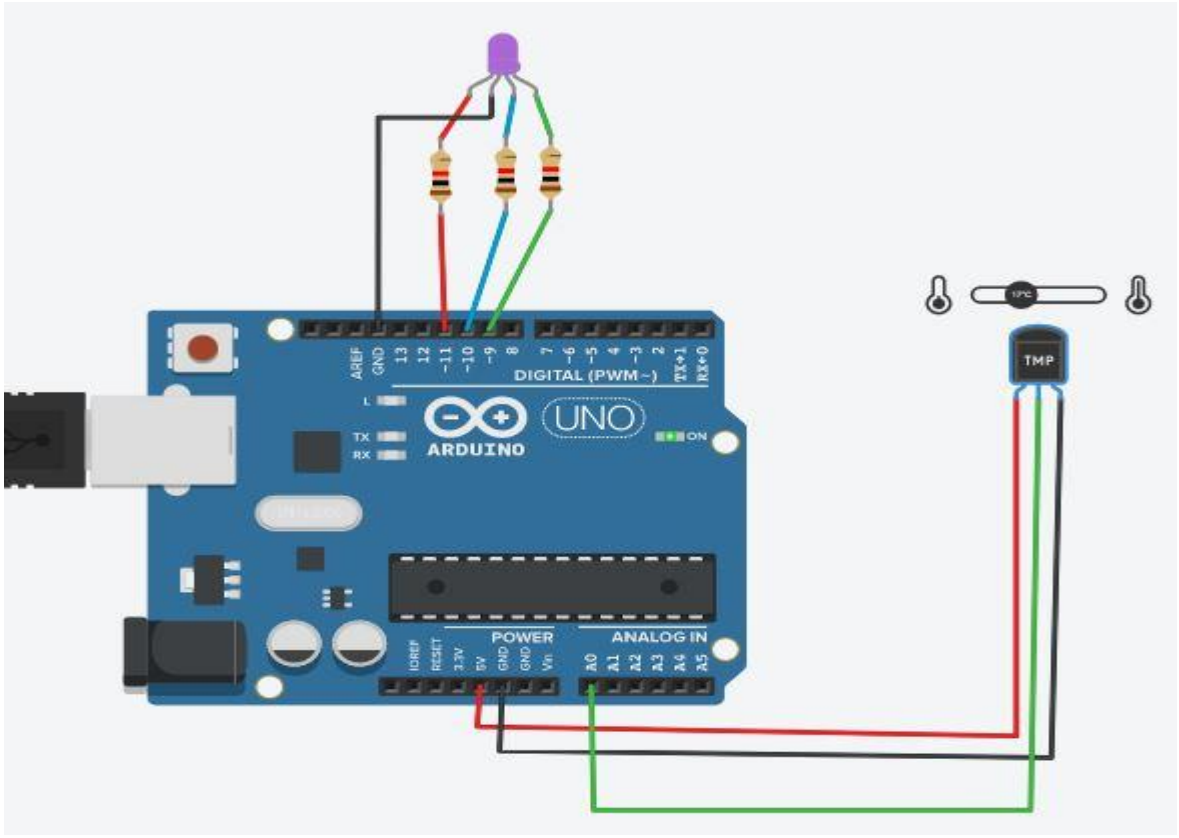


Code :

```
int V_tempsensor = 0;
void setup()
{
  pinMode(11, OUTPUT);
  pinMode(10, OUTPUT);
  pinMode(9, OUTPUT);
  pinMode(A0, INPUT);
}
void loop()
{
  analogWrite(11, 51);
  analogWrite(10, 204);
  analogWrite(9, 0);
  V_tempsensor = (-40 + 0.488155 * (analogRead(A0) - 20));
  if (V_tempsensor >= 50) {
    analogWrite(11, 255);
    analogWrite(10, 0);
    analogWrite(9, 0);
  }
  if (V_tempsensor >= 30) {
    analogWrite(11, 51);
    analogWrite(10, 51);
    analogWrite(9, 255);
  }
  if (V_tempsensor <= 10) {
    analogWrite(11, 0);
```

```
    analogWrite(10, 102);
    analogWrite(9, 0);
  }
  delay(10); // Delay a little bit to improve simulation performance
}
```

Output : (LED Color Vary in Red – Green – Yellow depend upon temperature)



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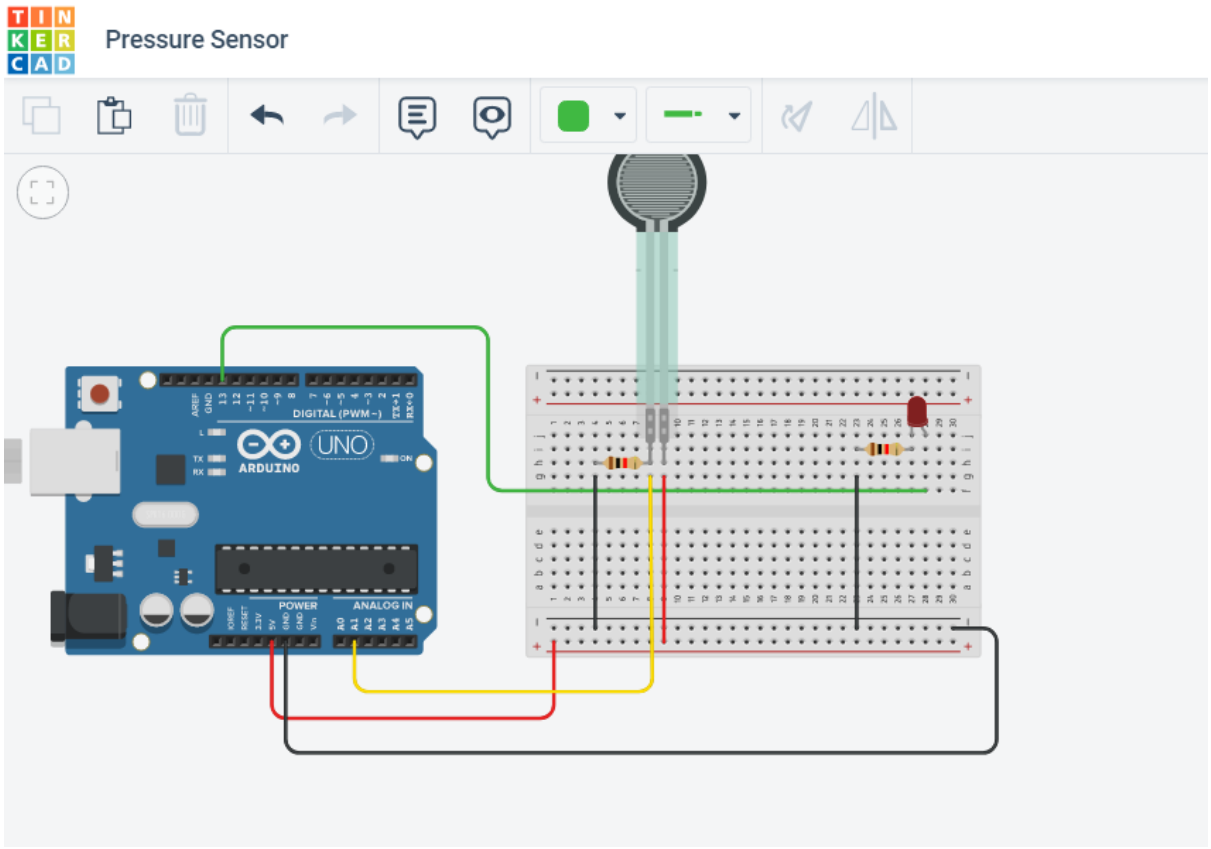
c. Pressure Sensor

A force-sensing resistor is a material whose resistance changes when a force, pressure or mechanical stress is applied. They are also known as force-sensitive resistor and are sometimes referred to by the initialism

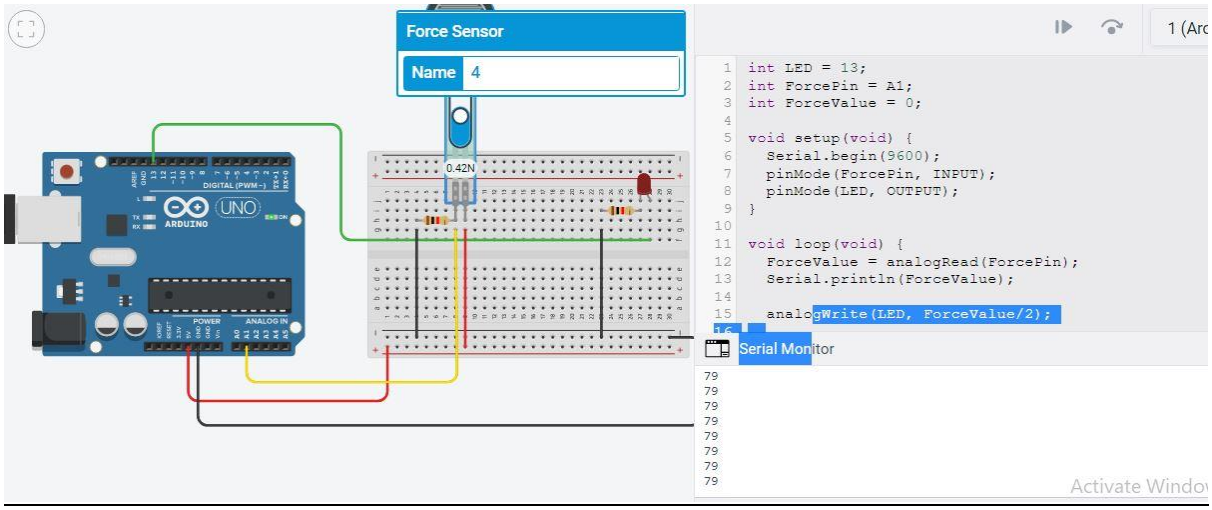
Sensor : Force Sensor



Code :

```
int LED = 13;
int ForcePin = A1;
int ForceValue = 0;
 void setup(void) {
  Serial.begin(9600);
  pinMode(ForcePin, INPUT);
  pinMode(LED, OUTPUT);
}
 void loop(void) {
  ForceValue = analogRead(ForcePin);
  Serial.println(ForceValue);
   analogWrite(LED, ForceValue/2);
   delay(100);
}
```

OUTPUT ---Serial Monitor – Value Change according to Pressure -vary



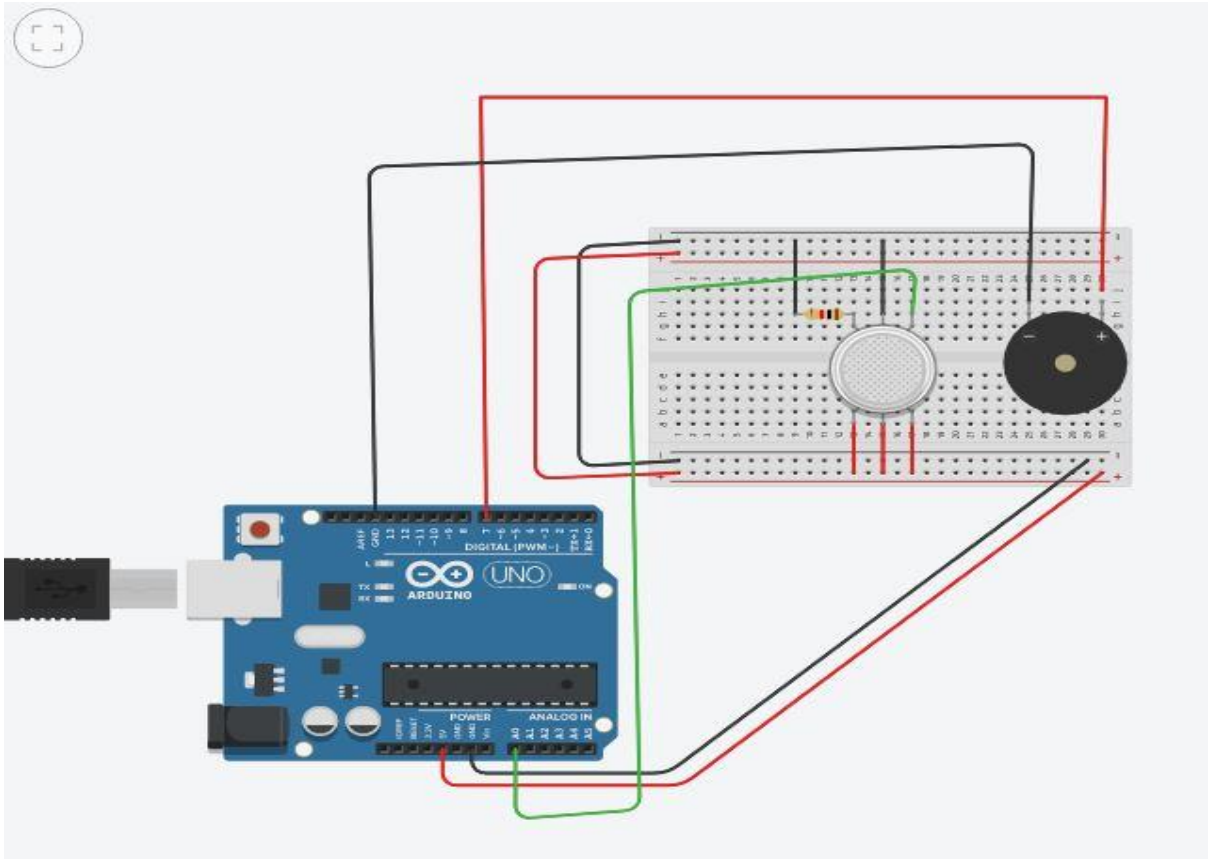
d. Gas Sensor

A gas detector is a device that detects the presence of gases in an area, often as part of a safety system. A gas detector can sound an alarm to operators in the area where the leak is occurring, giving them the opportunity to leave. This type of device is important because there are many gases that can be harmful to organic life, such as humans or animals.

Safety Gas Monitor

Gas detectors can be used to detect combustible, flammable and toxic gases, and oxygen depletion. This type of device is used widely in industry and can be found in locations, such as on oil rigs, to monitor manufacturing processes and emerging technologies such as photovoltaic. They may be used in firefighting.

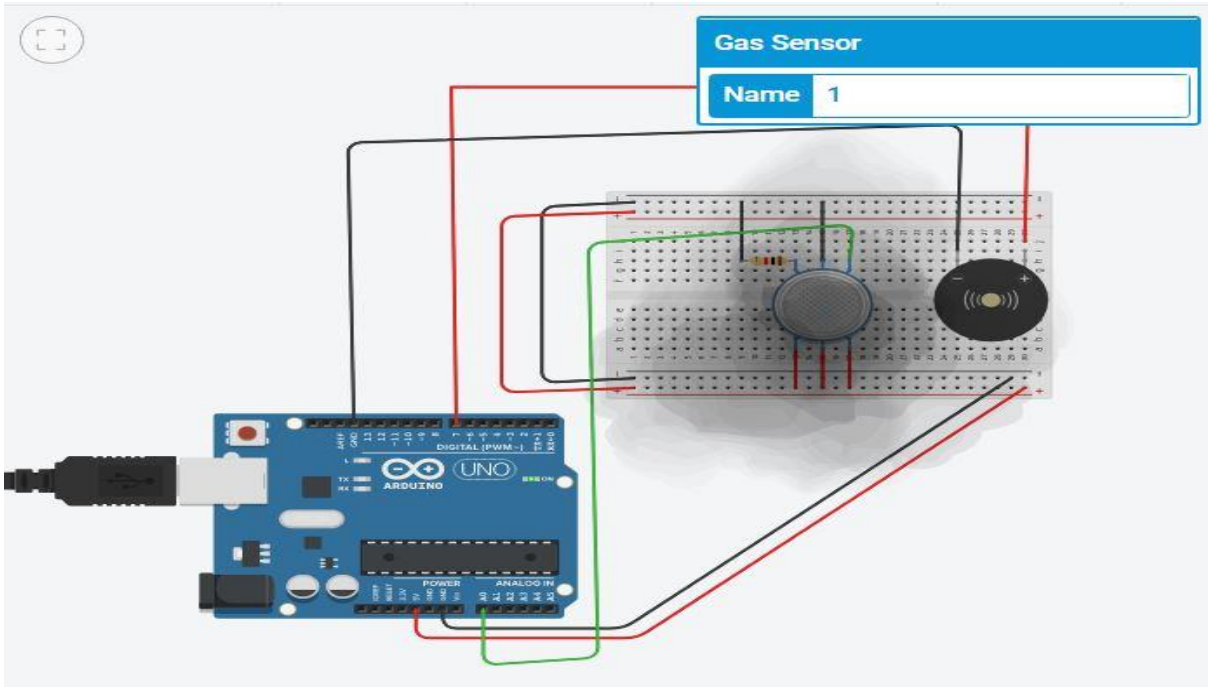
Sensor : Gas Senor



Code :

```
int V_Gassenssor = 0;
void setup()
{
  pinMode(A0, INPUT);
  pinMode(7, OUTPUT);
}
void loop()
{
  V_Gassenssor = analogRead(A0);
  if (V_Gassenssor > 250) {
    tone(7, 523, 1000);       // play tone 60 (C5 = 523 Hz)
  }
  delay(10);
}
```

Output : (BUZZER Sound Will come)



e. Soil Moisture Sensor

Soil moisture sensors measure the volumetric water content in soil. Since the direct gravimetric measurement of free soil moisture requires removing, drying, and weighing of a sample, 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.

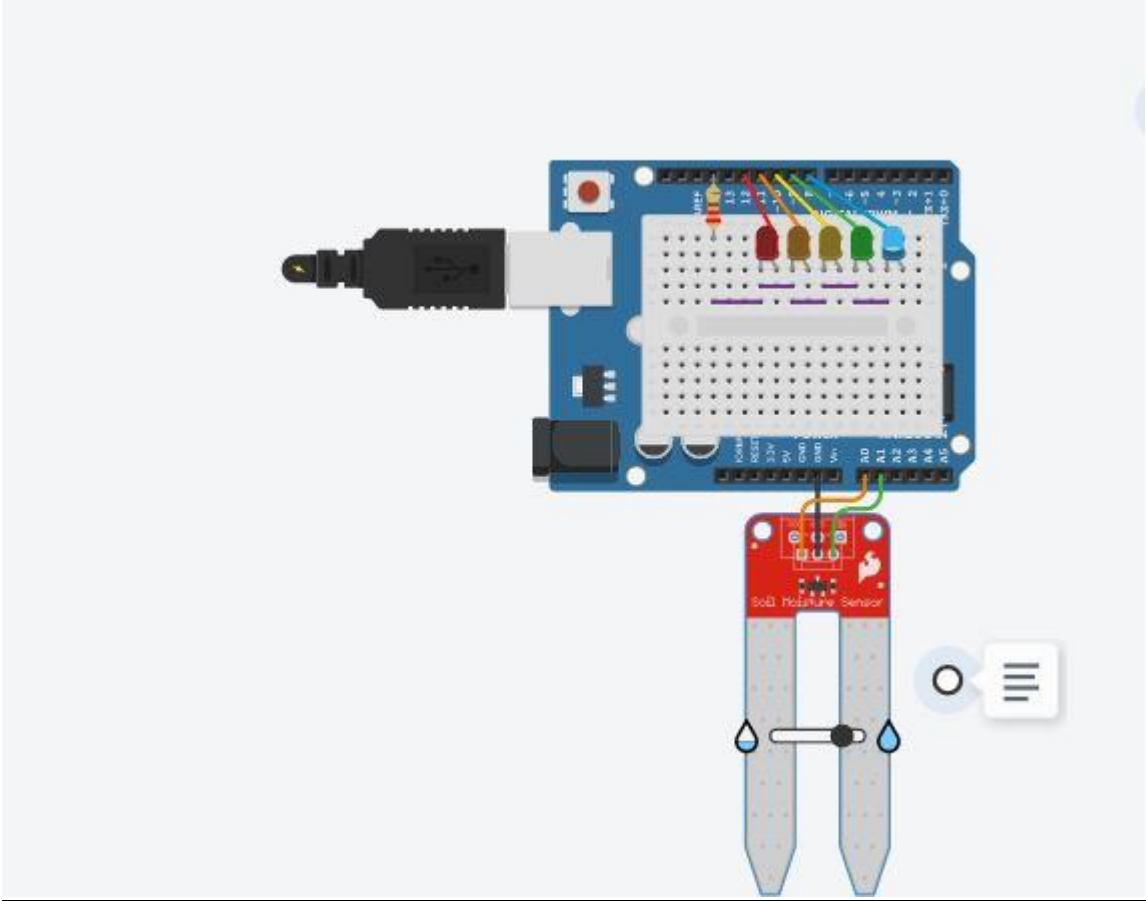
Sensor : Soil Moisture Sensor

Code :

```
moisture = 0
x = 0
y = 0
def on_forever():
  global moisture
  global x
  global y
  pins.digital_write_pin(DigitalPin.P1, 1)
  basic.pause(10)
  moisture = Math.map(pins.analog_read_pin(AnalogPin.P2), 0, 813, 0, 100)
  pins.digital_write_pin(DigitalPin.P1, 0)
  if moisture < 50:
    x = randint(0, 4)
    y = 0
    for index in range(9):
      led.plot_brightness(x, y, 255)
      led.plot_brightness(x, (y - 1), 32)
      led.plot_brightness(x, (y - 2), 8)
      led.plot_brightness(x, (y - 3), 2)
```

```
    led.plot_brightness(x, (y - 4), 0)
    y += 1
    basic.pause(50)
  else:
    basic.pause(1000)
basic.forever(on_forever)
```

Circuit Diagram :



OutPut :

On varying the soil moisture Sensor slide ., Depanding upon the moisture level the Led May glow

Red indicate the Soil is Dry , Yellow color indicate the soil is 50% Wet and Blue Color indicate the soil is completely Wet.

f. Ultrasonic Sensor

Ultrasonic sensors can detect the movement of targets and measure the distance to them in many automated factories and process plants. Sensors can have an on or off digital output for detecting the movement of objects, or an analog output proportional to distance.

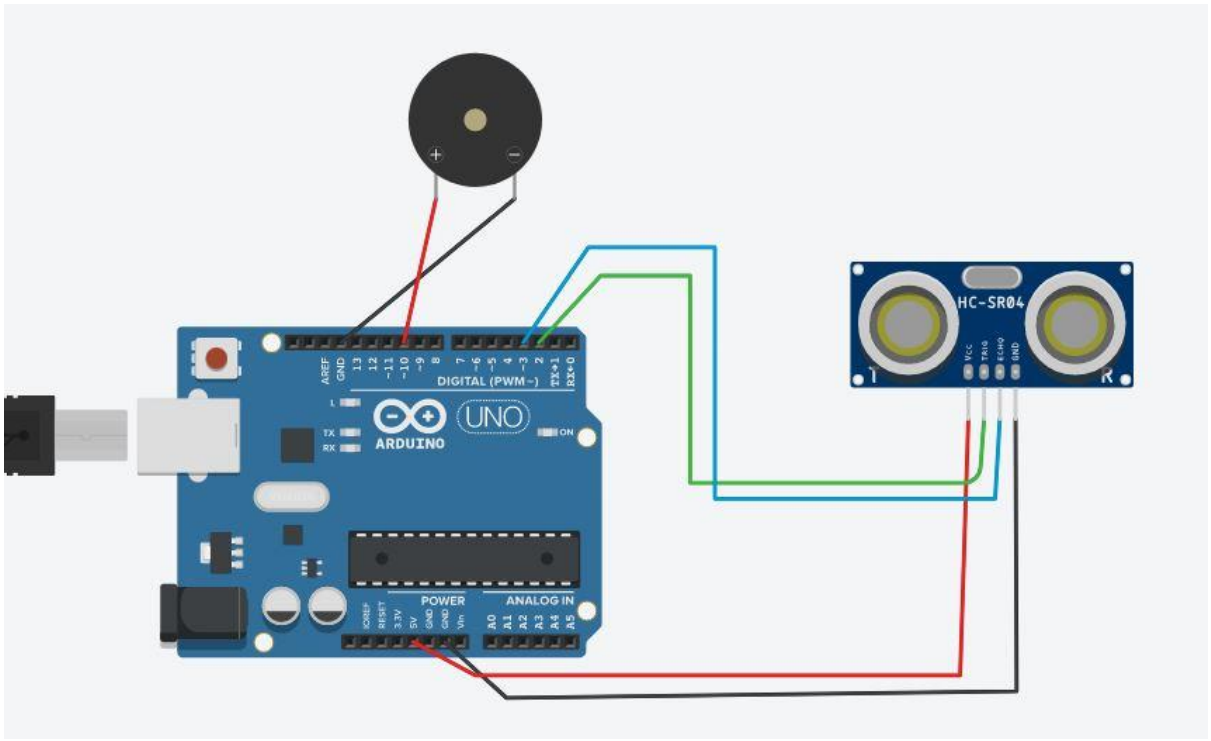
Sensor Used : Ultrosonic Sensor

Code :

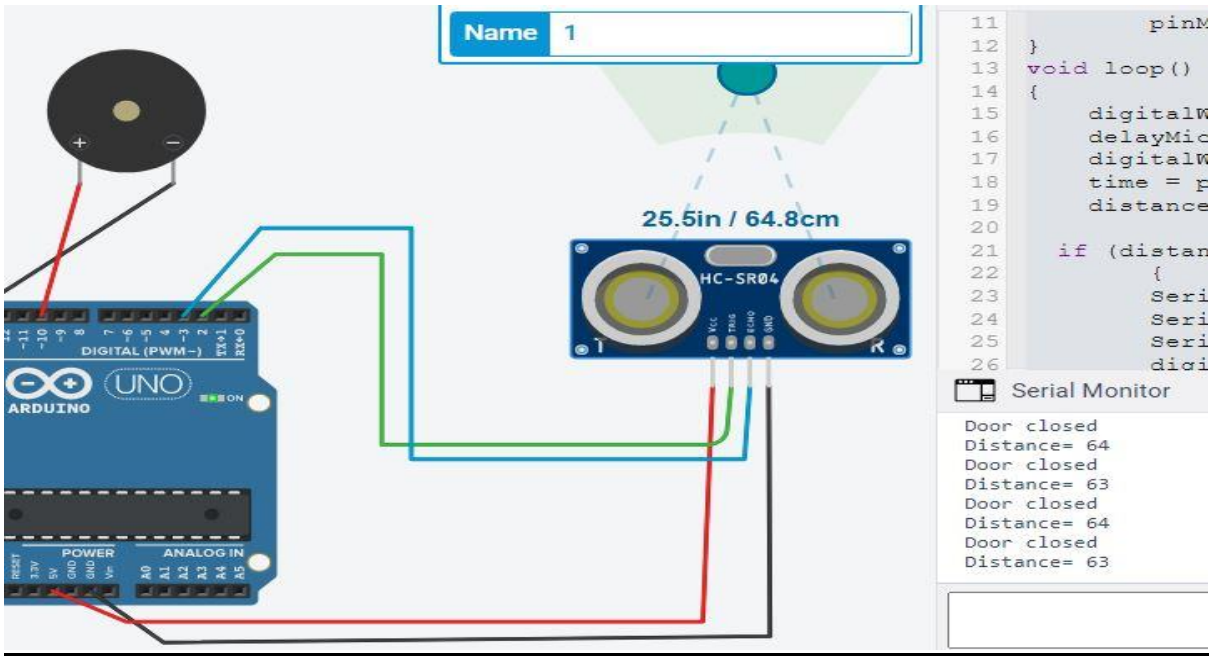
```
int trigger_pin = 2;
int echo_pin = 3;
int buzzer_pin = 10;
int time;
int distance;
void setup()
{
      Serial.begin (9600);
      pinMode (trigger_pin, OUTPUT);
      pinMode (echo_pin, INPUT);
      pinMode (buzzer_pin, OUTPUT);
}
void loop()
{
   digitalWrite (trigger_pin, HIGH);
   delayMicroseconds (10);
   digitalWrite (trigger_pin, LOW);
   time = pulseIn (echo_pin, HIGH);
   distance = (time * 0.034) / 2;

 if (distance <= 10)
      {
      Serial.println (" Door Open ");
      Serial.print (" Distance= ");
      Serial.println (distance);
      digitalWrite (buzzer_pin, HIGH);
      delay (500);
      }
 else {
      Serial.println (" Door closed ");
      Serial.print (" Distance= ");
      Serial.println (distance);
      digitalWrite (buzzer_pin, LOW);
      delay (500);
     }
}
```

Circuit Connection :



OutPut: (check the Serial Monitor ., it will shows the distance between the Ultra sonic sensor and object)



Conclusion

We have accessed the data from sensors and actuators and apply Arduino uno board. Further, data is collected, analyzed and visualized of the IR, temperature, pressure, gas sensors ,Soil moisture Sensor, Pressure sensor as well as piezoelectric and pneumatic actuator.