

SENSORS

Exploring the world of Sensors



Today's Focus

- Sensor Fundamental and Types
- Hands-on with IR and Ultrasonic Sensors
- Analog vs Digital Sensor Data Handling
- Sensor Interfacing Techniques
- Practical Applications

By the end of the lesson, you'll be able to...

Describe what a sensor is.

Classify different types of Sensors(IR, Ultrasonic,etc).

Learn how to interface sensor with microcontroller.

Use sensor in basic robotics or automation project.

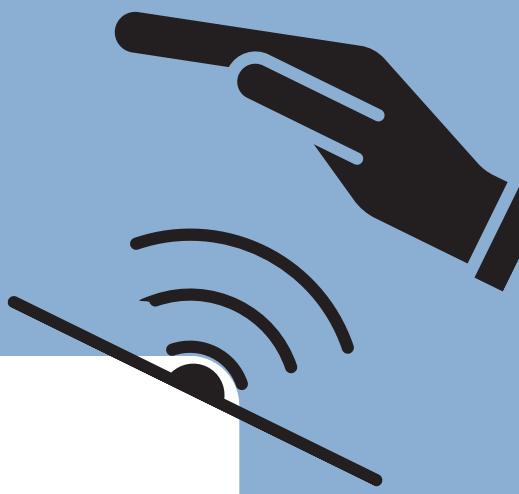
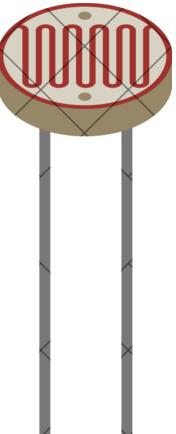
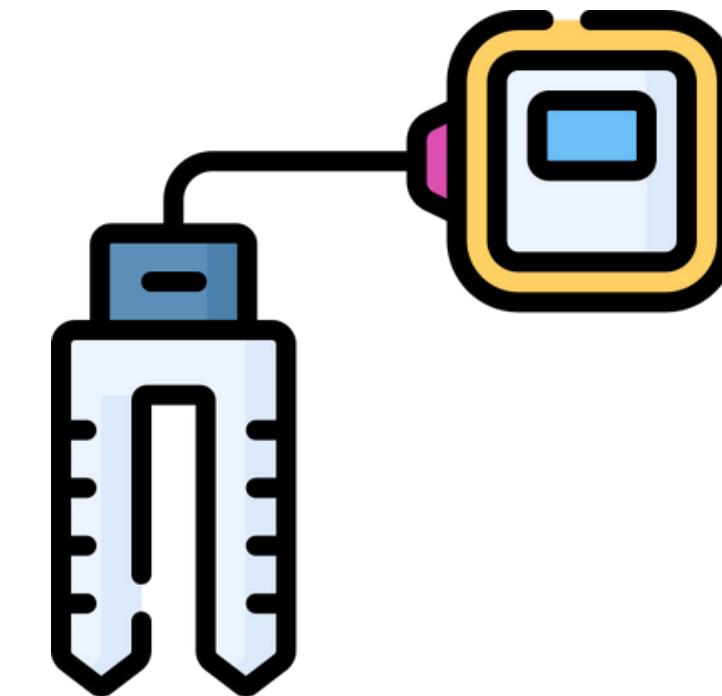
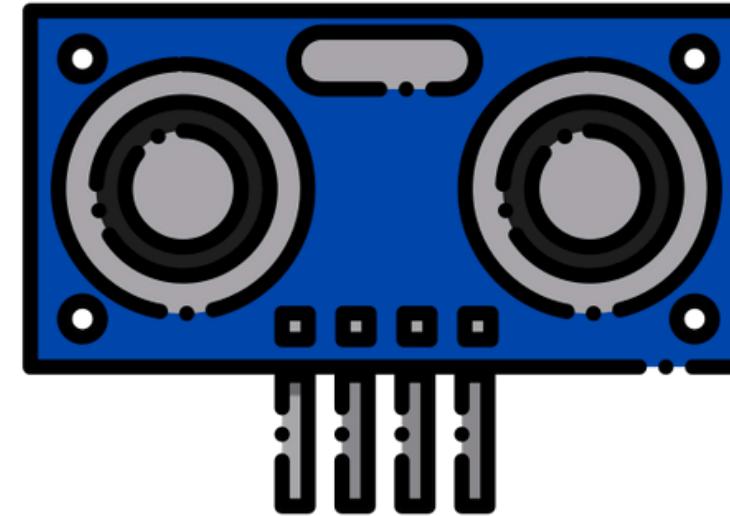
SENSORS

- An object that detects changes or events in the environment and converts it into a signal that can be read by an observer or electronic instrument.
- It is like an “eye” or “nose” or “ear” of an electronic system.
- Sensors are used in everyday objects such as automatic door, smartphone cameras and microphones, motion activated lights,etc.

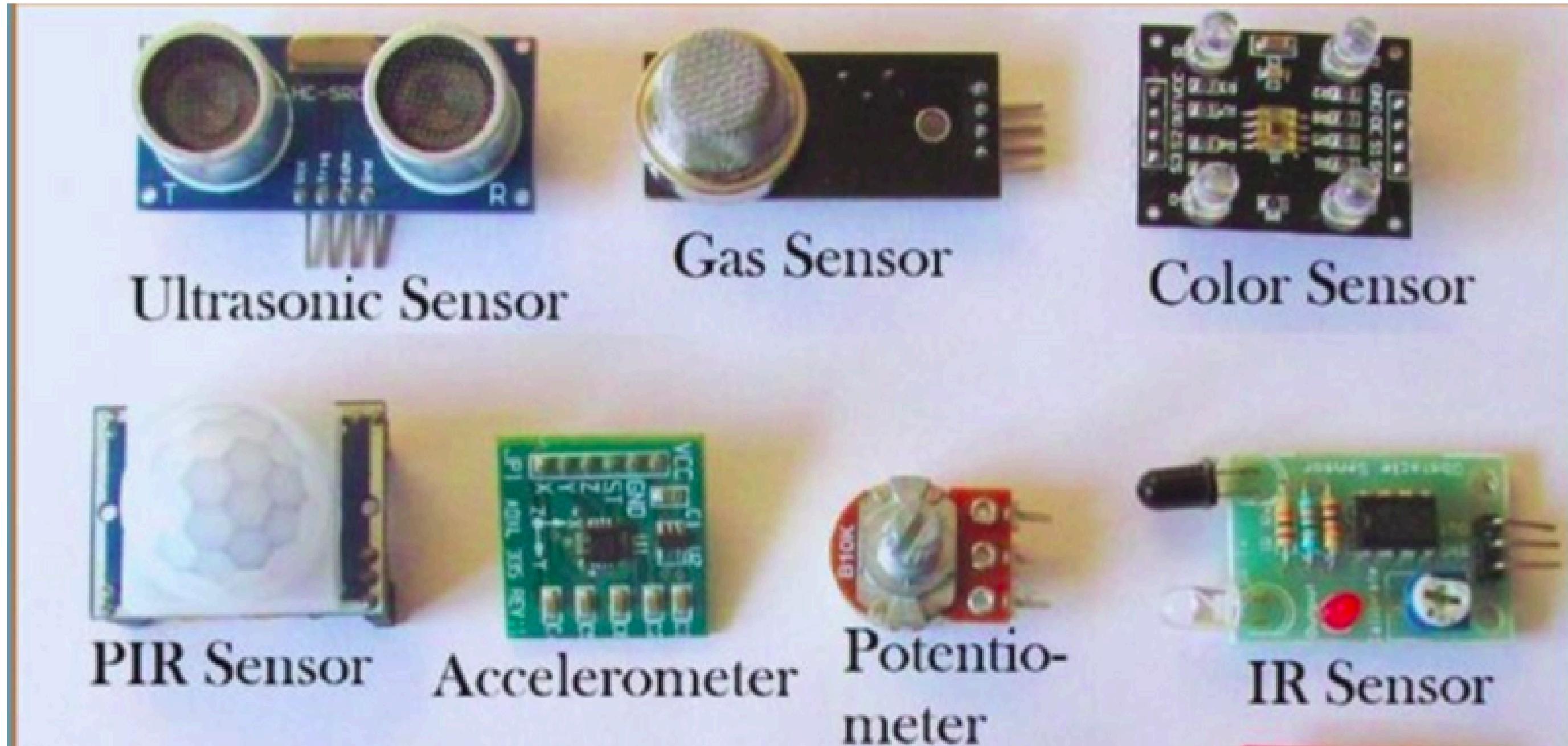


Types of Sensors

- Temperature: Thermistor,DHT11, LM35(Analog temp. sensor)
- Pressure: LVDT (Linear Variable Differential Transformer)
- Proximity & Displacement: Ultrasonic Sensor (HC-SR04),IR sensor
- Gas and Quality : MQ-series (MQ-5)
- Acceleration : MPU6050 (Gyro+Accelerometer)



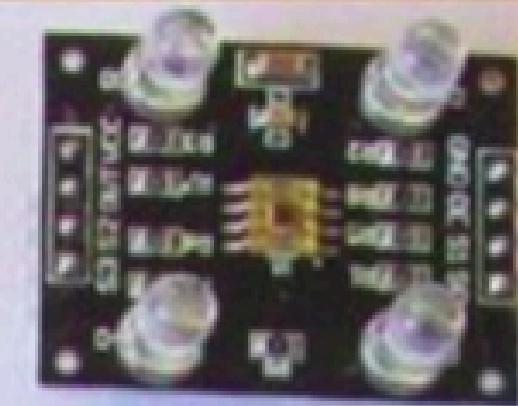
Types of Sensors



Ultrasonic Sensor



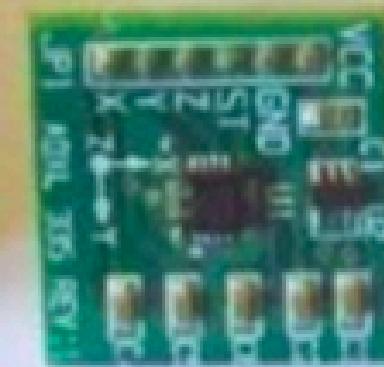
Gas Sensor



Color Sensor



PIR Sensor



Accelerometer



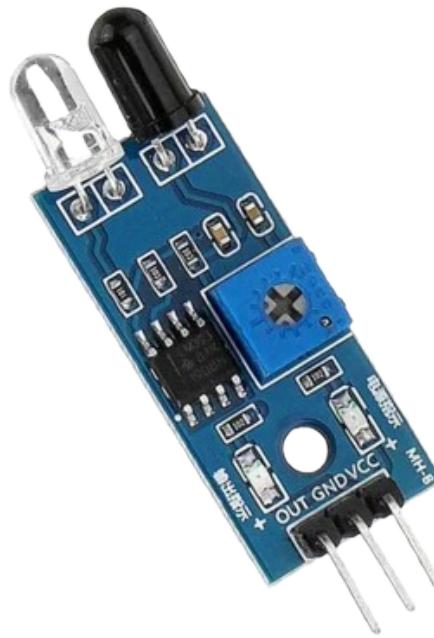
Potentio-
meter



IR Sensor

Basic Sensors in Electronics

- IR Sensor
- Ultrasonic Sensor
- LDR (light sensor)
- DHT11 (temperature & Humidity sensor)



IR Sensor



Ultrasonic
Sensor

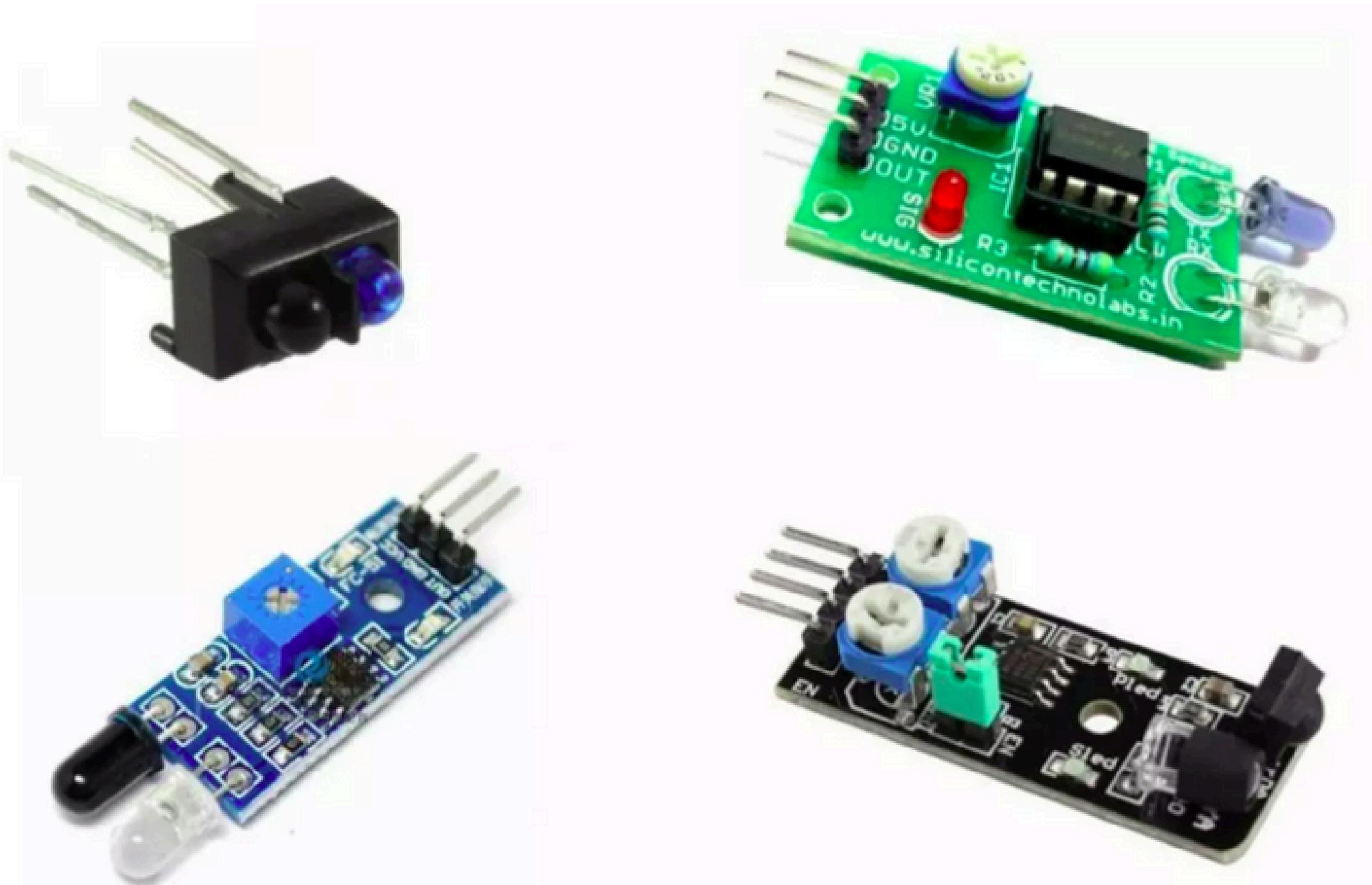


DHT11

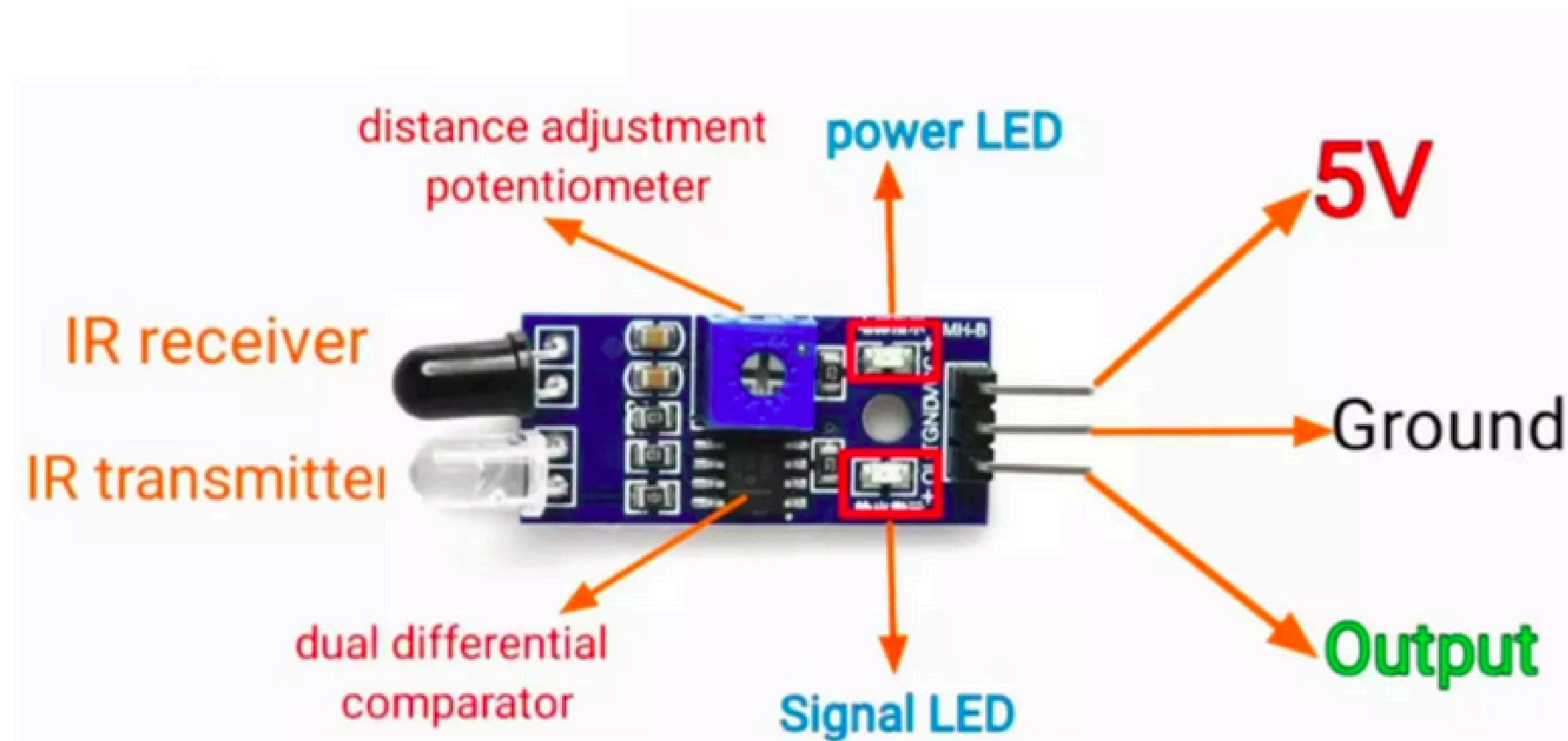
IR Sensor

- An infrared sensor is an electronic device that emits and/or detects infrared radiation to sense the environment.
- It is used to detect obstacles, motion, or heat depending upon application.

IR Sensor Modules

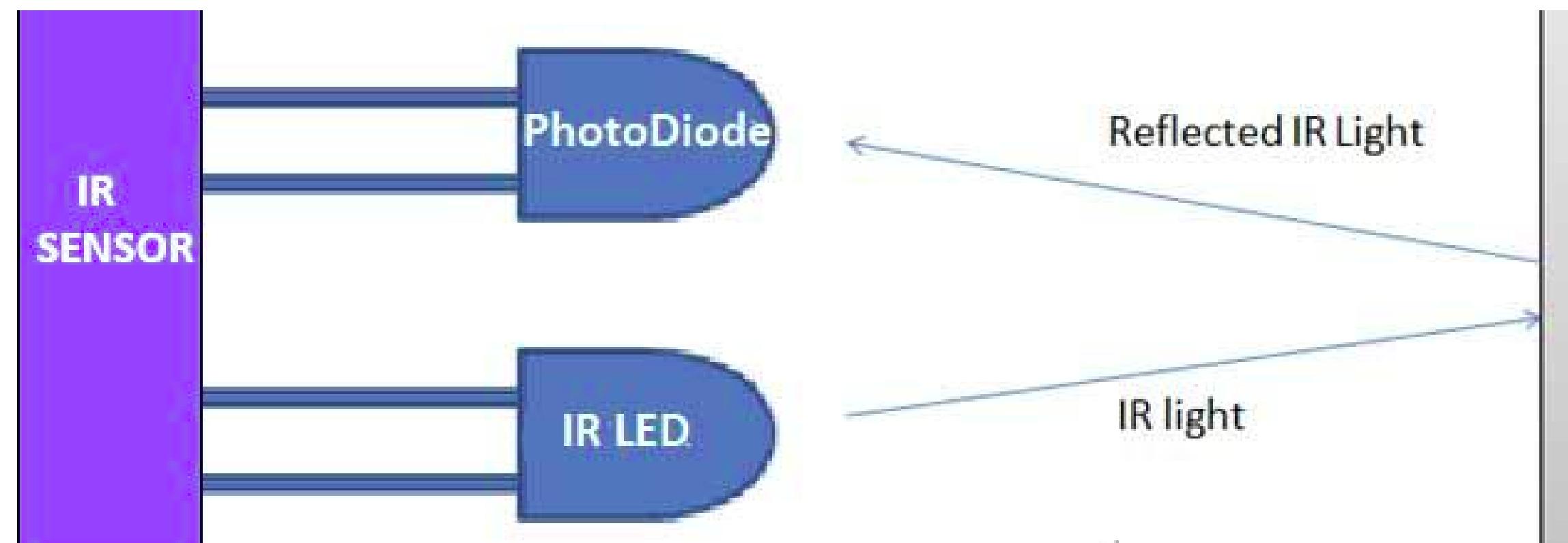


IR Sensor Modules



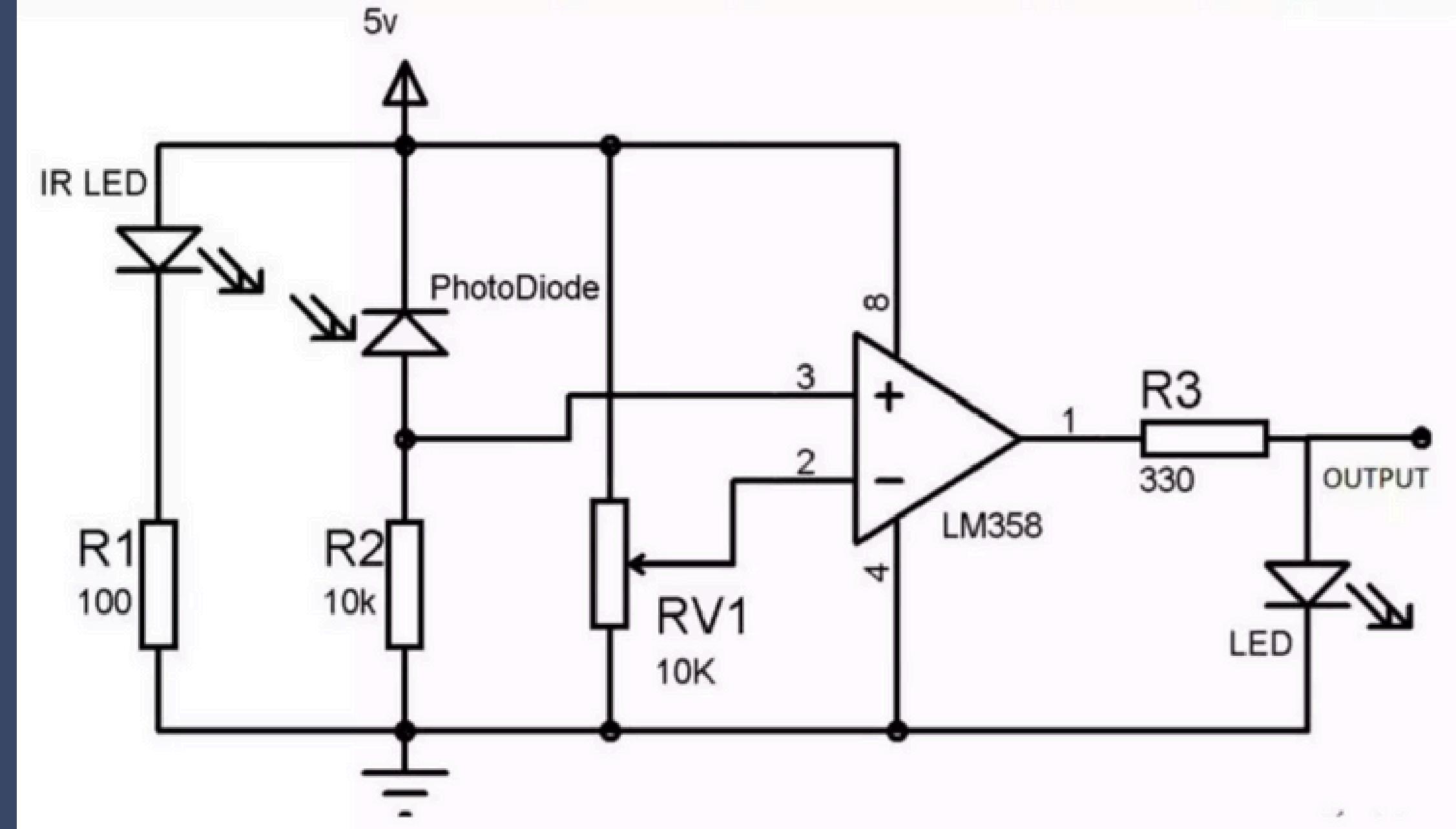
WORKING OF IR

- IR led keeps transmitting Infrared rays up to some range.
- When some objects comes in the IR range the IR wave hits the object and comes back.
- The Photodiode detects the IR which gets reflected from the object.

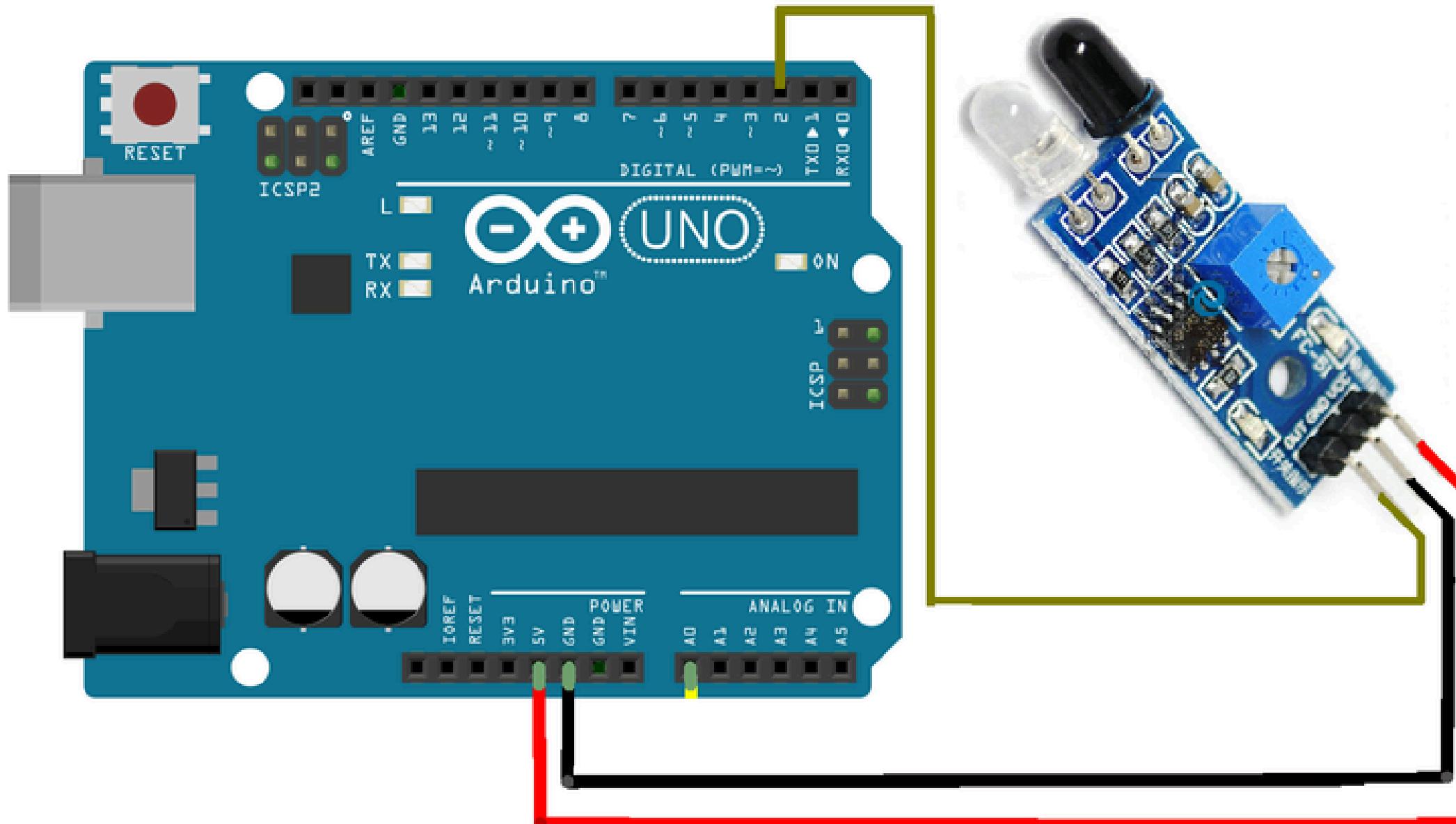


Completing the Circuit

IR SENSOR



INTERFACING WITH ARDUINO



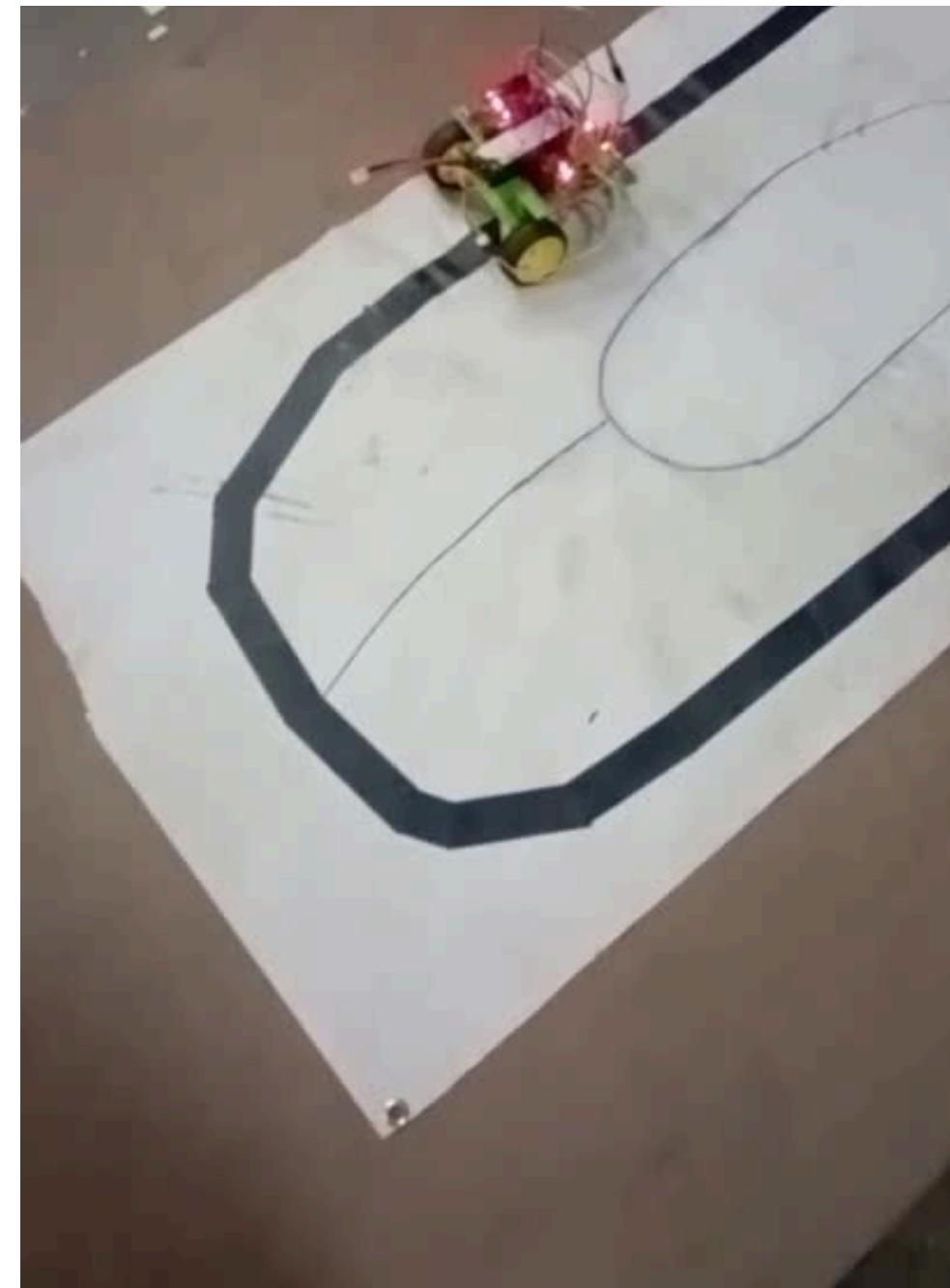
CODE

```
1 const int Sensor=2;
2
3 void setup() {
4     pinMode(Sensor,INPUT);
5     Serial.begin(9600);
6 }
7
8 void loop() {
9     if(digitalRead(Sensor)==HIGH)          //Check the sensor output
10    {
11        Serial.println("Object Detected");
12    }
13    else
14    {
15        Serial.println("No object in sight");
16    }
17    delay(100);                         // wait for a second
18 }
```

Practical Application

IR sensor

- Line following bot: As seen in video, IR sensor to detect black/white line on the floor to follow the line.
- Object detection bot: IR sensor detects nearby objects or walls to avoid collision.
- Automatic doors: IR sensors detect motion near doors to open/close automatically.



Ultrasonic Sensors

Ultrasonic Sensors

- An Ultrasonic Sensor is a device that measures the distance to an object using Ultrasonic Sound Waves.
- The Ultrasonic Sensor is also called “Transceiver Module” (Transmitter + Receiver).
- It transmits High Frequency Ultrasonic Waves of frequency greater than 20 KHz.
- It is commonly used for obstacle detection, object tracking, etc..

HC-SR04



HC-SR04:

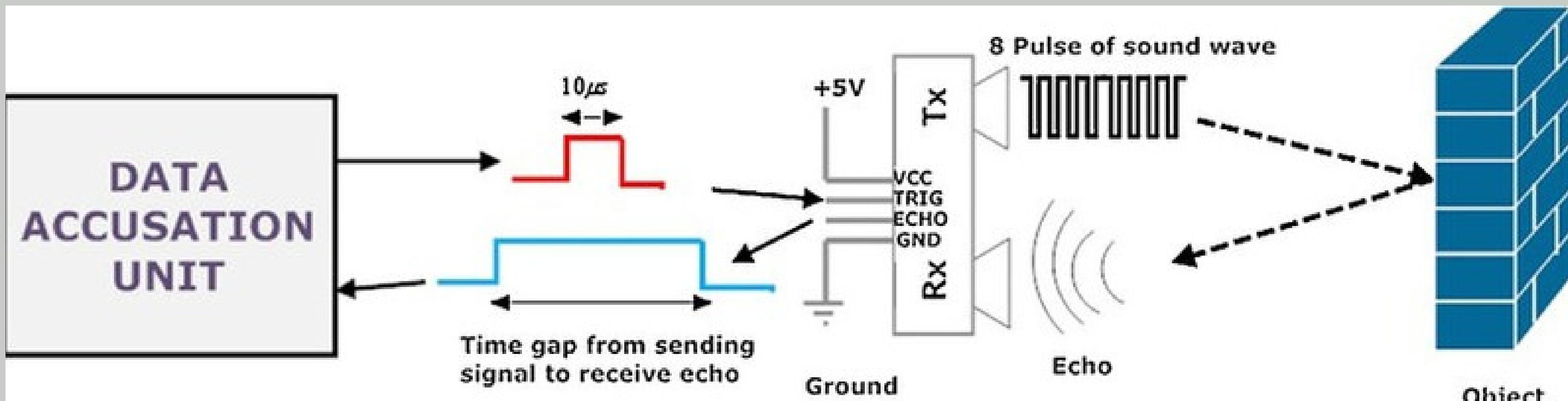
It has two main components:

- Trig: Send a 10us High Pulse (Digital Output)
- Echo: Measures duration of high pulse received

NOTE:

- Vcc requires 5V to operate.
- Range (2-400)cm

Working Principle

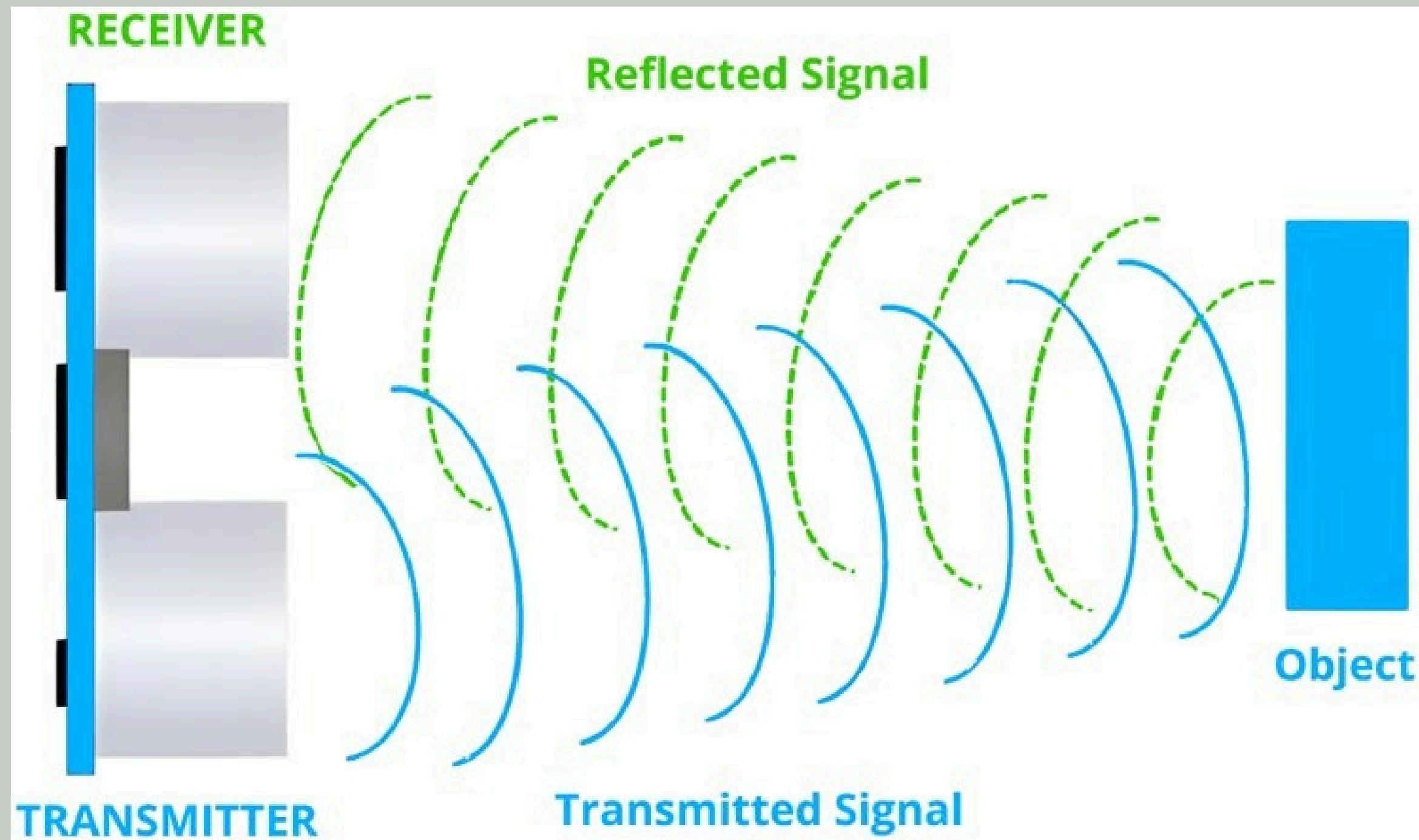


Applications

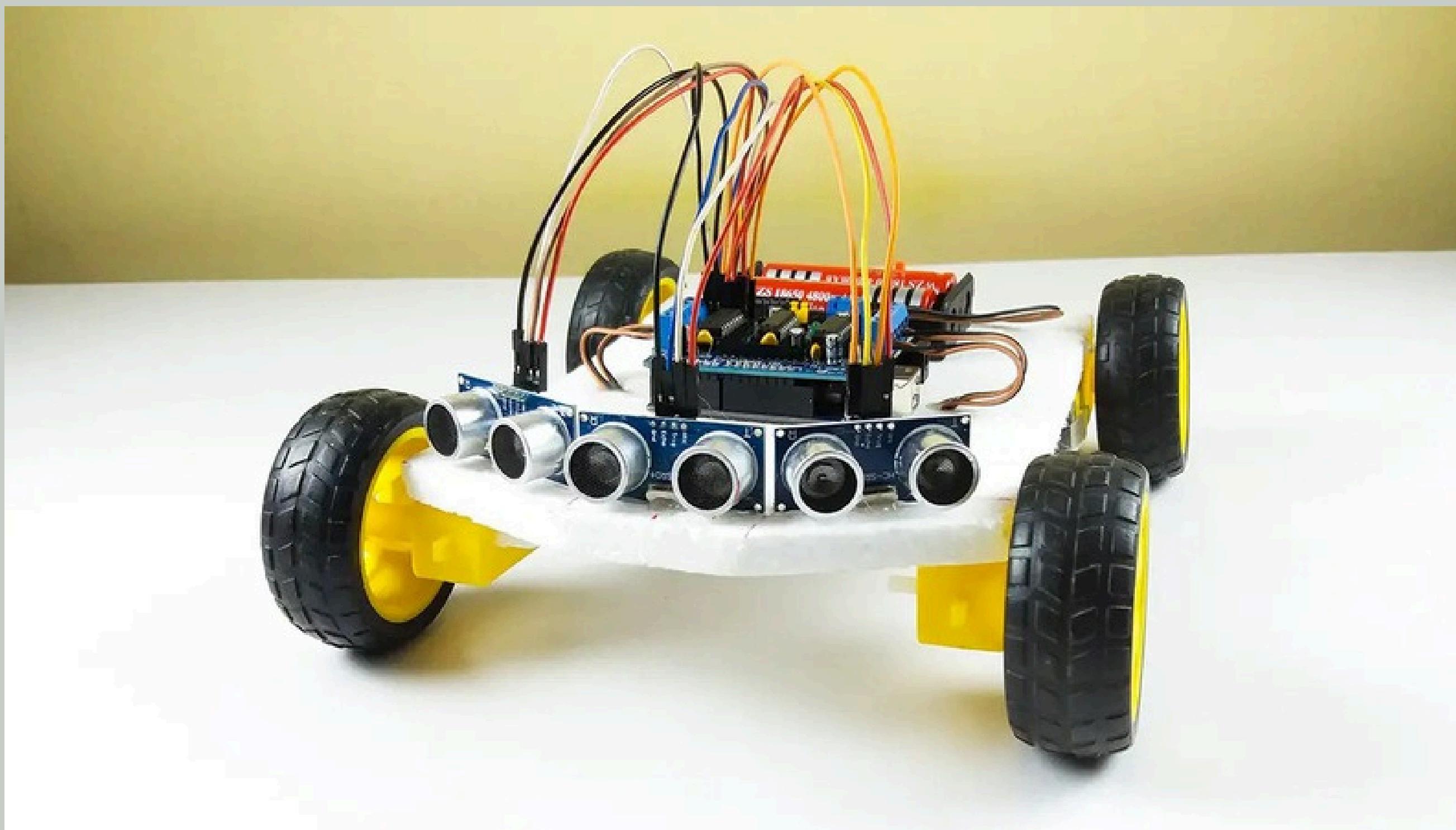
Ultrasonic Sensor can measure the following parameters, without even getting in contact with the medium which is to be measured:

- Distance
- Obstacle Avoiding Robot
- Parking Assistance System
- Automatic Door
- Maze-solving Micromouse

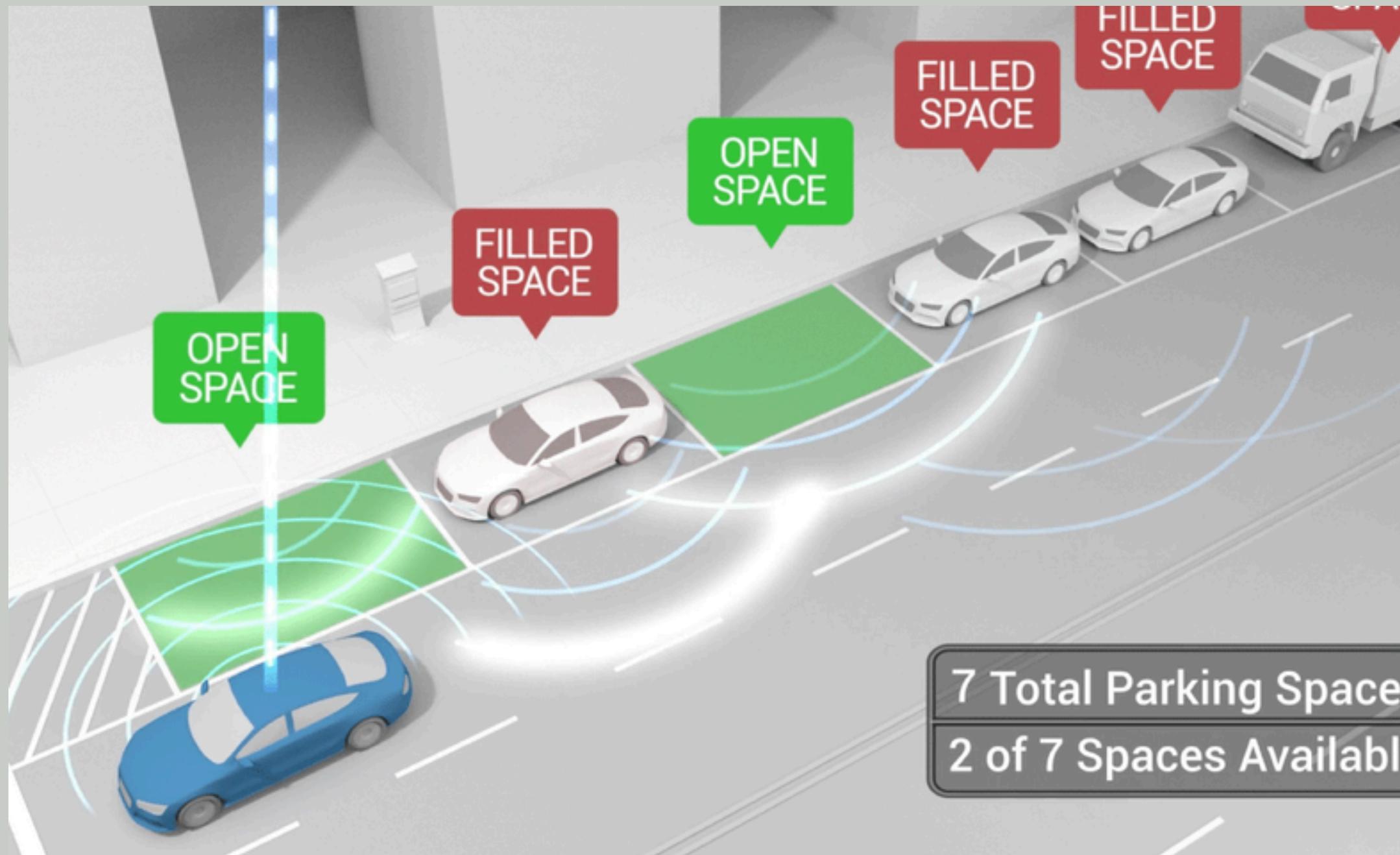
Proximity Sensor



Obstacle Avoiding Robot



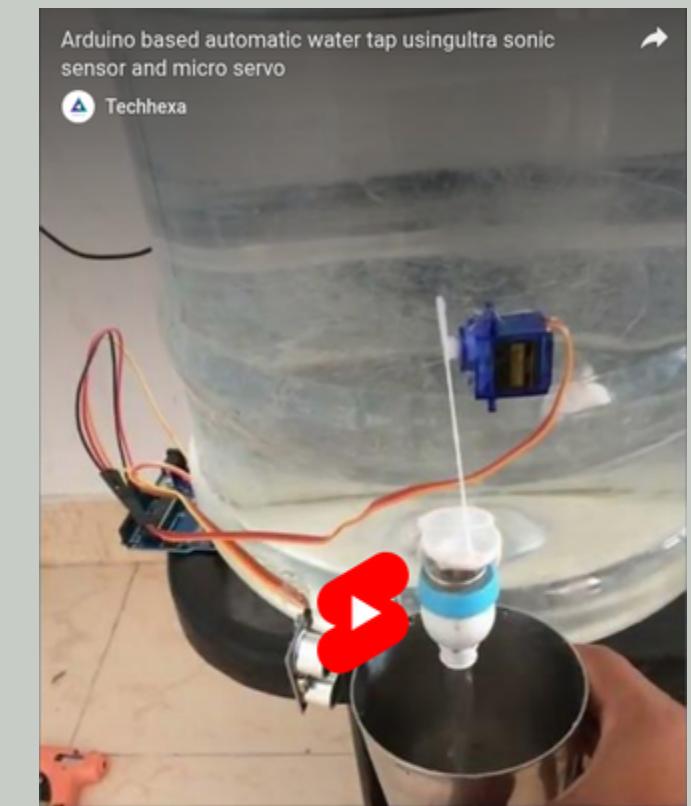
Advance Parking Assistance



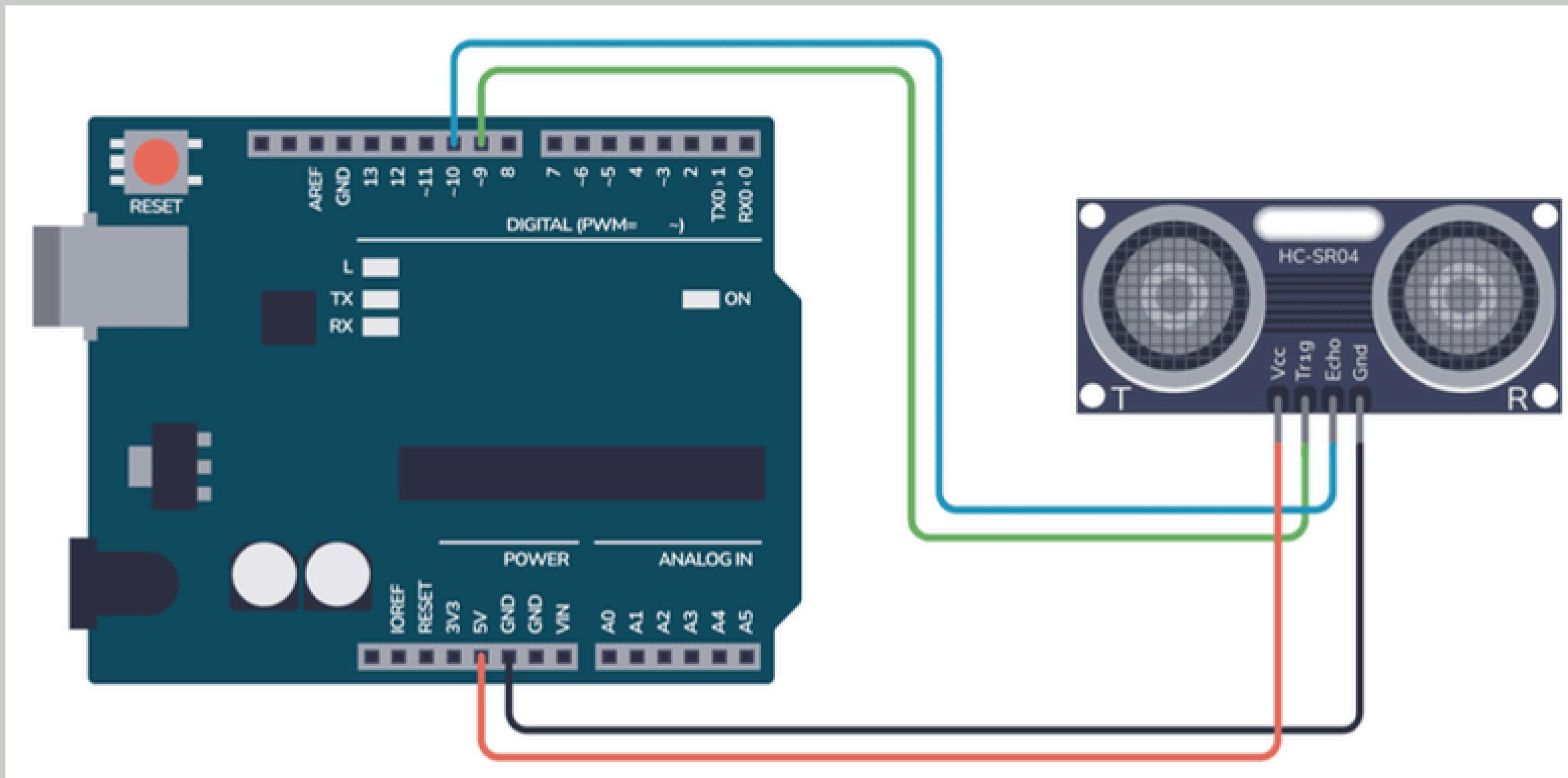
Measure depth of water



Automatic Water Dispenser



Circuit Diagram



Code

```
// Define pins for HC-SR04
const int trigPin = 9;
const int echoPin = 10;

void setup() {
Serial.begin(9600); // Start serial communication
pinMode(trigPin, OUTPUT);
pinMode(echoPin, INPUT);
}

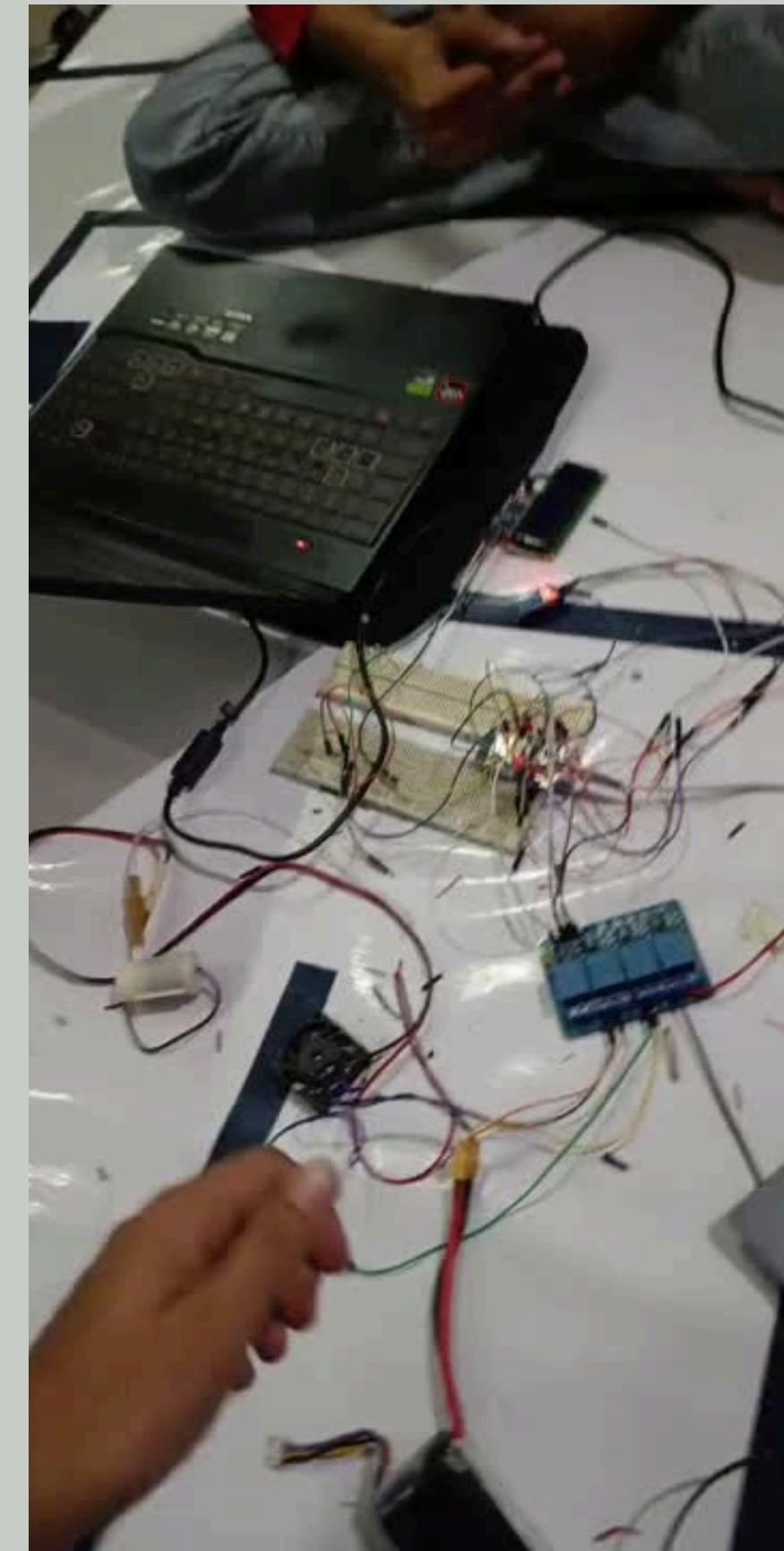
void loop() {
// Send a 10µs pulse to trigger the sensor
digitalWrite(trigPin, LOW);
delayMicroseconds(2);
digitalWrite(trigPin, HIGH);
delayMicroseconds(10);
digitalWrite(trigPin, LOW);
```

```
// Measure the echo pulse duration (in µs)
long duration = pulseIn(echoPin, HIGH);

// Calculate distance in cm (speed of sound = 343 m/s or 0.0343 cm/µs)
float distance = duration * 0.0343 / 2;

// Print distance to Serial Monitor
Serial.print("Distance: ");
Serial.print(distance);
Serial.println(" cm");

delay(500); // Wait before next reading
}
```



THANK YOU

