10 Class Study Material

Artificial Intelligence And Advanced Electronics

Questions?

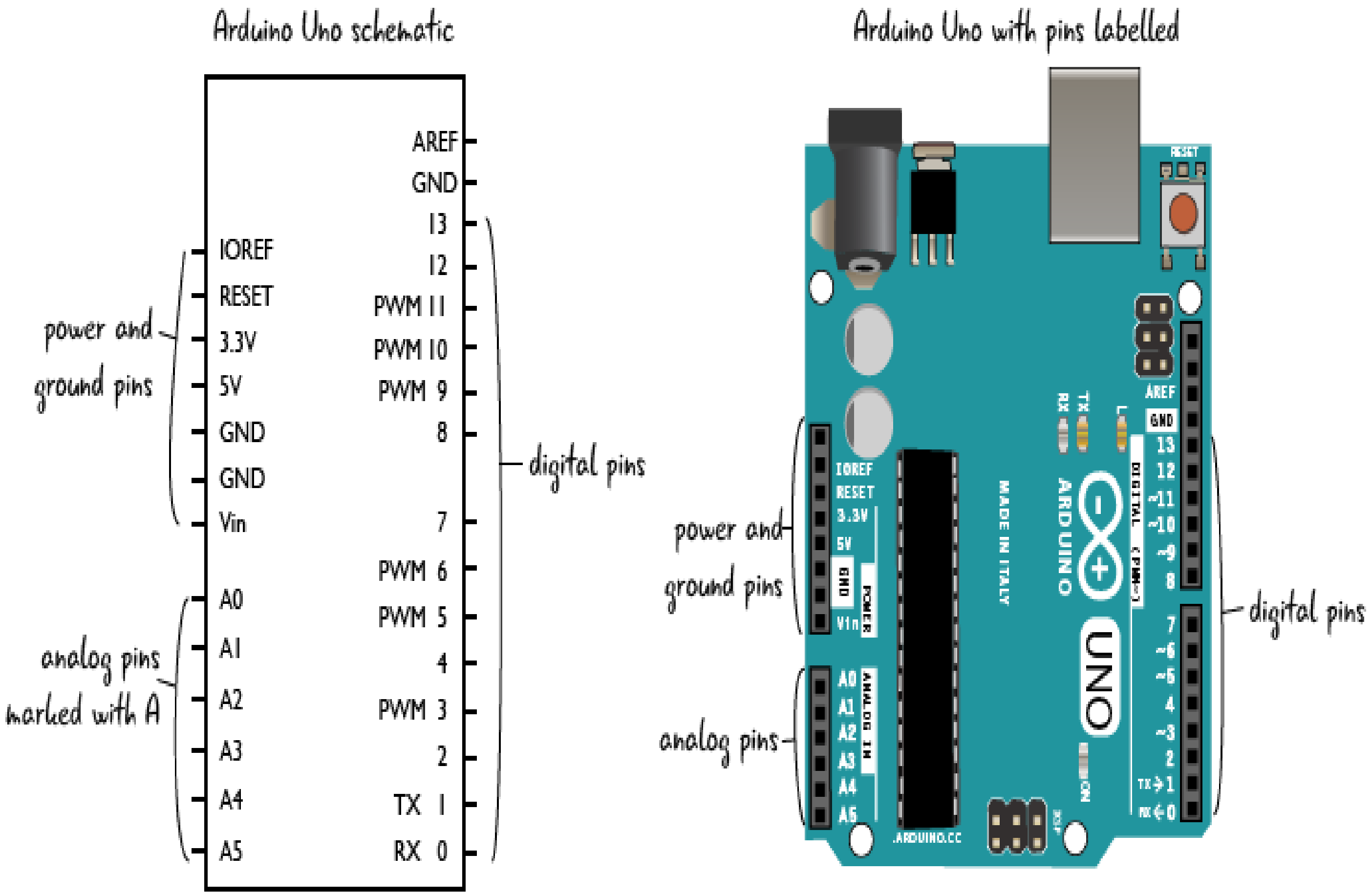
1. What are we going to learn? (Day 1)
2. Why this learning is important?
3. How this will beneficial for you?
4. Design a simple Project based on learning.

   Coding Ways: -

   Ans: We are going to learn Advanced Electronics
   1) Arduino
   2) Sensors – Ultra Sonic Sensor, IR Sensor, Soil Moisture Sensor
   3) Communication Module – Bluetooth HC-05 Module
   4) Switches – SPDT, DPDT, Electro-magnetic Switch (Relay)
   5) We will design a Project.

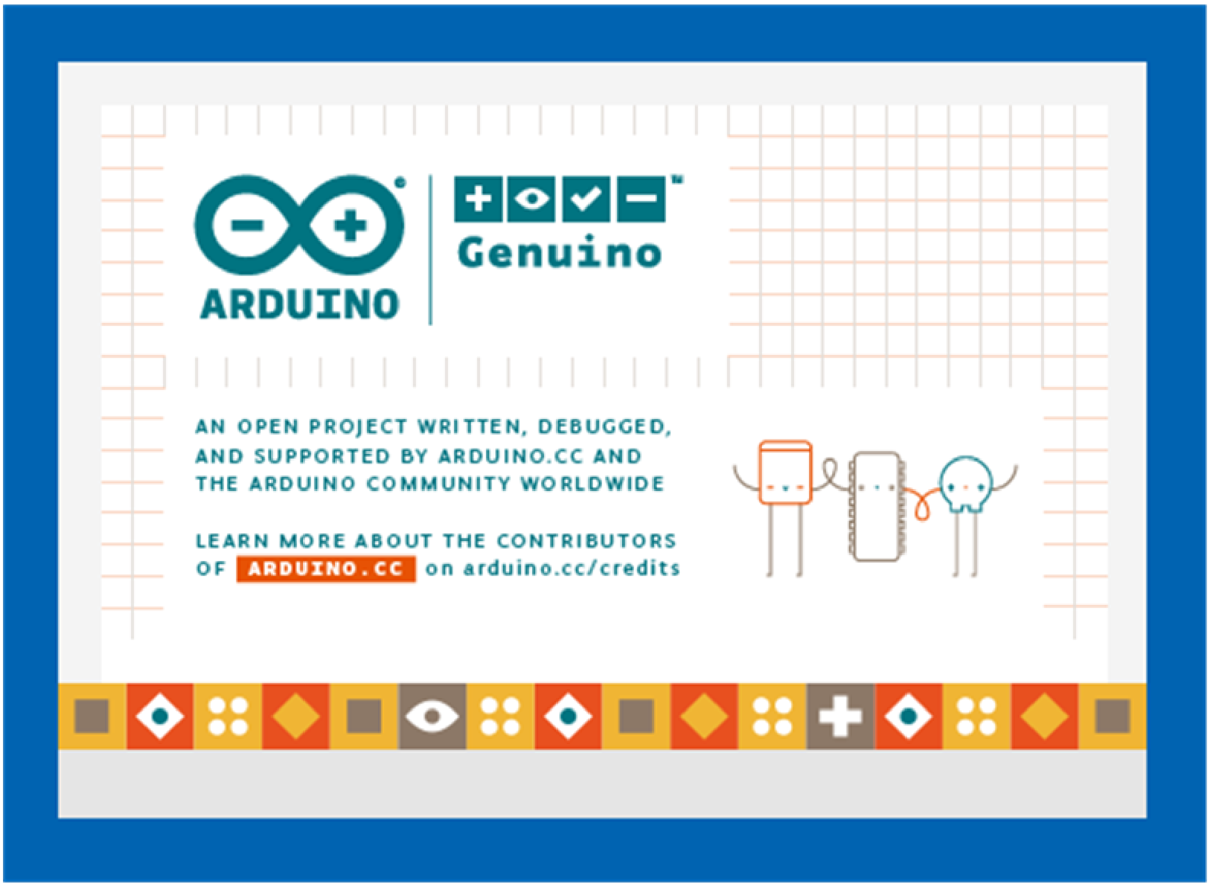
Start With Arduino: it’s a brain of Robots. Brain needs languages convey their thoughts similarly it also needed a language to communicate with their friends like Sensors, And Other Arduinos and Computers Mobile Phones.

We will focus mainly on Arduino UNO, See below Pin Dia-gram



Arduinos Language: As we speaking in English/ Similarly the speaking language of Arduino is “C”.

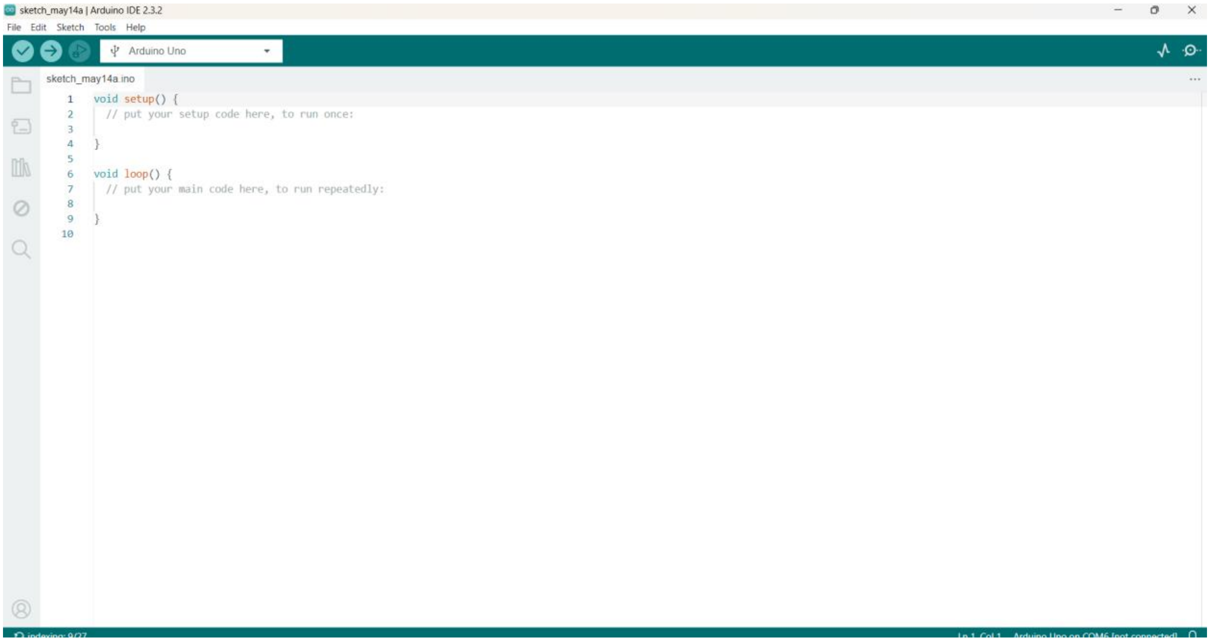
Installation of Arduino IDE.



AN OPEN PROJECT WRITTEN, DEBUGGED, AND SUPPORTED BY ARDUINO.CC AND THE ARDUINO COMMUNITY WORLDWIDE

LEARN MORE ABOUT THE CONTRIBUTORS OF ARDUINO.CC on arduino.cc/credits

Arduino IDE inside:



sketch_may14a | Arduino IDE 2.3.2
File Edit Sketch Tools Help
Arduino Uno
sketch_may14a.ino
indexing: 9/27
Ln 1, Col 1 Arduino Uno on COM6 [not connected]

```
void setup() {
  // put your setup code here, to run once:

}

void loop() {
  // put your main code here, to run repeatedly:

}

```

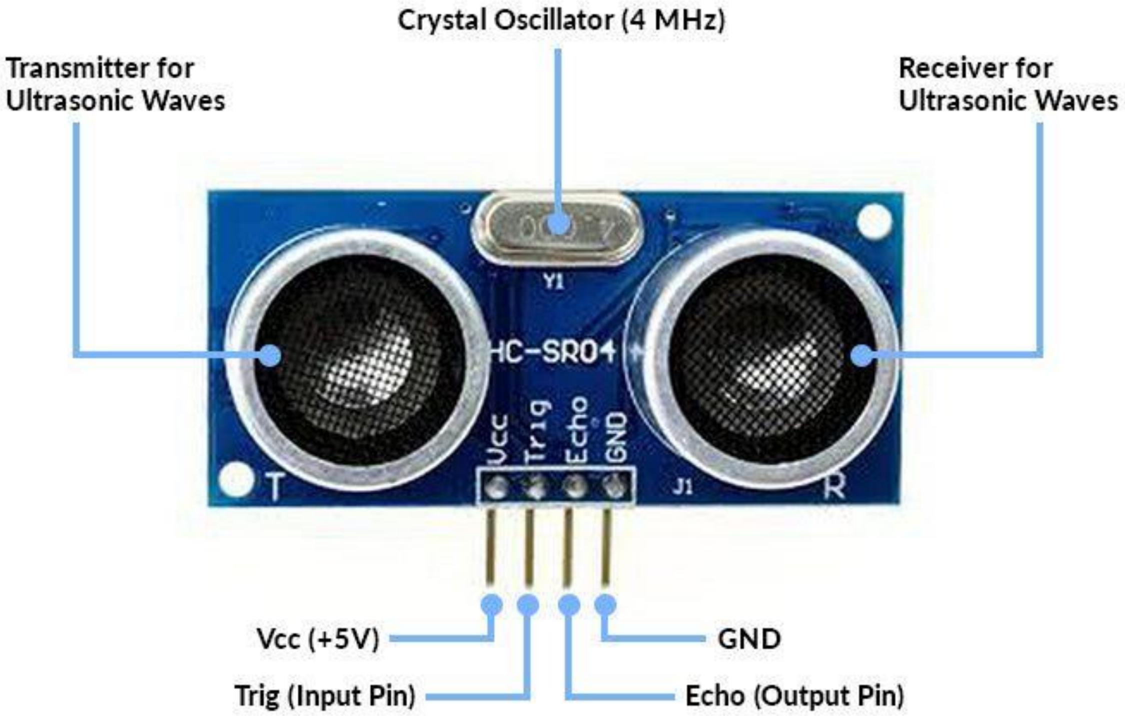
Best Way to Code Using AI Tool: **Chat gpt.**

Live Demo of Coding Using Chat Gpt:

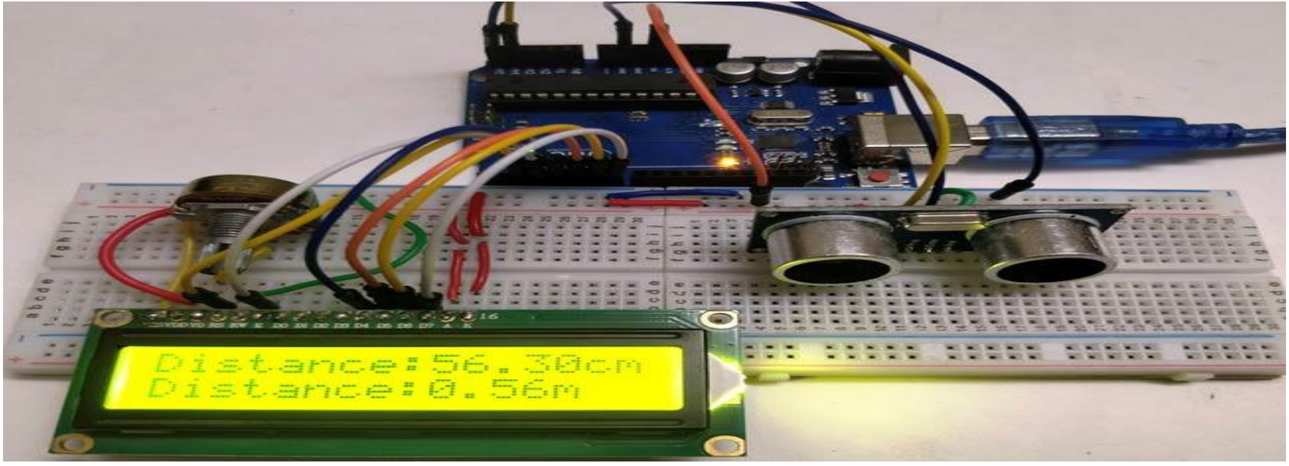
Sensors: Sensors are tools that detect things like light, temperature, or movement and turn that information into signals we can understand.

Ultra-Sonic: Ultrasonic sensors are devices that use sound waves with frequencies higher than the upper audible limit of human hearing to detect objects and measure distances. They emit ultrasonic pulses and then measure the time it takes for the sound waves to bounce back after hitting an object, allowing them to calculate distance. These sensors are commonly used in applications such as robotics, parking assistance systems, and industrial automation for non-contact distance measurement.

The frequency range typically used in ultrasonic sensors is above the upper limit of human hearing, which is about 20 kHz. Ultrasonic sensors commonly operate in frequencies ranging from 20 kHz to several megahertz (MHz).

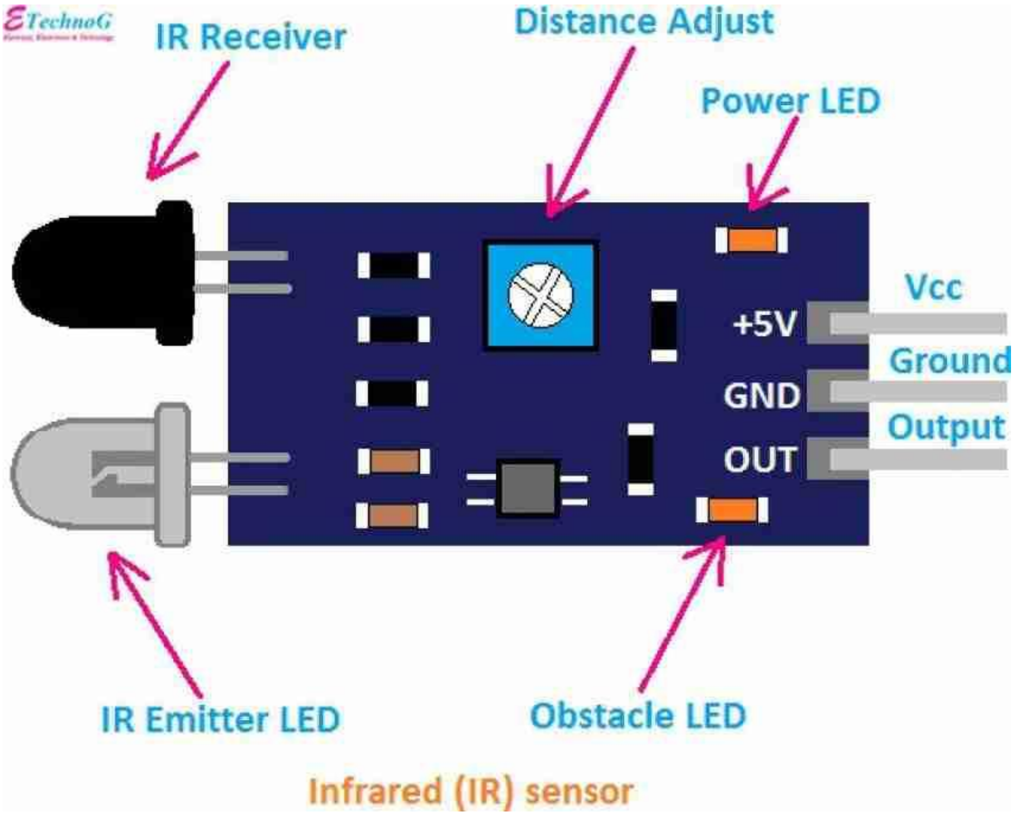

Crystal Oscillator (4 MHz)
Transmitter for Ultrasonic Waves
Receiver for Ultrasonic Waves
Y1
HC-SR04
Vcc
Trig
Echo
GND
T
J1
R
Vcc (+5V)
Trig (Input Pin)
GND
Echo (Output Pin)

```
// Code to measure Distance Using Ultra-Sonic Sensor
const int trigPin = 9; // Trigger pin of the ultrasonic sensor
const int echoPin = 10; // Echo pin of the ultrasonic sensor
void setup() {
  Serial.begin(9600); // Initialize serial communication
  pinMode(trigPin, OUTPUT); // Set the trigger pin as an output
  pinMode(echoPin, INPUT); // Set the echo pin as an input
}
void loop() {
  long duration, distance;
  // Clear the trigger pin to ensure a clean pulse
  digitalWrite(trigPin, LOW);
  delayMicroseconds(2);
  // Send a 10 microsecond pulse to trigger the sensor
  digitalWrite(trigPin, HIGH);
  delayMicroseconds(10);
  digitalWrite(trigPin, LOW);
  // Measure the duration of the echo pulse
  duration = pulseIn(echoPin, HIGH);
  // Calculate the distance based on the speed of sound (343 meters per second)
  // and the time it took for the echo to return
  distance = (duration * 0.0343) / 2;
  // Print the distance to the Serial Monitor
  Serial.print("Distance: ");
  Serial.print(distance);
  Serial.println(" cm");
  // Wait a short time before taking the next measurement
delay(1000);}
```



Project 1

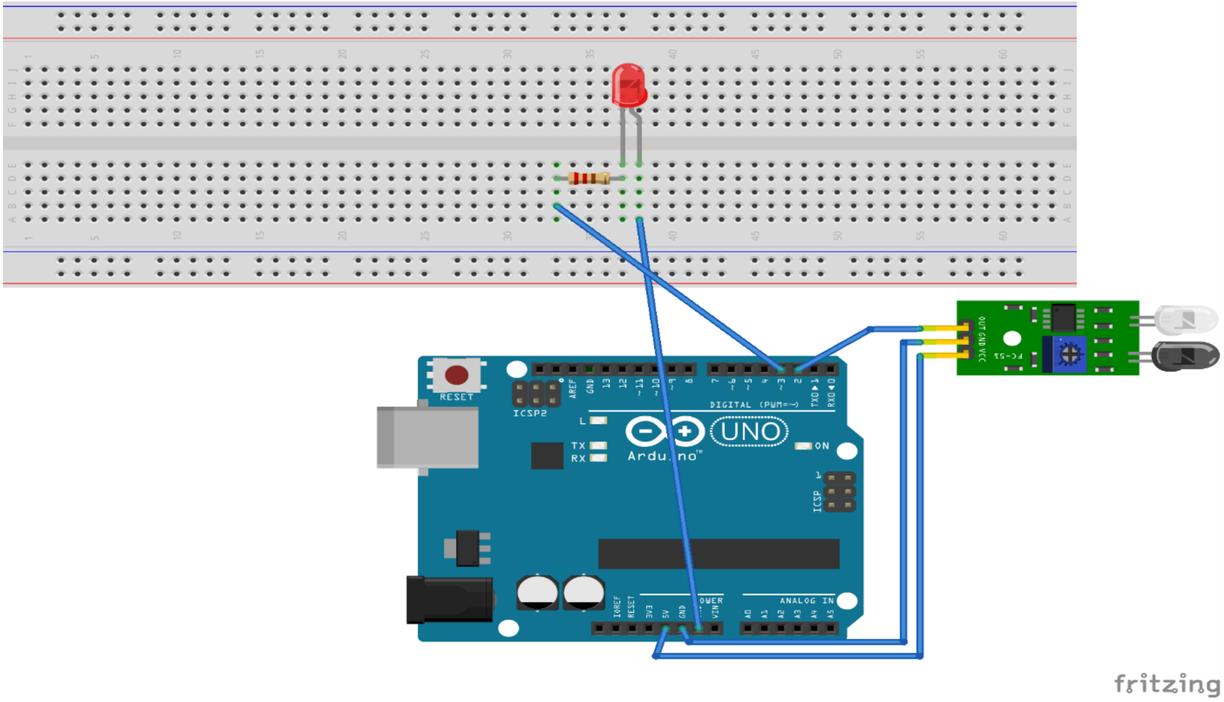
An IR (infrared) sensor is a device that detects infrared radiation in its surrounding environment. These sensors typically contain an IR transmitter and an IR receiver. The transmitter emits infrared light, which is invisible to the human eye, and the receiver detects any reflected or emitted IR radiation. When an object is in close proximity to the sensor, it reflects or emits IR light, which is then detected by the receiver. IR sensors are commonly used for proximity sensing, object detection, motion detection, and ambient light sensing in various applications such as security systems, robotics, and automatic appliances.



Applications:

1. Proximity Sensor
2. Distance Calculations

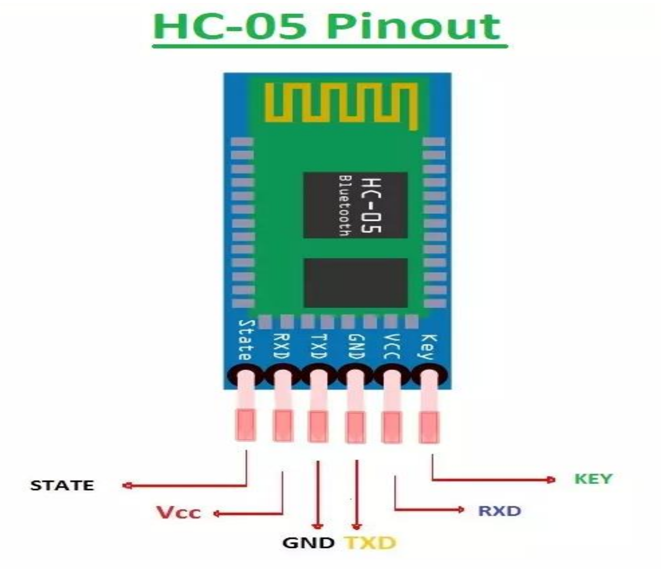
```
// Proximity Sensor
const int irSensorPin = 7; // Pin connected to the IR sensor

void setup() {
  Serial.begin(9600); // Initialize serial communication
  pinMode(irSensorPin, INPUT); // Set the IR sensor pin as an input
}

void loop() {
  int irSensorValue = digitalRead(irSensorPin); // Read the value from the IR sensor

  // Check if an object is detected
  if (irSensorValue == HIGH) {
    Serial.println("Object detected!"); // Print message if object is detected
  } else {
    Serial.println("No object detected"); // Print message if no object is detected
  }

  delay(1000); // Wait for a short time before taking the next reading
}
```



Project 2 Proximity Sensor

```
// Code to Find Distance Using IR Sensor

const int irSensorPin = A0; // Analog pin connected to the IR sensor

void setup() {
  Serial.begin(9600); // Initialize serial communication
}

void loop() {
  // Read the analog value from the IR sensor
  int irSensorValue = analogRead(irSensorPin);

  // Convert the analog value to voltage (assuming 5V Arduino)
  float voltage = irSensorValue * (5.0 / 1023.0);

  // Convert voltage to distance using a calibration equation
  // Replace the coefficients with values obtained from sensor datasheet or experimentation
  float distance = 1.0 / (voltage * 0.0012 + 0.08); // Example calibration equation

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

  delay(1000); // Wait for a short time before taking the next reading
}
```

Bluetooth Module



The HC-05 is a commonly used Bluetooth module for wireless communication. Here's a brief description of its pins:

1. **VCC**: This pin is used to power the module. It typically requires 3.3V or 5V depending on the model.
2. **GND**: Ground pin for the power supply.
3. **TXD**: Transmit Data pin. It sends data from the HC-05 module to another device.
4. **RXD**: Receive Data pin. It receives data from another device to the HC-05 module.
5. **STATE**: This pin is optional and is used for indicating the status of the module (e.g., whether it's in pairing mode or connected).
6. **EN (Enable)**: Some modules have this pin to enable or disable the module. When pulled HIGH, it enables the module; when pulled LOW, it disables it.

7. **KEY**: This pin is used to set the module in AT command mode. Pulling this pin HIGH or LOW for a certain duration can trigger the module to enter the AT command mode, where you can configure its settings.

Here are some applications of the HC-05 Bluetooth module:

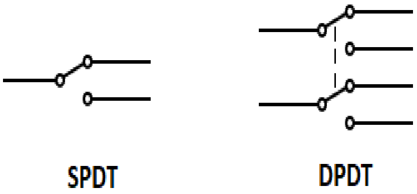
1. Wireless Serial Communication
2. Robotics and Remote Control
3. Smartphone Integration
4. Bluetooth Headsets and Audio Streaming
5. Wearable Technology
6. DIY Electronics Projects

Mobile App: **Arduino Bluetooth**

Arduino Robot Car Wireless Control
- HC-05 Bluetooth
- NRF24L01
- HC-12
Arduino Robot Car Control
Connect
Disconnect
Bluetooth status: Connected
How To Mechatronics
www.HowToMechatronics.com

SPDT and DPDT: Single Pole Double Throw means one stick can connect with two terminals but we able to connect only with one at a time in between two.

Double Pole Double Throw: With these two sticks with two terminals in such switch we are able to make two connections at a time among the four.

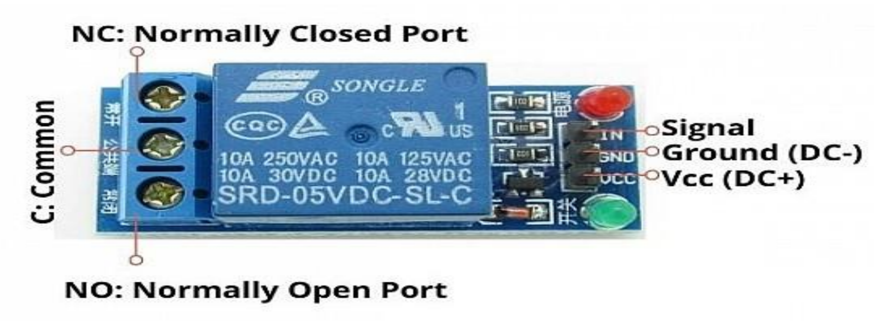


Relay

Relays are electromagnetic switches that are commonly used in a variety of applications to control high-power electrical devices or circuits using low-power signals. Some applications of relays include:

1. Home Automation Systems
2. Industrial Automation
3. Automotive Electronics
4. HVAC (Heating, Ventilation, and Air Conditioning) Systems
5. Lighting Control Systems
6. Motor Control
7. Power Distribution and Protection
8. Safety Interlocks
9. Remote Control Systems
10. Renewable Energy Systems

These are just a few examples, and relays find applications in many other fields as well due to their versatility and reliability in switching high-power loads.



In a typical relay, the connection for the AC supply would depend on the specific type of relay and its configuration. However, in general terms, the AC supply would be connected to the relay's "Common" (COM) and "Normally Open" (NO) or "Normally Closed" (NC) terminals, depending on the desired functionality.

Here's a basic explanation:

1. **Common (COM)**: This terminal is usually connected to one side of the AC supply. It serves as a common connection point for the switching action of the relay.

2. **Normally Open (NO)**: When the relay is not energized, this terminal remains open (disconnected). When the relay is activated (energized), it closes the circuit between the Common (COM) and Normally Open (NO) terminals, allowing current to flow through.
3. **Normally Closed (NC)**: Conversely, this terminal is normally closed (connected) when the relay is not energized. When the relay is activated (energized), it opens the circuit between the Common (COM) and Normally Closed (NC) terminals, interrupting the flow of current.

So, to connect an AC supply to a relay:

- Connect one wire of the AC supply to the Common (COM) terminal.
- Connect the other wire of the AC supply to either the Normally Open (NO) or Normally Closed (NC) terminal, depending on whether you want the circuit to be closed or open by default when the relay is not energized.

It's crucial to follow proper safety procedures and adhere to electrical codes when working with AC power to prevent accidents or damage to equipment. If you're unsure about wiring or safety precautions, it's best to consult with a qualified electrician or engineer.

Written By Ankush Sharma