lab Report

On

IR Infrared Obstacle Avoidance Sensor

Submitted by-

ANANYA PODDAR (2307007)

KALINGA INSTITUTE OF INDUSTRIAL TECHNOLOGY

Deemed to be University U/S 3 of the UGC Act, 1956

B. Tech Programme in Electronics and Electrical Engineering

School of Electronics Engineering

Kalinga Institute of Industrial Technology

Bhubaneswar, India

October 2021

OBJECTIVE :-

The **IR Infrared Obstacle Avoidance Sensor** detects obstacles by emitting infrared light and measuring the reflected signal. It provides a digital output (HIGH or LOW) depending on whether an object is detected. The **ESP32** can read the sensor's output and take appropriate action, such as stopping or turning a motor. In this tutorial, we'll interface the IR sensor with the ESP32 to detect obstacles.

REQUIRED COMPONENTS:-

- ESP32 Board
- IR Sensor
- Jumper wires
- Breadboard (optional)

THEORY:-

The IR Obstacle Avoidance Sensor operates on the principle of diffuse reflection of infrared light.

1. Emitter: The sensor houses an IR LED that continuously emits infrared light.
2. Detector: A photodiode is positioned to receive reflected IR light.
3. Operation:
   - No Obstacle: The IR light is not reflected back to the photodiode. The sensor's onboard comparator circuit outputs a HIGH digital signal (or LOW, depending on the sensor's configuration).
   - Obstacle Detected: When an object enters the range, it reflects the IR light back to the photodiode. The received signal changes the voltage on the comparator, causing the digital output pin to switch to LOW (or HIGH).
4. ESP32 Interface: The ESP32 reads this digital output pin. The change in state triggers the programmed logic (e.g., printing "Obstacle Detected" to the serial monitor). The sensor's sensitivity can be adjusted using a built-in potentiometer.

REQUIREMENTS :-

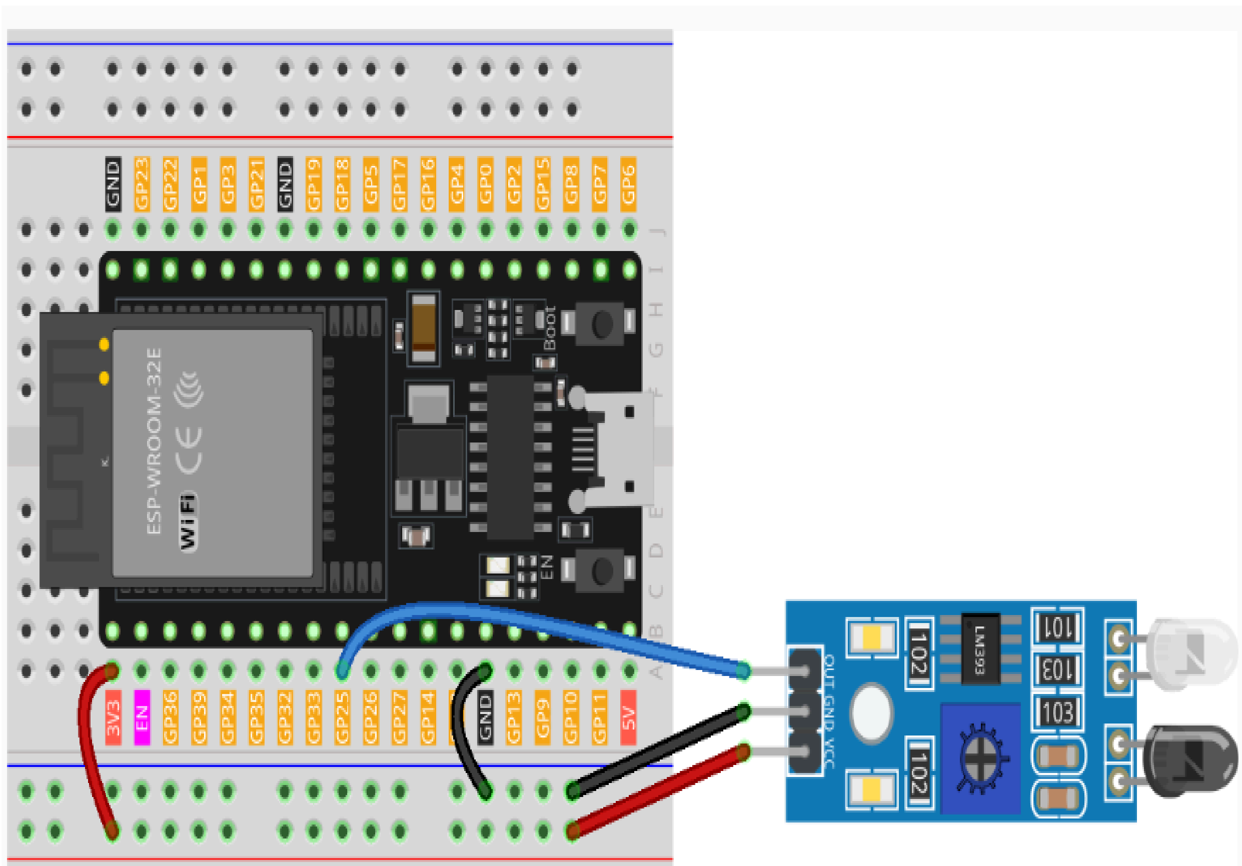
Step-by-Step Assembly Guide 🛠️

1. **Prepare the ESP32**: Ensure the ESP32 development board is connected to your computer via USB and the correct board is selected in the Arduino IDE.
2. **Power Connections**: Connect the power pins of the IR Sensor to the ESP32:
   - IR Sensor VCC → ESP32 3.3V Pin

    ○ IR Sensor GND → ESP32 GND Pin

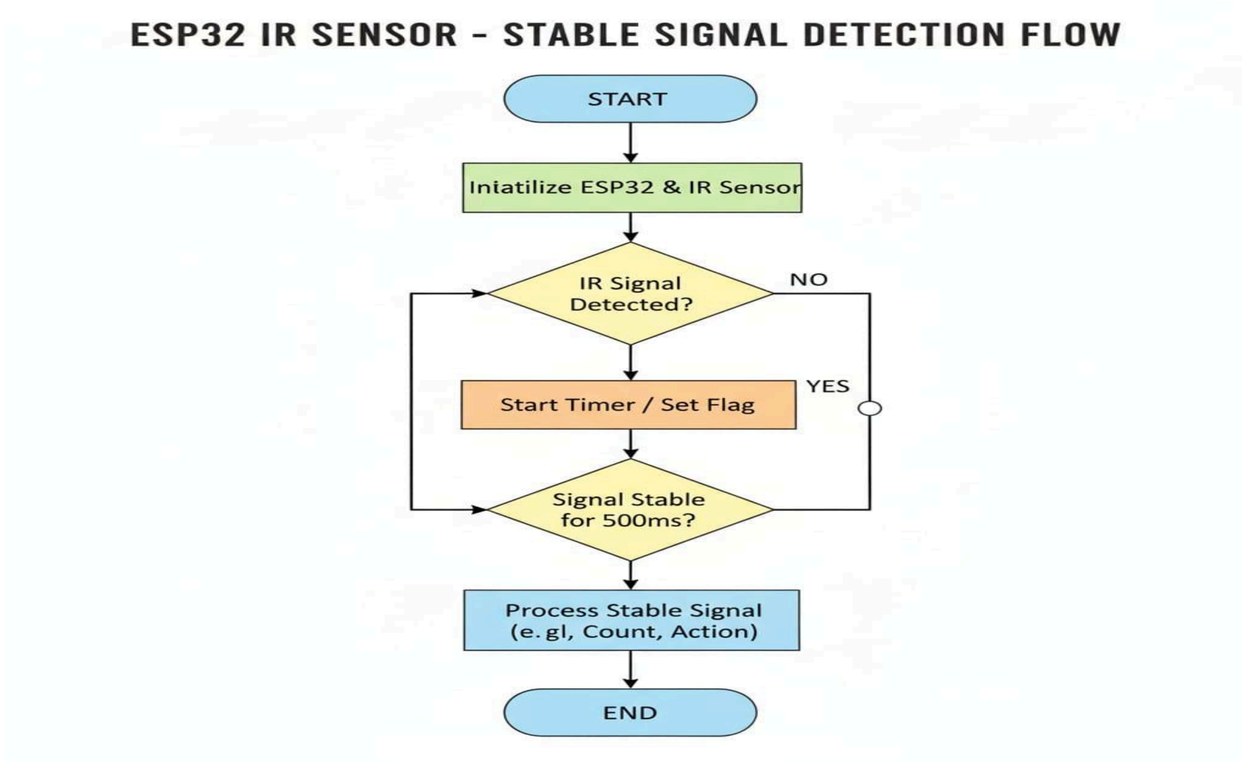
3. **Signal Connection:** Connect the digital output pin of the IR Sensor to a digital input pin on the ESP32. We will use GPIO 23 for this example.
    ○ IR Sensor OUT → ESP32 GPIO 23
4. **Upload Code:** Write and upload the code to the ESP32, defining GPIO 23 as the input pin and setting up the serial monitor for output.

CIRCUIT DIAGRAM :-



- IR SENSOR VCC → VIN, 3.3V (ESP32)
- IR SENSOR GND → GND (ESP32)
- IR SENSOR OUT → GPIO 15 (ESP32)

FLOWCHART :-



DESIGN CALCULATIONS/ CODE DEVELOPMENT :-

```
/*
  This code reads the digital value from a Infrared obstacle avoidance sensor connected to
  pin 25 and prints it to the serial monitor every 50 milliseconds.
  When the module detects obstacles ahead, the red indicator light on the module will
  illuminate and the OUT port will continuously output a low-level signal.
  Board: ESP32 Development Board
  Component: Infrared obstacle avoidance sensor
*/
```

```
// Define the pin numbers for the Infrared obstacle avoidance sensor

const int sensorPin = 25;

void setup() {

  pinMode(sensorPin, INPUT);  // Set sensorPin as input

  Serial.begin(9600);         // Start serial communication at 9600 baud rate

}

void loop() {

Serial.println(digitalRead(sensorPin));  // Read the digital value from the sensor and print it to the serial monitor

  delay(50);

}
```

OBSERVATIONS/RESULTS :-

Scenario	**IR Sensor Digital Output (GPIO 23)**	**IR Sensor Digital Output (GPIO 23)**
No Obstacle Present	HIGH (e.g., 3.3V)	No Obstacle Detected
Obstacle Placed in Front	LOW (e.g., 0V)	Obstacle Detected
Adjusting Potentiometer	Output state flips at different distances.	Demonstrated that the sensitivity/detection distance is tunable.

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Conclusion from Results:-

The ESP32 accurately read the digital state of the IR sensor, proving the successful interface and functional obstacle detection. The system provides a reliable binary (YES/NO) indication of an object's presence.

1. **Binary Reliability:** The sensor provides a clear, reliable **digital signal** (HIGH for no obstacle, LOW for obstacle), which simplifies the decision-making logic for the ESP32.

2. **Functional Interface:** The ESP32 successfully performed the `digitalRead()` operation, accurately translating the sensor's electrical state into a meaningful, executable command (serial output).
3. **Tunable Sensitivity:** By adjusting the **potentiometer** on the sensor module, the effective detection range was altered, proving that the system can be calibrated for specific application distances (e.g., a short-range robot bumper vs. a long-range gate sensor).

CONCLUSION :-

The interfacing of the IR Obstacle Avoidance Sensor with the ESP32 was successfully implemented. The system functions reliably, allowing the ESP32 to accurately interpret the sensor's digital HIGH/LOW output as a binary condition (object present or absent). This project serves as a robust platform for developing more complex applications requiring autonomous navigation, collision avoidance, and safety mechanisms.

REFERENCES:

References

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STUDENT SIGNATURES

NAME	ROLL NO.	SIGNATURE
ANANYA PODDAR	2307007	

SIGNATURE OF THE CONCERNED LAB FACULTY MEMBER

Signature of the concerned lab faculty member with date and comment