Wireless Project – esp32 connected to sensors

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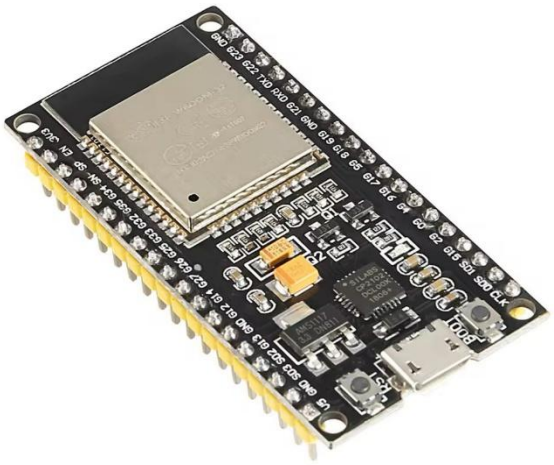
Esp32 component :

ESP32 is a low-cost, powerful microcontroller developed by Espressif Systems. It comes with built-in Wi-Fi and Bluetooth capabilities, making it ideal for IoT (Internet of Things) projects.

Key Features:

- Dual-core 32-bit processor
- Wi-Fi (802.11 b/g/n) and Bluetooth (Classic + BLE)
- Multiple GPIO pins (can control sensors, LEDs, motors, etc.)
- Supports protocols like SPI, I2C, UART, PWM, ADC, and DAC
- Low power consumption (ideal for battery-powered projects)



Common Uses:

- Home automation
- Wireless sensor networks
- Smart appliances
- Real-time data monitoring
- Robotics and automation projects

Wireless Sensor Alert System Using ESP32

1. Introduction

This project demonstrates a wireless sensor network using ESP32 microcontrollers. It involves four ESP32 boards communicating wirelessly. Each of the three ESP32s is connected to a different sensor (Ultrasonic, IR, and LDR), and the fourth ESP32 acts as a central unit that receives signals and triggers corresponding LEDs to indicate detection events.

2. Objective of project

- Build a low-power, low-latency wireless communication system.
- Detect physical changes using three different sensors.
- Indicate events visually through LEDs on a central ESP32.
- Use ESP-NOW protocol to ensure fast and reliable communication without Wi-Fi dependency.

3. Components Used

Component	Quantity	Description
ESP32 (ESP-WROOM-32)	4	Wi-Fi & Bluetooth-enabled microcontrollers
Ultrasonic Sensor (HC-SR04)	1	Distance measurement sensor
IR Sensor Module	1	Infrared obstacle detection module
LDR Sensor Module	1	Light intensity detection module
LEDs	3	Indicator LEDs for each sensor
Resistors (220Ω)	3	For current limiting on LEDs
Breadboard & Jumpers	3	For circuit assembly
Power Supply (USB or Battery)	4	Power for each ESP32

4. System Architecture

- **ESP32 #1 (Receiver):**
  - Connected to 3 LEDs on GPIO pins 32, 33, and 27.
  - Listens for ESP-NOW messages from other ESP32s.
  - Lights up the appropriate LED when a signal is received.
- **ESP32 #2 (Ultrasonic Sensor):**
  - Sends distance data if an object is detected within 50 cm.
  - Uses TRIG (GPIO 14) and ECHO (GPIO 12).
- **ESP32 #3 (IR Sensor):**
  - Sends signal when motion is detected by the IR sensor.
- **ESP32 #4 (LDR Sensor):**
  - Sends signal when light intensity drops below a certain threshold.

5. Communication Protocol: ESP-NOW

- ESP-NOW is a connectionless protocol developed by Espressif.
- Enables peer-to-peer communication.
- Very low-latency and no need for traditional Wi-Fi connection.
- MAC addresses are used to identify and send messages between devices.

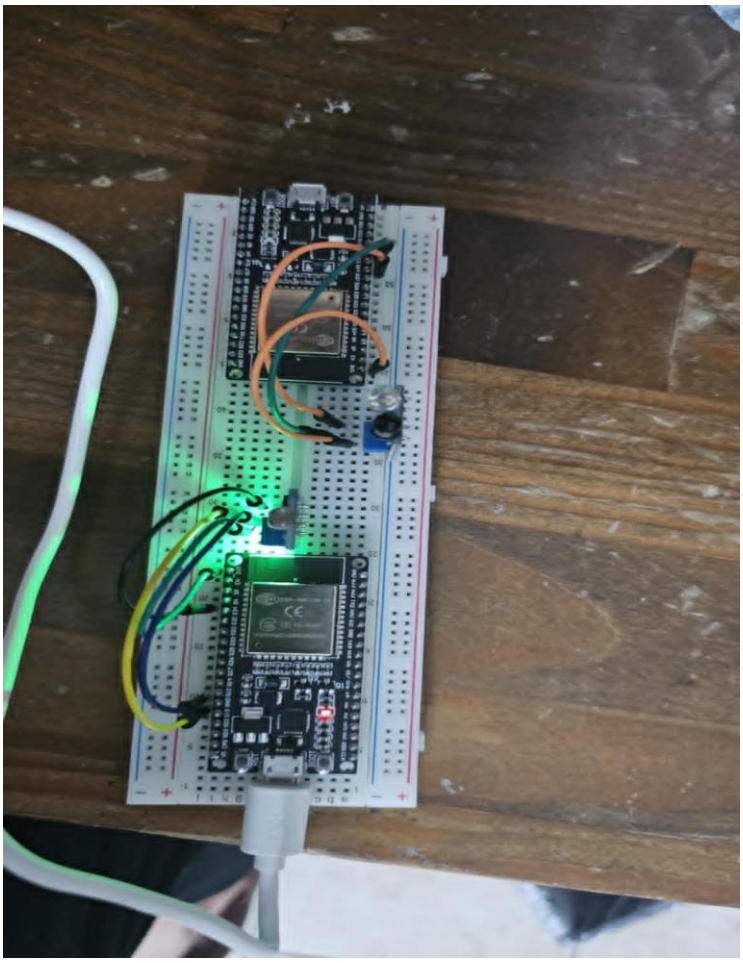
6. Working Mechanism

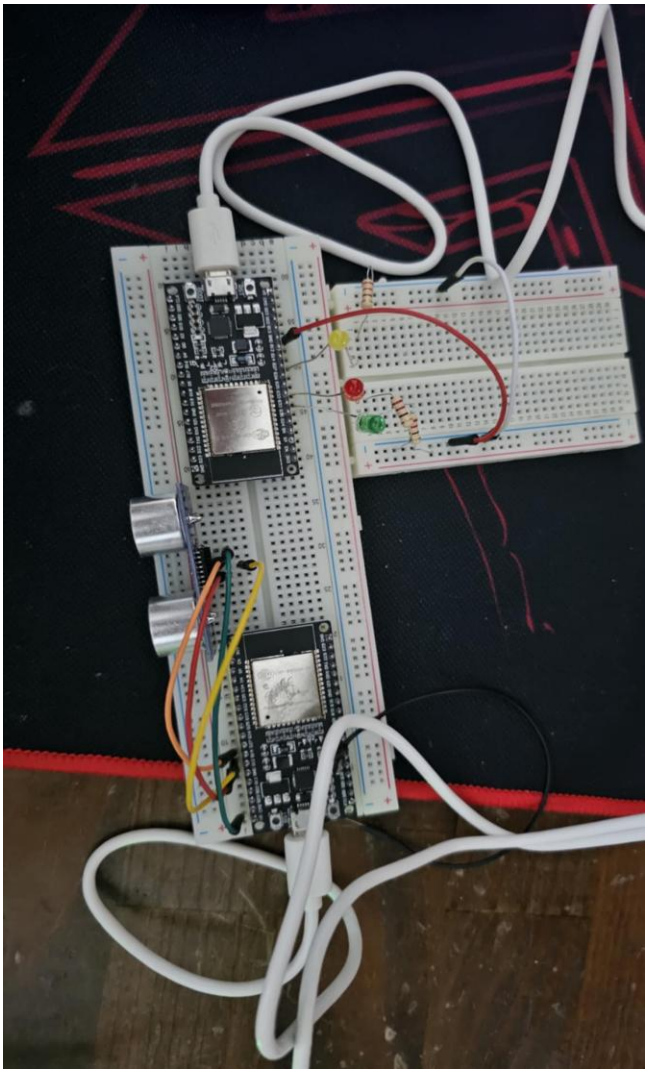
1. Each sender ESP32 reads its respective sensor data.
2. When a specific condition is met (e.g., object within 50cm, obstacle detected, darkness detected), it sends a signal to the main ESP32 via ESP-NOW.
3. The main ESP32 receives the message, checks the MAC address of the sender, and turns on the corresponding LED for a short duration to indicate detection.

8. Conclusion

The project successfully demonstrated real-time, wireless sensor communication using ESP32s and ESP-NOW. The use of MAC-address-based messaging allowed for easy identification of message sources. The system provides a scalable and energy-efficient solution for remote sensor monitoring in applications such as security systems, smart homes, and environmental monitoring.

Our project img :





I hope that everything is clear in this Report

And here you can see how our project is work :

Google drive video link :

https://drive.google.com/file/d/1MmJAbsDgjvzzMFi6NZp4PDpddClmTt7f/view?usp=drive_link