Project: Smoke and Gas Detection

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Smart Smoke and Gas Detection System Using ESP32 and Blynk

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1. Executive Summary

This project presents a Smart Smoke Gas Detection System using an ESP32 microcontroller, MQ-2 gas sensor, DHT11 temperature and humidity sensor, OLED display, and Blynk IOT platform.
The system continuously monitors gas and smoke levels in the environment and provides real-time alerts through a buzzer, LED indicators, OLED display, and mobile notifications via Blynk.
A baseline calibration mechanism is implemented to improve accuracy. When gas concentration exceeds a predefined threshold, the system activates alarms and logs events to the cloud. The project emphasizes real-time monitoring, safety automation, and remote access.

2. Introduction

Gas leakage and smoke incidents pose serious safety risks in homes and industries. Traditional gas detectors lack remote monitoring and smart alert features. This project aims to provide a smart IoT-based solution for early detection and remote monitoring.

Problem Statement

- No real-time gas level monitoring
- Lack of mobile alerts in conventional detectors
- Manual checking is unsafe and inefficient
- No environmental data logging

Project Goals

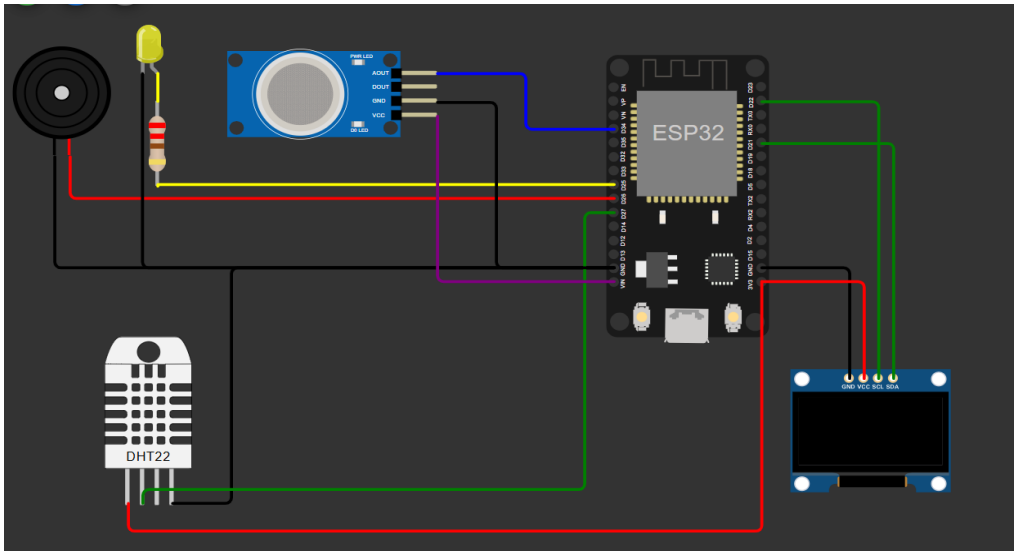
- Detect smoke and gas leakage using MQ-2 sensor
- Monitor temperature and humidity
- Provide real-time alerts using buzzer and LED
- Display live data on OLED
- Send data and alerts to Blynk web app
- Enable remote monitoring

3. Methodology / System Design

- **ESP32 Microcontroller**
  Acts as the main controller with built-in Wi-Fi capability.
- **MQ-2 Gas Sensor**
  Detects smoke, LPG, methane, and other harmful gases.
- **DHT11 Sensor**
  Measures temperature and humidity of the environment.

- **OLED Display (SSD1306)**
  Displays gas value, temperature, humidity, and system status.
- **Buzzer**
  Provides audible alert during gas leakage.
- **LED**
  Visual indication of danger state.
- **Power Supply**
  Voltage supply for ESP32 from laptop
- **Platform IO**
- **Blynk IoT Platform**

Circuit Diagram



4. Implementation

Hardware Wiring

- MQ-2 sensor connected to analog pin GPIO 34
- DHT11 connected to GPIO 27
- Buzzer connected to GPIO 26
- LED connected to GPIO 25
- OLED connected via I2C (SDA: 21, SCL: 22)

Platform IO and ESP32 Setup

- Install required libraries:
  - Blynk
  - Adafruit SSD1306

    - Adafruit GFX
    - DHT Sensor Library
- Set Wi-Fi credentials and Blynk Auth Token
- Upload code to ESP32

Blynk Setup

- Create a new Blynk project
- Select ESP32 board
- Add widgets:
    - Gauge (Gas Value – V0)
    - LED Widget (LED status – V1)
    - Button (Buzzer control – V2)
    - Gauge (Gas Raw Value – V3)
    - Gauge (Temperature – V4)
    - Gauge (Humidity – V5)
- Configure **Event "smoke_alert."**

ESP32 CONFIGURATION

Start system

Connect to WiFi

Initialize sensors and OLED

Calibrate MQ2 baseline

Loop:

Read gas sensor

If gas value > threshold:

Turn ON LED and buzzer

Send alert to Blynk

Else:

Turn OFF LED and buzzer

Read temperature and humidity

Display data on OLED

Code Snippet

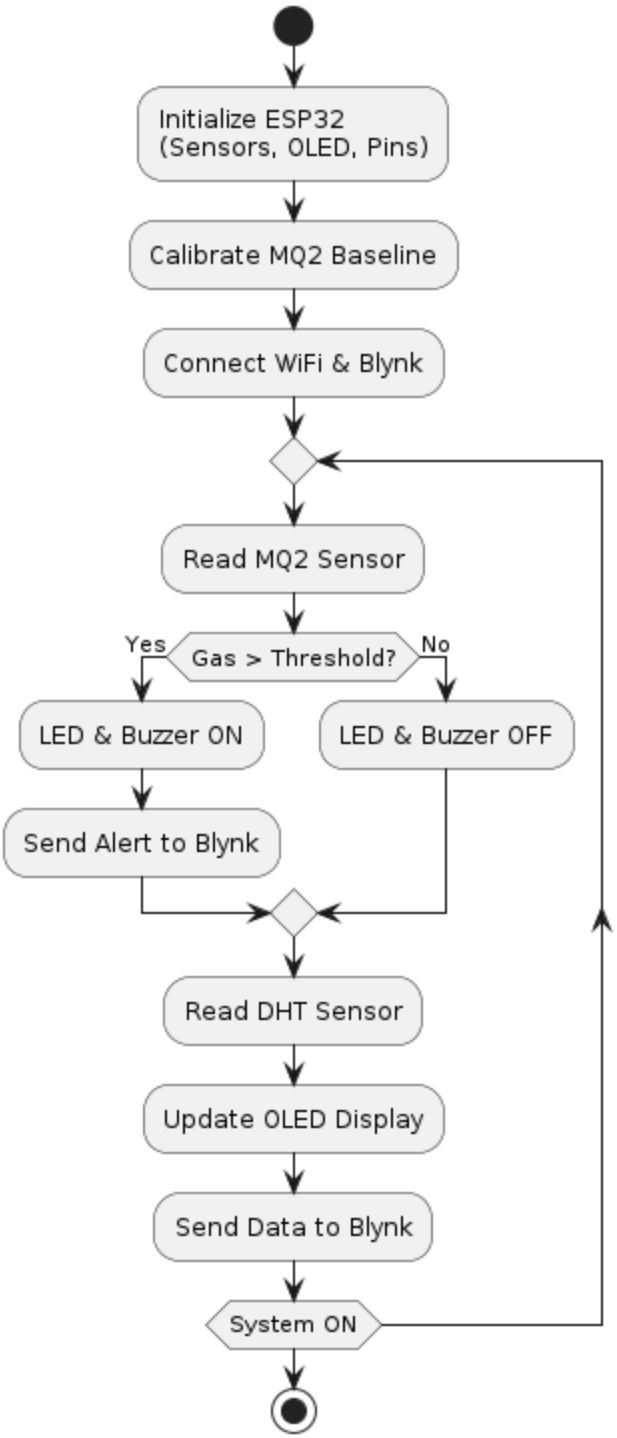
MQ-2 Gas Detection Logic:

```
int gasValue = rawValue - baseline;

if (gasValue > gasThreshold) {

 digitalWrite(LED_PIN, HIGH);

 digitalWrite(BUZZER_PIN, HIGH);

 Blynk.logEvent("smoke_alert", "Smoke/Gas Detected!");}
```

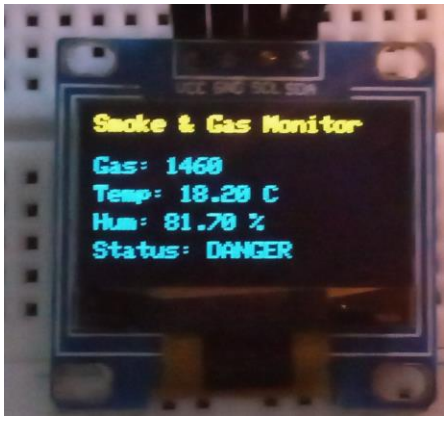
DHT Sensor Reading:

```
float t = dht.readTemperature();

float h = dht.readHumidity();

Blynk.virtualWrite(V4, t);

Blynk.virtualWrite(V5, h);
```

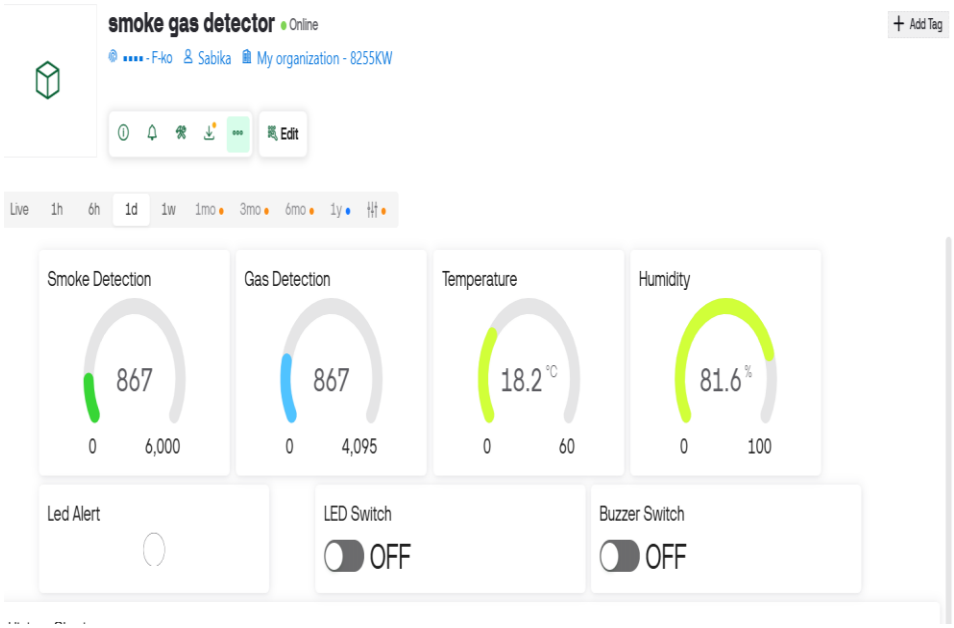
Flowchart Diagram:

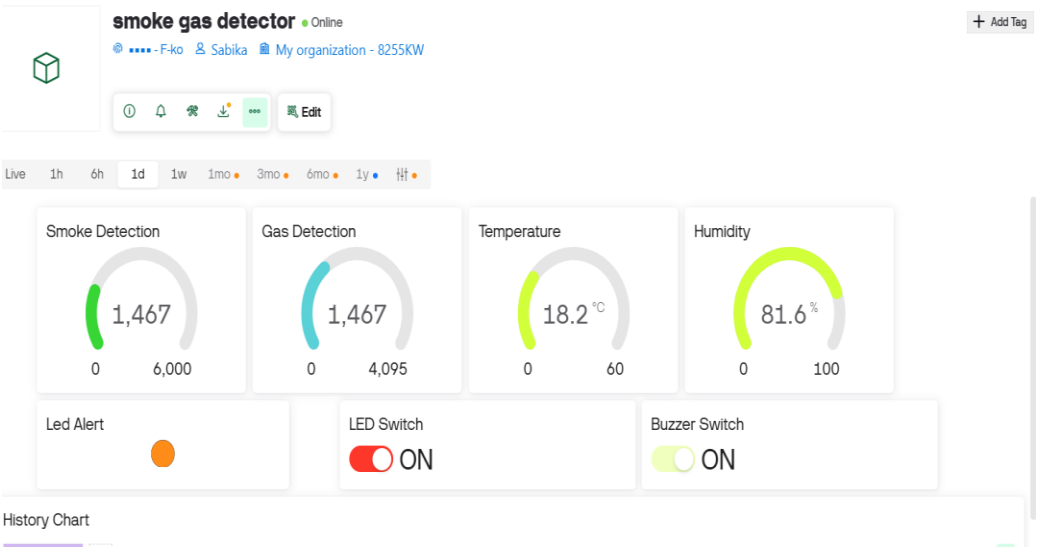

Initialize ESP32
(Sensors, OLED, Pins)
Calibrate MQ2 Baseline
Connect WiFi & Blynk
Read MQ2 Sensor
Yes
Gas > Threshold?
No
LED & Buzzer ON
LED & Buzzer OFF
Send Alert to Blynk
Read DHT Sensor
Update OLED Display
Send Data to Blynk
System ON

Output Screenshots

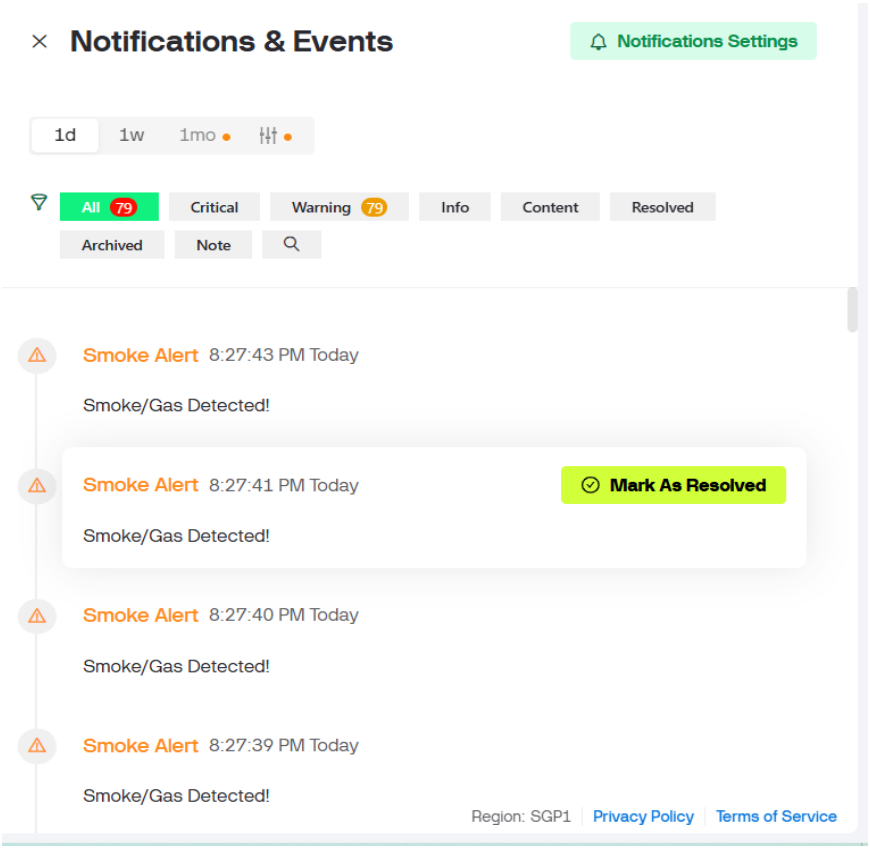


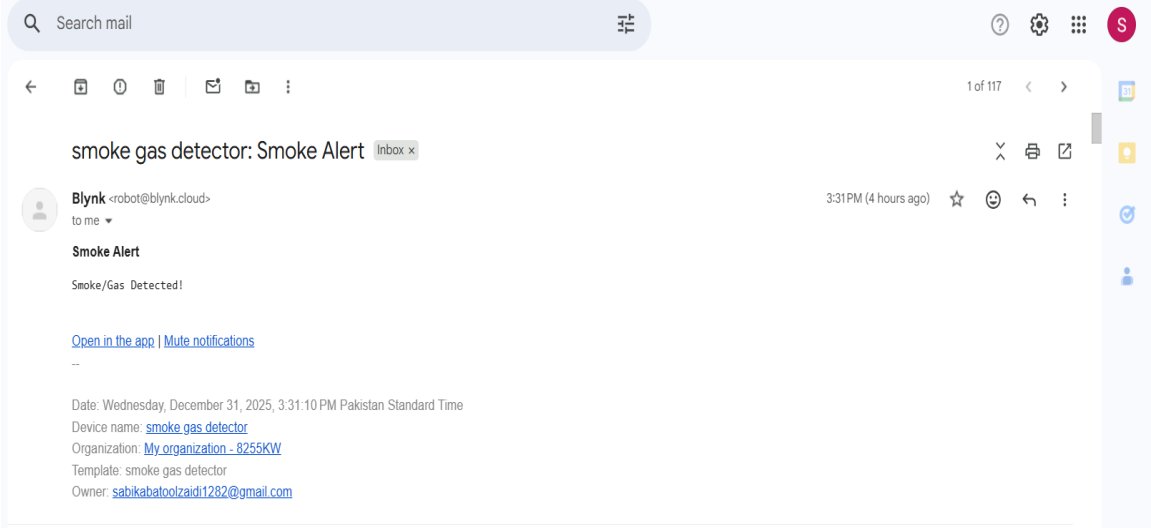
BLYNK DASHBOARD

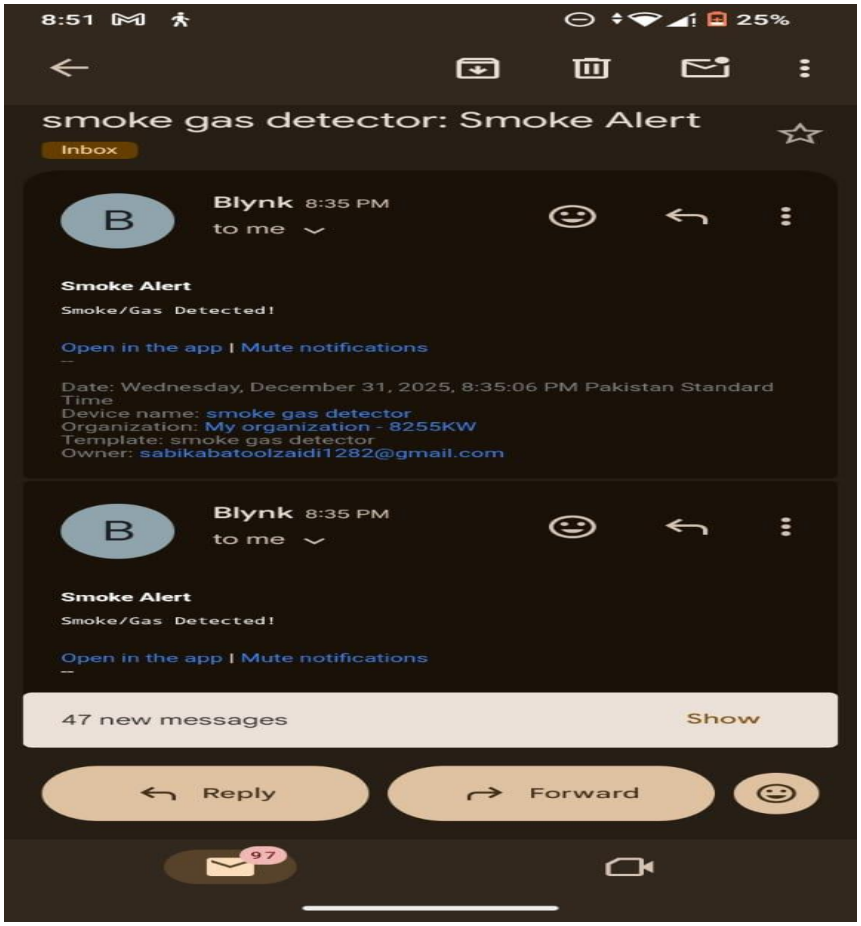




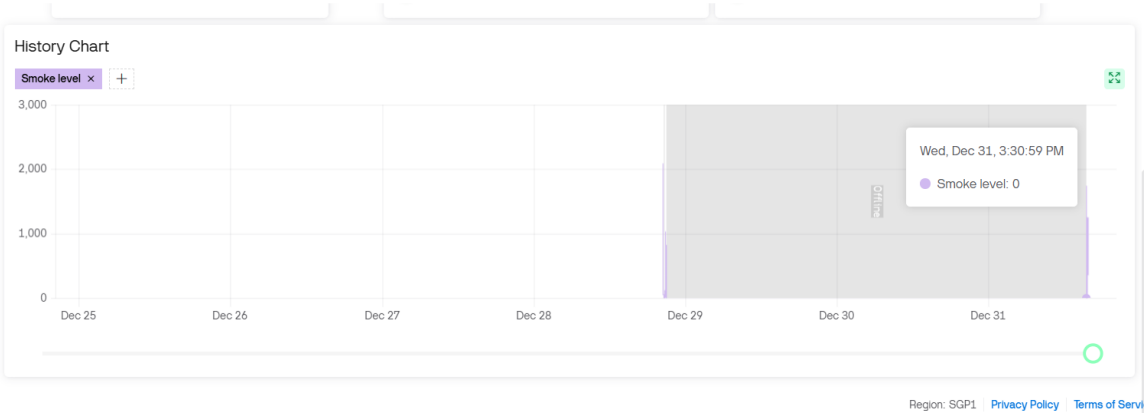
ALERT NOTIFICATION







History Graph



5. Results and Discussion

The system successfully detects gas leakage and provides real-time alerts.

Output Observations

- OLED displays live gas, temperature, and humidity values
- Buzzer and LED activate instantly on gas detection
- Blynk app shows real-time sensor data
- Alerts received on mobile device via email.

6. Testing and Validation / Limitations

Test Cases

- **Normal Environment:** Status SAFE, no alarm
- **Gas Exposure:** Status DANGER, alarm triggered
- **Wi-Fi Disconnection:** Auto reconnection
- **High Temperature:** Displayed correctly

Known Limitations

- MQ-2 cannot identify specific gas type
- Requires stable Wi-Fi connection

7. Conclusion and Future Work

This project demonstrates an effective IoT-based gas detection system. Future improvements include SMS alerts, better sensors, and data analytics.