Smart Gas Leak
&
Ventilation Control System

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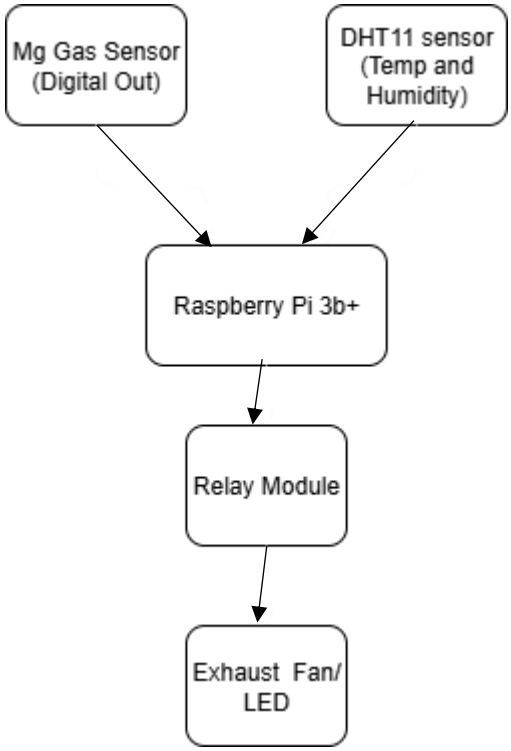
Introduction

I am Nitin Rajput, an MSc Electronics student from DAVV, Indore. This project focuses on home and industrial safety by detecting harmful gas leaks and automatically controlling ventilation systems. The goal is to prevent accidents caused by gas accumulation using a Raspberry Pi-based automated solution.

About the Project

- Detects presence of hazardous gases (like LPG, methane, smoke) using a gas sensor (MQ-2 or MQ-5).
- Measures gas concentration and triggers an alarm if levels exceed safe limits.
- Automatically turns on a ventilation system (fan/exhaust) via a relay module.
- Provides real-time monitoring and control using Raspberry Pi GPIO pins and Python.

Block Diagram



Components Required

- Raspberry Pi 3B+
- MQ-2 or MQ-5 Gas Sensor
- Relay module (5V, 1 channel)
- Buzzer or LED for alert
- DC Fan (12V or as per requirement)
- Jumper wires and breadboard or PCB

Wiring Diagram

- Gas sensor VCC → 3.3V on Raspberry Pi
- Gas sensor GND → GND
- Gas sensor analog/digital output → GPIO pin (e.g., GPIO 17)
- Relay module VCC → 5V
- Relay module GND → GND
- Relay input → GPIO pin (e.g., GPIO 27)
- Relay NO (Normally Open) → Fan +12V supply → Fan GND → Power supply GND

Ensure proper isolation between high-voltage fan and low-voltage Raspberry Pi using the relay.

Python Code Example

```
import RPi.GPIO as GPIO
import Adafruit_DHT
import time
# Pin setup
DHT_SENSOR = Adafruit_DHT.DHT11
DHT_PIN = 17
GAS_PIN = 27
RELAY_PIN = 22
GPIO.setmode(GPIO.BCM)   # Use BCM GPIO numbering
GPIO.setup(GAS_PIN, GPIO.IN)
GPIO.setup(RELAY_PIN, GPIO.OUT)
try:
 # Run 50 cycles (about 100 seconds at 2 sec delay)
        for i in range(50):
                humidity, temperature = Adafruit_DHT.read(DHT_SENSOR, DHT_PIN)
                gas_detected = GPIO.input(GAS_PIN) == GPIO.LOW    # Active LOW
                print(f"Cycle {i+1}")
                print(f"Temp: {temperature}°C, Humidity: {humidity}%, Gas: {'YES' if
    gas_detected else 'NO'}")
                if gas_detected or (temperature is not None and temperature > 35):
                        GPIO.output(RELAY_PIN, GPIO.HIGH)   # Turn relay ON
                        print(" ALERT: Ventilation ON")
```

```
                else:
                        GPIO.output(RELAY_PIN, GPIO.LOW)   # Turn relay OFF
                        print("Safe: Ventilation OFF")
                print("-" * 40)
                time.sleep(2)
except KeyboardInterrupt:
        print("Stopped by user")
finally:
        GPIO.cleanup()
        print("GPIO cleaned up. Program ended.")
```

How It Works

1. The gas sensor continuously monitors air for hazardous gases.
2. When gas concentration exceeds the threshold, Raspberry Pi triggers the relay.
3. Relay powers the fan to ventilate the area and an alert (buzzer/LED) is activated.
4. Python code continuously loops to monitor sensor data and control devices.

Future Scope

- Integrate mobile notifications (SMS/email) in case of gas leaks.
- Add multiple sensors for different gases (CO, LPG, methane).
- Implement AI-based predictive analysis for early detection.
- Integrate with home automation systems for complete safety.