

Smart IoT Air Quality Monitoring with Alerts

<https://www.youtube.com/watch?v=LpOkiUCrlpI>

Air pollution has become a major environmental and health concern due to the increasing concentration of harmful gases in homes, industries, and urban areas. Continuous monitoring of air quality is essential to detect hazardous gas levels and ensure a safe environment. This project presents a Smart IoT Air Quality Monitoring with Alerts system based on the ESP32 microcontroller and MQ-135 air quality sensor. The MQ-135 sensor continuously measures the concentration of harmful gases such as carbon dioxide (CO₂), ammonia (NH₃), smoke, benzene, and other volatile organic compounds (VOCs) present in the surrounding air.

The ESP32 processes the sensor data and uploads the real-time air quality information to the ThingSpeak cloud platform through Wi-Fi, enabling remote monitoring from anywhere. When the detected gas concentration exceeds a predefined threshold, the system activates a buzzer through a buzzer driver to provide an immediate audible warning. Simultaneously, a servo motor automatically opens a ventilation door or window to improve air circulation and reduce the concentration of harmful gases. The system operates using an adapter-based regulated power supply, ensuring reliable and continuous operation.

The proposed solution offers a low-cost, energy-efficient, and intelligent approach for indoor air quality monitoring in homes, laboratories, offices, hospitals, industries, and public buildings. By integrating IoT-based cloud monitoring with automatic ventilation control and real-time alerts, the system enhances safety, minimizes health risks caused by poor air quality, and supports smart building automation.

The features of the project are:

- ☐ Real-time Air Quality Monitoring using the MQ-135 gas sensor.
- ☐ ESP32-Based Smart Controller for fast data processing and Wi-Fi connectivity.
- ☐ IoT Cloud Monitoring with ThingSpeak for remote access to live air quality data.

- ☐ Automatic Buzzer Alert when harmful gas levels exceed the safety threshold.
- ☐ Automatic Ventilation Control using a servo motor to open a door/window for fresh air circulation.
- ☐ Continuous Air Pollution Detection for gases such as CO₂, NH₃, smoke, benzene, and VOCs.
- ☐ Wireless Data Transmission through built-in Wi-Fi without additional communication modules.
- ☐ Low Power Consumption suitable for continuous 24/7 operation.
- ☐ User-Friendly and Cost-Effective Design for homes, offices, industries, and laboratories.
- ☐ Scalable System that can be expanded with additional environmental sensors such as temperature, humidity, or particulate matter sensors.
- ☐ Real-Time Data Logging and Visualization through cloud-based graphs and historical records.
- ☐ Reliable and Automatic Operation with minimal human intervention, improving indoor environmental safety.

The main blocks of this project are:

- Power Supply.
- ESP32.
- MQ135 sensor.
- Buzzer.
- Servo Motor.

Software's used:

- Arduino IDE for Embedded C programming.
- Express SCH for Circuit design.
- IoT technology.

Block diagram

