# 📘 User Manual and Setup Guide

Smart Indoor Air Quality Monitoring System

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## 📜 Overview:

This device monitors indoor air quality by detecting pollutants such as PM1.0, PM2.5, PM4.0, PM10, VOC, NOx, as well as temperature and humidity using the Sensirion SEN55 sensor. The system displays real-time readings on an LCD and sends them remotely via MQTT using a SIM800L GSM module. Visual alerts are provided through LEDs, and a buzzer activates in poor air quality scenarios.

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## 📦 What's in the Box:

- Fully assembled air quality monitor
- Power supply (USB or battery)
- Antenna (for SIM800L)
- Quick-start card with setup instructions

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## 🛠️ Hardware Setup:

| Component | Connection Summary |
|---|---|
| SEN55 Sensor | I2C (SDA, SCL) to A4, A5 (Arduino) |
| SIM800L GSM | TX to pin 8, RX to pin 9 (SoftwareSerial) |
| LCD (16x2 I2C) | I2C to 0x27 address |
| Buzzer | Digital pin 4 |
| LEDs | Red = A2, Green = A1, Blue = A3 |
| Power | USB cable or 7.4V Li-ion battery |

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## ⚙️ Software Setup:

1. Install Arduino IDE

Download from https://www.arduino.cc/en/software

2. Required Libraries:
    - SensirionI2CSen5x
    - TinyGSM
    - PubSubClient
    - LiquidCrystal_I2C
    - LowPower (by Rocket Scream)
    - Timer

    You can install them via Arduino IDE → Library Manager.

3. Upload Code:
    - Open main.ino
    - Select board (e.g. Arduino Uno/Nano) and COM port
    - Upload

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## 🌐 MQTT Dashboard Setup:

**For Desktop (MQTT Explorer):**

- Broker: mqtt-dashboard.com
- Port: 1883
- View data from topics like hhh/herbert/pm25, hhh/herbert/voc, etc.

**For Mobile (IoT MQTT Panel):**

- Use same broker
- Add widgets (value display, gauges, graphs)
- Topics to subscribe:
    - hhh/herbert/pm1
    - hhh/herbert/pm25
    - hhh/herbert/pm10
    - hhh/herbert/voc
    - hhh/herbert/nox
    - hhh/herbert/temp
    - hhh/herbert/hum

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## 🔔 Alerts and Behavior:

| Condition | Visual/Auditory Response |
|---|---|
| Good Air (PM ≤ 100) | Green LED ON |
| Moderate (101≤ PM ≤ 200) | LED LED ON |
| Poor Air (>201) | Blue LED flashes, Buzzer sounds |

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## 💾 Optional Data Logging:

The system is configured to log sensor readings every 1 minute via MQTT. With minor modifications, it can be expanded to support SD card storage.

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## 💡 Troubleshooting:

| Problem | Solution |
|---|---|
| No MQTT data showing | Check GSM signal / SIM card |
| LCD blank | Check I2C address (should be 0x27) |
| Incorrect readings | Restart device or ensure airflow to sensor |
| Buzzer too loud | Add resistor in series to reduce volume |

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## 📈 Maintenance & Calibration:

- Calibration: Factory pre-calibrated. For long-term use, recalibration via Sensirion's software is recommended every 6–12 months.
- Cleaning: Keep air intake vents clear. Do not expose to water.

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