Project Deliverables: Portable Air Quality Monitor (USART)

1. Air Quality Sensing

- MQ135 sensor continuously measures gas concentrations (CO_2, VOCs, smoke).
- Analog output read via STM32F103 ADC input (PA0).

2. Environmental Measurement

- DHT22 sensor measures temperature and humidity.
- Single-wire digital communication (GPIO, PA4).

3. Data Processing

- STM32F103 (Nucleo-64) microcontroller processes sensor data.
- Compares measurements against user-defined thresholds.

4. User Alerts

- Buzzer activated (PA6 PWM) when thresholds are exceeded.
- Real-time sensor data and alerts displayed via USART (serial output, PA9) to PuTTY:
    - Gas sensor readings.
    - Temperature (°C) and humidity (%RH).
    - Alert notifications (e.g., "Buzzer ON/OFF", sensor errors).

5. Power and Control

- Powered from STM32 Nucleo 5 V (USB connection).
- Automatic initialization upon startup.

6. Controls and Indicators

- **Controls:**
    - Nucleo reset button for system restart.
- **Indicators:**
    - Serial data output via USART to PuTTY terminal.
    - Audible buzzer alerts.

7. Inputs and Outputs

- **Inputs:**
    - MQ135 analog → ADC (PA0).
    - DHT22 digital → GPIO (PA4).
- **Outputs:**

    - Buzzer (PWM, PA6).
    - USART TX (serial, PA9).

8. Physical Connections

- **STM32 Nucleo-64:** USB 5 V supply.
- **MQ135:** VCC (5 V), AO (PA0 ADC), GND.
- **DHT22:** VDD (3.3 V/5 V), DATA (PA4), GND.
- **Buzzer:** Positive (PA6 PWM), Negative (GND).
- **USART:** TX (PA9), baud rate 9600, 8-N-1 configuration.

9. Operation

- Sensor initialization upon power-up.
- Continuous readings (every 2s).
- USART data updates shown clearly via PuTTY.
- Buzzer alerts activated when thresholds are crossed.
- Reset to restart monitoring or silence alerts.