(Portable) Environmental Data Logger

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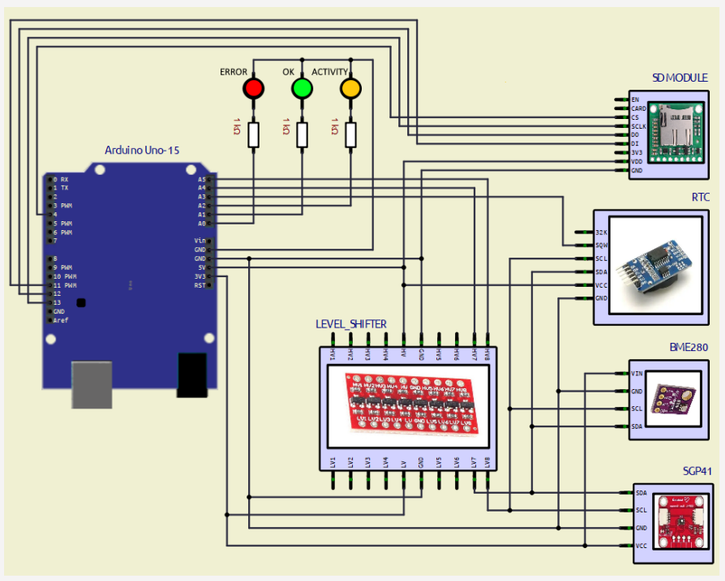
MOTIVATION

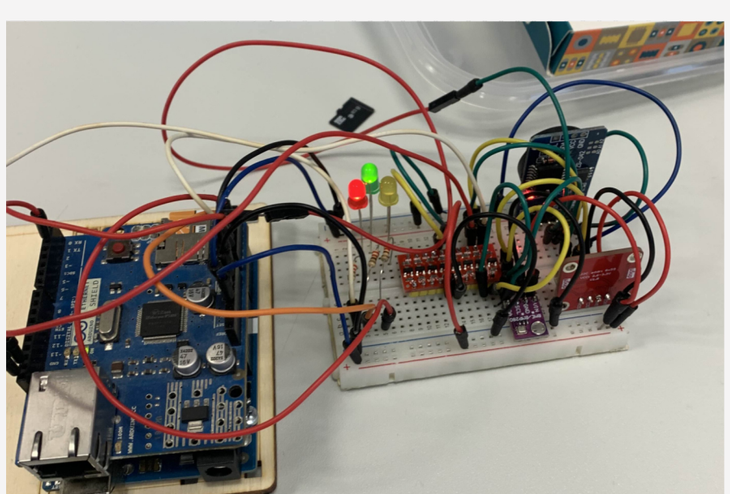
Air quality, temperature, and humidity significantly impact our health, mood, and productivity. With increasing climate change, capturing precise, real-time data about our surroundings is becoming essential. Our project enables the automated monitoring and logging of environmental parameters, providing insights into the quality of our indoor and outdoor environments. This information helps us anticipate specific conditions so we can prepare for or address them effectively.



Schematic diagram

POSSIBLE IMPACT

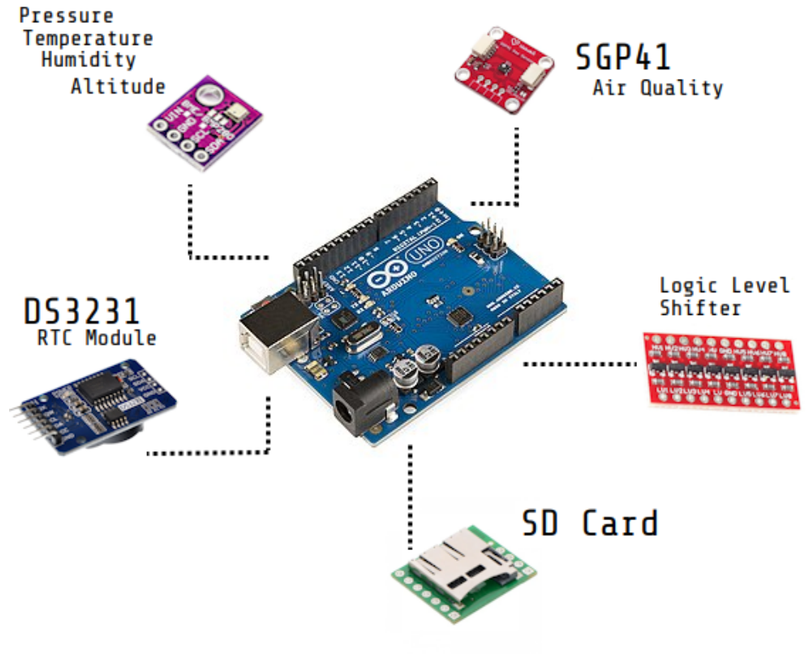
In smart offices and homes, air quality can be monitored across different rooms. Thanks to the SGP41 sensor, air purifiers or ventilation systems can be automatically triggered based on the detected VOC/NOx levels. The SGP41 also enables the detection of chemical or gas leaks. Meanwhile, the BME280 sensor monitors temperature and humidity, which is essential for maintaining optimal working conditions in homes, schools, and factories, as well as ensuring proper storage conditions for sensitive products.



Picture of a prototype

BME280

This sensor is used to measure temperature, humidity and pressure. Thanks to the high sensitivity of the pressure sensor, it can also calculate the current altitude with good accuracy. It has low power consumption and easy communication with I2C.



ZS-042 (DS3231)

This module provides accurate timing for the entire system. It communicates via the I2C bus and allows you to add accurate time stamps (date and time) to the measured data. Thanks to the backup battery, the time is not reset even if the power fails or the Arduino is restarted.

SGP41

The SGP41 is an advanced air quality sensor. It is specifically designed to detect two major types of indoor pollutants: volatile organic compounds (VOCs) and nitrogen oxides (NOx).

Logic Level Shifter

The Logic Level Shifter is a module for safe communication between components with different voltages. Since the Arduino Uno operates with 5V logic, while some sensors require 3.3V, this converter acts as a bridge. It ensures that the 5V signal from the Arduino does not destroy the more sensitive 3.3V components.

SD card

In our device, this part functions as a means to store data. All values measured by the sensors are saved to a text file directly on the card at regular intervals.

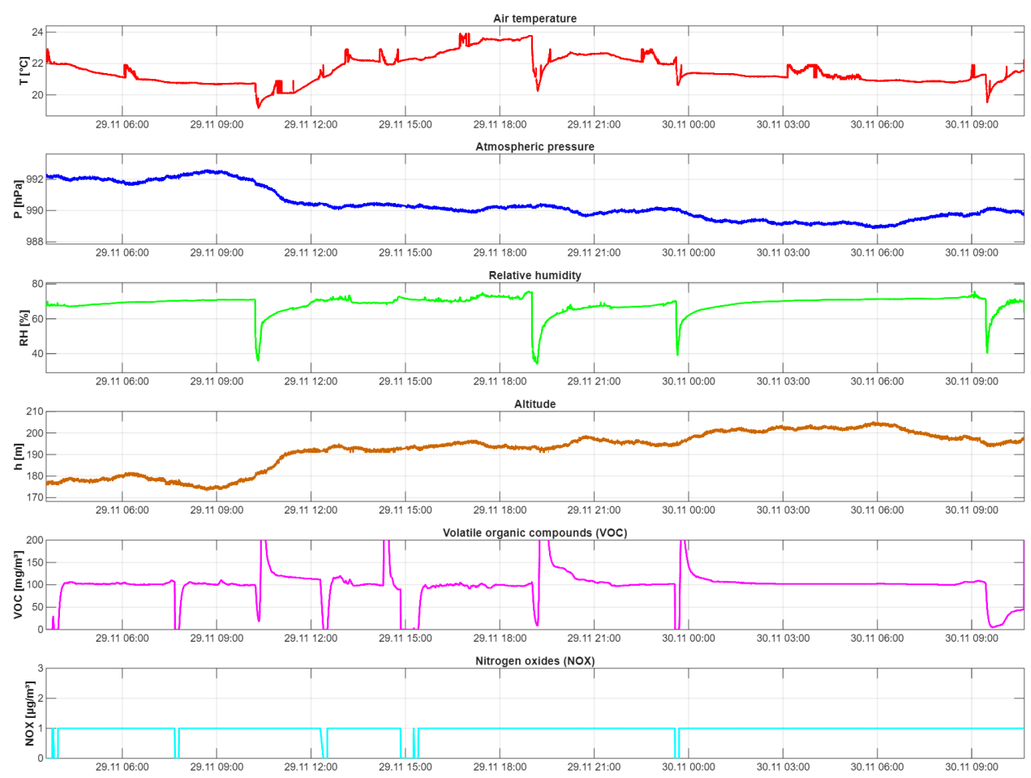
Raw log file

Time HH:MM:SS, Date DD/MM/YY, Temperature [°C], Pressure [hPa], Rel. Humidity [%], Altitude [m], VOC [-], NOX [-]

13:16:40	7/12/25	18.06	990.7	44.87	189.46	76	1
13:16:45	7/12/25	18.13	990.68	45.26	189.63	77	1
13:16:50	7/12/25	18.2	990.67	45.64	189.71	78	1
13:16:55	7/12/25	18.25	990.73	45.54	189.2	80	1
13:17:00	7/12/25	18.3	990.7	45.41	189.46	81	1

SYSTEM DESIGN

The Arduino Uno is a simple, well-supported platform with a wide range of available models. All selected modules communicate via the I2C bus, which simplifies the circuit design. The components used include the SGP41, BME280, SD Card module, DS3231, and a level shifter. This project is designed to monitor air quality, temperature, pressure, humidity, and altitude. The measured data is logged onto an SD card for subsequent retrieval and analysis.



Plotted data from the log file

Link to Github project page and demonstrational video →