Temperature, Relative Humidity, Carbon Dioxide Monitor

Features

- 2 high quality sensors tracking 3 air parameters
- Carbon Dioxide NDIR sensor
- Open source hardware & software
- Arduino compatible
- Integrated WiFi Internet connectivity
- USB port for power, debug and configuration
- Built-in air pump for active flow
- Direct and Cloud data access via API
- IOT / Internet of Things
- Low power consumption
- Ultra low cost

Applications

- Low cost Automated Monitoring
- Home monitoring
- Citizen science
- Smart Cities

Description

Carbon dioxide is a gas heavier than air. In small quantities of up to 5000ppm (0.5%) can cause headaches, lethargy, slowing of intellectual ability, irritability, sleep disturbance. In larger quantities can cause dizziness, loss of sight, hearing or knowledge. The fresh air contains between 360ppm and 410 ppm of CO2 [1].

With the built-in Wifi Connectivity, SMOGGIE-CO_2 will measure and report the CO_2 concentration automatically.
The design is open source, with complete hardware and software details publicly available on Github. It comes pre-programmed, but further modifications on its software are possible using Arduino. By default, all measurements are sent to the uRADMonitor servers, and are accessible with the API or can be viewed online. This makes it convenient for the classroom, for workshops or citizen science projects.
The uRADMonitor network is a global array of interconnected monitoring stations, focused on continuous Environmental Surveillance. Its purpose is to generate fully transparent open data, used to assert the quality of our environment. The uRADMonitor SMOGGIE-CO_2 data is accessible in real time via an API interface directly from the uRADMonitor cloud.

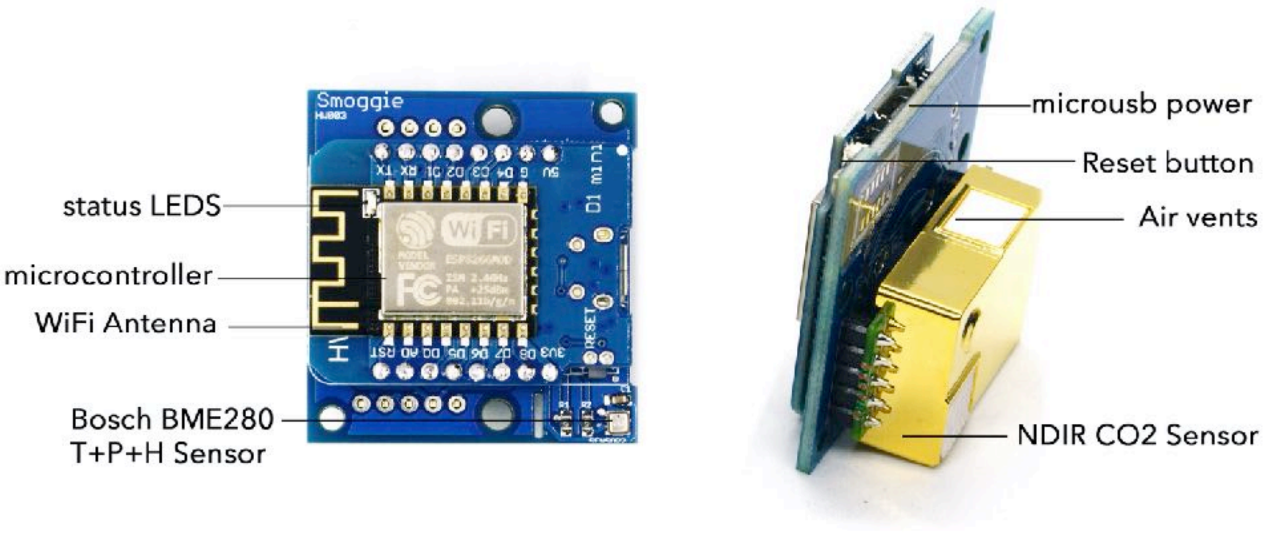
Sensors

The uRADMonitor SMOGGIE-CO_2 is an ultra low cost IOT Environmental detector with a high precision NDIR sensor to measure Carbon Dioxide and a MEMs sensor for temperature and humidity. The device connects to your wireless Internet Router via WiFi, to send the readings online.

Sensor	Parameter	Minimum value	Maximum value	Absolute Accuracy
MEMs	Temperature	-40 °C	+85 °C	± 1°C
	Humidity	0% RH	100% RH	± 2 %
NDIR CO_2 Sensor	CO_2	0 ppm	5000 ppm	± 5 %

Specification

Parameter	uRADMonitor AIR
Internet connection	WLAN connectivity to WiFi Internet Router
Standards	WLAN 2.4GHz IEEE 802.11 b/g/n
Wireless frequencies	2.400–2.4835 GHz ISM band
Modem Chip	Espressif esp8266
Modem certifications	CE, FCC
Antenna connector	PCB antenna
Enclosure Protection	IP65
Supply Voltage	micro USB 5V
Recommended Use Ratings	Temperature: -20°C to +65°C Humidity: 0RH to 95RH



uRADMonitor SMOGGIE assembled circuit board diagram in hardware version 3

Usage guide

- **Power supply**

The SMOGGIE-CO_2 uses a standard micro USB connector that is used to power the unit with a regular phone charger. The unit takes 5V to run.

- **Outdoor use and exposure to elements**

The unit comes in a plastic enclosure that protects the sensitive electronics from the elements. It can be directly installed outdoors. Make sure the USB connector faces down, so no rain can get inside. Do not cover the air circulation holes.

- **Precautions**

Do not expose the device to a large amount of dust such as in the woodworking centers. Do not expose the appliance to solvents or to a large amount of concentrated vapors of chemicals (acetone, paints, alcohol, butane, propane, etc.), because the sensors can wear out, or the measurements may become inconclusive. Do not expose the apparatus to mechanical shocks. Wherever possible, mount the appliance in a vertical position to extend the life of the built-in fan mechanisms.

- **Installing the unit**

For mounting, use the hole in the housing bracket. Ensure that you properly connect the power cord and secure it against vibration where necessary.

Warranty

uRADMonitor SMOGGIE-CO_2 is covered by a 12 months warranty for any defects in material or workmanship.

Data access

uRADMonitor is designed for easy and open data access. The data can be accessed in two ways:

- **<u>Local access</u>**

Applies where the uRADMonitor unit is part of a LAN network. The uRADMonitor unit serves an internal webpage accessible via port 80. To access the content open the unit's IP in your LAN network on a computer or a phone. The webpage served is as follows:

uRADMonitor SMOGGIE 1700001E - HW:4 SW:22

CUBIC CM1107 - running

Temperature:17.01C **Pressure:**101408Pa **Humidity:**45.11RH	**CO2:**436ppm	**Time:**309748s **Interval:**60s **Stats:**5113/5162 200	**WIFI:**connected **IP:**192.168.3.116 **DNS:**192.168.3.1

Warmup: 0s | JSON | CONFIG

uRADMonitor, a Magnasci SRL 2015-2020 project

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The JSON link points to a JSON formatted data source, that can be polled periodically to access the uRADMonitor unit readings. As this is done directly by connecting to the uRADMonitor unit, the server compensation layer is not used, so you would receive the raw readings. This is not the preferred way, and additional compensation must be implemented (eg. Temperature offset to compensate for internal heating, other corrections, etc). This functionality is offered rather for debugging and decentralised operation in critical situations such as server failure or malfunction.

- **Data access via the Server RESTful API**

This is the preferred data access method. REST API does not require the client to know anything about the structure of the API. Rather, the server needs to provide whatever information the client needs to interact with the service. An HTML form is an example of this: The server specifies the location of the resource, and the required fields. The browser doesn't know in advance where to submit the information, and it doesn't know in advance what information to submit. Both forms of information are entirely supplied by the server. Lookups should use GET requests. PUT, POST, and DELETE requests should be used for creation, mutation, and deletion.

The API is called for both directions of data transfer (upload and download). The uRADMonitor devices use the API to upload their measurements to the server, for further processing and storage in the database. The API is then used to access data by the frontend, the mobile app or third party systems that need the uRADMonitor data.

To use the API, please refer to the dedicated manual:
https://www.uradmonitor.com/api
https://www.uradmonitor.com/dashboard/

For questions regarding the use of the API you can contact us at support@uradmonitor.com

The use of uRADMonitor devices and the data sets generated by them can only be done in compliance with the general terms of use (TOS) presented on our website.

Health impact

Carbon Dioxide is a contributing factor to the **Sick building syndrome** (**SBS**), a medical condition where people in a building suffer from symptoms of illness or feel unwell for no apparent reason. The symptoms tend to increase in severity with the time people spend in the building, and improve over time or even disappear when people are away from the building. The main identifying observation is an increased incidence of complaints of symptoms such as headache, eye, nose, and throat irritation, fatigue, and dizziness and nausea. These symptoms appear to be linked to time spent in a building, though no specific illness or cause can be identified. A 1984 World Health Organization (WHO) report suggested up to 30% of new and remodeled buildings worldwide may be subject of complaints related to poor indoor air quality.

In homes and offices:

A 100 ppm increase in indoor CO2 concentration was significantly associated with headache (..). Office workers exposed to indoor CO2 concentrations higher than 800 ppm reported a significant increase in eye irritation and upper respiratory symptoms . A 100 ppm increase in dCO2 in the range from 467 to 2800 ppm in indoor CO2 was significantly associated with dry throat, tiredness, and dizziness (417 participants from 87 offices) (Lu et al., 2015). A 100 ppm increase in CO2 concentration (range, 549–1318 ppm) was positively correlated with non-specific symptoms including headache and dizziness (107 participants from 11 offices) although the correlation was not significant (Azuma et al., 2018).
Twenty-two participants were exposed to CO2 at 600, 1000, and 2500 ppm (three 2.5-h sessions, one day; artificially elevated CO2 concentrations) in an office-like chamber. Statistically significant decrements occurred in cognitive performance (decision making, problem resolution) starting at 1000 ppm (Satish et al., 2012).

In schools:

A study in schoolchildren exposed to indoor CO2 concentrations higher than 1000 ppm showed significantly higher risk for dry cough and rhinitis (654 children of 46 classrooms) but outdoor air flow rate per person was inversely correlated with indoor CO2 concentrations (Simoni et al., 2010). A 200 ppm increase in indoor CO2 concentration (range, 1000–2000 ppm) in 45 day care centers (DCCs) was significantly associated with reported wheezing in the 3186 attending children, and a positive trend was observed between CO2 concentration and the prevalence of asthma.

Source: " Effects of low-level inhalation exposure to carbon dioxide in indoor environments",
Web: https://www.sciencedirect.com/science/article/pii/S0160412018312807