

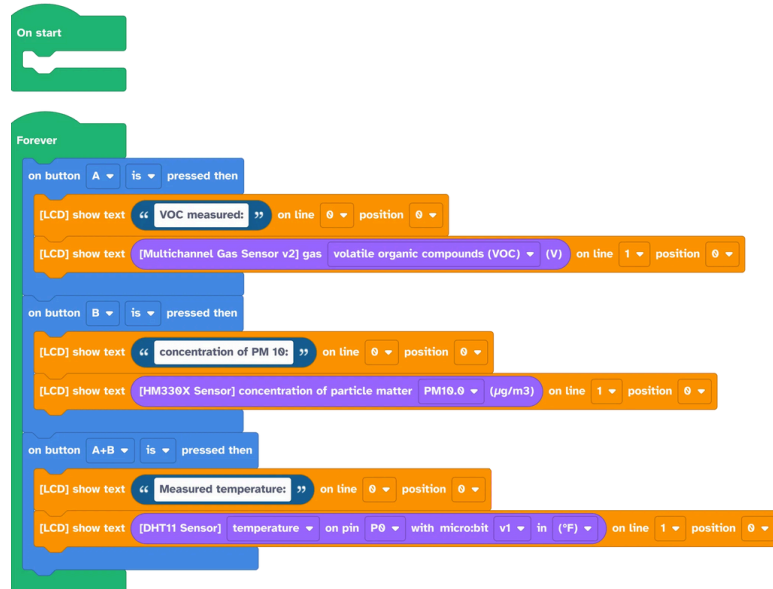


# Multi-sensor environmental data collection



The programming interfaces for the NUCLEO-L476RG, micro:bit, and Arduino boards are very similar. Here we present a program designed for micro:bit. It displays the measured elements on the LCD screen.

**Editor used:** vittascience.com/l476;  
vittascience.com/arduino or  
vittascience.com/microbit



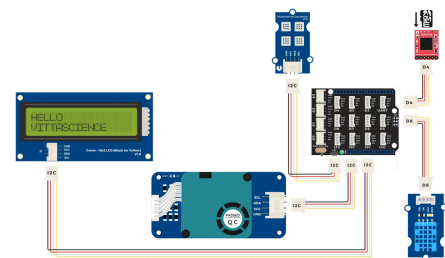
## Assembly connection with an Arduino

The HM3301 sensor is connected to an I2C port. The MICS6814 multi-channel sensor is connected to an I2C port on the shield.

The DHT11 humidity sensor is connected to a digital port (D2 to D8).

The display is connected to an I2C port.

The Openlog module for logging data to an SD card is connected to a digital port (D2 to D8).



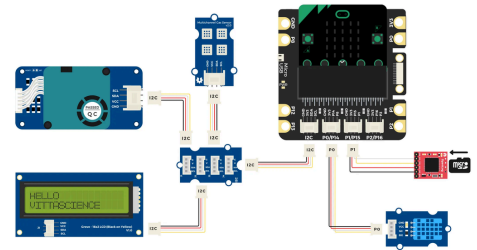
## Assembly connection with a micro:bit

The HM3301 sensor and the MICS6814 multi-channel sensor are connected to an I2C port on the shield.

The DHT11 humidity sensor is connected to a digital port (P1 or P2 as required).

The display is connected to an I2C port.

The Openlog module for logging data to an SD card is connected to a digital port P0.



## Automated data recording to SD card



## Code

```
from microbit import *
from lcd_i2c import LCD1602
from gas_gmxxx import GAS_GMXXX
from hm330x import HM330X
from dht11 import DHT11

lcd = LCD1602()
multichannel_v2 = GAS_GMXXX(0x08)
hm3301 = HM330X()
# DHT11 Sensor on pin0
dht11_0 = DHT11(pin0)

while True:
    if button_a.is_pressed():
        lcd.setCursor(0, 0)
        lcd.writeTxt('Mesure VOC:')
        lcd.setCursor(0, 0)
        lcd.writeTxt(str(multichannel_v2.calcVol(multichannel_v2.measure_VOC())))
    if button_b.is_pressed():
        lcd.setCursor(0, 0)
        lcd.writeTxt('Concentration PM 10:')
```

```
lcd.setCursor(0, 0)
lcd.writeTxt(str(hm3301.getData(5)))
if button_a.is_pressed() and button_b.is_pressed():
    lcd.setCursor(0, 0)
    lcd.writeTxt('Mesure temperature:')
    lcd.setCursor(0, 0)
    lcd.writeTxt(str(dht11_0.getData(d=1)*9/5 + 32))
uart.init(baudrate=4800, bits=8, parity=None, tx=pin0, rx=pin14)
uart.write('{{' * 3).format(hm3301.getData(3), ':')
multichannel_v2.calcVol(multichannel_v2.measure_NO2())) + '\n')
```



## Documentation: Glossary of pollutants

Pollutants	Effects on the environment (climatic and local)	Health effects	Maximum values recommended by WHO
<b>Fine particles PM10 / PM2.5</b>	<p>Diffusing or absorbing effect, increasing the greenhouse effect</p> <p>Damage to buildings and monuments: formation of a black layer, dirt</p>	<p>The finer the particle, the more harmful it is to the body:</p> <p>PM10: retained in the nose and deep respiratory tract</p> <p>PM2.5: penetrates deeply, crosses the lung barrier and enters the bloodstream</p>	<p>For PM2.5:</p> <p>10 µg/m<sup>3</sup> annual average</p> <p>25 µg/m<sup>3</sup> average over 24 hours</p> <p>For PM10:</p> <p>20 µg/m<sup>3</sup> annual average</p> <p>50 µg/m<sup>3</sup> average over 24 hours</p>
<b>Nitrogen dioxide (NO<sub>2</sub>)</b>	<p>Contributes to acid rain, affecting plants and soils</p> <p>Responsible for the formation of nitrate aerosols and their accumulation in the soil</p>	<p>High concentrations can be toxic and cause severe inflammation of the respiratory tract.</p>	<p>40 µg/m<sup>3</sup> annual average</p> <p>200 µg/m<sup>3</sup> hourly average</p>
<b>Carbon monoxide (CO)</b>	<p>Participates in the mechanism of ozone formation</p> <p>Transformation into CO<sub>2</sub>, contributing to the greenhouse effect</p>	<p>High-level poisoning: if indoor pollution, risk of poisoning</p> <p>Affects the central nervous system and sensory organs by binding to blood hemoglobin instead of oxygen</p>	<p>10 mg.m<sup>-3</sup> on average over 8 hours</p> <p>30 mg.m<sup>-3</sup> on average over 1 hour</p>
<b>Volatile organic compounds (VOCs)</b>	<p>Precursor to ozone formation</p>	<p>Different health effects depending on the specific compound</p>	<p>Varies depending on the compound</p>
<b>Ozone (O<sub>3</sub>)</b>	<p>Contributes to the greenhouse effect</p> <p>Disrupts photosynthesis, leading to lower crop yields</p> <p>Oxidation of materials</p>	<p>Gas that irritates the respiratory tract. At excessively high concentrations, it can cause breathing problems, asthma, decreased lung function, and the onset of respiratory diseases.</p>	<p>100 µg/m<sup>3</sup> average over 8 hours</p>