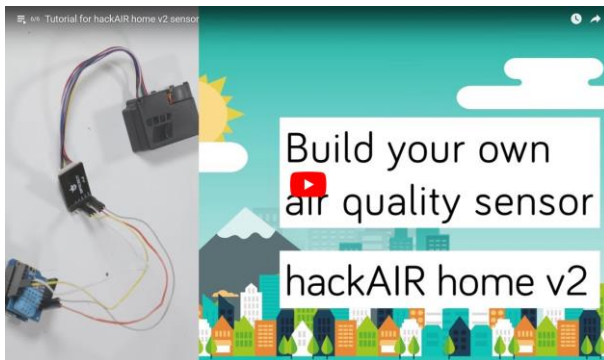


Tutorial

Build your own hackAIR home sensor v2

This sensor connects to your home or office WiFi, and automatically uploads a measurement every five minutes. You will need to plug it into a power socket. The node is based on the Wemos microcontroller and costs around Euro 30.

Video tutorial



Next to this written tutorial, you can also check out our video tutorial at

<http://www.hackair.eu/hackair-home-v2>.

What you need

Make sure you have the following materials and tools available. We provide links to online retailers, including Aliexpress, at <http://www.hackair.eu/hackair-home-v2>. Alternatively, visit your local electronics supplier.

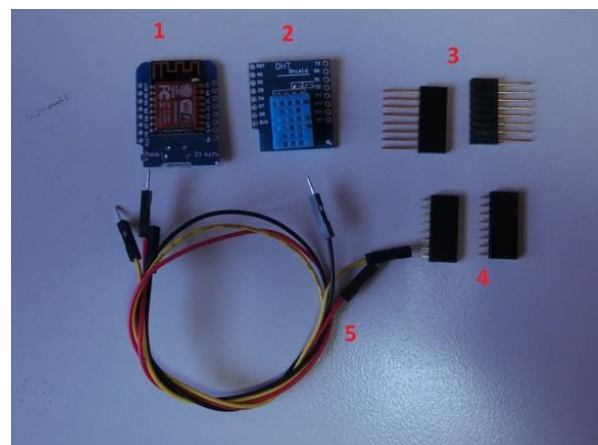
Materials

- Air quality sensor: Nova PM SDS011 (20 EUR)
- Microcontroller: Wemos D1 mini (with headers, 3 EUR)
- Temperature and humidity sensor: DHT22 (with shield and headers, 3 EUR)
- 4 M/F jumper wires (0,50 EUR for 40)
- Micro-USB cable and USB charger

Tools

- Soldering iron + soldering tin (from ca. 20 EUR)
- Poster putty
- Computer

For general soldering instructions, check out the tutorial introduction to soldering at <http://www.hackair.eu/hackair-home-v2>.



Assemble the sensor

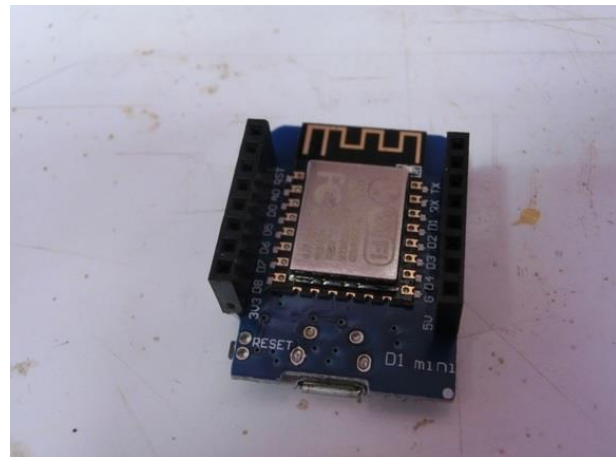
Step 1: Solder headers to your microcontroller

Solder the short headers to the Wemos microcontroller.

In order to keep the header stable during soldering use some poster putty (see red arrow)



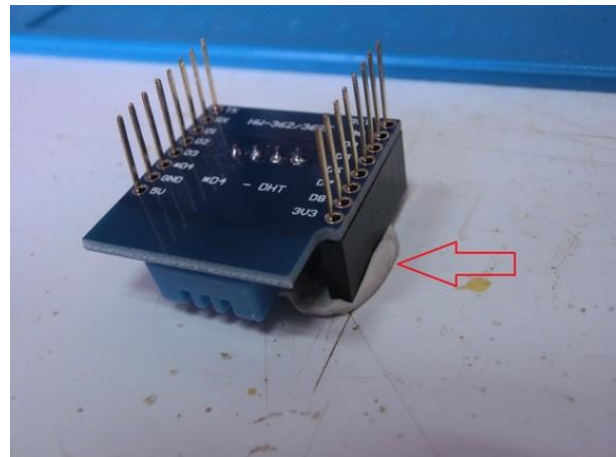
Your finished board should look like this:



Step 2: Solder headers to the humidity sensor shield.

Solder the long headers to the humidity sensor shield.

Use poster putty again, it really helps!



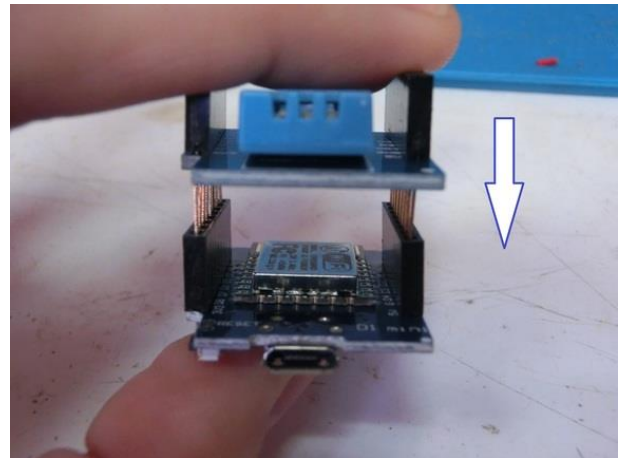
Your finished humidity sensor shield should look like this:



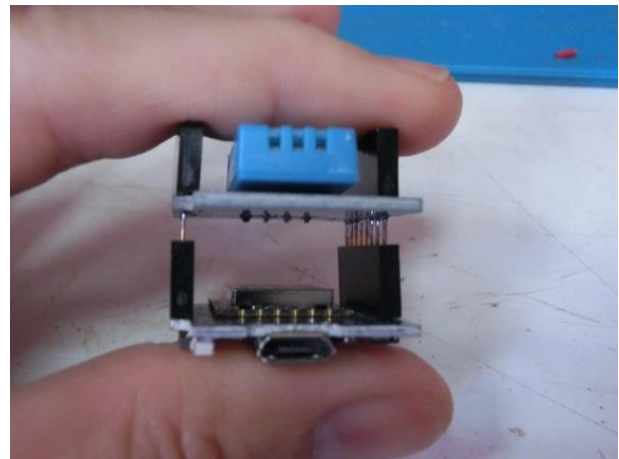
Step 3: Stack the shields

Stack the shield over the Wemos and check alignment. The white dots on both the Wemos board and the humidity sensor need to be on the same side.

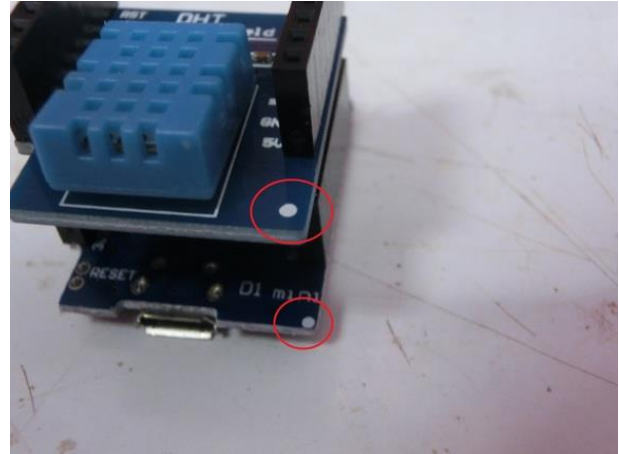
Check that all pins line up and everything is aligned. If everything is OK then plug it in (push it down as white arrow indicates).



Your finished Wemos shield pair should look like this:

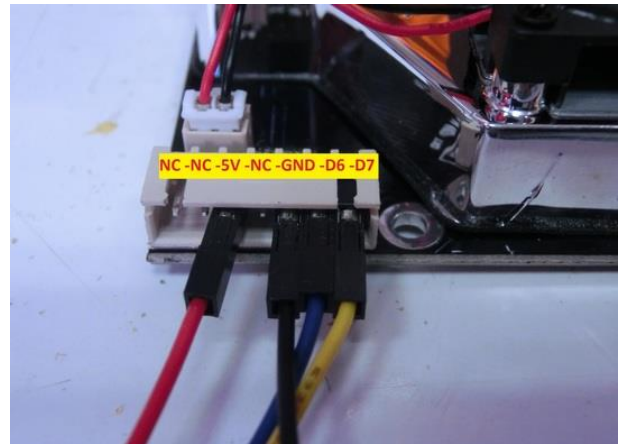


In order to check that you put the shield in the correct orientation there is an easy way: White dots. At the Wemos board as well as at the humidity sensor shield you are going to find a white dot in one of the corners. The white dots from Wemos board and sensor shield must be in the same side (just like the picture on the right).

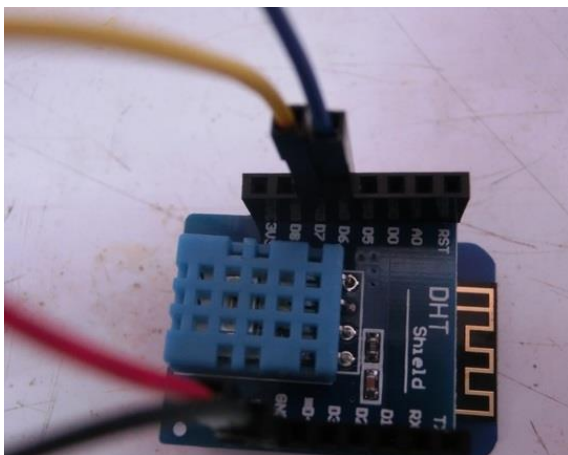


Step 4: Connect the cables

Connect the sensor with four M/F jumper wires as follows. The picture shows the connections of the female side to the SDS011 sensor.



Sensor	Wemos
5V	5V
GND	GND
RXD	D6
TXD	D7



Install the software

Step 1: Preparations and downloads

Download the Arduino IDE software and install it on your computer.

<https://www.arduino.cc/en/Main/Software>



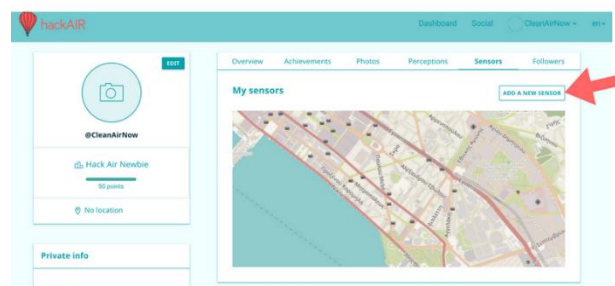
Download the latest version of the hackAIR library.

<https://github.com/hackair-project/hackAIR-Arduino/releases>

Register on the hackAIR platform (if you have not done that already).

<https://platform.hackair.eu/register>

Go to your user profile on the platform → Tab “Sensors” → click on “add a new sensor”.

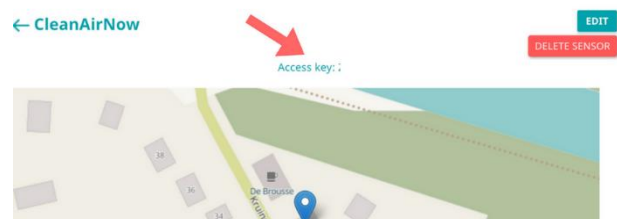


Fill in the information for your new sensor, including location details.

New sensor



Save the information that you have provided. Now you go back to your profile, go to the tab “My sensors”. Click on the arrow in the bottom right corner. This takes you to your sensor profile. Here you see the access key. Copy the access key into a document on your computer. You need it later.

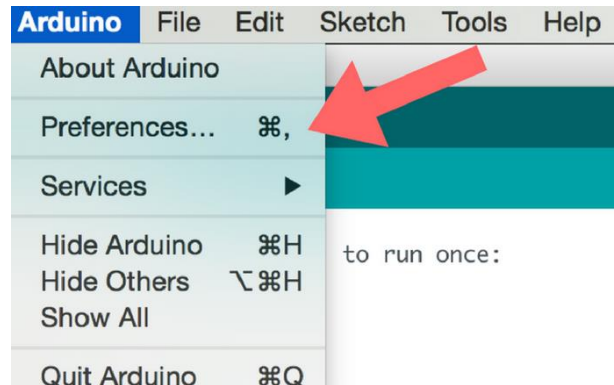


Step 2: Arduino set up

Now open the Arduino software to set it up to work with your sensor.

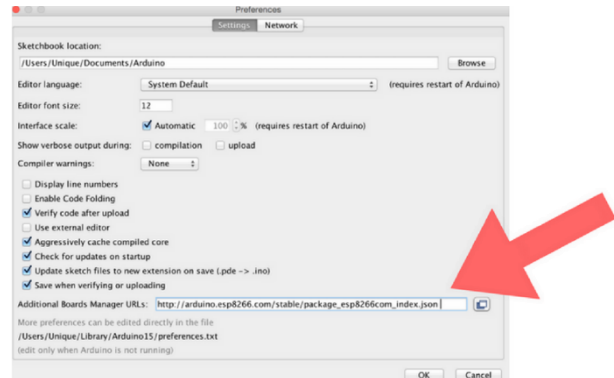


1. Add a board manager. Go to Arduino → Preferences

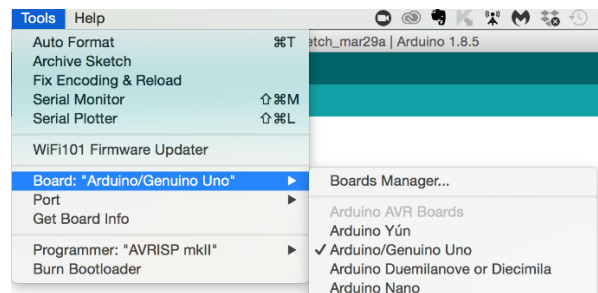


Add the following link to Additional Boards Manager URLs:

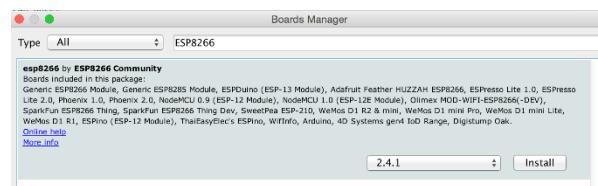
http://arduino.esp8266.com/stable/package_esp8266com_index.json



Go to Tools → Board → Boards Manager...



Search for ESP8266, click on it and install esp8266 by ESP8266 Community.

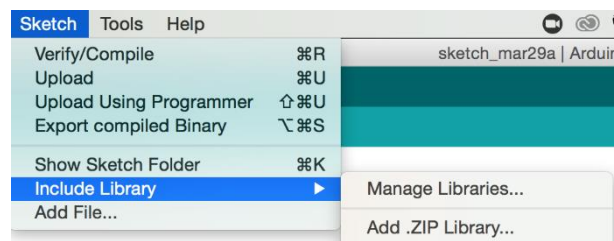


2. Install libraries

Click on Sketch → Include Library → Manage Libraries...

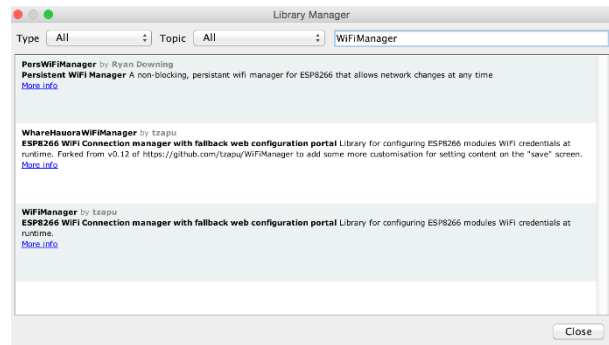
We need to install the following four additional libraries:

- WiFiManager by tzapu
- DHT sensor library by Adafruit
- Adafruit unified sensor library by Adafruit
- ESP8266WiFi by I.Grokhotkov

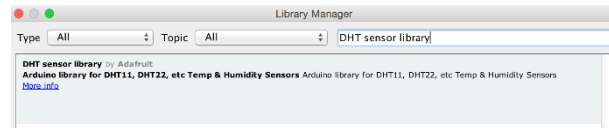


Search for WiFiManager.

Choose WiFiManager by tzapu and install it.



Search for DHT sensor library. Choose DHT sensor library by Adafruit and install it.



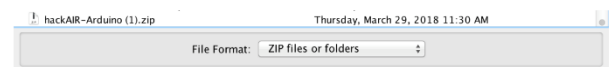
Search for Unified sensor abstraction layer. Choose Adafruit Unified Sensor and install it.



Search for esp8266wifi built-in. Choose ESP8266WiFi by I. Grokhotkov and install it.



Go to Sketch → Include library → include .zip library

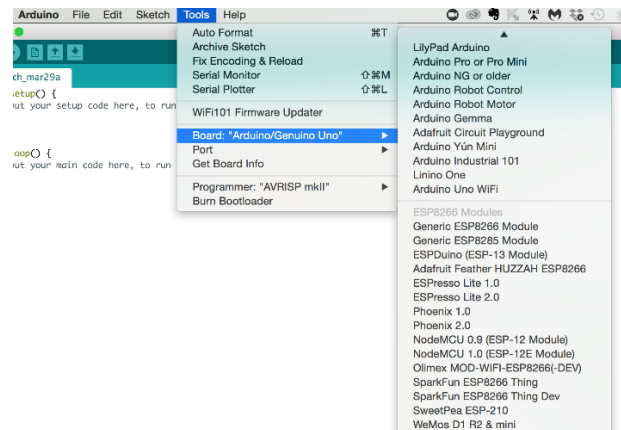


Find the folder in which your previously downloaded hackAIR-Arduino.zip is stored. Choose and install it.

3. Connect Wemos

Connect the Wemos sensor to your computer with the USB cable.

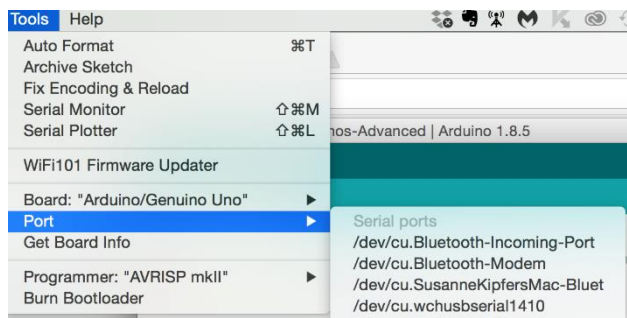
Select the correct board type by going to Tools → Board → Arduino → Wemos D1 R2 & mini



Select the correct port by going to Tools → Port → [name of the port]

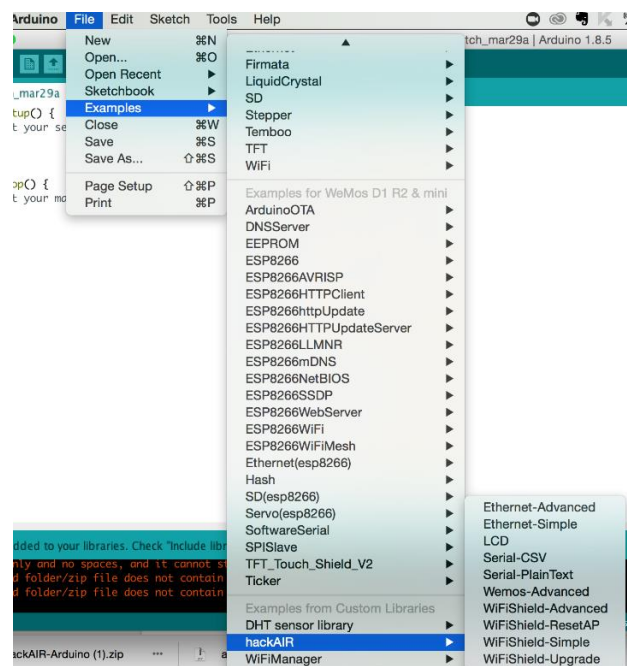
On Windows: If more than one port is shown, you can find the correct one in your computer's Device Manager.

On Mac: you'll first need to download USB2Serial drivers. You can find drivers linked in the online tutorial. Once that is done, choose something like "wchusbserial".

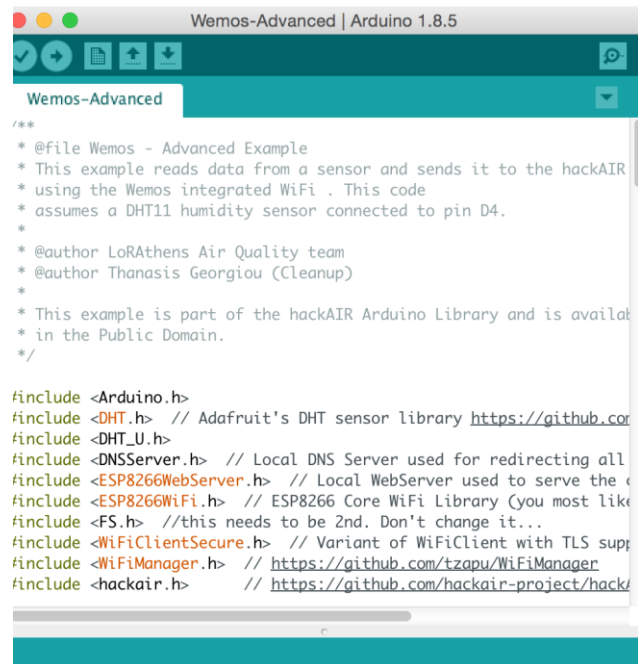


Step 3: Upload software to Wemos

Go to File → Examples → hackAIR → Wemos Advanced



This is the window that opens – it contains the software that needs to be uploaded to your Wemos sensor.



```

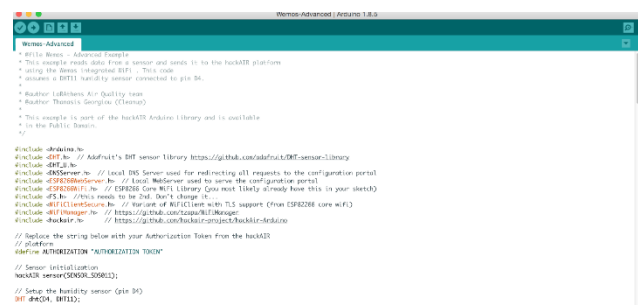
Wemos-Advanced | Arduino 1.8.5

/**
 * @file Wemos - Advanced Example
 * This example reads data from a sensor and sends it to the hackAIR
 * using the Wemos integrated WiFi . This code
 * assumes a DHT11 humidity sensor connected to pin D4.
 *
 * @author LoRAthens Air Quality team
 * @author Thanasis Georgiou (Cleanup)
 *
 * This example is part of the hackAIR Arduino Library and is available
 * in the Public Domain.
 */

#include <Arduino.h>
#include <DHT.h> // Adafruit's DHT sensor library https://github.com/adafruit/DHT-sensor-library
#include <DHT_U.h>
#include <DNSServer.h> // Local DNS Server used for redirecting all
#include <ESP8266WebServer.h> // Local WebServer used to serve the
#include <ESP8266WiFi.h> // ESP8266 Core WiFi Library (You most likely
#include <FS.h> //this needs to be 2nd. Don't change it...
#include <WiFiClientSecure.h> // Variant of WiFiClient with TLS support
#include <WiFiManager.h> // https://github.com/tzapu/WiFiManager
#include <hackair.h> // https://github.com/hackair-project/hackair
  
```

Scroll down to Line 27: `#define AUTHORIZATION "AUTHORIZATION TOKEN"`

Replace the words “AUTHORIZATION TOKEN” in the quotation marks with your sensor access key, but keep the quotation marks.



```

// Replace the string below with your Authorization Token from the hackAIR
// platform
#define AUTHORIZATION "AUTHORIZATION TOKEN"

// Sensor initialization
hackAIR sensor(SENSOR_ID);

// Setup the humidity sensor (pin D4)
DHT dht(D4, DHT11);
  
```

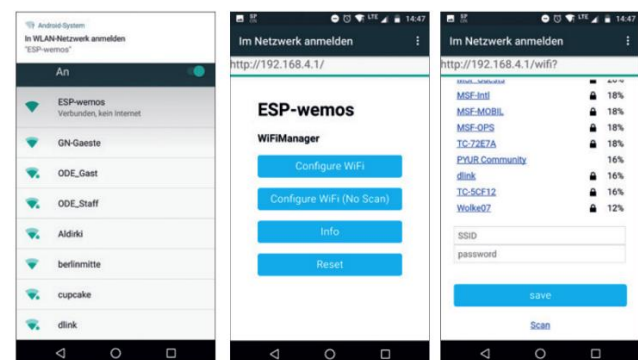
Now you are ready to upload the software. To do so, just click on the upload button (the arrow that points to the right)..



Step 4: Connect the sensor to the network

Now you are ready to use your sensor. Disconnect the Wemos from the computer, and reconnect it with the sensor. When you power it up, it will create a temporary WiFi network.

With your laptop or phone, connect to the WiFi network ESP-wemos. Go to 192.168.4.1 and configure the WiFi by entering the details of your home WiFi (SSID and password). Once set up correctly, the temporary network will disappear and the sensor starts measuring.



Measure air quality

Once your sensor is up and running, you can read its measurements on the platform:

- Browse to the <https://platform.hackair.eu> and login with your account
- Visit your profile and select your sensor area
- By selecting each sensor you will be able to see your measurements.

Check your sensor is working

If your sensor does not show up on the platform, you can check if the sensor is working with the Arduino software:

1. Connect your sensor to your computer
2. Select the right port
3. Open Tools > Serial Monitor
4. You should see:
 - a row of numbers appearing
 - the message “connected”
 - a line with:
`{"reading":{"PM2.5_AirPollutantValue":"X","PM10_AirPollutantValue":"Y"},"battery":"Z","tamper":"0","error":"0"}`.
5. Check your internet connection, and the SSID and password, if “connected” does not appear
6. Check your soldering and connections, if the line “{“reading”:{etc.” doesn’t appear.

You can’t get enough of measuring air quality?

hackAIR also has tutorials for two other sensors:

- **hackAIR cardboard** <http://www.hackair.eu/hackair-cardboard>
- **hackAIR mobile** <http://www.hackair.eu/hackair-mobile>