Fukuro

a « Do It Yourself » CO2 detector to better ventilate

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Version	Date	Content
1	26/02/2021	First version of the tutorial

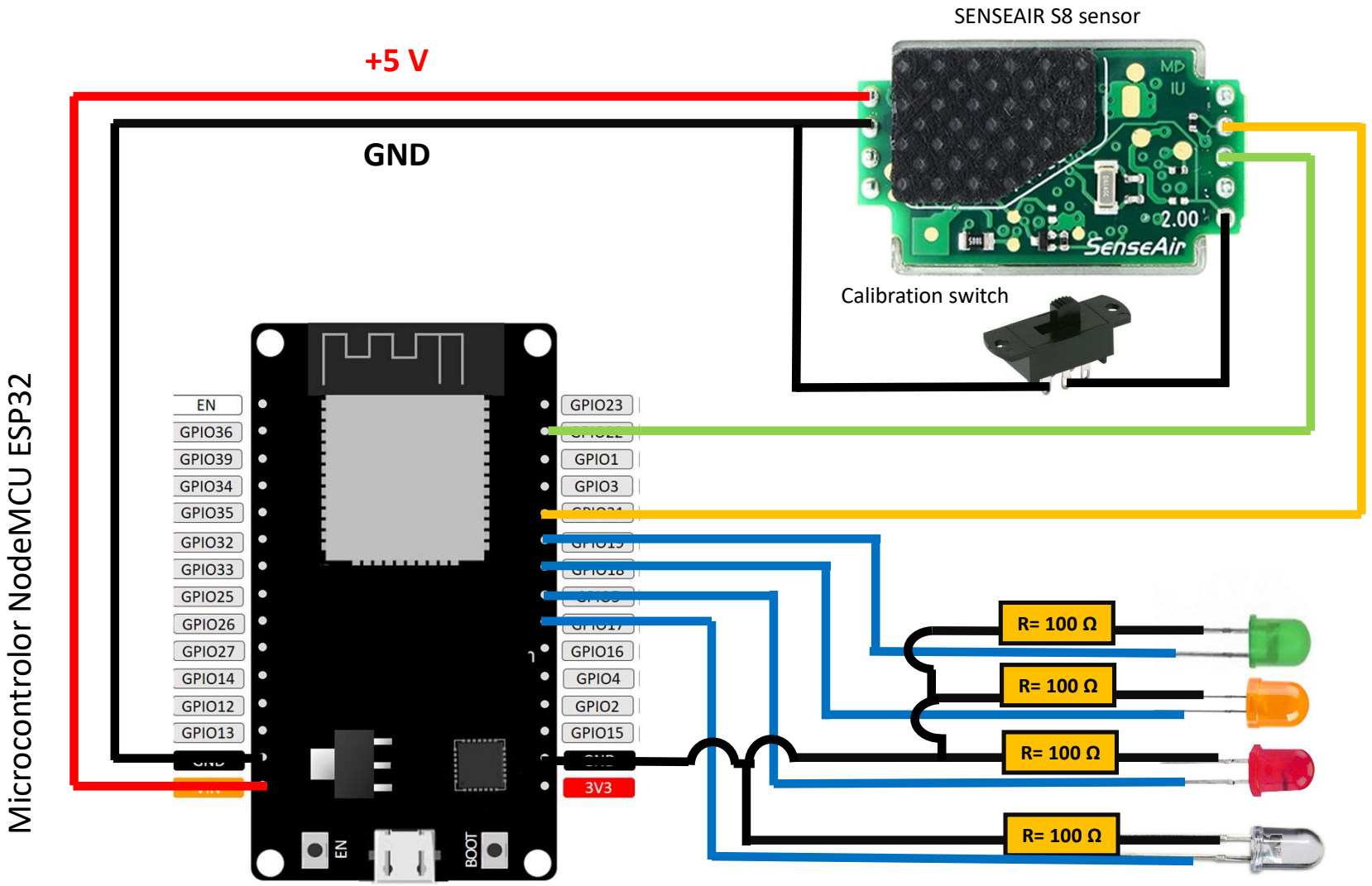
Content of the archiv

- fukuro_tutorial.pdf : this document
- fukuro_bottom.stl : bottom casing to print
- fukuro_upper.stl : upper casing to print
- fukuro_fakepcb.stl : « fake » pcb to print
- fukuro_sticker.pdf : face sticker for the upper casing

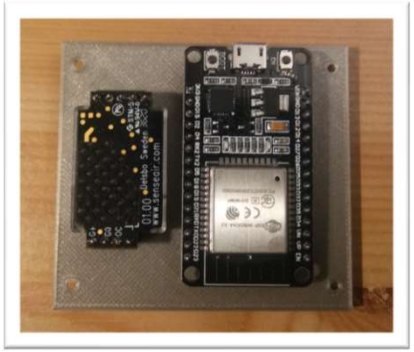
Bill of materials

Sourcing	Product ref.	Designation	Price incl. VAT (€)
		SENSEAIR S8 sensor	~ 25 – 30 €
GOTRONIC	2285196	Module NodeMCU ESP32	12,00
FARNELL	1003211	Red DEL 5mm	0,29
FARNELL	1003214	Green DEL 5mm	0,29
FARNELL	1003212	Orange DEL 5mm	0,48
FARNELL	1003309	Blue DEL 5mm	0,96
FARNELL	2785157	100 ohm resistor x 4	1,58
FARNELL	2931771	Slider switch	3,46
FARNELL	2503764	Wire	3,60
FARNELL	1187829	Pin headers	1,10
		Screw M2.5 - 4 x 2	
		Nut M2,5 x 2	
3D printed		Plastic bottom casing	
3D printed		Plastic upper casing	
3D printed		« Fake » printed circuit board	

The electronic scheme

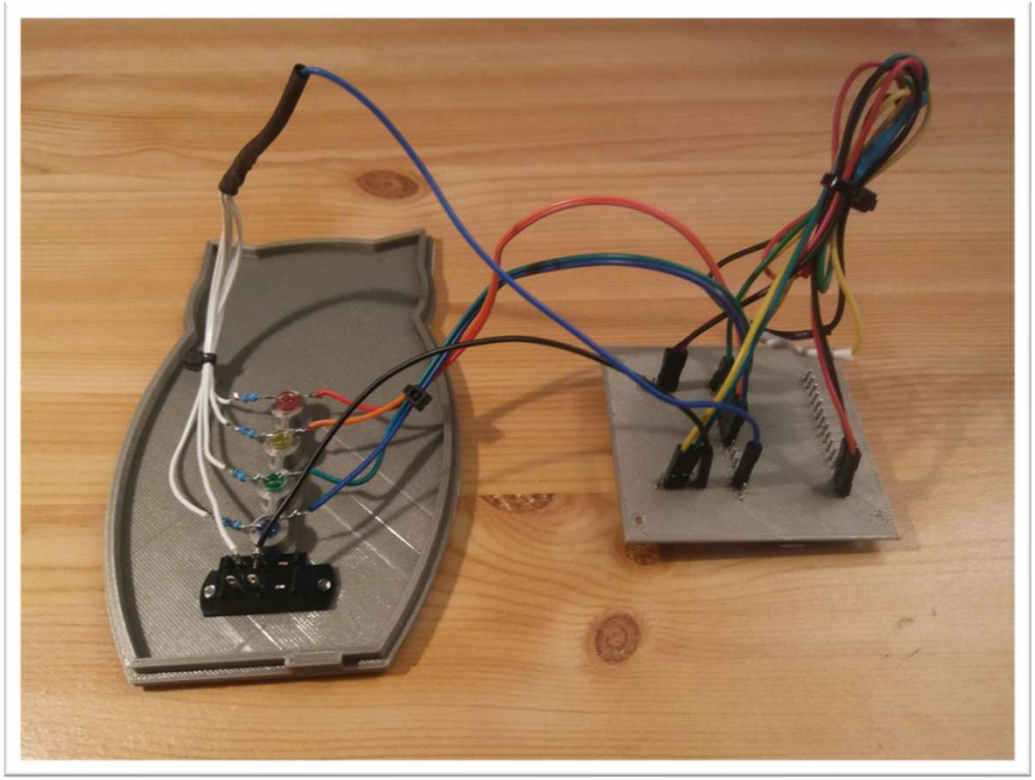


Manufacture of the electronic part



« fake » PCB printed in PLA

The two main parts (sensor S8 and microcontroler ESP32) are mounted on a « fake » printed circuit board printed in PLA. It allows the components to hold by wedging. The PLA part is relatively flexible and allows easy assembly of the components without unnecessary force.



Then the circuit must be wired according to the diagram given in this document. The junction between the common masses can be made by splicing and also hidden by heat-shrinkable tubing. The resistors can be welded directly on the led.

Cable clamps can be used to "discipline" the wires and facilitate subsequent mounting in the housing.

We advise to build the electronic part first and to test it alone with the control program (see below). Once this test has been successfully completed, the assembly can be carried out in the case, taking care to force on any of the wires or solders.

Software

The main sensor control program can be downloaded here :

https://github.com/SFeli/ESP32_S8

It has been completed as below to add 4 color leds triggered by 4 CO2 thresholds

In declarations, add :

```
int ledR =5;
int ledO =18;
int ledG =19;
Int ledB = 17
```

In the setup, add :

```
 pinMode(ledR, OUTPUT);
 pinMode(ledO, OUTPUT);
 pinMode(ledG, OUTPUT);
pinMode(ledB, OUTPUT);
```

In the main « loop » , add :

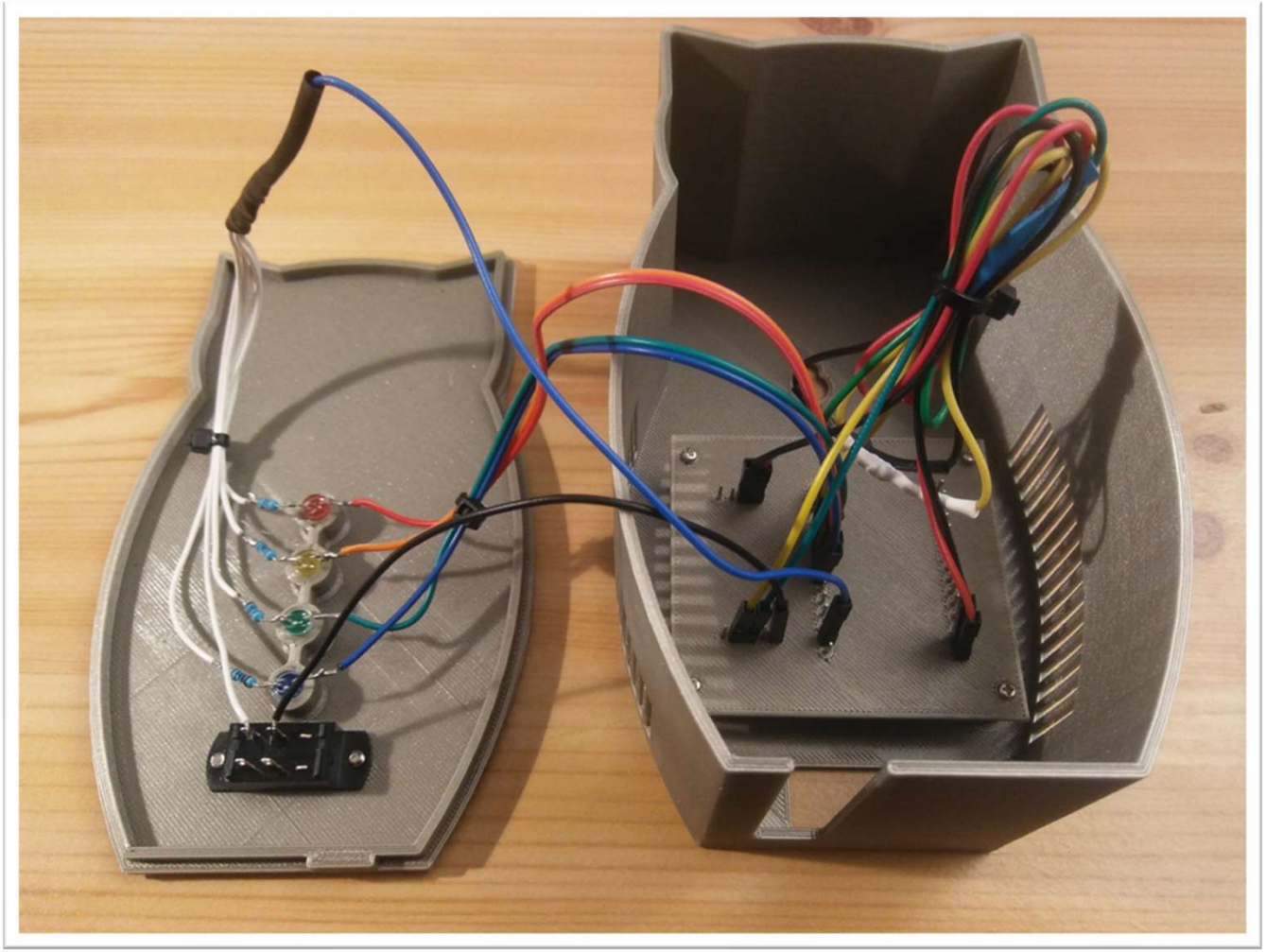
```
if (CO2 < 430){
            digitalWrite(ledB,HIGH);
            digitalWrite(ledG,LOW);
            digitalWrite(ledO,LOW);
            digitalWrite(ledR,LOW);
}
else if (CO2 < 800){
              digitalWrite(ledB,LOW);
            digitalWrite(ledG,HIGH);
            digitalWrite(ledO,LOW);
            digitalWrite(ledR,LOW);
}
else if  (CO2 >= 800 && CO2 < 1000){
             digitalWrite(ledB,LOW);
            digitalWrite(ledO,HIGH);
            digitalWrite(ledG,LOW);
            digitalWrite(ledR,LOW);
}
else if  (CO2 >= 1000){
             digitalWrite(ledB,LOW);
            digitalWrite(ledR,HIGH);
            digitalWrite(ledO,LOW);
            digitalWrite(ledG,LOW);
}
```

Manufacturing of the plastic housing

The case is in three parts, manufactured in PLA on a 3D printer. The front side is decorated with a printed, plasticized and glued label. The holes are made either with a punch (for circular shapes) or with a cutter (for two rectangular pockets). The upper part (blue) is only stuck for the moment. Magnets or screws can help to keep it in place. This will certainly be the subject of a future version.

Bottom casing ***Upper casing*** ***« Fake » PCB***

Final assembly



Calibration procedure of the S8 sensor

A "manual" calibration of the sensor is possible. To do this, simply place it in an environment where the CO2 level is between 400 and 430 PPM, for example outdoors, and follow the following procedure:

- Place the powered sensor outside,
- Wait 30 minutes or more for the sensor to stabilize,
- Set the calibration button to "Calibration" for about 6 seconds (minimum 4 seconds, maximum 8 seconds).
- Set the calibration button back to "measure" and leave the sensor for at least one hour, or more if you can; do not stand near it to avoid breathing on it and disturbing the calibration,
- The first step of the calibration is now completed;
- the "Outdoor" LED should now be on, confirming that the level of 400 to 430 PPM has been measured.

Attention! In order not to disturb the sensor which will continue to adjust its calibration, it is recommended not to make repeated on/off cycles to test it for example,

A manual calibration can be carried out regularly if you notice a "drift" of the sensor in the measured values.