Outdoor weather station

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Objectives

▶ Powered by battery, charged by solar panel

▶ Measured values:

- Temperature

- Humidity

- Atmoshperic pressure

- Air Quality (particles PM1.0, PM2.5, PM10.0)

▶ Historical data collection

▶ Easy, accessible dashboard

Microcontroller

As the brain of our system we chose ESP8266 (NodeMCU v3). It is a low cost microcontroller, but it meets all requirements such as:

- ▶ Wifi module
- ▶ Sleep function for saving power
- ▶ 3.3 V Logic
- ▶ I2C interface

During project construction it turned out,

that it is not compatible with standard

arduino libraries which may be considered,

as significant disadvantage
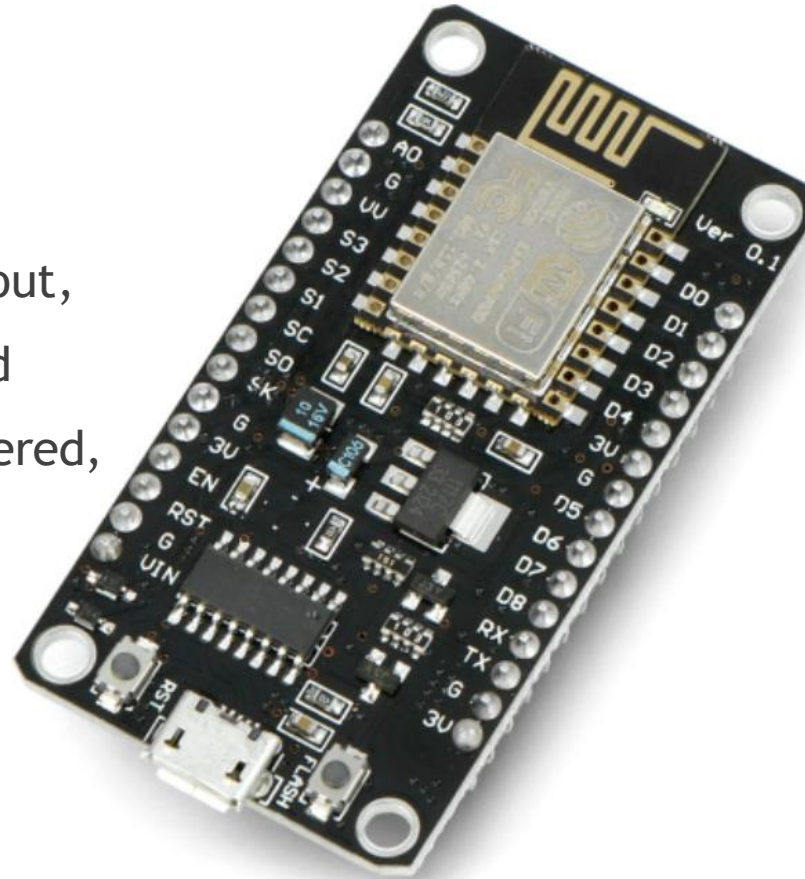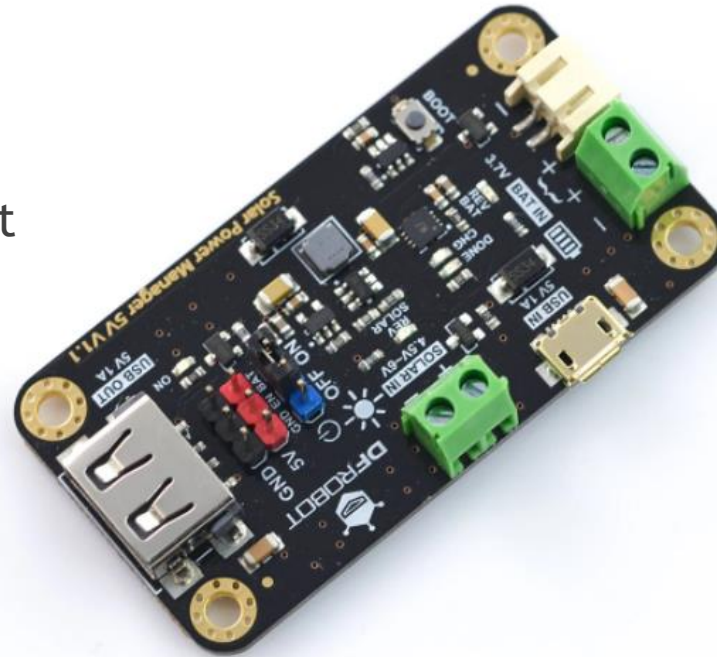
Esp 8266 NodeMCU v3 controller

Power supply

To provide continuous and renewable source of power we have chosen:

▶ Lithium-polimer Redox 2200mAh packet

▶ 3,5W/6V solar panel

▶ DFRobot Solar Power Manager – 5V output

DFRobot Solar Power Manager

Solar panel

Li-Pol 2200mAh battery

Sensors

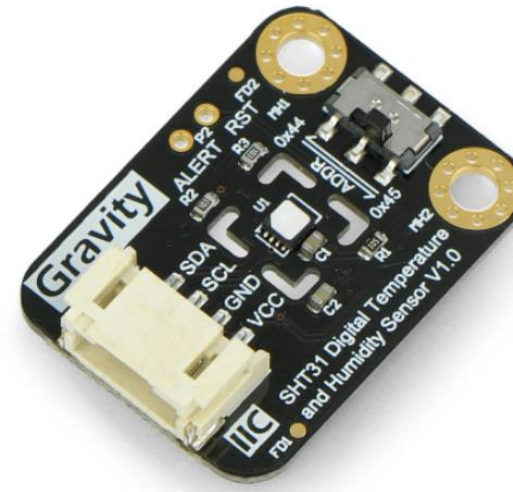The following sensors were used to measure all assumed quantites:

- ▶ SHT31-F - temperature (-40°C - 125°C ± 0.2°C) and humidity (0% - 100% ± 2%) sensor communicating via I2C

- ▶ BMP280 - Atmospheric Pressure (300hPa – 1100hPa ±0,12hPa) sensor communicating via I2C

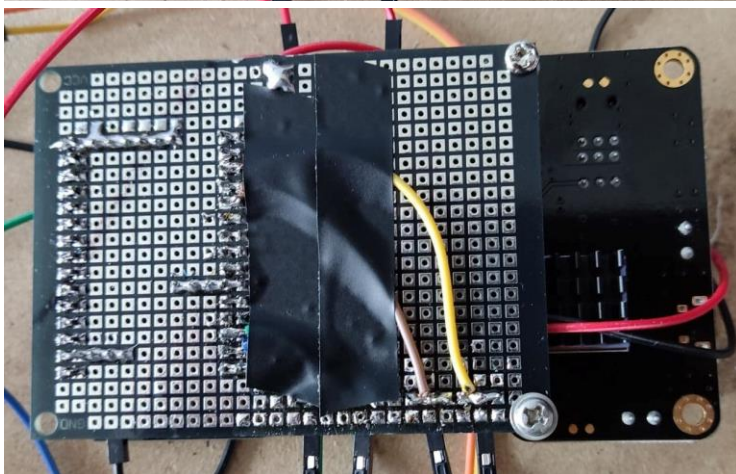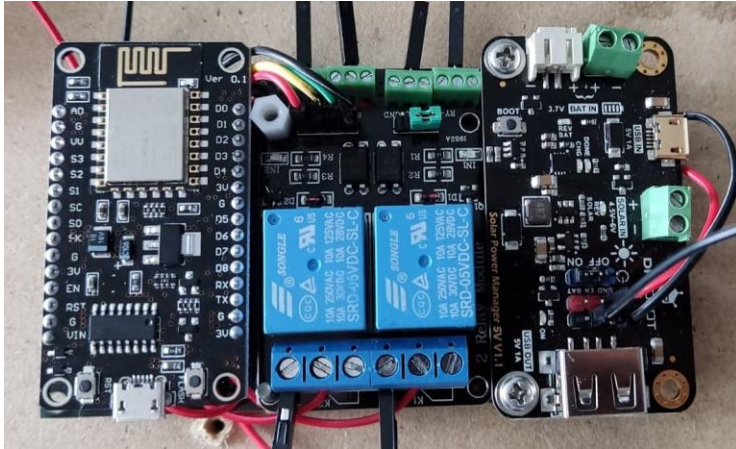- ▶ PMS3003 – particle (PM1.0, PM2.5, PM10.0) sensor communicating via UART
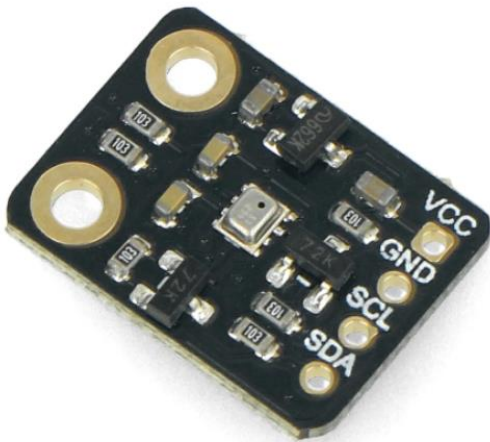
BMP280

PMS3003

SHT31-F

Construction

All components were mounted in two cases :

▶ First case – waterproof, containing logic, and power supply components such as: microcontroller, solar power manager, relays, battery

▶ Second case – partially open, containing sensors

Collecting data, dashboard

Data sent by the microcontroller are captured by script coupled with google sheet where the data is stored. Dashboard is created with google Data Studio and allows the user to view every stored quantity for every year, month, day, hour.


	Datetime	Temperature [°C]	Humidity [%]	Pressure [hPa]	PM 1.0[ug/m3]	PM 2.5[ug/m3]	PM 10.0[ug/m3]
2	2022-05-31 19:55:48	26.61	40.60	978	11	12	8
3	2022-05-31 20:50:28	25.83	41.16	978	8	8	5
4	2022-05-31 21:46:39	25.04	41.36	978	8	9	6
5	2022-05-31 22:42:58	24.27	43.11	978	8	9	6
6	2022-05-31 23:39:58	23.30	46.14	977	14	14	10
7	2022-06-01 00:37:07	23.15	47.98	978	10	10	8
8	2022-06-01 01:34:22	23.43	48.72	978	13	14	10
9	2022-06-01 02:31:33	23.48	48.76	978	11	11	8
10	2022-06-01 03:28:32	23.45	48.45	978	14	14	10
11	2022-06-01 04:25:30	23.42	48.20	978	13	14	10
12	2022-06-01 05:22:30	23.26	47.03	978	12	13	9
13	2022-06-01 06:19:30	23.12	47.69	979	14	14	10
14	2022-06-01 07:16:40	23.15	48.48	979	17	18	12
15	2022-06-01 08:13:44	23.18	49.87	979	16	17	12
16	2022-06-01 09:10:46	23.33	50.73	979	11	12	8
17	2022-06-01 10:07:51	23.33	51.96	980	5	5	4
18	2022-06-01 11:04:55	23.53	52.66	980	4	5	3
19	2022-06-01 12:01:59	23.74	49.31	980	4	4	3
20	2022-06-01 12:59:05	23.52	48.85	980	6	6	4
21	2022-06-01 13:56:12	23.73	45.20	979	3	3	2
22	2022-06-01 14:53:33	24.08	38.23	979	2	2	1
23	2022-06-01 15:50:48	24.58	37.61	979	3	3	2
24	2022-06-01 16:47:54	24.86	35.67	979	1	1	1
25	2022-06-01 17:44:34	25.27	37.81	979	3	3	2
26	2022-06-01 18:41:03	25.71	37.82	979	2	3	2

Datalogger
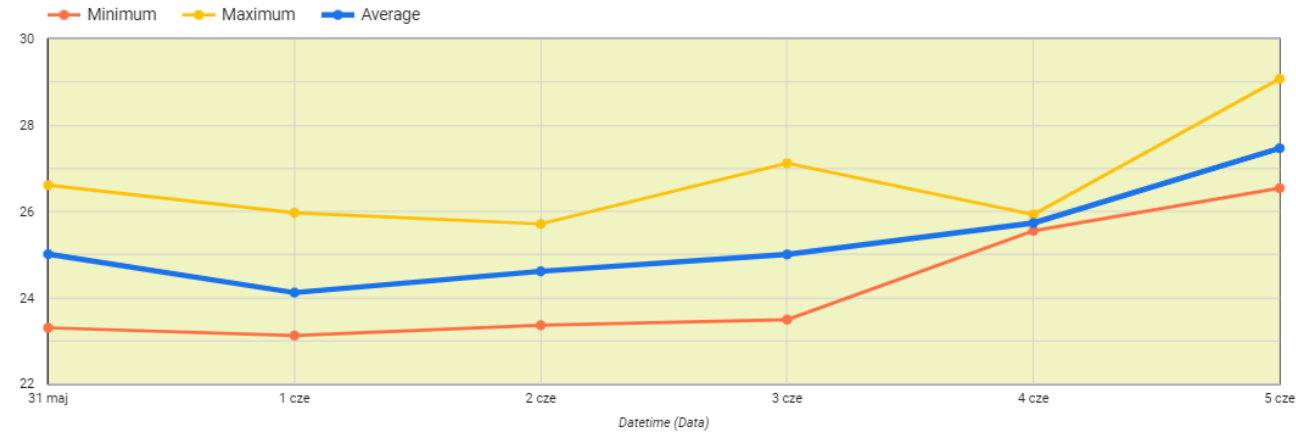
Summary

- Data is collected with 1 hour interval

- Battery provides power for approximately 4.5 days and can be recharded in

  4-5 hours of strong sunlight

- Station measures temperature, humidity, atmoshperic pressure and particles in air

- After sealing the housing station can operate all year round (except particles measures – it can be stored in temperature up to -40°C but can work in temperaturę up to -10°C),

- Dashboard and data storage is done with free gogle tools so maintenance of the station is free