Weather station: measuring environment related parameters

Worksheet for students **Team……**

Time for brainstorming

What do you know about weather stations? *Work with your team to search for information online and write your findings below.*

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What is temperature and humidity and why might be important to measure them? *Work with your team to search for information online and write your findings below.*

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Do you use (or would you consider using) a device or application to check weather related data?

- Which devices or applications are these and how they work?
- What data do you (or would you) check most often?
- Do you (or would you) make decisions based on this data?

Discuss with your team and write your answers below.

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Do you know what sensors such devices or applications use to monitor various data? How is this data transferred and/or stored?

Discuss with your team and write your answers below.

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Time to design your own weather station device

Think about what data you would like your weather data to measure, what sensors you need to use and were you should place them for accurate readings (bearing in mind that you will also need a component for transferring data). *Discuss with your team and write or draw your thoughts and ideas below*.

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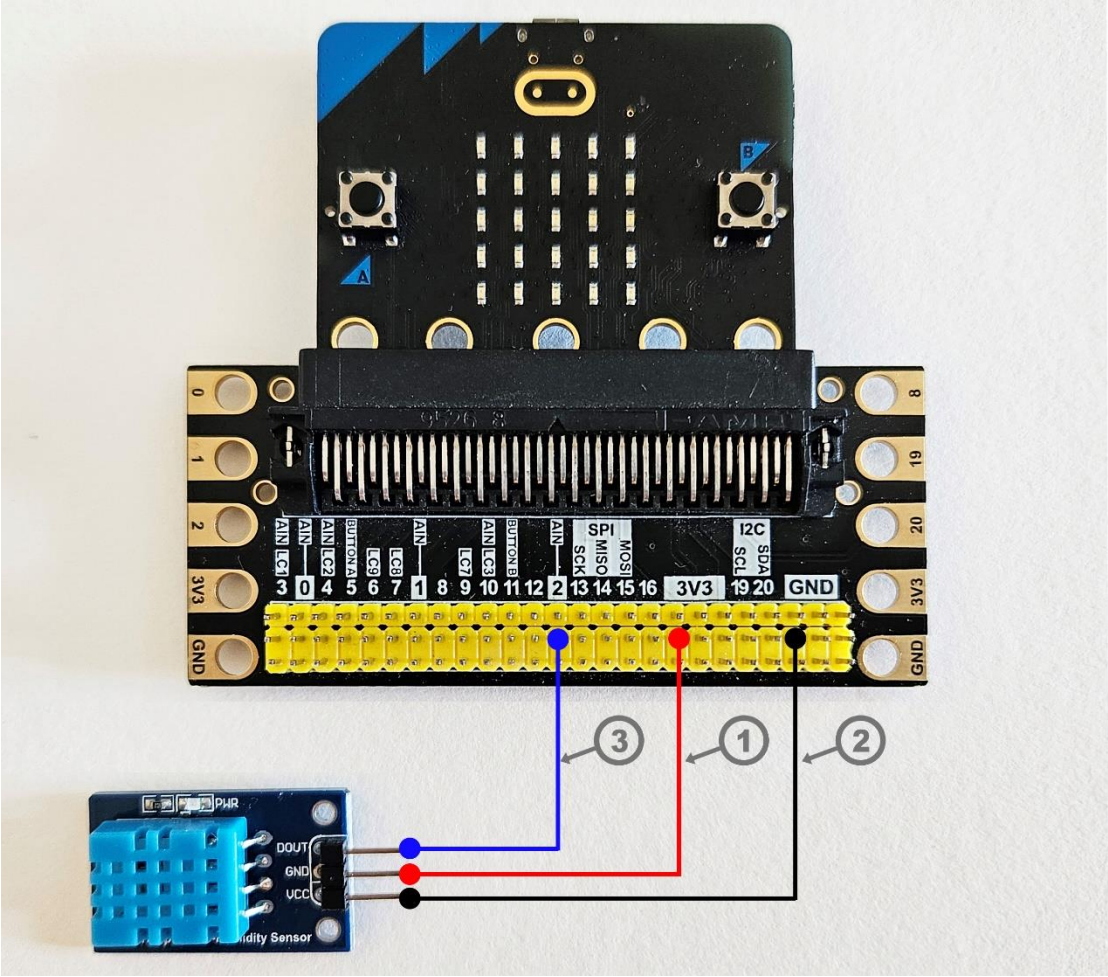
Time to create a weather station that can measure temperature and humidity (Level 1)

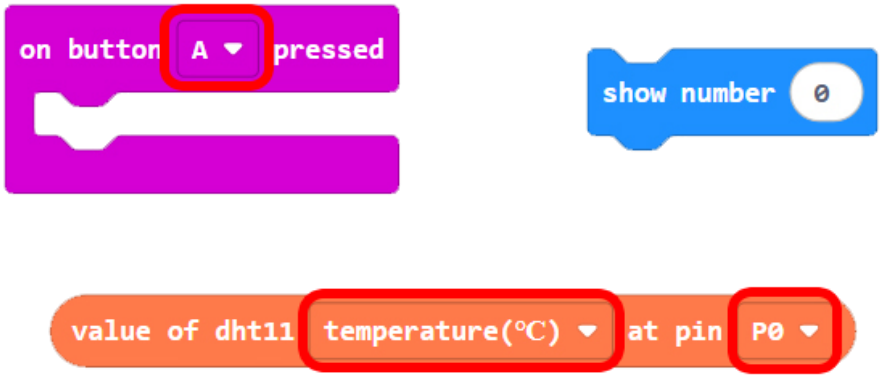
Let's get started.

Use the micro:bit, the Edge connector breakout board and the DHT11 sensor to create the following circuit. Before creating the circuit check the names on the pins of DHT11 sensor as the order might differ. Ensure that you will connect DOUT at pin 2, Vcc at 3V3, and GND at GND (or 0V).



Now, let's check if you can measure temperature and humidity.

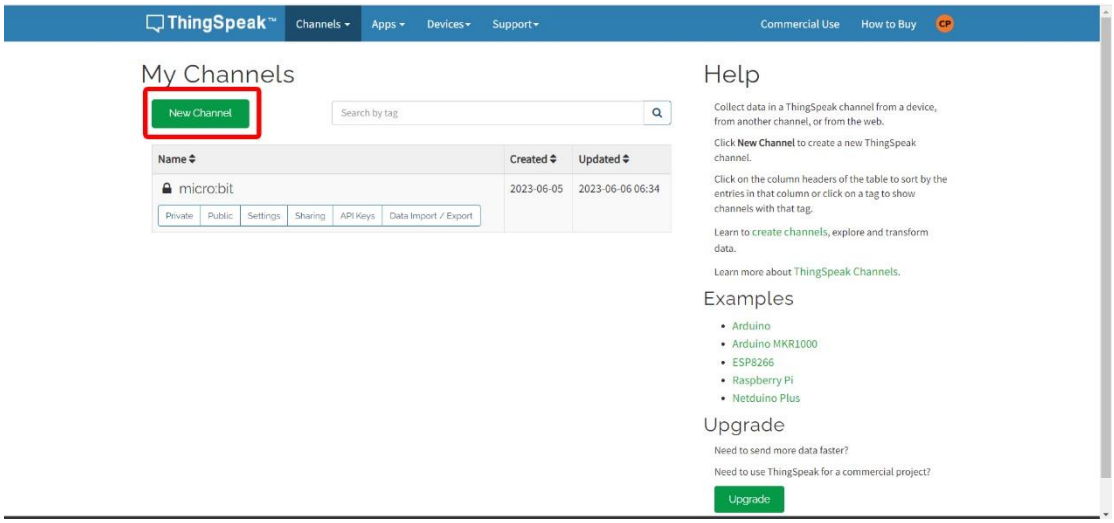
1. Open the Microsoft Makecode block-based environment (https://makecode.microbit.org/) and create a new project.
2. Import the "iot-environment-kit" extension (from the extension menu).
3. Assemble the following semi-structured script to display the temperature and humidity on the LED screen when Button A and Button B are pressed respectively. (Tip: Click on the arrows/floating menus to find the commands for programming "Button B", "humidity" and "P2").



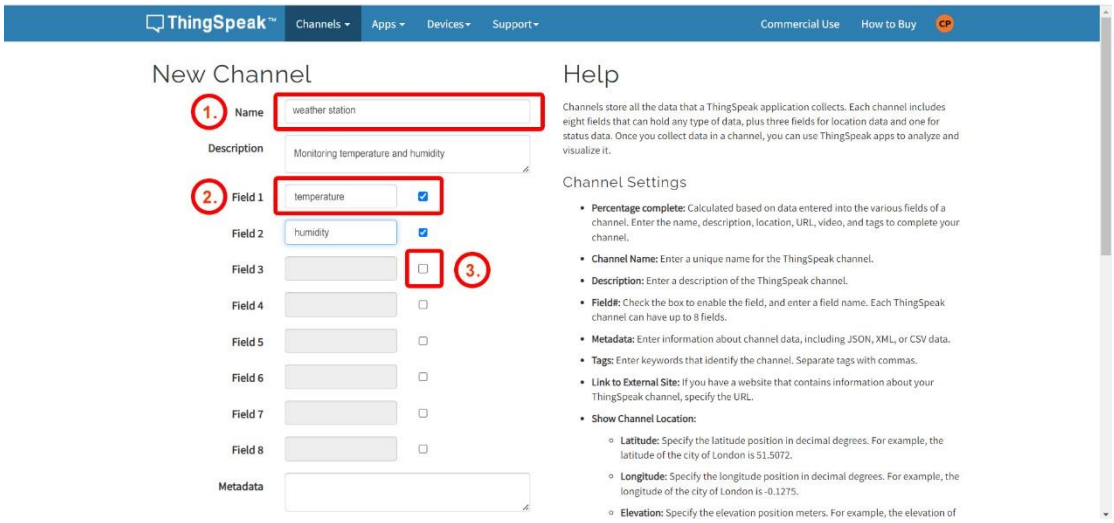
Download the script to the micro:bit and test if the DHT11 sensor works.

Time to make the weather station sending data to an IoT platform

To monitor our data we need to use an IoT platform. Let's open the ThingSpeak IoT platform (https://thingspeak.mathworks.com/). With the help of your teacher, log in to an existing account and create a "new channel".



Give a name to the channel and add the field you want to monitor.



After setting up your channel, click "Save Channel"

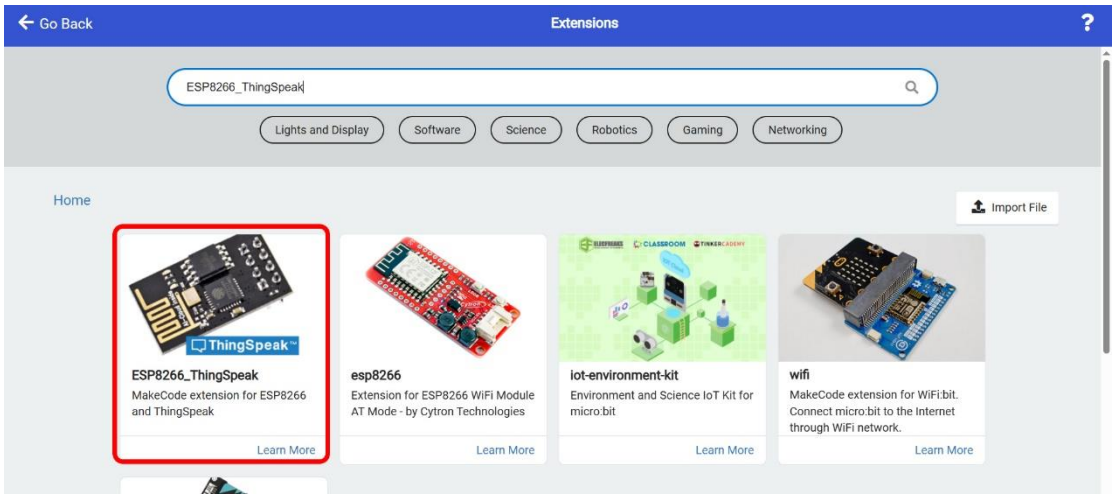
Adding and programming the ESP8266 WiFi module to send data

Let’s connect the ESP8266 WiFi module to the micro:bit to send the measured data to the ThingSpeak IoT platform.

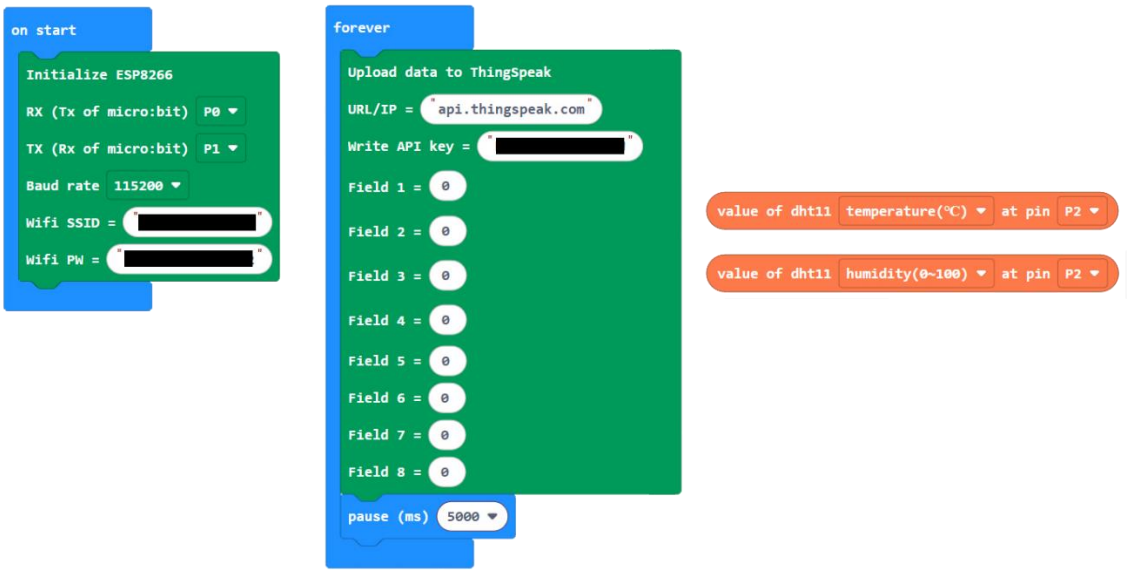
To do this, you need to connect the pins of the ESP8266 WiFi module to the pins of the micro:bit as shown in the following table:

ESP8266 pins	Edge Connector pins
3V3, EN	3V3
GND	GND
RX	P0
TX	P1

From the Extensions menu, add the ThingSpeak command groups to your project by typing “ESP8266_ThingSpeak” in the search bar and selecting the corresponding extension from the results returned.



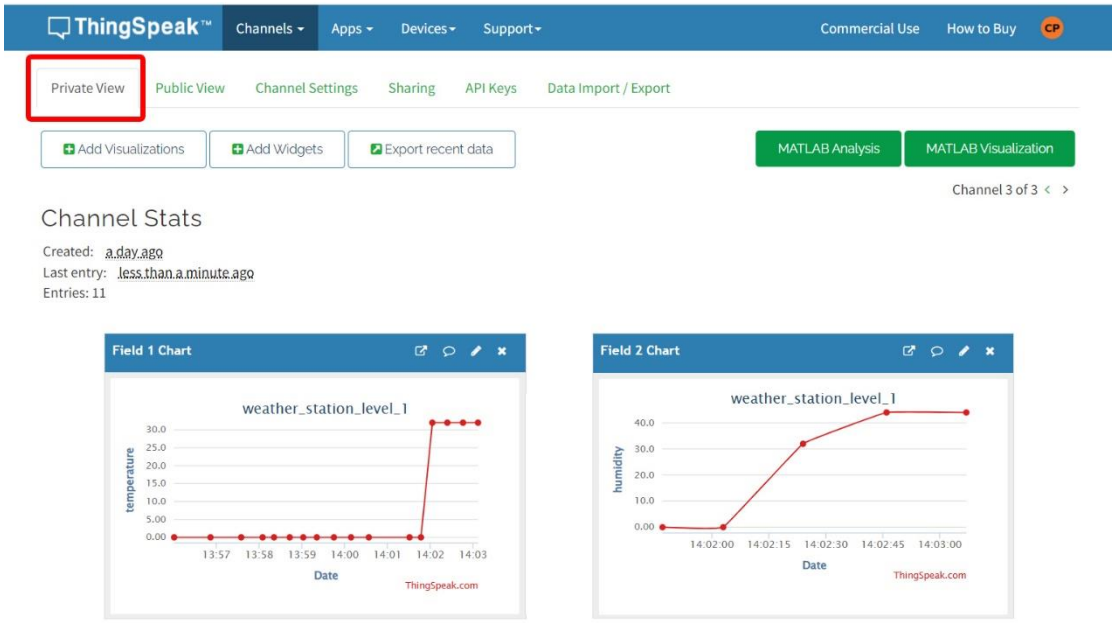
Then try assembling the following semi-structured script to enable your weather station to upload temperature and humidity data to ThingSpeak through fields 1 and 2. With the help of your teacher also fill in the “WiFi SSID”, “wifi PW” and “write API key” fields”.



After assembling the script, download it to the micro:bit

Monitoring data

At the “Private View” of your channel you can start monitoring your data.



Leave the weather station to record data for as long as possible. When you have enough results discuss the following with your team:

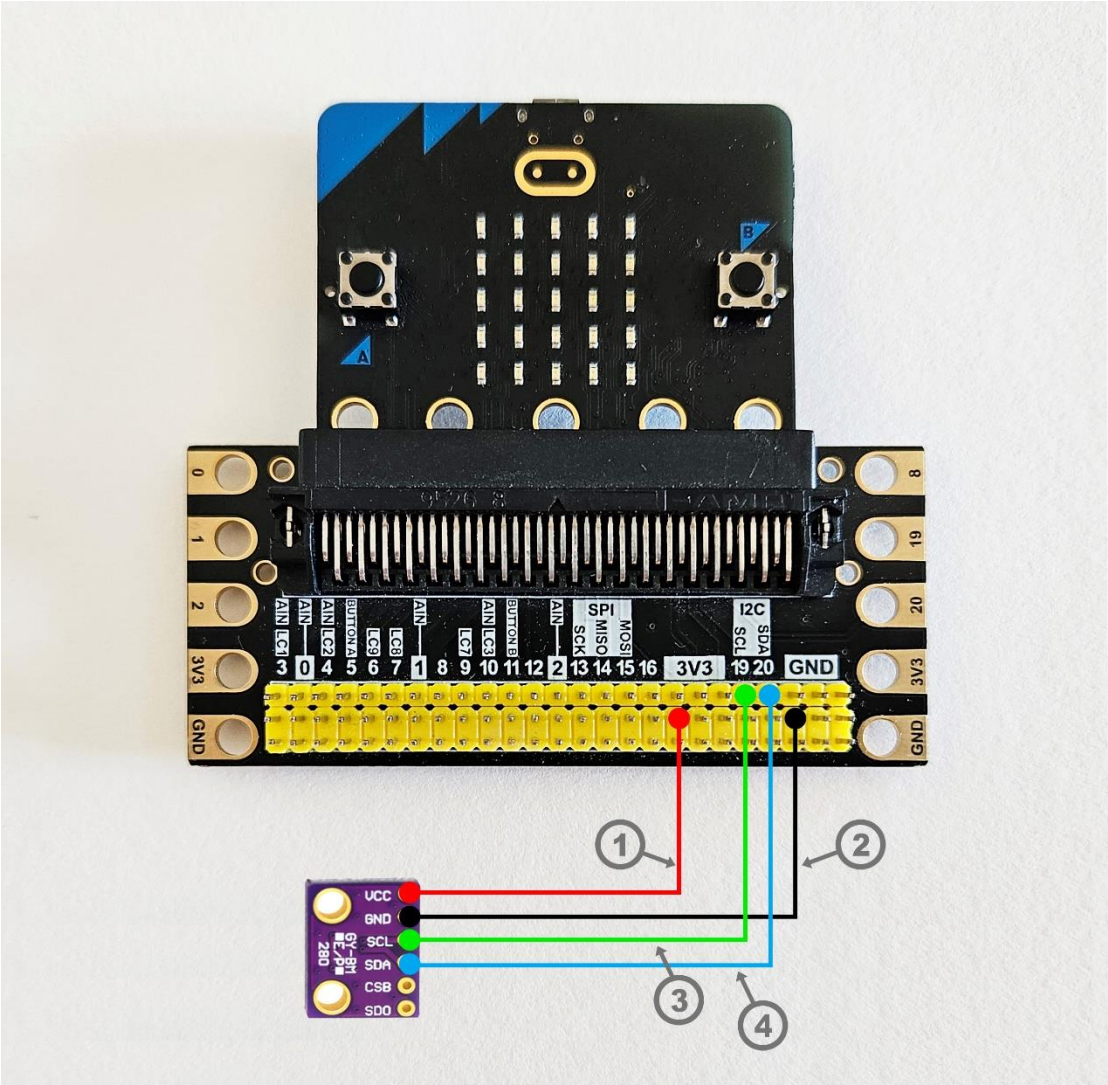
- What patterns do you notice between temperature and humidity?
- Compare your data with an online weather service. Are there differences? Why?
- How can real-time weather data help in daily decision-making (e.g., school events, energy use)?
- Would you share this data publicly? Why or why not?

Time for crafting!

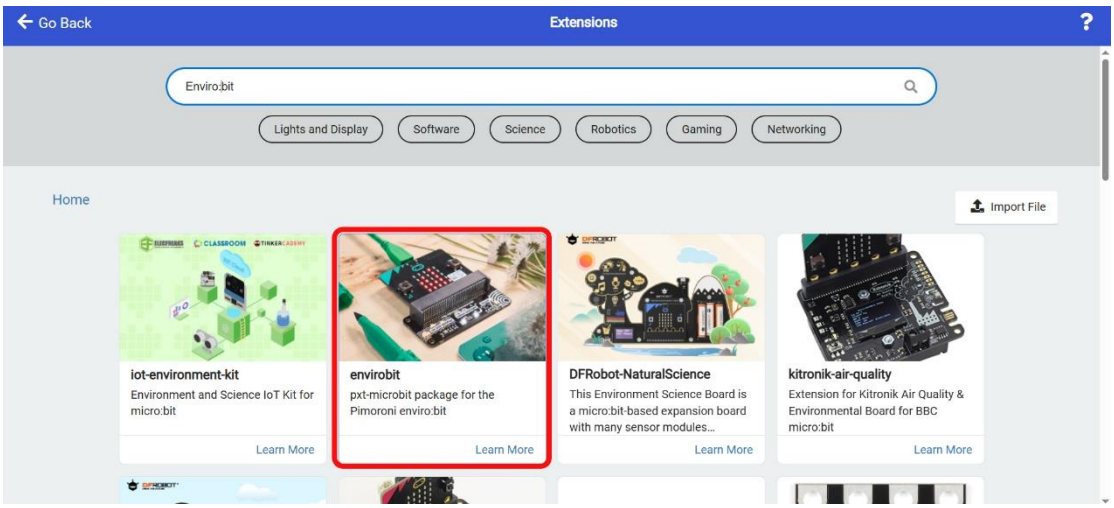
With the use of cardboards, colored papers, colored pens, glue etc. try to create a model for your weather station.

Time to add one more sensor to monitor barometric pressure (Level 2)

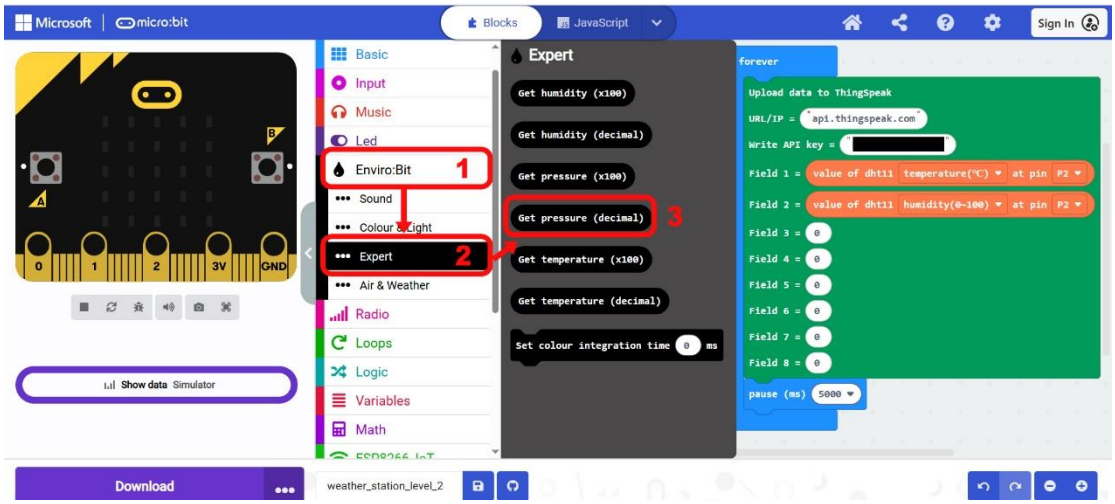
Add to the previous circuit the BMP280 sensor by connection the VCC to the 3V3, GND to Ground (or 0V), SCL to pin 19 (SCL) and SDA to pin 20 (SDA).



In MakeCode, add the “envirobit” extension to the previous script.



Then, from the “Expert” menu, add the “Get pressure (decimal)” to Field 3 of the “Upload data to ThingSpeak” sript.



Download the new script to your micro:bit.

Update also your channel to the ThingSpeak platform by adding one more field to receive the barometric pressure data.

Leave the weather station to monitor data for as long as possible and reflect on the results.

Wrapping up: reflecting on functionality and possible improvements

What was the most interesting part of building your weather station?

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What new skill or concept did you learn about IoT and weather data?

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Can you think of other parameters related to environment that could be measured and monitored by your weather station? Write your answer below and feel free to experiment further.

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