



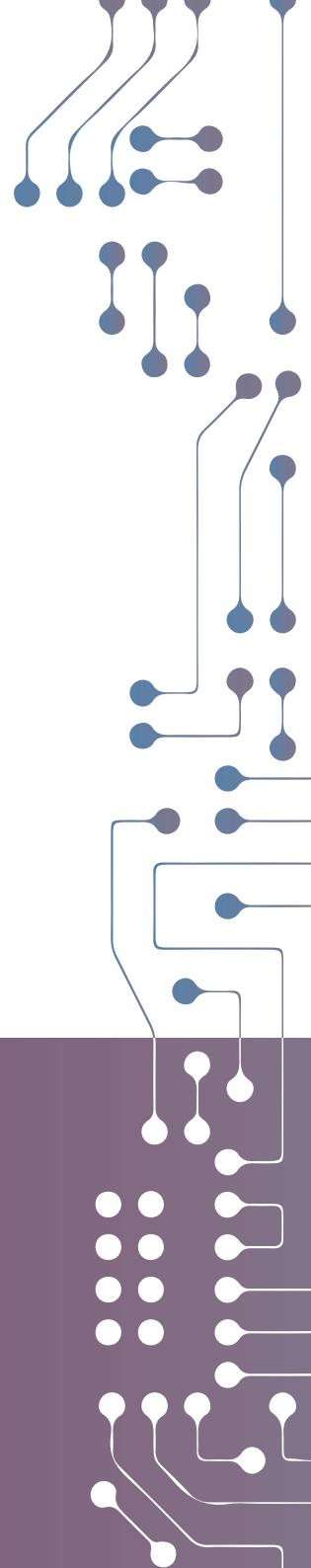
PARTICLE PHOTON2 TUTORIAL

smartPOT

FireFli PTY LTY ~ FE Basson

Introduction

The purpose of this project is to build a Smart Pot to help keep your favourite plants alive!
We will be utilising an inductive soil sensor and an UV sensor
We will display the data on a BLYNK Web dashboard as well as in the BLYNK mobile app.



Prerequisites

You should have a basic understanding of Particle WebIDE or Visual Studio Code and how to import libraries. You should also have some knowledge of setting up Particle WEBHOOKS.

You should have a Particle Photon2 and a Particle account. If you do not have an account, visit <https://www.particle.io> and register and account.

You should have a BLYNK account and a basic understanding of Blynk WEBHOOKS and Datastreams

You should have at least one Particle Photon2 claimed and active on your account.

Before you start

Connect the soil sensor as indicated in STEP TWO and load the `simple_soil.ino` sketch. You will need to determine the maximum and minimum readings of your sensor as they can vary drastically.

First place the sensor in open air and get the RAW reading from the serial print or Particle console event monitor. Then submerge the sensor in water and get the second RAW reading. Keep these nearby, we will use them later. Take care of the line on the sensor, do not submerge beyond that line!!

Bill of materials

Items you will need to complete this tutorial

- 1 x Particle Photon2
- 1 x Breadboard
- 1 x USB cable
- 1 x Capacitive Soil sensor
- 1 x Wave LTR390-UV sensor
- 1 x 3.7V LiPo battery (or suitable power supply)
- 1 x Jumper Wires (male2-male and male-2-female)
- 1 x 3D printed pot (optional ~ STL's provided)



Software used



Visual Studio Code



Cura Slicer



Autodesk Fusion360



Blynk

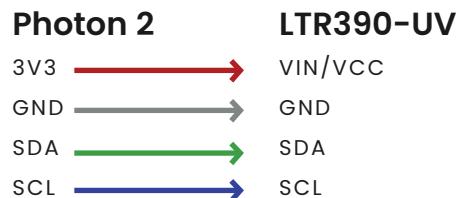
Step 1

LTR390-UV wiring

Place your Particle Photon2 on the breadboard and ensure there are exposed holes on either side as we will be connecting wires on both sides of the Photon2.

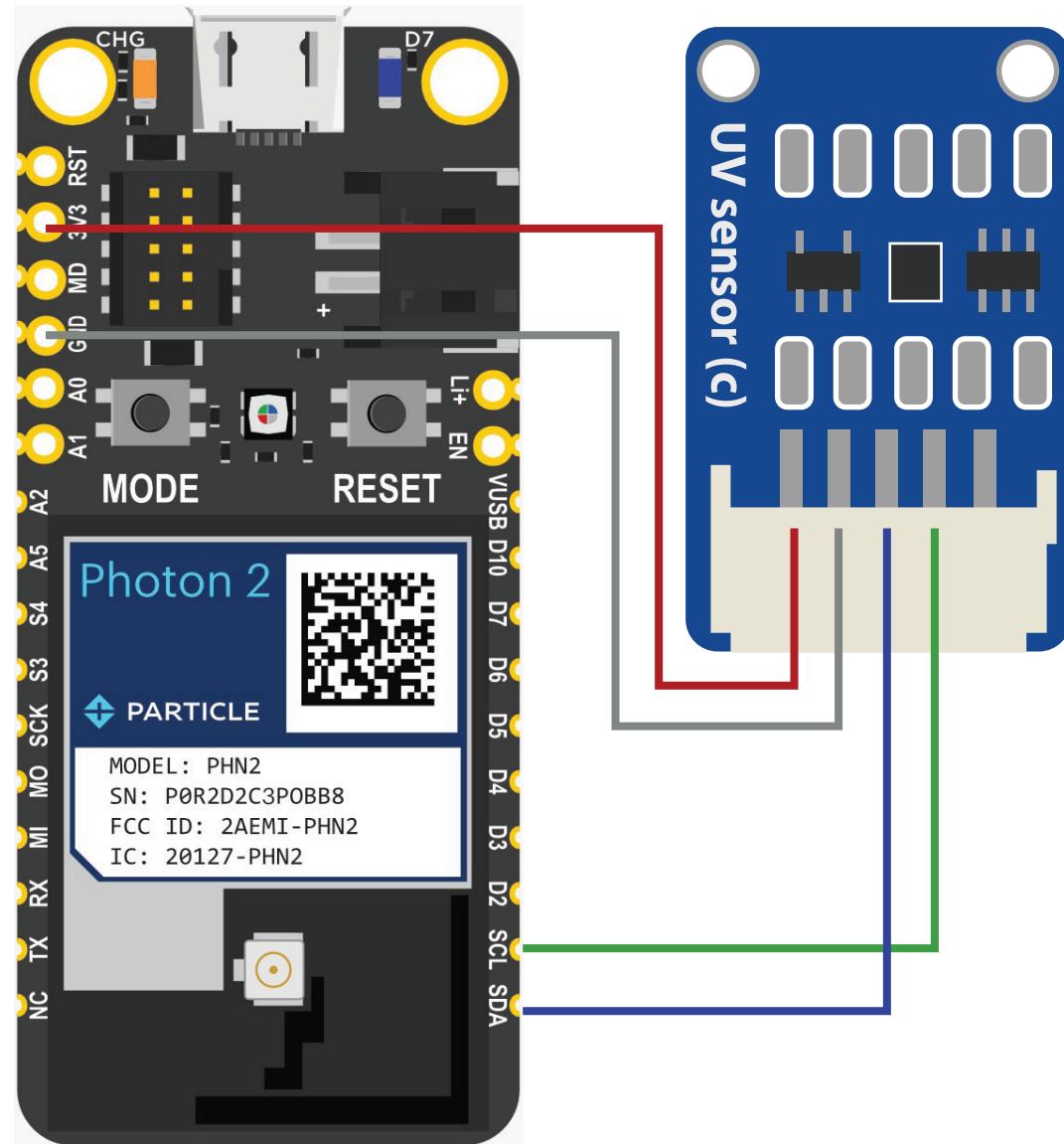
Make the necessary connections between die Photon2 and the LTR390-UV module

We will not be using the INT function in this tutorial so you can leave that unconnected



NOTE

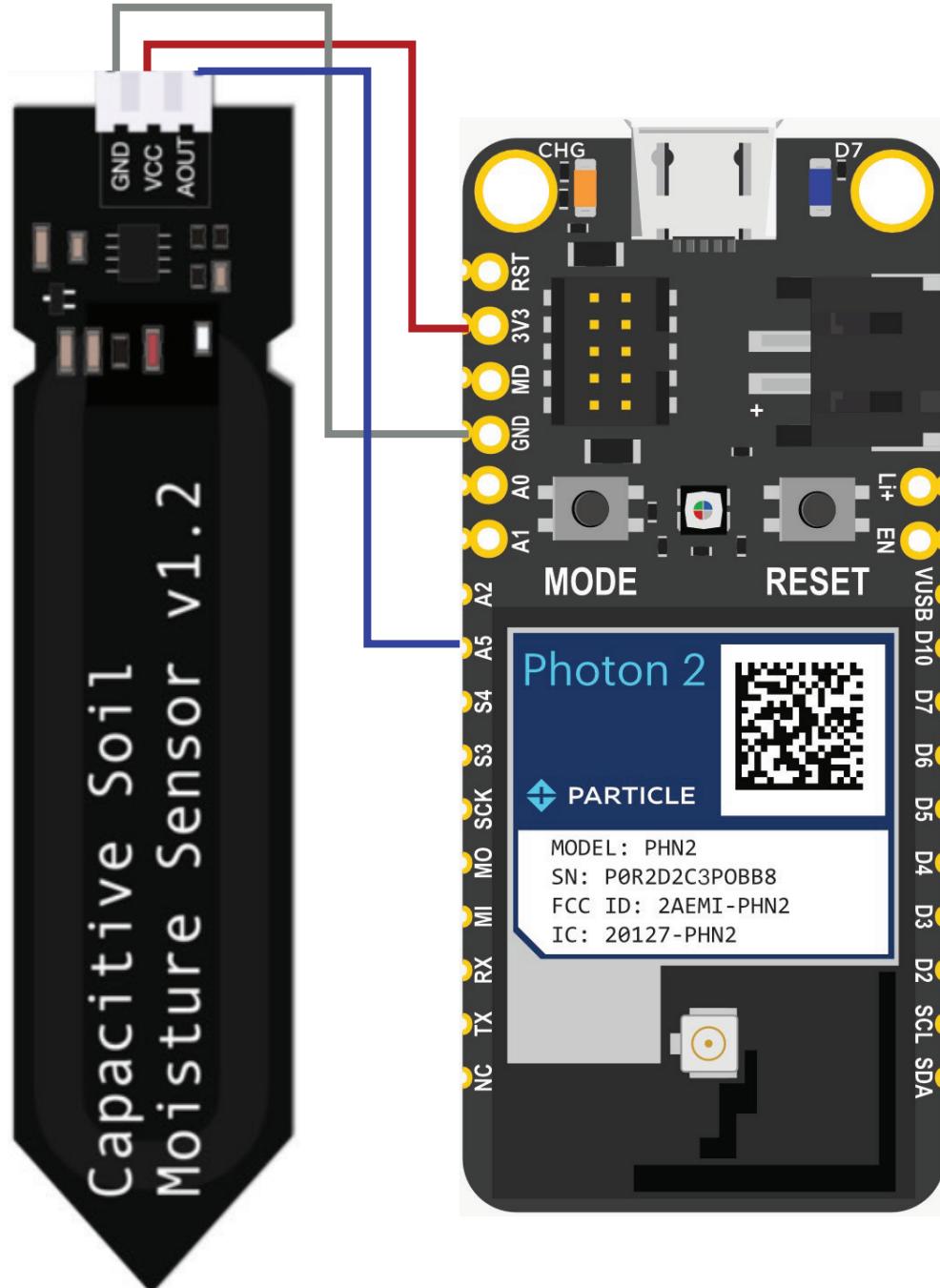
Depending on the jumper wires you selected, it might look a little different but as long as the pin outs match all should be good



Step 2

Soil sensor wiring

The Soil Sensor requires only three connections, VCC, GND and A5



Photon 2	Soil Sensor
3V3	VCC
GND	GND
A5	AOUT

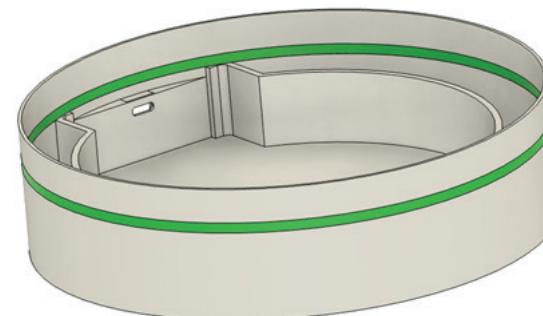
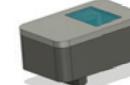
Step 3

3D prints

If you want to build the entire project, please make sure to print the following parts. Note that this can be quite a lengthy print, so be patient. I used PETG for this project and printed with a 0.8mm nozzle and a layer height of 0.6mm.

- Water tray
- Base
- Main pot
- UV sensor lid
- UV sensor connector
- UV Sensor base

The Base is made up of three parts to allow you to print with dual extrusion in order to include the LED RING. If you do no have dual extrusion, you can simply print the parts separately but will have to glue them together.



Step 4

Setting up everything on the breadboard

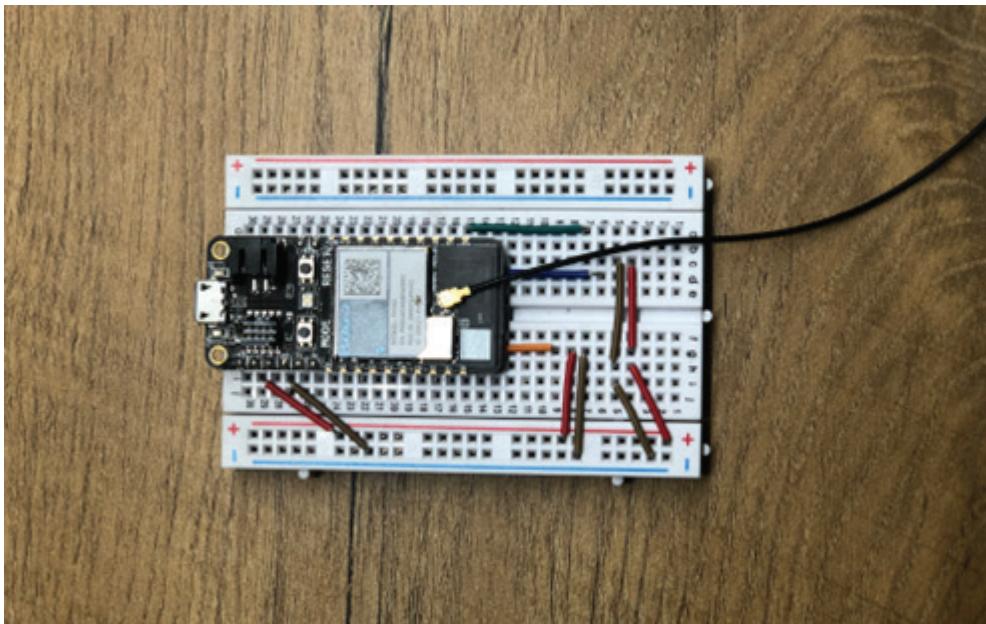
Now that you have all the individual wiring diagrams, we can start to prepare the breadboard.

Depending on the wiring you have on hand, your breadboard might look a little different. I opted for solid core option which can be placed neatly on the breadboard.

I allowed for the LTR-390-UV sensor on the right-hand side of the breadboard as this is where the I2C pins of the Photon is.

The Soil Sensor connects on the left-hand side of the breadboard.

You can also add the RGB LED (common anode) to the right of the Photon using pins D5, D6, D7. The common Anode of the LED goes to the V+ rail on the breadboard.



Step 5.1

Installing into the enclosure

Assemble the three parts of the sensor enclosure and insert the sensor as shown in

Fig 5.1

Place the breadboard in the base and make sure to align the USB port as indicated in

Fig 5.2

Fig 5.3 shows the sensor placed in position on the main body. Make sure to run the wires through the enclosed conduit in the main body to ensure the wires are not exposed to damp soil.

Now connect all the wires of both sensors to your breadboard - **Fig 5.4**

NOTE

make sure to tuck all the wires in the most inner ring to ensure that they do not come in contact with any water. Do no leave any wires in the middle ring with the drainage holes.



Fig 5.1

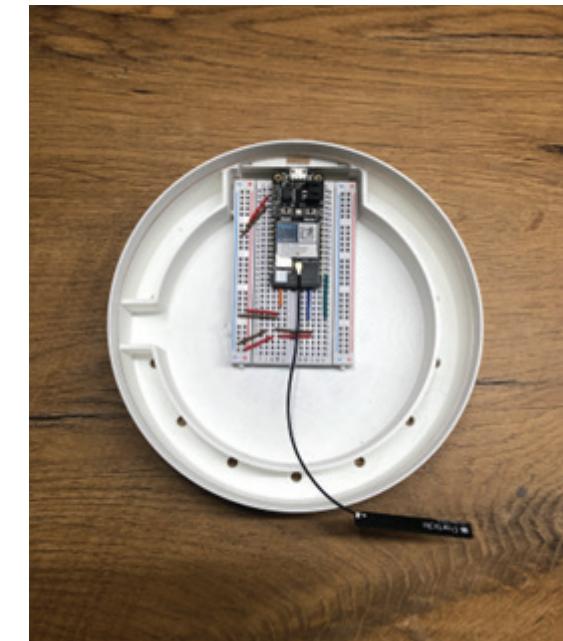


Fig 5.2



Fig 5.3



Fig 5.4

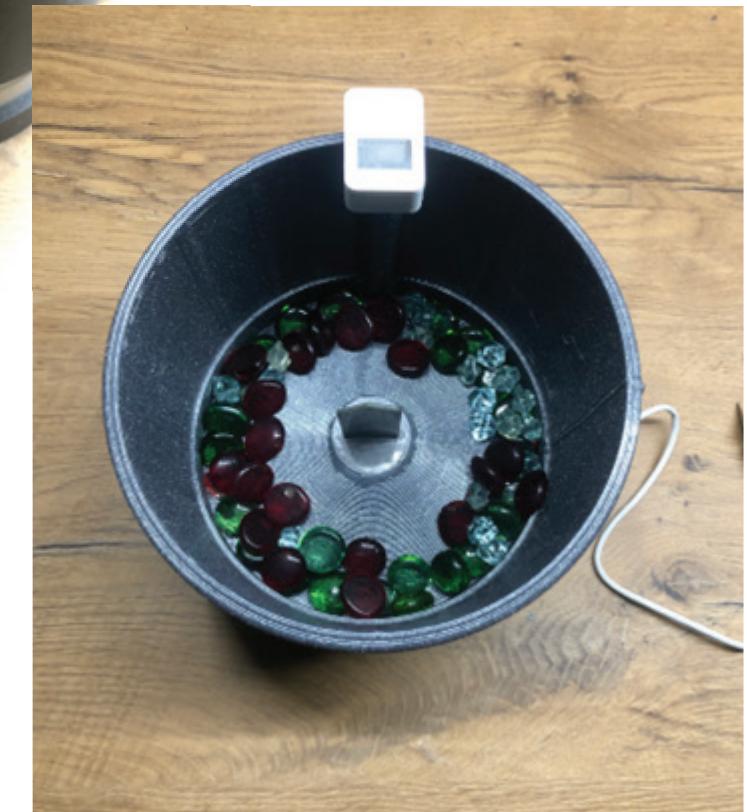
Step 5.2

Assemble the three parts of main assembly as shown in **Fig 5.5**

Place small gravel at the bottom of the pot plant to assist with draining access water and prevent soil from falling through the drainage holes - **Fig 5.6**

NOTE

It is time to use that Minimum and Maximum values you determined.



Step 6

Code

Everything has been done for you. Simply follow the link below and download the entire project from the Github repository. You will have to replace the the minimum and maximum values in the two lines below:

```
22  
23 | int min_raw_value = 1945;           // Adjust these with the values you determined  
24 | int max_raw_value = 2450;           // Adjust these with the values you determined  
25 |
```

https://github.com/friedl1977/Soil_Sensor

The repository also includes a folder with STL and STEP files if you want to print the enclosure or need to make some modifications on the design.

The code is quite heavily commented for informational purposes. You are welcome to remove these, but please keep all mentions of contributors in place if you intend to publish this code as some parts are loosely based on existing libraries even though quite heavily amended.



Fig 7.1

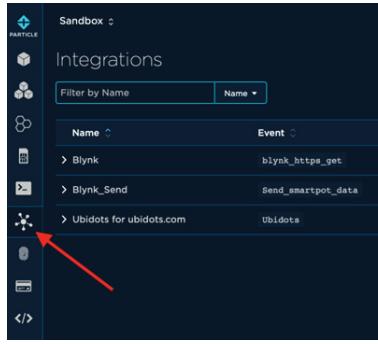


Fig 7.2

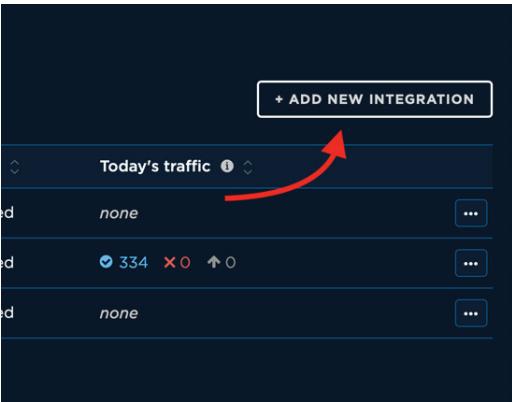


Fig 7.3

The screenshot shows the Particle Webhook configuration form. The fields are as follows:

- Name: Blynk_Send
- Event Name: Send_sm智pot_data
- URL: https://fra1.blynk.cloud/external/api/batch/update
- Request Type: GET
- Request Format: Query Parameters
- Device: Any
- Status: Enabled

Fig 7.4

Step 7.1

Particle Webhook and Exposed Variables

Fig 7.1 shows the exposed variables we set up in the code. These are needed to receive data from the Blynk App. You can find this by logging into Particle Console and clicking on the device you are using.

Now lets proceed in setting up the Webhook needed to send data to Blynk.

In the menu on the left of your screen, click on the INTEGRATIONS tab - **Fig 7.2**

The click on +ADD NEW INTEGRATION button on the top right - **Fig 7.3**

Complete the first section as indicated in **Fig 7.4**

NOTE

You will need to update the URL a little later once you obtained you sever address from BLYNK. If you already have the URL, you can add it now. It is only the ...fra1.blynk.cloud/.... Part that will vary depending on your location

Step 7.2

Advanced Settings

For information on dynamic data that can be sent in any of the fields below, please visit our docs.

QUERY PARAMETERS ⓘ

Default Custom

token	> {{t}}	x
V0	> {{new_soil_level}}	x
V1	> {{new_sun_light_level}}	x
V4	> {{sun_upper}}	x
V5	> {{sun_lower}}	x
V6	> {{water_upper}}	x
V7	> {{water_lower}}	x
V8	> {{H2O_Error}}	x
V9	> {{UV_Error}}	x

Fig 7.4

ENFORCE SSL ⓘ

Yes No



CANCEL **SAVE**

Fig 7.5

Next click on ADVANCE SETTINGS and select CUSTOM to expose the Query parameters.

For the purpose of this tutorial, please fill in the fields EXACTLY as indicated in **Fig 7.4**

If you change anything without amending your code accordingly, the Webhook will not work.

Right at the bottom, make sure to select enforce SSL and click SAVE – **Fig 7.5**

Step 8.1

BLYNK 2.0

Log in into your BLYNK account and click on the **Template** icon in the left menu - **Fig 8.1**

Click on **+NEW TEMPLATE** - **Fig 8.2**

For the purpose of this tutorial, fill in the fields exactly as indicated in **Fig 8.3**

When finished, click on **DONE**

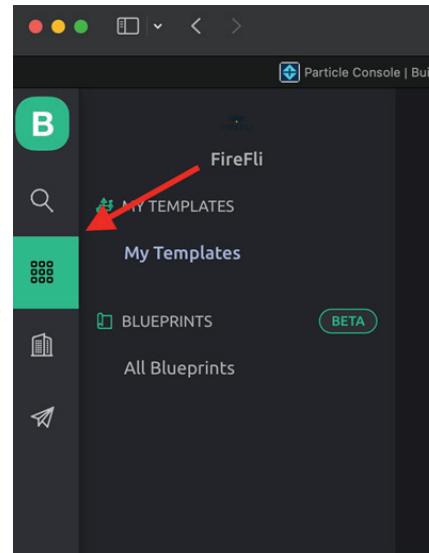


Fig 8.1

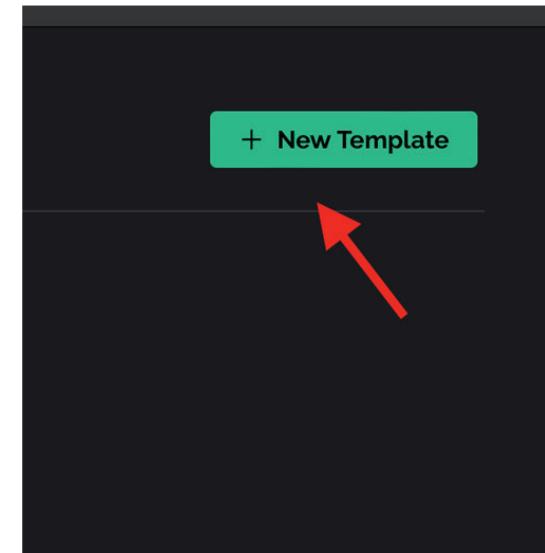


Fig 8.2

A screenshot of the 'Create New Template' dialog. It has four main sections: 'NAME' with a text input containing 'Smart Pot' (indicated by a red arrow), 'HARDWARE' with a dropdown set to 'Particle' (indicated by a red arrow), 'CONNECTION TYPE' with a dropdown set to 'WiFi' (indicated by a red arrow), and 'DESCRIPTION' with a text area containing 'Description'. In the bottom right corner, there is a progress bar showing '0 / 128' and two buttons: 'Cancel' and 'Done' (indicated by a red arrow pointing to it).

Fig 8.3

Step 8.2

BLYNK 2.0 – Continued

Lets start by configuring the DATASTREAMS required.

Click on **DATASTREAMS** as indicated in **Fig 8.4**

Next we need to enter **EDIT** mode. You can do this by clicking on the **EDIT** button on the top right of the screen after clicking on Datastreams.

Next click on **+NEW DATASTREAM** and choose **VIRTUAL PIN** - **Fig 8.5**

Complete the information as indicated in **Fig 8.6**

We will repeat this same process a couple of times. Please make sure to complete each Datastream **EXACTLY** as in the images that follow.

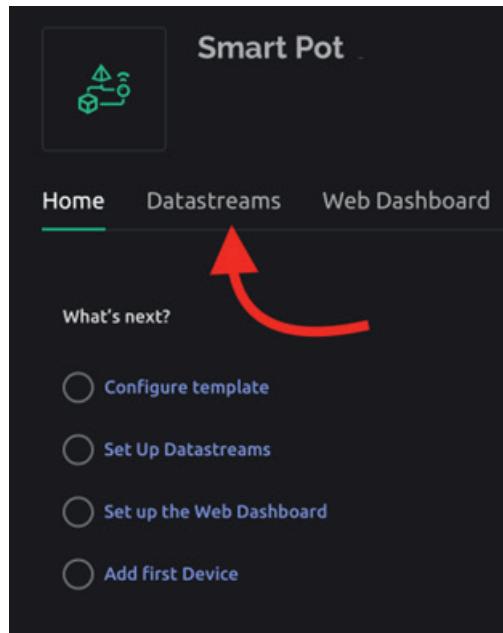


Fig 8.4

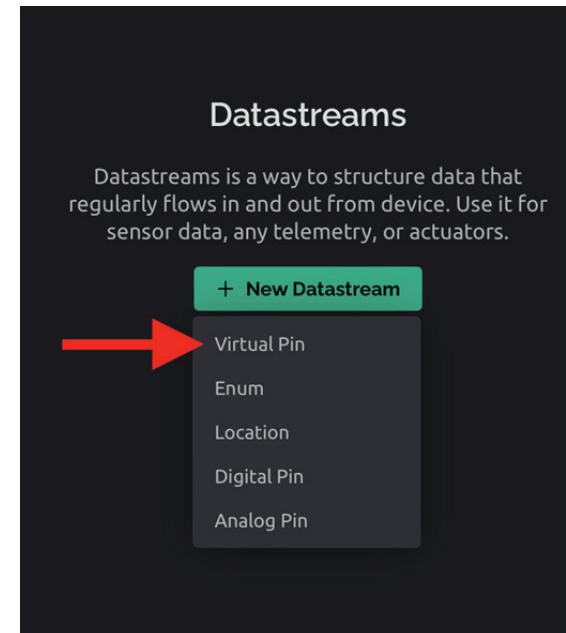


Fig 8.5

This screenshot shows the "Virtual Pin Datastream" configuration form. It includes fields for "NAME" (soil_level), "ALIAS" (soil level), "PIN" (V0), "DATA TYPE" (Integer), "UNITS" (Percentage, %), "MIN" (0), "MAX" (100), and "DEFAULT VALUE" (0). The "NAME" field has a small icon of a person next to it.

Fig 8.6

Step 8.3

BLYNK 2.0 – Continued

Virtual Pin 1 – **Fig 8.6**

Virtual Pin 2 – **Fig 8.7**

Virtual Pin 3 – **Fig 8.8**

Virtual Pin Datastream

NAME	Plant_Type_H2O	ALIAS	Plant Type H2O
PIN	V2	DATA TYPE	Integer
UNITS	None		
MIN	0	MAX	3
		DEFAULT VALUE	0

Fig 8.6

Virtual Pin Datastream

NAME	sun_light_level	ALIAS	sun light level
PIN	V1	DATA TYPE	Integer
UNITS	None		
MIN	0	MAX	8
		DEFAULT VALUE	0

Fig 8.7

Virtual Pin Datastream

NAME	Plant_Type_UV	ALIAS	Plant Type UV
PIN	V3	DATA TYPE	Integer
UNITS	None		
MIN	0	MAX	4
		DEFAULT VALUE	0

Fig 8.8

Step 8.4

BLYNK 2.0 – Continued

Virtual Pin 4 – **Fig 8.9**

Virtual Pin 5 – **Fig 8.10**

Virtual Pin 6 – **Fig 8.11**

Virtual Pin Datastream

NAME	UV_Lower	ALIAS	UV Lower
PIN	V5	DATA TYPE	Integer
UNITS	None		
MIN	0	MAX	10
		DEFAULT VALUE	0

Fig 8.9

Virtual Pin Datastream

NAME	UV_Upper	ALIAS	UV Upper
PIN	V4	DATA TYPE	Integer
UNITS	None		
MIN	0	MAX	10
		DEFAULT VALUE	0

Fig 8.10

Virtual Pin Datastream

NAME	Moisture_Upper	ALIAS	Moisture Upper
PIN	V6	DATA TYPE	Integer
UNITS	None		
MIN	0	MAX	100
		DEFAULT VALUE	Default Value

Fig 8.11

Step 8.5

BLYNK 2.0 – Continued

Virtual Pin 7 – **Fig 8.12**

Virtual Pin 8 – **Fig 8.13**

Virtual Pin 9 – **Fig 8.14**

Virtual Pin Datastream

NAME	H2O_Error	ALIAS	H2O Error		
PIN	V8	DATA TYPE	Integer		
UNITS	None				
MIN	0	MAX	1	DEFAULT VALUE	0

Fig 8.12

Virtual Pin Datastream

NAME	Moisture_Lower	ALIAS	Moisture Lower		
PIN	V7	DATA TYPE	Integer		
UNITS	None				
MIN	0	MAX	20	DEFAULT VALUE	0

Fig 8.13

Virtual Pin Datastream

NAME	UV_Error	ALIAS	UV Error		
PIN	V9	DATA TYPE	Integer		
UNITS	None				
MIN	0	MAX	1	DEFAULT VALUE	0

Fig 8.14

Step 9

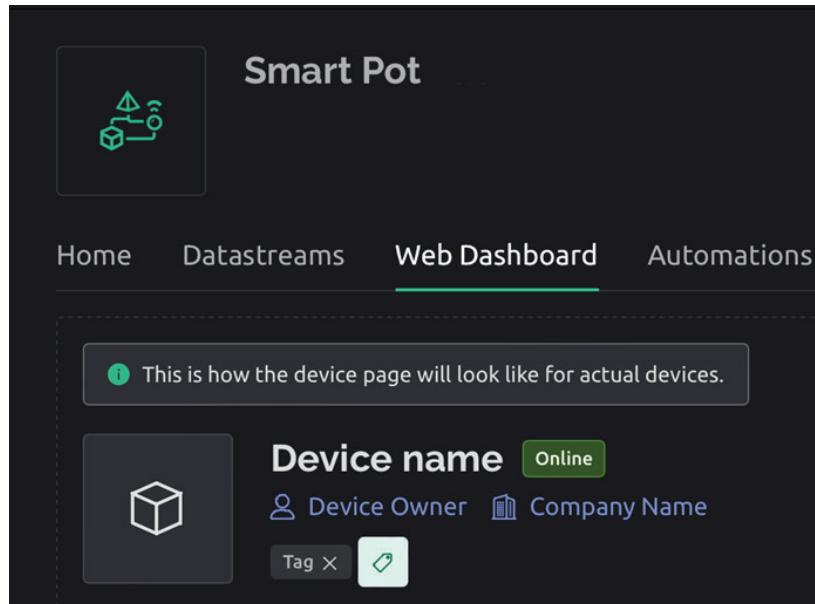


Fig 9.1

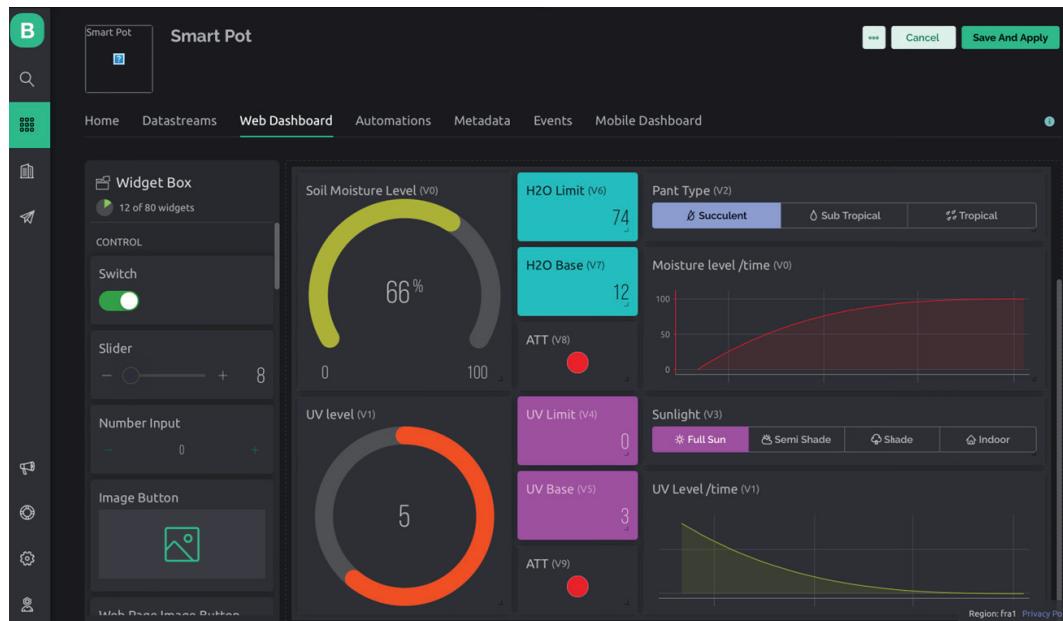


Fig 9.2

BLYNK 2.0 – Dashboard

Now lets start with the dashboard. To set up a dashboard click on **WEB DASHBOARD** and click on **EDIT** to enter edit mode – **Fig 9.1**

Fig 9.2 is an example of what your dashboard could look like. If you match the widgets and Virtual pins as indicated, your dashboard should function exactly the same.

When done, click **SAVE AND APPLY**

Step 10

BLYNK 2.0 – Adding a Device

Next we have to add a DEVICE.

To add a device, first click on the TEMPLATES icon in the left menu. Then click on the SMART POT template - **Fig 10.1**

Now click on + NEW DEVICE - **Fig 10.2**

Enter the Device name as Smart Pot. Once done, you will be presented with the unique details for your new device. Copy and paste the data as we will use it on your code - **Fig 10.3**

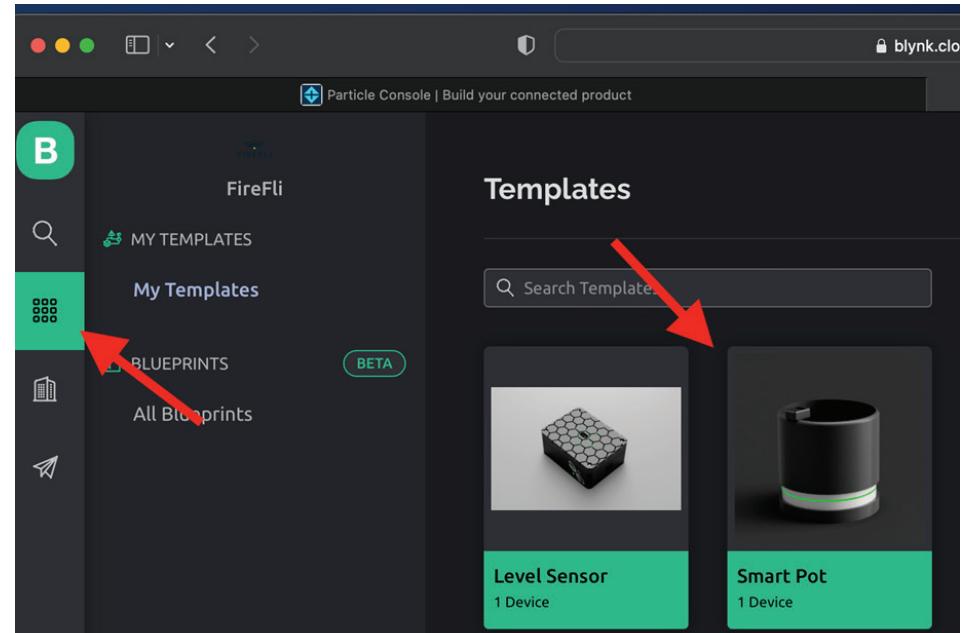


Fig 10.1

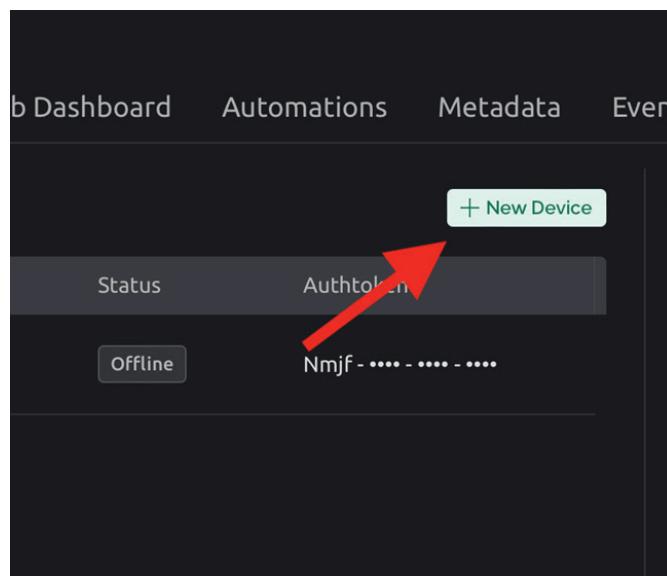


Fig 10.2

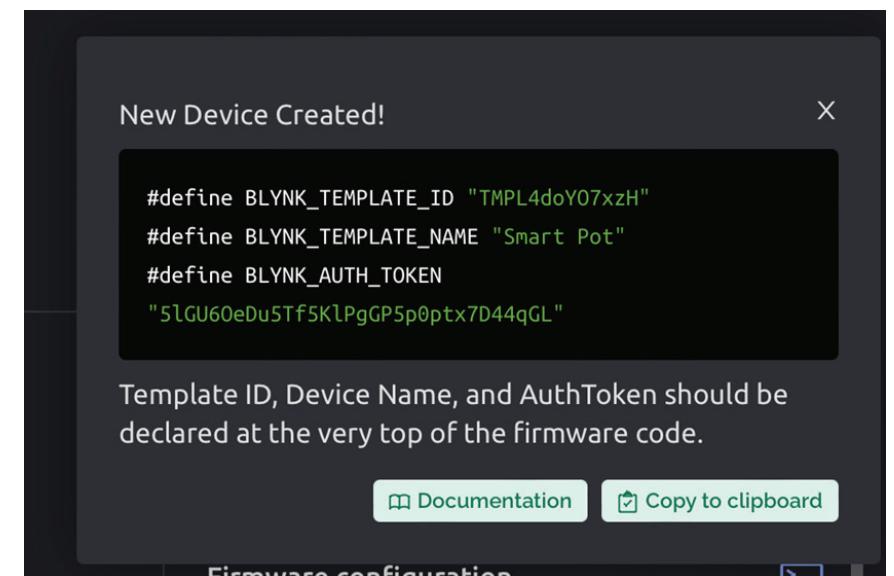


Fig 10.3

Step 11.1

BLYNK 2.0 – Webhooks

Now that we have done everything else, all we need to do is to configure the webhooks. To do so, first click on **SETTINGS** icon in the left menu and then click on Webhooks – **Fig 11.1**

Click on **+ New Webhook**

Choose **DEVICE DATASTREAM UPDATE** – **Fig 11.2**

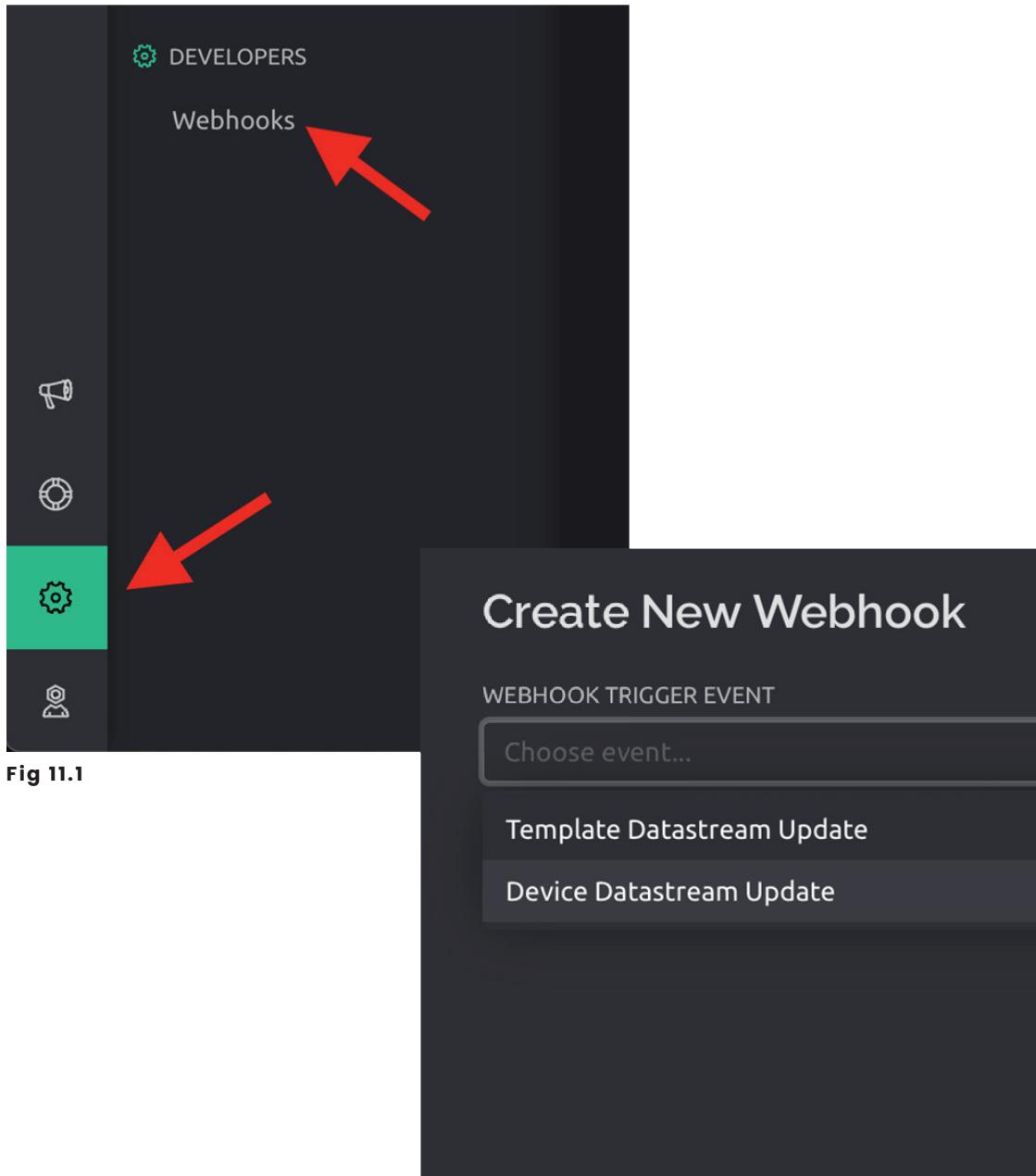


Fig 11.2

Step 11.2

CONTENT TYPE (application/json)

Web Form Custom JSON Plain text

```
1 {"args" : "{device_pinValue}"}
```

PLACEHOLDERS

Start typing

device_name
device_orgName
device_pin
device_dataStreamId
device_pinValue
device_tags
device_dataStream_X
device_metadata_X

Fig 11.3

Set Water type

WEBHOOK TRIGGER EVENT

Device Datastream Update

Select a system event that will trigger webhook.

WEBHOOK NAME

Set Water type

DEVICE

Smart Pot

DATASTREAM

Plant_Type_H2O (V2)

WEBHOOK URL

<https://api.particle.io/v1/devices/0a10aced202194944a04090c/Water>

REQUEST TYPE

GET POST PUT DELETE

Fig 11.4

Query parameters (optional)

Key Value

Authorization Method (optional)

AUTHENTICATION TYPE

Basic Auth OAuth 2.0 None

HTTP Headers (optional)

Authorization

Bearer YOUR PARTICLE API TOKEN

Use only letters, digits, spaces, /, _, :, ;, . and -

YOUR PARTICLE API TOKEN

Fig 11.5

BLYNK 2.0 – Webhooks

Next complete the webhook information EXACTLY as per **Fig 11.3, 11.4 and 11.5**.

There will be two changes. First is in Fig 11.3 where you will include your Particle Device ID in the webhook URL.

The second change will be the **PARTICLE ACCESS TOKEN**
- **Fig 12.1** To get the access token, proceed to **STEP 12**

Step 12

Visit the following link:

<https://docs.particle.io/reference/cloud-apis/access-tokens/>

Scroll down to the Create a Token (Browser-based) section.

Fill in your login details and set EXPIRES IN to NEVER - **Fig 12.1**

Click on CREATE TOKEN and copy and paste the token to your webhook. Be sure to include Bearer(space) and then your token.

We will now repeat this process to complete the second webhook.

Name the second webhook Set UV type. Use the following as your webhook URL:

<https://api.particle.io/v1/devices/{Your Particle Device ID}/Sunlight>

The only other difference is the datastream, be sure to select Plant_Type_UV(v3) - **Fig 12.2**

Create a token (browser-based)

You can also create a token using this web-browser control. This creates a token for your account, which can access all devices in your sandbox as well as products and organizations you have access to. Be careful with this token! The username, password, and MFA OTP token (if required) are necessary to create a new token.

User Email friedlb@icloud.com
Password
Expires In Never
Create token

Fig 12.1

ent that will trigger webhook.

DATASTREAM
Choose Datastream
soil_level (V0)
sun_light_level (V1)
Plant_Type_H2O (V2)
Plant_Type_UV (V3)
UV_Upper (V4)
UV_Lower (V5)
Plant_Type_UV (V3)
Custom JSON Plain text

Fig 12.2

Step 13

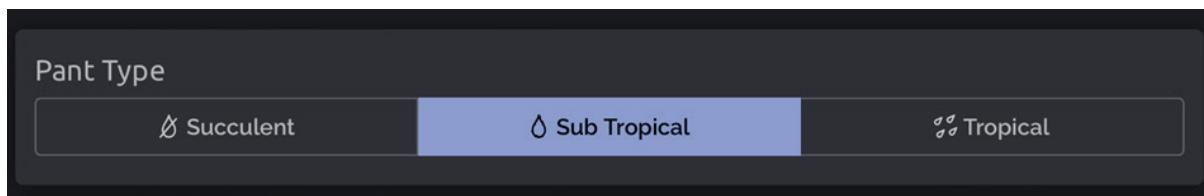


Fig 13.1

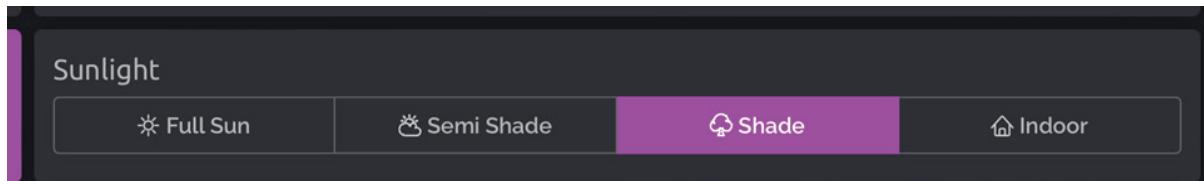


Fig 13.2

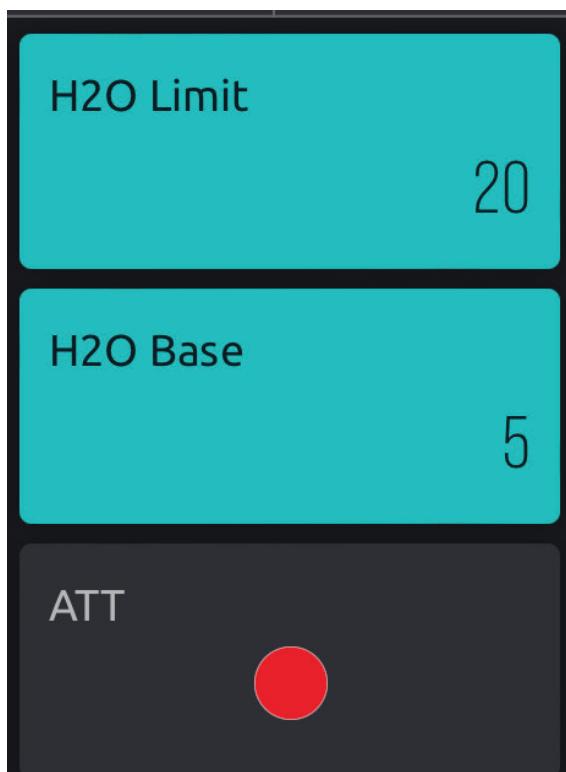


Fig 13.3

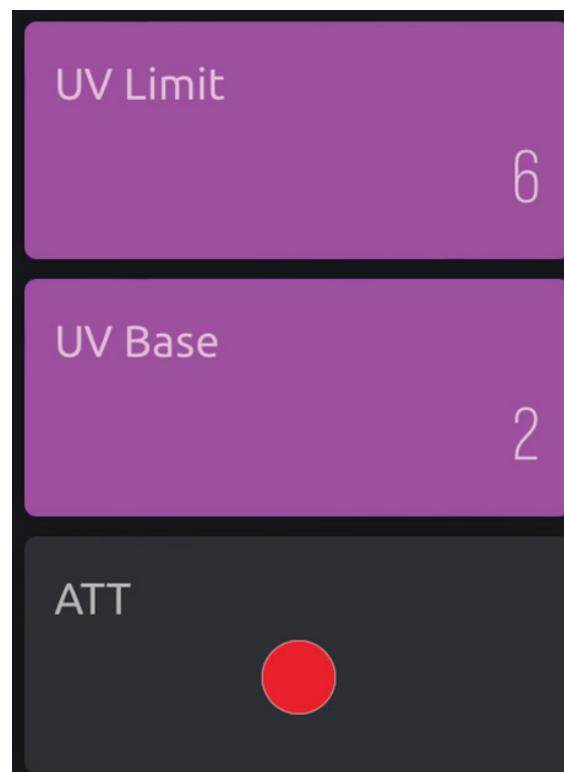


Fig 13.4

Working principal

In Figures 13.1 and 13.2 you choose your plant type.

Depending on your choice, a desired water level and UV level will be set - **Fig 13.3**

The two sensors will now start detecting the soil moisture level and current UV levels. If either of these are our of bounds the ATT LEDs will light up

There are also two gauges showing the actual Soil moisture and UV levels.

Lastly there are two graphs providing some historical data

Room for improvement

this is NOT a production ready design :)

Apply battery saving strategies.

Consider battery saving techniques.

Now that you have all the Datastreams and webhooks set up, why not create a BLYNK MOBILE APP as well :)



Important notice:

At the time of this tutorial, it was still unclear whether there is a solution to the offline error messages Blynk provides for Particle devices connected via API. I am trying to confirm this and will provide an update as soon as I have one. If you are able to solve this, please feel free to let us know in the Particle Forum so that other users can also benefit from the solution!

Enjoy the project!!