



# INTEL-IRRIS

Intelligent Irrigation System for Low-cost Autonomous Water Control  
in Small-scale Agriculture



# INTELLIGENT IRRIGATION SYSTEM FOR LOW-COST AUTONOMOUS WATER CONTROL IN SMALL-SCALE AGRICULTURE



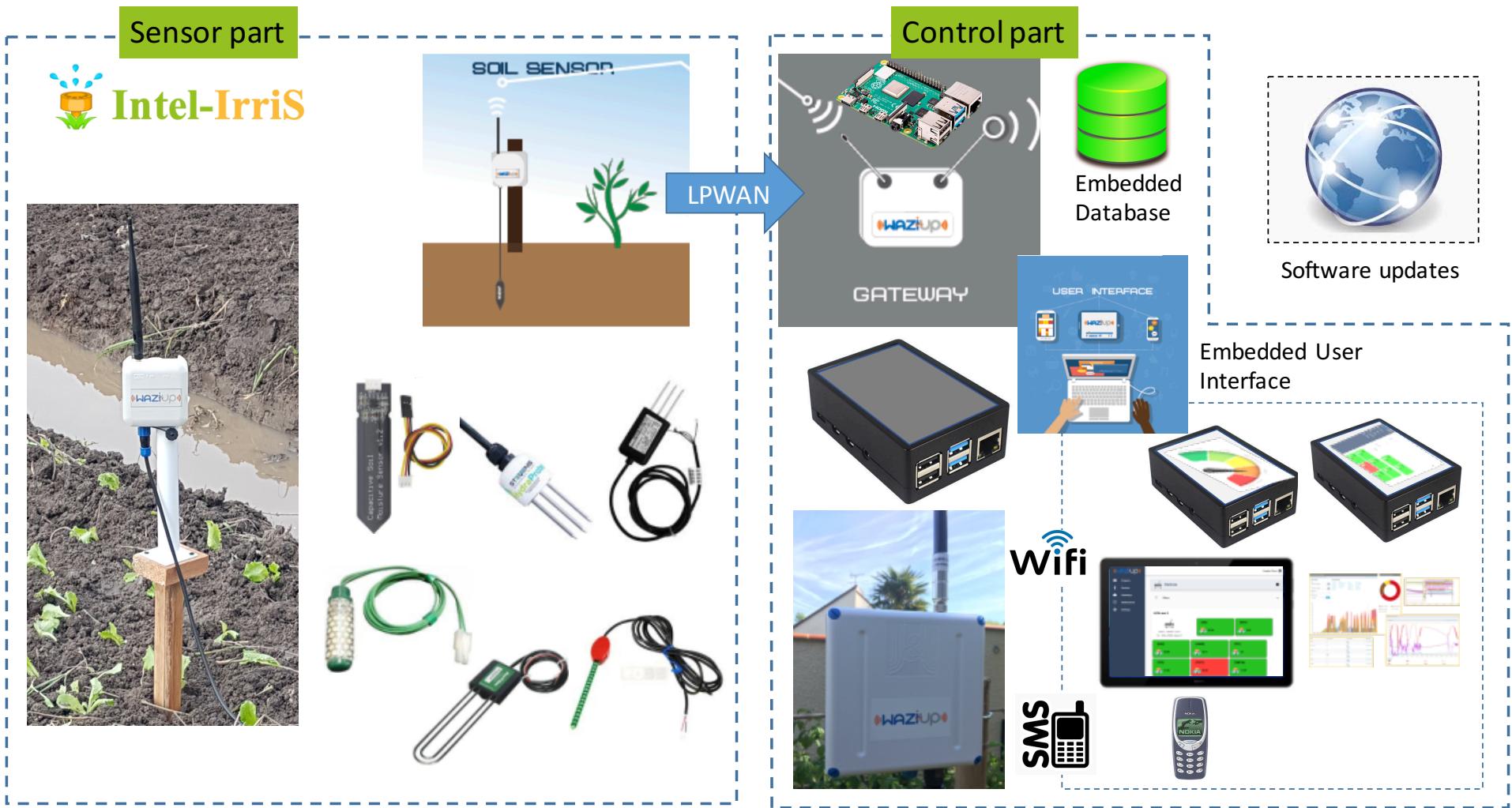
## Building the Intel-IrriS LoRa IoT platform Part 2: edge-enabled gateway (WaziGate)



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# Review: Technology components



# Review: Low-cost sensors



- Build on low-cost, low-power IoT expertise
- Increase accuracy of low-cost sensors by automatic and remotely controlled procedures for advanced calibration
- Enable deployment of several complementary low-cost sensors
- Include agricultural models / knowledge with corrective & predictive analytics

# Review: Smart embedded control

- Build on low-cost embedded & open IoT gateway expertise
- Implement the “Intelligent Irrigation in-the-box” with "plug-&-sense" approach
- Model complex water-soil-plant interaction
- Embed Decision Support System (DSS) and disruptive Artificial Intelligence (AI)
- Integration of various knowledge streams
- Fully autonomous



# Review: Starter-kits

- "Intelligent Irrigation in-the-box", "plug-&-sense"
- At least 100 starter-kit will be distributed



# WaziGate

- WaziGate is an IoT LoRa Gateway developed by WAZIUP
- WaziGate implements the edge-enabled IoT gateway approach
  - customized applications can be directly hosted in the gateway
  - the gateway can easily work without Internet connectivity
  - data are available to end-users in an embedded database
  - web-based visualization module provides graphical user interface
- You can find all the WaziGate documentation on the [WaziGate documentation page](#). There are 4 main sections describing the generic WaziGate main features:
  - Quick start: [https://www.waziup.io/documentation/wazigate/v2/quick\\_start/](https://www.waziup.io/documentation/wazigate/v2/quick_start/)
  - Installation: <https://www.waziup.io/documentation/wazigate/v2/install/>
  - LoRaWAN: <https://www.waziup.io/documentation/wazigate/v2/lorawan/>
  - WaziApps: <https://www.waziup.io/documentation/wazigate/v2/waziapps/>
  - Look at the generic installation video: <https://youtu.be/DvGdmdsGZHA>

# Install your WaziGate (1)

## ○ **INTEL-IRRIS WaziGate distribution (RPI3B/3B+/4B)**

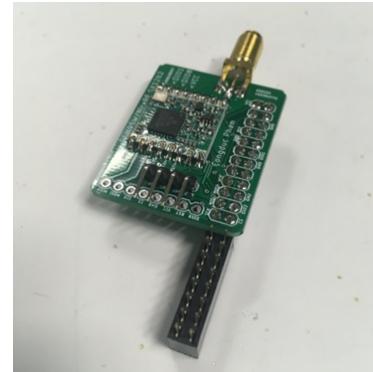
- comes pre-configured with a soil sensor device
- will work out-of-the box with the INTEL-IRRIS soil sensor device
- will be updated to host the INTEL-IRRIS irrigation application
- **Download the INTEL-IRRIS WaziGate SD card image from project website**
- <http://intel-iris.eu/results>
- Select EU868 or EU433 image
- Flash the SD card image on 8GB SD card class 10



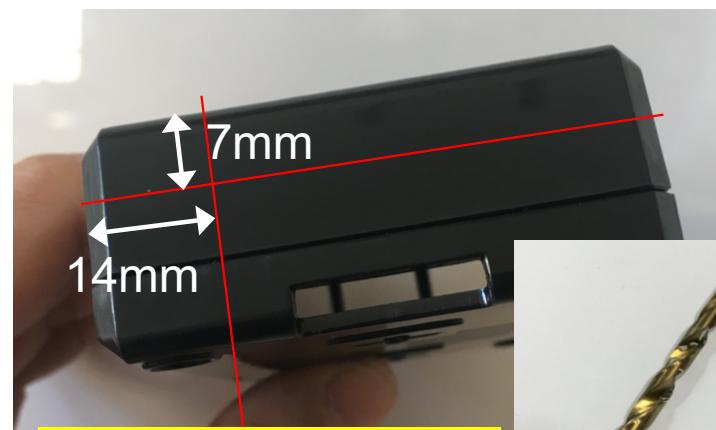
Look at the INTEL-IRRIS WaziGate video  
Video n°4 at t=124s: <https://youtu.be/j-1Nk0tv0xM?t=124>

# Install your WaziGate (2)

- Recommended RPI model is RPI3B
  - plug in the radio LoRa hat
  - The OLED screen is optional



- Drill a hole for the SMA connector on the RPI enclosure, SD card slot side

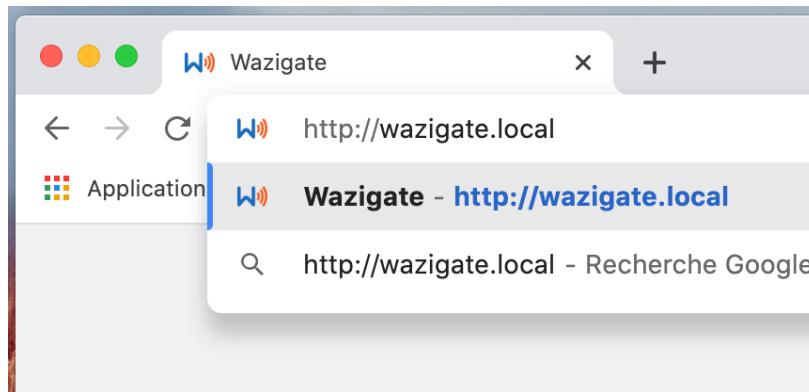
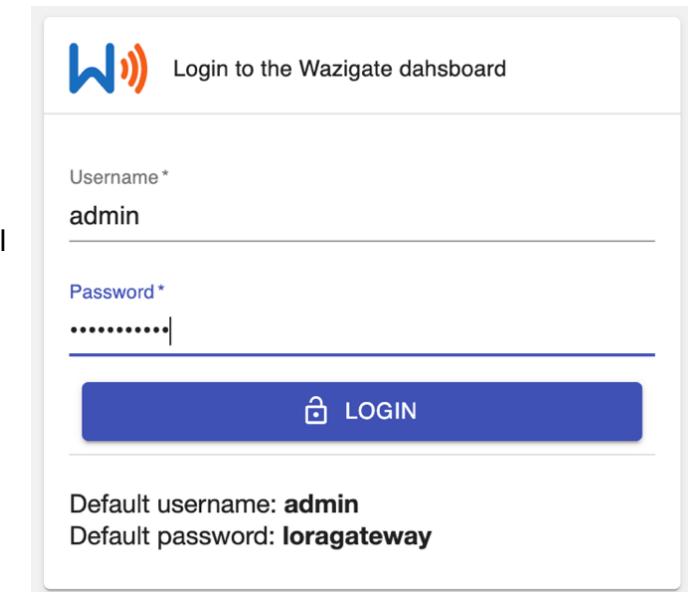


Use from 8mm to 12mm  
drill bit for metal



# Accessing your WaziGate

- Power the WaziGate, no Internet is required, wait 3-4mins (boot)
- Connect to **WAZIGATE\_XXXXXXXXXXXXXX** WiFi network
  - default WiFi password is loragateway
- Open web navigator. Go to <http://wazigate.local> or <http://10.42.0.1>

Login to the Wazigate dashboard

Username\*  
admin

Password\*  
.....

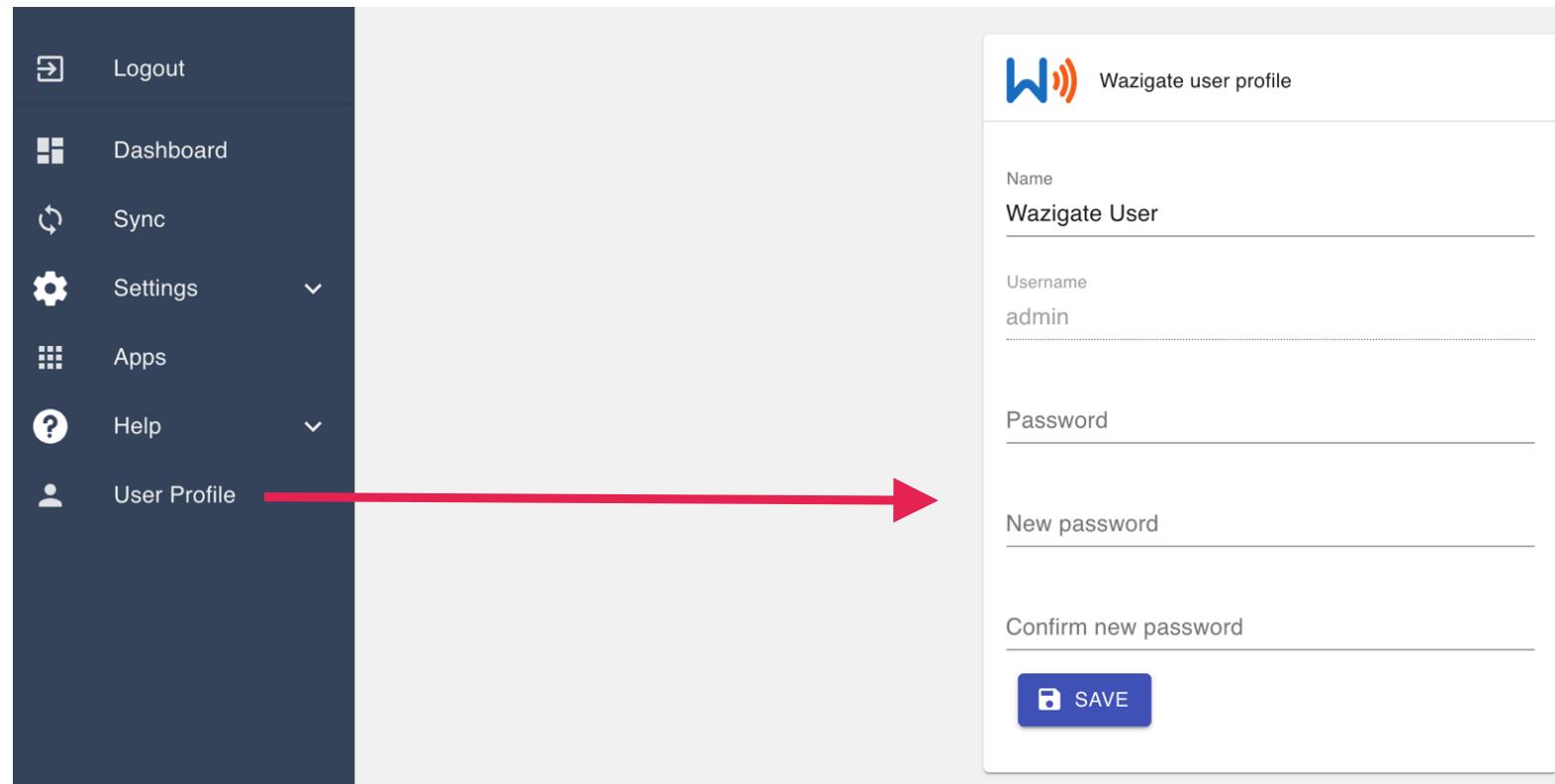
**LOGIN**

Default username: **admin**  
Default password: **loragateway**

- Use default login to connect
  - User: admin
  - Password: loragateway

# Change default password

- Once connected, it is recommended to change your password in the User Profile left menu

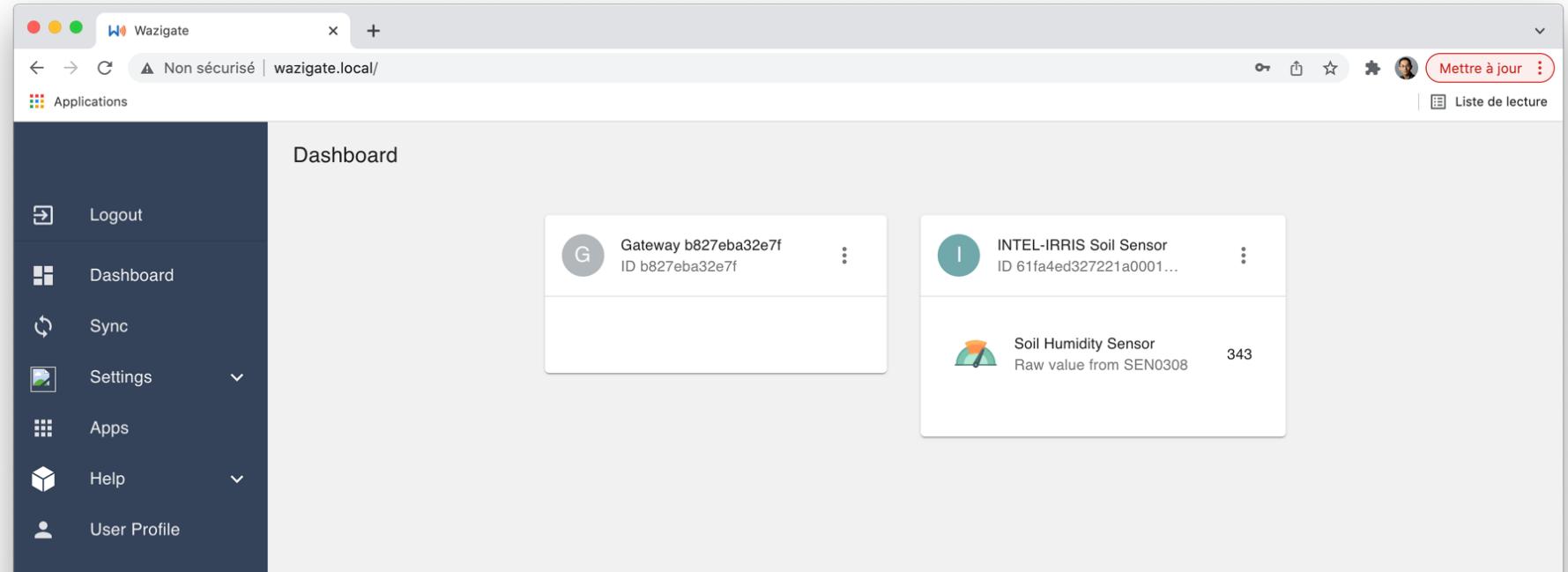


The screenshot illustrates the process of changing a default password. On the left, a dark-themed sidebar menu is displayed with the following items:

- Logout
- Dashboard
- Sync
- Settings
- Apps
- Help
- User Profile

A thick red arrow points from the "User Profile" menu item to the right side of the screen, where a detailed configuration page for a "Wazigate user profile" is shown. This page includes fields for Name (Wazigate User), Username (admin), Password, New password, and Confirm new password, along with a blue "SAVE" button at the bottom.

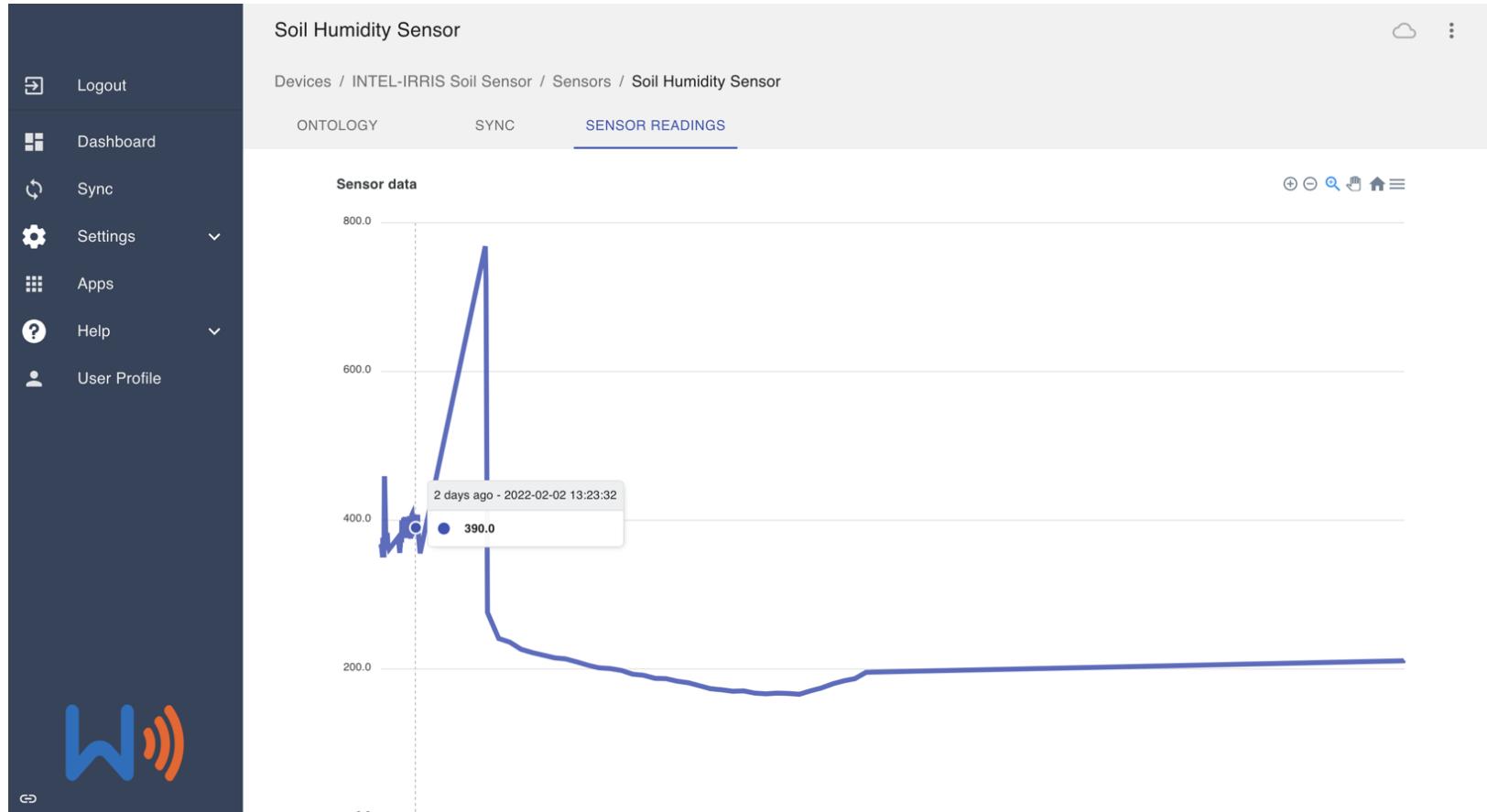
# WaziGate dashboard



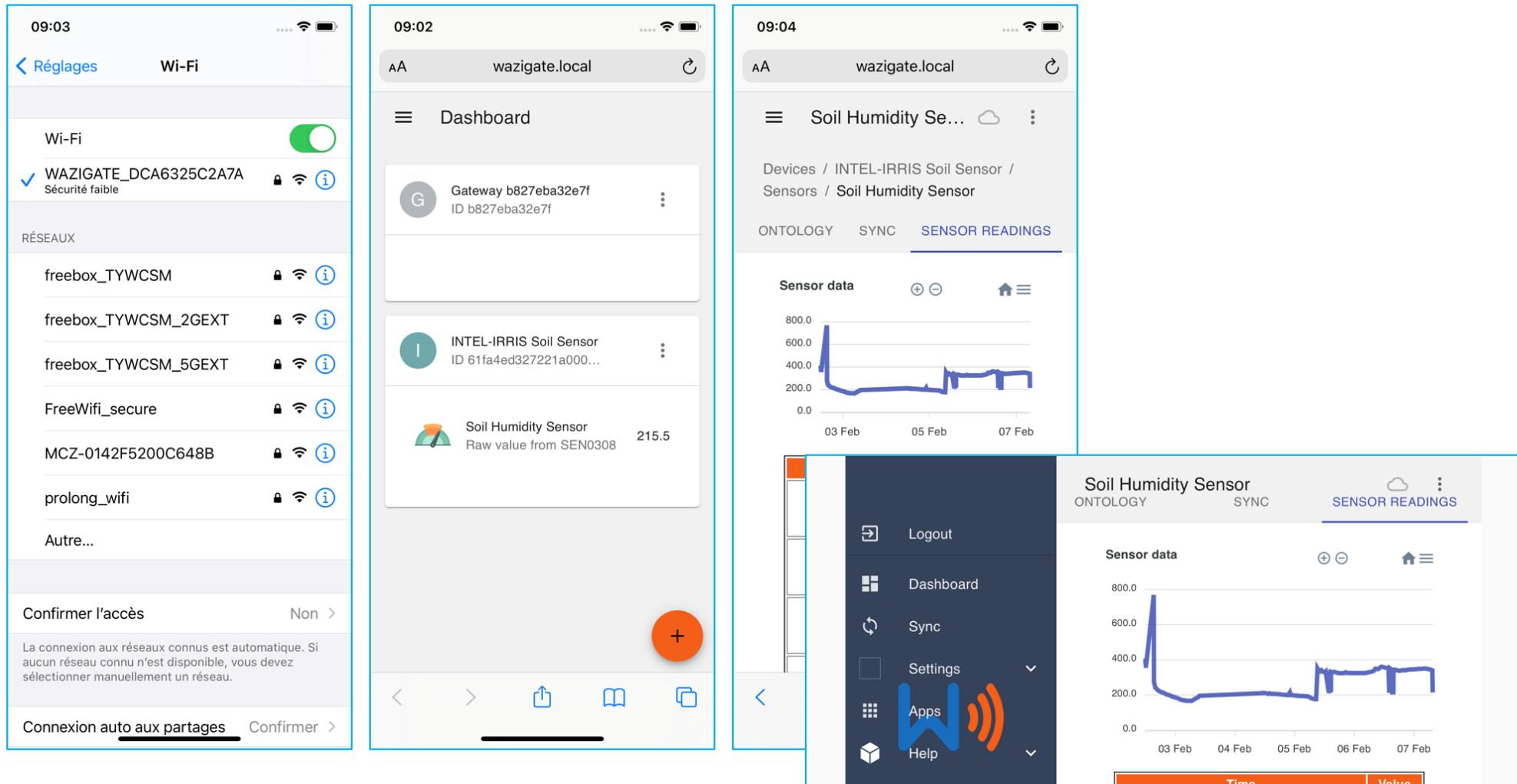
There is already a pre-configured INTEL-IRRIS soil sensor device with a SEN0308 soil humidity sensor ready to received data

The last received value is displayed in the device block

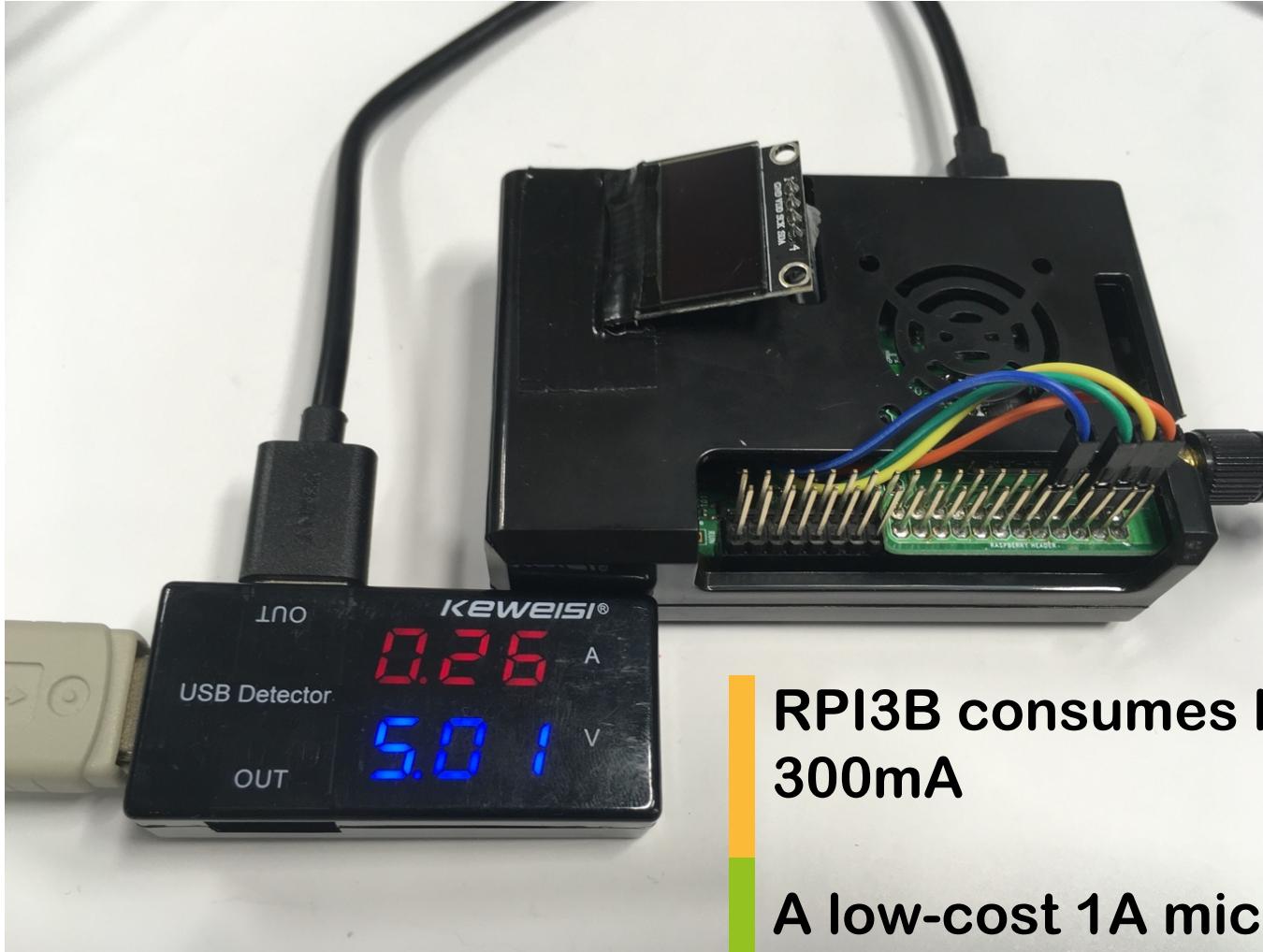
# Display sensor data



# All these steps with a smartphone



# WaziGate power consumption



RPI3B consumes less than  
300mA

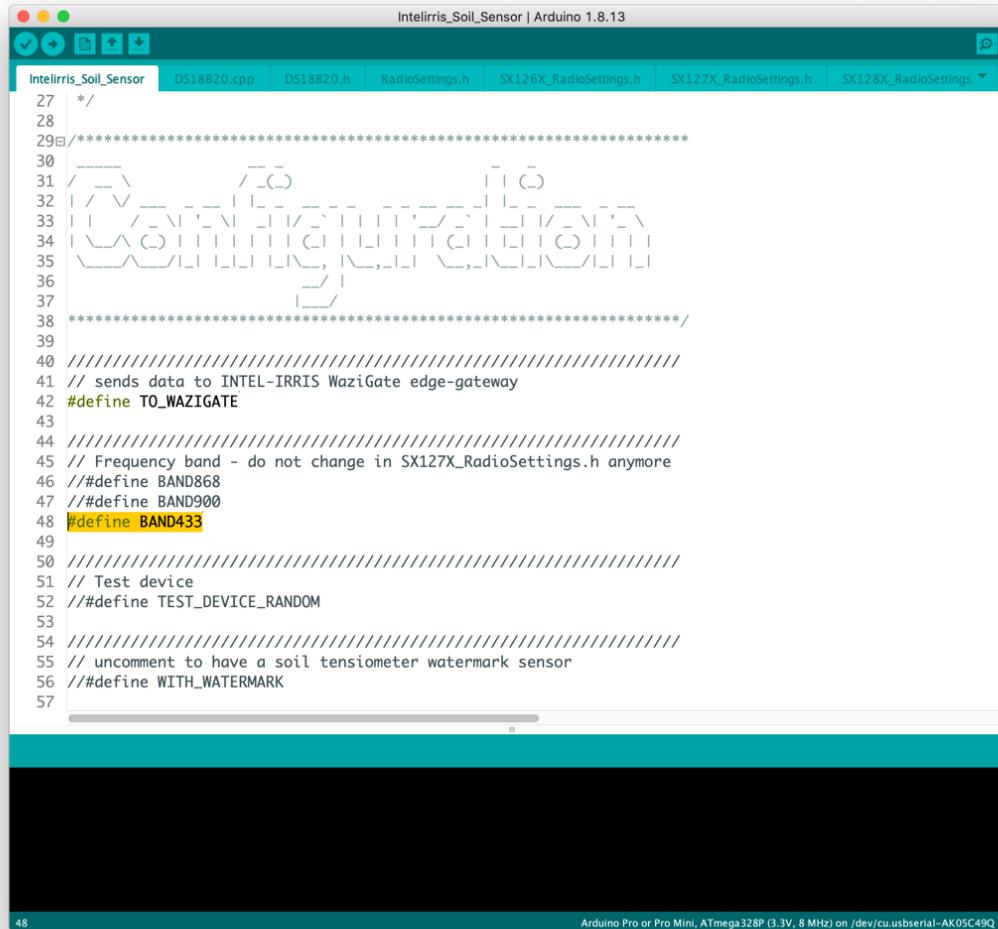
A low-cost 1A micro USB charger  
for smartphone is suitable

## Be sure that

```
#define TO_WAZIGATE
```

# is uncommented

# Configuring for EU433 band



```

Intelirris_Soil_Sensor | Arduino 1.8.13
Intelirris_Soil_Sensor DS18B20.cpp DS18B20.h RadioSettings.h SX126X_RadioSettings.h SX127X_RadioSettings.h SX128X_RadioSettings.h

27 /*
28 */
29 //*****
30 //----\ /----\ /----\ /----\
31 // / \ \ / \ / \ / \ / \ / \ / \
32 // | \ / \ / \ / \ / \ / \ / \ / \
33 // | \ / \ / \ / \ / \ / \ / \ / \
34 // | \ / \ / \ / \ / \ / \ / \ / \
35 // | \ / \ / \ / \ / \ / \ / \ / \
36 // | \ / \ / \ / \ / \ / \ / \ / \
37 // | \ / \ / \ / \ / \ / \ / \ / \
38 //*****
39 /////////////////
40 // sends data to INTEL-IRRIS WaziGate edge-gateway
41 #define TO_WAZIGATE
42
43 /////////////////
44 // Frequency band - do not change in SX127X_RadioSettings.h anymore
45 // #define BAND868
46 // #define BAND900
47 #define BAND433
48
49 ///////////////
50 // Test device
51 //#define TEST_DEVICE_RANDOM
52
53 ///////////////
54 // uncomment to have a soil tensiometer watermark sensor
55 //#define WITH_WATERMARK
56
57

```

Arduino Pro or Pro Mini, ATmega328P (3.3V, 8 MHz) on /dev/cu.usbserial-AK05C49Q

If you use the EU433 band

make sure that

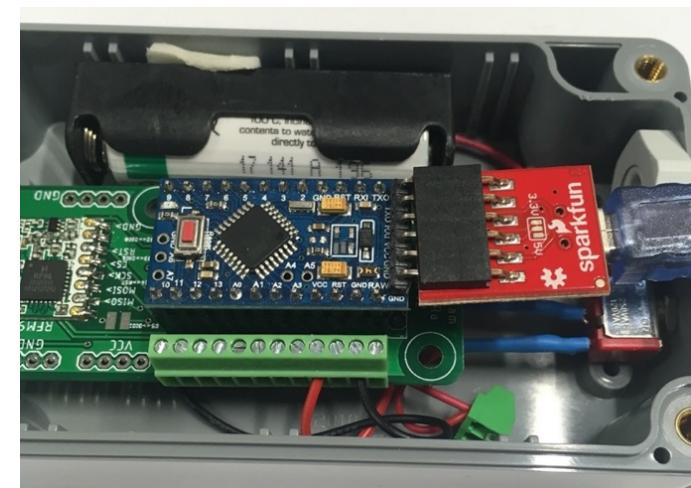
#define BAND433

is the only uncommented  
band option

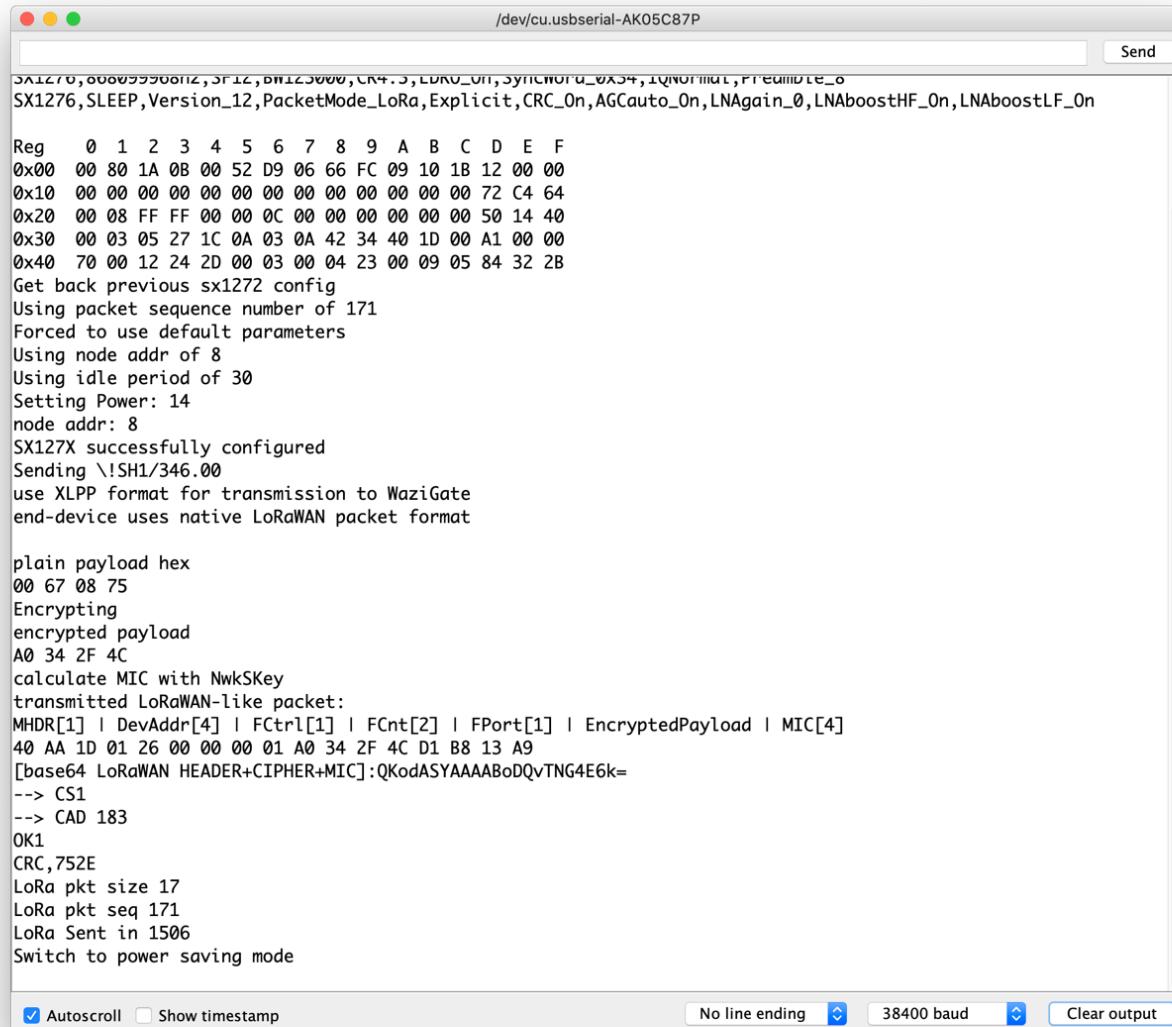
**Click on the "upload" button**



**And wait until upload is completed**



# Checking that device is operational



```

/dev/cu.usbserial-AK05C87P
Send

SX1276,0000000000000000,3F12,B0123000,CR4.5,LDRU_0H,SYNCHRO_0X34,TQNormal,Preamble_0
SX1276,SLEEP,Version_12,PacketMode_LoRa,Explicit,CRC_On,AGCAuto_On,LNAgain_0,LNAboostHF_On,LNAboostLF_On

Reg 0 1 2 3 4 5 6 7 8 9 A B C D E F
0x00 00 80 1A 0B 00 52 D9 06 66 FC 09 10 1B 12 00 00
0x10 00 00 00 00 00 00 00 00 00 00 00 00 00 00 72 C4 64
0x20 00 08 FF FF 00 00 0C 00 00 00 00 00 00 00 50 14 40
0x30 00 03 05 27 1C 0A 03 0A 42 34 40 1D 00 A1 00 00
0x40 70 00 12 24 2D 00 03 00 04 23 00 09 05 84 32 2B
Get back previous sx1272 config
Using packet sequence number of 171
Forced to use default parameters
Using node addr of 8
Using idle period of 30
Setting Power: 14
node addr: 8
SX127X successfully configured
Sending \!SH1/346.00
use XLPP format for transmission to WaziGate
end-device uses native LoRaWAN packet format

plain payload hex
00 67 08 75
Encrypting
encrypted payload
A0 34 2F 4C
calculate MIC with NwkSKey
transmitted LoRaWAN-like packet:
MHDR[1] | DevAddr[4] | FCtrl[1] | FCnt[2] | FPort[1] | EncryptedPayload | MIC[4]
40 AA 1D 01 26 00 00 00 01 A0 34 2F 4C D1 B8 13 A9
[base64 LoRaWAN HEADER+CIPHER+MIC]:QKodASYAAABoDQvTNG4E6k=
--> CS1
--> CAD 183
OK1
CRC,752E
LoRa pkt size 17
LoRa pkt seq 171
LoRa Sent in 1506
Switch to power saving mode

 Autoscroll  Show timestamp
  No line ending 38400 baud Clear output

```

**Open serial monitor**

**Set baud rate to 38400**

**See output from board**

**Check that transmission is OK**

# Transmission to WaziGate



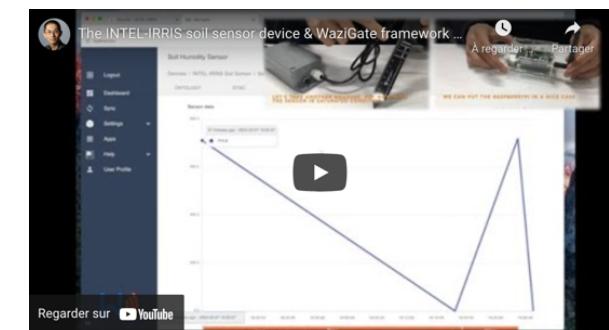
Parameters for  
INTEL-IRRIS WaziGate



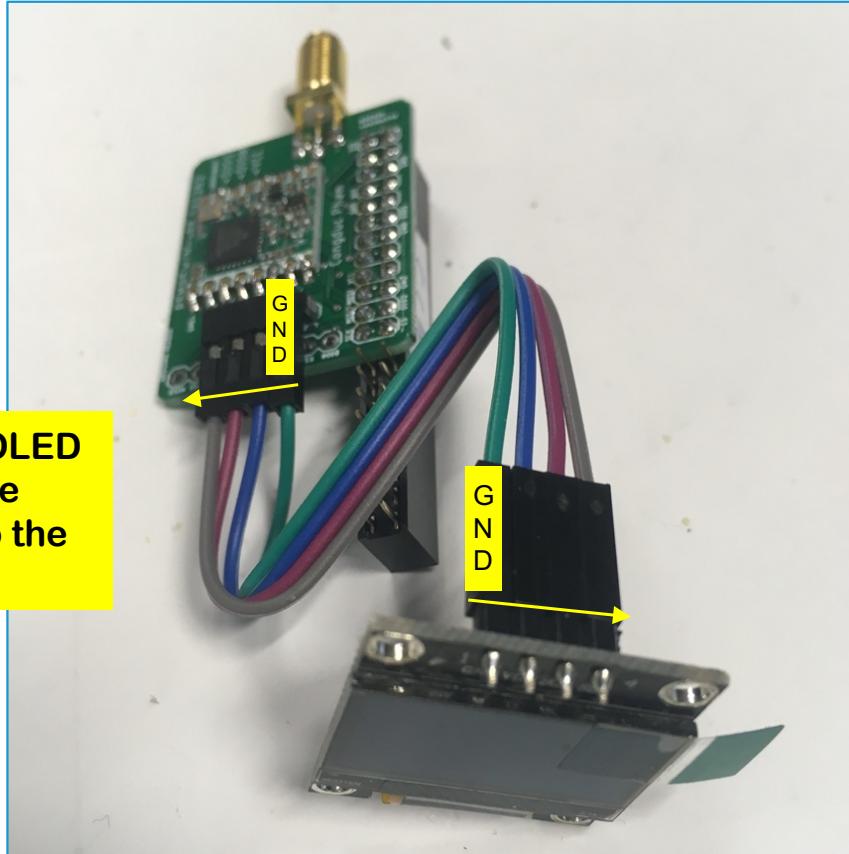
SF12BW125  
868.1MHz | 433.175MHz  
Node id is 26011DAA  
1 msg/60mins  
1 sensor  
XLPP data



This dedicated video will show all these steps, from connecting the SEN0308 to testing transmission to the WaziGate  
Video n°4: <https://youtu.be/j-1Nk0tv0xM>

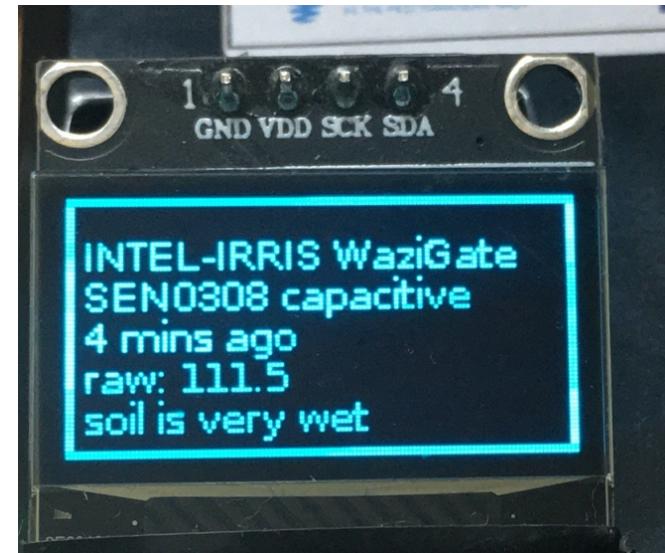


# Installing an optional OLED

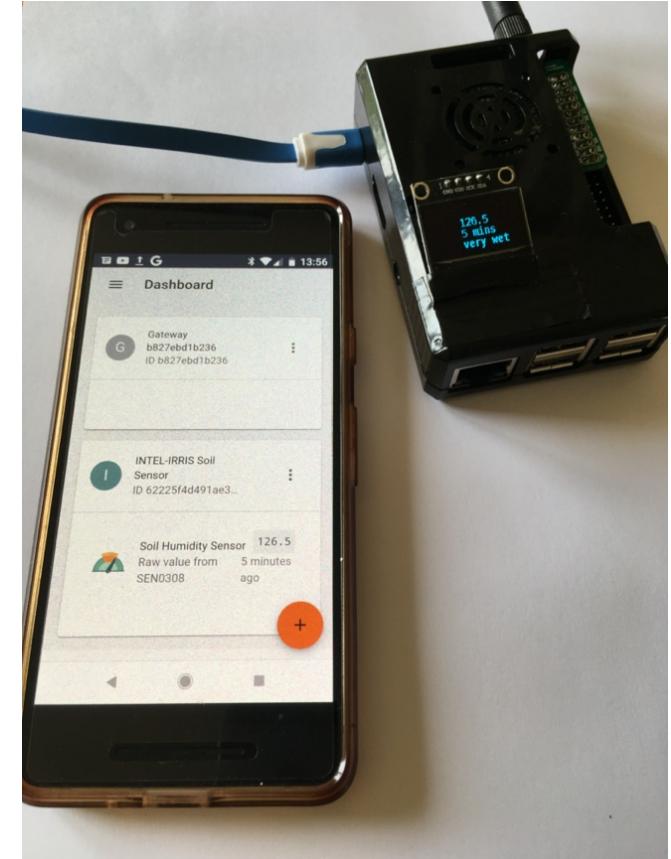
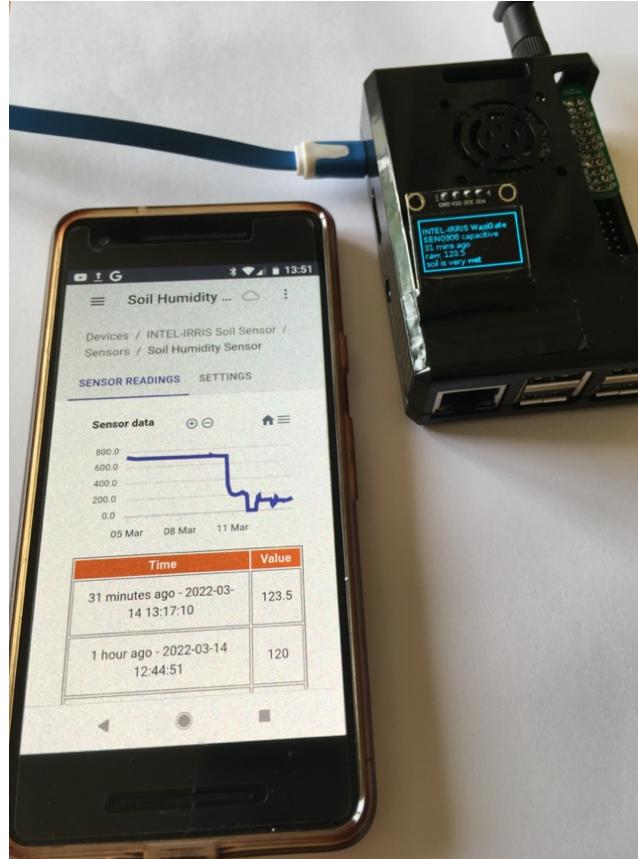
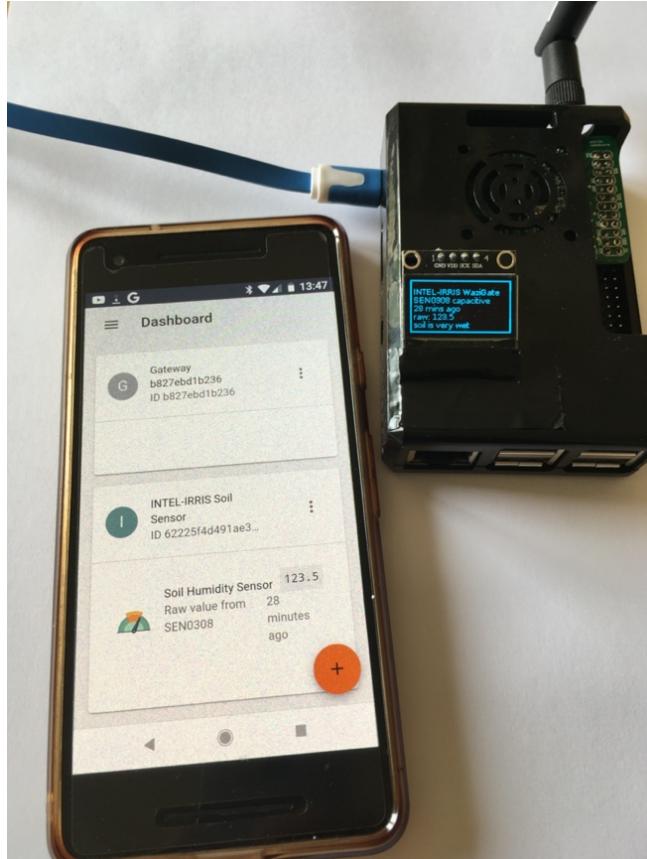


# With the optional OLED

- With a small .96" OLED screen, information summary can be easily displayed for the end-user: the sensor type, the sensor raw value, the time of last received data and the soil condition
- The main screen is displayed for 6s every 2mins. Then a screen saver display will show a shorter version of these information



# WaziGate User Interface





Starter-kit

Autonomous

Intelligent Irrigation

Plug-&-Sense

In-the-box