AgroSense_Positioning Water Leak Sensor LoRaWAN® Manual

V1.0

Author: Yuki

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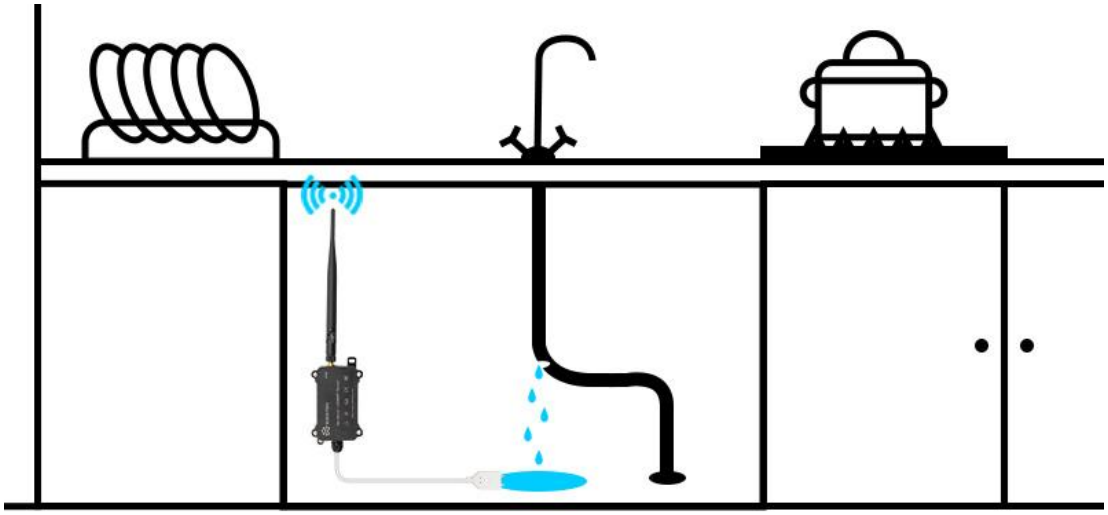
Contents

1 Product Description

1.1 Introduction

This AgroSense LoRaWAN® Positioning Water Leak Sensor detects water leakage at **fixed points**. Suitable for applications such as garage/kitchen water leakage detection. It reports the water leakage via LoRaWAN® protocol instantly as leakage detected.



The sensor benefits from LoRaWAN, which ensures stability and reliability. It is capable of covering a long transmission range while maintaining low power consumption. Unlike wireline devices, it is battery-powered, reducing the workload and complexity of deployment, design and development for end-users that can work via powering it, and setting the configuration in the cloud server.

1.2 Feature

- Includes a **high precision** sensor.
- Compatible with Worldwide **LoRaWAN® Networks**: Support the universal frequency bands EU868/ US915.
- LoRaWAN version: LoRaWAN Specification 1.0.3.
- **Long Range**: Up to 2 kilometers in the city, up to 10 kilometers in the wilderness, receive sensitivity -137dBm , transmit power up to 21dBm.
- **Ultra-low power** consumption design, traditional AAA alkaline dry battery can be used for one year.
- **Data encryption**: Provide end-to-end secure communication, including device authentication and network data encryption, to ensure the security of data transmission and prevent data theft and malicious attacks.
- **High stability and reliability:** good stability in noisy environments, able to penetrate buildings and obstacles, so it can maintain good communication quality in urban and suburban environments.
- Suitable for **Harsh Environments**: Can work normally under the temperature of -40℃ ~ 85℃, IP68 waterproof, suitable for outdoor use in harsh conditions, high UV, dusty, heavy rain and other bad weather.
- Monitor data and upload **real-time** data regularly.
- Modify the product parameters through **AT commands**.

1.3 Parameter

1. General Parameters

Product Model	AGLWPW01
Detection types	Various liquids such as water, oil, etc.
Detection modes	Fixed position detection

2.Wireless Parameters

Communication Protocol	Standard LoRaWAN® protocol
Network Access/Operating Mode	OTAA Class A
MAX Transmit Power	21dBm
Receiver Sensitivity	-137dBm/125kHz SF=12
Frequency Band	EU868/US915

3.Physical Parameters

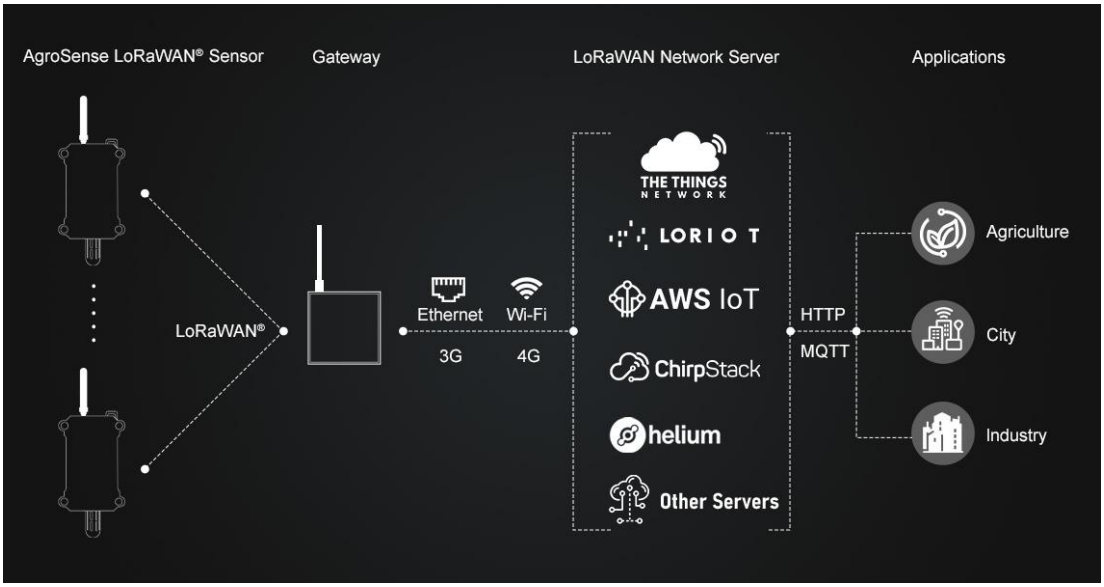
Lead Length	1 .0 meter
Power Supply	2 x AAA 1.5V batteries
Operating Temperature	-40°C ~85°C
Protection Class	IP68
Dimensions	131 × 62.7 × 27.5 mm
Mounting	Wall Mounting

2 Technical route

2.1 System Framework

AgroSense_Positioning Water Leak Sensor uses LoRAWAN technology, and it network architecture includes four parts: End Nodes, Concentrator/Gateway, Network Server and Application Server.

End Nodes	It is responsible for collecting sensing data and then transmitting it to Gateway via the LoRaMAC protocol.
Concentrator/Gateway	It is mainly responsible for transmitting node data to the server.
Network Server	Organize the data into JSON packets and decode them.
Application Server	Display the data.



The steps to achieve the detection of leak is:

1. Collect the leak data by sensor, and send the data from End Node to Gateway.
2. The Gateway packages node data and transmits it to the Network Server.
3. The Network Server decodes the data and sends it to the Applications.
4. Finally, user can monitor the data in the APP.

2.2 Regional frequency band

At the present moment, our product solely accommodates compatibility with the US915 and EU868.

area	frequency band	center frequency
China	470-510MHz	CN486MHz
America	902-928MHz	US915MHz
Europe	863-870MHz	EU868MHz
Korea	920-923MHz	KR922MHz
Australia	915-928MHz	AU923MHz
New Zealand	921-928MHz	NZ922MHz
Asia	920-923MHz	AS923MHz

3 Usage

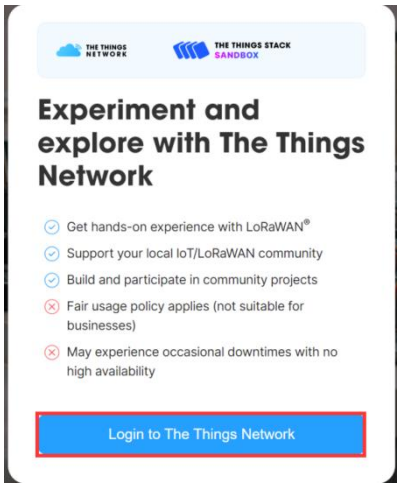
We use The Things Network as our Network Server, we need to configuration the country/ area frequency, inputting DEV EUI/ APP EUI/ APP Key, decodes, and connect to ThingSpeak.

DEV EUI	Unique identification of device, authorized by IEEE
APP EUI	Unique identification of application
APP Key	One of the join network parameters on OTAA mode, calculated by DE EUI

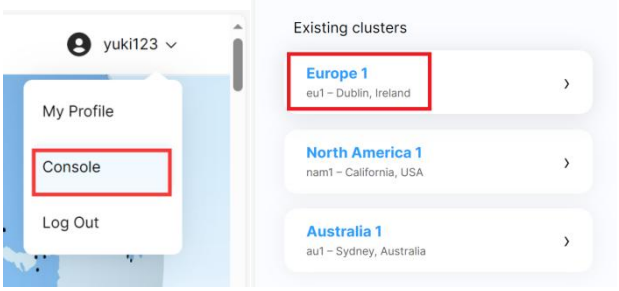
- End Nodes and Gateway: AgroSense_Positioning Water Leak Sensor.(The AgroSense series is applicable)
- Network Server: The Things Network. (Loriot, AWS IoT, ChirpStack, ect)
- Application Server: ThingSpeak.(Datacake, Blockbax, akenza, ect)

3.1 Network Server configuration

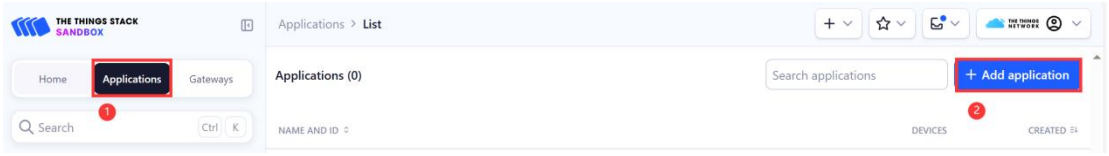
- Open The Things Network in your browser and login it. (Or register an account)



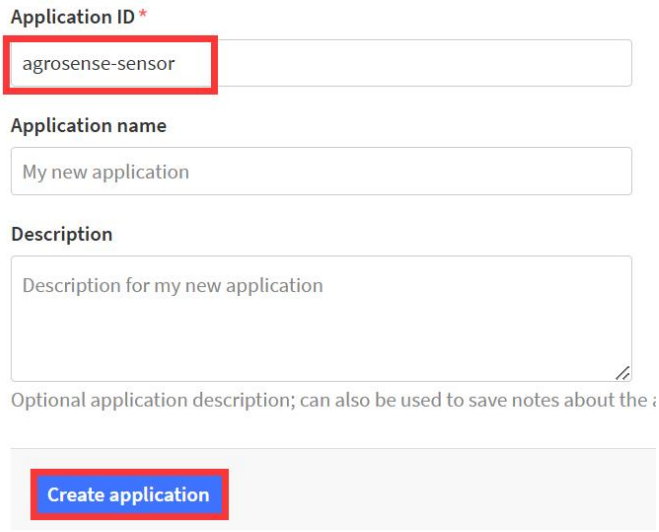
- Click “Console” and select clusters. (we take the European region for example.)



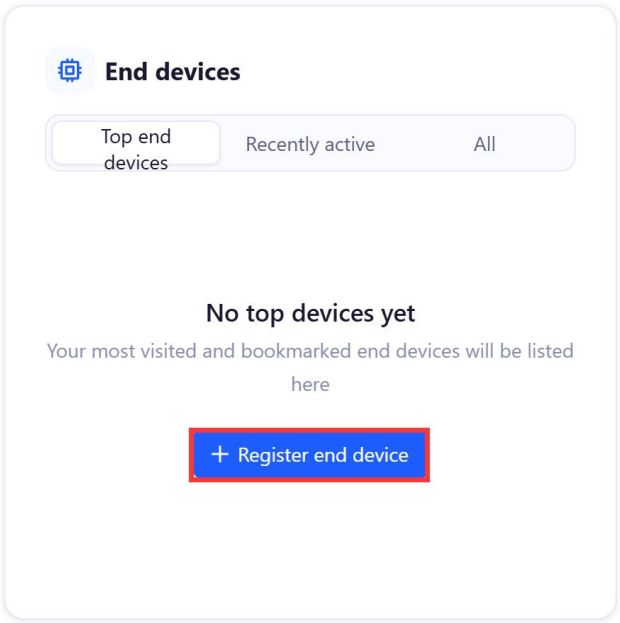
- Click “Go to applications” --> “+ Create application”.



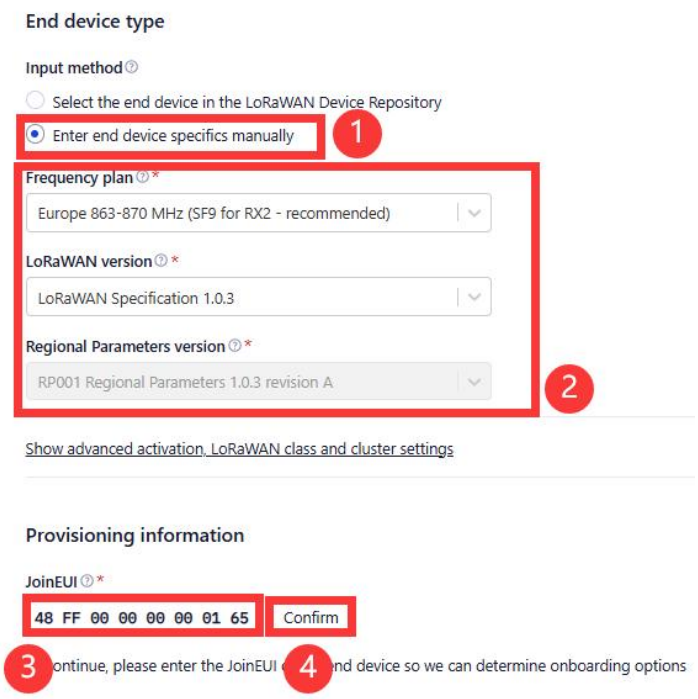
- Write the Application ID and click “Create application”.

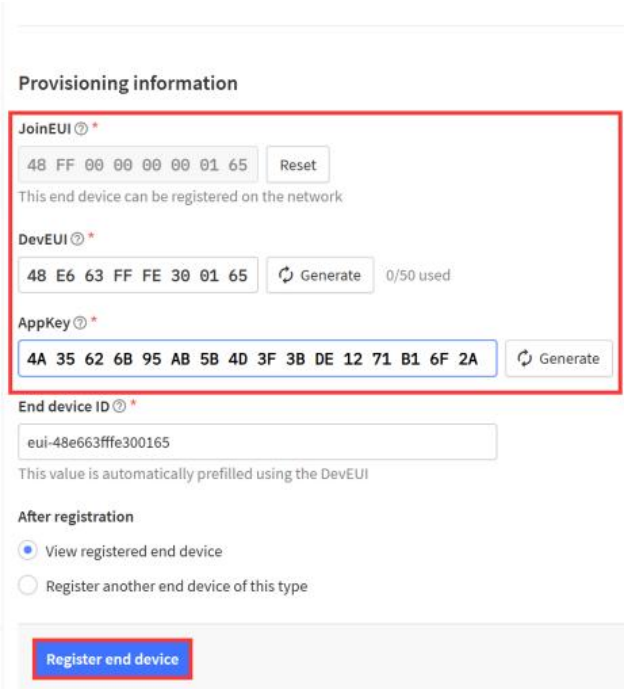


- Click “+ Register and device”.

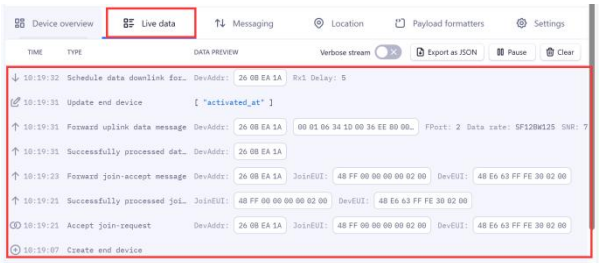


- Fllowing the steps, and input the DEV EUI/ APP EUI/ APP Key (notice: JoinEUI=APP EUI) and subsequently click on "Register end device" to complete the registration process.



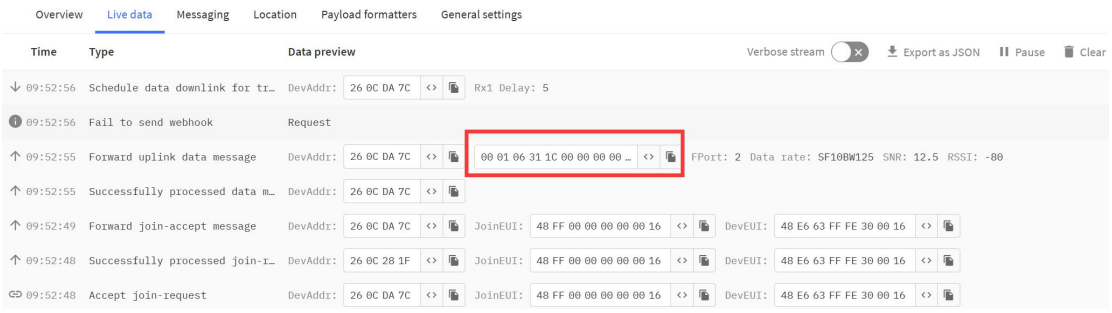


- Plug the battery and press RES button, you can see the device is connected successfully in the TTN.



3.2 Decoder

- Now, we need to decoder the data.



Data length	Data description	Value range	Explanation
byte 0	Data packet sequence number high 8 bits	0-0xFFFF	Counting starts from 0 and increments, resetting back to 0 after reaching 65535
byte 1	Data packet sequence number low 8 bits		
byte 2	Battery voltage		The value is obtained by amplifying the data by 10 times, and the actual value needs to be divided by 10 to convert to the actual battery voltage. The purpose of multiplying by 10 is to retain one decimal place of the voltage value. For example, if the value is 0x21 = 33, then the battery voltage is 3.3V.
byte 3	water leakage symbol		Normal is 0,leakage is 1.
byte 4	Number of leaks in 12 hours bits 8 to 15		For example, if the value of bits 8 to 15 is 0x02, and the low 8 bits value is 0x85, then the obtained number of leaks is 0x0285 = 645. it is get number of leaks value is 645.
byte 5	Number of leaks bits in 12 hours 0		

	to 7		
byte 6	Number of leaks bits in24 hours to 31		For example, if the value from the 8th to the 15th bit is 0x02, and the lower 8 bits value is 0x85, then the lumen value obtained is 0x00000285, which equals 645. the actual time is 645s
byte 7	Number of leaks bits in 12 hours 16 to 23		
byte 8	Number of leaks bits in 12 hours 8 to 15		
byte 9	Number of leaks bits in 12 hours 0 to 7		

Example: 0x00, 0x03, 0x1D, 0x00, 0x00, 0x02, 0x00, 0x00, 0x00, 0x03

Data parsing：

Battery voltage is 2.9 V.

water leakage symbol is 0.(Normal state)

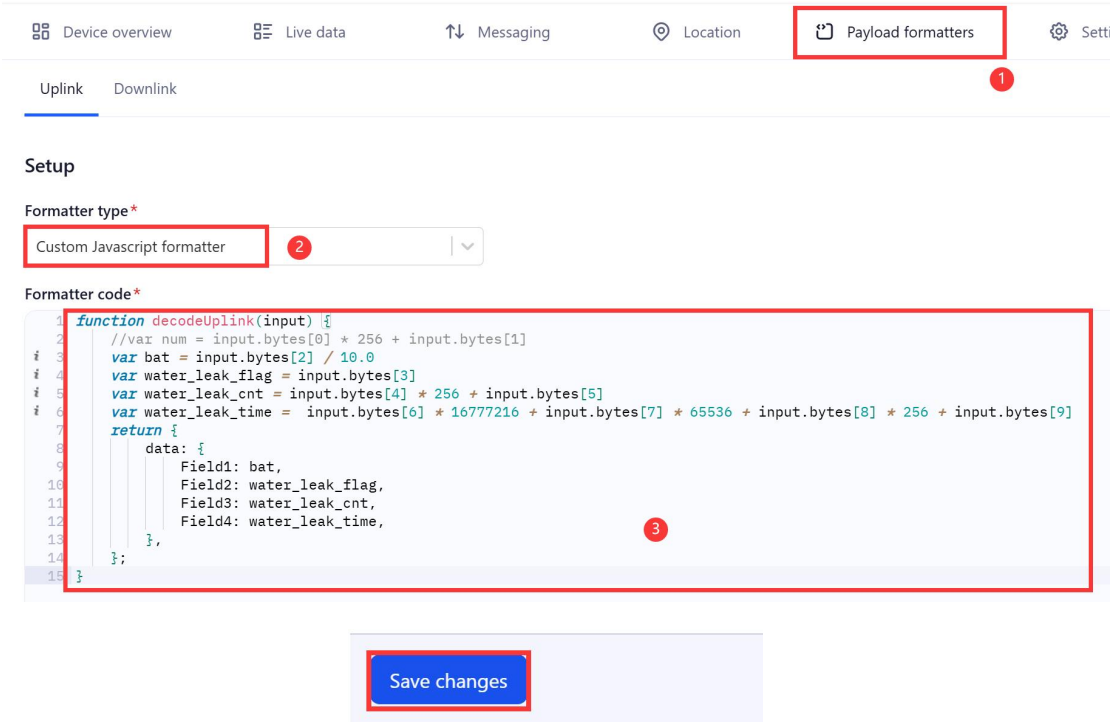
Number of leaks is 2.

Length of last leak is 3s.

- Know how to decode it after, we need to write it in code. (you can check it out on Github)

```
function decodeUplink(input) {
    //var num = input.bytes[0] * 256 + input.bytes[1]
    var bat = input.bytes[2] / 10.0
    var water_leak_flag = input.bytes[3]
    var water_leak_cnt = input.bytes[4] * 256 + input.bytes[5]
    var water_leak_time = input.bytes[6] * 16777216 + input.bytes[7] * 65536 + input.bytes[8] * 256 + input.bytes[9]
    return {
        data: {
            field1: bat,
            field2: water_leak_flag,
            field3: water_leak_cnt,
            field4: water_leak_time,
        },
    };
}
```

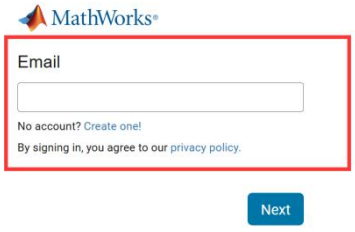
- Select “Payload formatters” and follow the steps.



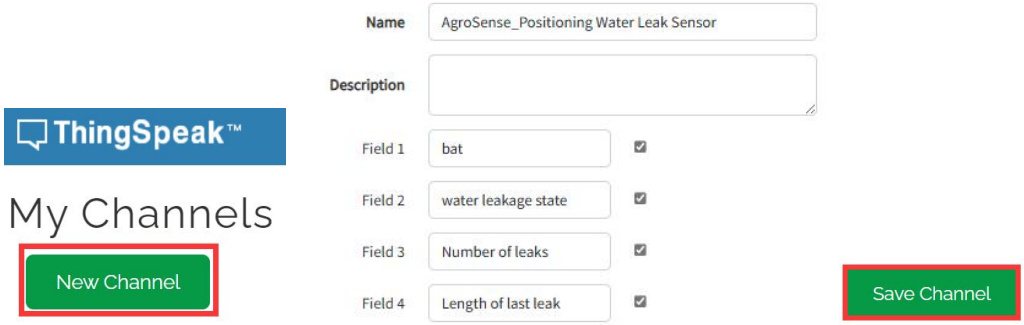
3.3 Application Server configuration

In the Application Server configuration, we need to create ThingSpeak channel and get Channel ID and API Key, this is the key to our connection to TTN.

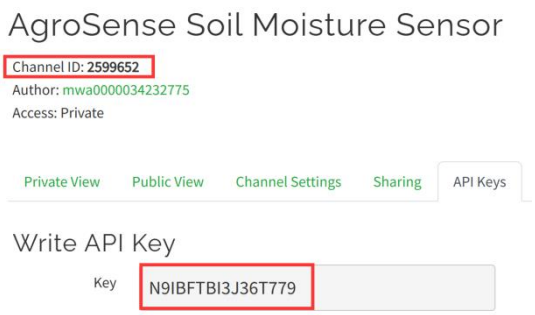
- Login to the ThingSpeak. (Or register an account)



- Click “New Channel”, fill in the Channel name and field names and click “Save Channel”.

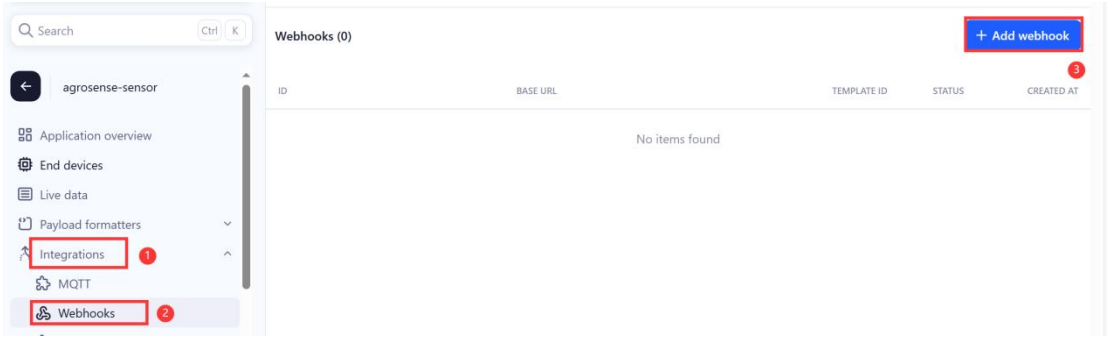


- After successful creation, copy the Channel ID and API Key.

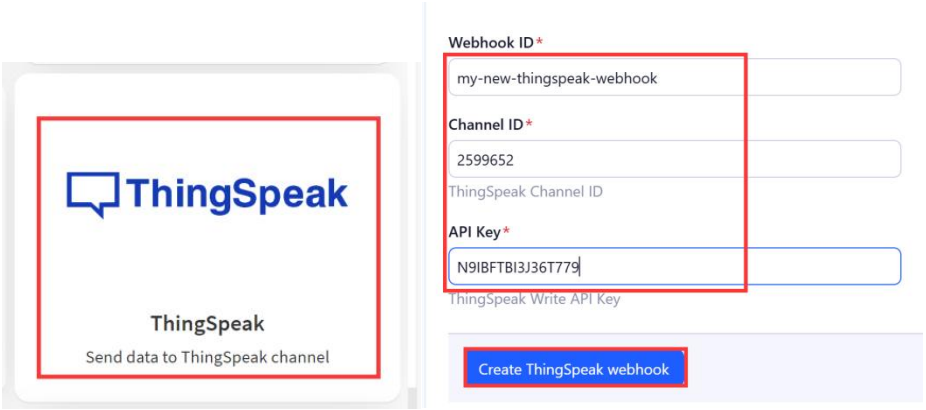


3.4 Connect the Network Server and Application Server

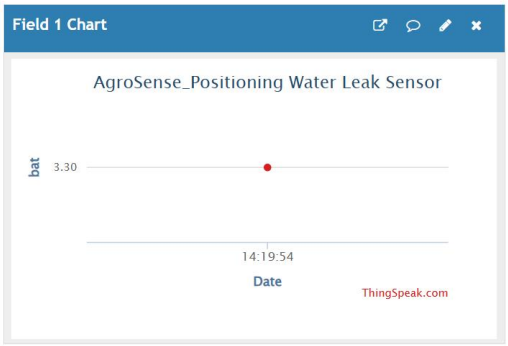
- In the TTN, click “integrations” --> “Webhooks” --> “+ Add webhook”.

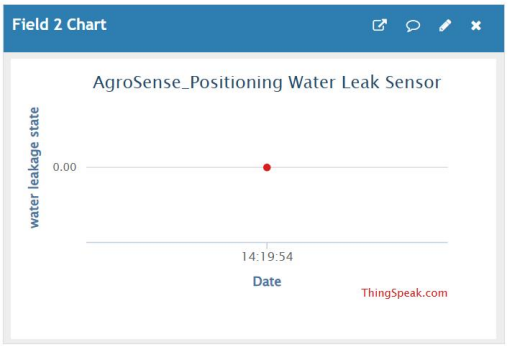


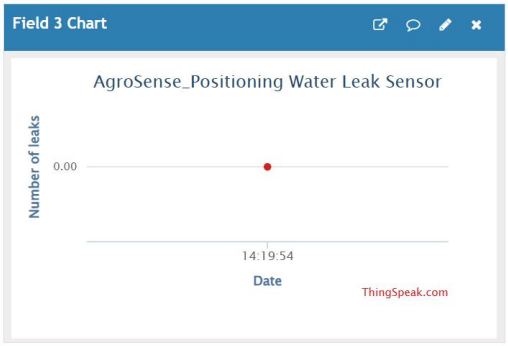
- Select “ThingSpeak”, Fill in the Webhook ID and paste the Channel ID and API Key, click “Create ThingSpeak Webhook”.

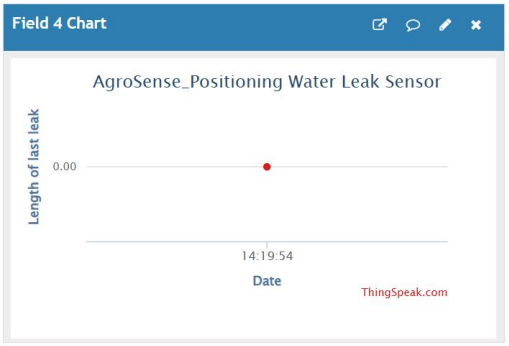


- Press RST button, wait about a minute, you will successfully see the data in ThingSpeak.









Leakage situation	Reporting of data
Normal state (No leakage)	Data reported every 12 hours.
Occasional leakage	Leak detected and reported once, No leak detected and reported once.
Persistent leakage	Reported every 1 minute, up to 5 consecutive times.