

UNOnext indoor air quality monitor

MQTT User Guide

VER 0.3



【Revision】

Date	Version	Description
2021/ 05 / 14	0.1	Initial Version
2021/ 10 / 12	0.2	Correct MQTT PM2.5 topic name in flatten mode
2021/ 10 /29	0.3	Correct the description on device power in Nested mode

【Overview】

UNOnext is an indoor air quality monitor to measure the space temperature / humidity / CO₂ / PM_{2.5} / PM₁₀ / TVOC / HCHO / O₃ / CO and expose the measurements directly via MQTT publishing and MODBUS RTU network.

UNOnext is suitable for many different types of environments, including residential buildings, commercial buildings, medical institutions, and places sensitive to air quality, such as nursing homes and day care centers.

This user guide focus on how to receive data from UNOnext via MQTT publishing and describe the data content published from UNOnext.

Specification	
Operation range	0°C to 50°C , 10-90% RH, IP20
Storage temp.	-20°C to 70°C
Power requirements	source 1: 9-24VDC+/-10% source 2: power adapter 12V/1A
Power consumption	Max 500mA@12VDC
Dimension	14.2cm(L) x 6.8cm(W) x 4.2cm(D) 5.6in(L) x 2.68in(W) x 1.65in(D)
Weight	208 g
Display	1.3" OLED
Location	1.5m from floor level
Accessory	Wall Mount, Power Adapter (Optional)
Connectivity	Mobus RTU (9K6, 38k4, 57k6, 76k8, 115k2) Wi-Fi 2.4G b/g/n, BLE 5.1

Sensors		
Sensing item	Range	Accuracy
Temperature	0-50°C	±1°C at 25°C and 50% rH
Humidity	0-100% rH	±5% at 25°C and 50% rH
CO ₂	350-10000 ppm	± 30 ppm ± 3%
PM _{2.5}	0-1000 ug/m ³	0-100 ug/m ³ ± 10 ug/m ³ , 100-1000 ug/m ³ ± 10%
PM ₁₀	0-1000 ug/m ³	Relative accuracy
HCHO	0-5000 ppb	±15% at 20~50°C
CO	0-500 ppm	±20ppm or ±5%
O ₃	0.5-10 ppm	Relative accuracy
TVOC	0-60000 ppb	±15% in lab test (Ethanol)
Luminance	0-10000 lux	Relative accuracy
Ext. temp.	NTC10k Thermistor	±0.3°C at 25°C and 50% rH

【Product Number Matrix】

Product Number	BLE	Wi-Fi	Temp. Humid.	PM2.5 PM10	CO ₂	Lux	TVOC	HCHO	CO	O ₃ *
UNO-6SR			●	●	●	●				
UNO-7TR			●	●	●	●	●			
UNO-6SW	●	●	●	●	●	●				
UNO-9SW	●	●	●	●	●	●	●	●	●	
UNO-7HW	●	●	●	●	●	●		●		

*The above are standard products. If you need a special combination, please contact Delta dealers.

【Required Firmware Version】

Name	Version
Sensor	1.01.45
Device	0.2.9
Wi-Fi	0.1.13

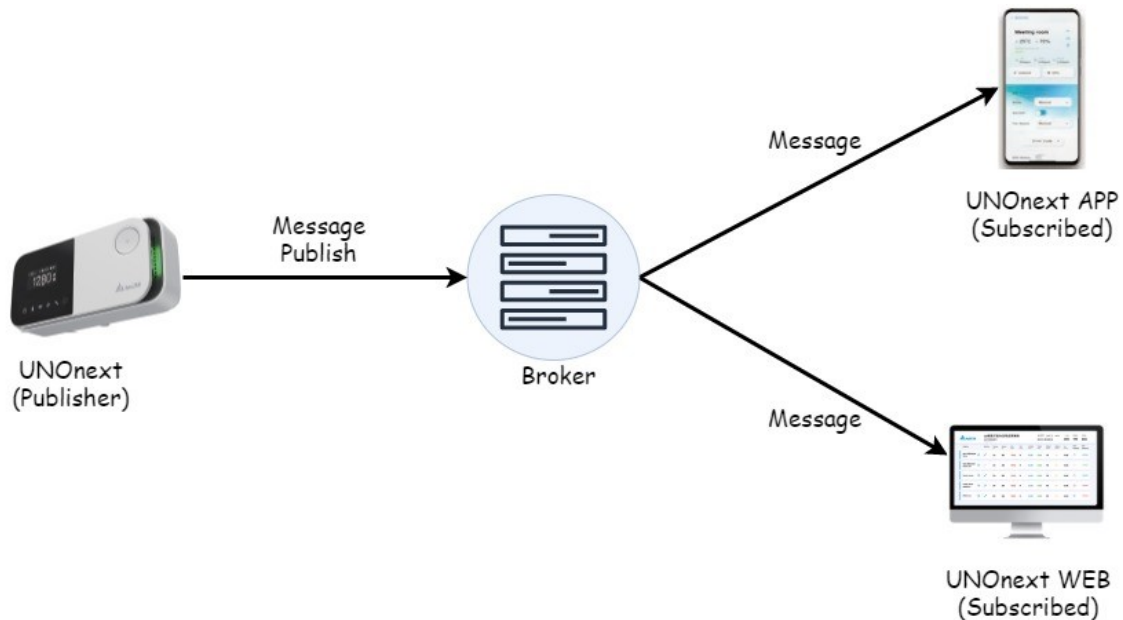
*The above are the minimal version requirement for this document

【UNOnext and MQTT】

Note : UNOnext support the MQTT v3.1.1

The Message Queueing Telemetry Transport(MQTT) is a lightweight publish/subscribe network protocol built on TCP/IP. There are two network entities in the typical MQTT protocol architecture : a message broker and multiple clients. Client can publish message to clients that subscribed the same topic through a broker server.

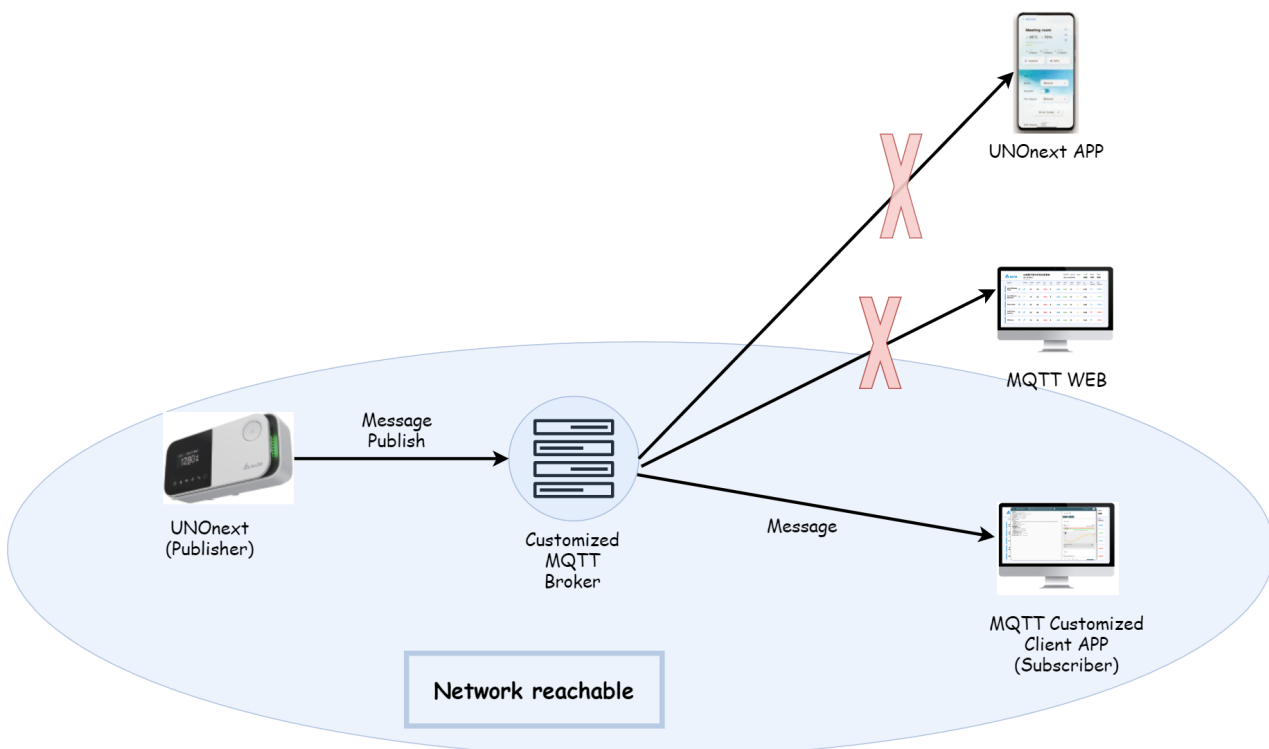
UNOnext, in MQTT protocol, is a message publisher and will publish sensor and device information periodically. It will connect to the default broker and UNOnext APP/Web (subscriber) will retrieve information from server.



UNOnext also can be set to connect to other MQTT broker. Then user can connect to the broker to receive sensor data via MQTT client application. Please note if the default broker has been changed, the UNO APP and UNO Web won't receive any data. The default broker setting can be recovered by executing factory reset.

For more information, read "Getting started" and "MQTT data format" section.

Note : MQTT configuration can be changed through UNOnext Engineer APP



【UNOnext MQTT Data Format】

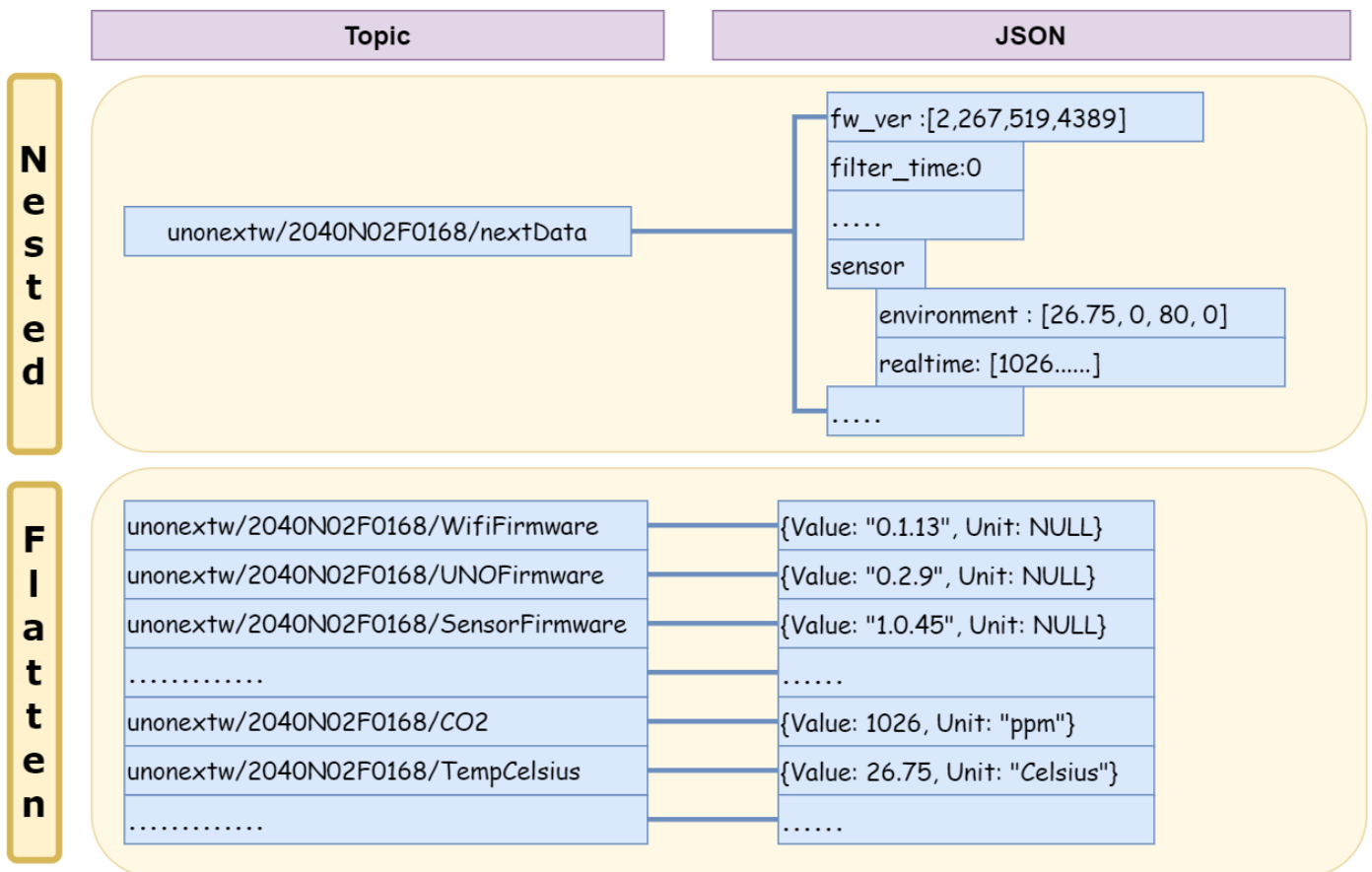
The data format of UNOnext follows JSON format. JSON is a standard text-based format with key-value pairing style. This section describes the meaning of the item in UNOnext's JSON and how to parsing valuable data from it.

There are two mode of UNOnext's MQTT : Flatten mode or Nested mode.

In Flatten mode, all keys with a topic respectively. The client can process data simply and only subscribe the specific topics.

In Nested mode, all keys are packaged in one topic and the publish frequency (i.e. 10 seconds roughly) is also slower than Flatten mode. The benefit of Nested mode is the reduction of network flow and the broker loading.

The default type is Flatten mode if the default broker has been changed.



【UNOnext Flatten Mode】

Note : Refer to “Getting started” section

The entities of JSON in Flatten mode are all composited of “Value” and “Unit”.

```
{ Value : “xxxx”, unit : “xxxx” }
```

The topic is composited of UNOnext’ serial number and object name. EX:

```
unonextw/xxxxxxxxxxxx/object_name
```

For example, the CO₂ object in UNOnext (2040N02F0168) should be:

```
unonextw/2040N02F0168/CO2      { Value : 800.0, unit : “ppm”}
```

The below is the description of UNOnext’s objects (topics).

(2040N02F0168 is a simulated UNOnext SN. Replace it with your UNOnext’s SN)

Topic	Description
1 unonextw/2040N02F0168/WifiFirmware	Wi-Fi firmware version of UNOnext. Unit is None.
2 unonextw/2040N02F0168/SensorFirmware	Sensor firmware version of UNOnext. Unit is None.
3 unonextw/2040N02F0168/UNOFirmware	Device firmware version of UNOnext. Unit is None.
4 unonextw/2040N02F0168/TempCelsius	Temperature in Celsius degree. Resolution is 0.01 °C.
5 unonextw/2040N02F0168/TempFahrenheit	Temperature in Fahrenheit degree. Resolution is 0.01 °F.
6 unonextw/2040N02F0168/Humidity	Relative humidity. Resolution is 0.01 %.
7 unonextw/2040N02F0168/Light	Ambient light. Resolution is 1 lux.
8 unonextw/2040N02F0168/CO2	Carbon dioxide. Resolution is 1 ppm.
9 unonextw/2040N02F0168/CO	Carbon monoxide. Resolution is 1 ppm.
10 unonextw/2040N02F0168/HCHO	Formaldehyde. Resolution is 1 ppb.
11 unonextw/2040N02F0168/TVOC	Total volatile organic compounds. Resolution is 1 ppb.
12 unonextw/2040N02F0168/O3	Ozone. Resolution is 1 ppb
13 unonextw/2040N02F0168/PM10	Particulate matter smaller than 10 micrometers . Unit is ug/m ³
14 unonextw/2040N02F0168/PM2p5	Particulate matter smaller than 2.5 micrometers . Unit is ug/m ³
15 unonextw/2040N02F0168/CtrlMode	Display if the equipment control mode is enabled. 1 means enabled.
16 unonextw/2040N02F0168/DigitalOutMode	Display whether the DigitalOut mode is enabled. If the DigitalOut mode is disabled, the RS485 mode is enabled.
17 unonextw/2040N02F0168/EquipmentPower	Display whether the ventilation fan’s power is enabled.
18 unonextw/2040N02F0168/EquipmentSpeed	Display what speed level of the ventilation fan is run. It may be 0,1,2,3.
19 unonextw/2040N02F0168/Equipment1Online	In RS485 mode, display whether the ventilation fan 1 online or not.
20 unonextw/2040N02F0168/Equipment2Online	In RS485 mode, display whether the ventilation fan 2 online or not.
21 unonextw/2040N02F0168/Equipment3Online	In RS485 mode, display whether the ventilation fan 3 online or not.
22 unonextw/2040N02F0168/Equipment4Online	In RS485 mode, display whether the ventilation fan 4 online or not.
23 unonextw/2040N02F0168/EquipmentErrCode	There are error happen on ventilation fan if the value is not zero.

【UNOnext Nested Mode】

Note : Refer to “Getting started” section

In Nested Mode, all data will be packed in one nested JSON structure and there is only one topic that need to be subscribed by clients. Moreover, the message publishing frequency (i.e. 10 seconds roughly) of Nested Mode is less than Flatten Mode’s.

The topic of Nested Mode is composited of UNOnext’s serial number:

`unonextw/xxxxxxxxxxxxx/nextData`

For example, the topic of UNOnext (2040N02F0168) should be:

`unonextw/2040N02F0168/nextData`

(2040N02F0168 is a simulated UNOnext SN. Replace it with your UNOnext’s SN)

The below is the structure of UNOnext’s data of nested mode:

Level 1	Level 2	Value	Description																																												
version		[Val1, Val2, Val3, Val4]	<p>Version information is packed into 4 values. The values :</p> <table border="1"> <tr> <td>Val1</td> <td>Don't Care</td> </tr> <tr> <td>Val2</td> <td>Wi-Fi Version</td> </tr> <tr> <td>Val3</td> <td>UNO Version</td> </tr> <tr> <td>Val4</td> <td>Sensor Version</td> </tr> </table> <p>The version format as below:</p> <table border="1"> <tr> <td colspan="4">Byte2</td> <td colspan="4">Byte1</td> </tr> <tr> <td>7</td><td>6</td><td>5</td><td>4</td> <td>3</td><td>2</td><td>1</td><td>0</td> <td>7</td><td>6</td><td>5</td><td>4</td> <td>3</td><td>2</td><td>1</td><td>0</td> </tr> <tr> <td colspan="4">Major</td> <td colspan="4">Minor</td> <td colspan="4">Build number</td> </tr> </table> <p>Example: 4389₍₁₀₎ = 1125₍₁₆₎ ==> 1.1.25₍₁₆₎ ==> 1.1.37₍₁₀₎</p>	Val1	Don't Care	Val2	Wi-Fi Version	Val3	UNO Version	Val4	Sensor Version	Byte2				Byte1				7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	Major				Minor				Build number			
Val1	Don't Care																																														
Val2	Wi-Fi Version																																														
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Byte2				Byte1																																											
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0																																
Major				Minor				Build number																																							
filter_time		Val	Reserved.																																												
filter_threshold		Val	Reserved.																																												
err_code		Val	Reserved.																																												
dry_contact		Val	<p>The ventilation fan control mode.</p> <table border="1"> <tr> <td>0</td> <td>RS485 mode</td> </tr> <tr> <td>1</td> <td>Digital Control mode</td> </tr> </table>	0	RS485 mode	1	Digital Control mode																																								
0	RS485 mode																																														
1	Digital Control mode																																														
btn_state		Val	Reserved.																																												
ctrl_mode		Val	<p>The state of UNOnext’s control mode.</p> <table border="1"> <tr> <td>0</td> <td>Disabled</td> </tr> <tr> <td>1</td> <td>Enabled</td> </tr> </table>	0	Disabled	1	Enabled																																								
0	Disabled																																														
1	Enabled																																														

【UNOnext Nested Mode】

Level 1	Level 2	Value	Description													
sensor	aqi	Val	Reserved. Internal use only													
	environment	[Val1, Val2, Val3, Val4]	The environment information: <table border="1"> <tr> <td>Val1</td> <td>Temperature (°C)</td> <td>0.01°C</td> </tr> <tr> <td>Val2</td> <td>NTC temprature (°C)</td> <td>0.01°C (null if no NTC)</td> </tr> <tr> <td>Val3</td> <td>Relative Humidity (%)</td> <td>0.01%</td> </tr> <tr> <td>Val4</td> <td>Ambient light (lux)</td> <td>1 lux</td> </tr> </table>	Val1	Temperature (°C)	0.01°C	Val2	NTC temprature (°C)	0.01°C (null if no NTC)	Val3	Relative Humidity (%)	0.01%	Val4	Ambient light (lux)	1 lux	
	Val1	Temperature (°C)	0.01°C													
	Val2	NTC temprature (°C)	0.01°C (null if no NTC)													
Val3	Relative Humidity (%)	0.01%														
Val4	Ambient light (lux)	1 lux														
realtime	[Val1, Val2, Val3, Val4, Val5, Val6, Val7]	The air quality sensor information: <table border="1"> <tr> <td>Val1</td> <td>CO2 (ppm)</td> </tr> <tr> <td>Val2</td> <td>CO (ppm)</td> </tr> <tr> <td>Val3</td> <td>HCHO (ppb)</td> </tr> <tr> <td>Val4</td> <td>TVOC (ppb)</td> </tr> <tr> <td>Val5</td> <td>O₃ (ppb)</td> </tr> <tr> <td>Val6</td> <td>PM_{2.5} (ug/m³)</td> </tr> <tr> <td>Val7</td> <td>PM₁₀ (ug/m³)</td> </tr> </table>	Val1	CO2 (ppm)	Val2	CO (ppm)	Val3	HCHO (ppb)	Val4	TVOC (ppb)	Val5	O ₃ (ppb)	Val6	PM _{2.5} (ug/m ³)	Val7	PM ₁₀ (ug/m ³)
Val1	CO2 (ppm)															
Val2	CO (ppm)															
Val3	HCHO (ppb)															
Val4	TVOC (ppb)															
Val5	O ₃ (ppb)															
Val6	PM _{2.5} (ug/m ³)															
Val7	PM ₁₀ (ug/m ³)															
fahrenheit	val	Temperature in Fahrenheit. (°F)														
device	cmd	Key: val	The key : value structure for ventilation control state. <table border="1"> <tr> <td>mode</td> <td>Reserved</td> </tr> <tr> <td>power</td> <td>1: power on 0: power off</td> </tr> <tr> <td>speed</td> <td>The fan speed level. 0 : power off 1 : low speed 2 : medium speed 3 : high speed</td> </tr> </table>	mode	Reserved	power	1: power on 0: power off	speed	The fan speed level. 0 : power off 1 : low speed 2 : medium speed 3 : high speed							
mode	Reserved															
power	1: power on 0: power off															
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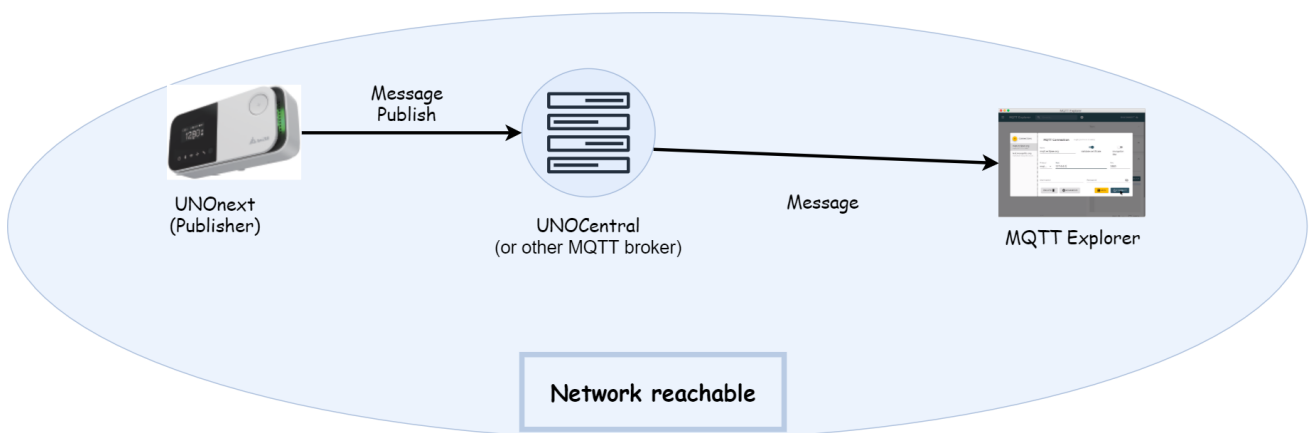
【UNOnext Nested Mode】

Level 1	Level 2	Value	Description																
device	err_code	[Val1, Val2, Val3, Val4, Val5, Val6, Val7, Val8]	<p>If UNOnext is run in RS485 mode, this item shows the status of the ventilation fan:</p> <table border="1"> <tbody> <tr> <td>Val1</td> <td>1: Fan1 online 0: Fan1 offline</td> </tr> <tr> <td>Val2</td> <td>0: Fan1 normal</td> </tr> <tr> <td>Val3</td> <td>1: Fan2 online 0: Fan2 offline</td> </tr> <tr> <td>Val4</td> <td>0: Fan2 normal</td> </tr> <tr> <td>Val5</td> <td>1: Fan3 online 0: Fan3 offline</td> </tr> <tr> <td>Val6</td> <td>0: Fan3 normal</td> </tr> <tr> <td>Val7</td> <td>1: Fan4 online 0: Fan4 offline</td> </tr> <tr> <td>Val8</td> <td>0: Fan4 normal</td> </tr> </tbody> </table>	Val1	1: Fan1 online 0: Fan1 offline	Val2	0: Fan1 normal	Val3	1: Fan2 online 0: Fan2 offline	Val4	0: Fan2 normal	Val5	1: Fan3 online 0: Fan3 offline	Val6	0: Fan3 normal	Val7	1: Fan4 online 0: Fan4 offline	Val8	0: Fan4 normal
Val1	1: Fan1 online 0: Fan1 offline																		
Val2	0: Fan1 normal																		
Val3	1: Fan2 online 0: Fan2 offline																		
Val4	0: Fan2 normal																		
Val5	1: Fan3 online 0: Fan3 offline																		
Val6	0: Fan3 normal																		
Val7	1: Fan4 online 0: Fan4 offline																		
Val8	0: Fan4 normal																		
wifi	rss	value	The rssi value of Wi-Fi connection.																

【Getting started】

This section will demonstrate how to receive data from UNOnext through MQTT client. For this example, we need a message broker, an UNOnext, a MQTT client software and UNOnext Engineer APP.

- * MQTT client : we will use MQTT explorer, a desktop MQTT client software. You can download it from <http://mqtt-explorer.com>.
- * Message broker : we will use the default broker in UNO Central. You can use other MQTT broker to replace it.
- * UNOnext Engineer APP : we use this app to set UNOnext's MQTT configuration.
- * UNOnext : In this example, the serial number of UNOnext is 2051N07F3043.



The below sections will describe how to get the UNOnext's CO₂ and temperature (°F) from MQTT Explorer.

Step 1 : Configure network

The first step of configuration is to check the network environment. In this example, we will connect the laptop, the UNOCentral and the UNOnext to the same wireless AP. The UNOCentral need to insert a physical network cable to the wireless AP. The IP address allocated to the UNOCentral is **192.168.1.168** (The MQTT broker's IP address in this example). Next, we need to configure the UNOnext to connect the wireless AP. (The SSID name is "ASUS_JERRY" in this example)

Step 1.1 : Setting UNOnext's Wi-Fi connection

A : Run UNO Engineer APP and find the UNOnext (2051N07F3043)



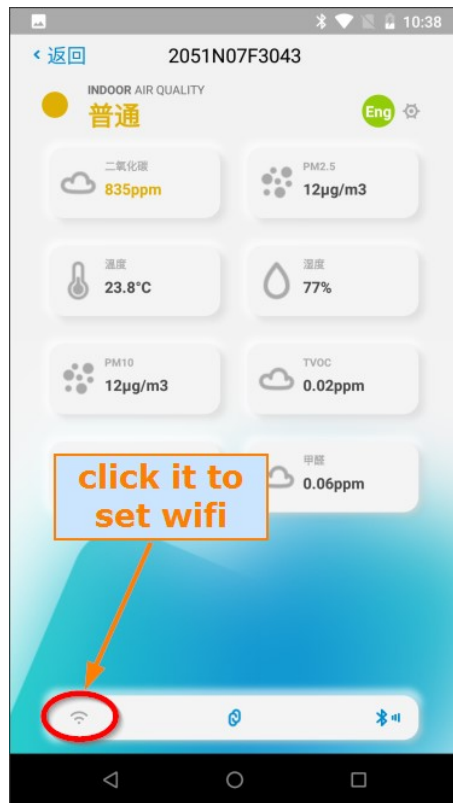
B : The BLE's notification remains lit.



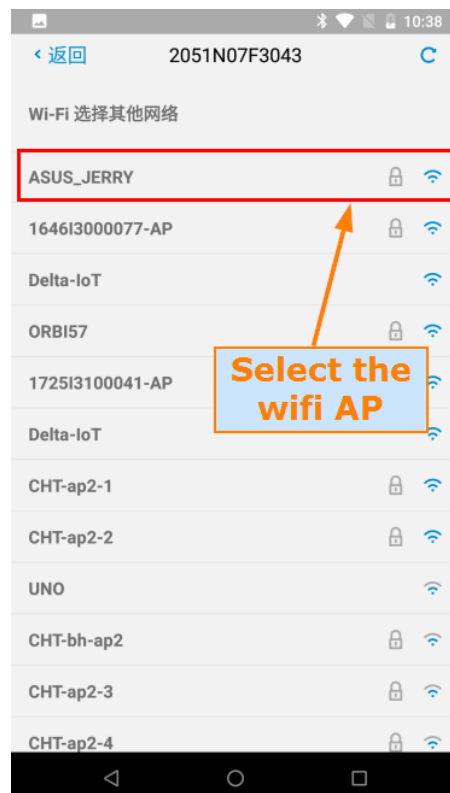
Step 1.1 : Setting UNOnext's Wi-Fi connection

Note : The phone's wi-fi function should be enabled on this step

C : Click the Wi-Fi icon to configure Wi-Fi connection.



D : Select the Wi - Fi AP's name.



Step 1.1 : Setting UNOnext's Wi-Fi connection

E : Input the password and press the connect button.

Then UNOnext will start to connect Wi Fi.



F : After several seconds, the Wi-Fi's notification should remain lit if everything is fine. The UNOnext's network configuration is ready.

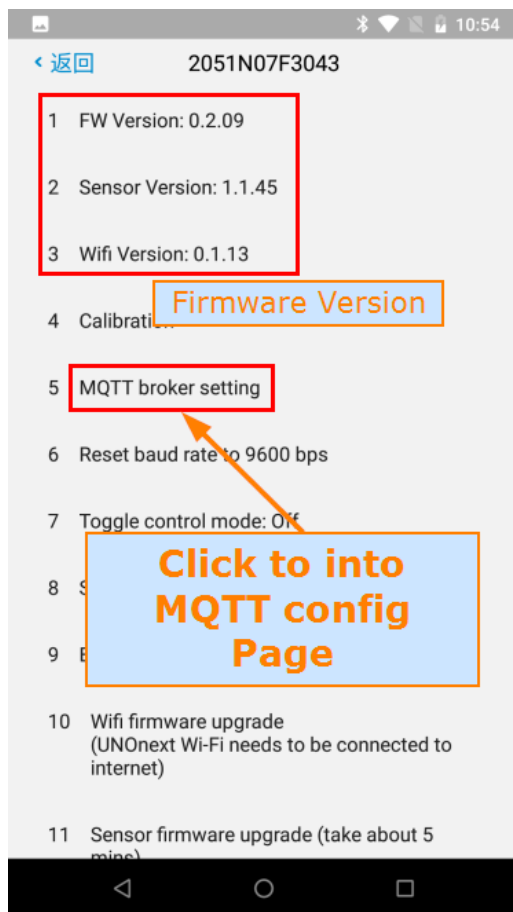


Step 2 : Setting UNOnext's MQTT configuration

A : After network configuration done, click “Eng” icon into device configuration page.

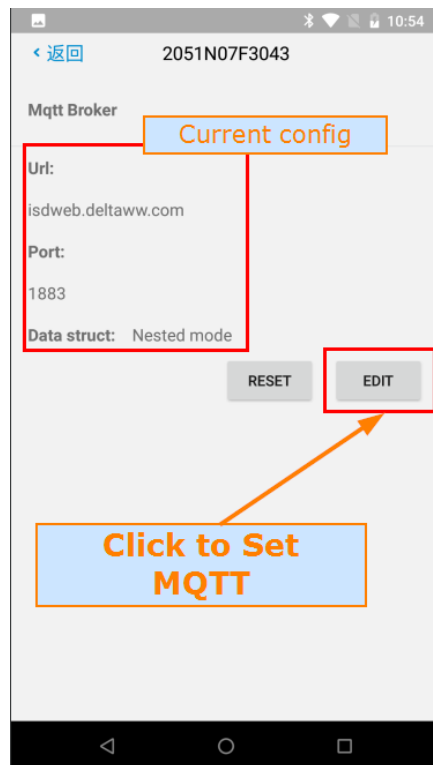


B : Enter MQTT configuration page.

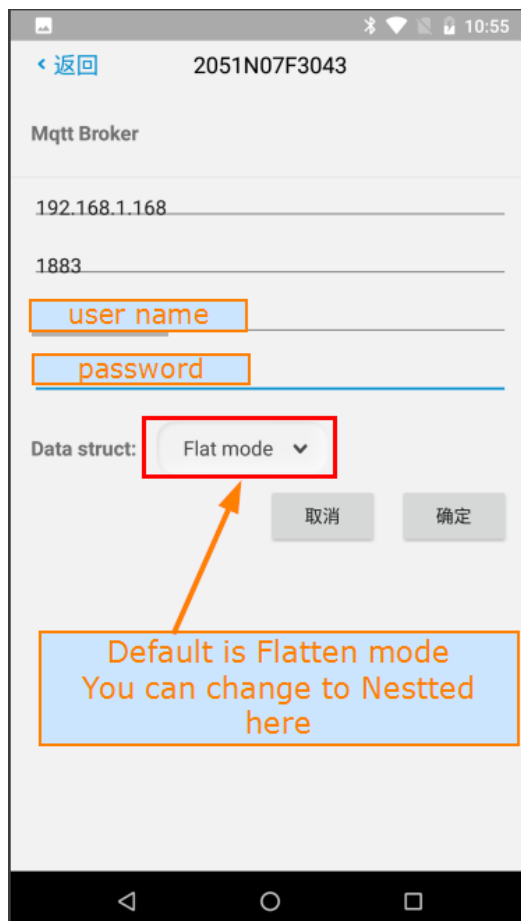


Step 2 : Setting UNOnext's MQTT configuration

D : Press "EDIT" to change MQTT's default config.



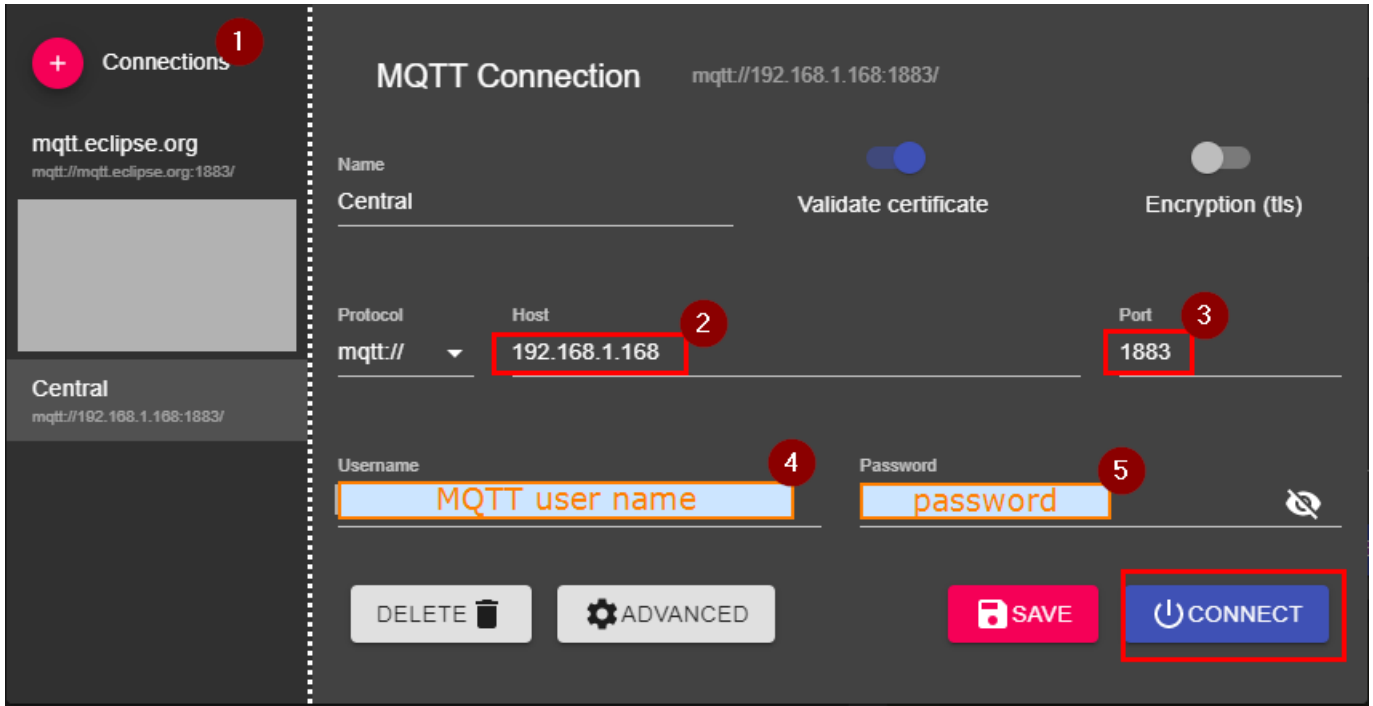
E : Input the MQTT broker's IP/Port/user name/password and press "Enter".
The UNOnext will connect to MQTT's new broker automatically now.



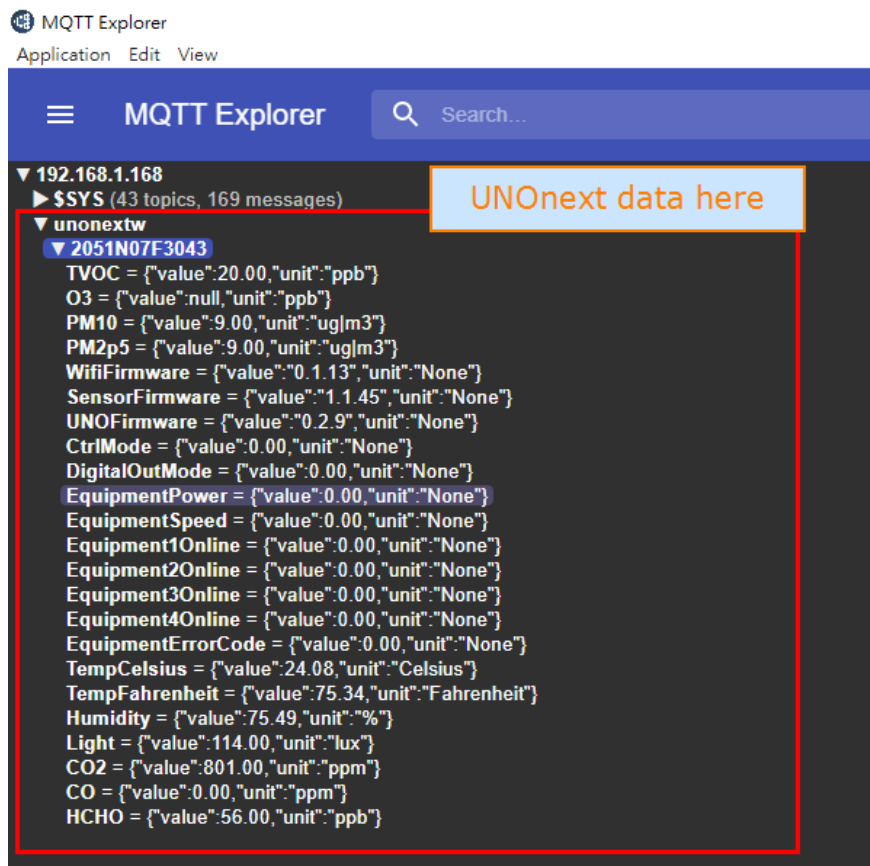
Step 3 : Receive UNOnext's data from MQTT Explorer

A : Run the MQTT explorer on PC. The first page in app you need to a new connection for UNOCentral. Then fill the MQTT broker's IP/port/user account/password and press "connect".

Note : MQTT explorer will subscribe all topics by default. You can change the setting on "ADVANCED" page to subscribe the specific topics only.



B : After connecting done, MQTT explorer will keep receive the whole data from Broker.



Step 3 : Receive UNOnext's data from MQTT Explorer

C : Our target in this example is to get Temperature and CO₂ Value.
Let's check the topic:

/unonextw/2051N0F73043/TempFahrenheit/

/unonextw/2051N0F73043/CO2/

And get the temperature value is 75.34 °F and the co2 value is 801 ppm.

MQTT Explorer
Application Edit View

MQTT Explorer Search...

192.168.1.168

▶ \$SYS (43 topics, 169 messages)

▼ unonextw

▼ 2051N0F73043

- TVOC = {"value":20.00,"unit":"ppb"}
- O3 = {"value":null,"unit":"ppb"}
- PM10 = {"value":9.00,"unit":"uglm3"}
- PM2p5 = {"value":9.00,"unit":"uglm3"}
- WifiFirmware = {"value":"0.1.13","unit":"None"}
- SensorFirmware = {"value":"1.1.45","unit":"None"}
- UNOFirmware = {"value":"0.2.9","unit":"None"}
- CtrlMode = {"value":0.00,"unit":"None"}
- DigitalOutMode = {"value":0.00,"unit":"None"}
- EquipmentPower = {"value":0.00,"unit":"None"}
- EquipmentSpeed = {"value":0.00,"unit":"None"}
- Equipment1Online = {"value":0.00,"unit":"None"}
- Equipment2Online = {"value":0.00,"unit":"None"}
- Equipment3Online = {"value":0.00,"unit":"None"}
- Equipment4Online = {"value":0.00,"unit":"None"}
- EquipmentErrorCode = {"value":0.00,"unit":"None"}
- TempCelsius = {"value":24.08,"unit":"Celsius"}
- TempFahrenheit = {"value":75.34,"unit":"Fahrenheit"}
- Humidity = {"value":75.49,"unit":"%"}
- Light = {"value":114.00,"unit":"lux"}
- CO2 = {"value":801.00,"unit":"ppm"}
- CO = {"value":0.00,"unit":"ppm"}
- HCHO = {"value":5.00,"unit":"ppm"}

unonextw/2051N0F73043/TempFahrenheit/

unonextw/2051N0F73043/CO2

Note : If the MQTT's configuration is changed, the UNO APP and UNO WEB won't receive UNOnext data. You can click "reset" button in MQTT setting page to restore to default setting.

2051N0F73043

Mqtt Broker

Url:
isdweb.deltaww.com

Port:
1883

Data struct: Nested mode

RESET EDIT

Click it will restore the MQTT's configuration to default setting

