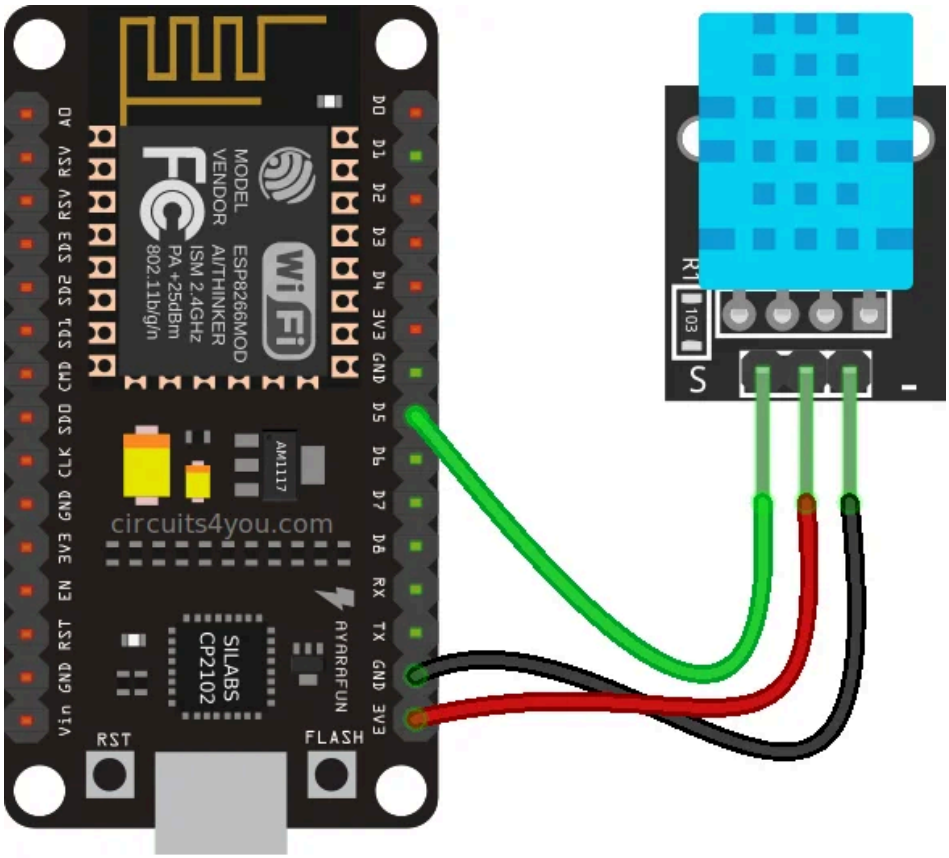


# Final Project

14.05.2025.

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## Overview

The aim of this project is to visualize the outputs from measuring air humidity using NodeMCU and ThingsBoard – a platform for IoT device management and IoT data collection, processing, and visualization.

## Goals

1. Read air humidity using an ESP8266 NodeMCU and a DHT11 sensor.
2. Implement a simple application with ThingsBoard Community Edition Demo Live server to perform telemetry injection and visualization of the provided sensor and NodeMCU microcontroller.

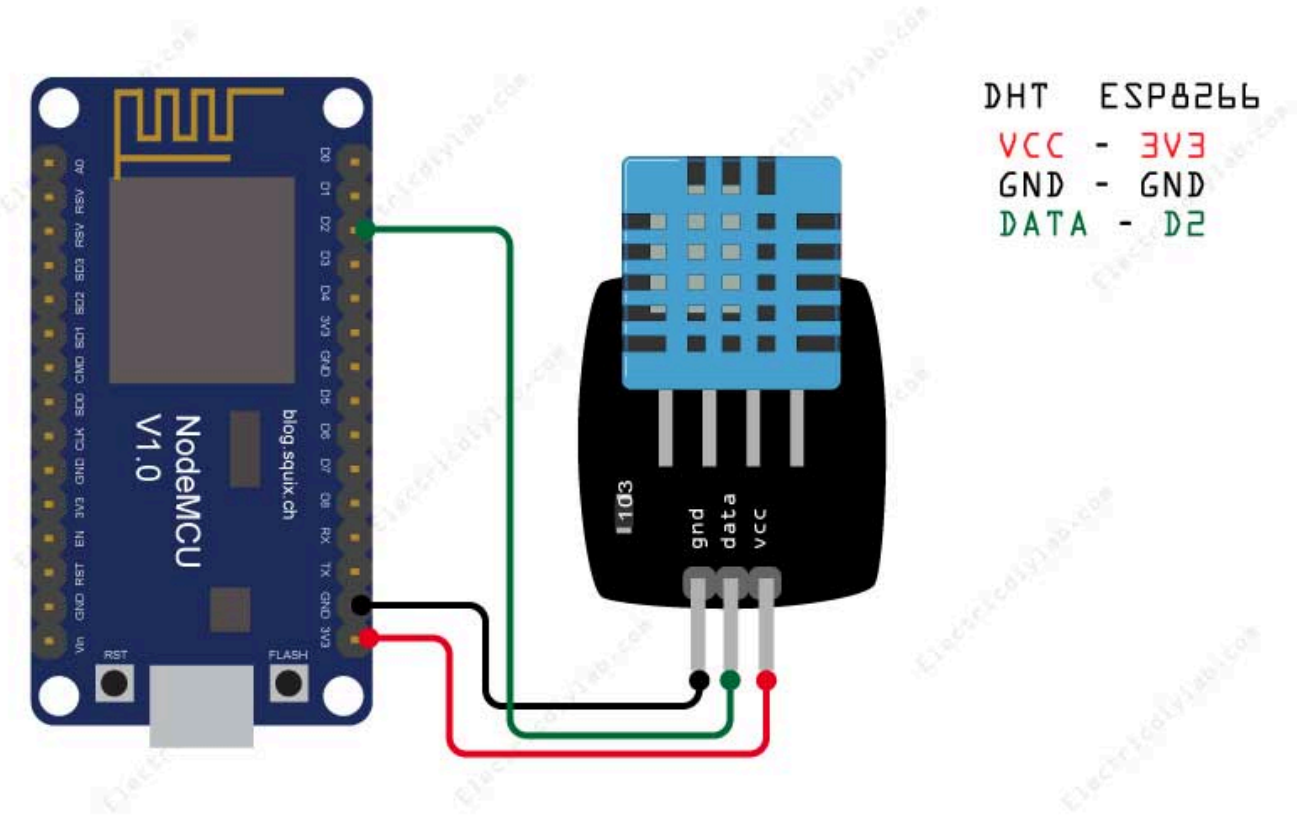
## Specifications of equipment and tools

NodeMCU ESP8266
DHT11 temperature and humidity sensor
Jumper wires
USB cable for uploading code

Thingsboard - IoT platform
Arduino IDE - development environment

## Connecting NodeCMU and sensor

To connect NodeCMU ESP8266 and sensor DHT11 we need 3 jumper wires. Connect as shown in picture:




Use a USB cable to connect it to your laptop so we can load code onto NodeMCU. First, we need to set up an Arduino IDE. Open Arduino IDE, go to Files and click on the Preferences. Copy following link to the Additional Boards Manager and click OK: http://arduino.esp8266.com/stable/package_esp8266com_index.json

Now, go to Tools and board and select Board Manager. Navigate to esp8266 by esp8266 community and install the software for Arduino.

Once all the above processes have been completed we are ready to program our esp8266 with Arduino IDE.

If the DHT library is not installed, install it via /Project/Include Libraries/Manage Libraries (choose Adafruit DHT Sensor Library).

Now we can create a new sketch and load it into NodeMCU by clicking Verify and Upload.

## Code

Let’s review what our code should look like:

- Read humidity values from sensor
- Publish results to ThingsBoard platform (PubSubClient - MQTT client library)

Once physical parts are connected, reading values from the sensor is easy.
Keep in mind ESP8266 pin mapping, in code we use DPIN 4 which is D2 pin on ESP8266 board. To create a DHT object we also need to specify DTYPE in this case it is DHT11. Now we can just use the readHumidity() function.

To publish results of measurement to the ThingsBoard platform we will use PubSubClient Arduino Library. It uses the MQTT protocol, and MQTT protocol runs over WiFi protocol on a physical level. So we need a WiFi Arduino Library.

For now, our code looks like this:

```
#include <PubSubClient.h>
#include <ESP8266WiFi.h>
#include <stdlib.h>

#include <DHT.h>

#include <credentials.h>

#define DPIN 4
#define DTYPE DHT11

DHT dht(DPIN,DTYPE);

WiFiClient client;
PubSubClient pubsub_client(client);

void setup() {
 Serial.begin(9600);
 dht.begin();

 delay(10);

 Serial.println("Connecting to ");
```

```
 Serial.println(ssid);

 WiFi.begin(ssid, pass);
 while (WiFi.status() != WL_CONNECTED) {
   delay(500);
   Serial.print(".");
 }
 Serial.println("");
 Serial.println("WiFi connected");
}

void loop() {
 delay(2000);

 float humidity = dht.readHumidity();
 Serial.println(humidity);

}
```

For security reasons, we created **credentials.h** file and added it to our sketch.

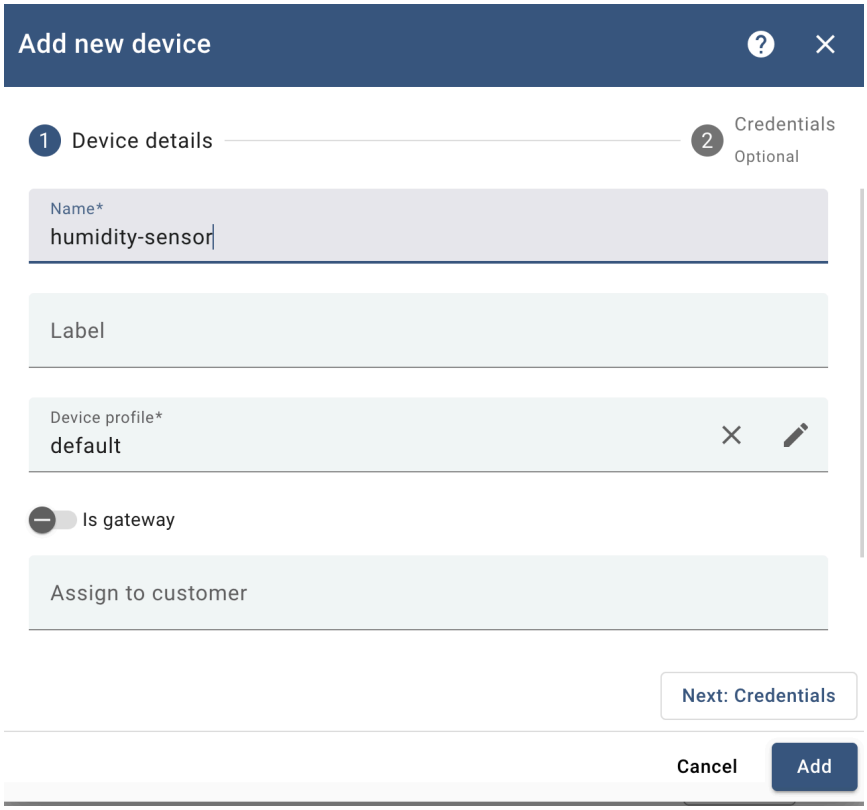
```
#define ssdi myssdiwhatever
#define pass mypassword
```

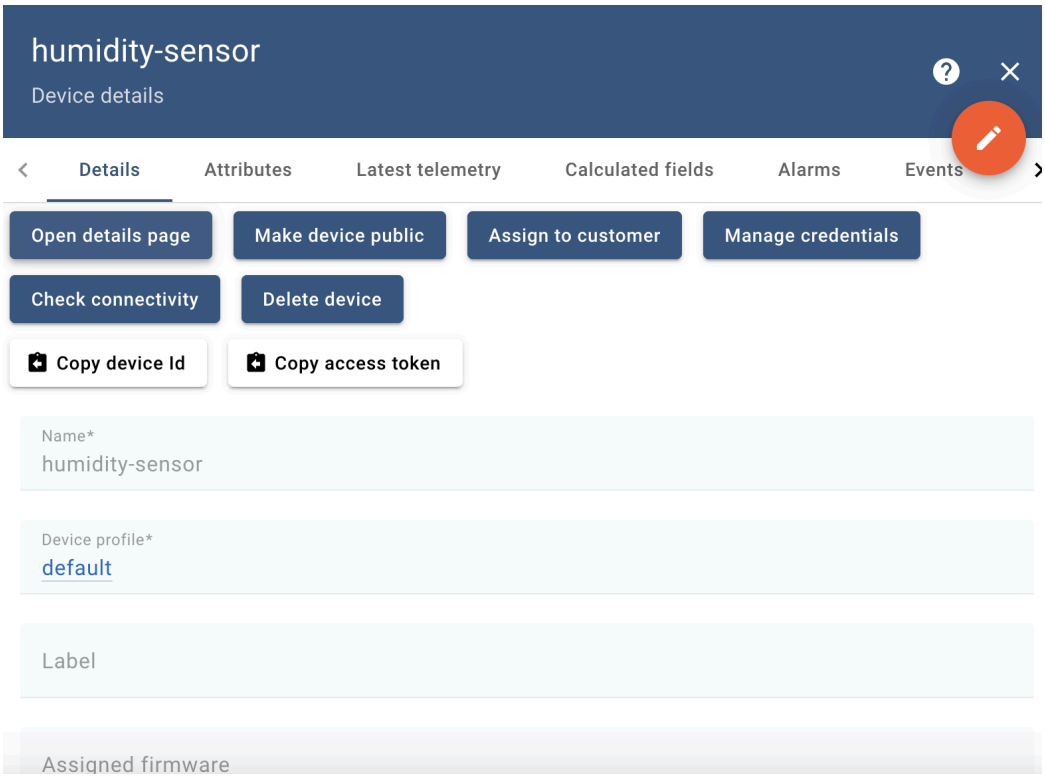
## ThingsBoard Platform

For the purpose of this project, we are using the ThingsBoard Demo Live server. Before we can connect to this server using the MQTT protocol, we need to set up a few things.

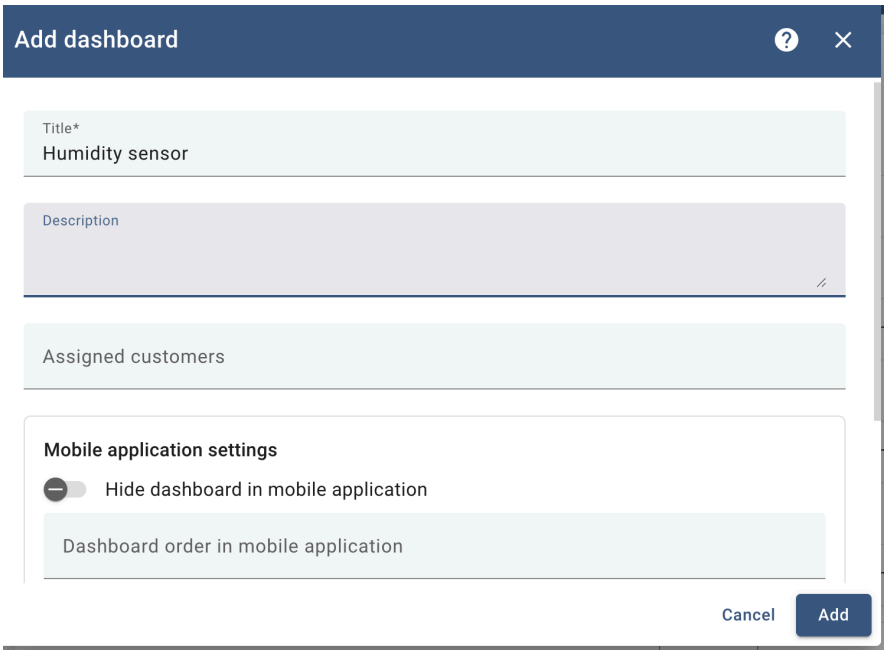
- Create new device, get access token and device id
- Use credentials.h file to store those
- Create new dashboard and show data

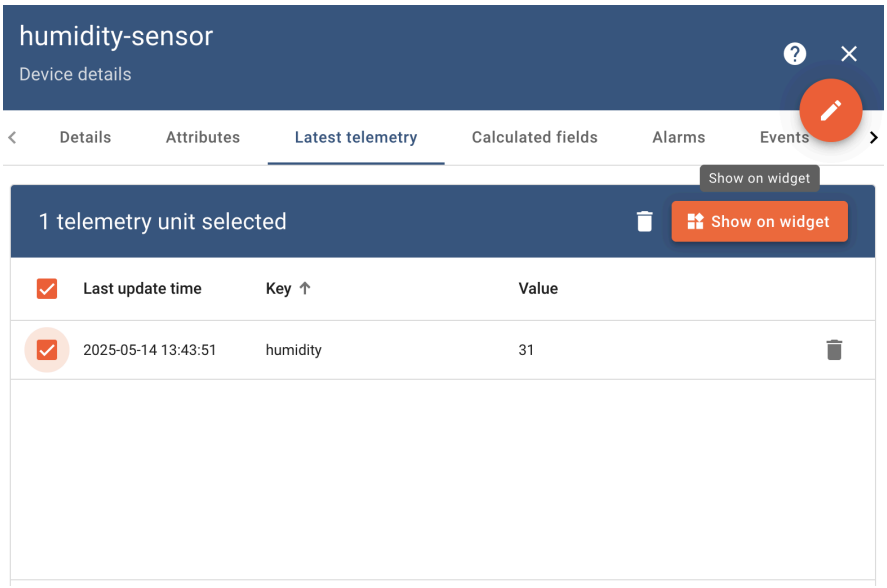
Create new device and copy device id and access token to credentials.h file.

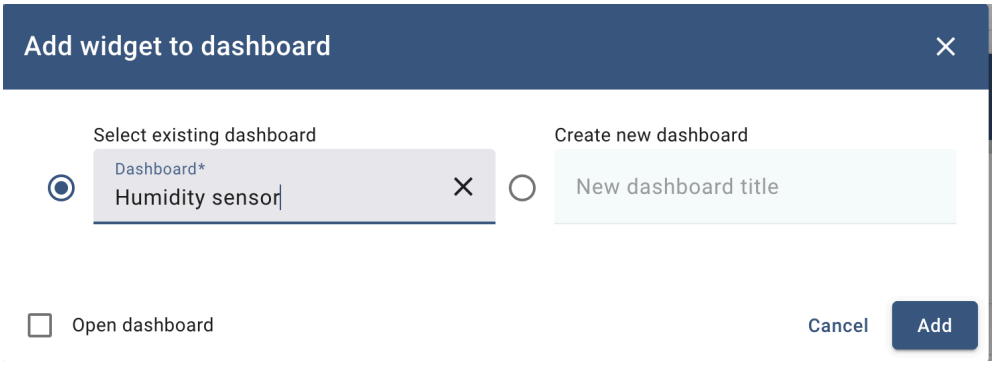


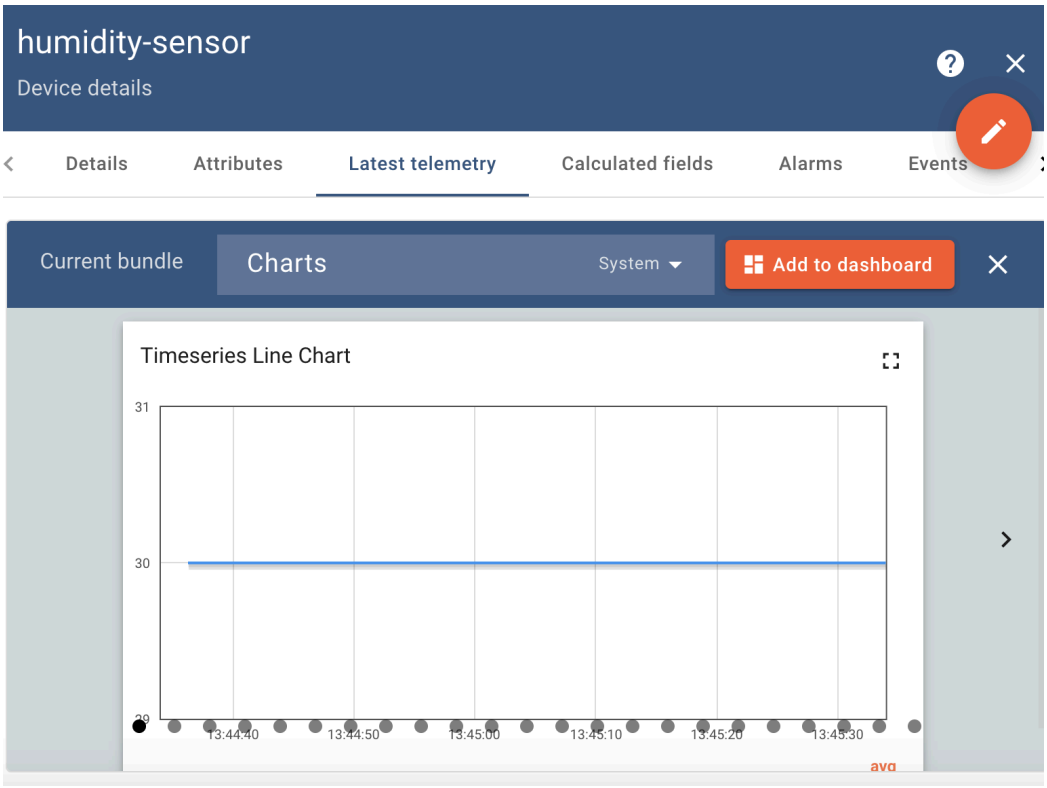
To create new dashboard and add select telemetry data to visualize follow next steps.



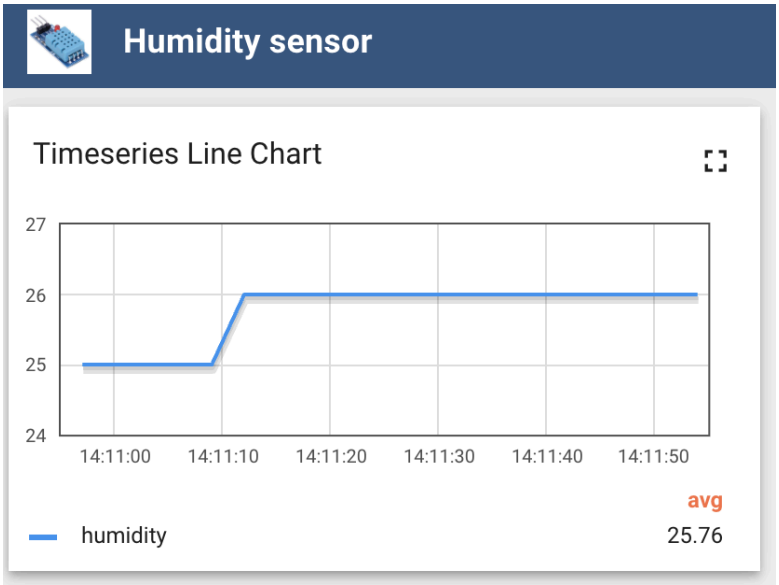



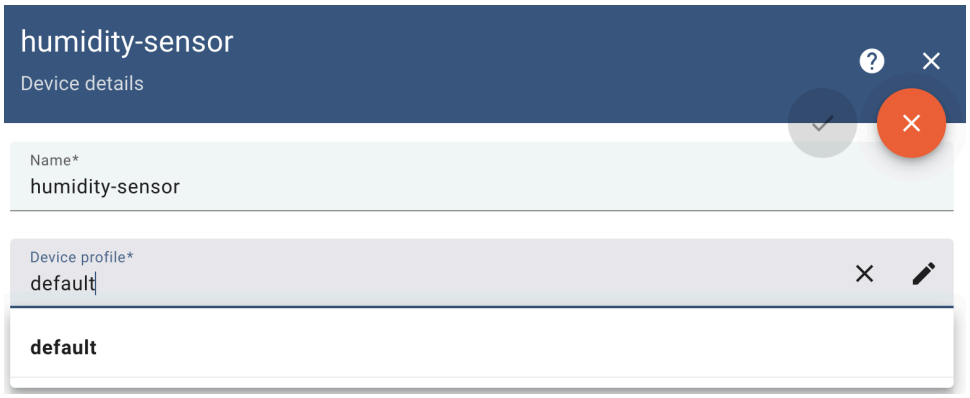
From Current bundle dropdown choose Charts. Then click Add to dashboard.

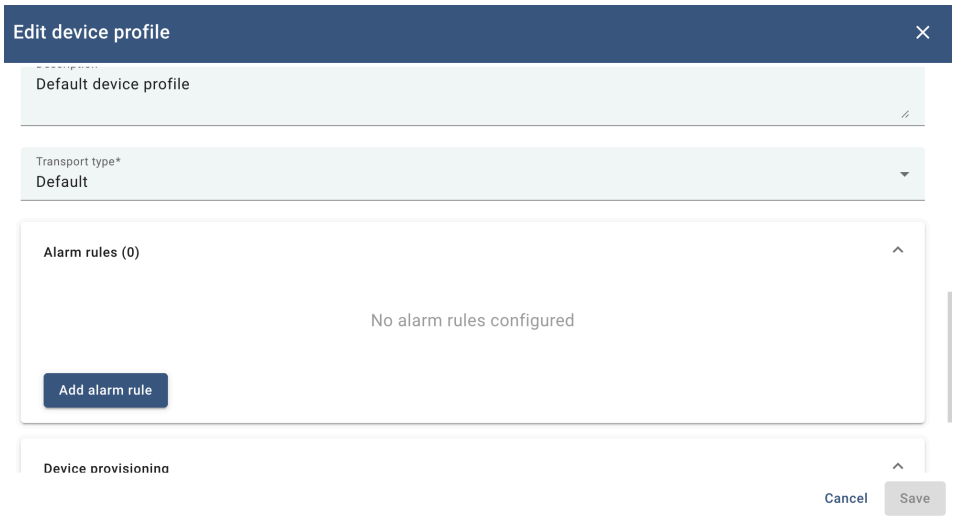


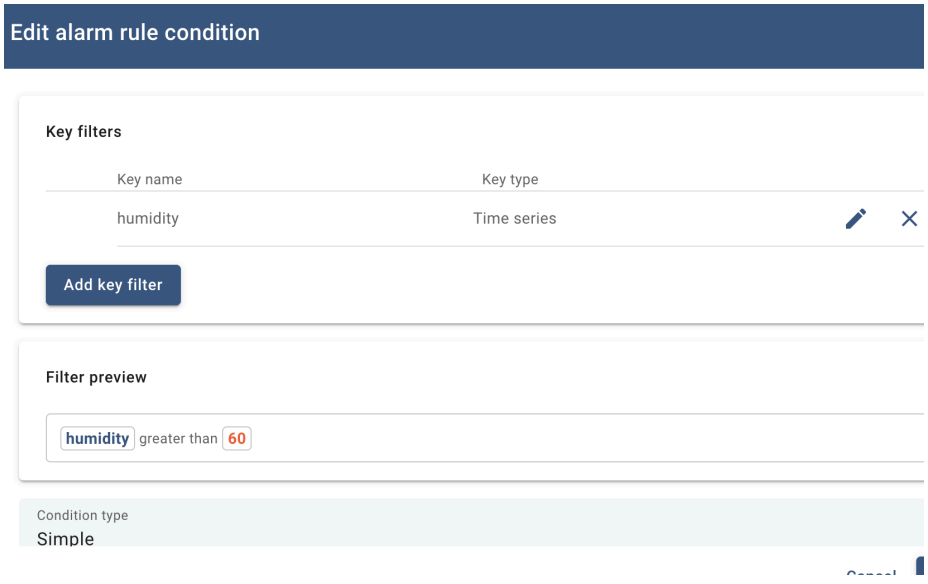

To further expand functionality of dashboards you can go to Edit mode. You can edit the whole dashboard or just individual widgets. Here, we removed the default widget title and added a logo to be shown when the dashboard is in fullscreen mode.



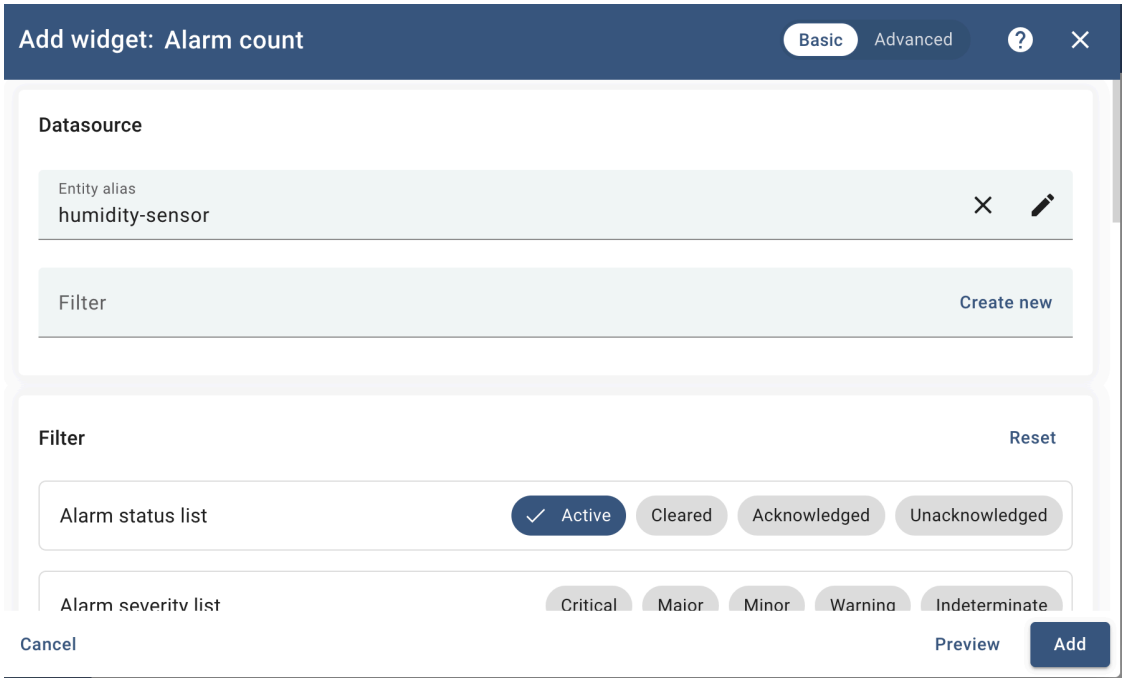

Let’s add a simple alarm that will notify us when humidity levels are too high. Go to Devices and select device, choose edit device profile.

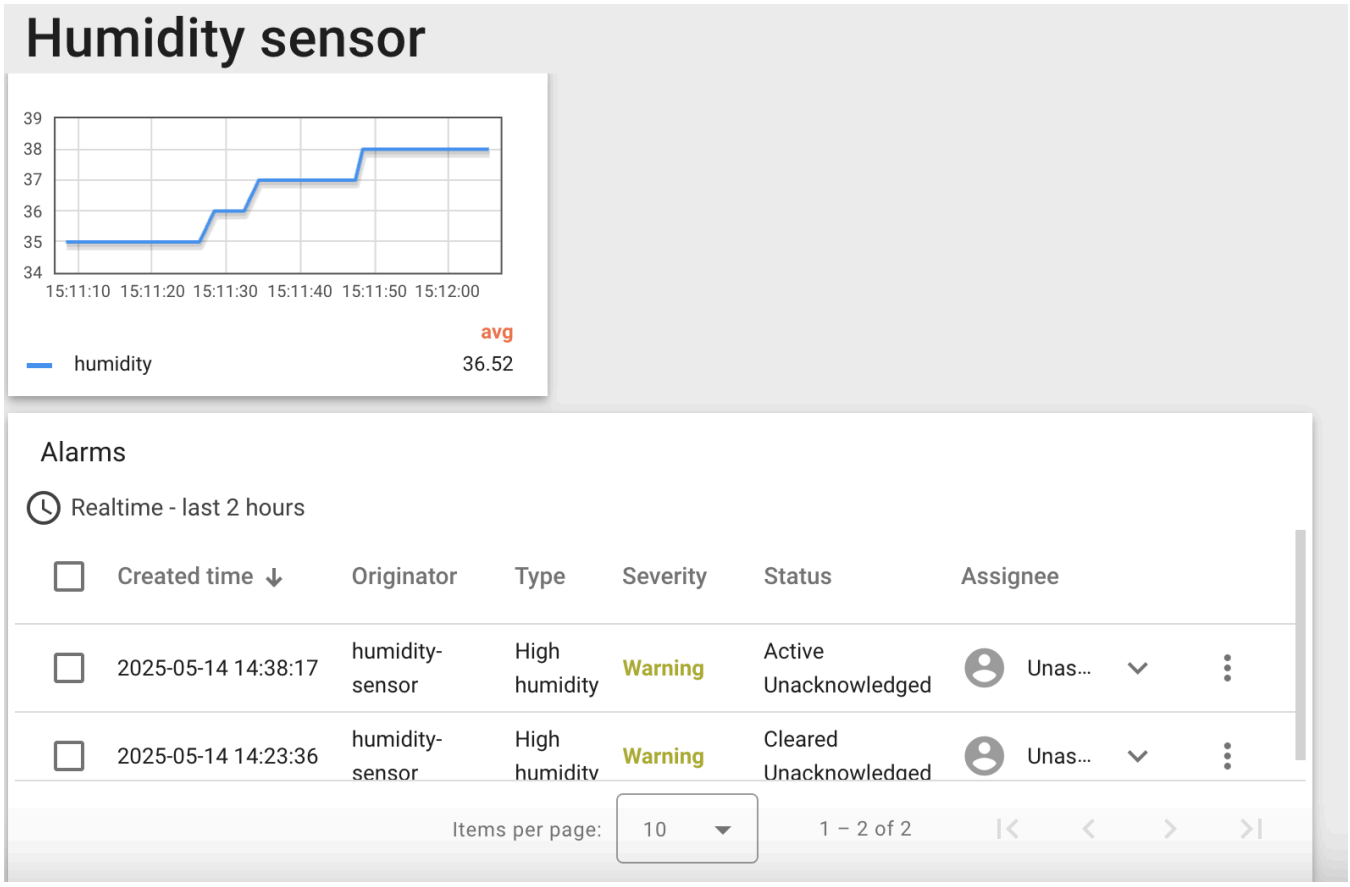

humidity-sensor
Device details
Name*
humidity-sensor
Device profile*
default
default


Edit device profile
Default device profile
Transport type*
Default
Alarm rules (0)
No alarm rules configured
Add alarm rule
Device provisioning
Cancel
Save


Edit alarm rule condition
Key filters
Key name
Key type
humidity
Time series
Add key filter
Filter preview
humidity
greater than
60
Condition type
Simple

Now we have created an alarm. We can add new widget to our dashboard.



To verify everything check from mobile phone or other device.

Keep nodeMCU plugged to the power source.

## Final code

```
#include <PubSubClient.h>
#include <ESP8266WiFi.h>
#include <stdlib.h>

#include <DHT.h>

#include <credentials.h>

#define DPIN 4
#define DTYPE DHT11

DHT dht(DPIN,DTYPE);

WiFiClient client;
PubSubClient pubsub_client(client);

void setup() {
 Serial.begin(9600);
 dht.begin();

 delay(10);

 Serial.println("Connecting to ");
 Serial.println(ssid);

 WiFi.begin(ssid, pass);
 while (WiFi.status() != WL_CONNECTED) {
   delay(500);
   Serial.print(".");
 }
 Serial.println("");
 Serial.println("WiFi connected");

 pubsub_client.setServer("demo.thingsboard.io", 1883);

 while (!pubsub_client.connect(device_id, access_token, NULL)) {
   delay(500);
```

```
 Serial.print(".");
}
 Serial.println("");
 Serial.println("Thingsboard connected");

}

void loop() {
 delay(2000);

 float humidity = dht.readHumidity();
 Serial.println(humidity);

 String payload = "{";  payload += "\"humidity\":";
 payload += humidity;
 payload += "}";
 Serial.println(payload);

 if(pubsub_client.publish("v1/devices/me/telemetry",payload.c_str()))




   Serial.println("Published");

}
```

## Sources


Github link to the project github.com/anikapet/humidity-sensor

ThingsBoard quick guide Getting Started with ThingsBoard

Guide to measure WiFi signal in dB by NodeMCU and publish it though ThingsBoard

Visualizing telemetry data using NodeMCU IoT device with ThingsBoard IoT Dashboard | by Isura Nirmal | Medium

NodeMCU Language Reference Manual

https://thingsboard.io/docs/user-guide/rule-engine-2-0/tutorials/create-clear-alarms/

ESP8266 pin mapping https://randomnerdtutorials.com/esp8266-pinout-reference-gpios/

DHT sensor Library https://github.com/adafruit/DHT-sensor-library

PubSubClient https://docs.arduino.cc/libraries/pubsubclient/

WiFi Client https://docs.arduino.cc/language-reference/en/functions/wifi/client/