

Beágyazott ipari vezérlők Szakszeminárium

WiFi kapcsolat megvalósítása. MQTT. NodeRed. Adatok tárolása a felhőben.

Kandó Kálmán Villamosmérnöki Szakkollégium

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IOT A GYAKORLATBAN: MÉRÉSADATGYŰJTÉS

Szakszeminárium

2022.11.22-23., 2022.11.25.

**A Kandó Kálmán Villamosmérnöki Szakkollégium 20 órás
szakszemináriumot szervez IoT a gyakorlatban:
mérésadatgyűjtés témakörben.**

TÉMAKÖRÖK:

- IoT fogalomköre, lehetőségek
- IoT kommunikációk
- Hálózati alapismeretek
- LoRa
- LoRaWAN
- LoRaWAN privát hálózat
- LoRaWAN adatküldés
- Node-RED
- Megjelenítés és adatfeldolgozás

ÜTEMEZÉS

Első nap - 2022.11.22.

- Elméleti alapok: 13.30-16.00
- Gyakorlati alapok 1: 16.00-18.30

Második nap - 2022.11.23.

- Gyakorlati alapok 2: 8.00-13.00

Harmadik nap - 2022.11.25.

- Miniprojektek: 13.00-15.30
- Bemutatók, vizsga: 15.30-17.00
- Értékelés: 17.00-17.30
- Oklevélatadó: 17.30-18.00

A jelentkezők további tájékoztatást kapnak a részletekről!

Kapcsolat:



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sador.tamas@uni-obuda.hu



Jelentkezés: <https://kando-szakkoli.uni-obuda.hu/>

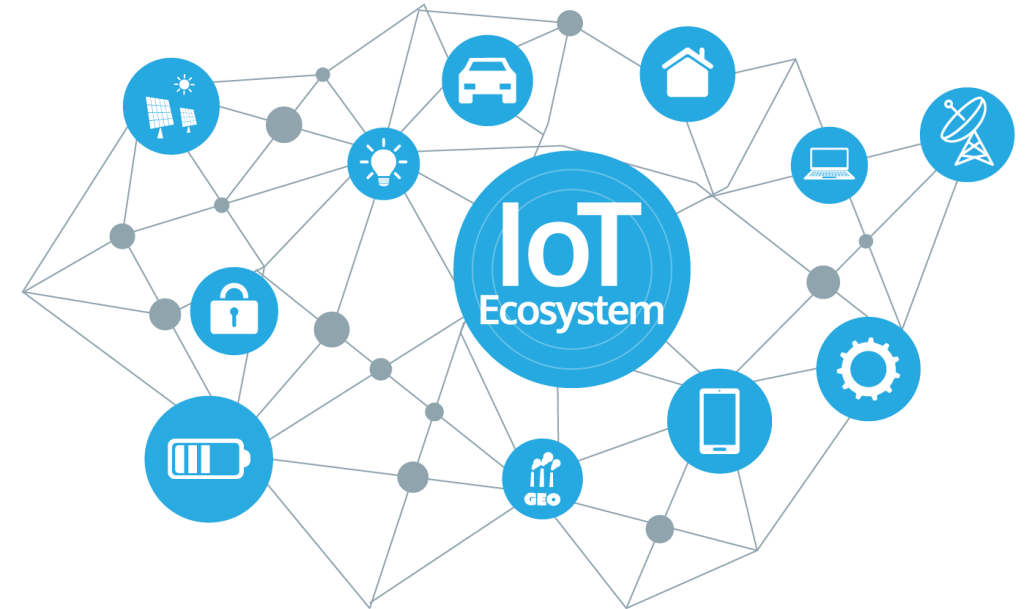
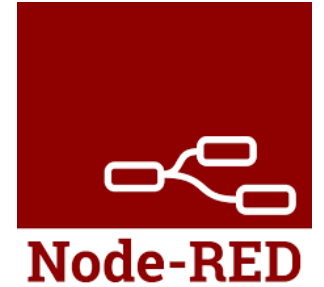
A program megvalósulását támogatja a Nemzeti Tehetség Program és a Miniszterelnökség, az Emberi Erőforrás Támogatáskezelő által kiírt "Szakkollégiumok tehetséggondozó programjainak támogatása" című pályázata.

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Tartalom

- IoT
- MQTT
- ORING PaaS MQTT
- JSON
- NodeRED
- ORING PaaS MQTT - Thing létrehozása
- ORING PaaS MQTT - Alkalmazás létrehozása
- ORING PaaS MQTT – Node-RED flow
- ORING PaaS MQTT – ESP32 Arduino kód
- ORING PaaS MQTT – Adatok megjelenítése



ORING PaaS MQTT

- Az ORing PaaS egy nagy teljesítményű felügyelt felhőplatform, amelyet ipari IoT-alkalmazásokhoz terveztek, és minden olyan háttérfunkciót biztosít, amely a nagyszabású IoT-megoldások működtetéséhez szükséges.
- Az MQTT protokoll támogatása miatt könnyedén kapcsolhatók eszközök a felülethez, és interakcióba léphetnek a felhőalkalmazásokkal.
- Az ORing PaaS biztonságosan és megbízhatóan dolgozza fel ezeket az üzeneteket.
- <https://docs.paas.oringnet.cloud/#introduction>
- <https://console.paas.oringnet.cloud/sign-up>



JSON

- „A JSON egy kis méretű, szöveg alapú szabvány, ember által olvasható adatcserére. A JavaScript szkriptnyelvből alakult ki egyszerű adatstruktúrák és asszociatív tömbök reprezentálására. A JavaScripttel való kapcsolata ellenére nyelvfüggetlen, több nyelvhez is van értelmezője.”
(<https://g.co/kgs/ZRcZLz>)
- A JSON az a JavaScript Object Notation rövidítése.
- JSON nem adattovábbítást jelent, hanem-ahogy a neve is mondja-JavaScript objektumot.
- A json fájlok .json kiterjesztést kapnak.
- <https://jsonlint.com/>



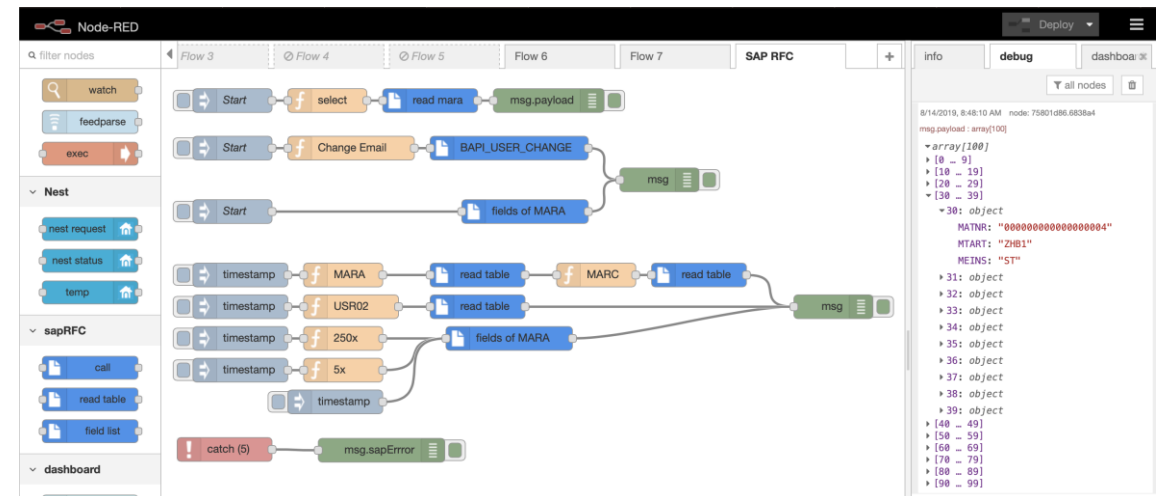
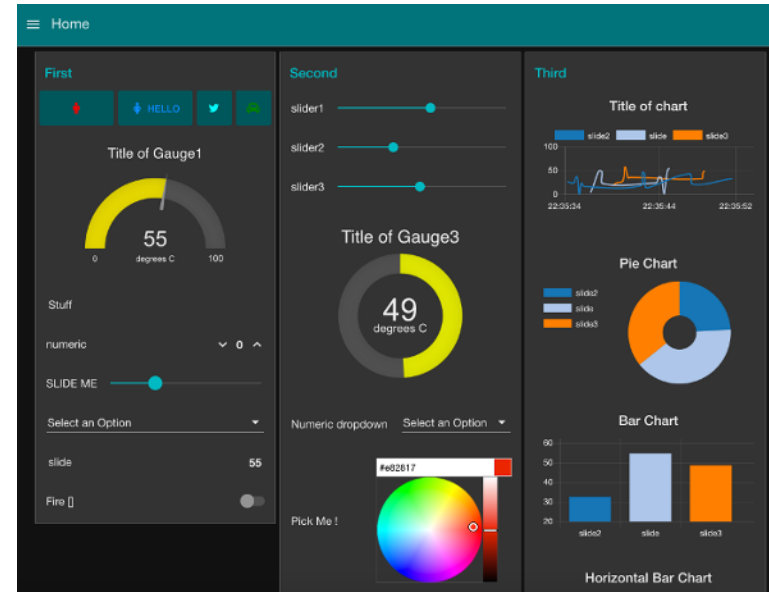
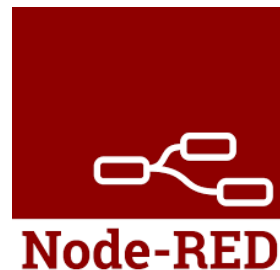
The screenshot shows the JSONLint website, titled "JSONLint - The JSON Validator". It features a text area with a JSON object:

```
{  "student": [    {      "id": 1,      "name": "Hallgató",      "lastname": "Helga"    },    {      "id": 2,      "name": "Diák",      "lastname": "Dotti"    }  ]}
```

 Below the text area are two buttons: "Validate JSON" and "Clear". Under the heading "Results", a green box displays the text "valid JSON".

Node-RED

- <https://nodered.org/>
- A Node-RED egy programozási eszköz hardvereszközök, API-k és online szolgáltatások új és érdekes módon történő összekapcsolására.
- Böngésző-alapú, grafikus szerkesztőt biztosít, amely megkönnyíti a folyamatok összekapcsolását.



Things

Name	Last cmd time	Last data time	Status	Created at ↑	...
Empty					

10 ▾ items per page

Refresh

+ Create new

→ ORING PaaS MQTT - Thing létrehozása

<https://console.paas.oringnet.cloud/thing/things>

Create a thing

Thing information

Device name *

ESP32 demo

Model Name *

KandoSzakkoli_IoT

Serial Number *

2021

Description

WiFi kapcsolat az ESP32 és az Oring IloT között. MQTT. NodeRed. Adatok tárolása a felhőben.

Visibility *

☒ Private

☐ Public

Thing Type *

☒ Device

☐ EoN

Coordinates

Longitude

latitude

Label

+ Add

Thing information

Data bucket

Configuration

Visibility *

Private

Public

Thing Type *

Device

EoN

Coordinates

Longitude

latitude

Label

+ Add

Data bucket

+ Add a bucket

Configuration

+ Add a config group

Cancel

Create

- Thing information
- Data bucket
- Configuration

Coordinates

Longitude

latitude

Label

+ Add

Data bucket

+ Add a bucket

Add a bucket

Identity

DHT11

CancelAdd

Add a shap

Identity *

temp

Alias

Homerseklet

Value type

Integer

Unit

°C

Transform function

Cancel

Add

Data bucket

+ Add a bucket

DHT11

DHT11

Delete the bucket

+ Add a shape

Shape ID	Data type	Alias	Unit	Transform function
			Empty	

Data bucket

+ Add a bucket

DHT11

DHT11

Delete the bucket

+ Add a shape


Shape ID	Data type	Alias	Unit	Transform function
temp	integer	Homerseklet	°C	
hum	integer	Para	%	

Data bucket





+ Add a bucket

DHT11

DHT11 

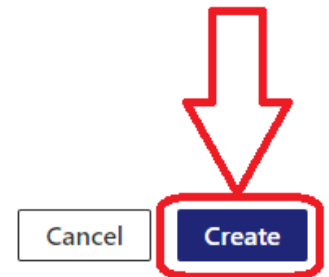
 Delete the bucket

+ Add a shape

Shape ID	Data type	Alias	Unit	Transform function
temp	integer	Homerseklet	°C	 
DHT11	integer	Para	%	 

Configuration

+ Add a config group



Back to thing list

ESP32 demo

Active

Last command: - Last data: -

Clone

Delete

Edit

BasicSparkplug

ID/SECRET

Identity

LAAMOEJel

Secret

ZkyfZnBy5Cffm4TP

Client ID

thing:LAAMOEJel

TOPIC

Command

\$thing/LAAMOEJel/\$cmd/\$downlink/

Downlink config

\$thing/LAAMOEJel/\$conf/\$expected/

Uplink config

\$thing/LAAMOEJel/\$conf/\$reported/

Data

\$thing/LAAMOEJel/\$data/

Information

Name	ESP32 demo
Serial number	2021
Model name	KandoSzakkoli_IoT
Description	WiFi kapcsolat az ESP32 és az Oring IoT között. MQTT. NodeRed. Adatok tárolása a felhőben.
Thing type	Device
Visibility	Private
Coordinates	
Created at	2021-10-26 19:24:14 +02:00

Label

Key	Value
	Empty

Applications

			Refresh	+ Create new
Name	Description	Created at		
MagiCity		5 months a...		
Illumination_meter		a year ago		
10 items per page		< >		

→ ORING PaaS MQTT - Alkalmazás létrehozása

Create an application

Information

Name *

ESP32 demo

Description

WiFi kapcsolat az ESP32 és az Oring IIoT között. MQTT, NodeRe...

Website

e.g. https://magicity.iiot.oringnet.cloud

Redirect URI *

http://localhost:3000

+ Add

Cancel

Create

←

Back to application list

ESP32 demo

🗑️

Delete

✎️

Edit

ID/SECRET

Identity

zL51K7ven

📄

Secret

Um-FYPGWxWKQCDvJQjqd.ZCEI~1Z5Fr.

📄

API KEY

API key

Generate

Information

Name	ESP32 demo
Description	WiFi kapcsolat az ESP32 és az Oring IloT között. MQTT. NodeRed. Adatok tárolása a felhőben.
Website	
Redirect URI	http://localhost:3000

← Back to application list

ESP32 demo



Delete



Edit

ID/SECRET

Identity

zL51K7ven

API KEY

API key

eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9.eyJjbGllbnRJZCI6In...

Secret

Um-FYPGWxWKQCDvJQjqd.ZCEI~1Z5Fr.

Revoke

Renew

Information

Name

ESP32 demo

Description

WiFi kapcsolat az ESP32 és az Oring IIoT között. MQTT. NodeRed. Adatok tárolása a felhőben.

Website

Redirect URI

http://localhost:3000

Node-RED

Flow 1 Flow 2

Q filter nodes

common

- inject
- debug
- complete
- catch
- status
- link in
- link out
- comment

function

- function
- switch
- change
- range
- template
- delay
- trigger
- exec

→ ORING PaaS MQTT - Node-RED flow

info

Search flows

- Flows
 - Flow 1
 - Flow 2**
- Subflows
- Global Configuration Nodes

Flow 2

Flow "5ec05e7e.e426a"

Dashboard

Thing

Command

Flow

Application

IIoT Galaxy

Node-RED

Flow 1

Flow 2

email MTA

email

email

advanced

bigtimer

ORing PaaS

oring paas thing

oring paas dashboard chart adapter

oring paas dashboard gauge adapter

redPic modules

ntp time

dashboard

button

Deploy

info

Search flows

Flows

Flow 1

Flow 2

Subflows

Global Configuration Nodes

Flow 2

Flow

"5ec05e7e.e426a"

Node-RED

filter nodes

Flow 1 Flow 2

email MTA

email

email

advanced

bigtimer

ORing PaaS

oring paas thing

oring paas dashboard chart adapter

oring paas dashboard gauge adapter

redPic modules

ntp time

dashboard

button

Edit oring-paas-thing node

Delete Cancel Done

Properties

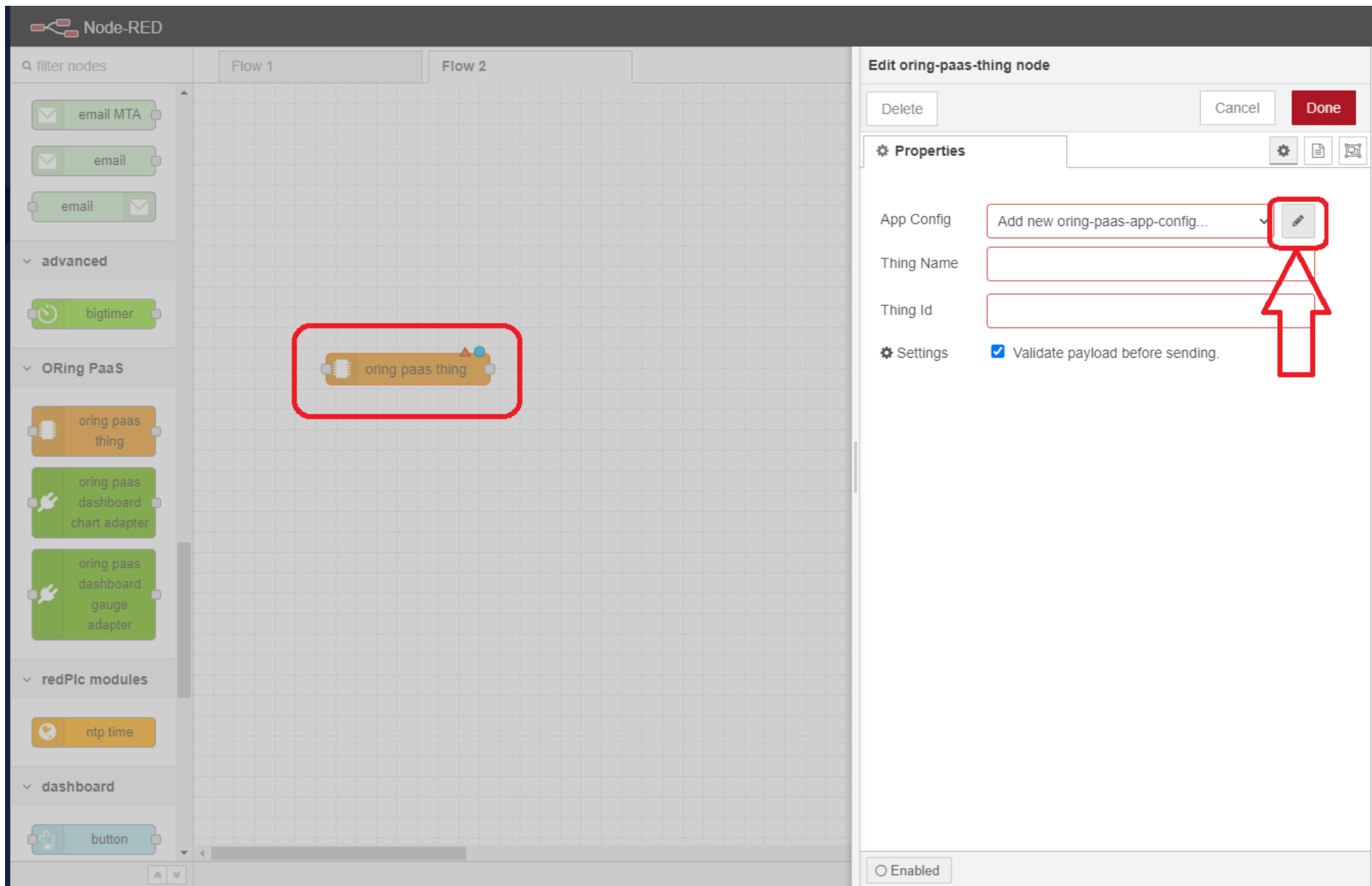
App Config Add new oring-paas-app-config...

Thing Name

Thing Id

Settings ☒ Validate payload before sending.

Enabled



ESP32 demo

ID/SECRET

Identity

zL51K7ven

Secret

Um-FYPGWxWKQCDvJQjqd.ZCEI~1Z5Fr.

API KEY

API key

eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9.eyJjbGllbnRJZCI6Im...

Revoke

Renew

Delete

Edit

Node-RED

filter nodes

watch

mysql

tail

social

email MTA

email

email

advanced

bigtimer

ORing PaaS

oring paas thing

oring paas dashboard chart adapter

oring paas dashboard gauge adapter

redPic modules

Flow 1

Flow 2

oring paas thing

Edit oring-paas-thing node > Add new oring-paas-app-config config node

Cancel

Add

Properties

App Name

ESP32_NodeRED_demo

App Identity

zL51K7ven

App Secret

.....

API Key

.....

Enabled

0 nodes use this config

On all flows

info

Search flows

Flows

Flow 1

Flow 2

Subflows

Global Configuration Nodes

oring-paas-app-config: 5159891d.9f28e8

Node

"5159891d.9f28e8"

Type

oring-paas-app-config

show more

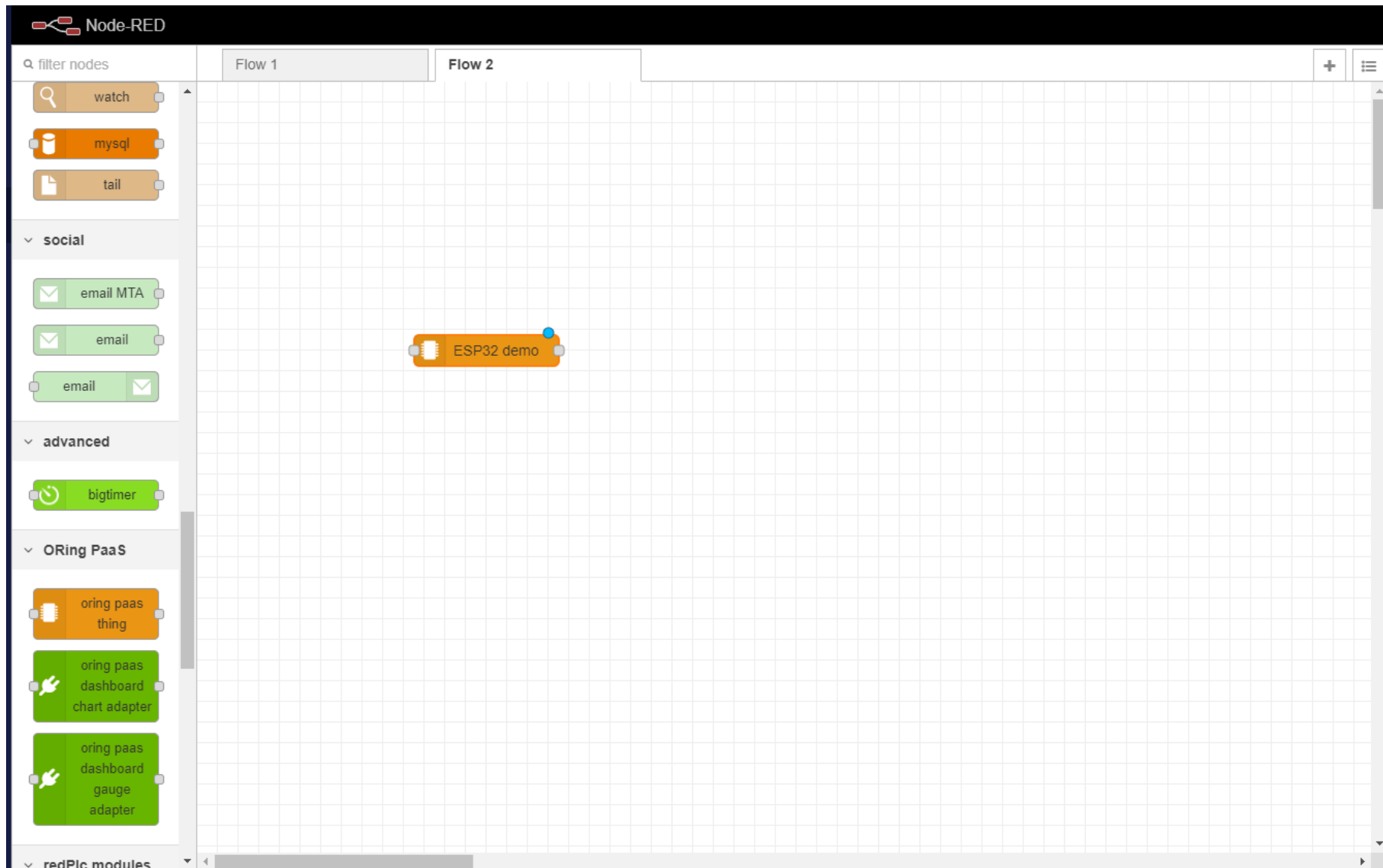
Deploy

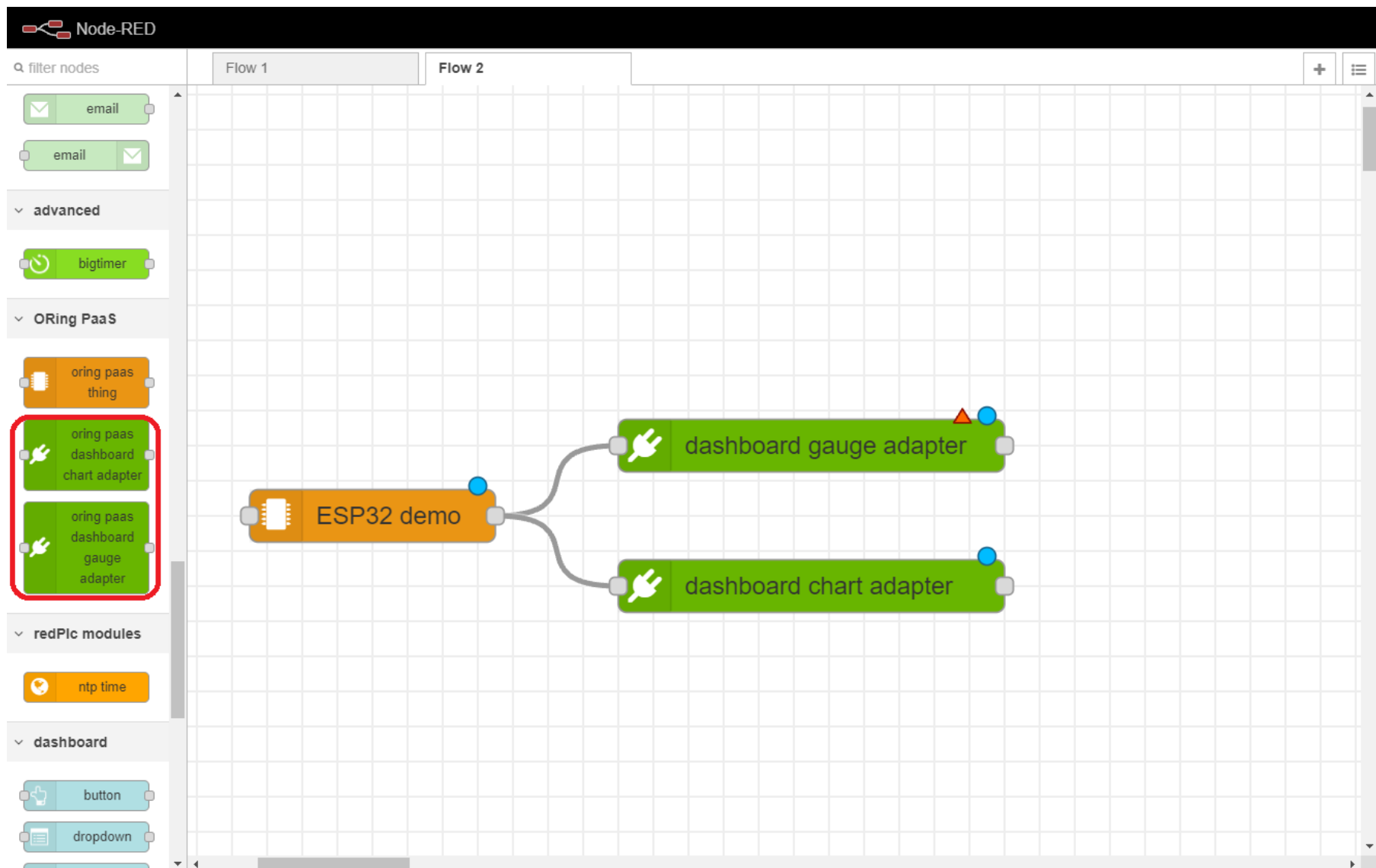
• ESP32 demo Active

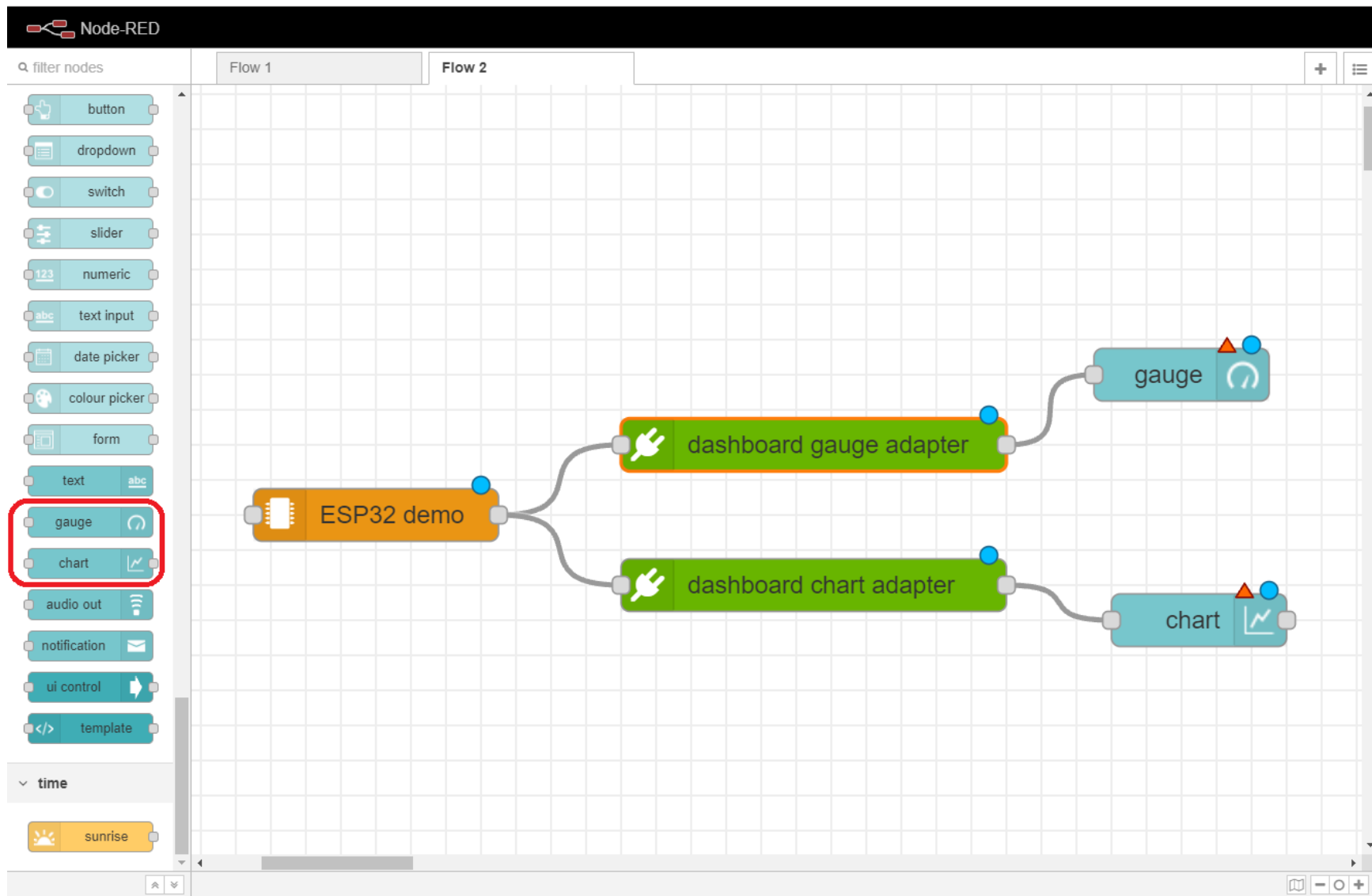
Last command: - Last data: -

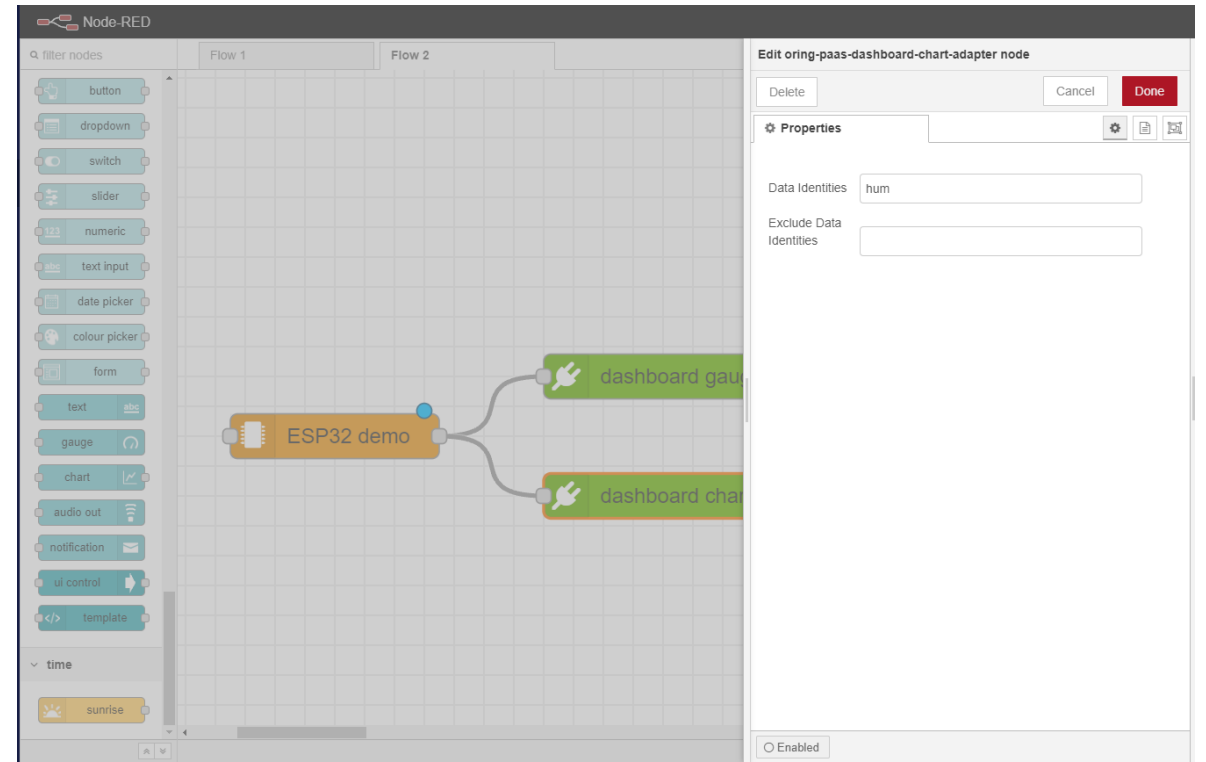
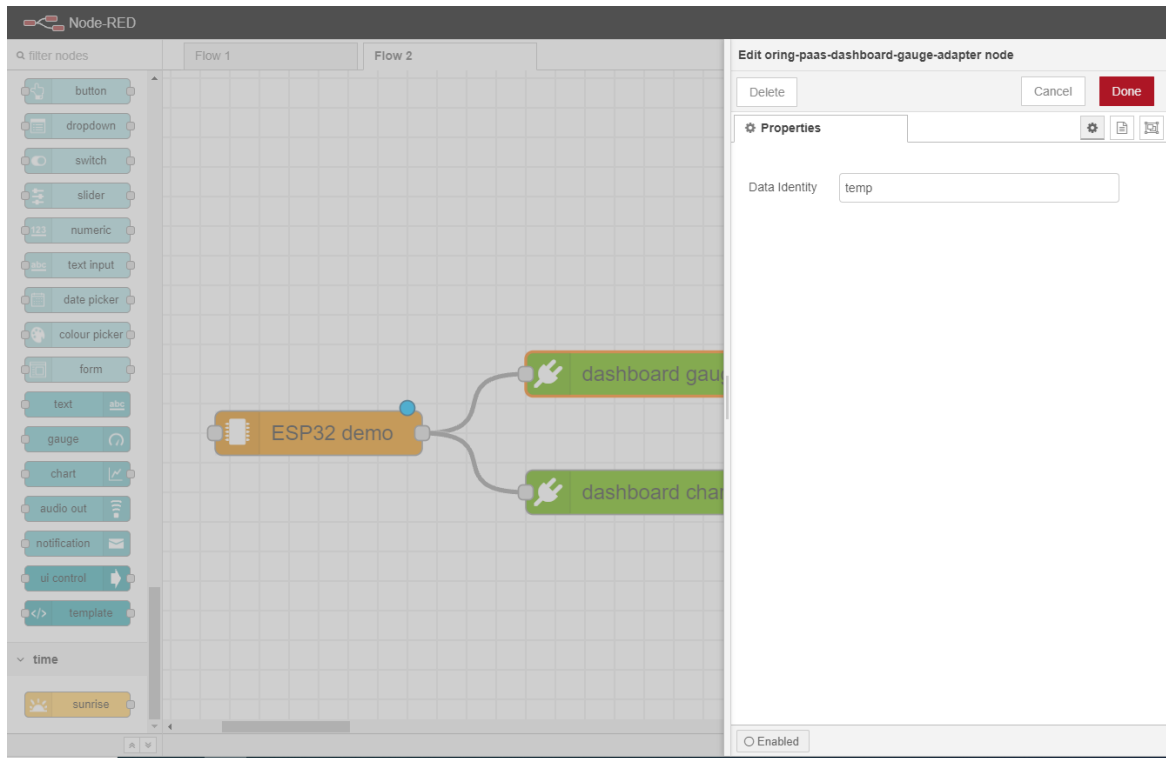
Basic	Sparkplug
ID/SECRET	
Identity	<input type="text" value="LAAMOEJel"/>
Secret	<input type="text" value="ZkyfZnBySCffm4TP"/>
Client ID	<input type="text" value="thing:LAAMOEJel"/>

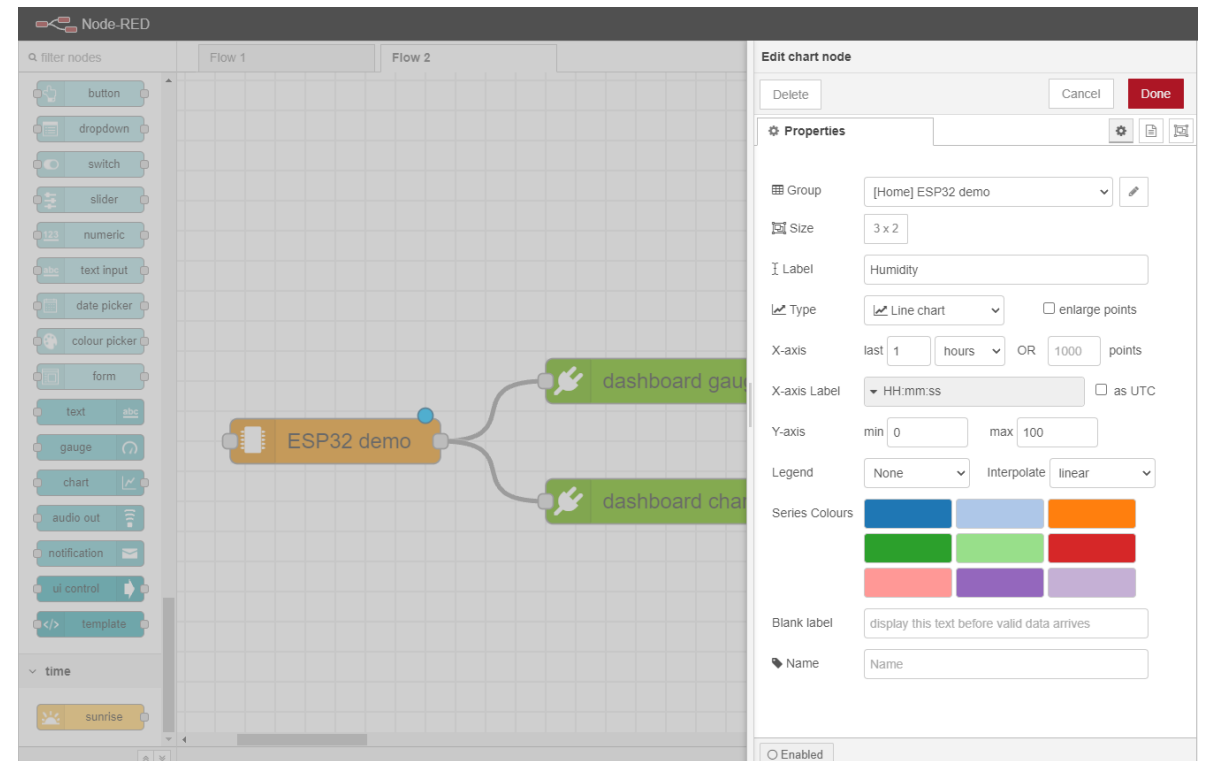
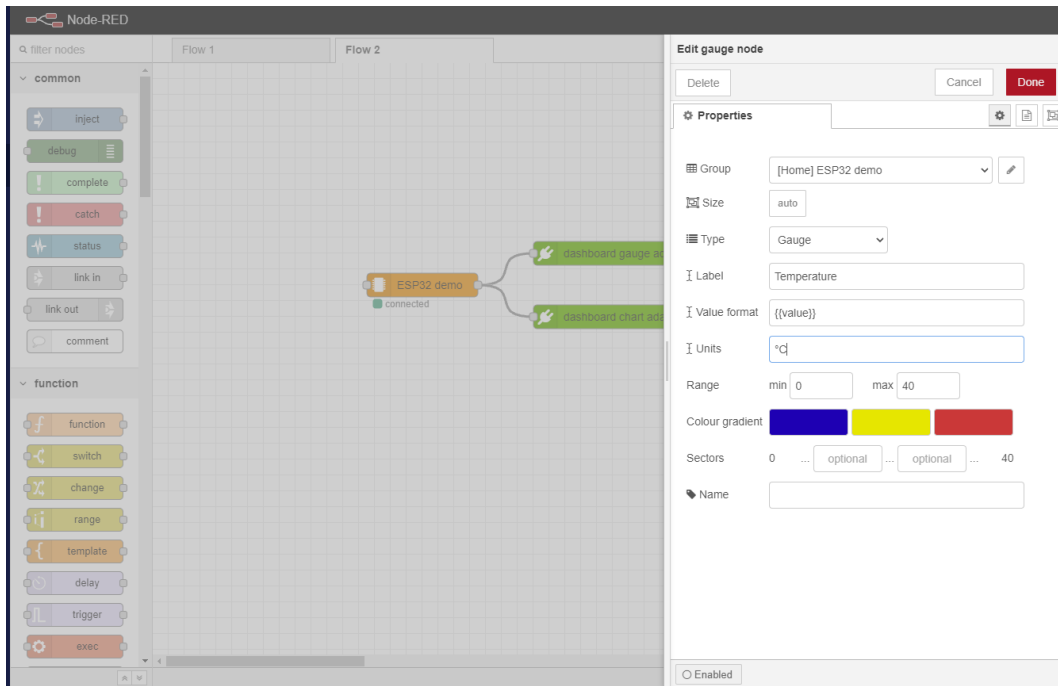
The screenshot shows the Node-RED web interface. On the left, a sidebar contains various node categories: 'watch', 'mysql', 'tail', 'social' (with 'email MTA', 'email', 'email'), 'advanced' (with 'bigtimer'), and 'ORing PaaS' (with 'oring paas thing', 'oring paas dashboard chart adapter', and 'oring paas dashboard gauge adapter'). The main workspace displays a flow with a single 'oring paas thing' node. On the right, the 'Edit oring-paas-thing node' configuration panel is open. It features a 'Delete' button, 'Cancel', and a 'Done' button (highlighted with a red box). Below these are tabs for 'Properties' and 'Settings'. The 'Properties' tab shows: 'App Config' set to 'ESP32_NodeRED_demo', 'Thing Name' set to 'ESP32 demo', and 'Thing Id' set to 'LAAMOEJel'. The 'Settings' tab has a checked option 'Validate payload before sending'. At the bottom of the configuration panel, there is an 'Enabled' toggle. On the far right, an 'info' sidebar shows the flow structure and details for the selected 'oring paas thing' node, including its ID 'bd8bb142.0f69a' and type 'oring-paas-thing'.

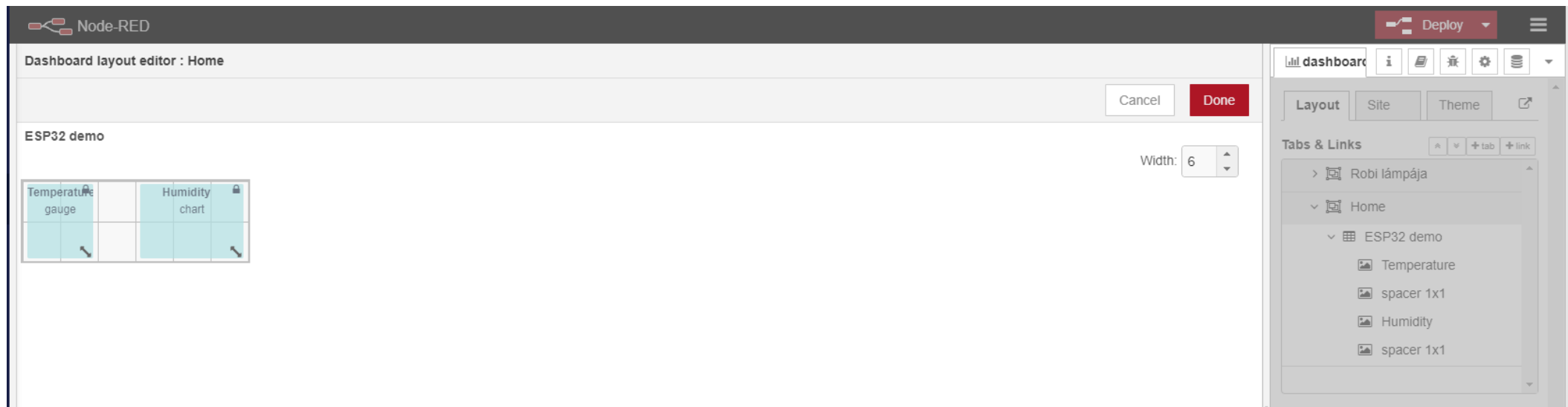
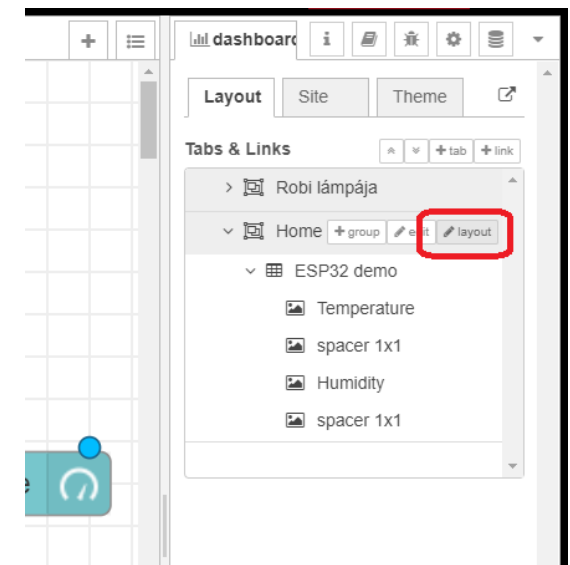
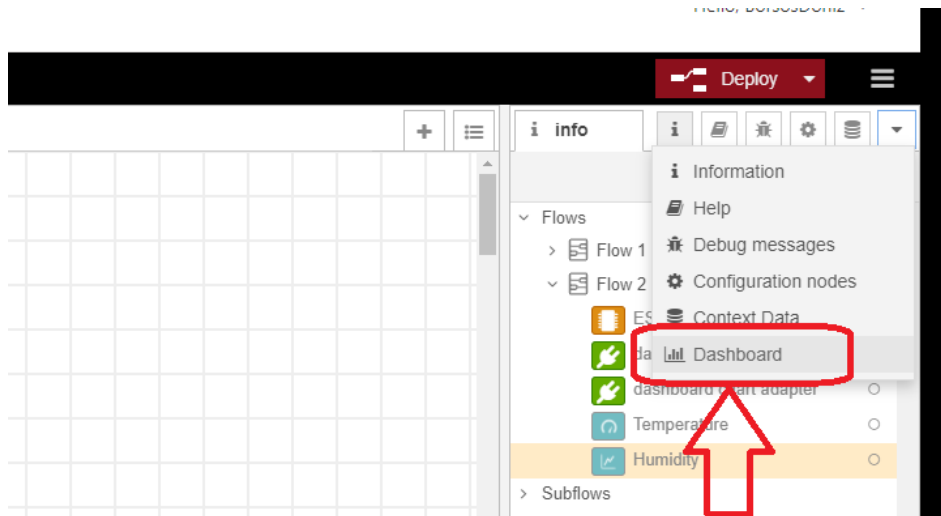




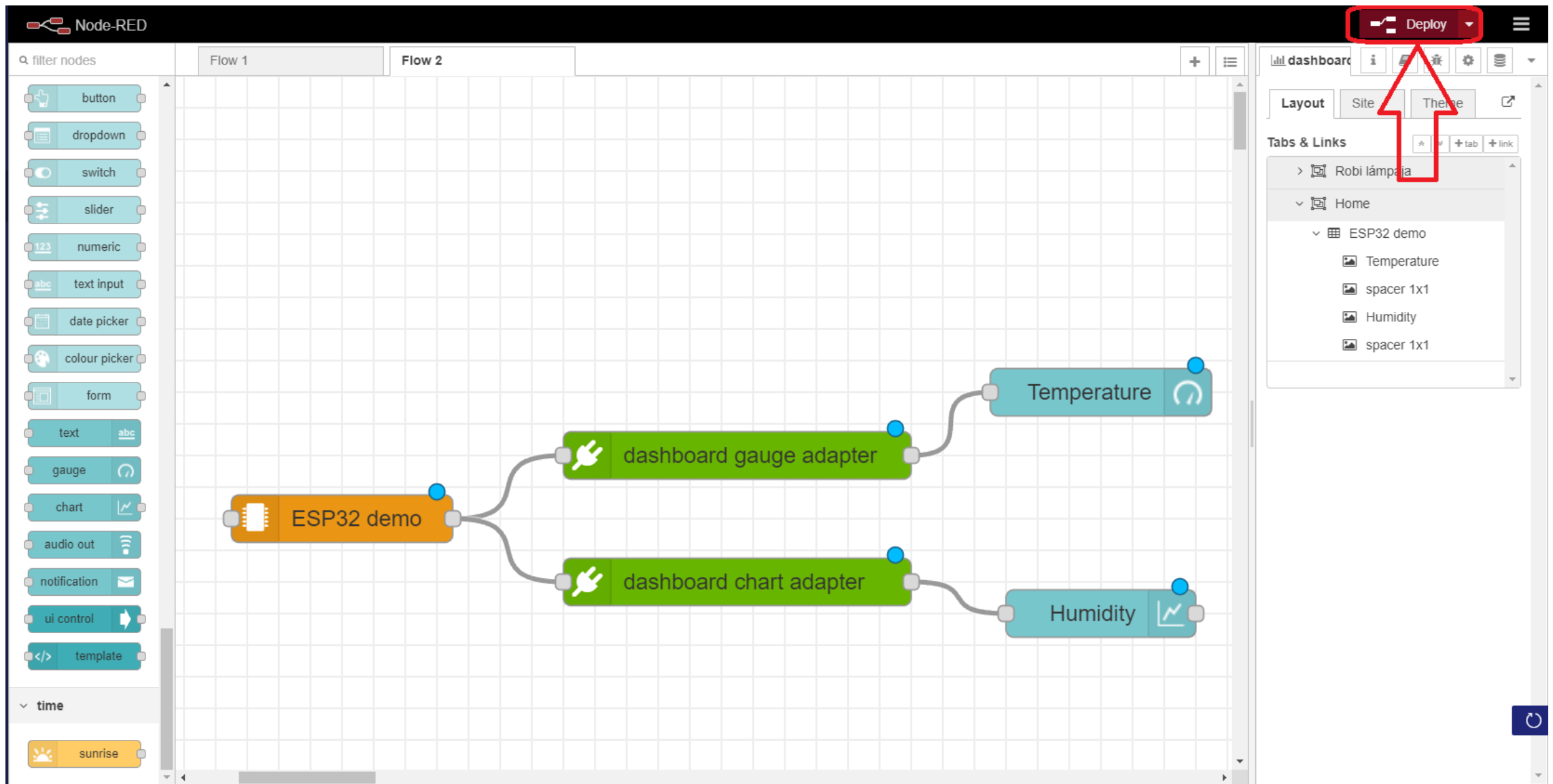






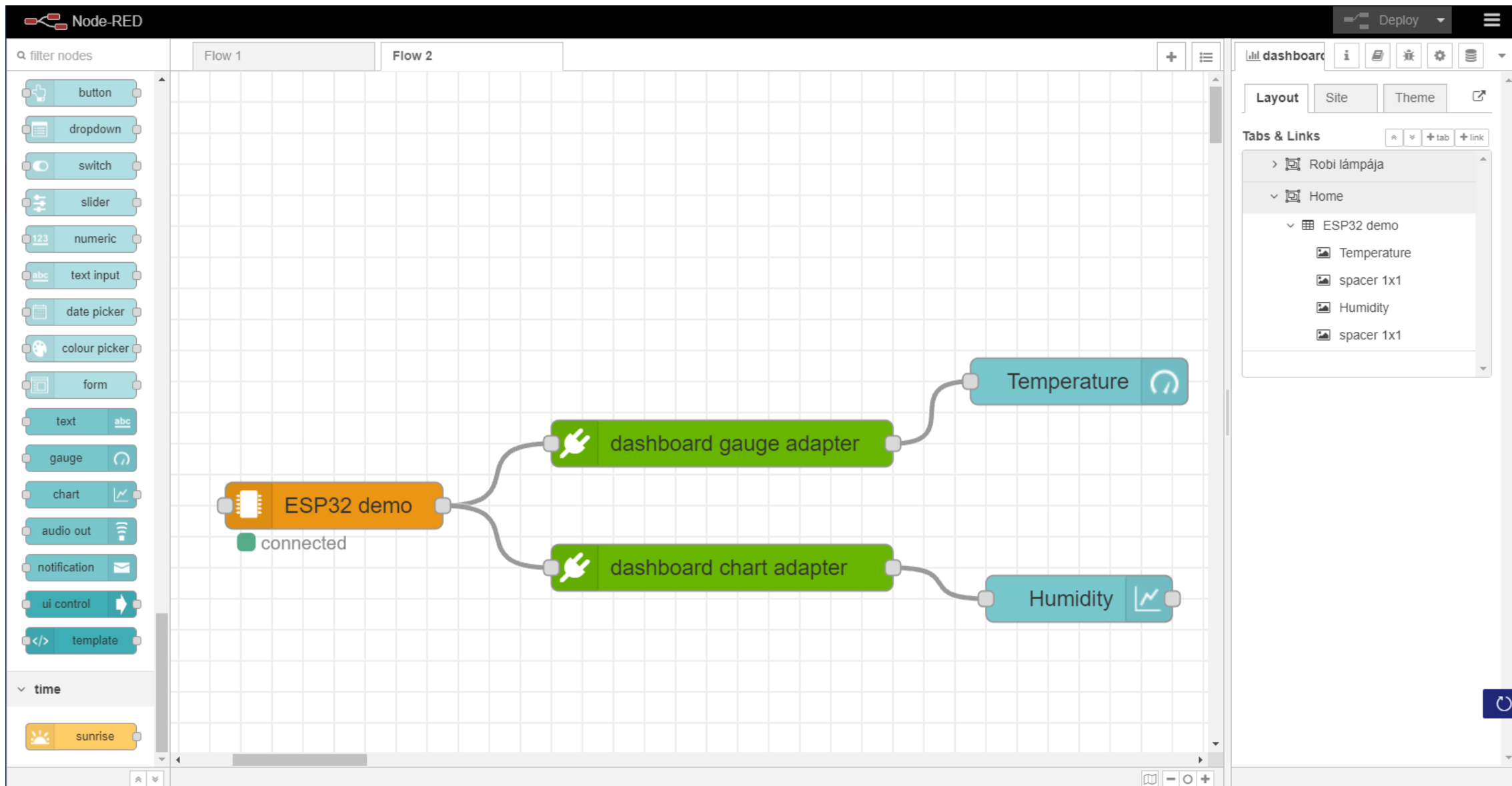


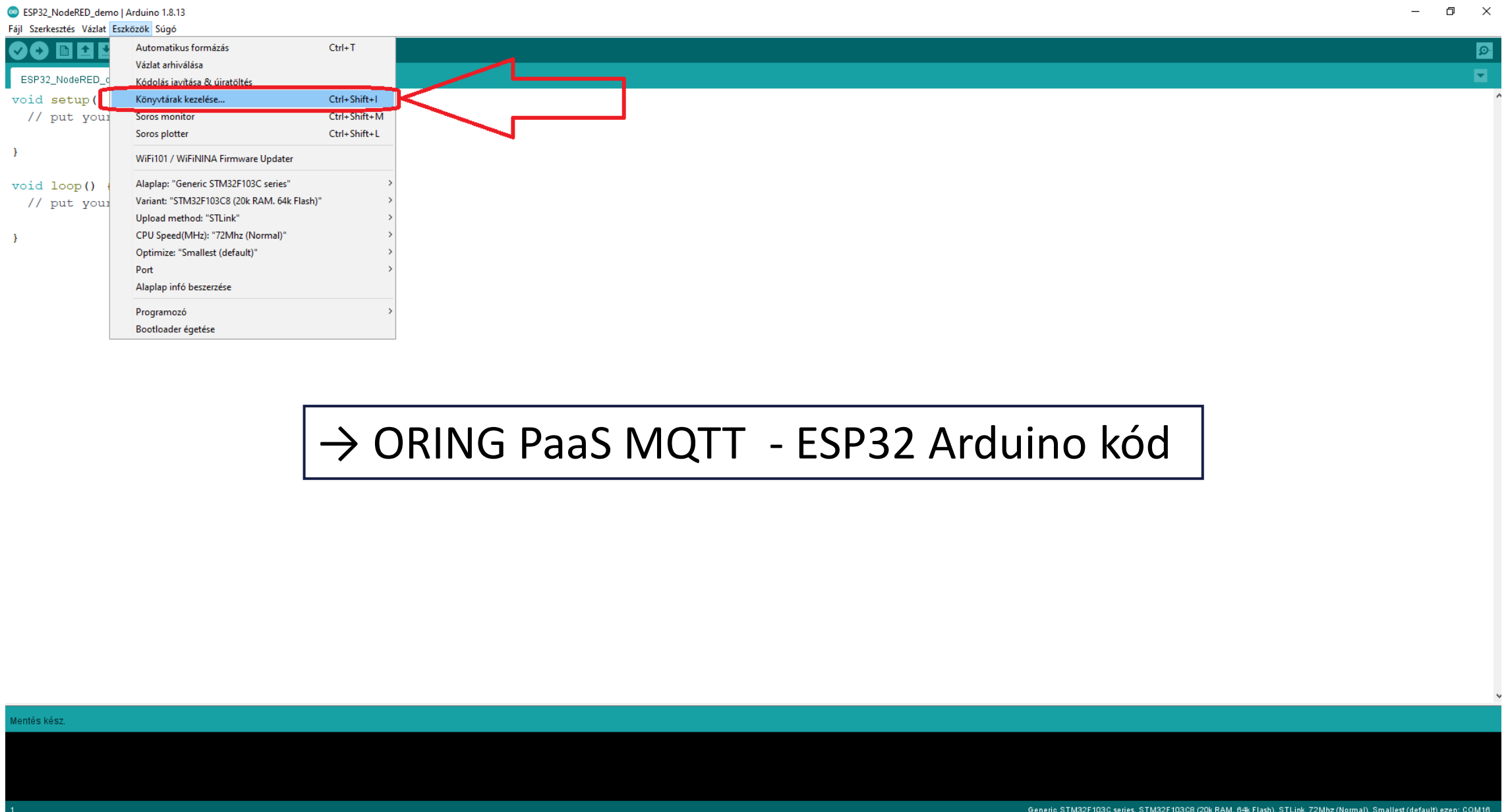
Node-RED interface showing a flow for an ESP32 demo. The flow starts with an "ESP32 demo" node, which branches into two parallel paths. The top path uses a "dashboard gauge adapter" node connected to a "Temperature" gauge. The bottom path uses a "dashboard chart adapter" node connected to a "Humidity" chart. The right sidebar shows the "dashboard" configuration, including "Layout" (Site, Theme) and "Tabs & Links" (Robi lámpája, Home, ESP32 demo, Temperature, spacer 1x1, Humidity, spacer 1x1). A red box highlights the "Deploy" button in the top right corner, with a red arrow pointing to it.

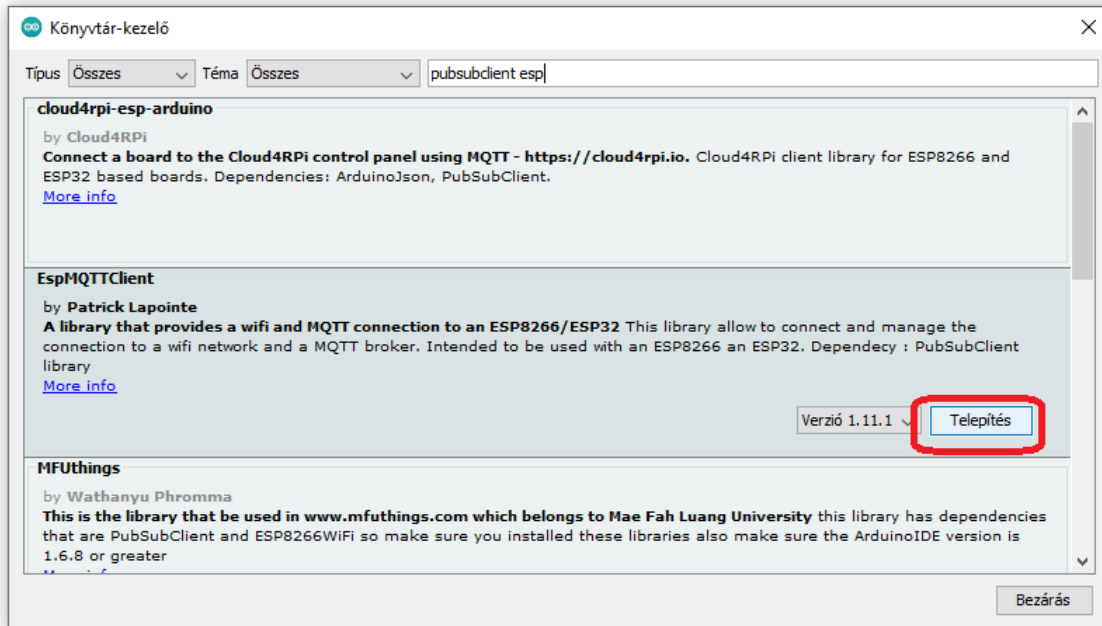


Node-RED interface showing a flow for an ESP32 demo. The flow includes an ESP32 demo node connected to two dashboard adapter nodes: dashboard gauge adapter and dashboard chart adapter. The dashboard gauge adapter is connected to a Temperature gauge node, and the dashboard chart adapter is connected to a Humidity chart node.

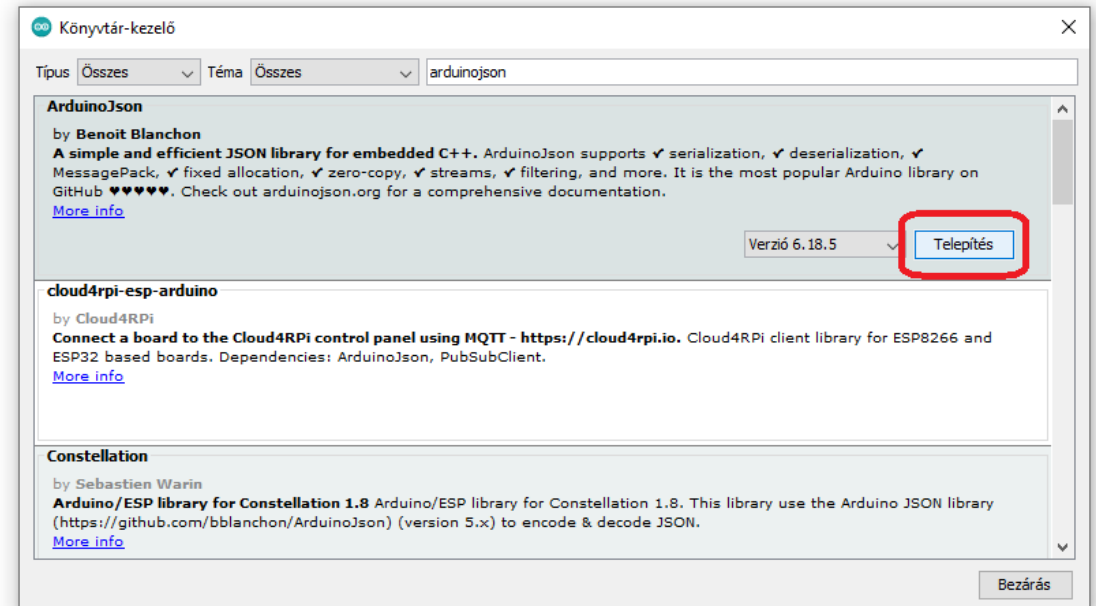
The interface also displays a sidebar with various input and output nodes, and a right-hand panel showing the dashboard configuration, including tabs and links.







➤ Arduino könyvtárak kezelése



Emlékeztető: Mintaprojekt – DHT11



	DHT11	DHT22
Operating Voltage	3 to 5V	3 to 5V
Max Operating Current	2.5mA max	2.5mA max
Humidity Range	20-80% / 5%	0-100% / 2-5%
Temperature Range	0-50°C / ± 2°C	-40 to 80°C / ± 0.5°C
Sampling Rate	1 Hz (reading every second)	0.5 Hz (reading every 2 seconds)
Body size	15.5mm x 12mm x 5.5mm	15.1mm x 25mm x 7.7mm
Advantage	Ultra low cost	More Accurate

Example 1: 40 data is received:

0011 0101 0000 0000 0001 1000 0000 0000 0100 1101
 High humidity 8 Low humidity 8 High temp. 8 Low temp. 8 Parity bit

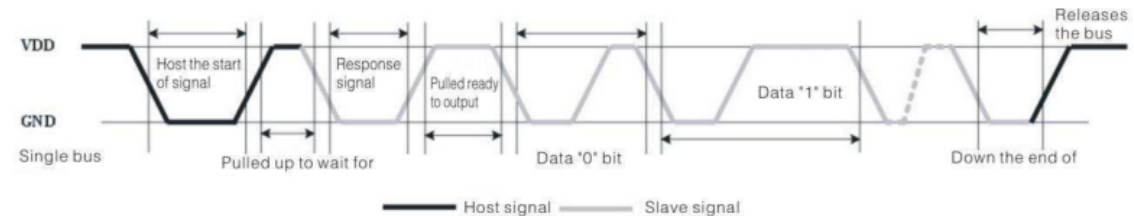
Calculate:

$0011\ 0101 + 0000\ 0000 + 0001\ 1000 + 0000\ 0000 = 0100\ 1101$

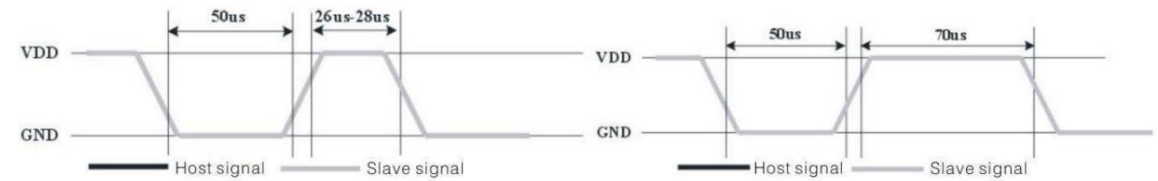
Received data is correct:

Humidity: $0011\ 0101 = 35H = 53\%RH$

Temperature: $0001\ 1000 = 18H = 24^{\circ}C$



Data Timing Diagram



Bit data "0" bit format

Bit data "1" bit format

https://www.hestore.hu/prod_getfile.php?id=12543

Emlékeztető: Mintaprojekt – DHT11

```
#include <Arduino.h>
#include <WiFi.h>
#include <WiFiClient.h>
#include <WiFiAP.h>
#include <WebServer.h>
#include "DHTesp.h"

DHTesp DhtSensor1;
float temp = 0;
float hum = 0;

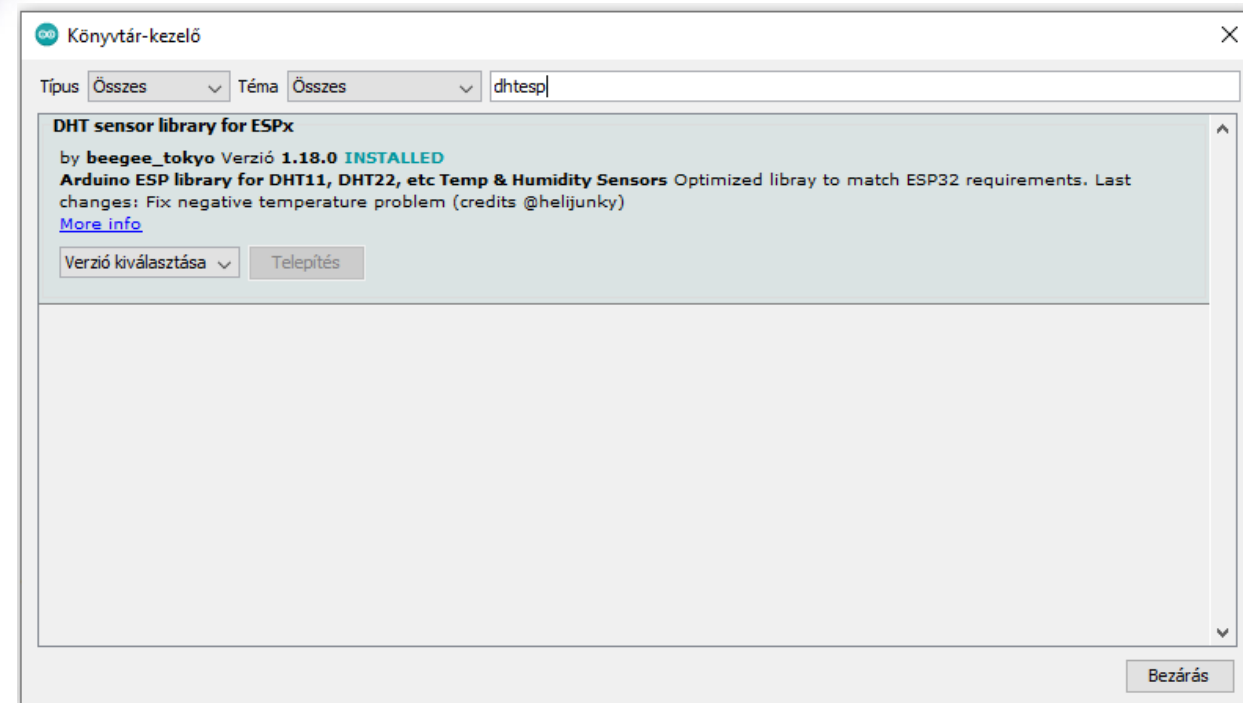
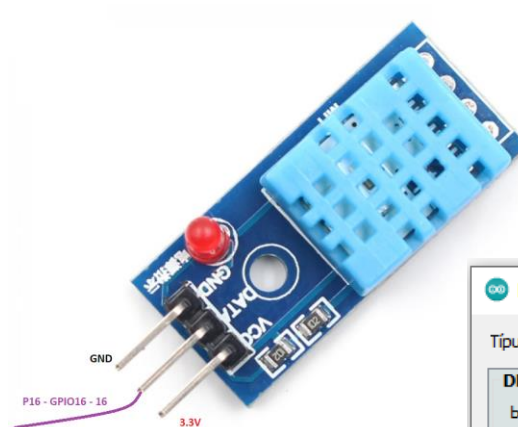
void setup() {
  DhtSensor1.setup(16, DHTesp::DHT11);
  Serial.begin(9600);
}

void loop() {

  temp = DhtSensor1.getTemperature();
  hum = DhtSensor1.getHumidity();

  Serial.print("Temperature = ");
  Serial.println(temp);
  Serial.print("Humidity = ");
  Serial.println(hum);

  delay(2000);
}
```



```
#include <Arduino.h>
#include <WiFi.h>
#include <WiFiClient.h>
#include <WiFiAP.h>
#include <WebServer.h>
#include <PubSubClient.h>
#include <ArduinoJson.h>
#include "DHTesp.h"
```

```
DHTesp DhtSensor1;
```

```
const char* ssid = "XXXXXXXXXX";
const char* password = "XXXXXXXXXX";
const char* mqttServer = "mqtt.paas.oringnet.cloud";
const int mqttPort = 1883;
const char* mqttUser = "LAAMOEJel";
const char* mqttPassword = "ZkyfZnBy5Cffm4TP";
```

```
int j=0;
char paychar[40];
```

```
StaticJsonBuffer<300> JSONbuffer;
JsonObject& JSONencoder = JSONbuffer.createObject();
char JSONmessageBuffer[100];
```

```
WiFiClient espClient;
PubSubClient client(espClient);
```

• **ESP32 demo** Active

Last command: - Last data: -

Basic Sparkplug

ID/SECRET

Identity	LAAMOEJel	📄
Secret	ZkyfZnBy5Cffm4TP	📄
Client ID	thing:LAAMOEJel	📄

```
void setup() {
  // put your setup code here, to run once:
  DhtSensor1.setup(16, DHTesp::DHT11);

  Serial.begin(115200);
  Serial.println();

  WiFi.begin(ssid, password);

  while (WiFi.status() != WL_CONNECTED) {
    delay(500);
    Serial.println("Csatlakozas WiFi halozathoz");
  }

  Serial.println("WiFi csatlakozas sikeres!");

  client.setServer(mqttServer, mqttPort);
  client.setCallback(callback);

  while (!client.connected()) {
    Serial.println("MQTT csatlakozas...");

    if (client.connect("thing:LAAMOEJel", mqttUser, mqttPassword)) {

      Serial.println("MQTT csatlakozva!");

    } else {

      Serial.print("MQTT csatlakozas sikertelen!");
      Serial.println(client.state());
      delay(1000);

    }
  }
}
```

```

}

void loop() {
  // put your main code here, to run repeatedly:
  int humid = DhtSensor1.getHumidity();

  int temp = DhtSensor1.getTemperature();

  if(j == 100)
  {
    JSONEncoder["id"] = "hum";
    JSONEncoder["value"] = humid;

    JSONEncoder.printTo(JSONMessageBuffer, sizeof(JSONMessageBuffer));
    Serial.println("Uzenet kuldes - MQTT topic..");
    Serial.println(JSONMessageBuffer);

    if (client.publish("$thing/LAAMOEJel/$data/DHT11", JSONMessageBuffer) == true) {
      Serial.println("Sikeres kuldes!");
    } else {
      Serial.println("Kuldes sikertelen!");
    }
  }

  JSONEncoder["id"] = "temp";
  JSONEncoder["value"] = temp;

  JSONEncoder.printTo(JSONMessageBuffer, sizeof(JSONMessageBuffer));
  Serial.println("Uzenet kuldes - MQTT topic..");
  Serial.println(JSONMessageBuffer);

  if (client.publish("$thing/LAAMOEJel/$data/DHT11", JSONMessageBuffer) == true) {
    Serial.println("Sikeres kuldes!");
  } else {
    Serial.println("Kuldes sikertelen!");
  }
}

j=0;
}

else {
  client.loop();
}
j++;
delay(100);
}
}

```

COM7

Küldés

Csatlakozas WiFi halozathoz
 WiFi csatlakozas sikeres!
 MQTT csatlakozas...
 MQTT csatlakozva!
 Uzenet kuldes - MQTT topic..
 {"id":"hum","value":46}
 Sikeres kuldes!
 Uzenet kuldes - MQTT topic..
 {"id":"temp","value":21}
 Sikeres kuldes!
 Uzenet kuldes - MQTT topic..
 {"id":"hum","value":46}
 Sikeres kuldes!
 Uzenet kuldes - MQTT topic..
 {"id":"temp","value":21}
 Sikeres kuldes!

☒ Automatikus görgetés
 ☐ Időbélyegző mutatása

Új sor

115200 baud

Kimenet törlése

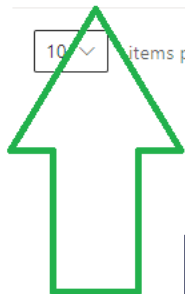
Things

Refresh [+ Create new](#)

Name	Last cmd time	Last data time	Status	Created at ↑	...
<input type="radio"/> <input checked="" type="radio"/> ESP32 demo			Active	a day ago	...

10 items per page

< >



→ ORING PaaS MQTT - Adatok megjelenítése

InformationConfigurationData

Hello, BorsosDoniz

← Back to thing list

Data

Edit buckets

BucketDHT11

OrderFrom new to old

Shapetemp

TimeBeginEnd

Search

RefreshDownload

Time	temp
2021-10-27 18:23:4 +02:00	21
2021-10-27 18:22:52 +02:00	21
2021-10-27 18:22:40 +02:00	21
2021-10-27 18:22:27 +02:00	21
2021-10-27 18:22:15 +02:00	21
2021-10-27 18:22:3 +02:00	21
2021-10-27 18:21:51 +02:00	21
2021-10-27 18:21:38 +02:00	21
2021-10-27 18:21:26 +02:00	21
2021-10-27 18:21:14 +02:00	21

10

 items per page

<>

InformationConfigurationData

Hello, BorsosDoniz

← Back to thing list

Data

Edit buckets

BucketDHT11

OrderFrom new to old

Shapehum

TimeBeginEnd

Search

RefreshDownload

Time	hum
2021-10-27 18:24:42 +02:00	60
2021-10-27 18:24:29 +02:00	93
2021-10-27 18:24:17 +02:00	95
2021-10-27 18:24:5 +02:00	78
2021-10-27 18:23:53 +02:00	47
2021-10-27 18:23:40 +02:00	47
2021-10-27 18:23:28 +02:00	48
2021-10-27 18:23:16 +02:00	47
2021-10-27 18:23:4 +02:00	47
2021-10-27 18:22:51 +02:00	47

10

 items per page

<

>

Node-RED

Flow 1Flow 2

filter nodes

common

inject

debug

complete

catch

status

link in

link out

comment

function

function

switch

change

range

template

delay

trigger

exec

ESP32 demo

connected

dashboard gauge adapter

dashboard chart adapter

Temperature

Humidity

info

Search flows

Flows

Flow 1

Flow 2

Subflows

Global Configuration Nodes

Temperature

Node"383b4620.7f8cba"

Typeui_gauge

show more

Deploy

https://ef66528a20-obudauniversity.node-red.paas.oringnet.cloud/#

Node-RED

Successfully deployed

Deploy

filter nodes

Flow 1

Flow 2

common

inject

debug

complete

catch

status

link in

link out

comment

function

function

switch

change

range

template

delay

trigger

exec

ESP32 demo

connected

dashboard gauge adapter

dashboard chart adapter

Temperature

Humidity

info

Search flows

Flows

Flow 1

Flow 2

Subflows

Global Configuration Nodes

Temperature

Node

"383b4620.7f8cba"

Type

ui_gauge

show more

Node-RED

filter nodes

Flow 1

Flow 2

common

inject

debug

complete

catch

status

link in

link out

comment

function

function

switch

change

range

template

delay

trigger

exec

ESP32 demo

connected

dashboard gauge adapter

dashboard chart adapter

Temperature

Humidity

dashboard

Layout

Site

Theme

⌵

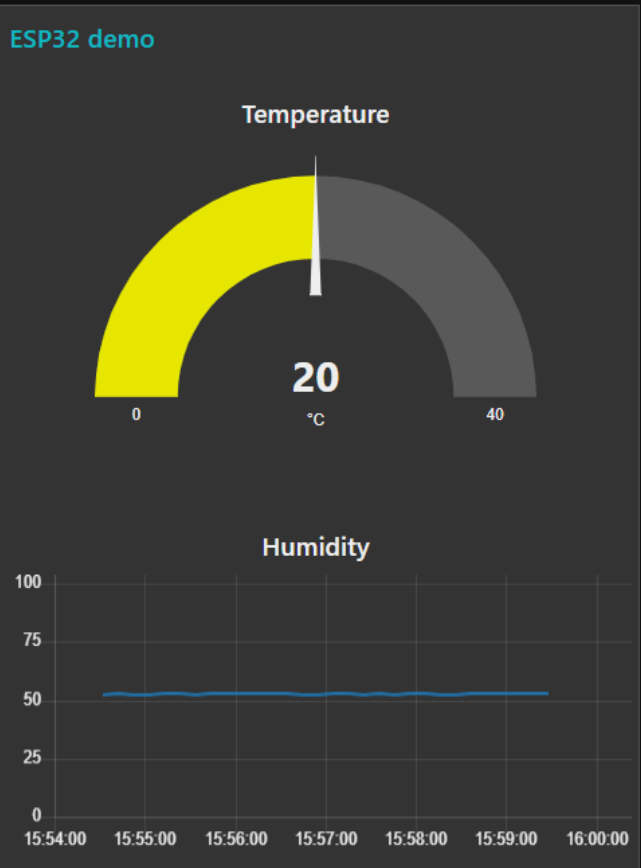
Tabs & Links

Robi lámpája

Adatok

Home

ESP32 demo



Q&A



MINISZTERELNÖKSÉG

Köszönöm a figyelmet!



MINISZTERELNÖKSÉG