UNIVERSITI SAINS ISLAM MALAYSIA
جَامِعَة العُلُوم الإِسْلَامِيَة المَالِيزِيَة
ISLAMIC SCIENCE UNIVERSITY OF MALAYSIA

AULAD CAMP + STEM

Jom Jadi Jurutera!

14 - 15 Disember 2022

Berilmu ▪ Berdisiplin ▪ Bertakwa / *Knowledgeable ▪ Disciplined ▪ Devout*

Universiti Sains Islam Malaysia, Bandar Baru Nilai, 71800, Nilai, Negeri Sembilan, Malaysia

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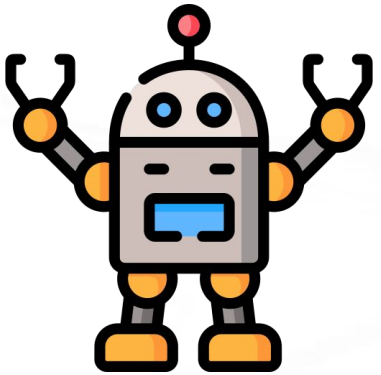
AULAD CAMP + STEM

Jom Jadi Jurutera!

Rabu (14 Disember)	Aktiviti
8.00 pagi	Taklimat & Pengenalan
9.00 **pagi**	MyIoT
1.00 ptg	Rehat
2.00 ptg	MyRobotic
5.00 ptg	Bersurai

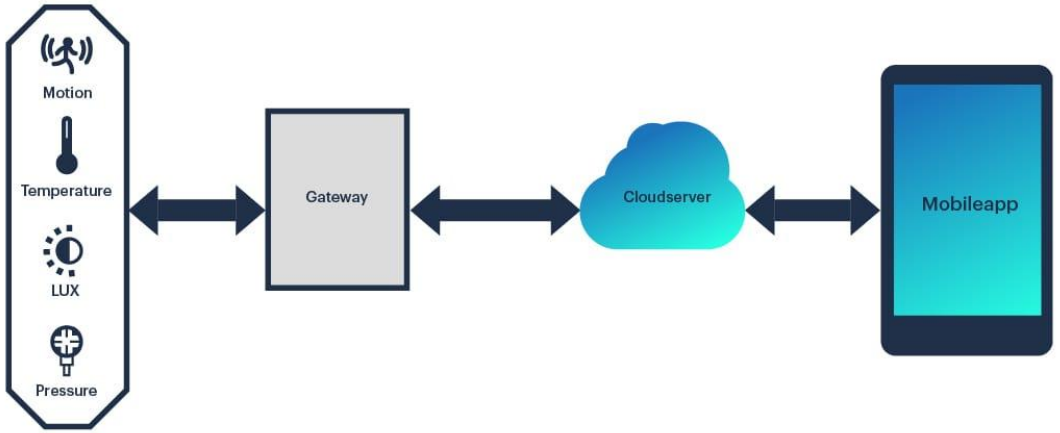


Khamis (15 Disember)	Aktiviti
8.00 pagi	Latihan Dalam Kumpulan
9.00 **pagi**	MySolar
1.00 ptg	Rehat
2.00 ptg	Persembahan / Pembentangan
4.00 ptg	Penutup & Sijil
5.00 ptg	Bersurai

Introduction of Internet of Things (IoT)

What is IoT?

The Internet of Things (IoT) describes the network of physical objects—“things”—that are embedded with sensors, software, and other technologies for the purpose of connecting and exchanging data with other devices and systems over the internet[1].



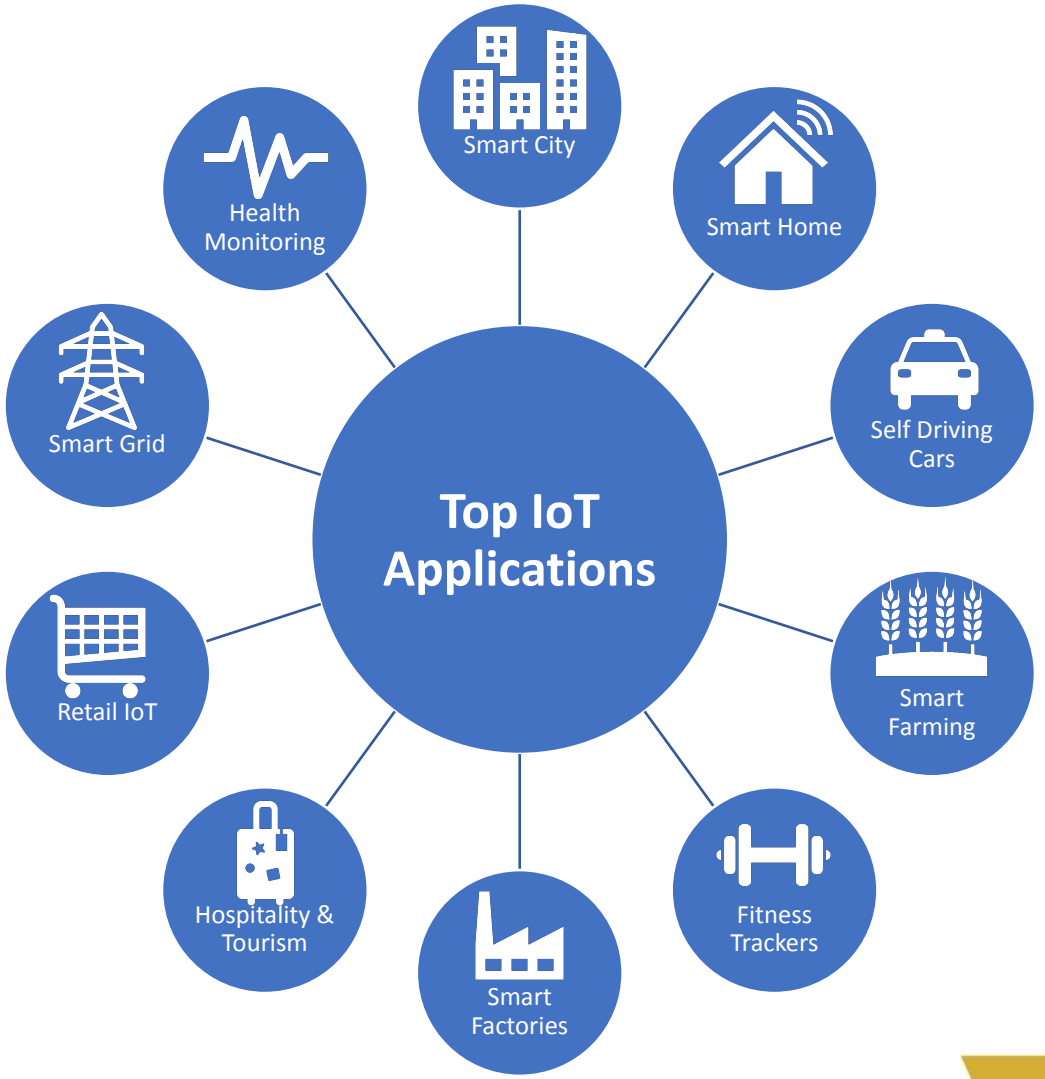
[1] “What is the internet of things (IOT)?,” *What Is the Internet of Things (IoT)? | Oracle Malaysia*. [Online]. Available: https://www.oracle.com/my/internet-of-things/what-is-iot/. [Accessed: 10-Dec-2022].

Why IoT is important?

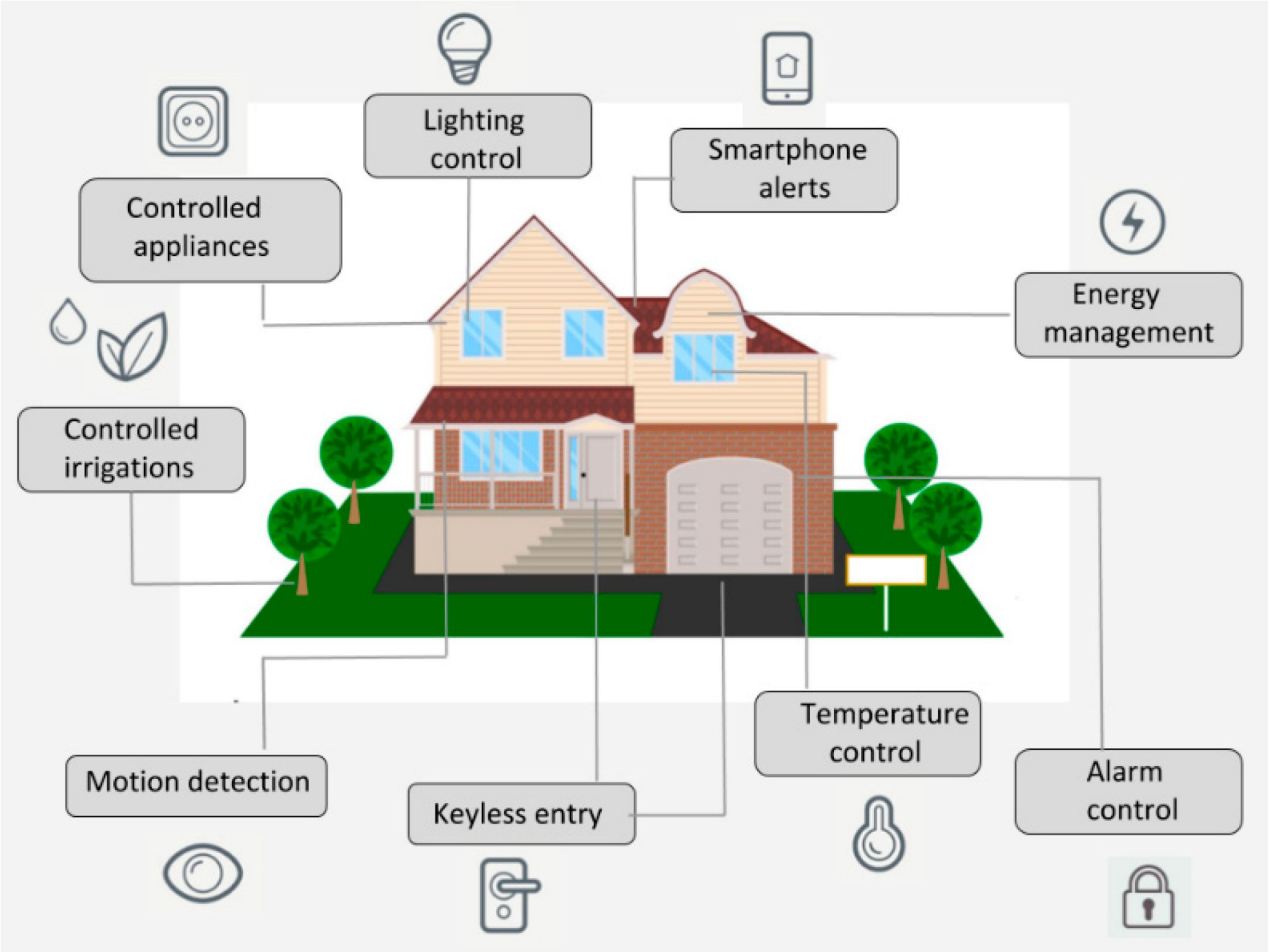
- Internet of Things help people live and work smarter, as well as gain complete control over their lives [2].

[2] Gillis, Alexander (2021). "What is internet of things (IoT)?". IOT Agenda. Retrieved 17 August 2021.

What is the application of IoT?

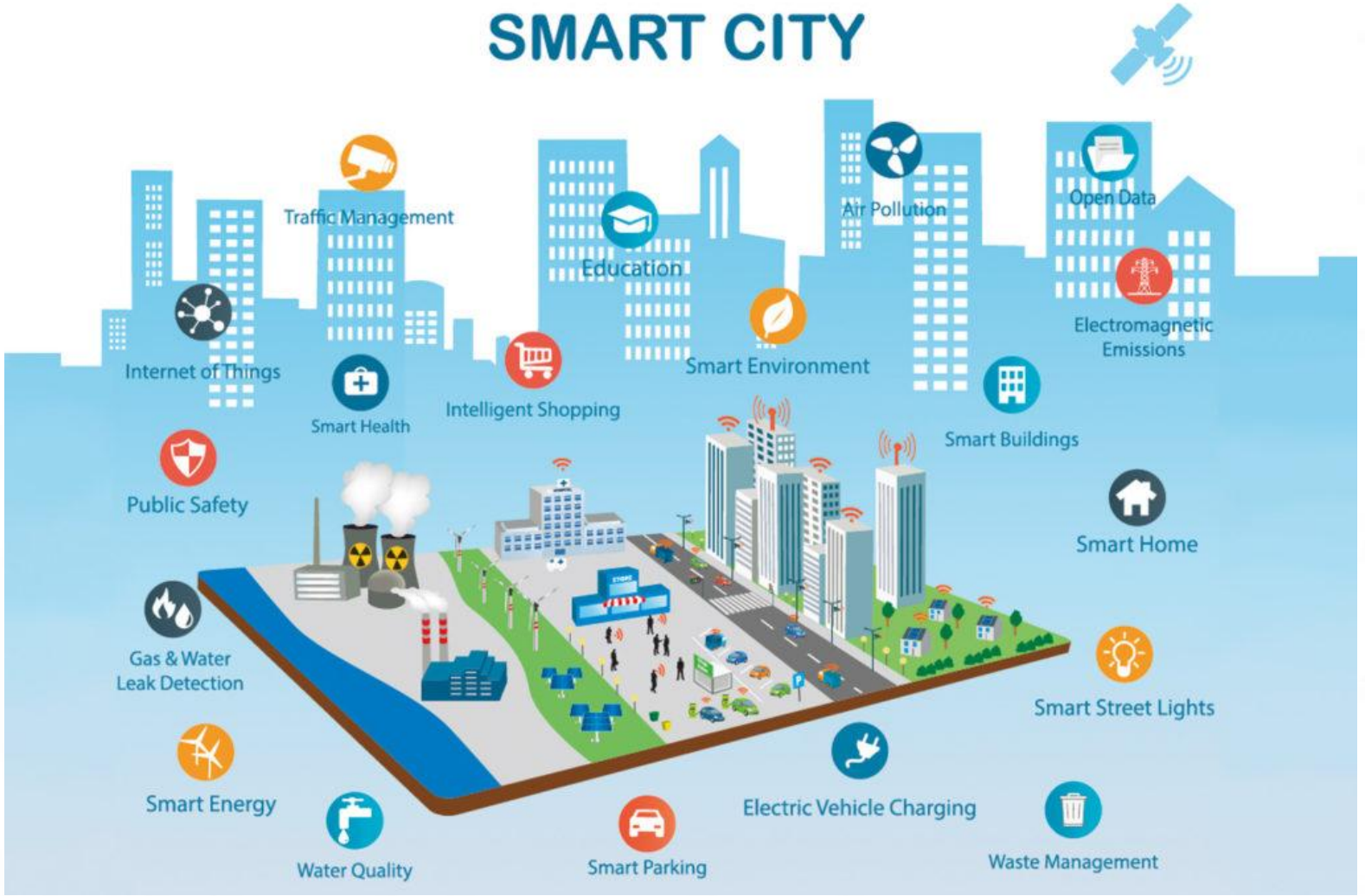


Smart Home



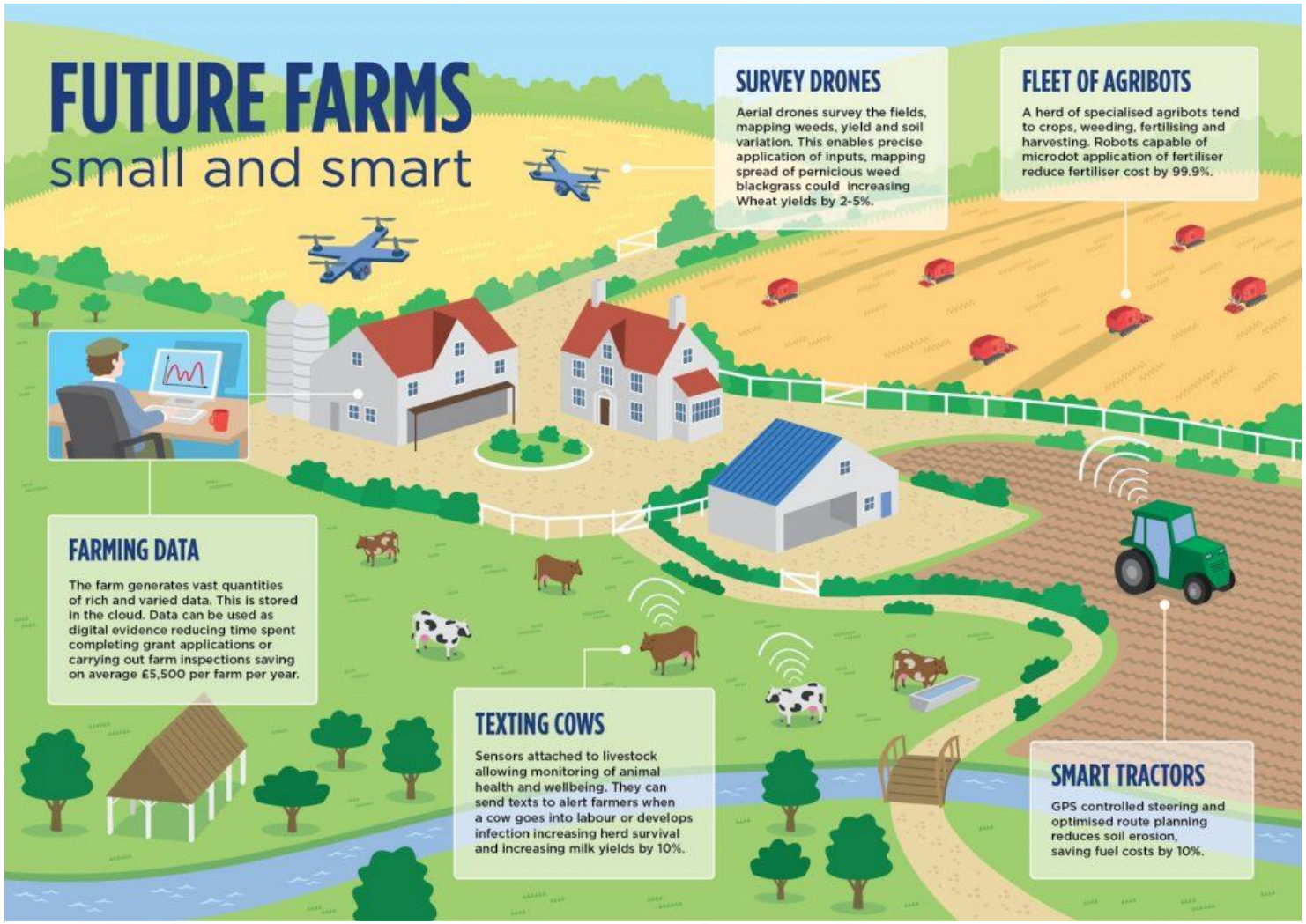
[4] C. Stolojescu-Crisan, C. Crisan, and B.-P. Butunoi, "An IOT-based Smart Home Automation System," *MDPI*, 30-May-2021. [Online]. Available: https://www.mdpi.com/1424-8220/21/11/3784. [Accessed: 10-Dec-2022].

Smart City



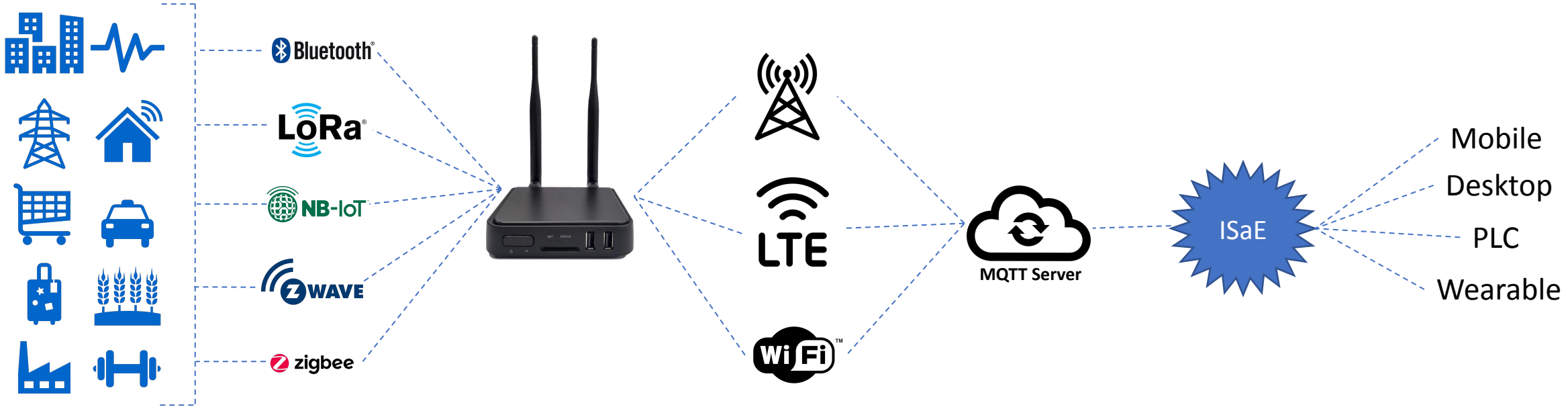
[3] N. Godse, "Smart cities of the future- powered by IOT," *Data Science Central*, 04-May-2022. [Online]. Available: https://www.datasciencecentral.com/smart-cities-of-the-future-powered-by-iot/. [Accessed: 10-Dec-2022].

Smart Farm



[5] R. Burnett, “Smart Farming - Digital Revolution of Agriculture,” *MaxBotix Inc.*, 29-Aug-2022. [Online]. Available: https://www.maxbotix.com/articles/smart-farming.htm. [Accessed: 10-Dec-2022].

How IoT works?



IoT Sensors » Wireless Connectors » IoT Gateway » Carrier » IoT Server » Business Rule Engine » Impact

IoT – Node-RED

#Practice Time!

Demonstration

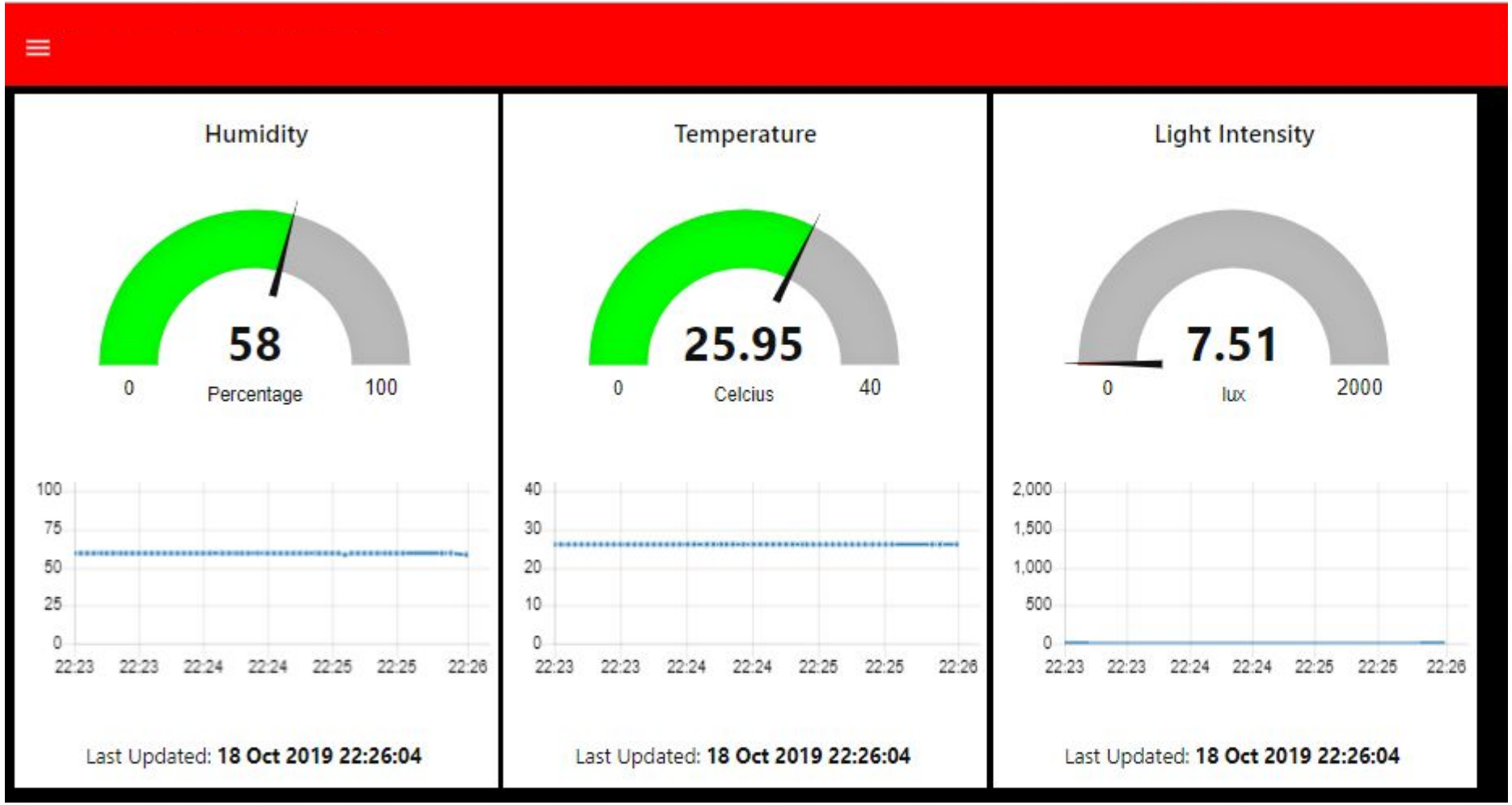
Sensors

(Temperature, Humidity and Light intensity)

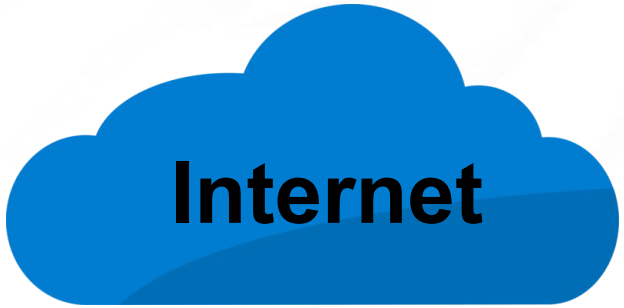
XDK 110

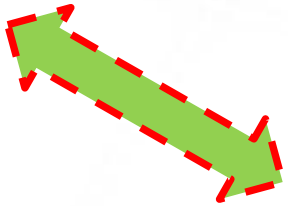
- Accelero-meter
- Gyroscope
- Magneto-meter
- Humidity sensor
- Pressure sensor
- Temperature sensor
- Acoustic sensor
- Digital light sensor
- 32-bit Microcontroller ARM
- Wireless LAN
- Bluetooth LE
- Li-Ion rechargeable battery

Dashboard


Humidity
58
0
Percentage
100
100
75
50
25
0
22:23
22:23
22:24
22:24
22:25
22:25
22:26
Last Updated: 18 Oct 2019 22:26:04
Temperature
25.95
0
Celcius
40
40
30
20
10
0
22:23
22:23
22:24
22:24
22:25
22:25
22:26
Last Updated: 18 Oct 2019 22:26:04
Light Intensity
7.51
0
lux
2000
2,000
1,500
1,000
500
0
22:23
22:23
22:24
22:24
22:25
22:25
22:26
Last Updated: 18 Oct 2019 22:26:04

Demo Setup





Network: *provides connectivity and transmission medium*

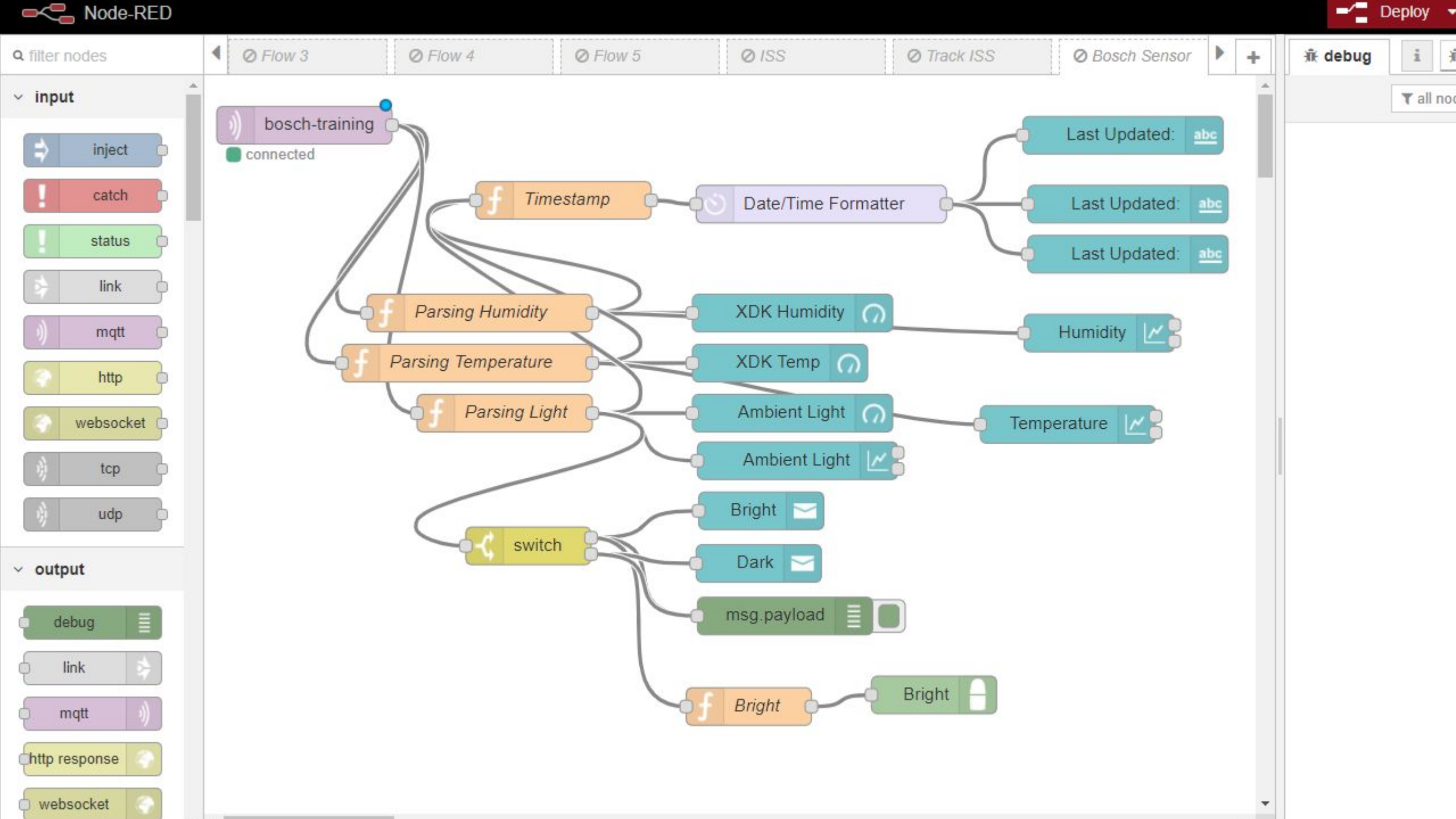
2

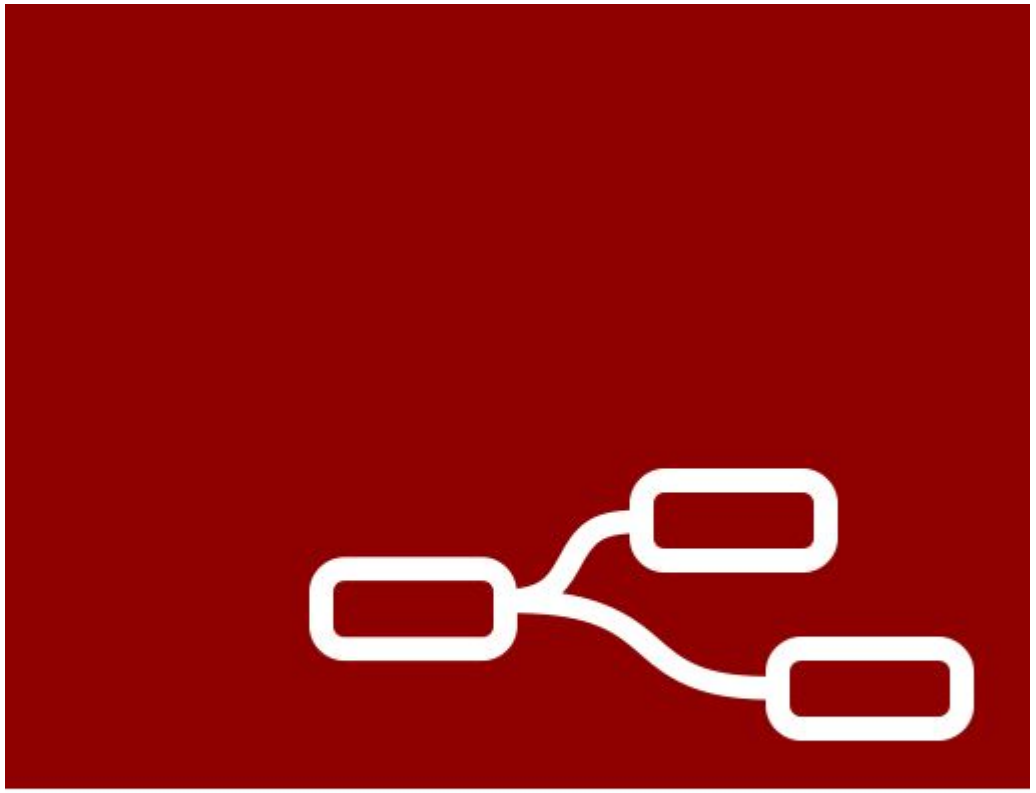
Thing: *measures and sends data (T, H and AL)*

1

IOT Platform (Dashboard):
user interface for visualization

3

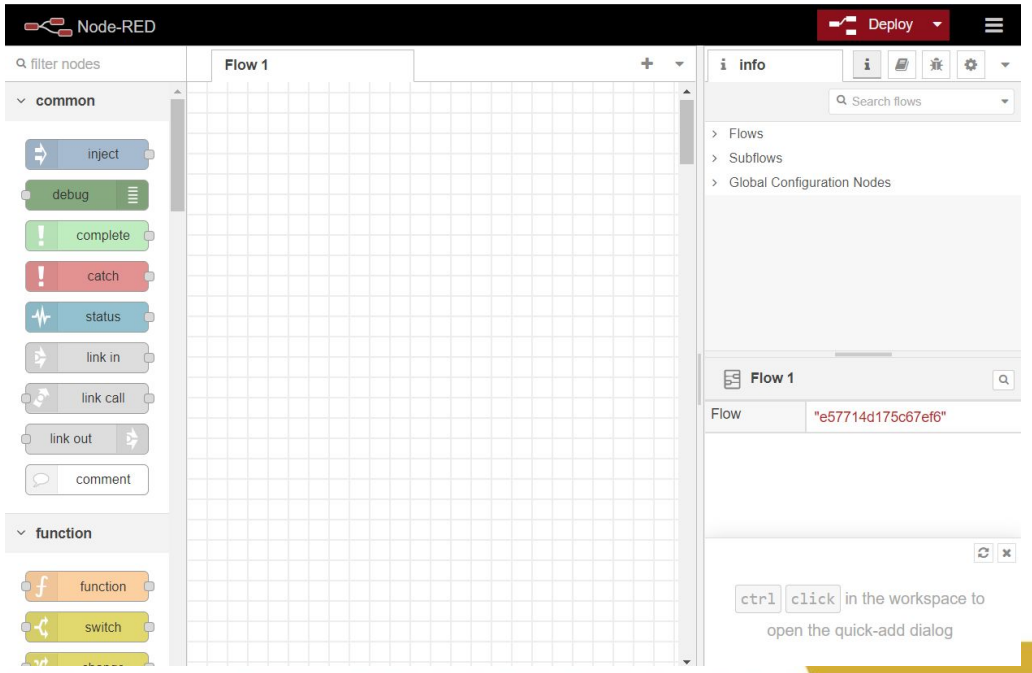

Node-RED
Deploy
filter nodes
Flow 3
Flow 4
Flow 5
ISS
Track ISS
Bosch Sensor
debug
input
inject
catch
status
link
mqtt
http
websocket
tcp
udp
output
debug
link
mqtt
http response
websocket
bosch-training
connected
Timestamp
Date/Time Formatter
Last Updated:
Last Updated:
Last Updated:
Parsing Humidity
Parsing Temperature
Parsing Light
XDK Humidity
XDK Temp
Ambient Light
Ambient Light
Humidity
Temperature
switch
Bright
Dark
msg.payload
Bright
Bright



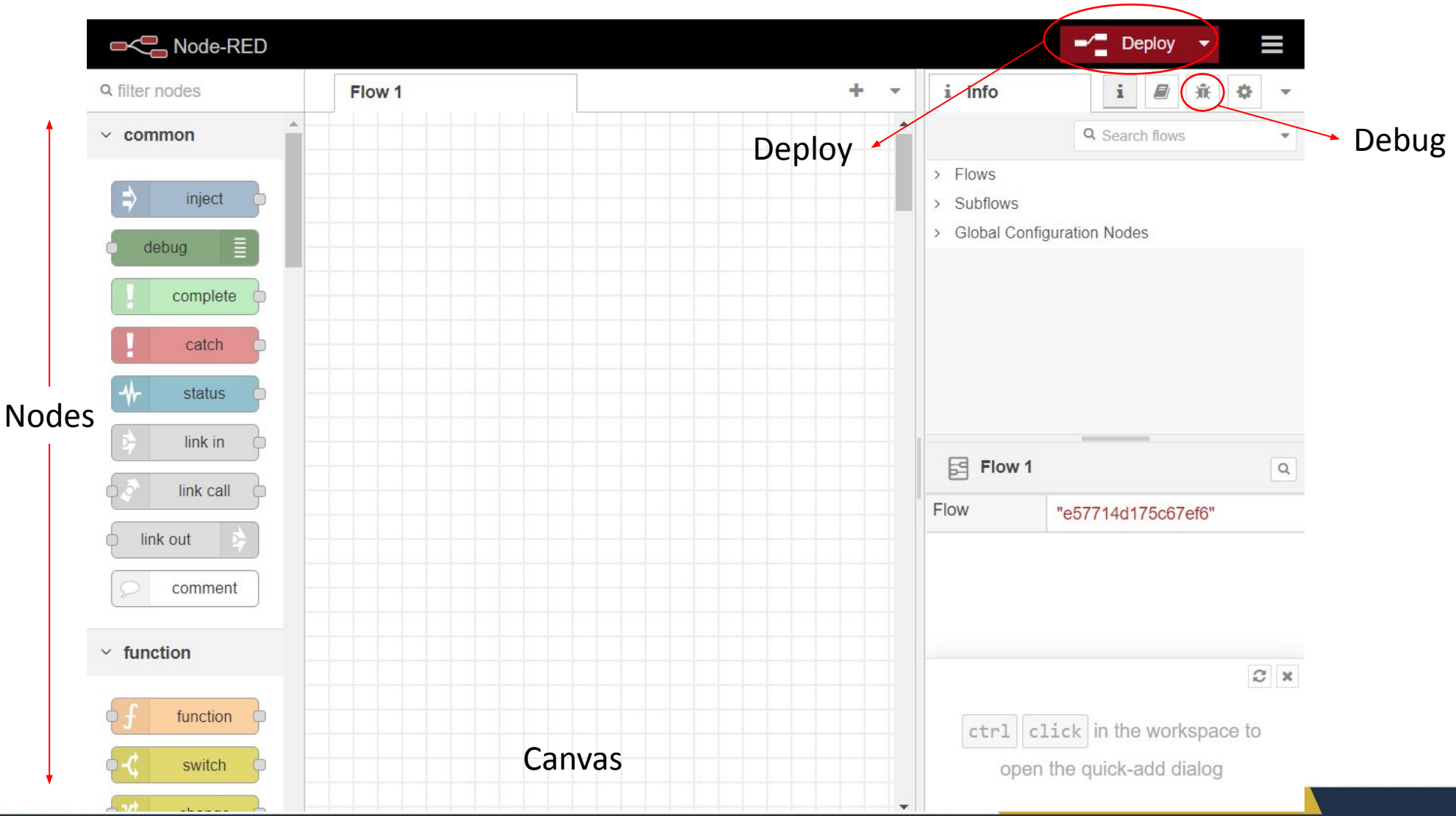
Node-RED

IoT – Node-RED

- **Node-RED** is a programming tool for wiring together hardware devices, APIs and online services in new and interesting ways.
- It provides a browser-based editor that makes it easy to wire together flows using the wide range of nodes in the palette that can be deployed to its runtime in a single-click.

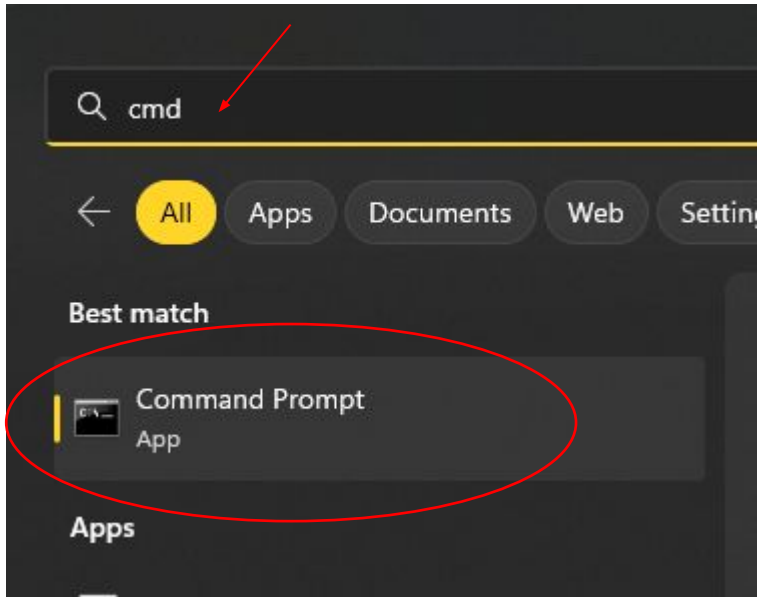


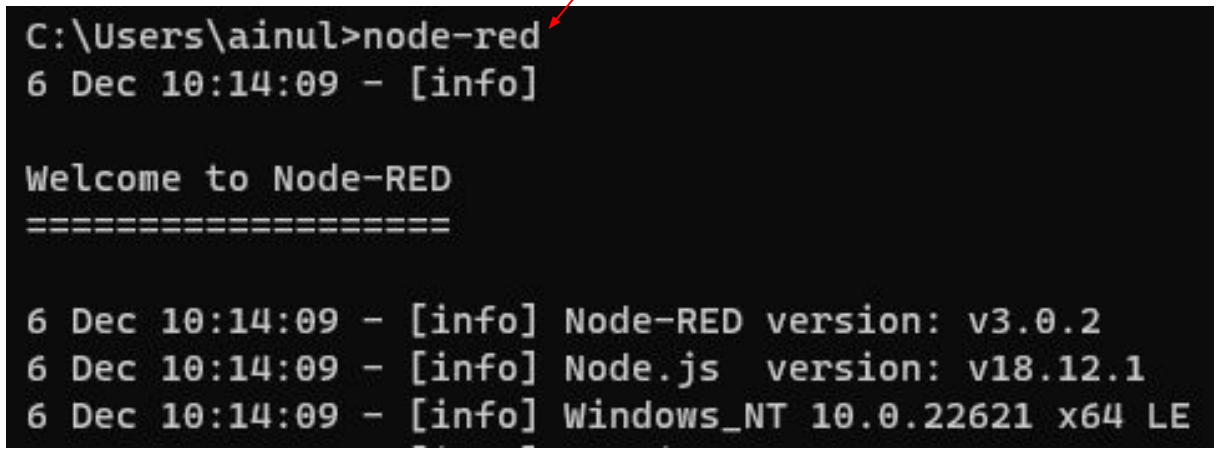
IoT – Node-RED


Node-RED
Deploy
filter nodes
Flow 1
info
common
inject
debug
complete
catch
status
link in
link call
link out
comment
function
function
switch
Search flows
Flows
Subflows
Global Configuration Nodes
Flow 1
Flow
"e57714d175c67ef6"
ctrl click in the workspace to
open the quick-add dialog
Deploy
Debug
Nodes
Canvas

IoT – Node-RED

1. Press Win key and type “cmd”
2. Open Command Prompt
3. Type “node-red”
4. Press Enter

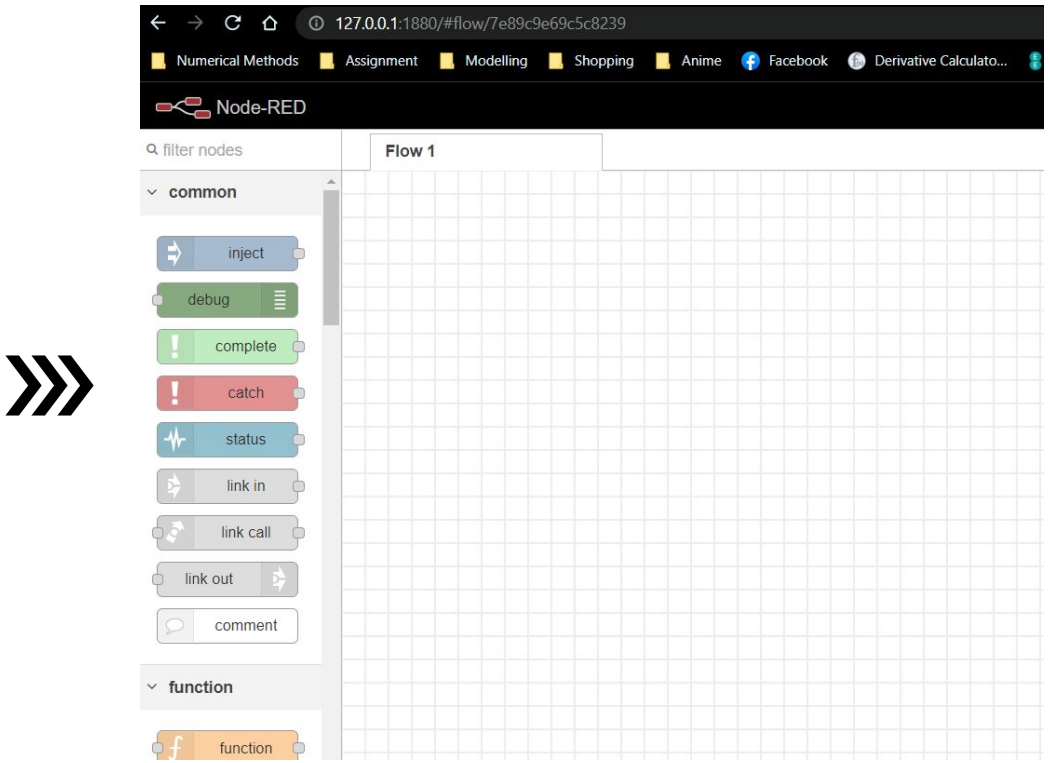




IoT – Node-RED

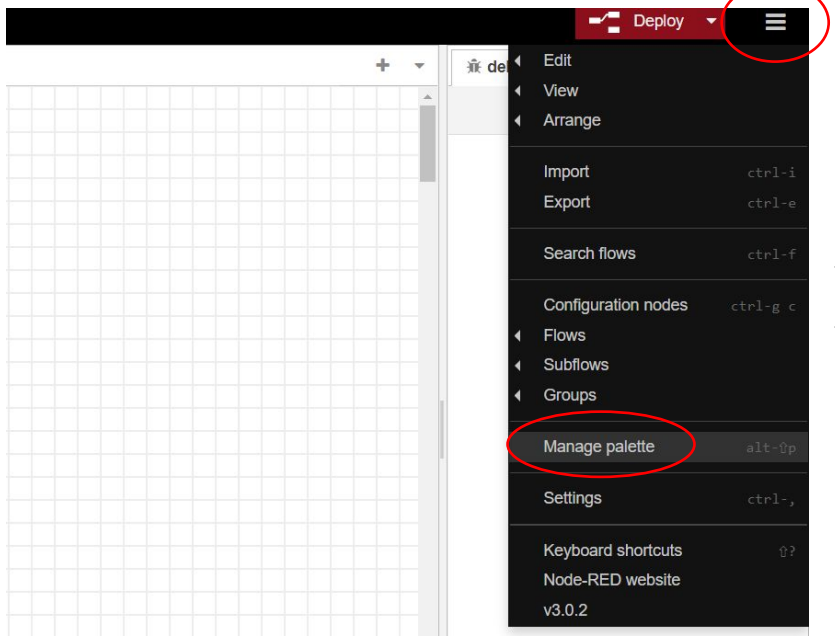
1. Copy the URL
2. Open browser and paste the URL
3. Press Enter

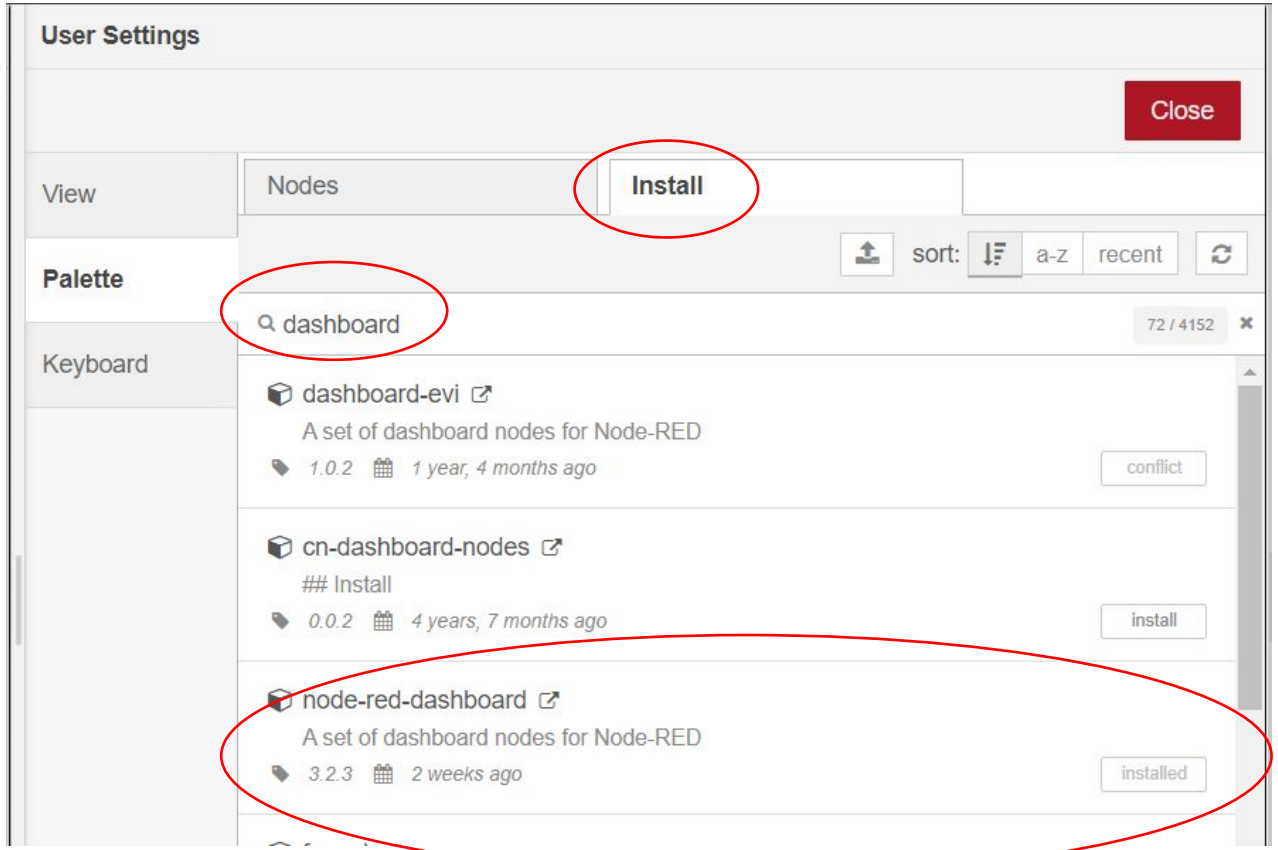
```
Welcome to Node-RED
===================

12 Dec 23:26:44 - [info] Node-RED version: v3.0.2
12 Dec 23:26:44 - [info] Node.js  version: v18.12.1
12 Dec 23:26:44 - [info] Windows_NT 10.0.22621 x64 LE
12 Dec 23:26:45 - [info] Loading palette nodes
12 Dec 23:26:46 - [info] Worldmap version 2.31.3
12 Dec 23:26:46 - [info] Dashboard version 3.2.3 started at /ui
12 Dec 23:26:46 - [info] Settings file  : C:\Users\ainul\.node-red\settings.js
12 Dec 23:26:46 - [info] Context store  : 'default' [module=memory]
12 Dec 23:26:46 - [info] User directory : \Users\ainul\.node-red
12 Dec 23:26:46 - [warn] Projects disabled : editorTheme.projects.enabled=false
12 Dec 23:26:46 - [info] Flows file     : \Users\ainul\.node-red\flows.json
12 Dec 23:26:46 - [info] Server now running at http://127.0.0.1:1880/
12 Dec 23:26:46 - [warn]

---------------------------------------------------------------------
Your flow credentials file is encrypted using a system-generated key.

If the system-generated key is lost for any reason, your credentials
file will not be recoverable, you will have to delete it and re-enter
your credentials.

You should set your own key using the 'credentialSecret' option in
your settings file. Node-RED will then re-encrypt your credentials
file using your chosen key the next time you deploy a change.
---------------------------------------------------------------------

12 Dec 23:26:46 - [info] Starting flows
```



IoT – Node-RED

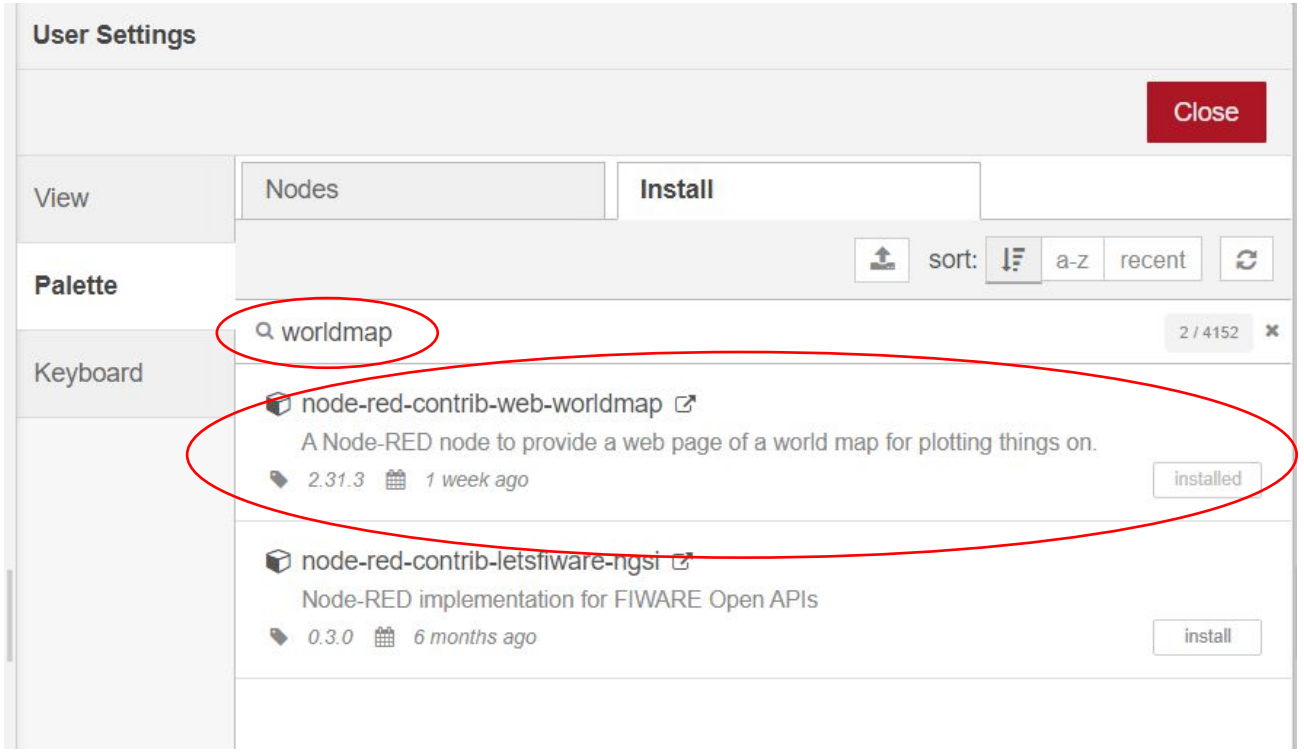
1. Press the triple line
2. Click manage palette
3. Click install
4. Type dashboard and install





IoT – Node-RED

1. Type worldmap
2. Install
3. Click Close



Task #1

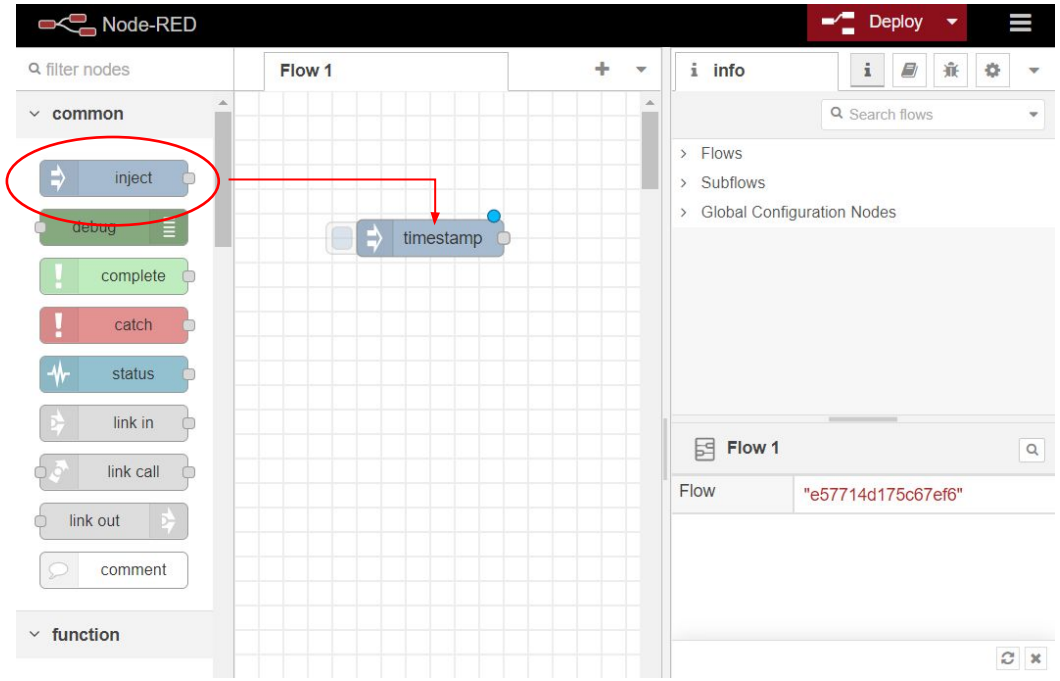
Hello World!

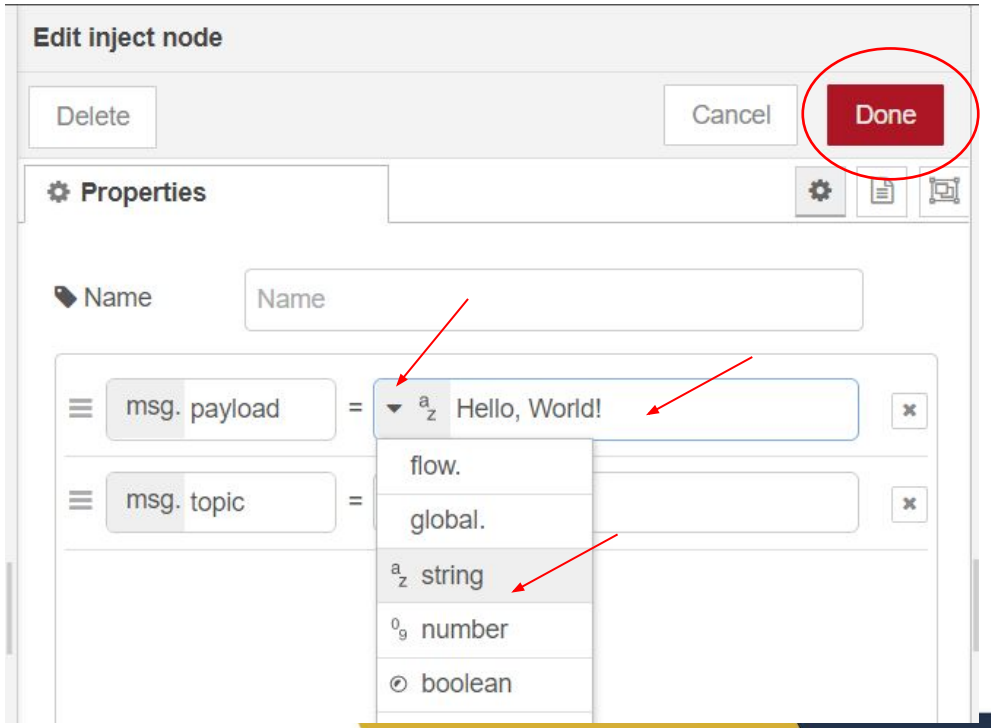

<hello-world/>

IoT – Node-RED

1. First Activity

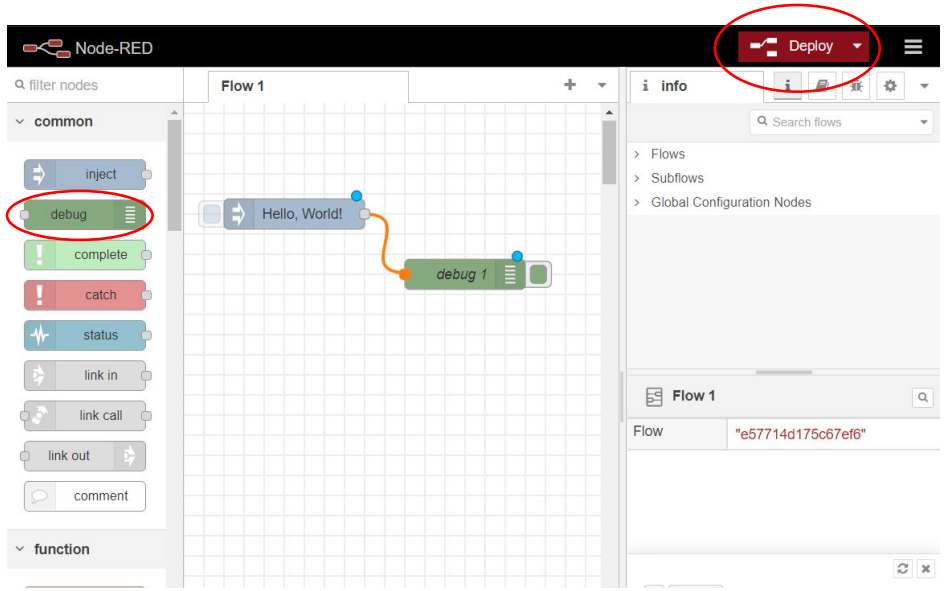
- Drag and place the inject node inside canvas
- Double click the inject node
- In payload field, select string and enter “Hello, “World!

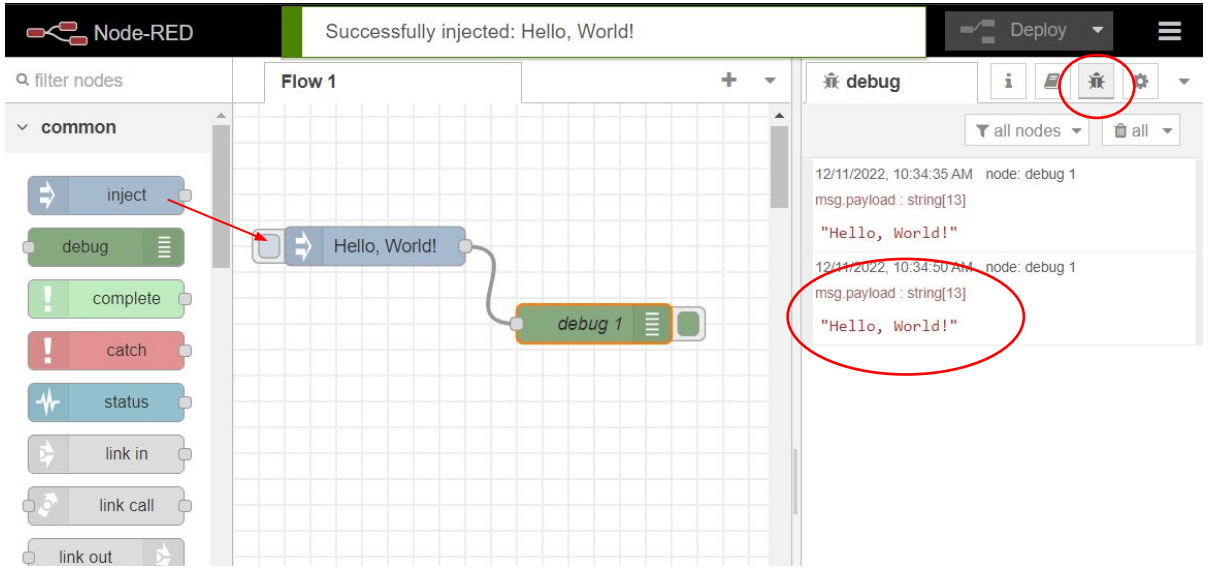




IoT – Node-RED

1. Drag and place the debug node inside canvas
2. Connect the nodes together
3. In payload field, select string and enter “Hello, “World!
4. Deploy and Run



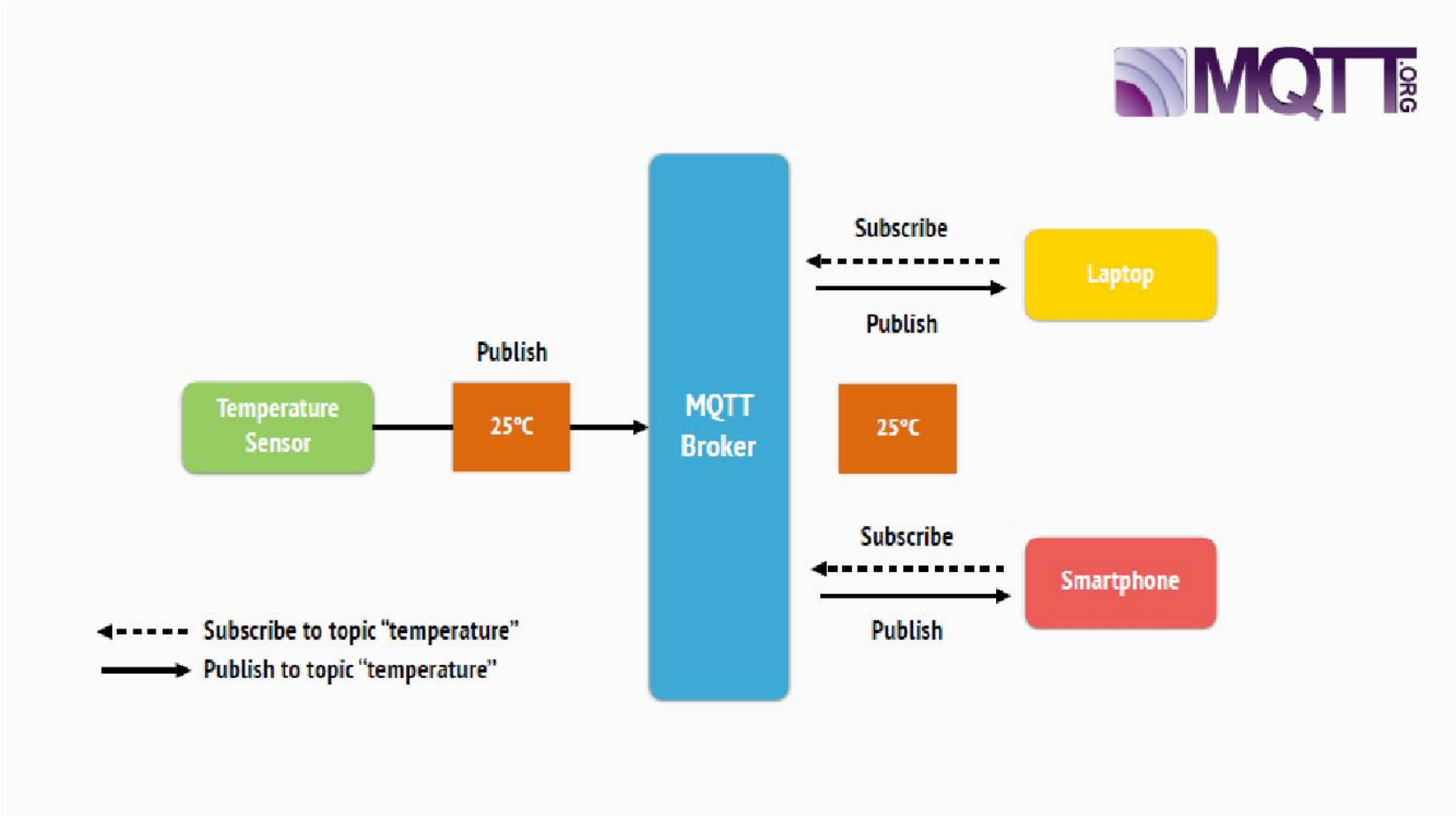


Task #2

Send Message

(from your computer to my computer)

MQTT


MQTT.ORG
Subscribe
Laptop
Publish
Publish
Temperature Sensor
25°C
MQTT Broker
25°C
Subscribe
Smartphone
Publish
Subscribe to topic "temperature"
Publish to topic "temperature"

Send Data through MQTT

MQTT Publisher

Send ‘Sensor Data’ through MQTT

MQTT Subscriber

Exercise

Sensor at My House

Send ‘Data’

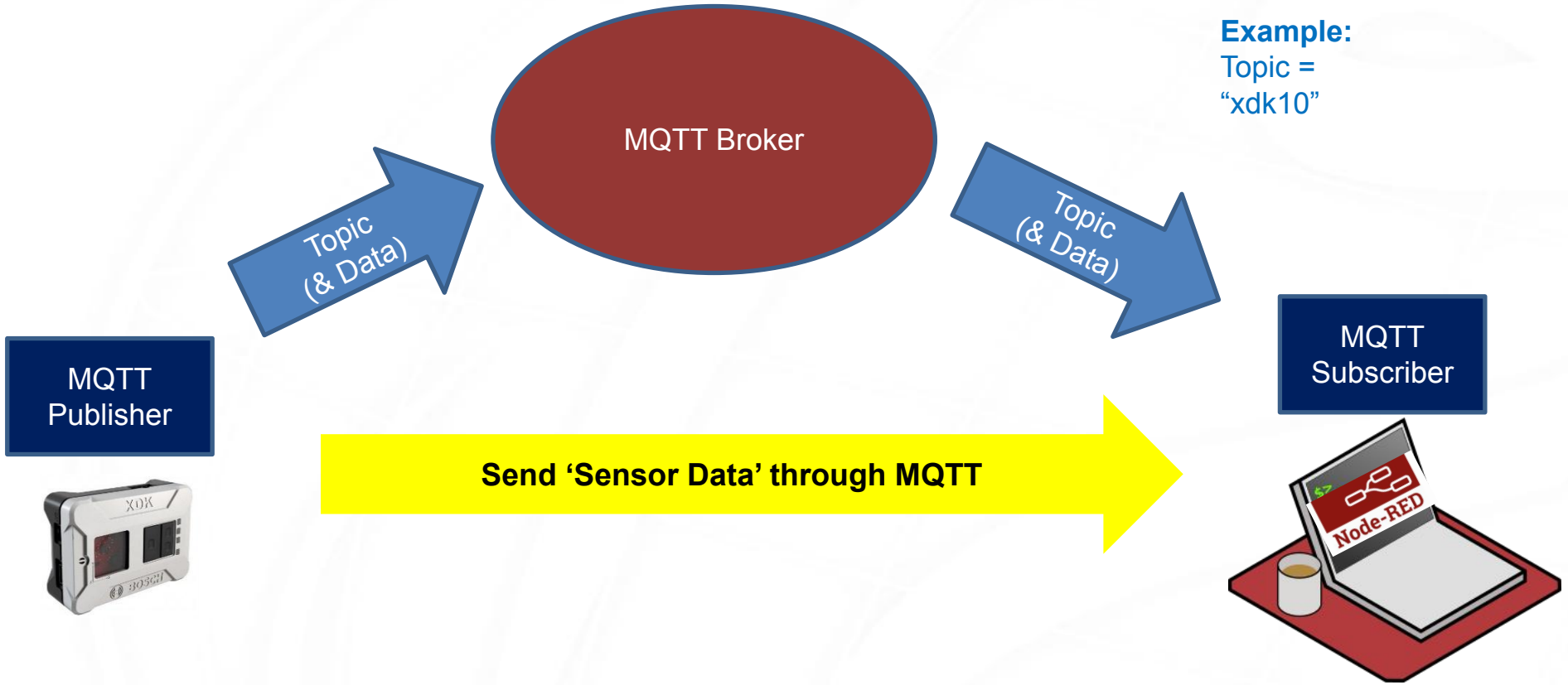
Your Laptop

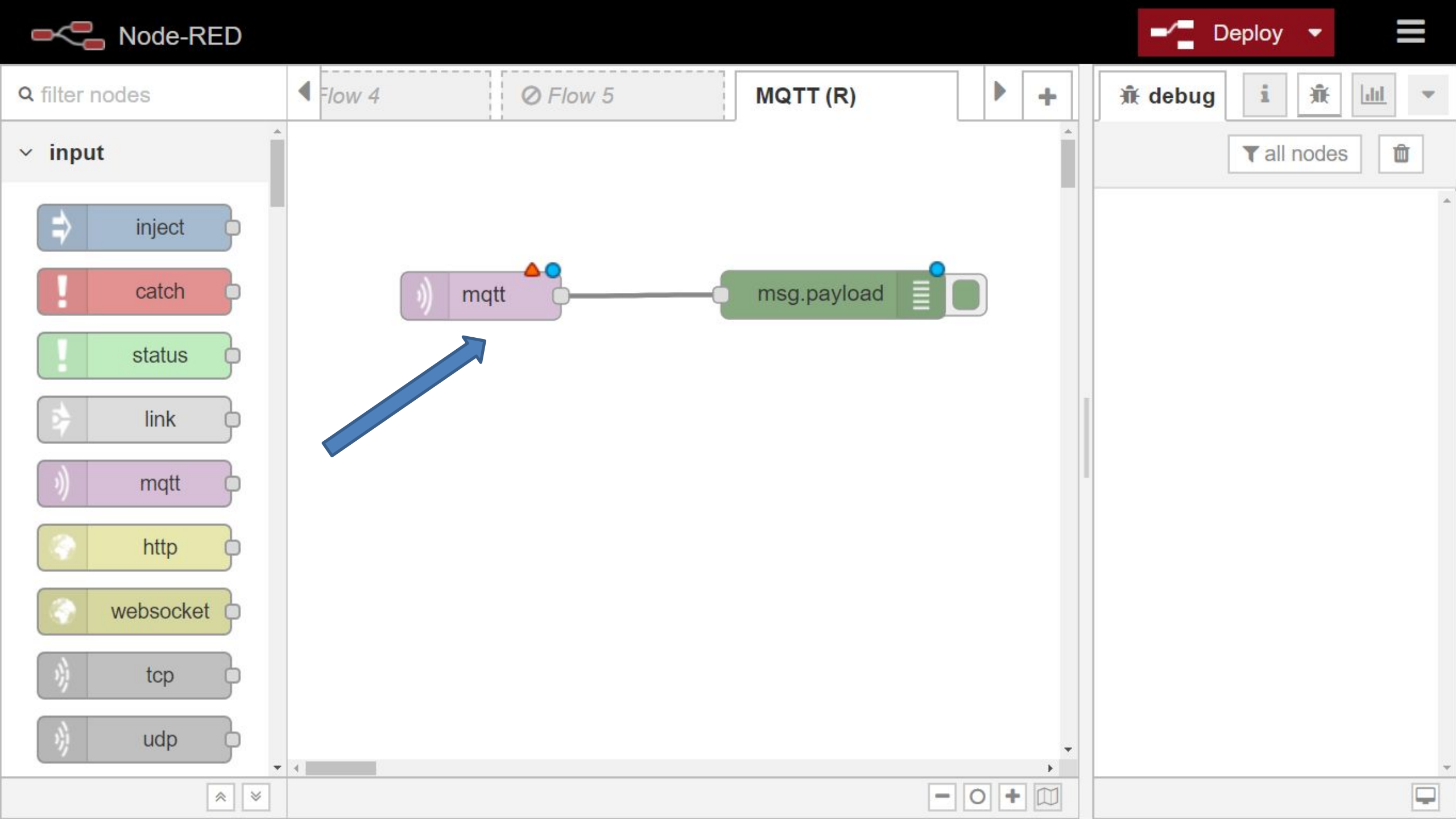
MQTT Publisher

Send ‘Data’ through MQTT

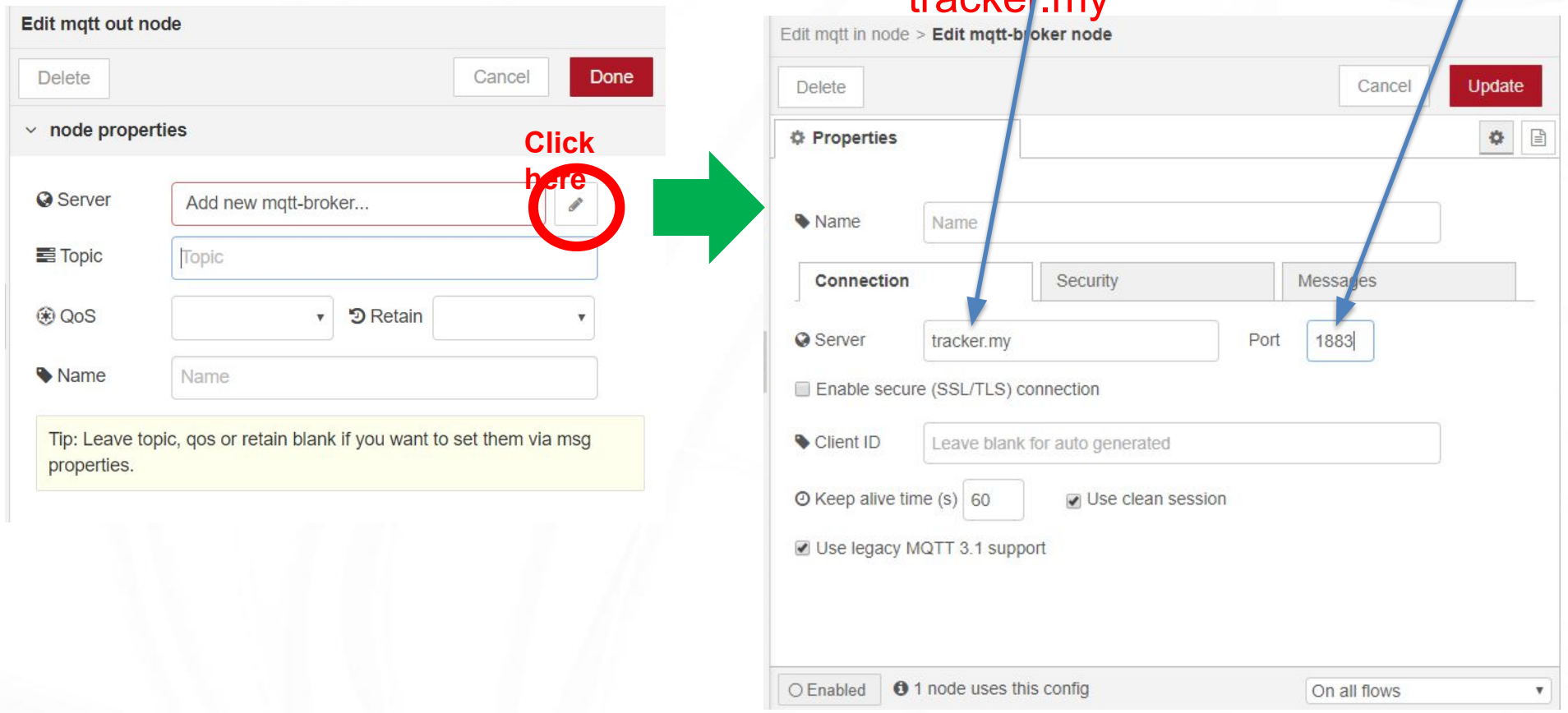
MQTT Subscriber

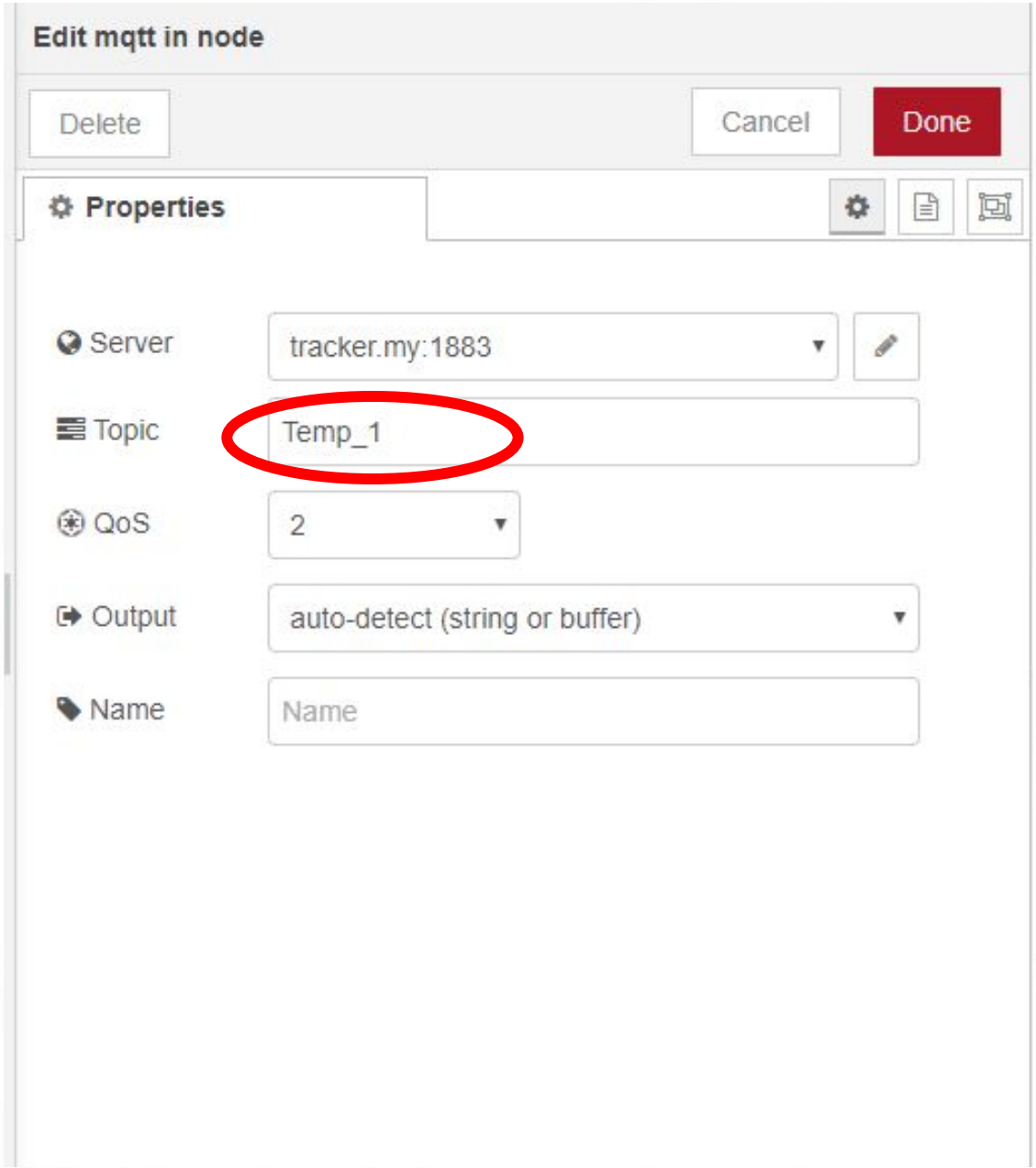
Send & Receive Data using MQTT



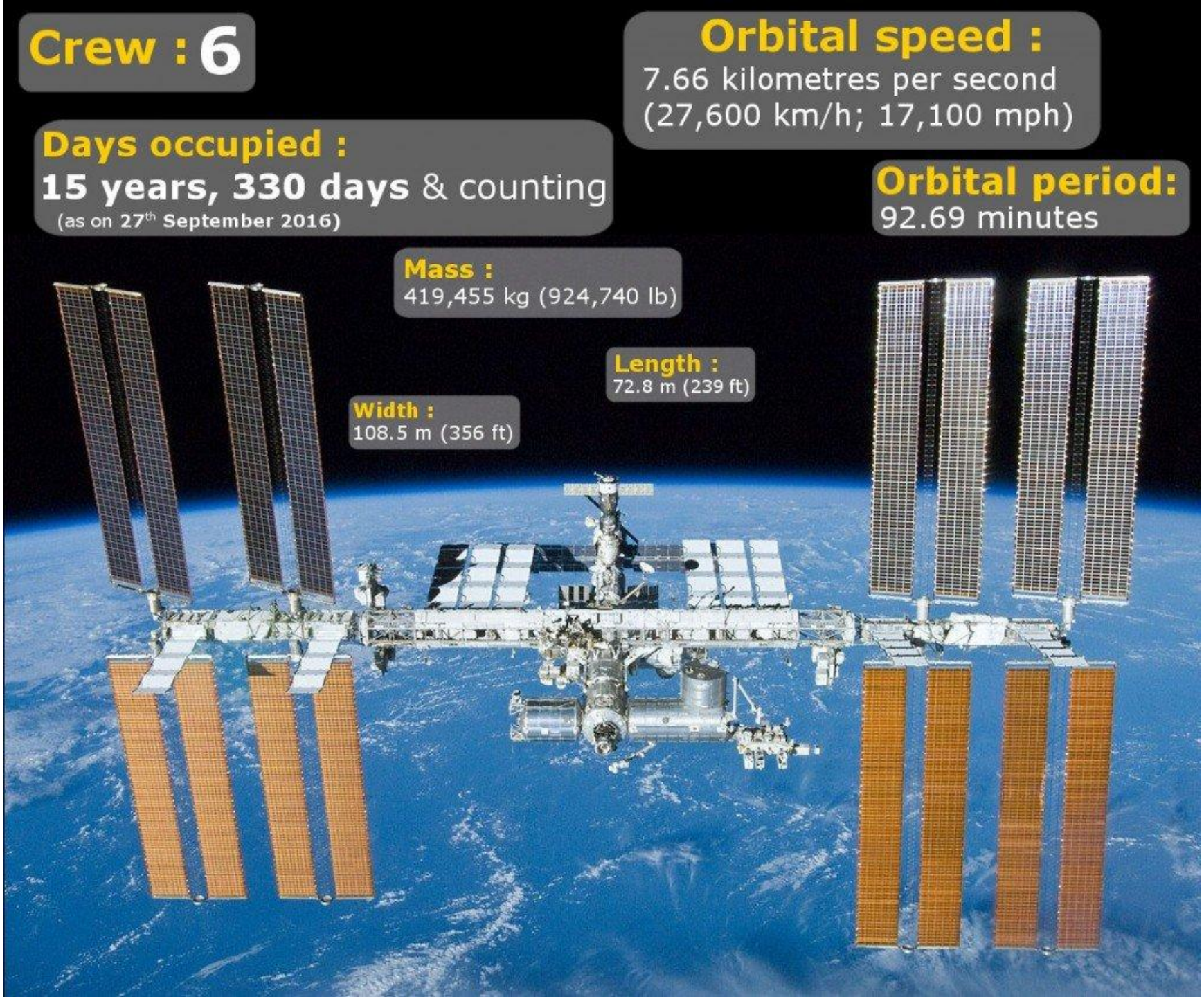

Node-RED
Deploy
filter nodes
Flow 4
Flow 5
MQTT (R)
debug
all nodes
input
inject
catch
status
link
mqtt
http
websocket
tcp
udp
mqtt
msg.payload

Configure MQTT Broker





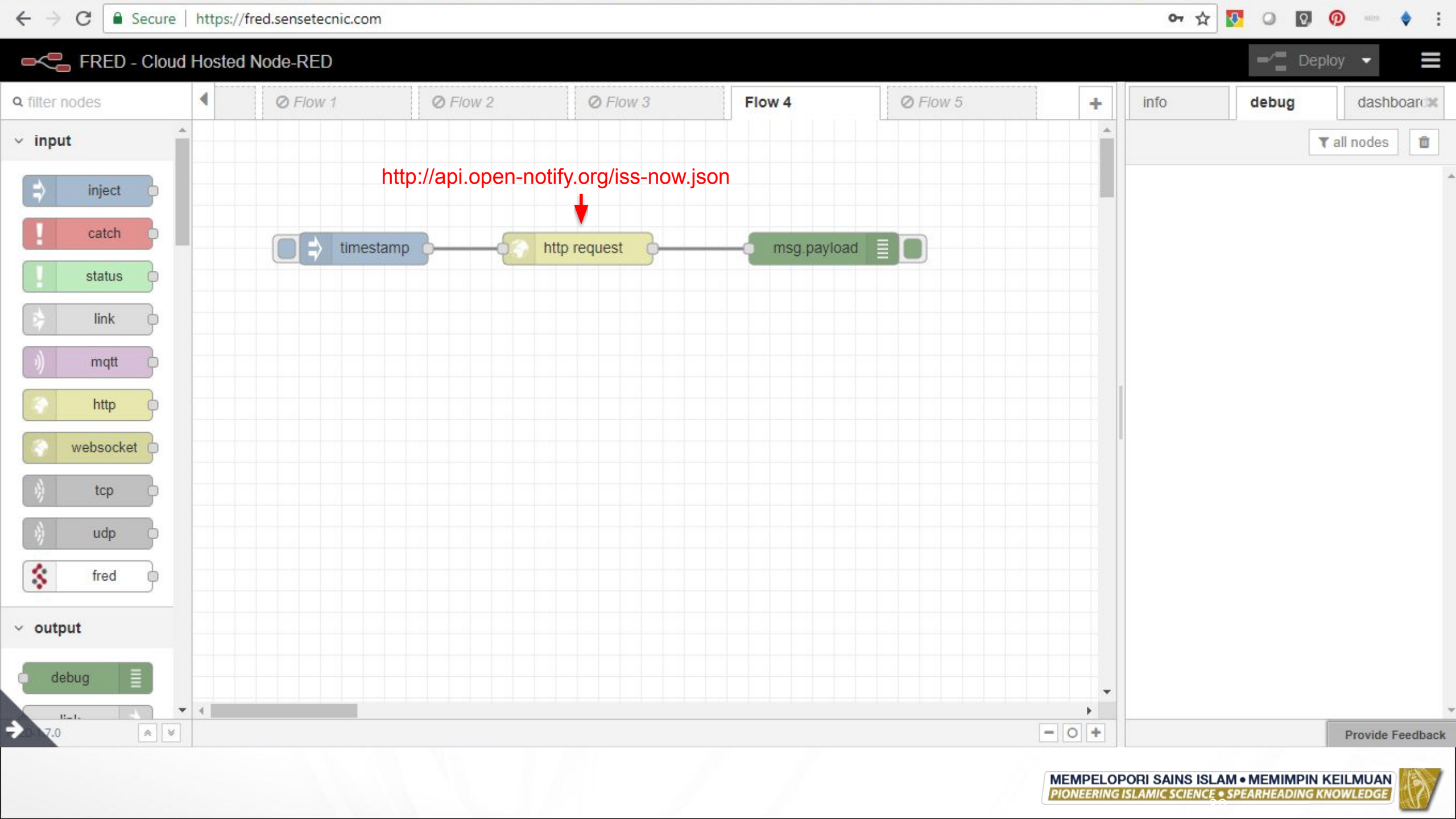
Let’s try another mission…


Crew : 6
Orbital speed :
7.66 kilometres per second
(27,600 km/h; 17,100 mph)
Days occupied :
15 years, 330 days & counting
(as on 27th September 2016)
Orbital period:
92.69 minutes
Mass :
419,455 kg (924,740 lb)
Length :
72.8 m (239 ft)
Width :
108.5 m (356 ft)

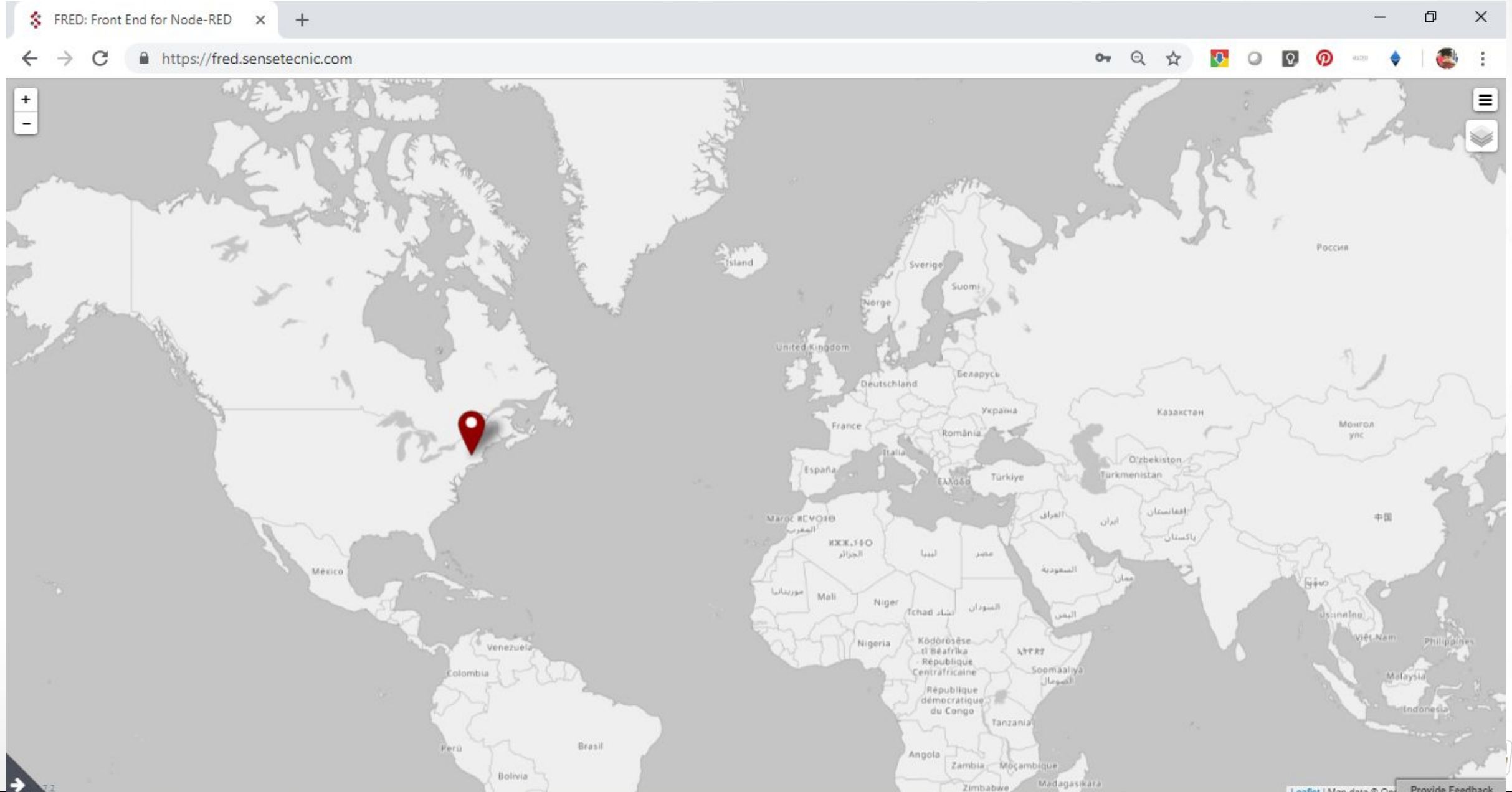
Where is the International Space Station (ISS)?

- Exercise: Tracking ISS using Node RED
  - Latitude and Longitude

Source Wikipedia: The **International Space Station** (**ISS**) is a space station, or a habitable artificial satellite, in low Earth orbit. Its first component launched into orbit in 1998, the last pressurised module was fitted in 2011, and the station is expected to operate until 2028. Development and assembly of the station continues, with components scheduled for launch in 2018 and 2019. The ISS is the largest human-made body in low Earth orbit and can often be seen with the naked eye from Earth.[8][9] The ISS consists of pressurised modules, external trusses, solar arrays, and other components. ISS components have been launched by Russian Proton and Soyuz rockets, and American Space Shuttles.[10]

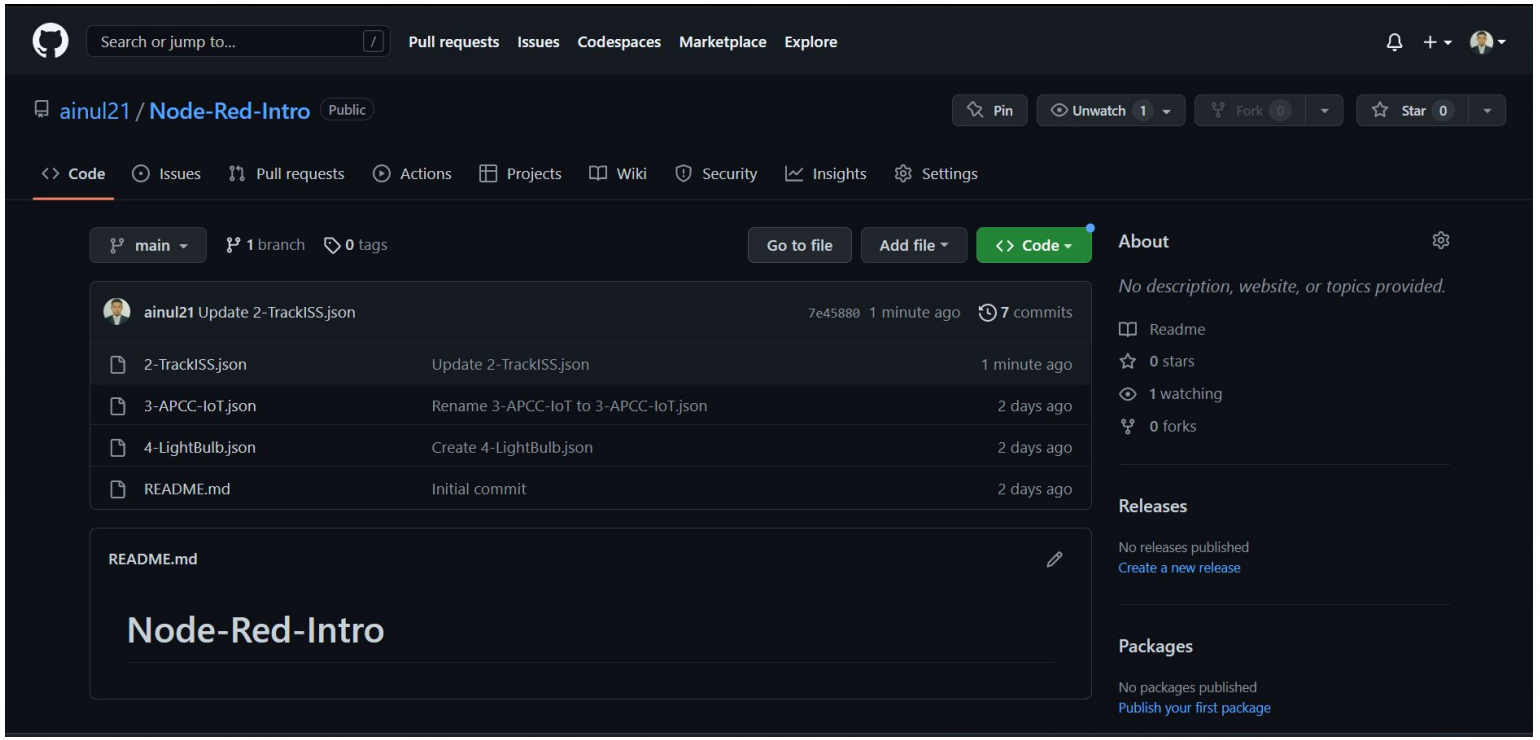

Secure | https://fred.sensetecnic.com
FRED - Cloud Hosted Node-RED
Deploy
filter nodes
Flow 1
Flow 2
Flow 3
Flow 4
Flow 5
info
debug
dashboard
all nodes
input
inject
catch
status
link
mqtt
http
websocket
tcp
udp
fred
output
debug
http://api.open-notify.org/iss-now.json
timestamp
http request
msg.payload
Provide Feedback
MEMPELOPORI SAINS ISLAM • MEMIMPIN KEILMUAN
PIONEERING ISLAMIC SCIENCE • SPEARHEADING KNOWLEDGE

Display on Map?



IoT – Node-RED

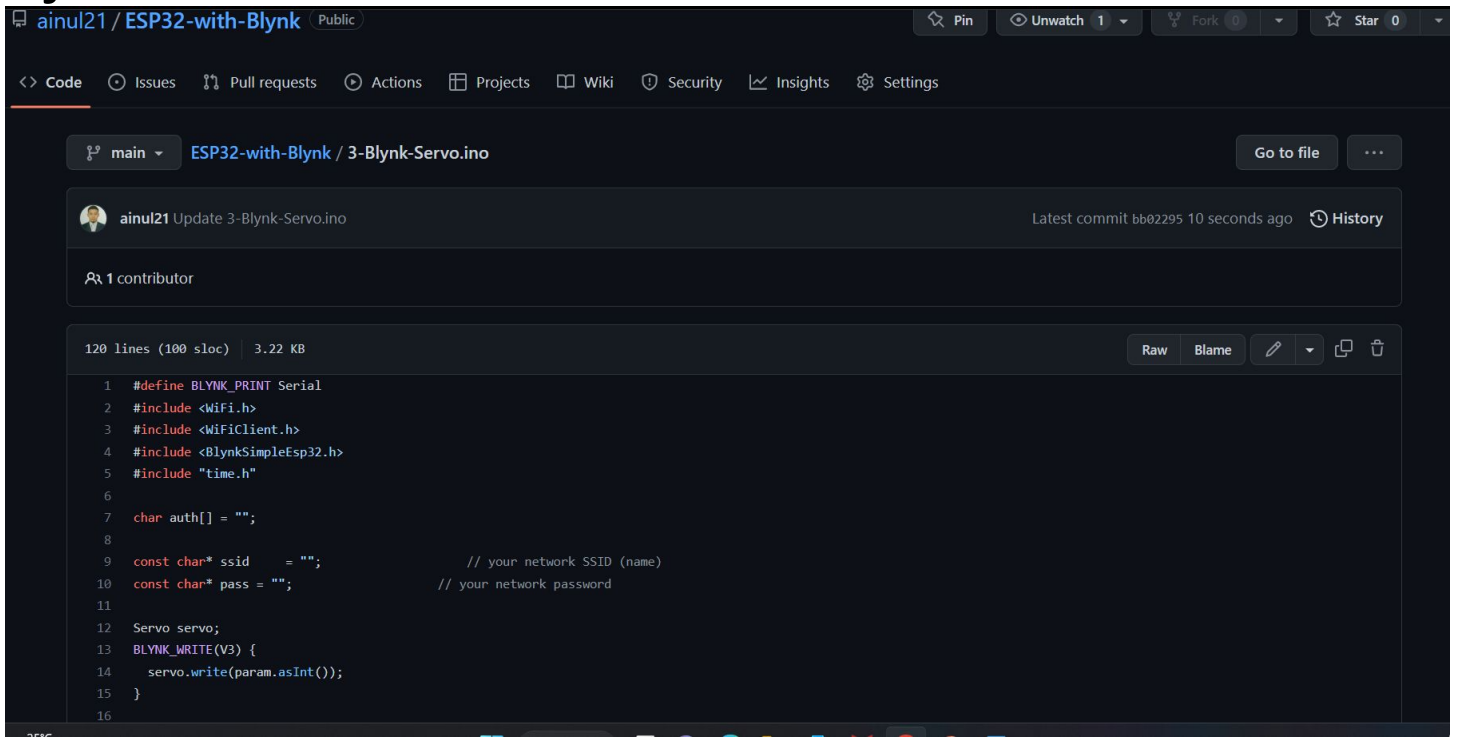
1. Open browser
2. Type URL
   - github.com/ainul21/Node-Red-Intro



IoT – Node-RED

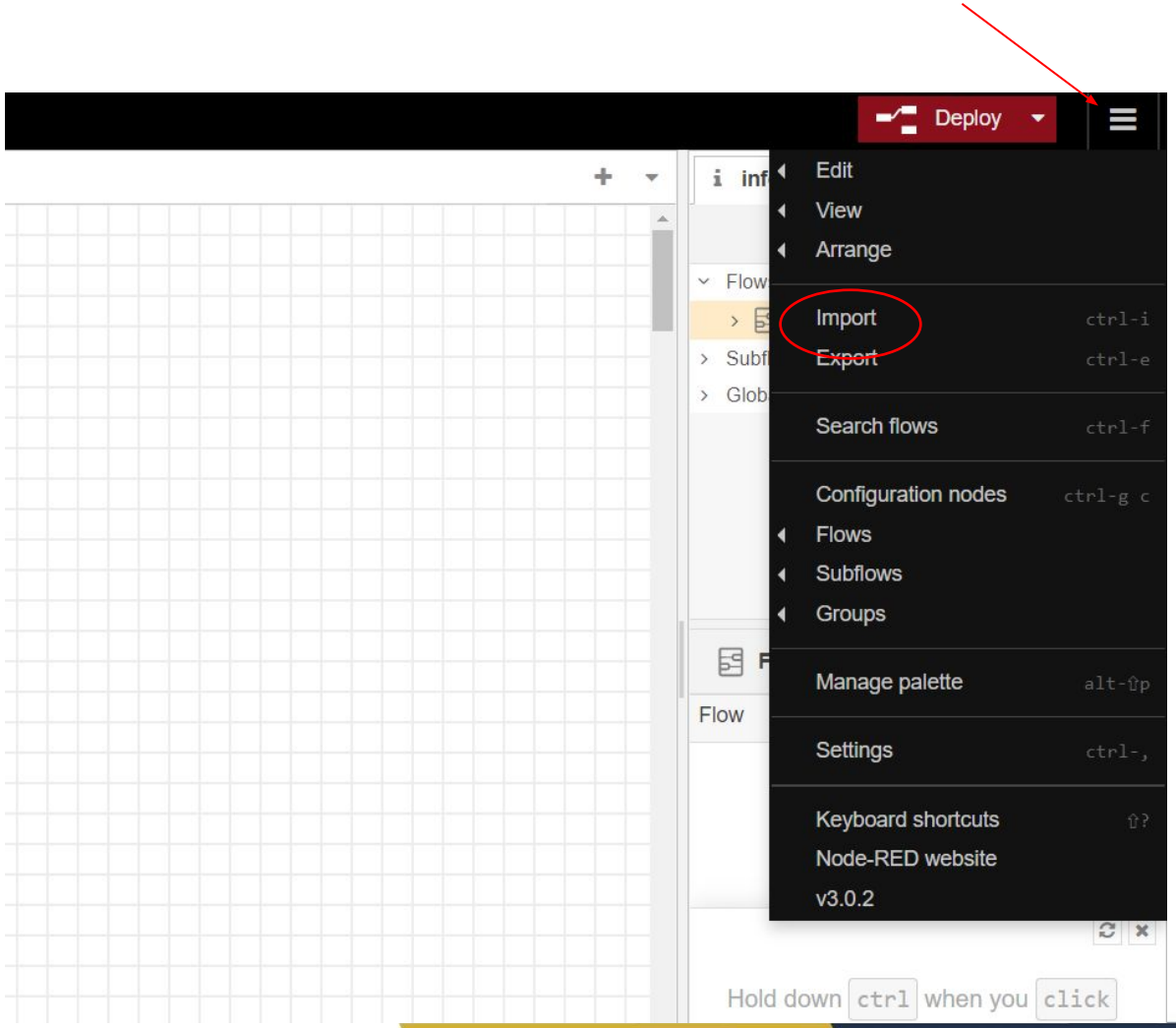
Task #2

- Go to GitHub
- Open file name: 2-TrackISS.json
- Copy the code



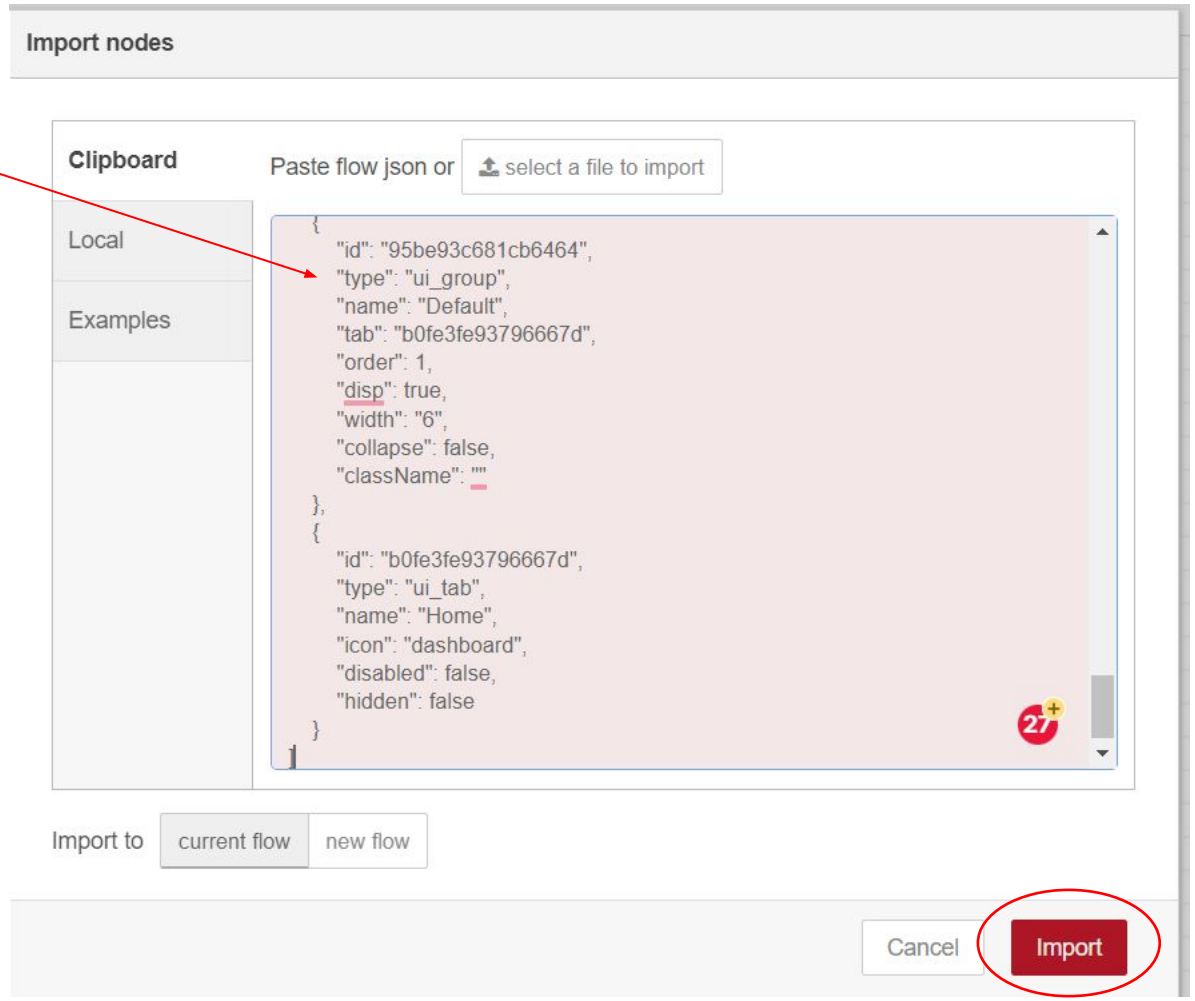
IoT – Node-RED

1. Click triple line button
2. Click Import



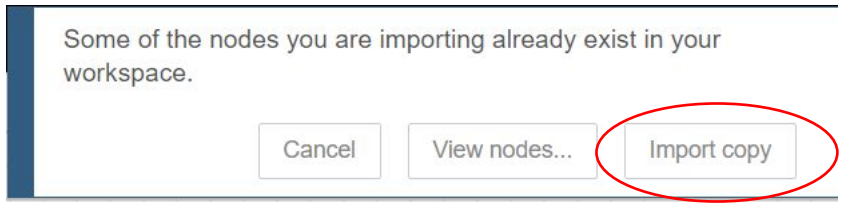
IoT – Node-RED

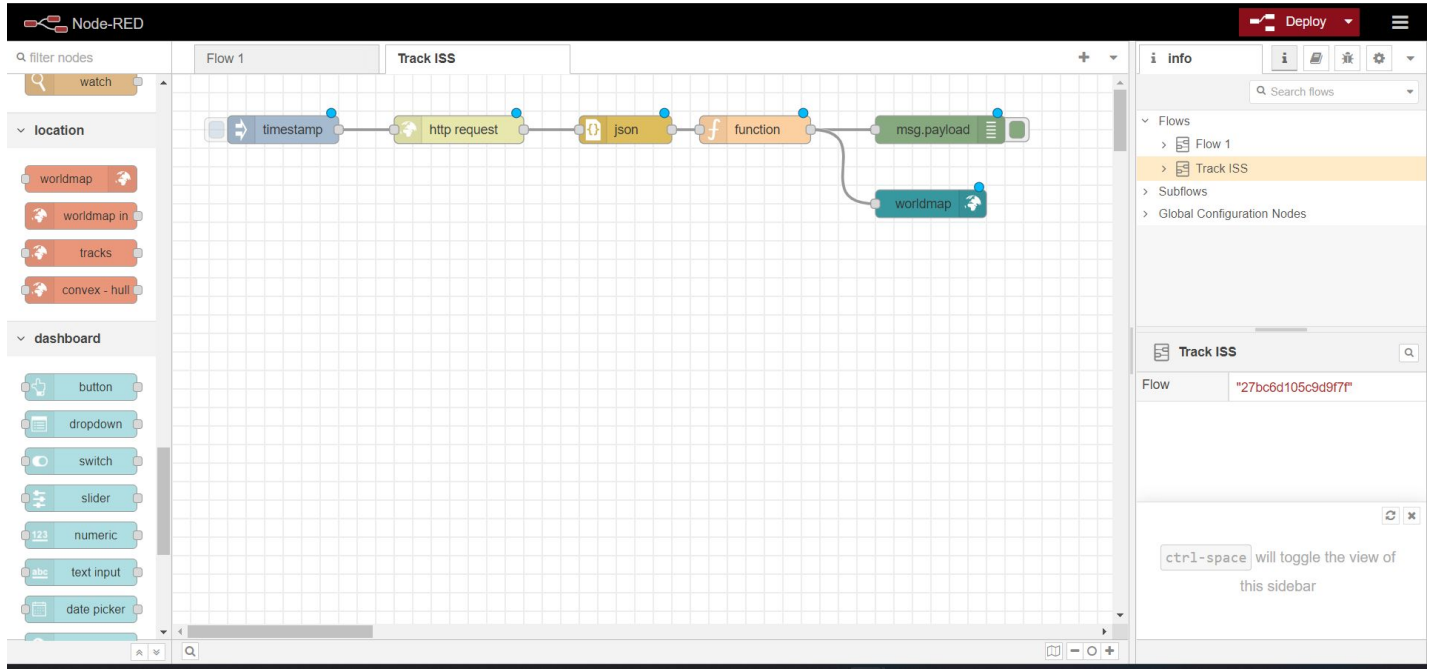
1. Paste the code
2. Click Import



IoT – Node-RED

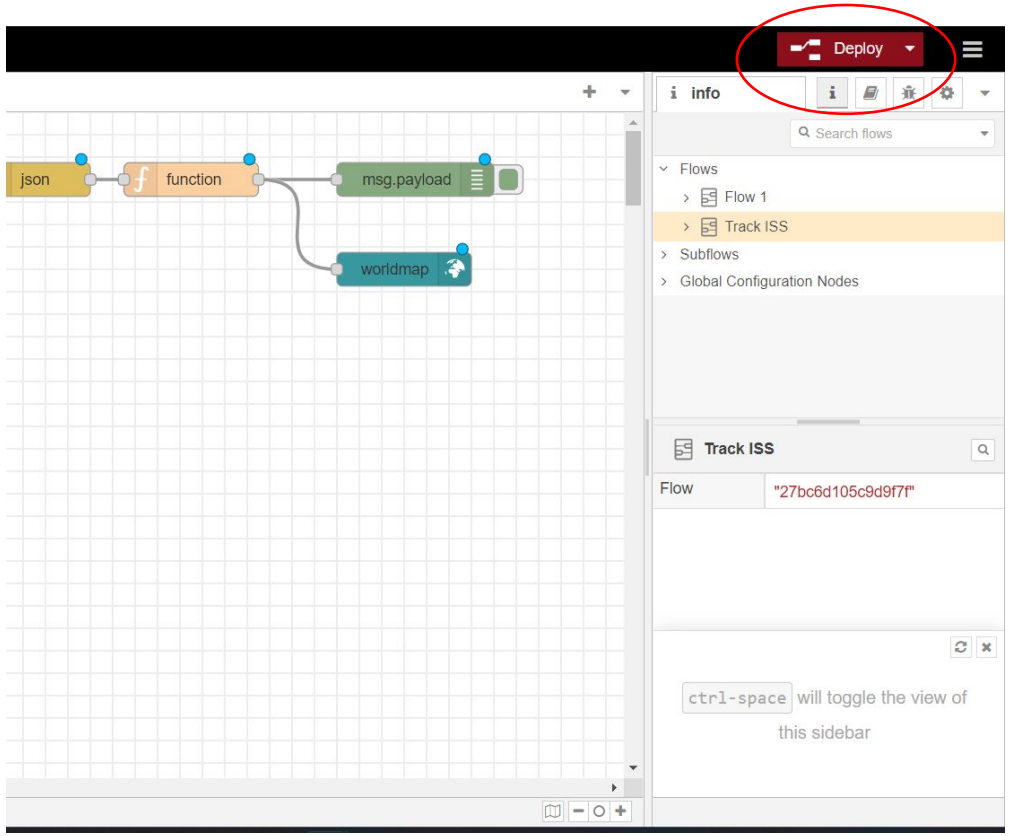
1. Click Import copy
2. Import complete

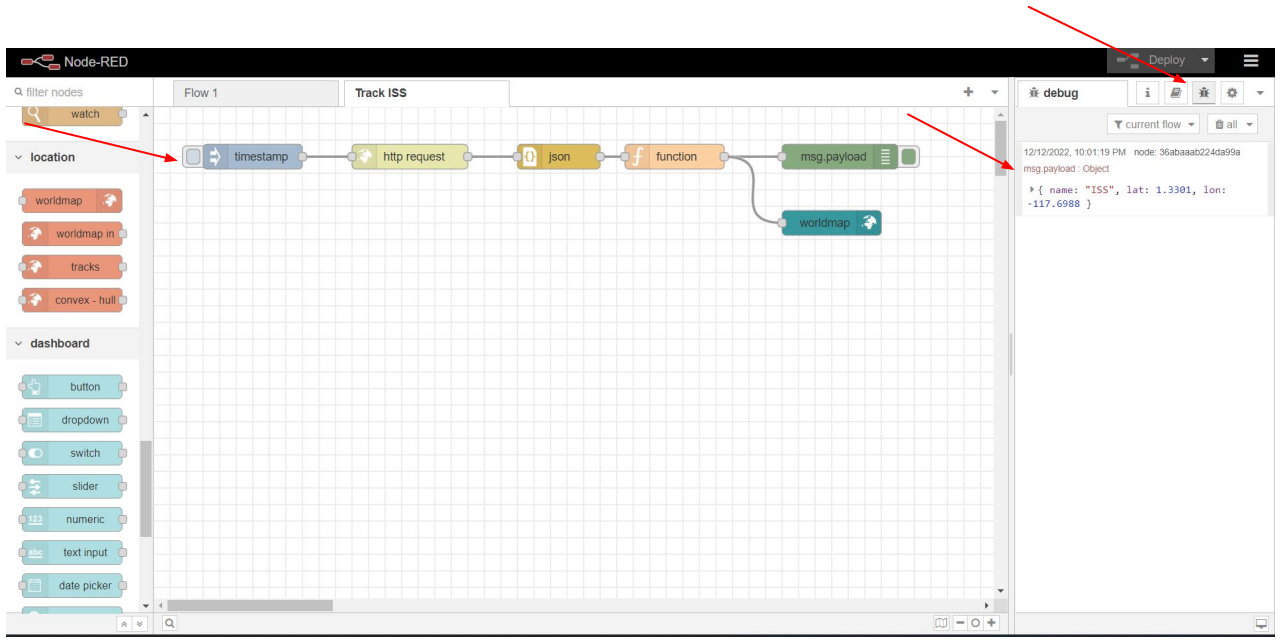




IoT – Node-RED

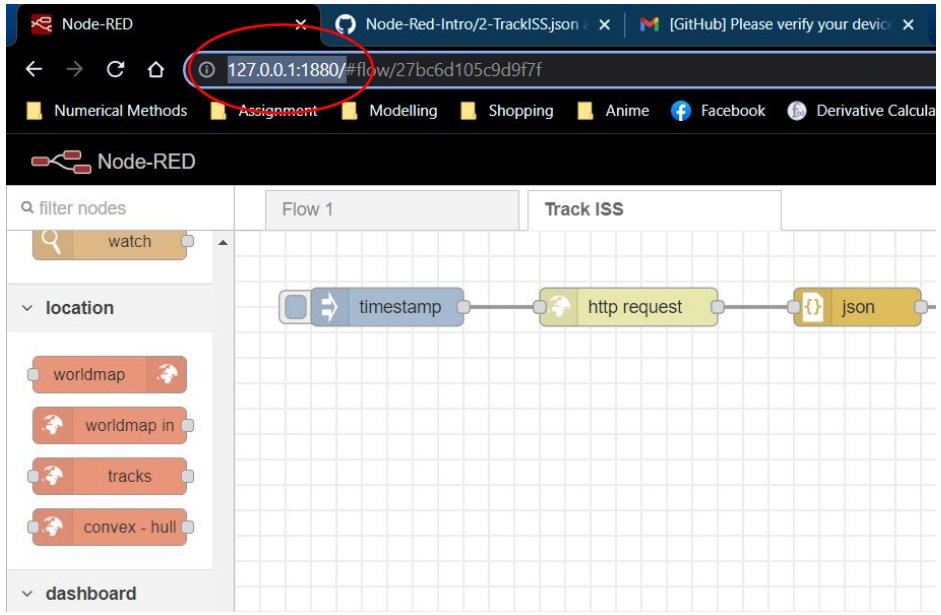
1. Click Deploy
2. Run the flow by clicking the inject trigger

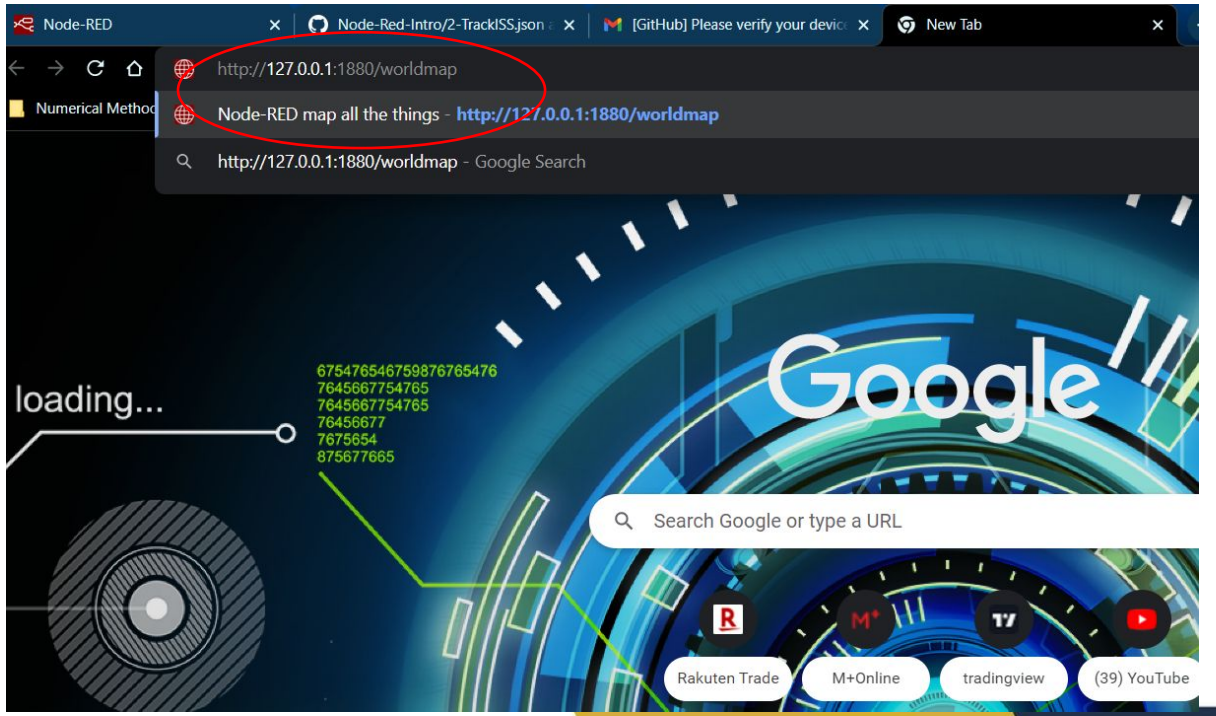




IoT – Node-RED

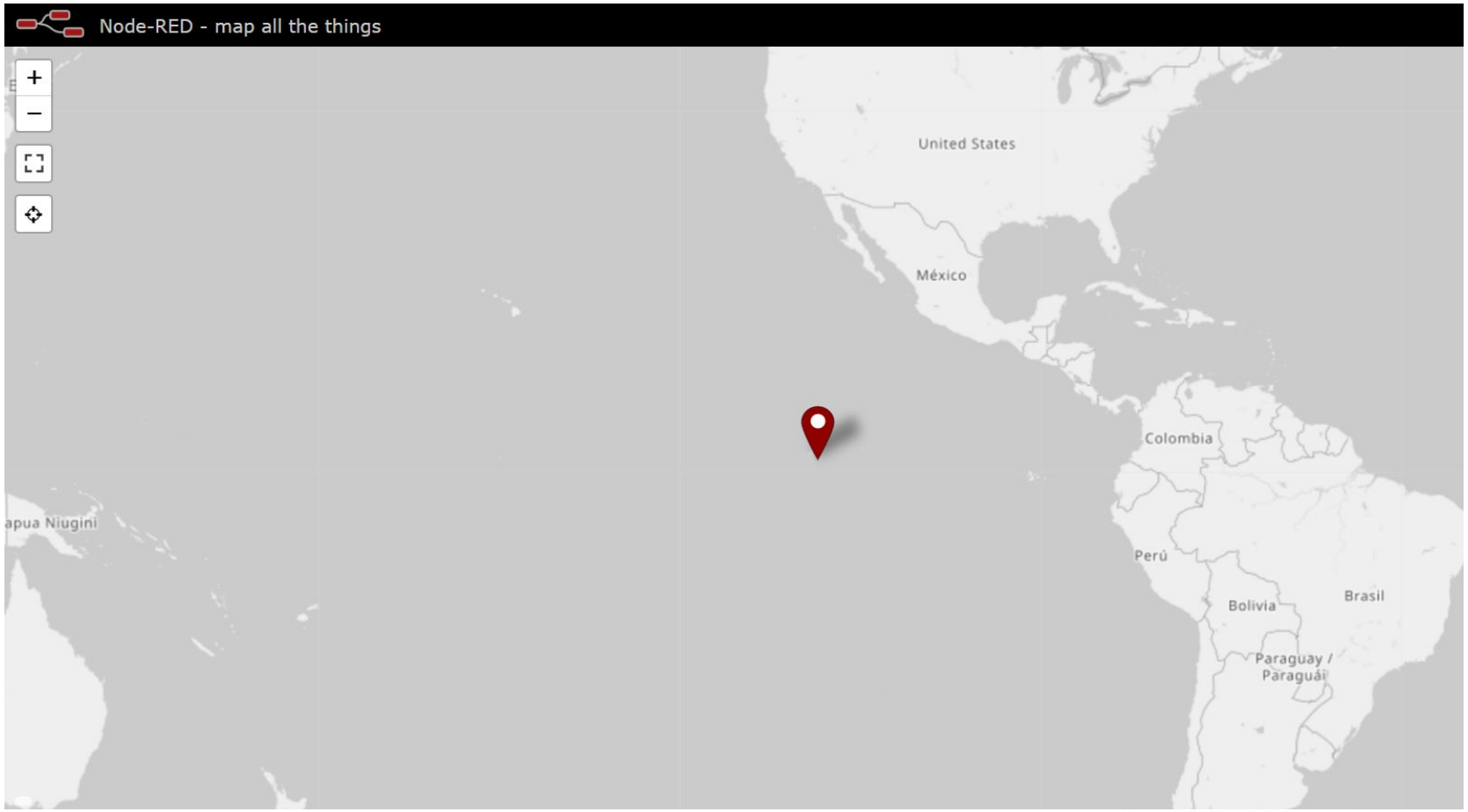
1. To open the map, copy the URL as below
2. Open new tab and paste the URL
3. Add worldmap at the end of /
4. Press Enter





IoT – Node-RED

Zoom and drag to achieve the best result of the tracker



Final Mission…

Can you switch on the light bulb from your computer?

IoT – ESP32 with Blynk

#Practice Time!

IoT – ESP32 with Blynk

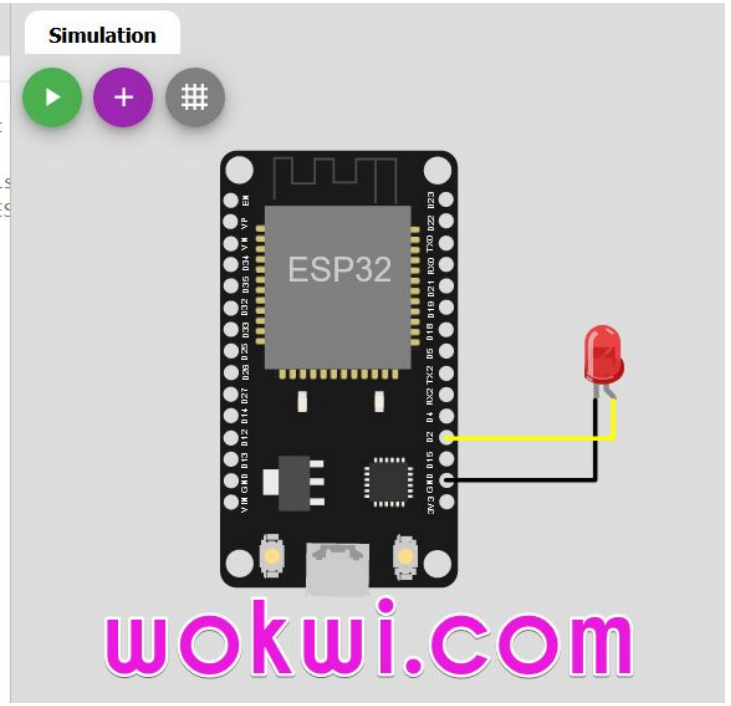
- **Blynk** is an IoT platform for mobile application and web-based application
- Used to control Arduino, Raspberry Pi and NodeMCU via Internet
- Very user friendly and easy to setup.
- In-app purchase

IoT – ESP32 with Blynk

- **Wokwi** is an online electronics simulator
- Used to simulate Arduino, ESP32 and many more
- Has limited amount of passive and active electronic component
- Free

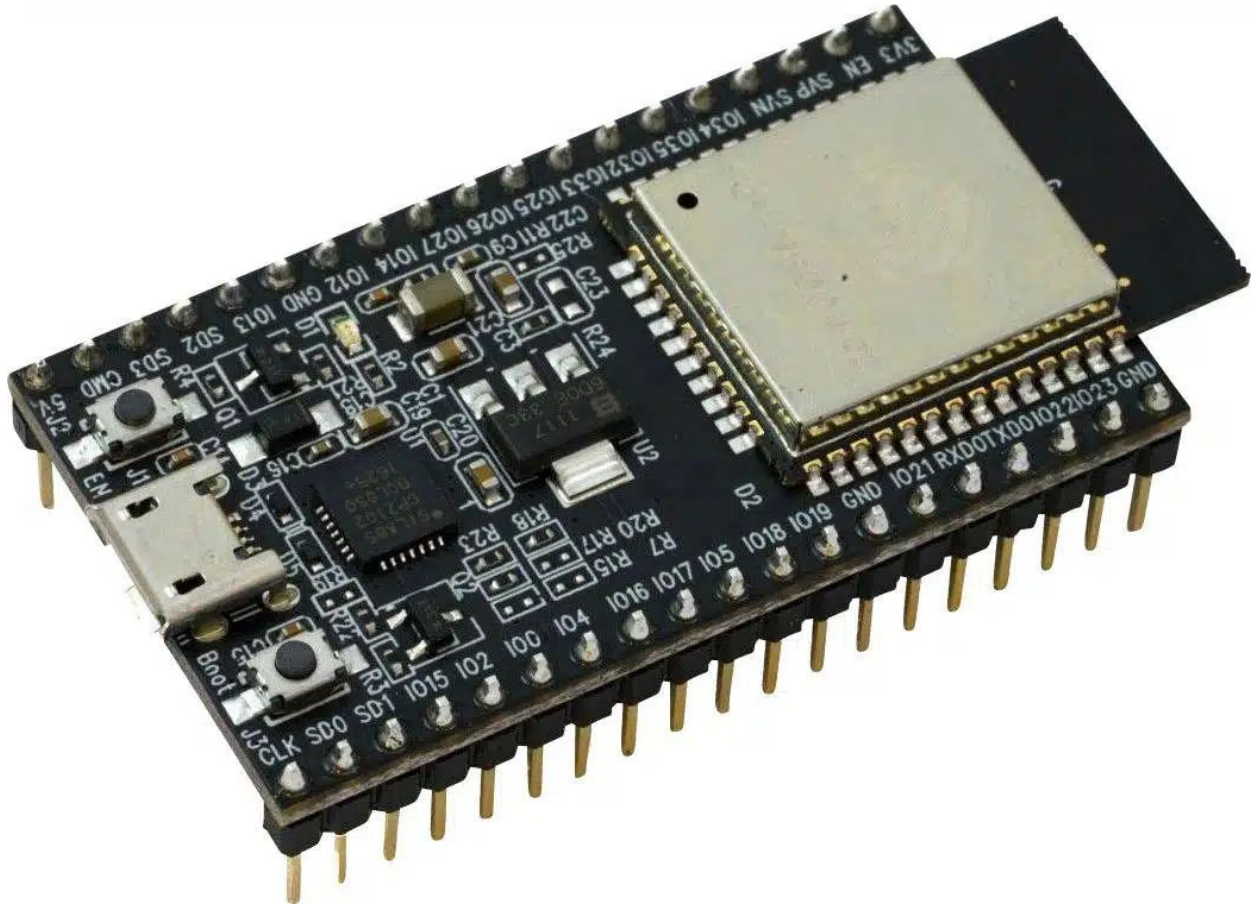
sketch.ino | diagram.json

```
/* Blink Example

   This example code is in the Public Domain (or CC0 licensed, at

   Unless required by applicable law or agreed to in writing, this
   software is distributed on an "AS IS" BASIS, WITHOUT WARRANTIES
   CONDITIONS OF ANY KIND, either express or implied.
*/
#include <stdio.h>
#include "freertos/FreeRTOS.h"
#include "driver/gpio.h"

#define LED_PIN GPIO_NUM_2
#define BLINK_TIME 1000

extern "C" void app_main()
{
    uint8_t led_value = 0;
    gpio_reset_pin(LED_PIN);
    gpio_set_direction(LED_PIN, GPIO_MODE_OUTPUT);


    while (1) {
```



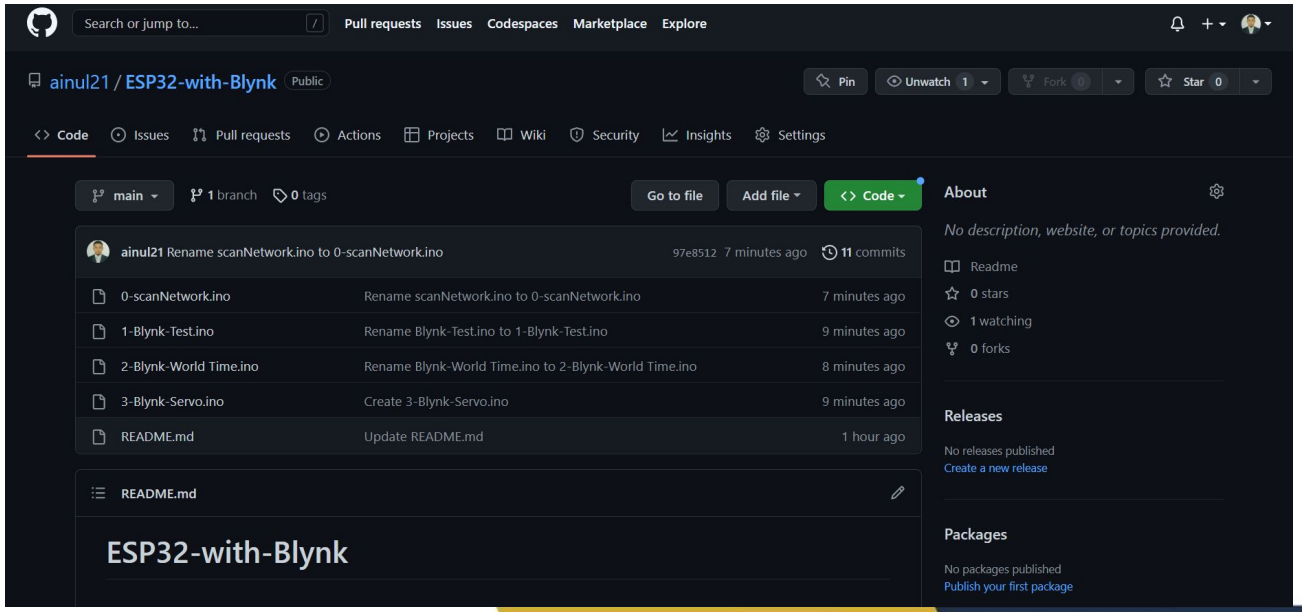
IoT – ESP32 with Blynk

- **ESP32** microcontroller integrated with Wi-Fi and Bluetooth module.
- Very practical for IoT project
  - Low-cost
  - Low-power
  - Many GPIO pin



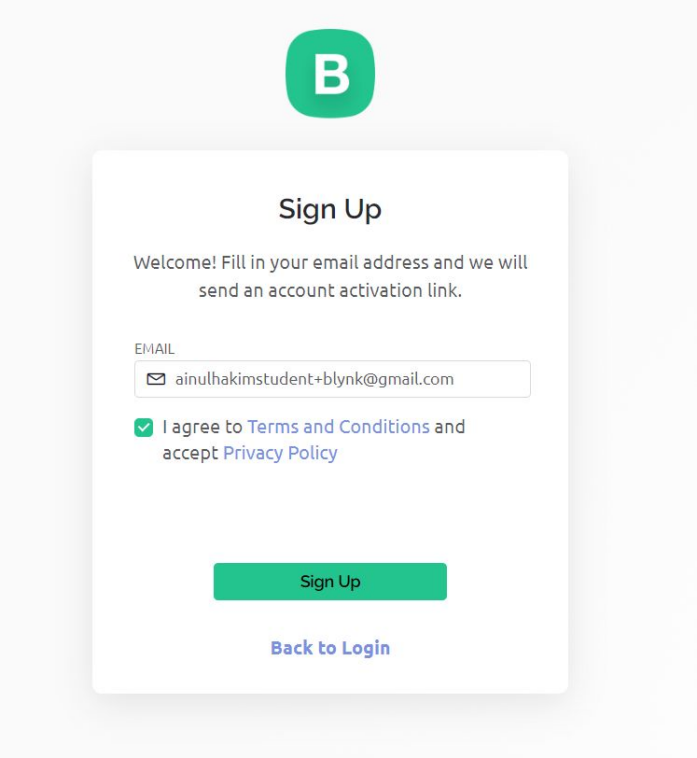
IoT – ESP32 with Blynk

1. Open browser
2. Type URL
   - github.com/ainul21/ESP32-with-Blynk
3. Open the Wokwi and Blynk web page, the link located at README.md

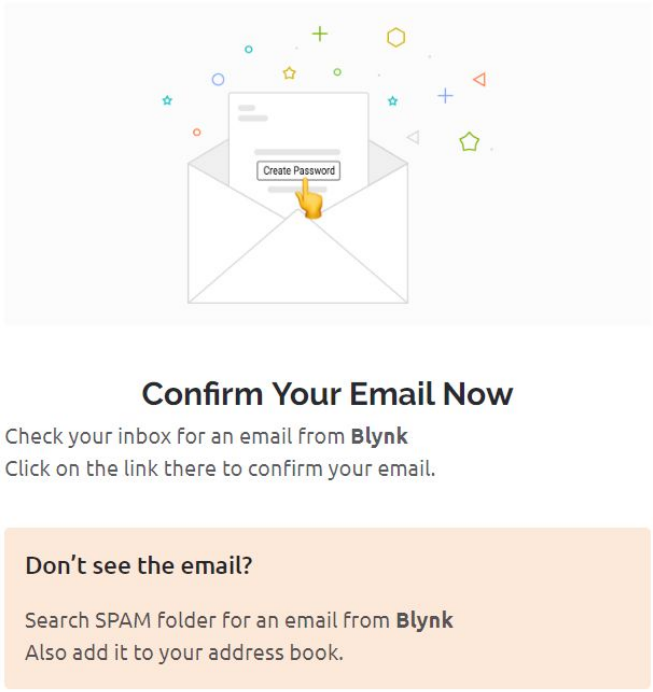


Iot – ESP32 with Blynk

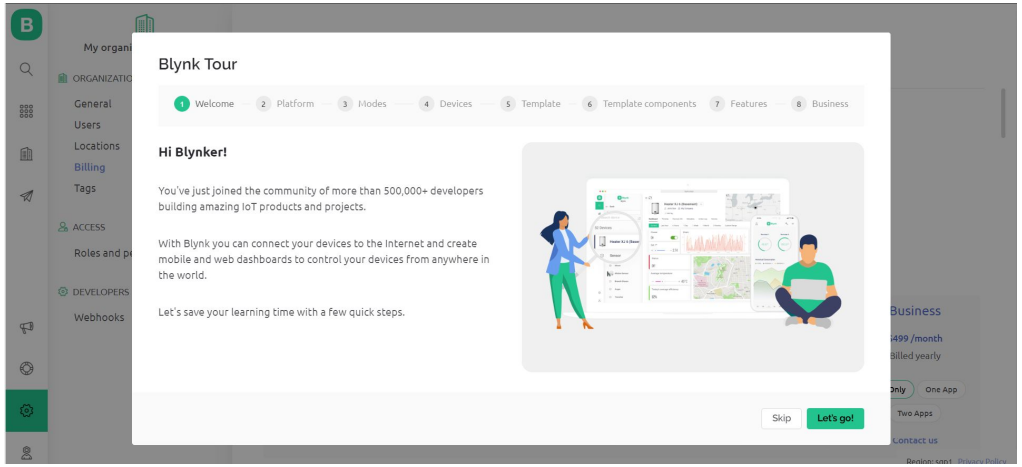
1. Open Blynk web page
2. Create new account/login



Register new account

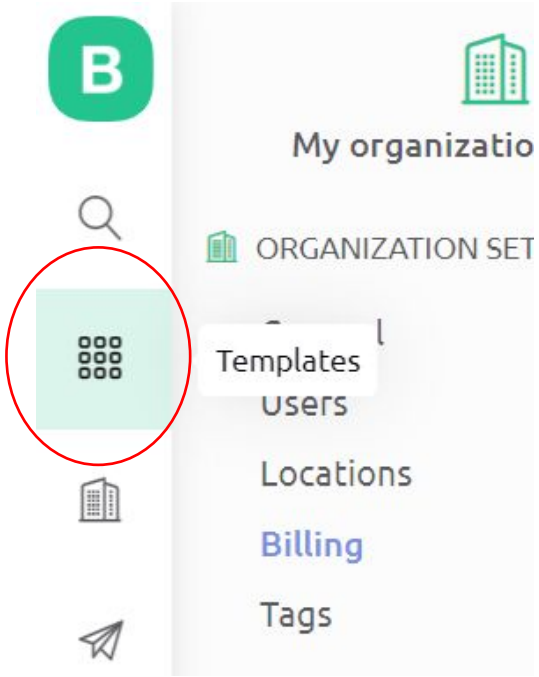


Click ESP32

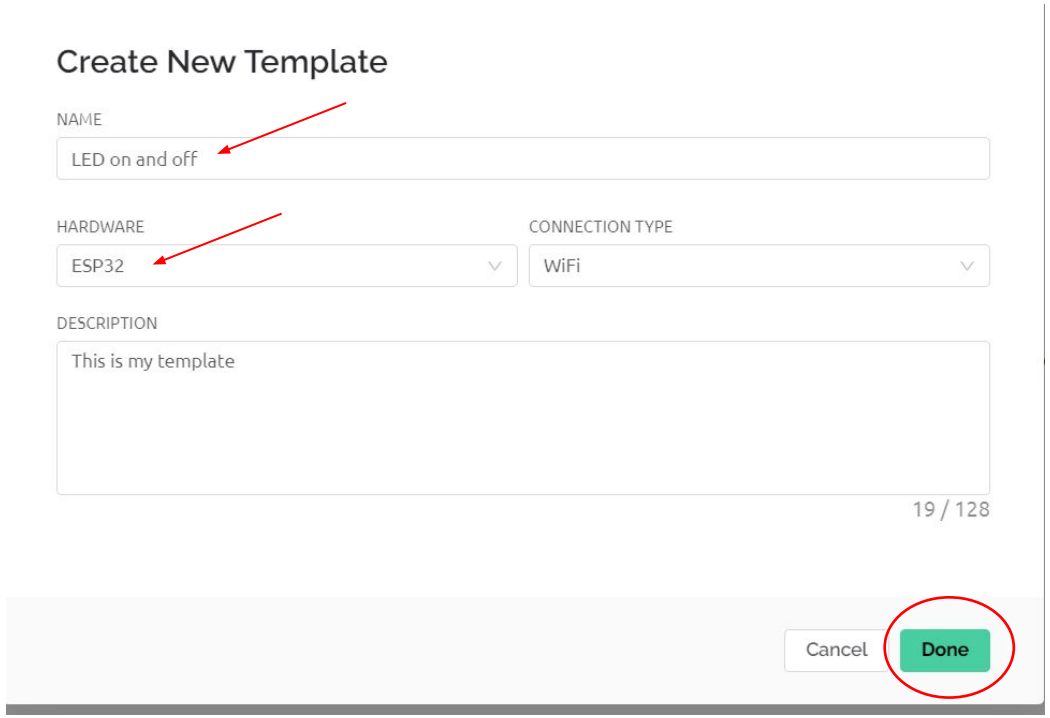


IoT – ESP32 with Blynk

1. Open Templates
2. Create New Template



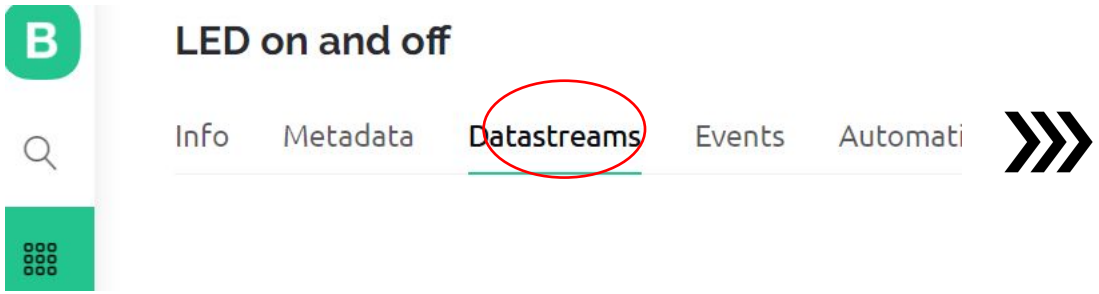
Register new account

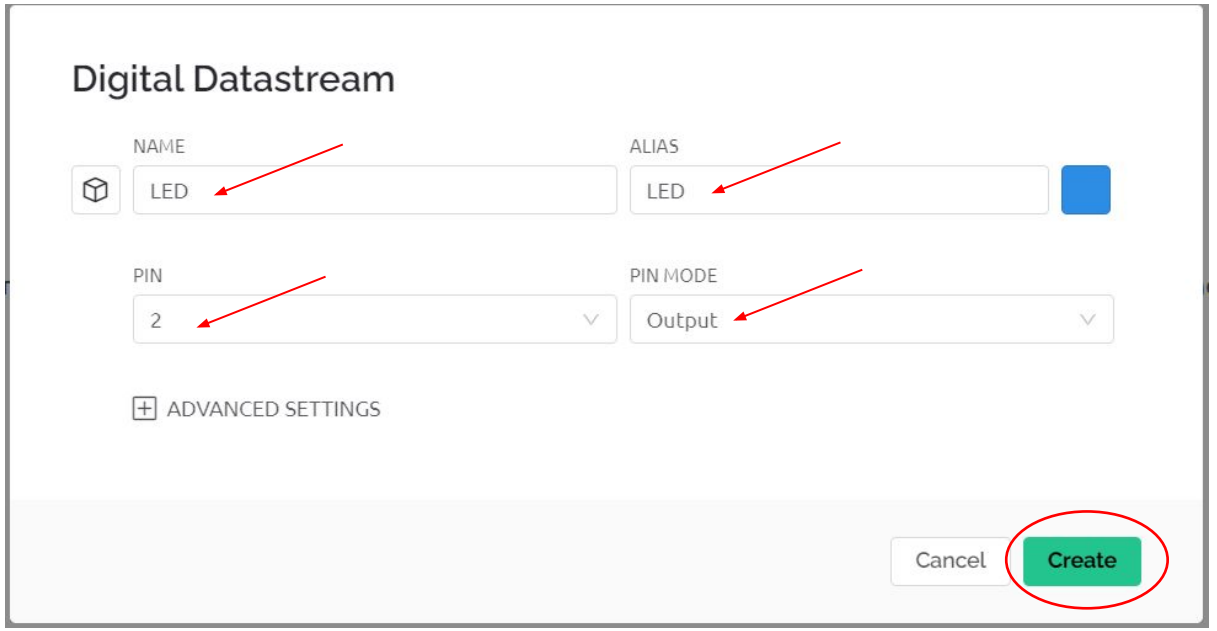


Click Done

IoT – ESP32 with Blynk

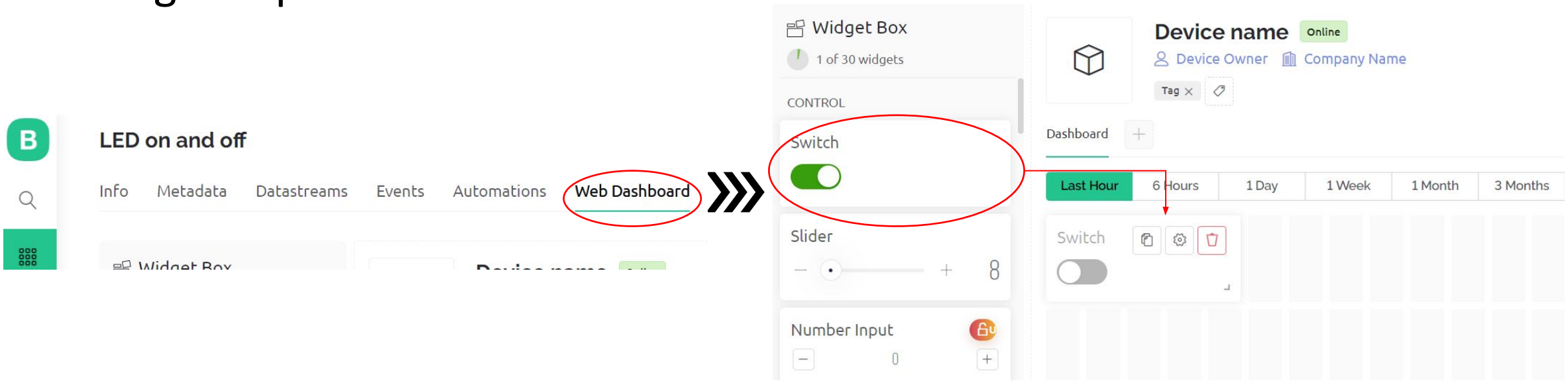
1. Open Datastream
2. Create New Datastream
3. Click Save





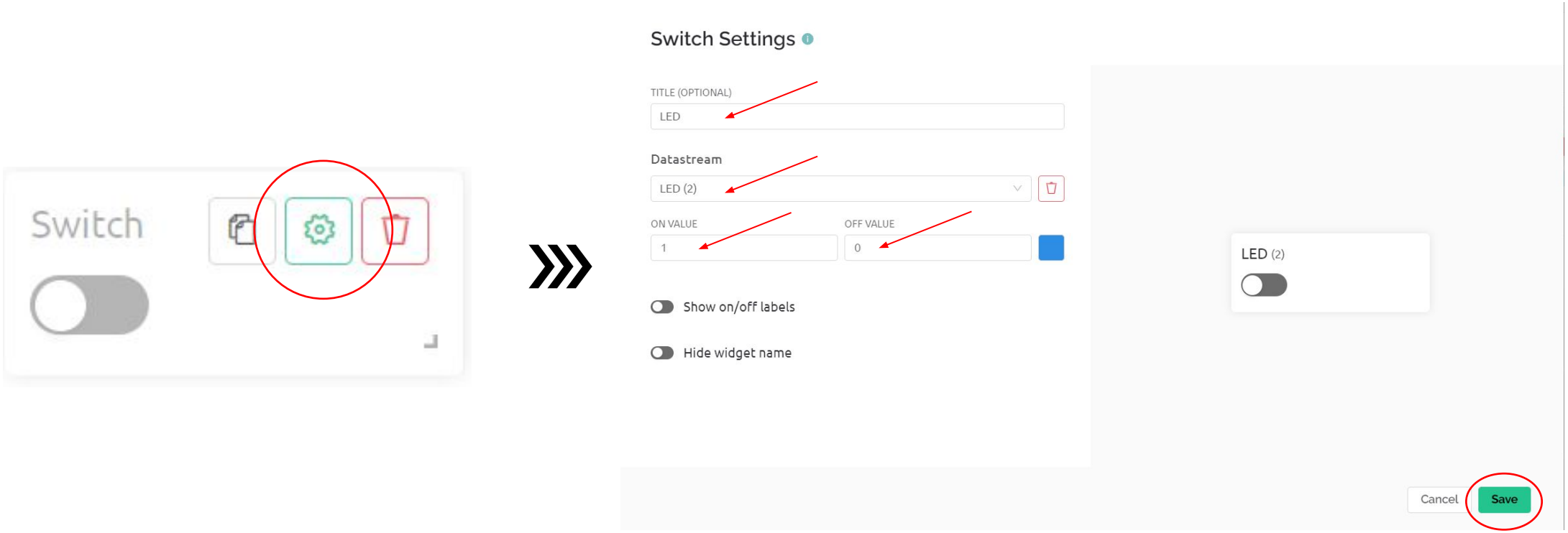
IoT – ESP32 with Blynk

1. Open Web Dashboard
2. At Widget Box find Switch
3. Drag and place the Switch into canvas



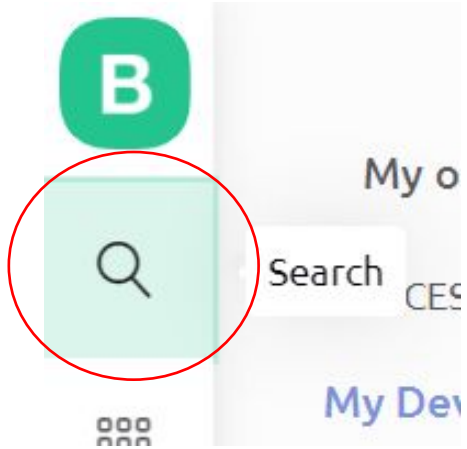
IoT – ESP32 with Blynk

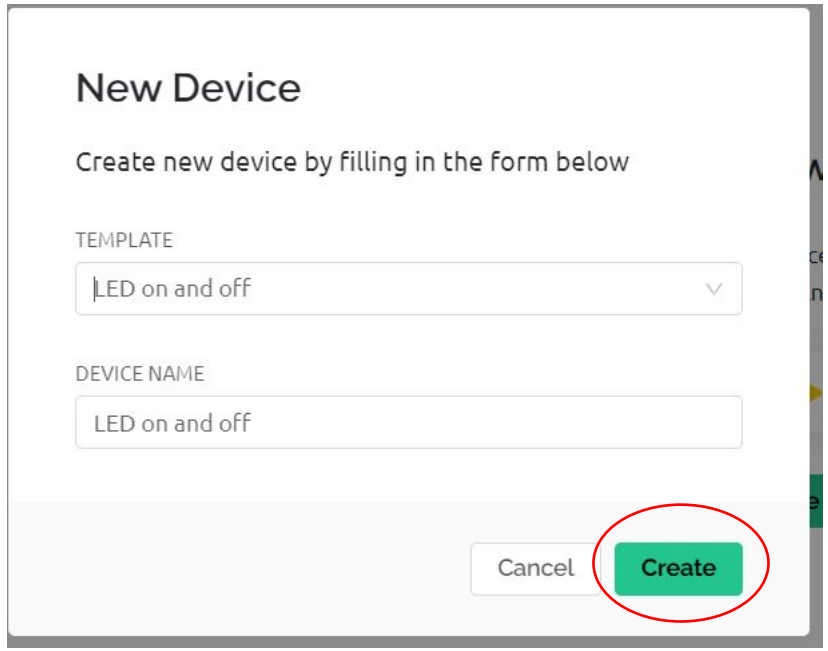
1. Click setting icon at Switch layout
2. Save the layout



IoT – ESP32 with Blynk

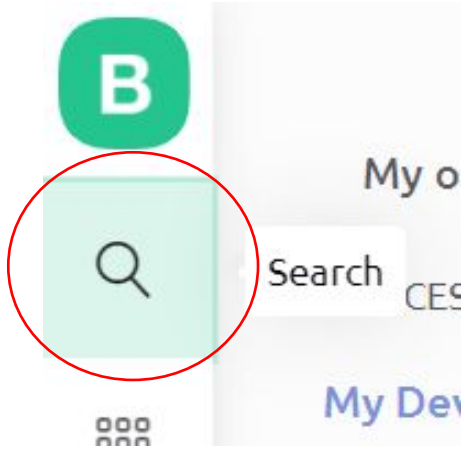
1. Open Search
2. Add New Device, click From Template
3. Create New Device

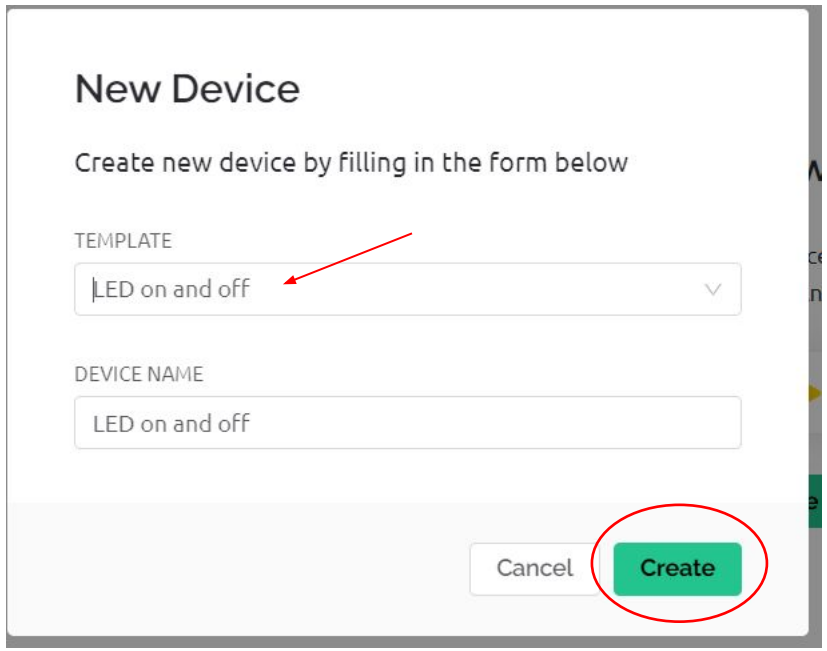


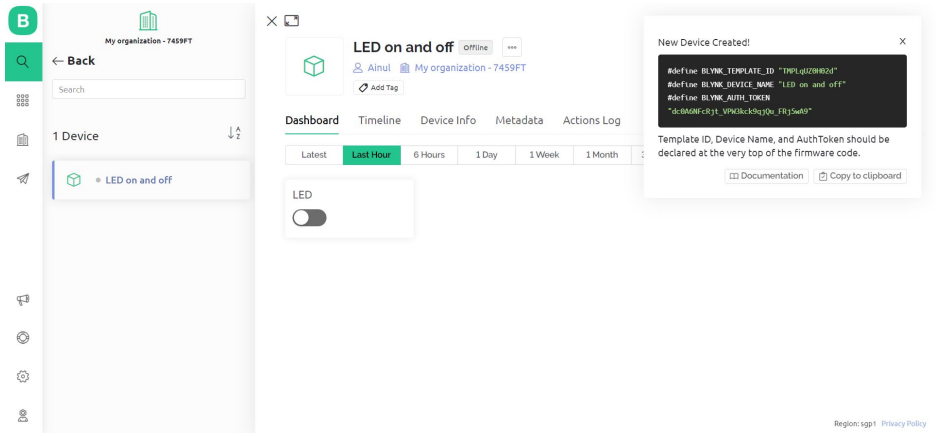


IoT – ESP32 with Blynk

1. Open Search
2. Add New Device, click From Template
3. Create New Device

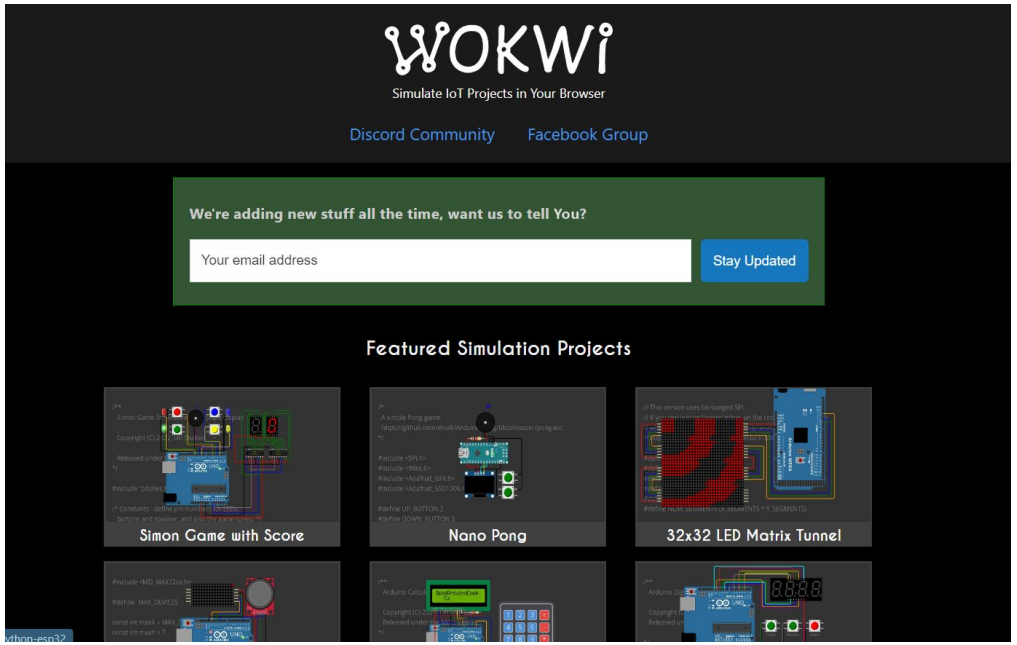




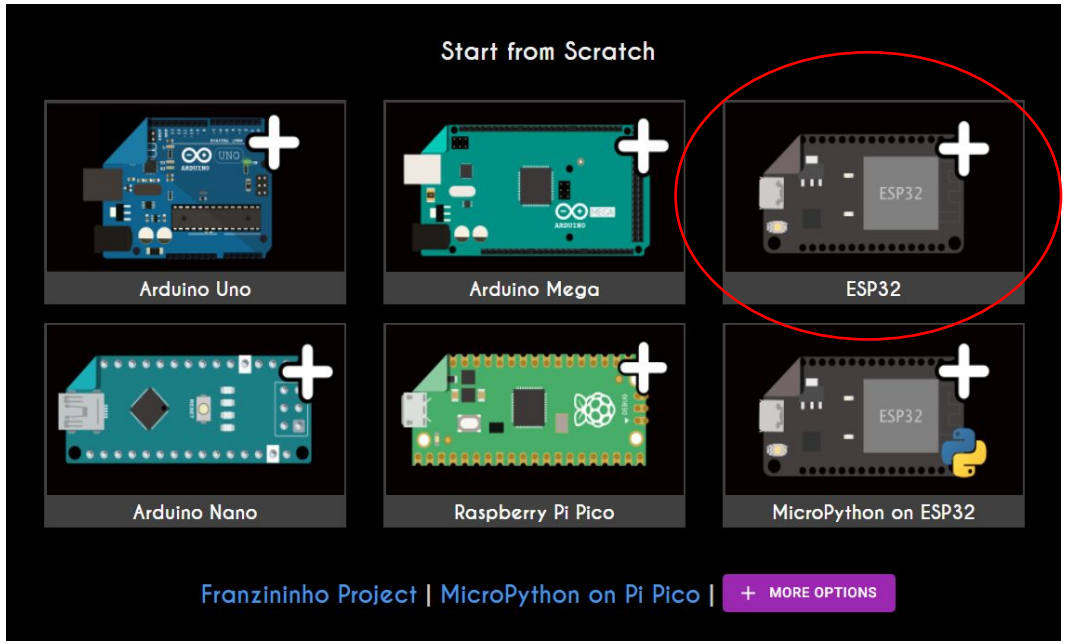


IoT – ESP32 with Blynk

1. Open Wokwi web page



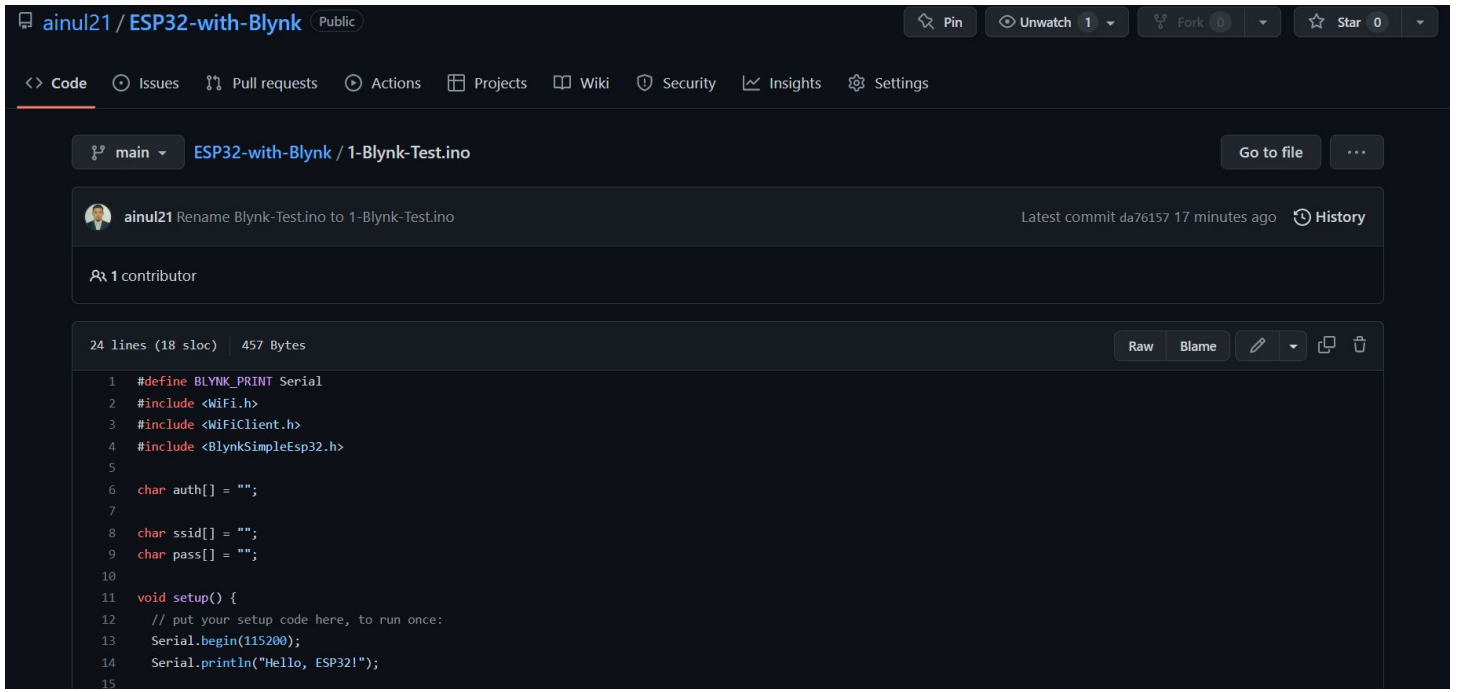
Scroll Down



Click ESP32

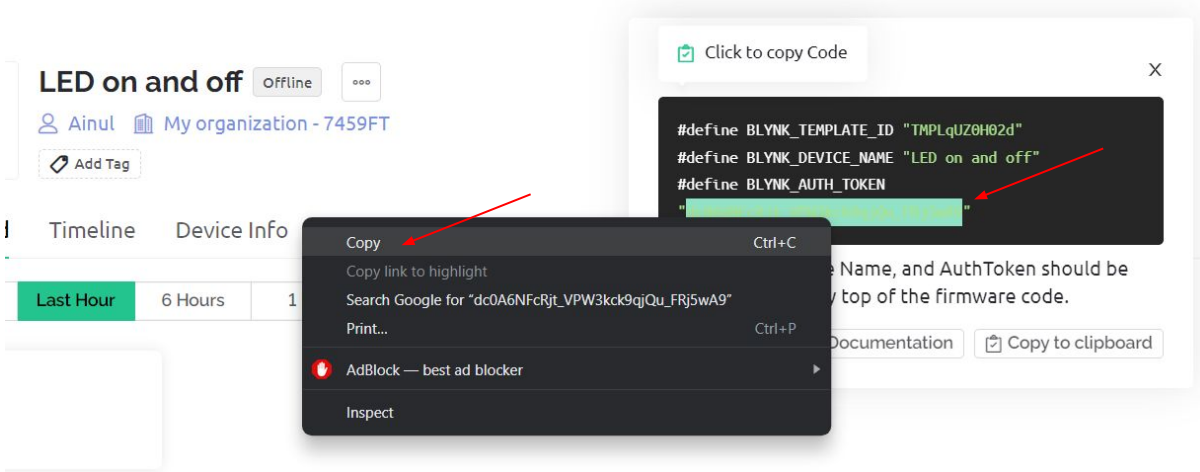
IoT – ESP32 with Blynk

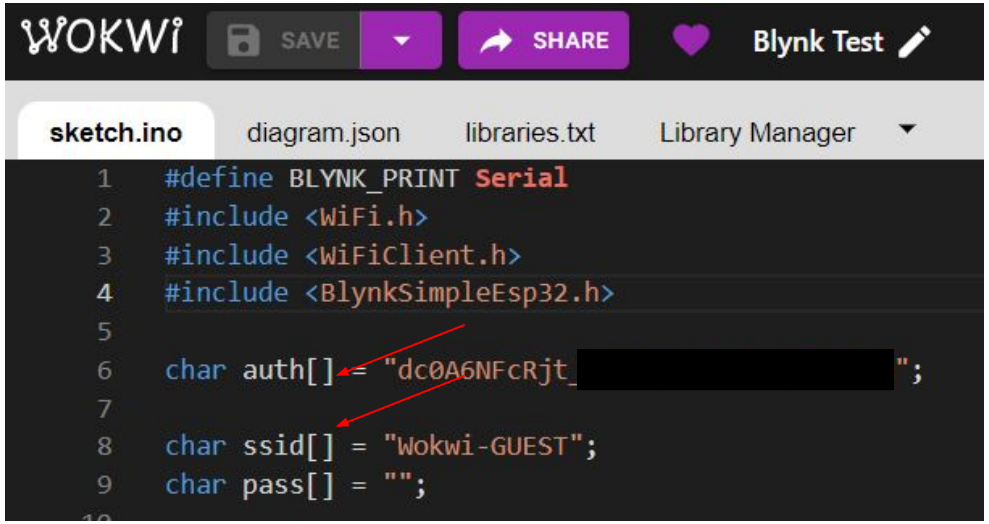
1. First Activity
   - Go to GitHub
   - Open file name: 1-Blynk-Test.ino
   - Copy the code
   - Paste the code at Wikwo
   - Add Blynk Library



IoT – ESP32 with Blynk

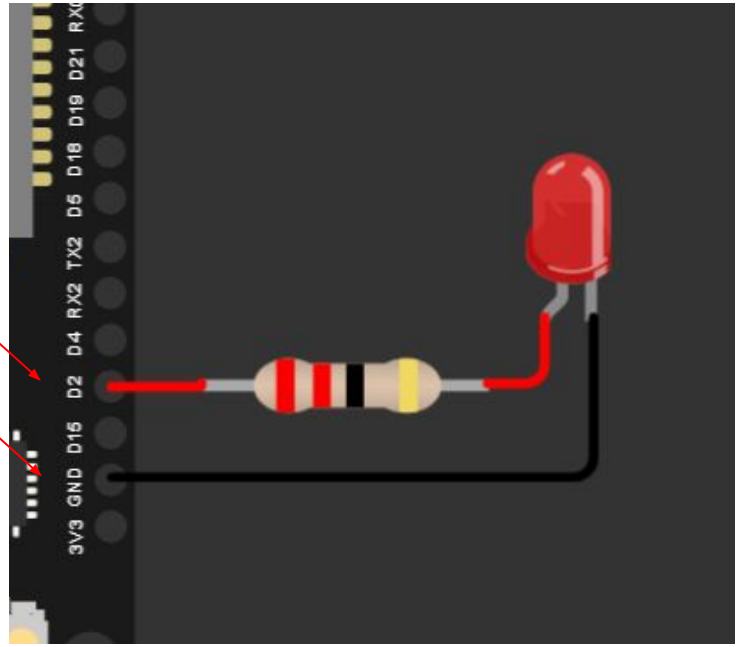
1. Copy the AuthKey from Blynk
2. Paste at the code
3. Add the SSID

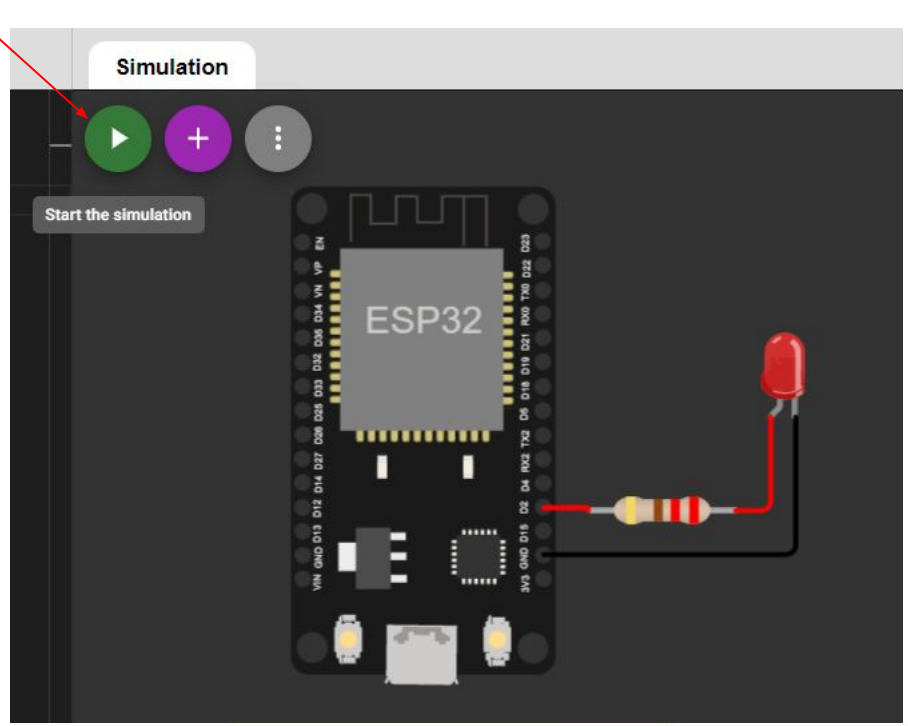




Iot – ESP32 with Blynk

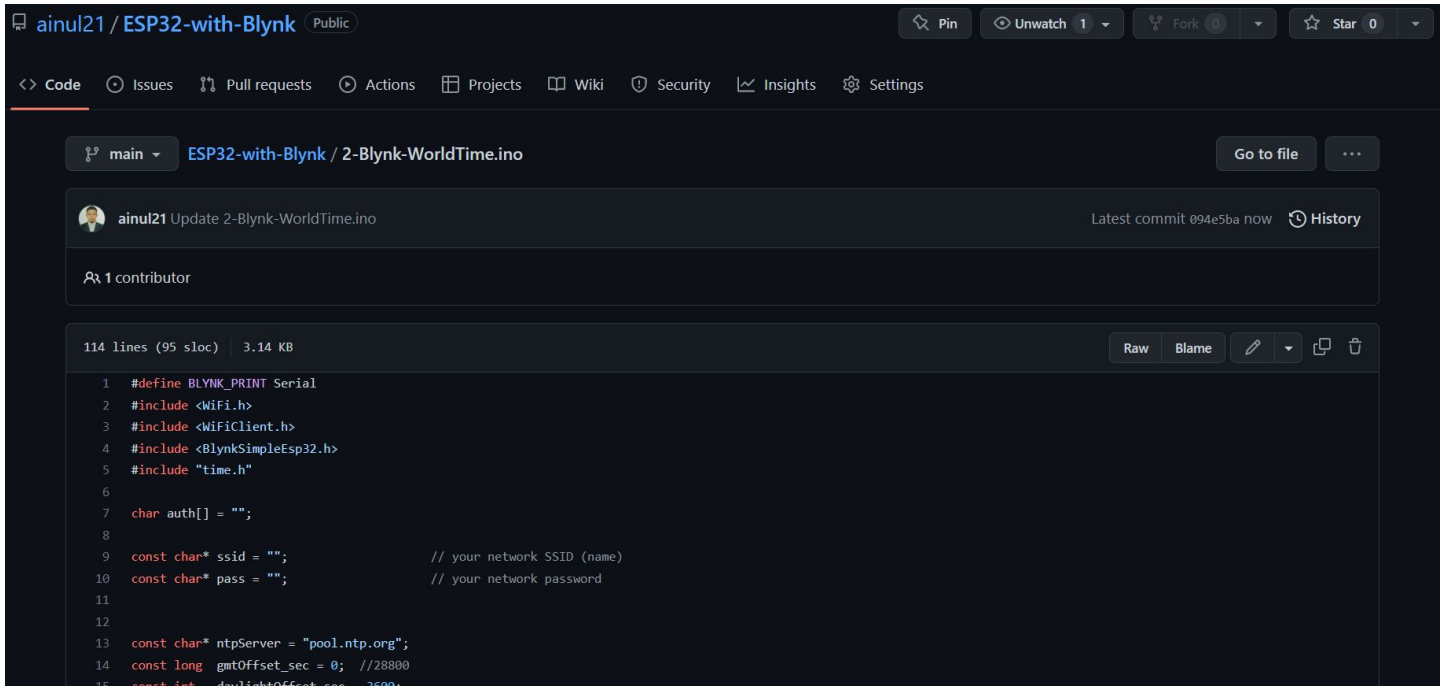
1. Add Resistor and LED on the canvas
2. Connect correctly the component
3. Start the simulation





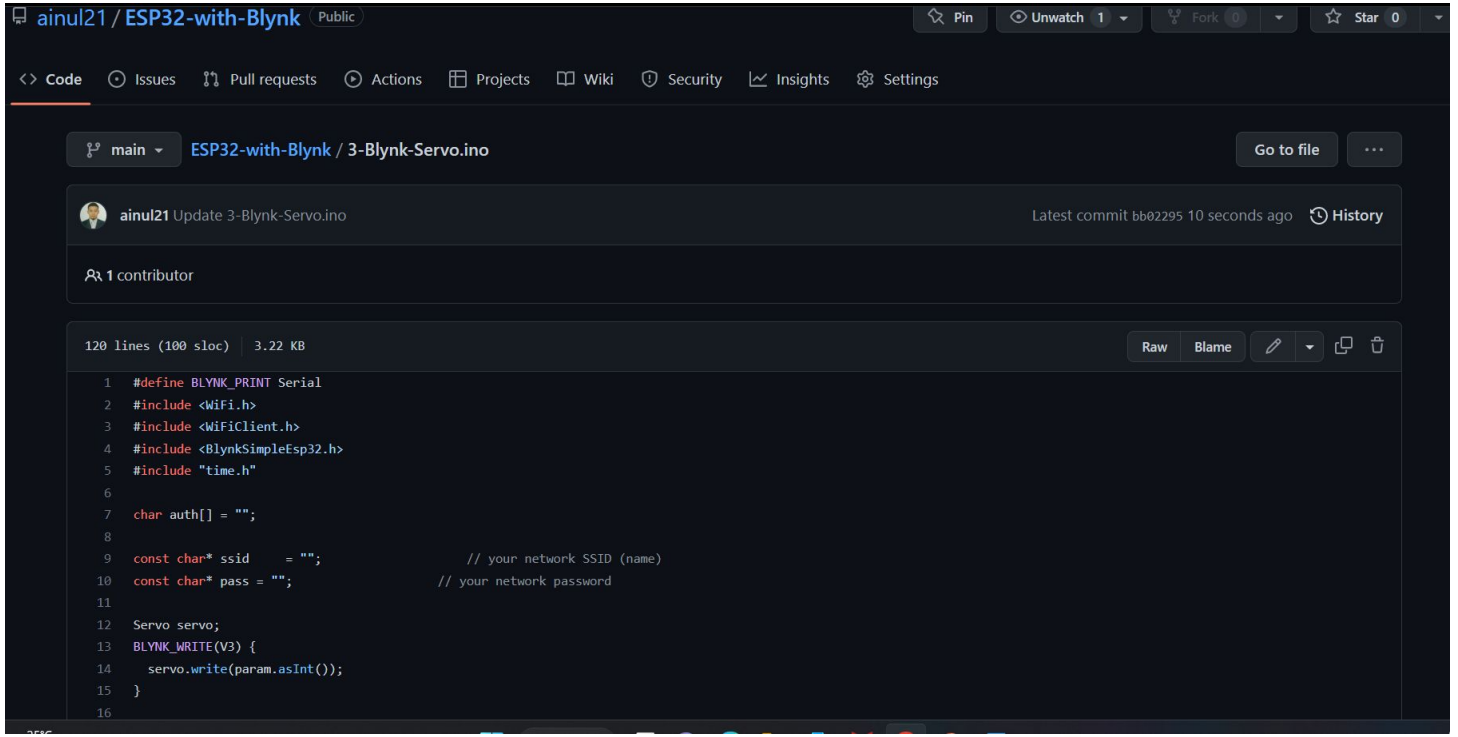
IoT – ESP32 with Blynk

1. Second Activity
   - Go to GitHub
   - Open file name: 2-Blynk-WorldTime.ino
   - Copy the code
   - Paste the code at Wikwo
   - Add Blynk Library



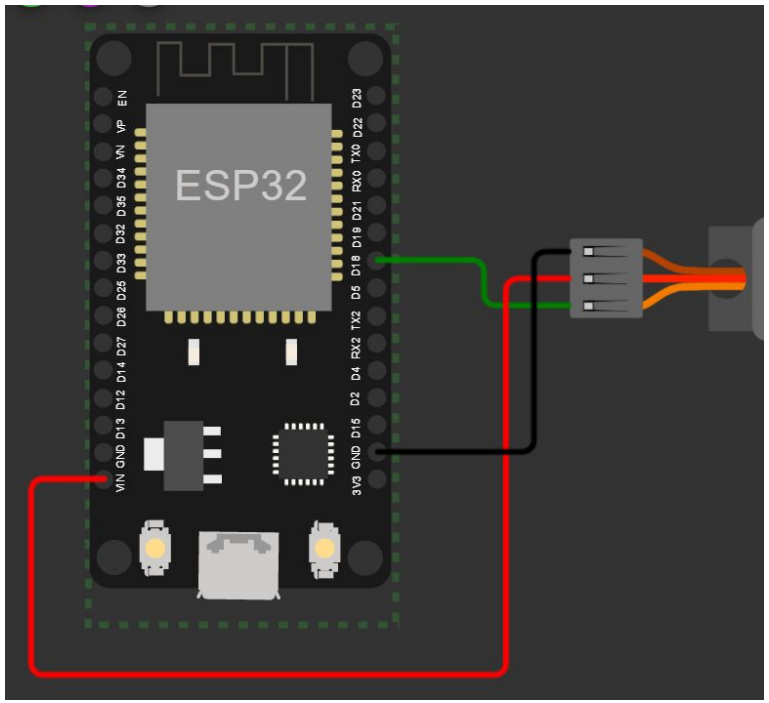
IoT – ESP32 with Blynk

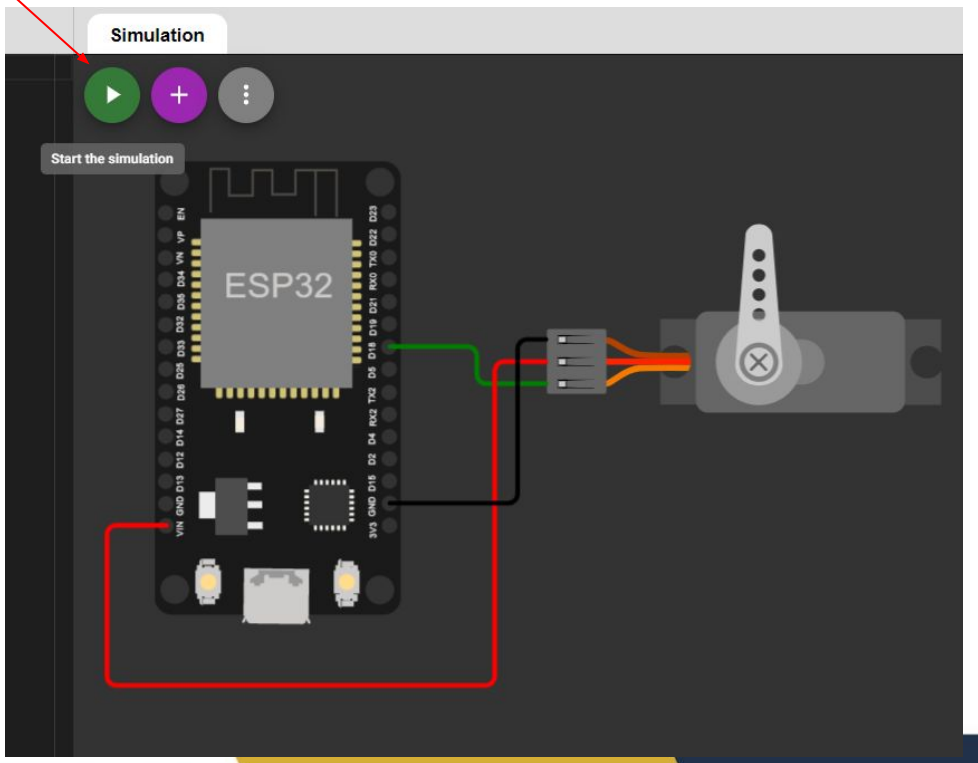
1. Third Activity
   - Go to GitHub
   - Open file name: 3-Blynk-Servo.ino
   - Copy the code
   - Paste the code at Wikwo
   - Add Blynk Library
   - Add ESP32Servo Library



Iot – ESP32 with Blynk

1. Add Servo on the canvas
2. Connect correctly the component (GND, VIN, D18)
3. Start the simulation



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