Week 9 - IoT Software

MQTT and Node Red

UNIT 3.

Raspberry Pi with Node-RED

- 3.1. Initial Setting
- 3.2. Access Detection using Node-RED
- 3.3. Send MQTT Payload

Install Node.js on Raspberry Pi (Max at Node 16!!!)

- Latest NodeJS Installation
  - Install the latest version of Node.js on your Raspberry Pi.

```
$ wget -O - https://raw.githubusercontent.com/meech-ward/NodeJs-Raspberry-Pi/master/Install-Node.sh | sudo bash;
```

  - Check your Node.js version on Raspberry Pi.

```
$ node –v
```

```
pi@raspberrypi:~ $ node -v
v16.10.0
```

  - You can test with a simple script if your installation is succeeded.

```
pi@raspberrypi:~ $ node
Welcome to Node.js v16.10.0.
Type ".help" for more information.
> var greeting = "Hello"
undefined
> console.log(greeting)
Hello
undefined
>
pi@raspberrypi:~ $
```

Install Node-RED

- Before we start Installation, we should update existing libraries.
  - Keep the library up to date by entering the following commands in succession:

```
$ sudo apt update
$ sudo apt upgrade
```

  - Download Node-RED. (it takes quite some time.)
  - Enter y for the two questions in the middle.

```
$ bash <(curl -sL https://raw.githubusercontent.com/node-red/linux-installers/master/deb/update-nodejs-and-nodered) –node16
```

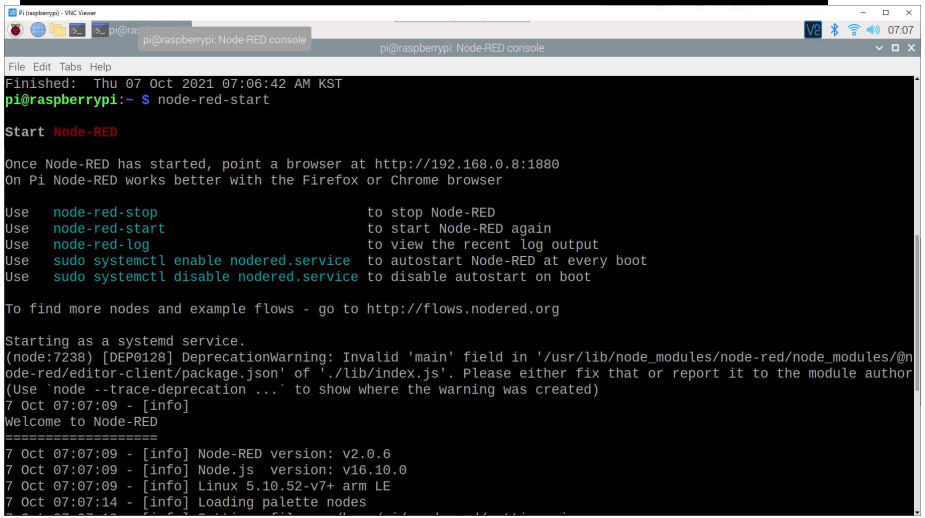
- Node-RED Installation Procedure

```
Running Node-RED install for user pi at /home/pi on raspbian


This can take 20-30 minutes on the slower Pi versions - please wait.

  Stop Node-RED                       ✔
  Remove old version of Node-RED      ✔
  Node option not specified           :   --node12 or --node14
  Leave existing Node.js              :   v16.10.0   Npm 7.24.0
  Clean npm cache                     -
  Install Node-RED core               ✔   2.0.6
  Move global nodes to local
  Npm rebuild existing nodes
  Install extra Pi nodes
  Add shortcut commands
  Update systemd script


Any errors will be logged to   /var/log/nodered-install.log
```

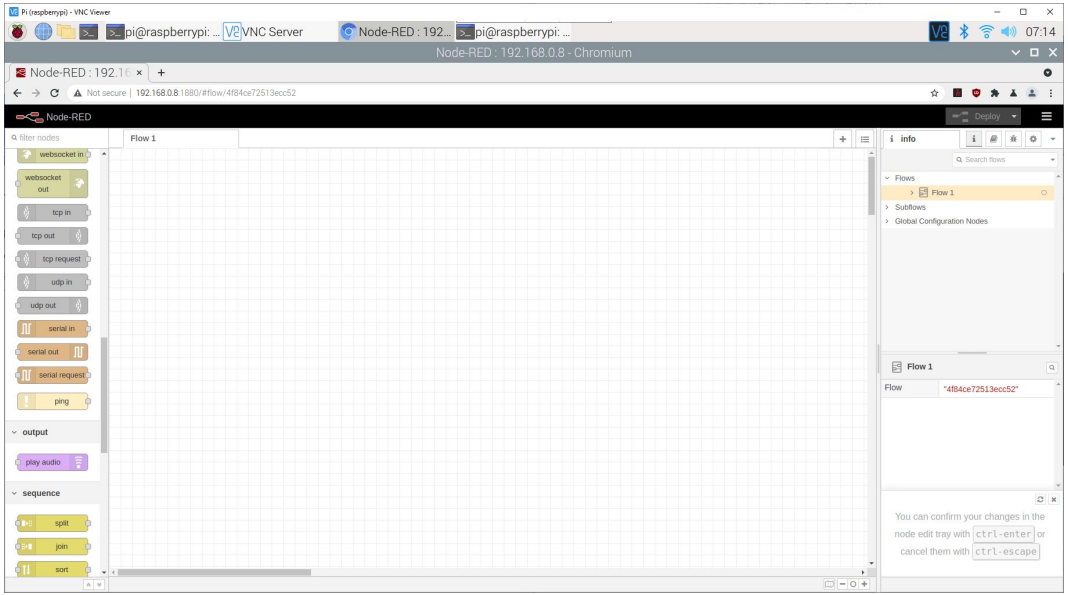
Start Node-RED

- Start Node-RED
  - Execute with Node JS through the following execution command:

```
$ node-red-pi --max-old-space-size=256
```



- Start Node-RED
  - Go to http://{Raspberry Pi's IP Address}:1880 in your browser.
  - Both NC browser and Windows browser are available, but here, use the browser in Raspberry Pi itself to access.



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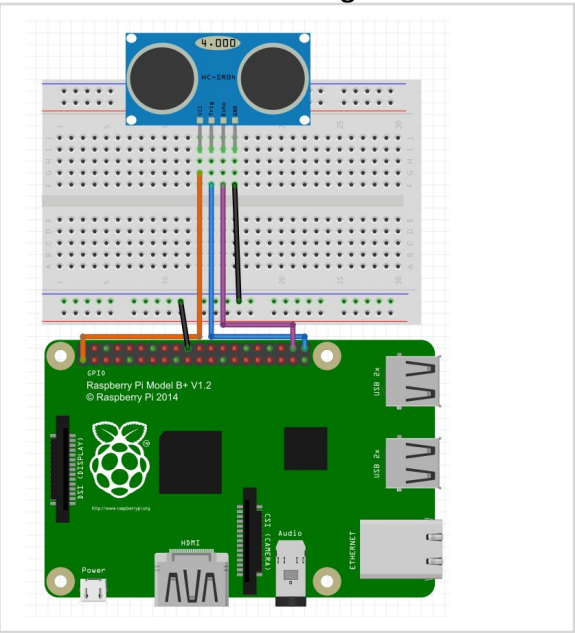
Access Detection using Node-RED

- Access Detection using Node-RED

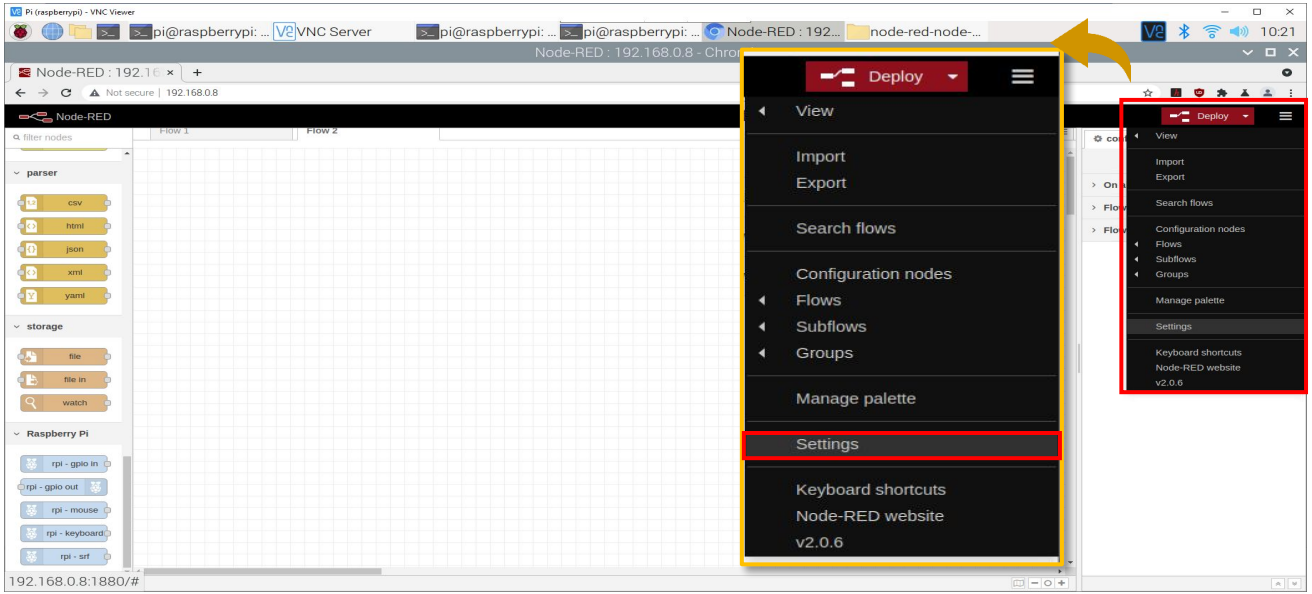


- An example of visualizing the measured distance by measuring the distance using the Ultrasonic Sensor with Node-RED.

- Circuit Diagram
  - HC-SR04 VCC – Raspberry Pi 3.3v
  - HC-SR04 GND – GNDs
  - HC-SR04 Trig – Raspberry Pi GPIO 21
  - HC-SR04 Echo – Raspberry Pi GPIO 20
  - Raspberry Pi GND – GNDs

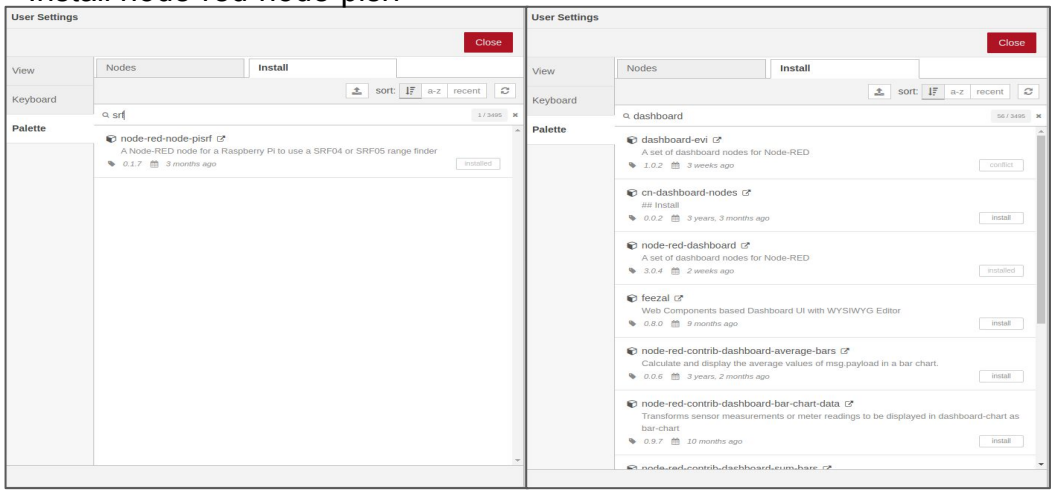
Install

- Install Nodes
  - To install Ultrasonic Sensor Node and Social Node, press Menu on the right side of the screen and click Settings.



Install Nodes

- Install node-red-node-pisrf

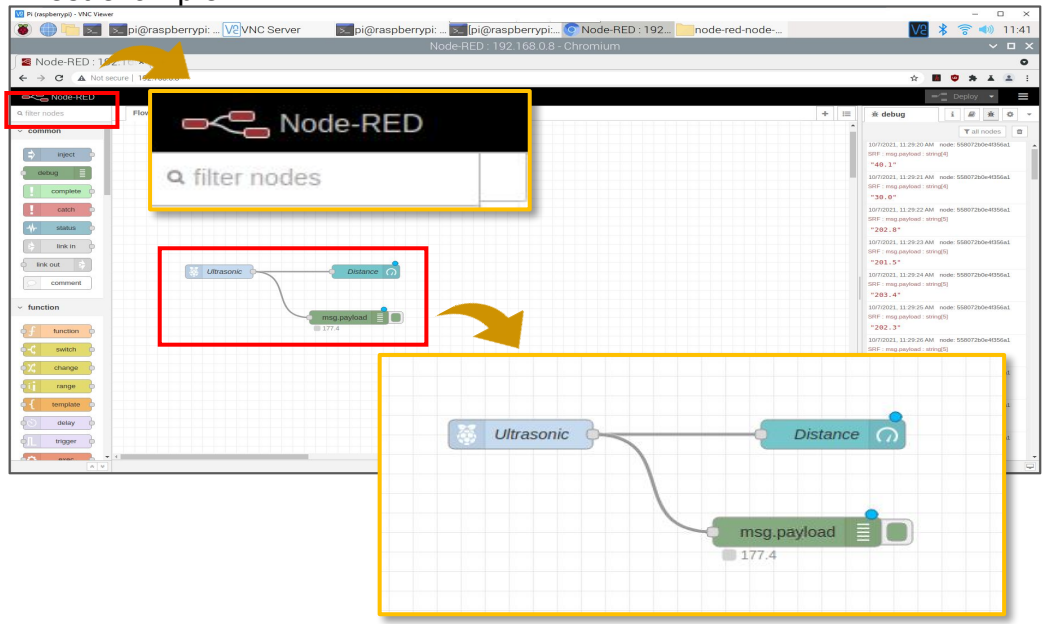


- Search for srf in the Pallete tab and install pisrf.
- Installation of the ultrasonic sensor to use in Node-RED

- Search dashboard and install node-red-dashboard.
- Installation to use Node-RED's dashboard node to provide simple visualization

Add Nodes

- Test example

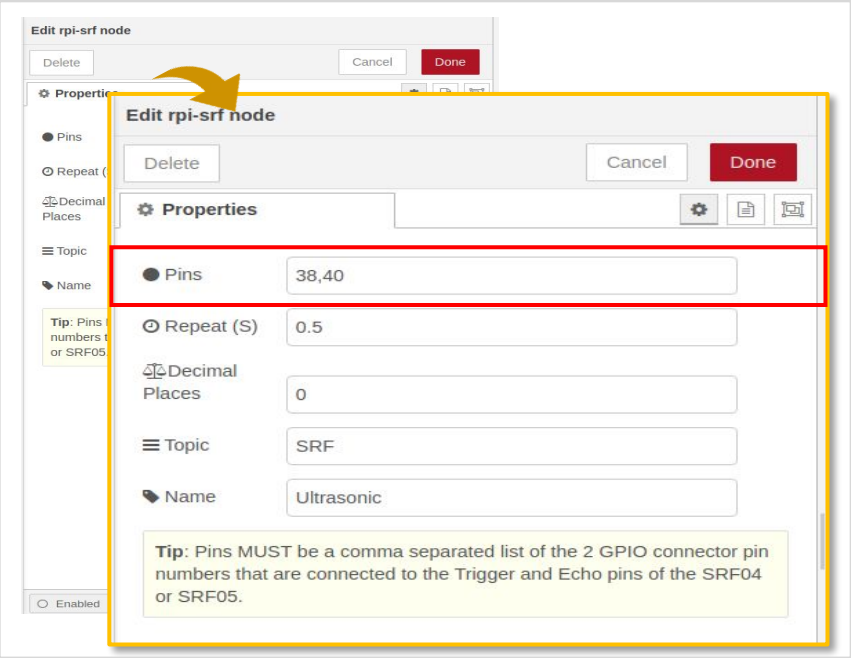


- Enter **srf, gauge**, and **debug** in the search input field on the top left where **filter nodes** is written, create nodes one by one, and connect them as shown in the figure on the left.

- Since the colors are separated, only the arrangement and connection are carried out, and the detailed setting is continued.

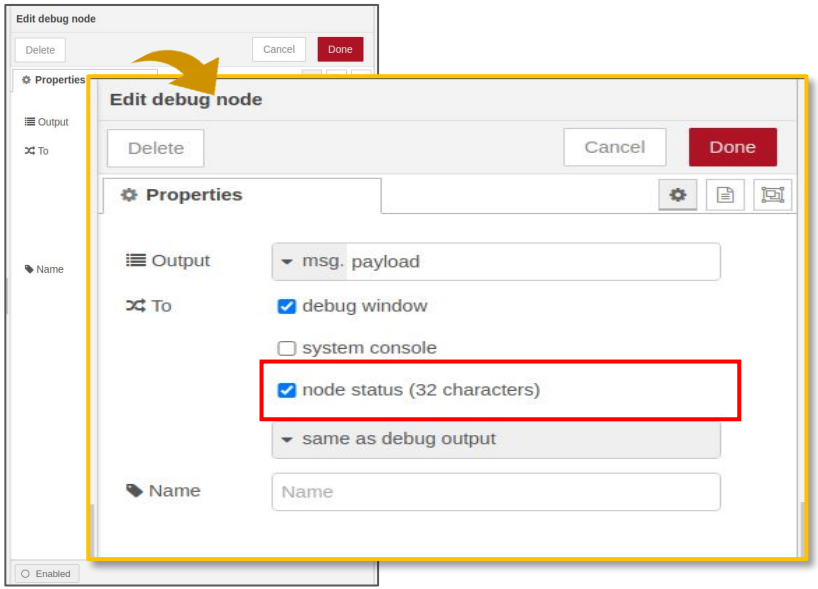
Edit Nodes

- Edit nodes' properties.



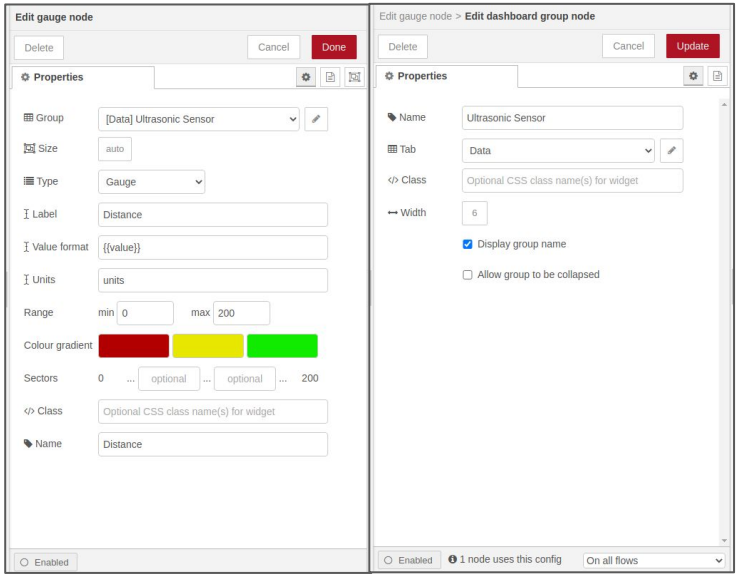
- rpi-srf node
  - One thing to note about pins is that you have to input Trig and Echo in order, and write the number of the pin itself, not the gpio pin number.
  - Trig and Ccho are connected to GPIO 21 and GPIO 20, respectively, and the number of these pins themselves are 38 and 40.
  - Repeat : repeat cycle
  - Name: Ultrasonic

- Edit nodes' properties.



- debug node
  - Check the node status.

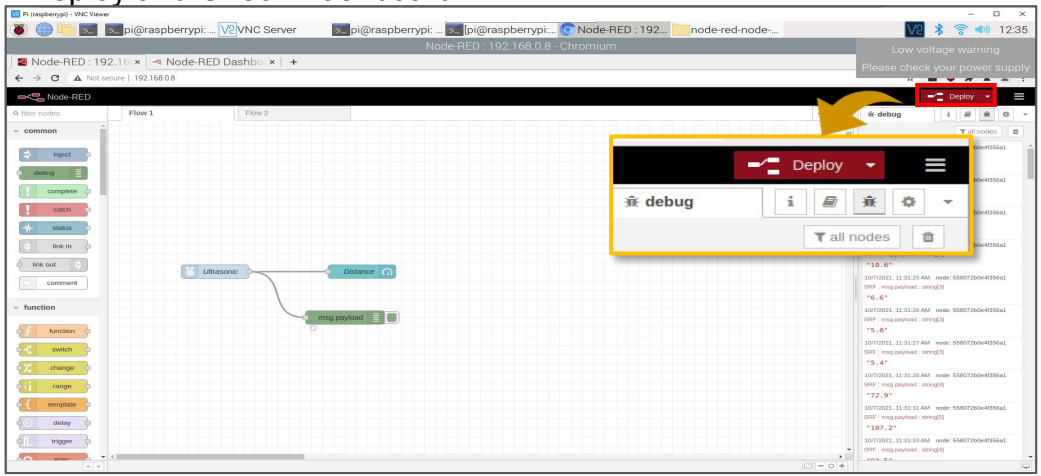
- Edit nodes' properties.



- gauge node
  - Group: Edit nodes' properties through the expand tab and the edit dashboard group node button so that they are in the same state as the screen on the right .
  - Label : Distance
  - Range: 0 – 200
  - Change colors freely
  - Name: Distance

Deploy Nodes

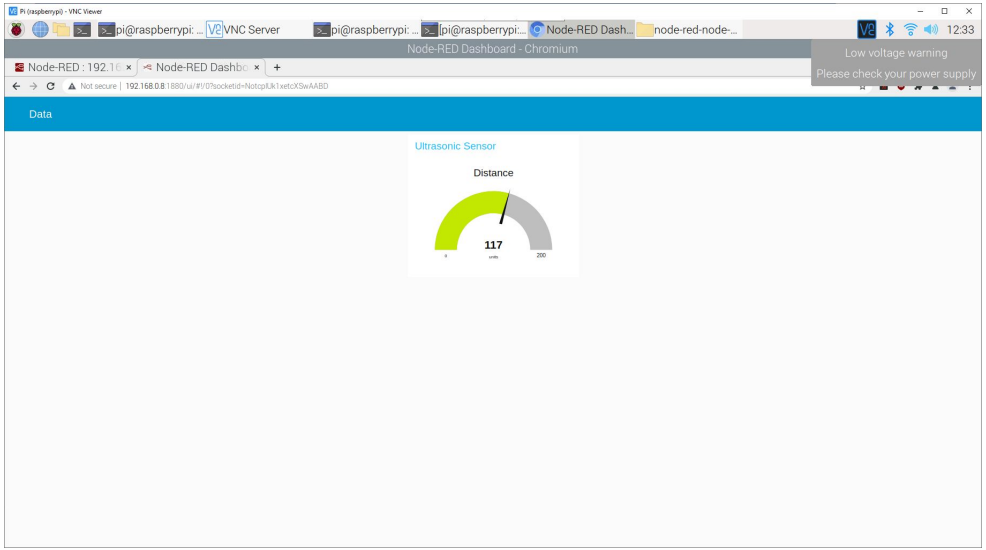
- Deploy and Check Dashboard



- Click the “Deploy” button to run the flow.
- If you click Debug messages, you can see that the observation values are output.

Check Dashboard

- Deploy and Check Dashboard
  - Connect to http://Raspberry Pi's IP Address:1880:/ui, so you can see gauge that changes according to the measurements of the sensor.



STOP, Now it's time for Quick DEMO!

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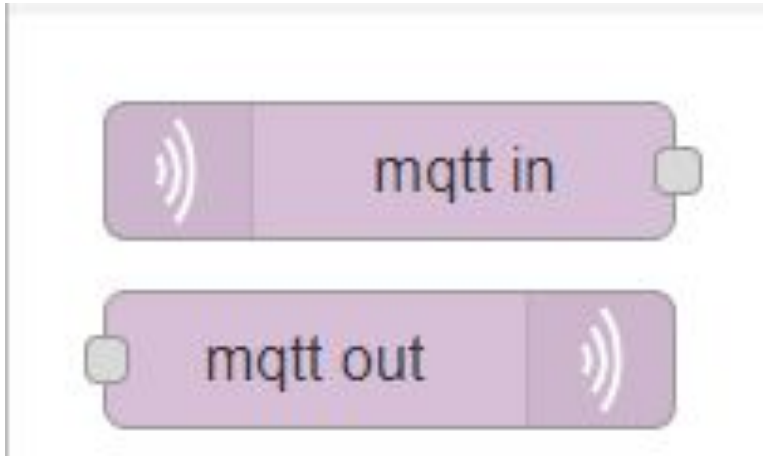
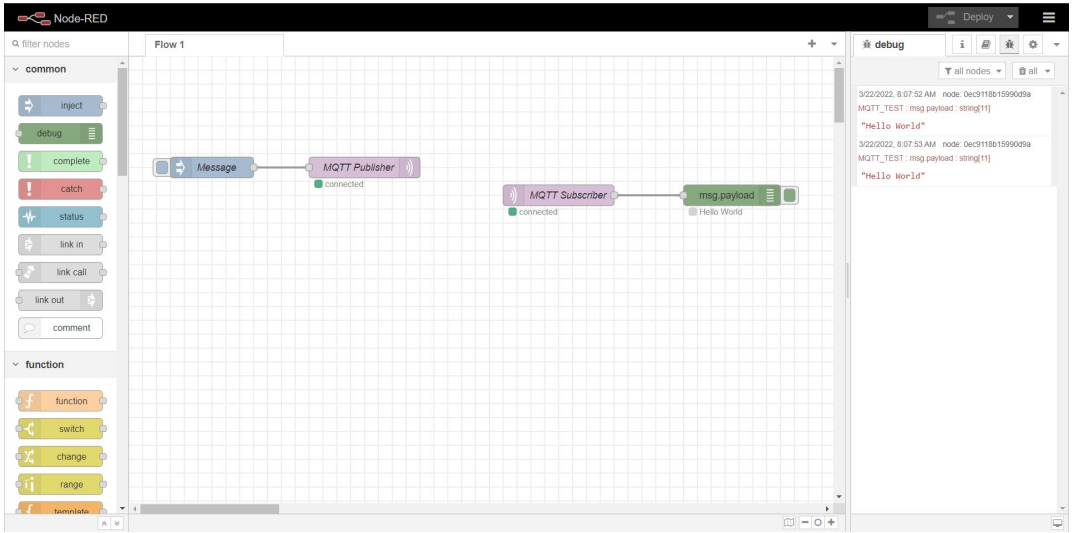
MQTT Nodes



Untuk berinteraksi (*publish* dan *subscribe*) dengan MQTT Broker:

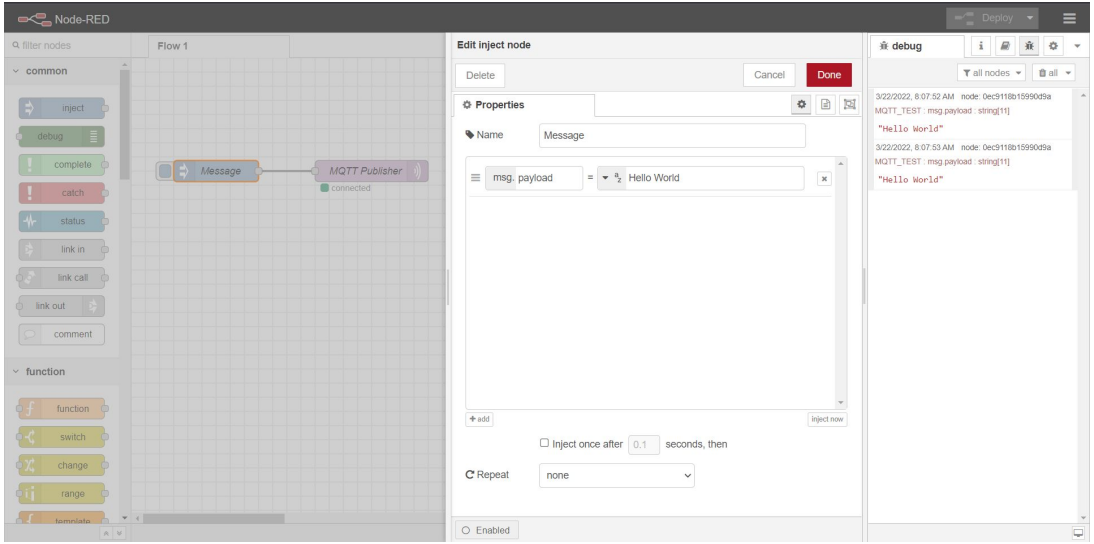
1. `mqtt in` merupakan *nodes* yang dapat kita gunakan untuk *subscribe* dari sebuah *topic* dan
2. `mqtt out` dapat kita gunakan untuk *publish* ke sebuah *topic* tertentu.

Initial setup (overview)



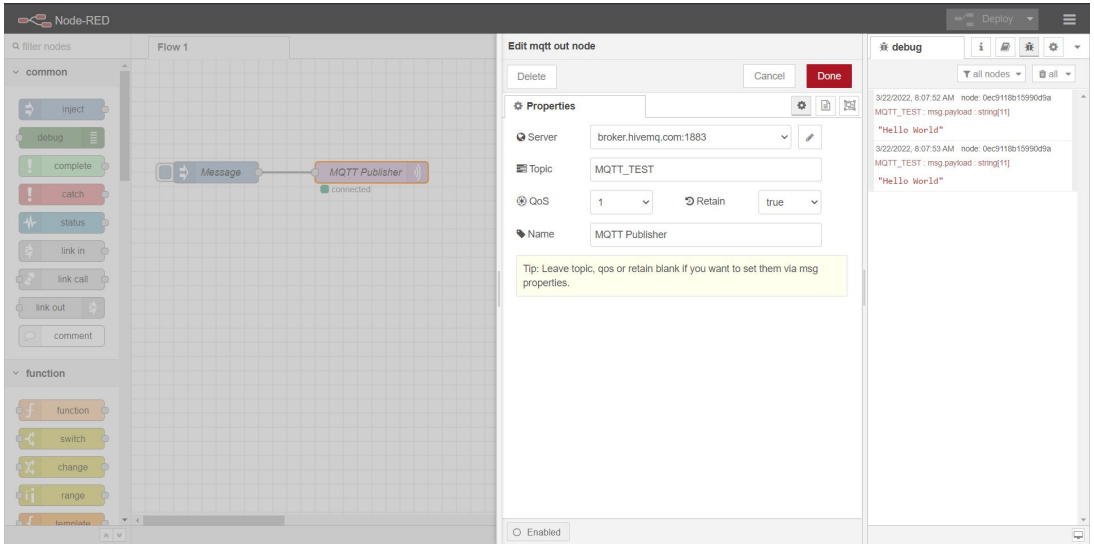
Kita dapat membuat sebuah skema sederhana untuk mempublish serta mensubscribe menggunakan dua nodes tadi seperti gambar di samping!

Initial setup (inject node)



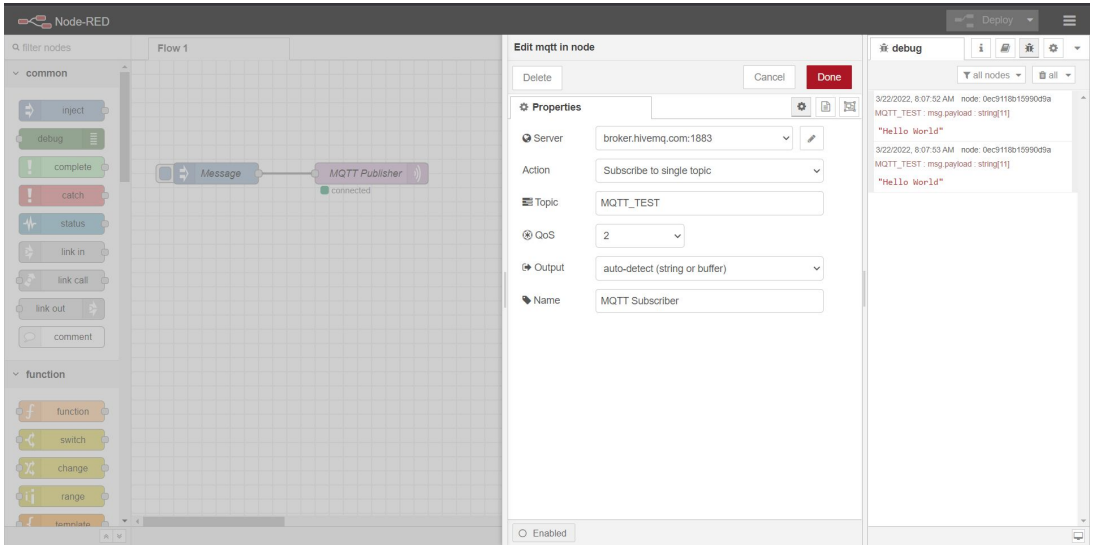
Dalam *nodes* `inject` kita perlu mendefinisikan `msg.payload`* sebagai sebuah *string* dan disini kita akan menampilkan data *string* `Hello World`*.

Initial setup (mqtt out node)



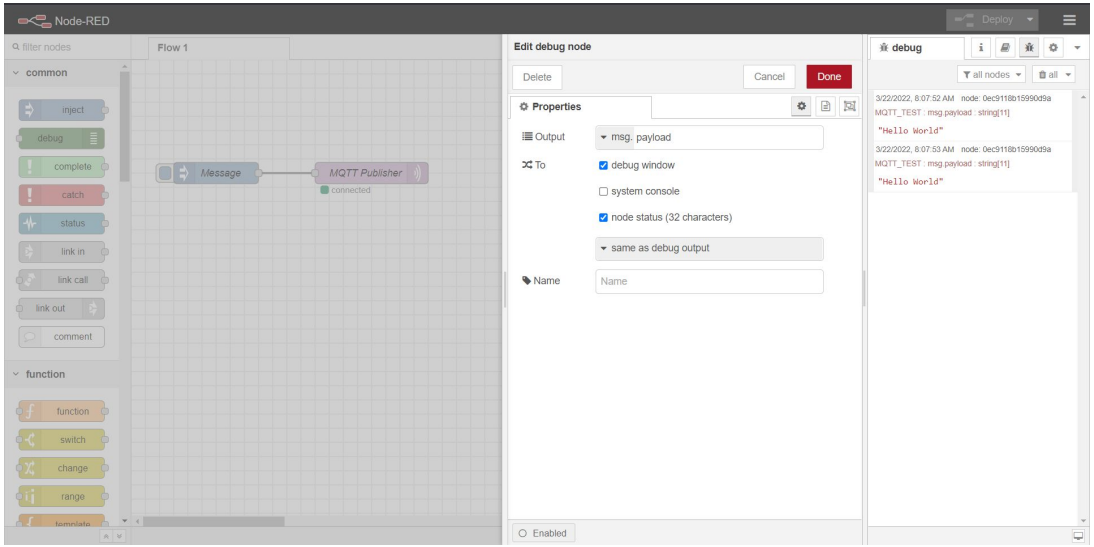
Dalam *node* `mqtt out`, pertama kita perlu mendefinisikan URL dari MQTT broker kita dan pada contoh kali ini kita akan menggunakan MQTT Broker (broker.hivemqt.com) yang *open for public* atau yang kita bisa akses secara gratis.

Initial setup (mqtt in node)



Dalam *node* `mqtt in`, kita perlu memastikan bahwa di bagian server kita menggunakan server yang sama dengan apa yang sudah kita konfigurasi di *node* `mqtt out`, serta pastikan juga bahwa dibagian `Topic` kita menggunakan `Topic` yang sama dengan apa yang kita konfigurasi di `mqtt out`. Berikut adalah contoh konfigurasi dalam *node* `mqtt in`.

Initial setup (debug node)



Kemudian *setup node* **debug** seperti konfigurasi di bawah ini agar kita bisa melihat pesan yang masuk melalui *debug console*.

STOP, Now it's time for Quick DEMO!

Challenge! [Berhadiah! :)]

Buatlah sebuah node-red flow dengan kondisi berikut

1. Dapatkan data sensor ultrasonic/menggunakan sensor yang ada/yang kalian pakai untuk project kalian dan kirimkan ke sebuah mqtt broker
2. Subscribe menggunakan node-red mqtt-in nodes dan tampilkan pada debug nodes