Introduction

We will create an IoT application containing four main parts:

- A TTN Node
- The TTN back-end
- A Node-Red application on your PC
- A Wifi connected actuator based on an ESP8266

Building a TTN node was part of one of our previous workshops. We will use the temp_humidity example, posting temperature and humidity to TTN.

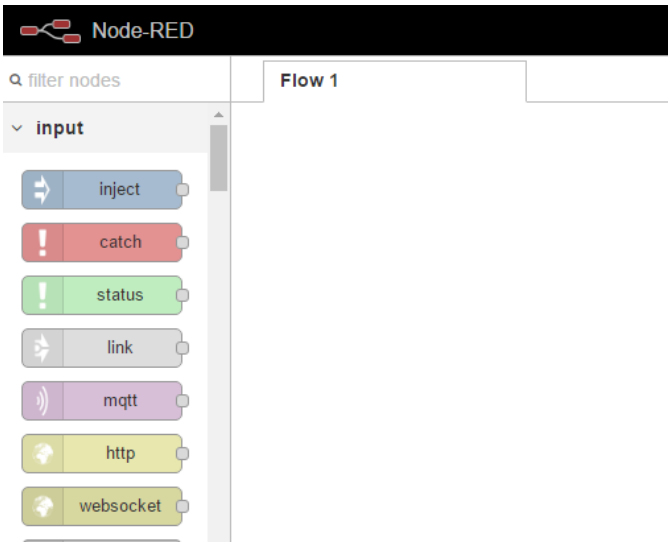
Installing NodeRed on a PC

Follow the instructions on https://nodered.org/docs/getting-started/installation to install NodeRed on your system.

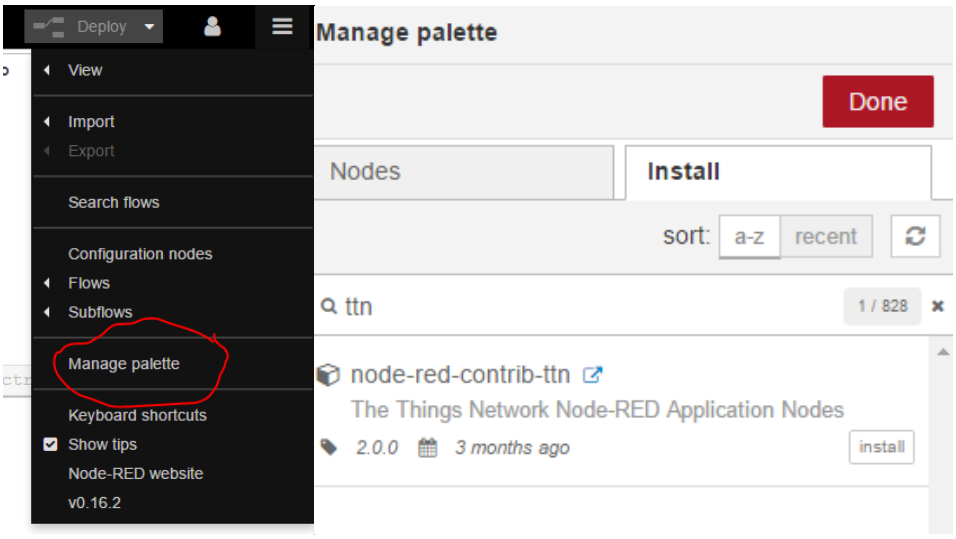
- On Windows it will be installed on your home directory.
- Enter the home directory in a command-line and start:

```
Node-red
```

- The log will show the address of the node-red web interface: http://127.0.0.1:1880/
- Open that address



- Now select the top right menu and select manage palette:

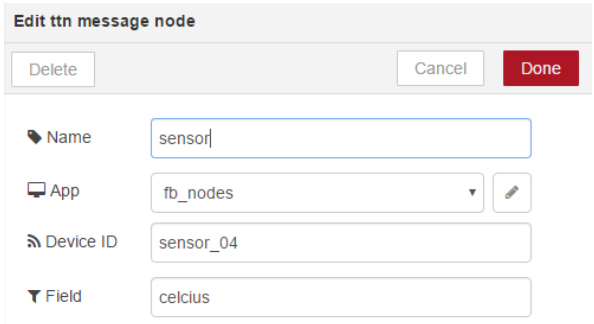


- Search for TTN in the Install tab and click install to install the TTN nodes.
- Click again install on the warning screen.
- 'Done' to exit the palette management.
- TTN nodes can now be added in your Node-Red flow.

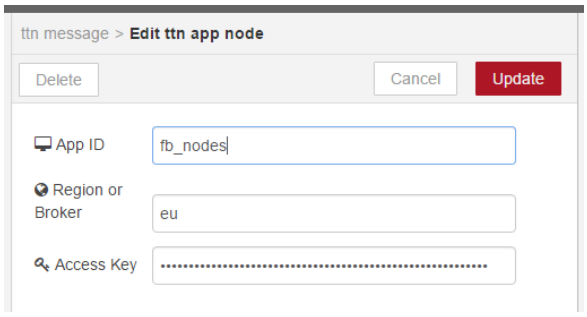
Node Red introduction

We start with a clean 'flow'. Remove any flows with the Menu->Flows->Delete flow.

- Add a TTN **message** node by drag and drop it on your flow screen.
- By double clicking on the TTN message node you can change the values:



The name can be any name, App refers to your TTN console. With the Pencil you can add your application here:



- App ID is the written name 'Application ID' from the TTN console

- Region is eu, it is already filled in grey, but you should type it in as well!
- Access Key is a copy of the access key of your application (access key of application, default key).
- Check Update and select your App in the previous screen.
- Device ID is the Device ID in TTN console

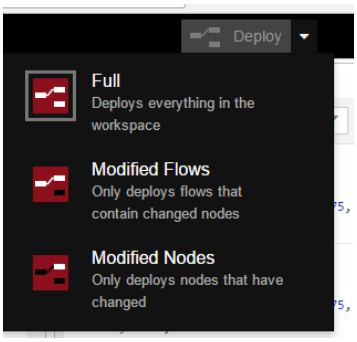
You can select celcius or humidity in 'field' if you use the temp_humidity sketch. If you leave 'field' empty all the fields will be shown. Beware that you use the same payload function in TTN as used in the previous nodes workshop!! If you do not have a payload function loaded, you can use an empty 'field', all the output will be shown. This is the payload function of the previous workshop:

```
function Decoder(bytes, port) {

var humi = 20+5*((bytes[1] >> 2) & 0x0F);
var temperature = -2400+6.25*(((bytes[1] & 0x03) << 8) | bytes[0]);
return {
humidity: humi,
celcius: temperature / 100.0
};
}
```

- Now add a 'Debug' output node to your flow and connect the both with a wire:

- Select msg.payload by double clicking on the debug node and activate it by clicking on the button on the right.
- Now activate your flow with Deploy->Full:



You will see the results of your node appear in the right debug column.

10-3-2017 21:55:08 node: 36f711c8.a790ce
msg.payload : Object
▸ { batterylow: true, celcius: 20.1875, humidity: 40 }

10-3-2017 21:56:24 node: 36f711c8.a790ce
msg.payload : Object
▸ { batterylow: true, celcius: 20.1875, humidity: 40 }

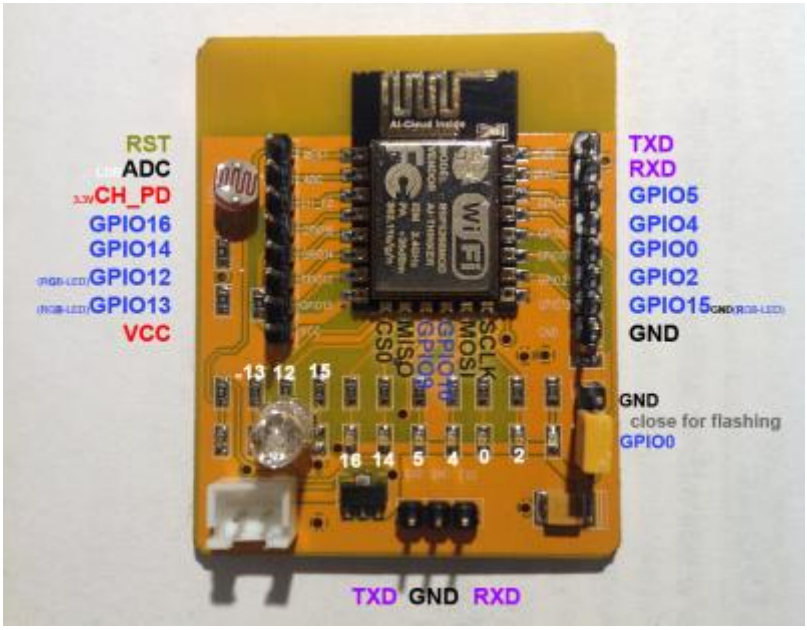
10-3-2017 21:57:40 node: 36f711c8.a790ce
msg.payload : Object
▸ { batterylow: true, celcius: 20.1875, humidity: 40 }

10-3-2017 21:58:55 node: 36f711c8.a790ce
msg.payload : Object
▸ { batterylow: true, celcius: 20.1875, humidity: 40 }

Install ESP Easy

We will install an ESP control program to manage the ESP module. First connect the module to your PC with the FTDI adapter:

- Connect your FTDI adapter after selecting 3V on it with the jumper.
- The wiring is straight, so connect GND->GND (blue), RX->RX (brown) and TX->TX (green).
- For programming you need to mount the jumper on the two-pin connector (shown in the lower right corner on the picture below
- Now connect the FTDI adapter to your PC and put the batteries in the holder.



Follow the instructions on:

https://www.letscontrolit.com/wiki/index.php/Tutorial_ESPEasy_Firmware_Upload

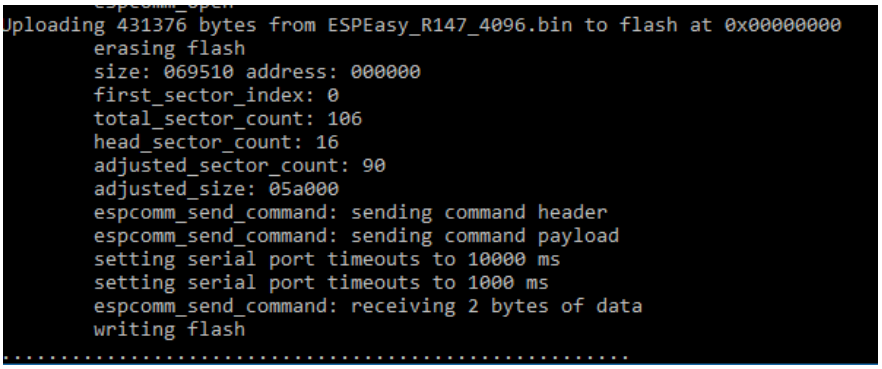
Fast track:

Download and unpack http://www.letscontrolit.com/downloads/ESPEasy_R147_RC8.zip

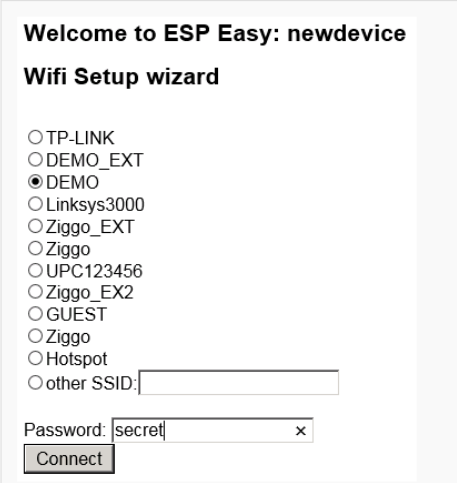
In the download directory start the flash tool:

Naam	Gewijzigd op	Type	Grootte
Source	28-12-2016 02:11	Bestandsmap	
ESPEasy_R147_512.bin	28-12-2016 02:11	BIN-bestand	422 kB
ESPEasy_R147_1024.bin	28-12-2016 02:11	BIN-bestand	422 kB
ESPEasy_R147_4096.bin	28-12-2016 02:11	BIN-bestand	422 kB
esptool	28-12-2016 02:11	Toepassing	39 kB
flash	20-2-2017 20:53	Windows-opdrac...	1 kB

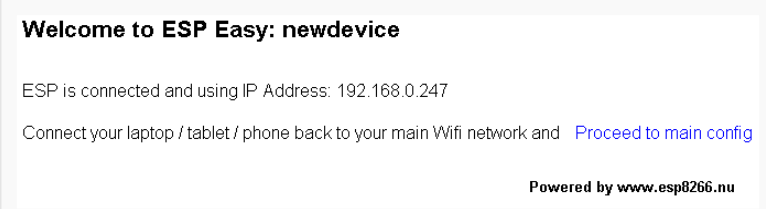
- Com port: you can check the COM port in the Arduino IDE or device management, fill in the right number
- Flash size is 4096
- Build version is 147
- Put the flash jumper on your module and start the upload. You may reset the board by connecting the RST pin as seen in the picture to GND.
- The flashing starts



- The module will restart and we have to find a wifi channel ESP_01. At this moment you should sync with other workshop attendees and power off your node until a free slot is available.
- Connect your system to the wifi SSID ESP_01 and go to your browser.
- No enter the Wifi Credentials:



The module will reconnect, and from that moment it can work together with other nodes because it is getting its own IP address. Take note of that address!



Now you can reconnect to the 'normal' wifi and check 'Proceed to main config'

Your module is activated, and can be controlled by http requests:

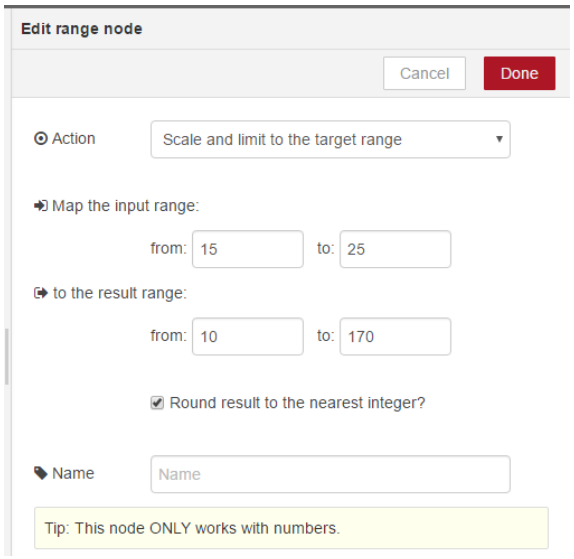
http://<your ESP address>/control?cmd=gpio,12,1 will light the RGB LED

- Connect the servo by putting three male jumper wires into the servo's connector. The Brown connection is GND, connect it to the GND pin of the ESP module board. The Red connection goes to the spare 5V pin of the FTDI. The signal (orange) goes to GPIO13 on the ESP module board.
- http://<your ESP address/control?cmd=Servo,1,13,100 in your browser will move the servo. 100 is the position, you can change it from 0-180

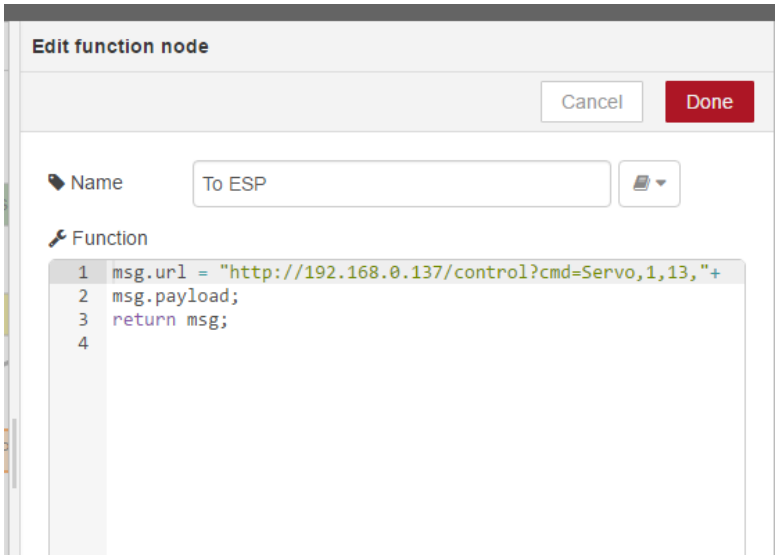
NodeRed Application

Now we are going to control the ESP according to the results of the TTN sensor.

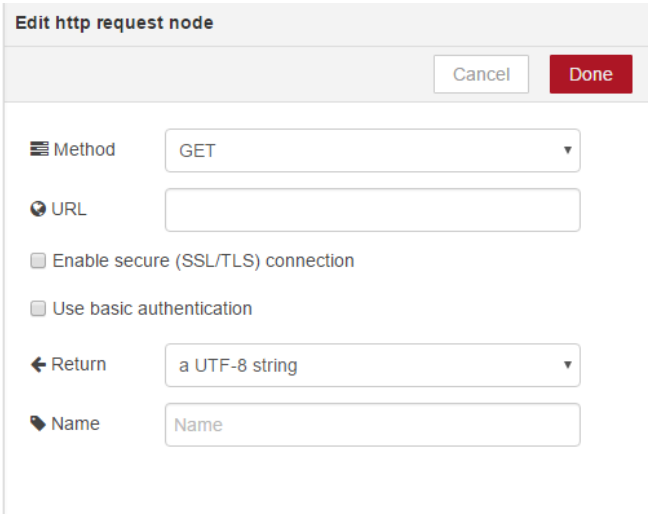
- Add a range function and connect it to the sensor output.
- Double click on the ‘range’ node:



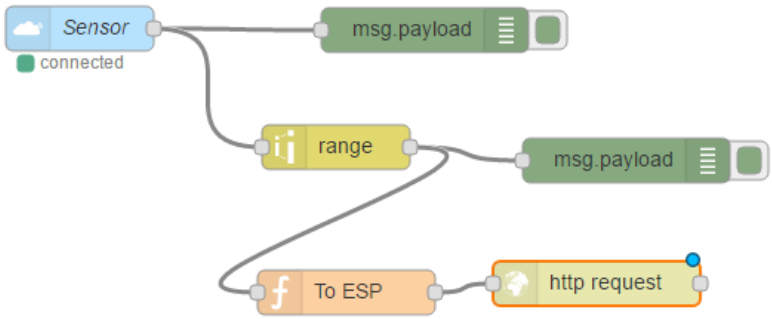
- We map the input results (Celsius temperature) from 15-25 to a servo position of 10 to 170 degrees, thereby creating an analogue gauge thermometer!
- Add a ‘function’
- Double click on the ‘function’ node:



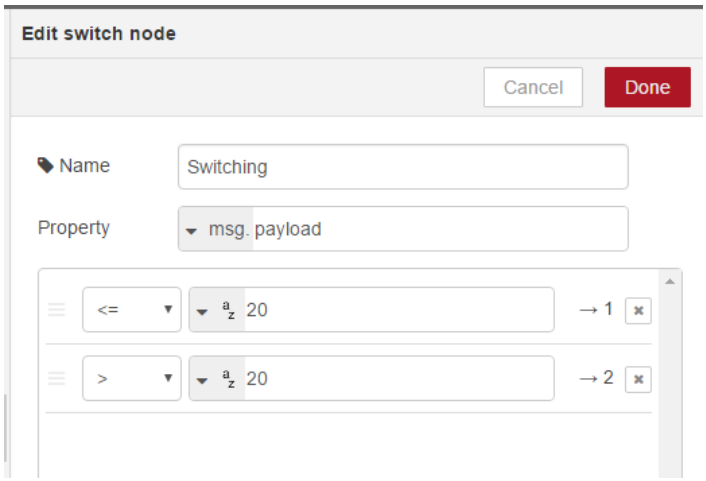
- Change the IP address according to your ESP.
- The last node we will add is a ‘HTTP Request’ to the ESP



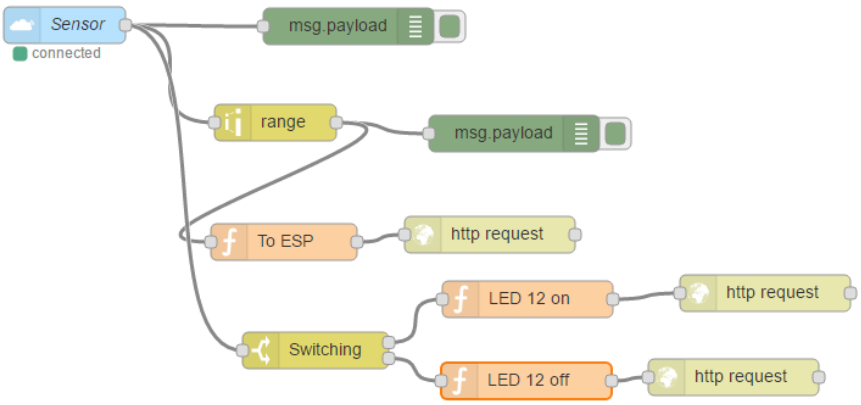
We constructed the URL already in the previous function and we connect the blocks. We can use ‘debug’ nodes to get some debug information:



Now we add a temperature switch for a heater or blower. We add the ‘switch’ node:



- Add two switches, less than 20 and greater than 20 (this is the temperature we are looking at). The switch now has two ‘exits’. The upper one is getting active when the temperature is low. The lower one when the temperature is higher.
- Now you can copy the URL function two times, and the HTTP request two times. The flow will look like this:



- Change the LED pin functions:
  - msg.url = http://<YOUR ESP ADDRESS>/control?cmd=GPIO,12,1 to put the LED on
  - msg.url = http://<YOUR ESP ADDRESS>/control?cmd=GPIO,12,0 to put the LED off
- You may connect your relay to output 12, it will switch when the temperature changes.

Attach the display

In the interface of the ESP module add a display under 'Devices':

Task Settings	Value
Device:	Display - OLED SSD1306 ?
Name:	display
Delay:	60
IDX / Var:	1
I2C Address:	3C
Rotation:	Normal
Display Size:	128x64
Line 1:	%ip%
Line 2:	

Connect:

- VCC->VCC
- GND->GND
- SDA->GPIO5
- SCL->GPIO4
- The display will show the IP address of your module.
- Now again copy the 'function' and 'HTTP request' node.
- Connect the 'function' node with your TTN sensor and the 'HTTP request' with the 'function' node.
- Change the 'function':

```
msg.url = "http://<YOUR ESP ADDRESS/control?cmd=oled,3,1,"+
msg.payload;
return msg;
```

Now the measurement of your sensor will show up on the OLED display!