

Prática 04.3:

Plataforma Raspberry Pi - Uso do Node-RED e GPIO RPi

Disciplina: **Introdução à Internet das Coisas - IMD0902**

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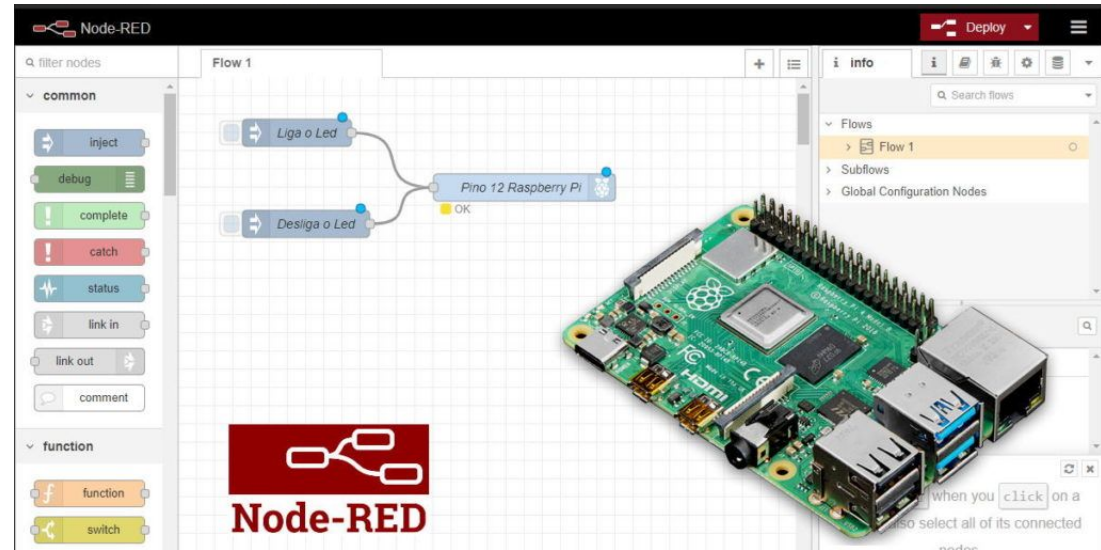
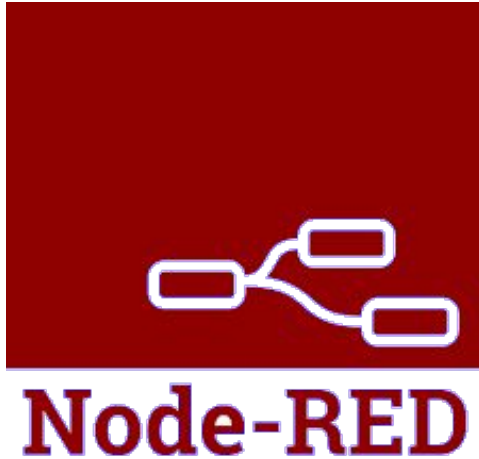
Aula:
Prática 04.3:
**Plataforma Raspberry Pi -
Uso do Node-RED e GPIO
RPi**

Tópicos

- **Experimento 01:** Uso do Node-RED para ler e escrever em GPIO do RPi
- Plataforma **Node-RED**
- **Experimento 02:** Uso do Node-RED para ler os valores do sensor DHT11
- **Experimento 03:** Uso do Node-RED para enviar dados via MQTT para a Plataforma IoT Adafruit IO
- Plataforma **Adafruit IO**

Experimento 01: Uso do Node-RED para ler e escrever em GPIO do RPi

Experimento 01: Uso do Node-RED para ler e escrever em GPIO do RPi



Node-RED:

- **Desenvolvimento de aplicações** baseado em **fluxo de dados**;
- Facilidade na criação de aplicações para integração de dispositivos IoT e serviços;

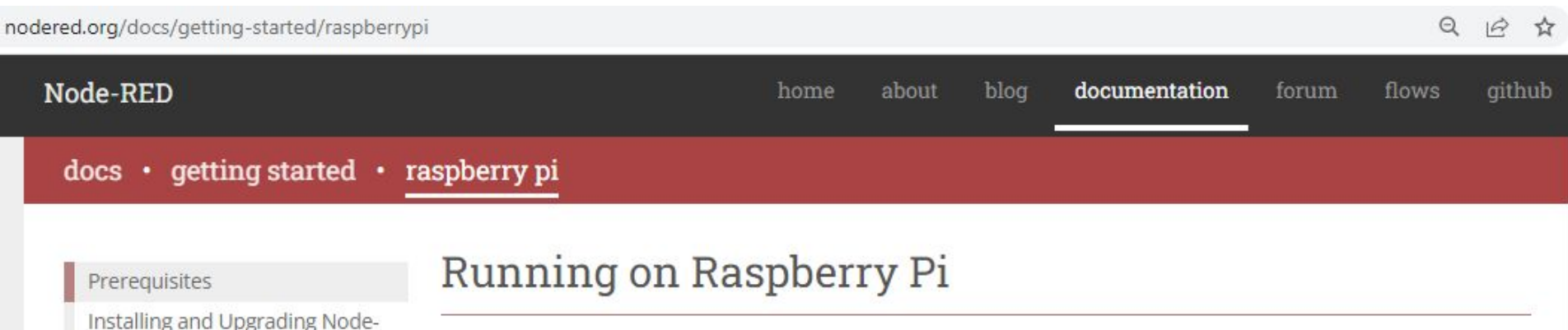
Experimento 01: Uso do Node-RED para ler e escrever em GPIO do RPi

➤ Instalação do **Node-RED** no Raspberry Pi:

- Comando:

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

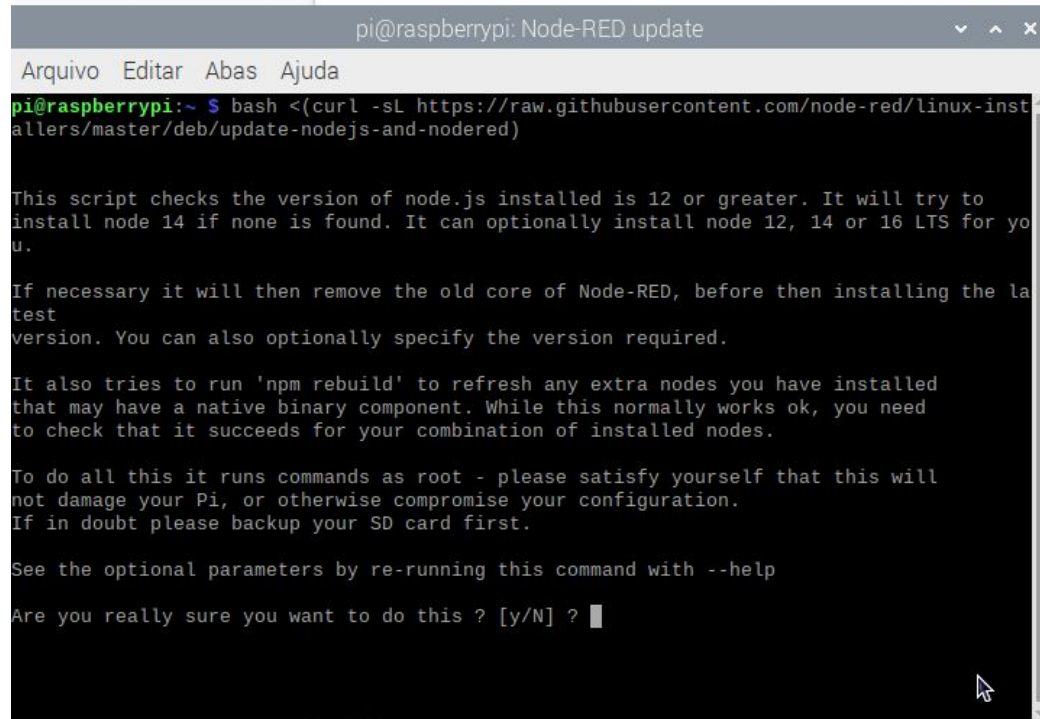
- Acessar o Node-RED: <http://localhost:1880/>



The screenshot shows the Node-RED documentation website. The browser address bar displays 'nodered.org/docs/getting-started/raspberrypi'. The website's navigation bar includes links for 'home', 'about', 'blog', 'documentation' (which is highlighted with a white underline), 'forum', 'flows', and 'github'. Below this, a breadcrumb trail reads 'docs • getting started • raspberry pi'. The main heading of the page is 'Running on Raspberry Pi'. On the left side, there is a sidebar with a 'Prerequisites' section, which includes a link to 'Installing and Upgrading Node-'. The page has a dark header and a red breadcrumb bar.

Experimento 01: Uso do Node-RED para ler e escrever em GPIO do RPi

- Instalação do **Node-RED** no Raspberry Pi:



```

pi@raspberrypi: Node-RED update
Arquivo  Editar  Abas  Ajuda
pi@raspberrypi:~ $ bash <(curl -sL https://raw.githubusercontent.com/node-red/linux-installers/master/deb/update-nodejs-and-nodered)

This script checks the version of node.js installed is 12 or greater. It will try to
install node 14 if none is found. It can optionally install node 12, 14 or 16 LTS for yo
u.

If necessary it will then remove the old core of Node-RED, before then installing the la
test
version. You can also optionally specify the version required.

It also tries to run 'npm rebuild' to refresh any extra nodes you have installed
that may have a native binary component. While this normally works ok, you need
to check that it succeeds for your combination of installed nodes.

To do all this it runs commands as root - please satisfy yourself that this will
not damage your Pi, or otherwise compromise your configuration.
If in doubt please backup your SD card first.

See the optional parameters by re-running this command with --help

Are you really sure you want to do this ? [y/N] ? █
  
```

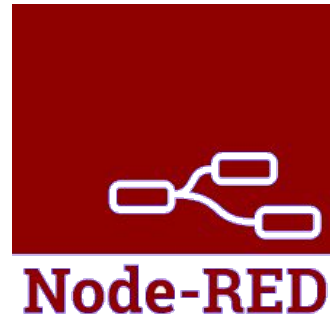
Experimento 01: Uso do Node-RED para ler e escrever em GPIO do RPi

➤ Instalação do **Node-RED** no Raspberry Pi:

```
pi@raspberrypi: ~  
Arquivo  Editar  Abas  Ajuda  
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      ✓  
Remove old version of Node.js       ✓  
Install Node.js 14 LTS               ✓ v14.19.3   Npm 6.14.17  
Clean npm cache                     ✓  
Install Node-RED core                ✓ 2.2.2  
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  
All done.  
You can now start Node-RED with the command node-red-start  
or using the icon under Menu / Programming / Node-RED  
Then point your browser to localhost:1880 or http://[your_pi_ip-address]:1880  
  
Started : sáb jun 4 09:51:16 -03 2022  
Finished: sáb jun 4 09:59:12 -03 2022  
  
You may want to run node-red admin init  
to configure your initial options and settings.  
  
pi@raspberrypi:~ S
```

Node-RED: O que é?

- Ferramenta para desenvolvimento de aplicações IoT;
- Objetivo principal: Conectar dispositivos IoT, hardwares, APIs e web services;
- Programação visual baseada em fluxos (FLOWs) de blocos de códigos (NÓS);
- Aplicação é uma combinação de:
 - Nós de entrada/saída;
 - Nós de funções/processamento;
- Linguagem JavaScript (.js)
- Opensource: <https://github.com/node-red/node-red>
- Interface visual e instalação simples;

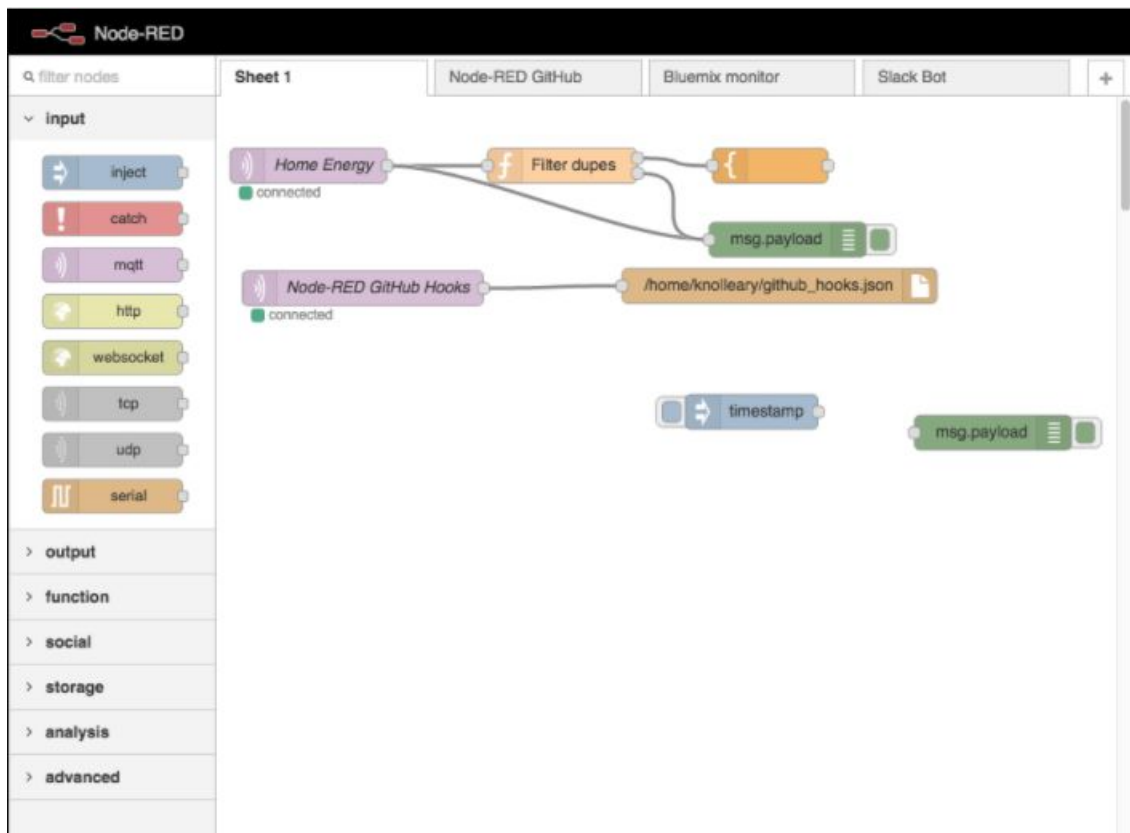


Node-RED: os Nós

Vários NÓS (blocos de códigos)

disponíveis para conexão:

- Dashboard
- Eventos http, websocket;
- Banco de dados (mongodb, mysql, azure sql, ..)
- Redes sociais (twitter, e-mail, facebook, ...);
- MQTT;
- IBM Watson;



Node-RED

localhost:1880/#flow/c634812d.937d7

Node-RED

filter nodes

common

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

function

- function
- switch
- change

Flow 1

Flow 2

input

function

msg.payload

template

msg.payload

Fluxos

Nós disponíveis

Deploy; Configs; Debug; Palette; ..

Deploy

info

Search flows

Flows

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

Flow 1

Flow

"c634812d.937d7"

The image shows the Node-RED web interface in a browser. The main area is the flow editor, which contains two flows, 'Flow 1' and 'Flow 2'. 'Flow 1' is active and shows a sequence of nodes: an 'input' node connected to a 'function' node, which is connected to a 'msg.payload' node. Below this, there is a 'template' node connected to another 'msg.payload' node. The left sidebar contains a 'filter nodes' search bar and two categories of nodes: 'common' (including inject, debug, complete, catch, status, link in, link out, and comment) and 'function' (including function, switch, and change). The right sidebar shows a 'Deploy' button and an 'info' tab. The 'info' tab displays a list of flows, with 'Flow 1' selected. Below the list, it shows the flow's ID as 'c634812d.937d7'. Red boxes and arrows are used to highlight specific features: a red box around the node palette on the left, a red box around the flow editor canvas, and a red box around the sidebar controls. Arrows point from the text labels to these highlighted areas.

Node-RED: os Nós

- Blocos de códigos para processamento de mensagens;
- Nós podem consumir, processar e gerar mensagens;
 - As mensagens são objetos JavaScript chamados **msg**
 - Cada mensagem contém propriedades específicas
 - Principal propriedade: **msg.payload**

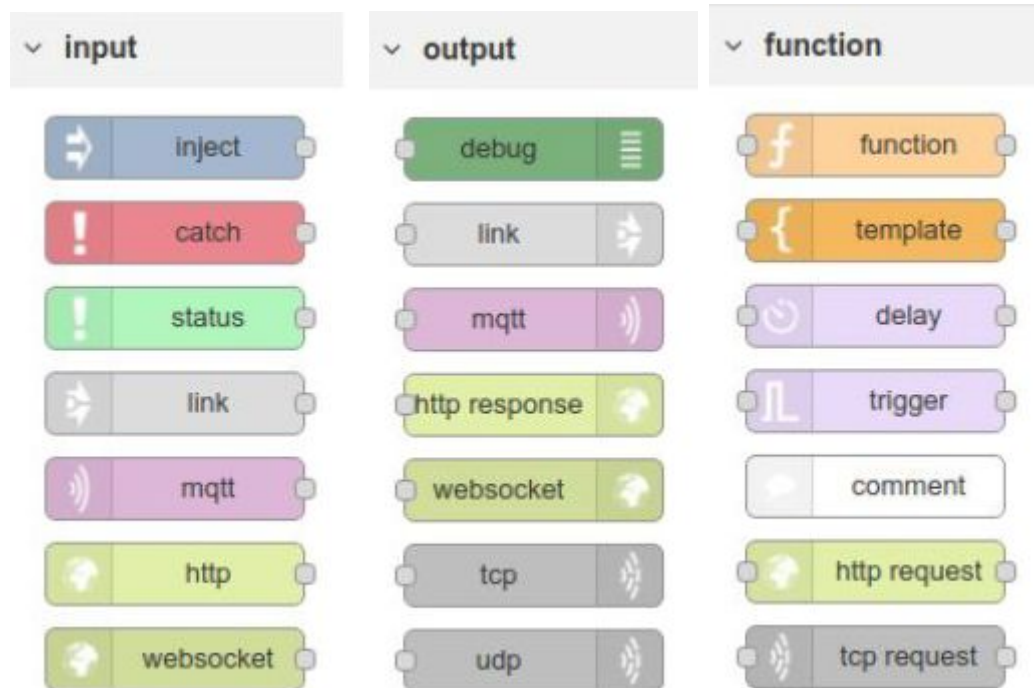


Node-RED: os tipos de Nós

Tipos de Nós:

- Nós de entrada;
- Nós de saída;
- Nós de processamento;
- Nós de função (programação em JavaScript)

**** Nós podem ser incorporados ou criados;**



Edit function node

Delete

Properties

Name

Name

Setup

On Start

On

```
1- if (msg.topic=="sensor1"){  
2   return [msg,null];  
3- }  
4- if (msg.topic=="sensor2"){  
5   return [null,msg];  
6- }
```



Precisa de algum
NÓ
diferente da lista?

Node-RED

Filter nodes

Sheet 1

Node-RED GitHub

Bluemix monitor

metrópole
DIGITAL

Input

Input

Filter dupes

msg.payload

homeknoleary.github_hooks.json

timestamp

msg.payload

Edit function node

Delete

Properties

Name

Name

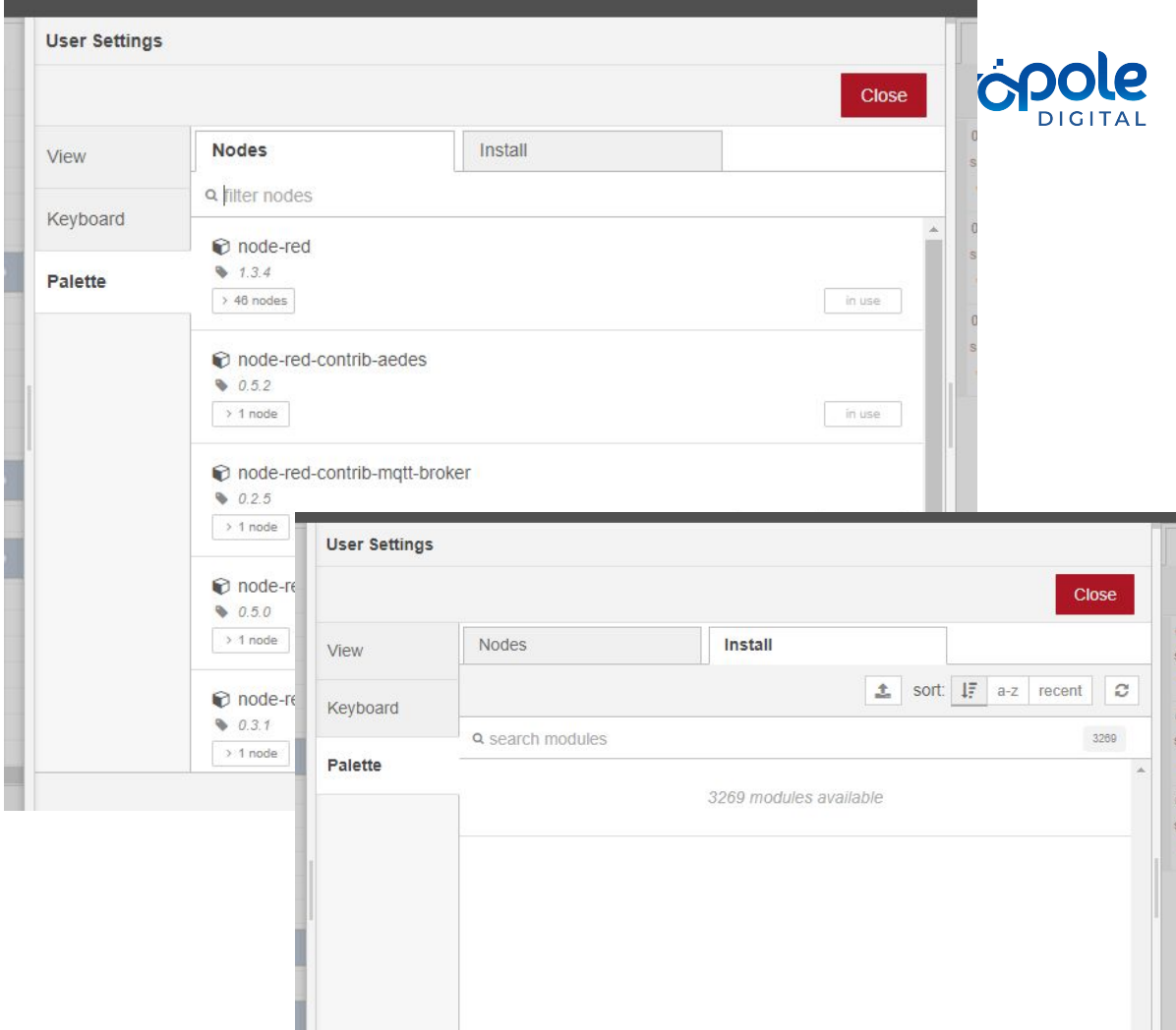
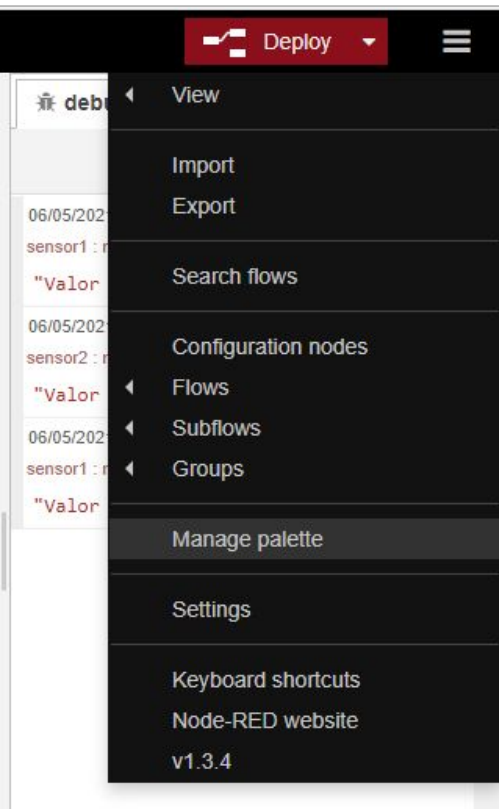
Setup

On Start

Outputs

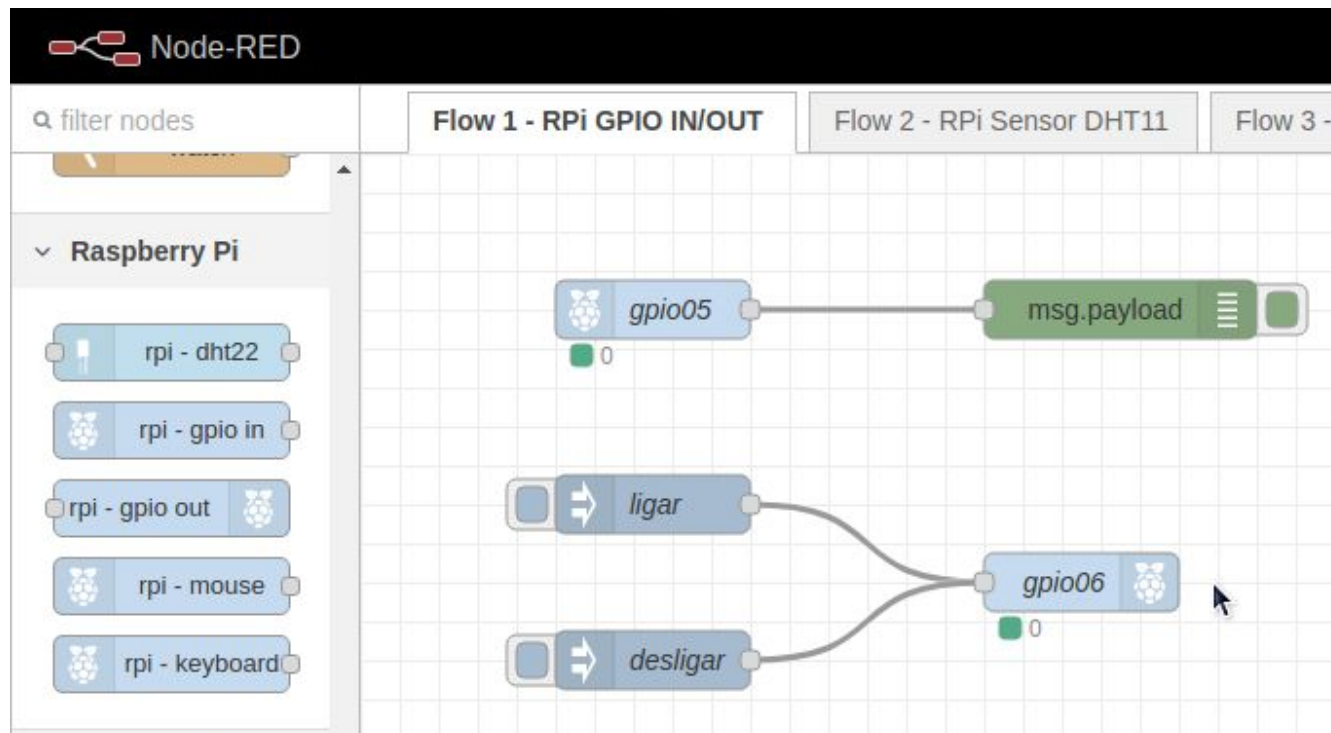
2

Node-RED: Instalar Nós



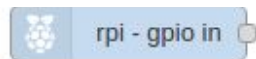
Experimento 01: Uso do Node-RED para ler e escrever em GPIO do RPi

➤ Nós específicos para Raspberry Pi:



Experimento 01: Uso do Node-RED para ler e escrever em GPIO do RPi

- Passo 01:
- Uso do nó “**rpi - gpio in**” para ler o valor do botão:

The image shows the Node-RED web interface. On the left, the 'Raspberry Pi' node palette is visible, containing nodes like 'rpi - dht22', 'rpi - gpio in', 'rpi - gpio out', 'rpi - mouse', and 'rpi - keyboard'. The main workspace shows a flow named 'Flow 1 - RPi GPIO IN/OUT' with a 'gpio05' node connected to 'ligar' and 'desligar' nodes. On the right, the 'Edit rpi-gpio in node' dialog is open. It has a 'Delete' button, 'Cancel', and 'Done' buttons. The 'Properties' section shows a table of GPIO pins. The 'BCM GPIO' is set to 5. The 'Resistor?' dropdown is set to 'pulldown' and 'Debounce' is set to 25 mS. The 'Name' field is 'gpio05'. A yellow box indicates 'Pins in Use: 5,6' and a tip states 'Only Digital Input is supported - input must be 0 or 1.'.

GPIO	Pin	GPIO	Pin
GPIO05 - 29	<input checked="" type="radio"/>	30 - Ground	<input type="radio"/>
GPIO06 - 31	<input type="radio"/>	32 - GPIO12	<input type="radio"/>
GPIO13 - 33	<input type="radio"/>	34 - Ground	<input type="radio"/>
GPIO19 - 35	<input type="radio"/>	36 - GPIO16	<input type="radio"/>
GPIO26 - 37	<input type="radio"/>	38 - GPIO20	<input type="radio"/>
Ground - 39	<input type="radio"/>	40 - GPIO21	<input type="radio"/>

BCM GPIO: 5

Resistor?: pulldown Debounce: 25 mS

☐ Read initial state of pin on deploy/restart?

Name: gpio05

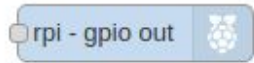
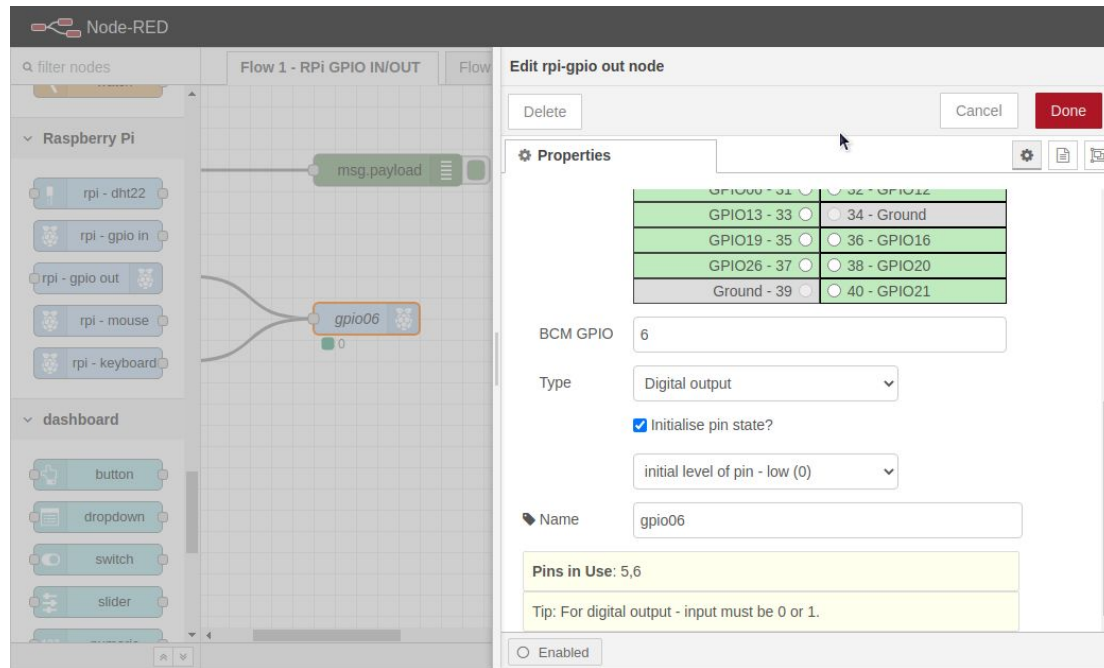
Pins in Use: 5,6

Tip: Only Digital Input is supported - input must be 0 or 1.

Experimento 01: Uso do Node-RED para ler e escrever em GPIO do RPi

➤ Passo 02:

- Uso do nó “**rpi - gpio out**” para escrever o status do LED:

Edit rpi-gpio out node

Delete Cancel Done

Properties

GPIO00 - 31	32 - GPIO12
GPIO13 - 33	34 - Ground
GPIO19 - 35	36 - GPIO16
GPIO26 - 37	38 - GPIO20
Ground - 39	40 - GPIO21

BCM GPIO: 6

Type: Digital output

☒ Initialise pin state?

initial level of pin - low (0)

Name: gpio06

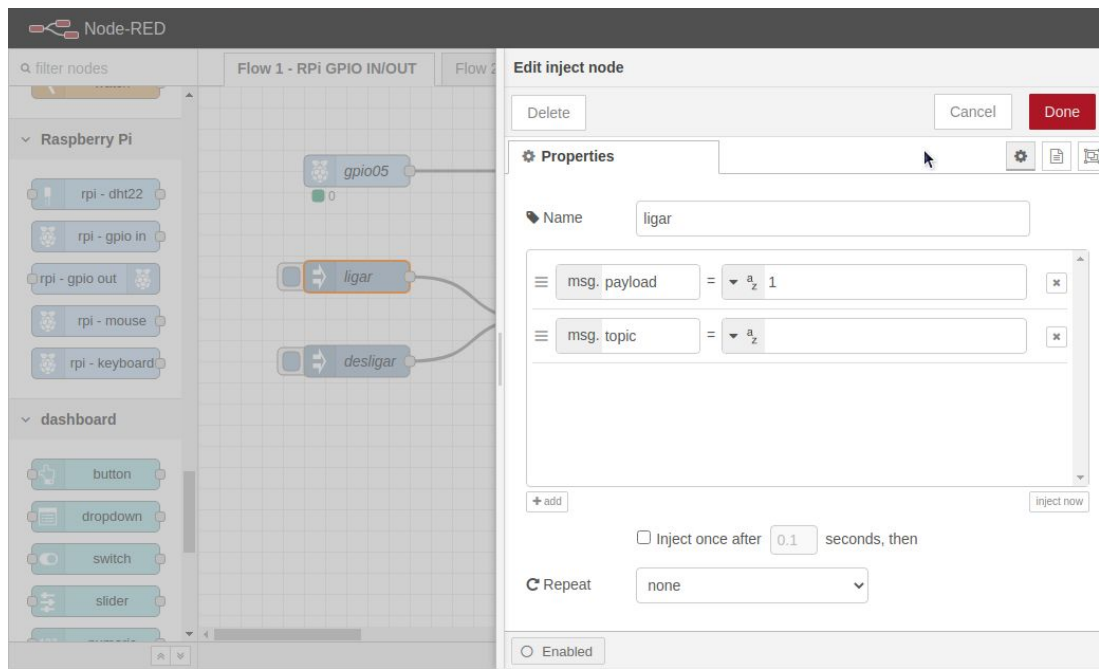
Pins in Use: 5,6

Tip: For digital output - input must be 0 or 1.

☐ Enabled

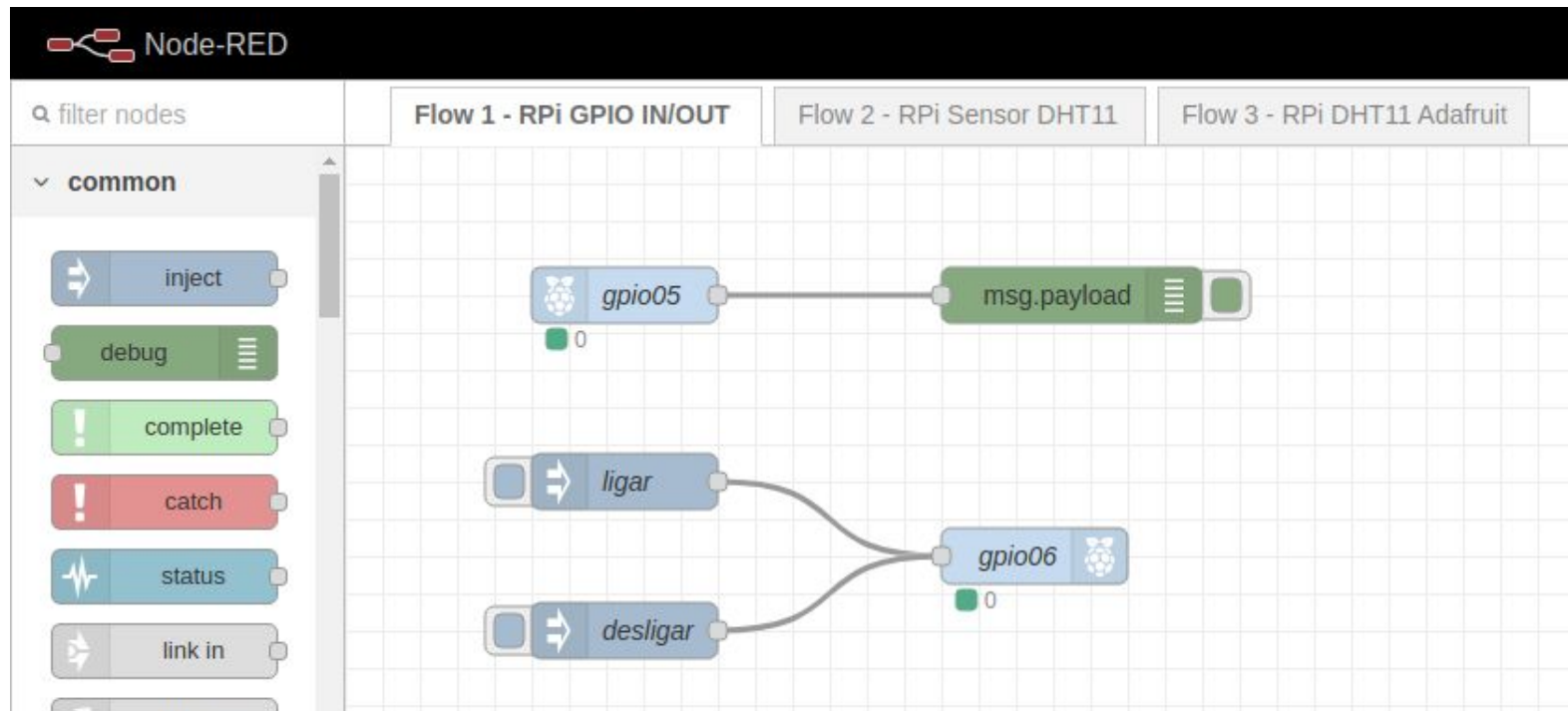
Experimento 01: Uso do Node-RED para ler e escrever em GPIO do RPi

- Passo 03:
- Uso do **“inject”** para escrever ‘1’ (ligar) ou ‘0’ (desligar) o LED;



Experimento 01: Uso do Node-RED para ler e escrever em GPIO do RPi

➤ FLOW 1 - RPi GPIO in/out:



Experimento 02: Uso do Node-RED para ler os valores do sensor DHT11

Experimento 02: Uso do Node-RED para ler os valores do sensor DHT11

➤ Instalação do **nó DHT11** no Node-RED:

The screenshot shows a web browser at the URL `flows.nodered.org/node/node-red-contrib-dht-sensor`. The Node-RED header is visible with navigation links: `home`, `about`, `blog`, `documentation`, `forum`, `flows` (active), and `github`. Below the header is a red search bar with the text "Search library" and a "+" icon, and a "Sign in with GitHub" button. The main content area displays the details for the `node-red-contrib-dht-sensor` node, version 1.0.4. The description reads "Node-red node for node-dht-sensor". Below this is a code box containing the command `npm install node-red-contrib-dht-sensor`. To the right, a "Node Info" sidebar provides additional details: Version: 1.0.4, Updated 3 years, 7 months ago, License: Apache 2.0, Rating: 4.5 stars with 2 users, and a link to "View on npm".

flows.nodered.org/node/node-red-contrib-dht-sensor

Apps Debian.org Latest News Help

Node-RED home about blog documentation forum **flows** github

Search library + Sign in with GitHub

node-red-contrib-dht-sensor 1.0.4

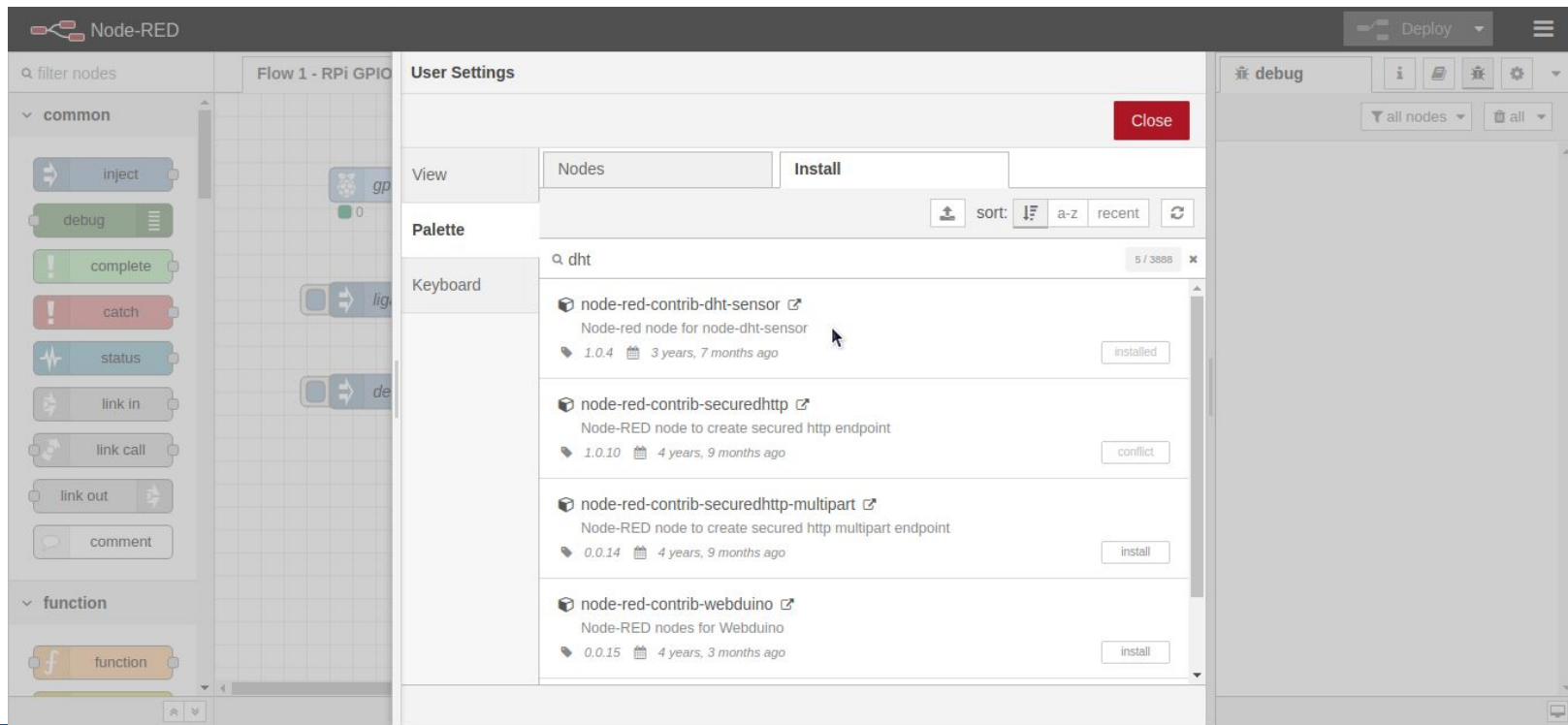
Node-red node for node-dht-sensor

```
npm install node-red-contrib-dht-sensor
```

Node Info
Version: 1.0.4
Updated 3 years, 7 months ago
License: Apache 2.0
Rating: 4.5 ★ 2
[View on npm](#)

Experimento 02: Uso do Node-RED para ler os valores do sensor DHT11

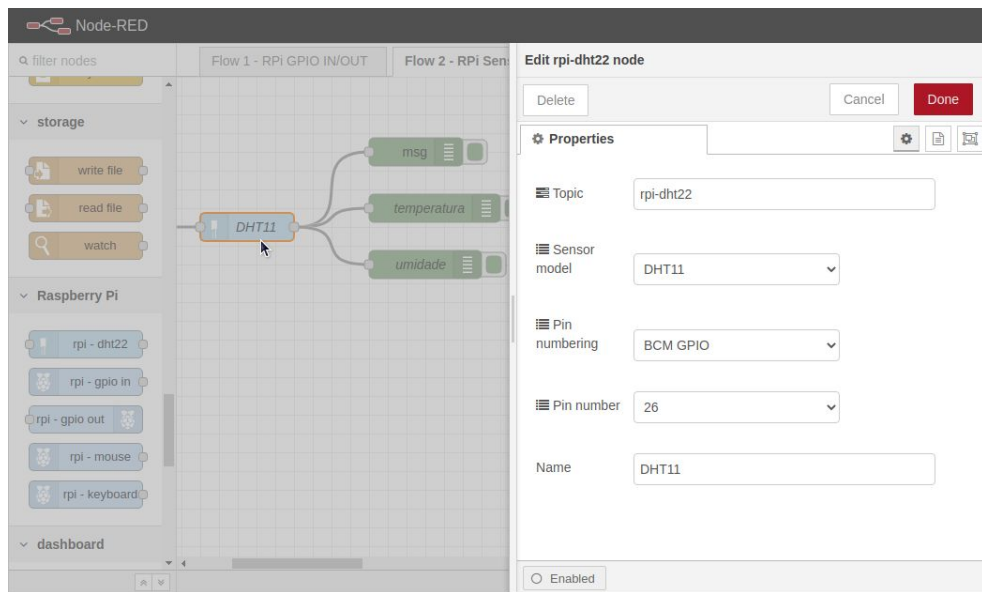
- Instalação do **nó DHT11** no Node-RED:



Experimento 02: Uso do Node-RED para ler os valores do sensor DHT11

➤ Passo 01:

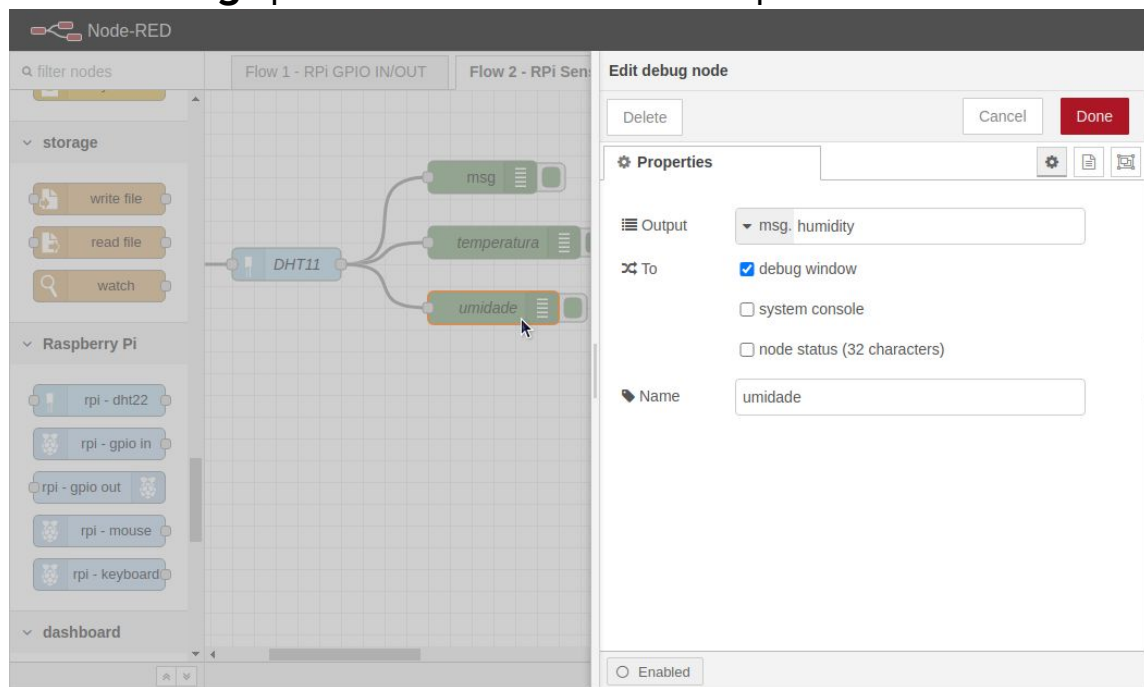
- Uso do nó “**rpi - dht22**” e configurar para DHT11:



- **Atenção:** coloque um resistor de 1k entre o VCC e o Data.

Experimento 02: Uso do Node-RED para ler os valores do sensor DHT11

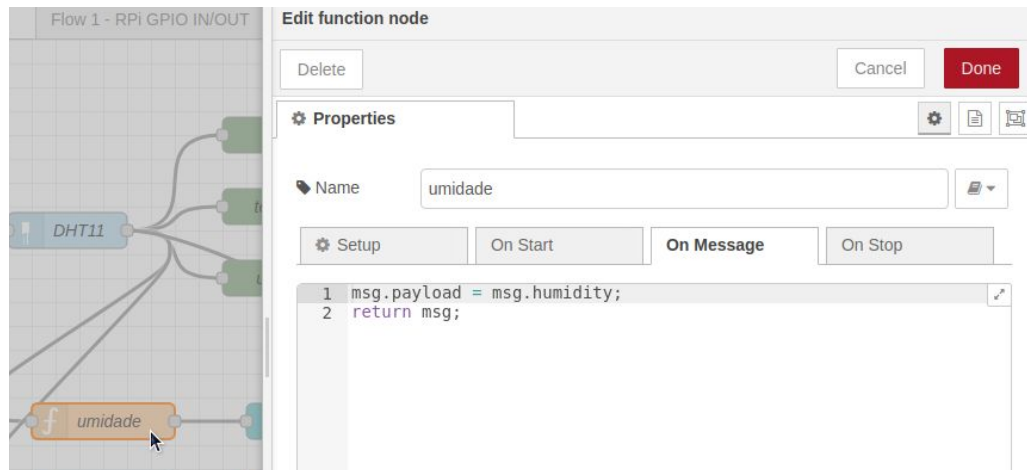
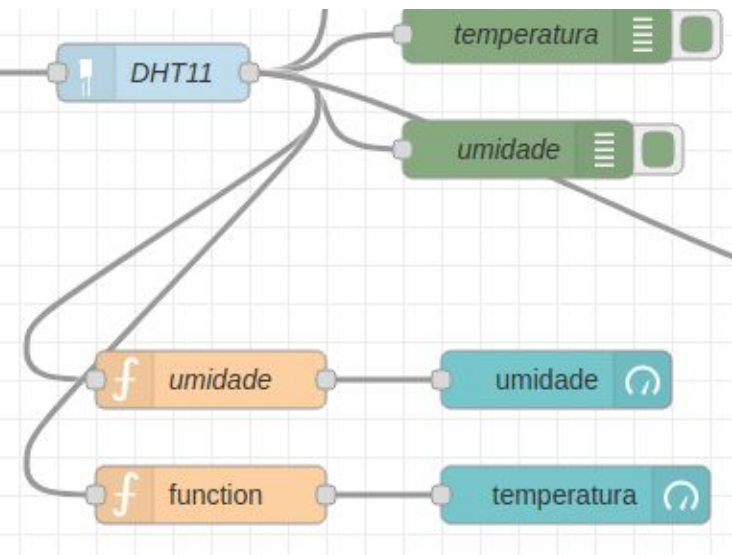
- Passo 02:
- Uso do nó **“debug”** para ler os valores de temperatura e umidade do DHT11:



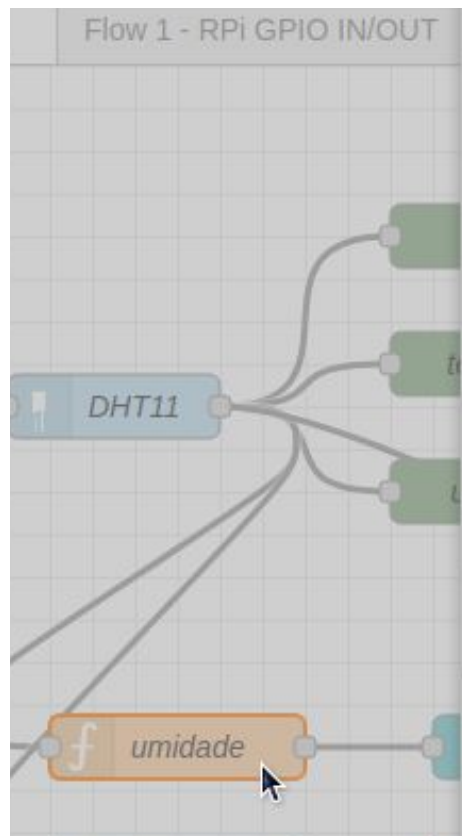
Experimento 02: Uso do Node-RED para ler os valores do sensor DHT11

➤ Passo 03:

- Baixar os nós de “**dashboard**” do Node-RED e acessar via **localhost:1880/ui**
- Uso do nó “**debug**” para ler os valores de temperatura e umidade do DHT11:



Experimento 02: Uso do Node-RED para ler os valores do sensor DHT11



The screenshot shows the Node-RED web interface. On the left, a flow titled 'Flow 1 - RPi GPIO IN/OUT' is visible. It contains a blue 'DHT11' sensor node connected to several green output nodes. Below it, an orange function node labeled 'umidade' is being edited. The right panel, titled 'Edit function node', shows the configuration for this node. The 'Name' field is set to 'umidade'. The 'On Message' tab is selected, and the code area contains the following JavaScript code:

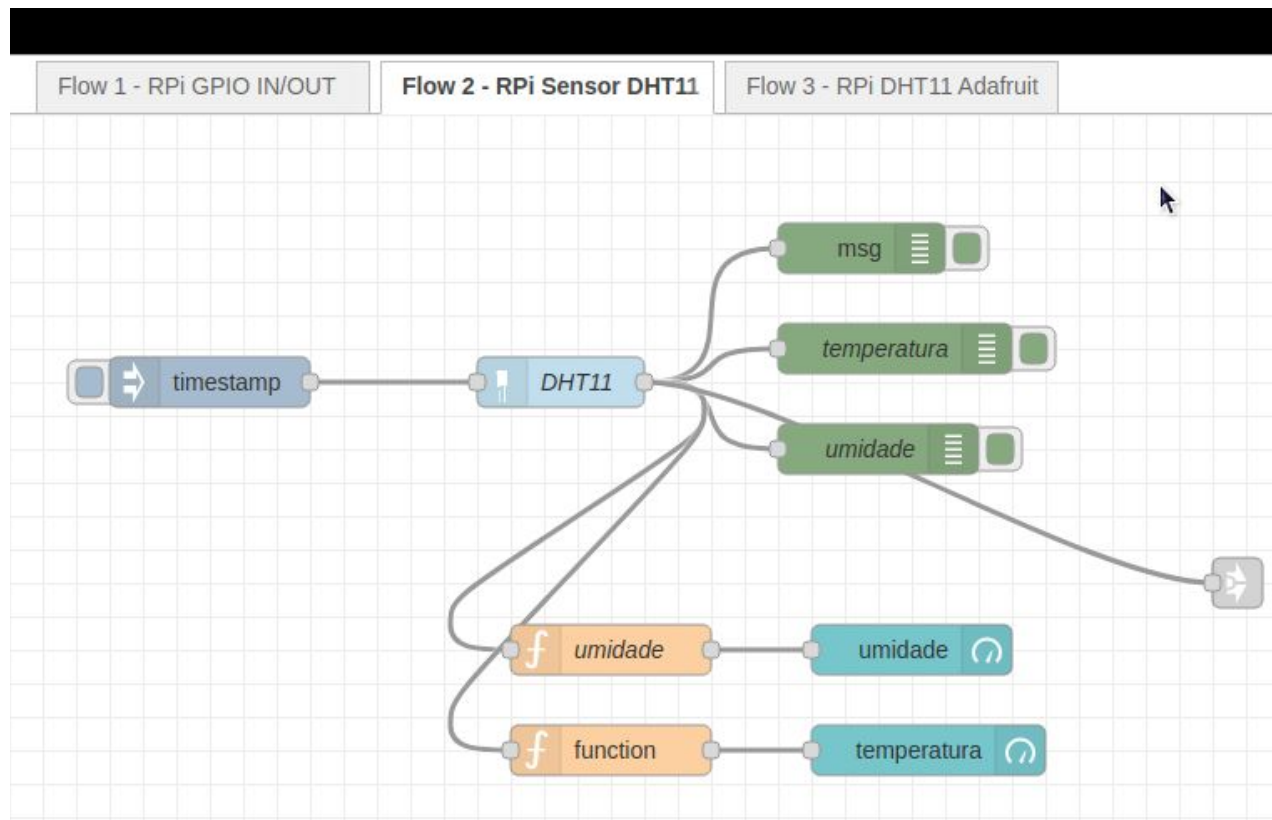
```
1 msg.payload = msg.humidity;  
2 return msg;
```

The interface includes buttons for 'Delete', 'Cancel', and 'Done' at the top right of the edit panel. There are also icons for settings, a file, and a refresh symbol.

Experimento 02: Uso do Node-RED para ler os valores do sensor DHT11

➤ **FLOW 2 - RPi**

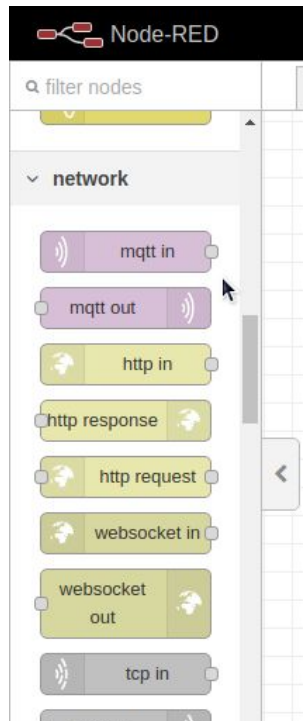
Sensor DHT11:



Experimento 03: Uso do Node-RED para enviar dados via MQTT para a Plataforma IoT Adafruit IO

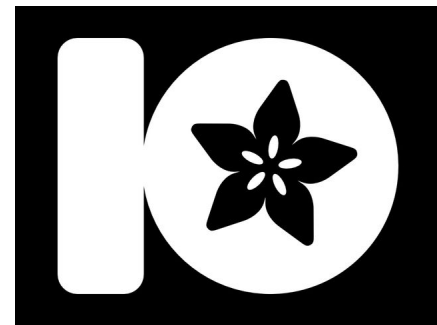
Experimento 03: Uso do Node-RED para enviar dados via **MQTT** para a Plataforma IoT Adafruit IO

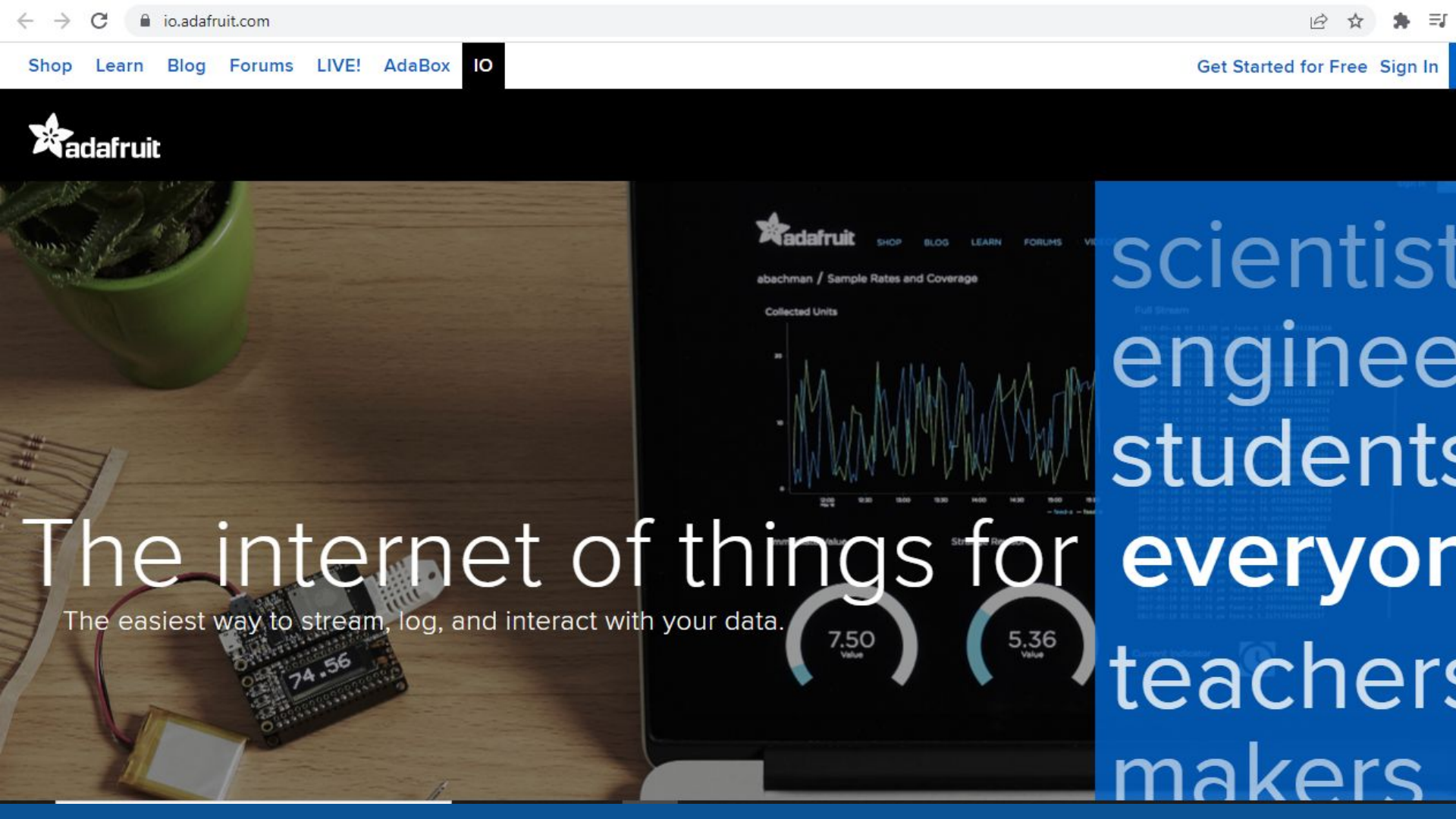
- Uso dos nós de rede **MQTT-in** e **MQTT-out** do **Node-RED**:



Adafruit IO: O que é?

- **Adafruit IO** é uma plataforma em nuvem para soluções de IoT;
- Empresa Adafruit Industries;
- Permite o gerenciamento dos dados IoT;
- Comunicação via MQTT com os dispositivos IoT;
- Gratuito!!





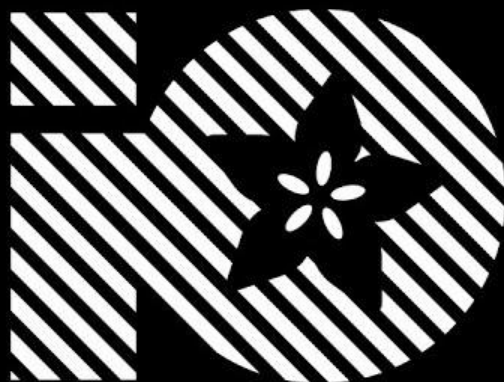
The internet of things for

The easiest way to stream, log, and interact with your data.

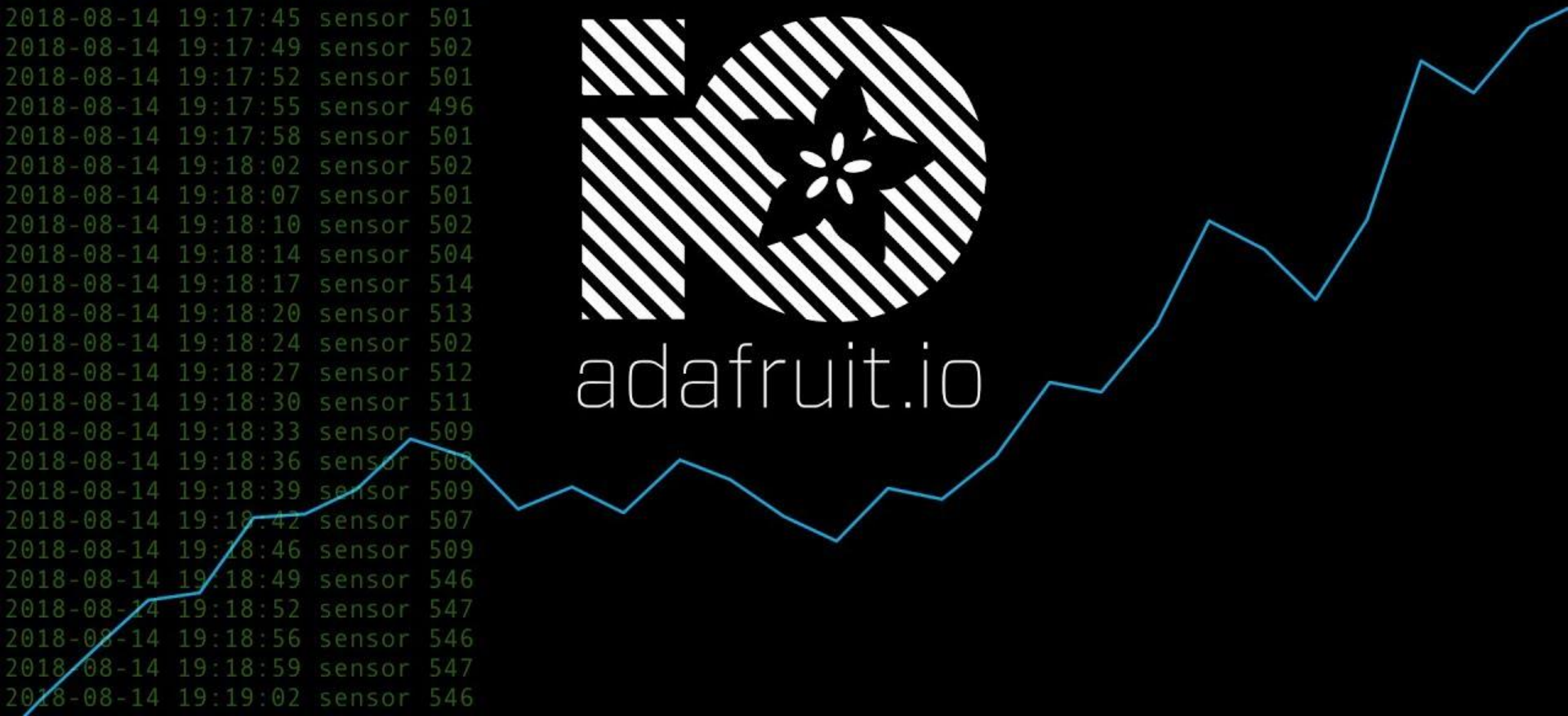


scientist
engineer
students
everyone
teachers
makers

2018-08-14 19:17:29 sensor 501
2018-08-14 19:17:32 sensor 500
2018-08-14 19:17:36 sensor 499
2018-08-14 19:17:39 sensor 501
2018-08-14 19:17:42 sensor 500
2018-08-14 19:17:45 sensor 501
2018-08-14 19:17:49 sensor 502
2018-08-14 19:17:52 sensor 501
2018-08-14 19:17:55 sensor 496
2018-08-14 19:17:58 sensor 501
2018-08-14 19:18:02 sensor 502
2018-08-14 19:18:07 sensor 501
2018-08-14 19:18:10 sensor 502
2018-08-14 19:18:14 sensor 504
2018-08-14 19:18:17 sensor 514
2018-08-14 19:18:20 sensor 513
2018-08-14 19:18:24 sensor 502
2018-08-14 19:18:27 sensor 512
2018-08-14 19:18:30 sensor 511
2018-08-14 19:18:33 sensor 509
2018-08-14 19:18:36 sensor 508
2018-08-14 19:18:39 sensor 509
2018-08-14 19:18:42 sensor 507
2018-08-14 19:18:46 sensor 509
2018-08-14 19:18:49 sensor 546
2018-08-14 19:18:52 sensor 547
2018-08-14 19:18:56 sensor 546
2018-08-14 19:18:59 sensor 547
2018-08-14 19:19:02 sensor 546



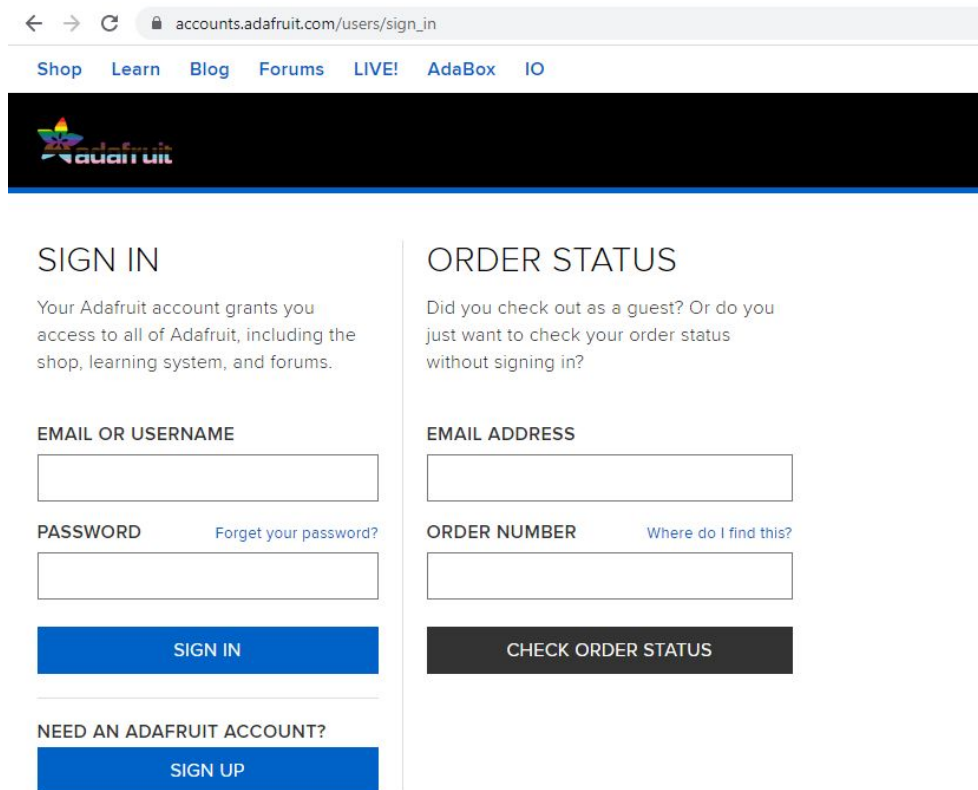
adafruit.io



Experimento 03: Uso do Node-RED para enviar dados via **MQTT** para a Plataforma IoT Adafruit IO

➤ **Passo 01 - Adafruit IO:**

Faça sua conta gratuita na plataforma!



The screenshot shows the 'accounts.adafruit.com/users/sign_in' page. At the top, there's a navigation bar with links: Shop, Learn, Blog, Forums, LIVE!, AdaBox, and IO. Below this is a black banner with the Adafruit logo. The main content area is divided into two columns. The left column is titled 'SIGN IN' and contains a description of account benefits, input fields for 'EMAIL OR USERNAME' and 'PASSWORD', a 'SIGN IN' button, and a 'NEED AN ADAFRUIT ACCOUNT?' section with a 'SIGN UP' button. The right column is titled 'ORDER STATUS' and contains a description, an 'EMAIL ADDRESS' input field, an 'ORDER NUMBER' input field, and a 'CHECK ORDER STATUS' button. A 'Forgot your password?' link is located next to the password field, and a 'Where do I find this?' link is next to the order number field.

accounts.adafruit.com/users/sign_in

Shop Learn Blog Forums LIVE! AdaBox IO

SIGN IN

Your Adafruit account grants you access to all of Adafruit, including the shop, learning system, and forums.

EMAIL OR USERNAME

PASSWORD [Forget your password?](#)

SIGN IN

NEED AN ADAFRUIT ACCOUNT?

SIGN UP

ORDER STATUS

Did you check out as a guest? Or do you just want to check your order status without signing in?

EMAIL ADDRESS

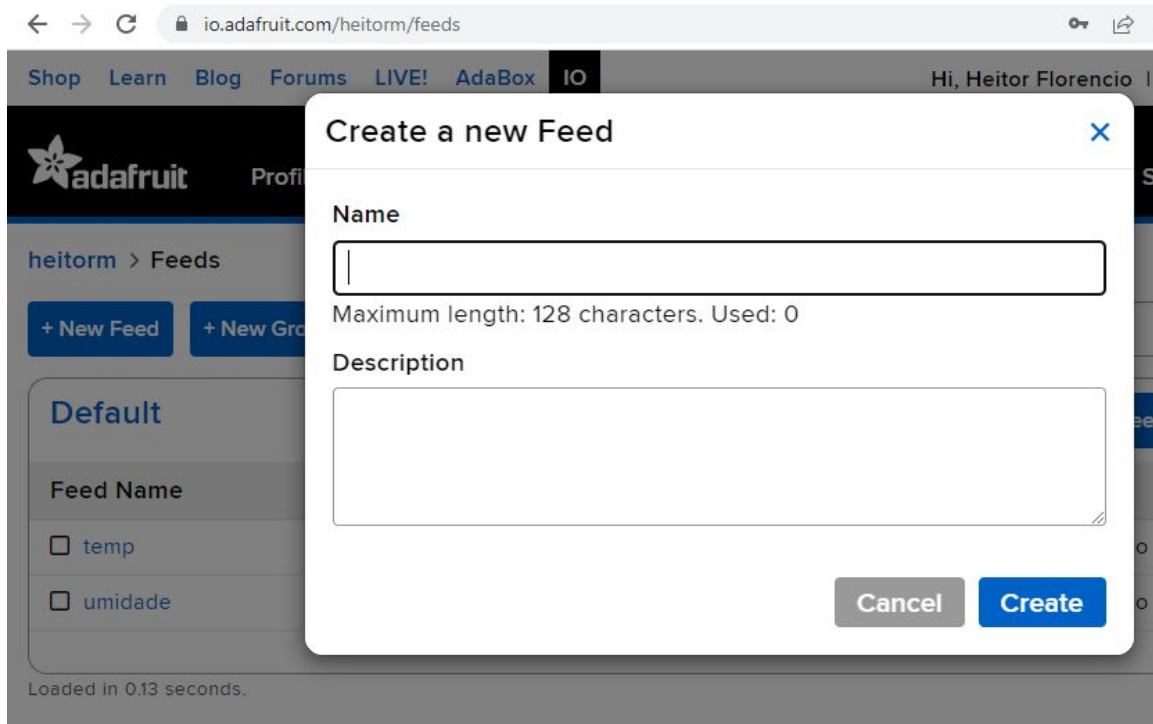
ORDER NUMBER [Where do I find this?](#)

CHECK ORDER STATUS

Experimento 03: Uso do Node-RED para enviar dados via **MQTT** para a Plataforma IoT Adafruit IO

➤ Passo 02 - Adafruit IO:

Crie os **feeds** (variáveis dos dispositivos IoT)



The screenshot shows the Adafruit IO web interface. A modal dialog titled "Create a new Feed" is open. It contains a "Name" input field with a placeholder bar, a "Description" text area, and a character count "Maximum length: 128 characters. Used: 0". At the bottom are "Cancel" and "Create" buttons. The background shows the user's profile "heiform" and a list of feeds under the "Default" group, including "temp" and "umidade".

io.adafruit.com/heiform/feeds

Shop Learn Blog Forums LIVE! AdaBox IO Hi, Heitor Florencio

adafruit

heiform > Feeds

+ New Feed + New Group

Default

Feed Name

☐ temp

☐ umidade

Loaded in 0.13 seconds.

Create a new Feed

Name

Maximum length: 128 characters. Used: 0

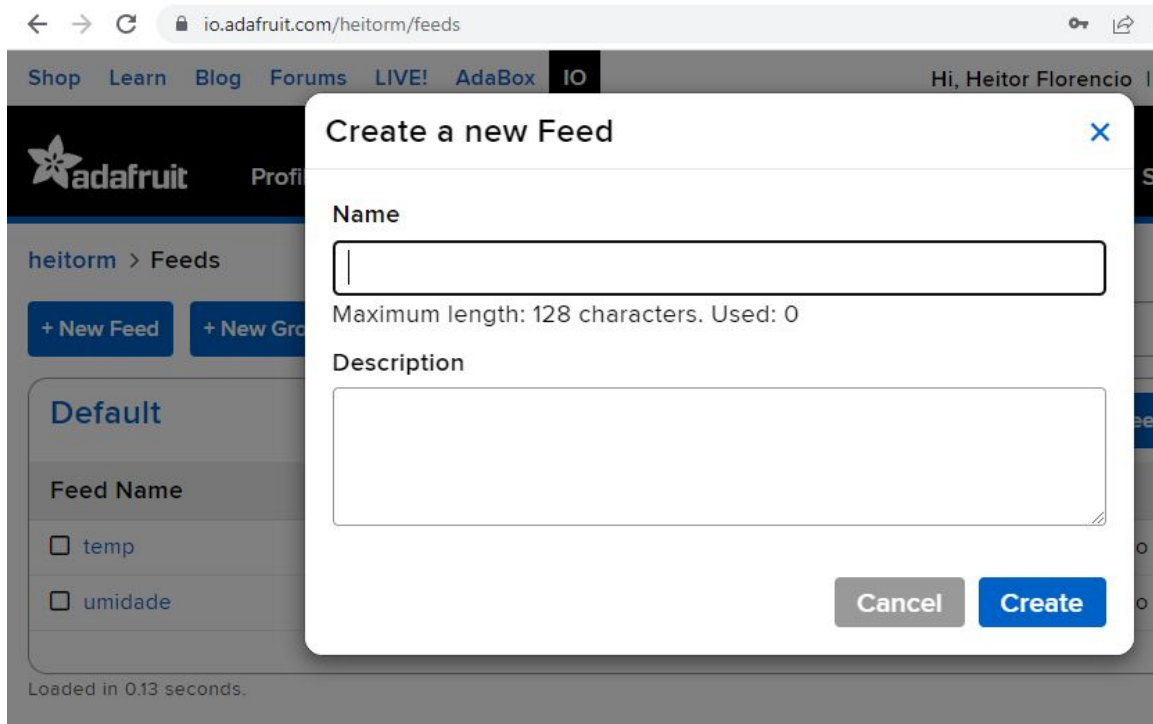
Description

Cancel Create

Experimento 03: Uso do Node-RED para enviar dados via **MQTT** para a Plataforma IoT Adafruit IO

➤ Passo 03 - Adafruit IO:

Crie os **feeds** (variáveis dos dispositivos IoT)



The screenshot shows the Adafruit IO web interface. A modal dialog titled "Create a new Feed" is open. It contains a "Name" input field with a placeholder bar, a "Description" text area, and a character count "Maximum length: 128 characters. Used: 0". At the bottom are "Cancel" and "Create" buttons. The background shows the user's profile "heiform" and a list of feeds under the "Default" group, including "temp" and "umidade".

io.adafruit.com/heiform/feeds

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adafruit

heiform > Feeds

+ New Feed + New Group

Default

Feed Name

☐ temp

☐ umidade

Loaded in 0.13 seconds.

Create a new Feed

Name

Maximum length: 128 characters. Used: 0

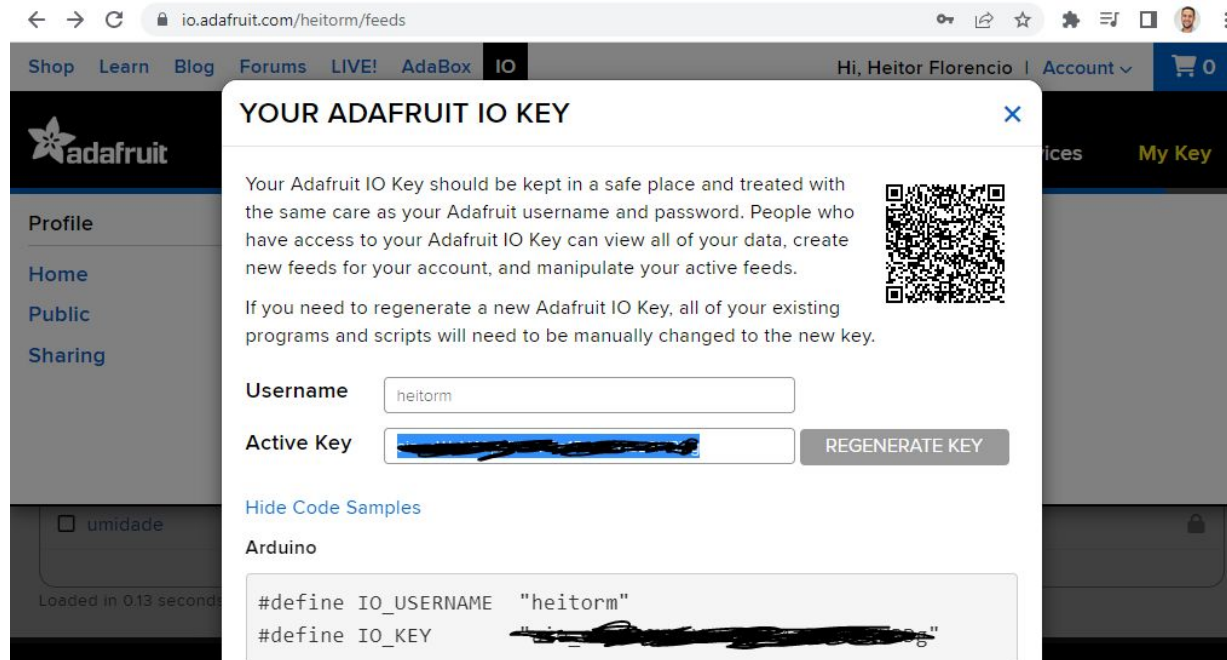
Description

Cancel Create

Experimento 03: Uso do Node-RED para enviar dados via **MQTT** para a Plataforma IoT Adafruit IO

➤ Passo 04 - Adafruit IO:

Guarde suas **credenciais** para
cadastrar na configuração
MQTT



io.adafruit.com/heitorm/feeds

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Hi, Heitor Florencio | Account ▾

adafruit

Profile

Home

Public

Sharing

YOUR ADAFRUIT IO KEY

Your Adafruit IO Key should be kept in a safe place and treated with the same care as your Adafruit username and password. People who have access to your Adafruit IO Key can view all of your data, create new feeds for your account, and manipulate your active feeds.

If you need to regenerate a new Adafruit IO Key, all of your existing programs and scripts will need to be manually changed to the new key.

Username

Active Key

REGENERATE KEY

Hide Code Samples

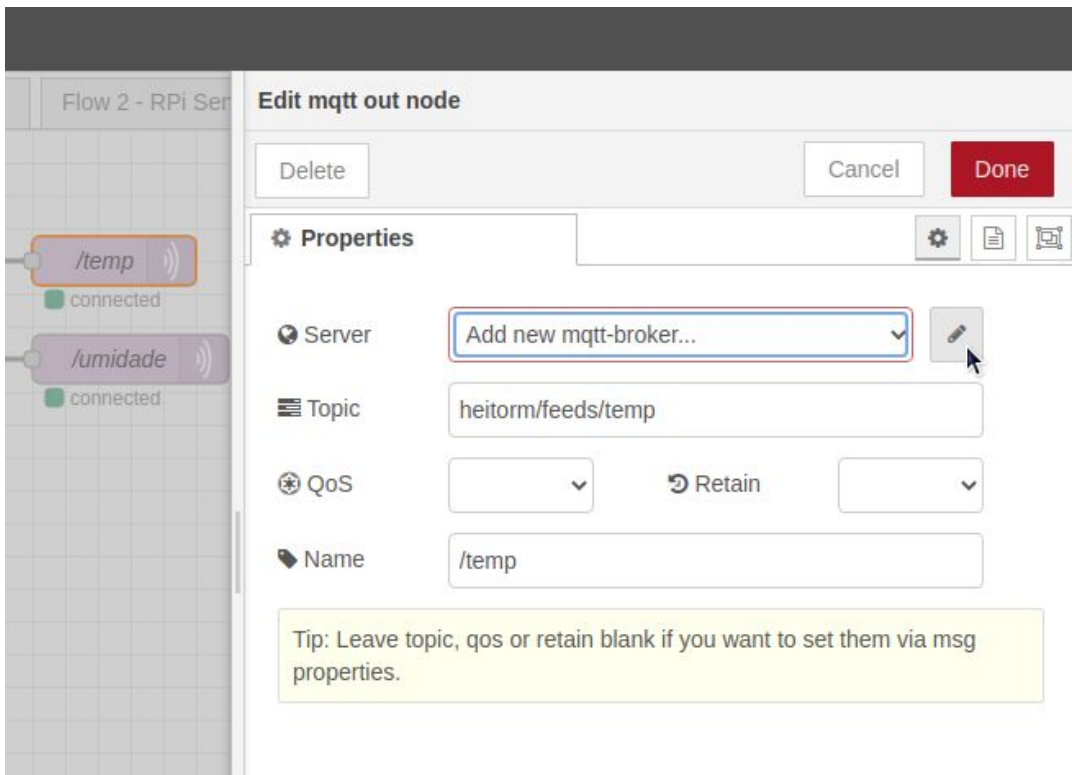
Arduino

```
#define IO_USERNAME "heitorm"
#define IO_KEY "REDACTED"
```

Experimento 03: Uso do Node-RED para enviar dados via **MQTT** para a Plataforma IoT Adafruit IO

➤ Passo 05 - **Node-RED**:

Uso do nó “**mqtt out**” para enviar os valores do sensor DHT11 para **sua conta** (com credenciais) da plataforma Adafruit IO.



Experimento 03: Uso do Node-RED para enviar dados via **MQTT** para a Plataforma IoT Adafruit IO

➤ Passo 05 - **Node-RED**:

Uso do nó “**mqtt out**” para enviar os valores do sensor DHT11 para sua conta (com credenciais) da plataforma **Adafruit IO**.

The screenshot shows the 'Edit mqtt out node' configuration window in Node-RED. The title bar indicates 'Edit mqtt out node > Edit mqtt-broker node'. At the top, there are three buttons: 'Delete', 'Cancel', and 'Update'. Below this is a 'Properties' section with a gear icon and a document icon. The main configuration area has three tabs: 'Connection' (selected), 'Security', and 'Messages'. Under the 'Connection' tab, the following settings are visible: 'Name' is 'broker-adafruit-heitor'; 'Server' is 'io.adafruit.com|' with a mouse cursor over it; 'Port' is '1883'; 'Connect automatically' is checked; 'Use TLS' is unchecked; 'Protocol' is 'MQTT V3.1.1'; 'Client ID' is 'Leave blank for auto generated'; 'Keep Alive' is '60'; and 'Session' has 'Use clean session' checked.

Experimento 03: Uso do Node-RED para enviar dados via **MQTT** para a Plataforma IoT Adafruit IO

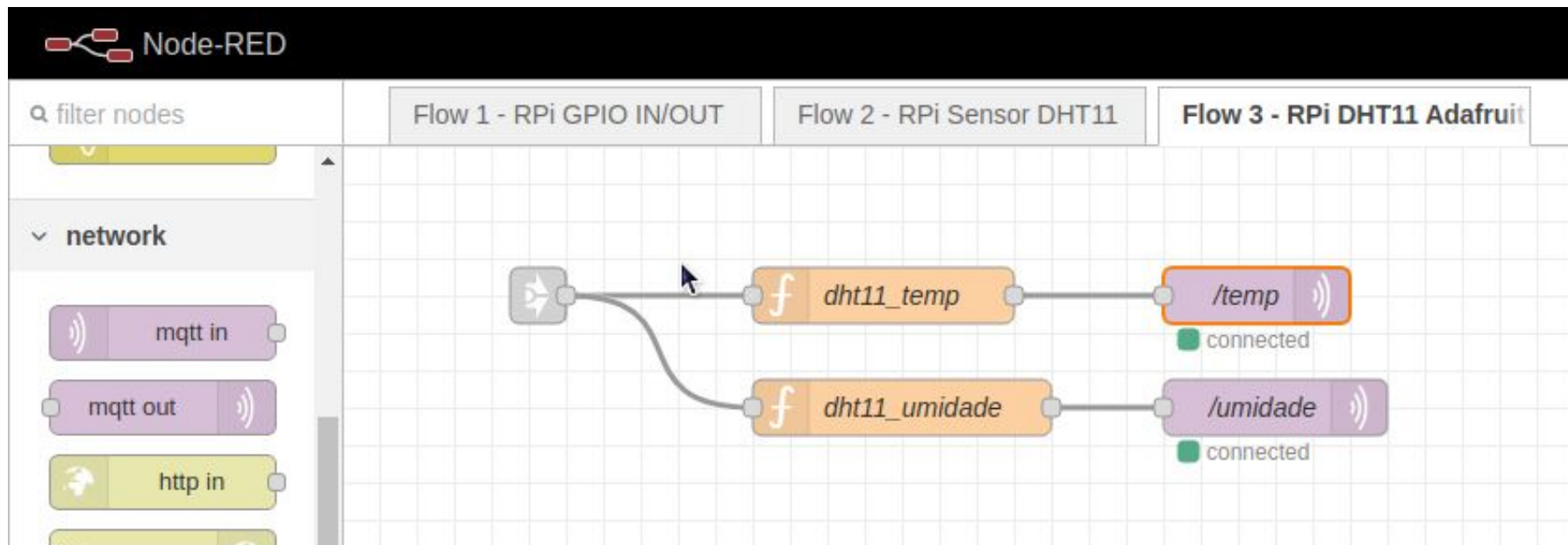
➤ Passo 05 - **Node-RED**:

Uso do nó “**mqtt out**” para enviar os valores do sensor DHT11 para **sua conta** (com **credenciais**) da plataforma Adafruit IO.

The screenshot shows the 'Edit mqtt-broker node' configuration window in Node-RED. The window has a title bar 'Edit mqtt out node > Edit mqtt-broker node' and buttons for 'Delete', 'Cancel', and 'Update'. Below the title bar is a 'Properties' tab with a gear icon and a document icon. The main configuration area has three tabs: 'Connection', 'Security', and 'Messages'. The 'Connection' tab is active, showing fields for 'Name' (broker-adafruit-heitor), 'Username' (heitorm), and 'Password' (masked with asterisks). At the bottom, there is a status bar with 'Enabled' (radio button), '2 nodes use this config', and 'On all flows' (dropdown menu).

Experimento 03: Uso do Node-RED para enviar dados via **MQTT** para a Plataforma IoT Adafruit IO

➤ **FLOW 3** - RPi DHT11 Adafruit:



O que discutimos hoje?

Tópicos

- **Experimento 01:** Uso do Node-RED para ler e escrever em GPIO do RPi
 - Plataforma **Node-RED**
 - **Experimento 02:** Uso do Node-RED para ler os valores do sensor DHT11
 - **Experimento 03:** Uso do Node-RED para enviar dados via MQTT para a Plataforma IoT Adafruit IO
 - Plataforma **Adafruit IO**
-

Dúvidas?

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