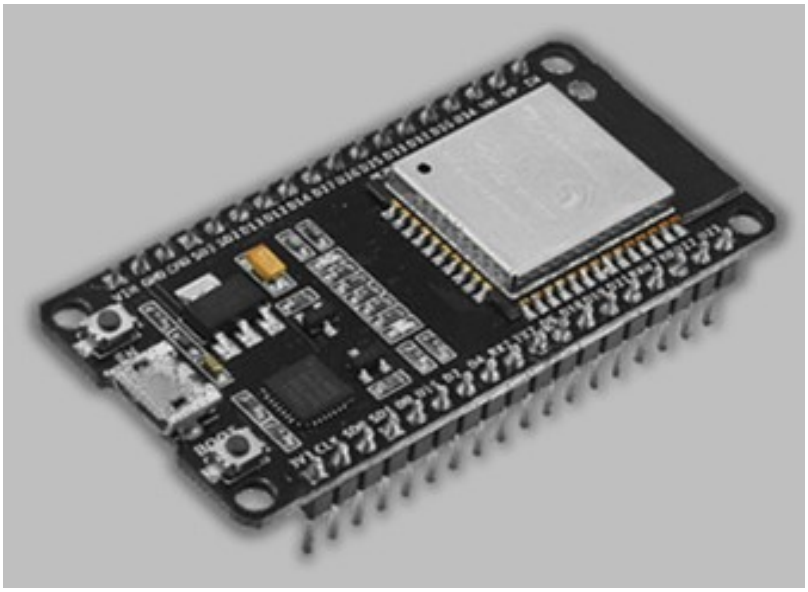
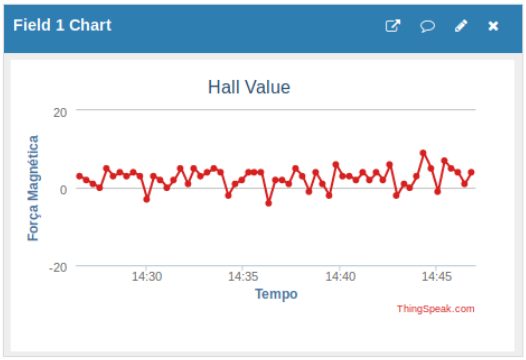
ESP 32/ESP8266

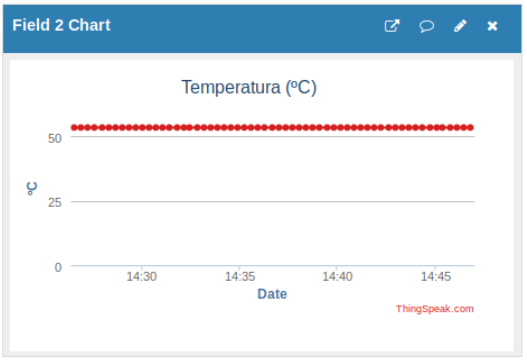
Microcontrolador, WiFi e Bluetooth



Channel Stats

Created: about 3 hours ago
Last entry: less than a minute ago
Entries: 261



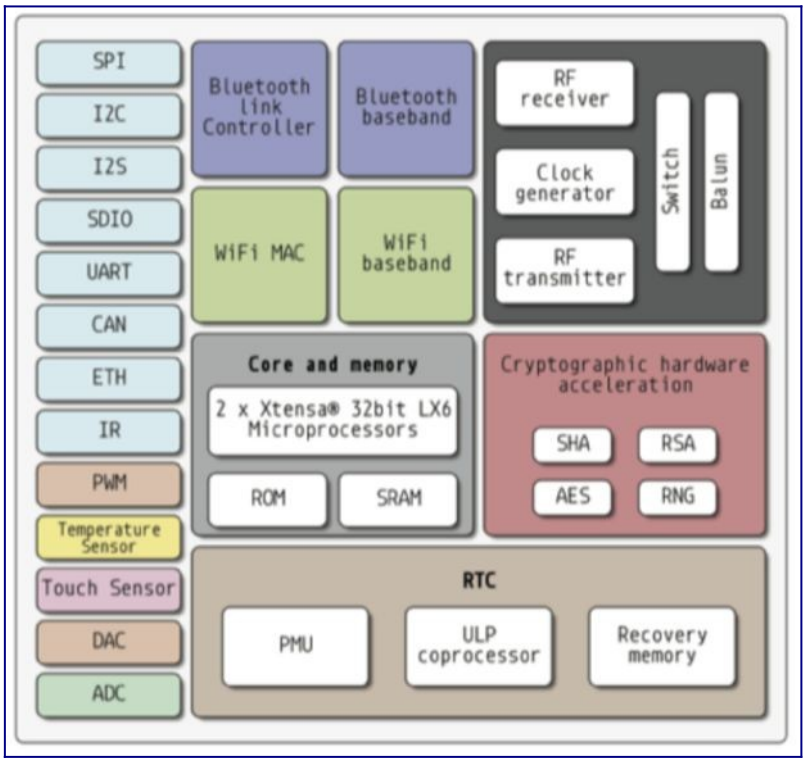


Índice

Introdution to ESP32 Board in Arduino IDE on Ubuntu Linux

ESP32 is highly-integrated with in-built antenna switches, RF balun, power amplifier, low-noise receive amplifier, filters, and power management modules. ESP32 adds priceless functionality and versatility to your applications with minimal Printed Circuit Board (PCB) requirements. ESP32 can interface with other systems to provide Wi-Fi and Bluetooth functionality through its SPI / SDIO or I2C / UART interfaces. Most of the **ESP32** framework is implemented. Most noticeable is the missing **analogWrite**. While analogWrite is on it's way, there are a few other extra options that you can use:

The ESP32 Main Characteristics



The ESP32 is an under US$10 board with great advantages over similar IoT boards in the market.

This board has a dual processed microprocessor that helps a lot, because when one processor is handle communication, the other one is in charge of I/O control, for example. This feature will prevent some issues that happen with ESP8266, where the sole CPU needs stop controlling I/Os when handle with Comm. Besides, the ESP32 has integrated WIFI, BLUETOOTH, DAC, several ADC (not only one as the ESP8266), capacitive touch sensors, etc (give a look at above block diagram). And the good news is that Power Consumption is almost the same as ESP8266.

Bellow a chart that can show us its main characteristics, and differences when compared with ESP8266:

Specifications	ESP8266	ESP32
MCU	Xtensa® Single-Core 32-bit L106	Xtensa® Dual-Core 32-bit LX6 600 DMIPS
802.11 b/g/n Wi-Fi	Yes, HT20	Yes, HT40
Bluetooth	None	Bluetooth 4.2 and below
Typical Frequency	80 MHz	160 MHz
SRAM	160 kBytes	512 kBytes
Flash	SPI Flash , up to 16 MBytes	SPI Flash , up to 16 MBytes
GPIO	17	36
Hardware / Software PWM	None / 8 Channels	1 / 16 Channels
SPI / I2C / I2S / UART	2/1/2/2	4/2/2/2
ADC	10-bit	12-bit
CAN	None	1
Ethernet MAC Interface	None	1
Touch Sensor	None	Yes
Temperature Sensor	None	Yes
Working Temperature	-40℃ ~ 125℃	-40℃ ~ 125℃

Let’s point its main properties for more details:

Key Features:

- 240 MHz dual-core Tensilica LX6 microcontroller with 600 DMIPS
- Integrated 520 KB SRAM
- Integrated 802.11 b/g/n HT40 Wi-Fi transceiver, baseband, stack and LwIP
- Integrated dual mode Bluetooth (classic and BLE)
- 16 MB flash, memory-mapped to the CPU code space
- 2.3V to 3.6V operating voltage
- -40°C to +125°C operating temperature
- Onboard PCB antenna / IPEX connector for external antenna

Sensors:

- Ultra-low noise analog amplifier
- Hall sensor
- 10x capacitive touch interfaces
- 32 kHz crystal oscillator

34 x GPIO:

- 3 x UARTs, including hardware flow control
- 3 x SPI
- 2 x I2S
- 18 x ADC input channels
- 2 x DAC
- 2 x I2C
- PWM/timer input/output available on every GPIO pin
- OpenOCD debug interface with 32 kB TRAX buffer
- SDIO master/slave 50 MHz
- Supports external SPI flash up to 16 MB
- SD-card interface support

Security Related:

- WEP, WPA/WPA2 PSK/Enterprise
- Hardware accelerated encryption: AES/SHA2/Elliptical Curve Cryptography/RSA-4096

Performance:

- Supports sniffer, Station, SoftAP and Wi-Fi direct mode
- Max data rate of 150 Mbps@11n HT40, 72 Mbps@11n HT20, 54 Mbps@11g, and 11 Mbps@11b
- Maximum transmit power of 19.5 dBm@11b, 16.5 dBm@11g, 15.5 dBm@11n
- Minimum receiver sensitivity of -97 dBm
- 135 Mbps UDP sustained throughput
- 5 µA power consumption in Deep-sleep

O ESP pode ser programado nas seguintes linguagens:

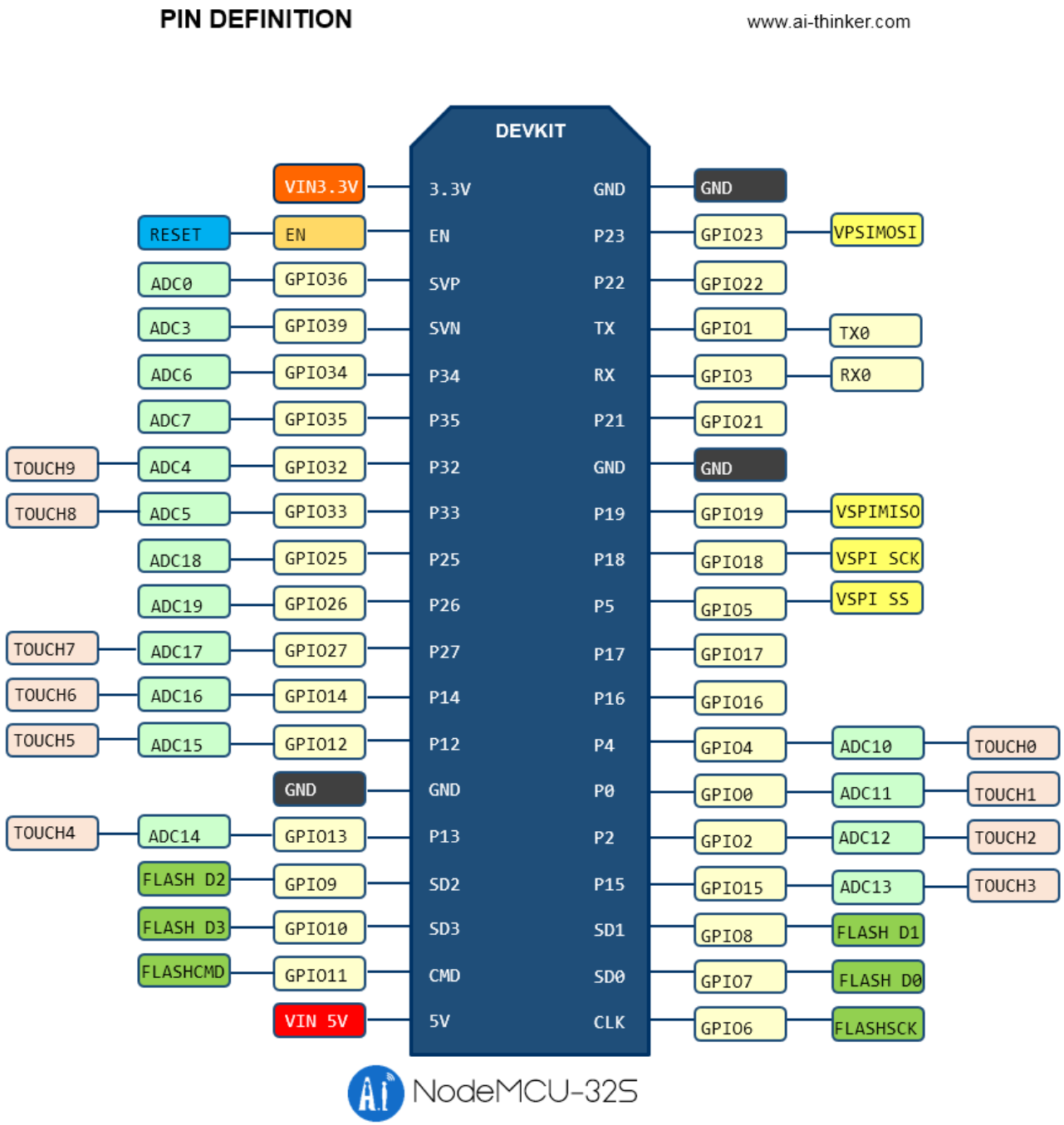
- LUA
- Arduino IDE
- MicroPython
- NodeJS (JavaScript) / Node-RED

Zerynth IDE (Python): https://docs.zerynth.com/latest/official/core.zerynth.docs/installationguide/docs/index.html

Chilipepr (LUA): http://chilipeppr.com/esp32

Micropython: https://randomnerdtutorials.com/getting-started-micropython-esp32-esp8266/

Pinout



Paǵina Oficial: https://wiki.ai-thinker.com/esp32/boards/nodemcu_32s

Especificações do Produto e Desenhos:

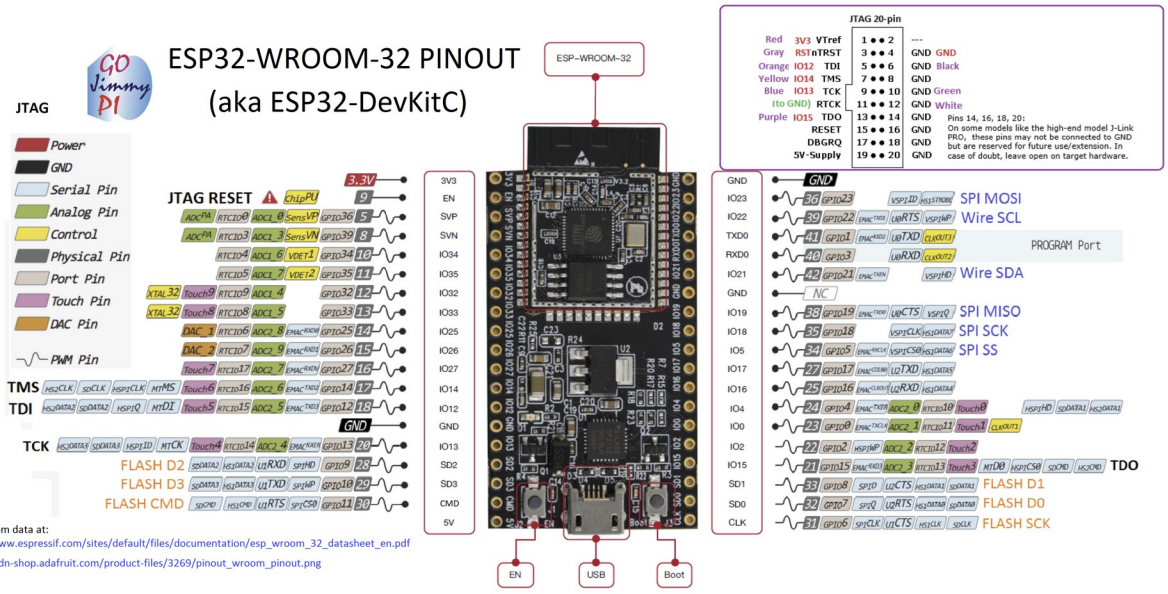
https://wiki.ai-thinker.com/_media/esp32/docs/nodemcu-32s_product_specification.pdf

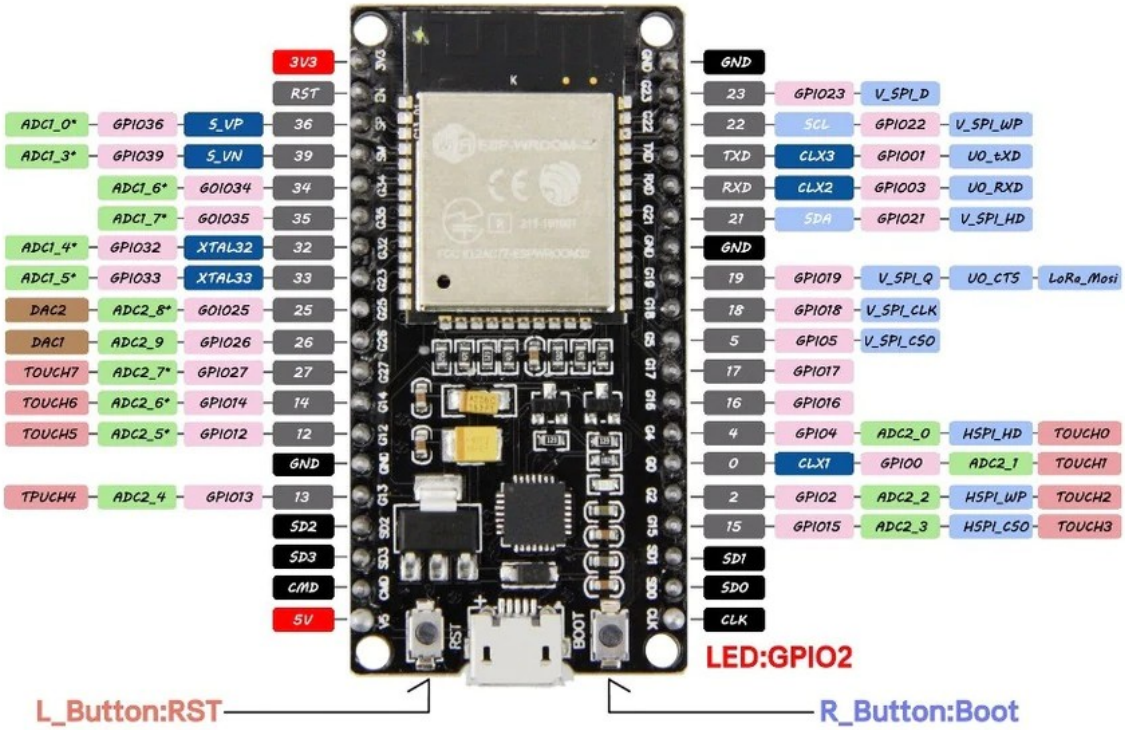
Firmware: ai-thinker_nodemcu-32s_dio_32mbit_v1.0_20161101.7z

Hardware: nodemcu_32s_hardware_resources.7z

NodeMCU: https://github.com/nodemcu/nodemcu-firmware/tree/dev-esp32

Arduino: https://github.com/espressif/arduino-esp32


ESP32-WROOM-32 PINOUT
(aka ESP32-DevKitC)
JTAG
ESP-WROOM-32
JTAG 20-pin
Power
GND
Serial Pin
Analog Pin
Control
Physical Pin
Port Pin
Touch Pin
DAC Pin
PWM Pin
JTAG RESET
TMS
TDI
TCK
FLASH D2
FLASH D3
FLASH CMD
SPI MOSI
Wire SCL
PROGRAM Port
Wire SDA
SPI MISO
SPI SCK
SPI SS
TDO
FLASH D1
FLASH D0
FLASH SCK
EN
USB
Boot
Adapted from data at:
http://www.espressif.com/sites/default/files/documentation/esp_wroom_32_datasheet_en.pdf
https://cdn-shop.adafruit.com/product-files/3269/pinout_wroom_pinout.png


3V3
RST
ADC1_0* GPIO36 S_VP 36
ADC1_3* GPIO39 S_VN 39
ADC1_6* GOI034 34
ADC1_7* GOI035 35
ADC1_4* GPIO32 XTAL32 32
ADC1_5* GPIO33 XTAL33 33
DAC2 ADC2_8* GOI025 25
DAC1 ADC2_9 GPIO26 26
TOUCH7 ADC2_7* GPIO27 27
TOUCH6 ADC2_6* GPIO14 14
TOUCH5 ADC2_5* GPIO12 12
GND
TPUCH4 ADC2_4 GPIO13 13
SD2
SD3
CMD
5V
GND
23 GPIO23 V_SPI_D
22 SCL GPIO22 V_SPI_WP
TXD CLX3 GPIO001 UO_tXD
RXD CLX2 GPIO003 UO_RXD
21 SDA GPIO021 V_SPI_HD
GND
19 GPIO19 V_SPI_Q UO_CTS LoRa_Mosi
18 GPIO18 V_SPI_CLK
5 GPIO5 V_SPI_CS0
17 GPIO17
16 GPIO16
4 GPIO4 ADC2_0 HSPI_HD TOUCH0
0 CLX1 GPIO0 ADC2_1 TOUCH1
2 GPIO2 ADC2_2 HSPI_WP TOUCH2
15 GPIO15 ADC2_3 HSPI_CS0 TOUCH3
SD1
SD0
CLK
LED:GPIO2
L_Button:RST
R_Button:Boot
ESP32 Rev1 Development
WiFi+Bluetooth Board
Pin Diagram

1 Programação através de Arduino IDE

Installing ESP32 Board in Arduino IDE (UBUNTU Linux)

In this tutorial we are installing ESP32 board in **Arduino IDE**. Its not same as installing ESP8266. **ESP32** is dual core CPU in arduino IDE it will not support all the functions but its enough to make many projects. Para instalar o ESP8266 siga este link, que é semelhante ao que faremos com o ESP-32:

https://arduino-esp8266.readthedocs.io/en/latest/installing.html

Step 1: Instalar última versão do arduino IDE

```
sudo apt-get update
sudo apt-get install ubuntu-make
```

Allow non root user to use tty0 (USB to Serial converter) serial communication with ESP32

sudo usermod -a -G dialout $USER

Faça o Logout do utilizador.

Step 1.2: Install git. By default its installed with ubuntu linux installation

sudo apt-get install git

Step 1.3: Get repository for **get–pip.py,** is a bootstrapping script that enables users to install **pip**, setup tools, and wheel in Python environments that don't already **have** them.

wget https://bootstrap.pypa.io/get-pip.py

Step 1.4: Run python get-pip.py

sudo python get-pip.py

Step 1.5: Install **pySerial** is a Python API module to access the serial port. **pySerial** provides a uniform API across multiple operating systems, including Windows, Linux, and BSD.

sudo pip3 install pyserial

Step 1.6: On terminal go to you **Arduino** installation directory using **cd command**

Step 1.7: Create directory **espressif** in **arduino-1.8.3/hardware/** folder

mkdir -p ~/Arduino/hardware/espressif

Step 1.8: Change directory to **espressif**

cd ~/Arduino/hardware/espressif

Step 1.9: Clone **esp32 core** from git to **esperssif** directory

git clone https://github.com/espressif/arduino-esp32.git esp32

Step 1.10: After cloning you will find **esp32** directory

cd esp32

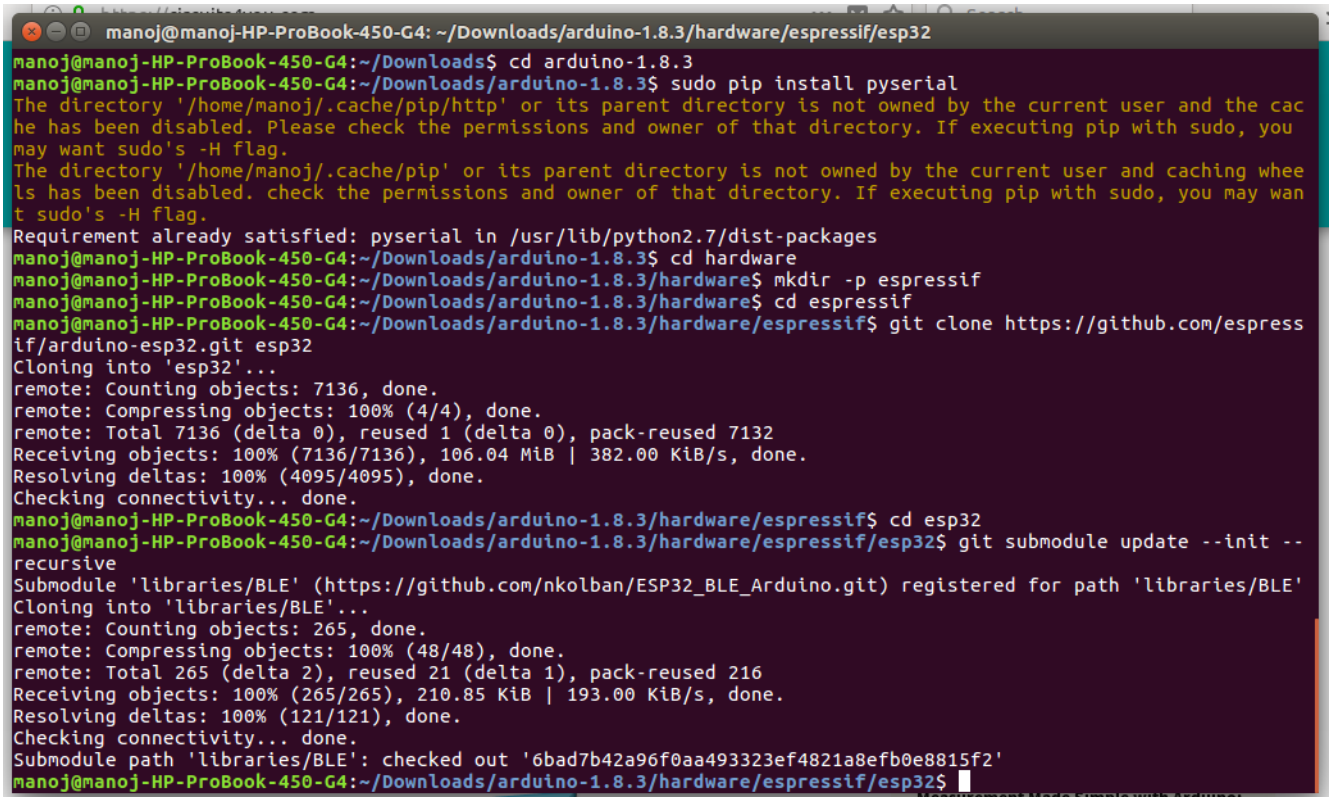
Step 1.11: Update submodules of ESP32

git submodule update –init –recursive

Step 1.12: Run following final commands

cd tools
python get.py

Here is my installation Screen shot



Step 2: Restart Your arduino IDE

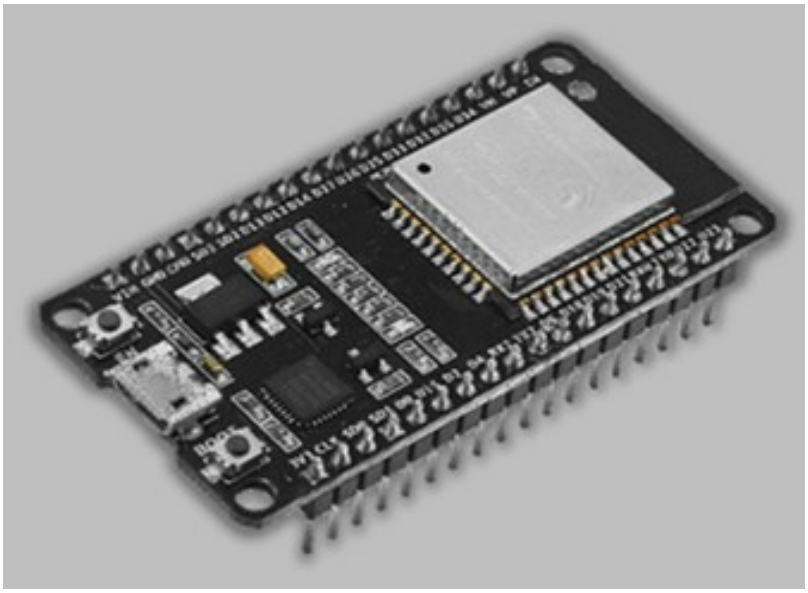
See in boards you will find ESP32 board. Go to Tools (Ferramentas), Placa and choose in this case NodeMCU-32S.

Temos um ESP-32 WROOM DEV Module. O ESP8266 é um AI Thinker com 4mb de ram.

Change Upload Speed to 115200 and search for the right Porta to make the connection.

Installing ESP32 Board in Arduino IDE (Windows Install)

Driver conversor USB-Série para ESP32 e ESP8266



Após a ligação do NodeMCU-32S no computador ele será identificado e a busca por drivers de instalação vai iniciar. Por padrão, o Windows vai procurar pelos drivers na internet e se ele encontrar a instalação vai ocorrer de forma automática.
Caso o Windows não consiga encontrar os drivers para instalação da placa, então terá que instalar manualmente.
Faça download do driver no link abaixo:
Driver CP2102 para Windows

Após o download faça a instalação dos drivers. Terminado a instalação, seu NodeMCU-32S já está pronto para ser usado.

A IDE do Arduino (Programa do Arduino) é uma ferramenta multiplataforma escrita em Java derivada dos projetos Processing e Wiring. Inclui um editor de código com recursos de realce de sintaxe, parênteses correspondentes e identação automática, sendo capaz de compilar e carregar programas para a placa com um único clique. Por isso não há a necessidade de editar Makefiles ou correr programas em ambientes de linha de comando.

Através da IDE do Arduino é possível programar (utilizando a linguagem do Arduino) para o NodeMCU-32S. Dessa forma, será possível trabalhar num ambiente mais simples, que é bastante conhecido por quem já programa para Arduino ou C / C++.

Antes de efetuar a instalação da IDE é necessário fazer a instalação do Java. Caso já possua o Java instalado, verifique se o mesmo está atualizado.

Para download do Java, basta aceder https://www.java.com/ e fazer o download do instalador.

Feito a instalação ou atualização do Java, já é possível fazer a instalação da IDE do Arduino.

Para fazer o download da versão atualizada da IDE do Arduino para Windows basta aceder https://www.arduino.cc/en/Main/Software e efetuar a instalação.

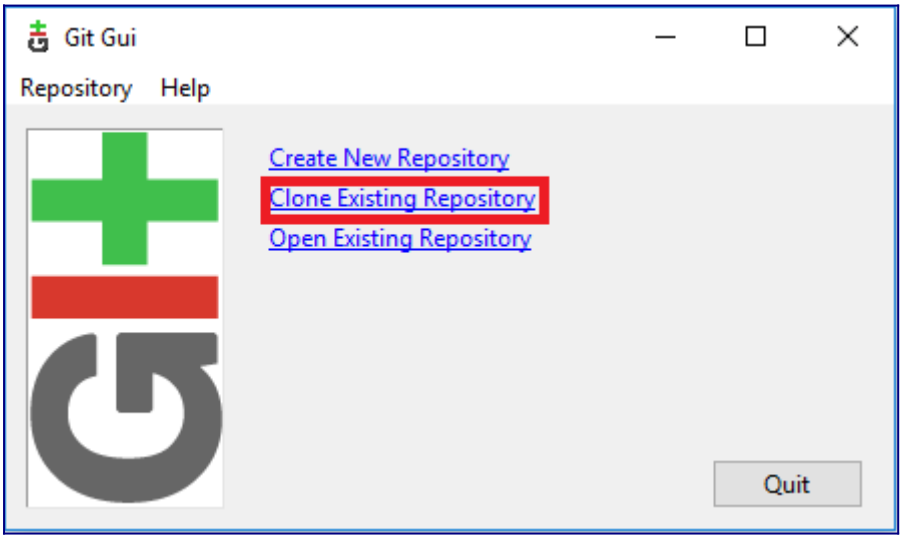
Após a instalação da IDE, será necessário prepararmos os Ficheiros necessários para que a IDE do Arduino possa reconhecer o NodeMCU-32S.

Faça o download do Git:

https://git-scm.com/download/win

Após o download, faça a instalação do programa. Terminado a instalação, acesse o caminho “C:\Program Files\Git\cmd” e execute “git-gui”.

Com o programa aberto, clique em “Clone Existing Repository”:



Na janela que abrir, insira as informações da seguinte forma:

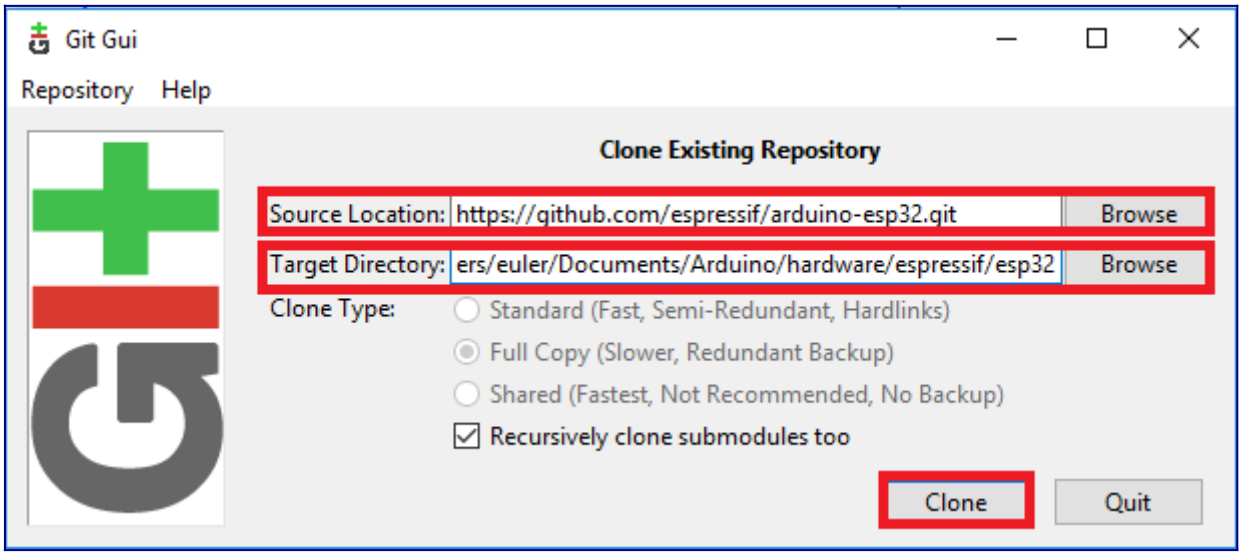
Source Location:

https://github.com/espressif/arduino-esp32.git

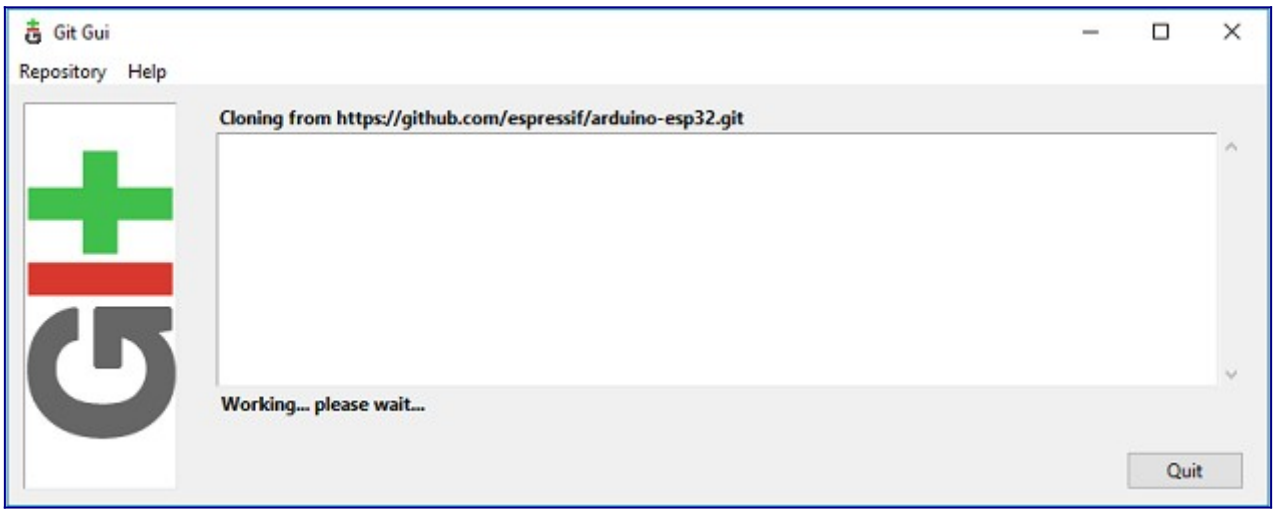
Target Directory:

C:/Users/**[Utilizador-PC]**/Documents/Arduino/hardware/espressif/esp32

OBS: Em “Target Directory:” apague o [USUARIO-PC] e insira o nome de utilizador do seu computador para que o caminho possa ser válido.

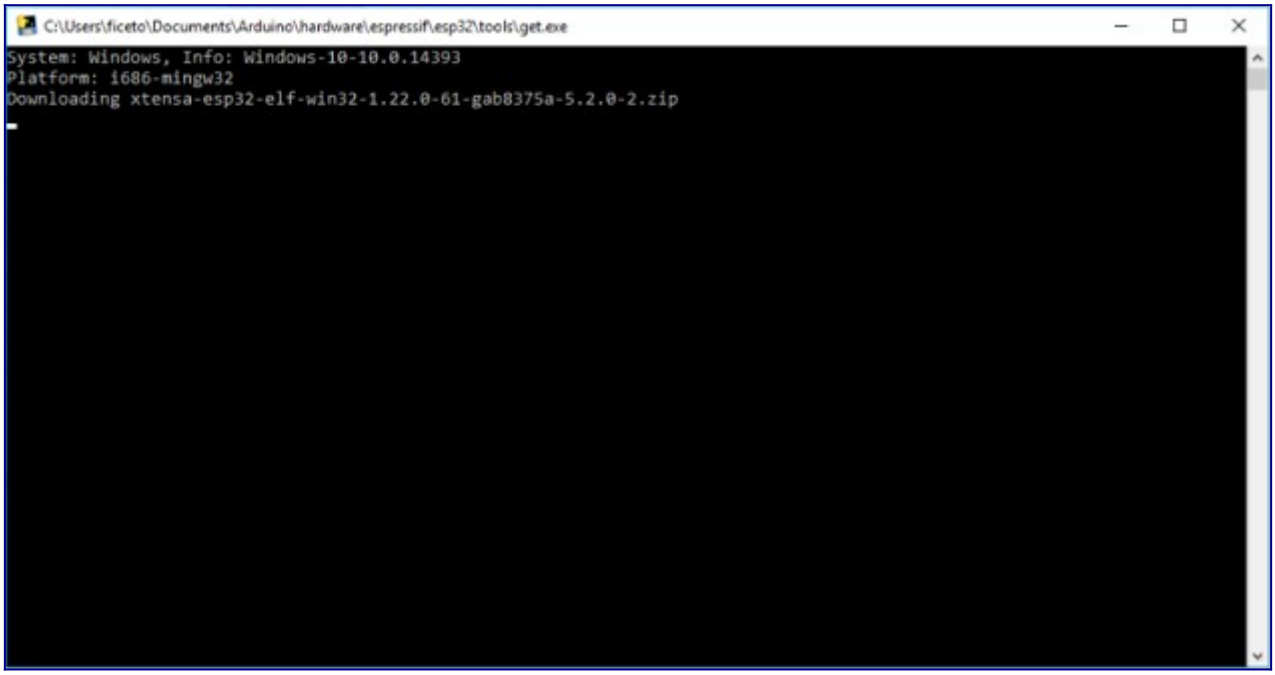


Após inserir as informações, clique em “Clone” para que o processo de cópia do repositório seja realizado:



Este processo é um pouco demorado, portanto paciência.

Finalizado a clonagem do repositório, acesse o caminho "C:/Users/**[USUARIO-PC]**/Documents/Arduino/hardware/espressif/esp32/tools" (**lembre-se de mudar [USUARIO-PC] para o nome de utilizador do seu computador**) e execute o "get.exe" e aguarde:



Este processo também é demorado.

Terminado, conecte o NodeMCU-32S ao computador e abra a IDE do Arduino.

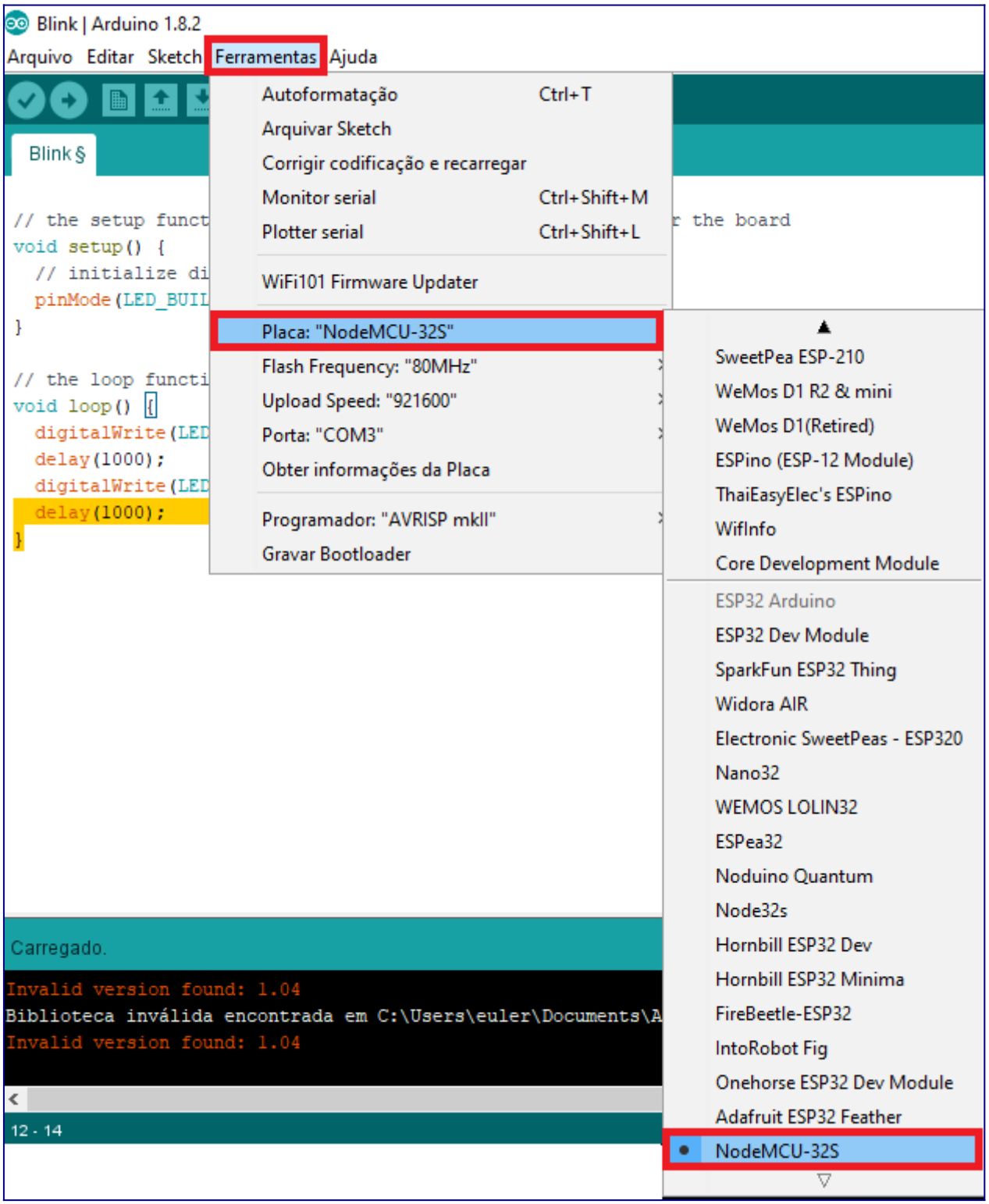
Com a IDE aberta, será mostrado algumas opções na barra de ferramentas da mesma. Abaixo é feito um apanhado geral (**das opções relevantes**) do menu Ficheiro e Ferramentas:

1. **Ficheiro**
    - **Novo:** abre uma nova instância da IDE.
    - **Abrir:** carrega na IDE projetos guardados no computador.
    - **Exemplos:** disponibiliza diversos exemplos que são separados por pastas e bibliotecas. Os exemplos estão em submenus e para abrir algum deles, basta selecionar e clicar.
    - **Fechar:** fecha a instância atual.

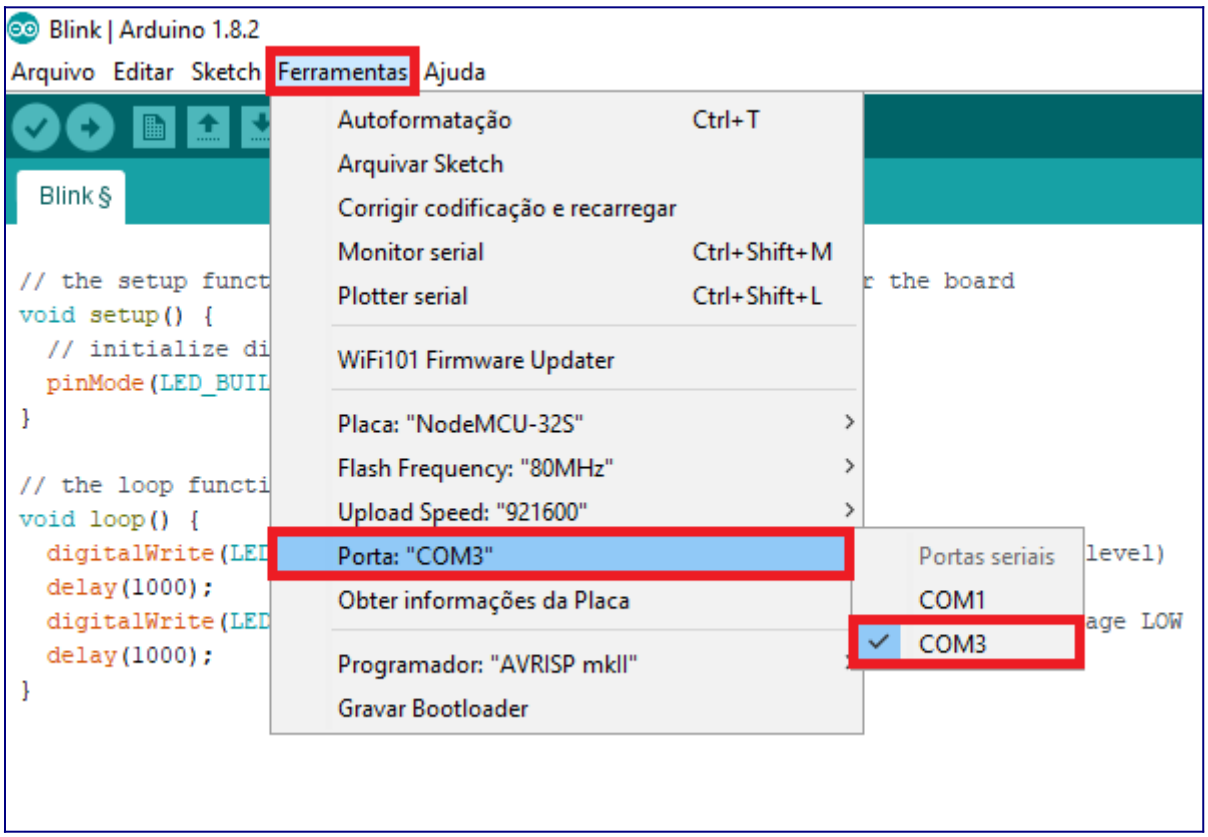
- **Guardar:** guarda as últimas modificações do seu projeto.
- **Guardar como:** se o projeto já foi guardado, mas deseja Guardar noutro local, essa é a opção indicada.
- **Preferências:** configurações gerais da IDE.
- **Sair:** encerra definitivamente a IDE.

2. **Ferramentas**
    - **Monitor série:** executa o terminal série que auxilia no recolha e envio de dados para a placa sem a necessidade de recorrer a uma ferramenta externa.
    - **Placa:** possibilita selecionar o modelo da placa que está ligado ao computador.
    - **Porta:** possibilita selecionar a porta COM em que a placa está recebendo/enviando informações.

No menu “Ferramentas” selecione a opção “Placas”, role a lista até o final e selecione “NodeMCU-32S”:



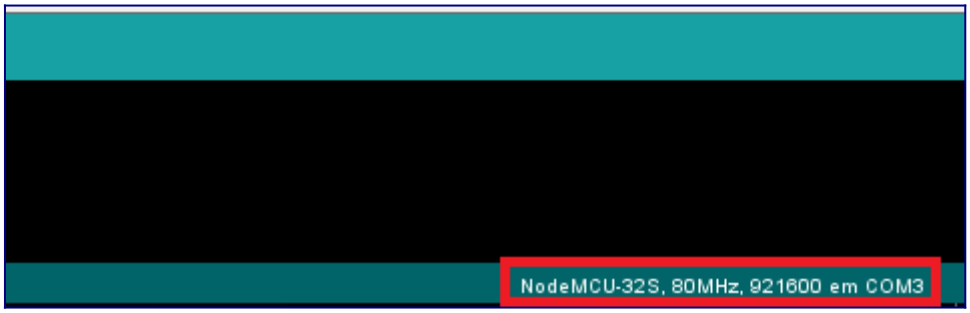
Ainda no menu “Ferramentas”, selecione a opção porta e marque a porta COM em que sua placa foi alocada:



Veja que a minha placa foi alocada na COM3, porém, o seu NodemCU-32S pode ter sido alocado em uma COM de outro valor. Caso não saiba em qual porta COM sua placa foi alocada, basta retornar no menu Iniciar do Windows, aceder a opção Dispositivos e Impressoras e verificar a porta em que seu NodeMCU-32S está ligado e retornar na IDE e selecionar a porta COM.

Feito essas configurações, sua IDE está pronta para enviar os códigos ao NodeMCU-32S.

Para um teste rápido, na IDE clique no menu “Ficheiro”, selecione a opção “Exemplos”, em seguida “01.Basics” e selecione “Blink”. Uma nova janela da IDE vai abrir. Faça a conferência das informações para garantir que nada foi alterado na placa e na porta. Se atente ao rodapé da IDE que mostra a placa e a porta COM que está configurada na IDE:



Agora, clique no botão de upload do código para o NodeMCU-32S e aguarde o código ser carregado na placa.

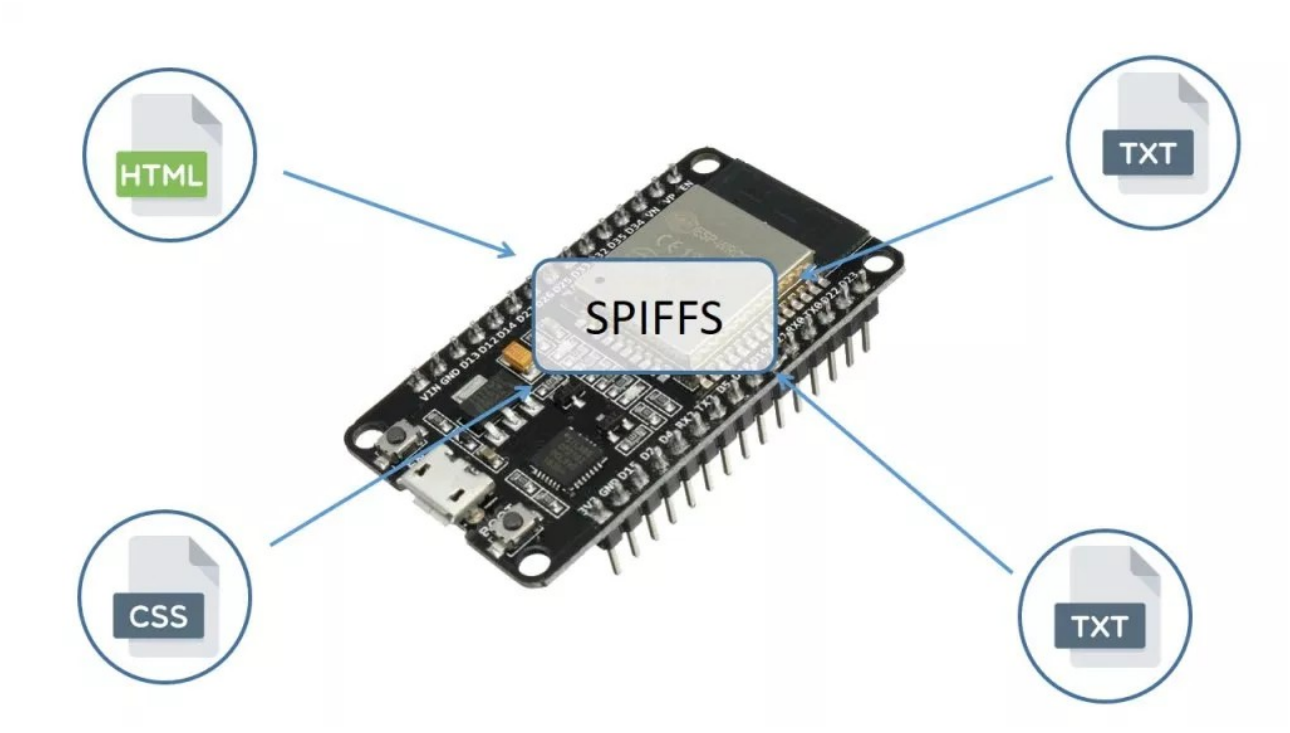
Terminado o carregamento, o LED da placa irá piscar com intervalo de 1 segundo:

Sempre que abrir a IDE, faça a conferência das informações para garantir que nada foi alterado. Geralmente, feito a configurações a primeira vez ela vai se manter sem necessidade de fazer alteração.

Reforçando: sem executar os passos de definição de placa e porta, caso você escreva o código ou utilize algum exemplo de código e tente carregar no NodeMCU-32S, o carregamento do código para a placa não será bem sucedido e um erro será mostrado na IDE.

Instalação de SPIFFS (File System)

https://randomnerdtutorials.com/install-esp32-filesystem-uploader-arduino-ide/



Fazer o download dos seguintes ficheiros para a pasta:

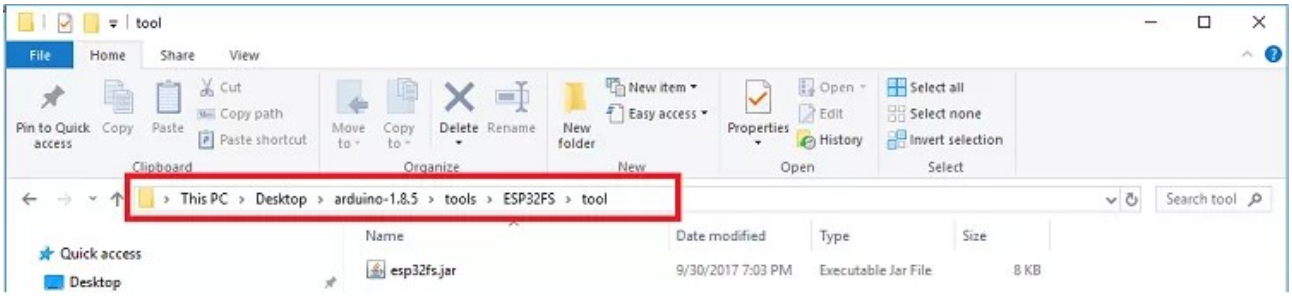
ESP-32

https://github.com/me-no-dev/arduino-esp32fs-plugin/releases/

ESP-8266

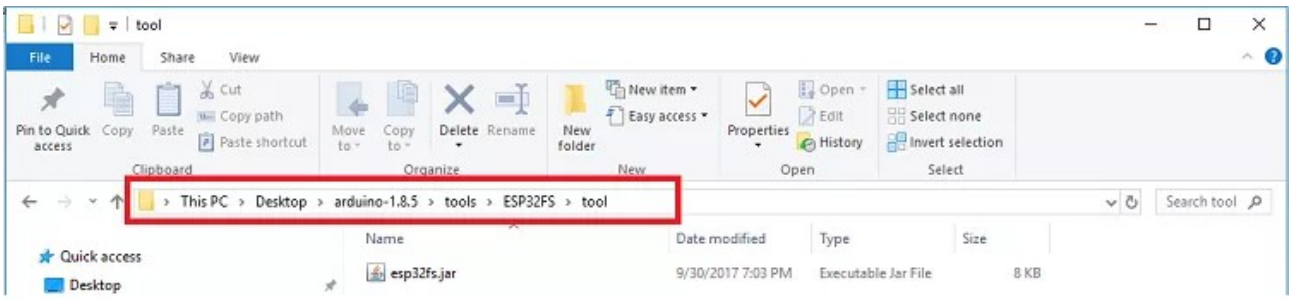
https://github.com/esp8266/arduino-esp8266fs-plugin/releases

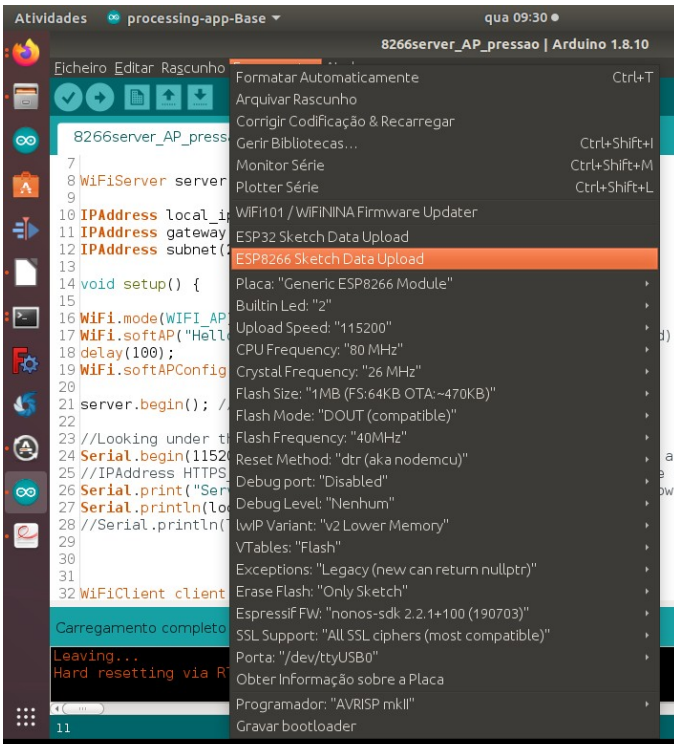
Descomprimir os ficheiros para a pasta Tools na em Arduino IDE:

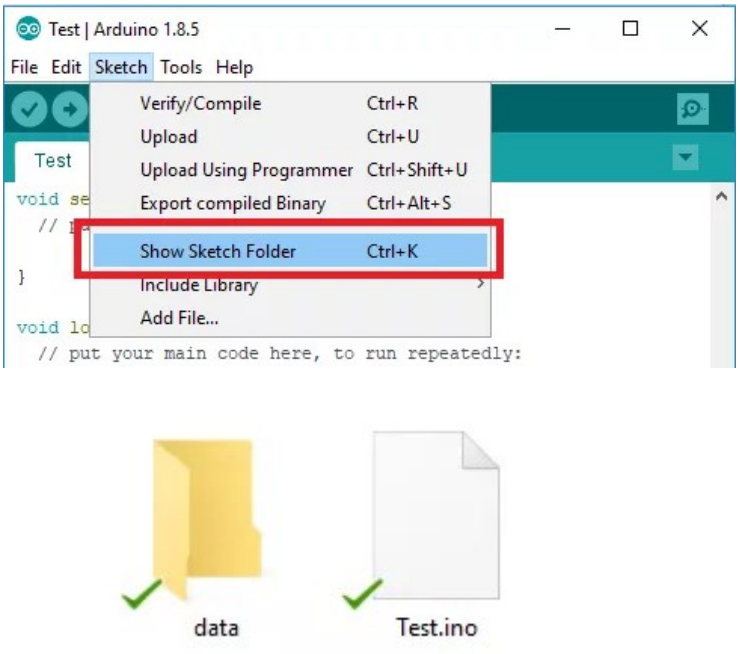


Reinicie o arduino IDE.

Depois verifique se o plugin está bem instalado Tools → ESP32 Skectch Data Upload:







Colocar os ficheiros na pasta “Show Sketch Folder” e criar a pasta data, que é onde se coloca os ficheiros que ficaram na SpiFFS.

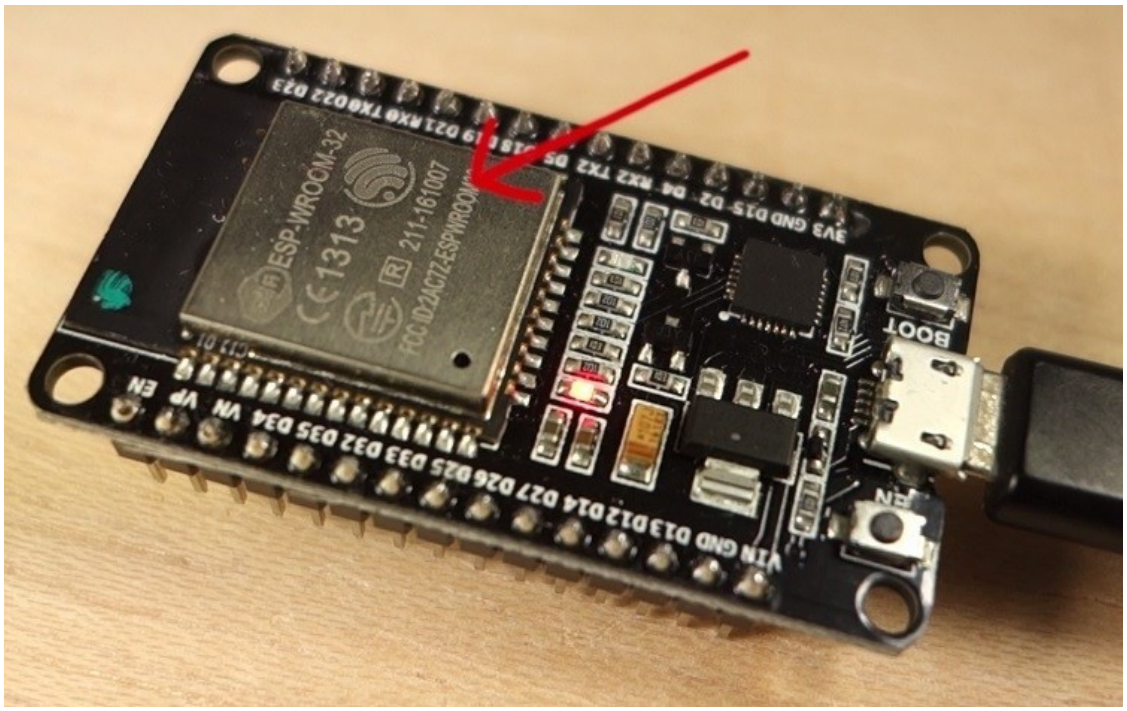
Note: in some ESP32 development boards you need to keep the ESP32 on-board “**BOOT**” button pressed while it’s uploading the files. When you see the “Connecting …….____……” message, you need to press the ESP32 on-board “**BOOT**” button.

Exemplos de Programas (Arduino IDE)

Exemplo 1: Efeito de Hall

The ESP32 Hall Effect Sensor

The ESP32 features a built-in hall effect sensor located behind the metal lid of the ESP32 chip as shown in the following figure.



A hall effect sensor can detect variations in the magnetic field in its surroundings. The greater the magnetic field, the greater the sensor's output voltage.

The hall effect sensor can be combined with a threshold detection to act as a switch, for example. Additionally, hall effect sensors are mainly used to:

- Detect proximity;
- Calculate positioning;
- Count the number of revolutions of a wheel;
- Detect a door closing;

- And much more.

Read Hall Effect Sensor – Arduino IDE

Reading the hall effect sensor measurements with the ESP32 using the Arduino IDE is as simple as using the hallRead() function.

In your Arduino IDE, go to **File** > **Examples** > **ESP32** > **HallSensor** sketch:

```
// Simple sketch to access the internal hall effect detector on the esp32.
// values can be quite low.
// Brian Degger / @sctv

int val = 0;

void setup() {
  Serial.begin(9600);
}

// put your main code here, to run repeatedly
void loop() {
  // read hall effect sensor value
  val = hallRead();
  // print the results to the serial monitor
  Serial.println(val);
  delay(1000);
}
```

Hall_Effect_Sensor.ino → hello@ruisantos.me curso ESP-32

This example simply reads the hall sensor measurements and displays them on the Serial monitor.

```
val = hallRead();
Serial.println(val);
```

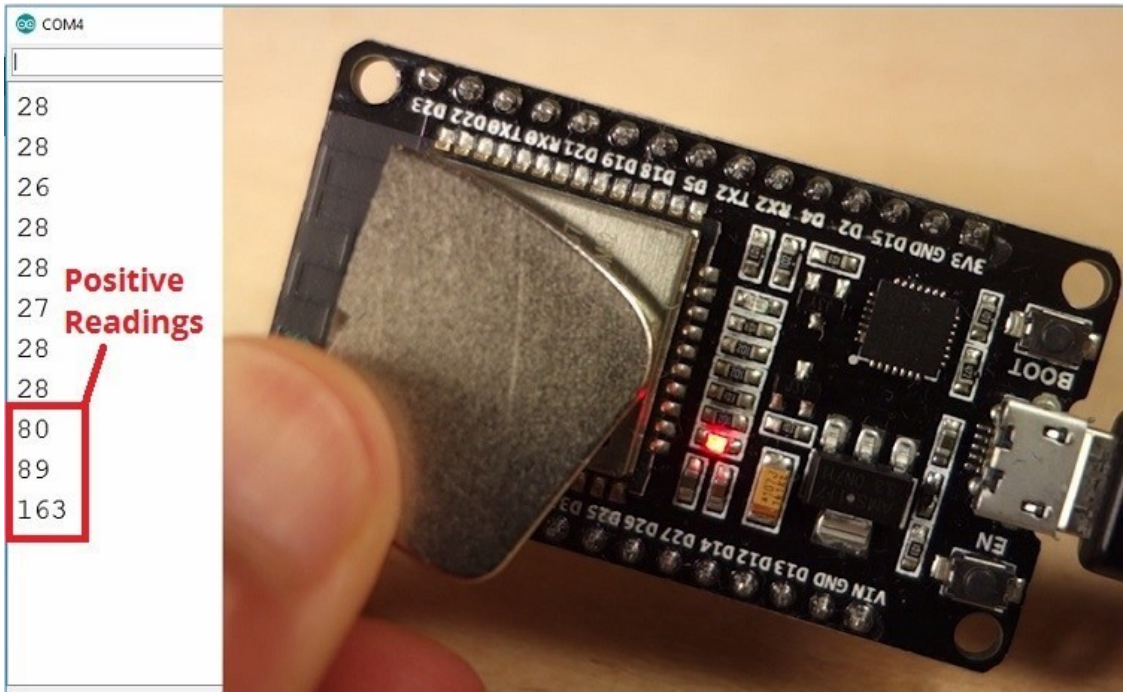
Add a delay of one second in the loop, so that you can actually read the values.

```
delay(1000);
```

Upload the code to your ESP32 board:

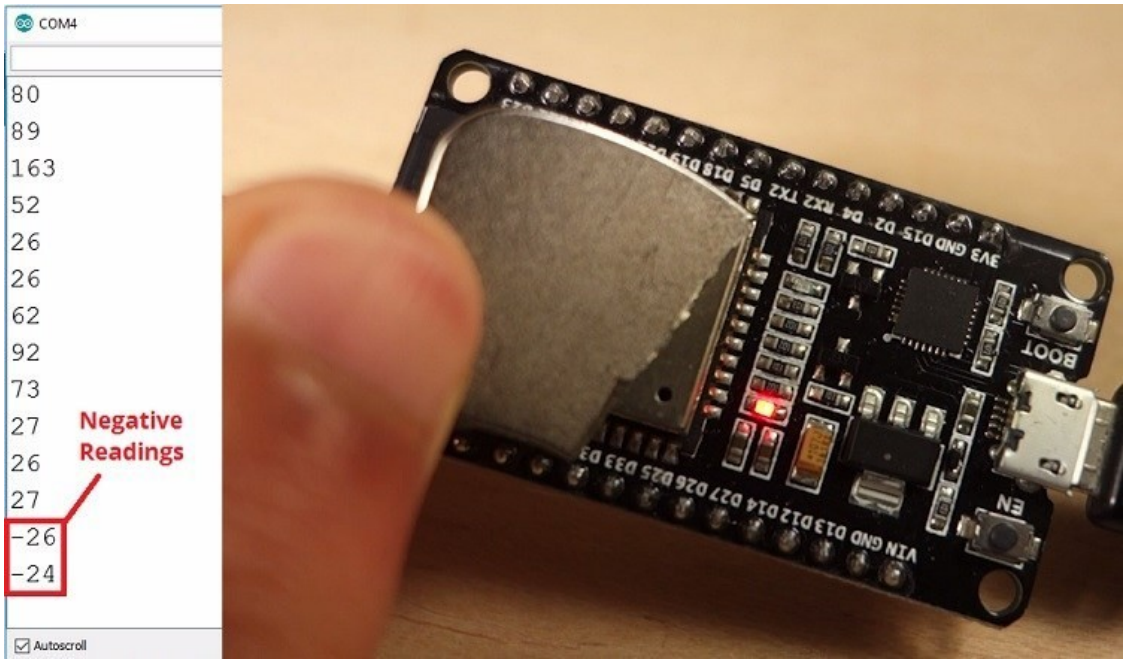
Demonstration

Once the upload is finished, open the Serial Monitor at a baud rate of 9600. Approximate a magnet to the ESP32 hall sensor and see the values increasing…



Or decreasing depending on the magnet pole that is facing the sensor:

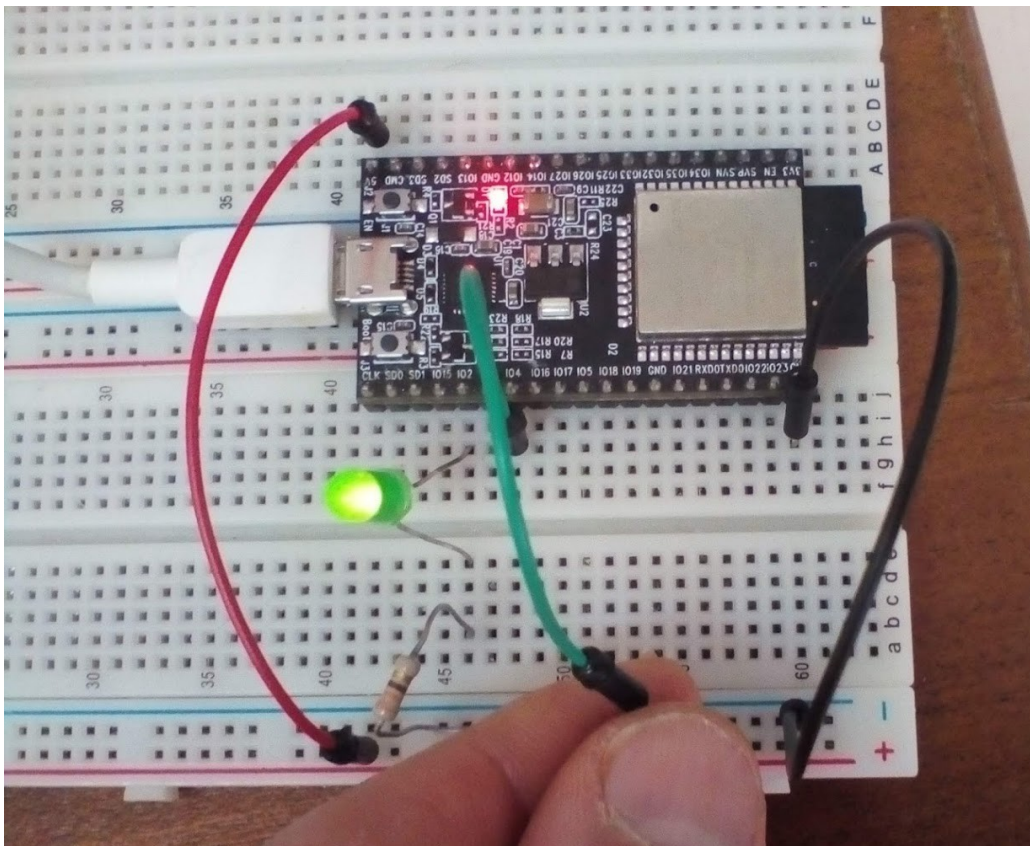
The closer the magnet is to the sensor, the greater the absolute values are.

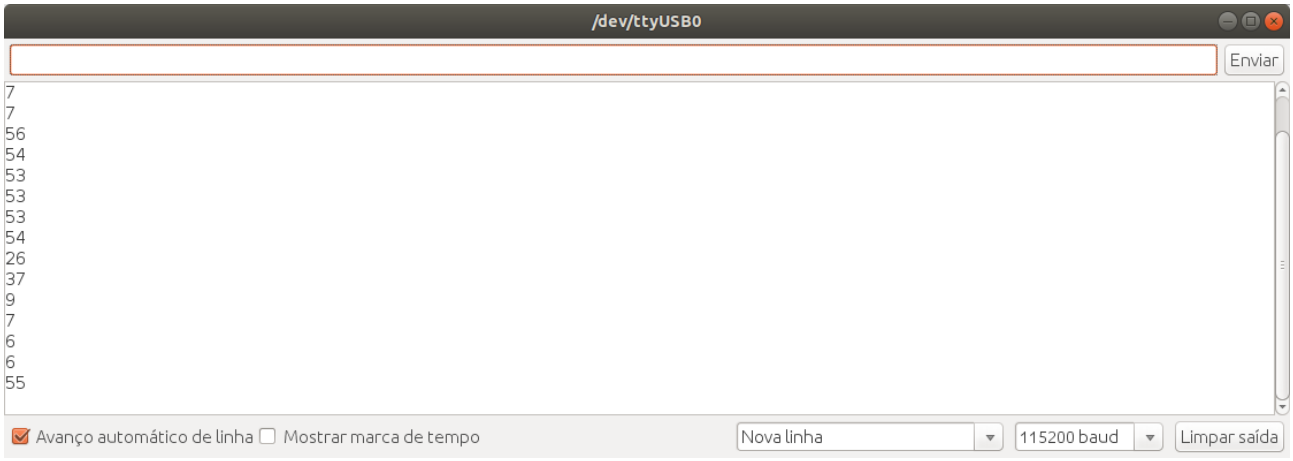


Exemplo 2: Efeito Capacitivo (Touch Sensor)

```
/*****************************************************
* ESP32 Touch Test and LED Ctrl
* Touch pin ==> Touch0 is T0 which is on GPIO 4 (D4).
* LED pin   ==> D2
*
* MJRoBot.org 6Sept17
*****************************************************/

#define TOUTCH_PIN T0 // ESP32 Pin D4
#define LED_PIN 2
int touch_value = 100;

void setup()
{
  Serial.begin(115200);
  delay(1000); // give me time to bring up serial monitor
  Serial.println("ESP32 Touch Test");
  pinMode(LED_PIN, OUTPUT);
  digitalWrite (LED_PIN, LOW);
}

void loop()
{
  touch_value = touchRead(TOUTCH_PIN);
  Serial.println(touch_value);  // get value using T0
  if (touch_value < 50)
  {
    digitalWrite (LED_PIN, HIGH);
  }
  else
  {
    digitalWrite (LED_PIN, LOW);
  }
  delay(1000);
}
```

touch.ino Mjrovai





Em vazio: >50 e led desligado
Em contacto: <10 e led ligado

Exemplo 3: Entrada Analógica

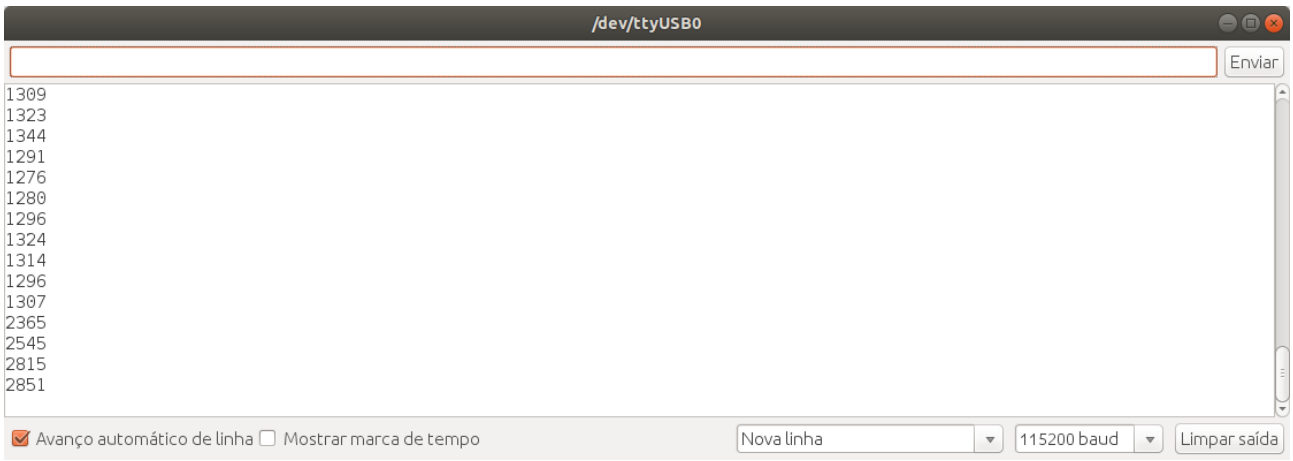
GPIO ADC Channel

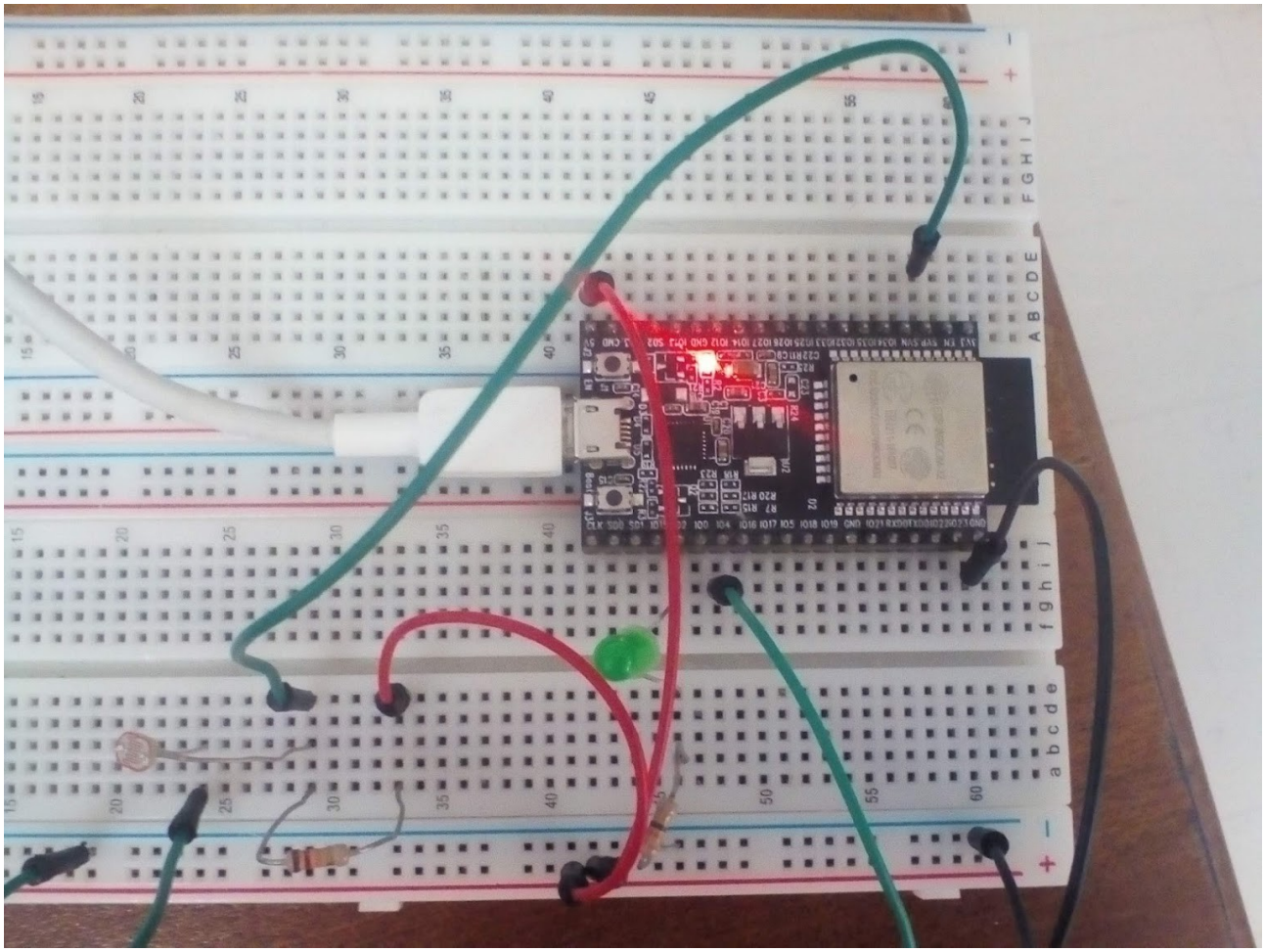
- GPIO 0 ==> ADC2_CH1
- GPIO 2 ==> ADC2_CH2
- GPIO 4 ==> ADC2_CH0
- GPIO 12 => ADC2_CH5
- GPIO 13 => ADC2_CH4
- GPIO 14 => ADC2_CH6
- GPIO 15 => ADC2_CH3
- GPIO 25 => ADC2_CH8
- GPIO 26 => ADC2_CH9
- GPIO 27 => ADC2_CH7
- GPIO 32 => ADC1_CH4
- GPIO 33 => ADC1_CH5
- GPIO 34 => ADC1_CH6
- GPIO 35 => ADC1_CH7
- GPIO 36 => ADC1_CH0
- GPIO 37 => ADC1_CH1
- GPIO 38 => ADC1_CH2
- GPIO 39 => ADC1_CH3

```
/*****************************************************
* ESP32 Analog Input Test
* Analog Input: ADC_1_0 pin ==> GPIO36 (VP).
*
* MJRoBot.org 6Sept17
*****************************************************/
//Analog Input
#define ANALOG_PIN_0 36
int analog_value = 0;

void setup()
{
  Serial.begin(115200);
  delay(1000); // give me time to bring up serial monitor
  Serial.println("ESP32 Analog IN Test");
}

void loop()
{
  analog_value = analogRead(ANALOG_PIN_0);
  Serial.println(analog_value);
  delay(500);
}
```

RTD

Com a RTD é possível ir dos 0 (luz total – telemóvel em cima sensor) aos 4095 (escuridão total – dedo no sensor)


/dev/ttyUSB0
Enviar
1309
1323
1344
1291
1276
1280
1296
1324
1314
1296
1307
2365
2545
2815
2851
Avanço automático de linha
Mostrar marca de tempo
Nova linha
115200 baud
Limpar saída



[analog.ino]

Exemplo 4: Entrada Analógica + Saída PWD

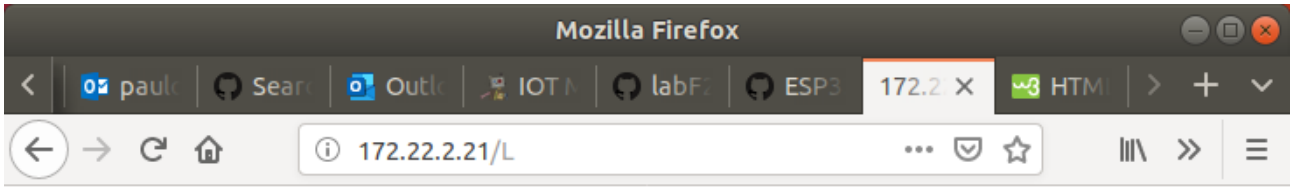
Use a mesma montagem anterior.

```
/*********************************************************
* ESP32 Analog Input Test
* Analog Input: ADC_1_0 pin ==> GPIO36 (VP).
*
* MJRoBot.org 6Sept17 / Paulo Glavao 28Jun19
*********************************************************/

//Analog Input
#define ANALOG_PIN_0 36
int analog_value = 0;

// PMW LED
#define LED_PIN 2
int freq = 5000;
int ledChannel = 0;
int resolution = 8;
int dutyCycle = 0;

void setup()
{
  Serial.begin(115200);
  delay(1000); // give me time to bring up serial monitor
  Serial.println("ESP32 Analog IN/OUT Test");

  ledcSetup(ledChannel, freq, resolution);
  ledcAttachPin(LED_PIN, ledChannel);
  ledcWrite(ledChannel, dutyCycle);
```

```
}
void loop()
{
  analog_value = analogRead(ANALOG_PIN_0);
  Serial.print("LDR: ");
  Serial.println(analog_value);
  dutyCycle = map(analog_value, 0, 4095, 0, 255);
  ledcWrite(ledChannel, dutyCycle);
  Serial.print("PWD: ");
  Serial.println(dutyCycle);
  delay(500);
}
```

analog_PWM.ino

Exemplo 5: Sending and Receiving Data From a Local Web Page




```
/* WiFi parameters and credentials */

#include <WiFi.h>
/*const char* ssid     = "YOUR SSID";
const char* password = "YOUR PASSWORD";
*/

const char* ssid     = "EACI";
const char* password = "SMD@EACI";

WiFiServer server(80);


/* DHT Temperature and Humidity Sensor */
/*#include "DHT.h"
#define DHTPIN 23
#define DHTTYPE DHT22
DHT dht(DHTPIN, DHTTYPE);
float localHum = 0;
float localTemp = 0;
/*

/* LED */
#define LED_PIN 2

//Analog Input
#define ANALOG_PIN_0 36
int analog_value = 0;

void setup()
```

```
{
  Serial.begin(115200);
  pinMode(LED_PIN, OUTPUT);
  delay(10);

  connectWiFi();

//  dht.begin();
}

int value = 0;

void loop()
{
  analog_value = analogRead(ANALOG_PIN_0);
  //getDHT();
  WiFiLocalWebPageCtrl();
}

/*****************************************************
* Get indoor Temp/Hum data
*****************************************************/
/*void getDHT()
{
  float tempIni = localTemp;
  float humIni = localHum;
  localTemp = dht.readTemperature();
  localHum = dht.readHumidity();
  if (isnan(localHum) || isnan(localTemp))   // Check if any reads failed and exit early (to try again).
  {
    localTemp = tempIni;
    localHum = humIni;
    return;
  }
}

*/
/*****************************************************
* Send and receive data from Local Page
*****************************************************/
void WiFiLocalWebPageCtrl(void)
{
  WiFiClient client = server.available();   // listen for incoming clients
  //client = server.available();
  if (client) {                             // if you get a client,
    Serial.println("New Client.");          // print a message out the serial port
    String currentLine = "";                // make a String to hold incoming data from the client
    while (client.connected()) {            // loop while the client's connected
      if (client.available()) {             // if there's bytes to read from the client,
        char c = client.read();             // read a byte, then
        Serial.write(c);                    // print it out the serial monitor
        if (c == '\n') {                    // if the byte is a newline character
```

```
        // if the current line is blank, you got two newline characters in a row.
        // that's the end of the client HTTP request, so send a response:
        if (currentLine.length() == 0) {
          // HTTP headers always start with a response code (e.g. HTTP/1.1 200 OK)
          // and a content-type so the client knows what's coming, then a blank line:
          client.println("HTTP/1.1 200 OK");
          client.println("Content-type:text/html");
          client.println();

          // the content of the HTTP response follows the header:
          //WiFiLocalWebPageCtrl();
/*            client.print("Temperature now is: ");
            client.print(localTemp);
            client.print("  oC<br>");
            client.print("Humidity now is:     ");
            client.print(localHum);
            client.print(" % <br>");
            client.print("<br>");*/

            client.print("<h1>Receiving Data from ESP32 webserver on 172.22.2.X</h1><hr><br>");

            client.print("Analog Data (LDR):     ");
            client.print(analog_value);
            client.print("<br>");
            client.print("<br>");

            client.print("Click <a href=\"/H\">here</a> to turn the LED on.<br>");
            client.print("Click <a href=\"/L\">here</a> to turn the LED off.<br>");

          // The HTTP response ends with another blank line:
          client.println();
          // break out of the while loop:
          break;
        } else {    // if you got a newline, then clear currentLine:
          currentLine = "";
        }
      } else if (c != '\r') {  // if you got anything else but a carriage return character,
        currentLine += c;      // add it to the end of the currentLine
      }

      // Check to see if the client request was "GET /H" or "GET /L":
      if (currentLine.endsWith("GET /H")) {
        digitalWrite(LED_PIN, HIGH);               // GET /H turns the LED on
      }
      if (currentLine.endsWith("GET /L")) {
        digitalWrite(LED_PIN, LOW);                // GET /L turns the LED off
      }
    }
  }
  // close the connection:
  client.stop();
```

```
    Serial.println("Client Disconnected.");
  }
}

/*********************************************************
* Connecting to a WiFi network
*********************************************************/
void connectWiFi(void)
{
  Serial.println();
  Serial.println();
  Serial.print("Connecting to ");
  Serial.println(ssid);
  WiFi.begin(ssid, password);
  while (WiFi.status() != WL_CONNECTED)
  {
    delay(500);
    Serial.print(".");
  }
  Serial.println("");
  Serial.println("WiFi connected.");
  Serial.println("IP address: ");
  Serial.println(WiFi.localIP());

  server.begin();
}
```

Original:

ESP32_WiFi_Server_Sending_Receiving_Data.ino

Transformado para a rede da escola: webserver_html.ino

ver endereço web dado pelo router através da porta série:


```
const char* ssid     = "EACI";
const char* password = "SMD@EACI";
```

Exemplo 6: ESP32 as HTTP Server using WiFi Access Point (AP) mode

As the heading suggests, this example demonstrates how to turn the ESP32 into an access point (AP), and serve up web pages to any connected client. To start with, plug your ESP32 into your computer and Try the sketch out; and then we will dissect it in some detail.

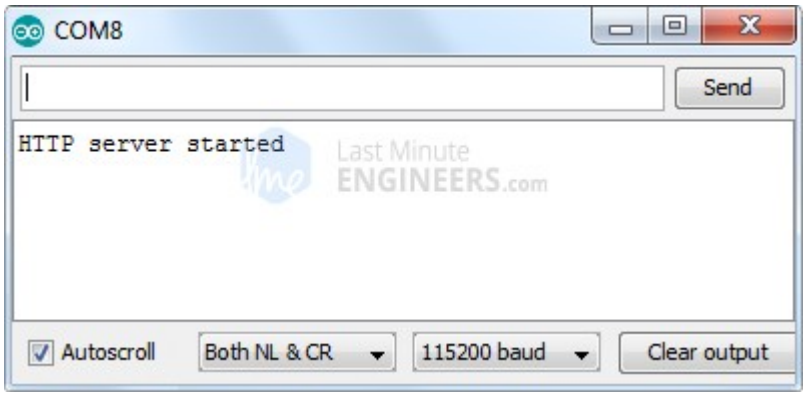
```
#include <WiFi.h>
#include <WebServer.h>

/* Put your SSID & Password */
const char* ssid = "ESP32";  // Enter SSID here
const char* password = "12345678";  //Enter Password here

/* Put IP Address details */
IPAddress local_ip(192,168,1,1);
IPAddress gateway(192,168,1,1);
IPAddress subnet(255,255,255,0);

WebServer server(80);

uint8_t LED1pin = 2;
bool LED1status = LOW;

uint8_t LED2pin = 5;
bool LED2status = LOW;

//Analog Input
#define ANALOG_PIN_0 36
int analog_value = 0;

void setup() {
  Serial.begin(115200);
  pinMode(LED1pin, OUTPUT);
  pinMode(LED2pin, OUTPUT);

  WiFi.softAP(ssid, password);
  WiFi.softAPConfig(local_ip, gateway, subnet);
  delay(100);

  server.on("/", handle_OnConnect);
  server.on("/led1on", handle_led1on);
  server.on("/led1off", handle_led1off);
  server.on("/led2on", handle_led2on);
  server.on("/led2off", handle_led2off);
  server.onNotFound(handle_NotFound);

  server.begin();
  Serial.println("HTTP server started");
}
void loop() {
  server.handleClient();
  if(LED1status)
  {digitalWrite(LED1pin, HIGH);}
  else
  {digitalWrite(LED1pin, LOW);}

  if(LED2status)
```

```
  {digitalWrite(LED2pin, HIGH);}
  else
  {digitalWrite(LED2pin, LOW);}
  analog_value = analogRead(ANALOG_PIN_0);
}

void handle_OnConnect() {
  LED1status = LOW;
  LED2status = LOW;
  Serial.println("GPIO4 Status: OFF | GPIO5 Status: OFF");
  server.send(200, "text/html", SendHTML(LED1status,LED2status));
}

void handle_led1on() {
  LED1status = HIGH;
  Serial.println("GPIO4 Status: ON");
  server.send(200, "text/html", SendHTML(true,LED2status));
}

void handle_led1off() {
  LED1status = LOW;
  Serial.println("GPIO4 Status: OFF");
  server.send(200, "text/html", SendHTML(false,LED2status));
}

void handle_led2on() {
  LED2status = HIGH;
  Serial.println("GPIO5 Status: ON");
  server.send(200, "text/html", SendHTML(LED1status,true));
}

void handle_led2off() {
  LED2status = LOW;
  Serial.println("GPIO5 Status: OFF");
  server.send(200, "text/html", SendHTML(LED1status,false));
}

void handle_NotFound(){
  server.send(404, "text/plain", "Not found");
}

String SendHTML(uint8_t led1stat,uint8_t led2stat){
  String ptr = "<!DOCTYPE html> <html>\n";
  ptr +="<meta charset=UTF-8 />";
  ptr +="<meta http-equiv=""refresh"" content=""2"">";
  ptr +="<head><meta name=\"viewport\" content=\"width=device-width, initial-
scale=1.0, user-scalable=no\">\n";
  ptr +="<title>LED Control</title>\n";
  ptr +="<style>html { font-family: Helvetica; display: inline-block; margin:
0px auto; text-align: center;}\n";
  ptr +="body{margin-top: 50px;} h1 {color: #444444;margin: 50px auto 30px;} h3
{color: #444444;margin-bottom: 50px;}\n";
  ptr +=".button {display: block;width: 80px;background-color: #3498db;border:
none;color: white;padding: 13px 30px;text-decoration: none;font-size:
25px;margin: 0px auto 35px;cursor: pointer;border-radius: 4px;}\n";
  ptr +=".button-on {background-color: #3498db;}\n";
  ptr +=".button-on:active {background-color: #2980b9;}\n";
  ptr +=".button-off {background-color: #34495e;}\n";
  ptr +=".button-off:active {background-color: #2c3e50;}\n";
  ptr +="p {font-size: 14px;color: #888;margin-bottom: 10px;}\n";
  ptr +="</style>\n";
  ptr +="</head>\n";
  ptr +="<body>\n";
  ptr +="<h1>ESP32 Web Server</h1>\n";
```

```
  ptr +="<h3>Using Access Point(AP) Mode</h3>\n";

   if(led1stat)
  {ptr +="<p>LED1 Status: ON</p><a class=\"button button-off\"
href=\"/led1off\">OFF</a>\n";}
  else
  {ptr +="<p>LED1 Status: OFF</p><a class=\"button button-on\"
href=\"/led1on\">ON</a>\n";}

    if(led2stat)
  {ptr +="<p>LED2 Status: ON</p><a class=\"button button-off\"
href=\"/led2off\">OFF</a>\n";}
  else
  {ptr +="<p>LED2 Status: OFF</p><a class=\"button button-on\"
href=\"/led2on\">ON</a>\n";}


  ptr +="<p>Leitura Analógica: ";
  ptr +=analogRead(ANALOG_PIN_0);
  ptr +="</p>";
  ptr +="</body>\n";
  ptr +="</html>\n";
  return ptr;
}
```

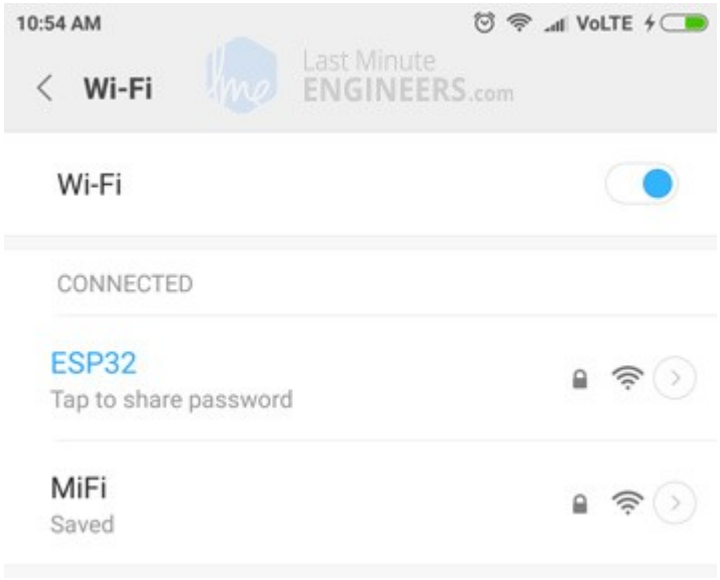
Accessing the Web Server in AP mode

After uploading the sketch, open the Serial Monitor at a baud rate of 115200. And press the RESET button on ESP32. If everything is OK, it will show **HTTP server started** message.

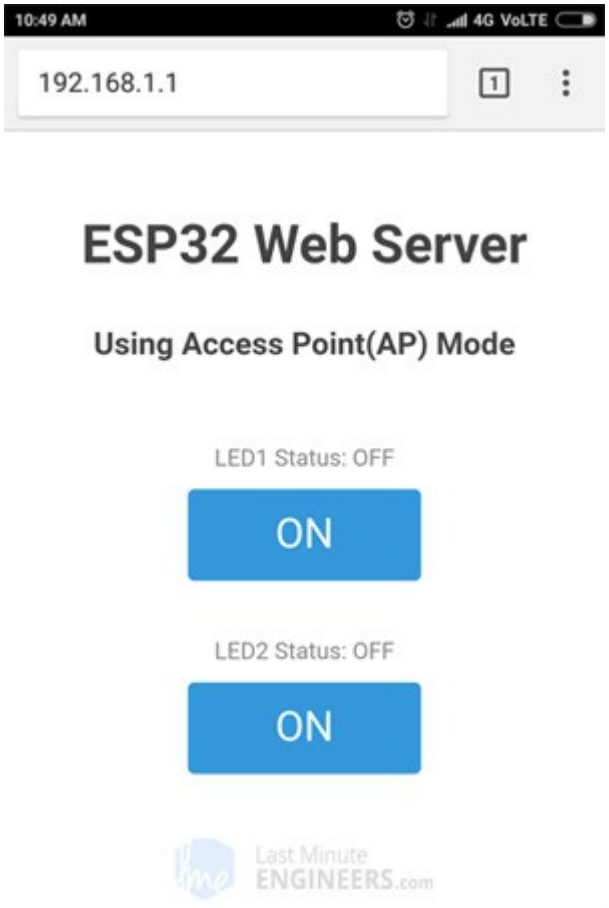


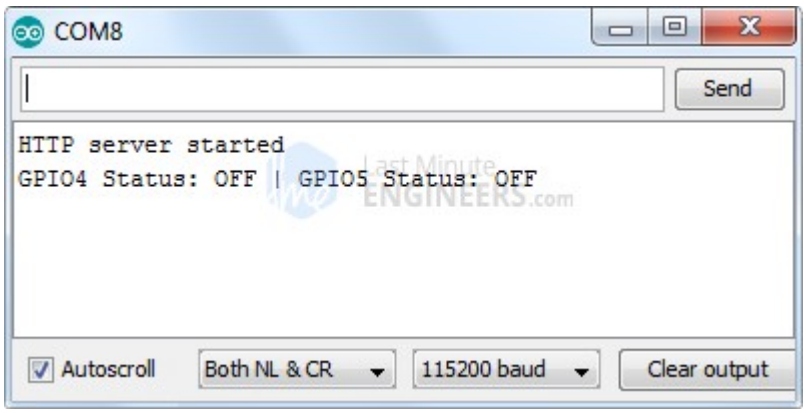
Next, find any device that you can connect to a WiFi network – phone, laptop, etc. And look for a network called **ESP32**. Join the network with password **123456789**.

simple web server



After connecting to your ESP32 AP network, load up a browser and point it to 192.168.1.1 The ESP32 should serve up a web page showing current status of LEDs and two buttons to control them. If take a look at the serial monitor at the same time, you can see status of ESP32's GPIO pins.

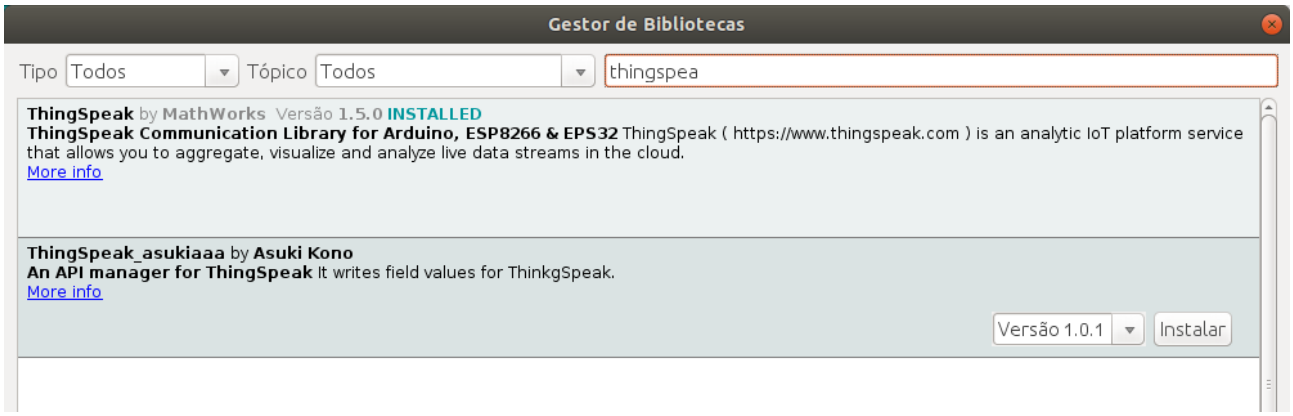


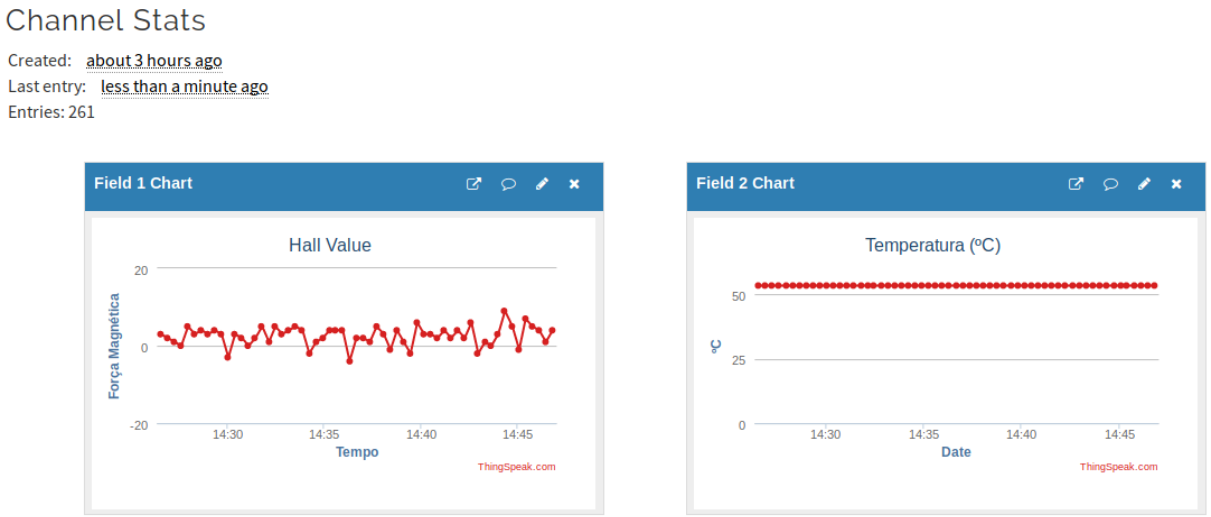

COM8
Send
HTTP server started
GPIO4 Status: OFF | GPIO5 Status: OFF
Autoscroll
Both NL & CR
115200 baud
Clear output

ThingSpeak

Análise de dados em web. Possibilidade de exportar dados para Matlab.

Instalar antes a biblioteca ThinkSpeak.



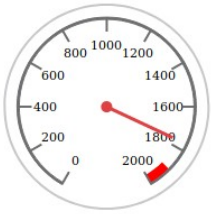


Field 3 Chart

Temp Sensor

a few seconds ago

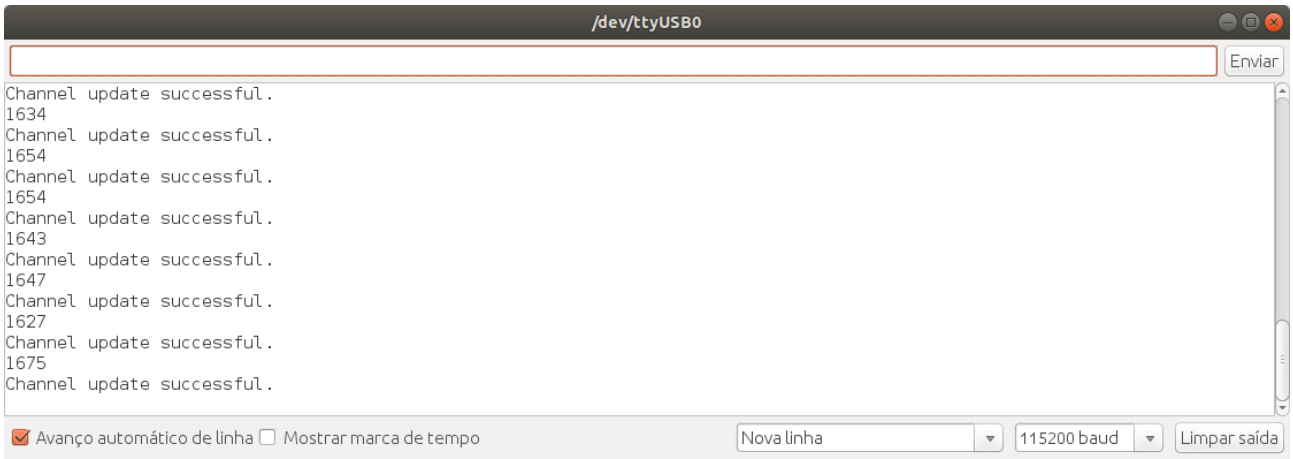
LDR



1767

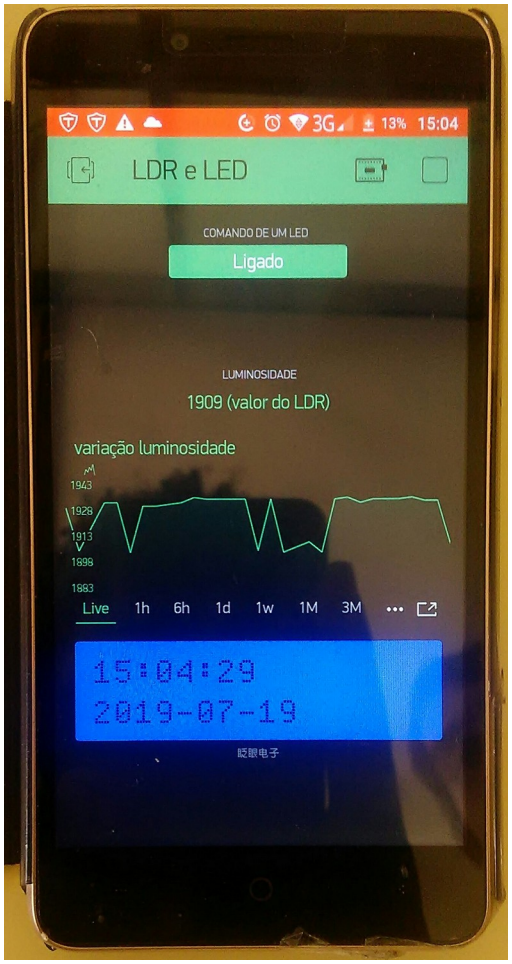
```
#include "ThingSpeak.h"
#include <WiFi.h>

#ifdef __cplusplus
extern "C" {
#endif
uint8_t temprature_sens_read();
#ifdef __cplusplus
}
#endif
uint8_t temprature_sens_read();

#define ANALOG_PIN_0 36
int analog_value = 0;


char ssid[] = "EACI"; // your network SSID (name)
char pass[] = "SMD@EACI"; // your network password
int keyIndex = 0; // your network key Index number (needed only for WEP)
WiFiClient client;

unsigned long myChannelNumber = 815527; //update
const char * myWriteAPIKey = "2IS0VFSE7U31WKZ6"; //update

void setup()
{
Serial.begin(115200); //Initialize serial

delay(10);
WiFi.mode(WIFI_STA);
ThingSpeak.begin(client); // Initialize ThingSpeak
}

void loop() {

int h = 0;
float t =0;

h = hallRead();
t = ((temprature_sens_read()-32)/1.8);              //changing temperature parameter to celsius

analog_value = analogRead(ANALOG_PIN_0);
Serial.println(analog_value);

// Connect or reconnect to WiFi
```

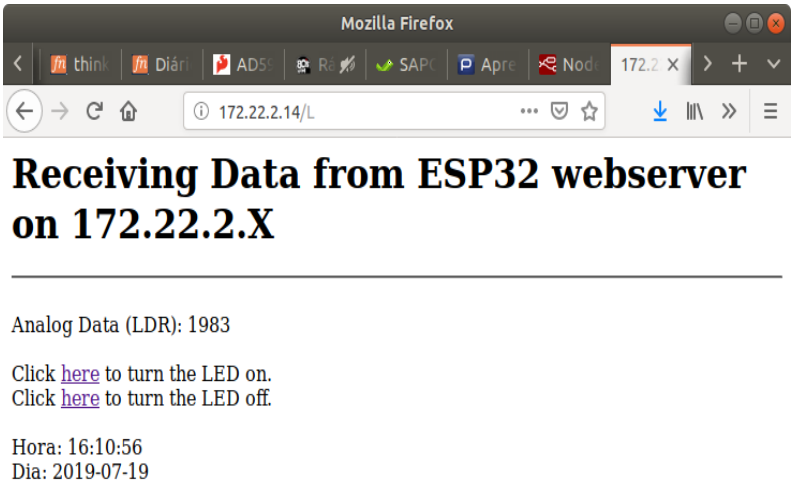
```
if(WiFi.status() != WL_CONNECTED){
Serial.print("Attempting to connect to SSID: ");
//Serial.println(SECRET_SSID);
while(WiFi.status() != WL_CONNECTED){
WiFi.begin(ssid, pass); // Connect to WPA/WPA2 network. Change this line if using open or WEP network
Serial.print(".");
delay(5000);
}
Serial.println("\nConnected.");
}

// Write to ThingSpeak. There are up to 8 fields in a channel, allowing you to store up to 8 different
// pieces of information in a channel.
ThingSpeak.setField(1, h);
ThingSpeak.setField(2, t);
ThingSpeak.setField(3, analog_value);

// write to the ThingSpeak channel
int x = ThingSpeak.writeFields(myChannelNumber, myWriteAPIKey);
if(x == 200){
Serial.println("Channel update successful.");
}
else{
Serial.println("Problem updating channel. HTTP error code " + String(x));
}

delay(20000); // Wait 20 seconds to update the channel again
}
```



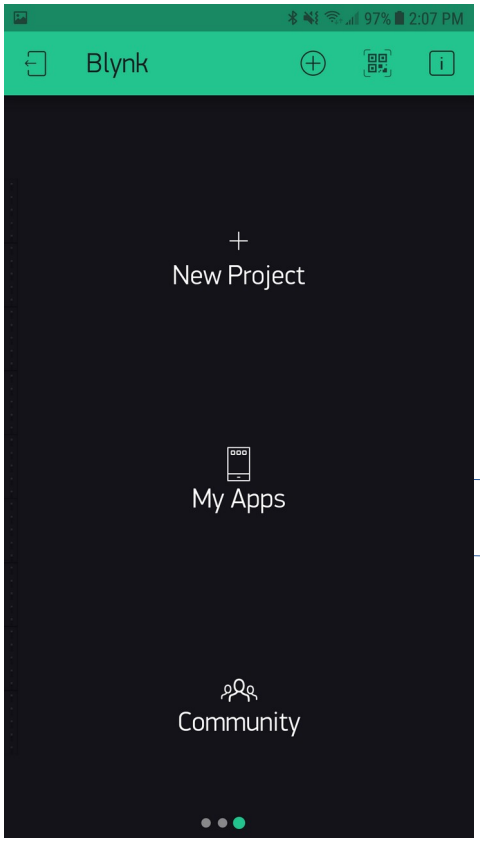
thingSpeak.ino

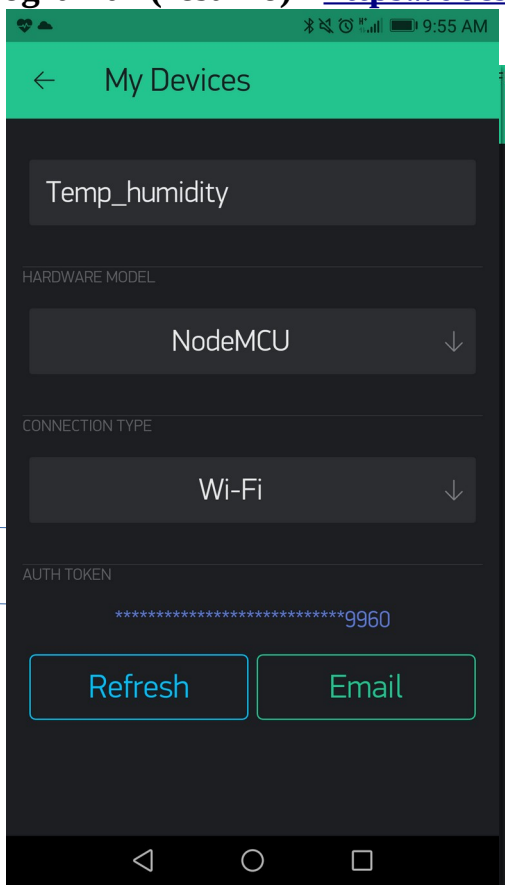
Exemplo 7: ESP ligado à aplicação de Telemóvel Blynk com data e hora dadas pela internet

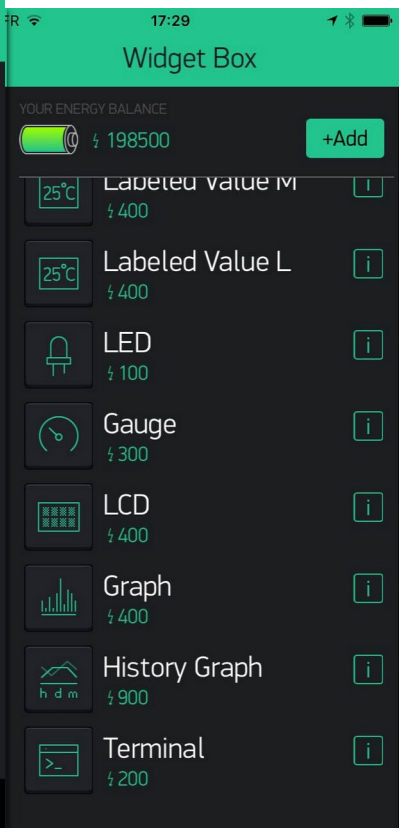


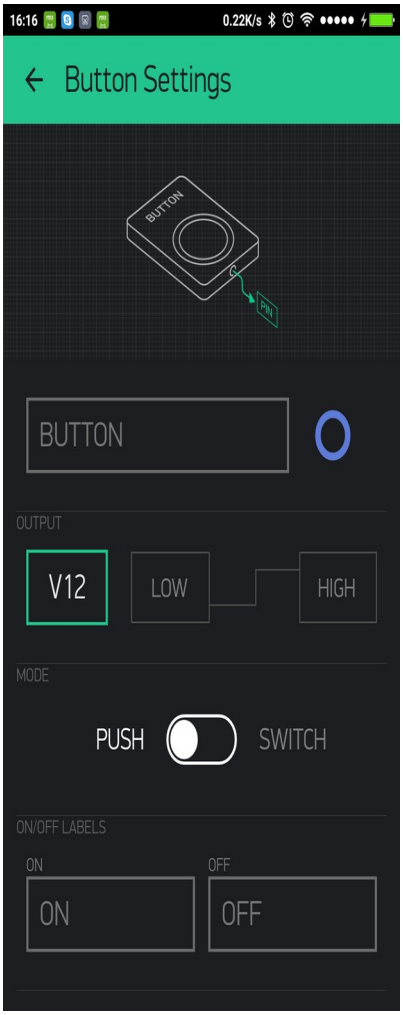


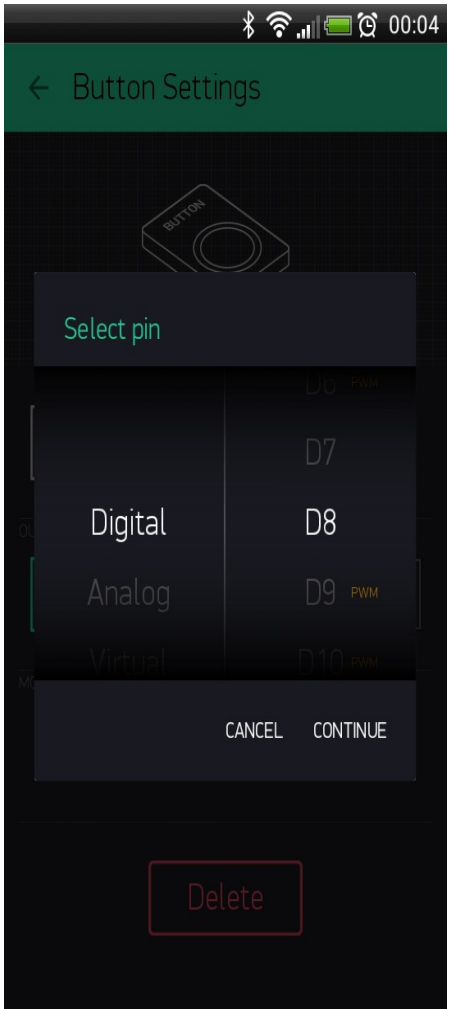
Como configurar Blynk e programar (resumo) - https://docs.blynk.cc/

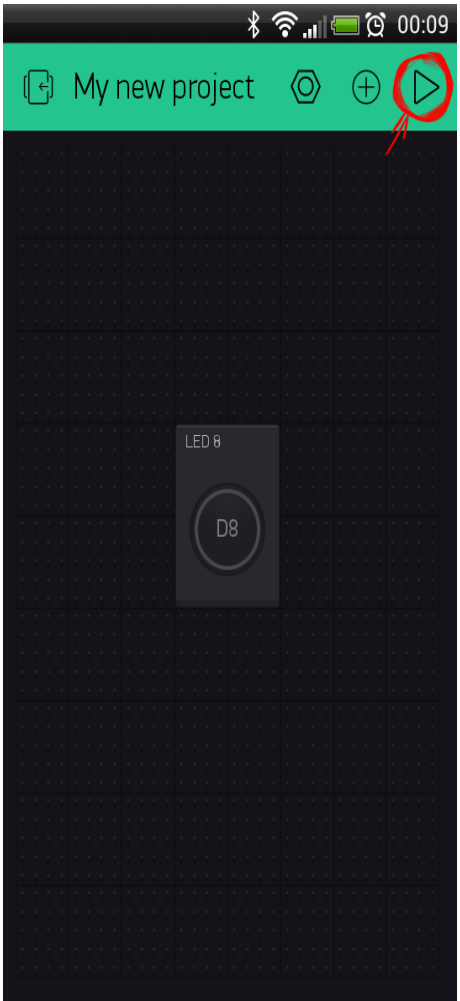












O blynk tem a vantagem (além de ser opensource) de se **pode ser instalado localmente** por exemplo num RaspBerry PI, o que permite a sua utilização de forma mais rápida, segura e sem limitações.

Os dados do gráfico Superchart podem ser exportados para .csv.

Programa ESP32

```
/* WiFi parameters and credentials */
#include <WiFi.h>
#define BLYNK_PRINT Serial
#include <BlynkSimpleEsp32.h> // Blynk-ESP32
#include <WiFiClient.h> // Wi-Fi client
/*const char* ssid     = "YOUR SSID";
const char* password = "YOUR PASSWORD";
*/

#include <NTPClient.h>
#include <WiFiUdp.h>
// https://github.com/taranais/NTPClient instalar esta biblioteca
// fazendo desta forma https://www.robocore.net/tutoriais/adicionando-bibliotecas-na-ide-arduino.html

const char* ssid     = "EACI";
const char* password = "SMD@EACI";

//-------- Token de Autenticação -----------
char auth[] = " vSW44z6xNbpmkVa6y2jO7o58IB2dxzIi"; // Coloque aqui o código de Token

WiFiServer server(80);

// Define NTP Client to get time
WiFiUDP ntpUDP;
NTPClient timeClient(ntpUDP);

/* DHT Temperature and Humidity Sensor */
/*#include "DHT.h"
#define DHTPIN 23
#define DHTTYPE DHT22
DHT dht(DHTPIN, DHTTYPE);
float localHum = 0;
float localTemp = 0;
/*

/* LED */
#define LED_PIN 2

//Analog Input
#define ANALOG_PIN_0 36
int analog_value = 0;

// Variables to save date and time
  String formattedDate;
  String dayStamp;
```

```
  String timeStamp;


BlynkTimer timer;
void sendSensor()
{

  analog_value = analogRead(ANALOG_PIN_0);     // Armazena os valores de leitura do sensor de luz


  Blynk.virtualWrite(V1, LED_PIN);             //No widget botão colocar no output GP2
  Blynk.virtualWrite(V2, analog_value);      // Valor de LDR porta virtual V2
  Blynk.virtualWrite(V3, timeStamp);          // Colocação da hora na 1ª linha do widget LCD
  Blynk.virtualWrite(V4, dayStamp);           // Colocação do dia na 2ª linha do widget LCD

}



void setup()
{
  Serial.begin(115200);
  pinMode(LED_PIN, OUTPUT);
  delay(10);

  connectWiFi();

  Blynk.begin(auth, ssid, password); // TOKEN+REDE+SENHA
  timer.setInterval(1000L, sendSensor);

//  dht.begin();

// Initialize a NTPClient to get time
  timeClient.begin();
  // Set offset time in seconds to adjust for your timezone, for example:
  // GMT +1 = 3600
  // GMT +8 = 28800
  // GMT -1 = -3600
  // GMT 0 = 0
  timeClient.setTimeOffset(3600);


}

int value = 0;

void data_hora() {
  while(!timeClient.update()) {
    timeClient.forceUpdate();
  }
  // The formattedDate comes with the following format:
  // 2018-05-28T16:00:13Z
  // We need to extract date and time
  formattedDate = timeClient.getFormattedDate();
  Serial.println(formattedDate);

  // Extract date
```

```
  int splitT = formattedDate.indexOf("T");
  dayStamp = formattedDate.substring(0, splitT);
  Serial.print("DATE: ");
  Serial.println(dayStamp);
  // Extract time
  timeStamp = formattedDate.substring(splitT+1, formattedDate.length()-1);
  Serial.print("HOUR: ");
  Serial.println(timeStamp);
  delay(1000);
}
void loop()
{
  analog_value = analogRead(ANALOG_PIN_0);
  //getDHT();
  WiFiLocalWebPageCtrl();

  timer.run();
  Blynk.run();
  data_hora();

}

/*****************************************************
* Get indoor Temp/Hum data
*****************************************************/
/*void getDHT()
{
  float tempIni = localTemp;
  float humIni = localHum;
  localTemp = dht.readTemperature();
  localHum = dht.readHumidity();
  if (isnan(localHum) || isnan(localTemp))   // Check if any reads failed and exit early (to try again).
  {
    localTemp = tempIni;
    localHum = humIni;
    return;
  }
}

*/
/*****************************************************
* Send and receive data from Local Page
*****************************************************/
void WiFiLocalWebPageCtrl(void)
{
  WiFiClient client = server.available();   // listen for incoming clients
  //client = server.available();
  if (client) {                             // if you get a client,
    Serial.println("New Client.");          // print a message out the serial port
    String currentLine = "";                // make a String to hold incoming data from the client
    while (client.connected()) {            // loop while the client's connected
      if (client.available()) {             // if there's bytes to read from the client,
        char c = client.read();             // read a byte, then
        Serial.write(c);                    // print it out the serial monitor
        if (c == '\n') {                    // if the byte is a newline character

          // if the current line is blank, you got two newline characters in a row.
```

```
        // that's the end of the client HTTP request, so send a response:
        if (currentLine.length() == 0) {
          // HTTP headers always start with a response code (e.g. HTTP/1.1 200 OK)
          // and a content-type so the client knows what's coming, then a blank line:
          client.println("HTTP/1.1 200 OK");
          client.println("Content-type:text/html");
          client.println();

          // the content of the HTTP response follows the header:
          //WiFiLocalWebPageCtrl();
/*          client.print("Temperature now is: ");
            client.print(localTemp);
            client.print("  oC<br>");
            client.print("Humidity now is:     ");
            client.print(localHum);
            client.print(" % <br>");
            client.print("<br>");*/

            client.print("<h1>Receiving Data from ESP32 webserver on 172.22.2.X</h1><hr><br>");

            client.print("Analog Data (LDR):     ");
            client.print(analog_value);
            client.print("<br>");
            client.print("<br>");

            client.print("Click <a href=\"/H\">here</a> to turn the LED on.<br>");
            client.print("Click <a href=\"/L\">here</a> to turn the LED off.<br>");
            client.print("<br>");
            client.print("Hora:     ");
            client.print(timeStamp);
            client.print("<br>");
            client.print("Dia:     ");
            client.print(dayStamp);
            client.print("<br>");

          // The HTTP response ends with another blank line:
          client.println();
          // break out of the while loop:
          break;
        } else {    // if you got a newline, then clear currentLine:
          currentLine = "";
        }
      } else if (c != '\r') {  // if you got anything else but a carriage return character,
        currentLine += c;      // add it to the end of the currentLine
      }

      // Check to see if the client request was "GET /H" or "GET /L":
      if (currentLine.endsWith("GET /H")) {
        digitalWrite(LED_PIN, HIGH);               // GET /H turns the LED on
      }
      if (currentLine.endsWith("GET /L")) {
        digitalWrite(LED_PIN, LOW);                // GET /L turns the LED off
      }
    }
  }
  // close the connection:
  client.stop();
```

```
    Serial.println("Client Disconnected.");
  }
}

/*****************************************************
* Connecting to a WiFi network
*****************************************************/
void connectWiFi(void)
{
  Serial.println();
  Serial.println();
  Serial.print("Connecting to ");
  Serial.println(ssid);
  WiFi.begin(ssid, password);
  while (WiFi.status() != WL_CONNECTED)
  {
    delay(500);
    Serial.print(".");
  }
  Serial.println("");
  Serial.println("WiFi connected.");
  Serial.println("IP address: ");
  Serial.println(WiFi.localIP());

  server.begin();
}
```

blynk_time_date.ino

Exemplo 8: Como ligar esp32 à rede eduroam

```
/*|----------------------------------------------------------|*/
/*|WORKING EXAMPLE FOR HASSELT UNIVERSITY                    |*/
/*|Only connection to eduroam network                        |*/
/*|https://www.uhasselt.be/eduroam                           |*/
/*|SKETCH PROVIDED BY: Thijs Vandenryt                       |*/
/*|----------------------------------------------------------|*/
#include <WiFi.h> //Wifi library
#include "esp_wpa2.h" //wpa2 library for connections to Enterprise networks
#define EAP_IDENTITY "paulo.galvao@estsetubal.ips.pt" //for student
//#define EAP_IDENTITY "id@uhasselt.be" //for researchers, scientists, teachers
#define EAP_PASSWORD "asua"
const char* ssid = "eduroam"; // Eduroam SSID
void setup() {
  byte error = 0;
  Serial.begin(115200);
  delay(10);
  Serial.println("Connecting to: ");
  Serial.println(ssid);
  WiFi.disconnect(true);  //disconnect from wifi to set new wifi connection
  error += esp_wifi_sta_wpa2_ent_set_identity((uint8_t *)EAP_IDENTITY, strlen(EAP_IDENTITY));
  error += esp_wifi_sta_wpa2_ent_set_username((uint8_t *)EAP_IDENTITY, strlen(EAP_IDENTITY));
  error += esp_wifi_sta_wpa2_ent_set_password((uint8_t *)EAP_PASSWORD, strlen(EAP_PASSWORD));
//Following times, it ran fine with just this line (connects very fast).
  if (error != 0) {
    Serial.println("Error setting WPA properties.");
  }
  WiFi.enableSTA(true);

  esp_wpa2_config_t config = WPA2_CONFIG_INIT_DEFAULT();
  if (esp_wifi_sta_wpa2_ent_enable(&config) != ESP_OK) {
    Serial.println("WPA2 Settings Not OK");
  }

  WiFi.begin(ssid); //connect to Eduroam function
  WiFi.setHostname("RandomHostname"); //set Hostname for your device - not neccesary
  while (WiFi.status() != WL_CONNECTED) {
    delay(500);
    Serial.print(".");
  }
  Serial.println("");
  Serial.println("WiFi connected");
  Serial.println("IP address set: ");
  Serial.println(WiFi.localIP()); //print LAN IP
}
void loop(){
  if (WiFi.status() != WL_CONNECTED) {
    WiFi.begin(ssid);
  }
  while (WiFi.status() != WL_CONNECTED) {
    delay(500);
    Serial.print(".");
  }
}
```

Hasselt_university_upload_second.ino

Exemplo 9: Enviar texto e comandos para LED’s através de formulários HTML (como estação STA)

https://github.com/labF212/ESP32/blob/master/formulario.ino

Pré-requisitos:

To build the asynchronous web server, you need to install these libraries.

- **ESP32:** install the ESPAsyncWebServer and the AsyncTCP libraries.
- **ESP8266:** install the ESPAsyncWebServer and the ESPAsyncTCP libraries.

These libraries aren’t available to install through the Arduino Library Manager, so you need to copy the library files to the Arduino Installation folder. Alternatively, in your Arduino IDE, you can go to **Sketch** > **Include Library** > **Add .zip Library** and select the libraries you’ve just downloaded.

```
#include <Arduino.h>
#ifdef ESP32
  #include <WiFi.h>
  #include <AsyncTCP.h>
#else
  #include <ESP8266WiFi.h>
  #include <ESPAsyncTCP.h>
#endif
#include <ESPAsyncWebServer.h>

AsyncWebServer server(80);

// REPLACE WITH YOUR NETWORK CREDENTIALS
const char* ssid     = "EACI";
const char* password = "SMD@EACI";

const char* PARAM_INPUT_1 = "input1";
const char* PARAM_INPUT_2 = "input2";
const char* PARAM_INPUT_3 = "input3";
const char* PARAM_INPUT_4 = "input4";
const char* PARAM_INPUT_5 = "input5";
const char* PARAM_INPUT_6 = "input6";
const char* PARAM_INPUT_7 = "input7";
const char* PARAM_INPUT_8 = "input8";
const char* PARAM_INPUT_9 = "input9";
const char* PARAM_INPUT_10 = "input10";

String palavra;
char letra;



/* LED */
#define LED_PIN1 15
#define LED_PIN2 16
#define LED_PIN3 17
#define LED_PIN4 18
#define LED_PIN5 19

// HTML web page to handle 3 input fields (input1, input2, input3)
const char index_html[] PROGMEM = R"rawliteral(
<!DOCTYPE HTML><html>
  <head>
  <meta charset="UTF-8"> <!--portuguese chars-->
  <meta name="viewport" content="width=device-width, initial-scale=1">
  <title>Comando de Robôs por ESP32</title>
  </head>

  <body>

  <h1>Palavra a enviar ao Robô</h1>
```

```
<form action="/get">
  Escreva a palavra (apenas com 10 caracteres): <input type="text" name="input1">
  <input type="submit" value="Enviar">
</form><br>

<div style="background-color:lightblue"><center>
<h1>Jogo do Galo</h1>
  <table>
    <!--Linha 1-->
    <tr><td>
    <form action="/get">
    <!--input4:<input type="submit" value="Submit">-->
    <!--input4: <input type="text" name="input4">-->
    <input type="submit" name="input2" value="Posição 1" />
    </form></td>
    <td>
    </ > <!--4 spaces-->
    </td>
    <td>
    <form action="/get">
    <input type="submit" name="input3" value="Posição 2" />
    </td>
    </form>
    <td>
    </ > <!--4 spaces-->
    </td>
    <td>
    <form action="/get">
    <input type="submit" name="input4" value="Posição 3" />
    </td>
    </form>
    <!--Linha 2-->
    </tr>
    </table>
    <table>
    <tr><td>
    <form action="/get">
    <input type="submit" name="input5" value="Posição 4" />
    </form></td>
    <td>
    </ > <!--4 spaces-->
    </td>
    <td>
    <form action="/get">
    <input type="submit" name="input6" value="Posição 5" />
    </td>
    <td>
    </ > <!--4 spaces-->
    </td>
    <td>
    <form action="/get">
    <input type="submit" name="input7" value="Posição 6" />
```

```
    </td>
    </tr></table>
    <!--Linha 3-->
    </tr>
    </table>
    <table>
    <tr><td>
    <form action="/get">
    <input type="submit" name="input8" value="Posição 7" />
    </form></td>
    <td>
    </ > <!--4 spaces-->
    </td>
    <td>
    <form action="/get">
    <input type="submit" name="input9" value="Posição 8" />
    </td>
    <td>
    </ > <!--4 spaces-->
    </td>
    <td>
    <form action="/get">
    <input type="submit" name="input10" value="Posição 9" />
    </td>
    </tr></table>


   </br>
  </div>
  <p id="demo">Hi.</p>
  <script>
  document.getElementById("demo").innerHTML="Programado por: Fernando Costeira e Paulo
Galvão";
  </script>
  <p><a href="https://github.com/labF212/ESP32">Obter código</a></p>



</body></html>)rawliteral";

void notFound(AsyncWebServerRequest *request) {
  request->send(404, "text/plain", "Not found");
}

void setup() {
  Serial.begin(115200);

  pinMode(LED_PIN1, OUTPUT);
  pinMode(LED_PIN2, OUTPUT);
  pinMode(LED_PIN3, OUTPUT);
  pinMode(LED_PIN4, OUTPUT);
  pinMode(LED_PIN5, OUTPUT);
```

```
  delay(10);

//  connectWiFi();



  WiFi.mode(WIFI_STA);
  WiFi.begin(ssid, password);
  if (WiFi.waitForConnectResult() != WL_CONNECTED) {
    Serial.println("WiFi Failed!");
    return;
  }
  Serial.println();
  Serial.print("IP Address: ");
  Serial.println(WiFi.localIP());

  // Send web page with input fields to client
  server.on("/", HTTP_GET, [](AsyncWebServerRequest *request){
    request->send_P(200, "text/html", index_html);
  });


   // Jogo da Palavra
  // Send a GET request to <ESP_IP>/get?input1=<inputMessage>
  server.on("/get", HTTP_GET, [] (AsyncWebServerRequest *request) {
    String inputMessage;
    String inputParam;
    // GET input1 value on <ESP_IP>/get?input1=<inputMessage>
    //Recebe a Palavra
    if (request->hasParam(PARAM_INPUT_1)) {
      inputMessage = request->getParam(PARAM_INPUT_1)->value();
      //inputParam = PARAM_INPUT_1;
      Serial.println("Letra");
      //Serial.println(inputParam);

      inputMessage.toLowerCase();
      Serial.println(inputMessage);

      //palavra+ = inputParam;
      for (int i = 0; i < 10; i++) {
      //Serial.println(palavra[i]);

      char letra = inputMessage[i];
      Serial.println(letra);


      if(letra == 'a'){
        digitalWrite(LED_PIN1, LOW);
        digitalWrite(LED_PIN2, HIGH);
        digitalWrite(LED_PIN3, HIGH);
        digitalWrite(LED_PIN4, HIGH);
        digitalWrite(LED_PIN5, HIGH);
```

```
  delay(400);
  }

if(letra == 'b'){
  digitalWrite(LED_PIN1, HIGH);
  digitalWrite(LED_PIN2, LOW);
  digitalWrite(LED_PIN3, HIGH);
  digitalWrite(LED_PIN4, HIGH);
  digitalWrite(LED_PIN5, HIGH);
  delay(400);
  }

if(letra == 'c'){
  digitalWrite(LED_PIN1, LOW);
  digitalWrite(LED_PIN2, LOW);
  digitalWrite(LED_PIN3, HIGH);
  digitalWrite(LED_PIN4, HIGH);
  digitalWrite(LED_PIN5, HIGH);
  delay(400);
  }

if(letra == 'd'){
  digitalWrite(LED_PIN1, HIGH);
  digitalWrite(LED_PIN2, HIGH);
  digitalWrite(LED_PIN3, LOW);
  digitalWrite(LED_PIN4, HIGH);
  digitalWrite(LED_PIN5, HIGH);
  delay(400);
  }

if(letra == 'e'){
  digitalWrite(LED_PIN1, LOW);
  digitalWrite(LED_PIN2, HIGH);
  digitalWrite(LED_PIN3, LOW);
  digitalWrite(LED_PIN4, HIGH);
  digitalWrite(LED_PIN5, HIGH);
  delay(400);
  }

if(letra == 'f'){
  digitalWrite(LED_PIN1, HIGH);
  digitalWrite(LED_PIN2, LOW);
  digitalWrite(LED_PIN3, LOW);
  digitalWrite(LED_PIN4, HIGH);
  digitalWrite(LED_PIN5, HIGH);
  delay(400);
  }

if(letra == 'g'){
  digitalWrite(LED_PIN1, LOW);
  digitalWrite(LED_PIN2, LOW);
  digitalWrite(LED_PIN3, LOW);
```

```
  digitalWrite(LED_PIN4, HIGH);
  digitalWrite(LED_PIN5, HIGH);
  delay(400);
  }

if(letra == 'h'){
  digitalWrite(LED_PIN1, HIGH);
  digitalWrite(LED_PIN2, HIGH);
  digitalWrite(LED_PIN3, HIGH);
  digitalWrite(LED_PIN4, LOW);
  digitalWrite(LED_PIN5, HIGH);
  delay(400);
  }

if(letra == 'i'){
  digitalWrite(LED_PIN1, LOW);
  digitalWrite(LED_PIN2, HIGH);
  digitalWrite(LED_PIN3, HIGH);
  digitalWrite(LED_PIN4, LOW);
  digitalWrite(LED_PIN5, HIGH);
  delay(400);
  }

if(letra == 'j'){
  digitalWrite(LED_PIN1, HIGH);
  digitalWrite(LED_PIN2, LOW);
  digitalWrite(LED_PIN3, HIGH);
  digitalWrite(LED_PIN4, LOW);
  digitalWrite(LED_PIN5, HIGH);
  delay(400);
  }

if(letra == 'k'){
  digitalWrite(LED_PIN1, LOW);
  digitalWrite(LED_PIN2, LOW);
  digitalWrite(LED_PIN3, HIGH);
  digitalWrite(LED_PIN4, LOW);
  digitalWrite(LED_PIN5, HIGH);
  delay(400);
  }

if(letra == 'l'){
  digitalWrite(LED_PIN1, HIGH);
  digitalWrite(LED_PIN2, HIGH);
  digitalWrite(LED_PIN3, LOW);
  digitalWrite(LED_PIN4, LOW);
  digitalWrite(LED_PIN5, HIGH);
  delay(400);
  }

if(letra == 'm'){
  digitalWrite(LED_PIN1, LOW);
```

```
  digitalWrite(LED_PIN2, HIGH);
  digitalWrite(LED_PIN3, LOW);
  digitalWrite(LED_PIN4, LOW);
  digitalWrite(LED_PIN5, HIGH);
  delay(400);
  }

if(letra == 'n'){
  digitalWrite(LED_PIN1, HIGH);
  digitalWrite(LED_PIN2, LOW);
  digitalWrite(LED_PIN3, LOW);
  digitalWrite(LED_PIN4, LOW);
  digitalWrite(LED_PIN5, HIGH);
  delay(400);
  }

if(letra == 'o'){
  digitalWrite(LED_PIN1, LOW);
  digitalWrite(LED_PIN2, LOW);
  digitalWrite(LED_PIN3, LOW);
  digitalWrite(LED_PIN4, LOW);
  digitalWrite(LED_PIN5, HIGH);
  delay(400);
  }

if(letra == 'p'){
  digitalWrite(LED_PIN1, HIGH);
  digitalWrite(LED_PIN2, HIGH);
  digitalWrite(LED_PIN3, HIGH);
  digitalWrite(LED_PIN4, HIGH);
  digitalWrite(LED_PIN5, LOW);
  delay(400);
  }

if(letra == 'q'){
  digitalWrite(LED_PIN1, LOW);
  digitalWrite(LED_PIN2, HIGH);
  digitalWrite(LED_PIN3, HIGH);
  digitalWrite(LED_PIN4, HIGH);
  digitalWrite(LED_PIN5, LOW);
  delay(400);
  }

if(letra == 'r'){
  digitalWrite(LED_PIN1, HIGH);
  digitalWrite(LED_PIN2, LOW);
  digitalWrite(LED_PIN3, HIGH);
  digitalWrite(LED_PIN4, HIGH);
  digitalWrite(LED_PIN5, LOW);
  delay(400);
  }
```

```
if(letra == 's'){
  digitalWrite(LED_PIN1, LOW);
  digitalWrite(LED_PIN2, LOW);
  digitalWrite(LED_PIN3, HIGH);
  digitalWrite(LED_PIN4, HIGH);
  digitalWrite(LED_PIN5, LOW);
  delay(400);
  }

if(letra == 't'){
  digitalWrite(LED_PIN1, HIGH);
  digitalWrite(LED_PIN2,HIGH);
  digitalWrite(LED_PIN3, LOW);
  digitalWrite(LED_PIN4, HIGH);
  digitalWrite(LED_PIN5, LOW);
  delay(400);
  }

if(letra == 'u'){
  digitalWrite(LED_PIN1, LOW);
  digitalWrite(LED_PIN2, HIGH);
  digitalWrite(LED_PIN3, LOW);
  digitalWrite(LED_PIN4, HIGH);
  digitalWrite(LED_PIN5, LOW);
  delay(400);
  }

if(letra == 'v'){
  digitalWrite(LED_PIN1, HIGH);
  digitalWrite(LED_PIN2, LOW);
  digitalWrite(LED_PIN3, LOW);
  digitalWrite(LED_PIN4, HIGH);
  digitalWrite(LED_PIN5, LOW);
  delay(400);
  }

if(letra == 'x'){
  digitalWrite(LED_PIN1, LOW);
  digitalWrite(LED_PIN2, LOW);
  digitalWrite(LED_PIN3, LOW);
  digitalWrite(LED_PIN4, HIGH);
  digitalWrite(LED_PIN5, LOW);
  delay(400);
  }

if(letra == 'y'){
  digitalWrite(LED_PIN1, HIGH);
  digitalWrite(LED_PIN2, HIGH);
  digitalWrite(LED_PIN3, HIGH);
  digitalWrite(LED_PIN4, LOW);
  digitalWrite(LED_PIN5, LOW);
  delay(400);
```

```
    }

  if(letra == 'z'){
    digitalWrite(LED_PIN1, LOW);
    digitalWrite(LED_PIN2, HIGH);
    digitalWrite(LED_PIN3, HIGH);
    digitalWrite(LED_PIN4, LOW);
    digitalWrite(LED_PIN5, LOW);
    delay(400);
    }

}
}

// JOGO DO GALO

// GET input2 value on <ESP_IP>/get?input2=<inputMessage>
// Recebe o numero da posição 1 da jogada do jogo do galo
else if (request->hasParam(PARAM_INPUT_2)) {
      digitalWrite(LED_PIN1, LOW);              // GET turns the LED off
      digitalWrite(LED_PIN2, HIGH);              // GET turns the LED off
      digitalWrite(LED_PIN3, HIGH);              // GET turns the LED on
      digitalWrite(LED_PIN4, HIGH);              // GET turns the LED on
      delay(2000);
}
// GET input3 value on <ESP_IP>/get?input3=<inputMessage>
// Recebe o numero da posição 2 da jogada do jogo do galo
else if (request->hasParam(PARAM_INPUT_3)) {
      digitalWrite(LED_PIN1, HIGH);              // GET turns the LED off
      digitalWrite(LED_PIN2, LOW);              // GET turns the LED off
      digitalWrite(LED_PIN3, HIGH);              // GET turns the LED on
      digitalWrite(LED_PIN4, HIGH);              // GET turns the LED on
      delay(2000);
}
// Recebe o numero da posição 3 da jogada do jogo do galo
else if (request ->hasParam(PARAM_INPUT_4)) {
      digitalWrite(LED_PIN1, LOW);              // GET turns the LED off
      digitalWrite(LED_PIN2, LOW);              // GET turns the LED off
      digitalWrite(LED_PIN3, HIGH);              // GET turns the LED on
      digitalWrite(LED_PIN4, HIGH);              // GET turns the LED on
      delay(2000);

    }
// Recebe o numero da posição 4 da jogada do jogo do galo
else if (request ->hasParam(PARAM_INPUT_5)) {
      digitalWrite(LED_PIN1, HIGH);              // GET /H turns the LED on
      digitalWrite(LED_PIN2, HIGH);              // GET /H turns the LED on
      digitalWrite(LED_PIN3, LOW);              // GET /H turns the LED on
      digitalWrite(LED_PIN4, HIGH);              // GET /H turns the LED on
      delay(2000);
    }
// Recebe o numero da posição 5 da jogada do jogo do galo
```

```
  else if (request ->hasParam(PARAM_INPUT_6)) {
       digitalWrite(LED_PIN1, LOW);              // GET /H turns the LED on
       digitalWrite(LED_PIN2, HIGH);              // GET /H turns the LED on
       digitalWrite(LED_PIN3, LOW);              // GET /H turns the LED on
       digitalWrite(LED_PIN4, HIGH);              // GET /H turns the LED on
       delay(2000);
     }
  // Recebe o numero da posição 6 da jogada do jogo do galo
  else if (request ->hasParam(PARAM_INPUT_7)) {
       digitalWrite(LED_PIN1, HIGH);              // GET /H turns the LED off
       digitalWrite(LED_PIN2, LOW);              // GET /H turns the LED off
       digitalWrite(LED_PIN3, LOW);              // GET /H turns the LED off
       digitalWrite(LED_PIN4, HIGH);              // GET /H turns the LED off
       delay(2000);
     }
  // Recebe o numero da posição 7 da jogada do jogo do galo
  else if (request ->hasParam(PARAM_INPUT_8)) {
       digitalWrite(LED_PIN1, LOW);              // GET /H turns the LED off
       digitalWrite(LED_PIN2, LOW);              // GET /H turns the LED off
       digitalWrite(LED_PIN3, LOW);              // GET /H turns the LED off
       digitalWrite(LED_PIN4, HIGH);              // GET /H turns the LED off
       delay(2000);
     }
  // Recebe o numero da posição 8 da jogada do jogo do galo
  else if (request ->hasParam(PARAM_INPUT_9)) {
       digitalWrite(LED_PIN1, HIGH);              // GET /H turns the LED off
       digitalWrite(LED_PIN2, HIGH);              // GET /H turns the LED off
       digitalWrite(LED_PIN3, HIGH);              // GET /H turns the LED off
       digitalWrite(LED_PIN4, LOW);              // GET /H turns the LED off
       delay(2000);
     }

  // Recebe o numero da posição 9 da jogada do jogo do galo
  else if (request ->hasParam(PARAM_INPUT_10)) {
       digitalWrite(LED_PIN1, LOW);              // GET /H turns the LED off
       digitalWrite(LED_PIN2, HIGH);              // GET /H turns the LED off
       digitalWrite(LED_PIN3, HIGH);              // GET /H turns the LED off
       digitalWrite(LED_PIN4, LOW);              // GET /H turns the LED off
       delay(2000);
     }

  else {
    inputMessage = "No message sent";
    inputParam = "none";
  }
  //Usar linhas seguintes para verificar envio de mensagens
  /*Serial.println(inputMessage);
  request->send(200, "text/html", "HTTP GET request sent to your ESP on input field ("
                              + inputParam + ") with value: " + inputMessage +
                              "<br><a href=\"/\">Return to Home Page</a>");
   */
});
```

```
  server.onNotFound(notFound);
  server.begin();
}

void loop() {

}
```

Exemplo 10: Enviar texto e comandos para LED’s através de formulários HTML (como Acess Point)

```
#http://onlineshouter.com/use-esp8266-wifi-modes-station-access-point/
#include <Arduino.h>
#ifdef ESP32
  #include <WiFi.h>
  #include <AsyncTCP.h>
#else
  #include <ESP8266WiFi.h>
  #include <ESPAsyncTCP.h>
#endif
#include <ESPAsyncWebServer.h>

AsyncWebServer server(80);

// REPLACE WITH YOUR NETWORK CREDENTIALS
const char* ssid     = "ROBOT";
const char* password = "eaci2020"; //tem de ter no minimo 8 char

const char* PARAM_INPUT_1 = "input1";
const char* PARAM_INPUT_2 = "input2";
const char* PARAM_INPUT_3 = "input3";
const char* PARAM_INPUT_4 = "input4";
const char* PARAM_INPUT_5 = "input5";
const char* PARAM_INPUT_6 = "input6";
const char* PARAM_INPUT_7 = "input7";
const char* PARAM_INPUT_8 = "input8";
const char* PARAM_INPUT_9 = "input9";
const char* PARAM_INPUT_10 = "input10";

String palavra;
char letra;


IPAddress local_IP(192,168,4,22);

IPAddress gateway(192,168,4,9);

IPAddress subnet(255,255,255,0);


/* LED */
#define LED_PIN1 15
#define LED_PIN2 16
#define LED_PIN3 17
#define LED_PIN4 18
#define LED_PIN5 19

// HTML web page to handle 3 input fields (input1, input2, input3)
const char index_html[] PROGMEM = R"rawliteral(
```

```
<!DOCTYPE HTML><html>
 <head>
 <meta charset="UTF-8"> <!--portuguese chars-->
 <meta name="viewport" content="width=device-width, initial-scale=1">
 <title>Comando de Robôs por ESP32</title>
 </head>

 <body>

 <h1>Palavra a enviar ao Robô</h1>
 <form action="/get">
  Escreva a palavra (apenas com 10 caracteres): <input type="text" name="input1">
  <input type="submit" value="Enviar">
 </form><br>

 <div style="background-color:lightblue"><center>
 <h1>Jogo do Galo</h1>
  <table>
   <!--Linha 1-->
   <tr><td>
   <form action="/get">
   <!--input4:<input type="submit" value="Submit">-->
   <!--input4: <input type="text" name="input4">-->
   <input type="submit" name="input2" value="Posição 1" />
   </form></td>
   <td>
   </ > <!--4 spaces-->
   </td>
   <td>
   <form action="/get">
   <input type="submit" name="input3" value="Posição 2" />
   </td>
   </form>
   <td>
   </ > <!--4 spaces-->
   </td>
   <td>
   <form action="/get">
   <input type="submit" name="input4" value="Posição 3" />
   </td>
   </form>
   <!--Linha 2-->
   </tr>
   </table>
   <table>
   <tr><td>
   <form action="/get">
   <input type="submit" name="input5" value="Posição 4" />
   </form></td>
   <td>
   </ > <!--4 spaces-->
   </td>
```

```
    <td>
    <form action="/get">
    <input type="submit" name="input6" value="Posição 5" />
    </td>
    <td>
    </ > <!--4 spaces-->
    </td>
    <td>
    <form action="/get">
    <input type="submit" name="input7" value="Posição 6" />
    </td>
    </tr></table>
    <!--Linha 3-->
    </tr>
    </table>
    <table>
    <tr><td>
    <form action="/get">
    <input type="submit" name="input8" value="Posição 7" />
    </form></td>
    <td>
    </ > <!--4 spaces-->
    </td>
    <td>
    <form action="/get">
    <input type="submit" name="input9" value="Posição 8" />
    </td>
    <td>
    </ > <!--4 spaces-->
    </td>
    <td>
    <form action="/get">
    <input type="submit" name="input10" value="Posição 9" />
    </td>
    </tr></table>


   </br>
  </div>
  <p id="demo">Hi.</p>
  <script>
  document.getElementById("demo").innerHTML="Programado por: Fernando Costeira e Paulo
Galvão";
  </script>
  <p><a href="https://github.com/labF212/ESP32">Obter código</a></p>



</body></html>)rawliteral";

void notFound(AsyncWebServerRequest *request) {
  request->send(404, "text/plain", "Not found");
```

```
}

void setup() {
  Serial.begin(115200);

  pinMode(LED_PIN1, OUTPUT);
  pinMode(LED_PIN2, OUTPUT);
  pinMode(LED_PIN3, OUTPUT);
  pinMode(LED_PIN4, OUTPUT);
  pinMode(LED_PIN5, OUTPUT);
  delay(10);

//  connectWiFi();

Serial.print("Setting soft-AP configuration ... ");

Serial.println(WiFi.softAPConfig(local_IP, gateway, subnet) ? "Ready" : "Failed!");

Serial.print("Setting soft-AP ... ");

Serial.println(WiFi.softAP(ssid,password) ? "Ready" : "Failed!");

Serial.print("Soft-AP IP address = ");

Serial.println(WiFi.softAPIP());


  //WiFi.mode(WIFI_STA);
  //WiFi.begin(ssid, password);
 /* if (WiFi.waitForConnectResult() != WL_CONNECTED) {
    Serial.println("WiFi Failed!");
    return;
  }
  Serial.println();
  Serial.print("IP Address: ");
  Serial.println(WiFi.localIP());
  Serial.println(WiFi.softAPIP());
 */

  // Send web page with input fields to client
  server.on("/", HTTP_GET, [](AsyncWebServerRequest *request){
    request->send_P(200, "text/html", index_html);
  });


   // Jogo da Palavra
  // Send a GET request to <ESP_IP>/get?input1=<inputMessage>
  server.on("/get", HTTP_GET, [] (AsyncWebServerRequest *request) {
    String inputMessage;
    String inputParam;
    // GET input1 value on <ESP_IP>/get?input1=<inputMessage>
    //Recebe a Palavra
```

```
if (request->hasParam(PARAM_INPUT_1)) {
  inputMessage = request->getParam(PARAM_INPUT_1)->value();
  //inputParam = PARAM_INPUT_1;
  Serial.println("Letra");
  //Serial.println(inputParam);

  inputMessage.toLowerCase();
  Serial.println(inputMessage);

  //palavra+ = inputParam;
  for (int i = 0; i < 10; i++) {
  //Serial.println(palavra[i]);

  char letra = inputMessage[i];
  Serial.println(letra);


  if(letra == 'a'){
    digitalWrite(LED_PIN1, LOW);
    digitalWrite(LED_PIN2, HIGH);
    digitalWrite(LED_PIN3, HIGH);
    digitalWrite(LED_PIN4, HIGH);
    digitalWrite(LED_PIN5, HIGH);
    delay(400);
    }

  if(letra == 'b'){
    digitalWrite(LED_PIN1, HIGH);
    digitalWrite(LED_PIN2, LOW);
    digitalWrite(LED_PIN3, HIGH);
    digitalWrite(LED_PIN4, HIGH);
    digitalWrite(LED_PIN5, HIGH);
    delay(400);
    }

  if(letra == 'c'){
    digitalWrite(LED_PIN1, LOW);
    digitalWrite(LED_PIN2, LOW);
    digitalWrite(LED_PIN3, HIGH);
    digitalWrite(LED_PIN4, HIGH);
    digitalWrite(LED_PIN5, HIGH);
    delay(400);
    }

  if(letra == 'd'){
    digitalWrite(LED_PIN1, HIGH);
    digitalWrite(LED_PIN2, HIGH);
    digitalWrite(LED_PIN3, LOW);
    digitalWrite(LED_PIN4, HIGH);
    digitalWrite(LED_PIN5, HIGH);
    delay(400);
    }
```

```
if(letra == 'e'){
  digitalWrite(LED_PIN1, LOW);
  digitalWrite(LED_PIN2, HIGH);
  digitalWrite(LED_PIN3, LOW);
  digitalWrite(LED_PIN4, HIGH);
  digitalWrite(LED_PIN5, HIGH);
  delay(400);
  }

if(letra == 'f'){
  digitalWrite(LED_PIN1, HIGH);
  digitalWrite(LED_PIN2, LOW);
  digitalWrite(LED_PIN3, LOW);
  digitalWrite(LED_PIN4, HIGH);
  digitalWrite(LED_PIN5, HIGH);
  delay(400);
  }

if(letra == 'g'){
  digitalWrite(LED_PIN1, LOW);
  digitalWrite(LED_PIN2, LOW);
  digitalWrite(LED_PIN3, LOW);
  digitalWrite(LED_PIN4, HIGH);
  digitalWrite(LED_PIN5, HIGH);
  delay(400);
  }

if(letra == 'h'){
  digitalWrite(LED_PIN1, HIGH);
  digitalWrite(LED_PIN2, HIGH);
  digitalWrite(LED_PIN3, HIGH);
  digitalWrite(LED_PIN4, LOW);
  digitalWrite(LED_PIN5, HIGH);
  delay(400);
  }

if(letra == 'i'){
  digitalWrite(LED_PIN1, LOW);
  digitalWrite(LED_PIN2, HIGH);
  digitalWrite(LED_PIN3, HIGH);
  digitalWrite(LED_PIN4, LOW);
  digitalWrite(LED_PIN5, HIGH);
  delay(400);
  }

if(letra == 'j'){
  digitalWrite(LED_PIN1, HIGH);
  digitalWrite(LED_PIN2, LOW);
  digitalWrite(LED_PIN3, HIGH);
  digitalWrite(LED_PIN4, LOW);
  digitalWrite(LED_PIN5, HIGH);
```

```
  delay(400);
  }

if(letra == 'k'){
  digitalWrite(LED_PIN1, LOW);
  digitalWrite(LED_PIN2, LOW);
  digitalWrite(LED_PIN3, HIGH);
  digitalWrite(LED_PIN4, LOW);
  digitalWrite(LED_PIN5, HIGH);
  delay(400);
  }

if(letra == 'l'){
  digitalWrite(LED_PIN1, HIGH);
  digitalWrite(LED_PIN2, HIGH);
  digitalWrite(LED_PIN3, LOW);
  digitalWrite(LED_PIN4, LOW);
  digitalWrite(LED_PIN5, HIGH);
  delay(400);
  }

if(letra == 'm'){
  digitalWrite(LED_PIN1, LOW);
  digitalWrite(LED_PIN2, HIGH);
  digitalWrite(LED_PIN3, LOW);
  digitalWrite(LED_PIN4, LOW);
  digitalWrite(LED_PIN5, HIGH);
  delay(400);
  }

if(letra == 'n'){
  digitalWrite(LED_PIN1, HIGH);
  digitalWrite(LED_PIN2, LOW);
  digitalWrite(LED_PIN3, LOW);
  digitalWrite(LED_PIN4, LOW);
  digitalWrite(LED_PIN5, HIGH);
  delay(400);
  }

if(letra == 'o'){
  digitalWrite(LED_PIN1, LOW);
  digitalWrite(LED_PIN2, LOW);
  digitalWrite(LED_PIN3, LOW);
  digitalWrite(LED_PIN4, LOW);
  digitalWrite(LED_PIN5, HIGH);
  delay(400);
  }

if(letra == 'p'){
  digitalWrite(LED_PIN1, HIGH);
  digitalWrite(LED_PIN2, HIGH);
  digitalWrite(LED_PIN3, HIGH);
```

```
  digitalWrite(LED_PIN4, HIGH);
  digitalWrite(LED_PIN5, LOW);
  delay(400);
  }

if(letra == 'q'){
  digitalWrite(LED_PIN1, LOW);
  digitalWrite(LED_PIN2, HIGH);
  digitalWrite(LED_PIN3, HIGH);
  digitalWrite(LED_PIN4, HIGH);
  digitalWrite(LED_PIN5, LOW);
  delay(400);
  }

if(letra == 'r'){
  digitalWrite(LED_PIN1, HIGH);
  digitalWrite(LED_PIN2, LOW);
  digitalWrite(LED_PIN3, HIGH);
  digitalWrite(LED_PIN4, HIGH);
  digitalWrite(LED_PIN5, LOW);
  delay(400);
  }

if(letra == 's'){
  digitalWrite(LED_PIN1, LOW);
  digitalWrite(LED_PIN2, LOW);
  digitalWrite(LED_PIN3, HIGH);
  digitalWrite(LED_PIN4, HIGH);
  digitalWrite(LED_PIN5, LOW);
  delay(400);
  }

if(letra == 't'){
  digitalWrite(LED_PIN1, HIGH);
  digitalWrite(LED_PIN2,HIGH);
  digitalWrite(LED_PIN3, LOW);
  digitalWrite(LED_PIN4, HIGH);
  digitalWrite(LED_PIN5, LOW);
  delay(400);
  }

if(letra == 'u'){
  digitalWrite(LED_PIN1, LOW);
  digitalWrite(LED_PIN2, HIGH);
  digitalWrite(LED_PIN3, LOW);
  digitalWrite(LED_PIN4, HIGH);
  digitalWrite(LED_PIN5, LOW);
  delay(400);
  }

if(letra == 'v'){
  digitalWrite(LED_PIN1, HIGH);
```

```
    digitalWrite(LED_PIN2, LOW);
    digitalWrite(LED_PIN3, LOW);
    digitalWrite(LED_PIN4, HIGH);
    digitalWrite(LED_PIN5, LOW);
    delay(400);
    }

  if(letra == 'x'){
    digitalWrite(LED_PIN1, LOW);
    digitalWrite(LED_PIN2, LOW);
    digitalWrite(LED_PIN3, LOW);
    digitalWrite(LED_PIN4, HIGH);
    digitalWrite(LED_PIN5, LOW);
    delay(400);
    }

  if(letra == 'y'){
    digitalWrite(LED_PIN1, HIGH);
    digitalWrite(LED_PIN2, HIGH);
    digitalWrite(LED_PIN3, HIGH);
    digitalWrite(LED_PIN4, LOW);
    digitalWrite(LED_PIN5, LOW);
    delay(400);
    }

  if(letra == 'z'){
    digitalWrite(LED_PIN1, LOW);
    digitalWrite(LED_PIN2, HIGH);
    digitalWrite(LED_PIN3, HIGH);
    digitalWrite(LED_PIN4, LOW);
    digitalWrite(LED_PIN5, LOW);
    delay(400);
    }

}
}

// JOGO DO GALO

// GET input2 value on <ESP_IP>/get?input2=<inputMessage>
// Recebe o numero da posição 1 da jogada do jogo do galo
else if (request->hasParam(PARAM_INPUT_2)) {
      digitalWrite(LED_PIN1, LOW);              // GET turns the LED off
      digitalWrite(LED_PIN2, HIGH);              // GET turns the LED off
      digitalWrite(LED_PIN3, HIGH);              // GET turns the LED on
      digitalWrite(LED_PIN4, HIGH);              // GET turns the LED on
      delay(2000);
}
// GET input3 value on <ESP_IP>/get?input3=<inputMessage>
// Recebe o numero da posição 2 da jogada do jogo do galo
else if (request->hasParam(PARAM_INPUT_3)) {
      digitalWrite(LED_PIN1, HIGH);              // GET turns the LED off
```

```
    digitalWrite(LED_PIN2, LOW);              // GET turns the LED off
    digitalWrite(LED_PIN3, HIGH);              // GET turns the LED on
    digitalWrite(LED_PIN4, HIGH);              // GET turns the LED on
    delay(2000);
}
// Recebe o numero da posição 3 da jogada do jogo do galo
else if (request ->hasParam(PARAM_INPUT_4)) {
    digitalWrite(LED_PIN1, LOW);              // GET turns the LED off
    digitalWrite(LED_PIN2, LOW);              // GET turns the LED off
    digitalWrite(LED_PIN3, HIGH);              // GET turns the LED on
    digitalWrite(LED_PIN4, HIGH);              // GET turns the LED on
    delay(2000);

   }
// Recebe o numero da posição 4 da jogada do jogo do galo
else if (request ->hasParam(PARAM_INPUT_5)) {
    digitalWrite(LED_PIN1, HIGH);              // GET /H turns the LED on
    digitalWrite(LED_PIN2, HIGH);              // GET /H turns the LED on
    digitalWrite(LED_PIN3, LOW);              // GET /H turns the LED on
    digitalWrite(LED_PIN4, HIGH);              // GET /H turns the LED on
    delay(2000);
   }
// Recebe o numero da posição 5 da jogada do jogo do galo
else if (request ->hasParam(PARAM_INPUT_6)) {
    digitalWrite(LED_PIN1, LOW);              // GET /H turns the LED on
    digitalWrite(LED_PIN2, HIGH);              // GET /H turns the LED on
    digitalWrite(LED_PIN3, LOW);              // GET /H turns the LED on
    digitalWrite(LED_PIN4, HIGH);              // GET /H turns the LED on
    delay(2000);
   }
// Recebe o numero da posição 6 da jogada do jogo do galo
else if (request ->hasParam(PARAM_INPUT_7)) {
    digitalWrite(LED_PIN1, HIGH);              // GET /H turns the LED off
    digitalWrite(LED_PIN2, LOW);              // GET /H turns the LED off
    digitalWrite(LED_PIN3, LOW);              // GET /H turns the LED off
    digitalWrite(LED_PIN4, HIGH);              // GET /H turns the LED off
    delay(2000);
   }
// Recebe o numero da posição 7 da jogada do jogo do galo
else if (request ->hasParam(PARAM_INPUT_8)) {
    digitalWrite(LED_PIN1, LOW);              // GET /H turns the LED off
    digitalWrite(LED_PIN2, LOW);              // GET /H turns the LED off
    digitalWrite(LED_PIN3, LOW);              // GET /H turns the LED off
    digitalWrite(LED_PIN4, HIGH);              // GET /H turns the LED off
    delay(2000);
   }
// Recebe o numero da posição 8 da jogada do jogo do galo
else if (request ->hasParam(PARAM_INPUT_9)) {
    digitalWrite(LED_PIN1, HIGH);              // GET /H turns the LED off
    digitalWrite(LED_PIN2, HIGH);              // GET /H turns the LED off
    digitalWrite(LED_PIN3, HIGH);              // GET /H turns the LED off
    digitalWrite(LED_PIN4, LOW);              // GET /H turns the LED off
```

```
        delay(2000);
       }

   // Recebe o numero da posição 9 da jogada do jogo do galo
   else if (request ->hasParam(PARAM_INPUT_10)) {
        digitalWrite(LED_PIN1, LOW);              // GET /H turns the LED off
        digitalWrite(LED_PIN2, HIGH);              // GET /H turns the LED off
        digitalWrite(LED_PIN3, HIGH);              // GET /H turns the LED off
        digitalWrite(LED_PIN4, LOW);              // GET /H turns the LED off
        delay(2000);
       }

   else {
     inputMessage = "No message sent";
     inputParam = "none";
   }
   //Usar linhas seguintes para verificar envio de mensagens
   /*Serial.println(inputMessage);
   request->send(200, "text/html", "HTTP GET request sent to your ESP on input field ("
                              + inputParam + ") with value: " + inputMessage +
                              "<br><a href=\"/\">Return to Home Page</a>");
    */
  });
  server.onNotFound(notFound);
  server.begin();
}

void loop() {

}
```

Exemplo 11: Controlar LED e servo com webserver

https://randomnerdtutorials.com/arduino-webserver-with-an-arduino-ethernet-shield/

```
/*
 Created by Rui Santos
 Visit: http://randomnerdtutorials.com for more arduino projects

 Arduino with Ethernet Shield
 */

#include <SPI.h>
#include <Ethernet.h>
#include <Servo.h>
int led = 4;
Servo microservo;
int pos = 0;
byte mac[] = { 0xDE, 0xAD, 0xBE, 0xEF, 0xFE, 0xED };   //physical mac address
byte ip[] = { 192, 168, 1, 178 };                      // ip in lan (that's what
you need to use in your browser. ("192.168.1.178")
byte gateway[] = { 192, 168, 1, 1 };                   // internet access via
router
byte subnet[] = { 255, 255, 255, 0 };                  //subnet mask
EthernetServer server(80);                             //server port
String readString;

void setup() {
 // Open serial communications and wait for port to open:
  Serial.begin(9600);
   while (!Serial) {
    ; // wait for serial port to connect. Needed for Leonardo only
  }
  pinMode(led, OUTPUT);
  microservo.attach(7);
  // start the Ethernet connection and the server:
  Ethernet.begin(mac, ip, gateway, subnet);
  server.begin();
  Serial.print("server is at ");
  Serial.println(Ethernet.localIP());
}


void loop() {
  // Create a client connection
  EthernetClient client = server.available();
  if (client) {
    while (client.connected()) {
      if (client.available()) {
        char c = client.read();

        //read char by char HTTP request
        if (readString.length() < 100) {
          //store characters to string
          readString += c;
          //Serial.print(c);
         }

         //if HTTP request has ended
         if (c == '\n') {
           Serial.println(readString); //print to serial monitor for debuging

           client.println("HTTP/1.1 200 OK"); //send new page
           client.println("Content-Type: text/html");
           client.println();
           client.println("<HTML>");
           client.println("<HEAD>");
           client.println("<meta name='apple-mobile-web-app-capable'
content='yes' />");
```

```
          client.println("<meta name='apple-mobile-web-app-status-bar-style'
content='black-translucent' />");
          client.println("<link rel='stylesheet' type='text/css'
href='http://randomnerdtutorials.com/ethernetcss.css' />");
          client.println("<TITLE>Random Nerd Tutorials Project</TITLE>");
          client.println("</HEAD>");
          client.println("<BODY>");
          client.println("<H1>Random Nerd Tutorials Project</H1>");
          client.println("<hr />");
          client.println("<br />");
          client.println("<H2>Arduino with Ethernet Shield</H2>");
          client.println("<br />");
          client.println("<a href=\"/?button1on\"\">Turn On LED</a>");
          client.println("<a href=\"/?button1off\"\">Turn Off LED</a><br />");
          client.println("<br />");
          client.println("<br />");
          client.println("<a href=\"/?button2on\"\">Rotate Left</a>");
          client.println("<a href=\"/?button2off\"\">Rotate Right</a><br />");
          client.println("<p>Created by Rui Santos. Visit
http://randomnerdtutorials.com for more projects!</p>");
          client.println("<br />");
          client.println("</BODY>");
          client.println("</HTML>");

          delay(1);
          //stopping client
          client.stop();
          //controls the Arduino if you press the buttons
          if (readString.indexOf("?button1on") >0){
              digitalWrite(led, HIGH);
          }
          if (readString.indexOf("?button1off") >0){
              digitalWrite(led, LOW);
          }
          if (readString.indexOf("?button2on") >0){
               for(pos = 0; pos < 180; pos += 3)  // goes from 0 degrees to 180
degrees
               {                                  // in steps of 1 degree
                 microservo.write(pos);              // tell servo to go to
position in variable 'pos'
                 delay(15);                       // waits 15ms for the servo
to reach the position
               }
          }
          if (readString.indexOf("?button2off") >0){
               for(pos = 180; pos>=1; pos-=3)     // goes from 180 degrees to 0
degrees
               {
                 microservo.write(pos);              // tell servo to go to
position in variable 'pos'
                 delay(15);                       // waits 15ms for the servo
to reach the position
               }
          }
           //clearing string for next read
           readString="";

        }
      }
    }
}
}
```

2 Programação através de MicroPython (rascunho)

Como instalar o programa Thonny

Linux:

$ sudo apt install python3-pip
$ pip3 install esptool
$ sudo pip3 install thonny
$ sudo apt install python3-tk

Also add permission to user to access the USB port:
$ sudo usermod -a -G dialout <user>
$ sudo chmod a+rw <port>

Run Thonny:
$ thonny

Windows:

Ir a https://thonny.org/ fazer o download e instalar.

Para quem tem o chocolatery instalado:

choco install thonny

Depois deve-se descarregar a ferramenta **esptool** no Thonny em:

Tools –> Manage Plugins

Também existe a versão portátil.

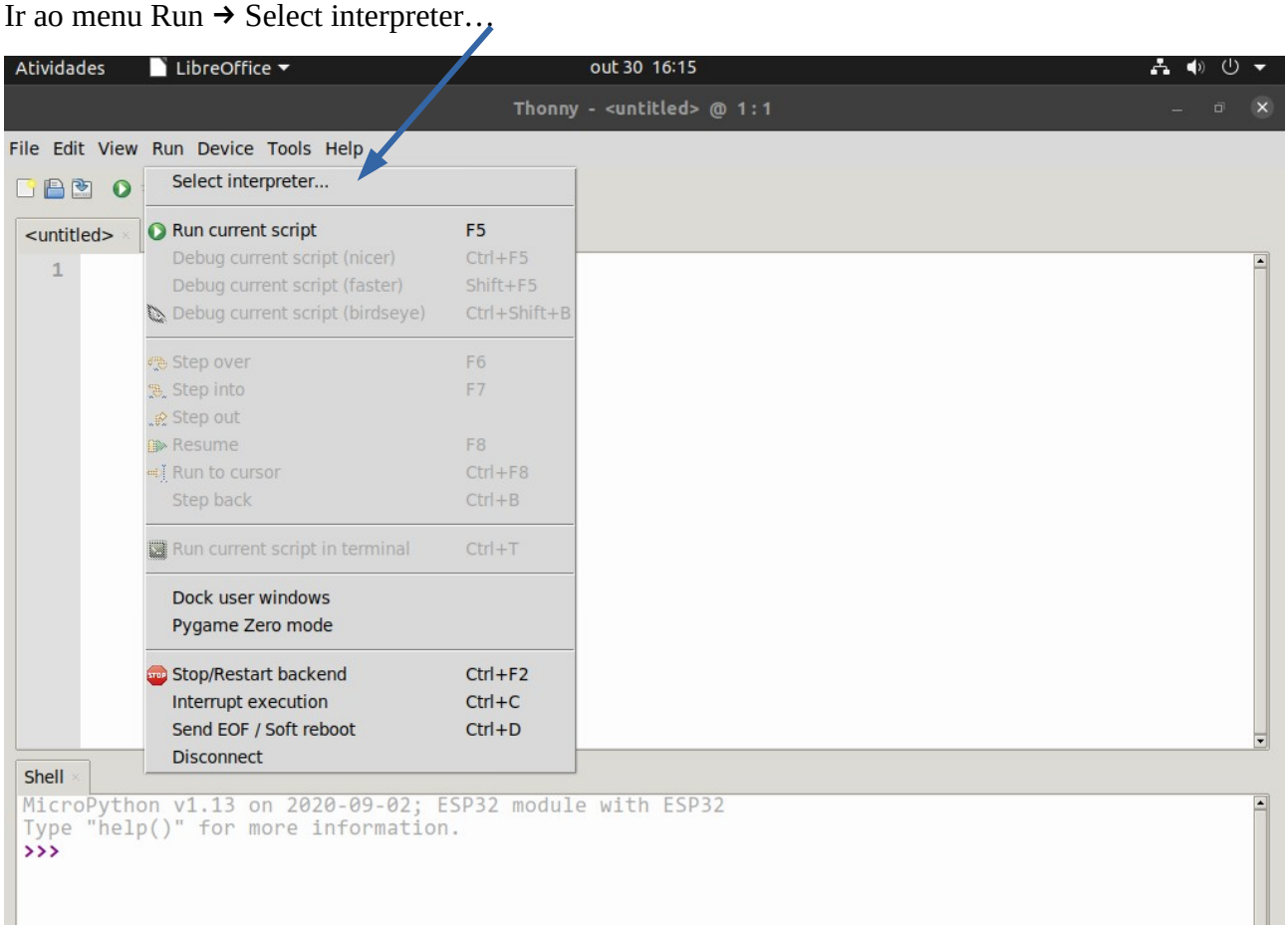
Como usar o Thonny para programar MicroPython em ESP-32

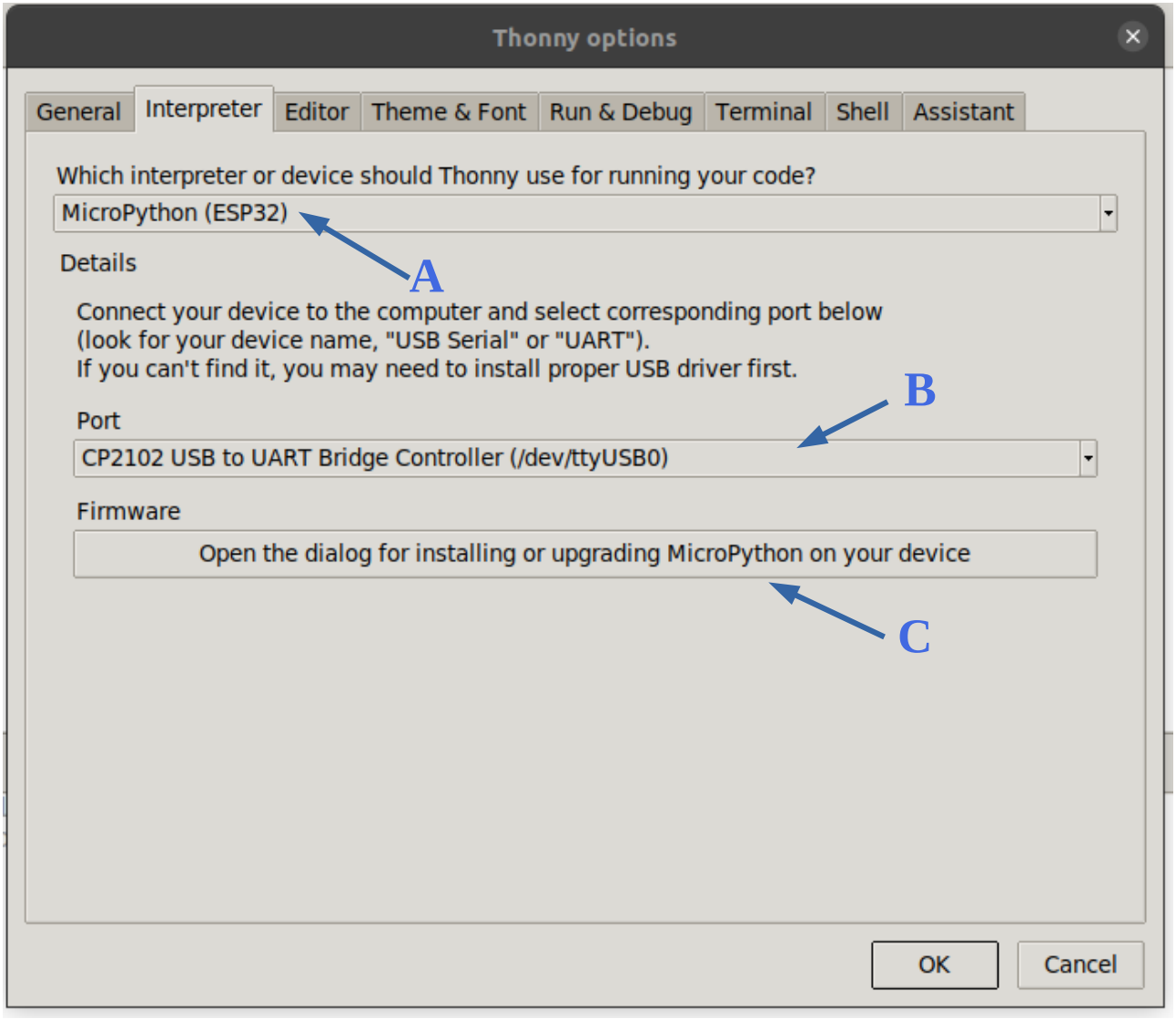
Nota: Também é válido para outros microprocessadores

1. Como enviar o firmware para o ESP-32

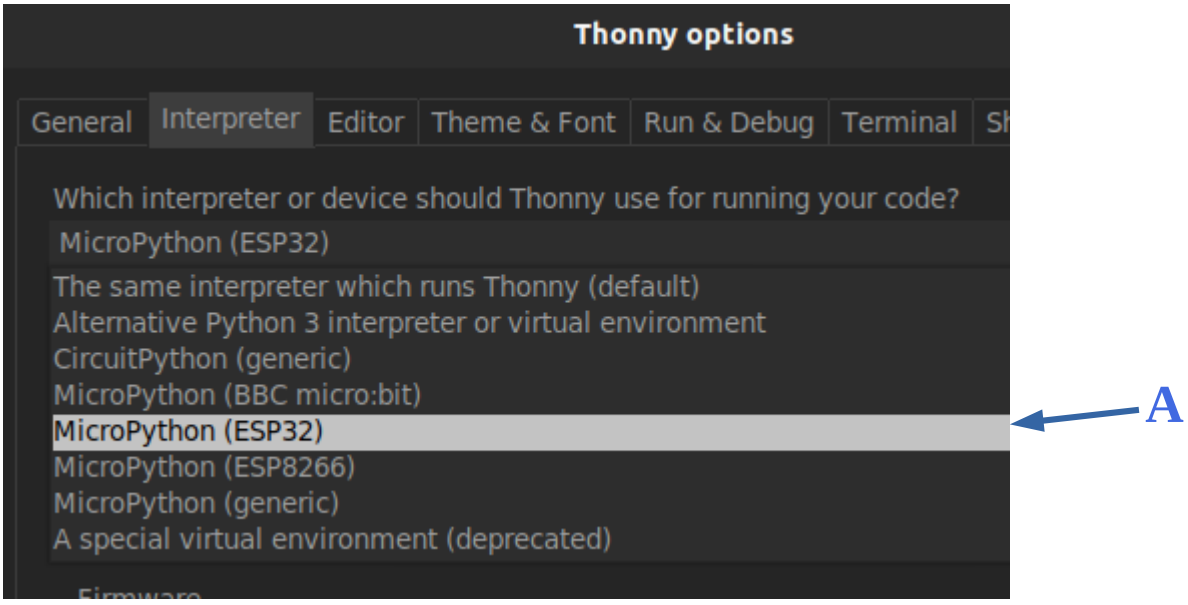
Fazer o download do firmware em: https://micropython.org/download/esp32/

Ir ao menu Run ➔ Select interpreter…

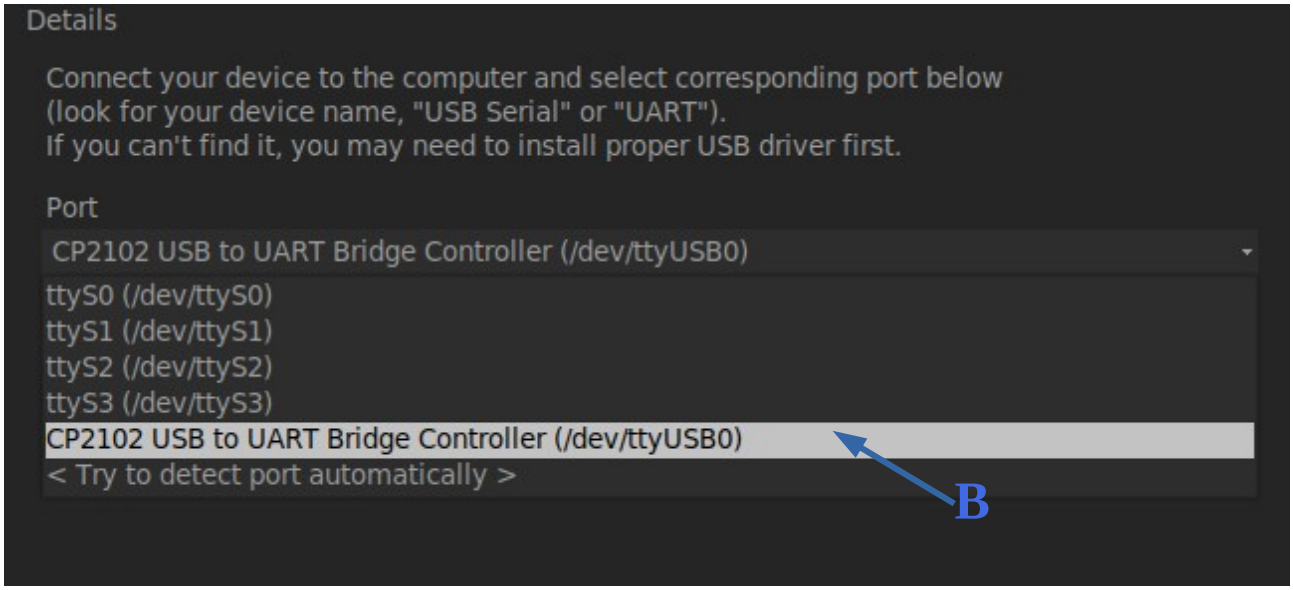




A - Escolher o interpretador:

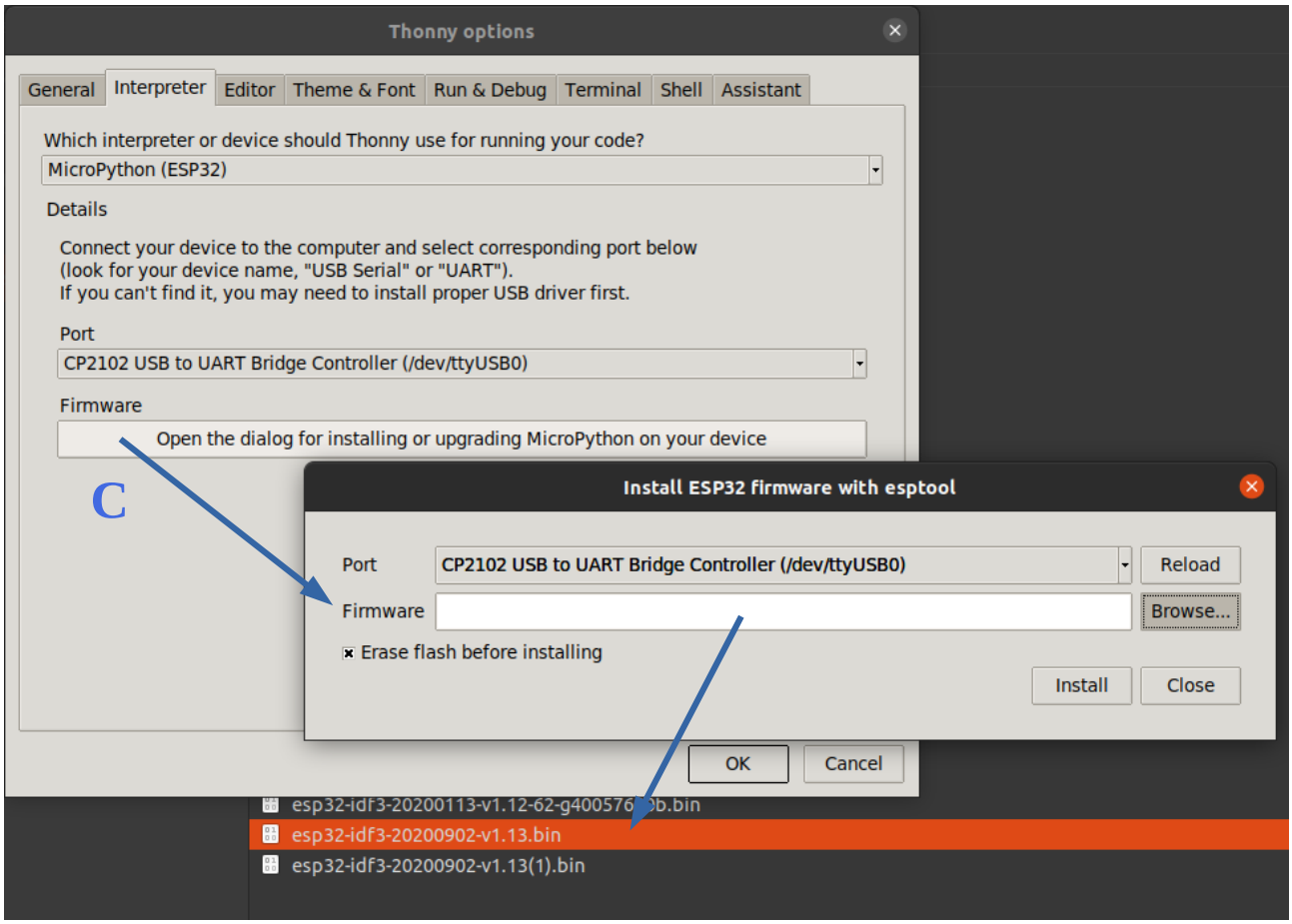


B - Escolher a porta de comunicação:

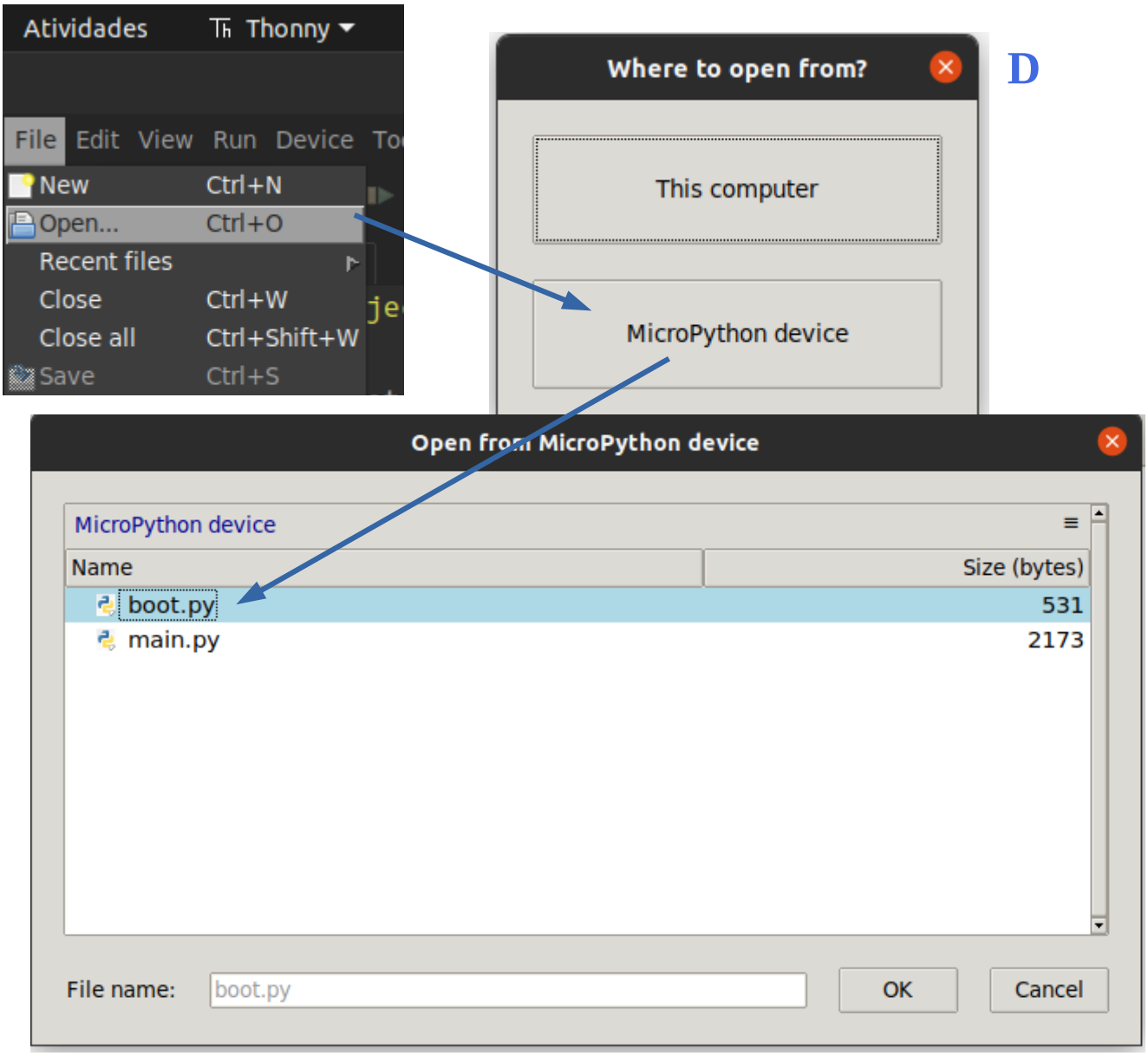


Em Windows será, por exemplo, COM1.

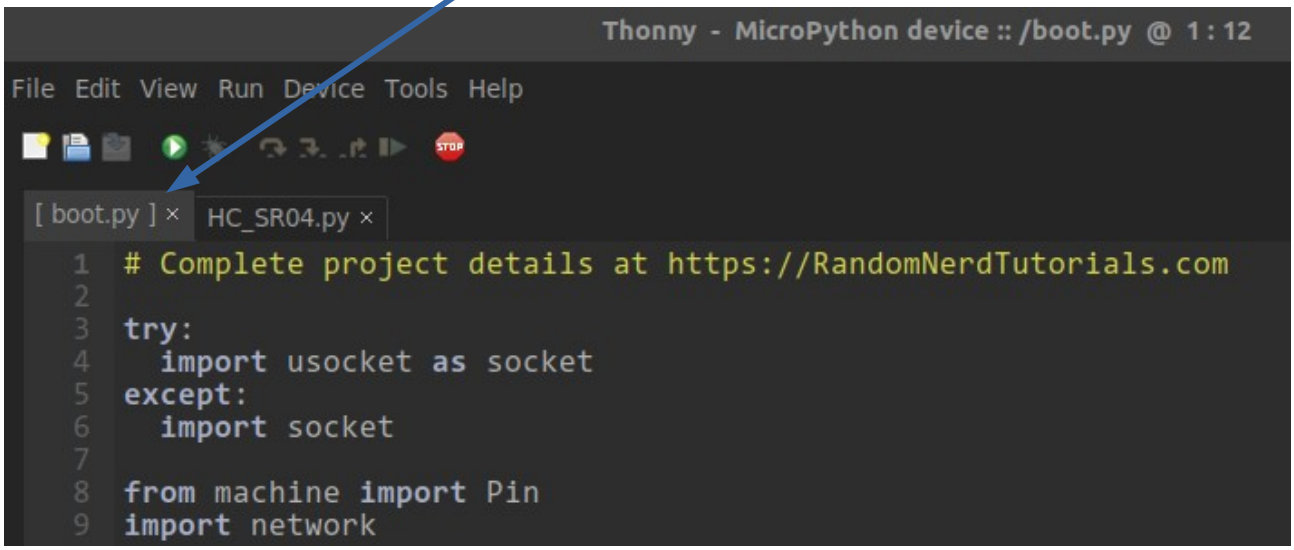
C - Escolher o Firmware de acordo com o interpretador.



2. Como ver os ficheiros existentes no ESP-32



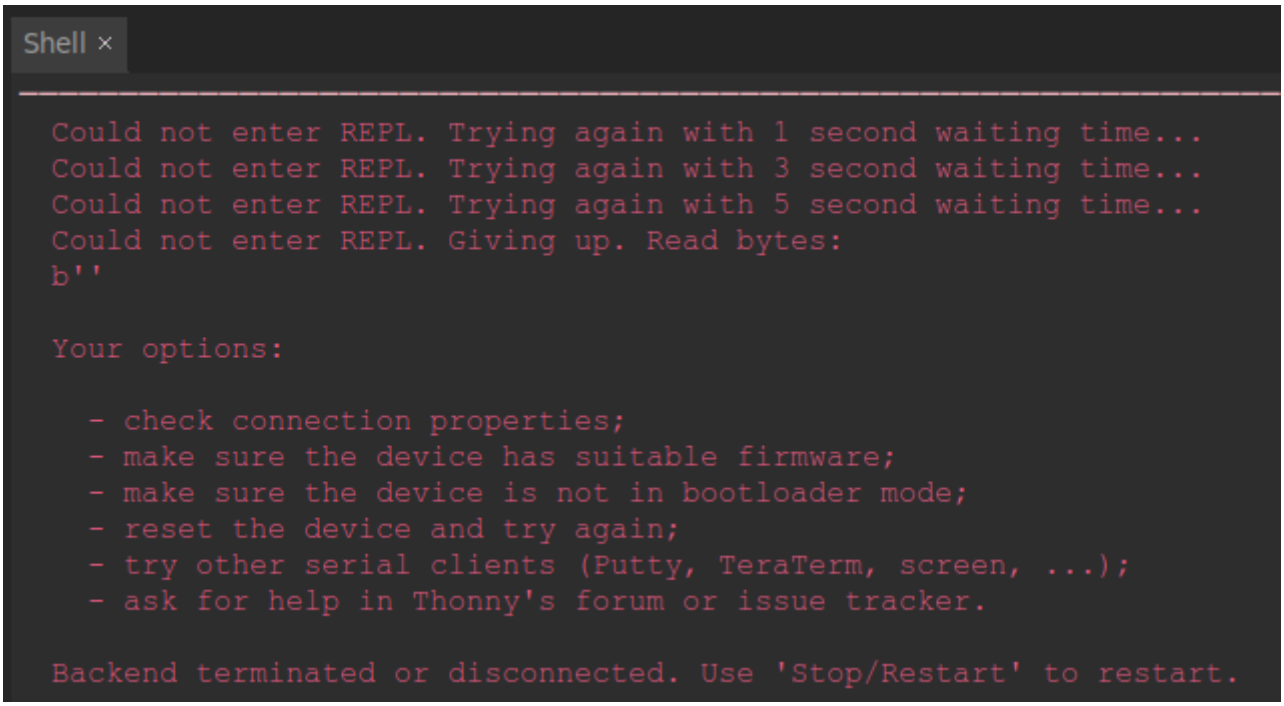
O ficheiro dentro de parêntesis rectos [boot.py] encontra-se no ESP e o ficheiro HC_SR04.py encontra-se no computador.



Comunicação:

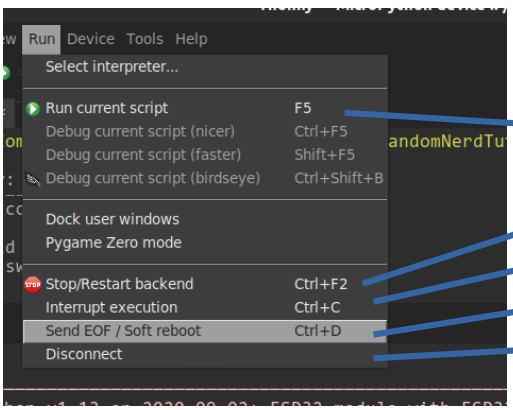
- Com erro:

Quando a Shell der este problema tente fazer STOP e se continuar a dar o mesmo erro, pressione o botão EN do ESP-32.



- Comunicação OK:

  Nota: Só quando existe comunicação é que aparece a caixa de diálogo D, quando se pretende abrir ficheiros no ESP.



Outras opções:
- Correr o programa atual
- Parar/Recomeçar a comunicação
- Interromper programa
- Fazer Reboot por software
- Desligar

O micropython corre por esta ordem:

1. boot.py
2. main.py
3. outros

Exemplo 1: Como criar funções e importá-la de outro ficheiro

1. Criar um ficheiro com o nome boot.py

```
import esp32

import blink

blink.blink_led()
```

2. Dados no ficheiro blink.py

```
from machine import Pin
import time

def blink_led():
    counter=5
    p= Pin (2,Pin.OUT)
    while (counter>0):
        p.on()
        time.sleep(0.5)
        p.off()
        time.sleep(0.15)
        counter -=1
    print("Done")
```

Exemplo 2: Read Hall Effect Sensor

To read the ESP32 hall effect sensor using MicroPython, you just need to use the following snippet of code:

```
import esp32
esp32.hall_sensor()
```

You need to import the esp32 module. Then, use the hall_sensor() method.

If you want to print the readings on the shell, you just need to use the print() function:

```
print(esp32.hall_sensor())
```

If you’re just getting started with MicroPython, you can read the following tutorial:

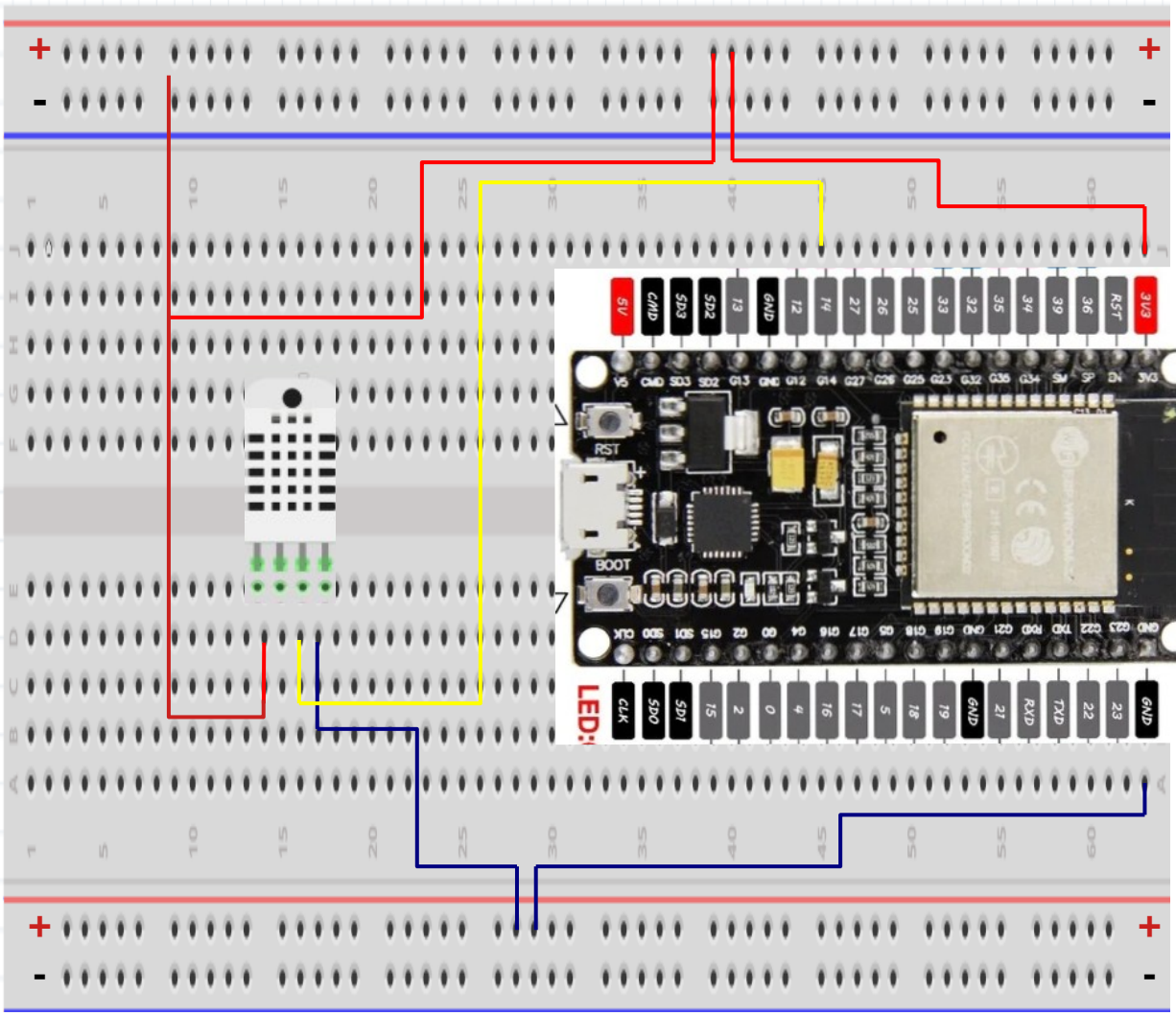
- Getting Started with MicroPython on ESP32

Wrapping Up

Throughout this tutorial you’ve learned that:

- The ESP32 features a built-in hall effect sensor
- The hall effect sensor can detect magnetic field changes in its surroundings
- The measurements from the sensor can increase or become negative depending on the magnet pole facing the sensor.

Exemplo 3: DHT11



Exemplo de ligações do ESP-32 Wroom ao DHT11 no pin digital 14

Como obter o Desenho do ESP-32 em FritZing:

https://drive.google.com/drive/folders/1q7VWBEJq7-LWyp2zIYuVQmyR7q3-Pdx6

Código fonte:

https://github.com/labF212/ESP32/blob/master/dht22.py

Complete project details at https://RandomNerdTutorials.com

```
from machine import Pin
from time import sleep
import dht

#sensor = dht.DHT22(Pin(14))
sensor = dht.DHT11(Pin(14))

while True:
  try:
    sleep(2)
    sensor.measure()
    temp = sensor.temperature()
    hum = sensor.humidity()
    temp_f = temp * (9/5) + 32.0
    print('Temperature: %3.1f C' %temp)
    print('Temperature: %3.1f F' %temp_f)
    print('Humidity: %3.1f %%' %hum)
  except OSError as e:
    print('Failed to read sensor.')
```

Exemplo 3: Web server on/off

https://randomnerdtutorials.com/esp32-esp8266-micropython-web-server/

boot.py

```
# https://raw.githubusercontent.com/RuiSantosdotme/Random-Nerd-Tutorials/
master/Projects/ESP-MicroPython/esp_web_server_boot.py

try:
  import usocket as socket
except:
  import socket

from machine import Pin
import network

import esp
esp.osdebug(None)

import gc
gc.collect()

ssid = 'REPLACE_WITH_YOUR_SSID'
password = 'REPLACE_WITH_YOUR_PASSWORD'

station = network.WLAN(network.STA_IF)

station.active(True)
station.connect(ssid, password)

while station.isconnected() == False:
  pass

print('Connection successful')
print(station.ifconfig())

led = Pin(2, Pin.OUT)
```

main.py

```
# Complete project details at
https://raw.githubusercontent.com/RuiSantosdotme/Random-Nerd-Tutorials/master/
Projects/ESP-MicroPython/esp_web_server_main.py

def web_page():
  if led.value() == 1:
    gpio_state="ON"
  else:
    gpio_state="OFF"

  html = """<html><head> <title>ESP Web Server</title> <meta name="viewport"
content="width=device-width, initial-scale=1">
  <link rel="icon" href="data:,"> <style>html{font-family: Helvetica;
display:inline-block; margin: 0px auto; text-align: center;}
```

```
  h1{color: #0F3376; padding: 2vh;}p{font-size: 1.5rem;}.button{display: inline-
block; background-color: #e7bd3b; border: none;
  border-radius: 4px; color: white; padding: 16px 40px; text-decoration: none;
font-size: 30px; margin: 2px; cursor: pointer;}
  .button2{background-color: #4286f4;}</style></head><body> <h1>ESP Web
Server</h1>
  <p>GPIO state: <strong>""" + gpio_state + """</strong></p><p><a href="/?
led=on"><button class="button">ON</button></a></p>
  <p><a href="/?led=off"><button class="button
button2">OFF</button></a></p></body></html>"""
  return html

s = socket.socket(socket.AF_INET, socket.SOCK_STREAM)
s.bind(('', 80))
s.listen(5)

while True:
  conn, addr = s.accept()
  print('Got a connection from %s' % str(addr))
  request = conn.recv(1024)
  request = str(request)
  print('Content = %s' % request)
  led_on = request.find('/?led=on')
  led_off = request.find('/?led=off')
  if led_on == 6:
    print('LED ON')
    led.value(1)
  if led_off == 6:
    print('LED OFF')
    led.value(0)
  response = web_page()
  conn.send('HTTP/1.1 200 OK\n')
  conn.send('Content-Type: text/html\n')
  conn.send('Connection: close\n\n')
  conn.sendall(response)
  conn.close()
```

```
# Complete project details at https://RandomNerdTutorials.com

#https://randomnerdtutorials.com/micropython-esp32-esp8266-dht11-dht22-web-server/


try:
  import usocket as socket
except:
  import socket

import network
from machine import Pin
import dht

import esp
esp.osdebug(None)

import gc
gc.collect()

ssid = 'EACI'
password = 'SMD@EACI'

station = network.WLAN(network.STA_IF)

station.active(True)
station.connect(ssid, password)

while station.isconnected() == False:
  pass

print('Connection successful')
print(station.ifconfig())

#sensor = dht.DHT22(Pin(14))
sensor = dht.DHT11(Pin(14))

def read_sensor():
  global temp, hum
  temp = hum = 0
  try:
    sensor.measure()
    temp = sensor.temperature()
    hum = sensor.humidity()
```

```
    if (isinstance(temp, float) and isinstance(hum, float)) or (isinstance(temp, int) and
isinstance(hum, int)):
      msg = (b'{0:3.1f},{1:3.1f}'.format(temp, hum))

      # uncomment for Fahrenheit
      #temp = temp * (9/5) + 32.0

      hum = round(hum, 2)
      return(msg)
    else:
      return('Invalid sensor readings.')
  except OSError as e:
    return('Failed to read sensor.')

def web_page():
  html = """<!DOCTYPE HTML><html>
<head>
  <meta name="viewport" content="width=device-width, initial-scale=1">
  <link rel="stylesheet" href="https://use.fontawesome.com/releases/v5.7.2/css/all.css"
integrity="sha384-
fnmOCqbTlWIlj8LyTjo7mOUStjsKC4pOpQbqyi7RrhN7udi9RwhKkMHpvLbHG9Sr"
crossorigin="anonymous">
  <style>
    html {
     font-family: Arial;
     display: inline-block;
     margin: 0px auto;
     text-align: center;
    }
    h2 { font-size: 3.0rem; }
    p { font-size: 3.0rem; }
    .units { font-size: 1.2rem; }
    .dht-labels{
      font-size: 1.5rem;
      vertical-align:middle;
      padding-bottom: 15px;
    }
  </style>
</head>
<body>
  <h2>ESP DHT Server</h2>
  <p>
    <i class="fas fa-thermometer-half" style="color:#059e8a;"></i>
    <span class="dht-labels">Temperature</span>
    <span>"""+str(temp)+"""</span>
    <sup class="units">&deg;C</sup>
```

```
  </p>
  <p>
    <i class="fas fa-tint" style="color:#00add6;"></i>
    <span class="dht-labels">Humidity</span>
    <span>"""+str(hum)+"""</span>
    <sup class="units">%</sup>
  </p>
</body>
</html>"""
  return html

s = socket.socket(socket.AF_INET, socket.SOCK_STREAM)
s.bind(('', 80))
s.listen(5)

while True:
  conn, addr = s.accept()
  print('Got a connection from %s' % str(addr))
  request = conn.recv(1024)
  print('Content = %s' % str(request))
  sensor_readings = read_sensor()
  print(sensor_readings)
  response = web_page()
  conn.send('HTTP/1.1 200 OK\n')
  conn.send('Content-Type: text/html\n')
  conn.send('Connection: close\n\n')
  conn.sendall(response)
  conn.close()
```

11. node red mqqt

https://randomnerdtutorials.com/micropython-mqtt-publish-bme680-esp32-esp8266/

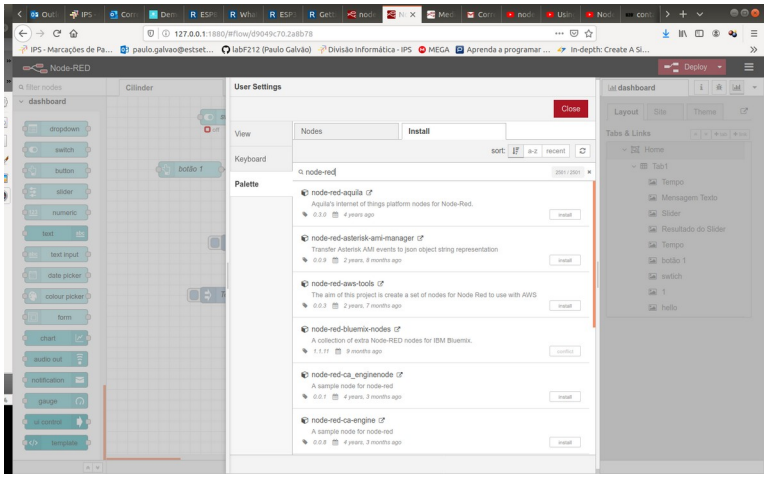
3 Programação através de Node-Red (rascunho)

O Node-Red é uma forma de programação por blocos em JavaScript. Necessita de ter instalado o node.js anteriormente.

Como instalar no ubuntu 18.03: https://skjoldtech.wordpress.com/2019/01/29/install-node-red-on-ubuntu-server-18-04-1-lts/
(ver como proteger o node-red com **password**).

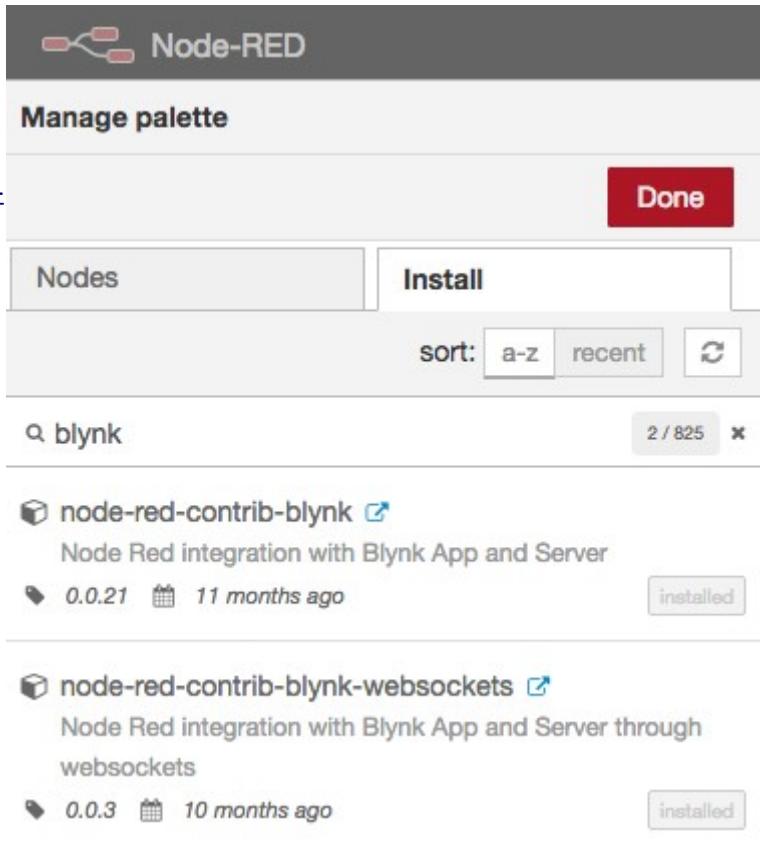
Como instalar no Windows10:
https://nodered.org/docs/getting-started/local#running

Dashboard (blocos para páginas web, gráficos):
https://randomnerdtutorials.com/getting-started-with-node-red-dashboard/
`npm install node-red-dashboard` (ou via interface)

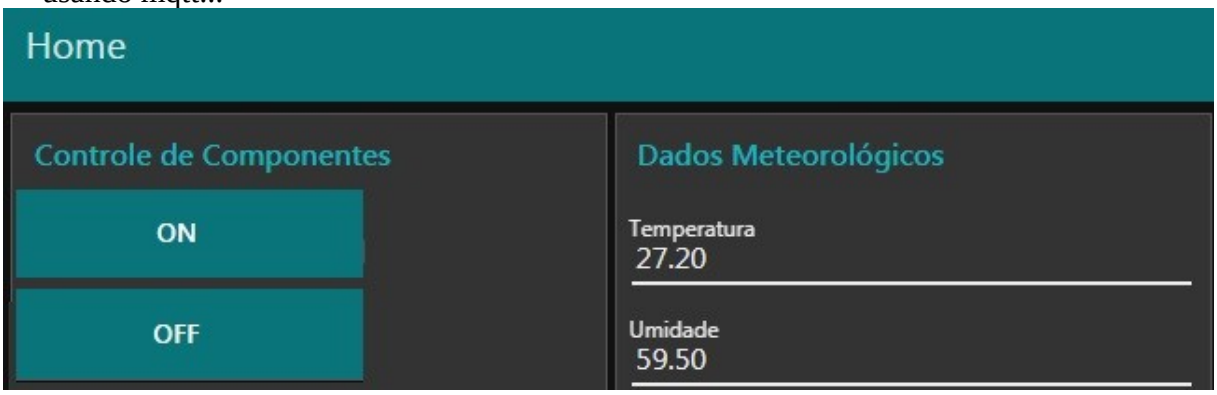


Instalar ligação blynk node-red:
https://www.npmjs.com/package/node-red-contrib-blynk-ws

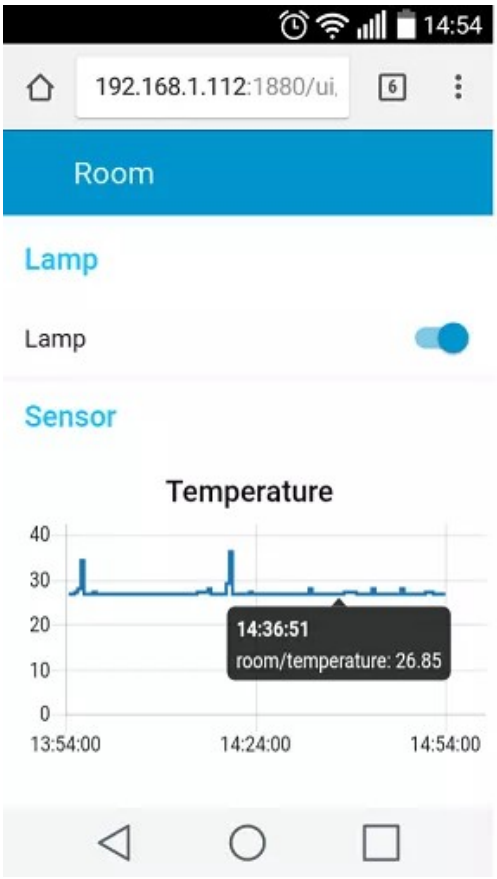
https://diyprojects.io/use-node-red-create-gateway-mysensors-blynk-local-server/#.XTcdhfzOVQJ
Blynk Server websockets

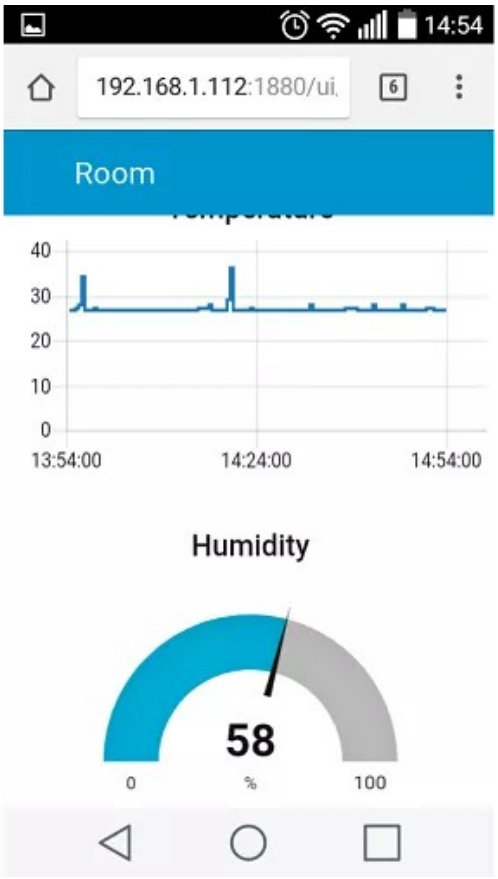


https://www.curtocircuito.com.br/blog/esp32:-node-red-editor-de-fluxo-on-line/
usando mqtt...



https://randomnerdtutorials.com/esp8266-and-node-red-with-mqtt/
Raspberry PI e mqtt



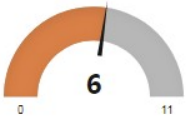


https://www.curtocircuito.com.br/blog/estacao-meteorologica-esp32-node-red/
IBM iot

Curto Circuito : Estação Meteorológica

Dados Meteorológicos

UV



Temperatura (°C)
28.23

Umidade (%)
42.72

Pressão Atmosférica...
926.37

Altitude (m)
749.85

Intensidade:
0

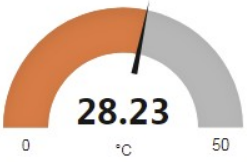
Tensão:
0.9

Ultra violeta lvl:
1123

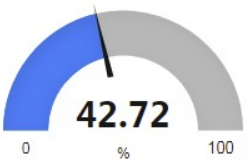
Contagem 6

Análise Gráfica: Gauge

Temperatura



Umidade



LED

Análise Gráfica: Linhas

Pressão

Altitude

4 Plataformas IOT e processamento de dados (rascunho)

As plataformas de IOT servem para guardar os dados recebidos pelos equipamentos IOT e fazer o seu processamento.

Os dados poderão ficar na nuvem através destas plataformas.

Outra opção é criarmos a nossa nuvem, num servidor próprio (Blynk) ou ainda criarmos nós uma base de dados com os dados recolhidos, para análise posterior por exemplo, numa folha de cálculo ou mesmo fazer uma ligação ao Matlab ou Labview.

Como instalar Blynk Server

O Blynk Server funciona na rede Eduroam.

> Blynk Server:
> https://docs.blynk.cc/
>
> https://github.com/blynkkk/blynk-server#blynk-server
>
> Blynk Server Python (com exemplos):
> https://github.com/blynkkk/lib-python
>
> Correr o servidor: `java -jar server-0.41.8.jar -dataFolder /path`
> `java -jar server-0.41.8.jar -dataFolder /home/zorro/Transferências`

```
Url for opening admin page. Must start from "/". For "/admin" url path will look like that "https://127.0.0.1:9443/admin".
```

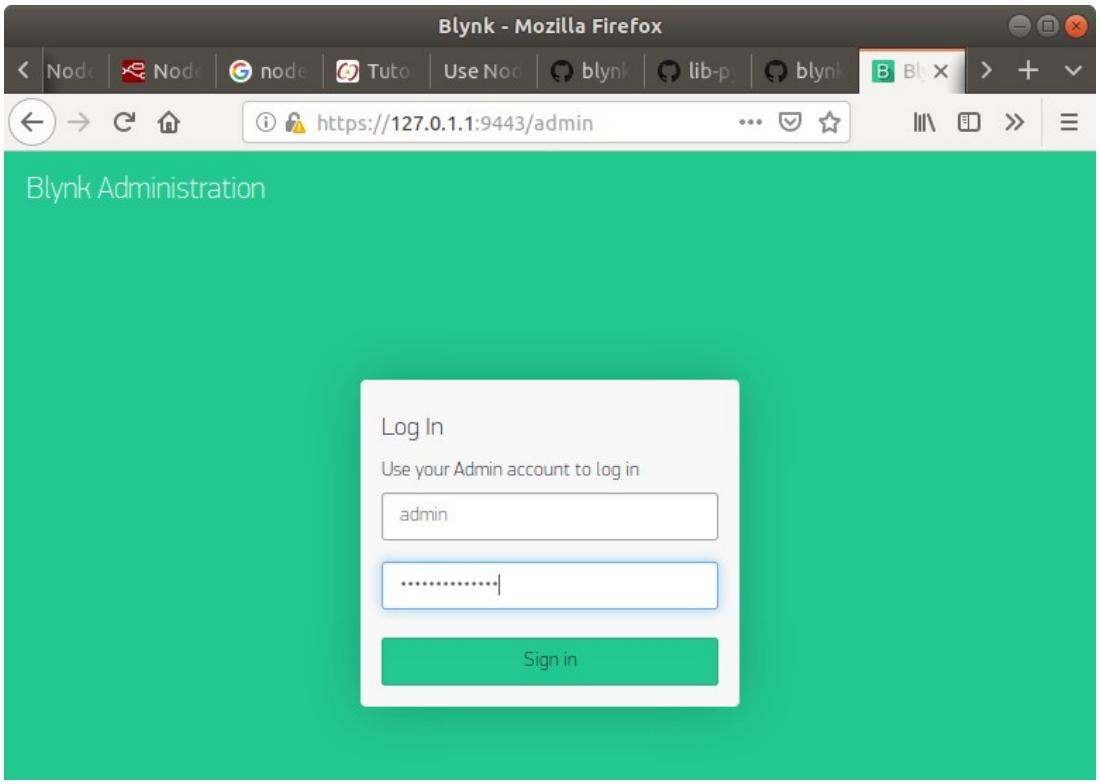
```
admin.rootPath=/admin
```

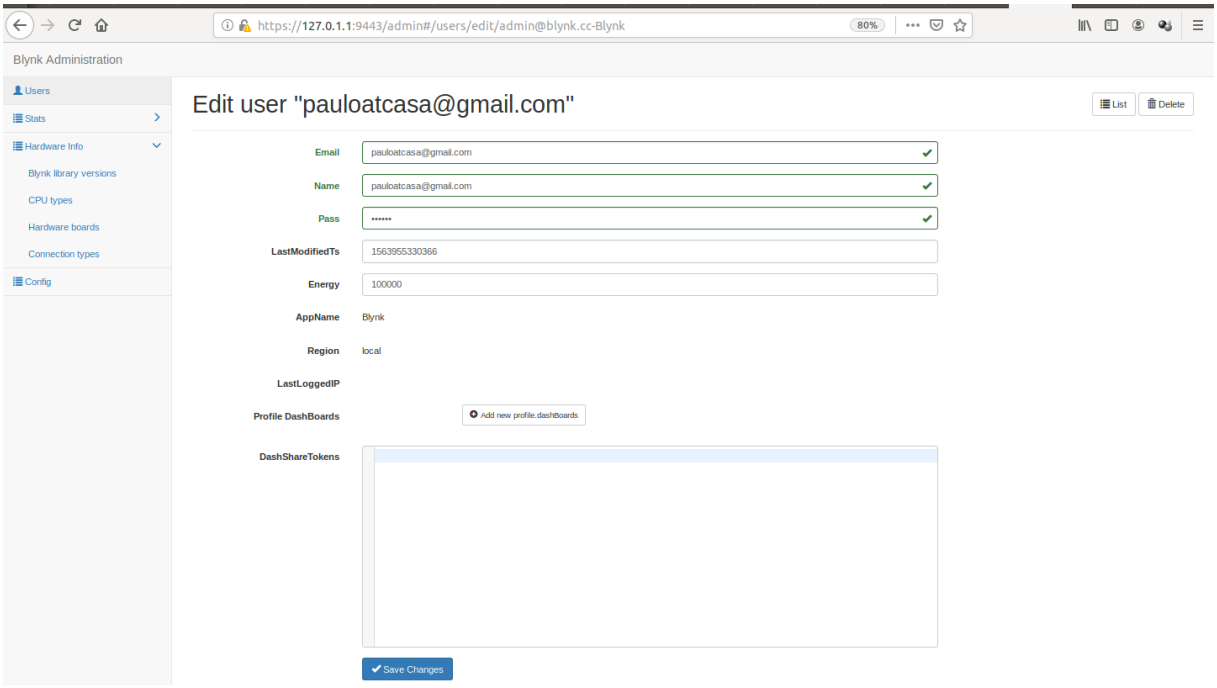
- Comma separated list of administrator IPs. Allow access to admin UI only for those IPs. You may set it for 0.0.0.0/0 to allow access for all. You may use CIDR notation. For instance, 192.168.0.53/24.

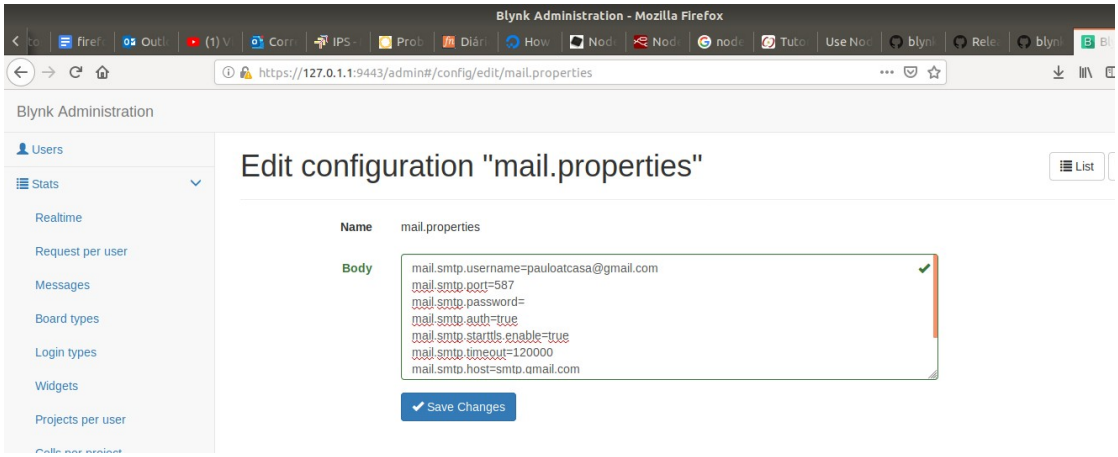
```
allowed.administrator.ips=0.0.0.0/0
```

- Default admin name and password. Will be created on initial server start

```
admin.email=admin@blynk.cc
admin.pass=admin
```

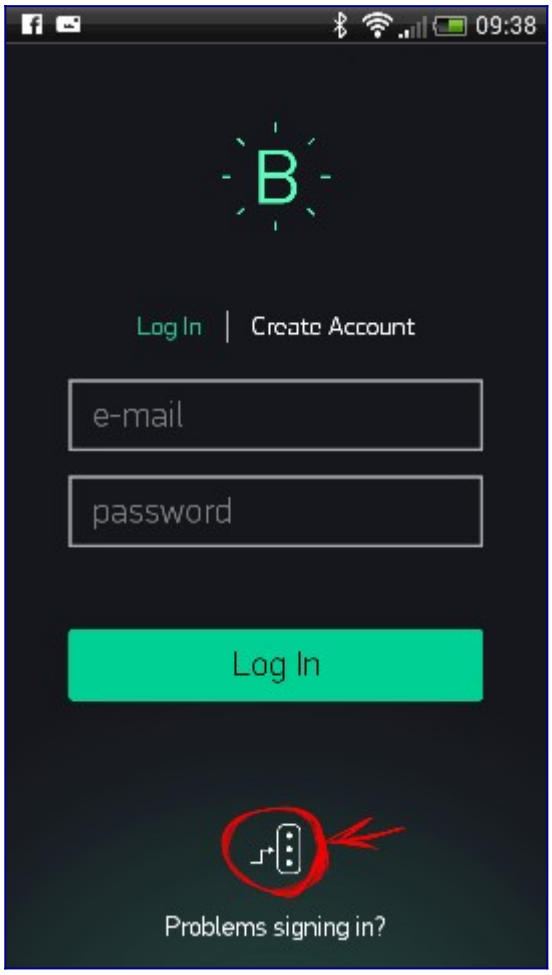

Blynk - Mozilla Firefox
https://127.0.1.1:9443/admin
Blynk Administration
Log In
Use your Admin account to log in
admin
Sign in

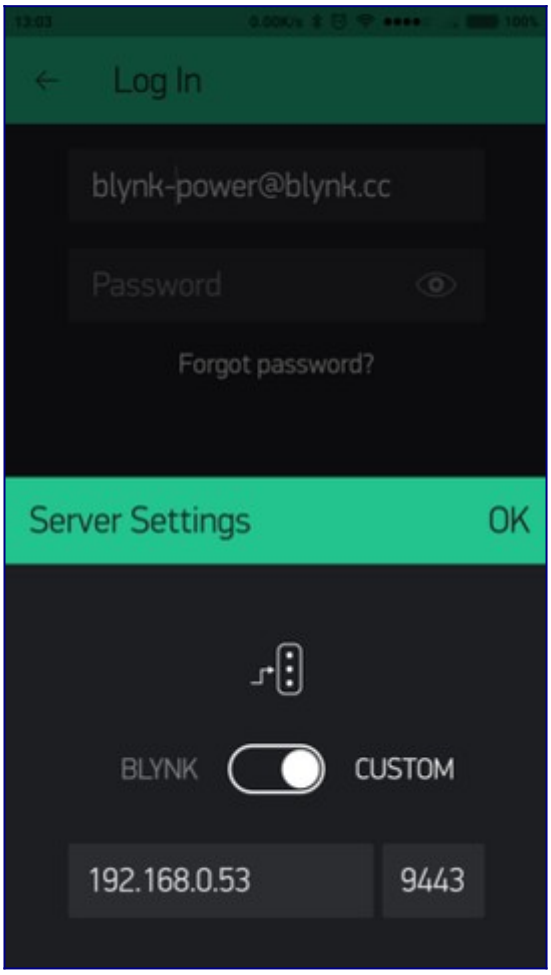

https://127.0.1.1:9443/admin#/users/edit/admin@blynk.cc-Blynk
Blynk Administration
Users
Stats
Hardware Info
Blynk library versions
CPU types
Hardware boards
Connection types
Config
Edit user "pauloatcasa@gmail.com"
List
Delete
Email
pauloatcasa@gmail.com
Name
pauloatcasa@gmail.com
Pass
LastModifiedTs
1563955330366
Energy
100000
AppName
Blynk
Region
local
LastLoggedIP
Profile DashBoards
Add new profile.dashBoards
DashShareTokens
Save Changes


Blynk Administration - Mozilla Firefox
https://127.0.1.1:9443/admin#/config/edit/mail.properties
Blynk Administration
Users
Stats
Realtime
Request per user
Messages
Board types
Login types
Widgets
Projects per user
Edit configuration "mail.properties"
List
Name
mail.properties
Body
mail.smtp.username=pauloatcasa@gmail.com
mail.smtp.port=587
mail.smtp.password=
mail.smtp.auth=true
mail.smtp.starttls.enable=true
mail.smtp.timeout=120000
mail.smtp.host=smtp.gmail.com
Save Changes

App and sketch changes

- Specify custom server path in your application





- Change your ethernet sketch from:

```
Blynk.begin(auth);
```
to
```
Blynk.begin(auth, "your_host", 8080);
```
or to
```
Blynk.begin(auth, IPAddress(xxx,xxx,xxx,xxx), 8080);
```

- Change your WIFI sketch from:

```
Blynk.begin(auth, SSID, pass));
```
to
```
Blynk.begin(auth, SSID, pass, "your_host", 8080);
```
or to
```
Blynk.begin(auth, SSID, pass, IPAddress(XXX,XXX,XXX,XXX), 8080);
```

ESP8266

Boards Manager

This is the suggested installation method for end users.

Prerequisites

- Arduino 1.6.8, get it from Arduino website.
- Internet connection

Instructions

- Start Arduino and open Preferences window.
- Enter `http://arduino.esp8266.com/stable/package_esp8266com_index.json` into *Additional Board Manager URLs* field. You can add multiple URLs, separating them with commas.
- Open Boards Manager from Tools > Board menu and find *esp8266* platform.
- Select the version you need from a drop-down box.
- Click *install* button.
- Don't forget to select your ESP8266 board from Tools > Board menu after installation.

You may optionally use *staging* boards manager package link:
`http://arduino.esp8266.com/staging/package_esp8266com_index.json`.
This may contain some new features, but at the same time, some things might be broken.

Using git version

This is the suggested installation method for contributors and library developers.

Prerequisites

- Arduino 1.6.8 (or newer, if you know what you are doing)
- git
- python 2.7
- terminal, console, or command prompt (depending on you OS)
- Internet connection

Instructions

- Open the console and go to Arduino directory. This can be either your *sketchbook* directory (usually `<Documents>/Arduino`), or the directory of Arduino application itself, the choice is up to you.
- Clone this repository into hardware/esp8266com/esp8266 directory. Alternatively, clone it elsewhere and create a symlink, if your OS supports them.

  ```
  cd hardware
  ```

```
mkdir esp8266com
cd esp8266com
git clone https://github.com/esp8266/Arduino.git esp8266
```

You should end up with the following directory structure:

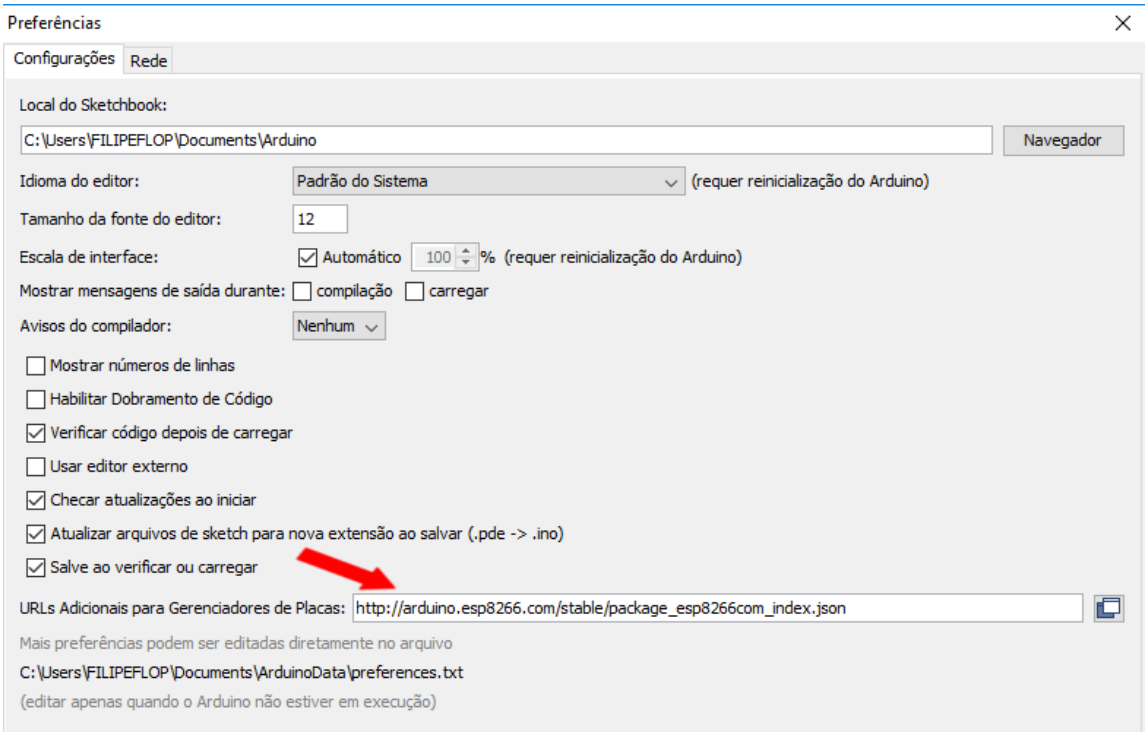
```
Arduino
|
--- hardware
    |
    --- esp8266com
        |
        --- esp8266
            |
            --- bootloaders
            --- cores
            --- doc
            --- libraries
            --- package
            --- tests
            --- tools
            --- variants
            --- platform.txt
            --- programmers.txt
            --- README.md
            --- boards.txt
            --- LICENSE
```

- Download binary tools

```
cd esp8266/tools
python get.py
```

- Restart Arduino

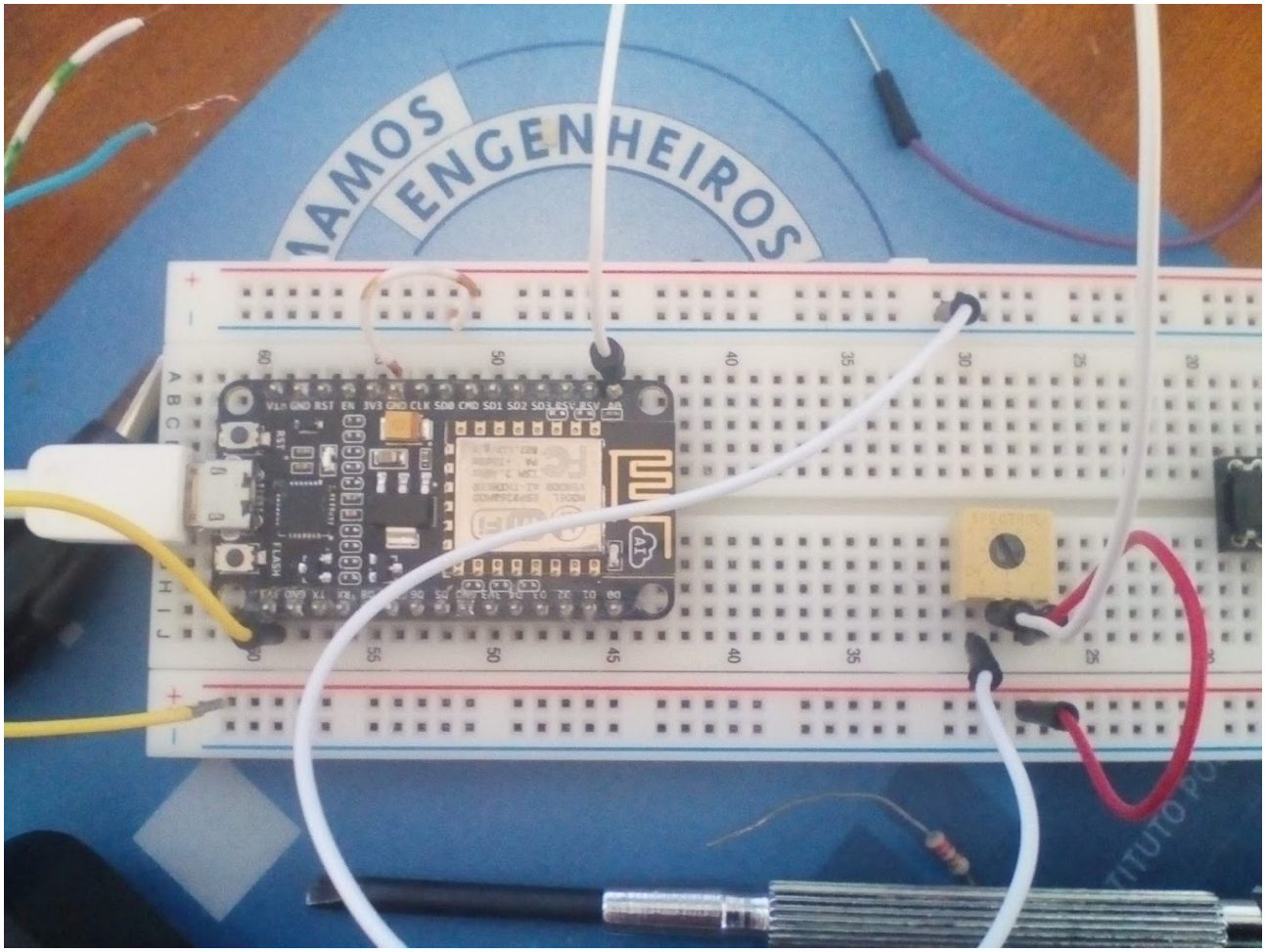
Com a ligação deste deu: https://www.filipeflop.com/blog/acelerometro-com-esp8266-nodemcu/



Exemplos de Programas

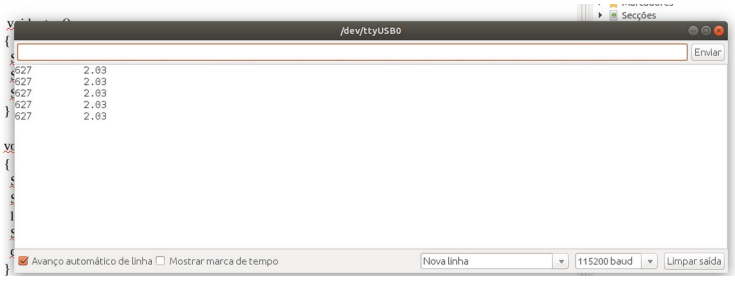
Exemplo 1: Potenciómetro

Atenção o adc provoca um erro de 0,1V



float leitura;

```
 void setup()
{
  Serial.begin(115200);
  Serial.println("Leitura do potenciometro");
  Serial.println("Valor        Volts");
}

void loop()
{
  Serial.print(analogRead(A0));
  Serial.print("          ");
  leitura = (analogRead(A0)*3.3/1023);
  Serial.println(leitura);
  delay(1500);
}
```



Exemplo 2: Geolocalização - http://ip-api.com/

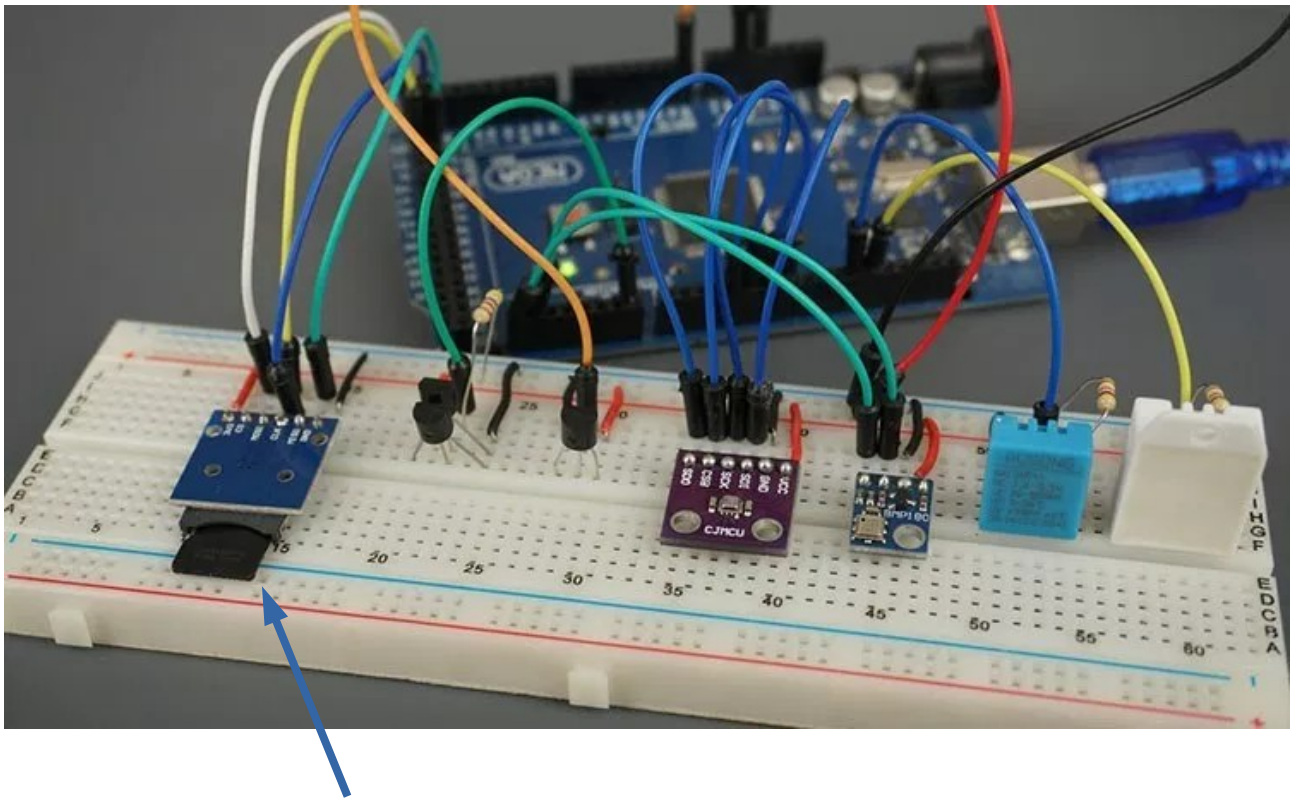
Como usar acelerómetro com ESP8266 NodeMCU - https://www.filipeflop.com/blog/acelerometro-com-esp8266-nodemcu/

https://mjrobot.org/tag/esp8266/ - microphton e protocolo MQTT

Neste novo tutorial, utilizando-se do protocolo MQTT, enviaremos os dados capturados, à um serviço the IoT, o *ThingSpeak.com* e para um aplicativo móvel, o *Thingsview.*

https://randomnerdtutorials.com/esp8266-adc-reading-analog-values-with-nodemcu/

Exemplo 3: Gravação de dados no local em cartão microSD

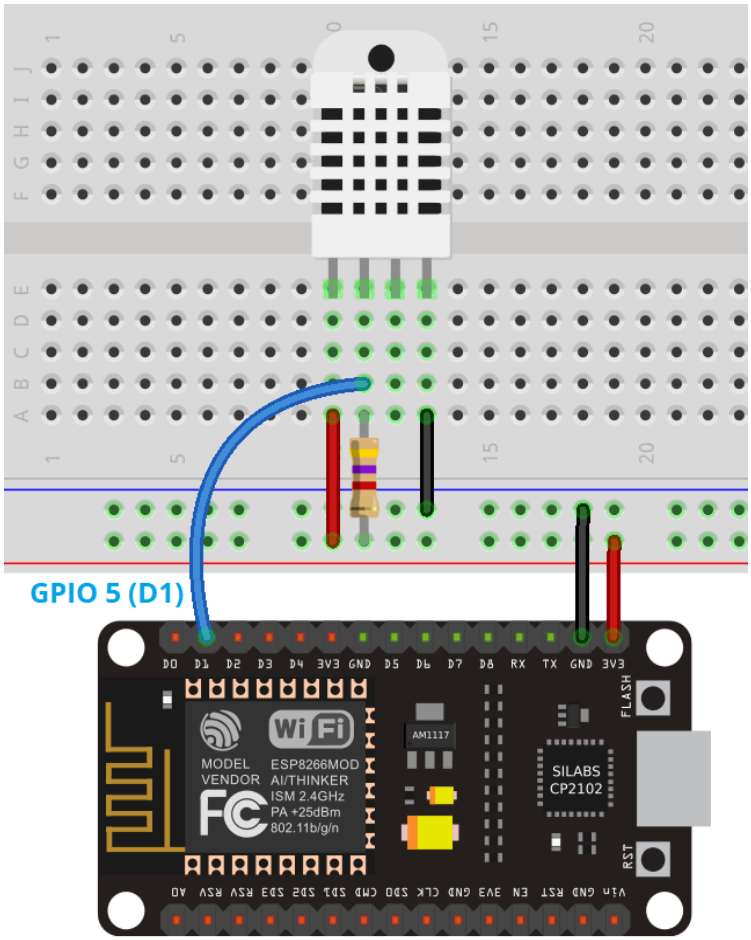


```
/*
 * Rui Santos
 * Complete Project Details https://randomnerdtutorials.com/dht11-vs-dht22-vs-lm35-vs-ds18b20-vs-bme280-vs-bmp180/
 */


#include <SD.h> // for the SD card

const int LM35sensorPin = A0;
float LM35sensorValue;
float LM35voltageOut;
float LM35temperature;

const int chipSelectSDCard = 53;
File myFile;

void setup() {
  Serial.begin(9600);


  pinMode(LM35sensorPin, INPUT);

  if(!SD.begin(chipSelectSDCard)) {
    Serial.println("SD card initialization failed!");
    return;
  }
  Serial.println("SD card initialization done.");

  myFile=SD.open("DATA.txt", FILE_WRITE);
  if (myFile) {
    Serial.println("File opened ok");
    // print the headings for our data
    myFile.println("LM35");
  }
  myFile.close();
}

void loop() {


  //LM35 SENSOR
  LM35sensorValue = analogRead(LM35sensorPin);
  LM35voltageOut = (LM35sensorValue * 5000) / 1024;

  // calculate temperature for LM35 (LM35DZ)
  LM35temperature = LM35voltageOut / 10;

  Serial.print("Temperature LM35(ºC): ");
  Serial.println(LM35temperature);
```

```
  Serial.println("");

  myFile = SD.open("DATA.txt", FILE_WRITE);
  if (myFile) {
    Serial.println("File open with success");
    myFile.print(LM35temperature);
    myFile.println(",");
  }
  myFile.close();

  delay(6000);
}
```

Exemplo 4: DHT11, NTPClient, WebServer (Lab212)

Montagem



Nota: Não usar resistência !!! Está a ligar a 3,3V

Código

```
//Complete project details at https://randomnerdtutorials.com/esp8266-dht11dht22-temperature-and-humidity-web-server-with-arduino-ide/
//Bonecos https://use.fontawesome.com/releases/v5.7.2/css/all.css exemplo: fa-pull-right


// Import required libraries
#include <Arduino.h>
#include <ESP8266WiFi.h>
#include <Hash.h>
#include <ESPAsyncTCP.h>
#include <ESPAsyncWebServer.h>
#include <Adafruit_Sensor.h>
#include <DHT.h>
#include <NTPClient.h>
#include <WiFiUdp.h>

// Define NTP Client to get time
WiFiUDP ntpUDP;
NTPClient timeClient(ntpUDP);
```

```
// Variables to save date and time
String formattedDate;
String dayStamp;
String timeStamp;

// Replace with your network credentials
const char* ssid = "EACI";
const char* password = "SMD@EACI";

#define DHTPIN 5     // Digital pin connected to the DHT sensor

// Uncomment the type of sensor in use:
#define DHTTYPE    DHT11     // DHT 11
//#define DHTTYPE    DHT22     // DHT 22 (AM2302)
//#define DHTTYPE    DHT21     // DHT 21 (AM2301)

DHT dht(DHTPIN, DHTTYPE);

// current temperature & humidity, updated in loop()
float t = 0.0;
float h = 0.0;

// Create AsyncWebServer object on port 80
AsyncWebServer server(80);

// Generally, you should use "unsigned long" for variables that hold time
// The value will quickly become too large for an int to store
unsigned long previousMillis = 0;    // will store last time DHT was updated

// Updates DHT readings every 10 seconds
const long interval = 10000;

const char index_html[] PROGMEM = R"rawliteral(
<!DOCTYPE HTML><html>
<head>
  <meta name="viewport" content="width=device-width, initial-scale=1">
  <link rel="stylesheet"
href="https://use.fontawesome.com/releases/v5.7.2/css/all.css"
integrity="sha384-
fnmOCqbTlWIlj8LyTjo7mOUStjsKC4pOpQbqyi7RrhN7udi9RwhKkMHpvLbHG9Sr"
crossorigin="anonymous">
  <style>
    html {
     font-family: Arial;
     display: inline-block;
     margin: 0px auto;
     text-align: center;
    }
    h2 { font-size: 3.0rem; }
    p { font-size: 3.0rem; }
    .units { font-size: 1.2rem; }
    .dht-labels{
      font-size: 1.5rem;
      vertical-align:middle;
      padding-bottom: 15px;
    }
  </style>
</head>
<body>
  <h3>Temperatura e Humidade no LabF212</h3>
  <p>
    <i class="fas fa-thermometer-half" style="color:#059e8a;"></i>
    <span class="dht-labels">Temperatura</span>
```

```
    <span id="temperature">%TEMPERATURE%</span>
    <sup class="units">&deg;C</sup>
  </p>
  <p>
    <i class="fas fa-tint" style="color:#00add6;"></i>
    <span class="dht-labels">Humidade</span>
    <span id="humidity">%HUMIDITY%</span>
    <sup class="units">%</sup>
  </p>
  <p>
    <i class="fas fa-calendar" style="color:#059e8a;"></i>
    <span class="dht-labels">Data</span>
    <span id="dayStamp">DAYSTAMP</span>
  </p>
  <p>
    <i class="fas fa-clock" style="color:#00add6;"></i>
    <span class="dht-labels">Hora</span>
    <span id="timeStamp">TIMESTAMP</span>
  </p>
</body>
<script>
setInterval(function ( ) {
  var xhttp = new XMLHttpRequest();
  xhttp.onreadystatechange = function() {
    if (this.readyState == 4 && this.status == 200) {
      document.getElementById("temperature").innerHTML = this.responseText;
    }
  };
  xhttp.open("GET", "/temperature", true);
  xhttp.send();
}, 10000 ) ;

setInterval(function ( ) {
  var xhttp = new XMLHttpRequest();
  xhttp.onreadystatechange = function() {
    if (this.readyState == 4 && this.status == 200) {
      document.getElementById("humidity").innerHTML = this.responseText;
    }
  };
  xhttp.open("GET", "/humidity", true);
  xhttp.send();
}, 10000 ) ;

setInterval(function ( ) {
  var xhttp = new XMLHttpRequest();
  xhttp.onreadystatechange = function() {
    if (this.readyState == 4 && this.status == 200) {
      document.getElementById("timeStamp").innerHTML = this.responseText;
    }
  };
  xhttp.open("GET", "/timeStamp", true);
  xhttp.send();
}, 10000 ) ;

setInterval(function ( ) {
  var xhttp = new XMLHttpRequest();
  xhttp.onreadystatechange = function() {
    if (this.readyState == 4 && this.status == 200) {
      document.getElementById("dayStamp").innerHTML = this.responseText;
    }
  };
  xhttp.open("GET", "/dayStamp", true);
  xhttp.send();
}, 10000 ) ;
```

```
</script>
</html>)rawliteral";

// Replaces placeholder with DHT values
String processor(const String& var){
  //Serial.println(var);
  if(var == "TEMPERATURE"){
    return String(t);
  }
  if(var == "HUMIDITY"){
    return String(h);
  }
  if(var == "TIMESTAMP"){
    return String(timeStamp);
  }
  else if(var == "DAYSTAMP"){
    return String(dayStamp);
  }
  return String();
}

void data_hora() {
  while(!timeClient.update()) {
    timeClient.forceUpdate();
  }
  // The formattedDate comes with the following format:
  // 2018-05-28T16:00:13Z
  // We need to extract date and time
  formattedDate = timeClient.getFormattedDate();
  Serial.println(formattedDate);

  // Extract date
  int splitT = formattedDate.indexOf("T");
  dayStamp = formattedDate.substring(0, splitT);
  Serial.print("DATA: ");
  Serial.println(dayStamp);
  // Extract time
  timeStamp = formattedDate.substring(splitT+1, formattedDate.length()-1);
  Serial.print("HORA: ");
  Serial.println(timeStamp);
  //delay(2000);
}



void setup(){
  // Serial port for debugging purposes
  Serial.begin(115200);
  dht.begin();

  // Connect to Wi-Fi
  WiFi.begin(ssid, password);
  Serial.println("Connecting to WiFi");
  while (WiFi.status() != WL_CONNECTED) {
    delay(1000);
    Serial.println(".");
  }

  // Print ESP8266 Local IP Address
  Serial.println(WiFi.localIP());

  // Route for root / web page
  server.on("/", HTTP_GET, [](AsyncWebServerRequest *request){
```

```
    request->send_P(200, "text/html", index_html, processor);
  });
  server.on("/temperature", HTTP_GET, [](AsyncWebServerRequest *request){
    request->send_P(200, "text/plain", String(t).c_str());
  });
  server.on("/humidity", HTTP_GET, [](AsyncWebServerRequest *request){
    request->send_P(200, "text/plain", String(h).c_str());
  });
    server.on("/timeStamp", HTTP_GET, [](AsyncWebServerRequest *request){
    request->send_P(200, "text/plain", String(timeStamp).c_str());
  });
    server.on("/dayStamp", HTTP_GET, [](AsyncWebServerRequest *request){
    request->send_P(200, "text/plain", String(dayStamp).c_str());
  });

  // Start server
  server.begin();

  // Initialize a NTPClient to get time
  timeClient.begin();
  // Set offset time in seconds to adjust for your timezone, for example:
  // GMT +1 = 3600
  // GMT +8 = 28800
  // GMT -1 = -3600
  // GMT 0 = 0
  timeClient.setTimeOffset(3600);
}


void loop(){
  unsigned long currentMillis = millis();

  data_hora();
  if (currentMillis - previousMillis >= interval) {
    // save the last time you updated the DHT values
    previousMillis = currentMillis;
    // Read temperature as Celsius (the default)
    float newT = dht.readTemperature();
    // Read temperature as Fahrenheit (isFahrenheit = true)
    //float newT = dht.readTemperature(true);
    // if temperature read failed, don't change t value
    if (isnan(newT)) {
      Serial.println("Failed to read from DHT sensor!");
    }
    else {
      t = newT;
      Serial.println(t);
    }
    // Read Humidity
    float newH = dht.readHumidity();
    // if humidity read failed, don't change h value
    if (isnan(newH)) {
      Serial.println("Failed to read from DHT sensor!");
    }
    else {
      h = newH;
      Serial.println(h);
    }
  }
  delay(1000);
}
```

Bonecos

https://use.fontawesome.com/releases/v5.7.2/css/all.css

exemplo: desenho bateria

```
fa-battery-empty:before{content:"\f244"}.fa-battery-full:before{content:"\
f240"}.fa-battery-half:before{content:"\f242"}.fa-battery-
quarter:before{content:"
```

colocar no código: fa-battery-full

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