Operational Equipment Efficieny Sensing

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🧐 About

This repo contains

- Firmware
- Circuit Diagram
- Detailed instructions

for OEESensing project.

Getting Started

These instructions will get you a copy of the project up and running on your system.

Prerequisites

Things you need to install the FW.

```
- Arduino IDE
```

Installing

A step by step series that tell you how to get the Firmware and Backend running

ESP32 Configuration

You should have Arduino IDE Installed

1. Add ESP32 Board to your Arduino IDE 1. In your Arduino IDE, go to File> Preferences Installing ESP32 Add-on in Arduino IDE Windows, Mac OS X, Linux open preferences 2. Enter `https://dl.espressif.com/dl/package_esp32_index.json` into the “Additional Board Manager URLs” field then, click the “OK” button: Note: if you already have the ESP32 boards URL, you can separate the URLs with a comma(each board will go to neaw line) as follows: `https://dl.espressif.com/dl/package_esp32_index.json,\n http://arduino.esp8266.com/stable/package_esp8266com_index.json`
2. Open the Boards Manager. Go to Tools > Board > Boards Manager...
3. Search for ESP32 and press install button for the ESP32 by Espressif Systems“:
4. That’s it. It should be installed after a few seconds.
5. In your Arduino sketchbook directory, create tools directory if it doesn't exist yet.
6. Unpack the tool into tools directory(present in libs/ESP32FS-1.0.zip) (the path will look like <home_dir>/Arduino/tools/ESP32FS/tool/esp32fs.jar).
7. Close and re-open the Arduino IDE.
8. Now copy the contents of the libs folder to the libraries directory of your Arduino
    1. If you are using windows, the libraries directory will be Documents/Arduino/libraries

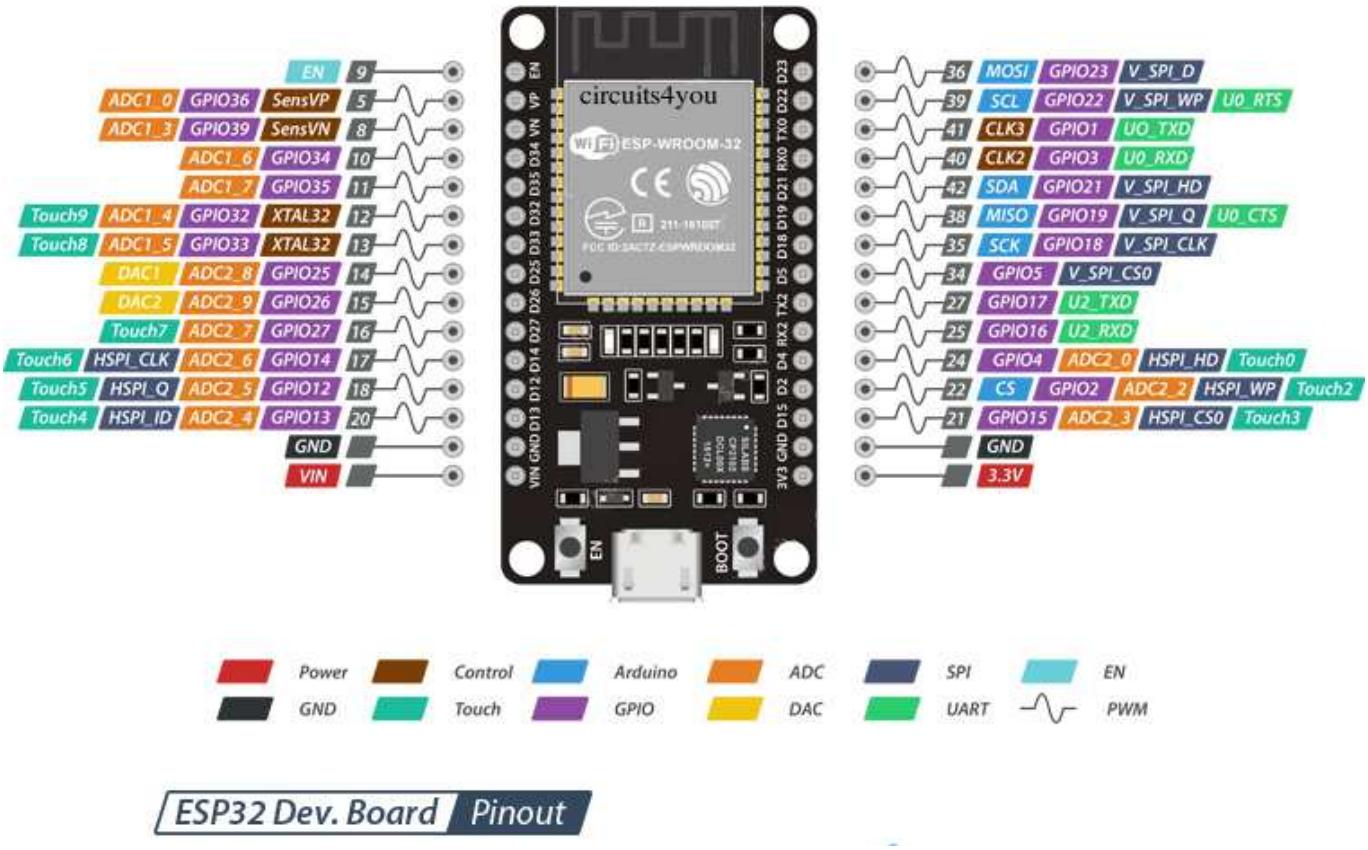
ESP32 Node FW Uploading

1. Select ESP32 Dev Module from Tools->Board->ESP32
2. Select the correct port from Tools->Port
3. Then open Firmware.ino file,
4. Select Tools > ESP32 Sketch Data Upload menu item. This should start uploading the files into ESP32 flash file system.
5. Now Upload the Code to your ESP32 Dev Module.
6. Your ESP32 is now ready to be used.

Circuit

ESP32 Dev Module Pinout

Follow the pinout diagram given below to connect different components to your TTGO LORA32 board.



Other Components

```
Other components pin connection details
```

Temperature Sensor DHT22

DHT22 Connections

DHT22 Pins	ESP32 Dev Module Pins
DATA OUT	23
VCC	5V
GND	GND

Vibration Sensor(MPU6050)

MPU6050 Connections

MPU6050 Pins	ESP32 Dev Module
SCL	22
SDA	21
VCC	3.3V

MPU6050 Pins	ESP32 Dev Module
GND	GND

Status LED

LED Connections

LED Pins	ESP32 Dev Module
Anode	D2 via 220Ω resistor
Cathode	GND

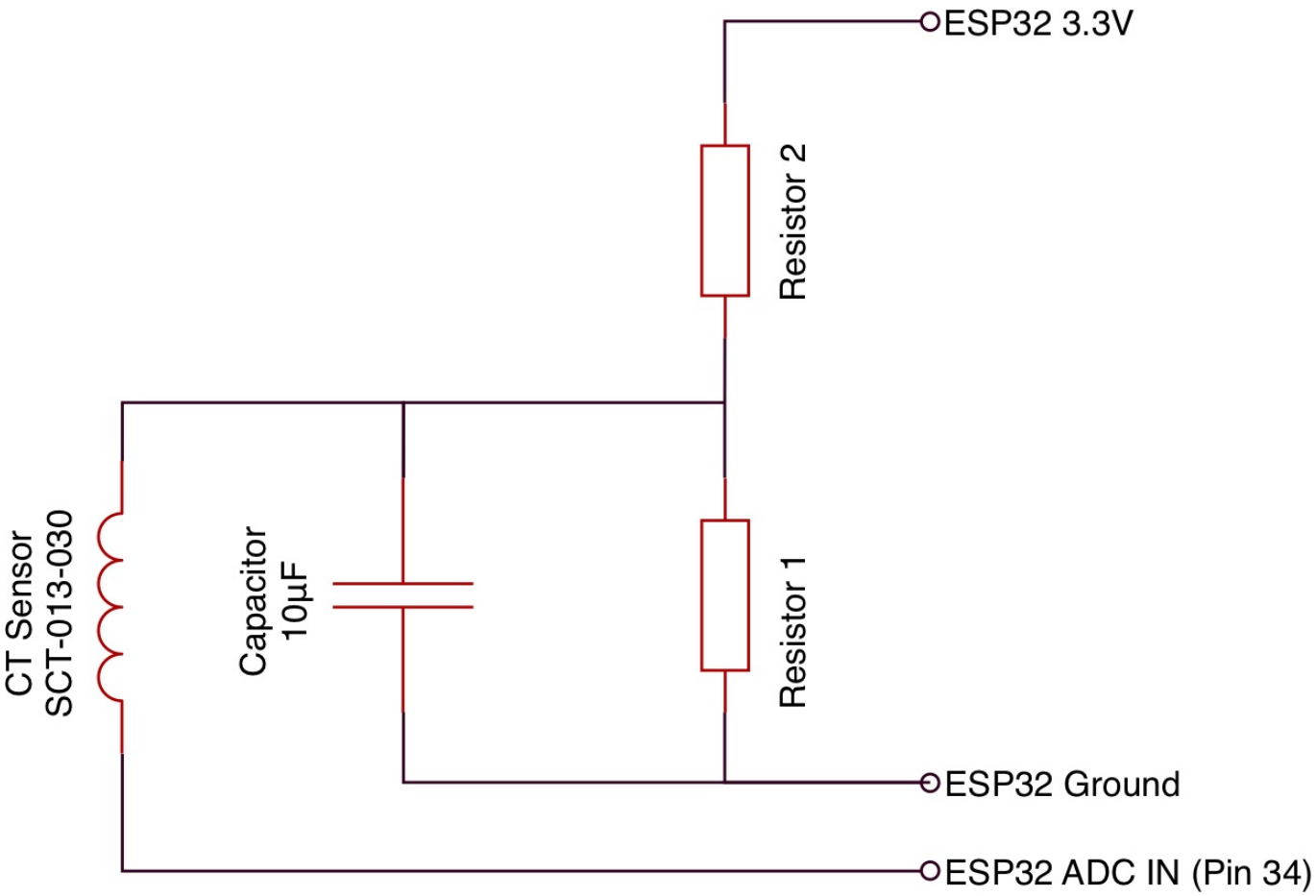
D2 is also connected to the internal LED of ESP32 Dev Module

SCT-013

SCT-013 Connections

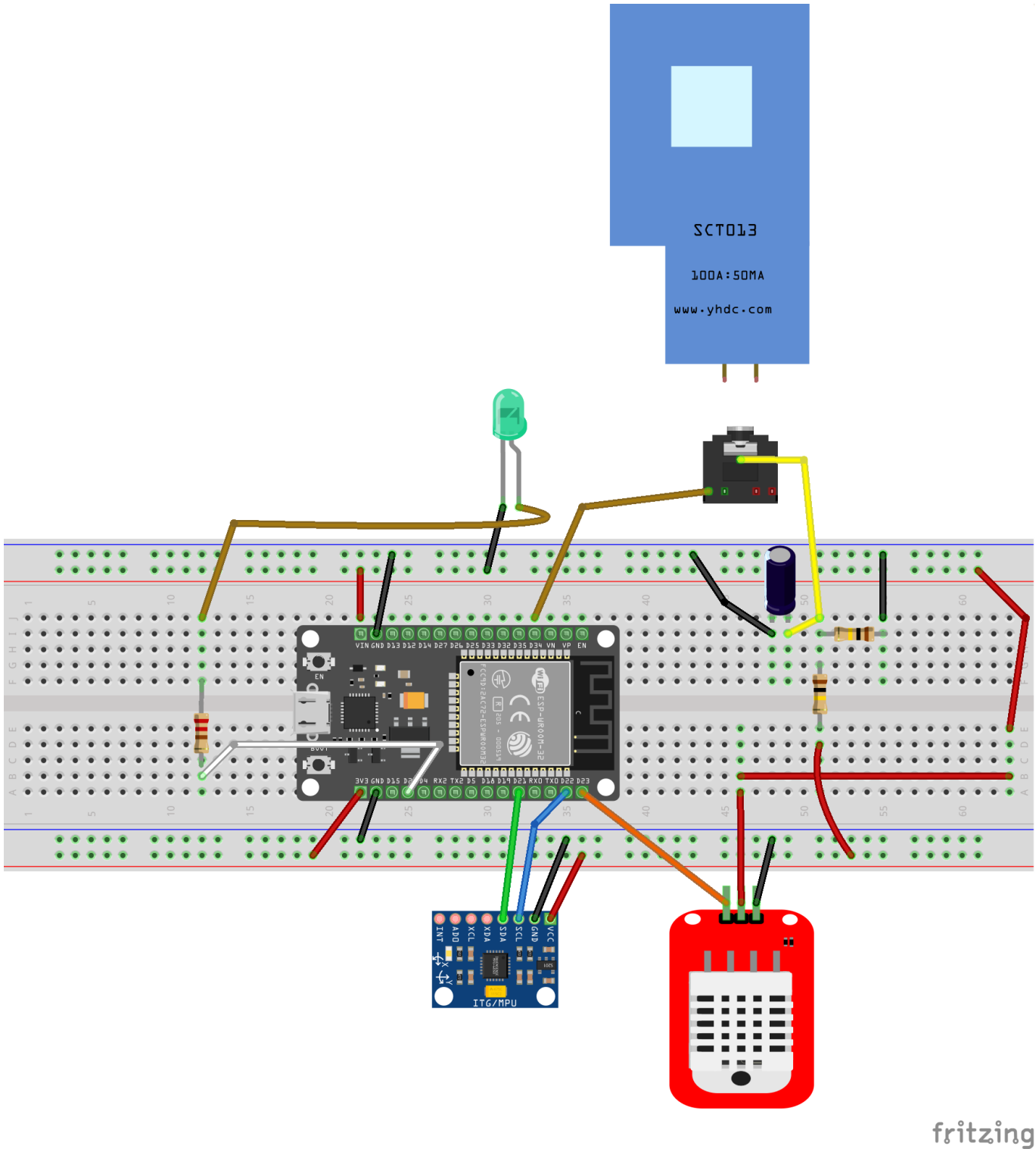
- Voltage Divider with 2x 100KΩ resistors.
- 10uF capacitor connected between Voltage Divider Circuit Output and GND
- 3.5mm Audio Jack connected between Voltage Divider Circuit Output and ESP32 Pin 34.

The overall SCT-013 connection assembly will look something like shown in the diagram below.



Complete Circuit Diagram

Here's the complete circuit diagram of the system.

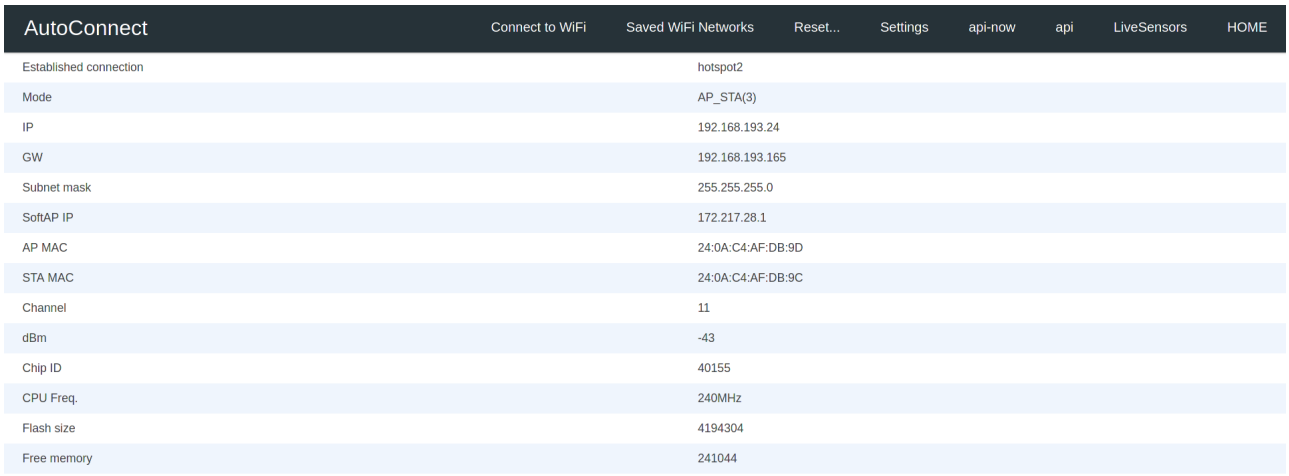


Usage

1. Power on your ESP32, it will present you with an AP named `OEE-someID` (while `OEE` can be changed in the portal)
2. Default captive portal password `12345678AP` which can be changed in captive portal.
3. Connect to the ESP32 access point and open the web-browser and navigate to the link `http://esp32.local/_ac`. This link will work on most of the operating systems but if your

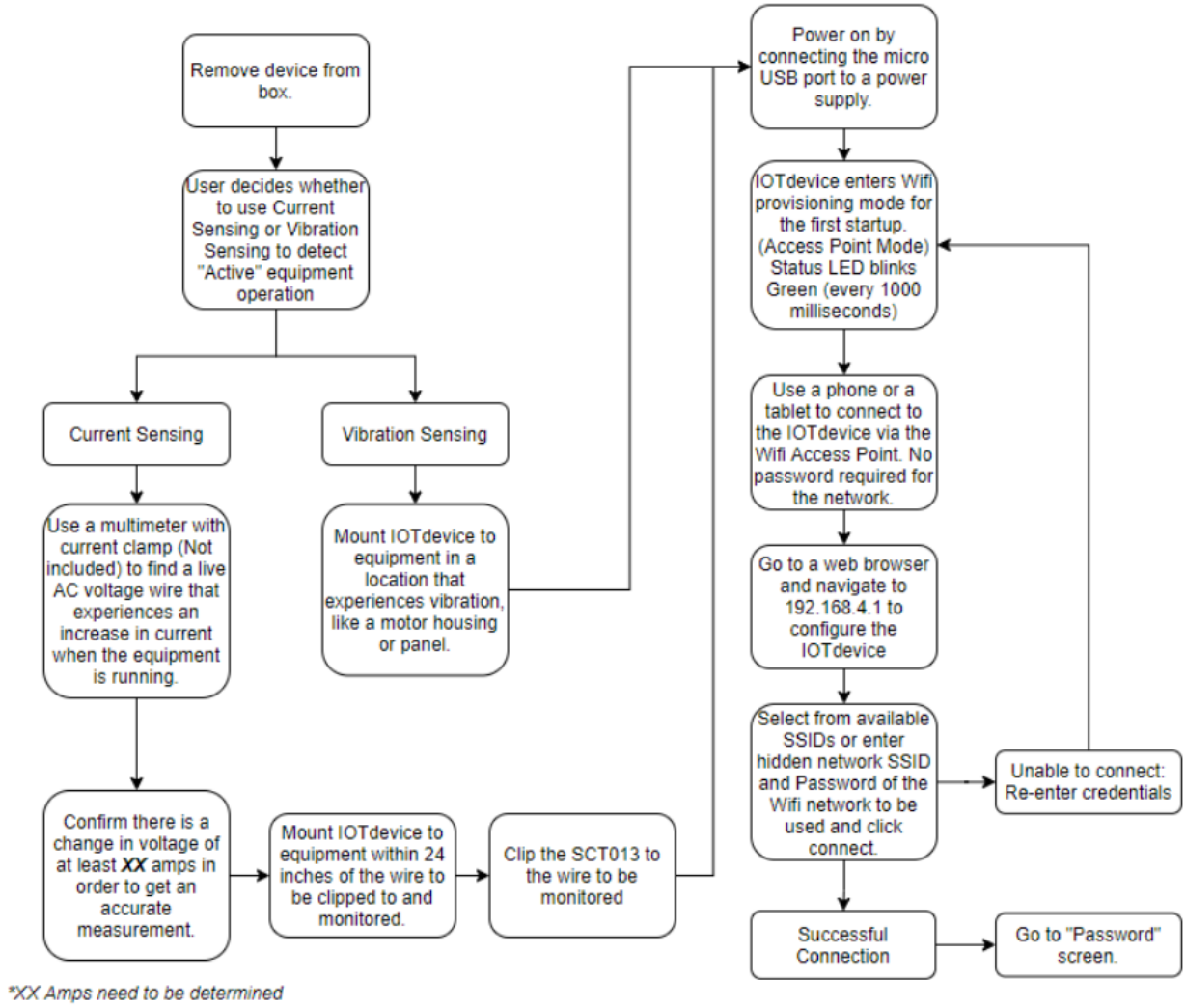
operating system is not allowing to open it, you may want to check the captive portal IP Address from the serial monitor and can use that IP address inplace of the above mentioned URL.

4. The default access IP Address is `http://172.217.28.1/_ac`
5. You will be presented with a main dashboard as shown below(based on your device)



6. Once connected to a WiFi network, you can again access the captive portal using same URL or the IP Address from the Serial monitor.
7. The data is published to the MQTT Topic `OEE/{hostname}` while the hostname is the one which you can define in Settings page of the captive portal.

The whole system is following the flowchart given below:

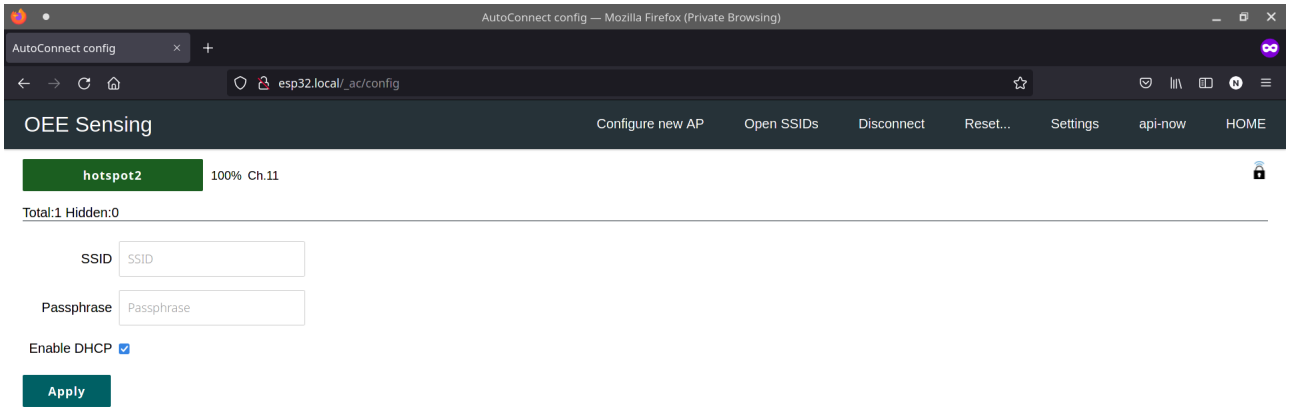


API Endpoints and HTML URLS

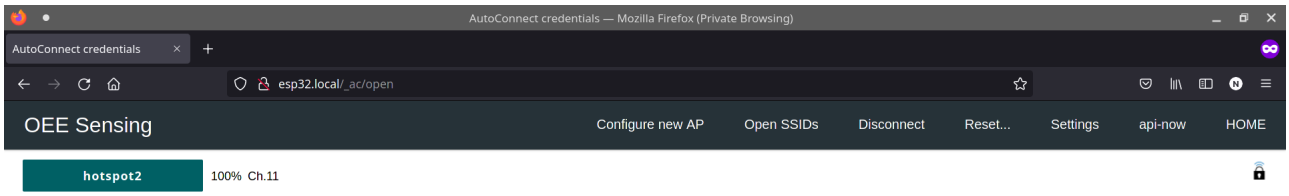
API Endpoints

Endpoint	Description
/api-now	API: live sensor readings in JSON format
/api	API: historical sensors data in JSON format
/LiveSensors	HTML PAGE: Live Sensor Data
/data	HTML PAGE: Historical Sensor Data
/_ac	HTML PAGE: Main Captive portal page
/	HTML PAGE: Historical Sensor Data

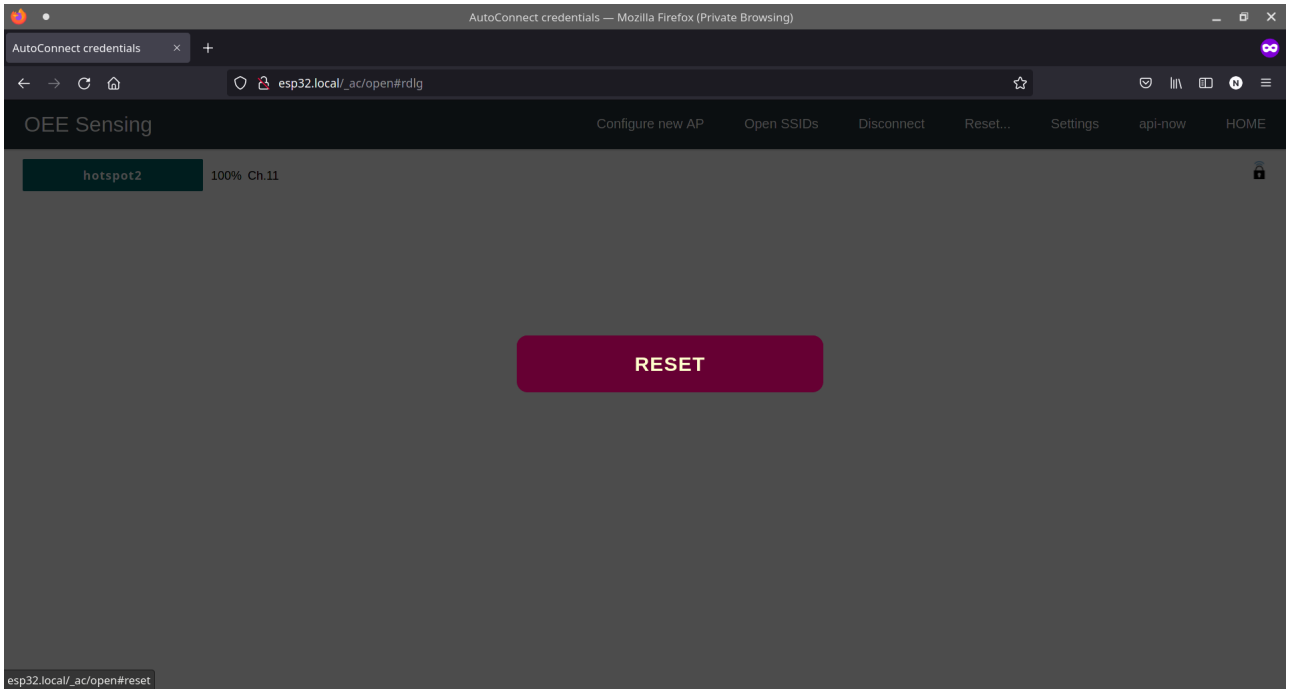
1. **Connect to WiFi** tab allows searching of nearby WiFi APs and adding them to the ESP32.



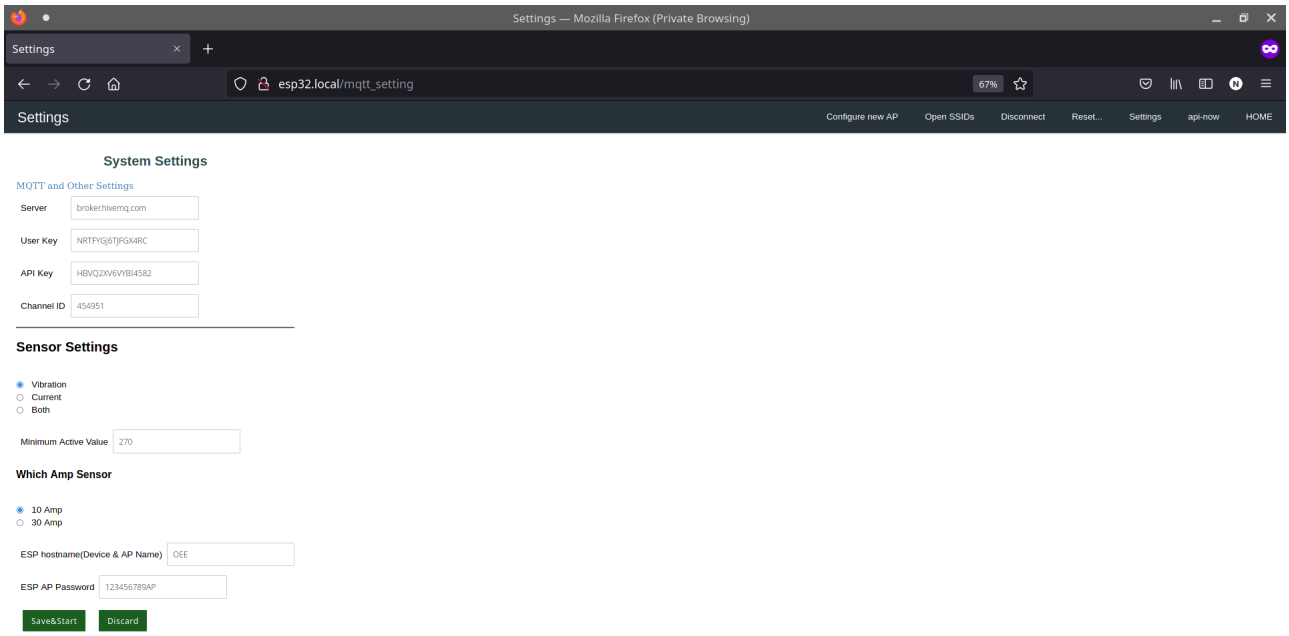
2. **Saved WiFi Networks** tab allows connecting to the saved access points.



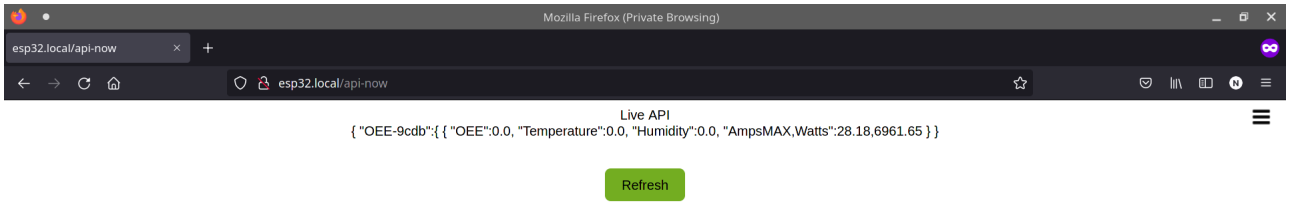
3. **Reset...** tab allows reseting of the device to factory settings.



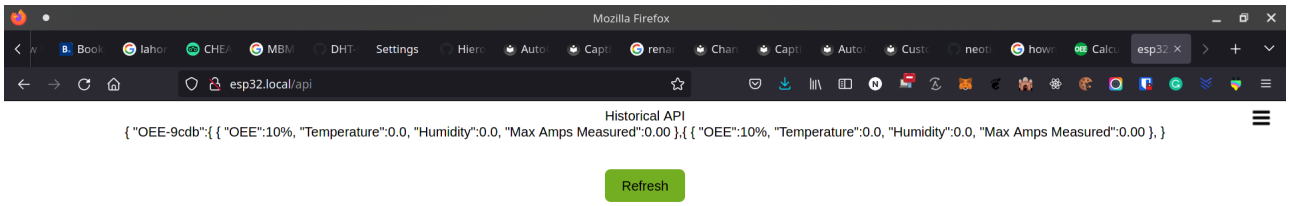
4. **Settings** tab contains settings related to MQTT and sensors.



5. **api-now** tab gives the live-sensor data in JSON format.

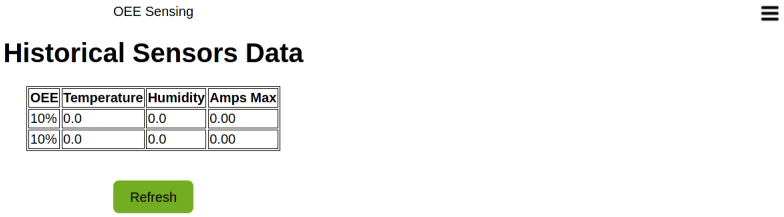


6. **api** tab gives the historical sensor data acquired after every 5 mintues.



7. **LiveSensors** tab shows live values of the sensors.

8. **HOME** tab shows historical sensor data in a HTML table form acquired after every 5 minutes.



List of Components

Following components are used to make this project

1. ESP32 Dev Kit Module https://www.amazon.com/HiLetgo-ESP-WROOM-32-Development-Microcontroller-Integrated/dp/B0718T232Z/ref=sr_1_3?crid=5EOAXOANUSCU&dchild=1&keywords=esp32+nodemcu&qid=1629587138&sprefix=esp32+node%2Caps%2C201&sr=8-3

2. Current Sensor (SCT-013) https://www.amazon.com/dp/B083S6YG36/ref=sspa_dk_detail_2?psc=1&pd_rd_i=B083S6YG36&pd_rd_w=lyRRH&pf_rd_p=887084a2-5c34-4113-a4f8-b7947847c308&pd_rd_wg=ARQkk&pf_rd_r=9X6KNTP47QE6X1QG8RGX&pd_rd_r=92990704-e6cd-4c90-9b74-93726cb99938&smid=A1G4TRJSF885ET&spLa=ZW5jcnlwdGVkUXVhbGlmaWVyPUFWVzdCSUhXNFU2VEwmZW5jcnlwdGVkSWQ9QTAxODU2MTcxQjNFVUI5M1ZTSUEwJmVuY3J5cHRlZEFkSWQ9QTA3OTA4NTcxR0ZGQ1JOQUFHSFFPJndpZGdldE5hbWU9c3BfZGV0YWlsJmFjdGlvbj1jbGlja1JlZGlyZWN0JmRvTm90TG9nQ2xpY2s9dHJ1ZQ==

3. DHT22 Temperature and Humidity Sensor https://www.amazon.com/Gowoops-Temperature-Humidity-Measurement-Raspberry/dp/B073F472JL/ref=sr_1_7?

dchild=1&keywords=dht22&qid=1624855583&sr=8-7

4. Vibration Sensor (IMU) (MPU6050) https://www.amazon.com/HiLetgo-MPU-6050-Accelerometer-Gyroscope-Converter/dp/B00LP25V1A/ref=sr_1_1?dchild=1&keywords=mpu6050&qid=1624855642&sr=8-1
5. Generic 3.5mm Green LED
6. Generic 3.5mm Audio Jack
7. Generic 10uF 25v Capacitor
8. Generic 220Ω and 100KΩ resistors
9. Generic 5V USB Micro B cable and adapter.

⛏ Built Using

- Python - For Cloud Gateway Pogramming
- Arduino - Embedded Framework and IDE - For Sensor Node Design

✍ Authors

- @Nauman3S - Development and Deployment