# SciTinyML

Scientific Use of Machine Learning on Low Power Devices

## Regional Workshop - Africa

# Arduino Nano-33 BLE Sense EI set-up and Getting Started with Edge Impulse

*Marcelo Rovai*
*Professor, UNIFEI - Brazil*

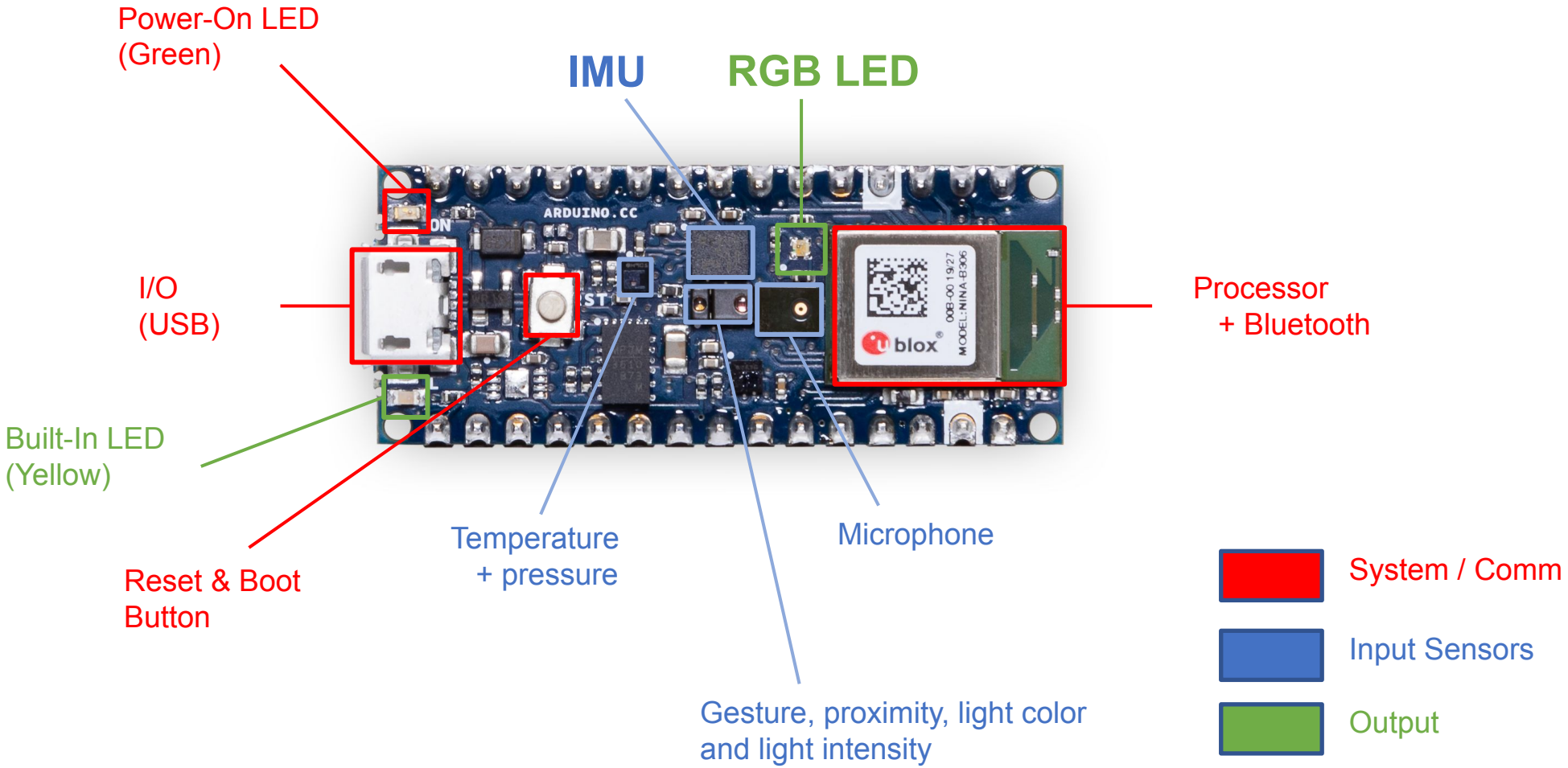
*Shawn Himel*
*Senior DevRel Engineer, Edge Impulse*

# Arduino Nano-33 BLE

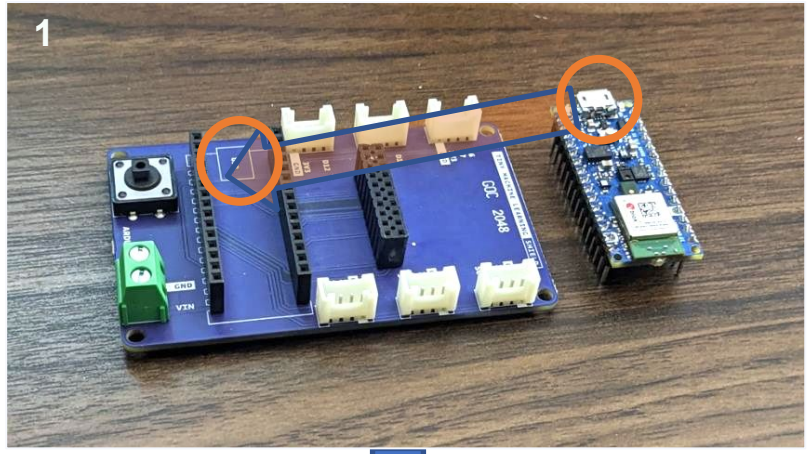
## Set up board and Arduino IDE

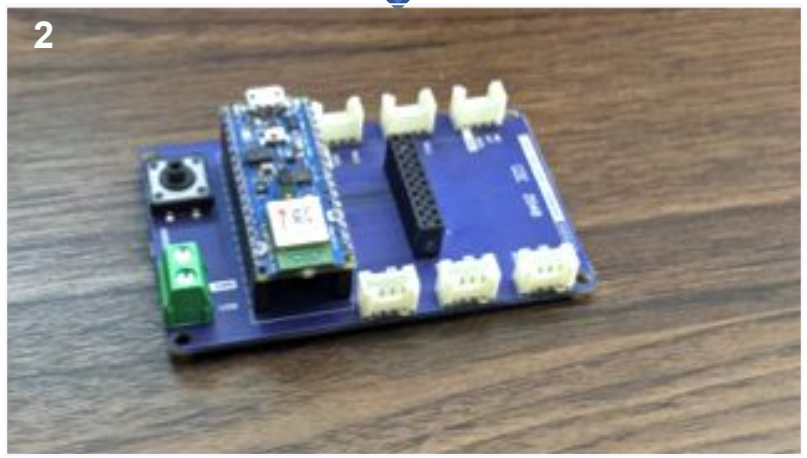

ARDUINO
TINY MACHINE
LEARNING KIT
in partnership with:
edX
TensorFlow
OV7675

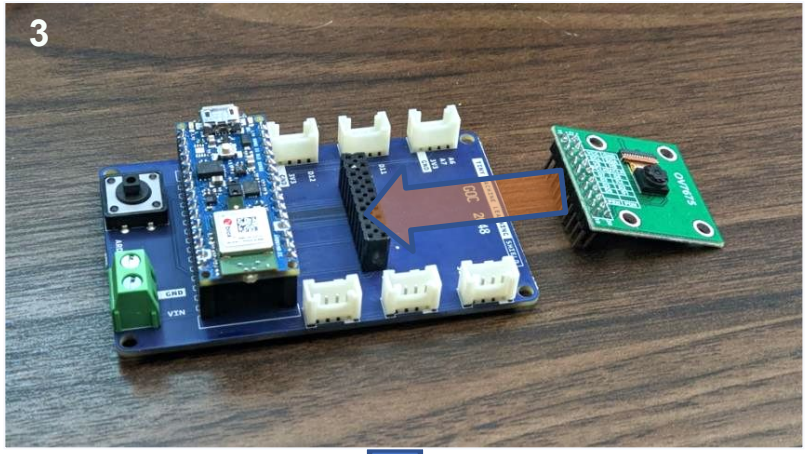
# Nano 33 BLE Sense (Development board)

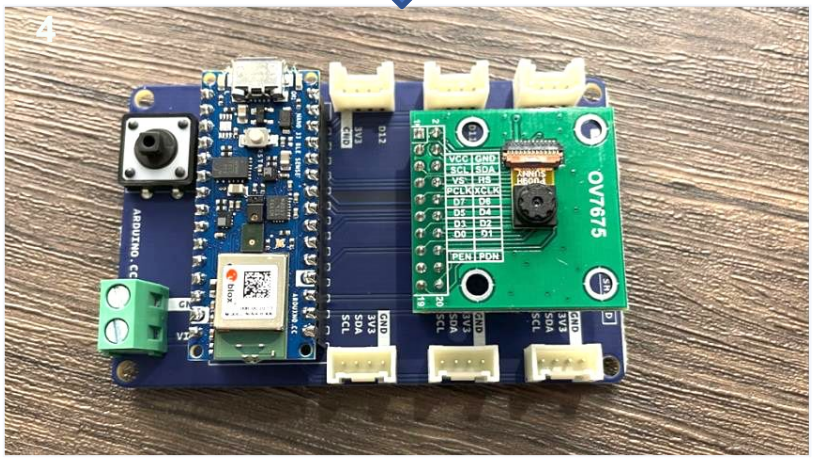


# Installing the Hardware

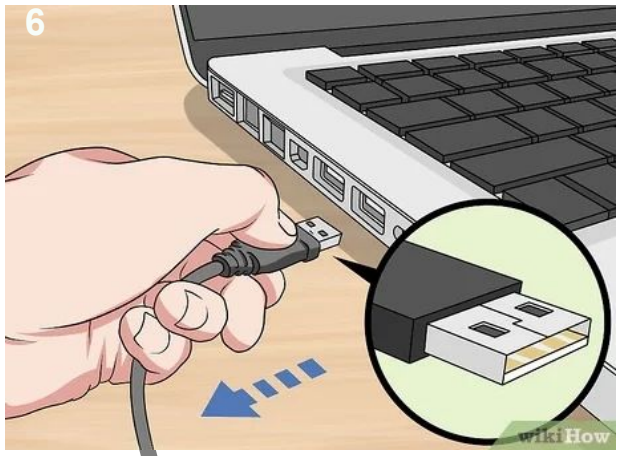


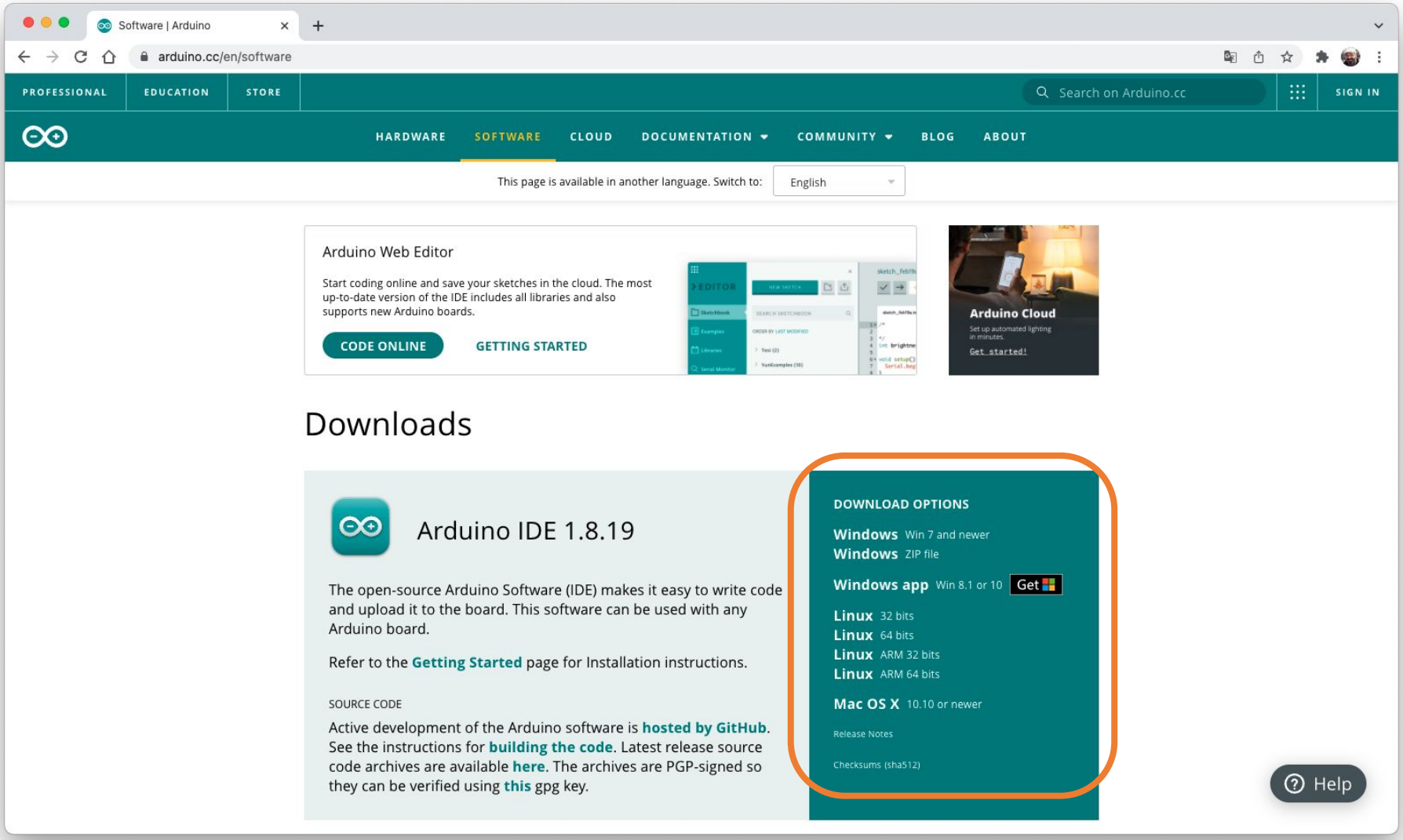



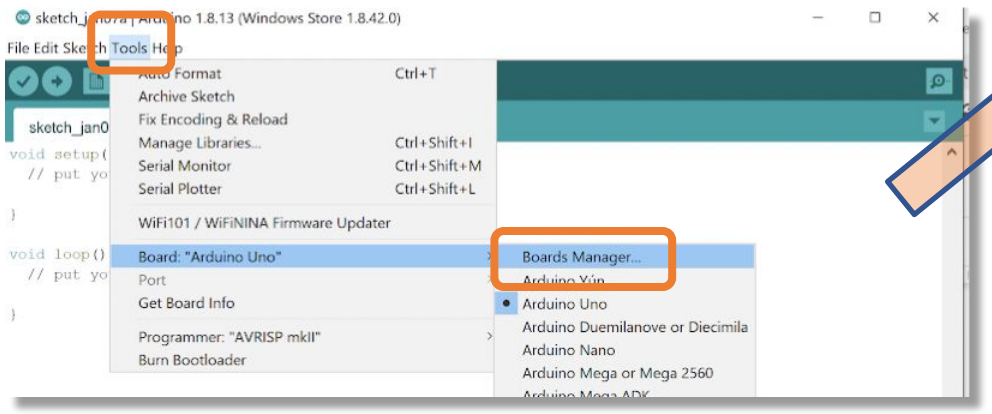


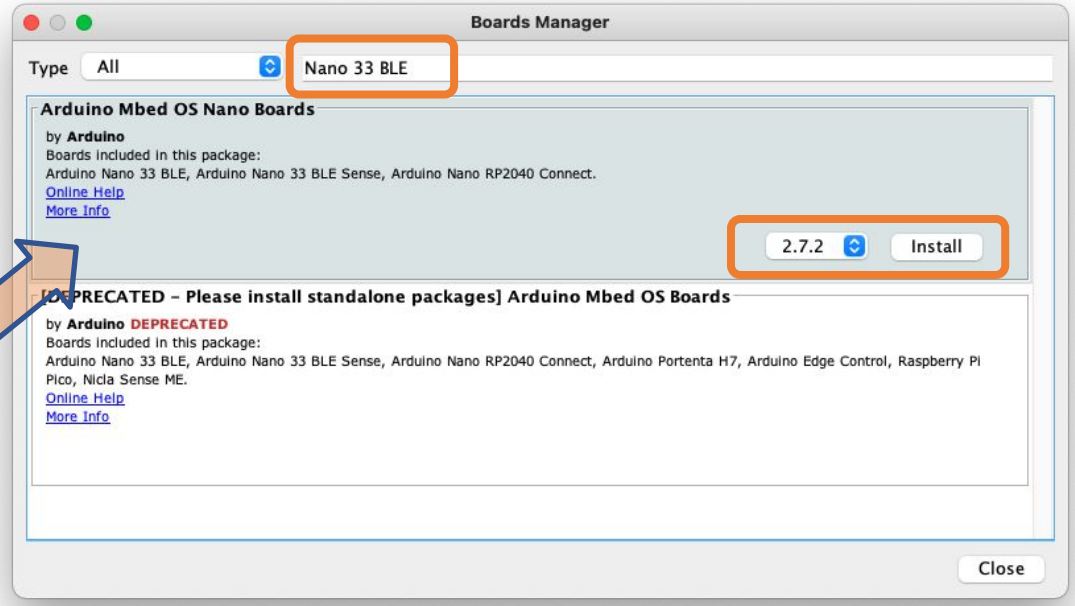


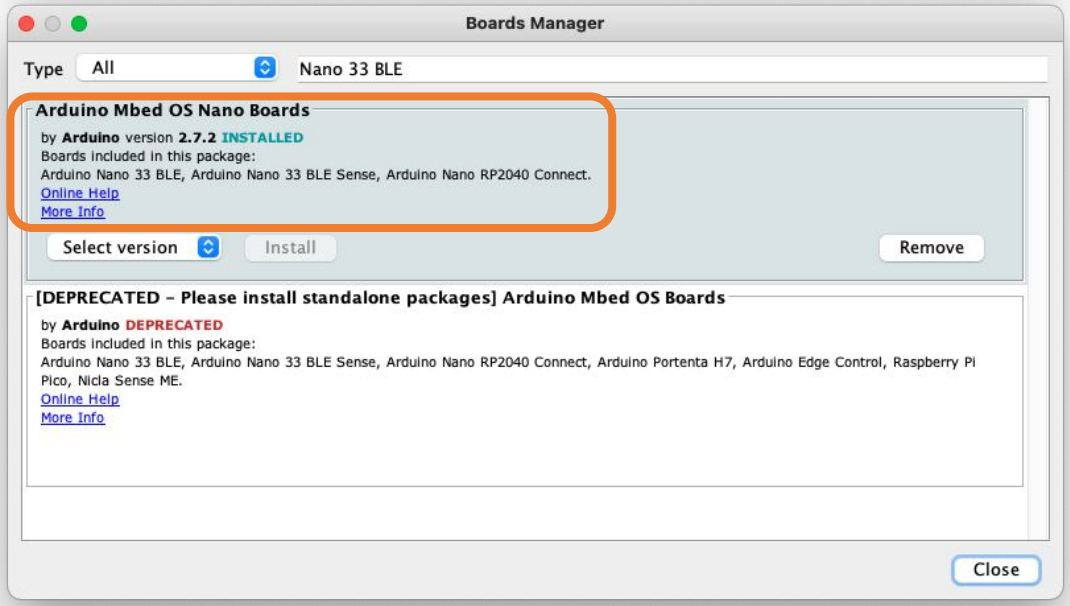
# Installing the Arduino IDE



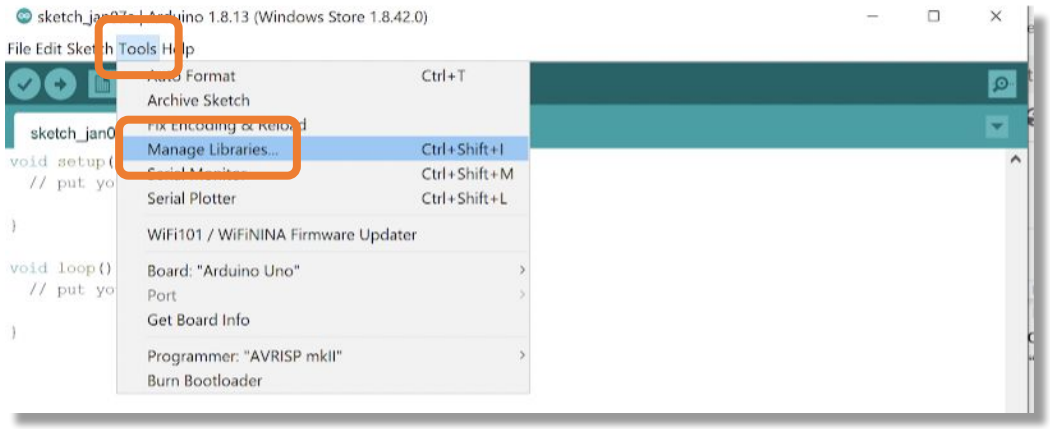
# Installing the Board Files

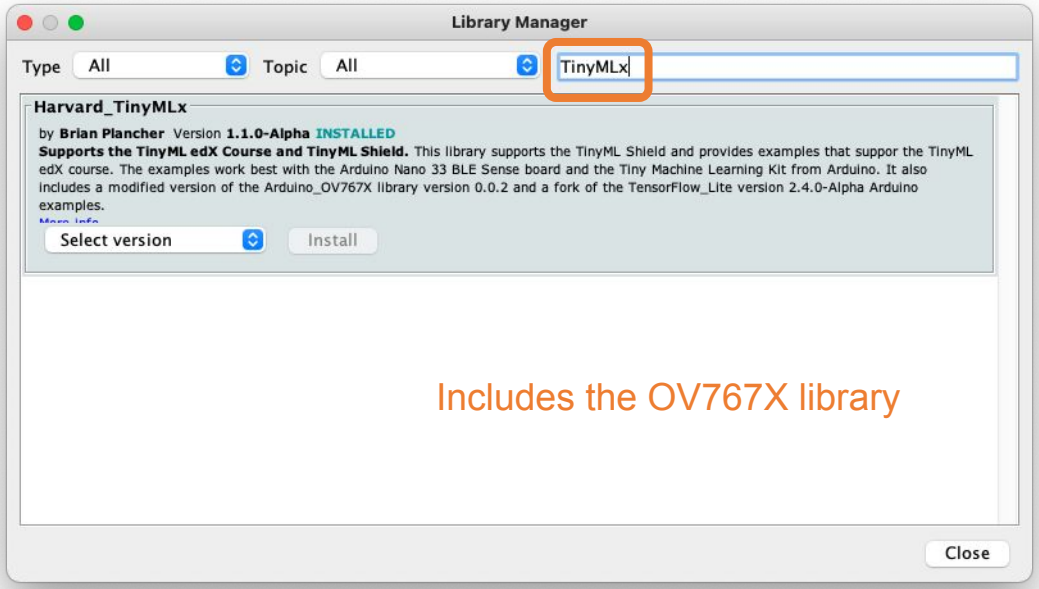


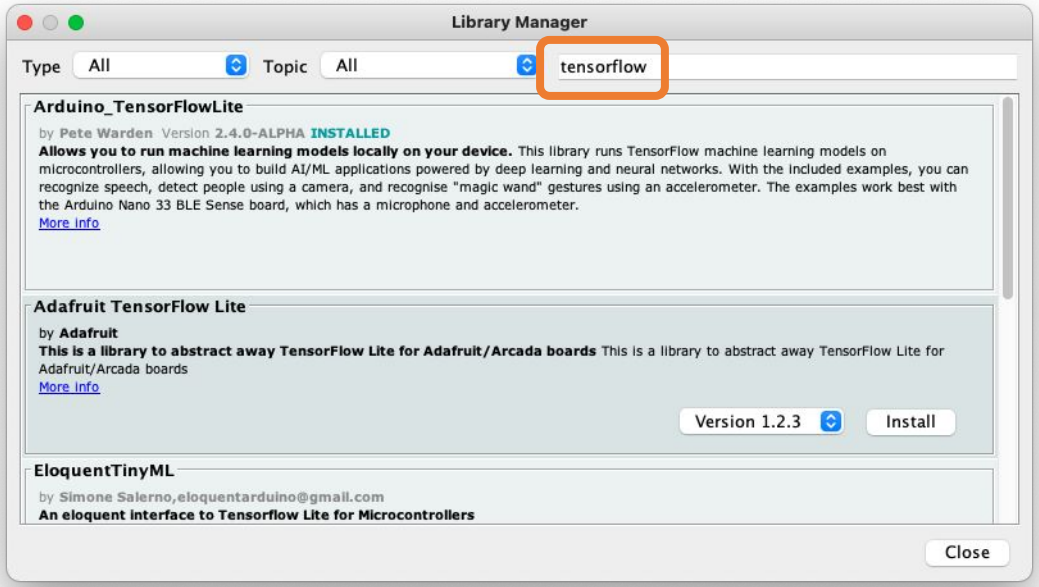



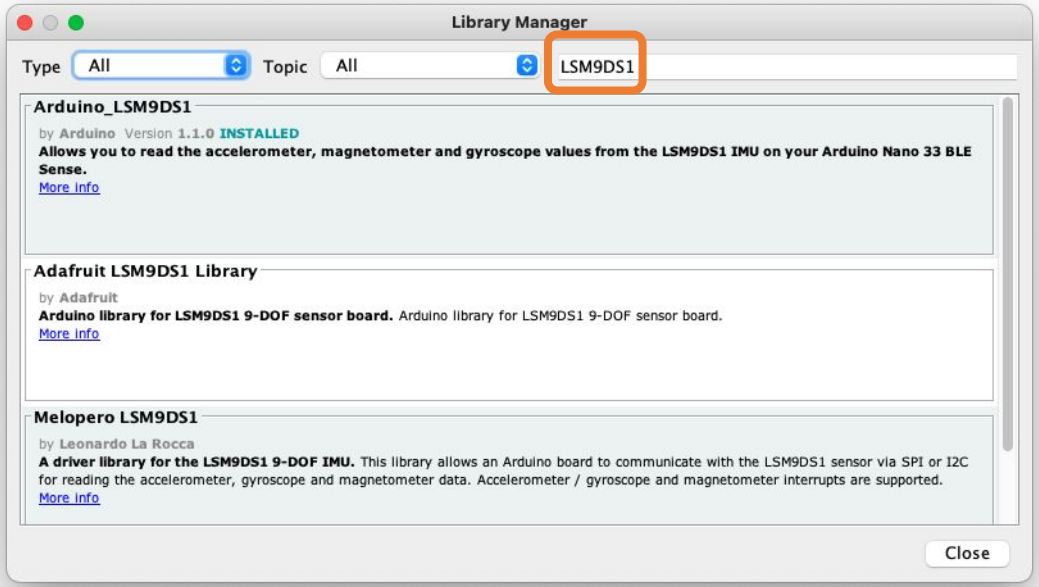
# Installing the Main Libraries



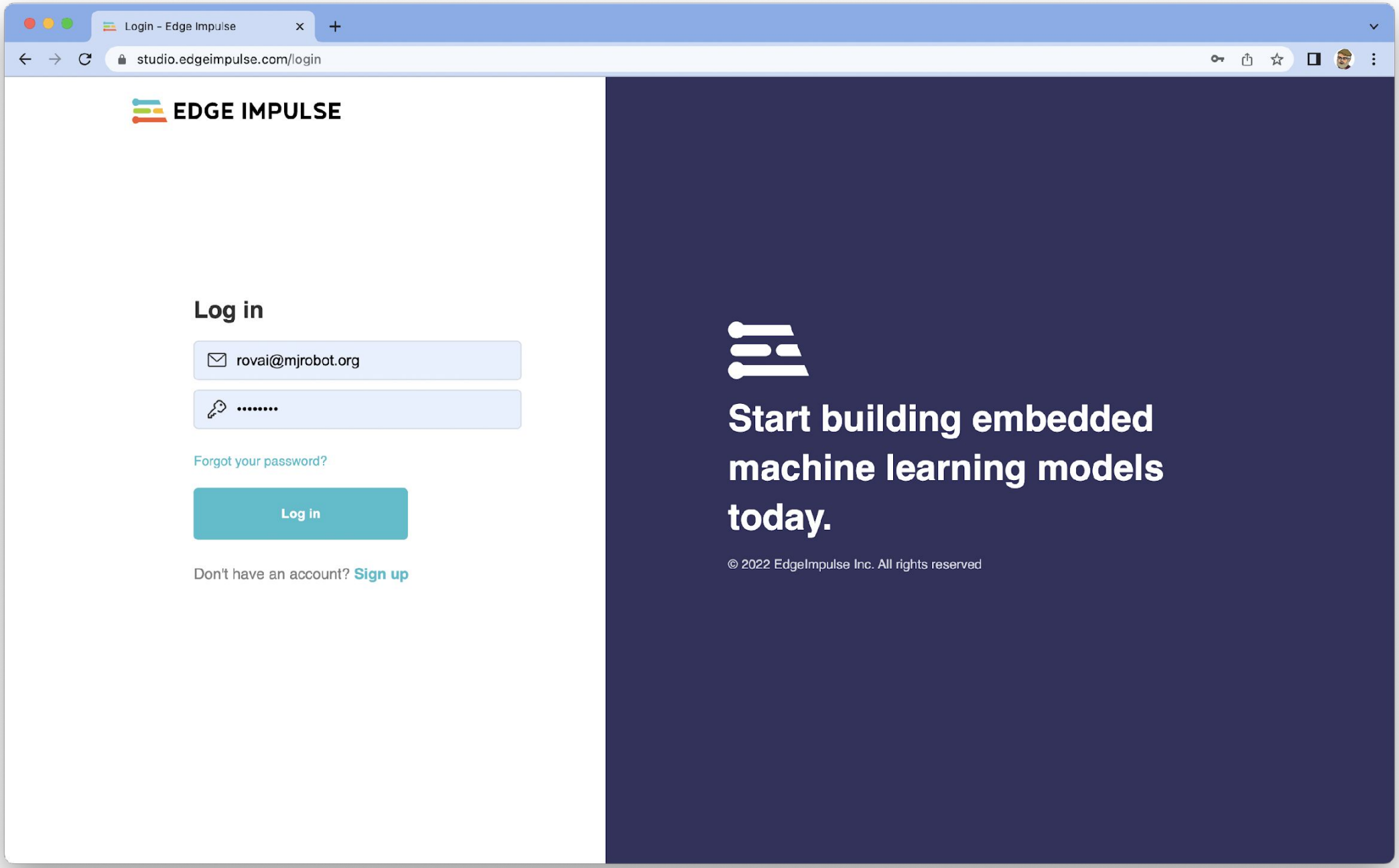




Includes the OV767X library



# Set up connection between Arduino Nano and Edge Impulse


Login - Edge Impulse
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Log in
rovai@mjrobot.org
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Forgot your password?
Log in
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Start building embedded machine learning models today.
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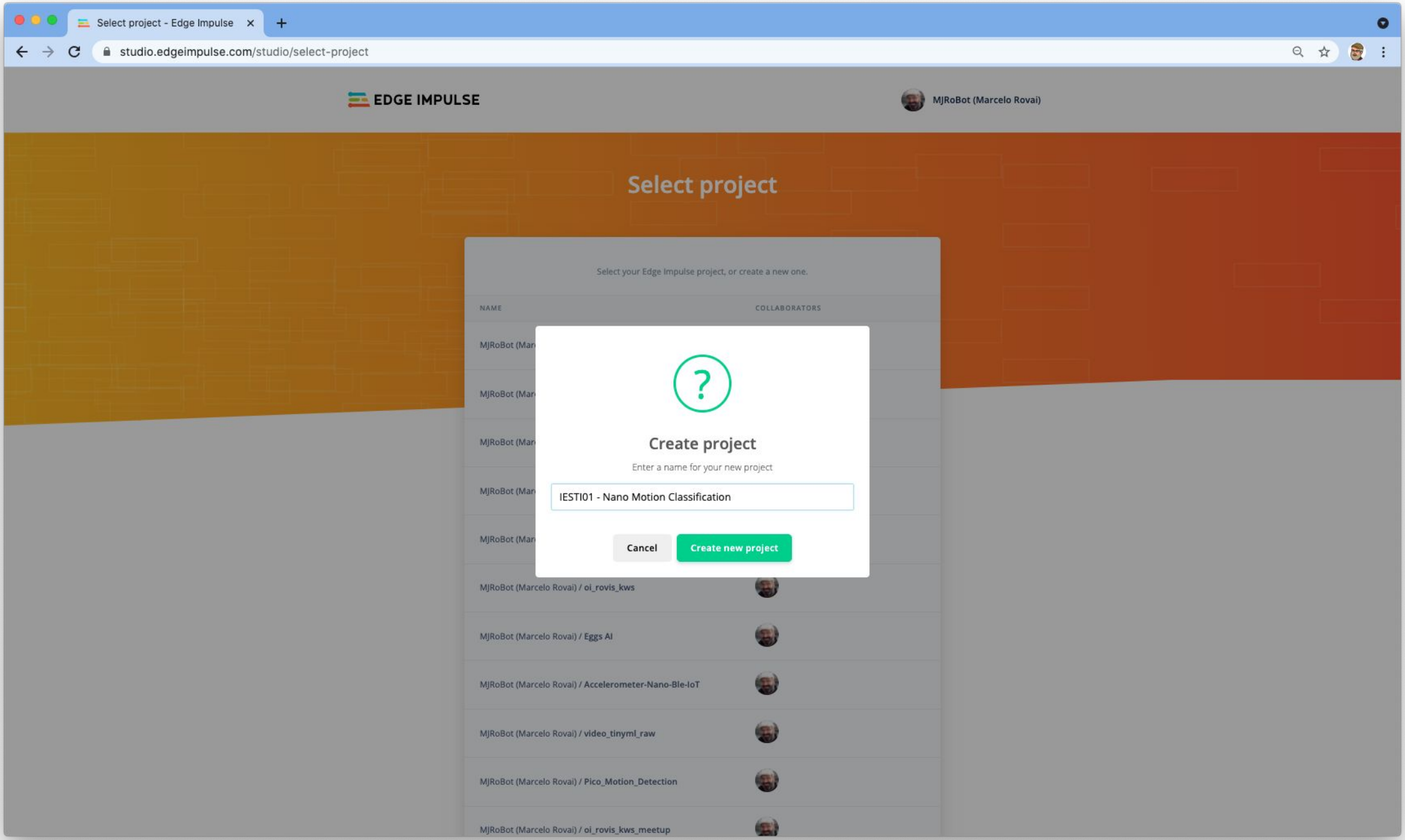
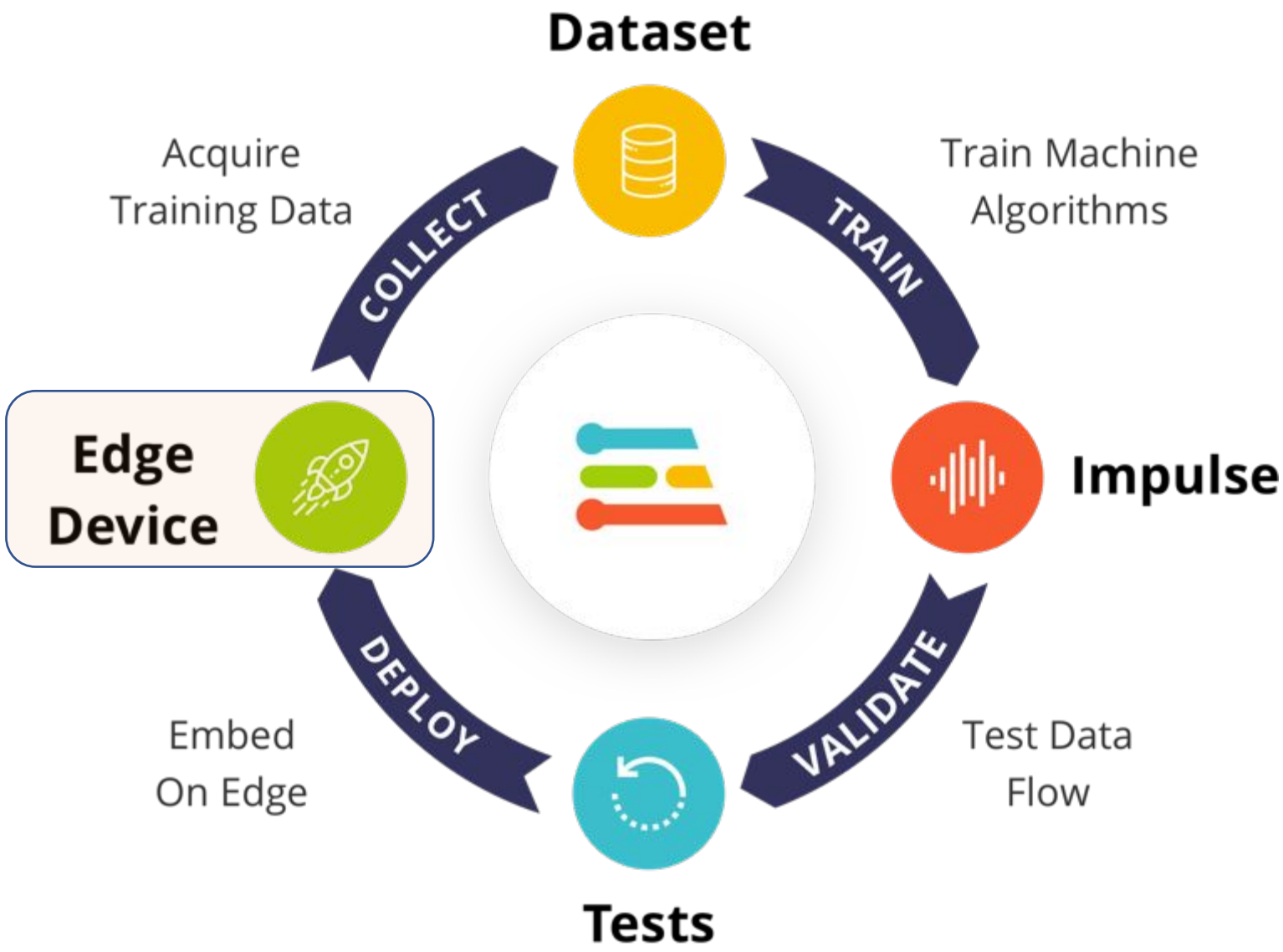
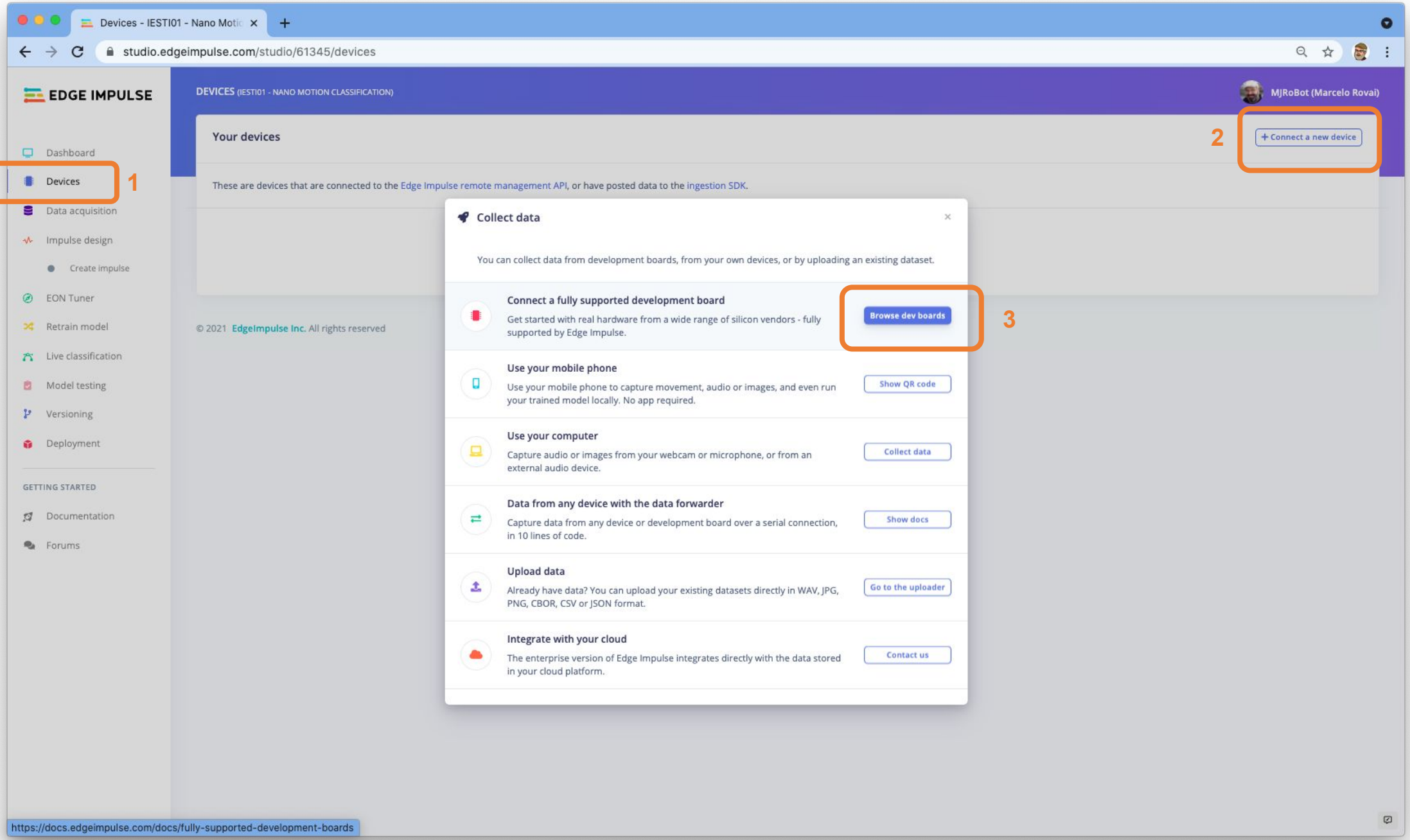

Select project - Edge Impulse
studio.edgeimpulse.com/studio/select-project
EDGE IMPULSE
MJRoBot (Marcelo Rovai)
Select project
Select your Edge Impulse project, or create a new one.
NAME
COLLABORATORS
Create project
Enter a name for your new project
IESTI01 - Nano Motion Classification
Cancel
Create new project
MJRoBot (Marcelo Rovai) / oi_rovis_kws
MJRoBot (Marcelo Rovai) / Eggs AI
MJRoBot (Marcelo Rovai) / Accelerometer-Nano-Ble-IoT
MJRoBot (Marcelo Rovai) / video_tinyml_raw
MJRoBot (Marcelo Rovai) / Pico_Motion_Detection
MJRoBot (Marcelo Rovai) / oi_rovis_kws_meetup




- Pre-Processing Data
- Design a Model
- Train a Model


Devices - IESTI01 - Nano Motic
studio.edgeimpulse.com/studio/61345/devices
EDGE IMPULSE
DEVICES (IESTI01 - NANO MOTION CLASSIFICATION)
MJRoBot (Marcelo Rovai)
Dashboard
Devices
1
Data acquisition
Impulse design
Create impulse
EON Tuner
Retrain model
Live classification
Model testing
Versioning
Deployment
GETTING STARTED
Documentation
Forums
Your devices
2
+ Connect a new device
These are devices that are connected to the Edge Impulse remote management API, or have posted data to the ingestion SDK.
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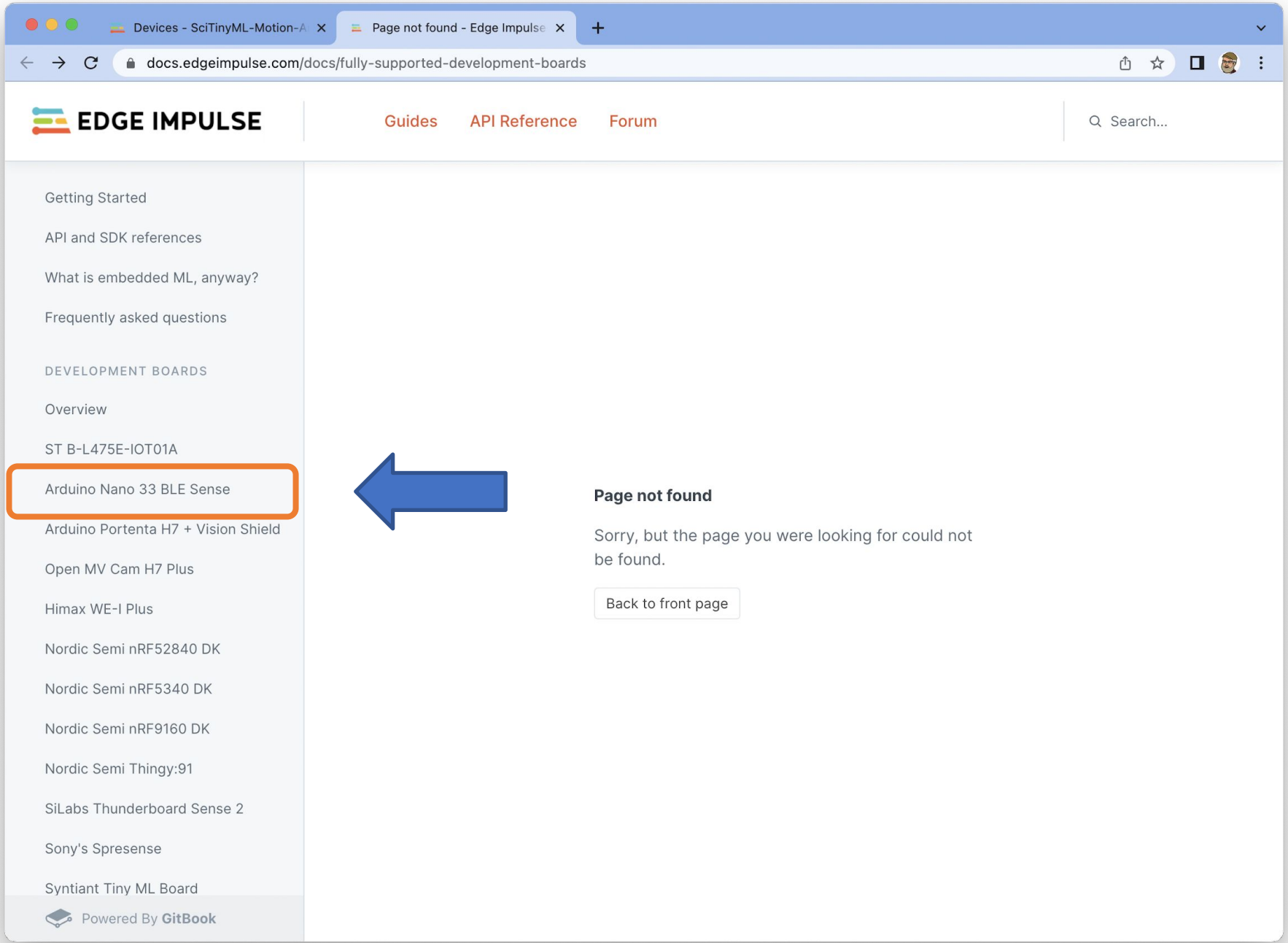
Collect data
You can collect data from development boards, from your own devices, or by uploading an existing dataset.
Connect a fully supported development board
Get started with real hardware from a wide range of silicon vendors - fully supported by Edge Impulse.
Browse dev boards
3
Use your mobile phone
Use your mobile phone to capture movement, audio or images, and even run your trained model locally. No app required.
Show QR code
Use your computer
Capture audio or images from your webcam or microphone, or from an external audio device.
Collect data
Data from any device with the data forwarder
Capture data from any device or development board over a serial connection, in 10 lines of code.
Show docs
Upload data
Already have data? You can upload your existing datasets directly in WAV, JPG, PNG, CBOR, CSV or JSON format.
Go to the uploader
Integrate with your cloud
The enterprise version of Edge Impulse integrates directly with the data stored in your cloud platform.
Contact us
https://docs.edgeimpulse.com/docs/fully-supported-development-boards


Devices - SciTinyML-Motion-A
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EDGE IMPULSE
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Forum
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Getting Started
API and SDK references
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Frequently asked questions
DEVELOPMENT BOARDS
Overview
ST B-L475E-IOT01A
Arduino Nano 33 BLE Sense
Arduino Portenta H7 + Vision Shield
Open MV Cam H7 Plus
Himax WE-I Plus
Nordic Semi nRF52840 DK
Nordic Semi nRF5340 DK
Nordic Semi nRF9160 DK
Nordic Semi Thingy:91
SiLabs Thunderboard Sense 2
Sony's Spresense
Syntiant Tiny ML Board
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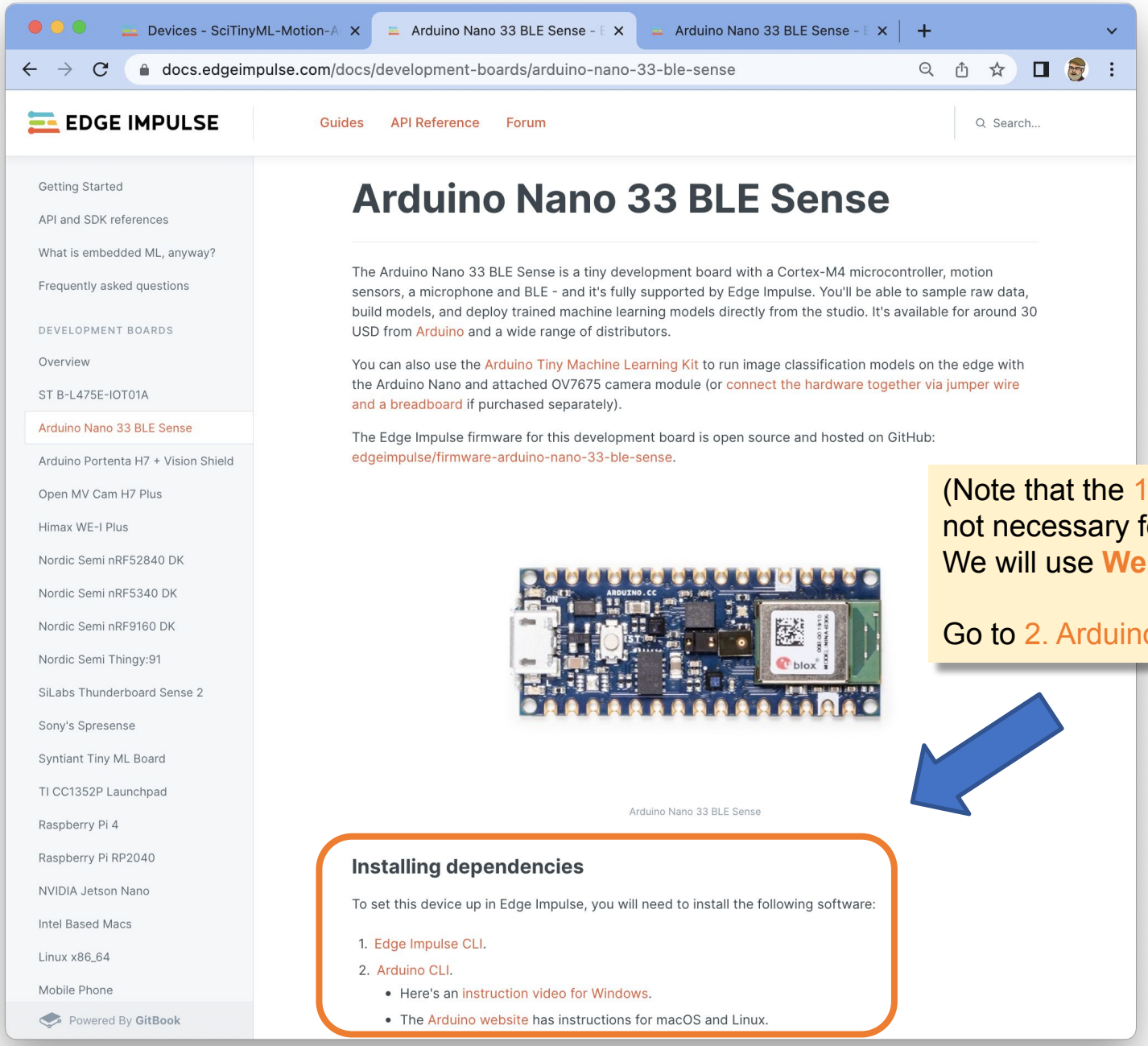
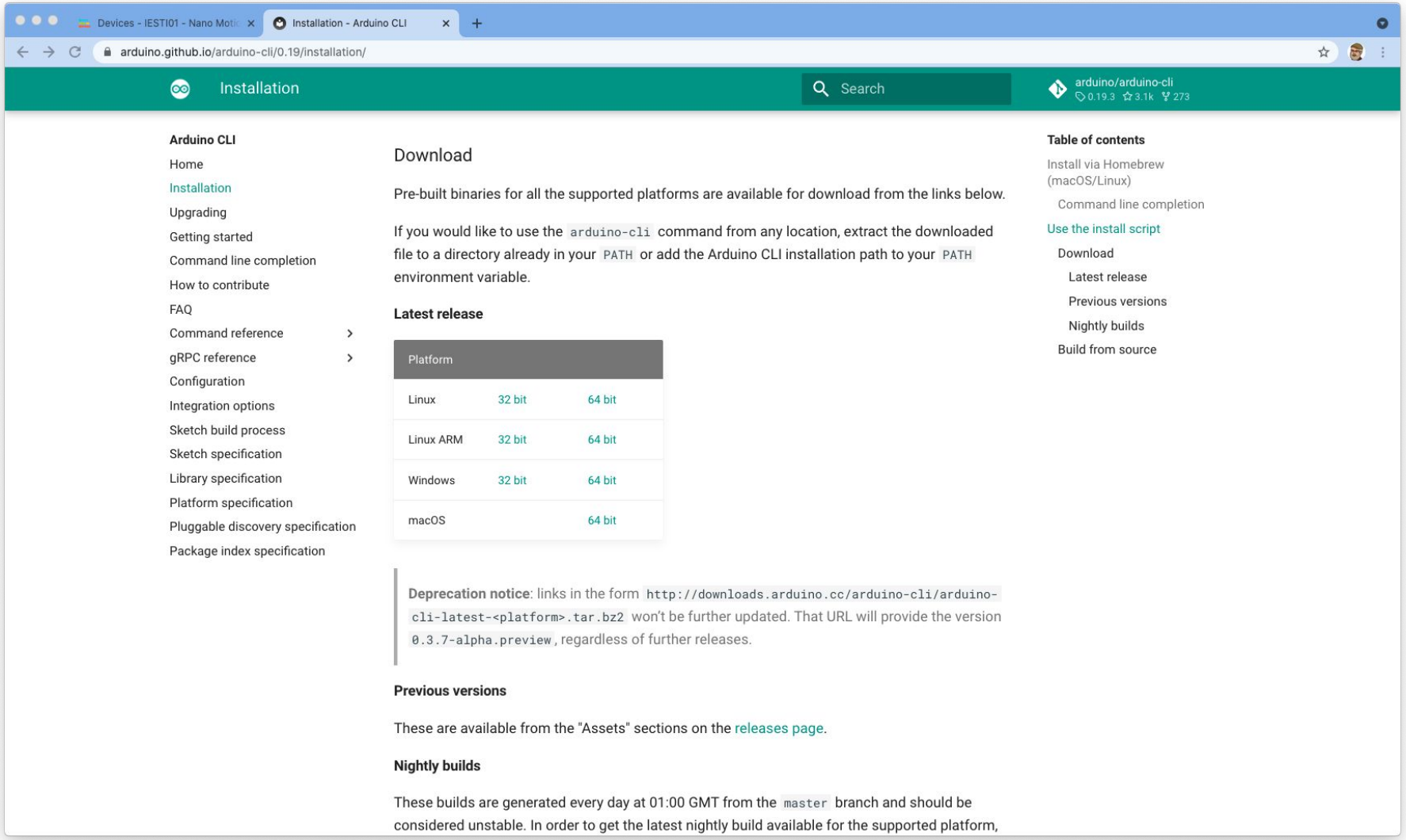
# EI/Arduino CLI

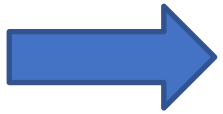



(Note that the 1. Edge Impulse CLI is not necessary for Arduino Nano-33. We will use **WebUSB** insteady)

Go to 2. Arduino CLI

# Arduino CLI



[See this video for Windows installation: https://www.youtube.com/watch?v=1jMWsFER-Bc](https://www.youtube.com/watch?v=1jMWsFER-Bc)

Devices - SciTinyML-Motion-A | Arduino Nano 33 BLE Sense - | Installation - Arduino CLI

docs.edgeimpulse.com/docs/development-boards/arduino-nano-33-ble-sense

EDGE IMPULSE

Guides API Reference Forum

Search...

- Getting Started
- API and SDK references
- What is embedded ML, anyway?
- Frequently asked questions

DEVELOPMENT BOARDS

- Overview
- ST B-L475E-IOT01A
- Arduino Nano 33 BLE Sense
- Arduino Portenta H7 + Vision Shield
- Open MV Cam H7 Plus
- Himax WE-I Plus
- Nordic Semi nRF52840 DK
- Nordic Semi nRF5340 DK
- Nordic Semi nRF9160 DK
- Nordic Semi Thingy:91
- SiLabs Thunderboard Sense 2
- Sony's Spresense
- Syntiant Tiny ML Board

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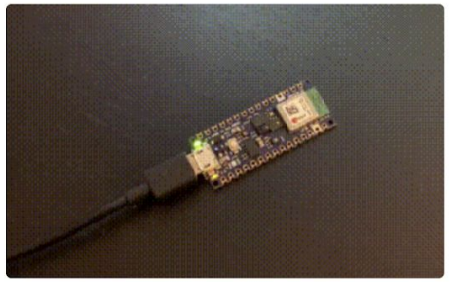
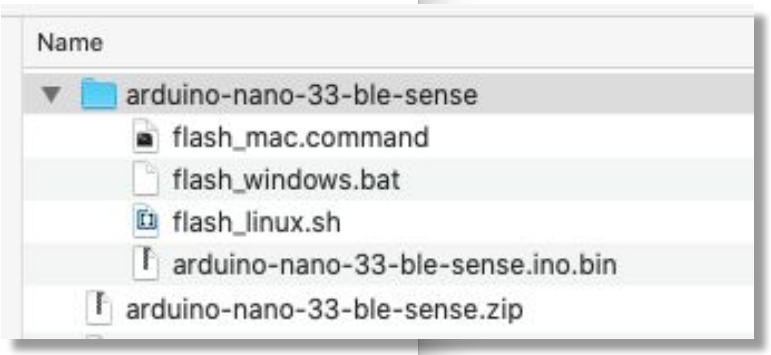
1

### 1. Connect the development board to your computer

Use a micro-USB cable to connect the development board to your computer. Then press RESET twice to launch into the bootloader. The on-board LED should start pulsating to indicate this.



Press RESET twice quickly to launch the bootloader on the Arduino Nano 33 BLE Sense.




2

### 2. Update the firmware

The development board does not come with the right firmware yet. To update the firmware:

1. Download the latest Edge Impulse firmware, and unzip the file.
2. Open the flash script for your operating system ( `flash_windows.bat` , `flash_mac.command` or `flash_linux.sh` ) to flash the firmware.
3. Wait until flashing is complete, and press the RESET button once to launch the new firmware.

3

### 3. Setting keys

From a command prompt or terminal, run:

```
edge-impulse-daemon
```

# MacOS

```
mjrovai — flash_mac.command — 126×44
Last login: Tue Nov  9 12:15:56 on ttys002
You have new mail.
/Users/mjrovai/Downloads/arduino-nano-33-ble-sense\ \(2\)/flash_mac.command ; exit;

The default interactive shell is now zsh.
To update your account to use zsh, please run `chsh -s /bin/zsh`.
For more details, please visit https://support.apple.com/kb/HT208050.
(base) MacBook-Pro-de-Marcelo:~ mjrovai$ /Users/mjrovai/Downloads/arduino-nano-33-ble-sense\ \(2\)/flash_mac.command ; exit;
Finding Arduino Mbed core...
Finding Arduino Mbed OK
Finding Arduino Nano 33 BLE...
Finding Arduino Nano 33 BLE OK
Flashing board...
Device        : nRF52840-QIAA
Version       : Arduino Bootloader (SAM-BA extended) 2.0 [Arduino:IKXYZ]
Address       : 0x0
Pages         : 256
Page Size     : 4096 bytes
Total Size    : 1024KB
Planes        : 1
Lock Regions  : 0
Locked        : none
Security      : false
Erase flash

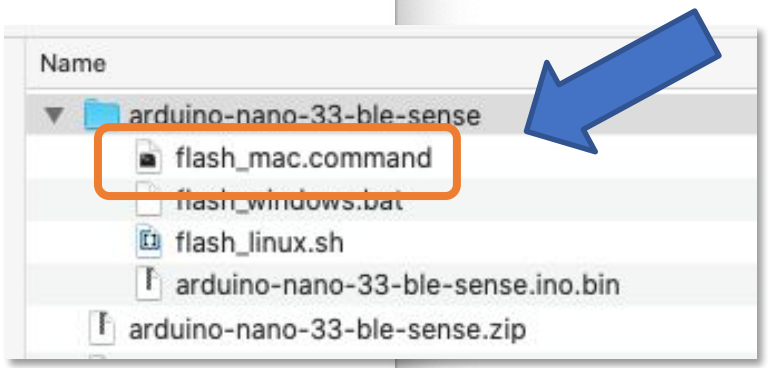
Done in 0.001 seconds
Write 280848 bytes to flash (69 pages)
[==============================] 100% (69/69 pages)
Done in 10.984 seconds

Flashed your Arduino Nano 33 BLE development board.
To set up your development with Edge Impulse, run 'edge-impulse-daemon'
To run your impulse on your development board, run 'edge-impulse-run-impulse'
logout
Saving session...
...copying shared history...
...saving history...truncating history files...
...completed.

[Process completed]
```

3.Nano-33 LED Stop Flashing

1. Press Nano-33 Reset button Twice
2. With Nano-33 LED Flashing:



# Windows 10

Prompt de Comando

```
Microsoft Windows [versão 10.0.19041.1052]
(c) Microsoft Corporation. Todos os direitos reservados.

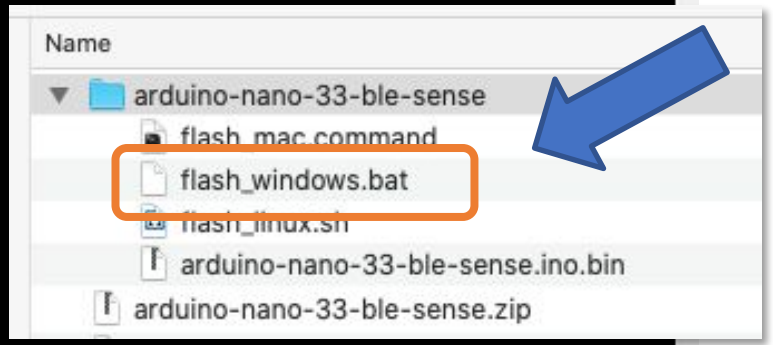
C:\Users\GUILH>arduino-cli
Arduino Command Line Interface (arduino-cli).

Usage:
  arduino-cli [command]

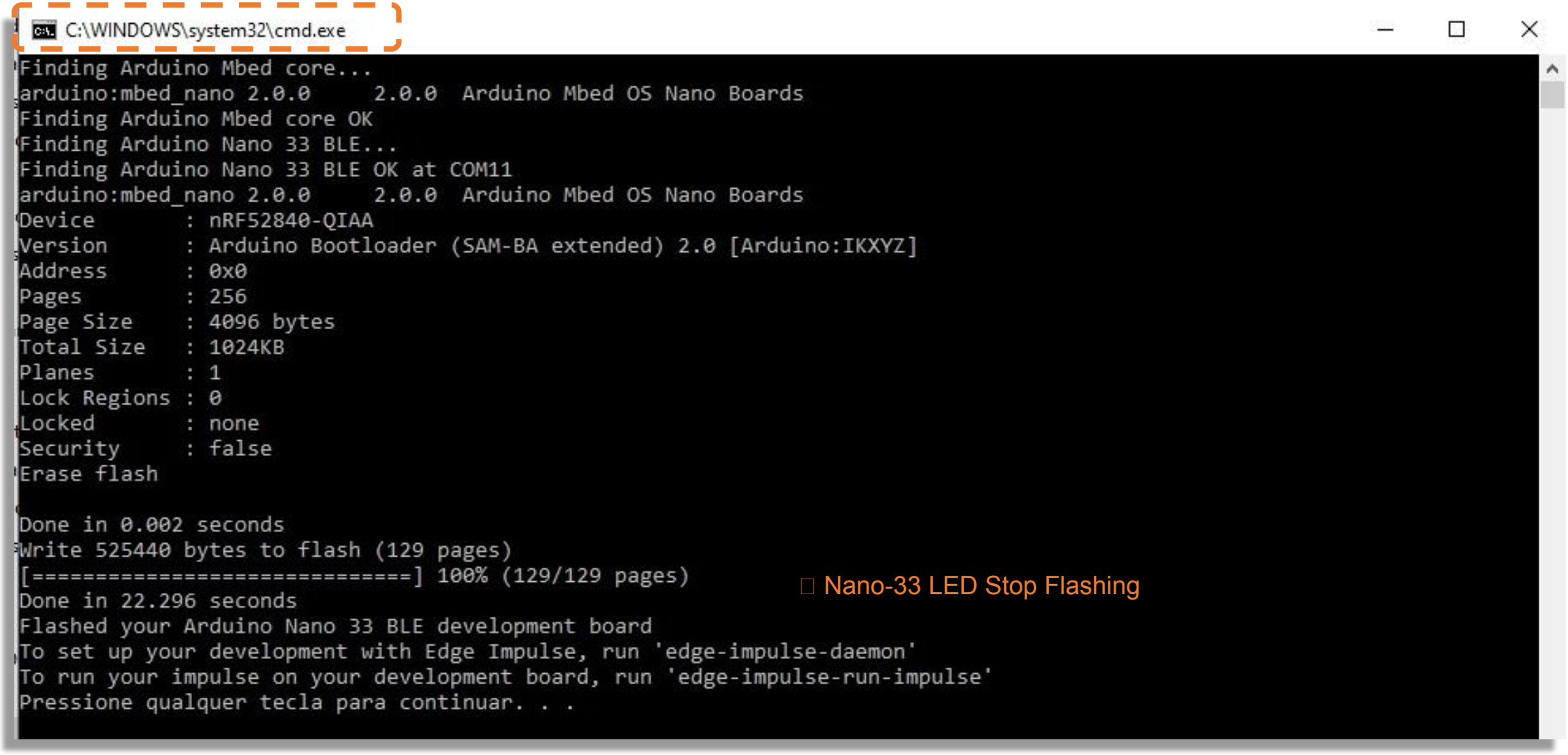
Examples:
  arduino-cli <command> [flags...]

Available Commands:
  board           Arduino board commands.
  burn-bootloader Upload the bootloader.
  cache           Arduino cache commands.
  compile         Compiles Arduino sketches.
  completion      Generates completion scripts
  config          Arduino configuration commands.
  core            Arduino core operations.
  daemon          Run as a daemon on port 50051
  debug           Debug Arduino sketches.
  help            Help about any command
  lib             Arduino commands about libraries.
  outdated        Lists cores and libraries that can be upgraded
  sketch          Arduino CLI sketch commands.
  update          Updates the index of cores and libraries
  upgrade         Upgrades installed cores and libraries.
  upload          Upload Arduino sketches.
  version         Shows version number of Arduino CLI.
```

1. Press Nano-33 Reset button Twice
2. With Nano-33 LED Flashing:



# Windows 10




 Nano-33 LED Stop Flashing

# Thanks

# Addendum:
# Using Edge Impulse CLI

# Installation

## Edge Impulse CLI optional Installation

This Edge Impulse CLI is used to control local devices, act as a proxy to synchronise data for devices that don't have an internet connection, and to upload and convert local files. The CLI consists of seven tools:

- edge-impulse-daemon - configures devices over serial, and acts as a proxy for devices that do not have an IP connection.
- edge-impulse-uploader - allows uploading and signing local files.
- edge-impulse-data-forwarder - a very easy way to collect data from any device over a serial connection, and forward the data to Edge Impulse.
- edge-impulse-run-impulse - show the impulse running on your device.
- edge-impulse-blocks - create organizational transformation blocks.
- eta-flash-tool - to flash the Eta Compute ECM3532 AI Sensor.
- himax-flash-tool - to flash the Himax WE-I Plus.

**Connect to devices without the CLI?** Recent versions of Google Chrome and Microsoft Edge can connect directly to fully-supported development boards, without the CLI. See this blog post for more information.

### Installation - macOS and Windows

1. Install Python 3 on your host computer.
2. Install Node.js v14 or higher on your host computer.
    - For Windows users, install the **Additional Node.js tools** when prompted. You may skip this setup if you have Visual Studio 2015 or more.
3. Install the CLI tools via:

```
npm install -g edge-impulse-cli --force
```

You should now have the tools available in your PATH.

### Installation - Linux/Ubuntu and Raspbian OS

# Installation

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npm install -g edge-impulse-cli --force
```

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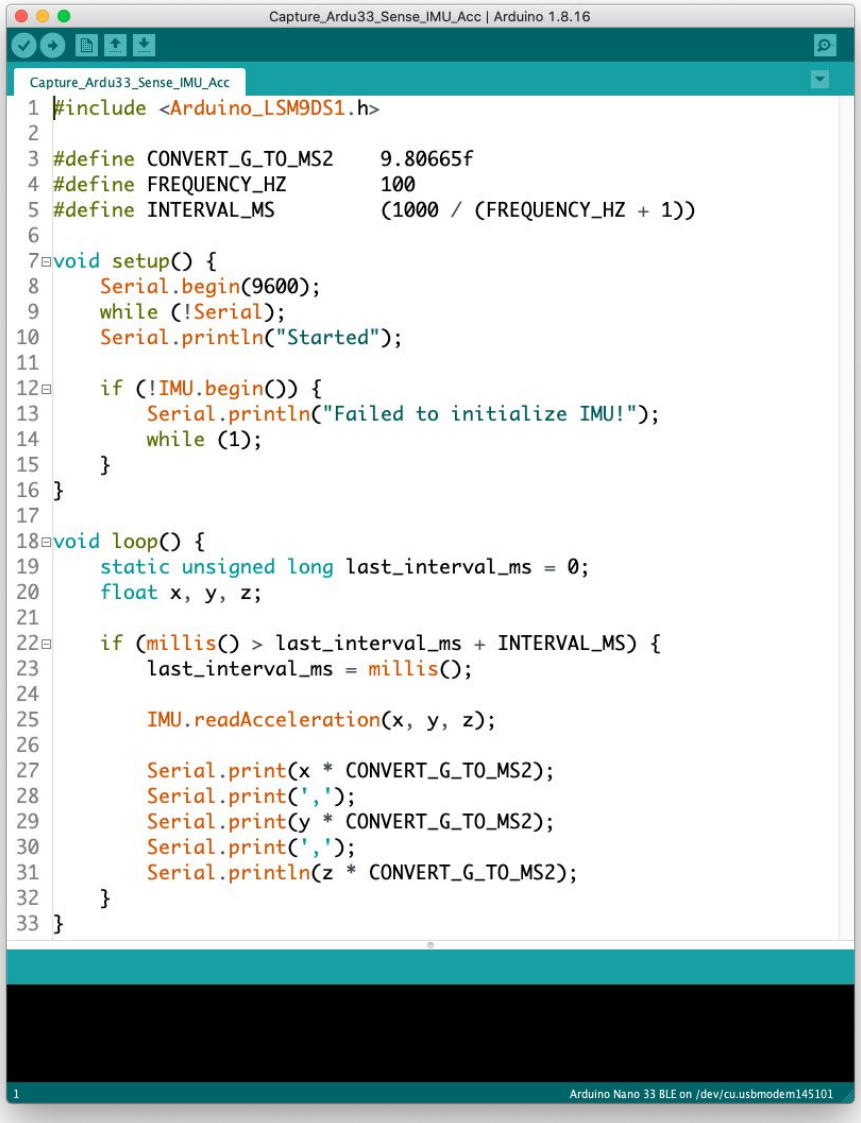
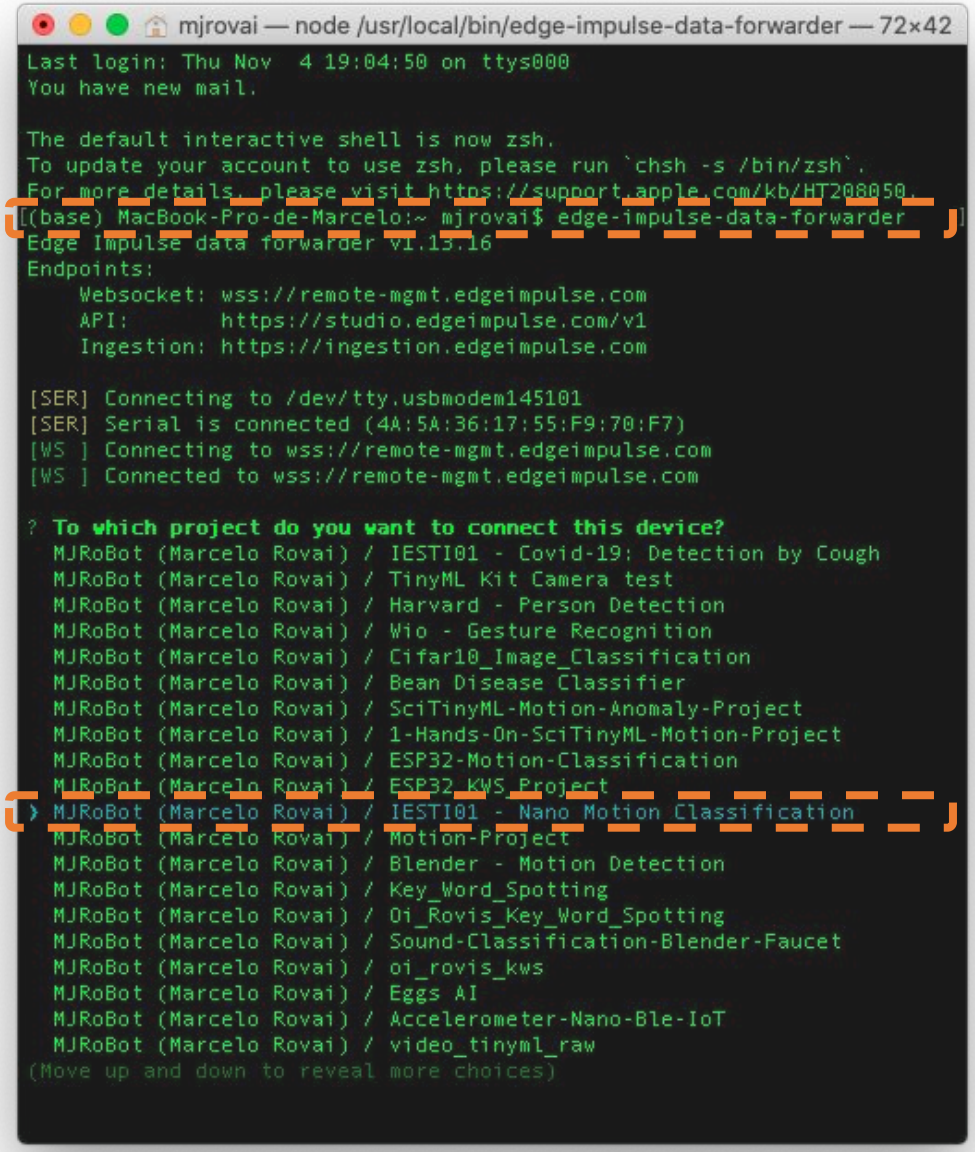
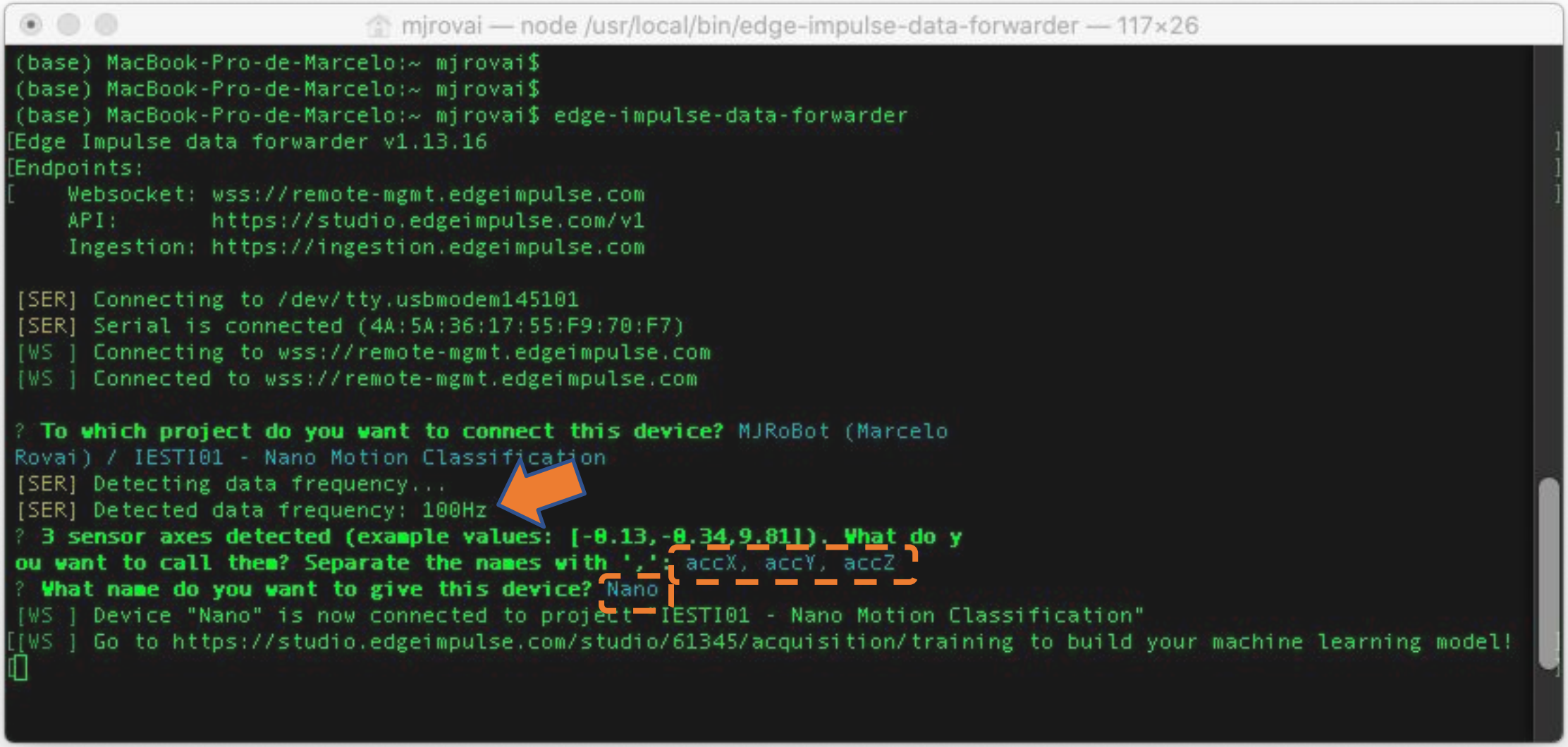
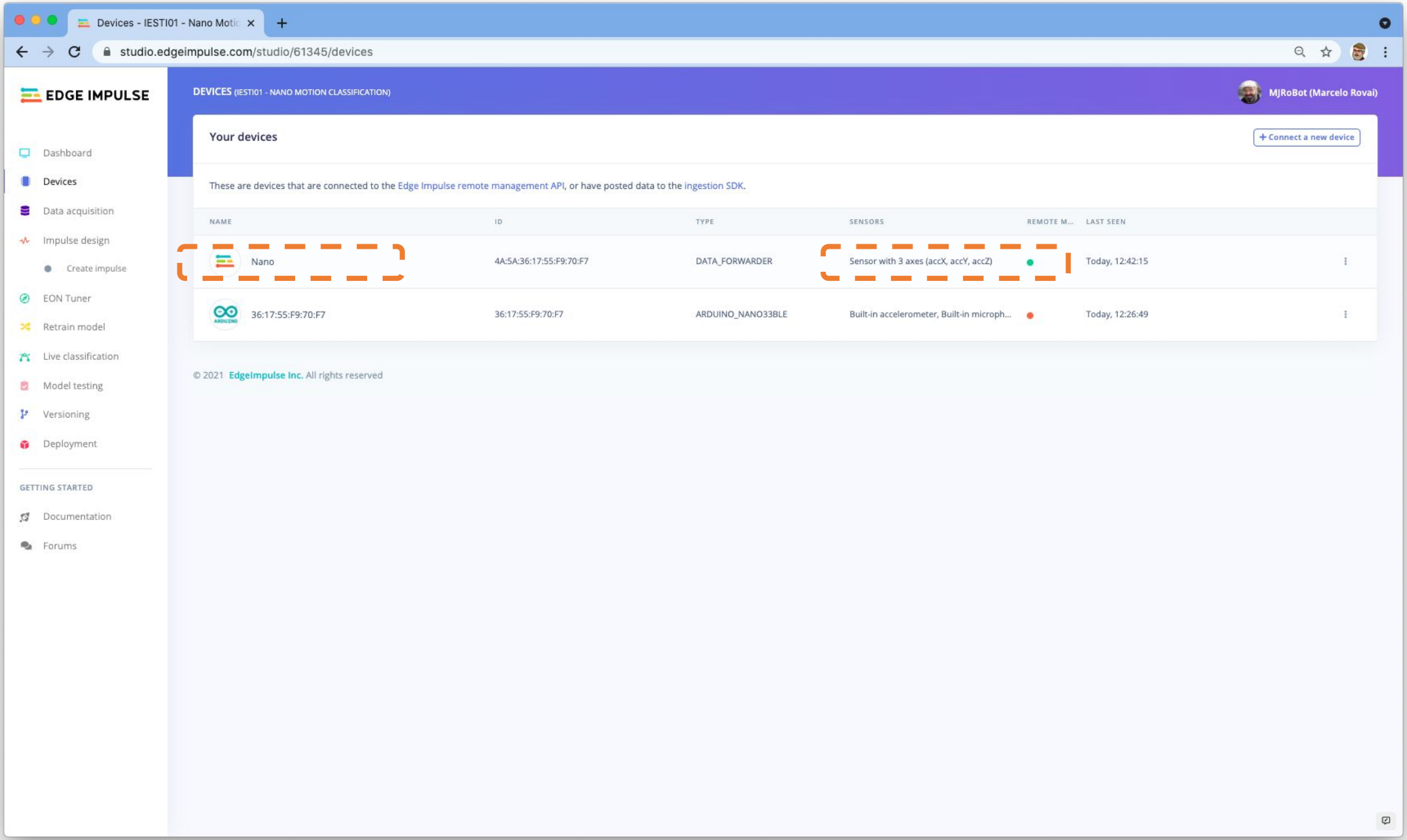
### Installation - Linux/Ubuntu and Raspbian OS

# Alternative Data Capture using EI CLI: $ edge-impulse-data-forwarder




mjrovai — node /usr/local/bin/edge-impulse-data-forwarder — 117×26
(base) MacBook-Pro-de-Marcelo:~ mjrovai$
(base) MacBook-Pro-de-Marcelo:~ mjrovai$
(base) MacBook-Pro-de-Marcelo:~ mjrovai$ edge-impulse-data-forwarder
[Edge Impulse data forwarder v1.13.16
[Endpoints:
[ Websocket: wss://remote-mgmt.edgeimpulse.com
API: https://studio.edgeimpulse.com/v1
Ingestion: https://ingestion.edgeimpulse.com
[SER] Connecting to /dev/tty.usbmodem145101
[SER] Serial is connected (4A:5A:36:17:55:F9:70:F7)
[WS ] Connecting to wss://remote-mgmt.edgeimpulse.com
[WS ] Connected to wss://remote-mgmt.edgeimpulse.com
? To which project do you want to connect this device? MJRoBot (Marcelo
Rovai) / IESTI01 - Nano Motion Classification
[SER] Detecting data frequency...
[SER] Detected data frequency: 100Hz
? 3 sensor axes detected (example values: [-0.13,-0.34,9.81]). What do y
ou want to call them? Separate the names with ',': accX, accY, accZ
? What name do you want to give this device? Nano
[WS ] Device "Nano" is now connected to project "IESTI01 - Nano Motion Classification"
[[WS ] Go to https://studio.edgeimpulse.com/studio/61345/acquisition/training to build your machine learning model!


Devices - IESTI01 - Nano Motic
studio.edgeimpulse.com/studio/61345/devices
EDGE IMPULSE
DEVICES (IESTI01 - NANO MOTION CLASSIFICATION)
MJRoBot (Marcelo Rovai)
Dashboard
Devices
Data acquisition
Impulse design
Create impulse
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Forums
Your devices
+ Connect a new device
These are devices that are connected to the Edge Impulse remote management API, or have posted data to the ingestion SDK.
NAME
ID
TYPE
SENSORS
REMOTE M...
LAST SEEN
Nano
4A:5A:36:17:55:F9:70:F7
DATA_FORWARDER
Sensor with 3 axes (accX, accY, accZ)
Today, 12:42:15
36:17:55:F9:70:F7
36:17:55:F9:70:F7
ARDUINO_NANO33BLE
Built-in accelerometer, Built-in microph...
Today, 12:26:49
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