

TinyML Arduino Kit Connection to Edge Impulse

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UNIFEI

Set up connection between Arduino Nano
and Edge Impulse

Login - Edge Impulse

studio.edgeimpulse.com/login

EDGE IMPULSE

Log in

rovai@mjrobot.org

.....

Forgot your password?

Log in

Don't have an account? [Sign up](#)



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
MJRoBot (Marcelo Rovai) / IESTI01 - Nano Motion Classification	?
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	

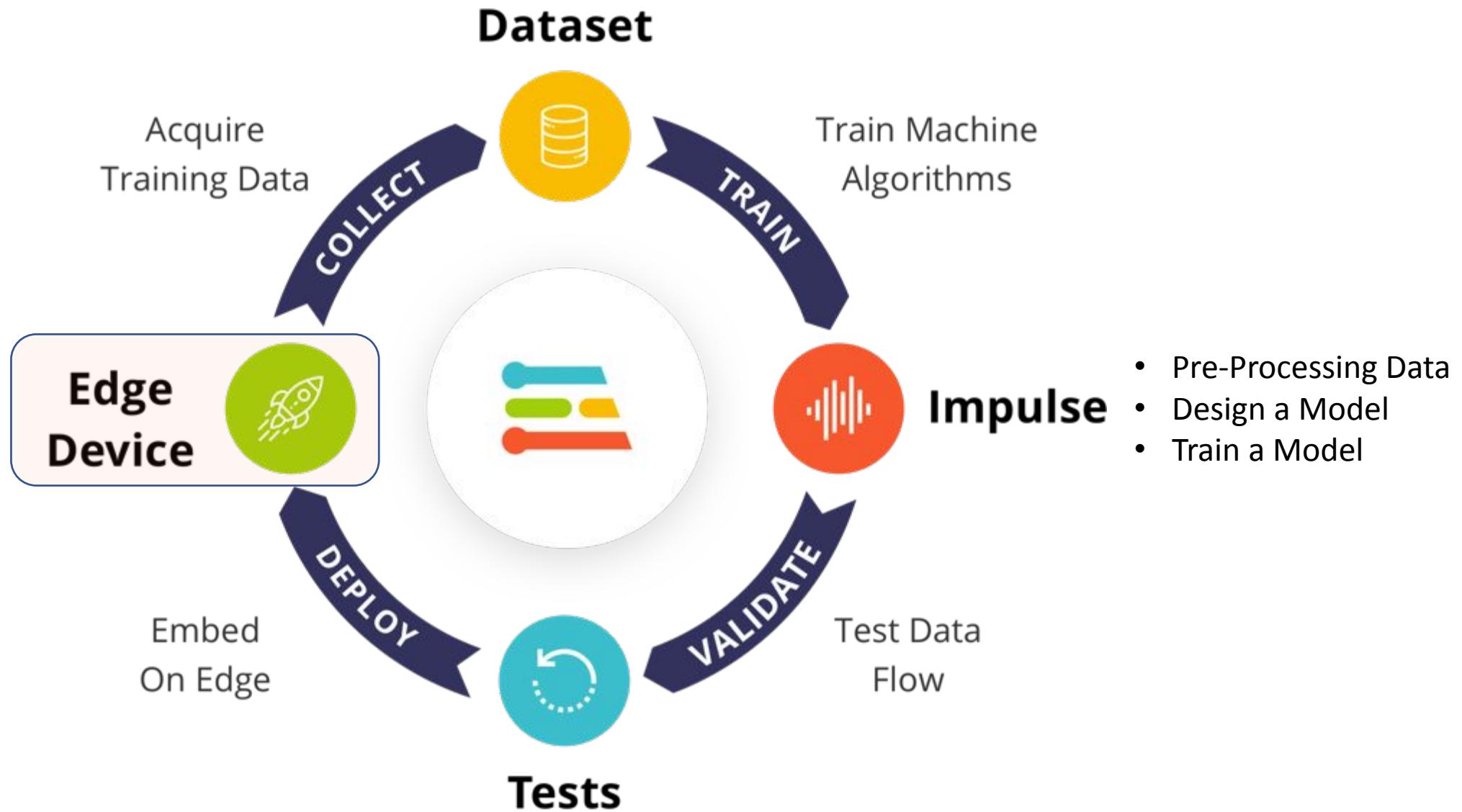
Create project

Enter a name for your new project

Cancel Create new project

?

4



Devices - IESTI01 - Nano Motion Classification

studio.edgeimpulse.com/studio/61345/devices

EDGE IMPULSE

DEVICES (IESTI01 - NANO MOTION CLASSIFICATION)

MJRoBot (Marcelo Rovai)

Your devices

These are devices that are connected to the Edge Impulse remote management API, or have posted data to the ingestion SDK.

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

Use your mobile phone

Use your computer

Data from any device with the data forwarder

Upload data

Integrate with your cloud

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1 Devices

2 + Connect a new device

3 Browse dev boards

<https://docs.edgeimpulse.com/docs/fully-supported-development-boards>

Devices - IESTI01 - Nano Motic Overview - Edge Impulse Docu +

docs.edgeimpulse.com/docs/development-platforms/fully-supported-development-boards

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DEVELOPMENT PLATFORMS
Overview
Officially supported MCU targets >
Officially supported CPU/GPU targets >

Overview

There is a list of development boards that are fully supported by Edge Impulse. These boards come with a special firmware which enables data collection from all their sensors, allows you to build new ready-to-go binaries that include your trained impulse, and come with examples on integrating your impulse with your custom firmware. These boards are the perfect way to start building Machine Learning solutions on real embedded hardware.

Officially supported MCU targets

- Arduino Nano 33 BLE Sense
- Arduino Nicla Sense ME
- Arduino Portenta H7 + Vision Shield
- Espressif ESP32
- Himax WE-I Plus
- Nordic Semi nRF52840 DK
- Nordic Semi nRF5340 DK
- Nordic Semi nRF9160 DK
- Nordic Semi Thingy:91
- Open MV Cam H7 Plus
- Silicon Labs xG24 Dev Kit
- Silicon Labs Thunderboard Sense 2
- Sony's Spresense
- ST B-L475E-IOT01A
- Syntiant Tiny ML Board
- TI CC1352P Launchpad
- Raspberry Pi RP2040



EI/Arduino CLI

The screenshot shows a web browser displaying the Edge Impulse documentation for the Arduino Nano 33 BLE Sense. The page title is "Arduino Nano 33 BLE Sense". The left sidebar lists various development boards, with "Arduino Nano 33 BLE Sense" highlighted. The main content area describes the board and its features, including its Cortex-M4 microcontroller, motion sensors, microphone, and BLE support. It also mentions the availability from Arduino and its use with the Arduino Tiny Machine Learning Kit. A blue arrow points from the text "Go to 2. Arduino CLI" to the "Installing dependencies" section at the bottom of the page.

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

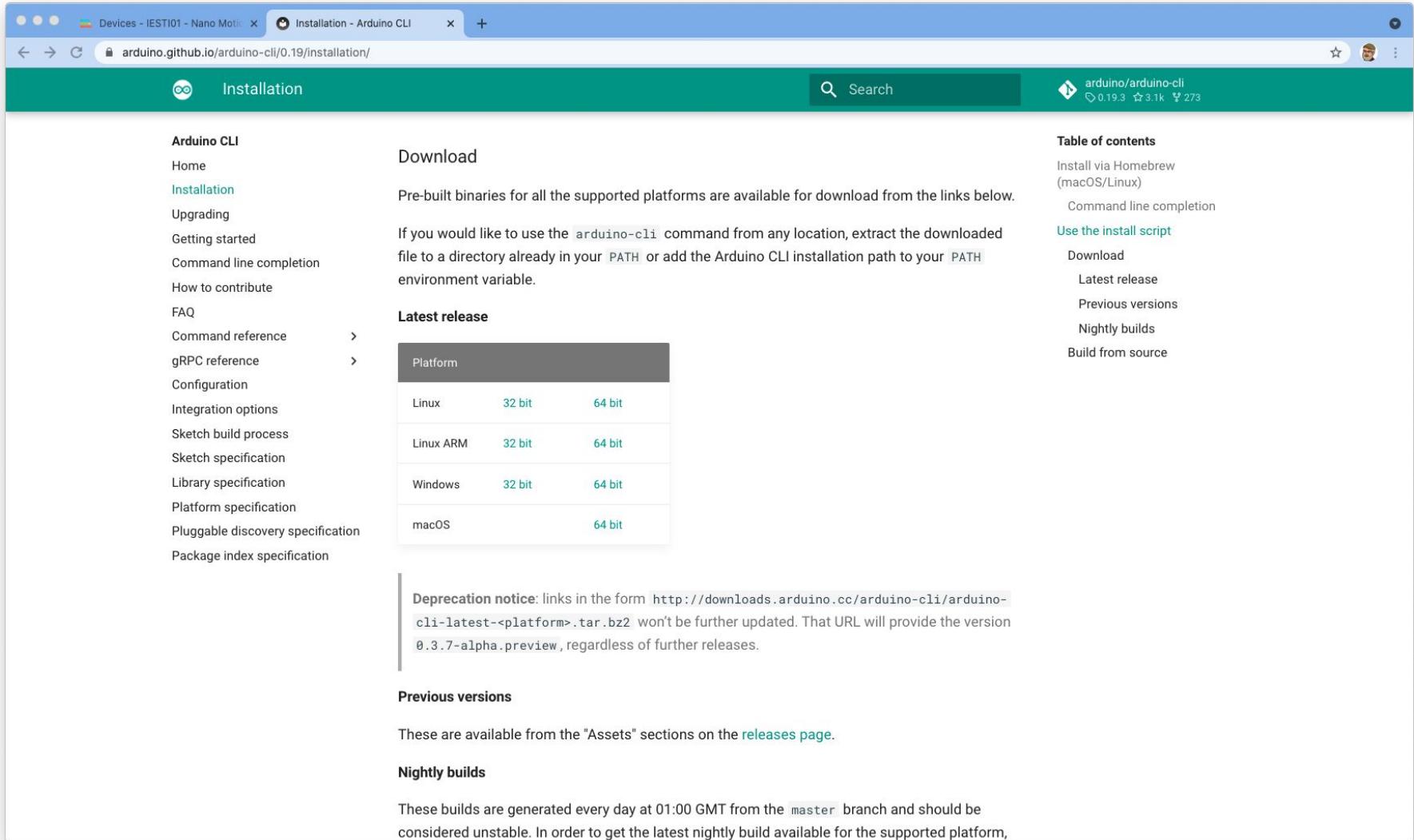
Go to 2. Arduino CLI

Installing dependencies

To set this device up in Edge Impulse, you will need to install the following software:

1. Edge Impulse CLI.
2. Arduino CLI.
 - Here's an instruction video for Windows.
 - The [Arduino website](#) has instructions for macOS and Linux.

Arduino CLI



The screenshot shows the "Installation" page for the Arduino CLI on GitHub. The URL in the address bar is arduino.github.io/arduino-cli/0.19/installation/. The page has a green header with the title "Installation". On the left, there's a sidebar with links like Home, Installation (which is active), Upgrading, Getting started, Command line completion, How to contribute, FAQ, Command reference, gRPC reference, Configuration, Integration options, Sketch build process, Sketch specification, Library specification, Platform specification, Pluggable discovery specification, and Package index specification. The main content area starts with a "Download" section, followed by a "Latest release" table, a "Deprecation notice" warning, a "Previous versions" section, and a "Nightly builds" section.

Table of contents

- Install via Homebrew (macOS/Linux)
- Command line completion
- Use the install script**
- Download
- Latest release
- Previous versions
- Nightly builds
- Build from source

Latest release

Platform	32 bit	64 bit
Linux	32 bit	64 bit
Linux ARM	32 bit	64 bit
Windows	32 bit	64 bit
macOS		64 bit

Deprecation notice: links in the form <http://downloads.arduino.cc/arduino-cli/arduino-cli-latest-<platform>.tar.bz2> won't be further updated. That URL will provide the version 0.3.7-alpha.preview, regardless of further releases.

Previous versions

These are available from the "Assets" sections on the [releases page](#).

Nightly builds

These builds are generated every day at 01:00 GMT from the `master` branch and should be considered unstable. In order to get the latest nightly build available for the supported platform,



See this video for Windows installation: <https://www.youtube.com/watch?v=1jMWsFER-Bc>

Arduino CLI Installation Summary

If you're on Windows:

- Unzip the .zip file to C:\Program Files\arduino-cli
- Open System Properties > Advanced > Environment Variables
- Path under "user variables" > Edit
- Add C:\Program Files\arduino-cli

If you're on macOS:

- I recommend using the curl method or homebrew shown on the installation page:
<https://arduino.github.io/arduino-cli/0.21/installation/>
- if you use the curl method, it likely installs arduino-cli to ~/bin. That might not be on your path. So, you might need to run: `export PATH=$PATH:~/bin`

Devices - SciTinyML-Motion-A X Arduino Nano 33 BLE Sense - E Installation - Arduino CLI x +

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

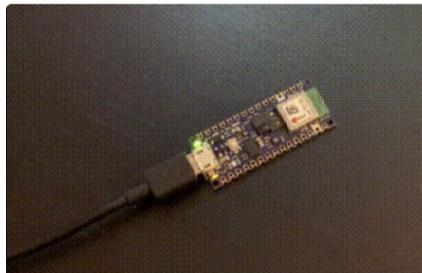
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Open MV Cam H7 Plus
Himax WE-I Plus
Nordic Semi nRF52840 DK
Nordic Semi nRF5340 DK
Nordic Semi nRF9160 DK
Nordic Semi Thingy:91
SiLabs Thunderboard Sense 2
Sony's Spresense
Syntiant Tiny ML Board

Powered By GitBook

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.



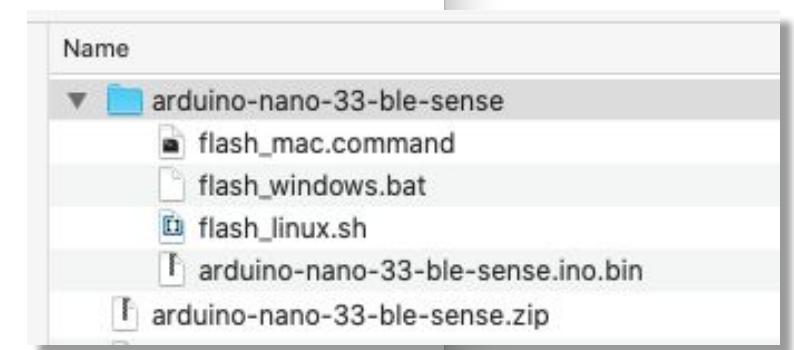
Press RESET twice quickly to launch the bootloader on the Arduino Nano 33 BLE Sense.

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:

```
1_edge-impulse-daemon
```



MacOS

```
mjrovai — flash_mac.command — 126x44
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

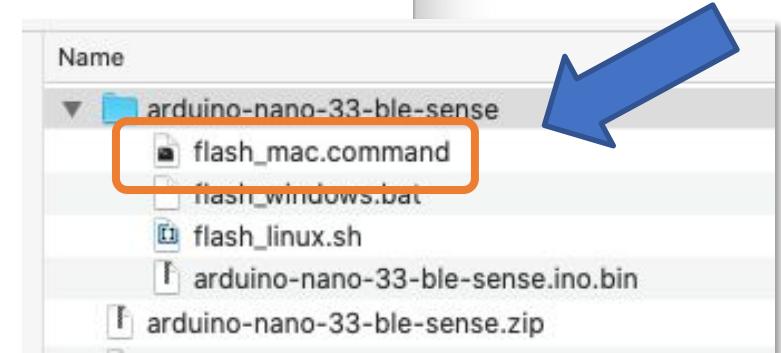
Done in 0.001 seconds
Write 280848 bytes to flash (69 pages)
[=====] 100% (69/69 pages)
Done in 10.984 seconds

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.

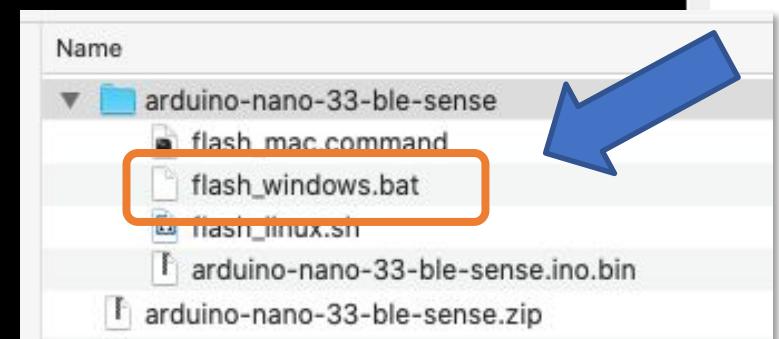
C:\Users\GUILH>arduino-cli
Arduino Command Line Interface (arduino-cli).

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:

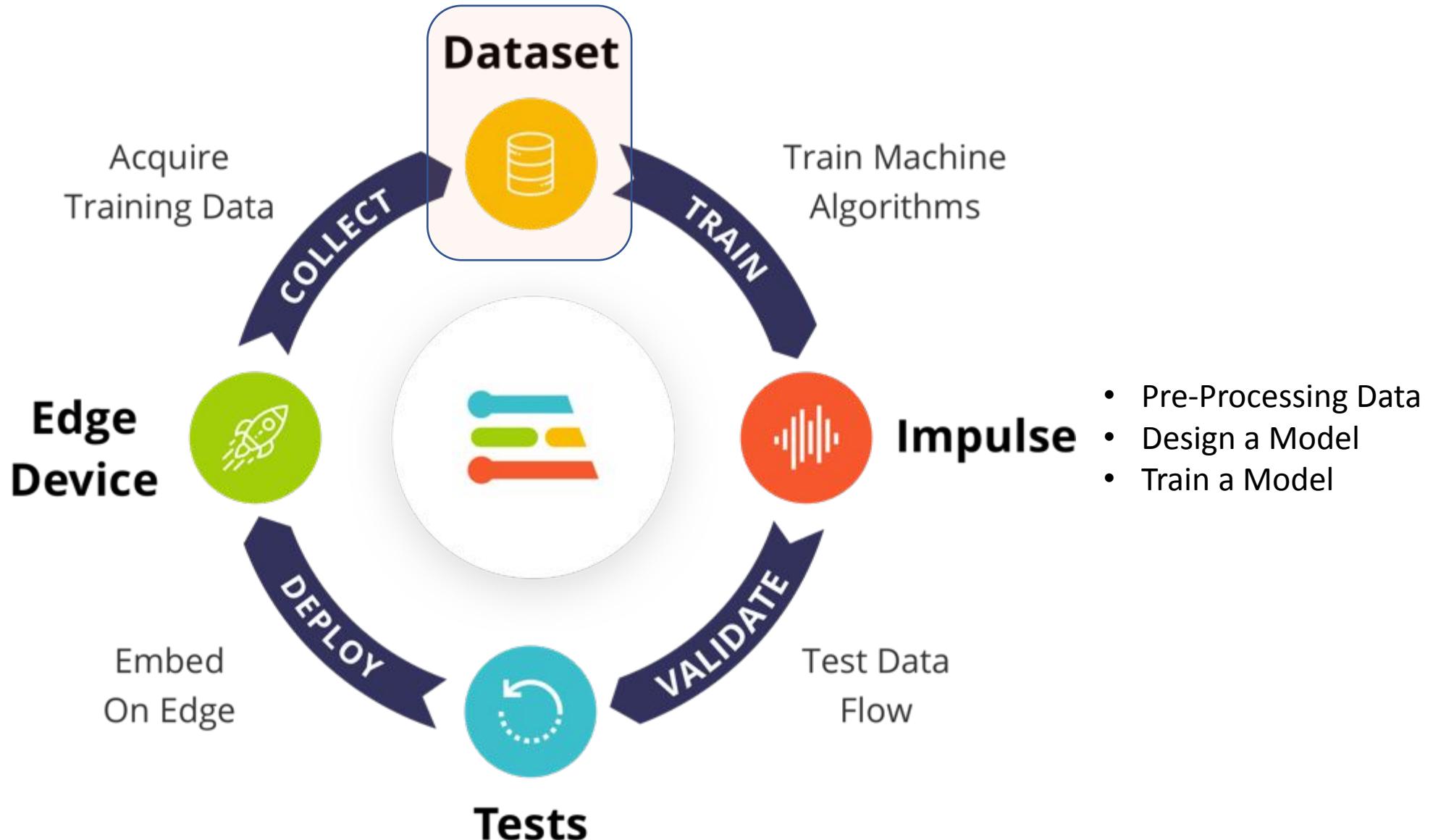


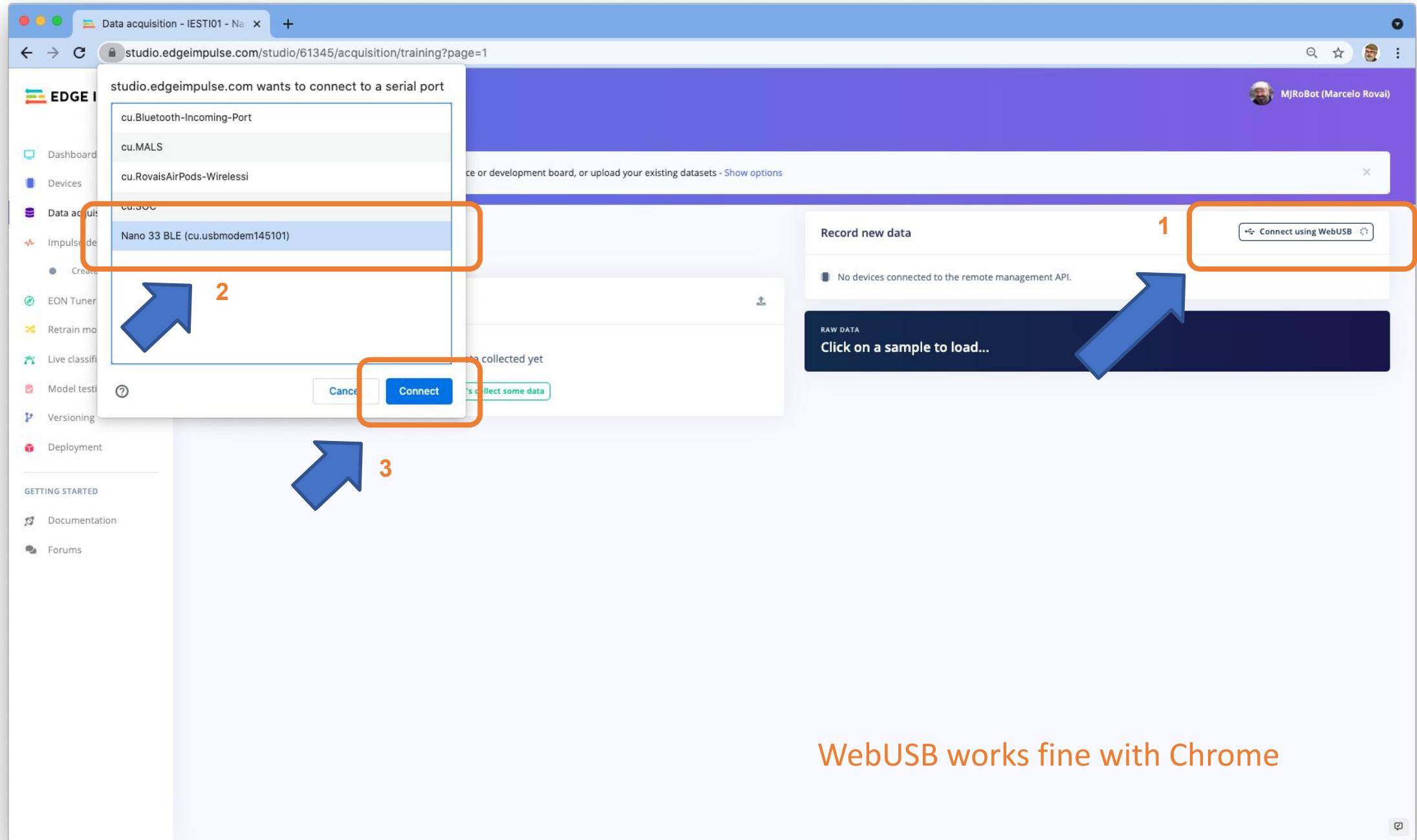
Windows 10

```
cmd C:\WINDOWS\system32\cmd.exe
Finding Arduino Mbed core...
arduino:mbed_nano 2.0.0      2.0.0  Arduino Mbed OS Nano Boards
Finding Arduino Mbed core OK
Finding Arduino Nano 33 BLE...
Finding Arduino Nano 33 BLE OK at COM11
arduino:mbed_nano 2.0.0      2.0.0  Arduino Mbed OS Nano Boards
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 0.002 seconds
Write 525440 bytes to flash (129 pages)
[=====] 100% (129/129 pages)          □ Nano-33 LED Stop Flashing
Done in 22.296 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'
Pressione qualquer tecla para continuar. . .
```

Sensor's Test





WebUSB works fine with Chrome

DATA ACQUISITION (IESTI01 - NANO MOTION CLASSIFICATION)

Training data Test data

Did you know? You can capture data from any device or development board, or upload your existing datasets - [Show options](#)

DATA COLLECTED

Collected data

No data collected yet

Let's collect some data

Record new data

Device: 36:17:55:F9:70:F7

Label: terrestrial (highlighted with orange border)

Sample length (ms.): 10000

Sensor: Built-in accelerometer

Frequency: 100Hz

Start sampling

RAW DATA
Click on a sample to load...

EDGE IMPULSE

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 - Create impulse
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- Retrain model
- Live classification
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- Forums

Accelerometer



EDGE IMPULSE

DATA ACQUISITION (IESTI01 - NANO MOTION CLASSIFICATION)

Training data Test data

Did you know? You can capture data from any device or development board, or upload your existing datasets - Show options

DATA COLLECTED 3m 20s TRAIN / TEST SPLIT 100% / 0%

SAMPLE NAME	LABEL	ADDED	LENGTH
lift.json.2jvhb7	lift	Today, 14:42:04	10s
lift.json.2jvh9pe3	lift	Today, 14:41:45	10s
lift.json.2jvh96uh	lift	Today, 14:41:26	10s
lift.json.2jvh8j6q	lift	Today, 14:41:06	10s
lift.json.2jvh80rg	lift	Today, 14:40:47	10s
lift.json.2jvh7g2v	lift	Today, 14:40:30	10s
lift.json.2jvh6uqu	lift	Today, 14:40:12	10s
lift.json.2jvh6c6a	lift	Today, 14:39:53	10s
lift.json.2jvh5qbe	lift	Today, 14:39:35	10s
lift.json.2jvh55hs	lift	Today, 14:39:14	10s
terrestrial.json.2jv...	terrestrial	Today, 14:26:56	10s
terrestrial.json.2jv...	terrestrial	Today, 14:26:29	10s

Record new data

Device: Nano

Label: lift

Sensor: Sensor with 3 axes (accX, accY, accZ)

Sample length (ms.): 10000

Frequency: 100Hz

Start sampling

RAW DATA lift.json.2jvhb7

accX accY accZ

Data acquisition - IESTI01

studio.edgeimpulse.com/studio/38744/acquisition/training?page=1

EDGE IMPULSE

DATA COLLECTED
10s

LABELS
1

Collected data

SAMPLE NAME	LABEL	ADDED	LENGTH
unifei.29js37tq	unifei	Today, 18:22:34	10s

Device ②
36:17:55:F9:70:F7

Label
unifei

Sample length (ms.)
10000

Sensor
Built-in microphone

Frequency
16000Hz

Start sampling

RAW DATA
unifei.29js37tq



0 1051 2103 3154 4206 5258 6309 7361 8413 9464

audio

▶ 0:10 / 0:10

⋮

Dashboard

Devices

Data acquisition

Impulse design

Create impulse

Retrain model

Live classification

Model testing

Versioning

Deployment

GETTING STARTED

Documentation

Forums

Record new data

Camera



A screenshot of the Edge Impulse data acquisition interface. The window title is "Data acquisition - IESTI01". The URL in the address bar is "studio.edgeimpulse.com/studio/114253/acquisition/training?page=1". The main area is titled "Record new data". It shows a "Device" dropdown set to "36:17:55:F9:70:F7", a "Label" input field containing "medicine", and a "Sensor" dropdown menu with "Camera (128x96)" selected, which is highlighted with an orange rectangle. To the right, there is a "Camera feed" window showing a live video stream of a blister pack of medicine tablets. A "Start sampling" button is located below the feed. At the bottom, a dark banner says "RAW DATA Click on a sample to load...". The footer of the page includes the copyright notice "© 2022 Edgimpulse Inc. All rights reserved" and a small logo.

Addendum: Using Edge Impulse CLI

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- [Eta Compute ECM3532 AI Sensor](#)
- [Eta Compute ECM3532 AI Vision](#)
- [OpenMV Cam H7 Plus](#)
- [Himax WE-I Plus](#)
- [Nordic Semi nRF52840 DK](#)
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COMMUNITY BOARDS

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- [Agora Product Development Kit](#)

EDGE IMPULSE FOR LINUX

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

DOCUMENTATION

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- [What is embedded ML, anyway?](#)
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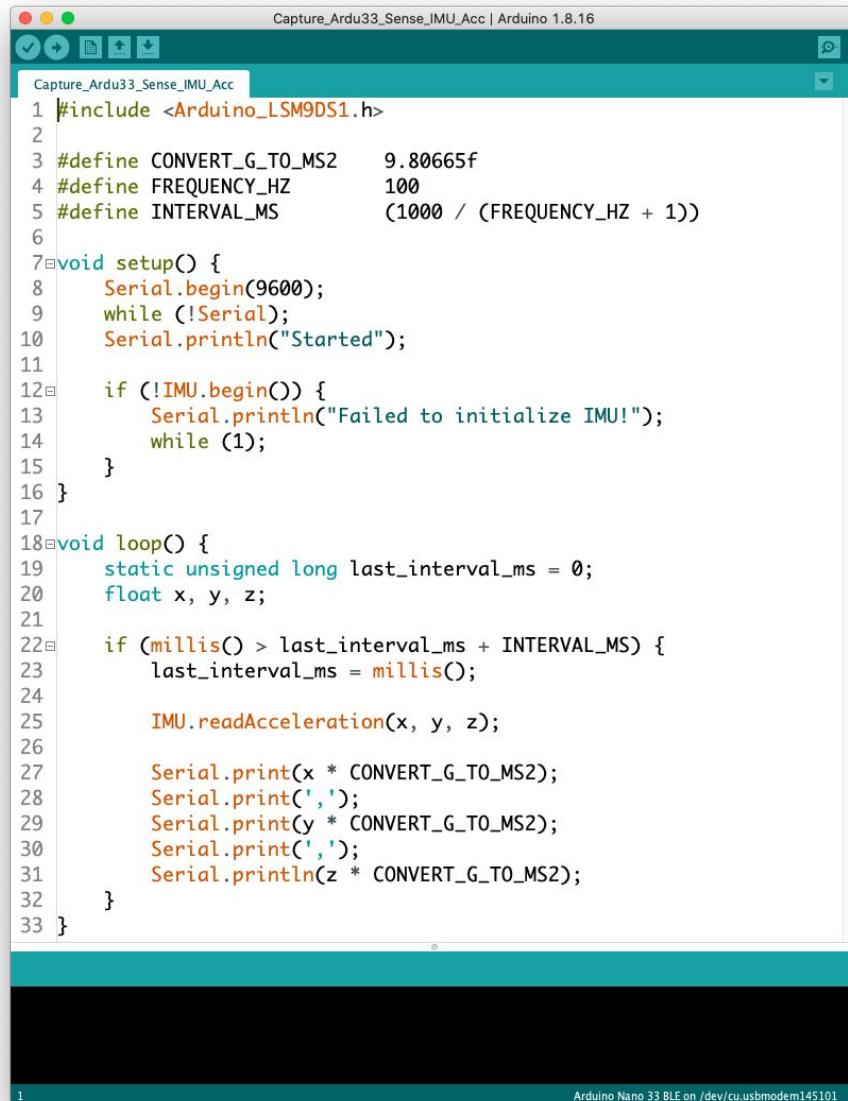
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npm install -g edge-impulse-cli --force
```

You should now have the tools available in your PATH.

Installation - Linux/Ubuntu and Raspbian OS

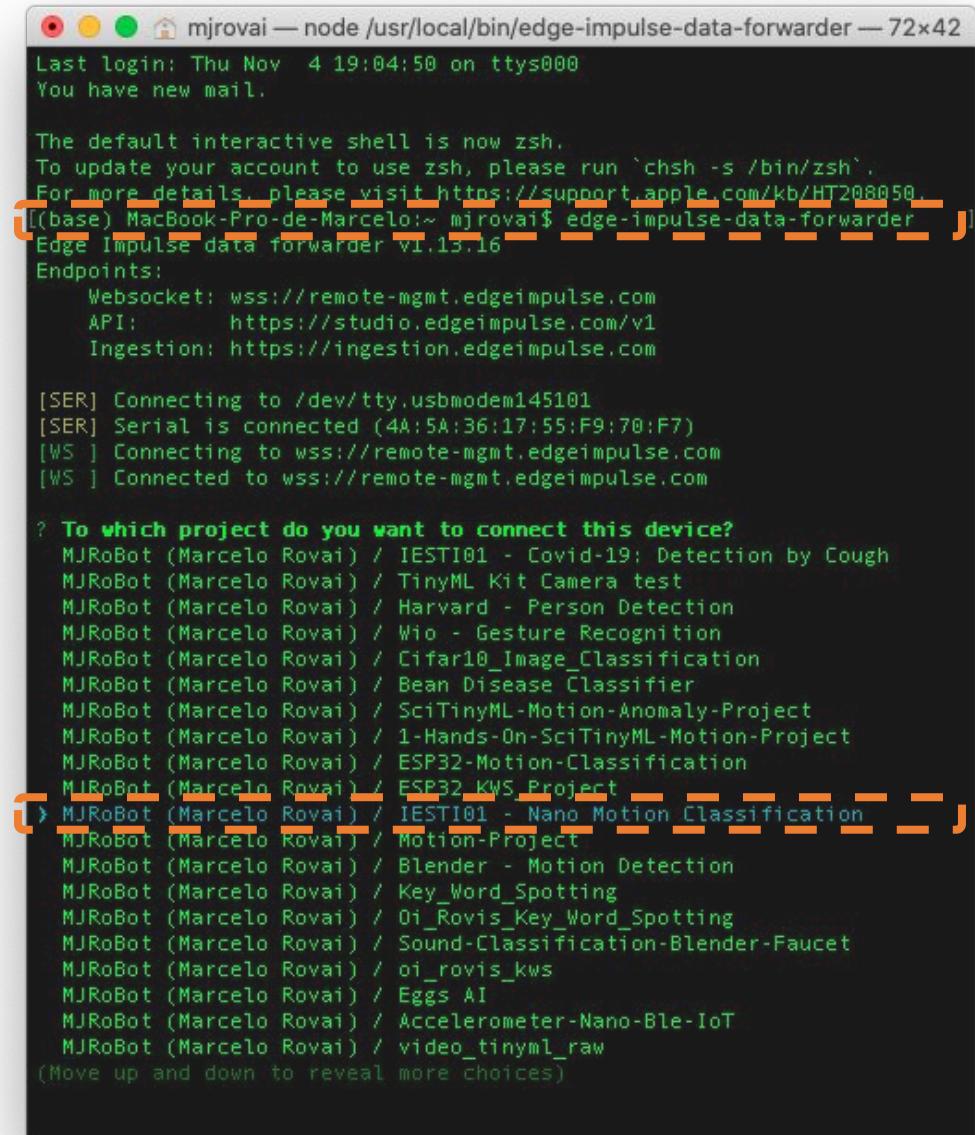
Alternative Data Capture using EI CLI: \$ edge-impulse-data-forwarder



The screenshot shows the Arduino IDE interface with a sketch titled "Capture_Ardu33_Sense_IMU_Acc". The code uses the Arduino_LSM9DS1 library to read acceleration data from an IMU. It initializes the serial port at 9600 bps, checks for IMU initialization, and then enters a loop where it reads acceleration values every 1000ms and prints them to the serial port.

```
1 #include <Arduino_LSM9DS1.h>
2
3 #define CONVERT_G_TO_MS2 9.80665f
4 #define FREQUENCY_HZ 100
5 #define INTERVAL_MS (1000 / (FREQUENCY_HZ + 1))
6
7 void setup() {
8     Serial.begin(9600);
9     while (!Serial);
10    Serial.println("Started");
11
12    if (!IMU.begin()) {
13        Serial.println("Failed to initialize IMU!");
14        while (1);
15    }
16 }
17
18 void loop() {
19     static unsigned long last_interval_ms = 0;
20     float x, y, z;
21
22     if (millis() > last_interval_ms + INTERVAL_MS) {
23         last_interval_ms = millis();
24
25         IMU.readAcceleration(x, y, z);
26
27         Serial.print(x * CONVERT_G_TO_MS2);
28         Serial.print(',');
29         Serial.print(y * CONVERT_G_TO_MS2);
30         Serial.print(',');
31         Serial.println(z * CONVERT_G_TO_MS2);
32     }
33 }
```

Arduino Nano 33 BLE on /dev/cu.usbmodem145101



The terminal window shows the command `edge-impulse-data-forwarder` being run. It displays the default interactive shell (zsh), system login information, and the Edge Impulse data forwarder version (v1.13.16). It then lists the available endpoints: Websocket (wss://remote-mgmt.edgeimpulse.com), API (https://studio.edgeimpulse.com/v1), and Ingestion (https://ingestion.edgeimpulse.com). The [SER] log shows the device connecting to the serial port and the websocket. The [WS] log shows the connection to the remote management endpoint. A question is posed: "To which project do you want to connect this device?", followed by a list of projects associated with the user "MJRobot (Marcelo Rovai)".

```
Last login: Thu Nov  4 19:04:50 on ttys000
You have new mail.

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$ 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 - Covid-19: Detection by Cough
MJRobot (Marcelo Rovai) / TinyML Kit Camera test
MJRobot (Marcelo Rovai) / Harvard - Person Detection
MJRobot (Marcelo Rovai) / Wio - Gesture Recognition
MJRobot (Marcelo Rovai) / Cifar10_Image_Classification
MJRobot (Marcelo Rovai) / Bean Disease Classifier
MJRobot (Marcelo Rovai) / SciTinyML-Motion-Anomaly-Project
MJRobot (Marcelo Rovai) / 1-Hands-On-SciTinyML-Motion-Project
MJRobot (Marcelo Rovai) / ESP32-Motion-Classification
MJRobot (Marcelo Rovai) / ESP32_KWS_Project
MJRobot (Marcelo Rovai) / IESTI01 - Nano Motion Classification
MJRobot (Marcelo Rovai) / Motion-Project
MJRobot (Marcelo Rovai) / Blender - Motion Detection
MJRobot (Marcelo Rovai) / Key_Word_Spotting
MJRobot (Marcelo Rovai) / Oi_Rovis_Key_Word_Spotting
MJRobot (Marcelo Rovai) / Sound-Classification-Blender-Faucet
MJRobot (Marcelo Rovai) / oi_rovins_kws
MJRobot (Marcelo Rovai) / Eggs AI
MJRobot (Marcelo Rovai) / Accelerometer-Nano-Ble-IoT
MJRobot (Marcelo Rovai) / video_tinyml_raw
(Move up and down to reveal more choices)
```

```
mjrovai — node /usr/local/bin/edge-impulse-data-forwarder — 117x26
(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 Motion Classification

studio.edgeimpulse.com/studio/61345/devices

EDGE IMPULSE

DEVICES (IESTI01 - NANO MOTION CLASSIFICATION)

MJRoBot (Marcelo Rovai)

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 microphone		Today, 12:26:49

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Dashboard

Devices

Data acquisition

Impulse design

Create impulse

EON Tuner

Retrain model

Live classification

Model testing

Versioning

Deployment

GETTING STARTED

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Forums

Thanks



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