



# Wio Terminal – Part 1

## Installation & Tests

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UNIFEI - Federal University of Itajubá, Brazil  
TinyML4D Academic Network Co-Chair



**UNIFEI**

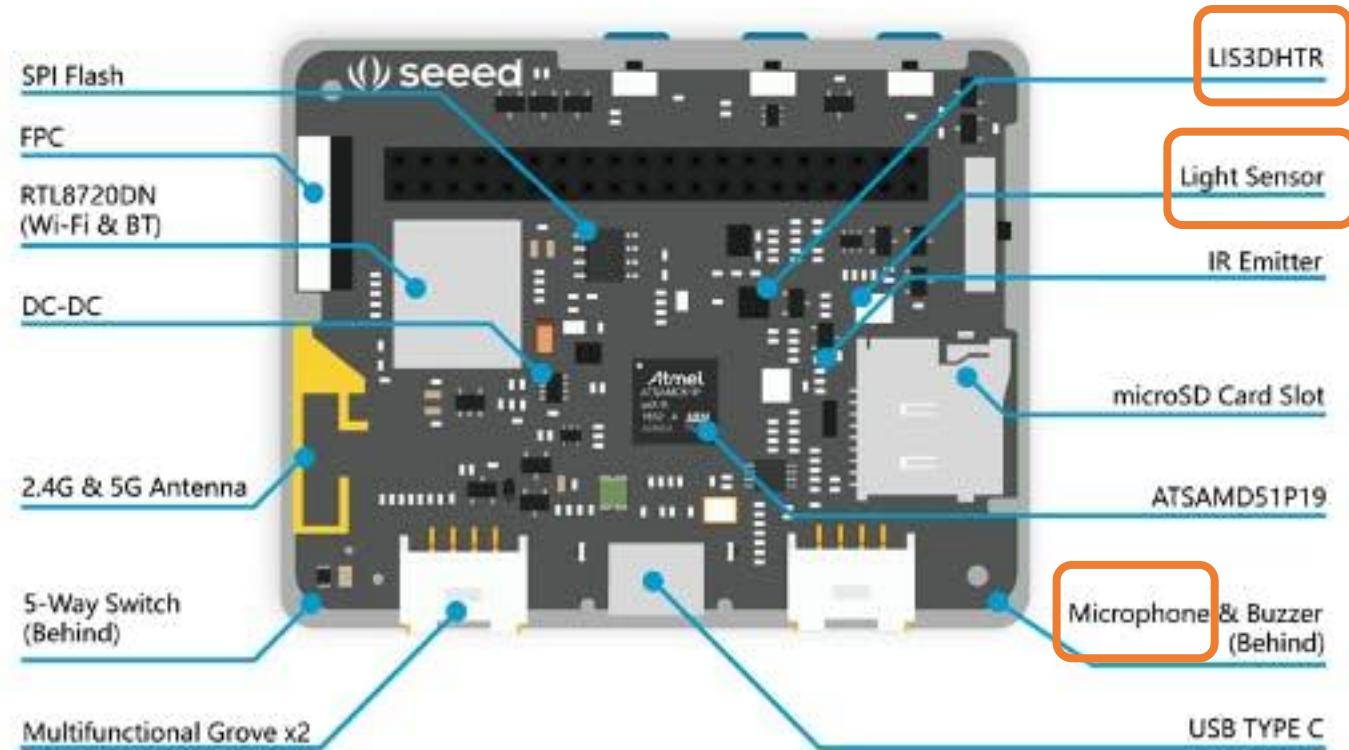
# The Wio Terminal

# The Wio Terminal

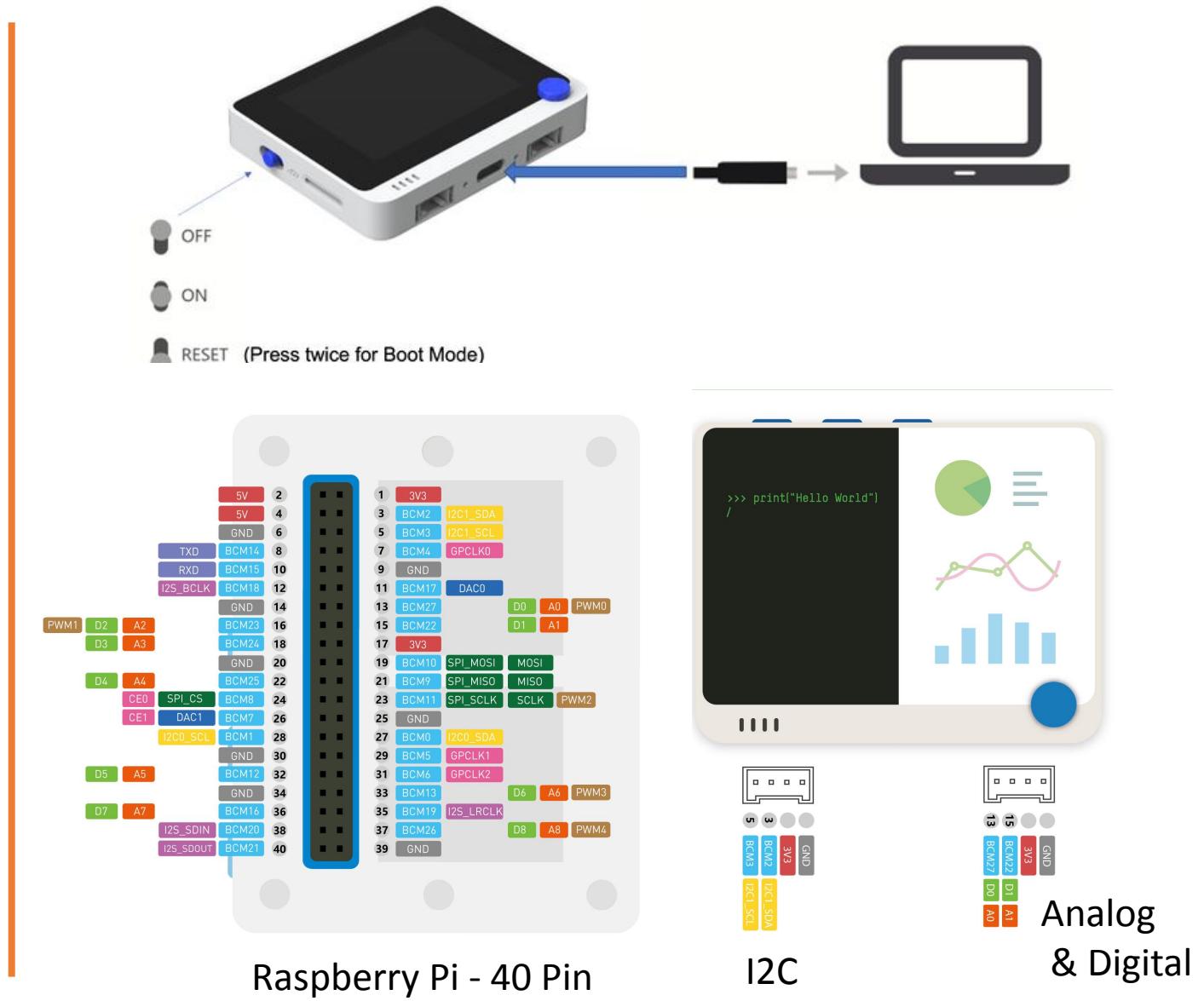
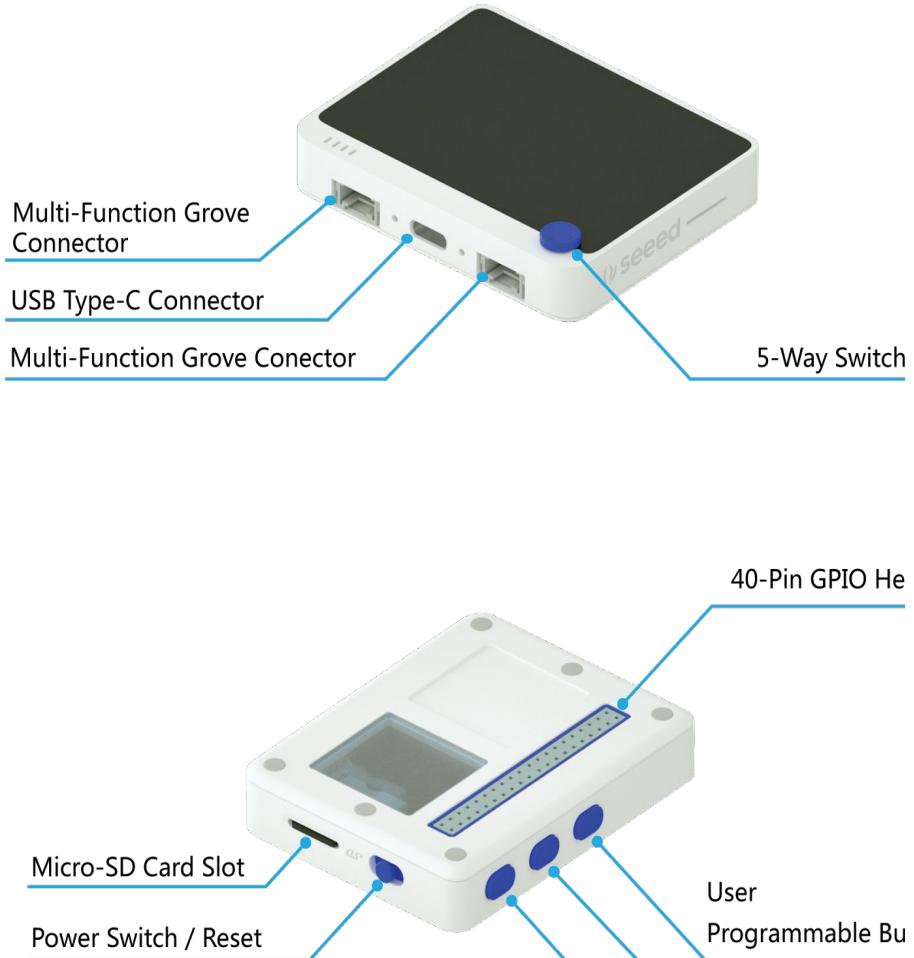
The [Wio Terminal](#) uses an ATSAMD51P19 microcontroller with ARM Cortex-M4F running at 120MHz (boost up to 200MHz), 4MB of external flash memory, and 192KB of RAM.

Wireless connectivity with Realtek RTL8720DN support. It is compatible with Arduino and MicroPython. It supports Bluetooth and Wi-Fi. There is a 2.4-inch LCD screen on Wio Terminal, an onboard Accelerometer (LIS3DHTR), a microphone, a buzzer, a microSD card slot, a light sensor, and an IR emitter (IR 940nm).

It has two multi-functional Grove connectors (I2C and Dig/Analog GPIOs) and Raspberry Pi-compatible 40-pin GPIO pins for additional add-on support.



# The Wio Terminal – Hardware installation / Expansion

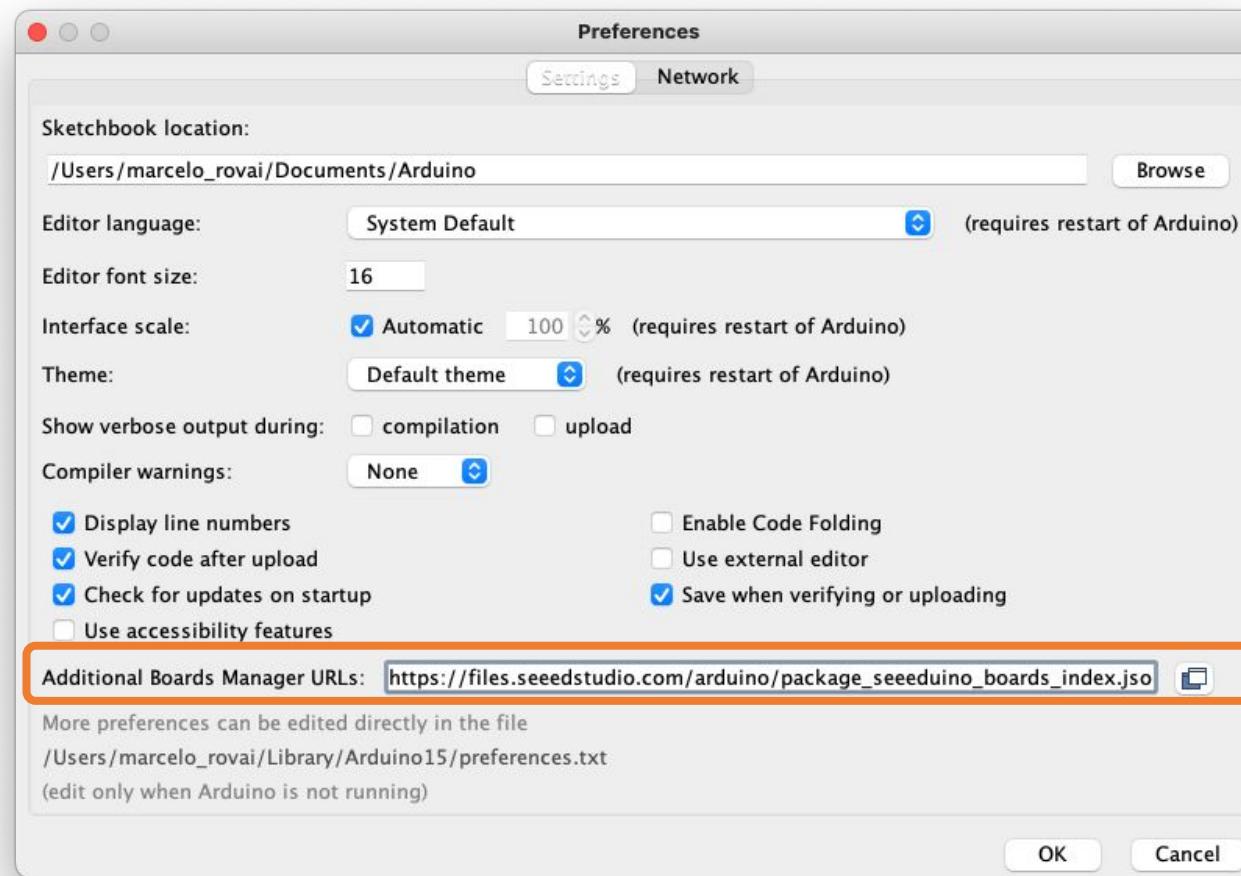


# Installing Wio Terminal – Arduino IDE

Open the Arduino IDE, and click on:

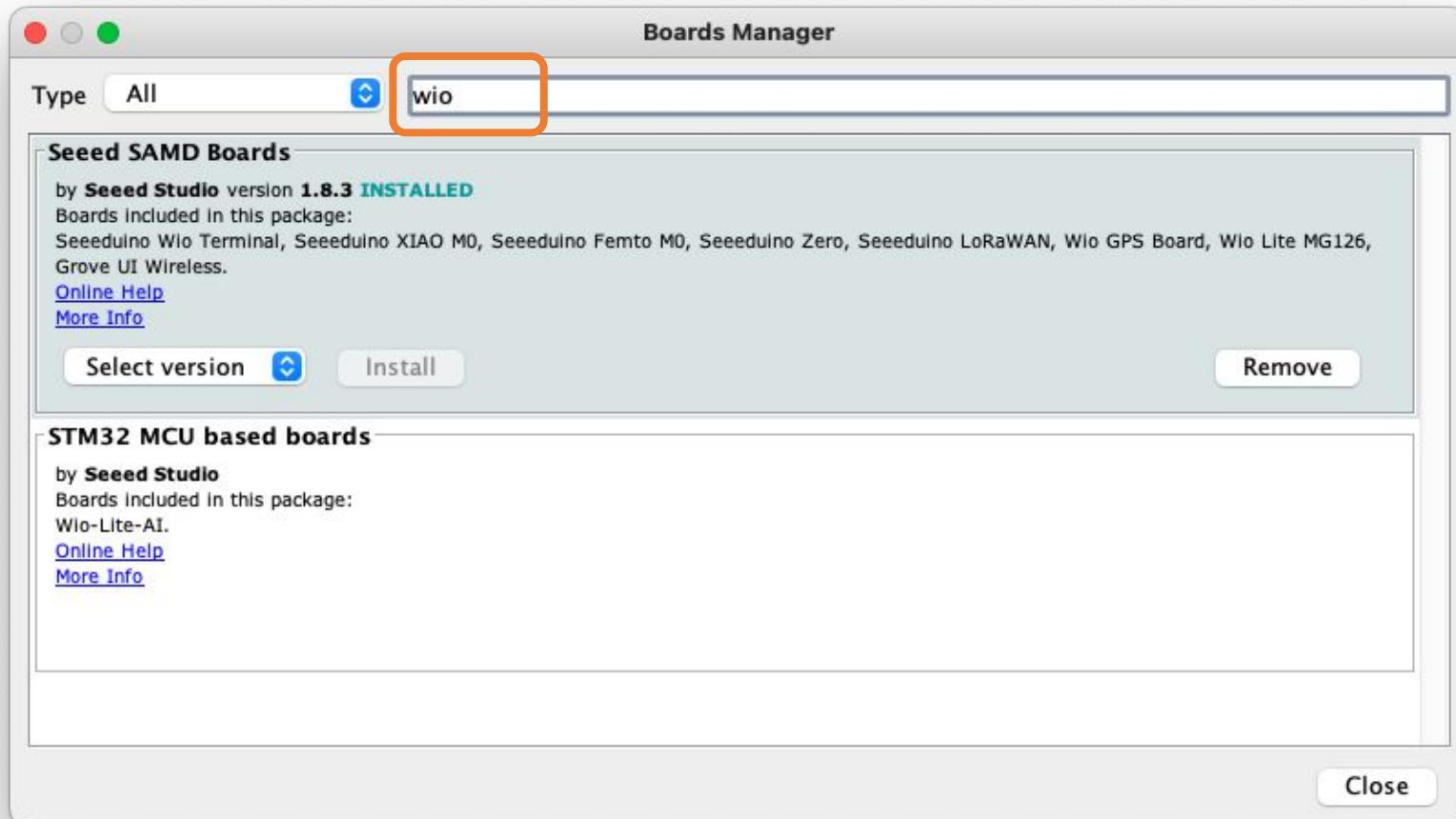
**File > Preferences**, and copy the below URL to **Additional Boards Manager URLs**:

**[https://files.seeedstudio.com/arduino/package\\_seeeduino\\_boards\\_index.json](https://files.seeedstudio.com/arduino/package_seeeduino_boards_index.json)**

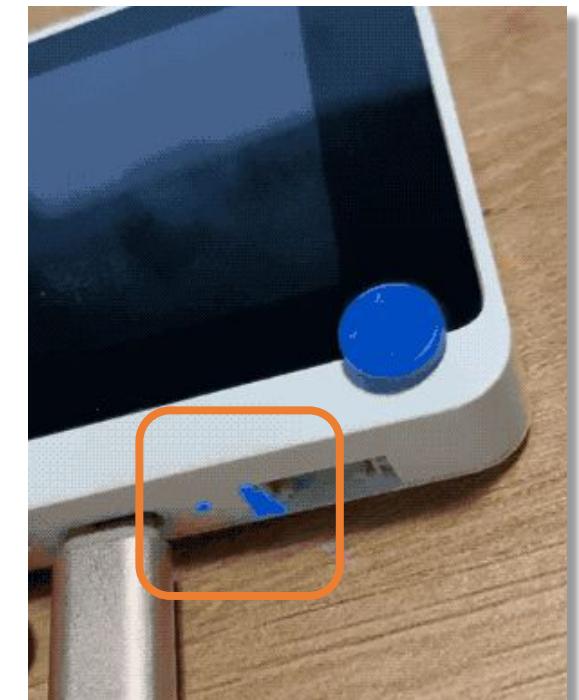
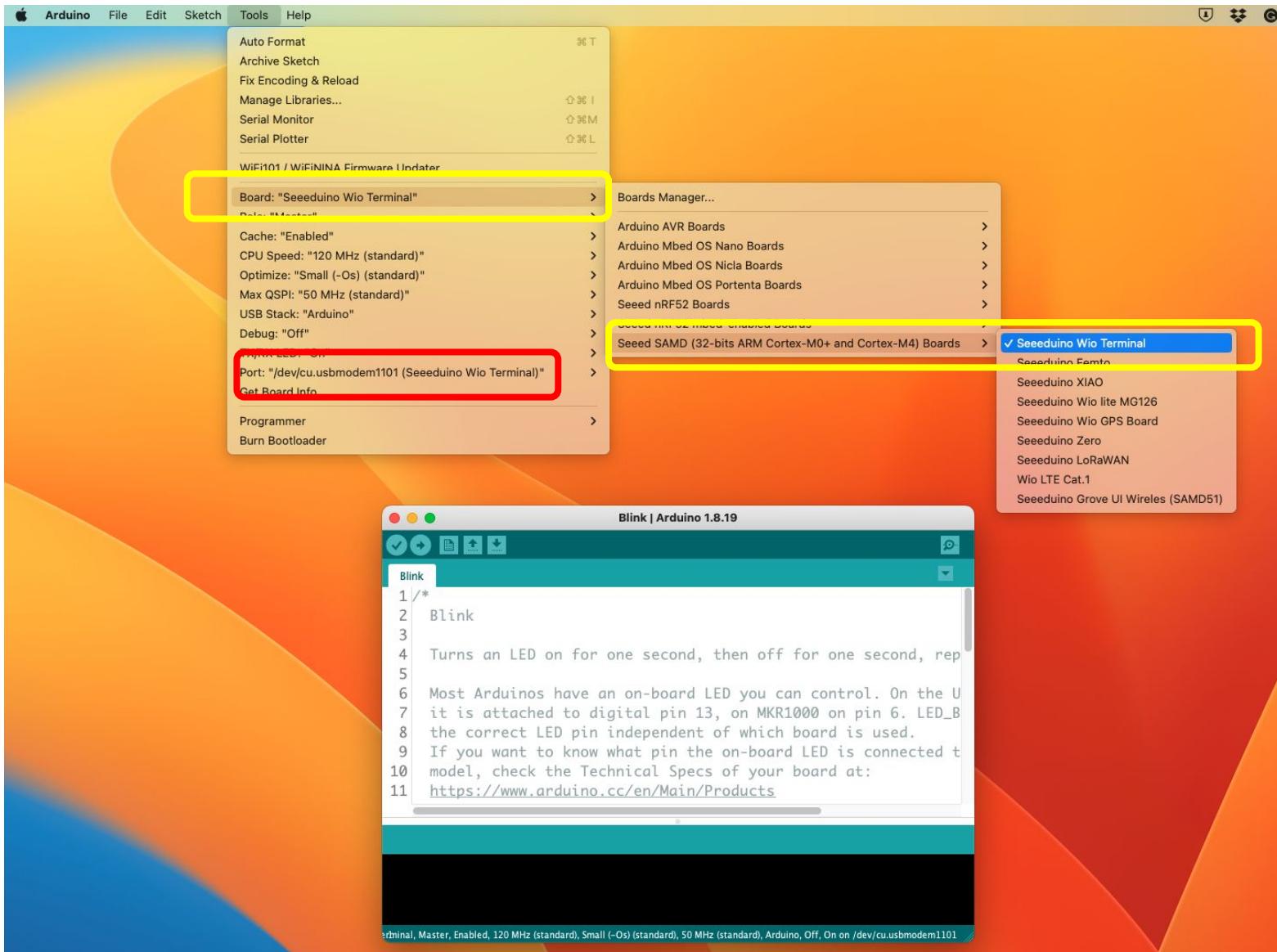


Click **Tools > Board > Board Manager** and Search **Wio Terminal** in the Boards Manager.

Install the last available version.



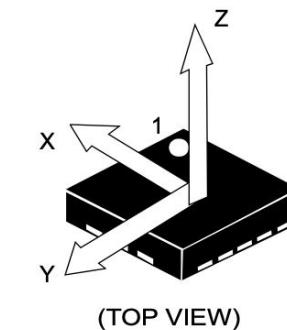
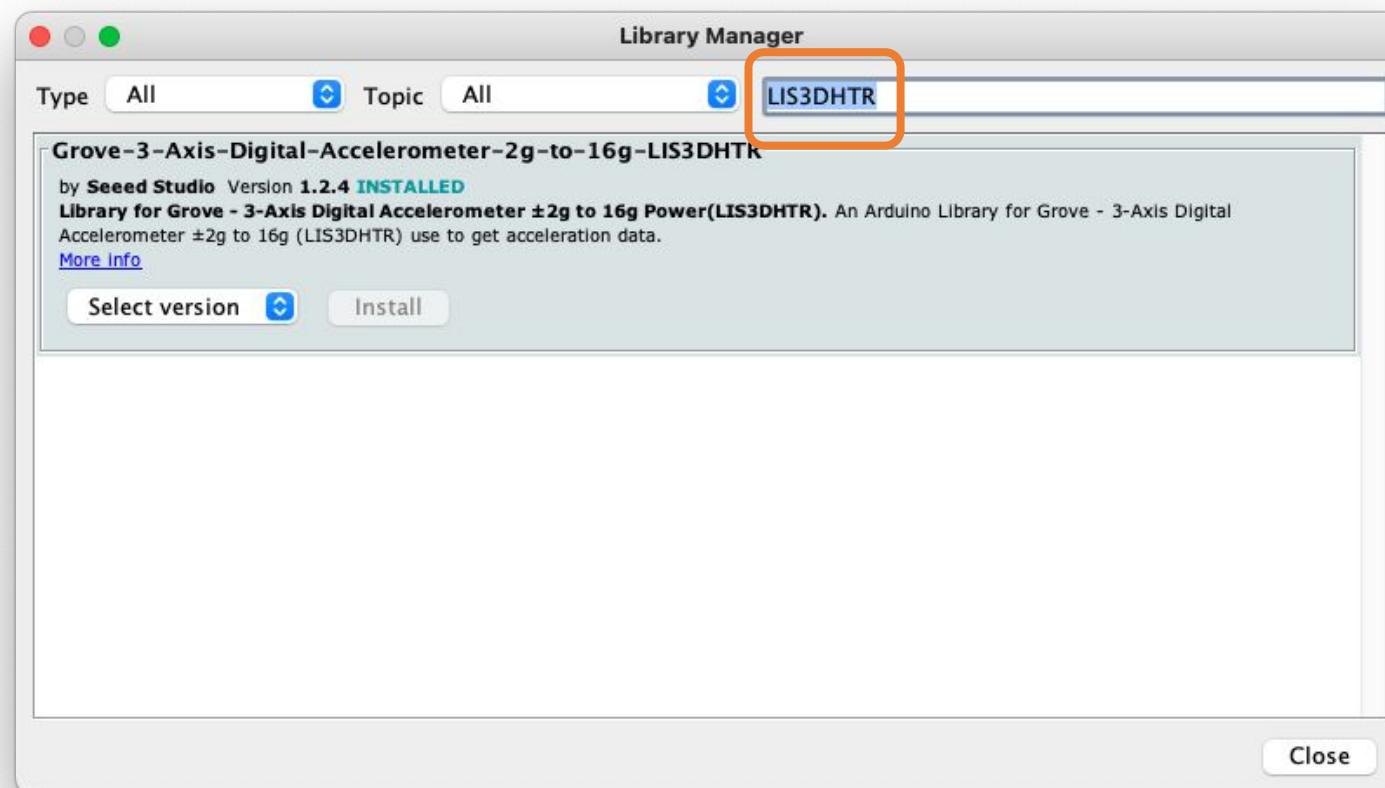
Select your **board** and **port**. Load the **Blink** sketch and run it.



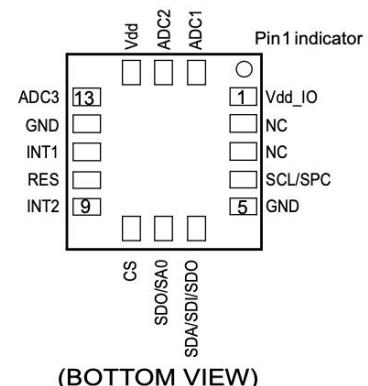
# Installing the 3-Axis Digital Accelerometer(LIS3DHTR) Library For Wio Terminal

Click Tools > Manage Libraries .. > and Search in the Libraries Manager.

Install the last available version.



DIRECTION OF THE  
DETECTABLE  
ACCELERATIONS



<https://www.mouser.cl/datasheet/2/389/cd00274221-1797088.pdf>

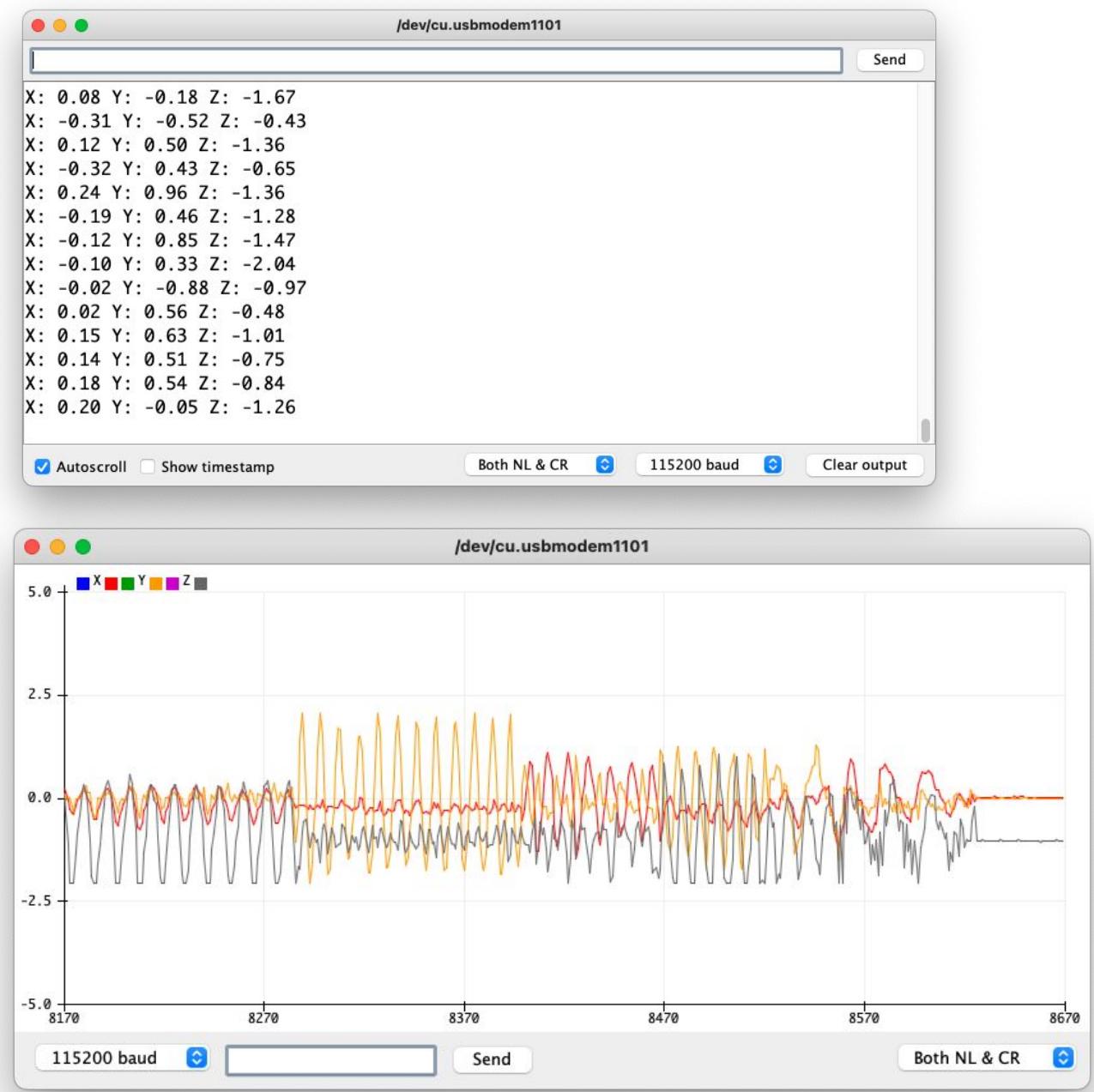
Acc\_LIS3DHTR\_test | Arduino 1.8.19

```

Acc_LIS3DHTR_test
1 #include "LIS3DHTR.h"
2 LIS3DHTR<TwoWire> lis;
3
4 void setup() {
5   Serial.begin(115200);
6   lis.begin(Wire1);
7
8   if (!lis) {
9     Serial.println("ERROR");
10    while(1);
11  }
12 lis.setOutputDataRate(LIS3DHTR_DATARATE_50HZ); //Data output rate
13 lis.setFullScaleRange(LIS3DHTR_RANGE_2G); //Scale range set to 2g
14 }
15
16 void loop() {
17   float x_values, y_values, z_values;
18   x_values = lis.getAccelerationX();
19   y_values = lis.getAccelerationY();
20   z_values = lis.getAccelerationZ();
21
22   Serial.print("X: "); Serial.print(x_values);
23   Serial.print(" Y: "); Serial.print(y_values);
24   Serial.print(" Z: "); Serial.print(z_values);
25   Serial.println();
26   delay(50);
27 }
28

```

Done uploading.  
done in 0.495 seconds  
Verify 38372 bytes of flash  
[=====] 100% (75/75 pages)  
Verify successful  
Done in 0.096 seconds



# Using the TFT Display

```
Acc_LIS3DHTR_LCD_test | Arduino 1.8.19
```

```
Acc_LIS3DHTR_LCD_test §
2 * Wio Terminal Setup
3 * IMU test and Display on TFT
4 * @MJRovai 23Feb23
5 */
6
7 #include "LIS3DHTR.h"
8 #include "TFT_eSPI.h"
9 LIS3DHTR<TwoWire> lis;
10 TFT_eSPI tft;
11
12 void setup() {
13   Serial.begin(115200);
14
15   // Initiate LCD
16   tft.begin();
17   tft.setRotation(3);
18   tft.fillScreen(TFT_WHITE);
19   tft.setFreeFont(&FreeSansBoldOblique12pt7b);
20
21   // Initiate Accelerometer
22   lis.begin(Wire1);
23
24   if (!lis.available()) {
25     Serial.println("Failed to initialize IMU!");
26     tft.drawString("Failed to initialize IMU!", 20, 10);
27     while (1);
28   }
29   else {
30     Serial.println("IMU initialized");
31     tft.drawString("IMU initialized", 20, 10);
32   }
33
34   //Setting output data rage to 100Hz, can be set up tp 5kHz
35   lis.setOutputDataRate(LIS3DHTR_DATARATE_100HZ);
36   //Scale range set to 16g, select from 2,4,8,16g
37   lis.setFullScaleRange(LIS3DHTR_RANGE_16G);
38 }
```

Done uploading.

Verify 65376 bytes of flash  
[=====] 100% (128/128 pages)  
Verify successful

```
Acc_LIS3DHTR_LCD_test | Arduino 1.8.19
```

```
Acc_LIS3DHTR_LCD_test §
40 void loop() {
41   float x_values, y_values, z_values;
42   x_values = lis.getAccelerationX();
43   y_values = lis.getAccelerationY();
44   z_values = lis.getAccelerationZ();
45
46   Serial.print("X: "); Serial.print(x_values);
47   Serial.print(" Y: "); Serial.print(y_values);
48   Serial.print(" Z: "); Serial.print(z_values);
49   Serial.println();
50
51   tft.drawString("X: ", 20, 60);
52   tft.drawString(String(x_values), 60, 60);
53   tft.drawString("Y: ", 20, 100);
54   tft.drawString(String(y_values), 60, 100);
55   tft.drawString("z: ", 20, 140);
56   tft.drawString(String(z_values), 60, 140);
57   delay(100);
58   //tft.fillScreen(TFT_WHITE);
59 }
60
```

Done uploading.

Verify 65376 bytes of flash  
[=====] 100% (128/128 pages)  
Verify successful



Set up connection between Wio Terminal  
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

Select project

Create a new project

Enter the name for your new project:

AAU-Wio-Gesture-Classification

Choose your project type:

Developer  
20 min job limit, 4GB or 4 hours of data, limited collaboration.

Enterprise  
No job or data size limits, higher performance, custom blocks. [Learn more](#)

Create new project

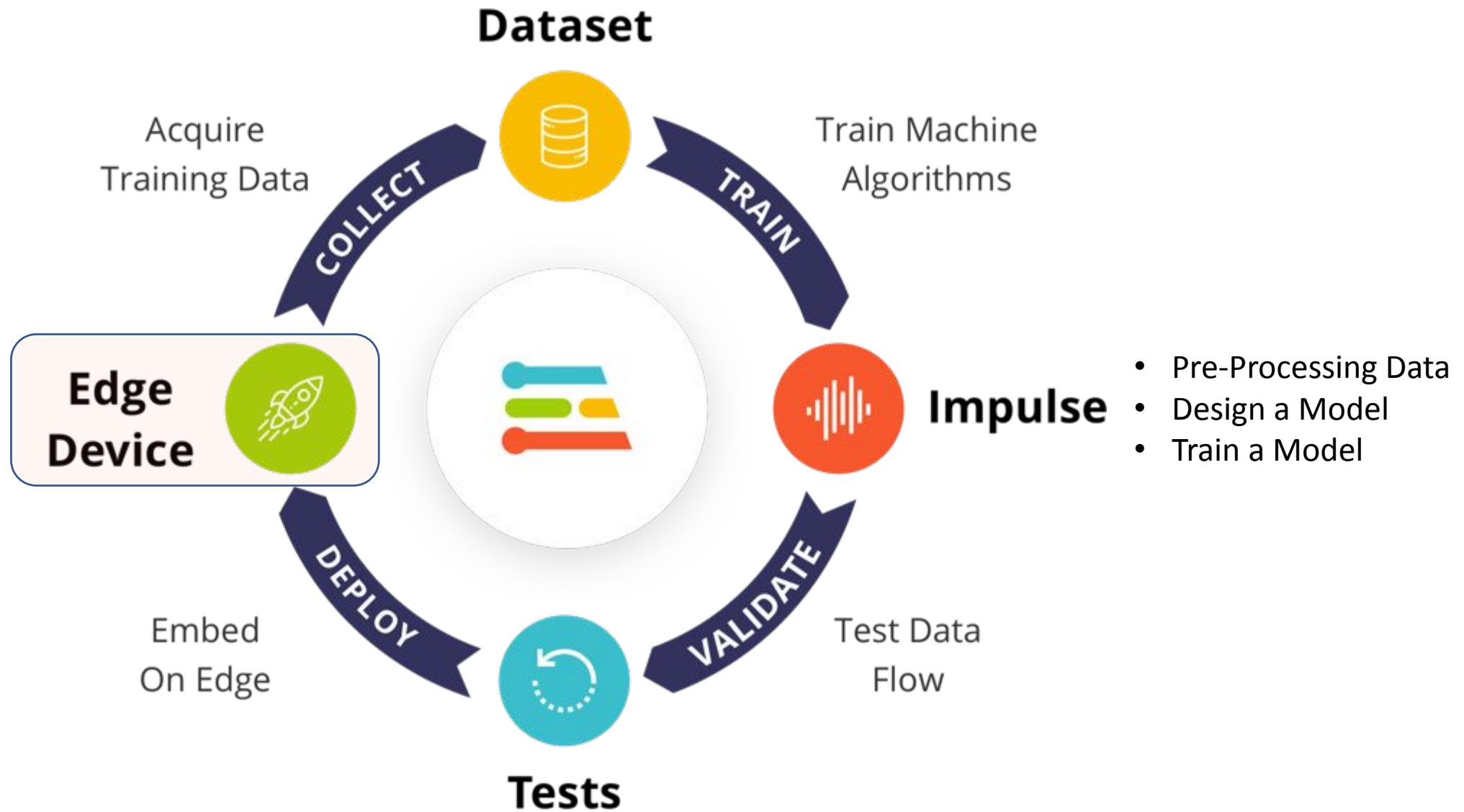
Marcelo Rovai / Cifar10\_Image\_Classification

Marcelo Rovai / IESTI01-Cifar10\_Classification

Marcelo Rovai / Bean Disease Classifier

Marcelo Rovai / IESTI01-Motion\_Classification-Anomaly\_Detection

The screenshot shows a web browser window for the Edge Impulse studio. The main background is orange with a grid pattern. A central modal window titled 'Create a new project' is open. Inside the modal, there's a text input field containing 'AAU-Wio-Gesture-Classification' which is highlighted with a red rounded rectangle. Below the input field is a section for choosing a project type, with 'Developer' selected (indicated by a blue radio button). The 'Enterprise' option is also available. At the bottom of the modal is a green 'Create new project' button. In the background, several other project thumbnails are visible, each showing a user profile picture and the project name. The top navigation bar includes the Edge Impulse logo, a user profile icon, and various menu icons.



Devices - IESTI01 - Nano Motion Classification

studio.edgeimpulse.com/studio/61345/devices

MJRoBot (Marcelo Rovai)

EDGE IMPULSE

1 Devices

2 + Connect a new device

3 Browse dev boards

DEVICES (IESTI01 - NANO MOTION CLASSIFICATION)

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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GETTING STARTED

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

The screenshot shows the Edge Impulse studio interface. On the left, a sidebar lists various features like Dashboard, Devices (which is highlighted with a red box and labeled '1'), Data acquisition, etc. The main area is titled 'DEVICES (IESTI01 - NANO MOTION CLASSIFICATION)' and shows a 'Your devices' section with a message about connected devices. A central modal window is open, titled 'Collect data', with the sub-section 'Connect a fully supported development board'. This section includes a 'Browse dev boards' button, which is highlighted with a red box and labeled '3'. Other sections in the modal include 'Use your mobile phone', 'Use your computer', 'Data from any device with the data forwarder', 'Upload data', and 'Integrate with your cloud'. The bottom of the page has a footer with copyright information and links to 'Documentation' and 'Forums'. A navigation bar at the top includes back, forward, search, and user profile icons. A blue footer bar at the bottom contains a link to the documentation page.

Overview - Edge Impulse Docu +  
docs.edgeimpulse.com/docs/development-platforms/fully-supported-development-boards

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Live classification

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**Officially supported AI Accelerators**

- Raspberry Pi 4
- Renesas RZ/V2L
- Texas Instruments SK-TDA4VM

**Community boards**

- Arducam Pico4ML TinyML Dev Kit
- Blues Wireless Swan
- RAKwireless WisBlock
- **Seeed Wio Terminal**
- Seeed reComputer Jetson
- Texas Instruments SK-AM62



Previous  
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Last modified 19d ago

WAS THIS PAGE HELPFUL? 

Seeed Wio Terminal - Edge Impulse

docs.edgeimpulse.com/docs/development-platforms/community-boards/seeed-wio-terminal

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Seeed Wio Terminal

## Setting up your development board

To set up your Seeed Wio Terminal, follow this guide: [Getting started with Edge Impulse - Seeed Wiki](#).



Next steps: building a machine learning model

Seed Wio Terminal - Edge Imp... Edge Impulse Getting Started +

wiki.seeedstudio.com/Wio-Terminal-TinyML-EI-1/

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Platform/Wio Terminal/TinyML/Edge Impulse Projects/Edge Impulse Getting Started

Search EN

**Wio Terminal Edge Impulse Getting Started**

 **EDGE IMPULSE**

**Edge Impulse** enables developers to create the next generation of intelligent device solutions with embedded Machine Learning. Machine Learning at the very edge will enable valuable use of the 99% of sensor data that is discarded today due to cost, bandwidth or power constraints.

Now, **Wio Terminal** is officially supported by the Edge Impulse. Let's see how to get Wio Terminal started with the Machine learning at the very edge!

### Installing dependencies

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

1. Node.js v12 or higher
2. Arduino CLI
3. The Edge Impulse CLI and a serial monitor. Install by opening command prompt or terminal and run:

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

**Note**  
Problems with installing the CLI? Please check [Installation and troubleshooting](#) for more reference.

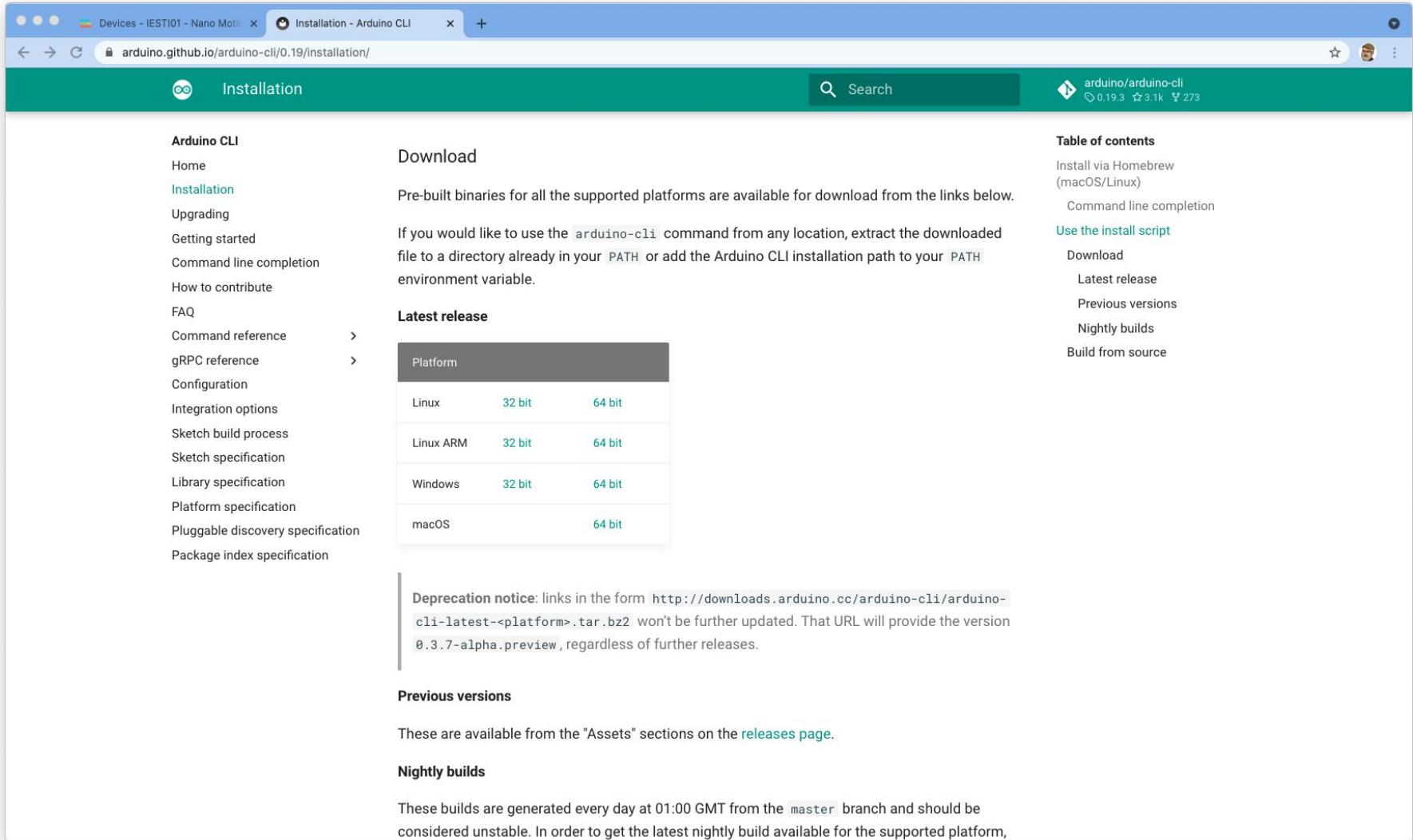
**Table of contents**

- Installing dependencies
- Connecting to Edge Impulse
  - 1. Connect the development board to your computer
  - 2. Setting Keys
  - 3. Verifying that the device is connected
- Training data acquisition
- Building a machine learning model
- Deploying to Wio Terminal
- Reference

(Note that the **1. Edge Impulse CLI** is not necessary for Wio Terminal. We will use **WebUSB** instead)

Go to **2. Arduino CLI**

# 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/](https://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	<a href="#">32 bit</a>	<a href="#">64 bit</a>
Linux ARM	<a href="#">32 bit</a>	<a href="#">64 bit</a>
Windows	<a href="#">32 bit</a>	<a href="#">64 bit</a>
macOS		<a href="#">64 bit</a>

**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:

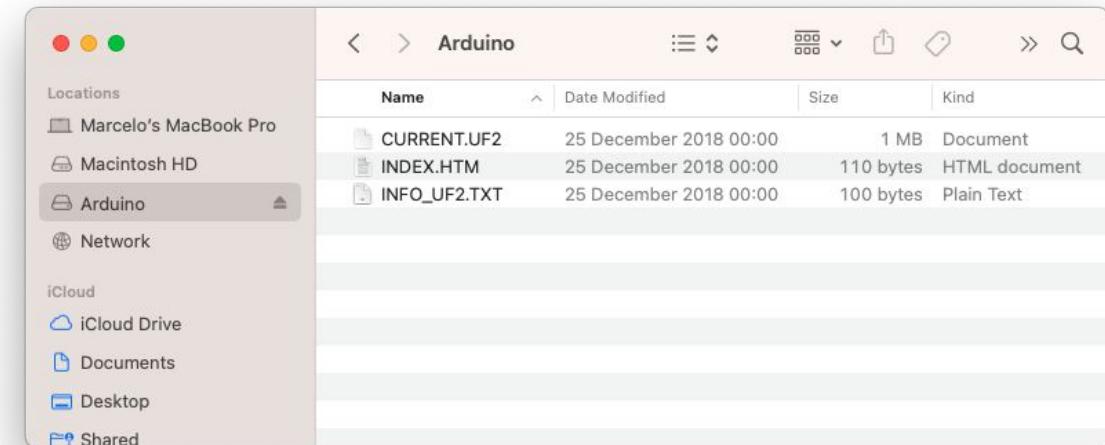
- Unzip the .zip file to C:\Program Files\arduino-cli
- Open System Properties > Advanced > Environment Variables
- Path under "user variables" > Edit
- Add C:\Program Files\arduino-cli

## 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`

# Firmware installation

1. Connect Wio Terminal to your computer.
2. Entering the bootloader mode by sliding the power switch twice quickly.
3. An external drive named Arduino should appear in your PC.
4. Drag the the downloaded [Edge Impulse uf2 firmware files](#) to the Arduino drive. Now, Edge Impulse is loaded on Seeeduino Wio Terminal!



A screenshot of a GitHub release page for 'wio-terminal-ei'. The page shows the 'Latest release' for version 1.4.0, which was released on April 15 by AIWintermuteAI. The release notes mention added built-in microphone support and internal light sensor support. The 'Assets' section contains three files:

- wio-terminal-ei-1.4.0.uf2 (highlighted with a red box)
- Source code (zip)
- Source code (tar.gz)

# Built-in Sensor's Test

AAU-Wio-Gesture-Classificatio

studio.edgeimpulse.com/studio/190030/acquisition/training?page=1

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studio.edgeimpulse.com wants to connect to a serial port

cu.Bluetooth-Incoming-Port

Arduino Nano 33 BLE (cu.usbmodem1101)

Seeed Wio Terminal (cu.usbmodem1101) - Paired

Marcelo Rovai / AAU-Wio-Gesture-Classification

Upload data Export data

Select your device or development board, or upload your existing datasets - Show options

Record new data

Connect using WebUSB

Cancel Connect

The screenshot shows the Edge Impulse Studio web interface. A modal dialog box is open in the center, titled 'studio.edgeimpulse.com wants to connect to a serial port'. It lists three options: 'cu.Bluetooth-Incoming-Port', 'Arduino Nano 33 BLE (cu.usbmodem1101)', and 'Seeed Wio Terminal (cu.usbmodem1101) - Paired'. The third option is highlighted with a blue background. At the bottom of this dialog are two buttons: 'Cancel' and 'Connect', with 'Connect' being highlighted by an orange rectangle. In the background, the main studio interface shows a purple header with the user's name 'Marcelo Rovai / AAU-Wio-Gesture-Classification'. Below the header are tabs for 'Upload data' and 'Export data'. A central area says 'Select your device or development board, or upload your existing datasets - Show options'. To the right, there's a 'Record new data' section with a note 'No devices connected to the remote management API.' and a 'Connect using WebUSB' button, also highlighted with an orange rectangle.

AAU-Wio-Gesture-Classification

studio.edgeimpulse.com/studio/190030/devices

EDGE IMPULSE

Marcelo Rovai / AAU-Wio-Gesture-Classification

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	REMOT...	LAST SEEN
23:D1:FF:14:17:05	23:D1:FF:14:17:05	SEEED_WIO_TERMINAL	Built-in accelerometer, Built-i...	●	Today, 17:12:18

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EDGE IMPULSE

Marcelo Rovai / AAU-Wio-Gesture-Classification

Training data Test data | Data explorer | Upload data Export data

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

Collected data

No data collected yet

Let's collect some data

Record new data

Device ②  
23:D1:FF:14:17:05

Label Sample length (ms.)  
lateral 10000

Sensor Frequency  
✓ Built-in accelerometer 100Hz

Built-in microphone

Built-in light sensor  
External multichannel gas(Grove-multichannel gas v2)  
External temperature&humidity&pressure sensor(Grove-BME280)  
External pressure sensor(Grove-DPS310)  
External distance sensor(Grove-TFmini)  
External 6-axis accelerometer(Grove-BMI088)  
External ultrasonic sensor(Grove-ultrasonic sensor)  
External CO2+Temp sensor(Grove-SCD30)

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studio.edgeimpulse.com/studio/190030/acquisition/training?page=1

EDGE IMPULSE

Training data Test data | Data explorer | Upload data Export data

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

DATA COLLECTED 10s TRAIN / TEST SPLIT 100% / 0% ▲

Collected data

SAMPLE NAME	LABEL	ADDED	LENGTH
lateral.3pq0n74t	lateral	Today, 17:12:17	10s

Record new data

Device ⓘ 23:D1:FF:14:17:05

Label lateral Sample length (ms.) 10000

Sensor Built-in accelerometer Frequency 100Hz

Start sampling

RAW DATA lateral.3pq0n74t

accX accY accZ

AAU-Wio-Gesture-Classifi: X +

studio.edgeimpulse.com/studio/190030/acquisition/training?page=1

EDGE IMPULSE

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

DATA COLLECTED  
5s

TRAIN / TEST SPLIT  
100% / 0% ▲

Collected data

SAMPLE NAME	LABEL	ADDED	LENGTH
yes.3pq19fp5	yes	Today, 17:22:15	5s

Record new data

Device ⓘ  
23:D1:FF:14:17:05

Label Sample length (ms.)  
yes 5000

Sensor Frequency  
Built-in microphone 16000Hz

Start sampling

RAW DATA  
yes.3pq19fp5



audio

▶ 0:05 / 0:05 ⏸

Dashboard Devices Data sources Data acquisition Impulse design Create impulse EON Tuner Retrain model Live classification Model testing Versioning Deployment

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AAU-Wio-Gesture-Classifi: X +

studio.edgeimpulse.com/studio/190030/acquisition/training?page=1

EDGE IMPULSE

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

DATA COLLECTED  
10s

TRAIN / TEST SPLIT  
100% / 0% ▲

Collected data

SAMPLE NAME	LABEL	ADDED	LENGTH
rock.3pq1fjf	rock	Today, 17:25:36	5s
yes.3pq19fp5	yes	Today, 17:22:15	5s

Record new data

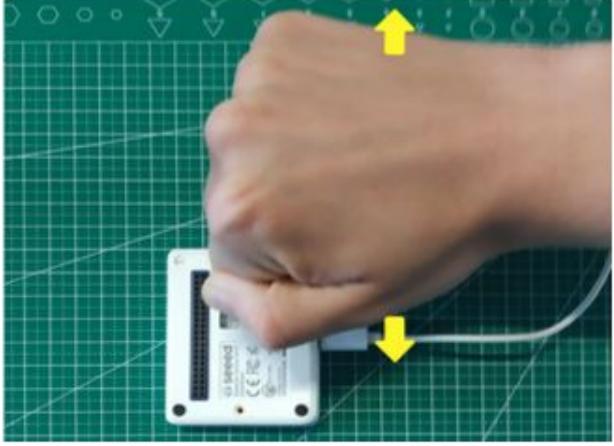
Device ⓘ  
23:D1:FF:14:17:05

Label Sample length (ms.)  
rock 5000

Sensor Frequency  
Built-in light sensor 62.5Hz

Start sampling

RAW DATA  
rock.3pq1fjf



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RAW DATA  
rock.3pq1fjf

4000  
3500  
3000  
2500  
2000  
1500  
1000  
500

0 519 1038 1557 2076 2595 3115 3634 4153 4672

illumination

# Thanks



UNIFEI

