



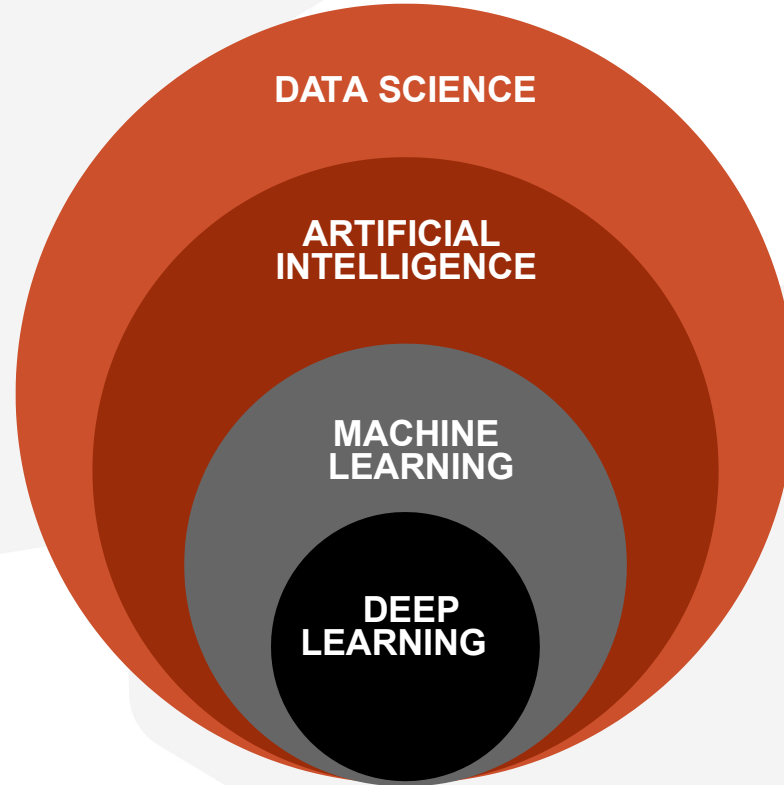
TinyML en Arduino Nano ESP32

*Luis Miguel Capacho Valbuena
Alexander López Parrado*

ARDUINO
DAYS 2026

March 27th - 28th
days.arduino.cc
#ArduinoDays26

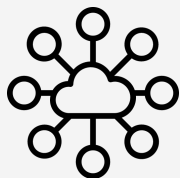
AI es un área de la ciencia de datos



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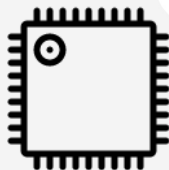
Aspectos que impulsaron el avance de la AI

1



**Disponibilidad
de Datos**

2



**Capacidad de
cómputo**

3



**Avances en
algoritmos**

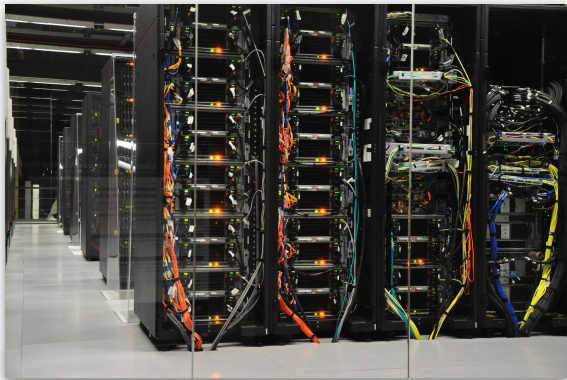
4



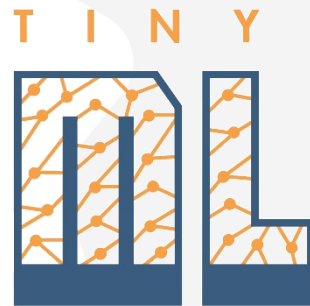
**Amplio
interés del
público**



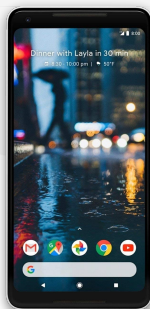
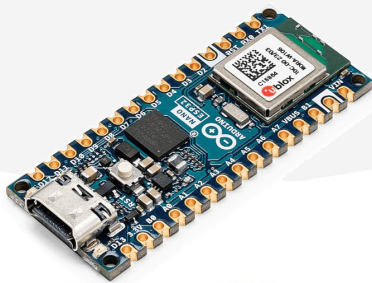
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Energía
Ancho de banda
Latencia



Energía
Ancho de banda
Latencia



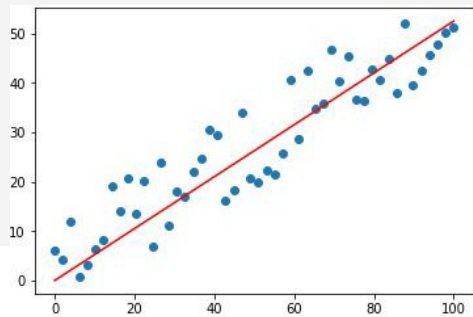
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Aplicaciones de TinyML

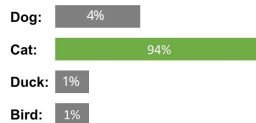
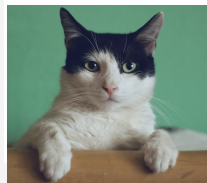
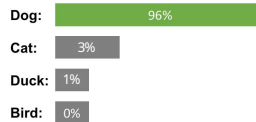
Aprendizaje supervisado

Aprendizaje no supervisado

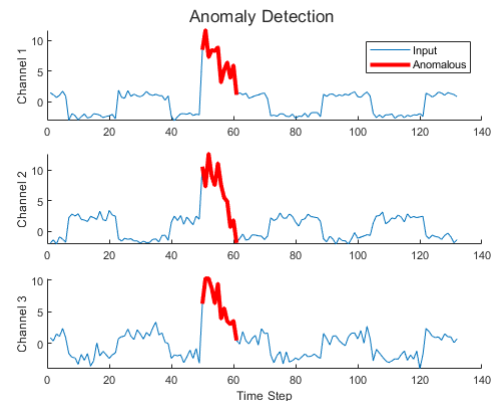
Regresión



Clasificación

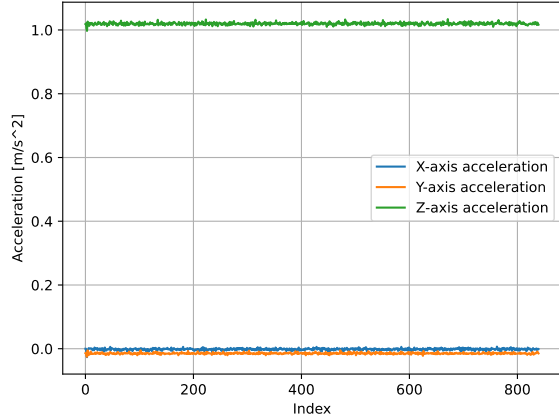


Detección de Anomalías

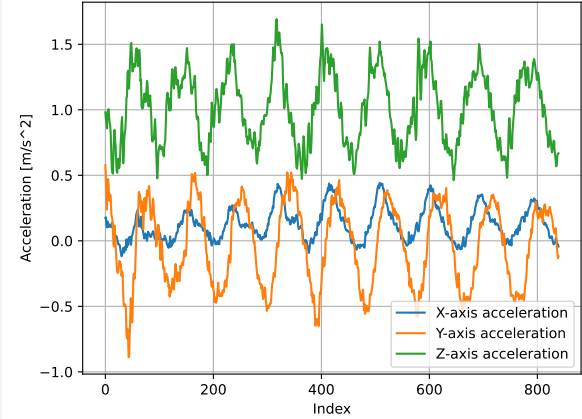


Clasificación de Gestos

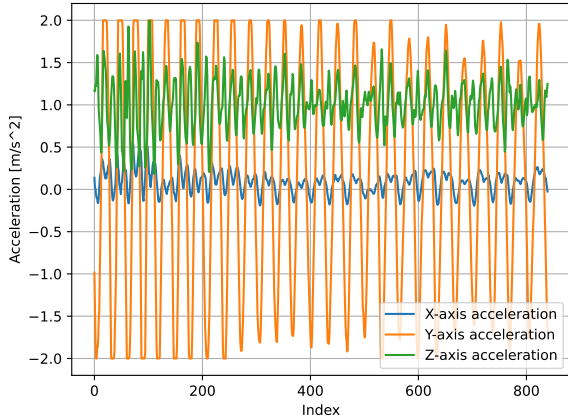
Acceleration data from quieto gesture



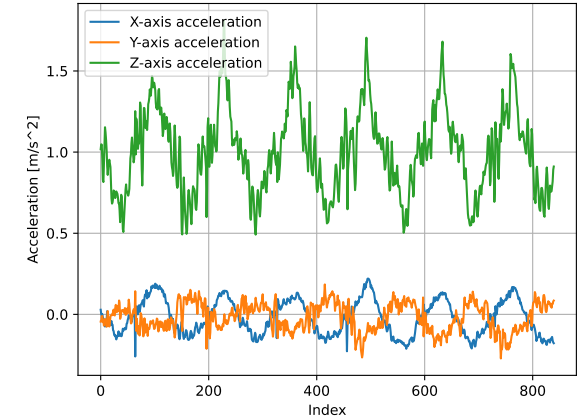
Acceleration data from giro gesture



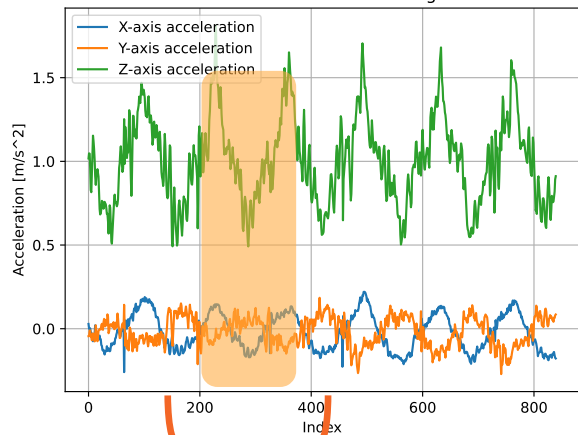
Acceleration data from sacudir gesture



Acceleration data from vertical gesture



Acceleration data from vertical gesture



Ventana 2s

- **Vectores de dimensión 27**
 - 800 para entrenamiento
 - 320 para pruebas
 - Cada vector debe etiquetarse

- **FFT de 16 puntos + log10**
- **Valor RMS**
- **9x3 características**

Feature data from vertical gesture



Capa de entrada

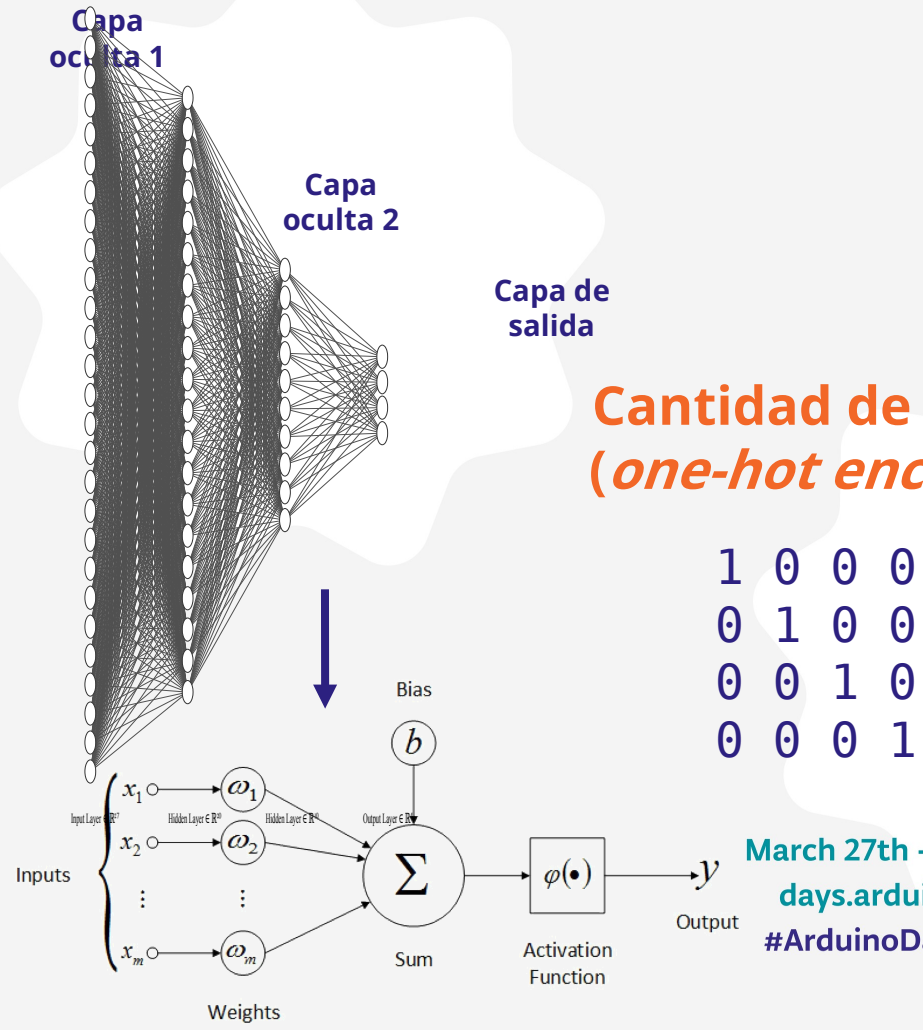
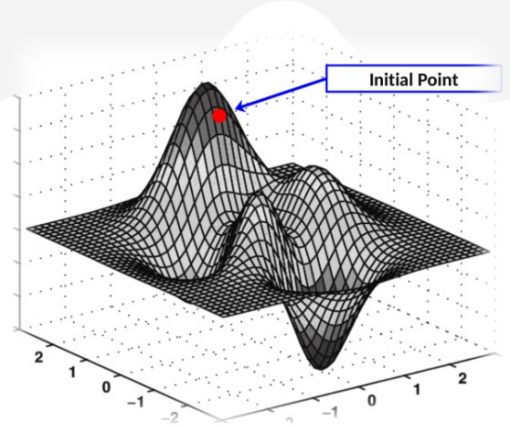
Capa oculta 1

Capa oculta 2

Capa de salida

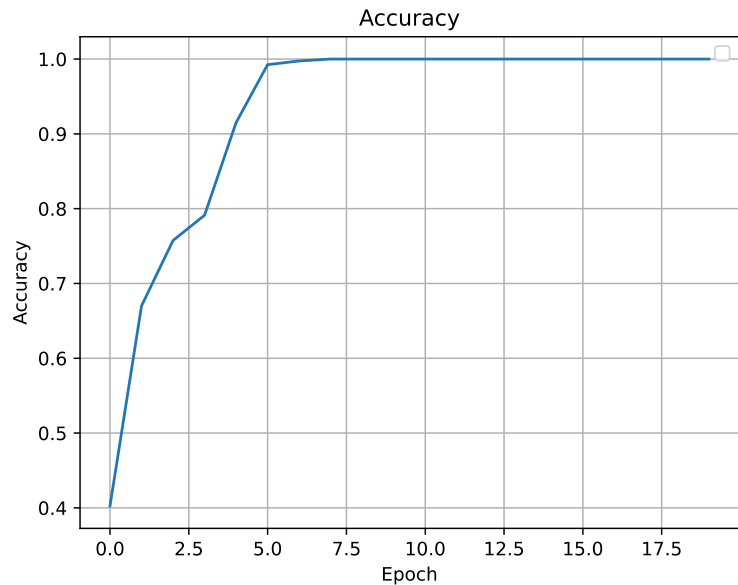
Características (27)

Cantidad de clases (*one-hot encoding*)

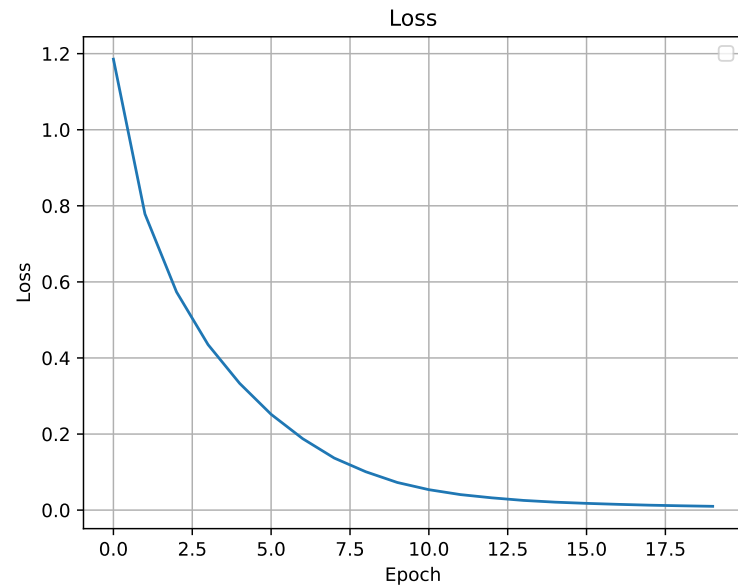


1	0	0	0
0	1	0	0
0	0	1	0
0	0	0	1

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Exactitud = correctas/total

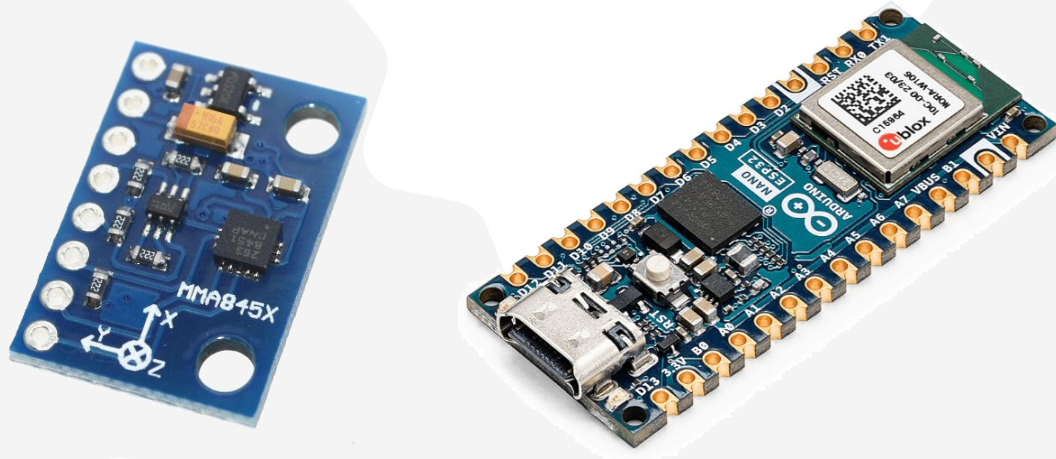


Pérdida = error de predicción



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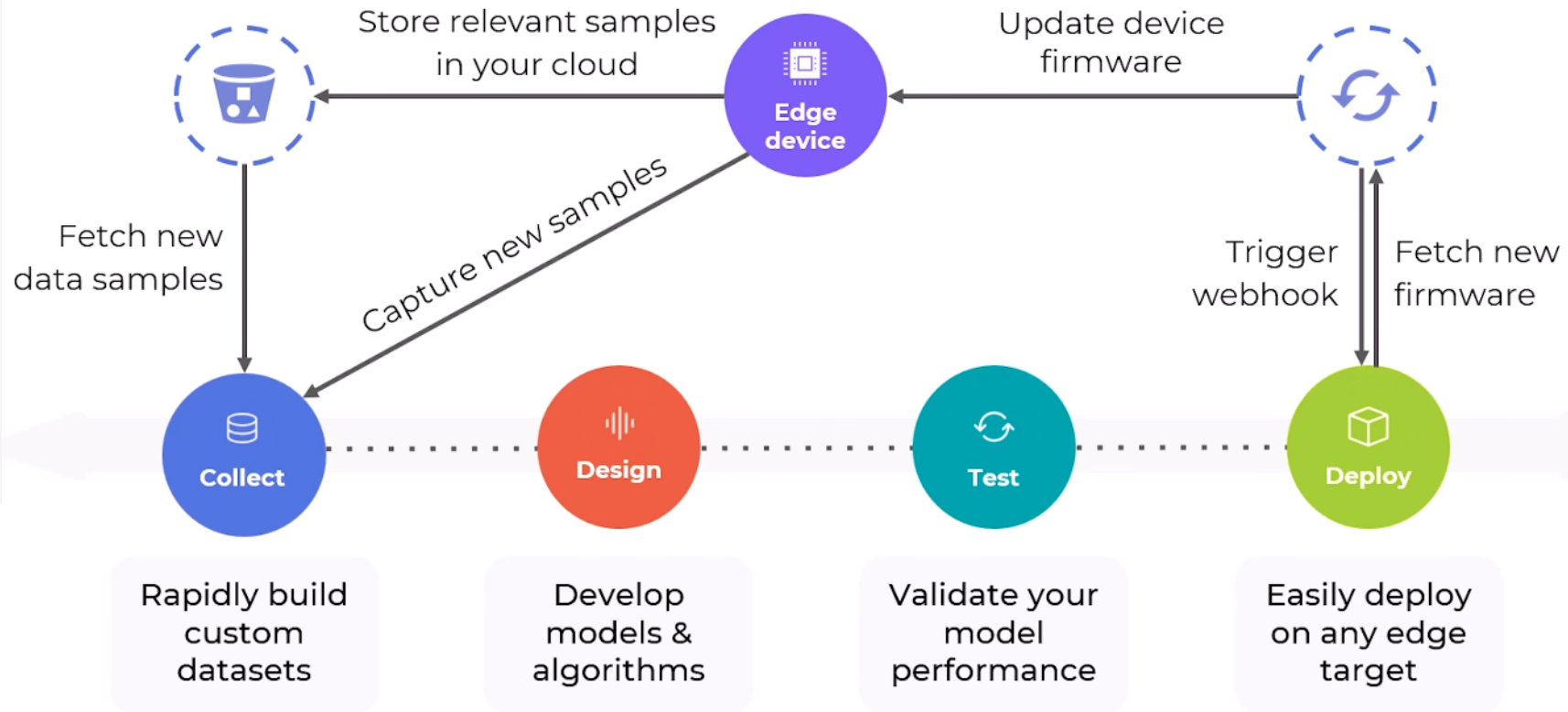
Demo: Detector de Gestos en Arduino Nano ESP32



EDGE IMPULSE
a Qualcomm company

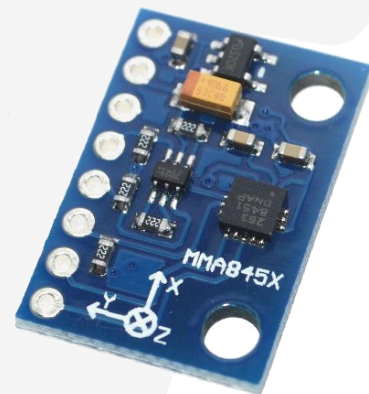
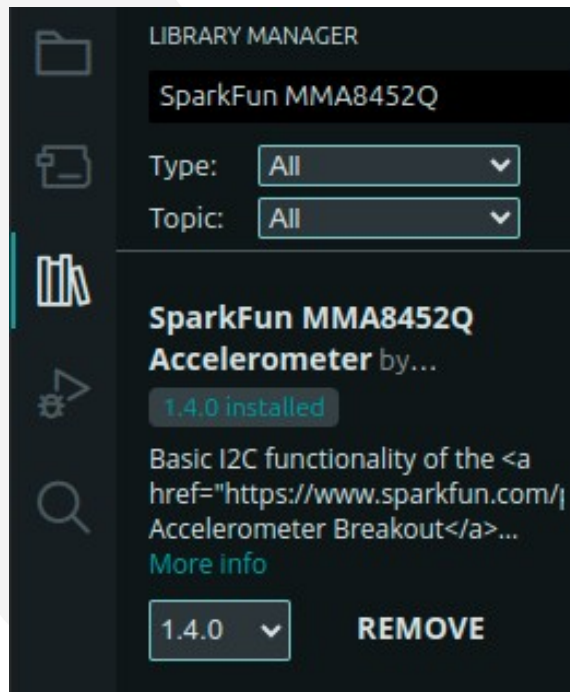
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Flujo de trabajo con Edge Impulse



Configuración acelerómetro MMA845X en Arduino IDE

Arduino IDE

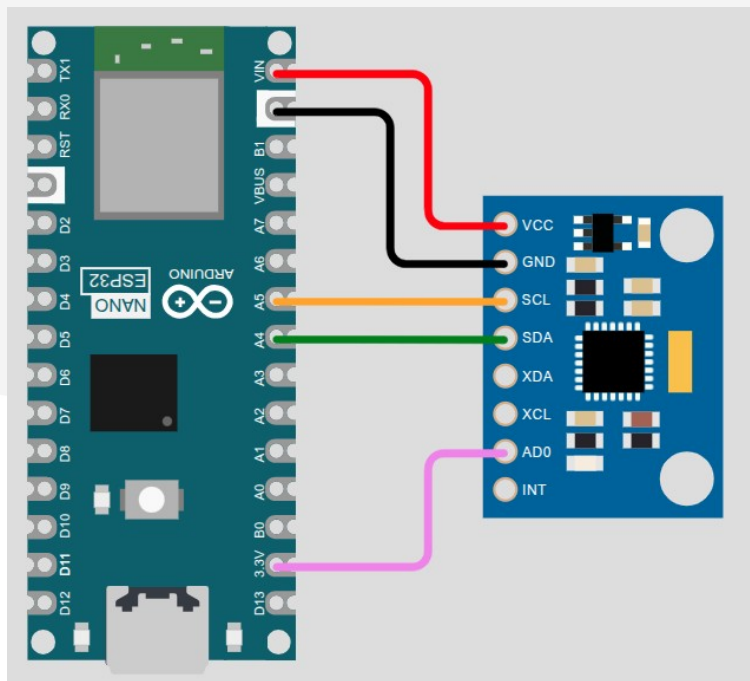


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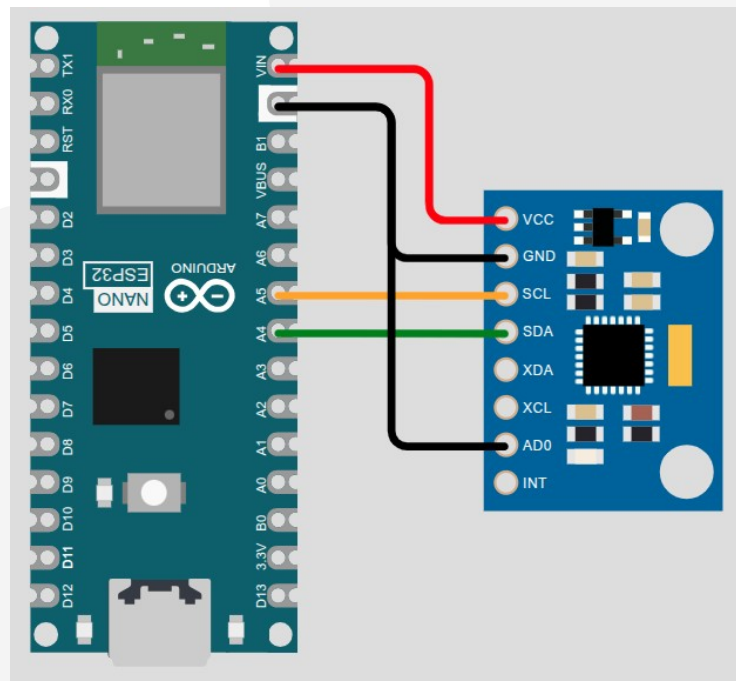
Conexión acelerómetro MMA845X con Arduino Nano ESP32

0x1D



A5 → SDL
A4 → SDA

0x1C



Skecth de prueba acelerómetro MMA845X con Arduino Nano ESP32 (Lectura 3 ejes)

```
#include <Wire.h>
#include "SparkFun_MMA8452Q.h"

MMA8452Q accel;

void setup() {
  Serial.begin(115200);
  Wire.begin(A4, A5);
  if (accel.begin(Wire, 0x1D) == false) {
    while (1);
  }
}
```

```
void loop() {
  if (accel.available()) {
    accel.read();
    Serial.print(accel.cx, 4);
    Serial.print(",");
    Serial.print(accel.cy, 4);
    Serial.print(",");
    Serial.println(accel.cz, 4);
  }
  delay(10);
}
```

Proyecto en Edge Impulse

Create a new project

Enter the name for your new project:



Nombre del proyecto

Choose your project type:

Personal

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

Enterprise

No job or data size limits, higher performance, custom blocks.



Tipo de proyecto de acuerdo al plan

Choose your project setting:

Public

Anyone on the internet can view and clone this project under the [3-Clause BSD license](#). Only invited users will be able to edit.

Private (3 of 3 remaining)

Only invited users can edit and view your project.



3 proyectos privados en cuenta gratuita

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Envío de datos a Edge Impulse

<https://nodejs.org/en/download>



En una terminal ejecutar

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

```
edge-impulse-data-forwarder
```



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Thank you!

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