

IESTI01 – TinyML

Embedded Machine Learning

17c. XIAOML Kit Overview & Tests

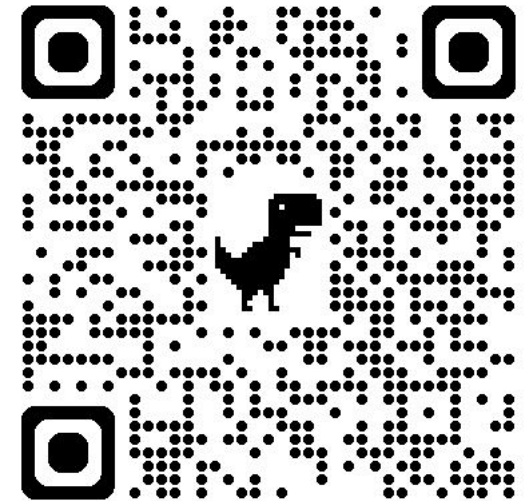
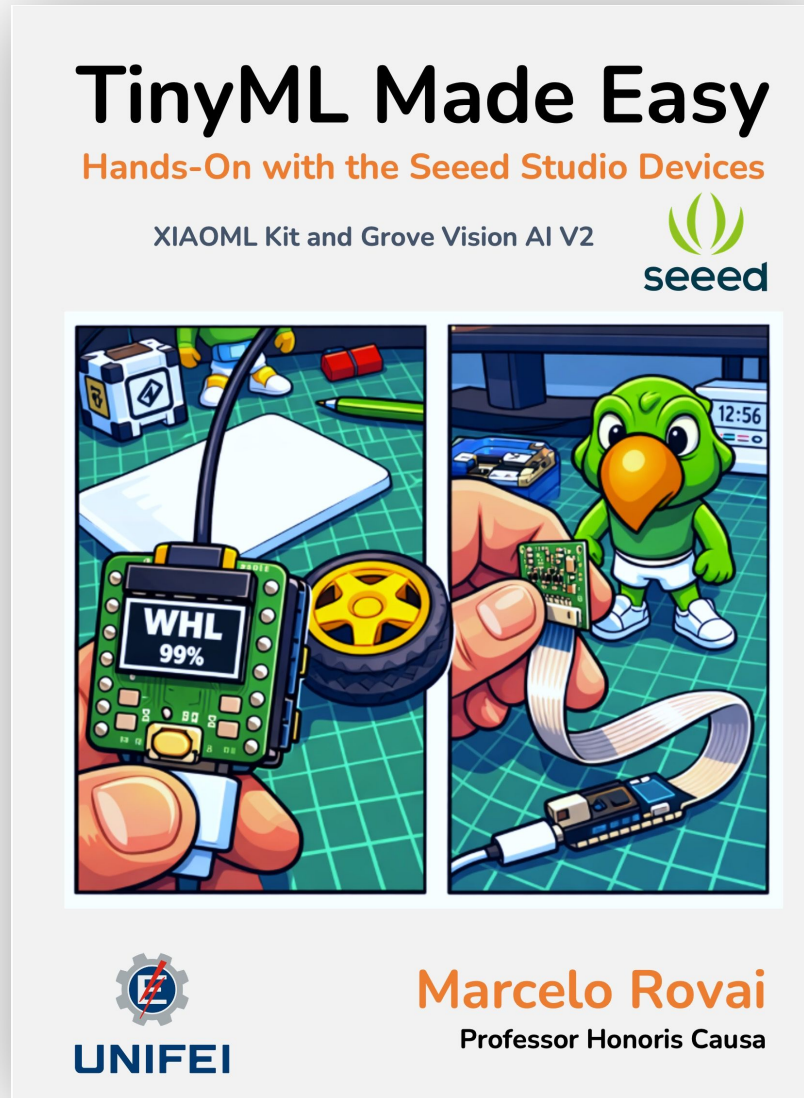


Prof. Marcelo Rovai

UNIFEI



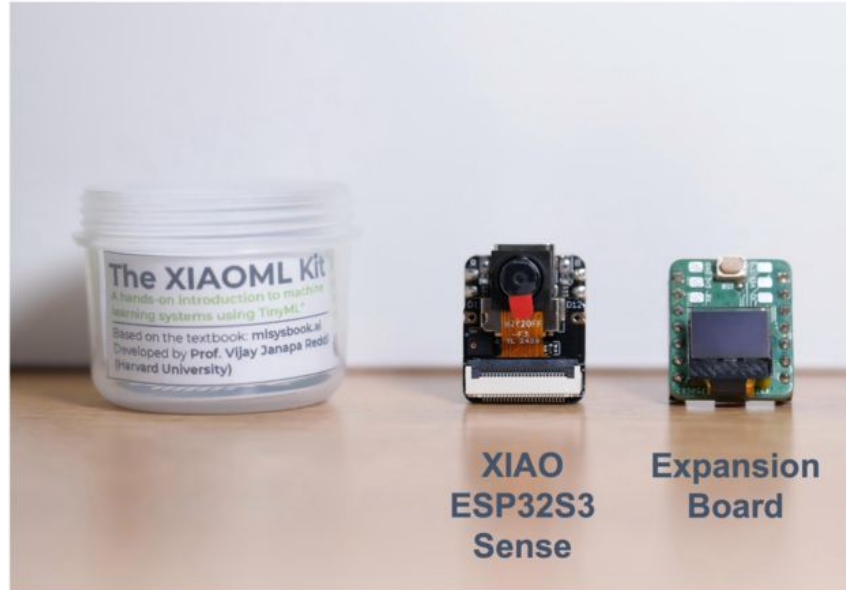
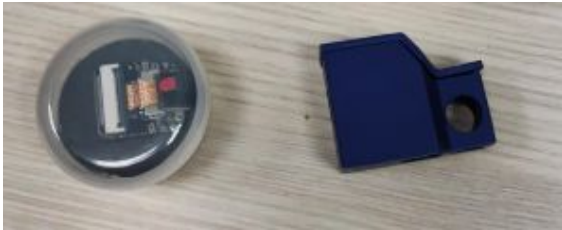
Course eBook



https://mjirovai.github.io/TinyML_Made_Easy_XIAO_ESP32S3_ebook/

The XIAOML Kit

The XIAOML Kit



Not included

Complete XIAOML Kit Components:

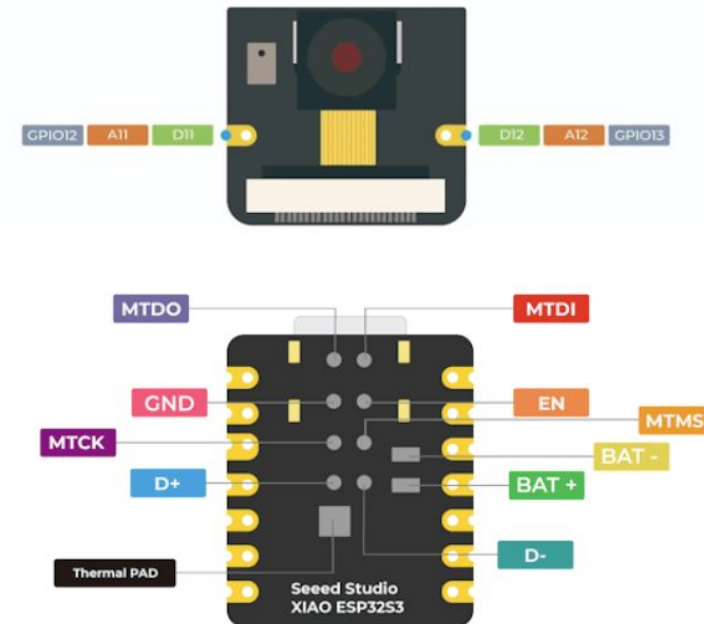
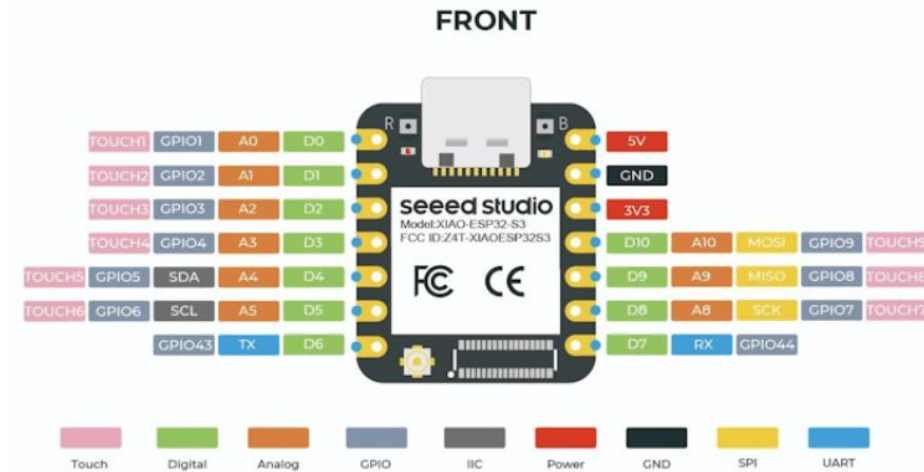
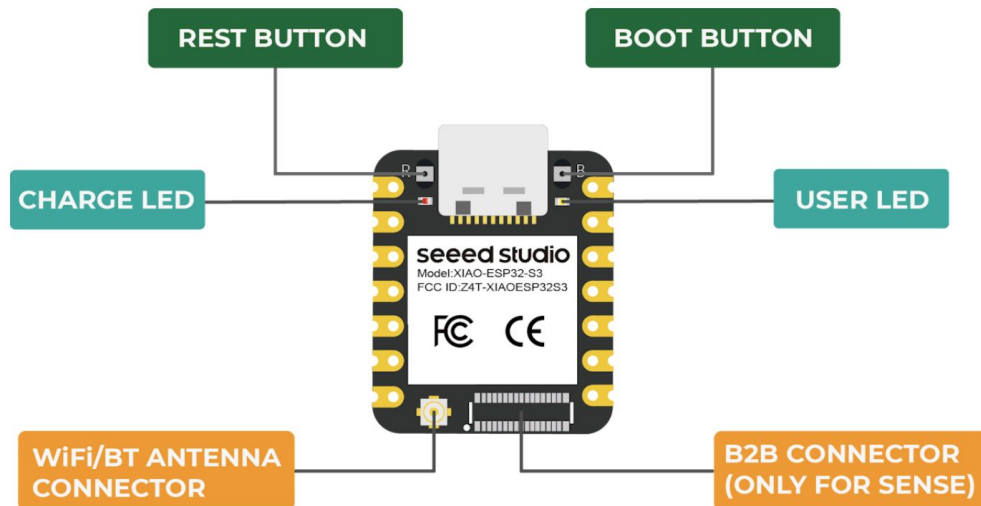
- **XIAO ESP32S3 Sense:** Main development board with integrated camera sensor, digital microphone, and SD card support
- **Expansion Board:** Features a 6-axis IMU (LSM6DS3TR-C) and 0.42" OLED display for motion sensing and data visualization
- **SD Card Toolkit:** Includes an SD card and a USB adapter for data storage and model deployment
- **USB-C Cable:** For connecting the board to your computer
- **Antenna and Heat Sinks**

The ESP32S3 Sense

Key Features

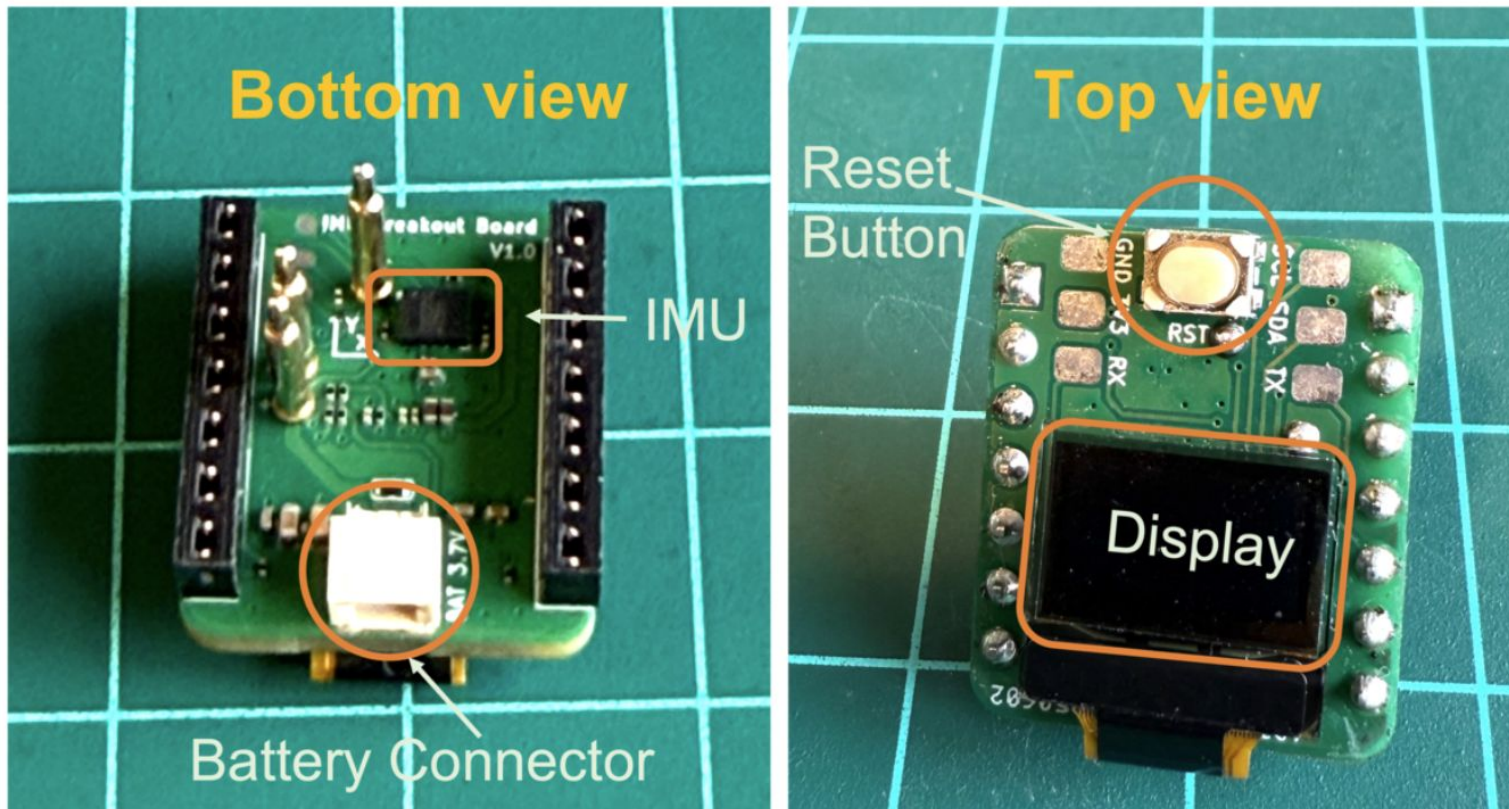
- **Powerful MCU:** ESP32S3 32-bit, dual-core, Xtensa processor operating up to 240 MHz, with Arduino / MicroPython support
- **Advanced Functionality:** Detachable OV2640 camera sensor for 1600 × 1200 resolution, compatible with OV5640 camera sensor, plus integrated digital microphone
- **Elaborate Power Design:** Lithium battery charge management with four power consumption models, deep sleep mode with power consumption as low as 14 μ A
- **Great Memory:** 8 MB PSRAM and 8 MB FLASH, supporting SD card slot for external 32 GB FAT memory
- **Outstanding RF Performance:** 2.4 GHz Wi-Fi and BLE dual wireless communication, supports 100m+ remote communication with U.FL antenna
- **Compact Design:** 21 × 17.5 mm, adopting the classic XIAO form factor, suitable for space-limited projects

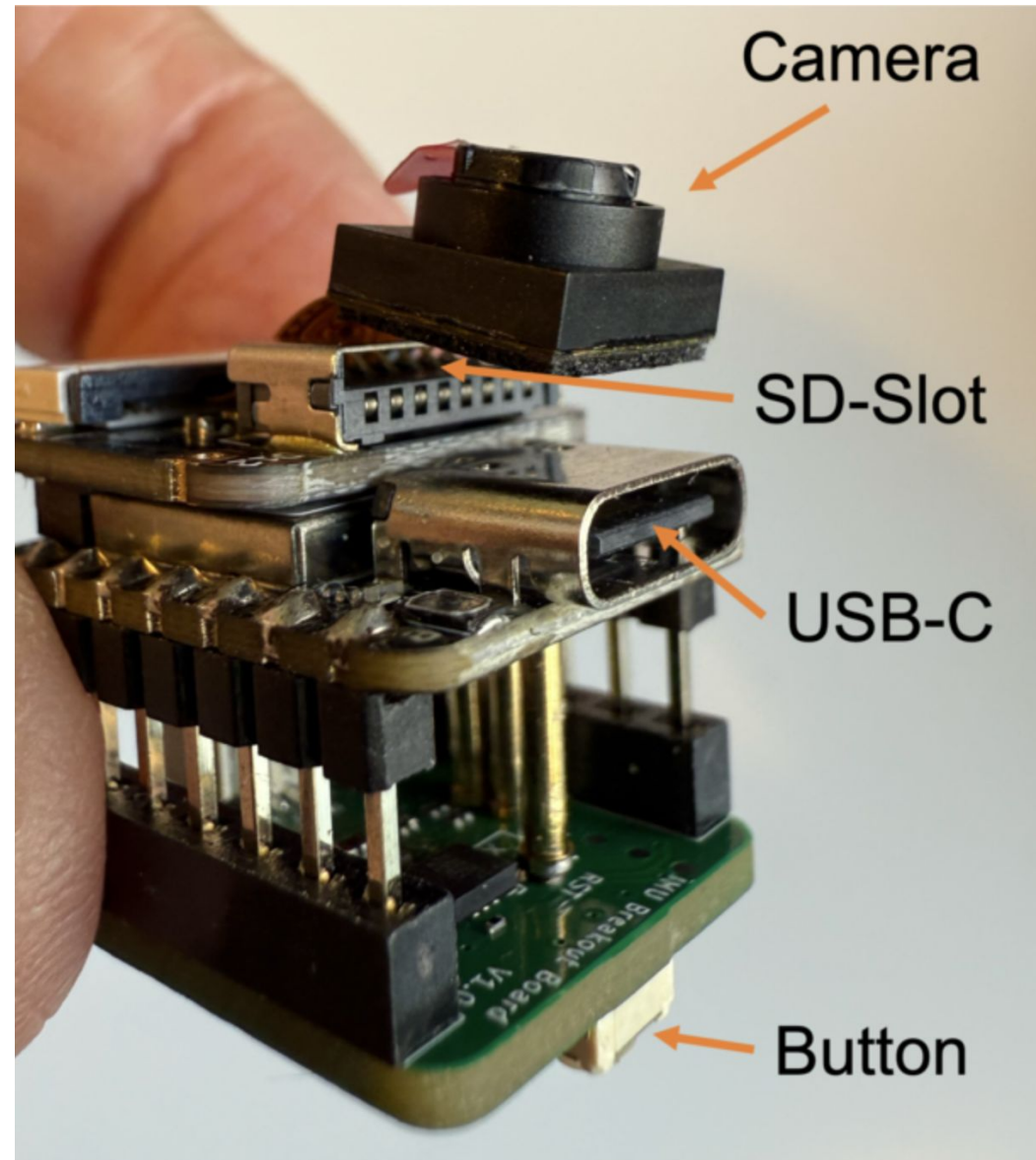
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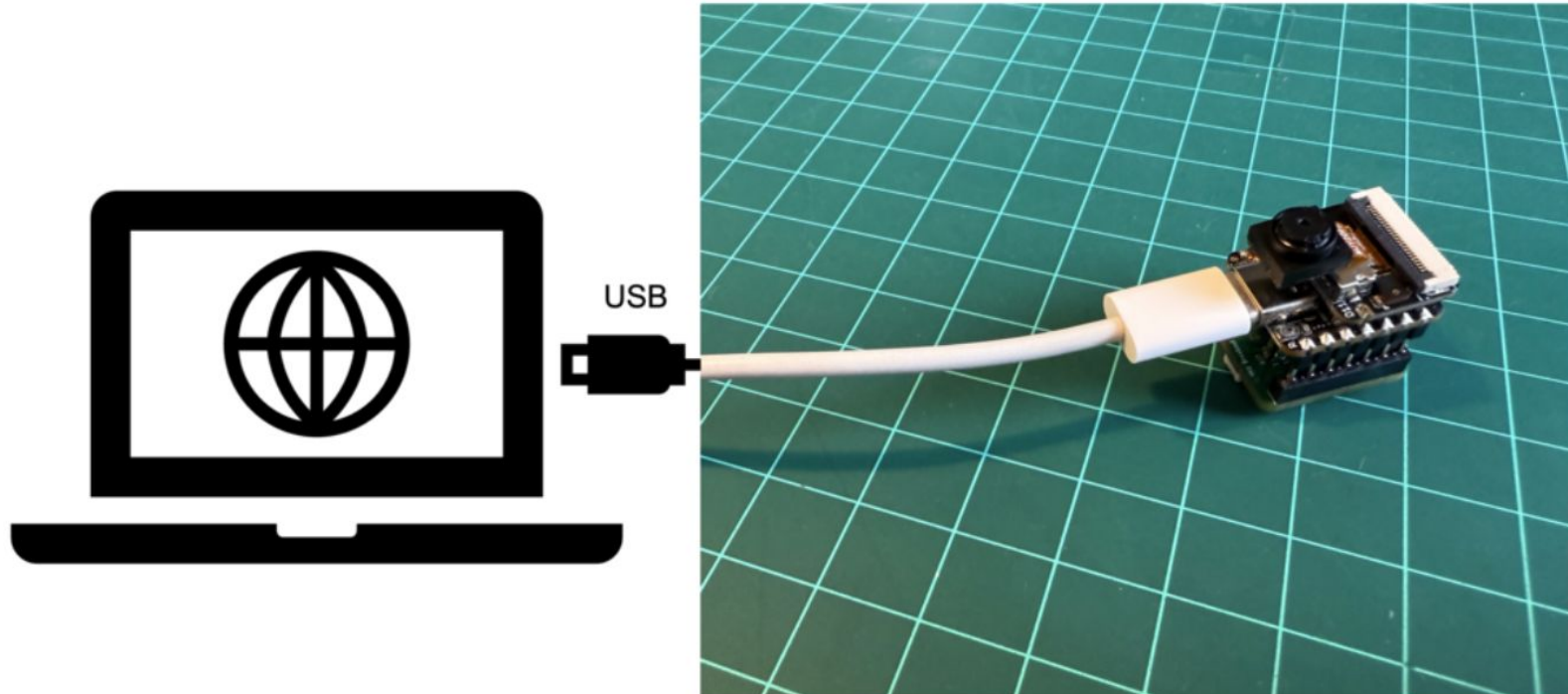
The Expansion Board

The expansion board extends the XIAOML Kit's capabilities for motion-based machine learning applications:

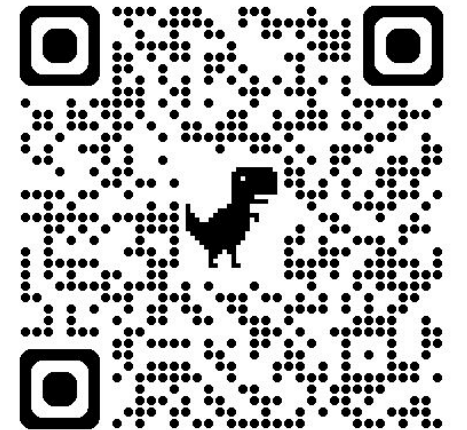
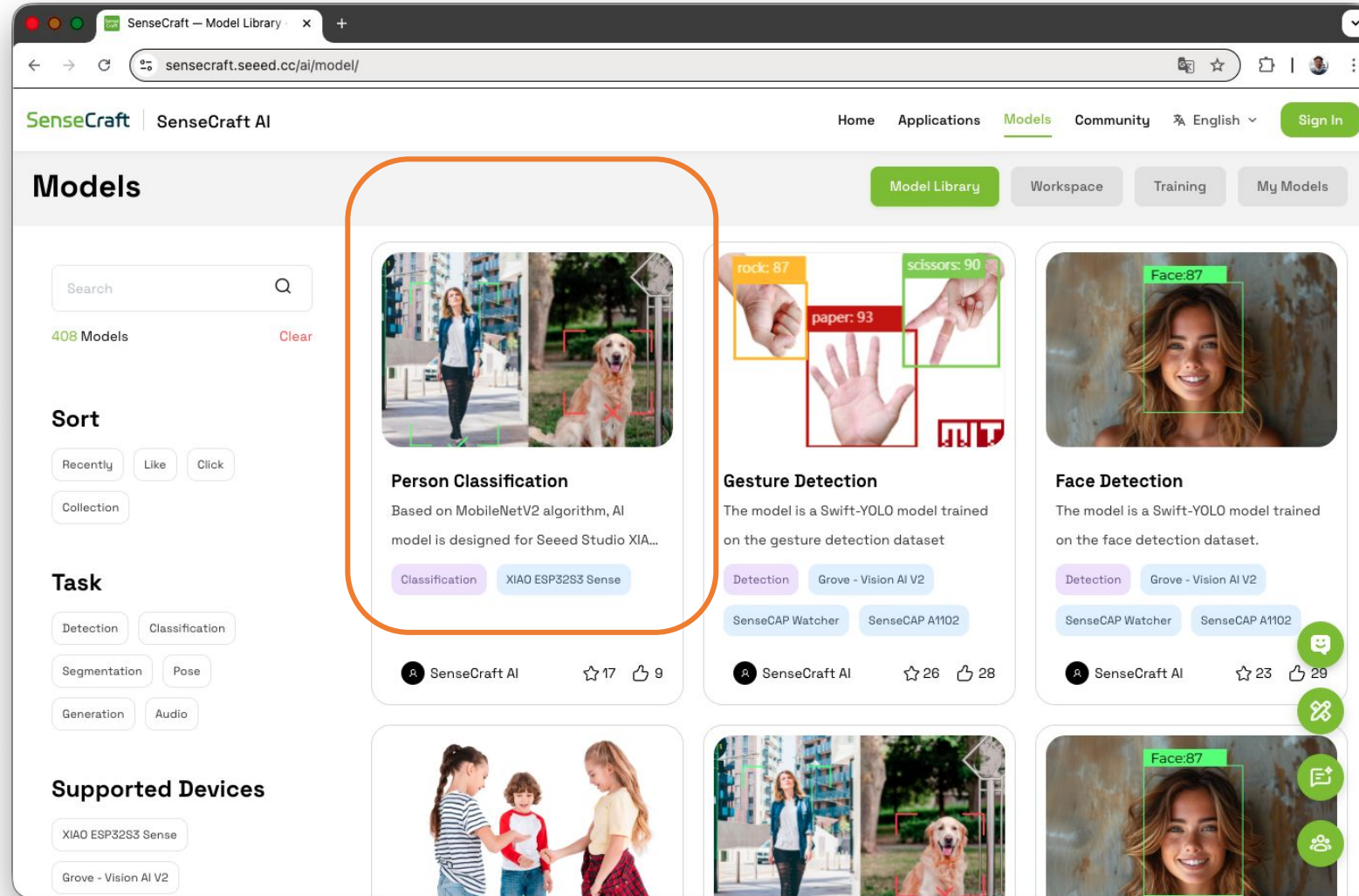




Testing the XIAOMI Kit – SenseCraft AI



Vision



<https://sensecraft.seeed.cc/ai/model>

SenseCraft — Person Classifi

sensecraft.seeed.cc/ai/view-model/60768-person-classification?tab=public&from=model-library

SenseCraft | SenseCraft AI

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Models

Model LibraryWorkspaceTrainingMy Models

< Back

Person Classification

Created at: 2024/9/19

Based on MobileNetV2 algorithm, AI model is designed for Seeed Studio XIAO ESP32S3 Sense device to realize effective classification of people

Task: Classification

Supported Devices: XIAO ESP32S3 Sense

Model Category: Human & Behavior

Publisher: SenseCraft AI

Model Precision: INT8

Model Format: TF Lite

Deploy Model

☆ 17👍 9

Model Introduction

This is a model designed for person classification, and its main function is to efficiently recognize and distinguish the presence or absence of people in an image or video. Through advanced deep learning techniques, the model is able to accurately detect human bodies in a scene and output information about whether there is a person or not.

The following are possible application scenarios for the model:

1.Security Surveillance: Used for real-time monitoring of video streams to detect the presence of characters and provide security alerts in a timely manner.

Model Introduction

Model Inference Example Image

Classes

SenseCraft — Deploy to Hard

sensecraft.seeed.cc/ai/model/deploy?id=60768&uniform_type=32&name=Person%20Classification&adapteds=7&task=2

SenseCraft

SenseCraft AI

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Deploy Person Classification

Supported Devices

The model can be deployed on the following devices. If you have no such device, you can purchase it by clicking

XIAO ESP32S3 Sense

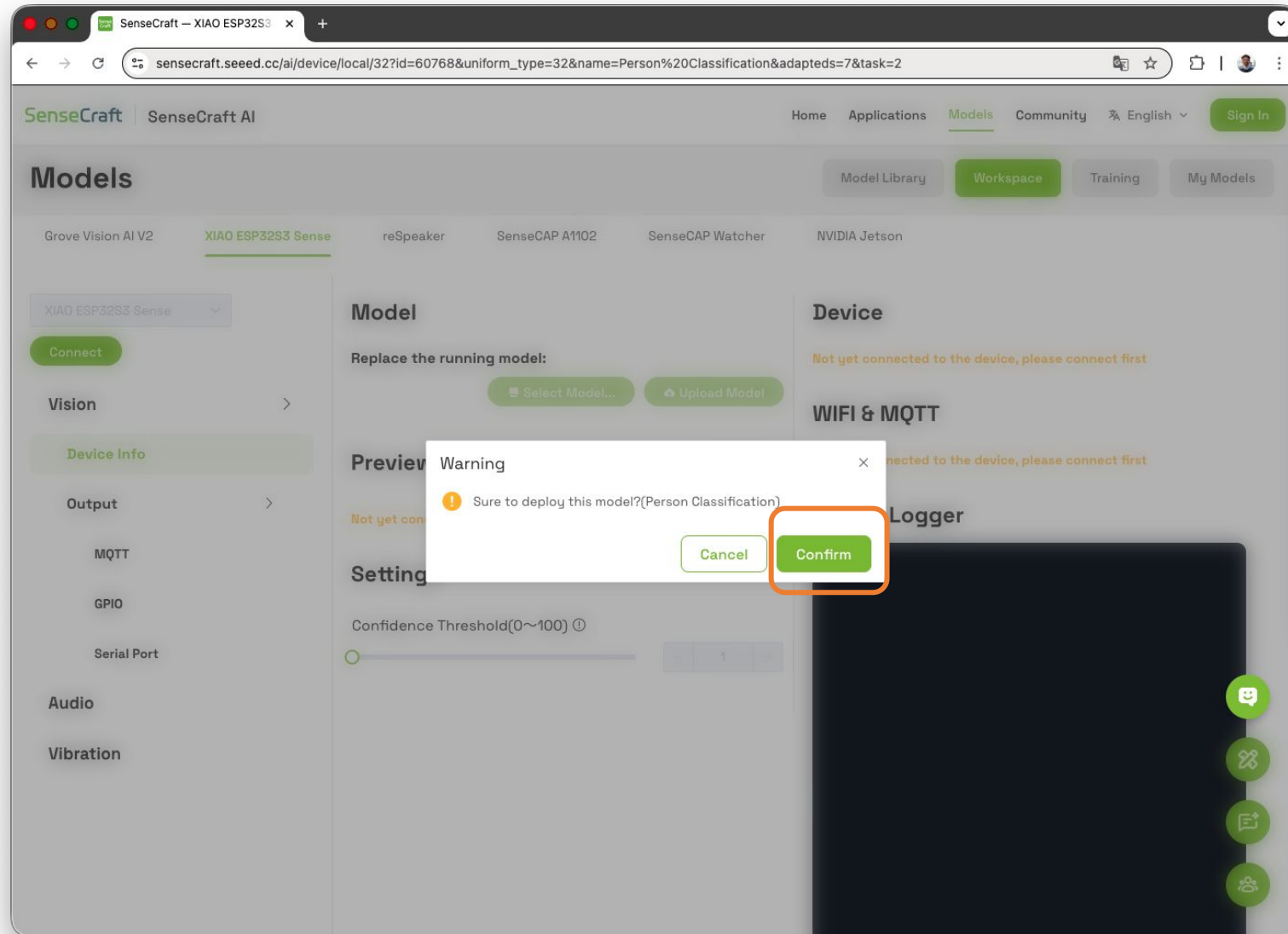
Connect Device

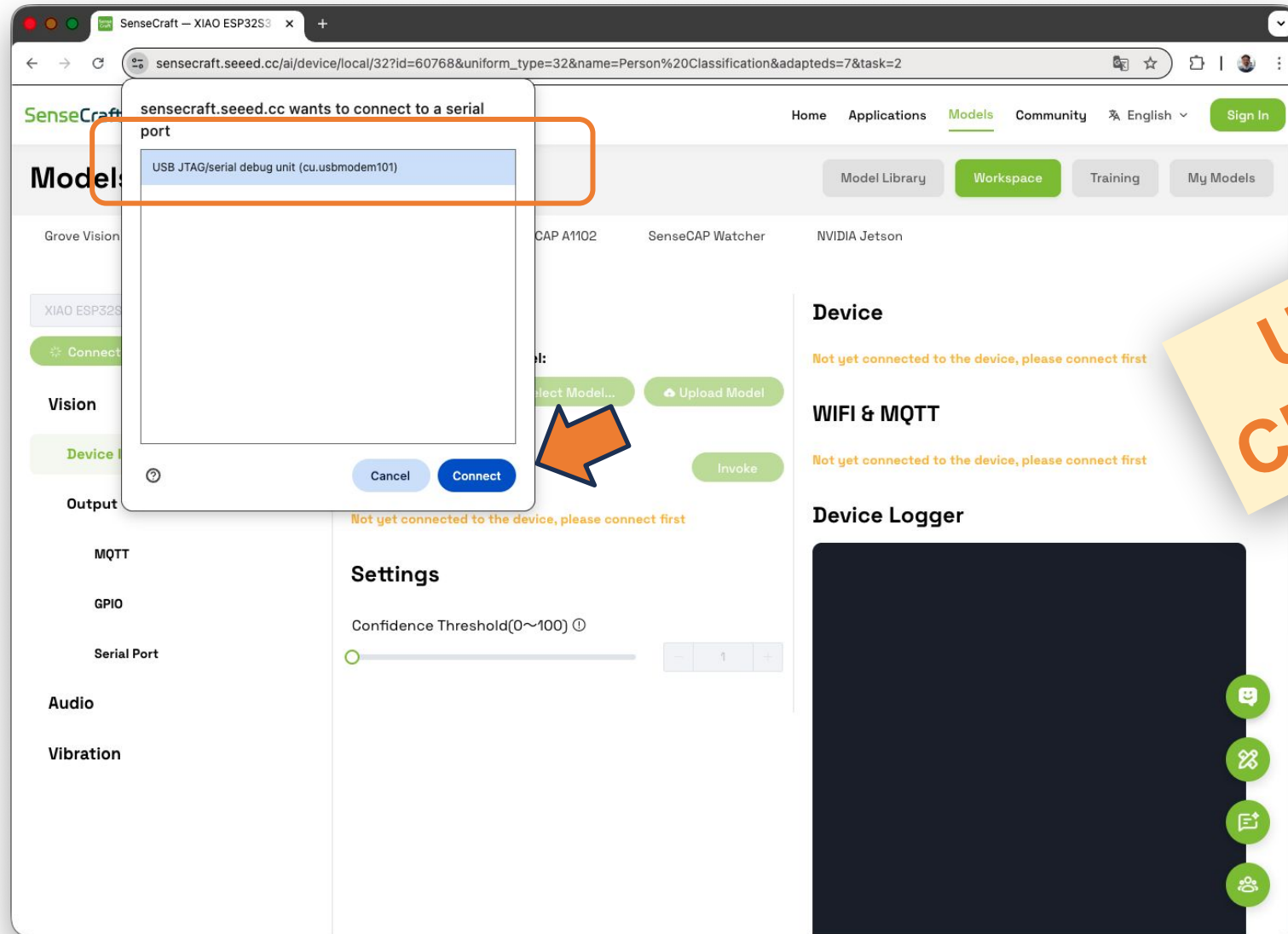
- Align the connector on the camera sensor expansion board with the B2B connector on the XIAO ESP32S3 Sense and press it to install camera sensor.

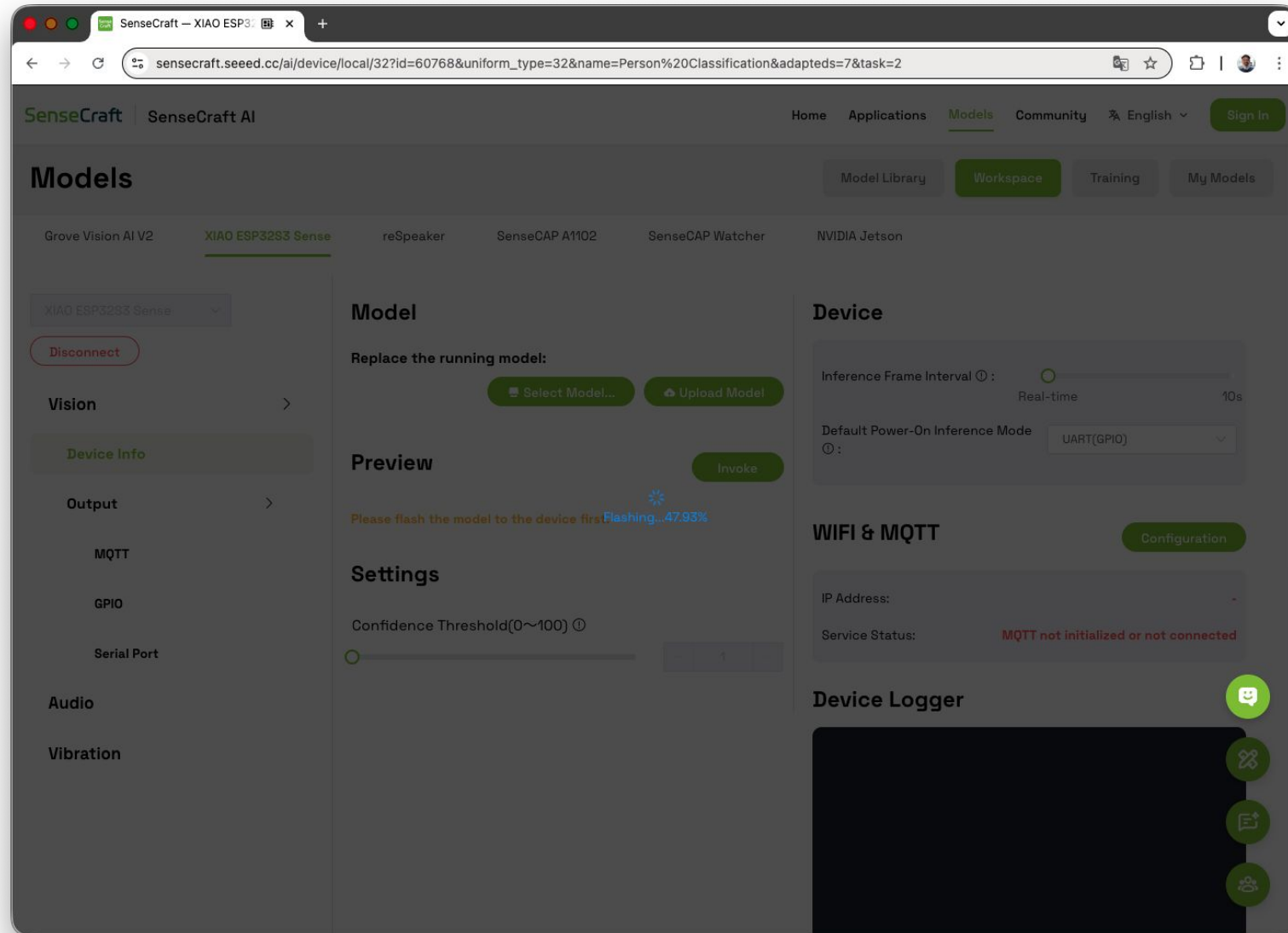


- Connect the XIAO ESP32S3 Sense to your computer via USB.
- Select USB JAG/serial debug unit to connect

Connect Device







SenseCraft — XIAO ESP32

sensecraft.seeed.cc/ai/device/local/32?id=60768&uniform_type=32&name=Person%20Classification&adapteds=7&task=2

SenseCraft AI

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Disconnect

Vision>

Device Info

Output>

MQTT

GPIO

Serial Port

Audio

Vibration

Model Name: Person Classification

Model Version: 1.0.0



Replace the running model:

Select Model...Upload Model

Preview



0%

Not a person

82%

Person

Device ID: 3528140269

Device Name: XIAO ESP32S3 Sense

Device Version: 2025.08.06

Inference Frame Interval ⓘ: Real-time10s

Default Power-On Inference Mode ⓘ: UART(USB)

WIFI & MQTT

Configuration

IP Address: -

Service Status: MQTT not initialized or not connected

Device Logger

```
perf:{"preprocess":99,"inference":537,"postprocess":0}
perf:{"preprocess":100,"inference":535,"postprocess":0}
perf:{"preprocess":100,"inference":535,"postprocess":0}
perf:{"preprocess":81,"inference":536,"postprocess":0}
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perf:{"preprocess":100,"inference":536,"postprocess":0}
```

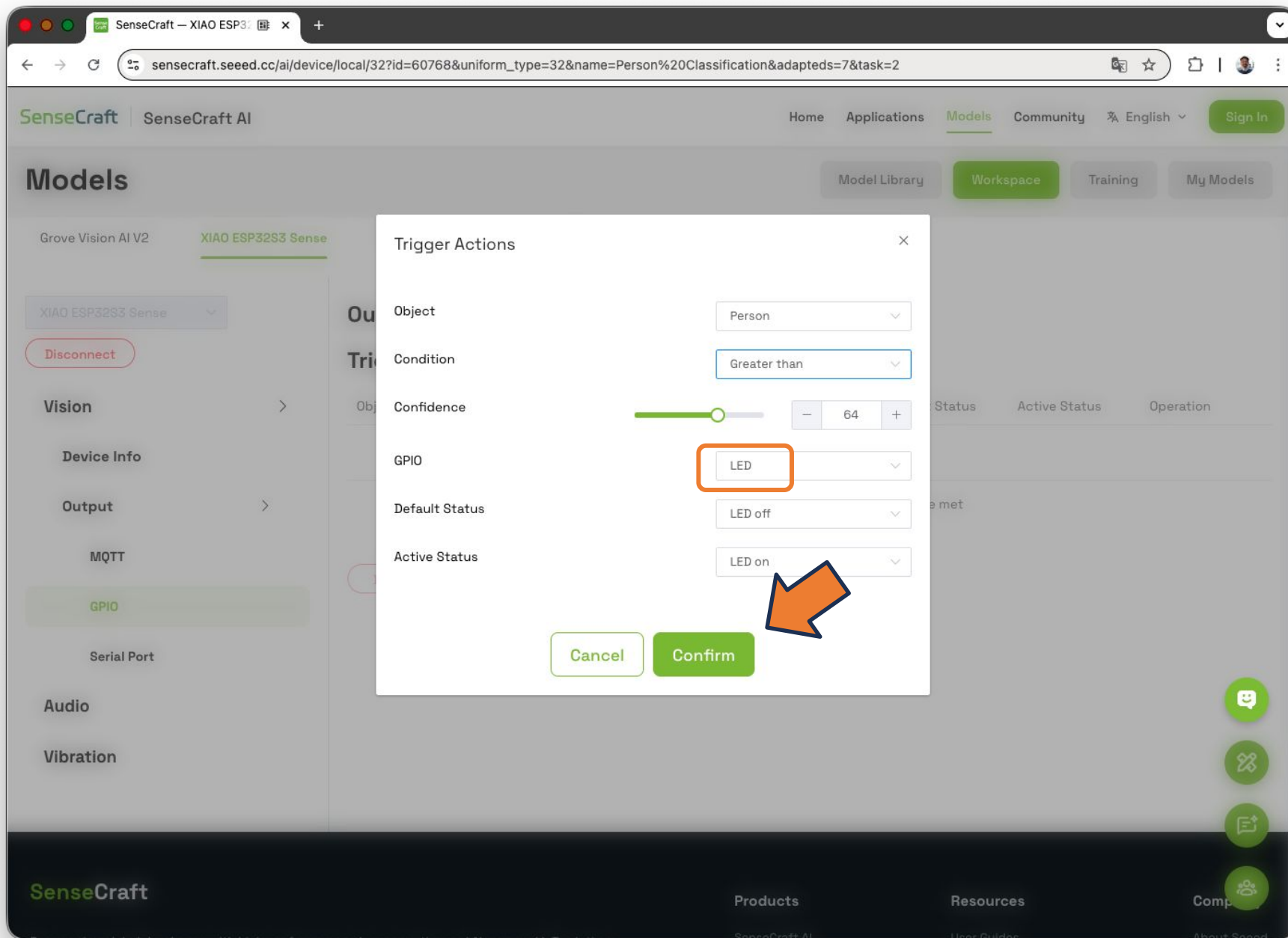
Vision - Post-processing

The screenshot displays the SenseCraft AI web interface for configuring a XIAO ESP32S3 Sense device. The browser address bar shows the URL: `sensecraft.seeed.cc/ai/device/local/32?id=60768&uniform_type=32&name=Person%20Classification&adapteds=7&task=2`.

The interface includes a top navigation bar with links for Home, Applications, Models (active), Community, English, and a Sign In button. Below this is a 'Models' section with tabs for Model Library, Workspace (active), Training, and My Models.

The main content area is divided into a left sidebar and a right main panel. The sidebar lists various output options: Vision, Device Info, Output, MQTT, GPIO (highlighted with an orange box), Serial Port, Audio, and Vibration. The main panel is titled 'Output data through GPIO' and 'Trigger Actions'. It features a table with columns: Object, GPIO, Condition, Confidence, Default Status, Active Status, and Operation. The table currently shows 'No Data'. Below the table, there is a button labeled '+ Trigger action when event conditions are met' (highlighted with an orange box), and two buttons labeled 'Delete' and 'Send'.

The bottom of the interface has a dark footer with the SenseCraft logo, links for Products, Resources, and a partially visible 'Comp' link, along with a vertical stack of four green circular icons on the right.



SenseCraft — XIAO ESP32

sensecraft.seeed.cc/ai/device/local/32?id=60768&uniform_type=32&name=Person%20Classification&adapteds=7&task=2

SenseCraft

SenseCraft AI

HomeApplicationsModelsCommunityEnglishSign In

Models

Model LibraryWorkspaceTrainingMy Models

Grove Vision AI V2

XIAO ESP32S3 Sense

reSpeaker

SenseCAP A1102

SenseCAP Watcher

NVIDIA Jetson

XIAO ESP32S3 Sense

Disconnect

Vision

Device Info

Output

MQTT

GPIO

Serial Port

Audio

Vibration

Output data through GPIO

Trigger Actions

Object	GPIO	Condition	Confidence	Default Status
Person	LED	Greater than	65	LED off

+ Trigger action when event conditions are met

DeleteSend

A close-up photograph of a hand holding a small, white, rectangular electronic module. The module is the XIAO ESP32S3 Sense, which has a white USB-C cable plugged into its bottom. An orange square is drawn on the module, highlighting a small, yellowish component, which is the LED mentioned in the screenshot. The background is slightly blurred, showing a desk with a computer monitor and other items.

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Audio

SenseCraft

SenseCraft AI

Home

Applications

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Community

English

Sign In

Disconnect

Vision

Device Info

Output

MQTT

GPIO

Serial Port

Audio

Vibration

The XIAO ESP32S3 is an excellent device for developing applications for IoT, smart homes, wireless wearables, AI, and more. SenseCraft provides you with the following three plug-and-play applications

Vision AI Detetcion



SenseCraft provides pre-train AI models that support object detection and classification.

Using

Audio Classification



SenseCraft supports audio classification training for detecting environmental noise and recognizing different sound events.

Try it now

No device? buy it now

Abnormal Vibration Detection



Integration of advanced sensing technology, and signaling algorithms to accurately monitor and detect anomalies in specific environments or equipment states.

Try it now

No device? buy it now

You are currently running [Vision AI Detection](#) . If you want to try other Application, please replace the device with the correct one and reconnect it.

SenseCraft

Products

Resources

Company

SenseCraft — XIAO ESP32

sensecraft.seeed.cc/ai/device/local/32?id=60768&uniform_type=32&name=Person%20Classification&adapteds=7&task=2

SenseCraft

SenseCraft AI

HomeApplicationsModelsCommunityEnglishSign In

Disconnect

Vision>

Device Info

Output>

MQTT

GPIO

Serial Port

Audio

Vibration

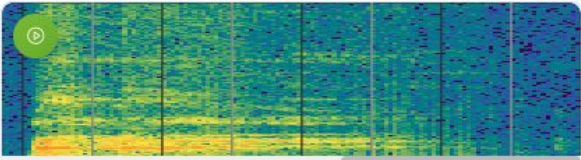
No model

Replace the running model:

Select Model...Upload Model

Preview

Stop



Recognition Threshold(0.0~1.0)

0

Device

Device ID: d61e9b02b5f343547a394d1401b09340

Device Name: XIAO ESP32-S3 (sound_classification)

Device Version: 1.12.30

Default Power-On Inference Mode: DisableEnable

Device Logger

SenseCraft — XIAO ESP32-S3

sensecraft.seeed.cc/ai/device/local/32?id=60768&uniform_type=32&name=Person%20Classification&adapteds=7&task=2

SenseCraft AI

Home Applications **Models** Community English Sign In

Disconnect

Vision

Device Info

Output

MQTT

GPIO

Serial Port

Audio

Vibration

No model

Replace the running model:

Select Model...

Search

Choose a model to deploy

Public AI Models My Own Models

Lumos keyword rec...

Cat Meow Detection

Total 2 30/page 1

Device Name: XIAO ESP32-S3 (sound_classification)

Device Version: 1.12.30

Default Power-On Inference Mode: Disable Enable

Device Logger

SenseCraft — XIAO ESP32

sensecraft.seeed.cc/ai/device/local/32?id=60768&uniform_type=32&name=Person%20Classification&adapteds=7&task=2

SenseCraft

SenseCraft AI

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Disconnect

Vision>

Device Info

Output>

MQTT

GPIO

Serial Port

Audio

Vibration

Model Name: Lumos keyword recognition

Model Version: 1.0.0

Replace the running model:

Select Model...Upload Model

Preview

Stop

10%

Background N...

90%

lumos

Recognition Threshold(0.0~1.0)

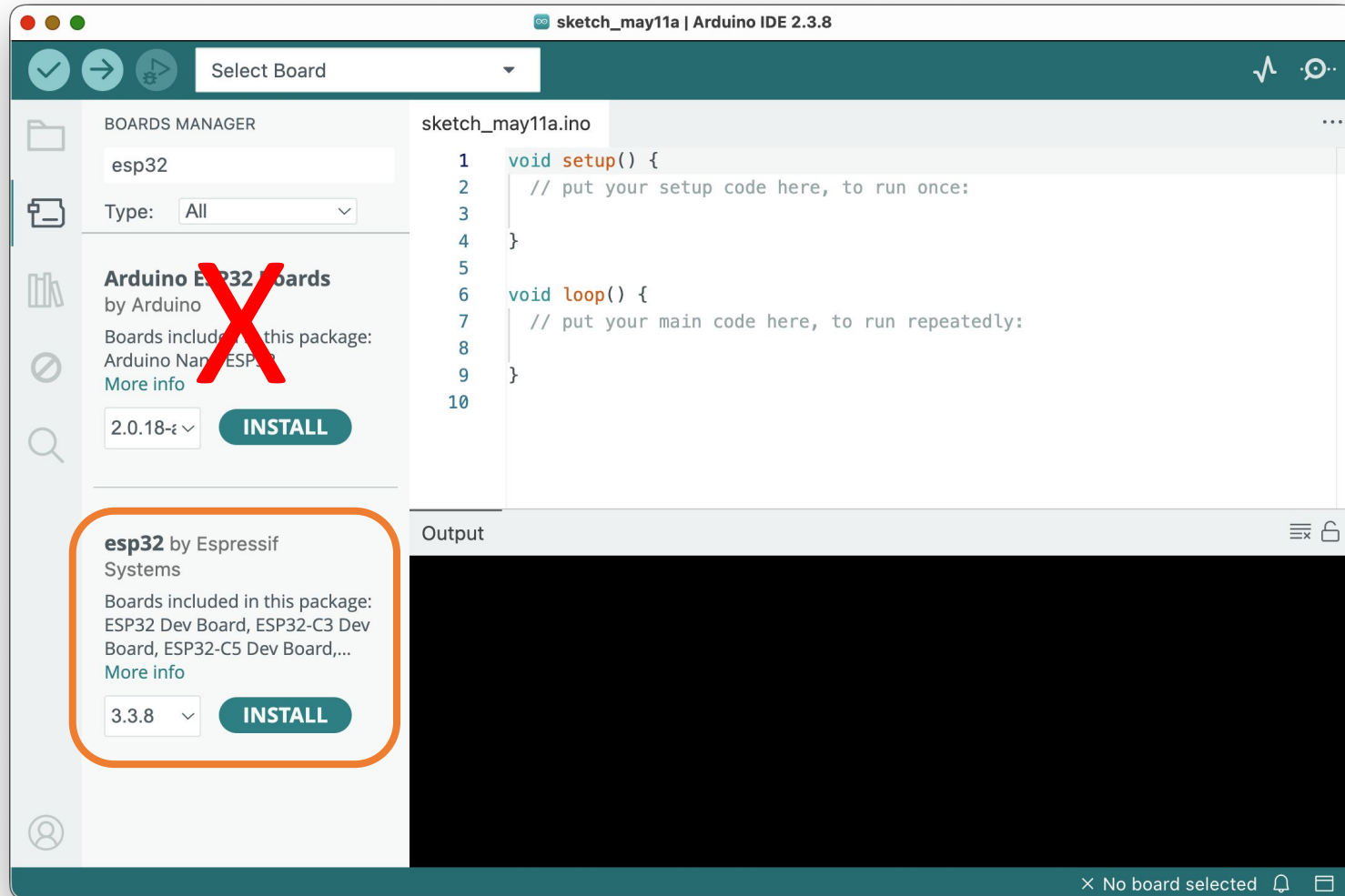
0.67

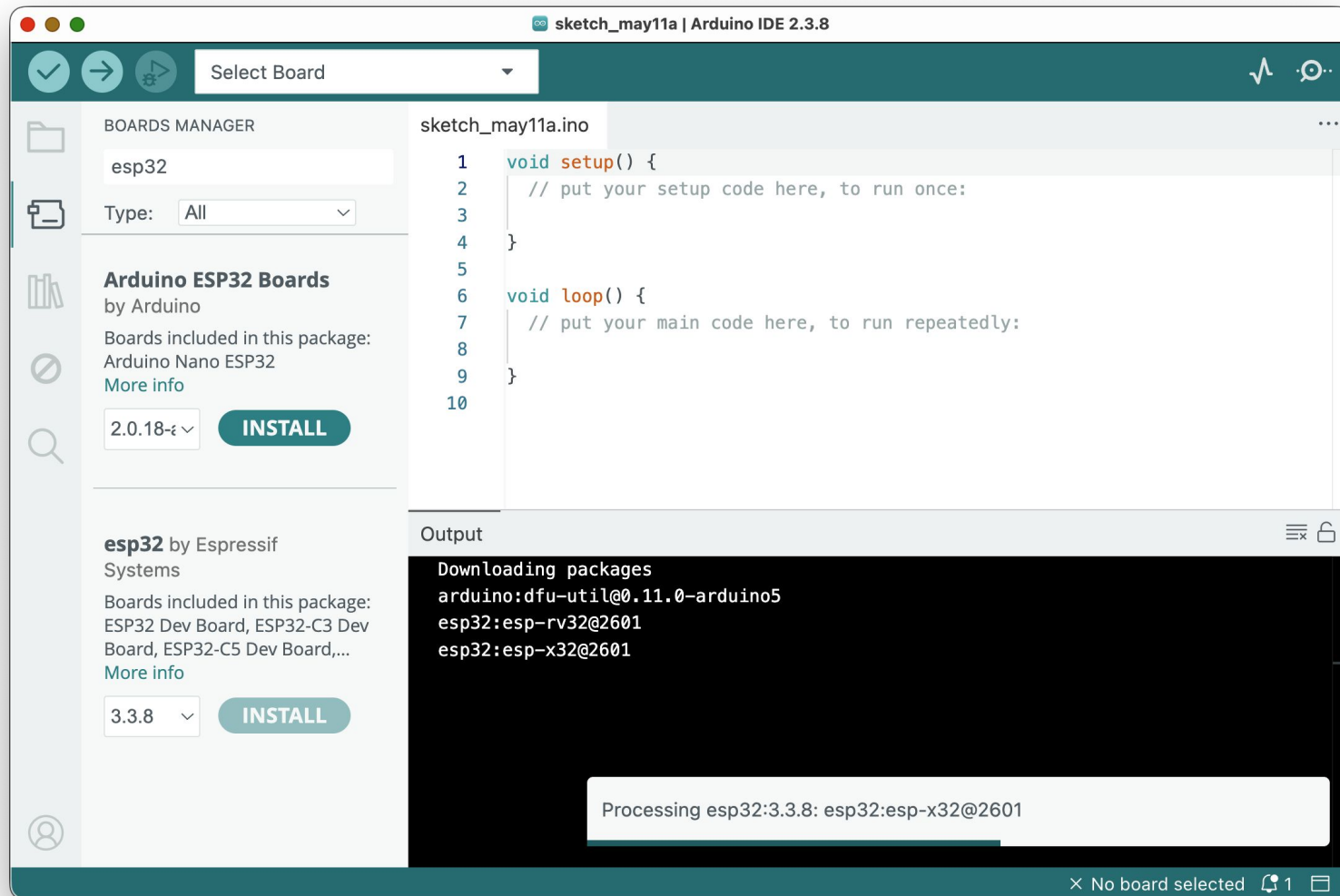
Device

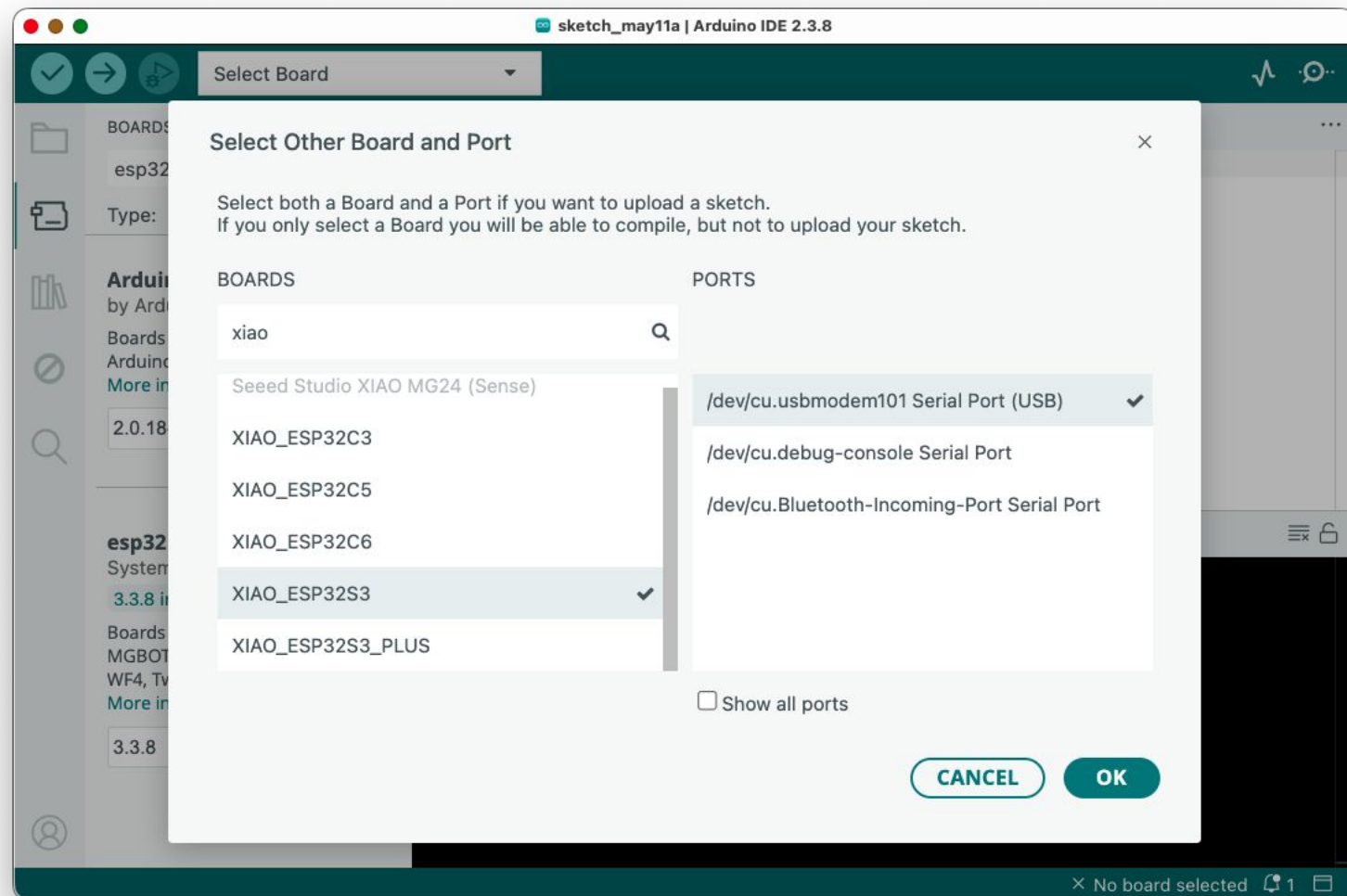
Device Name: XIAO ESP32-S3

Device ID: d61e9b02b5f343547a394d1401b09340

Testing the XIAOML Kit – Arduino IDE





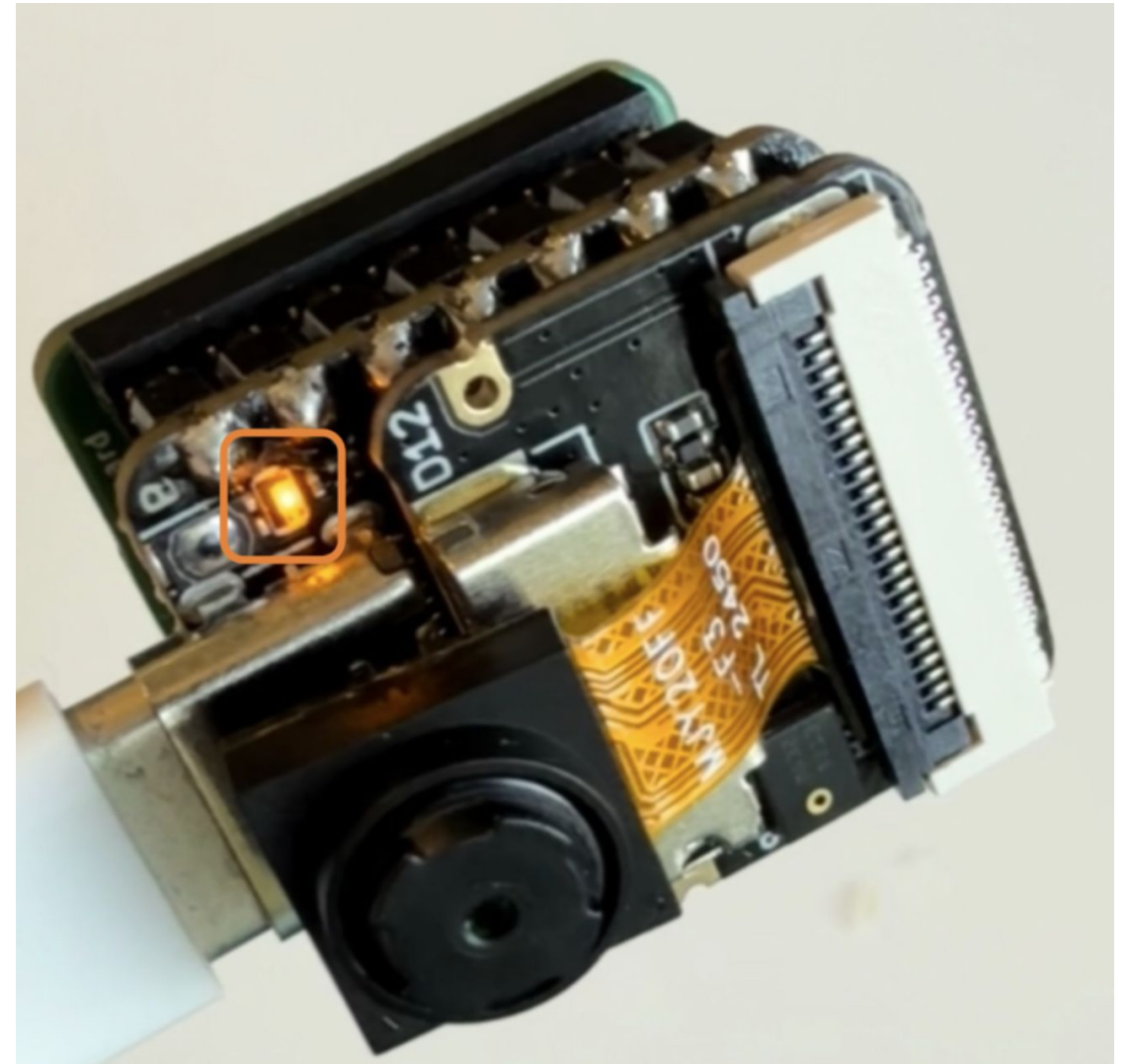


Test installation with Blink

```
#define LED_BUILT_IN 21 // This line is optional

void setup() {
  pinMode(LED_BUILT_IN, OUTPUT); // Set the pin as output
}

// Remember that the pins work with inverted logic
// LOW to turn on and HIGH to turn off
void loop() {
  digitalWrite(LED_BUILT_IN, LOW); //Turn on
  delay (1000); //Wait 1 sec
  digitalWrite(LED_BUILT_IN, HIGH); //Turn off
  delay (1000); //Wait 1 sec
}
```



Test Microphone

```
#include <ESP_I2S.h>
I2SClass I2S;

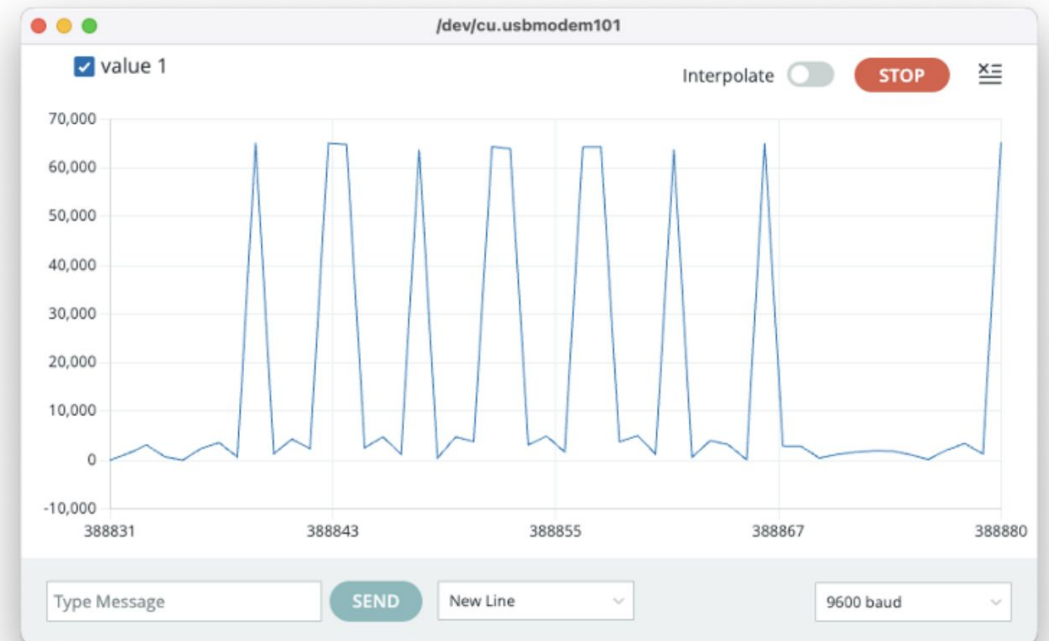
void setup() {
  Serial.begin(115200);
  while (!Serial) {
  }

  // setup 42 PDM clock and 41 PDM data pins
  I2S.setPinsPdmRx(42, 41);

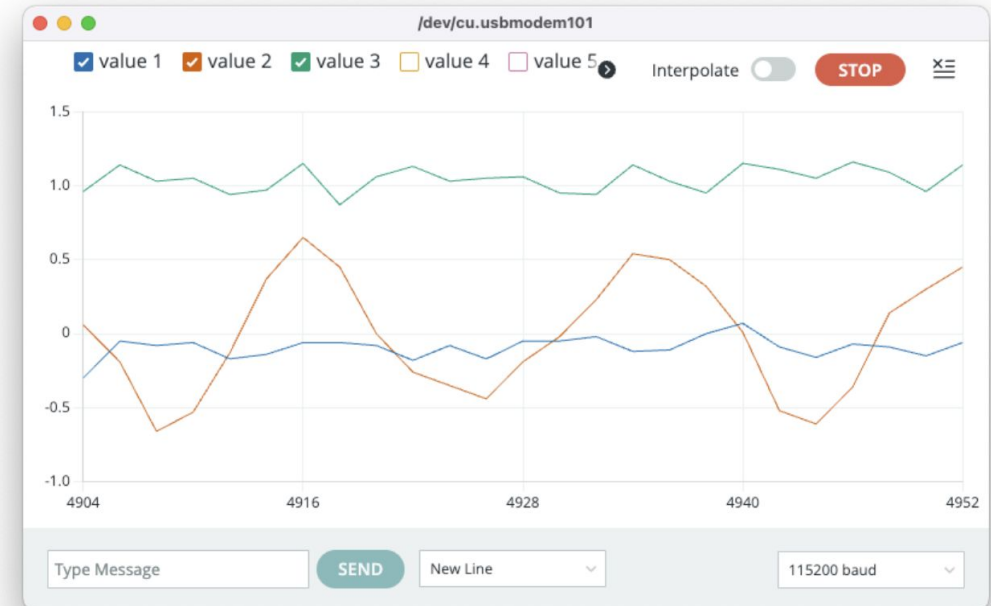
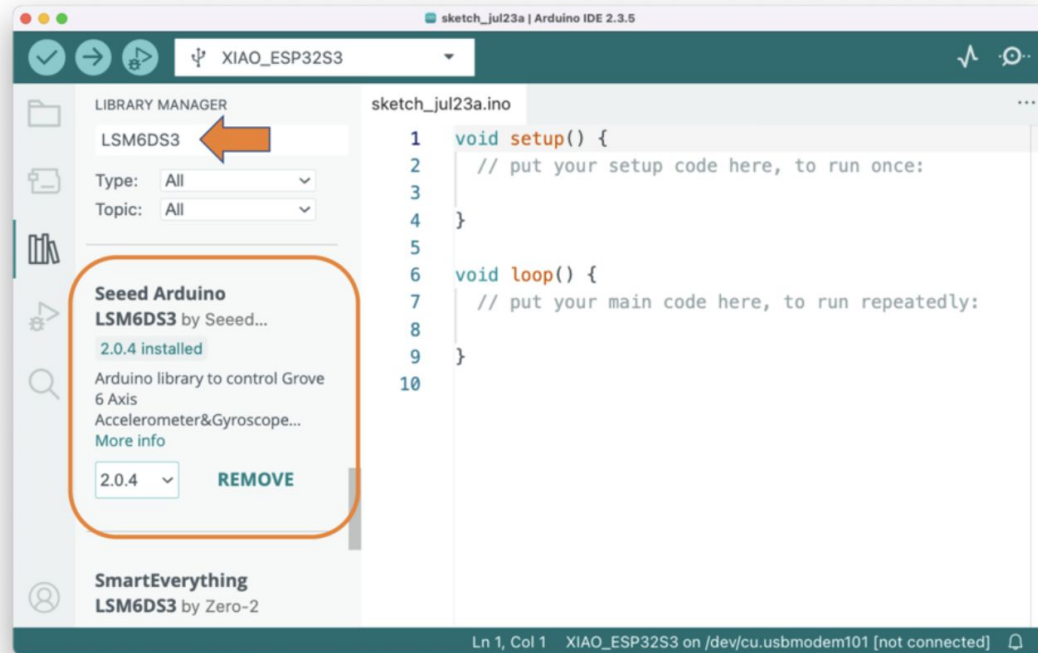
  // start I2S at 16 kHz with 16-bits per sample
  if (!I2S.begin(I2S_MODE_PDM_RX,
    16000,
    I2S_DATA_BIT_WIDTH_16BIT,
    I2S_SLOT_MODE_MONO)) {
    Serial.println("Failed to initialize I2S!");
    while (1); // do nothing
  }
}

void loop() {
  // read a sample
  int sample = I2S.read();

  if (sample && sample != -1 && sample != 1) {
    Serial.println(sample);
  }
}
```

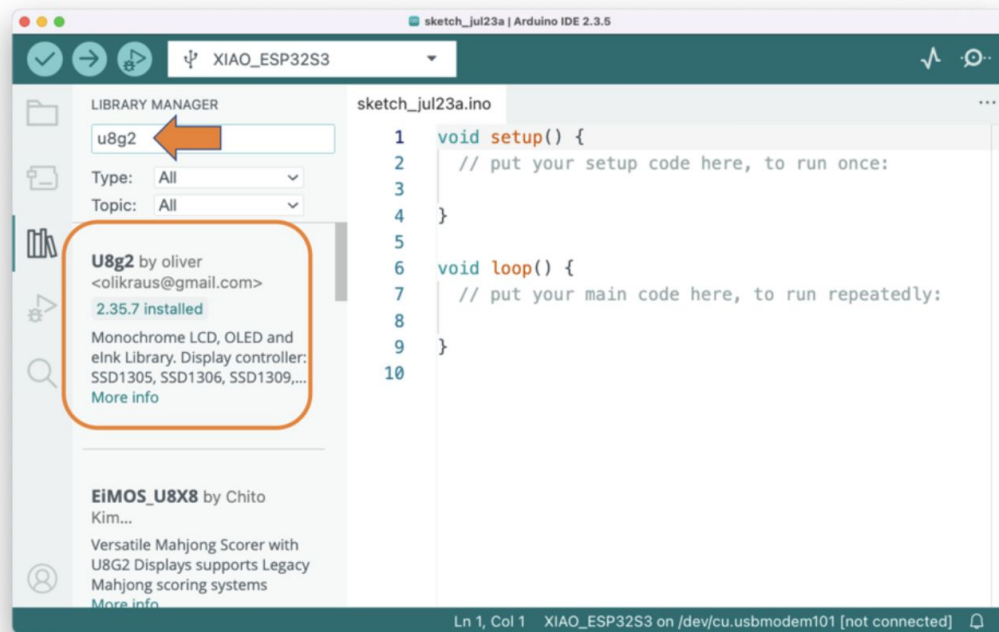


Test IMU (LSM6DS3TR-C)

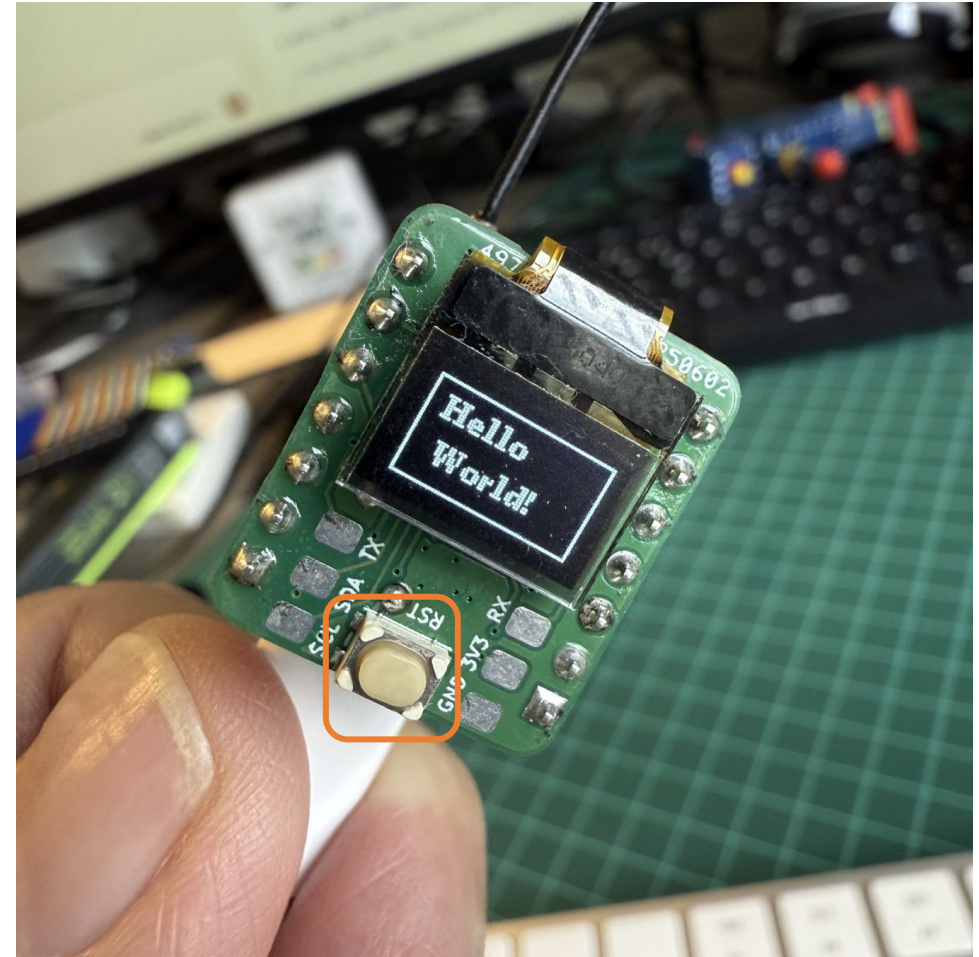


Imu_test.ino

Test OLED Display (SSD1306)



After upload, if necessary, press the reset button



oled_test.ino

Thanks



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