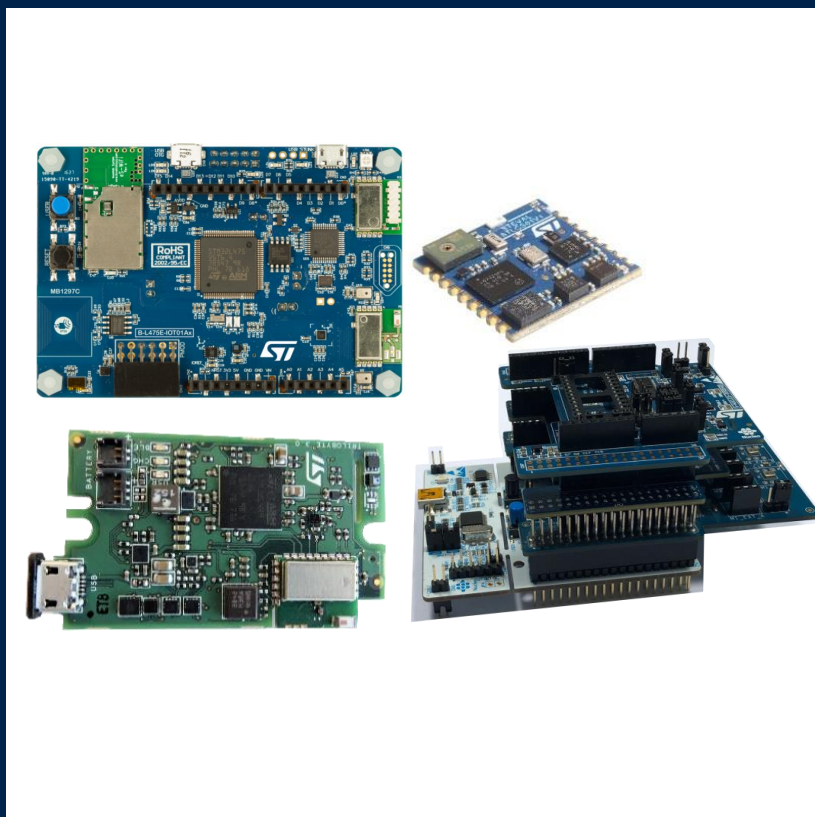




life.augmented



Quick Start Guide

STM32Cube function pack for ultra-low power IoT node with Artificial Intelligence (AI) application based on audio and motion sensing (FP-AI-SENSING1)

Version 1.5 (April 13, 2021)

Agenda

1 Hardware and Software overview

2 Setup & Demo Examples

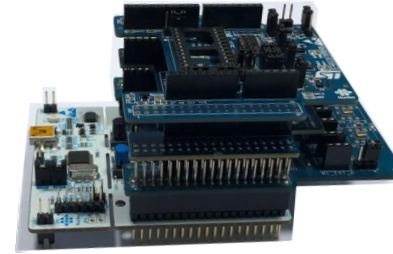
3 Documents & Related Resources

4 STM32 Open Development Environment: Overview

1- Hardware and Software overview

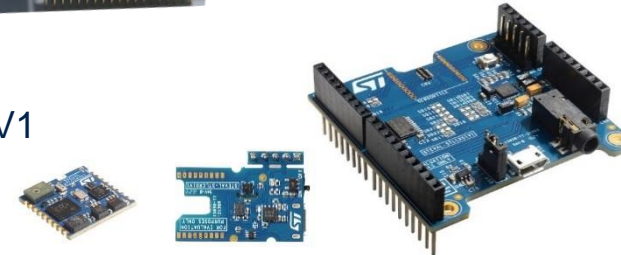
1. STM32 Nucleo with expansion boards

- NUCLEO-L476RG + X-NUCLEO-CCA02M1 + X-NUCLEO-IDB05A1 + X-NUCLEO-IKS01A2

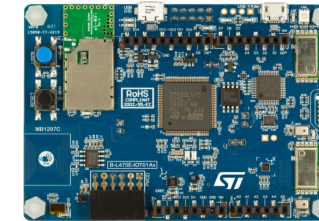


2. STEVAL-STLKT01V1 evaluation boards

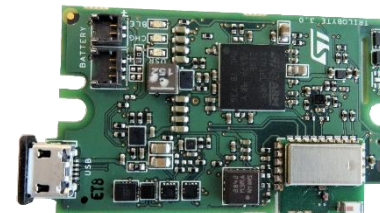
- STEVAL-STLCS01V1 + STEVAL-STLCR01V1 + STEVAL-STLCX01V1



3. STM32L4 Discovery Board for IoT node (B-L475E-IOT01A)



4. STEVAL-MKSBOX1V1 evaluation board



Motion MEMS and environmental sensors expansion board

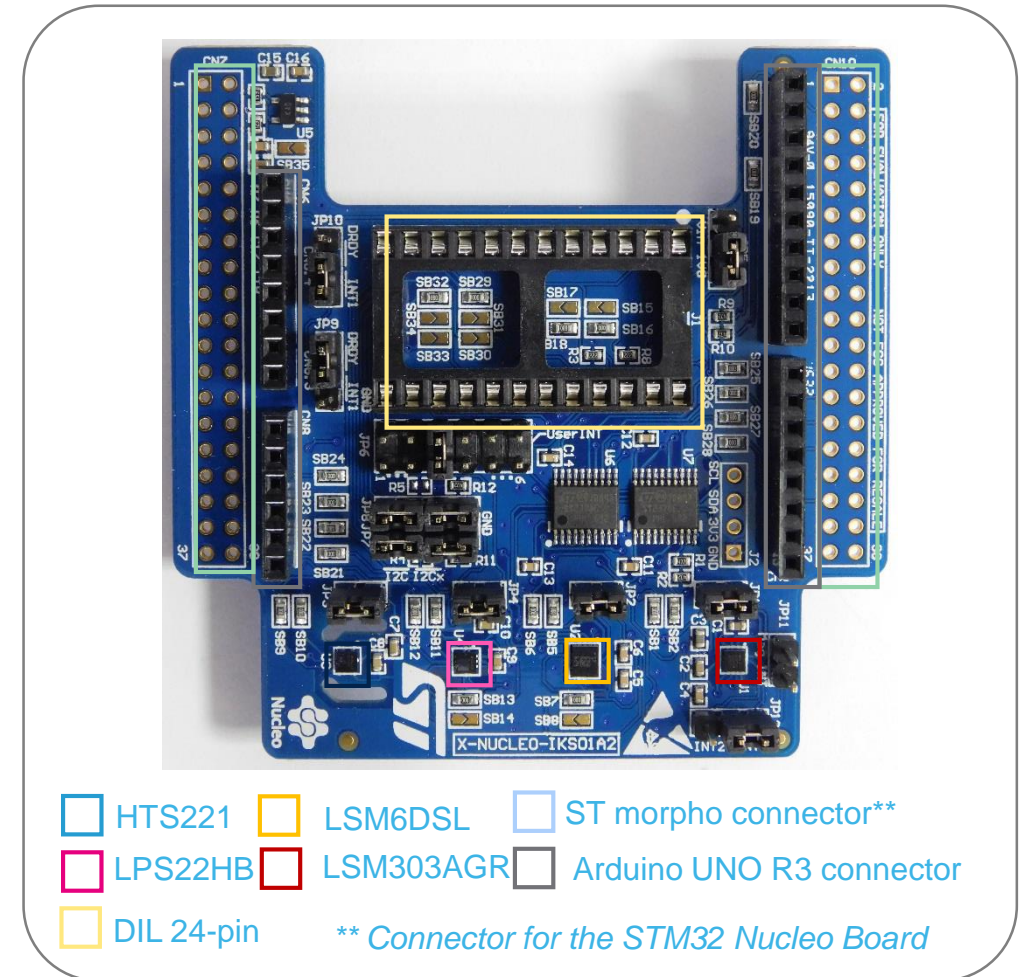
STM32 Nucleo with Expansion boards - Hardware Overview (1/4)

X-NUCLEO-IKS01A2 Hardware Description

- The X-NUCLEO-IKS01A2 is a motion MEMS and environmental sensor evaluation board system.
- It is compatible with the Arduino UNO R3 connector layout, and is designed around ST's latest sensors.

Key Product on board

- LSM6DSL MEMS 3D accelerometer ($\pm 2/\pm 4/\pm 8/\pm 16$ g) + 3D gyroscope ($\pm 125/\pm 245/\pm 500/\pm 1000/\pm 2000$ dps)
- LSM303AGR MEMS 3D magnetometer (± 50 gauss) + MEMS 3D accelerometer ($\pm 2/\pm 4/\pm 8/\pm 16$ g)
- LPS22HB MEMS pressure sensor, 260-1260 hPa absolute digital output barometer
- HTS221 Capacitive digital relative humidity and temperature
- DIL 24-pin Socket available for additional MEMS adapters and other sensors (UV index)



Latest info available at www.st.com
X-NUCLEO-IKS01A2

Bluetooth Low Energy Expansion Board

STM32 Nucleo with Expansion boards - Hardware Overview (2/4)

X-NUCLEO-IDB05A1 Hardware Description

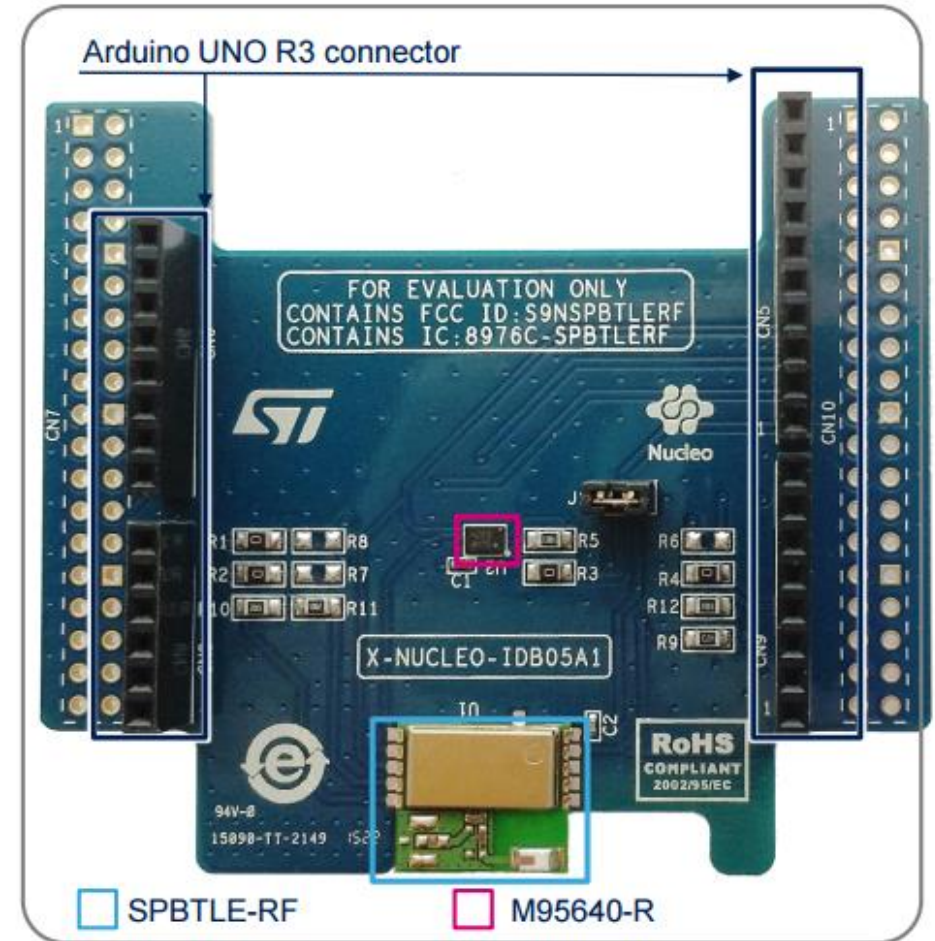
- The X-NUCLEO-IDB05A1 is a Bluetooth Low Energy (BLE) evaluation and development board system, designed around ST's SPBTLE-RF Bluetooth Low Energy module based on BlueNRG-MS.
- The BlueNRG-MS processor hosted in the SPBTLE-RF module communicates with the STM32 Nucleo developer board host microcontroller through an SPI link available on the Arduino UNO R3 connector.

Key Products on board

Bluetooth Low Energy, FCC and IC certified, module based on Bluetooth® Low Energy wireless network processor BlueNRG-MS, BLE4.2 compliant.

SPBTLE-RF integrates a BALF-NRG-01D3 balun and a chip antenna. It embeds 32 MHz and 32.768 kHz crystal oscillators for the BlueNRG-MS.

M95640-R 64-Kbit serial SPI bus EEPROM with high-speed clock interface



Latest info available at www.st.com
X-NUCLEO-IDB05A1

Digital MEMS microphone expansion board

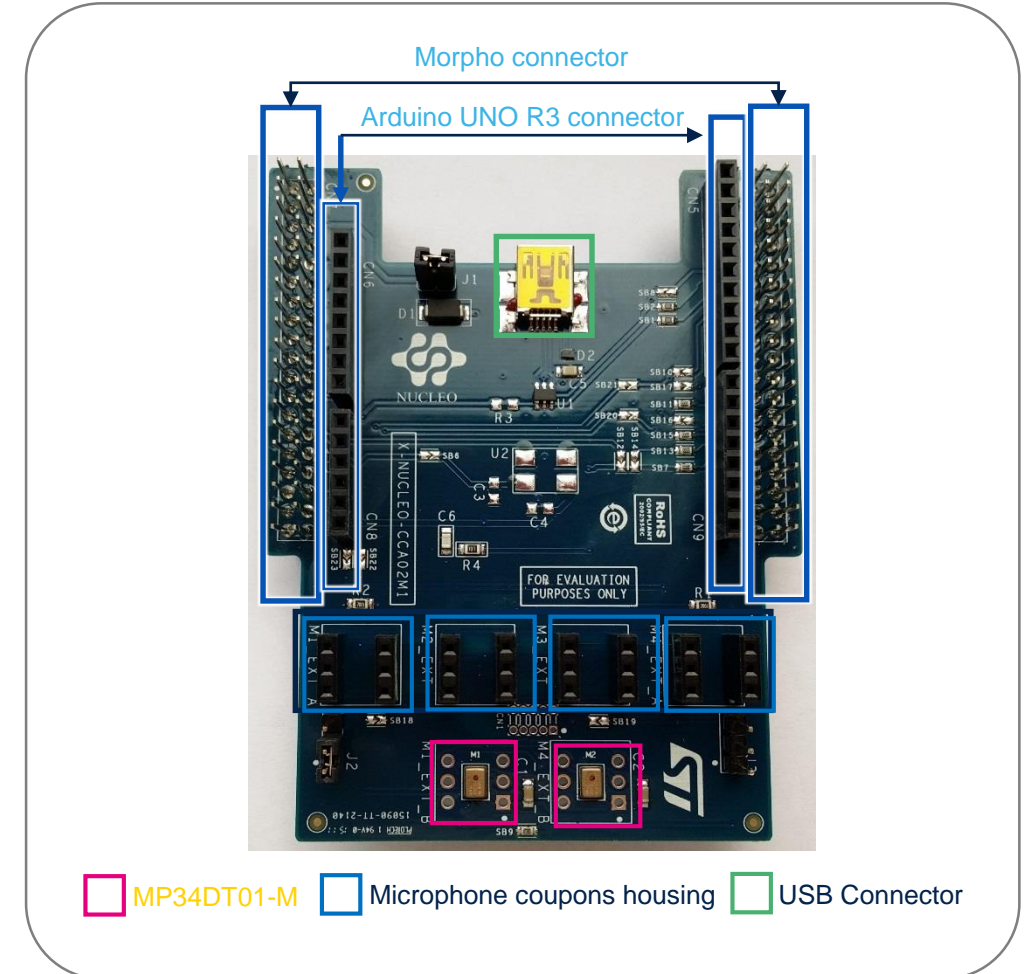
Hardware Overview (3/4)

X-NUCLEO-CCA02M1 Hardware Description

- The X-NUCLEO-CCA02M1 is a board based on digital MEMS microphones. It has two MP34DT01-M microphones soldered on board and it offers the possibility to plug additional microphones using MP34DT01 based coupon evaluation boards (STEVAL-MKI129V* or STEVAL-MKI155V*).
- The X-NUCLEO-CCA02M1 enables the acquisition and streaming of up to 4 microphones using both I2S and SPI bus available on ST morpho connector.

Key Products on board

- MP34DT01-M: Ultra-compact, low-power, omnidirectional, digital MEMS microphone built with a capacitive sensing element and an IC interface.



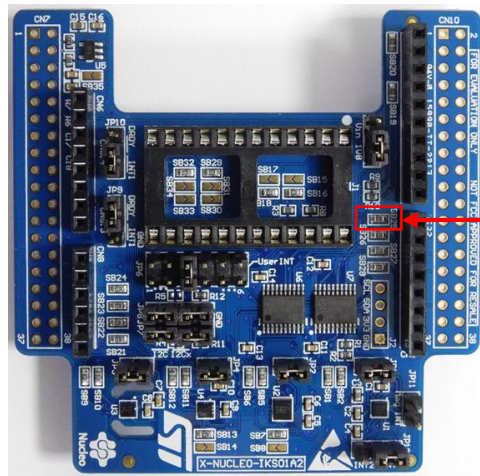
Latest info available at www.st.com
X-NUCLEO-CCA02M1

Important Hardware Additional Information

Hardware Overview (4/4)

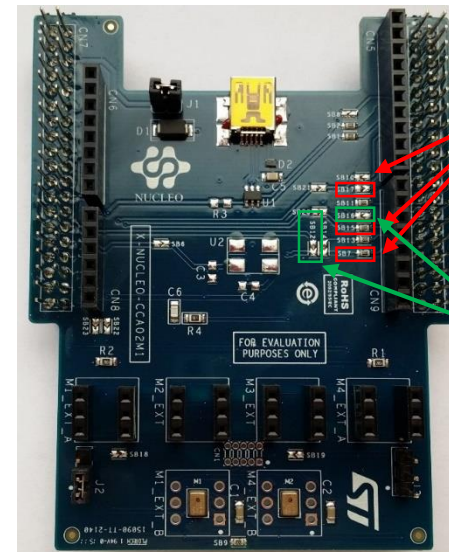
Before connecting the expansion board to the NUCLEO-L476RG board it is needed to change default solder bridges on the expansion boards

➤ On the X-NUCLEO-IKS01A2



Open
SB25

➤ On the X-NUCLEO-CCA02M1



Open
SB7/SB15/SB17

Close
SB12/SB16

SensorTile development kit (STEVAL-STLKT01V1)

Hardware Overview

SensorTile development kit Hardware Description

- STEVAL-STLKT01V1 is the development kit for the SensorTile board (STLCS01V1), a highly Integrated Development Platform with a broad range of functionalities aiming to improve system design cycle and accelerate delivery of results
- Two host boards are also provided as part of the kit, both featuring SWD programming interface
 - Cradle expansion has a plugin connection for SensorTile Core System and an Arduino interface
 - The Cradle is a small host featuring battery charger and SD card interface that supports on-the-field testing and data acquisition campaigns

Key Product on board

- SensorTile module (STEVAL-STLCS01V1) with STM32L476JG, LSM6DSM, LSM303AGR, LPS22HB, MP34DT05-A, BlueNRG-MS, BALF-NRG-02D3 and LD39115J18R
- SensorTile expansion Cradle board equipped with audio DAC, USB port, STM32 Nucleo, Arduino UNO R3 and SWD connector
- SensorTile Cradle with battery charger, humidity and temperature sensor, SD memory card slot, USB port and breakaway SWD connector
- 100 mAh Li-Ion battery
- Plastic box
- SWD programming cable



Latest info available at www.st.com
STEVAL-STLKT01V1

STM32L4 Discovery Board for IoT node (B-L475E-IOT01A)

Hardware Overview

STM32L4 Discovery Board for IoT node Hardware Description

The STM32L4 Discovery kit for the IoT node (B-L475E-IOT01A) allows users to develop applications with direct connection to cloud servers. The STM32L4 Discovery kit enables a wide diversity of applications by exploiting low-power multilink communication (BLE, Sub-GHz), multiway sensing (detection, environmental awareness) and ARM® Cortex®-M4 core-based STM32L4 Series features. Arduino™ Uno V3 and PMOD connectivity provide unlimited expansion capabilities with a large choice of specialized add-on boards.

Key Product on board

- Ultra-low-power STM32L4 Series MCUs based on ARM® Cortex® -M4 core with 1 Mbyte of Flash memory and 128 Kbytes of SRAM, in LQFP100 package
- Bluetooth® V4.1 module (SPBTLE-RF)
- Sub-GHz (868 or 915 MHz) low-power-programmable RF module (SPSGRF-868 or SPSGRF-915)
- Wi-Fi® module Inventek ISM43362-M3G-L44 (802.11 b/g/n compliant)
- Dynamic NFC tag based on M24SR with its printed NFC antenna
- 2 digital omnidirectional microphones (MP34DT01)
- Capacitive digital sensor for relative humidity and temperature (HTS221)
- High-performance 3-axis magnetometer (LIS3MDL), 3D accelerometer and 3D gyroscope (LSM6DSL), 260-1260 hPa absolute digital output barometer (LPS22HB), Time-of-Flight and gesture-detection sensor (VL53L0X)
- USB OTG FS with Micro-AB connector
- Expansion connectors: Arduino™ Uno V3, PMOD
- Flexible power-supply options: ST LINK USB VBUS or external sources
- On-board ST-LINK/V2-1 debugger/programmer with USB re-enumeration capability: mass storage, virtual COM port and debug port



Latest info available at www.st.com
B-L475E-IOT01A

STEVAL-MKSBOX1V1 evaluation board

Hardware Overview

Multi sensor kit with portable sensor box and smart sensor app Hardware Description

The STEVAL-MKSBOX1V1 (SensorTile.box) is a ready-to-use box kit with wireless IoT and wearable sensor platform to help you use and develop apps based on remote motion and environmental sensor data, regardless of your level of expertise.

The SensorTile.box board fits into a small plastic shroud with a long-life rechargeable battery, and the ST BLE Sensor app on your smartphone connects via Bluetooth to the board and allows you to immediately begin using the wide range of default IoT and wearable sensor applications.

SensorTile.box includes a firmware programming and debugging interface that allows professional developers to engage in more complex firmware code development using the STM32 Open Development Environment (STM32 ODE), which includes a sensing AI function pack with neural network libraries.

Key Product on board

- Ultra-low-power STM32L4 Series MCUs based on ARM® Cortex® -M4 MCU 120 MHz with 2048 kbytes Flash (STM32L4R9ZI)
- Accurate temperature : STTS751
- Low power precise 6x IMU: LSM6DSOX
- Stand-alone XLs: LIS3DHH, LIS2DW12
- Magnetometer: LIS2MDL
- Altimeter / pressure sensor : LPS22HH
- Wide-band microphone: MP23ABS1
- Humidity sensor: HTS221



Latest info available at www.st.com
STEVAL-MKSBOX1V1



FP-AI-SENSING1

Software Overview

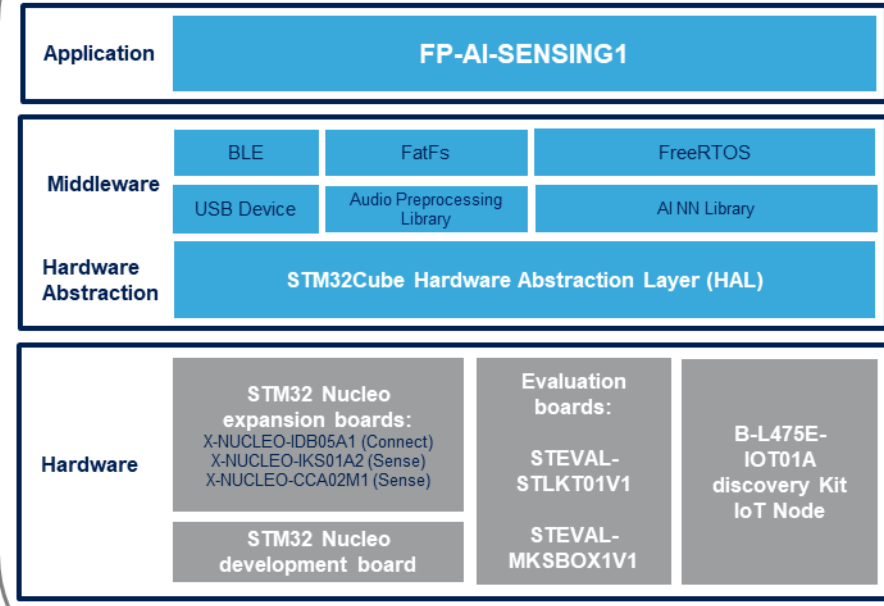
Software Description

- FP-AI-SENSING1 is an STM32Cube function pack featuring examples that let you connect your IoT node to a smartphone via BLE and use a suitable Android™ or iOS™ application, like the ST BLE Sensor app, to configure the device.
- The package enables advanced applications such as human activity recognition or audio scene classification, on the basis of outputs generated by neural networks (NN). The NN are implemented by libraries generated by the X-CUBE-AI extension for STM32CubeMX tool. The package comes with an AI utility for data logging and annotation on SD card. The user is able to record the data from the sensors and to define what are the classes or the events he wants to record. With the recorded annotated data, the user will be able to train his own Neural Network on his PC/GPU/Cloud, get the model, use X-CUBE-AI extension for STM32CubeMX tool for conversion, and then run it on the STM32 platform.

Key features

- Complete firmware to develop an IoT node with BLE connectivity, digital microphone, environmental and motion sensors, and perform real-time monitoring of sensors and audio data
- Middleware libraries generated thanks to STM32CubeMx extension called X-CUBE-AI, featuring example implementation of neural networks for real-time human activity recognition (HAR) and acoustic scene classification (ASC) applications
- AI utility for data logging and annotation on SD card
- Ultra-low power implementation based on the use on an RTOS
- Compatible with ST BLE Sensor application for Android/iOS, to perform sensor data reading, audio and motion algorithm feature demo, and firmware update over the air (FOTA)
- Easy portability across different MCU families, thanks to STM32Cube.
- Free, user-friendly license terms.

Overall Software Architecture



Latest info available at www.st.com
FP-AI-SENSING1



2- Setup & Demo Examples

2.1- Setup

Setup & Demo Examples

HW prerequisites

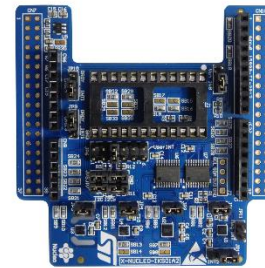
- 1x STM32 Nucleo Bluetooth Low Energy expansion board (**X-NUCLEO-IDB05A1**)
- 1x STM32 Nucleo Motion MEMS and environmental sensor expansion Board (**X-NUCLEO-IKS01A2**)
- 1x STM32 Nucleo Digital MEMS microphone expansion board (**X-NUCLEO-CCA02M1**)
- 1x STM32 Nucleo Development Board (**NUCLEO-L476RG**)
- 1x Android™ or iOS™ device
- 1x PC with Windows 7 and above
- 1x USB type A to Mini-B USB cable



NUCLEO-L476RG



X-NUCLEO-IDB05A1



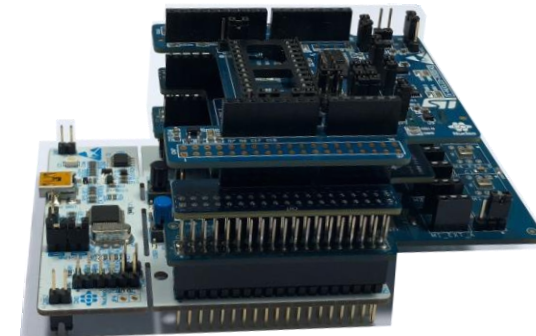
X-NUCLEO-IKS01A2



X-NUCLEO-CCA02M1



Mini USB



It is necessary to connect the boards in the order shown in this picture

Setup Overview

HW prerequisites and setup with SensorTile (1/2)

- 1x SensorTile Kit (STEVAL-STLKT01V1):
 - SensorTile Core System: STLCS01V1
 - SensorTile Cradle eXpansion: STLCX01V1
 - SensorTile Cradle: STLCR01V1
 - Battery
 - Programming cable
- 1x Android™ or iOS™ device
- 1x PC with Windows 7 and above
- 1x STM32-Nucleo or ST-Link programmer
- 1x USB type A to Mini-B USB cable for the ST-Link
- 1x USB type A to Micro-B USB cable for SensorTile Cradles



Mini USB



Micro USB

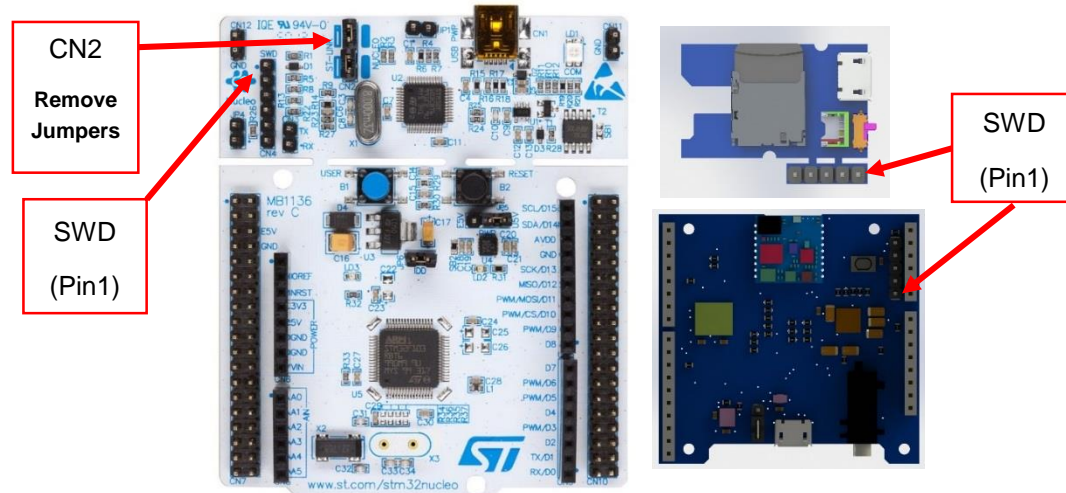
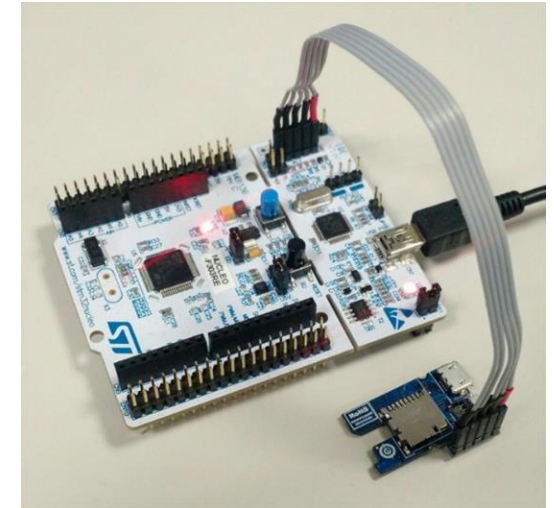


Setup Overview

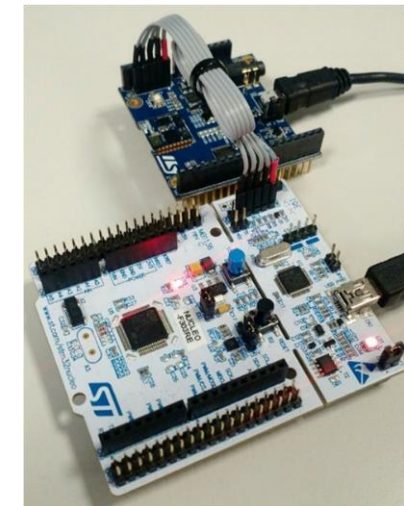
HW prerequisites and setup with SensorTile (2/2)

- In order to program the board you need to connect an external ST-Link to the SWD connector on the cradles, a 5pin flat cable is provided within the SensorTile Kit package
- The easiest way is to get an STM32-Nucleo board which includes an ST-Link V2.1 programmer
- Be sure that CN2 Jumpers are OFF and connect your STM32 Nucleo board to the SensorTile Cradle through the provided cable paying attention to the polarity of the connectors. Pin 1 can be identified by a little circle on the PCB silkscreen (STM32 Nucleo board and SensorTile Cradle Expansion) or by the square shape of the soldering pad of the connector (SensorTile Cradle).

Cradle SWD connection



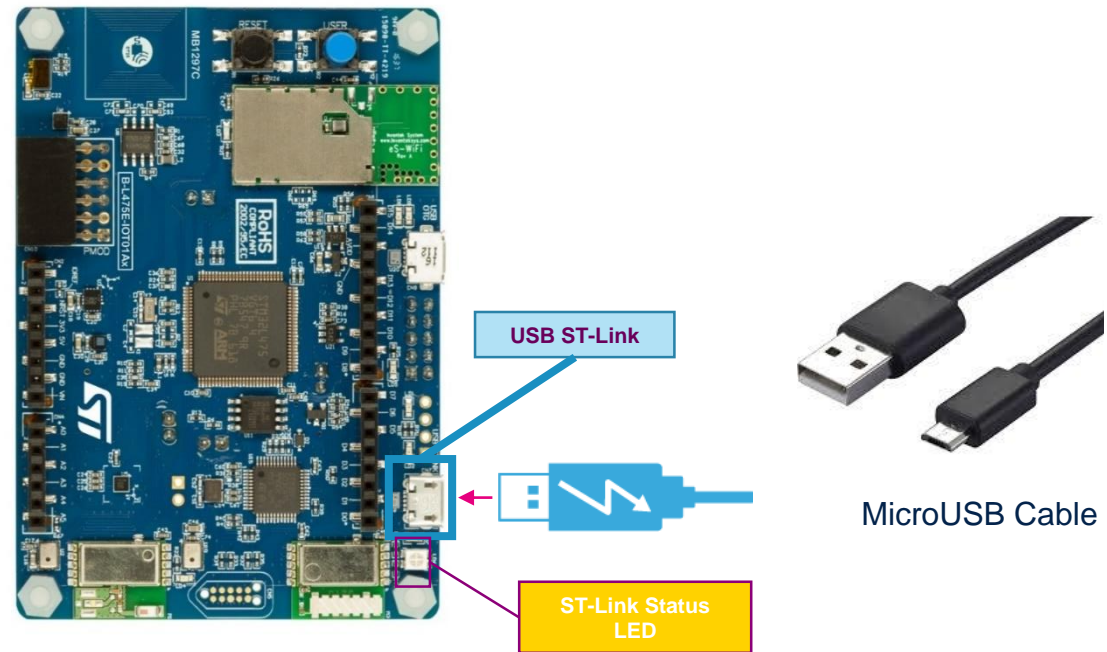
Cradle eXpansion SWD connection



Setup & Application Examples

HW prerequisites for B-L475E-IOT01A

- 1x B-L475E-IOT01A development board
- Laptop/PC with Windows 7, 8 or 10
- 1 x microUSB cable



B-L475E-IOT01A

Setup & Application Examples

HW prerequisites for STEVAL-MKSBOX1V1

- 1x STEVAL-MKSBOX1V1 evaluation board
- Laptop/PC with Windows 7, 8 or 10
- 1 x microUSB cable
- 1x USB type A to Mini-B USB cable
- ST-Link/V2 in-circuit debugger/programmer for STM8 and STM32



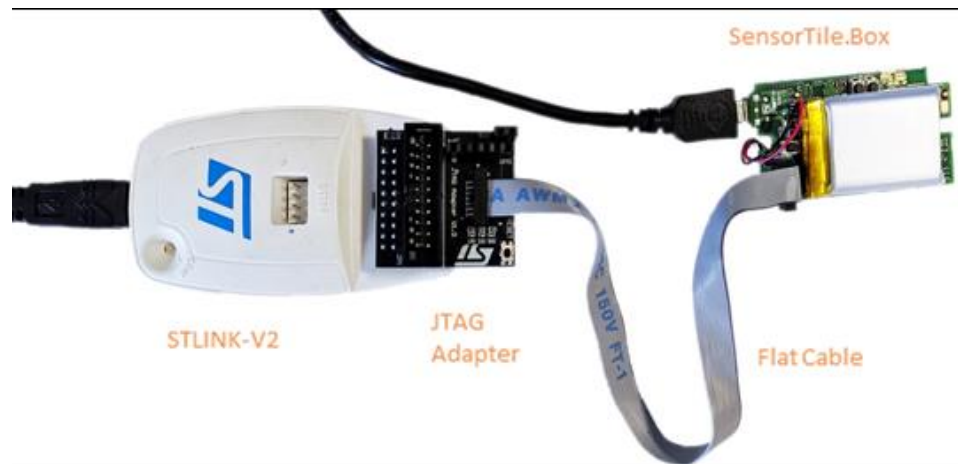
MicroUSB Cable



Mini USB



ST-Link/V2



STEVAL-MKSBOX1V1

Setup & Application Examples

Software and Other prerequisites

- **STSW-LINK009**
 - ST-LINK/V2-1 USB driver
- **STSW-LINK007**
 - ST-LINK/V2-1 firmware upgrade
- **FP-AI-SENSING1**
 - Copy the .zip file content into a folder on your PC. The package will contain source code example (Keil, IAR, System Workbench) based only on **NUCLEO-L476RG**, **STEVAL-STLKT01V1**, **B-L475E-IOT01A** or **STEVAL-MKSBOX1V1**
- **ST BLE Sensor Application** for [Android](#)/[iOS](#) to download from Google Store / iTunes

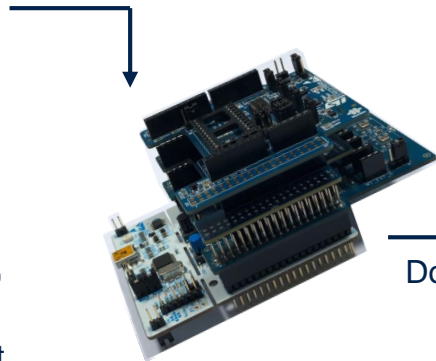
FP-AI-SENSING1

Setup Overview

1 <https://www.st.com/en/embedded-software/stm32-ode-function-pack-sw.html>



2 Select FP-AI-SENSING1



3 Download & unpack

FP-AI-SENSING1 package structure

Name

- _htmresc ← Docs
- Documentation ← BSP, HAL and drivers
- Drivers ← BlueNRG, AI-Libraries, FatFs, FreeRTOS
- Middlewares ← Application example
- Projects ← Boot loader binary
- Utilities
- package.xml
- Release_Notes.html

4
.\Projects\STM32L476RG-Nucleo\Applications\SENSING1\EWARM

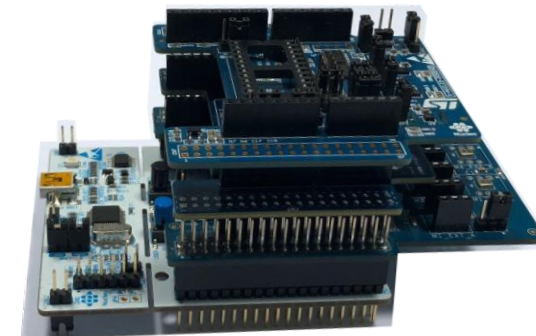
6 Android™/iOS™ smartphone and ST ST BLE Sensor application



6



5 Compile/Flash and Run the project



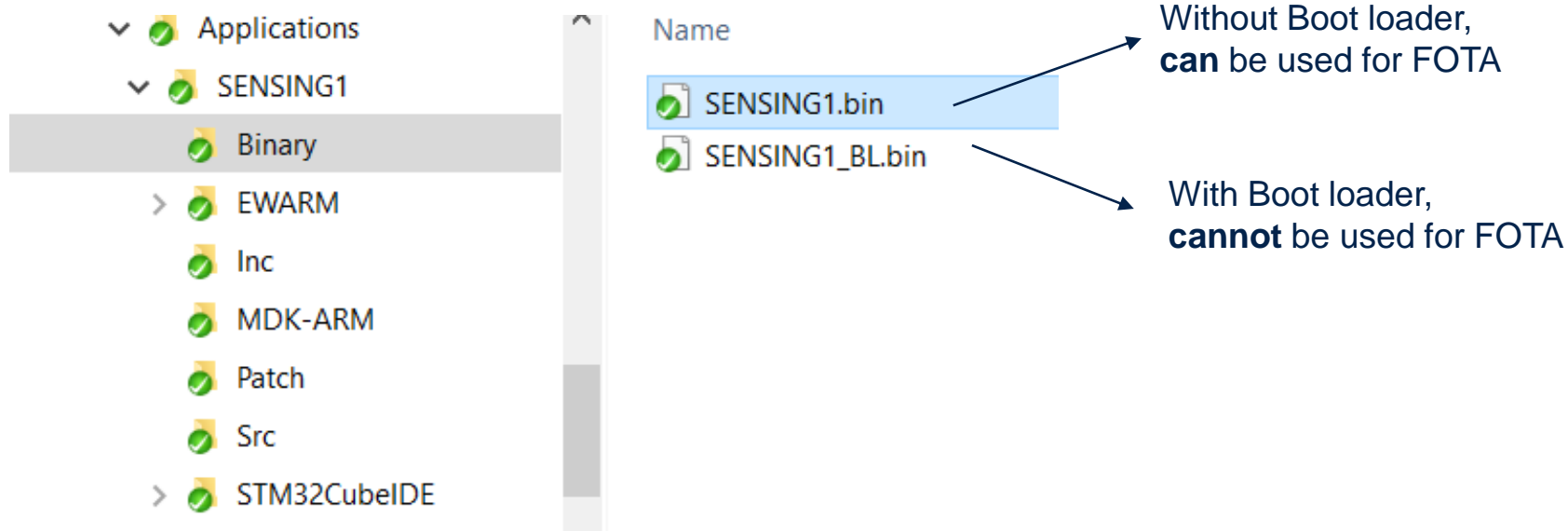
IMPORTANT:
Read the chapter "The Boot Process" on User Manual for understanding how to install the Boot Loader on the board

FP-AI-SENSING1

Installation procedure (1/2)

How to install the pre-compiled binary:

- Inside the package there is one folder called “Binary” that contains:



- pre-compiled FP-AI-SENSING1 (*.bin) FW that can be flashed to a supported NUCLEO-L476RG, SensorTile, SensorTile.box board or B-L475E-IOT01A using the ST-Link at the right position (0x08004000)
 - **Important Note:** this pre-compiled binary is compatible with the FOTA update procedure
- pre-compiled FP-AI-SENSING1+BootLoader (*_BL.bin) FW that could be directly flashed to a supported NUCLEO-L476RG, SensorTile, SensorTile.Box board or B-L475E-IOT01A using the ST-Link or by doing “Drag & Drop” (the latter only for STM32 Nucleo and B-L475E-IOT01A)
 - **Important Note:** this pre-compiled binary is not compatible with the FOTA update procedure

FP-AI-SENSING1

Installation procedure (2/2)

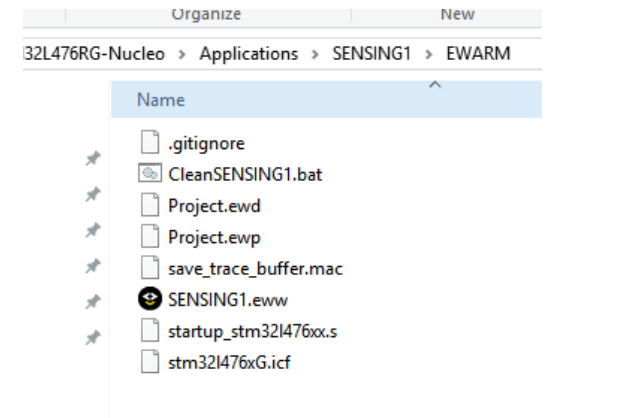
How Install the code after compiling the project:



- Compile the project with your preferred IDE
- On Windows: for each IDE and for each platform there is one batch script:
 - IAR toolchain Embedded Workbench:
 - CleanSENSING1.bat
 - System Workbench for STM32:
 - CleanSENSING1.bat
 - µVision toolchain - MDK-ARM Professional:
 - CleanSENSING1.bat
- For Linux/iOS: only for Openstm32 IDE and for each platform there is one OpenOCD:
 - CleanSENSING1.sh

It's necessary to edit this file for setting the right installation and Library path

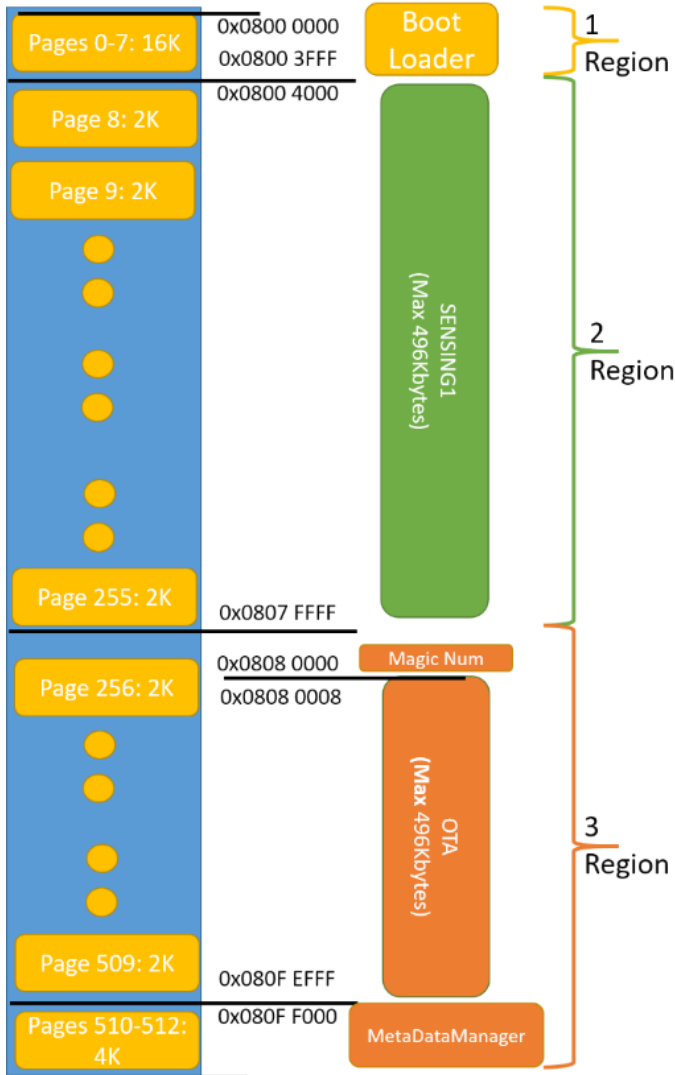
- These scripts perform the following steps:
 - Full Flash Erase
 - Flash the right BootLoader at the right position (0x08000000)
 - Flash the SENSING1 firmware at the right position (0x08004000)
 - This is the firmware that was compiled with the IDE
 - **This firmware is compatible with the FOTA update procedure**
 - Save a complete Binary FW that includes both SENSING1 and the BootLoader
 - This binary can be directly flashed to a supported STM32 Nucleo, SensorTile and B-L475E-IOT01A board board using the ST-Link or by doing “Drag & Drop” (the latter only for STM32 Nucleo and B-L475E-IOT01A boards)
 - **Important Note:** this additional pre-compiled binary is not compatible with the FOTA update procedure



```
CI\WINDOWS\system32\cmd.exe
Clean FP-AI-SENSING1
Full Chip Erase
STM32 ST-LINK CLI v3.2.0.0
STM32 ST-LINK Command Line Interface
Hard reset is performed.
ST-LINK SN : 066CFF485754727567021940
ST-LINK Firmware version : V2329M18
Connected via SWD.
SWD Frequency = 4000K.
Target voltage = 3.3 V.
Connection mode = Normal.
Device ID:0x415
Device Flash Size : 1024 Kbytes
Device Family :STM32L4x1/L4x5/L4x6
Full chip erase...
Flash memory erased.
Install BootLoader
STM32 ST-LINK CLI v3.2.0.0
STM32 ST-LINK Command Line Interface
ST-LINK SN : 066CFF485754727567021940
ST-LINK Firmware version : V2329M18
Connected via SWD.
SWD Frequency = 4000K.
Target voltage = 3.3 V.
Connection mode = Normal.
Device ID:0x415
Device Flash Size : 1024 Kbytes
Device Family :STM32L4x1/L4x5/L4x6
Loading file...
Flash Programming:
File : ..\..\..\Utilities\BootLoader\STM32L476RG\BootLoaderL4.bin
Address : 0x08000000
Memory programming...
Reading and verifying device memory...
Memory programmed in 1s and 329ms.
Verification...OK
Programming Complete.
Install FP-AI-SENSING1
STM32 ST-LINK CLI v3.2.0.0
STM32 ST-LINK Command Line Interface
ST-LINK SN : 066CFF485754727567021940
ST-LINK Firmware version : V2329M18
Connected via SWD.
SWD Frequency = 4000K.
Target voltage = 3.3 V.
Connection mode = Normal.
```

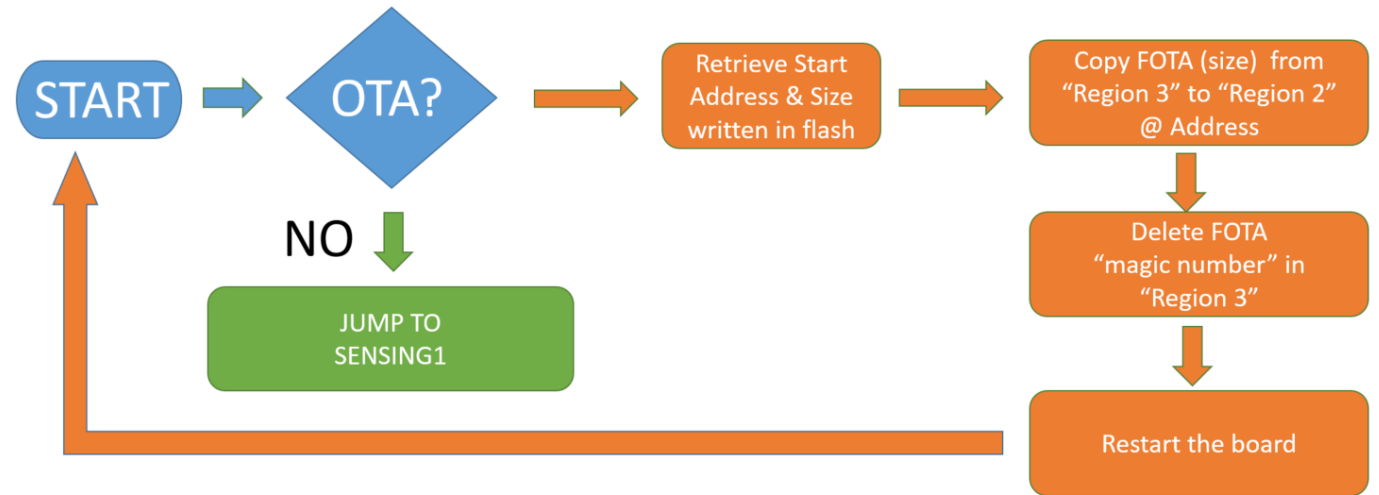
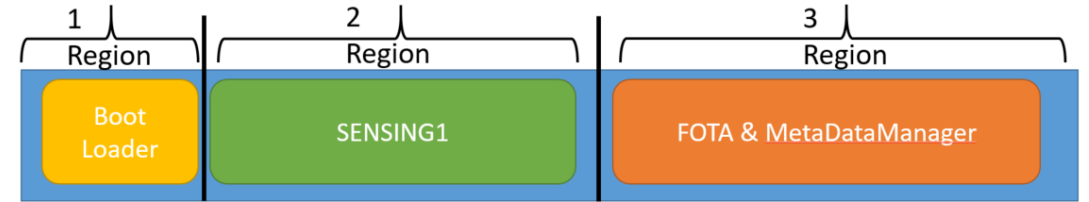
FP-AI-SENSING1

Flash Management and Boot Process



Flash Structure

FLASH Organization



Boot Sequence

*Region 3 start for SensorTile.box is 0x08100000" (vs. 0x08080000 for all other boards)

FP-AI-SENSING1

Using serial line monitor – e.g. Tera Term

FP-AI-SENSING for NUCLEO-L476RG or B-L475E-IOT01A

When pressing the **RESET** User button on STM32 board
You can see the initialization phase

```
COM10 - Tera Term VT
File Edit Setup Control Window Help
UART Initialized
OK Accelero/Gyroscope Sensor
OK Magneto Sensor
OK Humidity/Temperature1 Sensor
OK Pressure/Temperature2 Sensor
Disabled Accelero Sensor
Disabled Gyroscope Sensor
Disabled Magneto Sensor
Disabled Humidity Sensor
Disabled Temperature Sensor1
Disabled Pressure Sensor
Disabled Temperature Sensor2

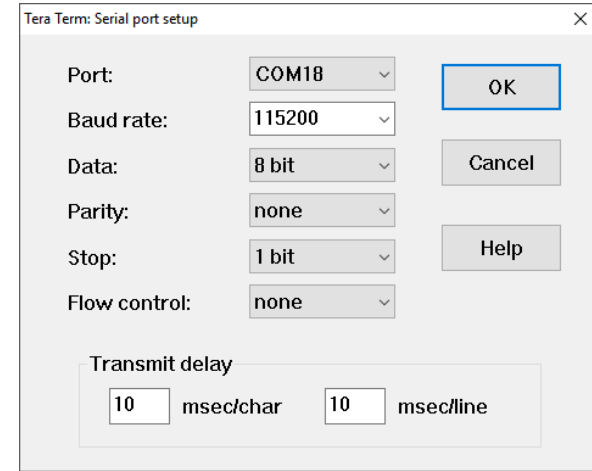
-----
STMicroelectronics AI-SENSING1
Version 3.0.0
STM32L476RG-Nucleo board

<HAL 1.10.0-0>
Compiled Jun 19 2019 18:02:05 <IAR>

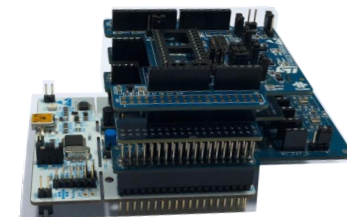
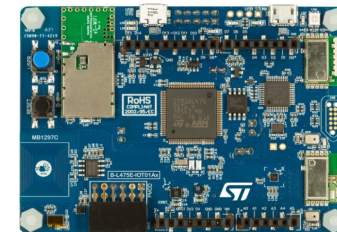
-----
Meta Data Manager read from Flash
Meta Data Manager version=0.13.0
Generic Meta Data found:
  NODE_NAME Size=8 [bytes]

SERVER: BLE Stack Initialized
  BoardName= NAI_300
  BoardMAC = c6:9b:51:35:17:51
HW & SW Service W2ST added successfully
Console Service W2ST added successfully
Config Service W2ST added successfully
Testing BootLoaderCompliance:
  Version 2.0.0
  MagicNum OK
  MaxSize =7c000
  OTIStartAdd OK
  OTIDoneAdd OK
BootLoader Compliant with FOTA
>>>>>CONNECTED 7b:53:79:95:0f:78
UUID Rescan Forced
Enabled Humidity Sensor <One Shot>
Enabled Temperature Sensor1 <One Shot>
Enabled Pressure Sensor <One Shot>
Enabled Temperature Sensor2 <One Shot>
L476_AI-SENSING1_3.0.0
```

When the boards are connected to an Android or iOS device, you can see what is transmitted via BLE



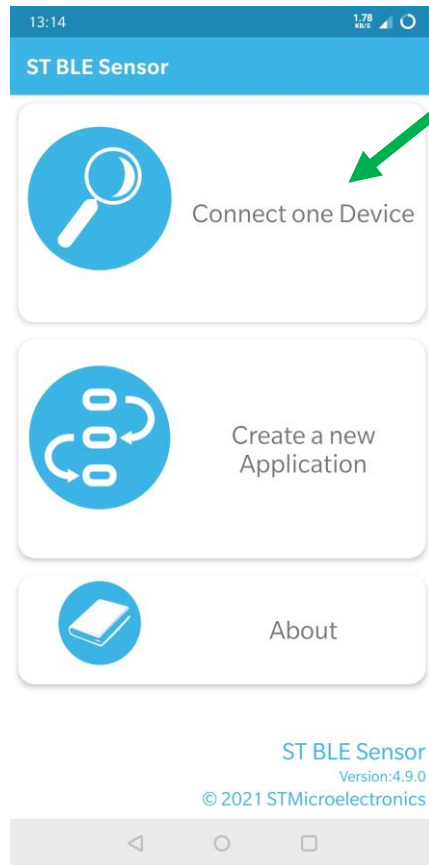
Configure the serial line monitor (speed, LF)



2.2- ST BLE Sensor Application

FP-AI-SENSING1

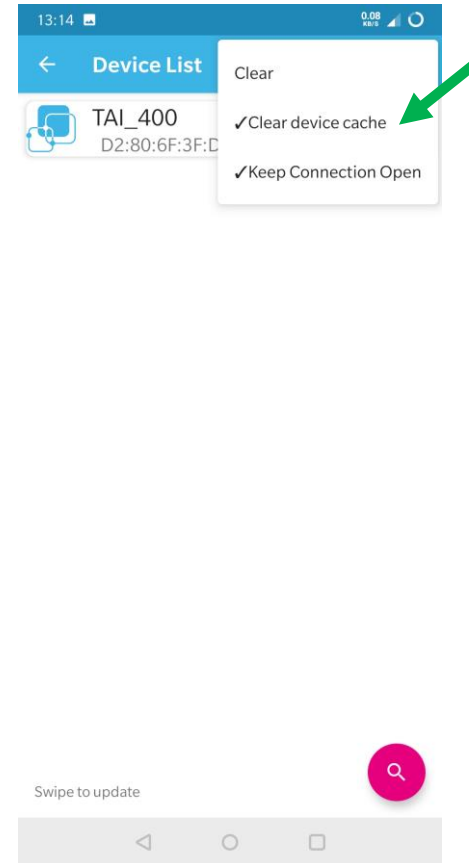
ST BLE Sensor Application for Android/iOS (1/6) Initial Steps



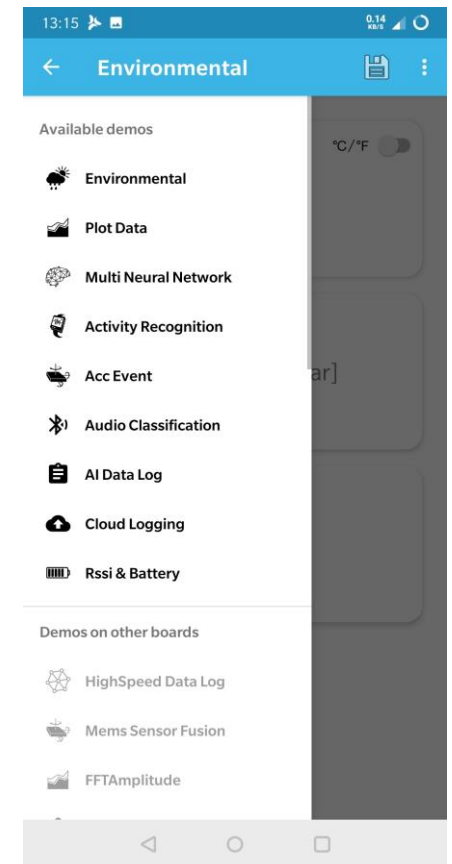
Starting Page



Discovery Page



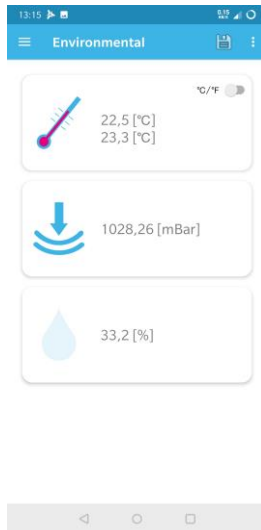
Clear Device Cache



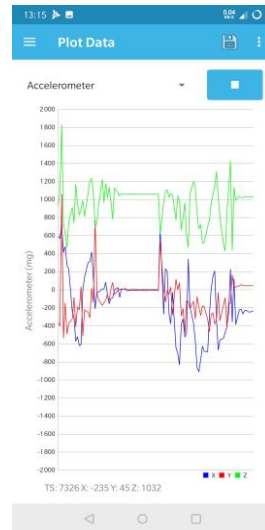
Device Connected

FP-AI-SENSING1

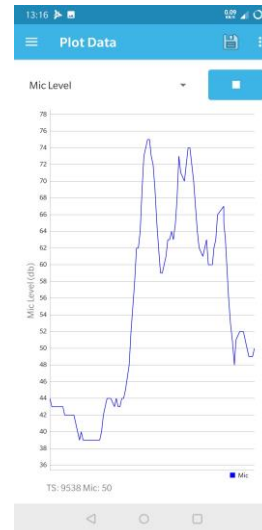
ST BLE Sensor Application for Android/iOS (2/6) Data Monitoring



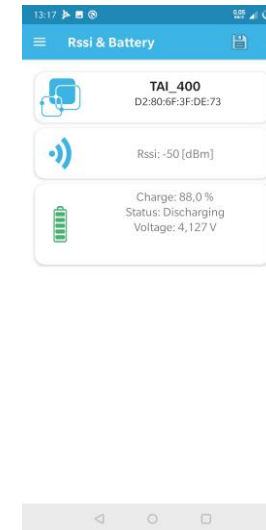
Environmental



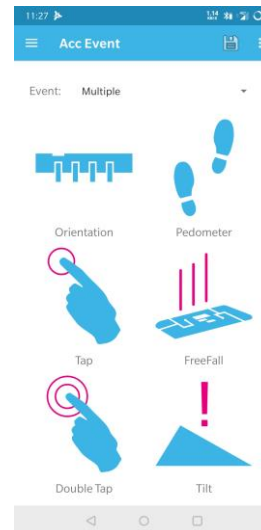
Accelerometer plot



Microphones level plot



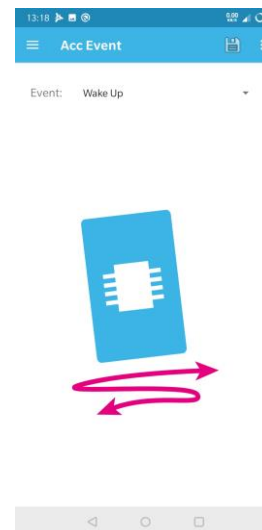
RSSI & Battery



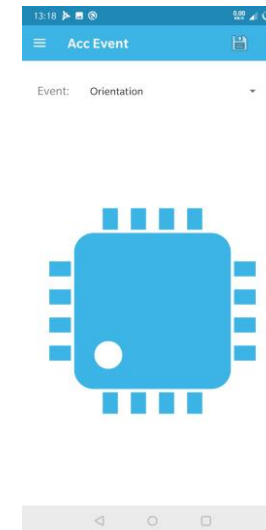
Multiple events



Pedometer



Wake Up

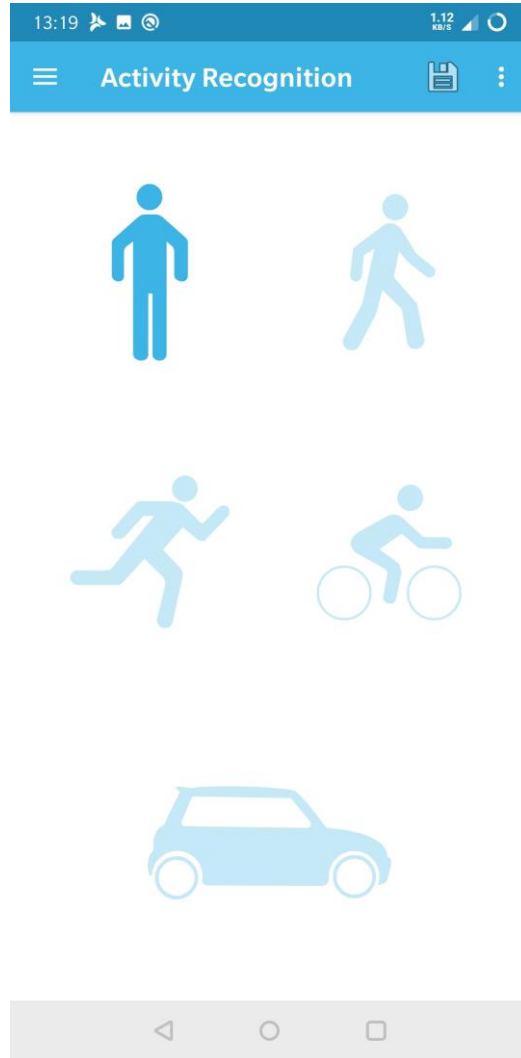


Orientation

FP-AI-SENSING1

ST BLE Sensor Application for Android/iOS (3/6) HAR and ASC Features

AI Algorithms – Android version



HAR-GMP/HAR_IGN Activity Recognition



Audio Scene Classification



Select the algorithm to enable

ASC+GMP

Configuration selection

Human Activity Classification



13:20:16: Stationary

Audio Scene Classification



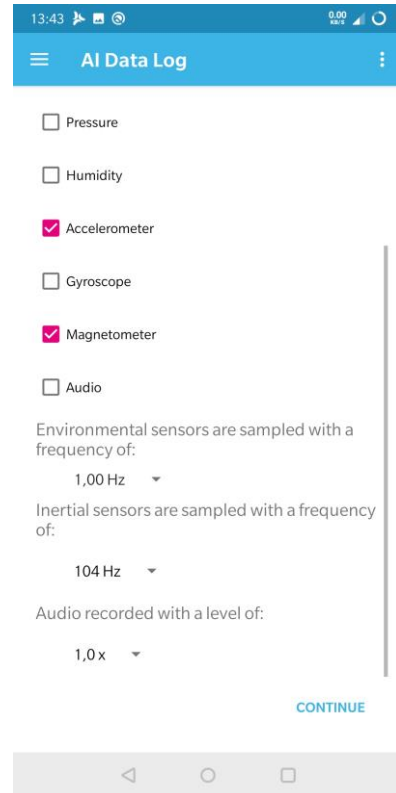
13:20:16: Outdoor



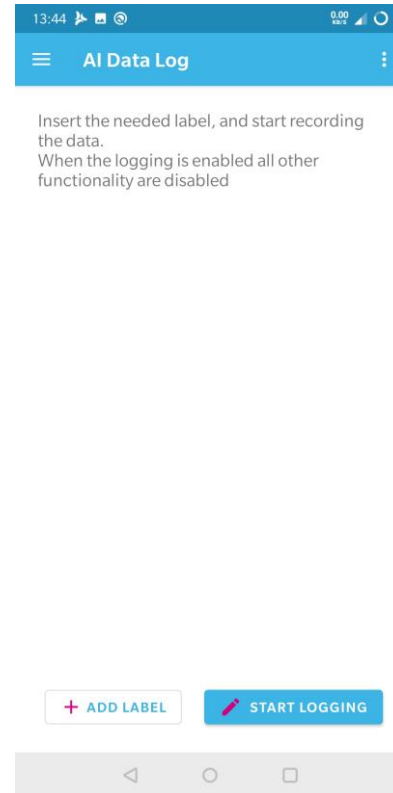
FP-AI-SENSING1

ST BLE Sensor Application for Android/iOS (5/6) Data logger

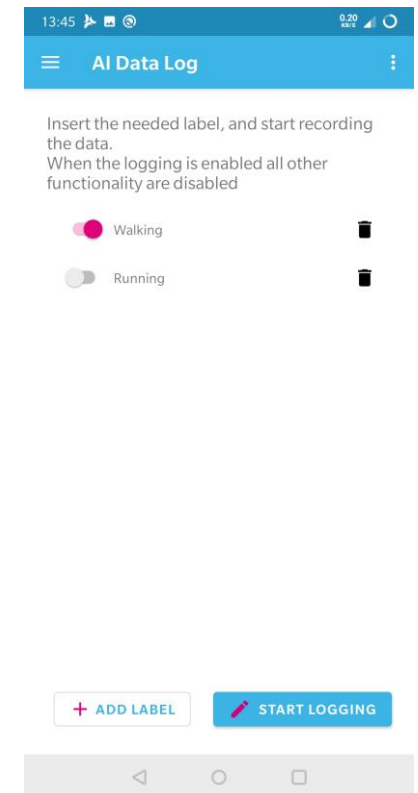
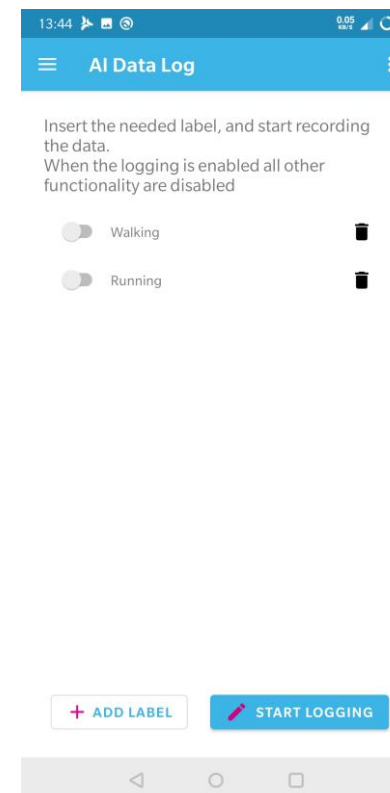
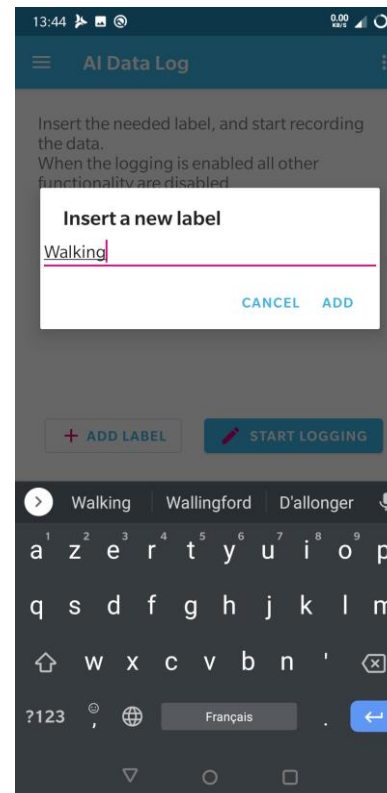
SD Data Log – Android version



Choose Sensors and Sampling Frequency



Add Labels for Annotation



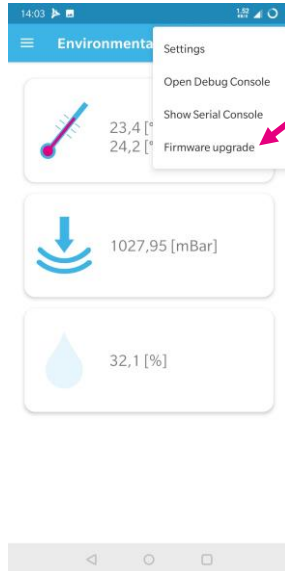
Log & Annotate Sensor Data

- Data logging feature is available in order to enable users to create their data sets for training their NN models
- Pre-processing python scripts for model re-training are also provided in the package

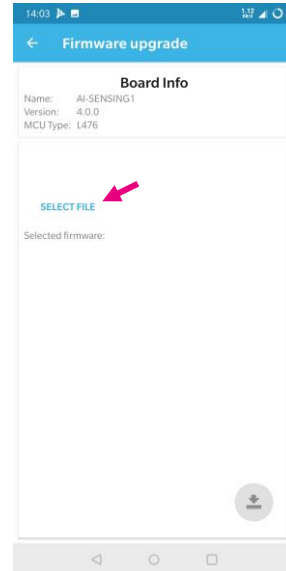
FP-AI-SENSING1

ST BLE Sensor Application for Android/iOS (6/6)

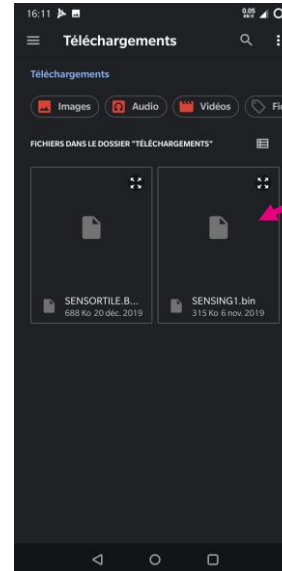
FOTA



Firmware update menu



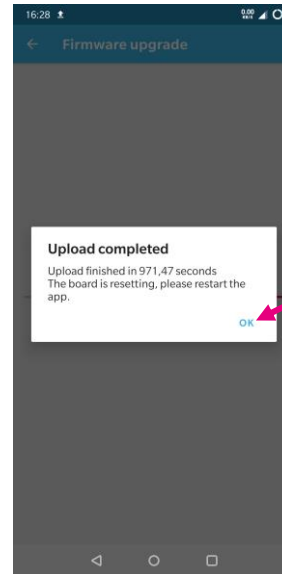
Firmware update file selection



Firmware upgrade



application page during FOTA and on completion



```

COM10 - Tera Term VT
File Edit Setup Control Window Help
OTA AI-SENSING1 SIZE=290973 uwCRCValue=f46735da
Start FLASH Erase
End FLASH Erase 143 Pages of 2KB
r5gf_AI-SENSING1_3.0.0
OTA Update saved
CRC Initialized
OTA CRC-checked
Full Fota
OTA will be installed at next board reset
AI-SENSING1 will restart
UART Initialized
OK Accelero/Gyroscope Sensor
OK Magneto Sensor
OK Humidity/Temperature1 Sensor
OK Pressure/Temperature2 Sensor
Disabled Accelero Sensor
Disabled Gyroscope Sensor
Disabled Magneto Sensor
Disabled Humidity Sensor
Disabled Temperature Sensor1
Disabled Pressure Sensor
Disabled Temperature Sensor2

-----
STMicroelectronics AI-SENSING1
Version 3.0.0
STM32L476RG-Nucleo board

<HAL 1.10.0_0>
Compiled Jun 18 2019 15:06:43 <IAR>

-----
Meta Data Manager read from Flash
Meta Data Manager version=0.13.0
Generic Meta Data found:
  NODE_NAME Size=8 [bytes]

SERVER: BLE Stack Initialized
  BoardName = NAI_300
  BoardMAC = c6:9b:51:35:17:51
HW & SW Service U281 added successfully
Console Service U281 added successfully
Config Service U281 added successfully
Testing BootloaderCompliance:
  Version 2.0.0
  MagicNum OK
  MaxSize =7c000
  OTAStartAdd OK
  OTADoneAdd OK
BootLoader Compliant with FOTA
>>>>>CONNECTED 65:31:40:97:8a:c3
UUID Rescan Forced
Enabled Humidity Sensor (One Shot)
Enabled Temperature Sensor1 (One Shot)
Enabled Pressure Sensor (One Shot)
Enabled Temperature Sensor2 (One Shot)

Disabled Humidity Sensor
Disabled Temperature Sensor1
Disabled Pressure Sensor
Disabled Temperature Sensor2
    
```

Terminal window information after FOTA

3- Documents & Related Resources

Documents & Related Resources (1/2)

All documents are available in the DESIGN tab of the related products webpage

FP-AI-SENSING1

- **DB3785**: STM32Cube function pack for ultra-low power IoT node with artificial intelligence (AI) application based on audio and motion sensing – [data brief](#)
- **UM2524**: Getting started with the STM32Cube function pack for ultra-low power IoT node for Artificial Intelligence (AI) application based on audio and motion sensing – [user manual](#)
- [Software setup file](#)

X-NUCLEO-CCA02M1

- [Gerber files](#), [BOM](#), [Schematics](#)
- **DB2593**: Digital MEMS microphones expansion board based on MP34DT01-M for STM32 Nucleo – [data brief](#)
- **UM1900**: Getting started with the digital MEMS microphones expansion board based on MP34DT01-M for STM32 Nucleo – [user manual](#)

X-NUCLEO-IDB05A1

- [Gerber files](#), [BOM](#), [Schematic](#)
- **DB2592**: Bluetooth Low Energy expansion board based on SPBTLE-RF module for STM32 Nucleo – [data brief](#)
- **UM1912**: Getting started with X-NUCLEO-IDB05A1 Bluetooth low energy expansion board based on SPBTLE-RF module for STM32 Nucleo – [user manual](#)
- **AN4642**: Overview of the BLE Profiles application for X-CUBE-BLE1, expansion for STM32Cube – [application note](#)

X-NUCLEO-IKS01A2

- [Gerber files](#), [BOM](#), [Schematic](#)
- **DB3009**: Motion MEMS and environmental sensor expansion board for STM32 Nucleo – [data brief](#)
- **UM2121**: Getting started with the X-NUCLEO-IKS01A2 motion MEMS and environmental sensor expansion board for STM32 Nucleo – [user manual](#)

Documents & Related Resources (2/2)

All documents are available in the DESIGN tab of the related products webpage

STEVAL-STLKT01V1

- Gerber files, BOM, Schematic
- **DB2956**: SensorTile development kit – [data brief](#)
- **UM2101**: Getting started with the STEVAL-STLKT01V1 SensorTile integrated development platform – [user manual](#)

B-L475E-IOT01A:

- [Gerber files](#), [BOM](#), [Schematic](#)
- **DB3009**: Motion MEMS and environmental sensor expansion board for STM32 Nucleo – [product specification](#)
- **UM2121**: Getting started with motion MEMS and environmental sensor expansion board for STM32 Nucleo – [user manual](#)

STEVAL-MKSBOX1V1

- [Gerber files](#), [BOM](#), [Schematic](#)
- **DB3903**: SensorTile.box wireless multi sensor development kit with user friendly app for IoT and wearable sensor applications – [data brief](#)
- **UM2580**: How to use the wireless multi sensor development kit with customizable app for IoT and wearable sensor applications – [user manual](#)

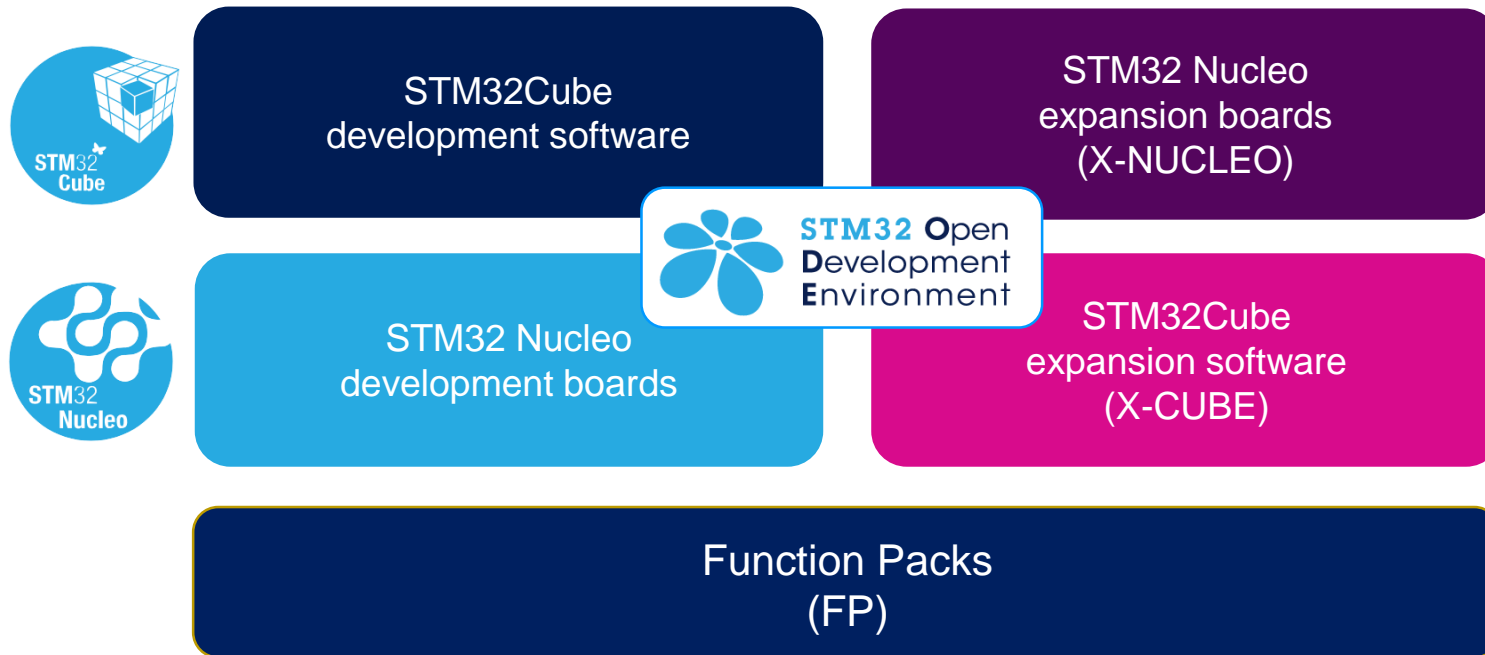
4- STM32 Open Development Environment: Overview



STM32 Open Development Environment

Fast, affordable Prototyping and Development

- The STM32 Open Development Environment (STM32 ODE) is an open, flexible, easy, and affordable way to develop innovative devices and applications based on the STM32 32-bit microcontroller family combined with other state-of-the-art ST components connected via expansion boards. It enables fast prototyping with leading-edge components that can quickly be transformed into final designs



For further information, please visit www.st.com/stm32ode

Thank you

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