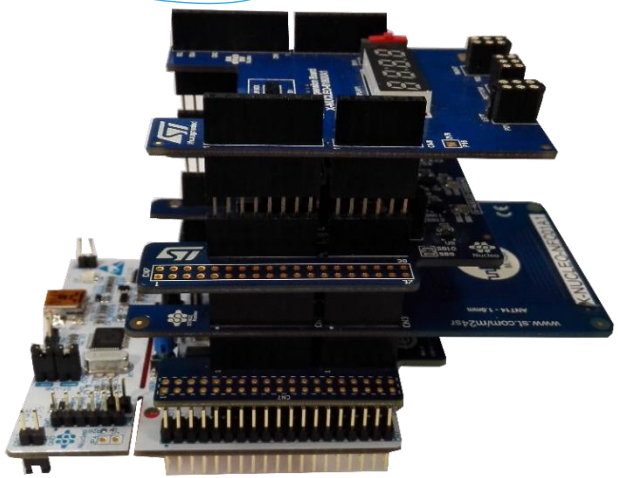
Quick Start Guide

Bluetooth low energy, sensors and NFC tag software for STM32Cube (BLUEMICROSYSTEM3)



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Version 1.0.1 (September 15, 2016)

Quick Start Guide Contents

Motion MEMS and environmental sensors Expansion Board

Hardware Overview (1/6)

X-NUCLEO-IKS01A1 Hardware Description

- The X-NUCLEO-IKS01A1 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

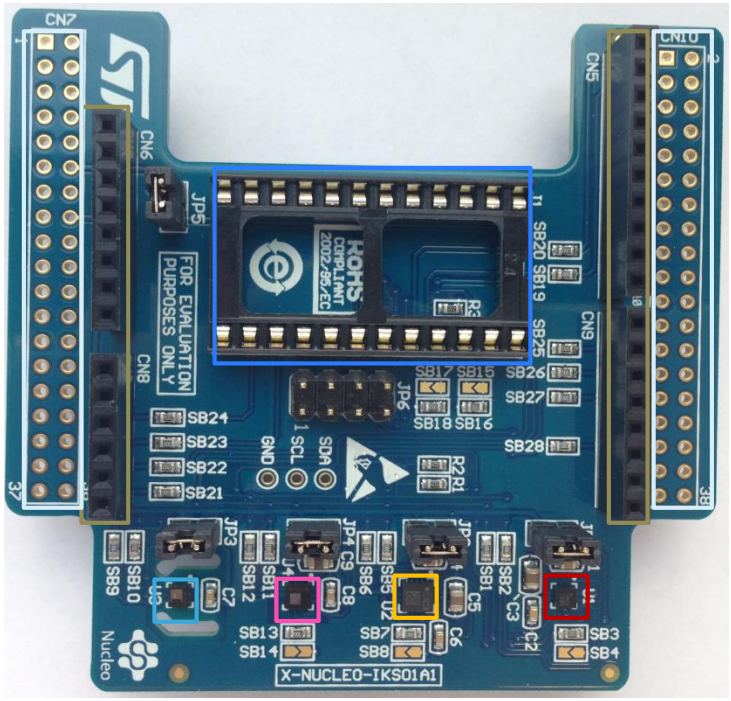
LSM6DS0: MEMS 3D accelerometer (±2/±4/±8 g) + 3D gyroscope (±245/±500/±2000 dps)

LIS3MDL: MEMS 3D magnetometer (±4/ ±8/ ±12/ 16 gauss)

LPS25HB: 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)



HTS221 LSM6DS0 ST morpho connector**

LPS25HB LIS3MDL Arduino UNO R3 connector

DIL 24-pin

Latest info available at www.st.com
X-NUCLEO-IKS01A1

** Connector for the STM32 Nucleo Board

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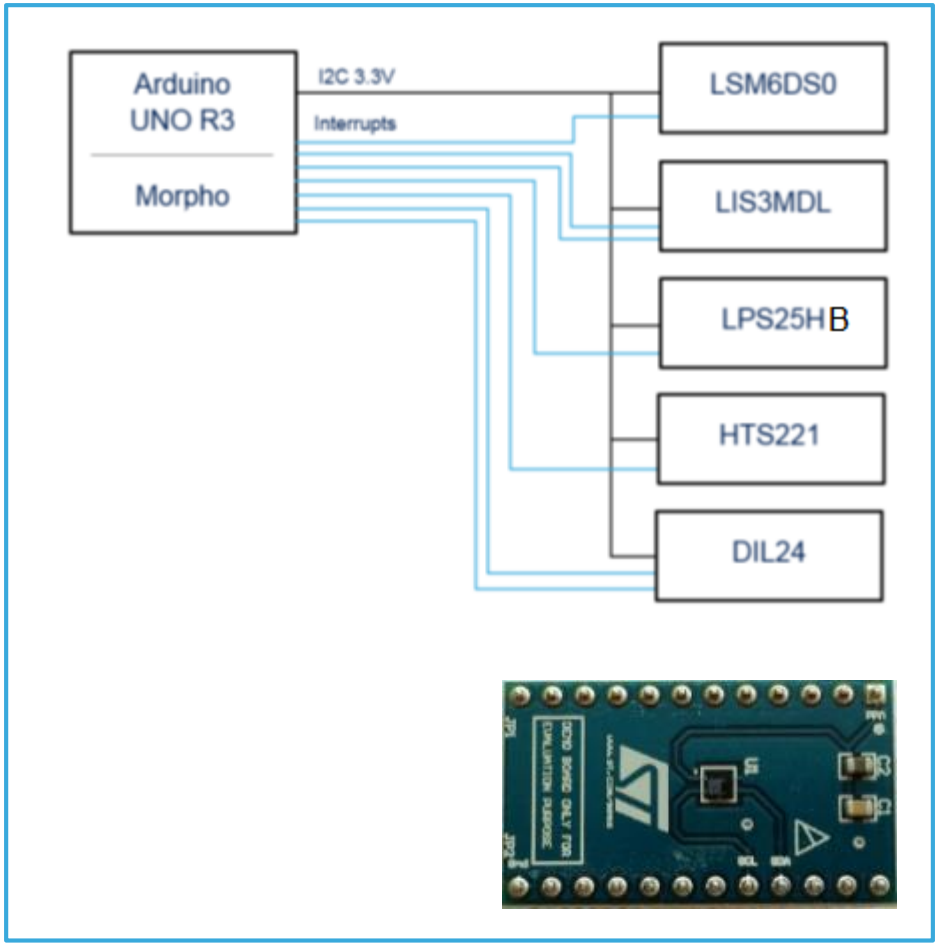
Motion MEMS and environmental sensors Expansion Board

Hardware Overview (2/6)

Key Features

- The X-NUCLEO-IKS01A1 is a motion MEMS and environmental sensor evaluation board system.
- All sensor sensors are connected on a single I²C bus
- Sensor I²C address selection
- Each sensor has separate power supply lines allowing power consumption measurement
- Sensor disconnection (disconnect the I²C bus as well as the power supply)
- Interrupt and DRDY signals from sensors
- DIL24 socket (Compatible to STEVAL-MKI***V* MEMS adapter boards)



* is used as a wildcard character for related part number

Bluetooth Low Energy Expansion Board
Hardware Overview (3/6)

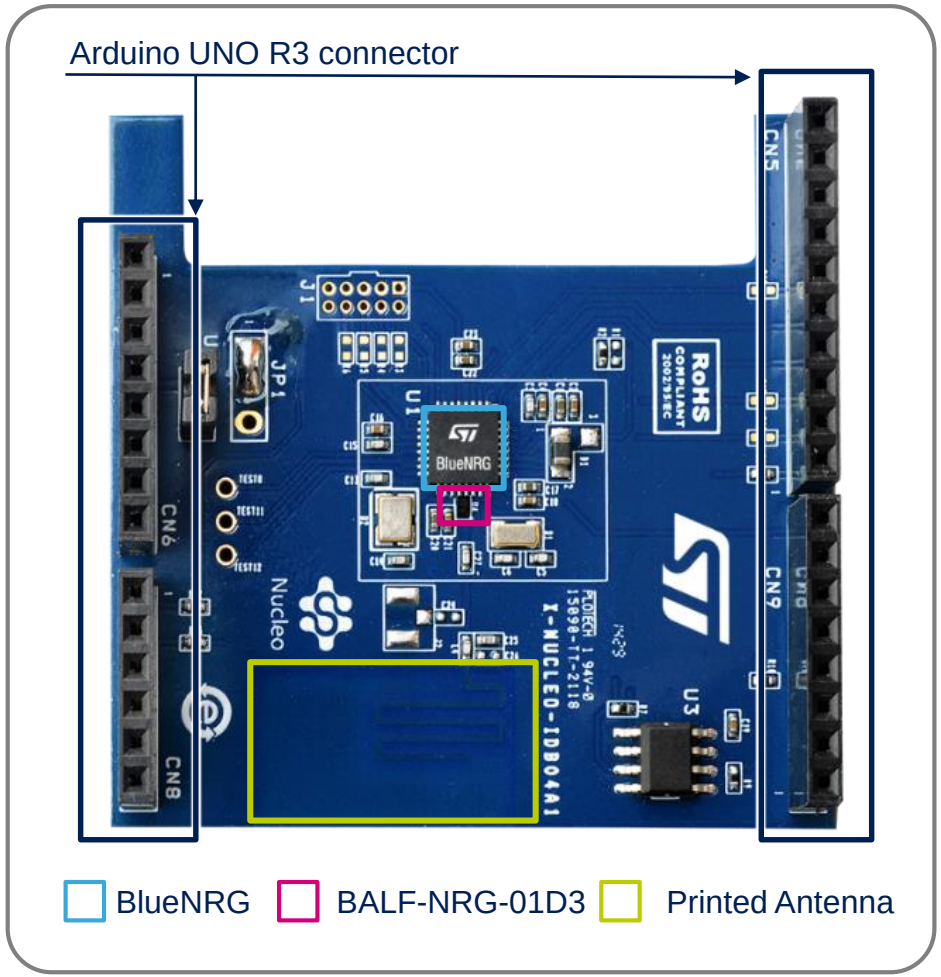
X-NUCLEO-IDB04A1 Hardware Description

- The X-NUCLEO-IDB04A1 is a Bluetooth Low Energy (BLE) evaluation and development board system, designed around ST's BlueNRG BLE network processor.
- The BlueNRG processor communicates with STM32 Nucleo developer board host microcontroller though an SPI link available on the Arduino UNO R3 connector.

Key Products on board

BlueNRG
ST Bluetooth® Low Energy wireless network processor, BLE4.0 compliant

BALF-NRG-01D3
50 Ω nominal input / conjugate match balun to BlueNRG transceiver, with integrated harmonic filter, insuring matching and filtering



Latest info available at www.st.com
X-NUCLEO-IDB04A1

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Bluetooth Low Energy Expansion Board
Hardware Overview (4/6)

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 though an SPI link available on the Arduino UNO R3 connector.

Key Products on board

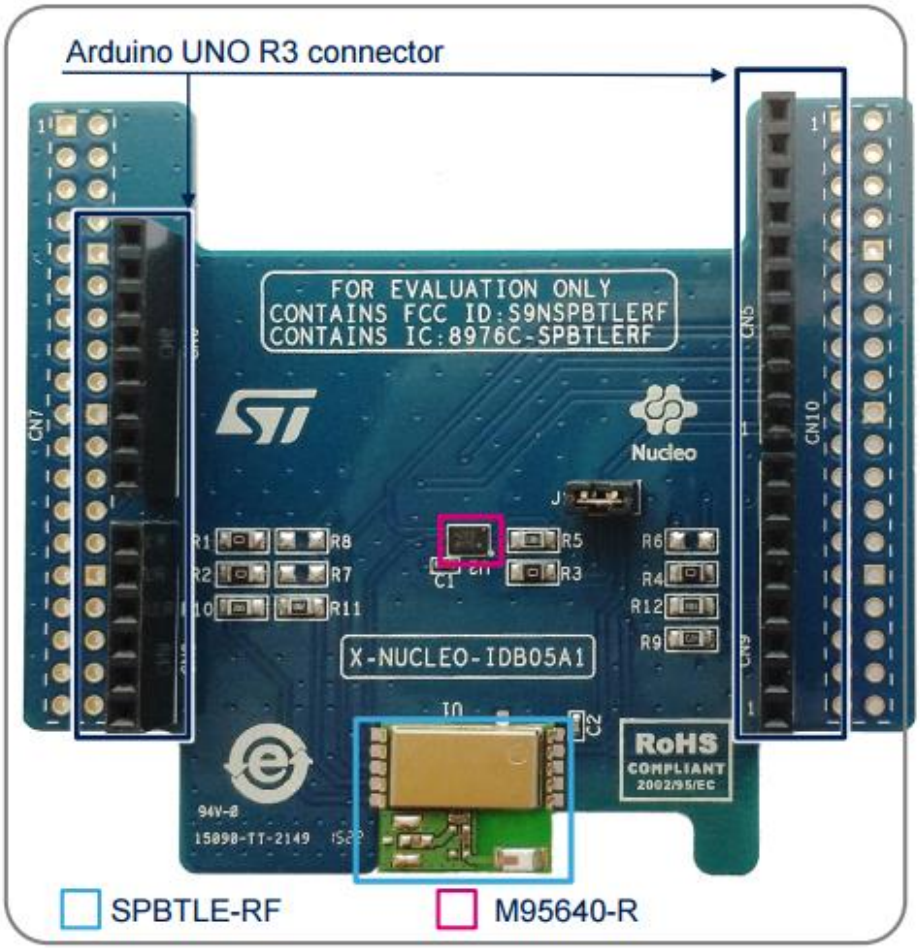
SPBTLE-RF

Bluetooth Low Energy, FCC and IC certified, module based on Bluetooth® Low Energy wireless network processor BlueNRG-MS, BLE4.1 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

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Dynamic NFC tag expansion board
Hardware Overview (5/6)

X-NUCLEO-NFC01A1 Hardware Description

- The X-NUCLEO-NFC01A1 is a Dynamic NFC tag evaluation board to allow expansion of the STM32 Nucleo boards. It is compatible with the Arduino UNO R3 connector layout and it is designed around the M24SR64-Y. The M24SR64-Y device is a dynamic NFC/RFID tag IC with a dual interface. It embeds a 64 Kbit EEPROM memory. It can be operated from an I²C interface or by a 13.56 MHz RFID reader or a NFC phone

Key Product on board

M24SR64-Y

- M24SR64-Y Dynamic NFC/RFID tag IC
- NFC antenna: 31 mm x 30 mm 13.56 MHz double layer inductive antenna etched on the PCB (ANT14)
- Compatible with STM32 Nucleo boards
- Equipped with Arduino UNO R3 connector
- Powered through the Arduino UNO R3 connectors
  3 color LEDs for general purpose

Latest info available at www.st.com
X-NUCLEO-NFC01A1

Hardware Overview (6/6)

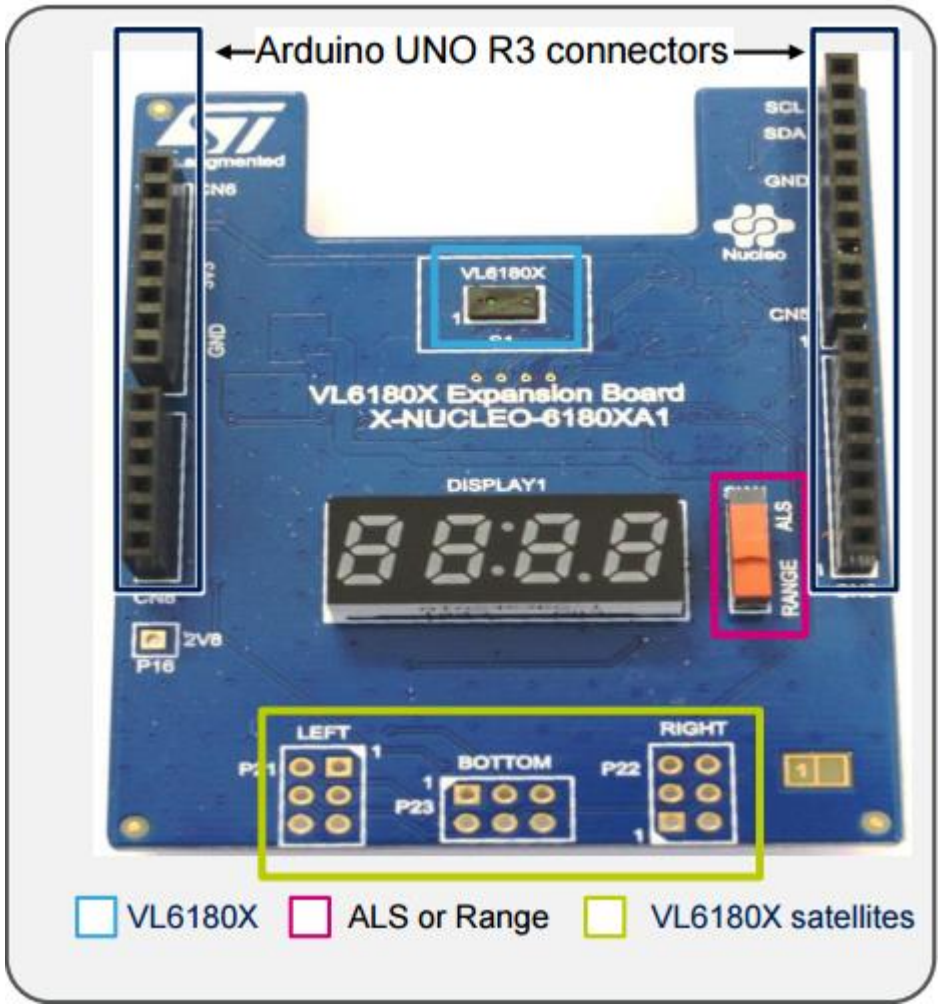
X-NUCLEO-6180XA1 Hardware Description

- The X-NUCLEO-6180XA1 is a proximity and ambient light sensor evaluation and development board system, designed around the VL6180X, a device based on ST's FlightSense™ time-of-flight technology.
- The VL6180X communicates with the STM32 Nucleo developer board host microcontroller through an I²C link available on the Arduino UNO R3 connector

Key Product on board

VL6180X
proximity, gesture and ambient light sensor (ALS)
Selection between ranging and ALS measurement

Possibility to add 3 VL6180X satellite boards (order code: VL6180X-SATEL)



Latest info available at www.st.com
X-NUCLEO-6180XA1

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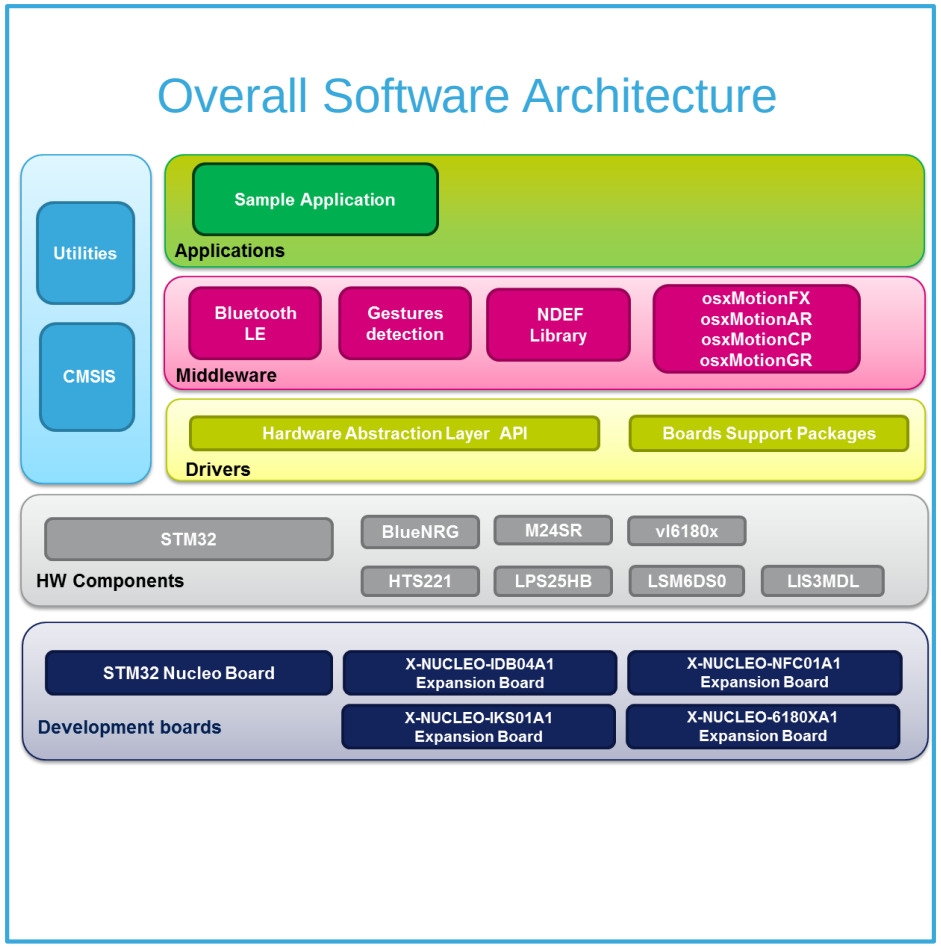
Software Overview

BLUMICROSYSTEM3 Software Description

BLUMICROSYSTEM3 is an expansion software package for STM32Cube

Key features

- Complete middleware to build applications using temperature and humidity sensors (HTS221), pressure sensor (LPS25HB) and motion sensors (LIS3MDL and LSM6DS0), VL6180X proximity and ambient light sensing module and M24SR64-Y Dynamic NFC/RFID tag (using the NDEF standard).
- The package is compatible with the motion sensor LSM6DS3 DIL24 expansion component
- Very low power Bluetooth Low Energy (BlueNRG) single-mode network processor, compliant with Bluetooth specifications core 4.1 for transmitting information to one client
- Easy portability across different MCU families, thanks to STM32Cube
- Compatible with BlueMS application for Android/iOS (Version >2.0.0) available on respective online markets (Play Store/iTunes)
- Free, user-friendly license terms
- Sample implementation available on board X-NUCLEO-NFC01A1, X-NUCLEO-IKS01A1, X-NUCLEO-6180XA1 and X-NUCLEO-IDB04A1 (or X-NUCLEO-IDB05A1), when connected to NUCLEO-F401RE or NUCLEO-L476RG



Latest info available at www.st.com
BLUEMICROSYSTEM3

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Quick Start Guide Contents

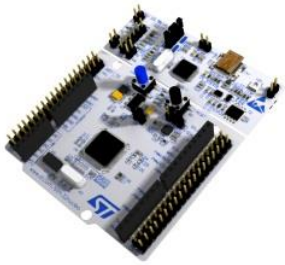
BLUMICROSYSTEM3: Bluetooth low energy, sensors and NFC tag software
Hardware and Software overview

Setup & Demo Examples
Documents & Related Resources

STM32 Open Development Environment: Overview

Setup & Demo Examples
HW prerequisites

- 1 x Dynamic NFC tag expansion board expansion board (**X-NUCLEO-NFC01A1**)
- 1 x Bluetooth Low Energy Expansion Board (**X-NUCLEO-IDB05A1** or **X-NUCLEO-IDB04A1**)
- 1 x Motion MEMS and environmental sensor expansion board (**X-NUCLEO-IKS01A1**)
- 1 x STM32 Nucleo proximity, gesture and ambient light expansion board (**X-NUCLEO-6180XA1**)
- 1 x STM32 Nucleo development board (**NUCLEO-F401RE or NUCLEO-L476RG**)
- 1 x NFC-enabled Android™ or iOS™ device
- 1x Windows 8/7 - Laptop/PC
- 1 x USB type A to Mini-B USB cable



NUCLEO-F401RE
NUCLEO-L476RG

X-NUCLEO-IDB05A1

X-NUCLEO-NFC01A1

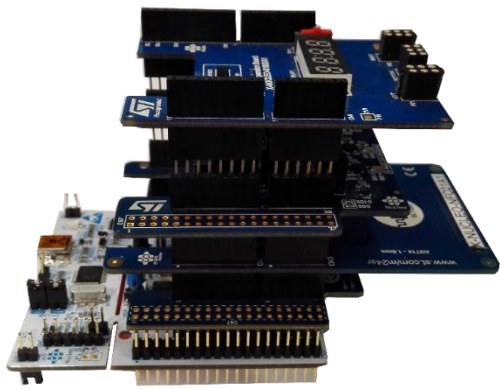
X-NUCLEO-IDB04A1

X-NUCLEO-6180XA1

X-NUCLEO-IKS01A1

Mini USB

For optimizing the performances of the SPBTLE-RF module present on X-NUCLEO-IDB05A1 expansion board, it's necessary to follow this sequence of boards stack



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SW prerequisites

- **STSW-LINK008:** ST-LINK/V2-1 USB driver
- **STSW-LINK007:** ST-LINK/V2-1 firmware upgrade
- **BLUEMICROSYSTEM3**
  - This installer install all the necessary drivers for the X-CUBE expansion, run the procedure for asking all the licenses necessary for all the osxMotionFX/osxMotionAR/osxMotionCP/oscMotionGR
  - the package will contain source code example (Keil, IAR, System Workbench) based only on **NUCLEO-F401RE or NUCLEO-L476RG**

Bluetooth low energy, sensors and NFC tag software

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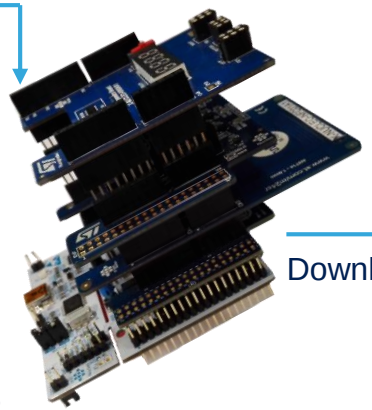
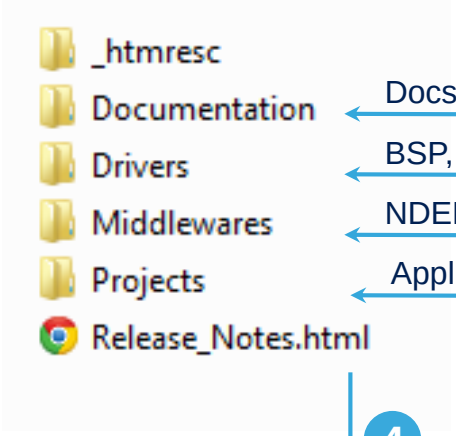
1 www.st.com/x-nucleo

2 Select BLUEMICROSYSTEM3



3 Download & unpack

BLUEMICROSYSTEM3 package structure

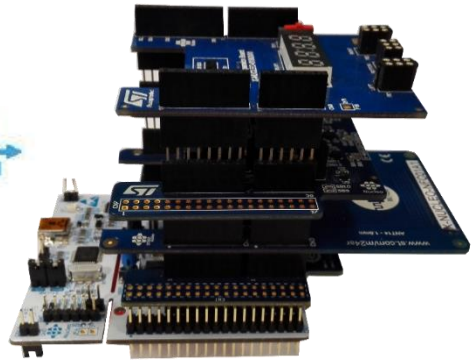


4 .\BLUMICROSYSTEM3\Projects\Multi\Applications\BlueMicrosystem3\EWARM\STM32F401RE-Nucleo

5 Compile/Flash and Run the project

KEIL™ Tools by ARM

IAR SYSTEMS



6 NFC-enabled Android™ smartphone and STM BlueMS application

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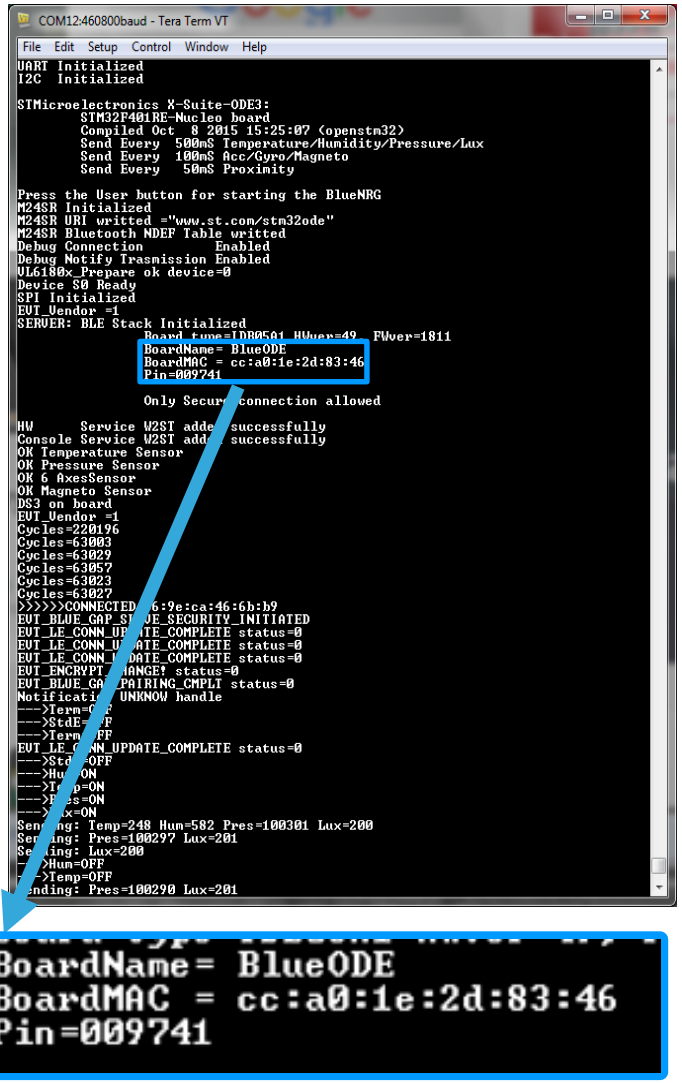
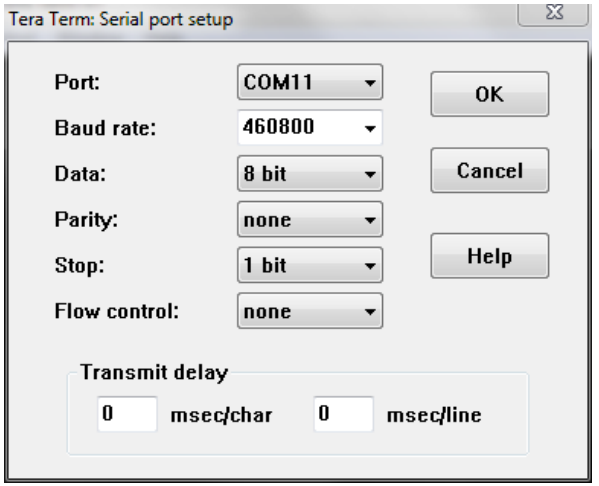
Using serial line monitor – e.g.TeraTerm

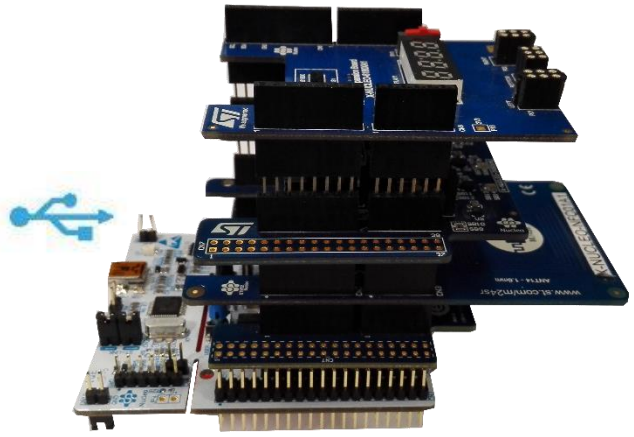
BLUMICROSYSTEM3 for NUCLEO-F401RE/NUCLEO-L476RG

- Pressing the **RESET** button on STM32 Nucleo board triggers the initialization phase
- Pressing the **USER** button the STM32 Nucleo board will start the BLE service
- The system only allows secure connections:
  - For Android devices with NFC reader, facility and security pairing is done by using the NFC tag
  - For other devices it is necessary to manage the parameters manually





Configure the serial line monitor (speed, LF)



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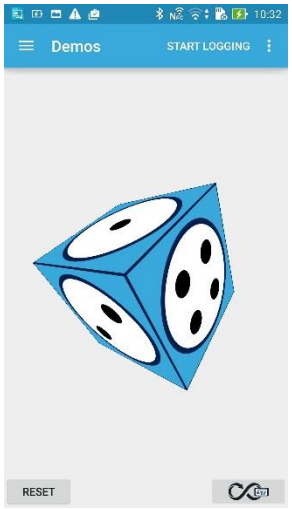
BLUEMICROSYSTEM3

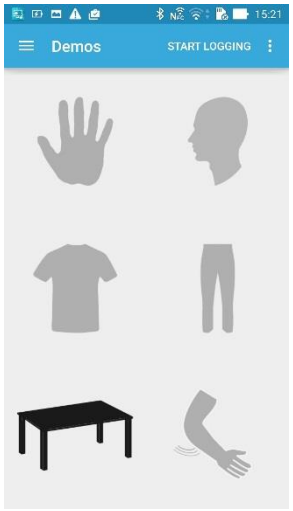
BlueMS Application for **Android**/**iOS**

OPEN.MEMS Library
Android version

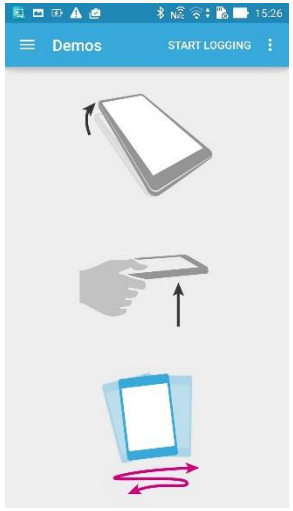


osxMotionFX sensor fusion page

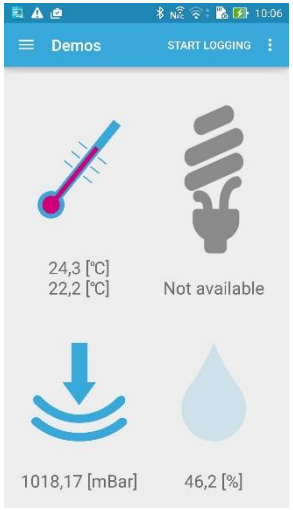
osxMotionAR activity recognition page



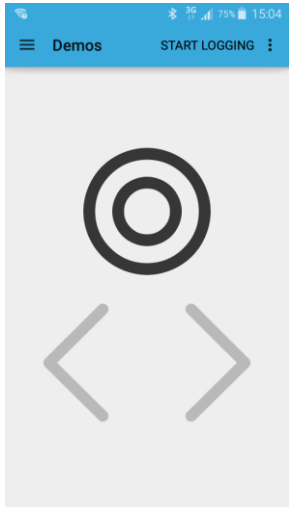
osxMotionCP carry position recognition page



osxMotionGR gesture recognition page

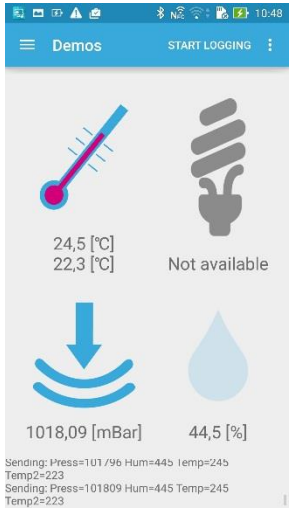


Environmental page

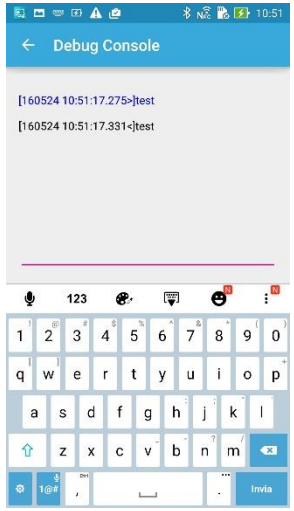


Proximity gesture recognition page

Console
Android version

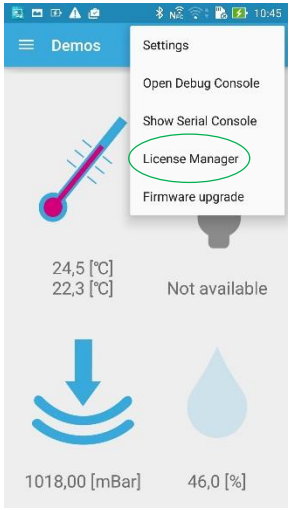


Serial Console (stdout/stderr)

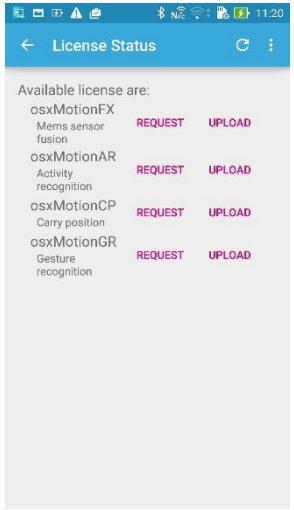


Debug Console (stdin/stdout/stderr)

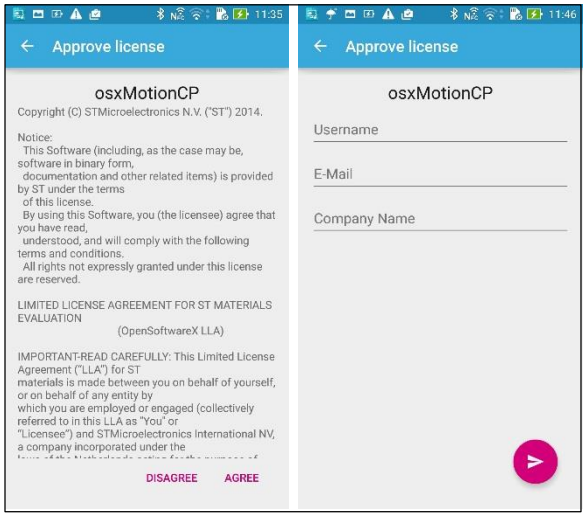
BlueMS Application for Android/iOS: License Manager



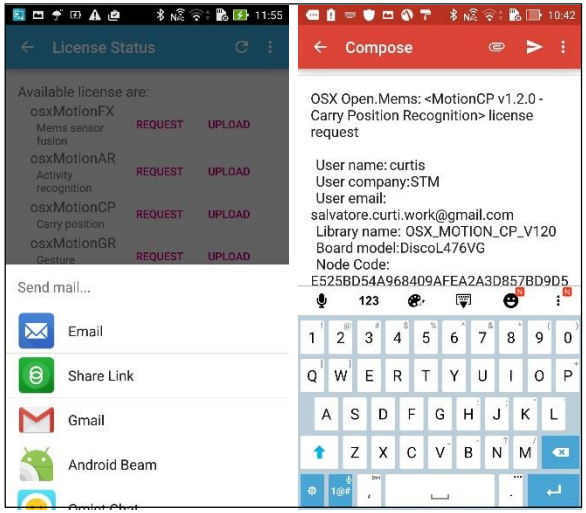
BlueMS: menu option



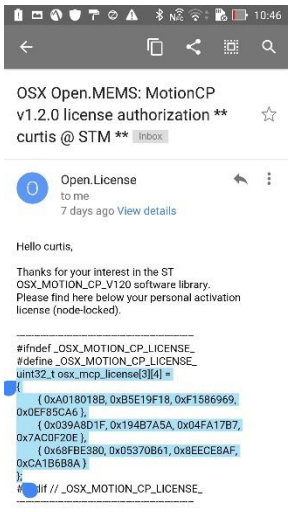
BlueMS: License status page

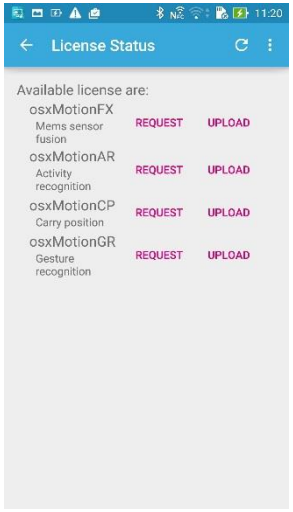


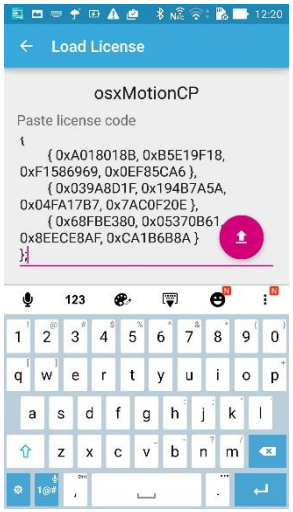
BlueMS: osxMotionCP license request



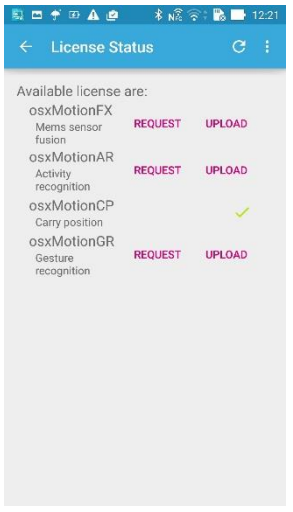
BlueMS: Generated license request email







BlueMS: Copy license details, select UPLOAD and paste



BlueMS: osxMotionCP license enabled

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Documents & Related Resources (1/2)

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

BLUEMICROSYSTEM3:

- **DB2755:** Bluetooth low energy, sensor and NFC tag software expansion for STM32Cube – **data brief**
- **UM1991:** Getting started with the software package for Bluetooth low energy, sensor and NFC tag software in BLUEMICROSYSTEM3 – **user manual**

X-NUCLEO-NFC01A1:

- Gerber files, BOM, Schematic
- **DB2353:** Dynamic NFC tag expansion board based on M24SR for STM32 Nucleo – **data brief**
- **AN4624:** Getting started with the STM32 Nucleo and the M24SR expansion board X-NUCLEO-NFC01A1 – **application note**
- **UM1793:** Dynamic NFC tag expansion board based on M24SR for STM32 Nucleo – **user manual**

X-NUCLEO-IDB04A1:

- Gerber files, BOM, Schematic
- **DB2316:** Bluetooth Low Energy expansion board based on BlueNRG for STM32 Nucleo – **data brief**
- **AN4642:** Overview of the BLE Profiles application for X-CUBE-BLE1 expansion for STM32Cube - **application note**
- **UM1765:** Bluetooth Low Energy expansion board based on BlueNRG for STM32 Nucleo - **user manual**

Consult www.st.com for the complete list

Documents & Related Resources (2/2)

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

X-NUCLEO-ID05A1:

- 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**

X-NUCLEO-6180XA1:

- Gerber files, BOM, Schematic
- **DB2473:** Proximity and ambient light sensor expansion board based on VL6180X for STM32 Nucleo – **data brief**
- **AN4663:** VL6180X expansion boards - Description of version 1 and version 2 –**application note**
- **UM1852:** Proximity and ambient light sensor expansion board based on VL6180X for STM32 Nucleo – **user manual**

X-NUCLEO-IKS01A1:

- Gerber files, BOM, Schematic
- **DS10619:** Motion MEMS and environmental sensor expansion board for STM32 Nucleo – **data sheet**
- **UM1820:** Motion MEMS and environmental sensor expansion board for STM32 Nucleo - **user manual**

Consult www.st.com for the complete list

Quick Start Guide Contents

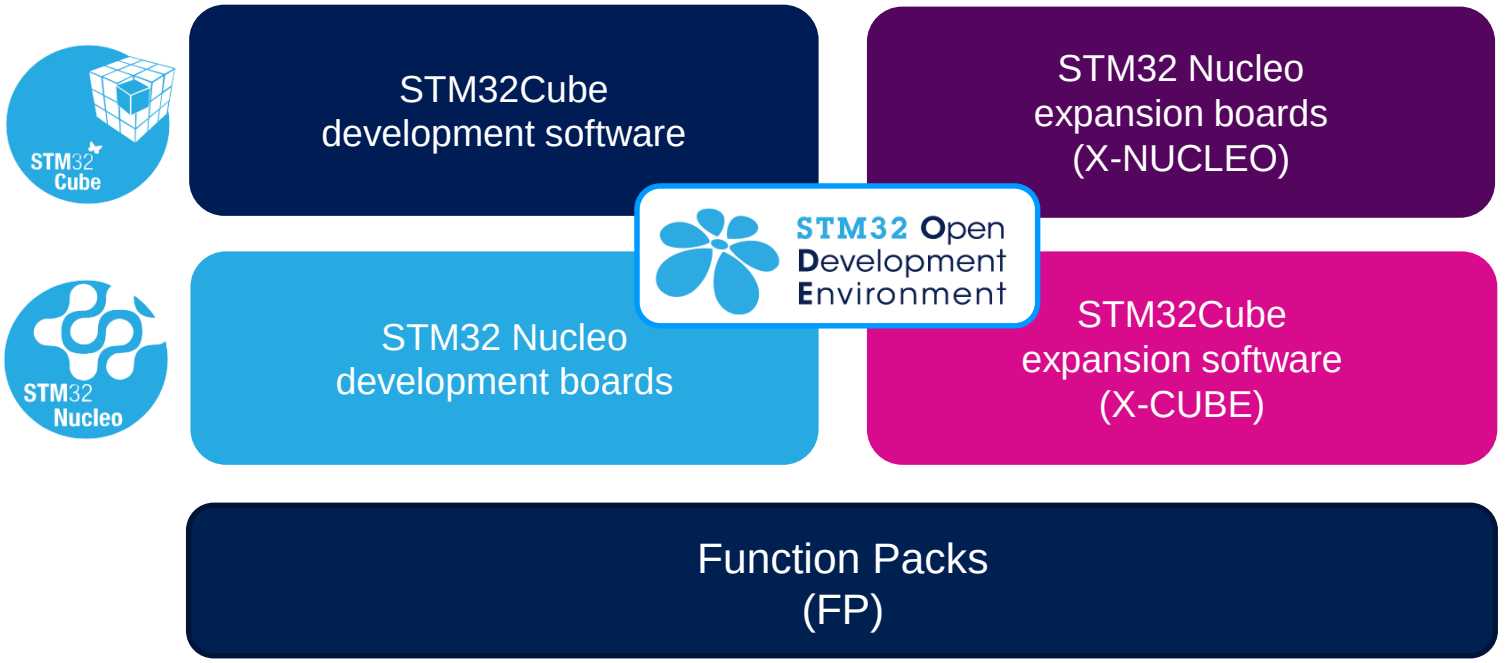
BLUMICROSYSTEM3: Bluetooth low energy, sensors and NFC tag software
Hardware and Software overview

Setup & Demo Examples
Documents & Related Resources

STM32 Open Development Environment: Overview

STM32 Open Development Environment
Fast, affordable Prototyping and Development

- The STM32 Open Development Environment (ODE) consists of a set of stackable boards and a modular open SW environment designed around the STM32 microcontroller family.



www.st.com/stm32ode

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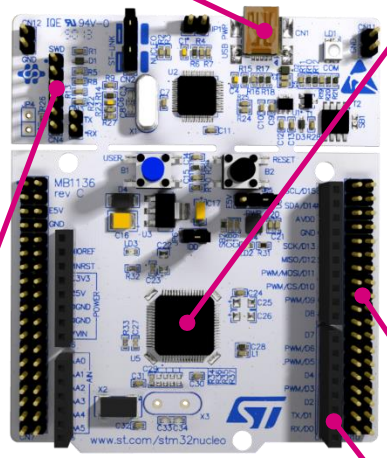
Development Boards (NUCLEO)

- A comprehensive range of affordable development boards for all the STM32 microcontroller series, with unlimited unified expansion capabilities and integrated debugger/programmer functionality.

Power supply through USB or external source

Integrated debugging and programming ST-LINK probe



STM32 microcontroller

STM32 F0 STM32 F1 STM32 F2 STM32 F3 STM32 F4 STM32 F7

STM32 L0 STM32 L1

Complete product range
from ultra-low power to high-performance

ST morpho extension header

Arduino™ UNO R3 extension headers

STM32 Nucleo

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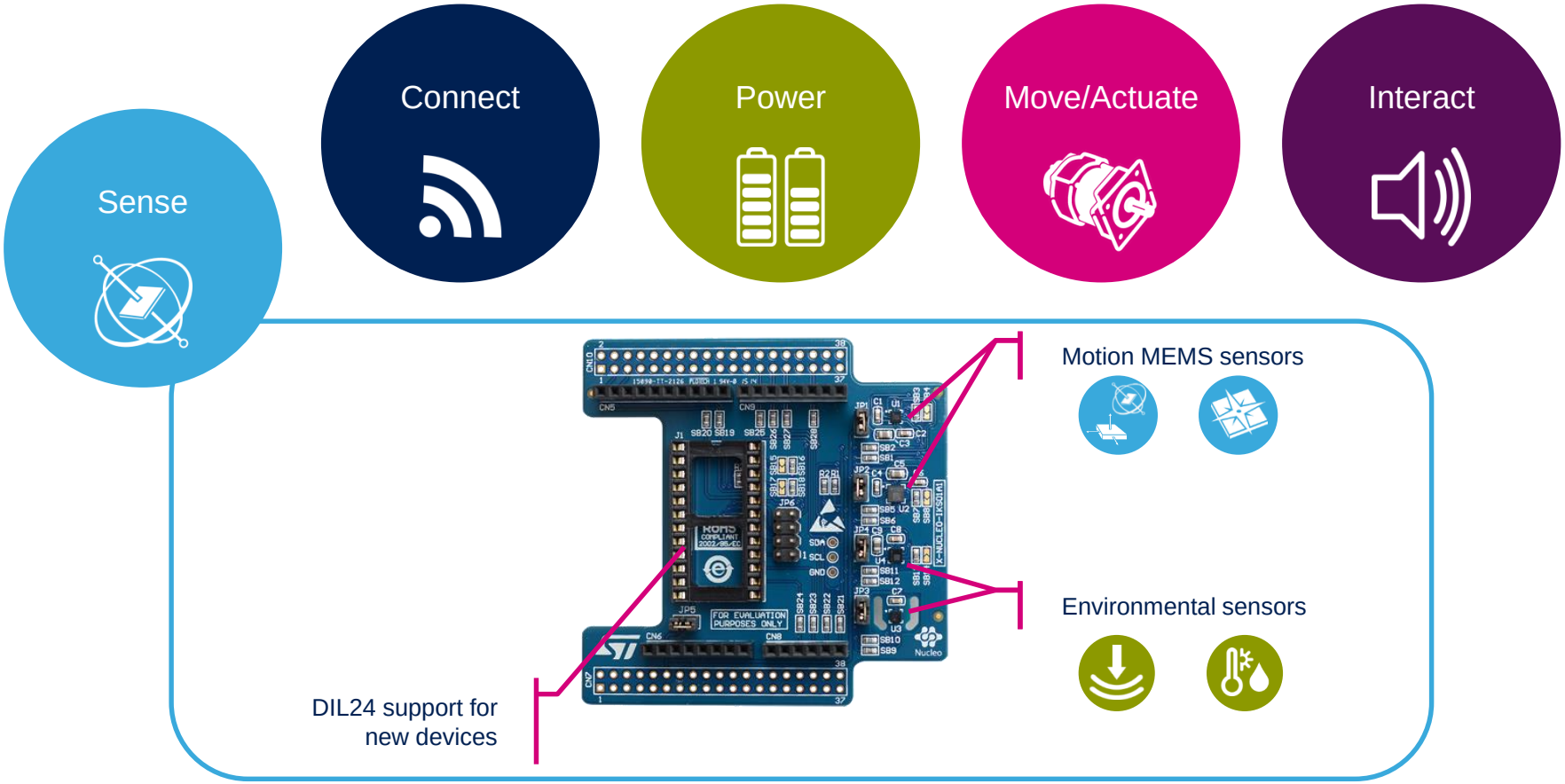
Expansion Boards (X-NUCLEO)

- Boards with additional functionality that can be plugged directly on top of the STM32 Nucleo development board directly or stacked on another expansion board.



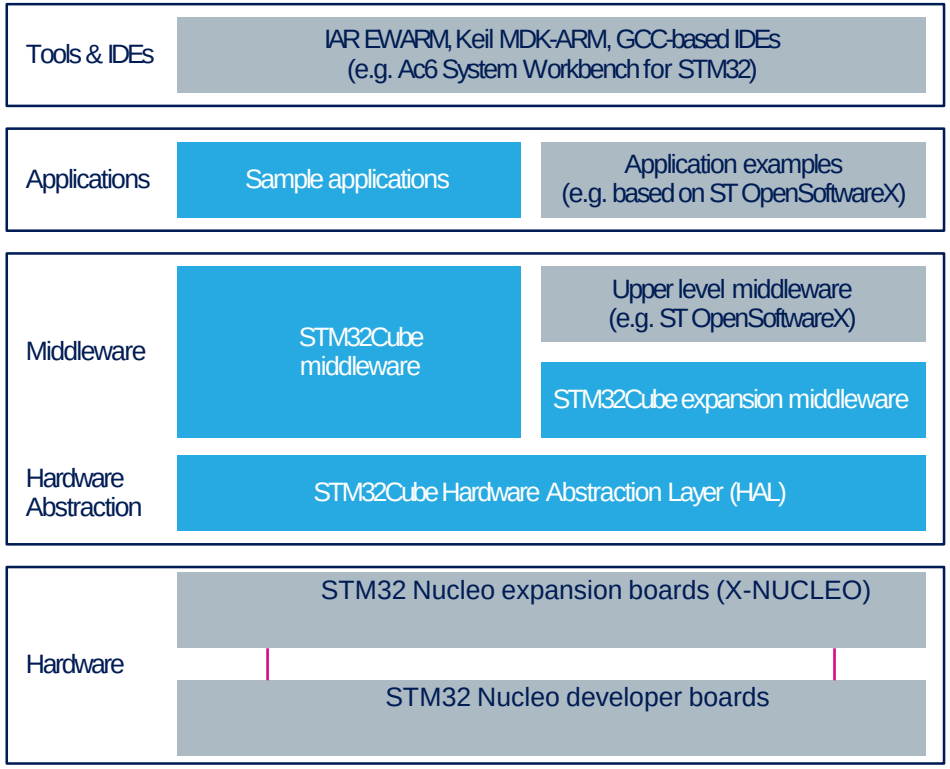
Example of STM32 expansion board (X-NUCLEO-IKS01A1)

STM32 Open Development Environment

Software components

- **STM32Cube software (CUBE)** - A set of free tools and embedded software bricks to enable fast and easy development on the STM32, including a Hardware Abstraction Layer and middleware bricks.

- **STM32Cube expansion software (X-CUBE)** - Expansion software provided free for use with the STM32 Nucleo expansion board and fully compatible with the STM32Cube software framework. It provides abstracted access to expansion board functionality through high-level APIs and sample applications.



- **Compatibility with multiple Development Environments -** The STM32 Open Development Environment is compatible with a number of IDEs including IAR EWARM, Keil MDK, and GCC-based environments. Users can choose from three IDEs from leading vendors, which are free of charge and deployed in close cooperation with ST. These include Eclipse-based IDEs such as Ac6 System Workbench for STM32 and the MDK-ARM environment.

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OPEN LICENSE MODELS: STM32Cube software and sample applications are covered by a mix of fully open source BSD license and ST licenses with very permissive terms.

www.st.com/stm32cube

www.st.com/x-cube

STM32 Open Development Environment
Building block approach

The building blocks	Your need	Our answer

Accelerometer, gyroscope
Inertial modules, magnetometer
Pressure, temperature, humidity
Proximity, microphone

Sense — COLLECT

Bluetooth LE, Sub-GHz radio
NFC, Wi-Fi, GNSS

Connect — TRANSMIT

Audio amplifier
Touch controller
Operation Amplifier

Translate — ACCESS

Stepper motor driver
DC & BLDC motor driver
Industrial input / output

Move / Actuate — CREATE

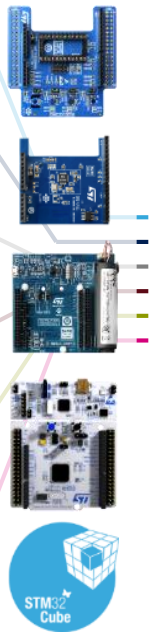
Energy management & battery

Power — POWER

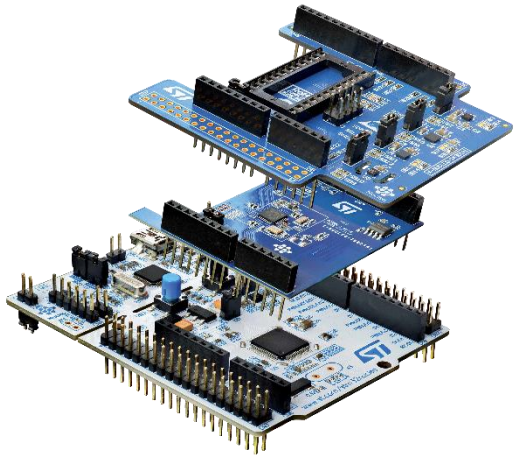
General-purpose microcontrollers
Secure microcontrollers

Process — PROCESS

Software



STM32 Open Development Environment



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