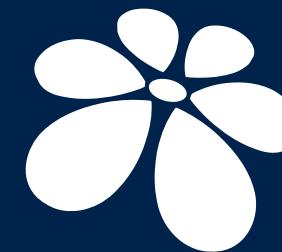


# Quick Start Guide

## X-NUCLEO-IKS4A1

An STM32 Nucleo expansion board *quick description of the board*



**STM32 Open  
Development  
Environment**

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# X-NUCLEO-IKS4A1 expansion board

## Hardware overview 1/2

### Hardware Description

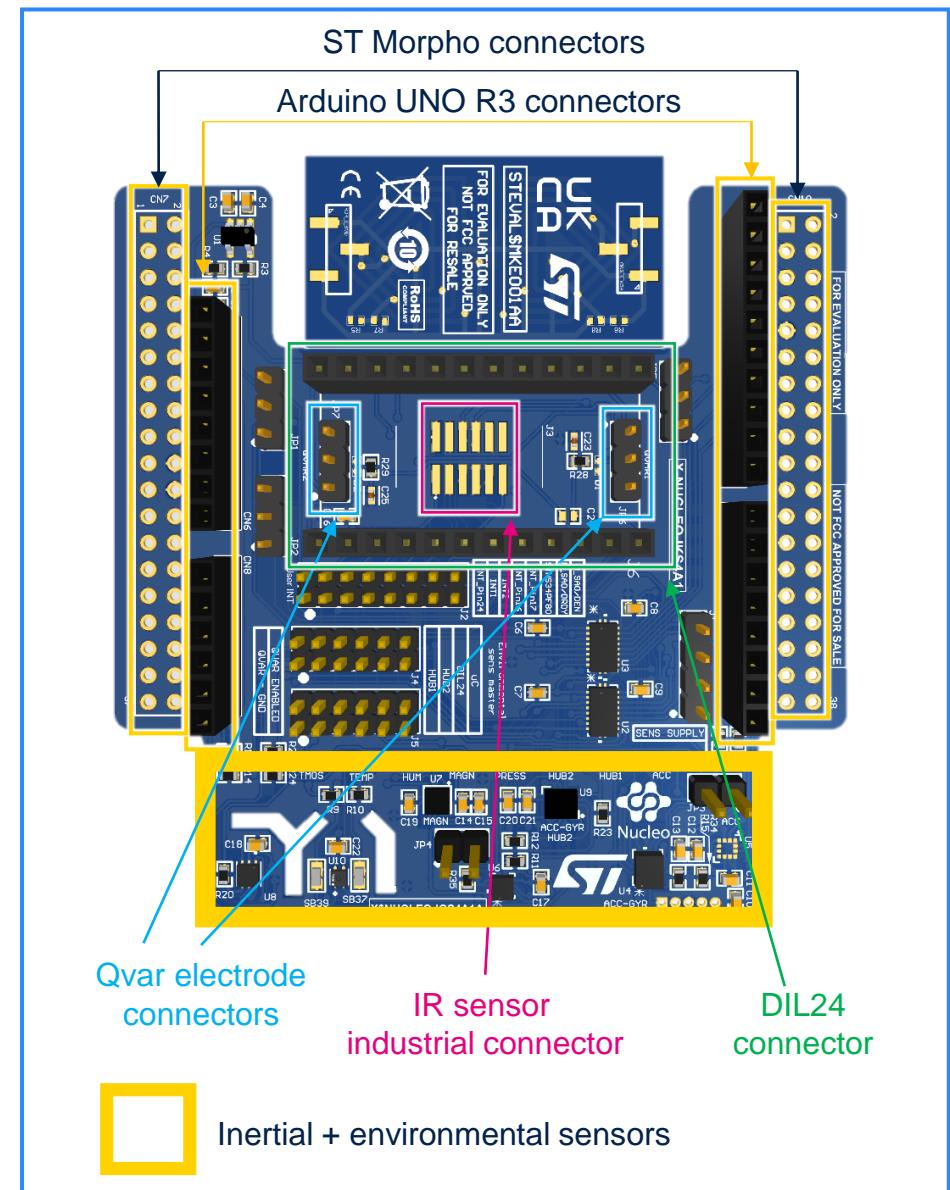
The X-NUCLEO-IKS4A1 is an STM32 Nucleo expansion board to control and develop custom applications with the latest released inertial and environmental ST MEMS sensors. On board are mounted:

- LIS2DUXS12 3-axis accelerometer with Qvar, AI and anti-aliasing
- LSM6DSO16IS: 3-axis accelerometer + 3-axis gyroscope with ISPU
- LSM6DSV16X: 6-axis IMU with AI, Qvar and embedded sensor fusion
- LIS2MDL: 3-axis magnetometer
- LPS22DF: high precision nano pressure sensor
- STTS22H: temperature sensor
- SHT40AD1B: humidity sensor from Sensirion

### Main Features:

Thanks to the embedded functions of ST MEMS sensors, it is possible to develop applications with sensor HUB functionalities (control up to 4 environmental sensors through 6-axis sensor), Qvar electrode (swipe and touch gestures) and IR sensor (motion and presence detection).

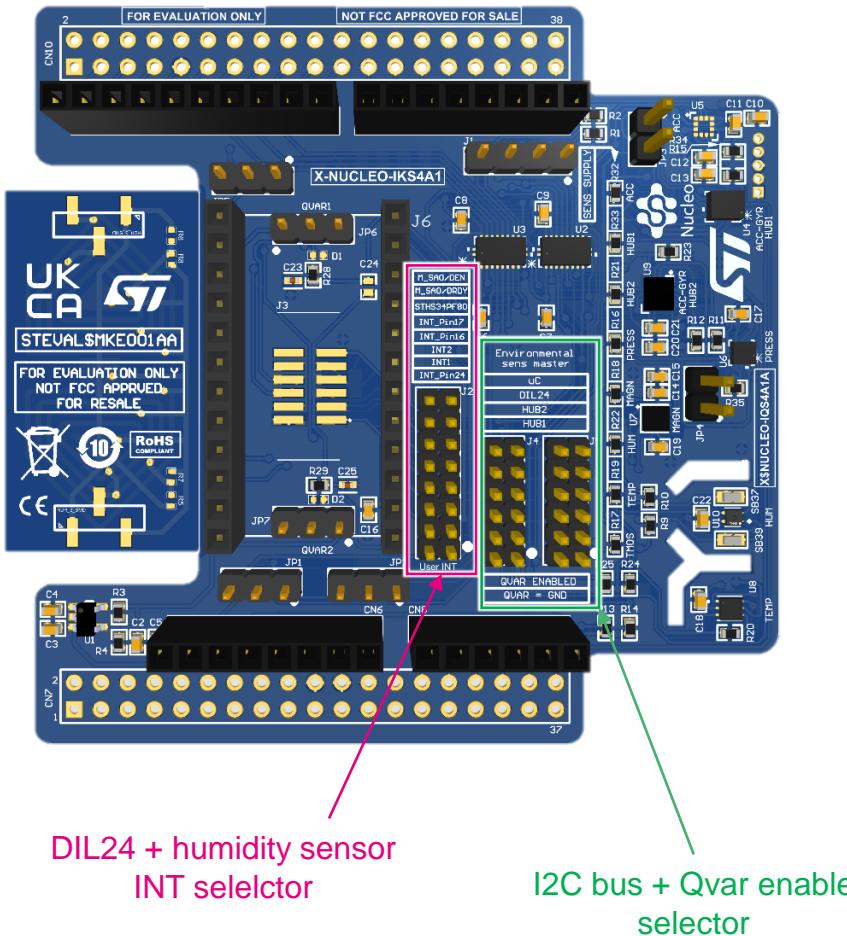
Latest info available at [www.st.com](http://www.st.com)  
X-NUCLEO-IKS4A1



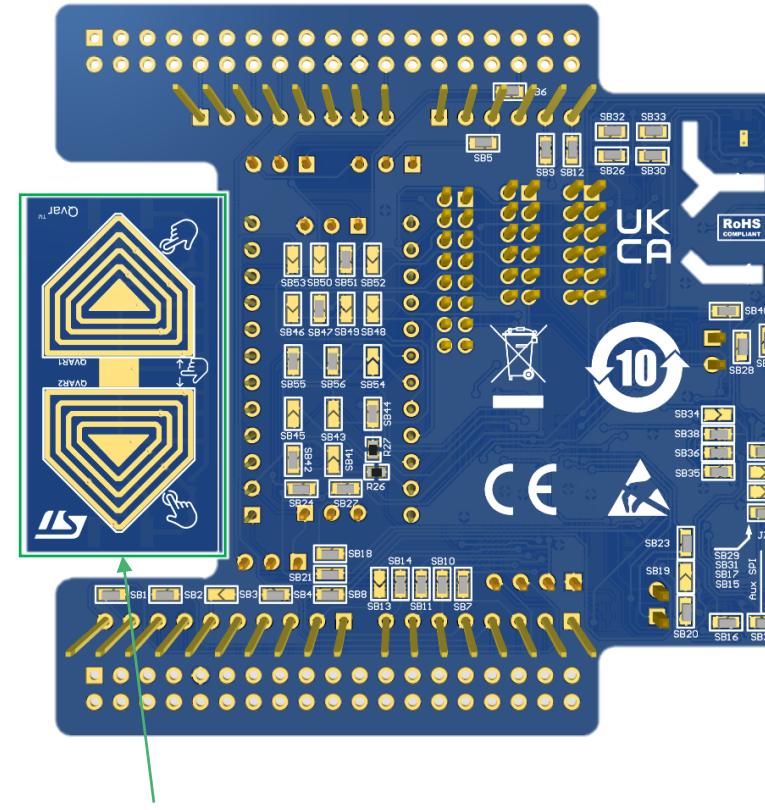
# X-NUCLEO-SNK1M1 expansion board

## Hardware overview 2/2

Top view



Bottom view



Click here to check pin configuration tables

# X-CUBE-MEMS1 software package

## SW architecture overview

### Software Description:

- The software package X-CUBE-MEMS1

### Key Features:

- This software is gathering Temperature, Humidity, Pressure and Motion sensor drivers for the HTS221, LPS22HB, LPS22HH, STTS751, LSM6DSL, LSM303AGR, LSM6DSO, LIS2DW12, LIS2MDL, ASM330LHH, IIS2DLPC, IIS2ICLX, IIS2MDC, ISM303DAC, ISM330DLC, LIS2DH12, LPS33HW, LPS33K, LSM6DSOX, A3G4250D, AIS2DW12, AIS328DQ, AIS3624DQ, H3LIS331DL, ISM330DHCX, LIS3MDL, LSM6DSR, LSM6DSRX, STTS22H, LSM6DSO32, LPS22CH, LPS27HHTW, AIS2IH, LSM6DSO32X, LIS2DTW12, LPS22DF, LIS2DU12, ILPS22QS, ILPS28QSW, LPS28DFW, ASM330LHHX, IIS3DWB, LSM6DSV16X, LSM6DSV16BX, LSM6DSV, LSM6DSV16B, LIS2DUX12, LIS2DUXS12, SHT40AD1B, LSM6DSV32X, STHS34PF80, LSM6DSO16IS, SGP40 devices, running on STM32
- Several examples to show the innovative hardware features of the inertial and environmental sensors
- Sample application to transmit real time sensors data to a PC
- Compatible with the Unicleo-GUI graphical user interface to display sensors data and configure outputs
- Sample implementation available on X-NUCLEO-IKS01A3 or X-NUCLEO-IKS02A1 or X-NUCLEO-IKS4A1 boards connected to a NUCLEO-F401RE, NUCLEO-L152RE, NUCLEO-U575ZI-Q or NUCLEO-L073RZ development board
- Advanced Motion or Infrared libraries with sample applications available only for NUCLEO-F401RE, NUCLEO-U575ZI-Q, NUCLEO-L152RE and NUCLEO-L073RZ
- Easy portability across different MCU families, thanks to STM32Cube
- Free, user-friendly license terms

Latest info available at [www.st.com](http://www.st.com)  
[X-CUBE-MEMS1](http://www.st.com/X-CUBE-MEMS1)

Application	Applications								
Middleware	MotionAC	MotionAD	MotionAR	MotionAT					
	MotionAW	MotionCP	MotionDI	MotionEC					
	MotionFA	MotionFD	MotionFX	MotionGC					
	MotionGR	MotionID	MotionMC	MotionPE					
	MotionPM	MotionPW	MotionSD	MotionSM					
	MotionSP	MotionTL	MotionVC	InfraredPD					
STM32Cube Hardware Abstraction Layer (HAL)									
Hardware Abstraction	STM32 Nucleo expansion boards X-NUCLEO-IKS01A3 (Sense) X-NUCLEO-IKS02A1 (Sense) X-NUCLEO-IKS4A1 (Sense)								
	STM32 Nucleo development board								
Calibration Algorithms	Magnetometer Calibration	Gyroscope Calibration	Accelerometer Calibration	Industrial Algorithms FFT & Vibration Monitoring					
Position Tracking	Sensor Fusion	eCompass	Tilt Sensing	Vertical Context	Airplane Detection	Dynamic Inclinometer			
Activity Tracking for Mobile Devices	Activity Recognition	Carry Position	Gesture Recognition	Pedometer	Fall Detection				
Activity Tracking for Wrist Devices	Activity Recognition for Wrist	Pose Estimation	Motion Intensity Detection	Standing vs Sitting	Desk Detection	Fitness Activities	Active Time	Pedometer	Sleep Monitoring

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# Demo Example: Bill Of Material

## HW pre-requisites

- 1x *description* expansion board  
**(X-NUCLEO-IKS4A1)**
- 1x STM32 Nucleo development board of  
**NUCLEO-F401RE, NUCLEO-U575ZI-Q, NUCLEO-L152RE, NUCLEO-L073RZ**
- 1x USB type A to micro-B cable
- 1x Laptop/PC with Windows 7, 8 or above
- 1x 12-pins Industrial cable (not included)



A to micro.B  
USB Cable



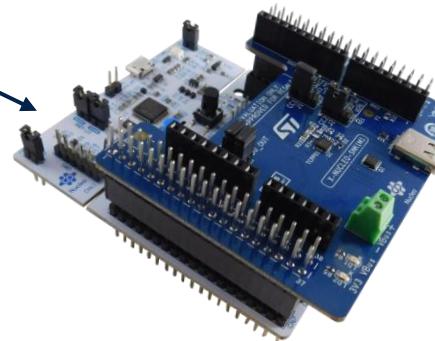
12-pins Industrial cable



X-NUCLEO-IKS4A1



NUCLEO-F401RE or  
NUCLEO-L073RZ or  
NUCLEO-L152RE or  
NUCLEO-U575ZI-Q

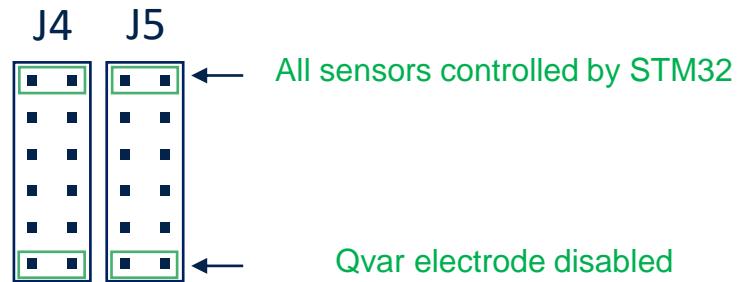


NUCLEO  
stacked solution

# Hardware setup

## Jumpers' configuration

I2C bus/Qvar enable configuration setting jumpers J4 and J5



- To change I2C master (sensor HUB1/2, DIL24) move jumper from the first raw (on both connectors).
- To enable the Qvar electrode move the last jumpers up of 1 raw

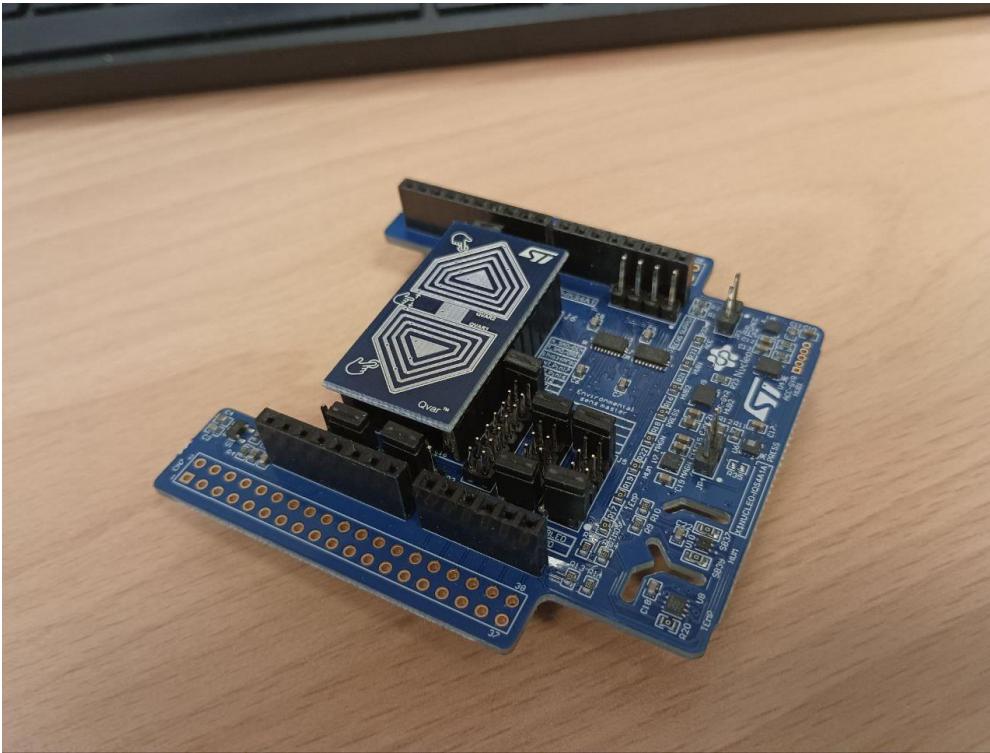
N.B. If sensor HUB1 is used as master I2C, the Qvar raws do not need a jumper (as they are in common with SDA and SCL)

# Demo Example: software tools

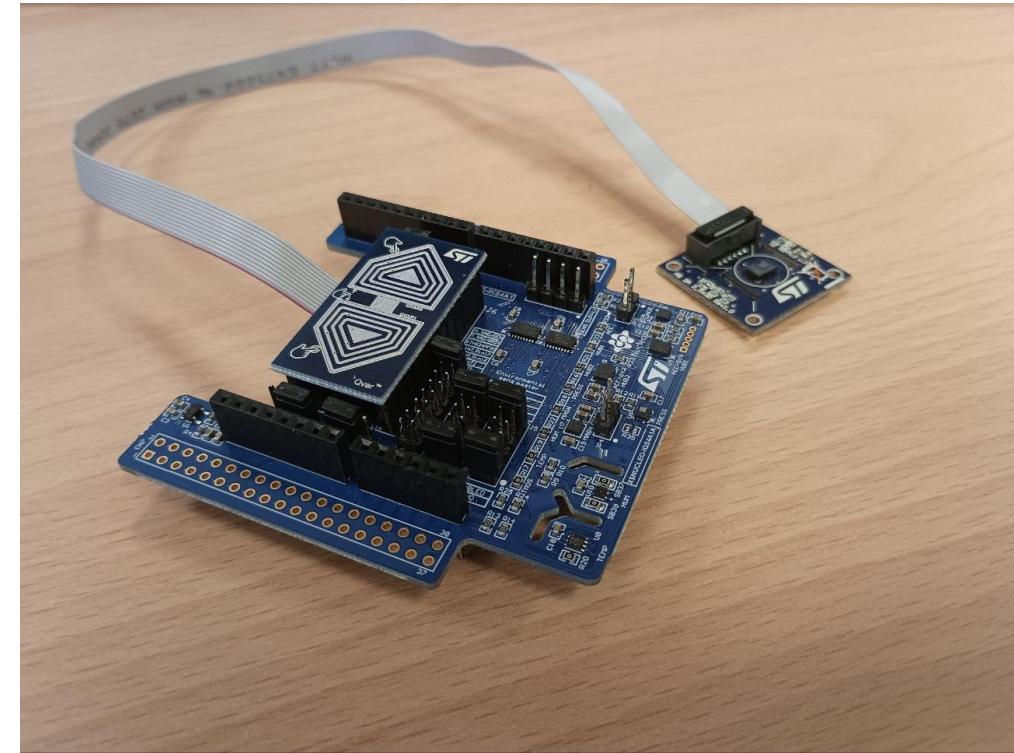
## SW pre-requisites

- [STM32CubeIDE](#) : All-in-one multi-OS software tool for programming STM32 products or [STSW-LINK009](#): ST-LINK/V2-1 USB driver
- [STM32CubeMonUCPD](#) : Monitoring and configuration software tool for STM32 USB-C and Power Delivery 3.0 applications
- [X-CUBE-MEMS1](#): software package including the application examples for [NUCLEO-F401RE](#), [NUCLEO-U575ZI-Q](#), [NUCLEO-L152RE](#) and [NUCLEO-L073RZ](#) to be associated with the [X-NUCLEO-IKS01A3](#), [X-NUCLEO-IKS02A1](#) and [X-NUCLEO-IKS4A1](#)

# Demo Examples for different operating modes



Qvar electrode application



Qvar electrode + IR sensor (not included)  
application

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# Documents & related resources

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

## X-NUCLEO-IKS4A1 :

- Data brief [DB5091](#): Motion MEMS and environmental sensor expansion board for STM32 Nucleo
- User manual [UM3239](#): Getting started with the X-NUCLEO-IKS4A1 motion MEMS and environmental sensor expansion board for STM32 Nucleo
- [SCHEMATIC](#)
- [GERBER](#)
- [BOM](#)

## X-CUBE-MEMS1 :

- Data brief [DB2442](#): Sensor and motion algorithm software expansion for STM32Cube
- User manual [UM1859](#): Getting started with the X-CUBE-MEMS1 motion MEMS and environmental sensor software expansion for STM32Cube

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# STM32ODE Ecosystem

## FAST, AFFORDABLE PROTOTYPING AND DEVELOPMENT

The STM32 Open Development Environment (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.

The STM32ODE includes the following five elements:

- STM32 Nucleo development boards. A comprehensive range of affordable development boards for all STM32 microcontroller series, with unlimited unified expansion capability, and with integrated debugger/programmer
- STM32 Nucleo expansion boards. Boards with additional functionality to add sensing, control, connectivity, power, audio or other functions as needed. The expansion boards are plugged on top of the STM32 Nucleo development boards. More complex functionalities can be achieved by stacking additional expansion boards
- STM32Cube software. A set of free-of-charge tools and embedded software bricks to enable fast and easy development on the STM32, including a Hardware Abstraction Layer, middleware and the STM32CubeMX PC-based configurator and code generator
- STM32Cube expansion software. Expansion software provided free of charge for use with STM32 Nucleo expansion boards, and compatible with the STM32Cube software framework
- STM32Cube Function Packs. Set of function examples for some of the most common application cases built by leveraging the modularity and interoperability of STM32 Nucleo development boards and expansions, with STM32Cube software and expansions.

The STM32 Open Development Environment is compatible with a wide range of development environments including STM32CubeIDE, IAR EWARM, Keil MDK-ARM, and GCC/LLVM-based IDEs, with the possibility to integrate the various components such as STM32CubeMX, STM32CubeProgrammer or STM32CubeMonitor.



STM32 Nucleo development boards



STM32 Open Development Environment



STM32Cube development boards



STM32 Nucleo expansion boards (X-NUCLEO)



STM32Cube expansion software (X-CUBE)

Function Packs

# STM32 Open Development Environment: all that you need

The combination of a broad range of expandable boards based on leading-edge commercial products and modular software, from driver to application level, enables fast prototyping of ideas that can be smoothly transformed into final designs.

To start your design:

- Choose the appropriate STM32 Nucleo development board (NUCLEO) and expansion (X-NUCLEO) boards (sensors, connectivity, audio, motor control etc.) for the functionality you need.
- Select your development environment (IAR EWARM, Keil MDK and GCC/LLVM-based IDEs) and use the free STM32Cube tools and software such as [STM32CubeMX](#), [STM32CubeProgrammer](#), [STM32CubeMonitor](#) or [STM32CubeIDE](#).
- Download all the necessary software to run the functionality on the selected STM32 Nucleo expansion boards.
- Compile your design and upload it to the STM32 Nucleo development board.
- Then start developing and testing your application.

Software developed on the STM32 Open Development Environment prototyping hardware can be directly used in an advanced prototyping board or in an end product design using the same commercial ST components, or components from the same family as those found on the STM32 Nucleo boards.

