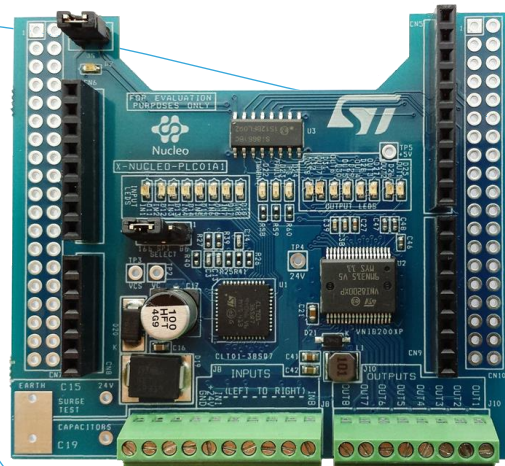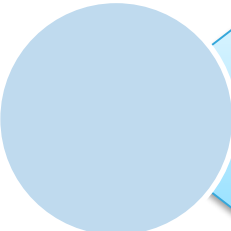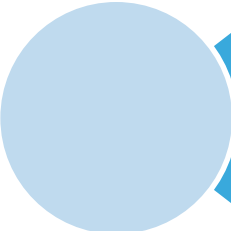# Quick start guide

Industrial input/output expansion board based on CLT01-38SQ7
and VNI8200XP for STM32 Nucleo
(X-NUCLEO-PLC01A1)

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Version 1.1.0 (May 25, 2016)

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X-NUCLEO-PLC01A1: Industrial input/output expansion board
Hardware and Software overview

Setup & Demo Examples
Documents & Related Resources

STM32 Open Development Environment: Overview

X-NUCLEO-PLC01A1 hardware description

- The X-NUCLEO-PLC01A1 is an industrial input/output evaluation board designed around the CLT01-38SQ7 and VNI8200XP devices, allowing the expansion of the STM32 Nucleo boards.

- The CLT01-38SQ7 and the VNI8200XP communicate with the STM32 Nucleo board through a SPI link available on the Arduino UNO R3 connector.
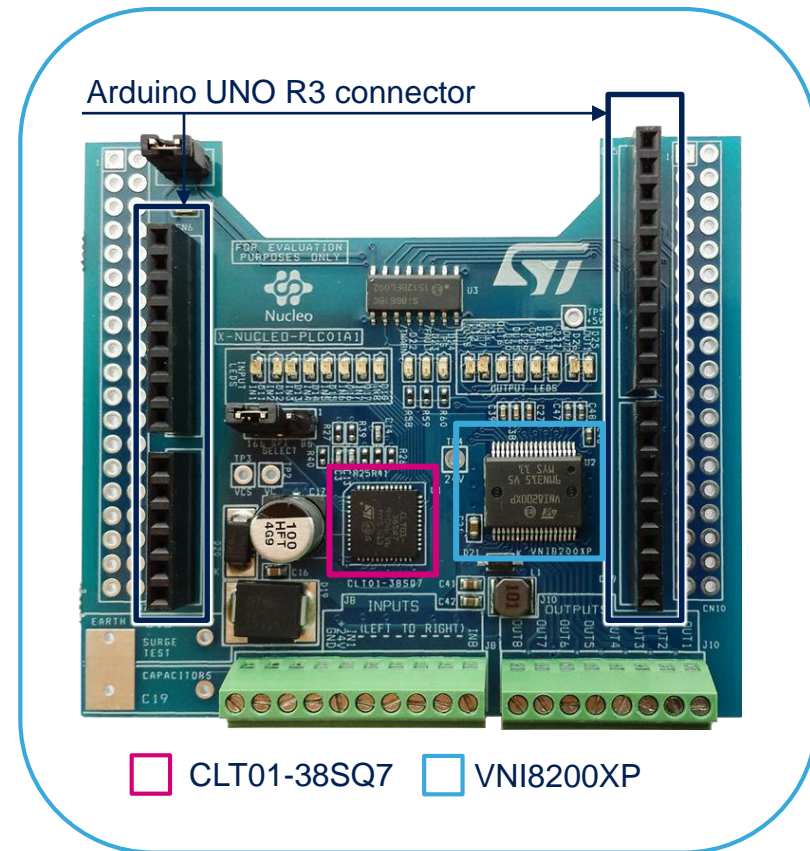
Key products on board

CLT01-38SQ7
High-speed protected digital termination array

VNI8200XP
Octal high-side smart-power solid-state relay with serial/parallel selectable interface on device

Arduino UNO R3 connector

☐ CLT01-38SQ7   ☐ VNI8200XP

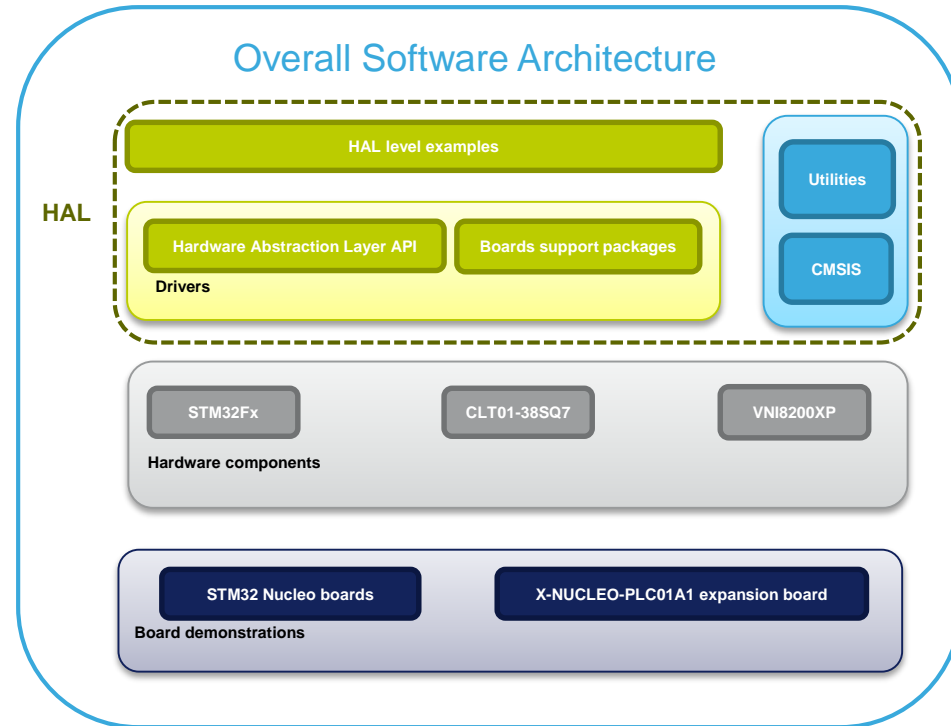Latest info available at www.st.com
X-NUCLEO-PLC01A1

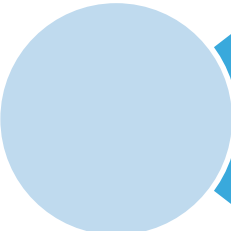life.augmented

X-CUBE-PLC1 software description

- The X-CUBE-PLC1 is a software package which provides drivers running on the STM32 microcontroller for the CLT01-38SQ7 and the VNI8200XP devices. It is expansion software for the STM32Cube tool that eases portability across different STM32 MCUs.

- Implementation examples are available for the industrial input/output expansion board (X-NUCLEO-PLC01A1) plugged on top of an STM32 Nucleo board (NUCLEO-F030R8, NUCLEO-F103RB or NUCLEO-F401RE).

Key features
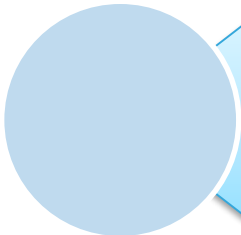
- Firmware examples for building applications using CLT01-38SQ7 and VNI8200XP devices

- Easy hands-on approach for building industrial PLCs (Programmable Logic Controller) for the most common application cases

- Easy portability across different MCU families thanks to STM32Cube

- Free, user-friendly license terms

Overall Software Architecture

HAL level examples

Hardware Abstraction Layer API	Boards support packages

Drivers

Utilities

CMSIS

STM32Fx	CLT01-38SQ7	VNI8200XP

Hardware components

STM32 Nucleo boards	X-NUCLEO-PLC01A1 expansion board

Board demonstrations

Latest info available at www.st.com
X-CUBE-PLC1

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Setup & demo examples
Hardware prerequisites

- 1x STM32 Nucleo development board
  (**NUCLEO-F030R8 or NUCLEO-F103RB or NUCLEO-F401RE**)

- 1x STM32 Nucleo industrial input/output expansion board
  (**X-NUCLEO-PLC01A1**)

- 1x USB type A to mini-B USB cable

- 1x Windows 8/7 - Laptop/PC

- 1x external power supply at 24 V

NUCLEO-F401RE
NUCLEO-F030R8
NUCLEO-F103RB

Mini USB Cable

X-NUCLEO-PLC01A1 plugged on a
compatible STM32 Nucleo board

X-NUCLEO-PLC01A1

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Software prerequisites

- **STSW-LINK008:** ST-LINK/V2-1 USB driver

- **STSW-LINK007:** ST-LINK/V2-1 firmware upgrade

- **X-CUBE-PLC1**
  - Copy the .zip file content into a folder on your PC
  - The package contains the source code example (Keil, IAR, SW4STM32) based on **NUCLEO-F030R8 or NUCLEO-F103RB or NUCLEO-F401RE**

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Use NUCLEO-F030R8 or NUCLEO-F103RB or NUCLEO-F401RE with X-CUBE-PLC1 package

1 Go to www.st.com/x-nucleo

2 Select
X-NUCLEO-PLC01A1

3

Download and unpack
X-CUBE-PLC1

X-CUBE-PLC1 package

Generic Nucleo docs

Documentation

CLT01-38SQ7 SPI driver
VNI8200XP SPI driver
PLC interface example

Drivers

Application examples

Projects

Release_Notes.html

4

Download and install STM32
Nucleo ST-LINK/V2-1 USB driver

6

Modify and build application

KEIL
Tools by ARM

IAR SYSTEMS

Open
STM32
Tools

5

Open project example

Documents & related design resources

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

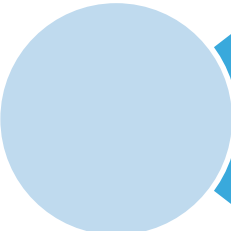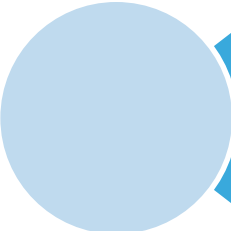X-NUCLEO-PLC01A1:

- Gerber files, BOM, and schematics

- **DB2622**: Industrial input/output expansion board based on VNI8200XP and CLT01-38SQ7 for STM32 Nucleo – **Databrief**

- **UM1918**: Getting started with the industrial input/output expansion board based on VNI8200XP and CLT01-38SQ7 for STM32 Nucleo – **User manual**

X-CUBE-PLC1:
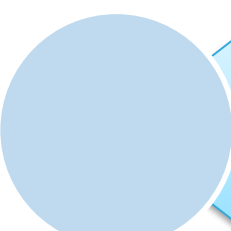
- **DB2617**: Industrial input/output software expansion for STM32Cube – **Databrief**

- **UM1914**: Getting started with the software package for industrial input/output in X-CUBE-PLC1 software expansion for STM32Cube – **User manual**

- Software setup file

Consult www.st.com for the complete list

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STM32 Open Development Environment: Overview

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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.
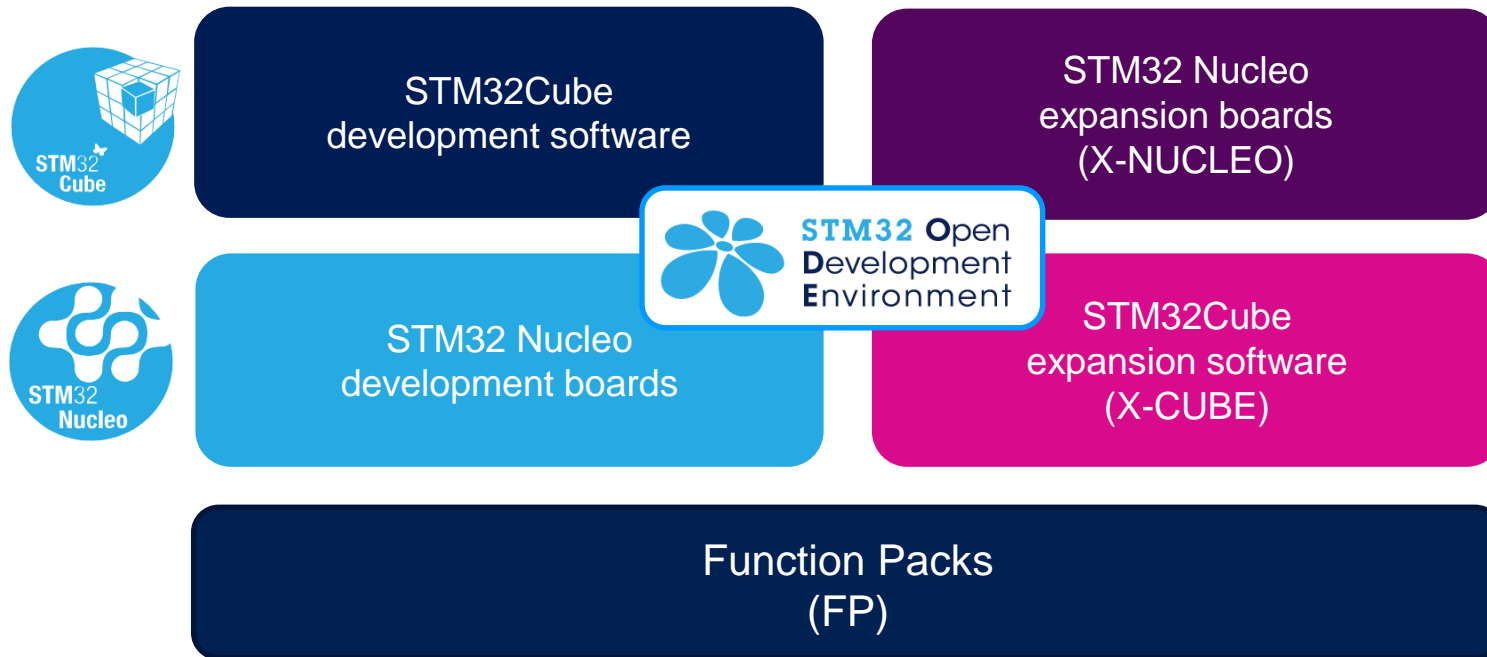

www.st.com/stm32ode

- 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

STM32 microcontroller

Integrated debugging and programming ST-LINK probe

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

www.st.com/stm32nucleo

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

Sense

Connect

Power

Move/Actuate

Interact

Motion MEMS sensors

Environmental sensors

DIL24 support for new devices
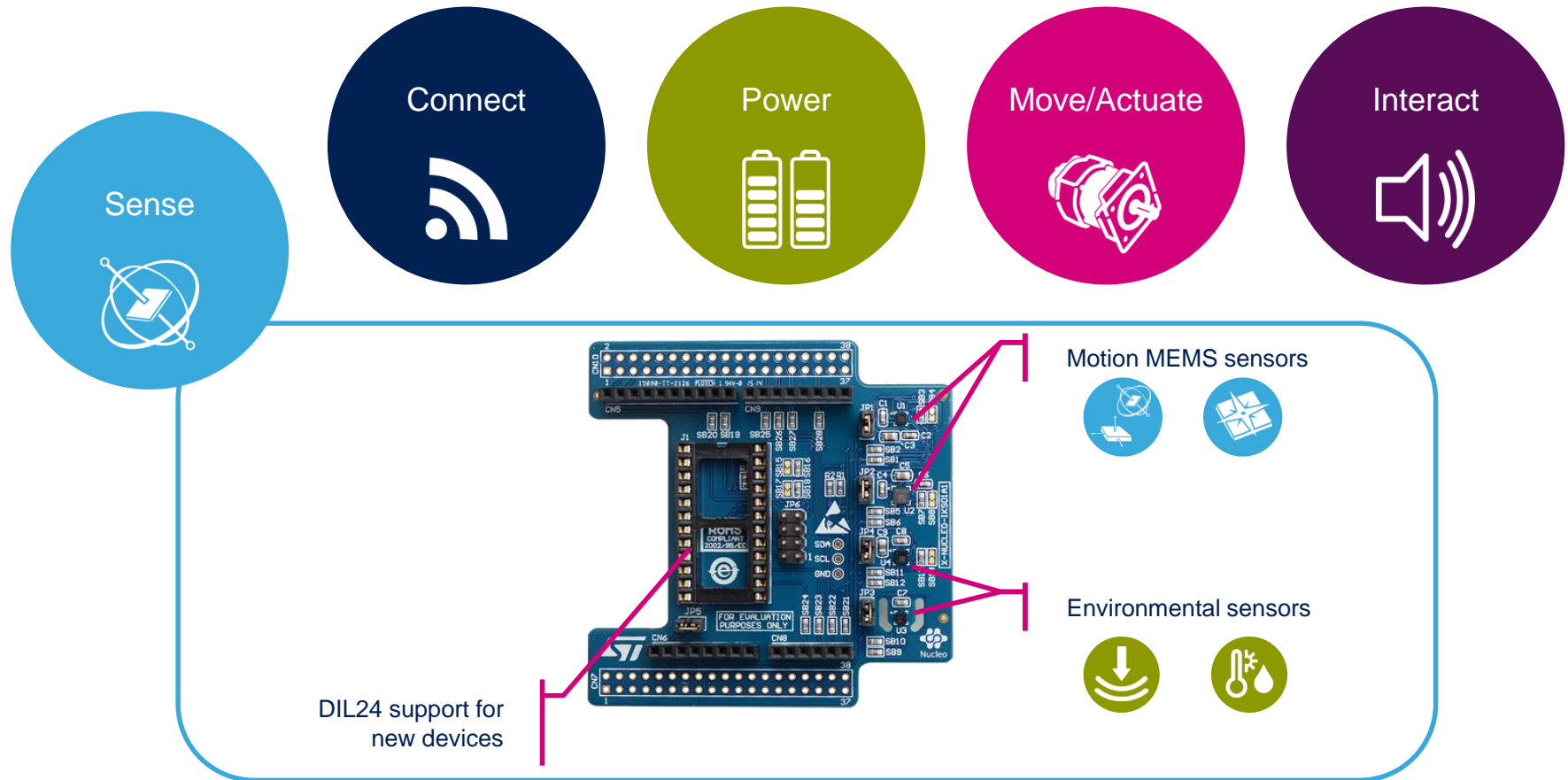
Example of STM32 expansion board (X-NUCLEO-IKS01A1)

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www.st.com/x-nucleo

- **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.

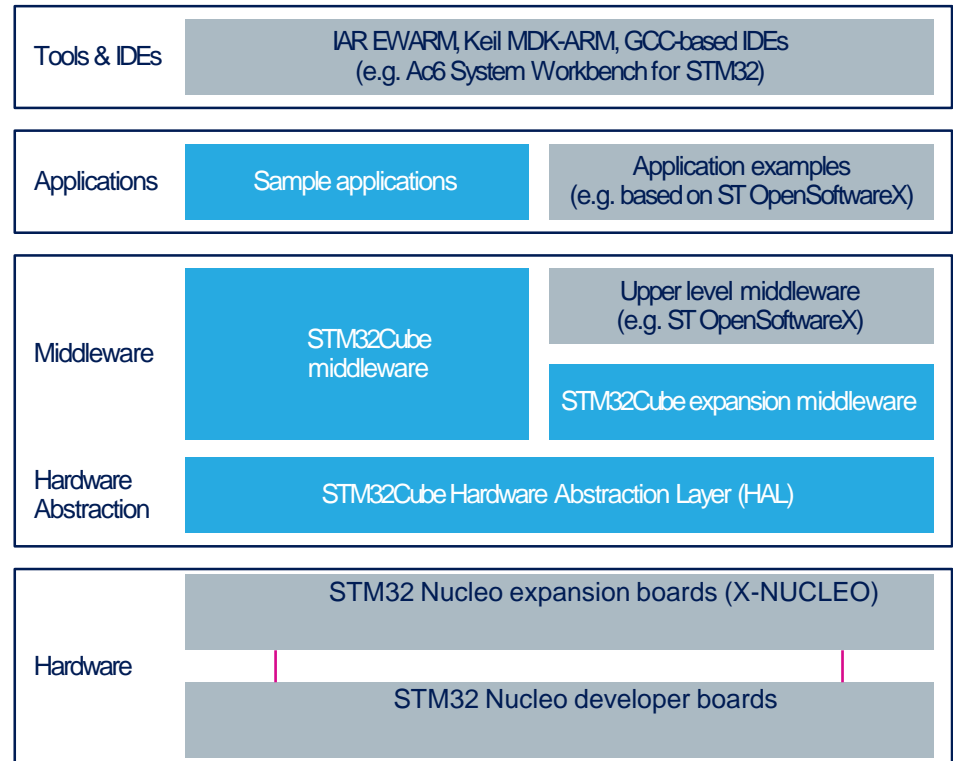- **STM32Cube expansion software (X-CUBE)** - Expansion software provided free for use with the STM32 Nucleo expansion board and fully compatible with the STM32Cube software framework. It provides abstracted access to expansion board functionality through high-level APIs and sample applications.

Tools & IDEs	IAR EWARM, Keil MDK-ARM, GCC-based IDEs (e.g. Ac6 System Workbench for STM32)	
Applications	Sample applications	Application examples (e.g. based on ST OpenSoftwareX)
Middleware	STM32Cube middleware	Upper level middleware (e.g. ST OpenSoftwareX)
		STM32Cube expansion middleware
Hardware Abstraction	STM32Cube Hardware Abstraction Layer (HAL)	
Hardware	STM32 Nucleo expansion boards (X-NUCLEO)	
	STM32 Nucleo developer boards	

- **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.

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

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The building blocks ▶ Your need ▶ Our answer

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

COLLECT

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

TRANSMIT

Translate
- Audio amplifier
- Touch controller
- Operation Amplifier

ACCESS

Move / Actuate
- Stepper motor driver
- DC & BLDC motor driver
- Industrial input / output

CREATE

Power
- Energy management & battery

POWER

Process
- General-purpose microcontrollers
- Secure microcontrollers

PROCESS

Software

STM32 **O**pen **D**evelopment **E**nvironment

STM32 Cube

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