

STM32Cube function pack for IoT node with BLE connectivity, digital microphone, environmental and motion sensors

Application	FP-SNS-ALLMEMS1		
Middleware	BLE	USB Device	Audio PDM to PCM
	FatFs	MotionAR/CPFAFX/GR	MotionD/PE/SD/TLVC
Hardware Abstraction	AcousticSLBF	BlueVoiceADPCM	Meta Data Manager
	STM32Cube Hardware Abstraction Layer (HAL)		
Hardware	STM32 Nucleo expansion boards X-NUCLEO-BNRG2A1 (Connect) X-NUCLEO-IKS01A2 (Sense) X-NUCLEO-IKS01A3 (Sense) X-NUCLEO-CCA02M2 (Sense)		STEVAL-BCNKT01V1 STEVAL-STLKT01V1
	STM32 Nucleo development board		STEVAL-MKSBOX1V1 evaluation board



Product summary	
STM32Cube function pack for IoT node with BLE connectivity, digital microphone, environmental and motion sensors	FP-SNS-ALLMEMS1
Motion MEMS and environmental sensor expansion board for STM32 Nucleo	X-NUCLEO-IKS01A2/X-NUCLEO-IKS01A3
BLE expansion board based on the BLUENRG-M2SP module for STM32 Nucleo	X-NUCLEO-BNRG2A1
Digital MEMS microphone expansion board based on MP34DT06J for STM32 Nucleo	X-NUCLEO-CCA02M2
BlueCoin starter kit	STEVAL-BCNKT01V1
Multisensor kit with portable sensor box and smart sensor app	STEVAL-MKSBOX1V1
SensorTile development kit	STEVAL-STLKT01V1
Applications	Factory Automation Cloud Connectivity Smart Farming Tracking

Features

- Complete firmware to develop an IoT node with BLE connectivity, digital microphone, environmental and motion sensors
- Middleware libraries for sensor data fusion, accelerometer-based real-time activity recognition, carry position, gesture recognition, motion intensity recognition, user current pose recognition, working mode recognition, tilt angles evaluation, vertical movement detection, fitness activities quantity repetition, acoustic source localization and beam forming, audio processing and streaming over BLE communication profile, SD card data logging
- Compatible with [STBLESensor](#) application for Android/iOS, to perform sensor data reading, audio and motion algorithm feature demo, and firmware update over the air (FOTA)
- Sample implementation available for [STEVAL-BCNKT01V1](#), [STEVAL-MKSBOX1V1](#) and [STEVAL-STLKT01V1](#) board and for [X-NUCLEO-CCA02M2](#), [X-NUCLEO-IKS01A3](#) (or [X-NUCLEO-IKS01A2](#)) and [X-NUCLEO-BNRG2A1](#) connected to a [NUCLEO-F446RE](#) or [NUCLEO-F401RE](#) or [NUCLEO-L476RG](#) board
- Easy portability across different MCU families, thanks to [STM32Cube](#)
- Free, user-friendly license terms

Description

[FP-SNS-ALLMEMS1](#) is an [STM32Cube](#) function pack which lets you connect your IoT node to a smartphone via BLE and use a suitable Android™ or iOS™ application, like the [STBLESensor](#) app, to view real-time environmental sensor data, motion sensor data, digital microphone levels and battery level.

The package also enables advanced functions such as voice communication over BLE, sound source localization and acoustic beam forming using inputs from multiple microphones, as well as sensor data fusion and accelerometer-based real-time activity recognition, carry position, gesture recognition, motion intensity recognition, audio data logging and MEMS sensor data logging on SD card.

Moreover, it provides real-time information about the user current pose based on data from a device, working mode (sitting/standing desk position), tilt angles of the device, the repetitions of various fitness activities performed and the vertical movement.

This package, together with the suggested combination of STM32 and ST devices, can be used to develop specific wearable applications, or smart things applications in general.

The software runs on the STM32 microcontroller and includes all the necessary drivers to recognize the devices on the [STM32 Nucleo](#) development board and expansion boards, as well as on the [STEVAL-BCNKT01V1](#), [STEVAL-MKSBOX1V1](#) and [STEVAL-STLKT01V1](#) evaluation boards.

1 Detailed description

1.1 What can you do with STM32Cube function packs?

STM32Cube function packs leverage the modularity and interoperability of STM32 Nucleo and X-NUCLEO boards together with STM32Cube and X-CUBE software to create function examples for some of the most common use cases of different application technologies.

These software function packs are designed to exploit the underlying STM32 ODE hardware and software components as much as possible to best satisfy the requirements of final user applications.

Moreover, function packs may include additional libraries and frameworks that are not present in the original X-CUBE packages, thus enabling new functionalities allowing real and usable system for developers.

1.2 What is STM32Cube?

STM32Cube is a combination of a full set of PC software tools and embedded software blocks running on STM32 microcontrollers and microprocessors:

- [STM32CubeMX](#) configuration tool for any STM32 device; it generates initialization C code for Cortex-M cores and the Linux device tree source for Cortex-A cores
- [STM32CubeIDE](#) integrated development environment based on open-source solutions like Eclipse or the GNU C/C++ toolchain, including compilation reporting features and advanced debug features
- [STM32CubeProgrammer](#) programming tool that provides an easy-to-use and efficient environment for reading, writing and verifying devices and external memories via a wide variety of available communication media (JTAG, SWD, UART, USB DFU, I2C, SPI, CAN, etc.)
- STM32CubeMonitor family of tools ([STM32CubeMonRF](#), [STM32CubeMonUCPD](#), [STM32CubeMonPwr](#)) to help developers customize their applications in real-time
- [STM32Cube MCU and MPU packages](#) specific to each STM32 series with drivers (HAL, low-layer, etc.), middleware, and lots of example code used in a wide variety of real-world use cases
- [STM32Cube expansion packages](#) for application-oriented solutions

1.3 How does this software complement STM32Cube?

This software is based on the STM32CubeHAL. It extends STM32Cube by providing a board support package (BSP) for the [BlueNRG-MS](#) and [BlueNRG-2](#), sensor expansion board and middleware components for communication with other Bluetooth low energy devices, for sensor data fusion, real-time audio library, voice communication over Bluetooth low energy and SD card data logging.

The package contains audio libraries (AcousticBF, AcousticSL and BlueVoiceADPCM) and motion sensor libraries (MotionAR, MotionCP, MotionFA, FusionFX, MotionGR, MotionID, MotionPE, MotionSD, MotionTL, MotionVC) useful for sensing applications based on BLE communication.

FP-SNS-ALLMEMS1 also contains FatFs generic FAT file system module which provides access to storage devices such as memory card and hard disk (feature available only for the [STEVAL-STLCS01V1](#) and [STEVAL-MKSBOX1V1](#) evaluation boards).

The motion algorithms are managed through special software designed for mobile and wearable applications and are strictly limited to work with accelerometer and pressure data only, to facilitate low power consumption strategies commonly required in these applications, in compliance with Bluetooth specifications.

The provided drivers abstract low-level hardware details, so middleware components and applications can access the sensors in a hardware-independent manner.

The package includes a sample application to transmit the values read from all the sensors to a Bluetooth low energy-enabled device such as an Android™ or iOS™.

The [STBLESensor](#) Android/iOS application, available on the respective application stores, displays the values read from sensors. The application also allows firmware update over the air as well as displaying battery information.

The [STEVAL-STLKT01V1](#) and [STEVAL-MKSBOX1V1](#) boards go in shutdown mode if they are not connected to an Android/iOS device for a period longer than a fixed range time.

RELATED LINKS

Visit the [X-CUBE-MEMS1](#) web page on www.st.com for further information on the motion sensor libraries

Visit the [X-CUBE-MEMSMIC1](#) web page on www.st.com for further information on AcousticBF and AcousticSL audio libraries

Visit the [FP-AUD-BVLINK1](#) web page on www.st.com for further information on BlueVoiceADPCM audio library

Revision history

Table 1. Document revision history

Date	Version	Changes
12-Apr-2016	1	Initial release.
13-Jun-2016	2	Updated cover page image. Updated cover page features and description.
12-Oct-2016	3	Added reference to Gas Gauge for STEVAL-STLKT01V1
15-Dec-2016	4	Added X-NUCLEO-IKS01A2 expansion board support information
08-May-2017	5	Updated cover page image, features and description. Updated How does this software complement STM32Cube?
03-July-2017	6	Minor text and formatting changes. Updated cover page image, features and description.
19-Oct-2017	7	Updated cover page image, features, description and How does this software complement STM32Cube?
29-Jan-2018	8	Updated cover page image and How does this software complement STM32Cube?
01-Oct-2019	9	Updated cover page image. Added STEVAL-MKSBOX1V1, X-NUCLEO-IKS01A3 and STBLESensor compatibility information.
28-May-2020	10	Updated cover page image, features, product summary table and Section 1.3 How does this software complement STM32Cube? . Added X-NUCLEO-BNRG2A1 and X-NUCLEO-CCA02M2 compatibility information.

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