

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

Application	FP-SNS-MOTENV1		
Middleware	BLE	USB Device	Meta Data Manager
	MotionFX/AR	MotionCP/GR	MotionD/PM
Hardware Abstraction	FatFS		
Hardware Abstraction	STM32Cube Hardware Abstraction Layer (HAL)		
Hardware	STM32 Nucleo expansion boards X-NUCLEO-IDB05A1 (Connect) X-NUCLEO-IKS01A1/ X-NUCLEO-IKS01A2 (Sense) P-NUCLEO-IKA02A1 (Sense)		
	STM32 Nucleo development board		

Features

- Complete firmware to develop an IoT node with BLE connectivity, environmental and motion sensors
- Middleware libraries for sensor data fusion and accelerometer-based real-time activity recognition
- Compatible with [BlueMS](#) applications for Android/iOS, to perform sensor data reading, motion algorithm features demo and firmware update (FOTA)
- Example implementation available for the [X-NUCLEO-IKS01A2](#) (or [X-NUCLEO-IKS01A1](#)), [P-NUCLEO-IKA02A1](#) and [X-NUCLEO-IDB05A1](#) (or [X-NUCLEO-IDB04A1](#)) connected to a [NUCLEO-F401RE](#) or [NUCLEO-L476RG](#) or [NUCLEO-L053R8](#) board
- Easy portability across different MCU families, thanks to [STM32Cube](#)
- Free, user-friendly license terms



Description

FP-SNS-MOTENV1 is an [STM32Cube](#) function pack, which lets you connect your IoT node to a smartphone via BLE and uses a suitable Android™ or iOS™ application, such as the [BlueMS](#) app, to view real-time motion and environmental (such as temperature, relative humidity, carbon monoxide) sensor data.

This package also enables advanced functions such as the sensor data fusion and accelerometer-based real-time activity recognition.

Together with the suggested combination of STM32 and ST devices, it can be used to develop specific wearable and environmental 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.

Product summary	
STM32Cube function pack for IoT node with BLE connectivity and environmental and motion sensors	FP-SNS-MOTENV1
Bluetooth low energy expansion board based on SPBTLE-RF module for STM32 Nucleo	X-NUCLEO-IDB05A1
Motion MEMS and environmental sensor expansion board for STM32 Nucleo	X-NUCLEO-IKS01A1 X-NUCLEO-IKS01A2
STM32 Nucleo pack: electrochemical toxic gas sensor expansion board with CO sensor	P-NUCLEO-IKA02A1

■ Detailed description

What can you do with STM32Cube function packs?

The [STM32Cube](#) function packs leverage the modularity and interoperability of STM32 Nucleo and X-NUCLEO boards, and STM32Cube and X-CUBE software, to create function examples, embodying some of the most common use cases, for each application area.

These software function packs are designed to exploit as much as possible the underlying [STM32 ODE](#) hardware and software components to best fit the requirements of final users' applications.

Moreover, function packs may include additional libraries and frameworks which do not present the original X-CUBE packages, thus enabling new functionalities and creating a real and usable system for developers.

What is STM32Cube?

STM32Cube™ is designed by STMicroelectronics to reduce development effort, time and cost across the entire STM32 portfolio.

STM32Cube version 1.x includes:

- STM32CubeMX, a graphical software configuration tool that allows the generation of C initialization code using graphical wizards.
- A comprehensive embedded software platform specific to each series (such as the STM32CubeF4 for the STM32F4 series), which includes:
 - the STM32Cube HAL embedded abstraction-layer software, ensuring maximized portability across the STM32 portfolio
 - a consistent set of middleware components such as RTOS, USB, TCP/IP and graphics
 - all embedded software utilities with a full set of examples

How does this software complement STM32Cube?

The proposed software is based on the STM32CubeHAL, the package extends STM32Cube by providing a board support package (BSP) for the [BlueNRG-MS](#), sensor expansion board and middleware components for communication with other Bluetooth low energy devices and for sensor data fusion.

BlueNRG-MS is a very low power Bluetooth low energy (BLE) single-mode network processor.

The MotionFX filtering and predictive suite uses advanced algorithms to intelligently integrate multiple MEMS sensor outputs, regardless of environmental conditions achieving an optimal performance. Real-time motion sensor data fusion is set to increase accuracy, resolution, stability and response time (feature not available on [NUCLEO-L053R8](#)).

The MotionAR real-time software acquires data from the accelerometer to recognize user activities. The software can also be combined with other human motion recognition algorithms and, as well as the MotionFX, can significantly improve user experience in advanced motion-based applications in consumer, computer, industrial and medical fields (feature not available on [NUCLEO-L053R8](#)).

The MotionCP real-time software acquires data from the accelerometer and recognizes the board position (on desk, on head, near head, shirt pocket, trouser pocket and swinging arm) (feature not available on [NUCLEO-L053R8](#)).

The MotionGR real-time software acquires data from the accelerometer and recognizes user gestures (pick-up, glance and wake-up) (feature not available on [NUCLEO-L053R8](#)).

The MotionID real-time software acquires data from the accelerometer to recognize user motion intensity. These softwares can be combined with other human motion recognition algorithms to significantly improve user experience in advanced motion-based applications in the consumer, computer, industrial and medical fields (feature not available on [NUCLEO-L053R8](#)).

The MotionPM real-time software acquires data from accelerometer and counts the number of steps and related frequency (feature not available on [NUCLEO-L053R8](#)).

Activity recognition, motion intensity recognition, carry position and gesture recognition are managed through special softwares designed for mobile and wearable applications; the respective algorithms are strictly limited to work with accelerometer data only to facilitate low power consumption strategies commonly required in these

applications, in compliance with Bluetooth specifications core 4.0 (X-NUCLEO-IDB04A1) or 4.1 (X-NUCLEO-IDB05A1) for STM32 Nucleo boards.

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 (temperature, humidity, pressure, accelerometer, magnetometer, gyroscope) to a Bluetooth low energy-enabled device such as an Android™ or iOS™-based smartphone.

The BlueMS Android/iOS application, available on the respective application stores, displays the values read from accelerometer, magnetometer, gyroscope, temperature, humidity, pressure and CO gas concentration (when P-NUCLEO-IKA02A1 is present). The application also allows Over-The-Air firmware update (with X-NUCLEO-IDB05A1 Bluetooth low energy expansion boards only).

Revision history

Table 1. Document revision history

Date	Version	Changes
17-Feb-2016	1	Initial release.
13-Apr-2016	2	Updated cover page Features Added NUCLEO-L053R8 compatibility information
22-Jul-2016	3	Added STEVAL-STLKT01V1 compatibility information Added FOTA information Added reference to Gas Gauge for STEVAL-STLCS01V1
14-Dec-2016	4	Updated title, cover image, cover page Features and Description Added X-NUCLEO-IKS01A2 compatibility information
02-Mar-2017	5	Updated cover page Features and Description, and How does this software complement STM32Cube?
20-Jul-2017	6	Updated cover image, features, description and logo in cover page.
27-Oct-2017	7	Updated cover image, features, description and How does this software complement STM32Cube?
08-Mar-2018	8	Updated cover image. Added P-NUCLEO-IKA02A1 compatibility information.

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