Quick Start Guide
STM32Cube function pack for IoT node with BLE Mesh connectivity and Sensor Model (FP-SNS-BLEMESH1)
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FP-SNS-BLEMESH1: STM32Cube function pack for IoT node with BLE Mesh connectivity and Sensor Model
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STM32 Open Development Environment: Overview
Hardware Description

• The X-NUCLEO-IDB05A1 is a Bluetooth Low Energy (BLE) evaluation and development board system, designed around ST’s SPBTLE-RFTR Bluetooth Low Energy module based on BlueNRG-MS.

• The BlueNRG-MS processor hosted in the SPBTLE-RFTR 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-RFTR

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
X-NUCLEO-IKS01A2 Hardware Description

- The X-NUCLEO-IKS01A2 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

**LSM6DSL**
MEMS 3D accelerometer (±2/±4/±8/±16 g) + 3D gyroscope (±125/±245/±500/±1000/±2000 dps)

**LSM303AGR**
MEMS 3D magnetometer (±50 gauss) + MEMS 3D accelerometer (±2/±4/±8/±16 g)

**LPS22HB**
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)
BLE Sensor Model (FP-SNS-BLEMESH1)

Software Overview

Function Pack Description

FP-SNS-BLEMESH1 is an STM32Cube function pack which lets you connect BLE nodes to a smartphone via BLE and use a suitable Android™ or iOS™ application, to view real-time environmental sensor data, motion sensor data using BLE mesh sensor model.

Key features

- Complete software to build Mesh network with Bluetooth low energy (BLE) nodes supporting the “BLE Mesh Sensor Model”, defined in BLE Mesh Specification V1.0
- Transmission of environmental and motion sensor data to proxy node using the “Sensor Model”.
- User can see sensors value on hyper terminal or on a mobile application, such as the companion BlueNRG-Mesh app available for Android/iOS
- Sample implementation available on X-NUCLEO-IDB05A1 board and X-NUCLEO-IKS01A2 connected to a NUCLEO-L476RG development board
- Easy portability across different MCU families, thanks to STM32Cube
- Free, user-friendly license terms

Overall Software Architecture

Application
Sensor Model Applications

Middleware
BlueNRG Mesh Library
ST Cryptographic Library

Hardware Abstraction
STM32Cube Hardware Abstraction Layer (HAL)

Hardware
STM32 Nucleo expansion boards
X-NUCLEO-IDB05A1 (Connect)
X-NUCLEO-IKS01A2 (Sense)

STM32 Nucleo development board

Latest info available at www.st.com
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H/W prerequisites

- 1x Motion MEMS and environmental sensor expansion board (X-NUCLEO-IKS01A2)
- 1x Bluetooth Low Energy Expansion Board (X-NUCLEO-IDB05A1)
- STM32 Nucleo development board NUCLEO-L476RG
- 1x BLE-enabled Android™ device
- Laptop/PC with Windows 7, 8 or 10
- 1x USB type A to Mini-B USB cable
Setup & Demo Examples
SW prerequisites

- **FP-SNS-BLEMESH1 package**
  - Download and extract the **FP-SNS-BLEMESH1** package, version 1.0.0

- **A toolchain to build the firmware**
  - The FP-SNS-BLEMESH1 has been developed and tested with
    - IAR Embedded Workbench for ARM® (EWARM) toolchain + ST-Link
    - RealView Microcontroller Development Kit (MDK-ARM) toolchain + ST-LINK
    - System Workbench for STM32 (SW4STM32) + ST-LINK (*)

- **BlueNRG-Mesh App, available for iOS ([Link](#)) and Android ([Link](#))**

- **Serial line monitor e.g. Termite (Windows), or Minicom (Linux)**

(*) For Linux users: System Workbench for STM32 (SW4STM32) is the only supported IDE
Sensor Model - Demo Execution
Sensor Model Architecture

Sensor PID Values

<table>
<thead>
<tr>
<th>Sensor Name</th>
<th>Property ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>TEMPERATURE_PID</td>
<td>0x0071</td>
</tr>
<tr>
<td>PRESSURE_PID</td>
<td>0x2A6D</td>
</tr>
<tr>
<td>HUMIDITY_PID</td>
<td>0x2A6F</td>
</tr>
<tr>
<td>MAGNETO_METER_PID</td>
<td>0x2AA1</td>
</tr>
<tr>
<td>ACCELEROMETER_PID</td>
<td>0x2BA1</td>
</tr>
<tr>
<td>GYROSCOPE_PID</td>
<td>0x2BA2</td>
</tr>
</tbody>
</table>
FP-SNS-BLEMESH1
BLE Mesh connectivity and Sensor Model software

1. www.st.com/STM32ODE-FP
2. Select FP-SNS-BLEMESH1
3. Download & unpack
4. FP-SNS-BLEMESH1 package structure
   - Docs
   - BSP, HAL and drivers
   - Application example

5. BlueNRG-Mesh app
   For iOS / Android™
6. Compile/ Flash and Run the project

www.st.com
Sensor Demo Using Android Application
Download and Install the BlueNRG-Mesh Android App


Please note the updated Sensor App will be available soon on the store.
The Current App from the store does not yet support extended sensors
Provision the Sensor Device by clicking +
Provision the device (2/2)

1. Add Configuration
2. Device Provisioned

Click 'S' to view
Click Model TAB

1

Click 'refresh' to get all sensor data

2

3

Sensor Model (Compact View)
Sensor Model (Extended View)

1. Get All Sensors view
2. Click each icon to get respective sensor value
3. Click icon to get All sensors values
Sensor Demo Using iOS Application
Follow the instructions below to install BNRG-Mesh app on a compatible iOS device.

**Step 1.** Follow the link to Apple Store at STSW-BNRG-Mesh to download the app directly to your iOS device or search for BlueNRG-Mesh app.

**Step 2.** Ensure that Bluetooth radio is enabled.

**Step 3.** Launch the app by clicking on the icon.

**Step 4.** If Bluetooth is off or not supported, you are presented with a dialog box that prompts you to enable Bluetooth on your device. At this stage, you can either:
The App has following sections:

1) **Nodes Tab:** opens the “Network View”, which shows the list of all the nodes in the mesh network. This is the default view (that is, the home page) of the App.

2) **Device Tabs:** Opens the “Provisioning View” which allows adding new provisioned mesh capable devices into the mesh network.

3) **Groups Tab:** opens the “Groups View”, which shows the list of all the groups in the network.

4) **Models Tab:** opens the “Model View”, which shows the list of nodes supporting the selected model. It allows sending specific messages to the nodes.

5) **Side Menu:** contains global settings, which affects the App as a whole.
When devices view opened, the App starts scanning for unprovisioned mesh capable devices in the proximity.

The devices are identified by their UUIDs and are listed with RSSI values.

The provisioning process will get started by clicking on the (+) icon in front of each device name.
• This is the default view of the BlueNRG-Mesh iOS app, which shows the overall network status with a summary of the node type and features.

• All provisioned node will be presented in this nodes tab.

• User can also view or update the node settings or configuration.

• Each node element has a toggle button used to send on/off commands, which can be “Vendor Model” or “Generic Model” depending on the global settings (accessible from the side menu).
• Models view allows users to access a model specific functionality.

• When the Models Tab is tapped for the first time, it opens the “Model Selection View” to choose a specific model.

• Once the selected model view will appear. The app will remember that selected model, so that, the next time you select the Models Tab, the last chosen model view will open up.

• You can switch the model view to any other model by tapping the “Model Selection” icon at the top right of each model view.
After selecting the sensor model from the model selection view, this view will be representing all the sensor nodes.

Each sensor node itself containing the four further division, first three among them representing the sensors and the last one will open the detailed sensor model view.

Detailed sensor view will advocate all the available sensors of the sensor node with their respective values.

On upper right extreme, there is an icon to open the model selection view.
• Detailed sensor view will show all the available sensors, with their respective values.

• On click of each sensor, it will update that sensor value only i.e in our case, First is Temperature sensor, on click of temperature sensor, current temperature value will be updated.

• Refresh icon on the extreme right corner of the screen will refresh the sensor values of all the sensors.

**NOTE:** If a node is not active to receive or send the protocols to communicate, it will show “Sensor Data not available” beneath each sensor icon.
FP-SNS-BLEMESH1:
  • **DB3817**: STM32Cube function pack for IoT node with BLE Mesh Connectivity and Sensor Model – [data brief]
  • **UM2536**: Getting started with FP-SNS-BLEMESH1 function pack for IoT node with BLE Mesh connectivity and Sensor Model – [user manual]
  • **UM2180**: Getting started with the ST BlueNRG-Mesh Android application
  • Software setup file

X-NUCLEO-IDB05A1:
  • 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-IKS01A2:
  • Gerber files, BOM, Schematic
  • **DB3009**: Motion MEMS and environmental sensor expansion board for STM32 Nucleo – [data brief]
  • **UM2121**: Getting started with the X-NUCLEO-IKS01A2 motion MEMS and environmental sensor expansion board for STM32 Nucleo – [user manual]

Consult www.st.com for the complete list
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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.

- STM32Cube development software
- STM32 Nucleo development boards
- STM32 Nucleo expansion boards (X-NUCLEO)
- STM32Cube expansion software (X-CUBE)
- Function Packs (FP)

www.st.com/stm32ode
STM32 Nucleo
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

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

ST morpho extension header

Arduino™ UNO R3 extension headers

www.st.com/stm32nucleo
STM32 Nucleo
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.
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.

**Tools & IDEs**

- IAR EWARM, Keil MDK-ARM, GCC-based IDEs (e.g. Ac6 System Workbench for STM32)

**Applications**

- Sample applications (e.g. based on ST OpenSoftwareX)

**Middleware**

- STMicroelectronics middleware

**Hardware Abstraction**

- STMicroelectronics Hardware Abstraction Layer (HAL)

**Hardware**

- STM32 Nucleo expansion boards (X-NUCLEO)

**STM32 Nucleo developer boards**

**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

- Sense
  - Accelerometer, gyroscope
  - Inertial modules, magnetometer
  - Pressure, temperature, humidity
  - Proximity, microphone
- Connect
  - Bluetooth LE, Sub-GHz radio
  - NFC, Wi-Fi, GNSS
- Translate
  - Audio amplifier
  - Touch controller
  - Operation Amplifier
- Move / Actuate
  - Stepper motor driver
  - DC & BLDC motor driver
  - Industrial input / output
- Power
  - Energy management & battery
- Process
  - General-purpose microcontrollers
  - Secure microcontrollers
- Software

Your need

- Collect
- Transmit
- Access
- Create

Our answer

www.st.com/stm32ode