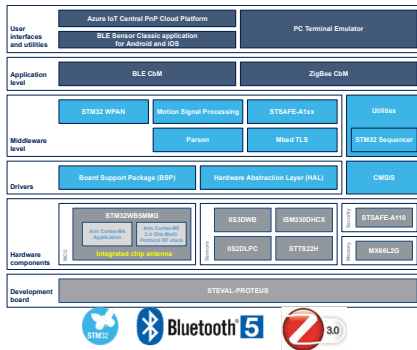


## Software package for the STEVAL-PROTEUS1 kit with signal processing to enable predictive maintenance in a WPAN



### Features

- Firmware package to demonstrate an industrial sensor node for condition-based monitoring (CbM) and predictive maintenance (PdM) applications in a WPAN based on Bluetooth® Low Energy or Zigbee connectivity
- Temperature and motion sensors real-time monitoring of meaningful key parameters and equipment status
- STM32 wireless personal area network middleware developed within the STM32WB framework used to support Bluetooth® Low Energy 5 or Zigbee 3.0 applications
- Motion signal processing middleware for vibration analysis in time domain (speed RMS and acceleration peak) and frequency domain (FFT with programmable size, averaging, overlapping, and windowing)
- Configurable alarm and warning thresholds based
- On-board battery status monitor
- Bluetooth® Low Energy example firmware compatible with the [STBLESensor](#) mobile app for Android and iOS, to display data on the app and bridging data to the Azure IoT central PnP cloud dashboard
- Low power technique for Bluetooth example firmware to keep the STM32WB in stop mode 2 when not in use for consumption reduction while still ensuring sending its status in the BLE advertising packet periodically and accepting a BLE connection request at any time
- FUOTA function for Bluetooth example firmware
- Zigbee mesh network example firmware for coordinator (ZC), router (ZR) and end-device (ZED). ZR and ZED act as server so they collect info to be sent to ZC that can also turn on/off the LED of any server and interfacing with a gateway via UART
- Sample implementations available for the [STEVAL-PROTEUS1](#) kit
- Based on [STM32Cube](#) software development environment for STM32 microcontrollers
- Free, user-friendly license terms

### Description

The [STSW-PROTEUS](#) is an [STM32Cube](#)-based software package for vibration and temperature condition equipment monitoring over Bluetooth® Low Energy and ZigBee connectivity.

The application captures vibration and temperature data from MEMS sensors. It uses them as inputs to perform complex algorithms such as frequency and time domain vibration analysis. Then, it transfers the ready-to-use results into a wireless personal area network (WPAN). This feature makes the IoT node suitable for condition-based maintenance (CBM) and predictive maintenance (PdM) to reduce productivity losses due to an unplanned machine downtime.

The [STSW-PROTEUS](#) software package includes two different projects to address both Bluetooth® Low Energy and Zigbee applications.

Product summary	
Software package for the STEVAL-PROTEUS1 kit with signal processing to enable predictive maintenance in a WPAN	<a href="#">STSW-PROTEUS</a>
Industrial sensor evaluation kit for condition monitoring based on the 2.4 GHz STM32WB5MMG module	<a href="#">STEVAL-PROTEUS1</a>
BLE sensor application for Android and iOS	<a href="#">STBLESensor</a>
Applications	<a href="#">Condition Monitoring/IoT for Smart Industry</a>

The Bluetooth® Low Energy application makes the board as GATT server and GAP peripheral able to accept a connection with a mobile device through a dedicated mobile app ([STBLESensor](#)) to facilitate nodes configuration, local monitoring equipment status, fast firmware upgrade over the air (FUOTA), and data monitoring to the dedicated Azure IoT PnP central cloud dashboard.

The FUOTA function is useful for updating to a new version, but also for replacing and testing any other BLE example firmware designed for [STEVAL-PROTEUS1](#). You must turn [STEVAL-PROTEUS1](#) off and then on again after downloading [STSW-PROTEUS](#) via FUOTA regardless of the previously loaded firmware. You can also do this by holding down the power button for 3s.

The ZigBee application firmware provides an example to show how to create a Zigbee centralized network, and how to communicate from one node to another one using clusters.

Once the Zigbee mesh network is created, the server (for example, routers and end devices) stores information about battery, temperature and CbM status in the related attributes.

The client (for example, coordinator) can read the information and can ask to turn on/off an LED of any server as well.

The coordinator sends information about the status both for the network and the devices (for example, battery info, temperature and CBM status) to the gateway via USB-VCP. Also, it manages commands coming from the gateway (for example, RTC synchronization, on/off of the LED of any device). The communication between coordinator and gateway is JSON-formatted.

Each project is released as a source code for the [STEVAL-PROTEUS1](#) kit. The projects are developed for three IDEs for the STM32 MCU: IAR Embedded Workbench® for Arm, Keil® microcontroller development kit for Arm, and ST integrated development environment for STM32.

## Revision history

**Table 1. Document revision history**

Date	Revision	Changes
24-Jun-2022	1	Initial release.
21-Jun-2023	2	Updated STBLESensor with STBLESensorClassic in all the document.
05-Dec-2024	3	Updated Features, Product summary and Description.

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