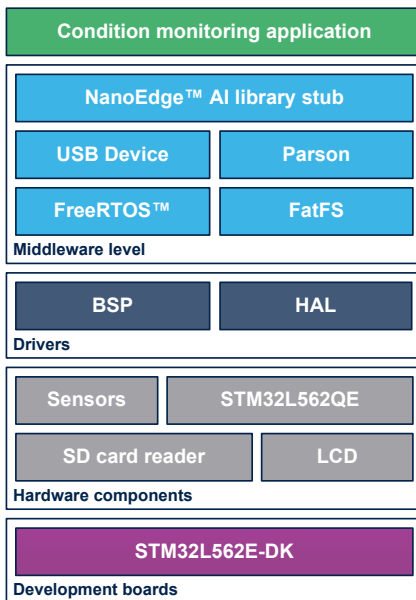


Artificial Intelligence (AI) condition monitoring function pack for STM32Cube



Features

- Complete firmware to program an STM32L5 sensor node for condition monitoring and predictive maintenance applications
- Stub for replacement with a Cartesiam Machine Learning library generated using the NanoEdge™ AI Studio for the desired AI application
- Configuration and acquisition of STMicroelectronics iNEMO LSM6DSO 3D digital accelerometer and gyroscope
- Data logging on a microSD™ card
- Simple LCD user interface
- Autonomous mode controlled by user button
- Interactive command-line interface (CLI) for
 - Node and sensor configuration
 - Data logging
 - Learning and detection phase management of the NanoEdge™ library
- Easy portability across STM32 microcontrollers by means of the STM32Cube ecosystem
- Free and user-friendly license terms

Description

Condition monitoring is a major component of predictive maintenance systems, allowing production performance improvement, cost reduction and a drastic decrease of the downtime due to routine maintenance.

The FP-AI-NANOEDG1 function pack helps to jump-start the implementation and development of condition monitoring applications designed with the NanoEdge™ AI Studio solution from Cartesiam (a member of the ST Partner program).

NanoEdge™ AI Studio simplifies the creation of autonomous Machine Learning libraries with the possibility of running not just inference but also training on the edge. It facilitates the integration of predictive maintenance capabilities as well as the security and detection with sensor patterns self-learning and self-understanding, exempting users from special skills in mathematics, Machine Learning, data science, or creation and training of Neural Network.

FP-AI-NANOEDG1 covers the entire design of the Machine Learning cycle from the data set acquisition to the integration of NanoEdge™ AI Studio generated libraries on a physical node. It runs the inference in real time on an STM32L562QE ultra-low-power microcontroller (Arm® Cortex®-M33 at 110 MHz with 512 Kbytes of Flash memory and 256 Kbytes of SRAM), taking physical sensor data as input. The NanoEdge™ library generation itself is out of the scope of this function pack and must be generated using NanoEdge™ AI Studio.

FP-AI-NANOEDG1 implements a wired interactive command-line interface (CLI) to configure the node, record data, and manage learning and detection phases. However, all these operations can also be performed in a standalone battery-operated mode through the user button, without having the console. A simple UI implemented on the LCD monitors the processing and its outcome.

Product status link
FP-AI-NANOEDG1



1 General information

The FP-AI-NANOEDG1 function pack runs on STM32 microcontrollers based on Arm® cores.

Note: Arm is a registered trademark of Arm Limited (or its subsidiaries) in the US and/or elsewhere.



1.1 Ordering information

FP-AI-NANOEDG1 is available for free download from the www.st.com website.

1.2 What is STM32Cube?

STM32Cube is an STMicroelectronics original initiative to significantly improve designer's productivity by reducing development effort, time and cost. STM32Cube covers the whole STM32 portfolio.

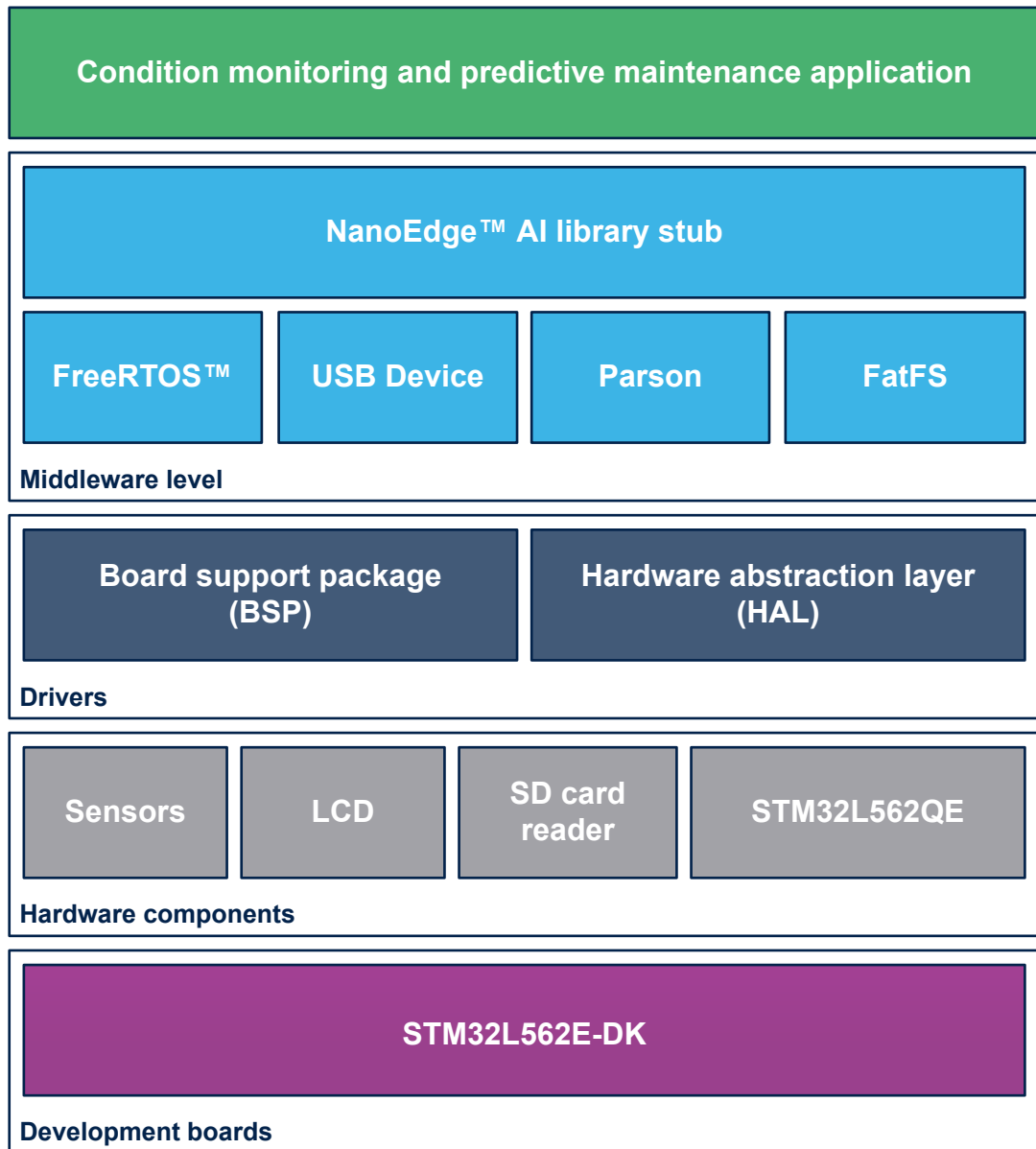
STM32Cube includes:

- A set of user-friendly software development tools to cover project development from the conception to the realization, among which are:
 - STM32CubeMX, a graphical software configuration tool that allows the automatic generation of C initialization code using graphical wizards
 - STM32CubeIDE, an all-in-one development tool with peripheral configuration, code generation, code compilation, and debug features
 - STM32CubeProgrammer (STM32CubeProg), a programming tool available in graphical and command-line versions
 - STM32CubeMonitor (STM32CubeMonitor, STM32CubeMonPwr, STM32CubeMonRF, STM32CubeMonUCPD) powerful monitoring tools to fine-tune the behavior and performance of STM32 applications in real-time
- STM32Cube MCU & MPU Packages, comprehensive embedded-software platforms specific to each microcontroller and microprocessor series (such as STM32CubeL5 for the STM32L5 Series), which include:
 - STM32Cube hardware abstraction layer (HAL), ensuring maximized portability across the STM32 portfolio
 - STM32Cube low-layer APIs, ensuring the best performance and footprints with a high degree of user control over the HW
 - A consistent set of middleware components such as RTOS, USB Device, USB PD, FAT file system, Touch library, Trusted Firmware (TF-M), mbedTLS, and mbed-crypto
 - All embedded software utilities with full sets of peripheral and applicative examples
- STM32Cube Expansion Packages, which contain embedded software components that complement the functionalities of the STM32Cube MCU & MPU Packages with:
 - Middleware extensions and applicative layers
 - Examples running on some specific STMicroelectronics development boards

2 Global architecture

The top-level architecture of the FP-AI-NANOEDG1 function pack is shown in Figure 1.

Figure 1. FP-AI-NANOEDG1 architecture



3 License

FP-AI-NANOEDG1 is delivered under the *Mix Ultimate Liberty+OSS+3rd-party V1* software license agreement (SLA0048).

The software components provided in this package come with different license schemes as shown in Table 1.

Table 1. Software component license agreements

Software component	Owner	License
Cortex [®] -M CMSIS	Arm Limited	Apache License 2.0
FreeRTOS [™]	Amazon.com, Inc. or its affiliates	MIT
STM32L5xx_HAL_Driver	STMicroelectronics	BSD-3-Clause
Board support package (BSP)	STMicroelectronics	BSD-3-Clause
STM32L5xx CMSIS	Arm Limited - STMicroelectronics	Apache License 2.0
FatFS	ChaN	BSD-3-Clause
Parson	Krzysztof Gabis	MIT
Applications	STMicroelectronics	Ultimate Liberty (source release)

Revision history

Table 2. Document revision history

Date	Version	Changes
30-Jun-2020	1	Initial release.
3-Aug-2020	2	Updated Features and Description .

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