

Latest Generation Motion Sensors



Sensors for the OnLife era



LSM6DSV: Best-in-class, low noise IMU



LIS2DUX12: AI-enhanced accelerometer



SensorTile.box PRO



Sensors for the OnLife era

Standalone devices able to sense, process and take action



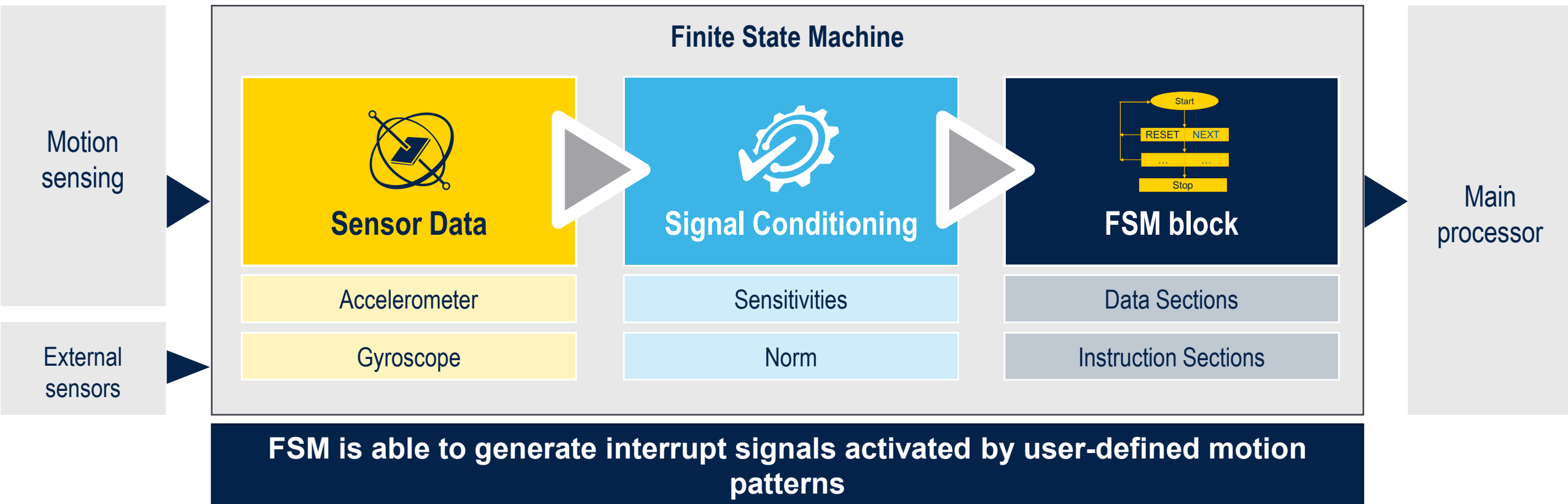
Embedded sensor fusion with game rotation vector

MLC: In-sensor classification engine based

Adaptive self configurability

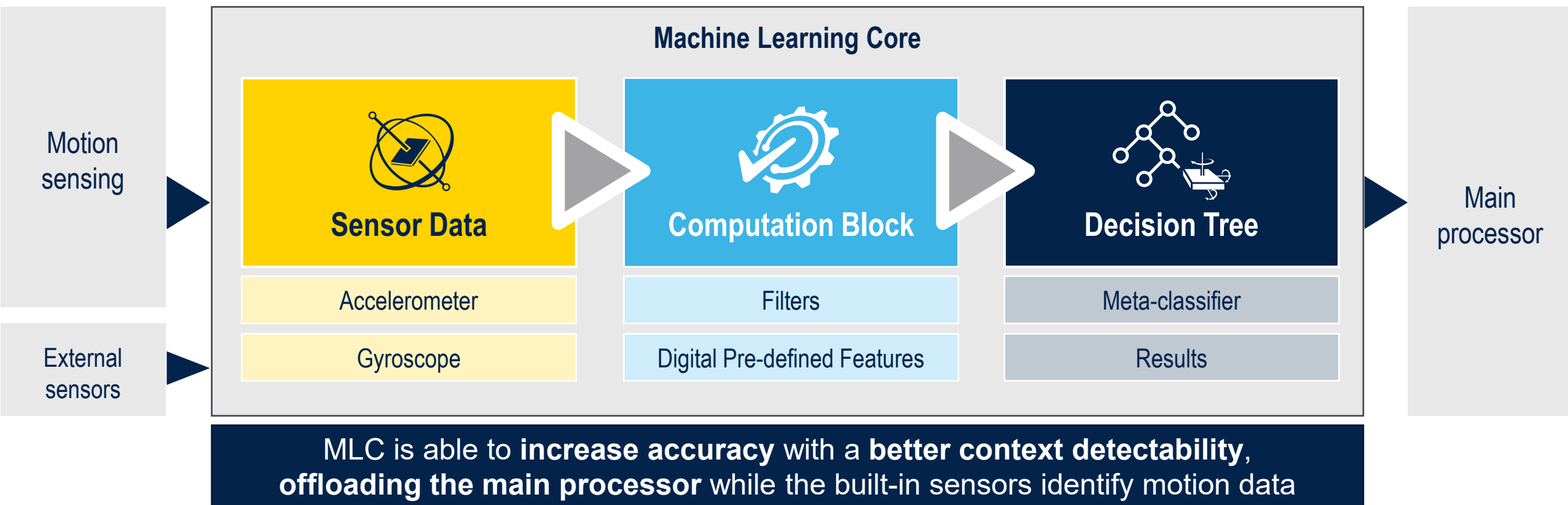
Sensors with Finite State Machine

FSM is an in-sensor behavioral model composed of a finite number of states and transitions between states



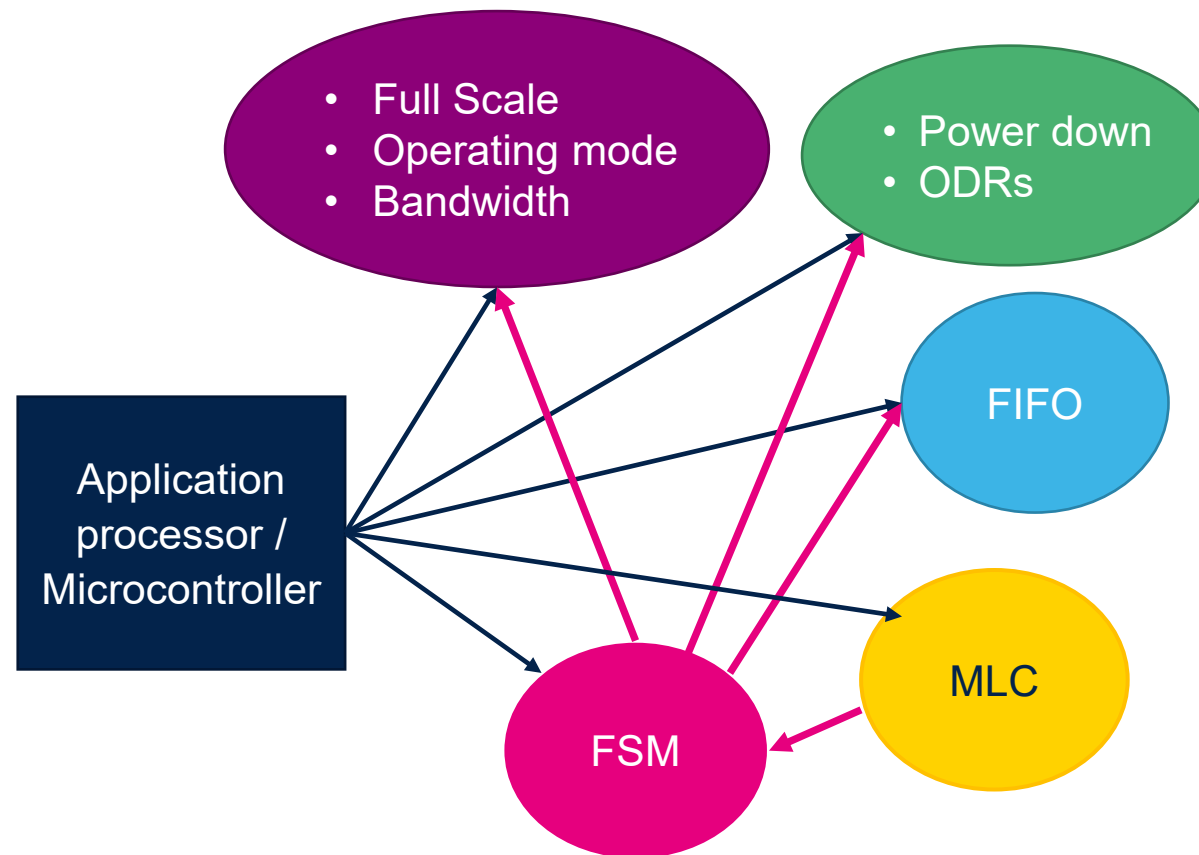
Sensors with Machine Learning Core

MLC is an in-sensor classification engine based on a decision tree logic



Adaptive self-configuration

**FSM can change the device configuration:
Application processor can be kept in sleep mode (power optimization)**



ODR = Output Data Rate
FIFO = First In First Out
MLC = Machine Learning Core
FSM = Finite State Machine



Why processing in the edge?

The perfect solutions for IoT platforms

Solutions enabled on inertial sensors with MLC and FSM @ Low power*

Human activity recognition for wrist-worn device	6 μ A
Gym activity recognition	6 μ A
Hard-fall detection	41 μ A
Wrist-tilt	9 μ A
Jiggle gesture	4.5 μ A
Android wear OS navigation gestures	17 μ A
Tap detection	95 μ A
Pedometer (Advanced by MLC & FPR block)	4.5 μ A
Sleep detection	1 μ A

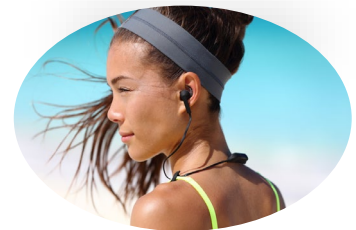
High Precision solutions
+
Current optimization at
System Level



Increased
battery life



User experience



STMicroelectronics launches a new advanced 6-axis IMU with embedded sensor fusion and AI



High-performance 6-axis IMU embeds sensor fusion & AI



First AI-enhanced smart accelerometers from STMicroelectronics raise performance and efficiency for always-aware applications



Design always-aware applications with power-saving smart MEMS accelerometers





LSM6DSV Family

Best-in-class low noise and high stability 6x IMU

Low noise accelerometer and gyro
 $60 \mu\text{g} / \sqrt{\text{Hz}}$ (All FS), $2.8 \text{ mpds} / \sqrt{\text{Hz}}$

Embedded sensor fusion
Low power, low latency – high performance

Advanced processing in the edge
FSM and MLC 2.0; ASC with ST libraries!





LSM6DSV & LSM6DSV16X

6x IMU for UI, OIS & EIS

High end IMUs with OIS/EIS channel, exportable AI & Qvar™



Key features

- Dedicated core UI, OIS & EIS
- HAODR < 1% (LSM6DSV16X)
- Finite State Machine
- MLC 2.0 and Qvar (LSM6DSV16X)
- VDDIO: 1.2V
- I2C / SPI / I3C (1.1) primary for UI and QVAR

Target applications

- Motion tracking and gesture detection
- AR / VR / MR applications
- Wearables & IoT connected devices
- Indoor navigation
- Smartphones and handheld devices
- EIS and OIS for camera applications

LSM6DSV16X
(2.5x3.0x0.86mm3 LGA14)

High End IMU low Noise		
Accelerometer	FS	±16g
	UI noise	60 µg / √Hz
Gyroscope	FS	±4000 dps
	UI Noise	2.8 mdps / √Hz
	BI	3dph
Low Power	UI	0.65 mA





LSM6DSV32X

IMU for sport, wearable & IoT application with 32g accelerometer & MLC + Qvar™



LSM6DSV32X
(2.5x3.0x0.86mm3 LGA14)

- ✓ FS: ± 4000 dps, ± 32 g
- ✓ Idd 0.65 mA
- ✓ Gyro noise 2.8mdps/ $\sqrt{\text{Hz}}$
- ✓ G_OffDr: ± 0.008 dps/ $^{\circ}\text{C}$

IMU with Accelerometer up to 32g

Configurable Power mode

Smart feature configurable

Advanced interfaces: I2C, SPI & I3C® 1.1

Activity recognition low power (MLC) & Qvar™



LSM6DSV16BX

High-end IMUs with 6-axis UI & audio accelerometer, AI and Qvar



LSM6DSV16BX
(2.5 x 3.0 x 0.71 mm LGA14)

- FS: ± 4000 dps, ± 16 g
- Idd 0.60 mA (UI) & 0.95 mA (UI+TDM)
- Gyroscope noise 3.5 mdps / $\sqrt{\text{Hz}}$,
- Audio accelerometer noise 30 μg / $\sqrt{\text{Hz}}$
- G_OffDr: ± 0.008 dps / $^{\circ}\text{C}$

Triple core for UI, audio accelerometer & Qvar

Dedicated channel for Audio XL
(TDM interface, Low noise & wide BW)

Smart feature configurable
(FSM 2.0, MLC 2.1)

Advanced interfaces: I²C, SPI, I³C 1.1, TDM

Qvar

Sensor fusion low power for always-on applications

SFLP plug & play for processing in the edge



Features

- 6x Game Rotation Vector (accelerometer + gyroscope)
- Rotation vector output available as quaternion format (W, X, Y, Z)
- X, Y, Z quaternion components can be stored in FIFO

Performance

- Static accuracy (heading, pitch, roll) 0.5⁽¹⁾, 1.5, 1.5 deg
- Low Dynamic accuracy (heading, pitch, roll) 0.7⁽¹⁾, 0.5, 0.5 deg
- Calibration time⁽²⁾ 0.8 s
- Orientation stabilization time 0.7 s

Power consumption

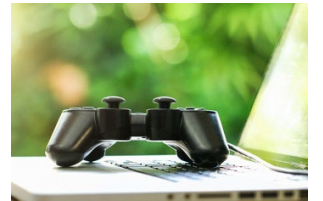
- SFLP extra power: 30uA @120Hz in the edge with 50% power reduction vs. external MCU⁽³⁾ processing

(1) Heading / 5min

(2) Time required to reach steady state

(3) Same Sensor Fusion software library running on STM32L476RG cortex M4 @ 65 uA (120Hz ODR)

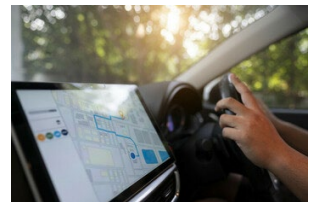
Gaming



Wearable



Navigation



LIS2DUX12

Ultra-low-power 3-axis digital smart accelerometer with AAF



LIS2DUX12
(2.0 x 2.0 x 0.74 mm LGA12)

- Low power [LP]: 6.2 μ A @ 50 Hz ODR with AAF on
- Low noise [LP]: 220 μ g/ $\sqrt{\text{Hz}}$
- Embedded digital functions: tap / double tap recognition, free fall detection, 6D/4D orientation
- Programmable interrupts

Anti alias filter in low power mode

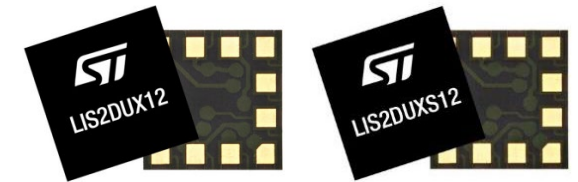
Machine Learning Core (2.0) and FSM

Advanced interfaces: I2C, SPI & I³C 1.1

Ultra-thin package

LIS2DUX12 and LIS2DUXS12

Ultra Low Power Accelerometer with Qvar, anti-aliasing, finite state machine and machine learning core



2 x 2 x 0.74mm

HIGHLIGHTS

- Tap / Double-tap recognition / Wake up detection / Free fall detection / 6D/4D orientation and Activity / Inactivity
- Pedometer
- Embedded machine learning core (MLC)
- Programmable finite state machine (FSM)
- Integrated analog hub / Qvar sensing channel (* S version)

KEY FEATURES

- Acceleration range: $\pm 2/\pm 4/\pm 8/\pm 16$ g
- Enhanced flexibility with embedded FIFO up to 128 samples
- Low current consumption
 - 2.7 μ A at 1.6Hz (ultra-low power mode)
 - 6.2 μ A at 50Hz with Anti-Alias Filter (lower power mode)
 - 10.8 μ A with Anti-Alias Filter (high performance mode)
- I3C interface option

TARGET APPLICATIONS



Game controllers



Smart Watch



Wrist Bands



True Wireless Stereo (TWS)



Asset Trackers

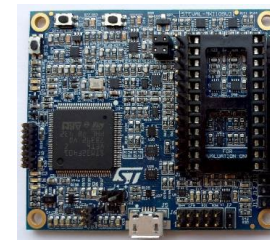


Motion-activated user interface



life.augmented

EVALUATION BOARDS



STEVAL-MKI109V3
ProfiMEMS motherboard

+



STEVAL-MKI238A
STEVAL-MKI235KA
DIL24 adapter kit



STEVAL-SMARTAG2



SensorTile.box PRO

Ready-to-use programmable wireless IoT node

ST makes IoT sensing accessible with a ready-to-use device connectable via Bluetooth® to your smartphone



Built into a compact box
Bundled with app for smartphone

Fast Prototyping: design an IoT node and wearable sensor applications quickly and easily, without performing any programming

Complete Solution: from simple to advanced programming

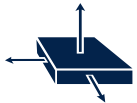
Expandable and customizable: connect accessories to expand SensorTile.box PRO features and tailor the device to your needs

Sense, process, and connect

Motion sensors



6-axis inertial measurement unit
LSM6DSV16X



3-axis low-power accelerometer
LIS2DU12



3-axis magnetometer
LIS2MDL



Motion sensors

Low-voltage local digital
temperature sensor
STTS22H



Altimeter / pressure sensor
LPS22DF



Digital microphone / audio sensor
MP23DB01HP



Processing & memory



Ultra-low-power with FPU Arm
Cortex-M33 with TrustZone®
STM32U585AI



microSD™ card slot

Connectivity

Bluetooth Low Energy 5.2 SoC
BLUENRG-355AC



NFC tag on board
ST25DV04K



Three different working modes

1

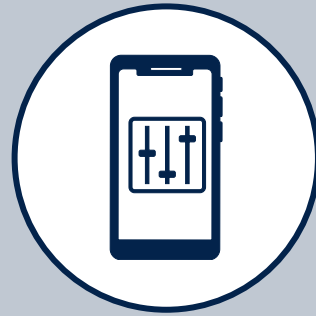
ENTRY MODE



Enjoy different **ready-to-use applications** already embedded in the tool, approaching the IoT world from the baseline

2

EXPERT MODE



Explore in deep the different possibilities offered by the tool while **managing parameters, algorithms, and output** directly from your smartphone

3

PRO MODE



Create from scratch your own tailored application exploiting provided libraries, AI algorithms and in general the **STM32 open development environment**

