ISM6HG256X

Ultra-precise intelligent IMU capturing every motion, even in toughest industrial environments

Challenges for sensors in industrial environment

- Continuous monitoring for years with battery-operated sensors
- Comprehensive event capture: no incidents missed
- Accurate and precise tracking
- High level of integration for a small size sensor node
- Reliable tracking in any environment

Unlock smarter tracking and safety with a single solution

Asset tracking

Logistics and shipping services track location, status, and damage in real time

Worker personal protective equipment

Wearables detect falls and impacts, instantly triggering emergency alerts

Condition monitoring

Monitor industrial equipment for vibration, shock, and precise motion tracking

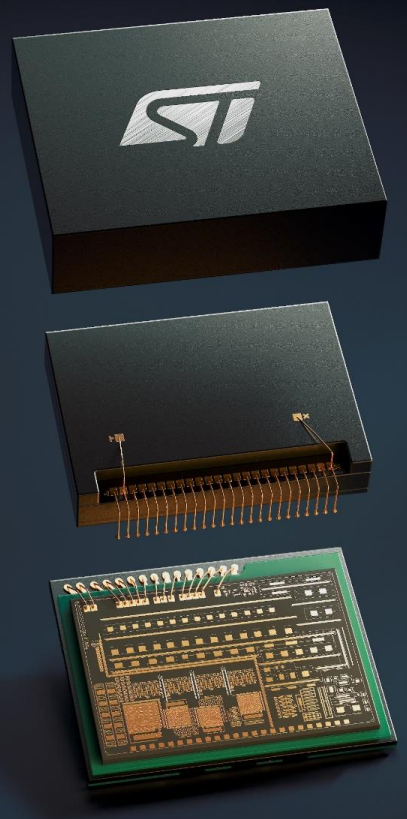
Robots and factory automation

Track motion and detect unusual vibration, shock, or impact instantly

Track, monitor, and protect — **all in one powerful component!**

The new industrial IMU: ISM6HG256X

Intelligent, accurate IMU with simultaneous detection of low-g (16g) and high-g (256g) acceleration



Top-notch accuracy & stability

IMU with dual accelerometer full-scale designed to never miss any event, even the most severe

Processing at the edge and self-configurability

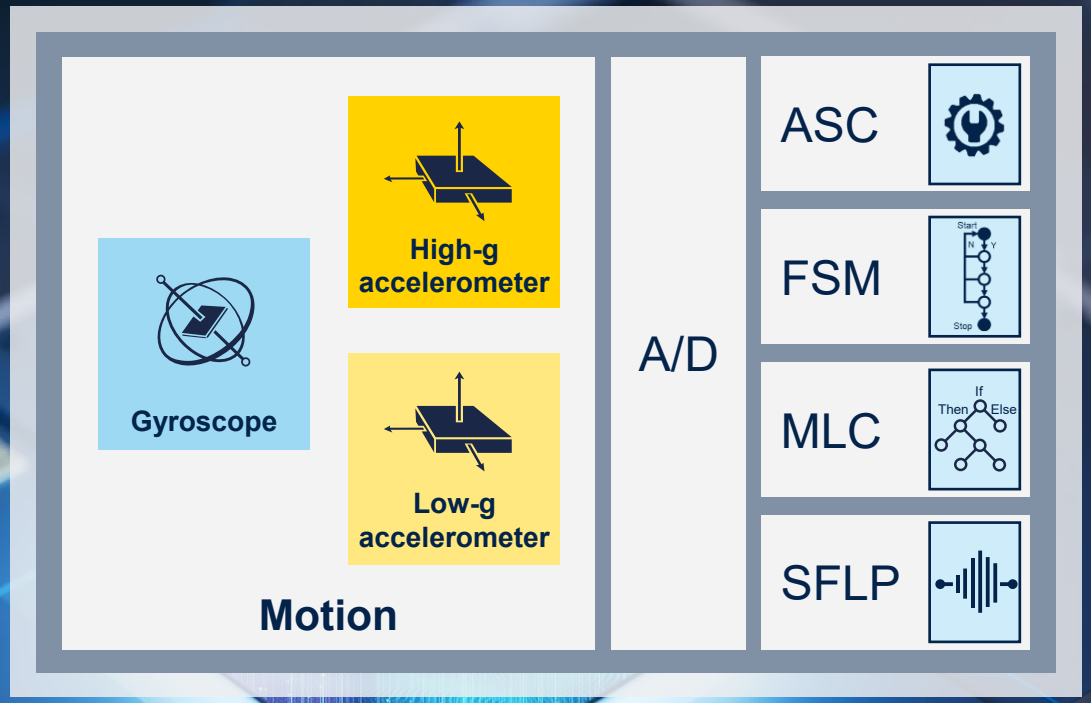
Optimized performance and system level-power saving

Suitable for harsh environments

Operates reliably at temperatures up to 105˚C

What's inside the ISM6HG256X?

A new sensor technology that accurately, efficiently and simultaneously measures both high and low acceleration levels



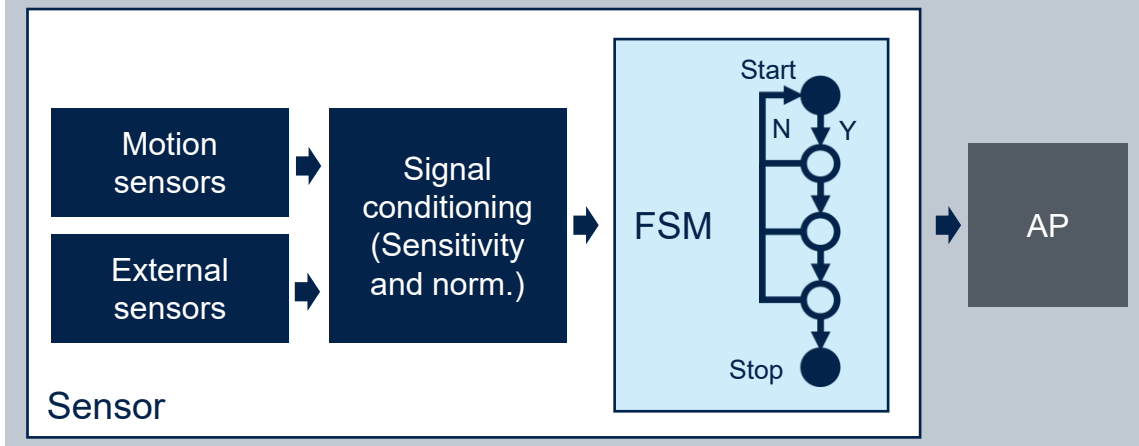
Consistent performance and **valuable insights** for accurate sensing of both **subtle vibrations and severe shocks**

Edge AI and self-configuration:

- Finite state machine (FSM)
- Machine learning core (MLC)
- Adaptive self-configuration (ASC)
- Sensor fusion low power (SFLP)

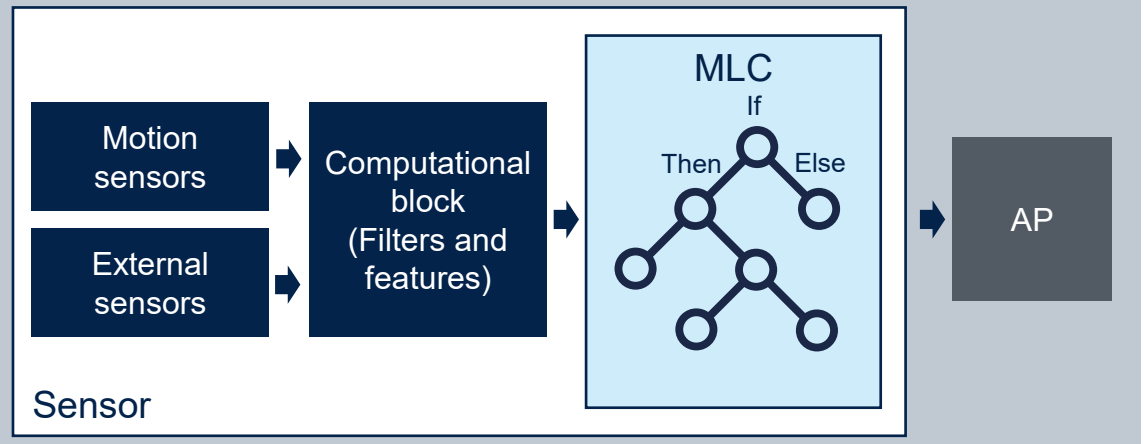
Edge processing with MLC and FSM

Finite state machine (FSM)



- FSM is composed of a finite number of user-defined states and transitions between them
- FSM can be in just one of the states and move to another one only if the transition condition is met
- Each state can be composed of a command or a next / reset condition

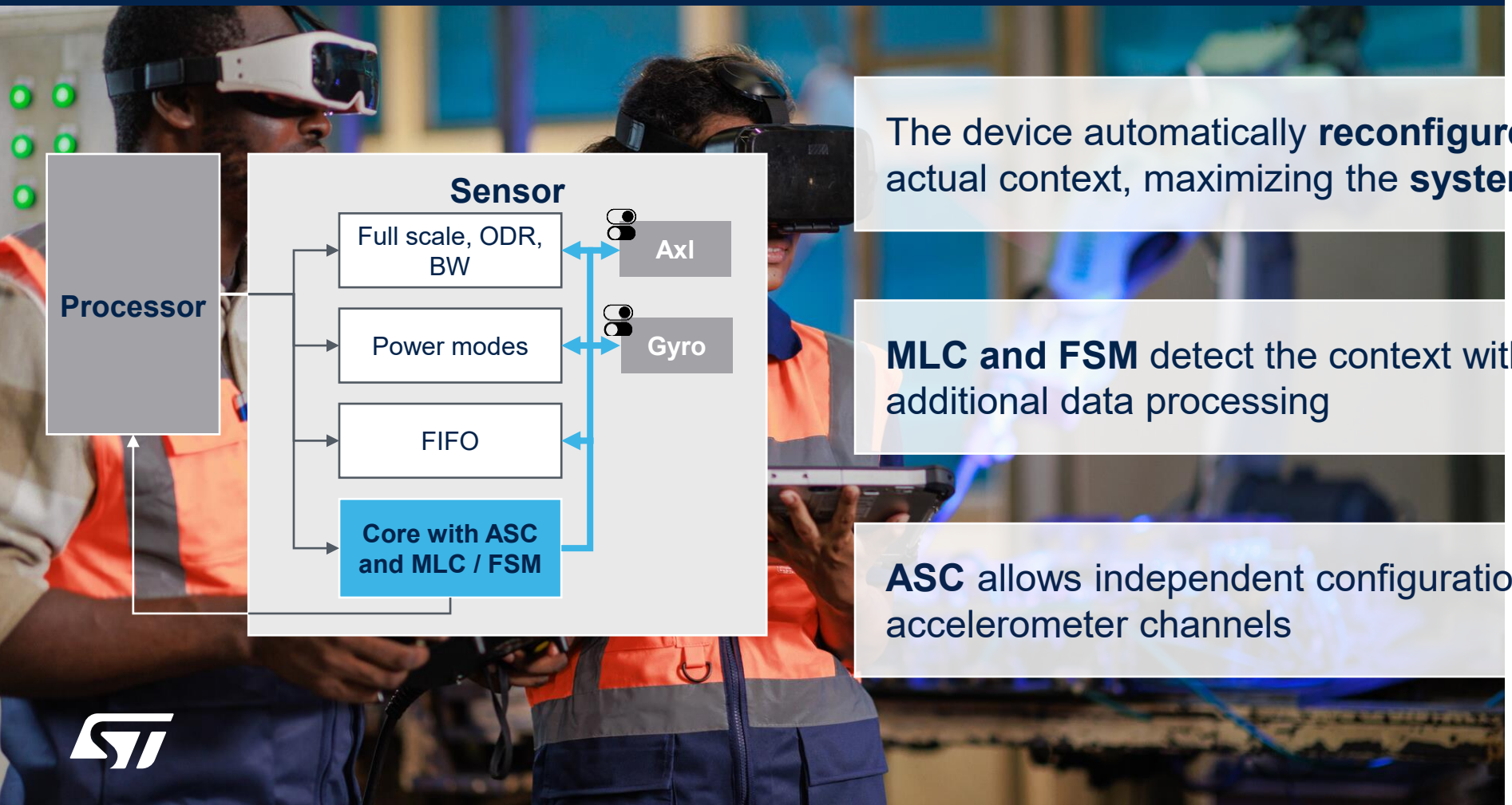
Machine learning core (MLC)



- The MLC runs predictive models based on a decision tree logic: a series of configurable nodes characterized by an “if-then-else” condition
- Decision tree is “built” offline through analysis of data sets
- It uses sensor data to compute a set of statistical parameters to identify patterns matching with user-defined classes

Adaptive self-configuration (ASC)

Always perfectly fits the context



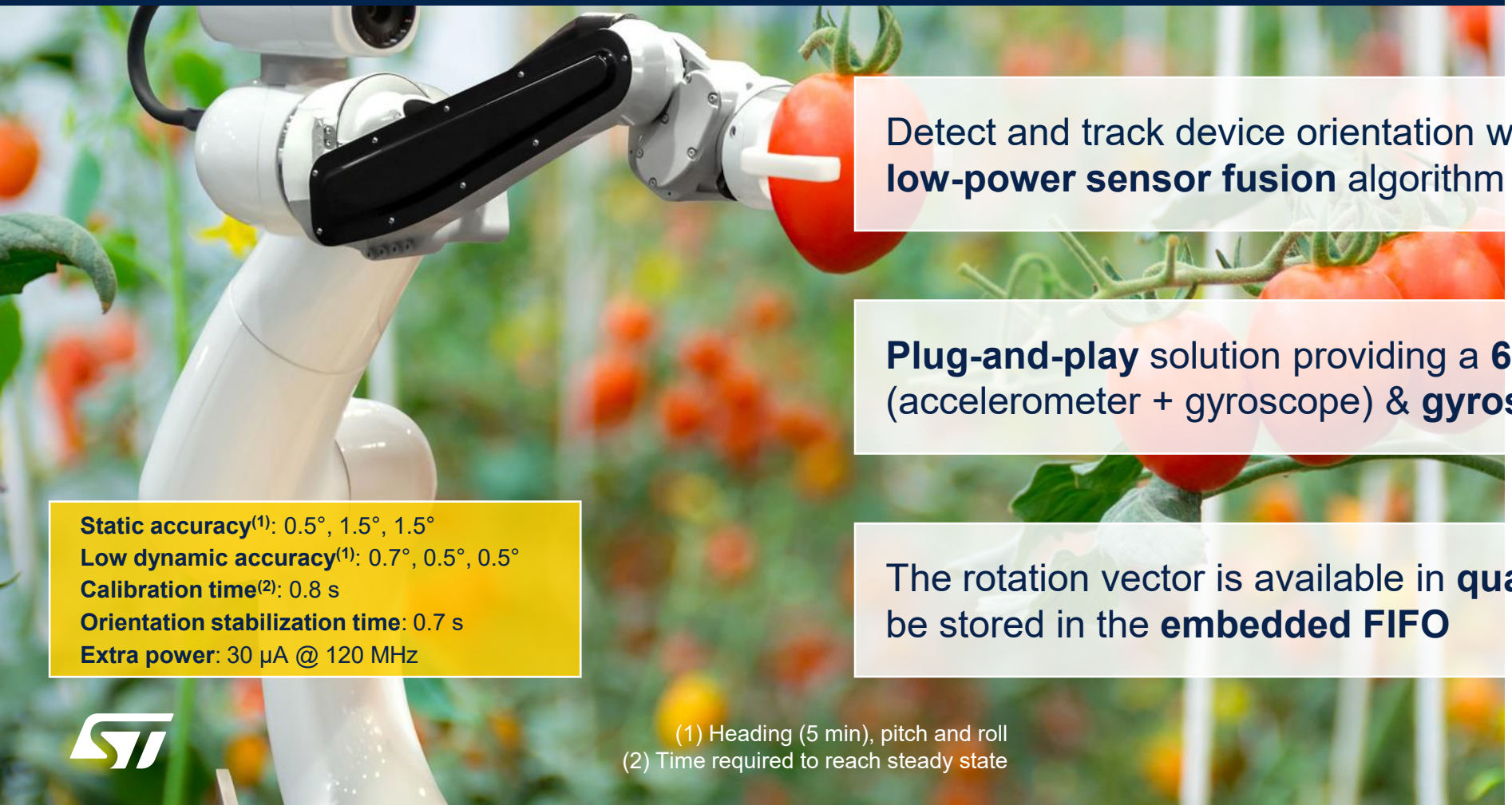
The device automatically **reconfigures itself** based on the actual context, maximizing the **system efficiency**

MLC and FSM detect the context without the need for additional data processing

ASC allows independent configuration of gyroscope and accelerometer channels

3D orientation

Track and monitor orientation in 3D space



Detect and track device orientation with the **embedded low-power sensor fusion** algorithm consuming only **30 µA**

Plug-and-play solution providing a **6x rotation vector** (accelerometer + gyroscope) & **gyroscope-bias calibration**

The rotation vector is available in **quaternion format** and can be stored in the **embedded FIFO**

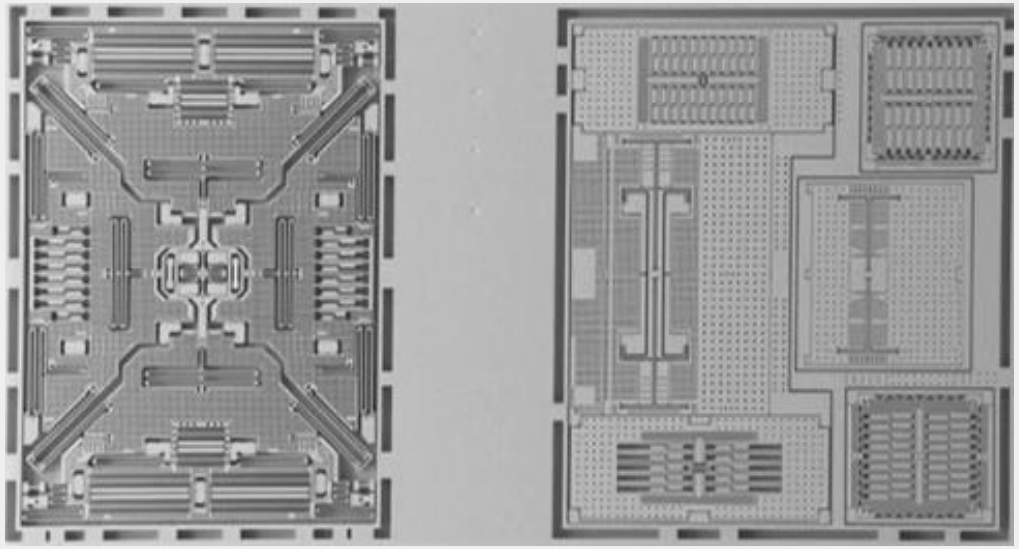
Static accuracy(1): 0.5°, 1.5°, 1.5°
Low dynamic accuracy(1): 0.7°, 0.5°, 0.5°
Calibration time(2): 0.8 s
Orientation stabilization time: 0.7 s
Extra power: 30 µA @ 120 MHz

(1) Heading (5 min), pitch and roll
(2) Time required to reach steady state

Differentiating features vs competitors

Design

Industry-first high performance 6-axis IMU with a **dedicated high-g accelerometer** for intense impact and shock detection



Top view of two accelerometers (high-g & low-g) and gyroscope in the same device

Applications

Continuous acceleration measurement and dynamic position monitoring

ISM6HG256X: comparison vs competitors

Features	ISM6HG256X	Competitor IMUs
Sensing	Three independent sensing elements in a single package • Gyroscope • Low-g accelerometer (±16 g) • High-g accelerometer (±256 g)	Two sensing elements in a single package • Gyroscope • Low-g accelerometer (up to ±64 g)
Signal dynamics reconstruction	Capable of high-fidelity motion tracking and reconstruction also when acceleration is very high intensity or frequency	Limited reconstruction of dynamics and up to limited acceleration
Edge AI	Machine learning core, finite state machine, adaptive self-configuration, sensor fusion low power	--
Reliable operation	Reliable operation in a wide temperature range **(up to +105°C)**	In some cases, limited to **+85°C**
Software libraries	High-g & low-g fusion, sensor fusion, context awareness, asset tracking & warranty, calibration, …	Basic libraries for standard operations

Competitor devices:
TDK: IIM-42652/3 and IIM4565x
Bosch: BMI330 and BMI088

Industrial smart IMU for asset tracking
From challenges to solutions

	ISM6HG256X
Continuous monitoring for years with battery-operated sensors	Low-power edge processing to **classify event directly in the node** and save power
Comprehensive event capture: no incidents missed	**Dual accelerometer:** nothing is missed before, during, and after **any kind of event**
Accurate and precise tracking	Top-notch **accuracy** and **stability** enabling precise dead-reckoning
High level of integration for a small size sensor node	IMU with dual accelerometer and edge processing in a small **2.5 x 3 mm²** package
Reliable tracking in any environment	Reliable operation in a wide temperature range: -40 to **+105°C**

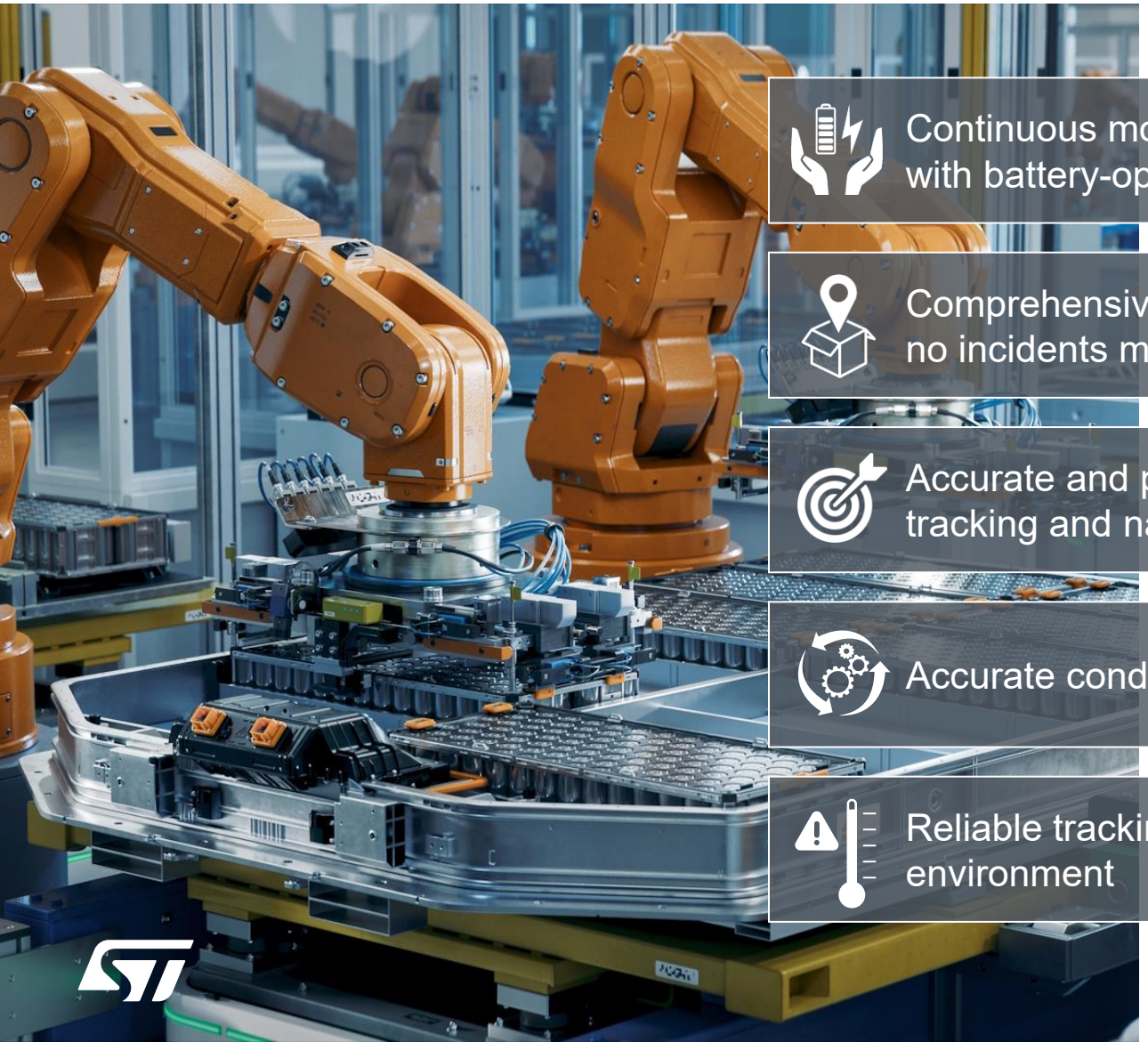
Industrial smart IMU for workers PPE
From challenges to solutions

	ISM6HG256X
Continuous monitoring for years with battery-operated sensors	Low-power edge processing to **classify event directly in the node** and save power
Continuous accurate motion tracking	Embedded **ultralow power sensor fusion** and sensor **self-configuration**
Comprehensive event capture: no incidents missed	**Dual accelerometer:** nothing is missed before, during, and after **any kind of event**
High level of integration for a small size sensor node	IMU with dual accelerometer and edge processing in a **2.5 x 3 mm²** package

Industrial smart IMU for condition monitoring
From challenges to solutions

	ISM6HG256X
Continuous monitoring for years with battery-operated sensors	Low-power edge processing to **classify event directly in the node** and save power
Comprehensive event capture: no incidents missed	**Dual accelerometer:** nothing is missed before, during, and after **any kind of event**
Accurate condition monitoring	Top-notch accuracy & stability, **wide-band vibration measurement** (2 kHz) and **very wide measurement range** (up to 256g)
Reliable tracking in any environment	Reliable operation in a wide temperature range: -40 to **+105°C**

Industrial smart IMU for robots & factory automation
From challenges to solutions



	ISM6HG256X
Continuous monitoring for years with battery-operated sensors	Low-power edge processing to **classify event directly in the node** and save power
Comprehensive event capture: no incidents missed	**Dual accelerometer:** nothing is missed before, during, and after **any kind of event**
Accurate and precise motion tracking and navigation	Top-notch **accuracy**, **stability, and ultralow power sensor fusion** enabling precise dead-reckoning
Accurate condition monitoring	Top-notch accuracy & stability, **wide-band vibration measurement** (2kHz) and **very wide measurement range** (up to 256g)
Reliable tracking in any environment	Reliable operation in a wide temperature range: -40 to **+105°C**

ISM6HG256X
Ideal for asset tracking

Intelligent, accurate IMU with simultaneous low-g and high-g acceleration detection

2 fully independent low-noise full-scale accelerometers:
Low-g accelerometer: up to 16g | 65 µg / √Hz
High-g accelerometer: up to 256g | 1 mg / √Hz

Low noise full-scale gyroscope
up to 4000 dps

Intelligent sensor
MLC & FSM 2.0, ASC, SFLP 2.0, free fall & shock detection

Low power consumption:
0.22 mA – Accelerometer low-g or high-g HP
0.8 mA – Combo (gyroscope + low-g & high-g accelerometer) HP

Embedded smart FIFO
4.5 Kbyte

Multiple interfaces
SPI, I2C, I3C 1.2 V compatible

Extended operating temperature
-40 to +105 °C

Compact package
LGA 2.5 x 3 x 0.71 14L

A comprehensive software offering for your application

Use cases

- Shocks
- Orientation
- Tilt detection
- Moving
- Still detection
- Free fall
- Drop detection
- Transport system detection
- Position tracking

Available software

- Smart asset tracking
- Car care (Towing, jacking, bump/crash)
- Activity recognition
- Fall / Hard-fall detection

Implemented on MLC / FSM*

- MotionAC (accelerometer calibration)
- MotionAD (airplane detection)
- MotionFT (sliding DFT)
- MotionTL (tilt angles)
- MotionXLF (high-g, low-g fusion)
- MotionAT (active time)
- MotionFD (fall detection, fall height estimation)
- MotionGC (gyroscope calibration)

Software libraries

(*) MLC: Machine learning core
FSM: Finite state machine

ISM6HG256X is part ST's longevity program

10 years longevity commitment

ST focuses on markets requiring long life cycles

Protecting the investments of our customers that need state-of-the-art sensors but have long development, certification or field life cycles

10-year longevity from product introduction date

Design and manufacturing for higher robustness

Calibration & testing for higher accuracy & quality

Higher endurance to shock and vibration

Industrial temperature range

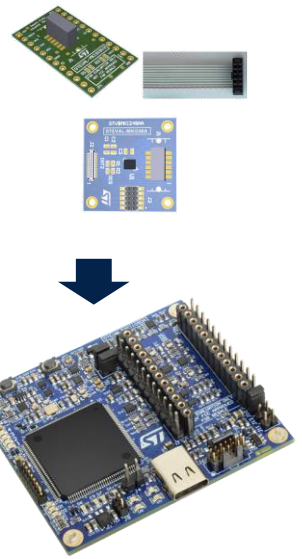
ST's longevity program

Ecosystem for ISM6HG256X

Hardware

Evaluate

STEVAL-MKI248KA



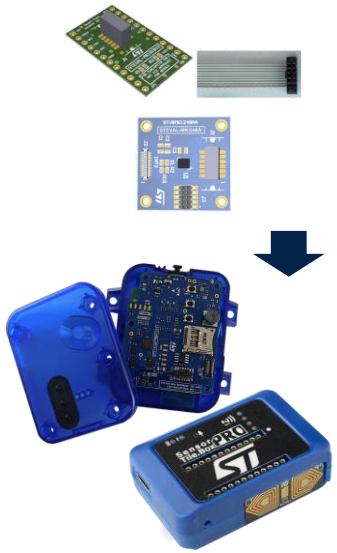
STEVAL-MKI109D

Develop

X-NUCLEO-IKS5A1

Prototype

STEVAL-MKI248KA



STEVAL-STWINBX1
STEVAL-MKBOXPRO

Software

Desktop software solution

MEMS Studio

Mobile application

STBLESensor

Ready-to-go application examples

GitHub

X-CUBE-MEMS1
FP-SNS-STBOX1
FP-SNS-DATALOG2

Our technology starts with You