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# STEVAL-PDETECT1 Presence detection solution

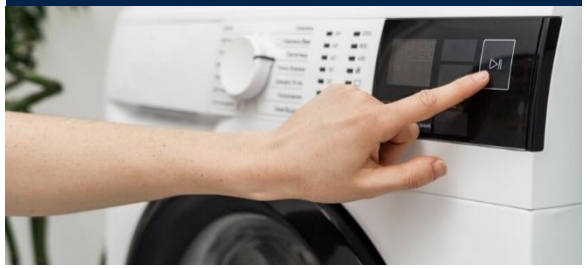
# Presence and occupancy detection Market and applications

Global occupancy sensor market **2022 $2.1B** with **CAGR of 12%**, with North America region expected to be most opportunistic market with accumulating 38% revenue in 2022[1]

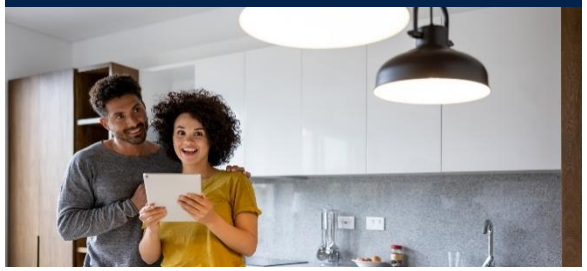
Room and desk occupancy

Alarms system

Control panel & user interface

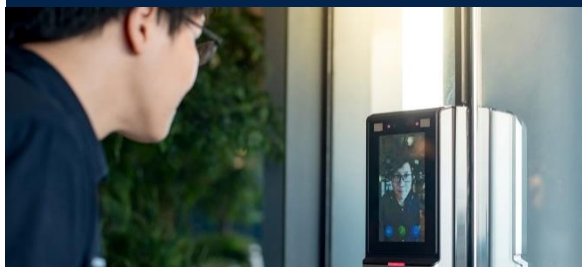


Lighting control



Heat, ventilation & air conditioning control

Intercom & access



USD 6.6 Billion by 2032

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Source: Future Market Insights: https://www.futuremarketinsights.com/reports/occupancy-sensor-market

# Presence and occupancy sensor Market challenges

## Key considerations

- False triggering of occupancy
  - sunlight shining
  - heating objects
  - passing by person
  - ambient conditions
- Multiple sensing technologies
  - to reduce false triggers and ensure true occupancy detection
- Low-power
- Wire-free installation
- User privacy


## Main needs

- Detect occupancy
- Detect motion
- Detect distance
- Detect gestures
- Scalable solutions
- Small, less bulky form factors
- Low cost
- Lower false positive rate
- Higher detection rates
- Better privacy controls

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# Presence and occupancy detection
# TMOS and Time-of-Flight technologies


## Thermal MOS (TMOS)

- Ultralow power consumption (µW)
- Wide Field of View
- Adjustable range & FoV *with lens*
- Wake up the system
- Passive sensor
- Detection by IR heat

**Complimentary technologies**

## Time-of-Flight

- Touchless control with gesture
- Passing-by detection
- People counting
- Ranging (distance)
- Active (transmit and receiver)
- Detection by IR light

FlightSense

**TMOS + Time-of-Flight can be used to reduce power consumption and solve corner cases for gesture, people counting, and other applications.**

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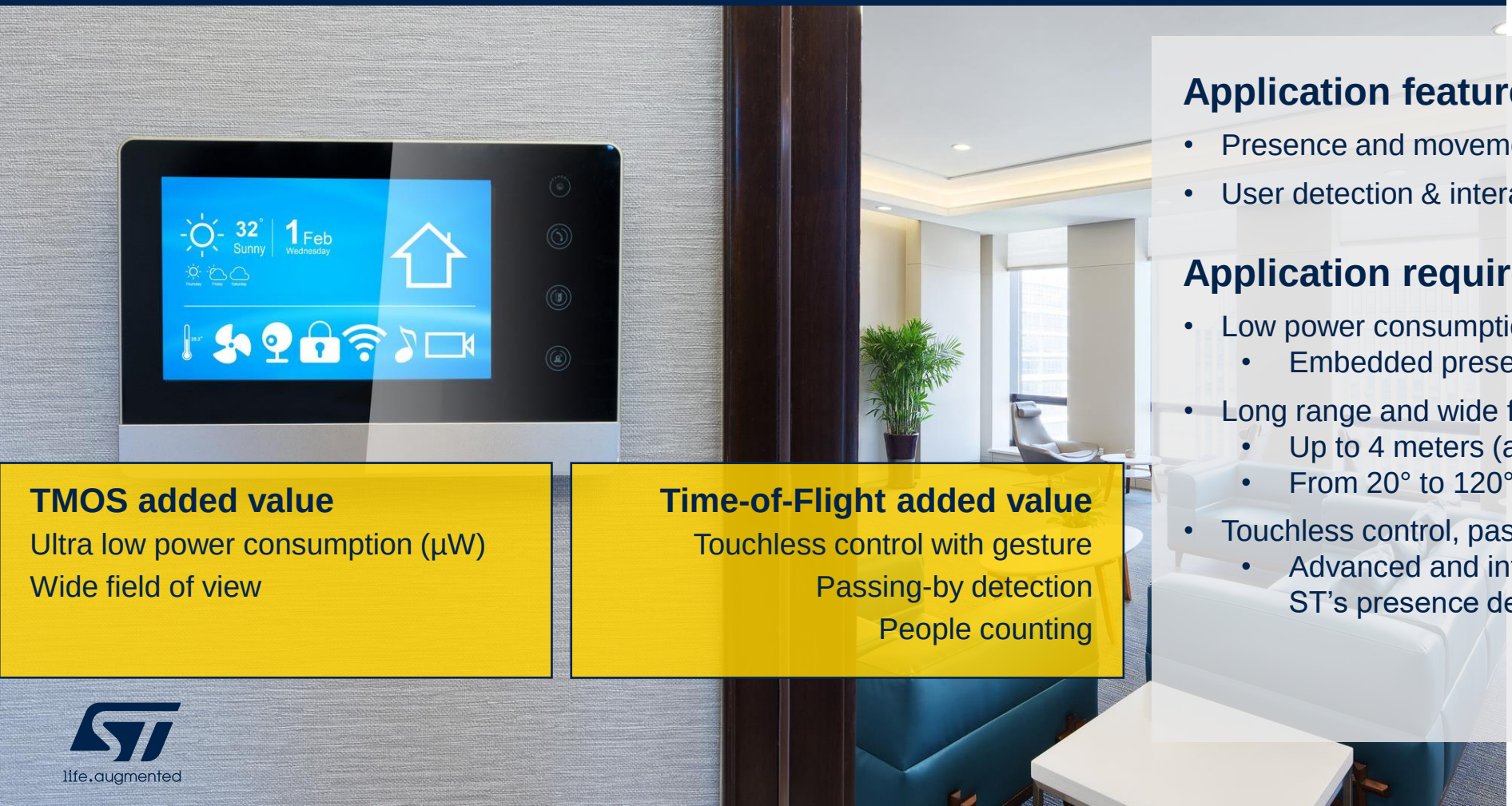
# Building & home control
# Control panel and smart thermostat

## A longer life for battery operated user panel with enhanced features




**TMOS added value**

Ultra low power consumption (µW)

Wide field of view

**Time-of-Flight added value**

Touchless control with gesture

Passing-by detection

People counting

### Application features

- Presence and movement detection
- User detection & interaction with the device

### Application requirements

- Low power consumption (battery operated)
  - Embedded presence and motion algorithms
- Long range and wide field-of-view
  - Up to 4 meters (and longer with lens)
  - From 20° to 120° applicative field-of-view
- Touchless control, passing-by & people counting
  - Advanced and intelligent features only possible with ST's presence detection technologies

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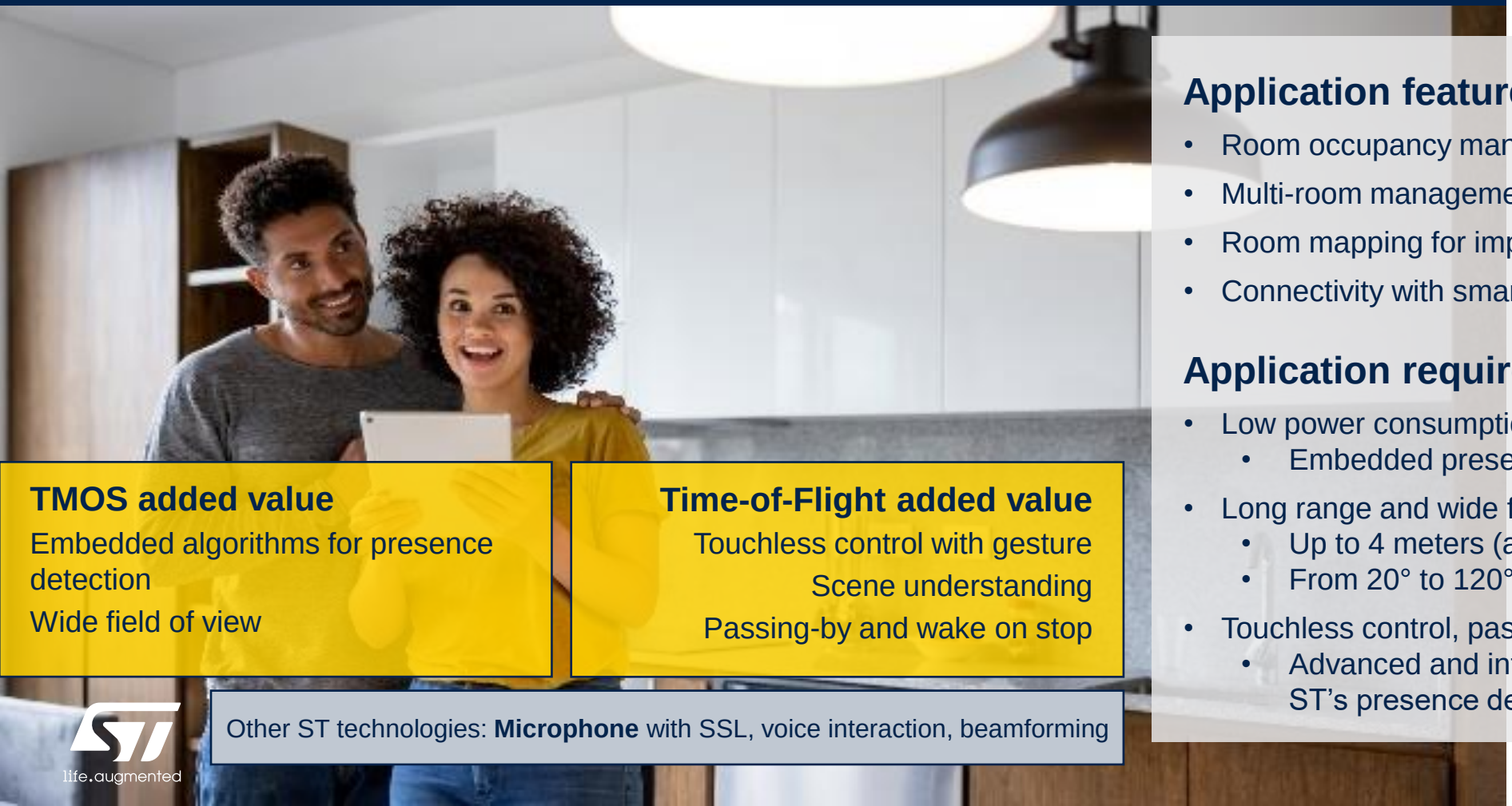
# Building & home control
# Smart speakers & smart Light

## Presence detection enabled user interface and light



### TMOS added value

Embedded algorithms for presence detection

Wide field of view

### Time-of-Flight added value

Touchless control with gesture

Scene understanding

Passing-by and wake on stop

Other ST technologies: **Microphone** with SSL, voice interaction, beamforming

### Application features

- Room occupancy management
- Multi-room management
- Room mapping for improve user experience
- Connectivity with smart home and lighting control systems

### Application requirements

- Low power consumption (battery operated)
  - Embedded presence and motion algorithms
- Long range and wide field-of-view
  - Up to 4 meters (and longer with lens)
  - From 20° to 120° applicative field-of-view
- Touchless control, passing-by & people counting
  - Advanced and intelligent features only possible with ST's presence detection technologies

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# Building & home control
# Indoor alarm system & wireless room sensors

## Wide area system activation for home security

**TMOS added value**

Ultra low power consumption (µW)

Optical stack flexibility

Detect presence static person

**Time-of-Flight added value**

Room occupancy

User positioning

Multi-zone detection

### Application features

- Detect static presence and movement indoors
- Detect if presence within a given distance
- Passage Detection
- Collect data to improve energy efficiency

### Application requirements

- Presence detection when user is not moving
  - Embedded presence and motion algorithms
- Long range and wide field-of-view
  - Up to 10 meters
  - From 20° to 120° applicative field-of-view
- Room occupancy
  - Real-time data analysis and statistics for buildings occupancy management

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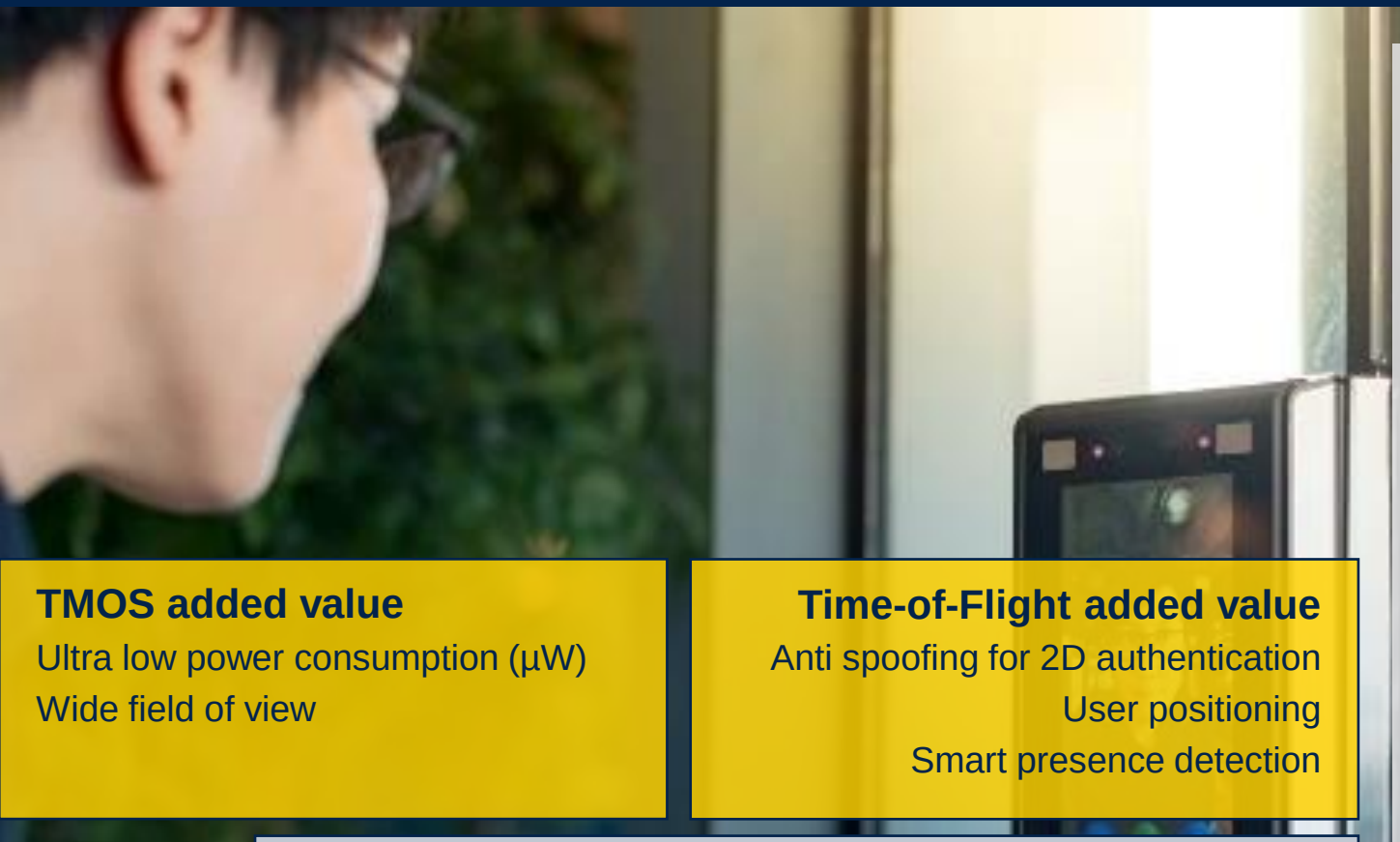
# Building & home control
# Access control & smart Lock

## Presence detection enabled people authentication



**TMOS added value**

Ultra low power consumption (µW)

Wide field of view

**Time-of-Flight added value**

Anti spoofing for 2D authentication

User positioning

Smart presence detection

Other ST technologies:

- **Microphone** with SSL, voice interaction, beamforming
- **UWB** for indoor positioning
- **CMOS camera** for user authentication

### Application features

- Detect user approaching the device
- Enable display and other higher power components
- Help the camera performing authentication

### Application requirements

- Long range and wide field-of-view
  - Up to 4 meters
  - From 20° to 120° applicative field-of-view
- Anti-spoofing solution
  - Add a layer of depth information
- User positioning
  - 3 axis (XYZ) information to ensure a good and smooth user experience
- Multi-human presence

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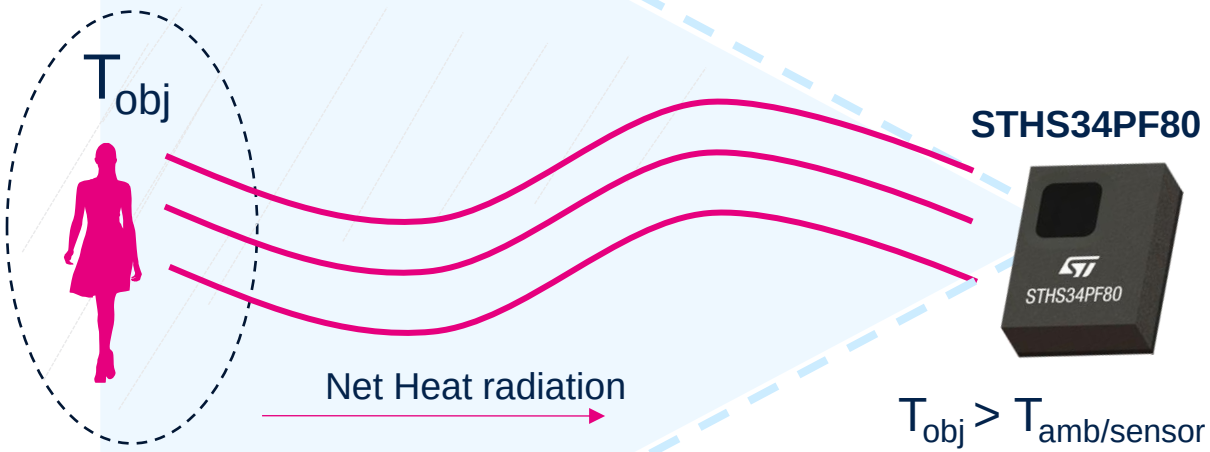
# TMOS
# Thermal Metal Oxide Semiconductors

## Disruptive TMOS sensing technology




### Non-intrusive presence detection
Based on invisible infrared heat

### Low power
Sensor can be configured to operate in very low power modes (5uA typ @ 1Hz)

### Small and thin
Surface mount (SMT) package

**TMOS detects net amount of infrared radiation that is collected in the FoV**

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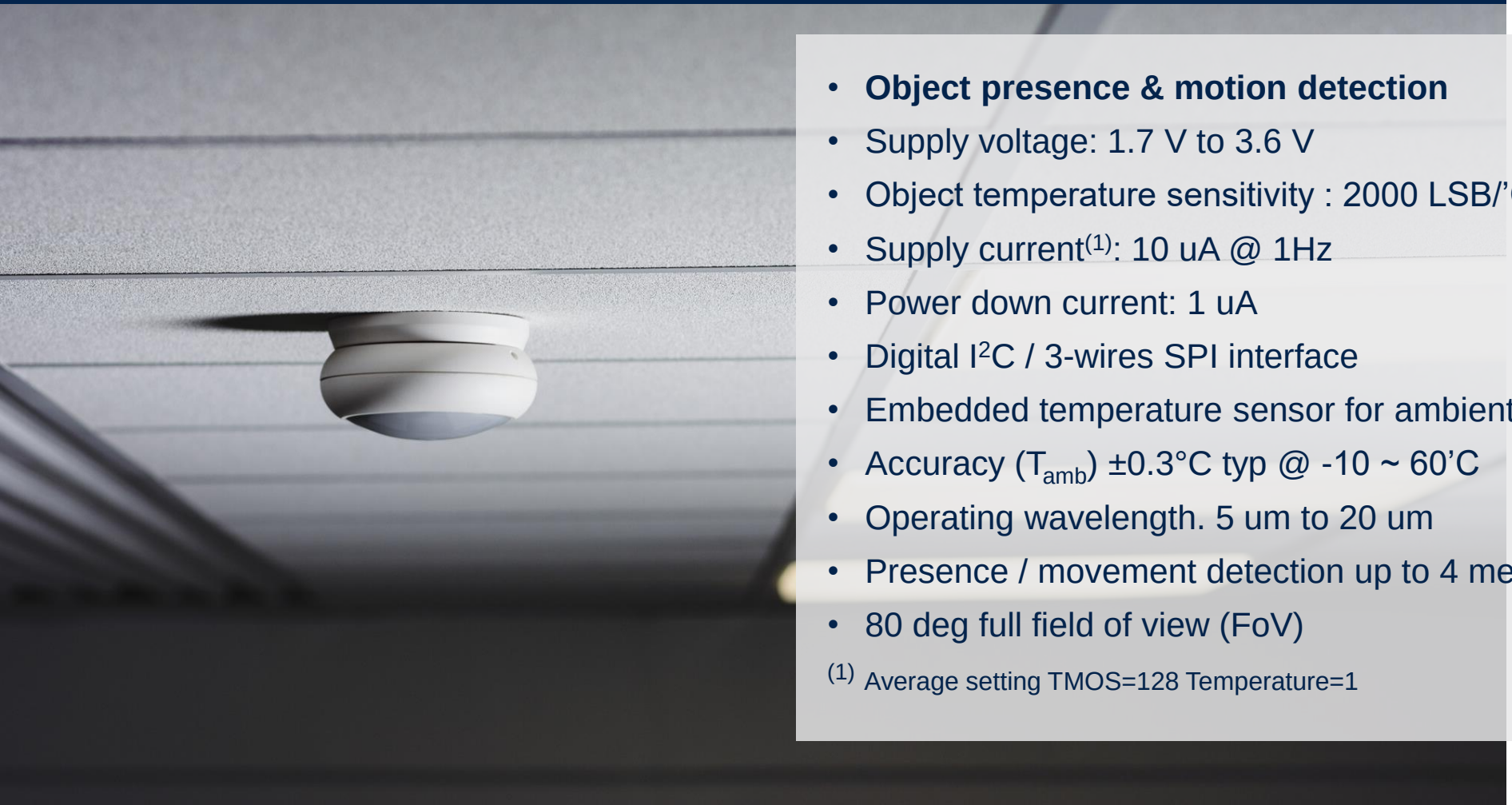
# Infrared sensor – STHS34PF80
# Single pixel presence & motion detector

**IR based technology for occupancy detection measuring integration of IR radiation changed by absolute temperature**

**STHS34PF80 product page**



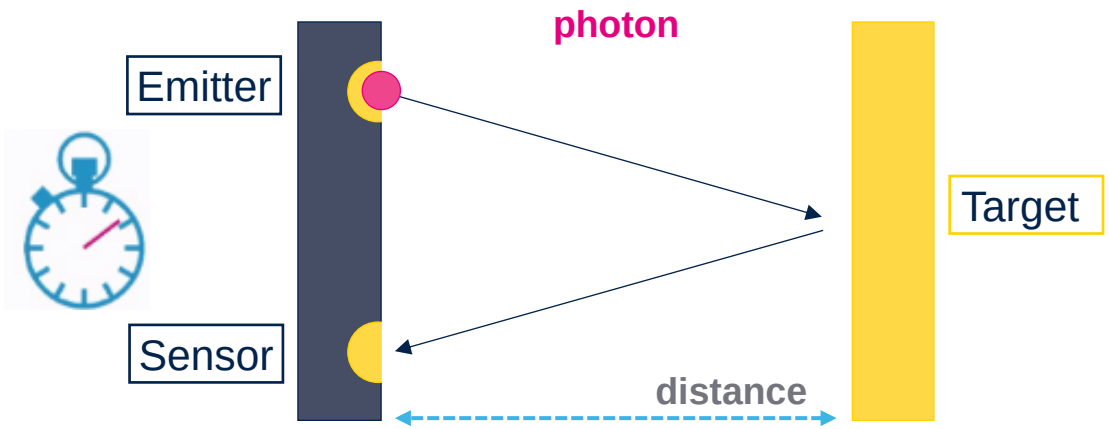
- **Object presence & motion detection**
- Supply voltage: 1.7 V to 3.6 V
- Object temperature sensitivity : 2000 LSB/’C
- Supply current(1): 10 uA @ 1Hz
- Power down current: 1 uA
- Digital $I^2C$ / 3-wires SPI interface
- Embedded temperature sensor for ambient
- Accuracy ($T_{amb}$) ±0.3°C typ @ -10 ~ 60’C
- Operating wavelength. 5 um to 20 um
- Presence / movement detection up to 4 meter
- 80 deg full field of view (FoV)

(1) Average setting TMOS=128 Temperature=1


**LGA-10L 3.2 x 4.2 x 1.455 mm**

# FlightSense … Making light work

## Time-of-Flight principle




**Measured distance** = Photon travel time / 2 x Speed of light

1mm round-trip takes 6.7ps

- ST proprietary **Flight**Sense™ technology
- True distance measurement
  Independent of target size, color & reflectance
- Fast and low power
- Truly invisible 940nm illumination

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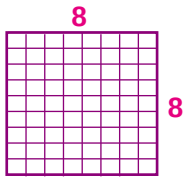
LAF & T2F  Obj detect  Gesture

# VL53L8 | Product introduction

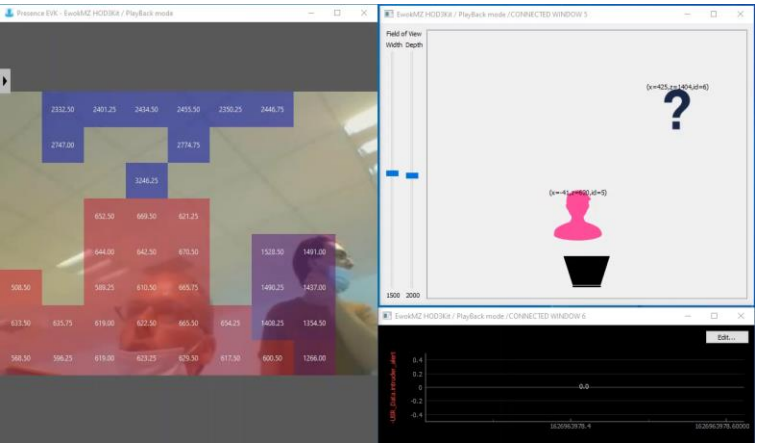
## 2nd gen multi-zone dToF module with on-chip processing

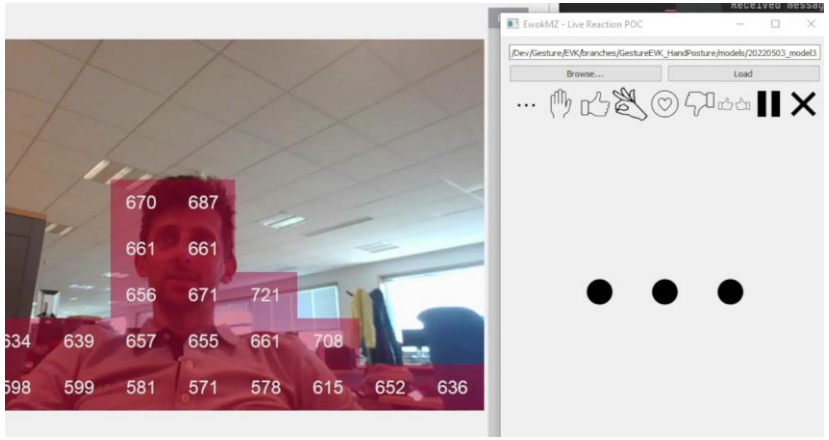
**In mass production**

**Half power** consumption **| Twice as robust** to sun light **| Half host memory** usage
**ST in-house lenses | 1V2 I/O** support










- 4m ranging across the whole FoV
- Excellent close distance linearity from 4 cm
- Automated crosstalk compensation
- Time-of-Flight processing (32-bit MCU)
- I²C & SPI interface: 1V2 & 1V8 I/O
- AVDD: 3V3 | DVDD: 1V8
- 4 x 4 + 4 zones @ 60 fps
- 8 x 8 + 4 zones @ 15 fps

**Light emitter**
- 940nm VCSEL
- Advanced ST in-house DOE
- Class1 laser [IEC 608825-1, 2014]

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# Ambient light sensor (ALS)

## VD6283
### 6 channels ALS + Flicker

Intel C1 certified

Qualcomm certified

- **Smallest color sensor** on the market
- 6 channels from 400 to 1100nm: **R, G, B, IR, Visible and Clear**
- **Lux and CCT information** for screen color and brightness control
- **Light flicker frequency extraction** to remove banding effect on webcam
- **Ultra sensitive** in low light environment

Screen color management

Screen brightness

Camera banding removal

Order code: **VD6283TA45/1**


**Example of ALS:**
Flicker mitigation during video calls

**In mass production**

**Example of ALS:**
Screen brightness based on day & night


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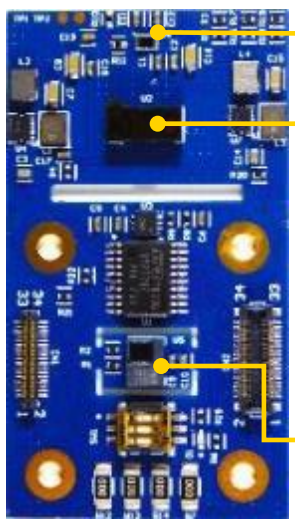
# STEVAL-PDETECTV1 System overview 1/2

## STEVAL-PDETECTV1
## Presence detection add-on for STWIN.box

- Add-on evaluation kit connected to STWIN.box targeting human presence applications
- Enable low power, user privacy, and reduce false trigger with multi-sensor modalities
- **Key sensor products:**
  - **VD6283TX** ambient light sensor
  - **VL53L8CX** proximity sensor
  - **STHS34PF80** far infrared TMOS sensor

## Hardware overview

- Add-on daughter card connection from STWIN.Box which can support up to 3 STEVAL-PDETECTV1 connected simultaneously for multi sensor tracking
- TMOS lens (TMOS63-10) and Tim-of-Flight cover glass (IR136C0-IC09-A066) with example case included in the kit




**Ambient light Sensor (ALS):**
- R, G, B, IR, Visible and Clear

**2nd Gen multi-zone dToF module with on-chip processing:**
- Half power consumption
- Twice as robust to sun light
- 8x8 multizone, up to 4mt, with 65° FoV

**Infrared Thermal Metal Oxide Semiconductors (TMOS) sensor:**
- Non-intrusive presence detection
- Low power (5uA typ @ 1Hz)
- Small and thin

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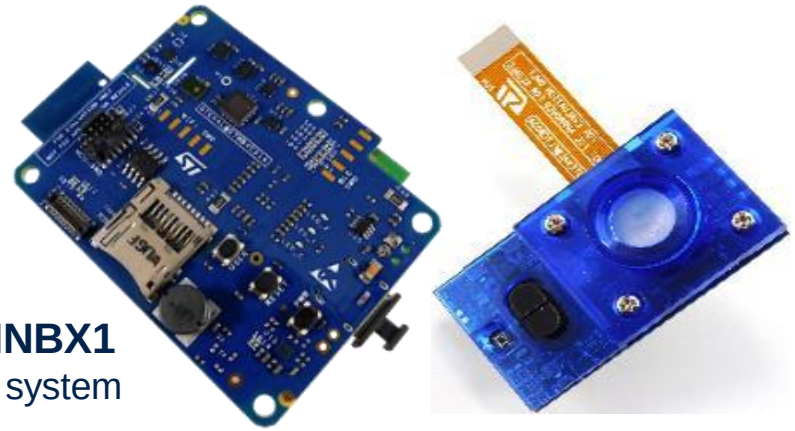
# STEVAL-PDETECTV1
# System overview 2/2

**STEVAL-PDETECTV1**
**Presence detection add-on for STWIN.box**

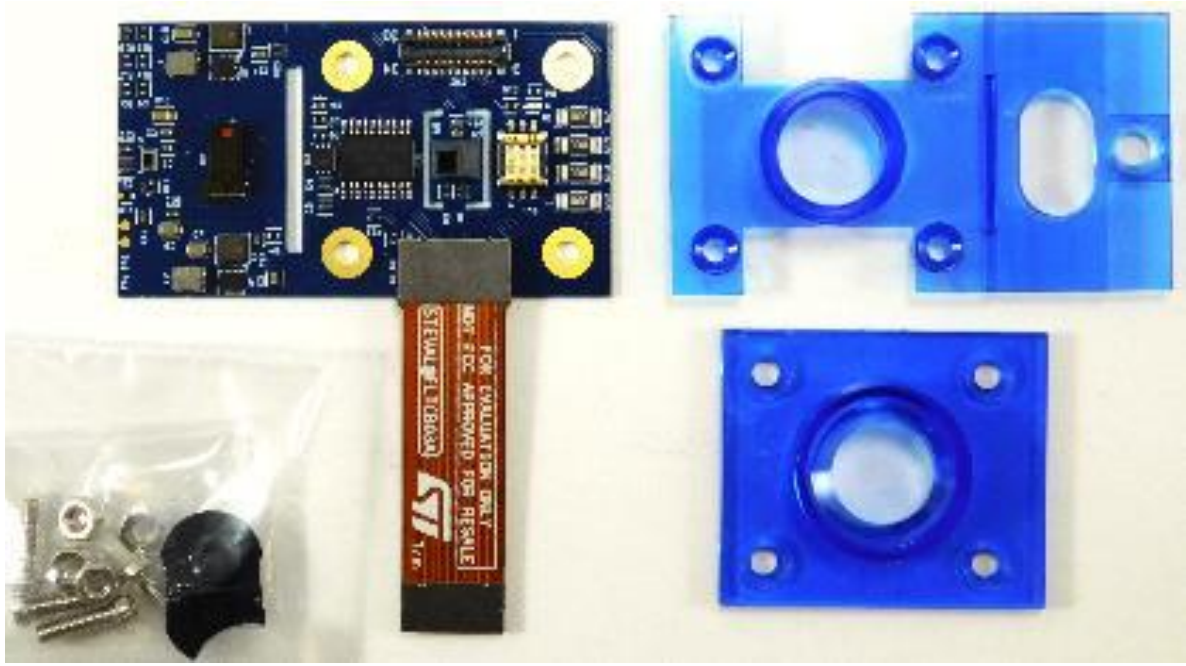
- STEVAL-STWINBX1 STWIN.box (sold separately)
- STEVAL-PDETCS1 board
- TMOS Fresnel lens: TMOS63-10
  - Distance : up to 15 m detection
  - FoV: 10 degree FoV
- TMOS Fresnel lens case: TMOS63-10 holder case
- Time-of-Flight cover glass: IR136C0-IC09-A066
- STEVAL-FLTCB03 flexible cable.



**STEVAL-STWINBX1**
STWIN.box core system

STEVAL-PDETCS1
**STWIN.box extension board**

TMOS63-10
**TMOS lens and plastic case**



STEVAL-FLTCB03
**34 pin 3 cm flex cable**

IR136C0-IC09-A066
**Time-of-Flight cover glass**

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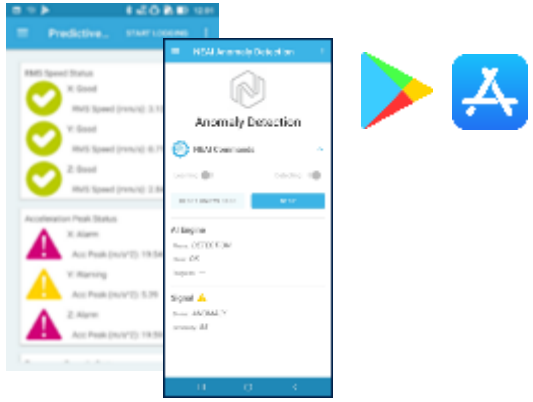
*Sold Separately

# STEVAL-STWINBX1
# Wireless industrial node

## Industrial SensorTile development kit for the next smart edge devices




Azure
IoT Central

*Link: https://www.st.com/en/evaluation-tools/steval-stwinbx1.html*

### Key products

- **STM32U5** Cortex-M33@160MHz 768kB RAM, 2MB Flash
- **ISM330DHCX, IIS3DWB** vibration MEMS sensor
- **IIS2DLPC** ULP axel MEMS sensor
- **STTS22H** Temperature MEMS sensors
- **ILPS22QS** Pressure Sensor
- **Add-ons** with 6 Axis + **ISPU (ISM330IS)** or **IIS3DWB** and Temperature (STTS22H) sensors
- **STSAFE-A110**: security for peripherals and IoT devices

### Key features

- Smart industrial sensor node
- Embedded preprocessing based on AI and Condition Monitoring algorithms enabling Predictive Maintenance
- Distributed AI between ISPU add-on and onboard MCU
- Temperature, vibration and wake-up with MEMS sensor
- STBLESensor App for device management + Azure IoT Central Dashboard
- Data Logging and rich SW ecosystem

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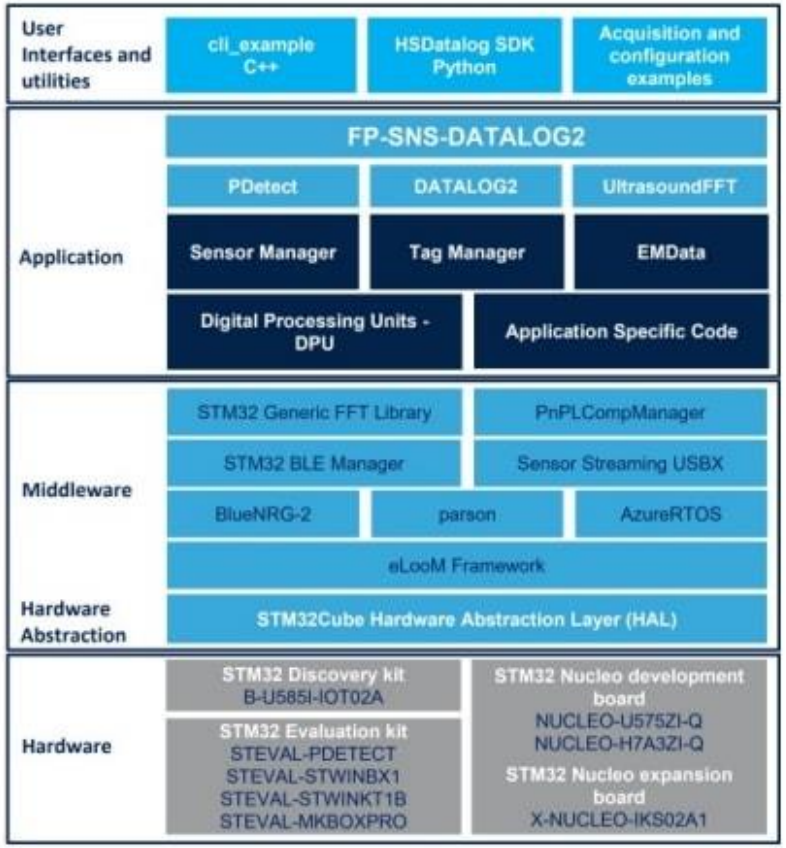
# FP-SNS-DATALOG2
# Firmware package and GUI

- The **FP-SNS-DATALOG2 firmware function pack** provides a comprehensive solution for saving data from any combination of sensors and microphones configured up to the maximum sampling rate.
- It natively supports STEVAL-STWINBX1 with its external addons (STEVAL-PDETECT1 and others).
- Streams the result to a **PC GUI** via USB and a dedicated example for human presence and motion detection (PDetect) for STEVAL-STWINBX1 with STEVAL-PDETECT1
- Mobile App: **ST BLE Sensor**




## Key features

- High-rate (up to 6 Mbit/s) data capture software suite:
  - Dedicated Python SDK, ready-to-use for integration into any data science design flow
  - Compatible with ST BLESensor app for system setup and real-time control
  - Synchronized timestamping and labelling mechanisms common to all sensors
- Firmware modular examples based on eLooM (Embedded Light Object Oriented framework for STM32) to enable code reusability at application level
- Based on AzureRTOS

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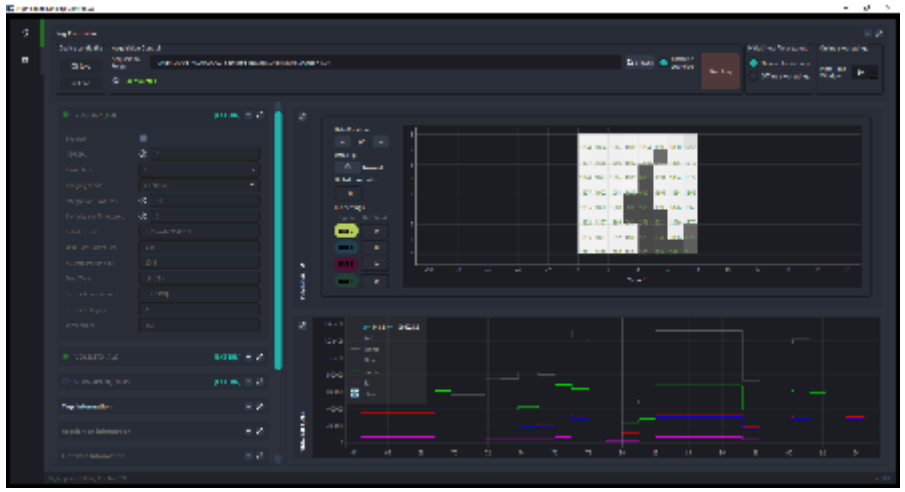
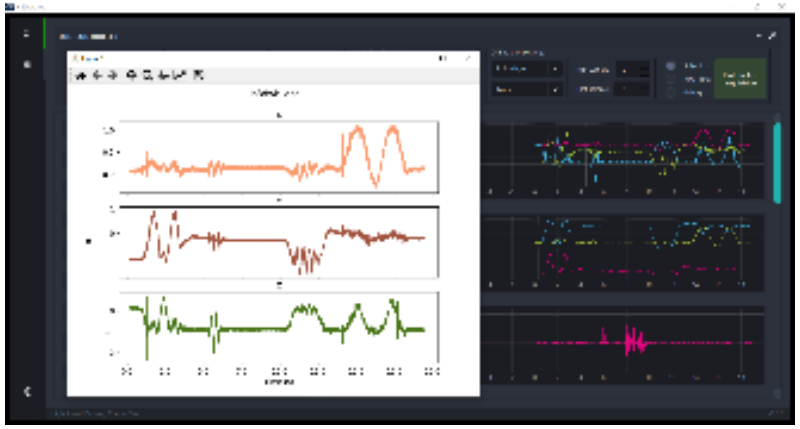
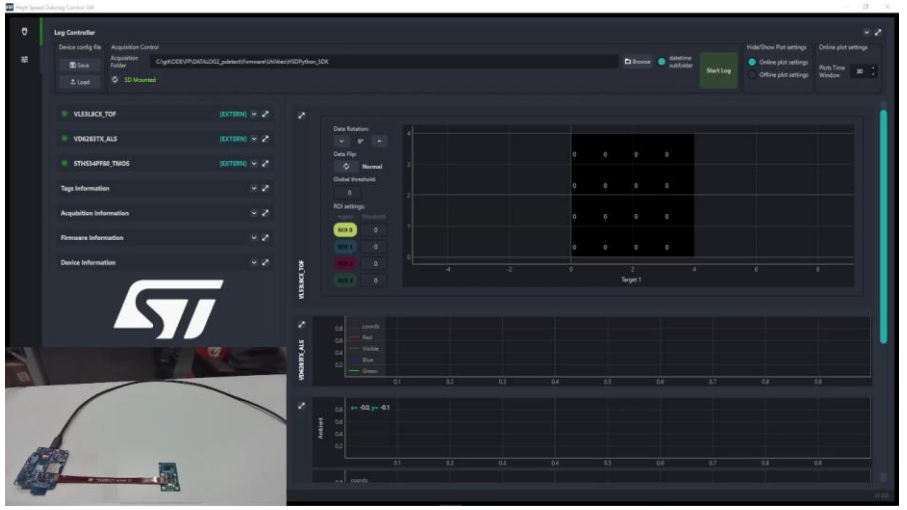
# FP-SNS-DATALOG2
# High speed data logging GUI

- Dedicated Python SDK, ready-to-use for integration into any data science design flow
- Real Time Plot GUI Data logging and labelling from any combination of sensors at up to maximum sampling rate
- Support for STWIN.box + PDETECT1:
  - Data for the Time of Flight sensor is shown in a heat map by zone.
  - Data for the ALS and TMOS sensors are shown as line graphs
- Data from the acquisition is saved in the PC folders
- Companion SW application for PC and Smartphone







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# STEVAL-PDETECT1
# Presence detection solutions

## Application examples

HVAC


Thermostat

Security systems

Room entry detection


Access controls

Smart Light

Room occupancy

## DEMO CES 2024


**CES2024 demo video →**


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# Our technology starts with You



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