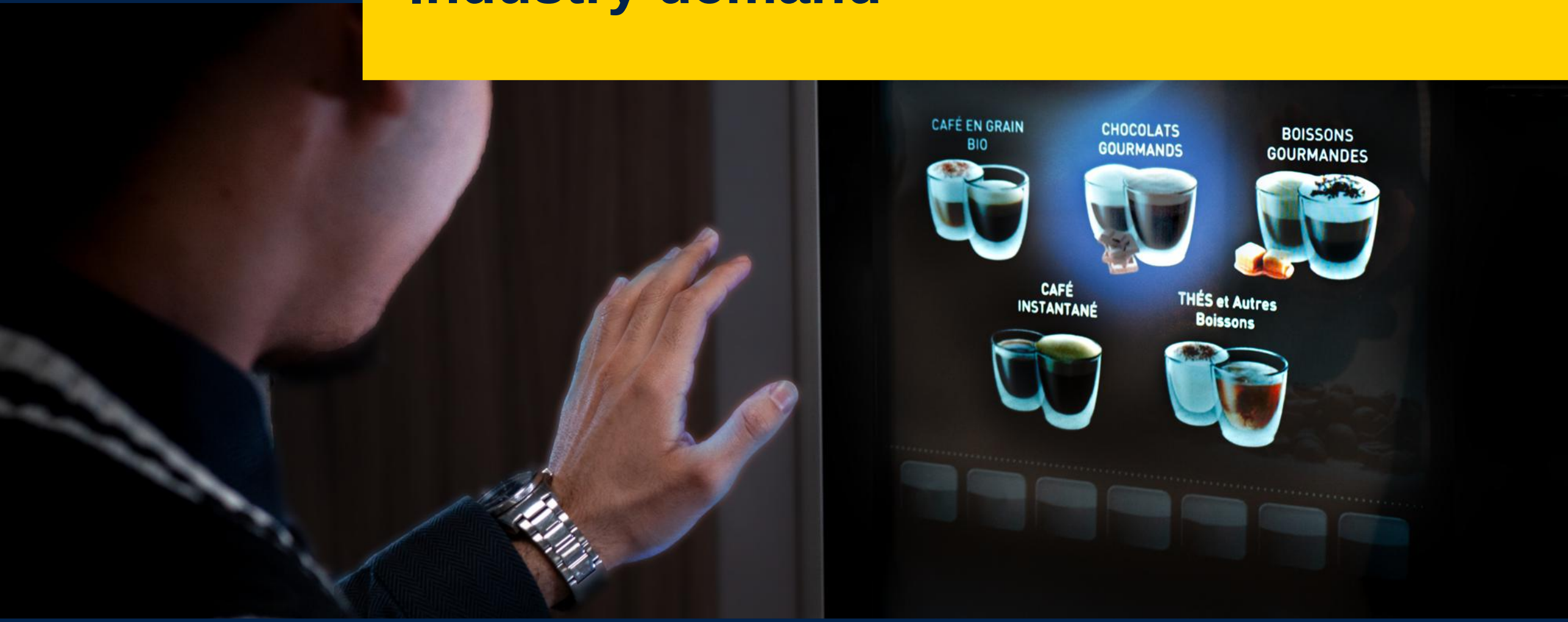
# **Gesture and hand posture recognition AI** based on ST FlightSense technology

11th March 2025

# Speakers’ introduction

# Industry demand



# Evolution in HMI (human-machine interaction)

**Cap to a new world!**

**TODAY**

Touchscreen

Keyboard

Mouse

**Etc.**

**FUTURE**



Wave a hand



Thumb up

**Endless possibilities!**

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# Why gesture and hand posture recognition?

## Revolutionizing HMI

**Improved human-computer interaction**

Reduces reliance on physical input devices like keyboard and mouse

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**Enhanced user experience**

Immersive and interactive experiences

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**Improved sanitation and hygienic**

Minimizes contamination risks

# Why gesture and hand posture recognition?

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**Improved human-computer interaction**

Reduces reliance on physical input devices like keyboard and mouse

**Enhanced user experience**

Immersive and interactive experiences

**Improved sanitation and hygienic**

Minimizes contamination risks

**Efficiency and safety**

Intuitive system control and reduced physical contact

# Gesture & hand posture recognition

**Let's picture it!**

# Unlimited markets

**Innovation**


Thermostats

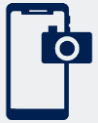
Switch

Service robots

Smart speakers / assistants

Laptops

Tablets



Smartphones

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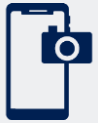
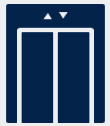

Smartphones

## Hygienic


Digital Signage


Sanitary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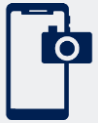
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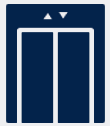
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Kitchen appliances


Industrial robots


Production lines

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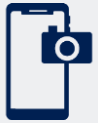
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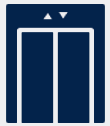
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## Entertainment


Toy robots


Gaming


AR/VR

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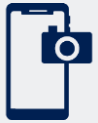
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**Hygienic**


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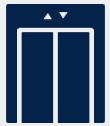
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**Safety**


Kitchen appliances


Industrial robots


Production lines

**Entertainment**


Toy robots


Gaming


AR/VR

**Personal electronics, home appliances, industrial systems, robots & toys**

**+ Many more…**

# Exploring the hardware & software

# Turnkey solution portfolio

## A complete ecosystem in an all-in-one solution

**One ToF sensor**


VL53L7CX

or

VL53L8CX

**One FREE software**

STSW-IMG035

**One turnkey solution**

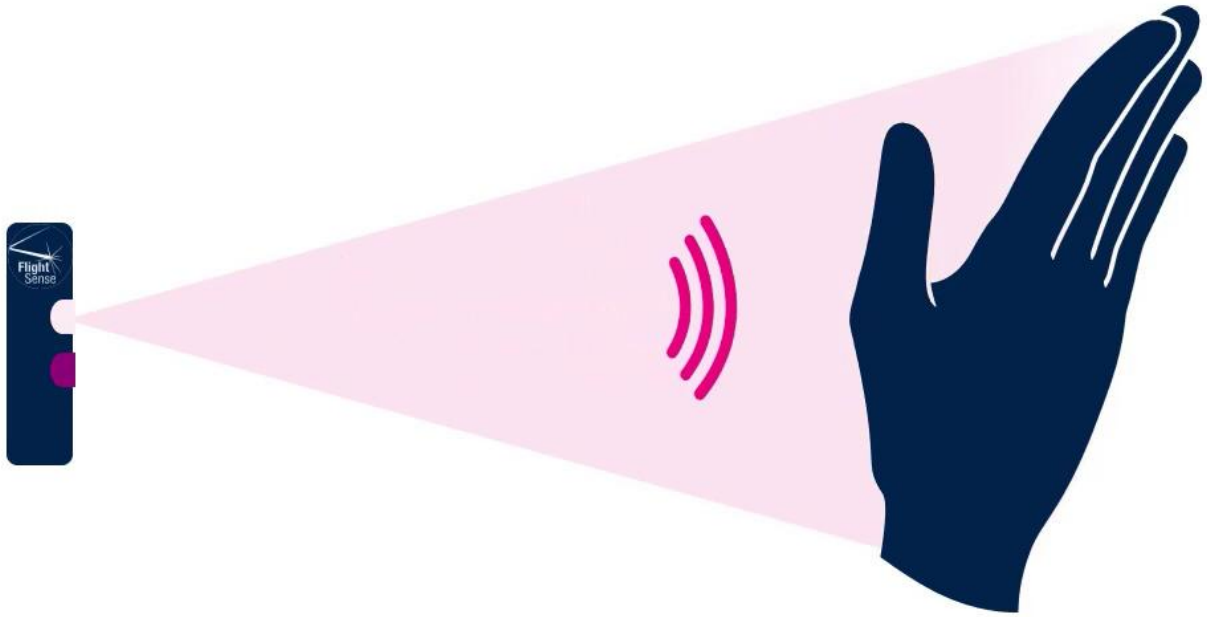
Ready to use!

# Deep dive in Time-of-Flight sensors


life.augmented

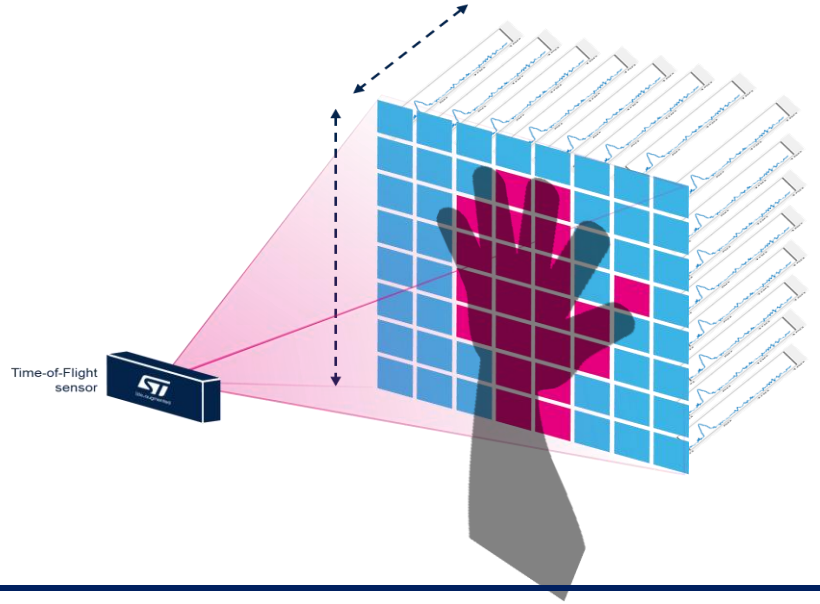
# FlightSense & Multi-zone ToF principle

## Time-of-Flight Principle




## Multizone ToF Principle

A multi-zone Time-of-Flight sensor divides the field of view into multiple zones, allowing it to capture depth information from several points simultaneously.



# Multi-zone FlightSense ToF benefits

## Cost-effective

- ✓ **Inexpensive** sensor, system architecture, and development
- ✓ **Short timeframe** easy to integrate, all-in-one solution

## Low power consumption

- ✓ **Low power ToF** compared to other technology
- ✓ **Light gesture algorithm** can be run on low-power MCU

## Low processing complexity

- ✓ **Light data flow** unlike radar & camera
- ✓ **General purpose MCU** already embedded in most architecture

≠ Radar

## Independent

- ✓ **Not subject to external factors:** target color, shape & size

≠ Traditional infra-red

## Privacy

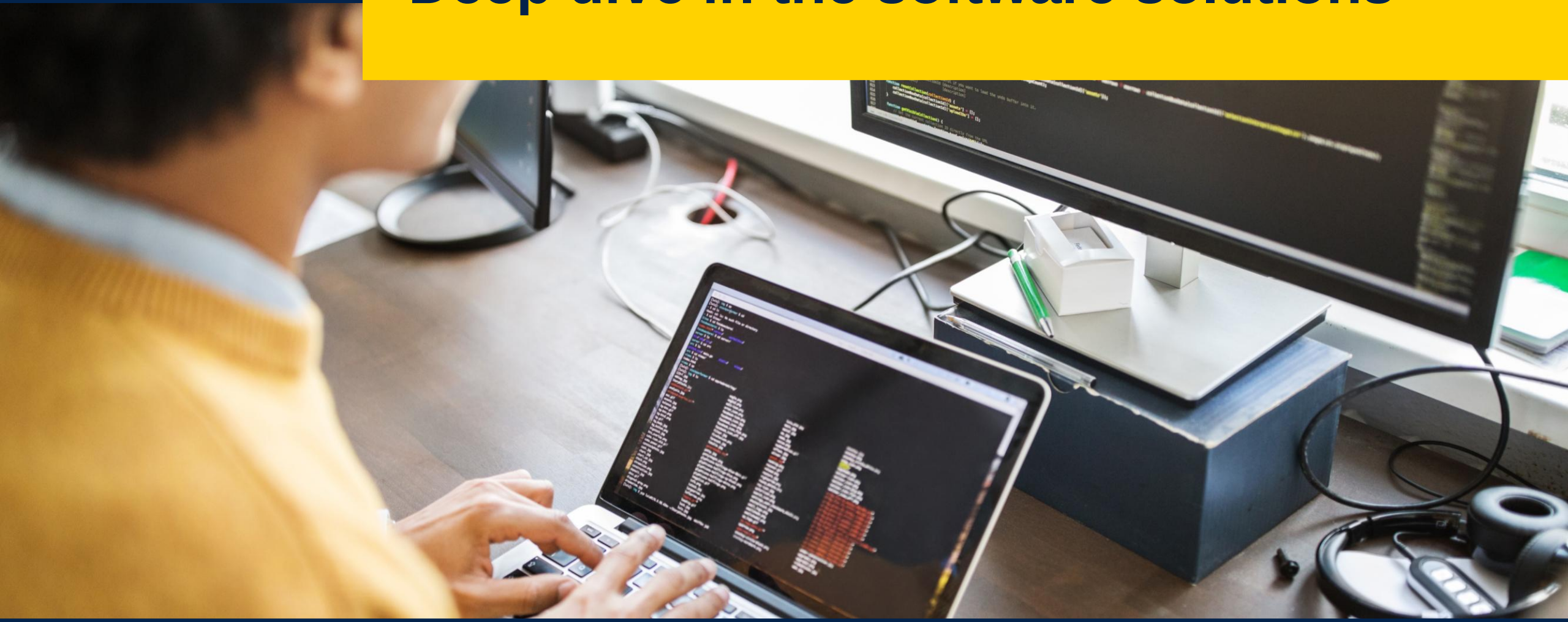
- ✓ **No image** only multiple distance measurement

≠ Camera

# Compatible with two multi-zone ToF sensors

| | | VL53L7CX | VL53L8CX |
|---|---|---|---|
| | |  |  |
| **Field of view** | | **60° x 60° (90° diagonal)** | 45° x 45° (65° diagonal) |
| **Resolution** | | Up to 8x8 (64 zones) | |
| **Common features** | | Autonomous low power mode | |
| **Additional features** | | | **External synchronization pin** |
| **Driver** | | 100% compatible | |
| **Interfaces** | | I²C (1 MHz) | I²C (1 MHz) and **SPI** (3 MHz) |
| **Distance ranging** | Dark condition | 350 cm | **400 cm** |
| | Under ambient light* | 65 cm | **285 cm** |
| **Power consumption**** | | 4.5 mW | **1.6 mW** |
| **Module size** | | **6.4 x 3.0 x 1.6 mm** | 6.4 x 3.0 x 1.75 mm |

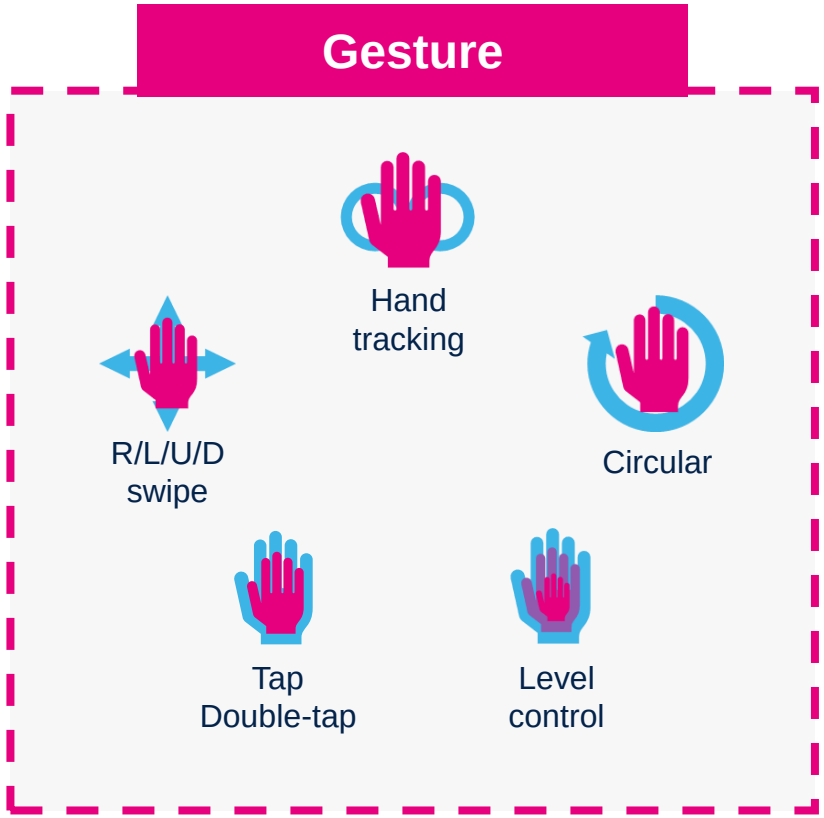
# Deep dive in the software solutions



life.augmented

# Turnkey solution portfolio

## Two ST solutions for contactless HMI




MOTION Algorithm

# Turnkey solution portfolio

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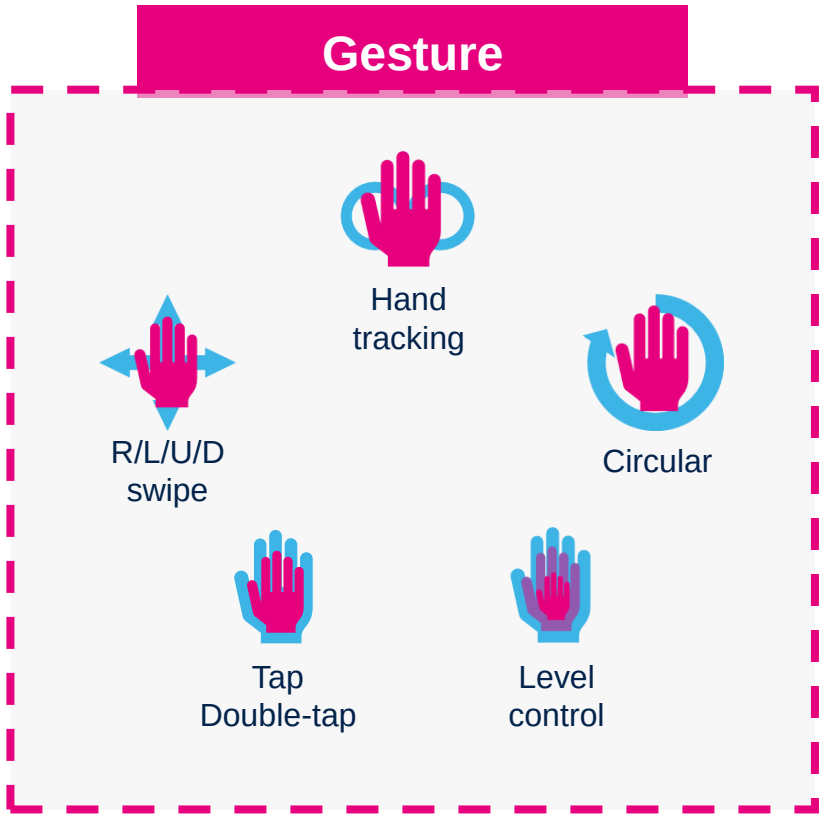
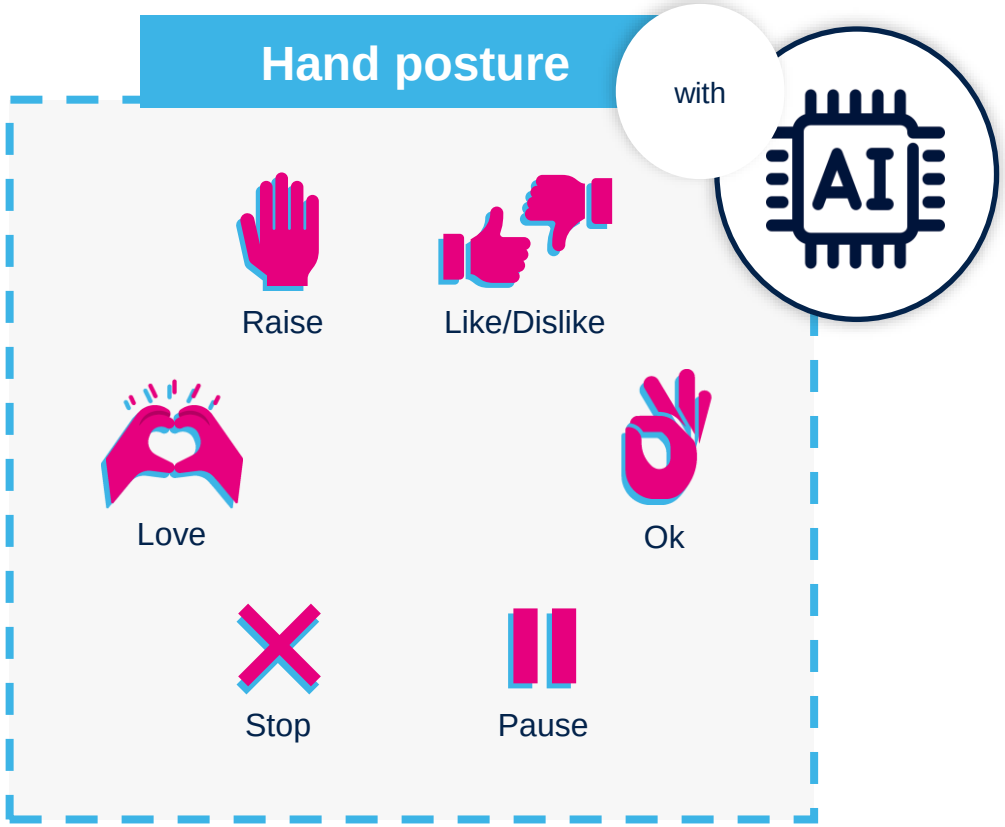


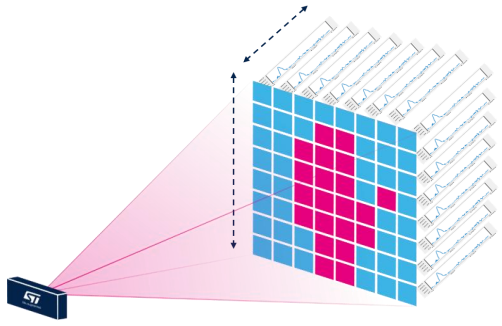

**MOTION** Algorithm

**POSTURE** Processing

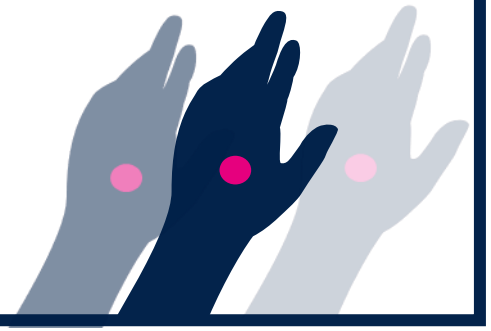
# Gesture recognition software principle

**Natural human interaction enabler**

1 Sensor data extraction



2 Hand tracking



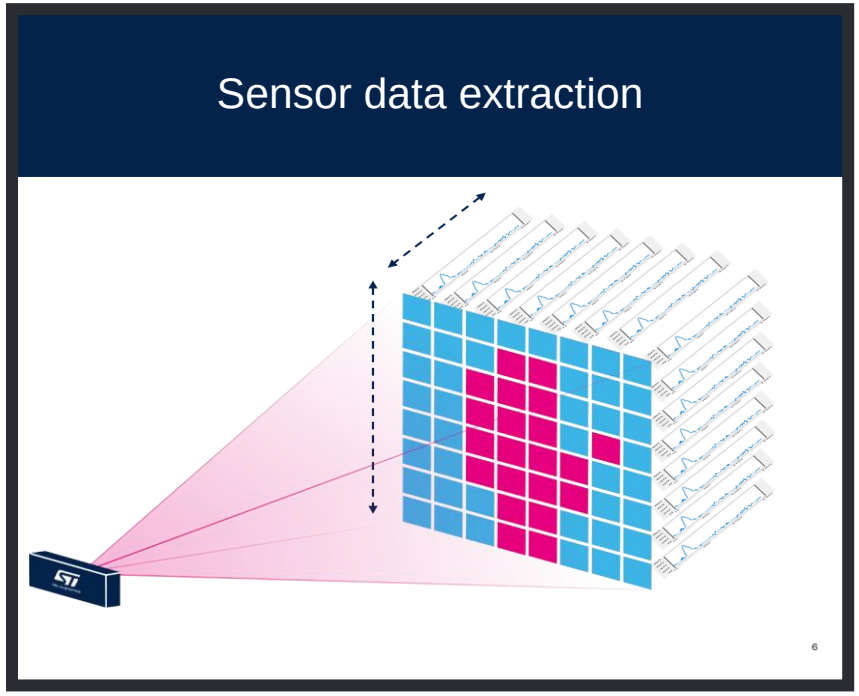
3 Associating motion with gesture

“Left”

4 Application control

“Next picture”

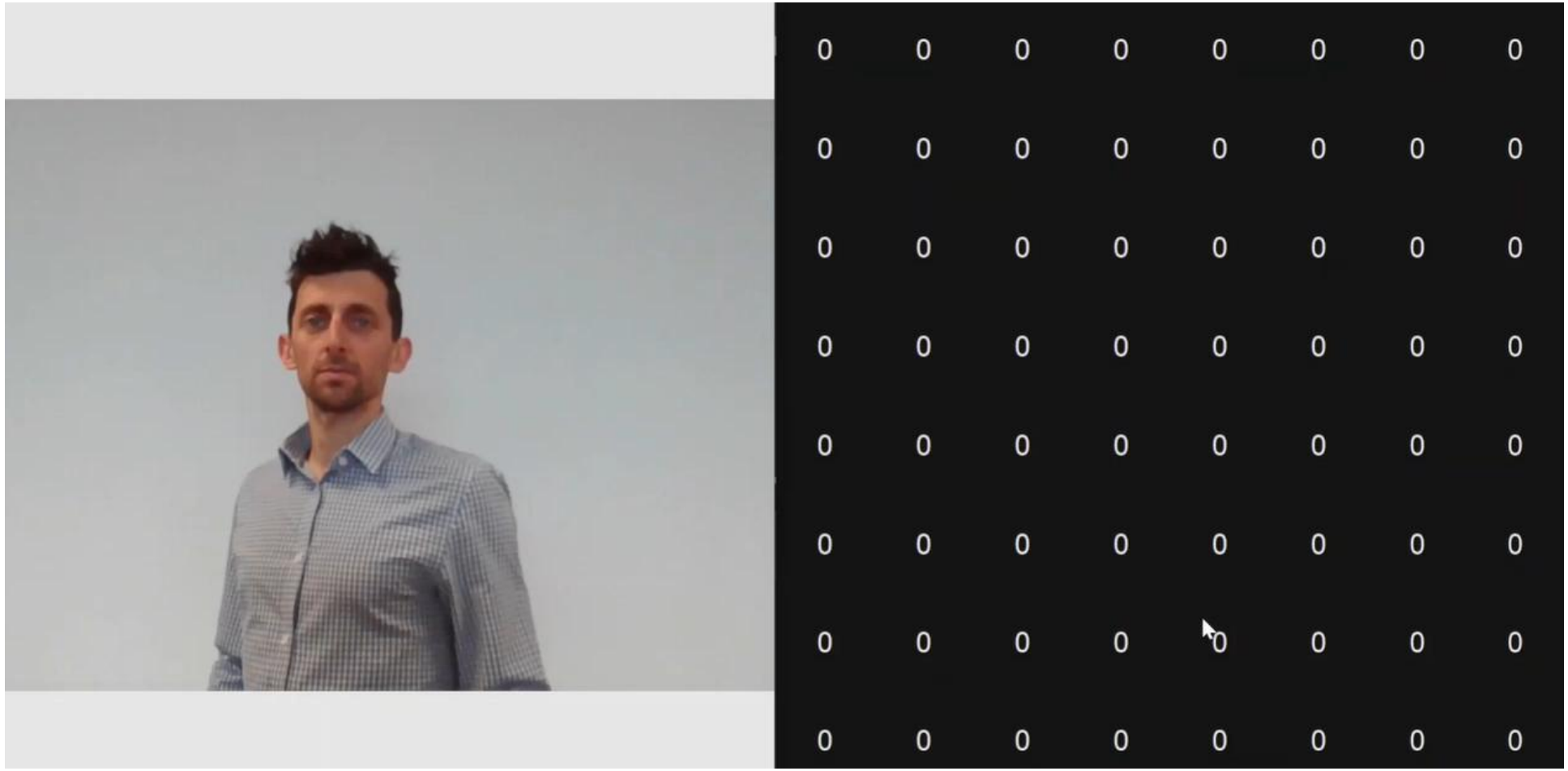
# Step 1: Data extraction via ToF sensor




**Using multizone Time-of-Flight sensor data:**

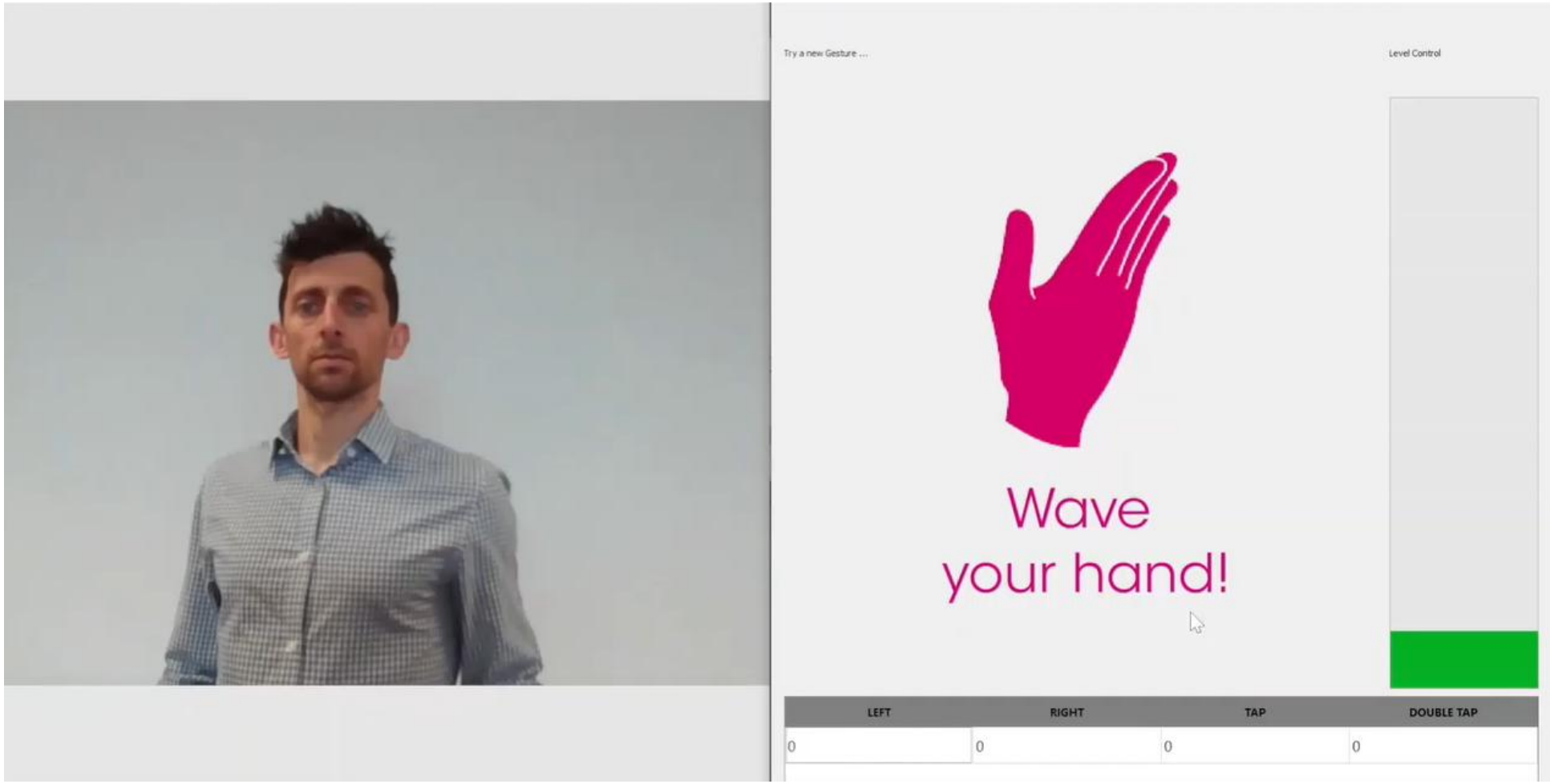
- Distances for each zones
- Signal (quantity of photons)

# Step 2: Hand tracking

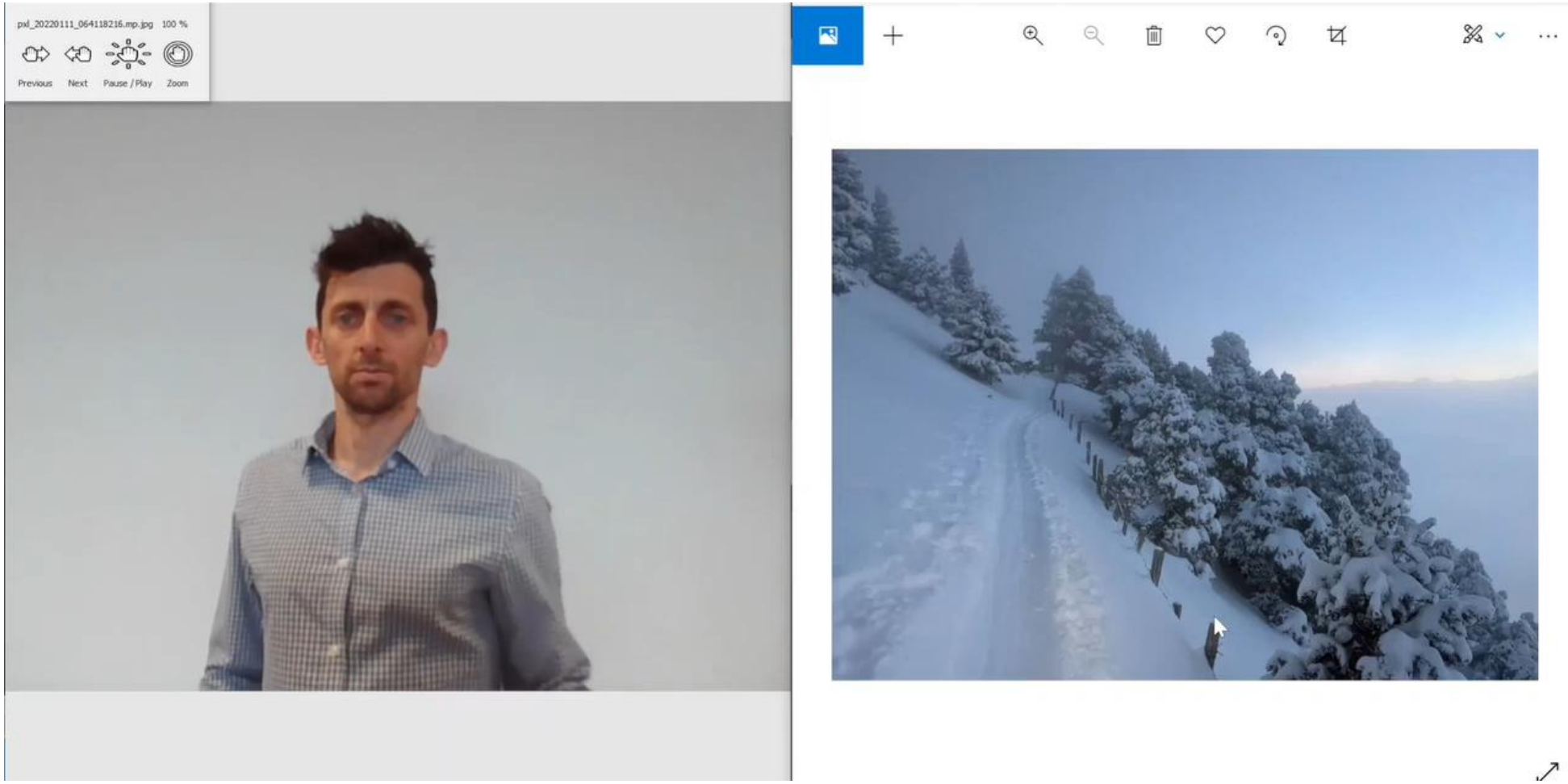



*using the ST Gesture_EVK*

# Step 3: Gesture recognition



# Step 4: Application control

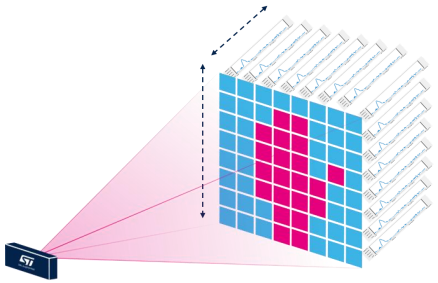



*using the ST Gesture_EVK*

# Hand posture AI workflow

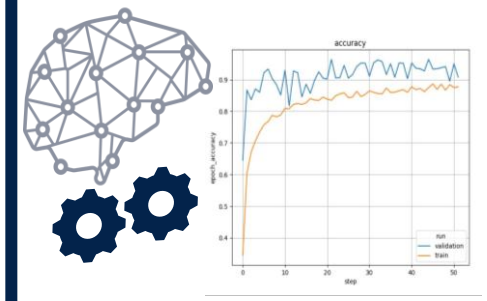
**Well known AI flow applied on hand posture recognition**

1 Sensor data extraction

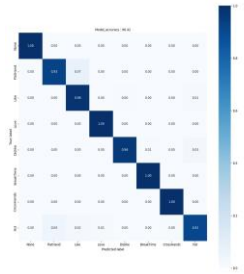


2 Dataset collection


3 Model training




4 Model evaluation

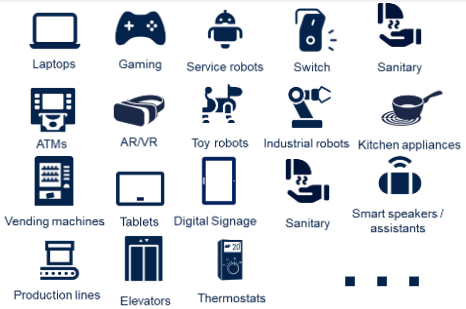


5 Deployment

STM32 Open Development Environment

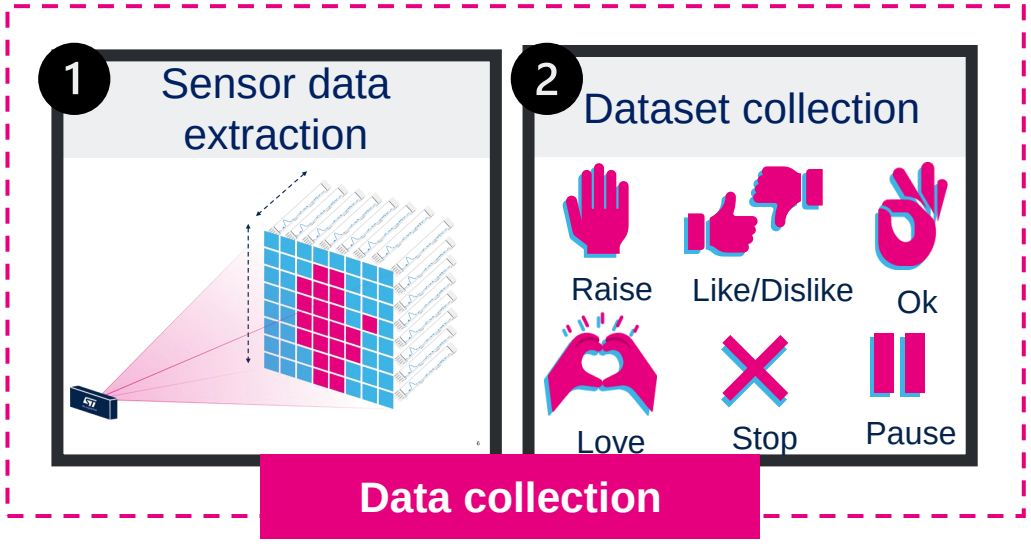
STM32 Cube.AI

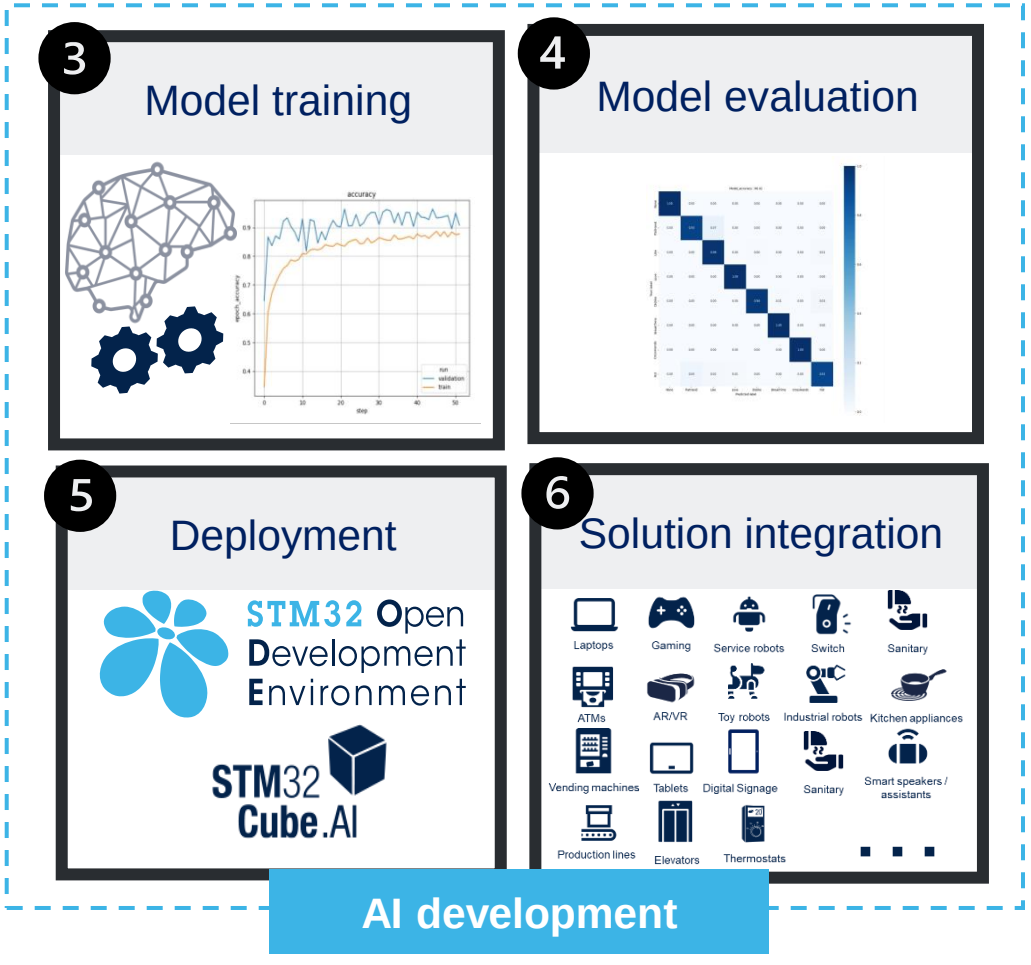
6 Solution integration



# Hand posture AI framework

## A comprehensive ST AI framework based on 2 tools

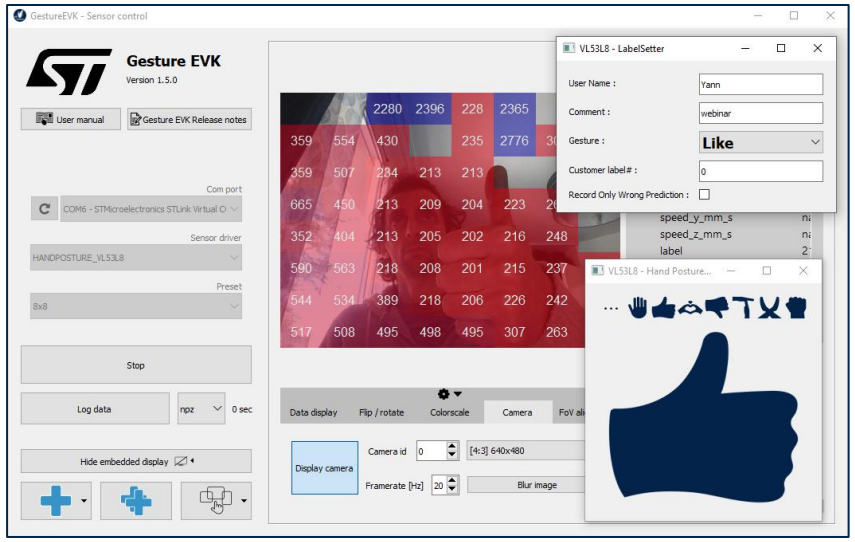


# Hand posture AI framework

## A comprehensive ST AI framework based on 2 tools

### ❶ + ❷ Gesture EVK GUI



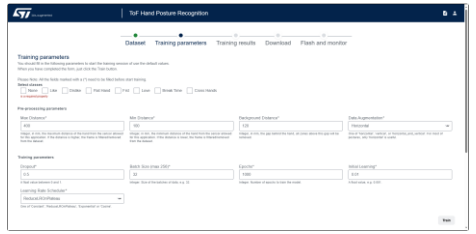

**Data collection**

### ❸ ❹ + ❺ ❻ ST model zoo and web app

GitHub

- AI Python scripts
- ST public dataset
- Model topologies

**Hand posture Web app**
User interface



**AI development**

# Demo

**Create your own hand posture solution in less than 10 minutes**

The application

1. Collect data
2. Organize the dataset
3. Train the model
4. Evaluate the model
5. Deploy the solution
6. Test your application
7. Enhance your model

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# Create your hand posture solution

1 2 3 4 5 6 7

## Collect data

# Create your hand posture solution

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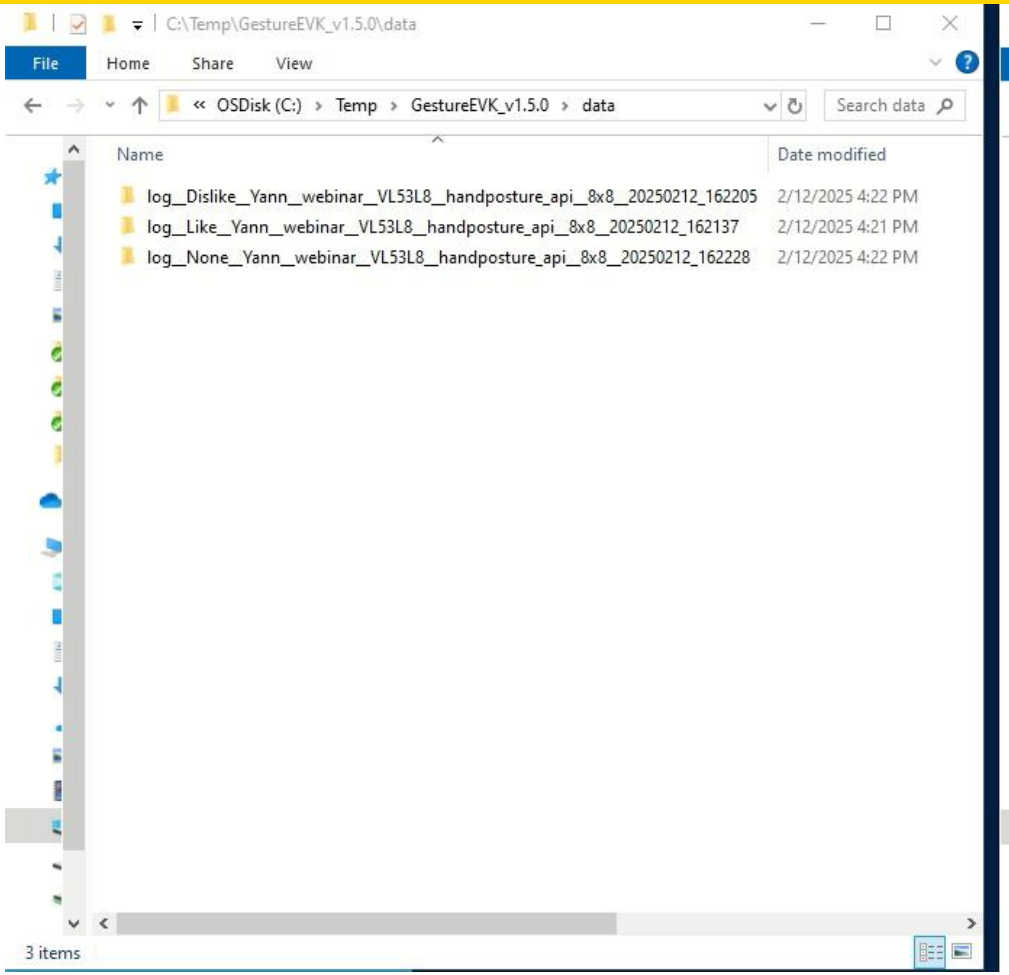
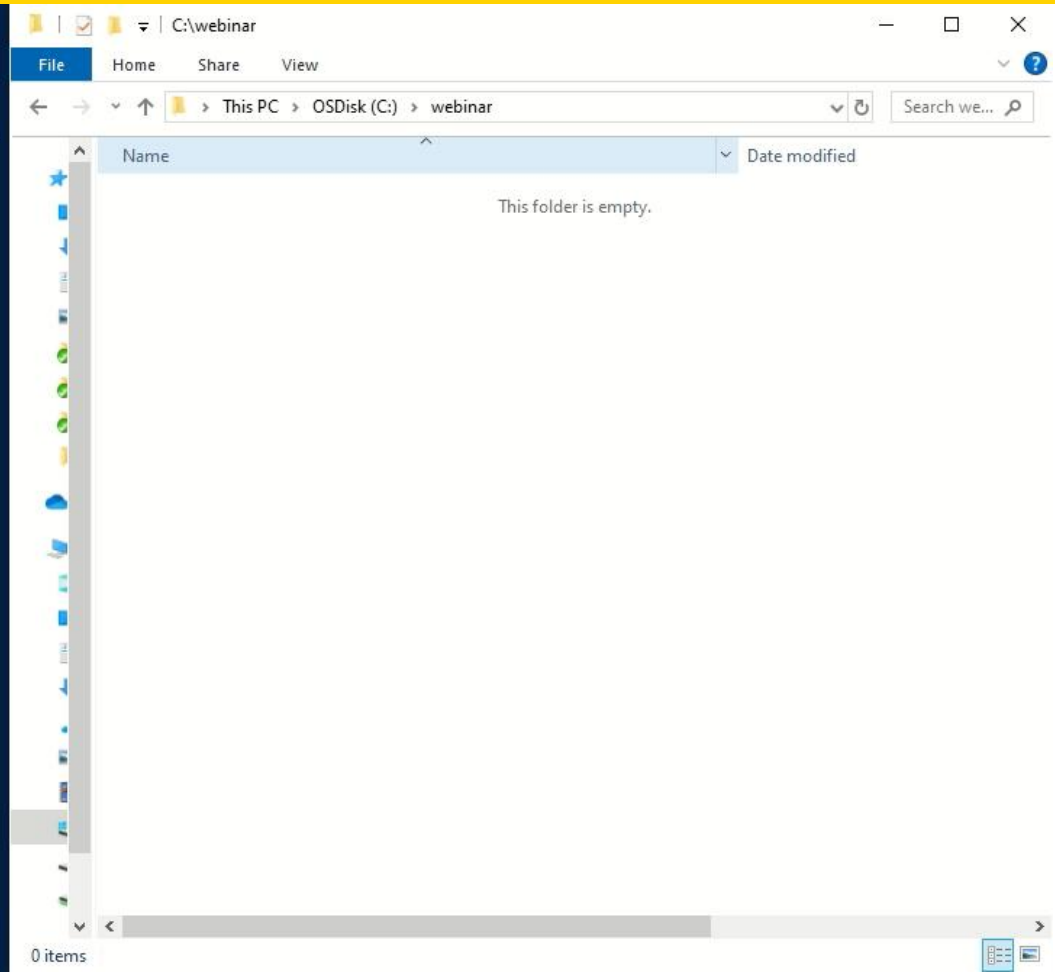
## Organize the dataset

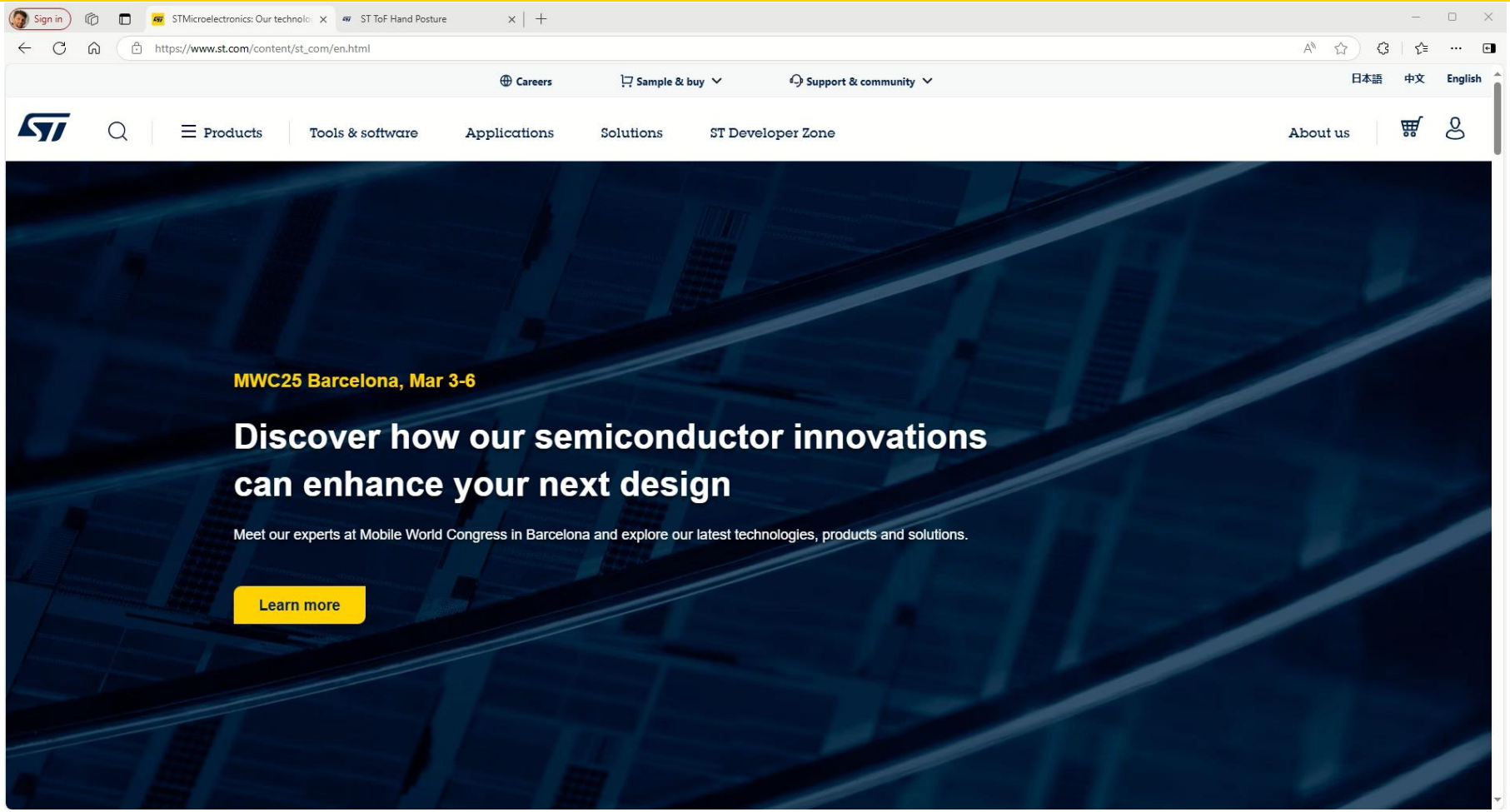


# Create your hand posture solution

1 2 **3** 4 5 6 7

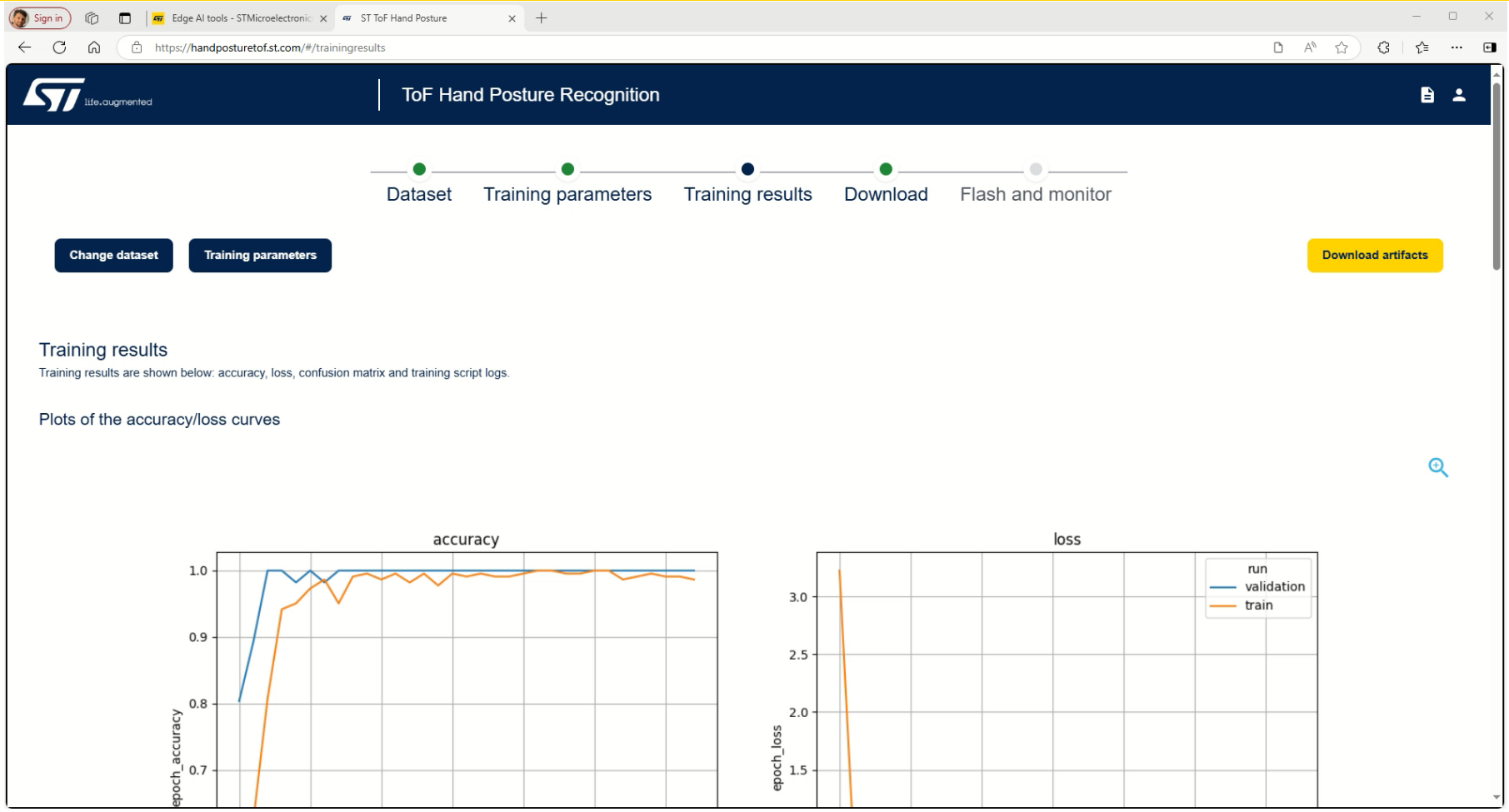
## Train the model



# Create your hand posture solution

1 2 3 **4** 5 6 7

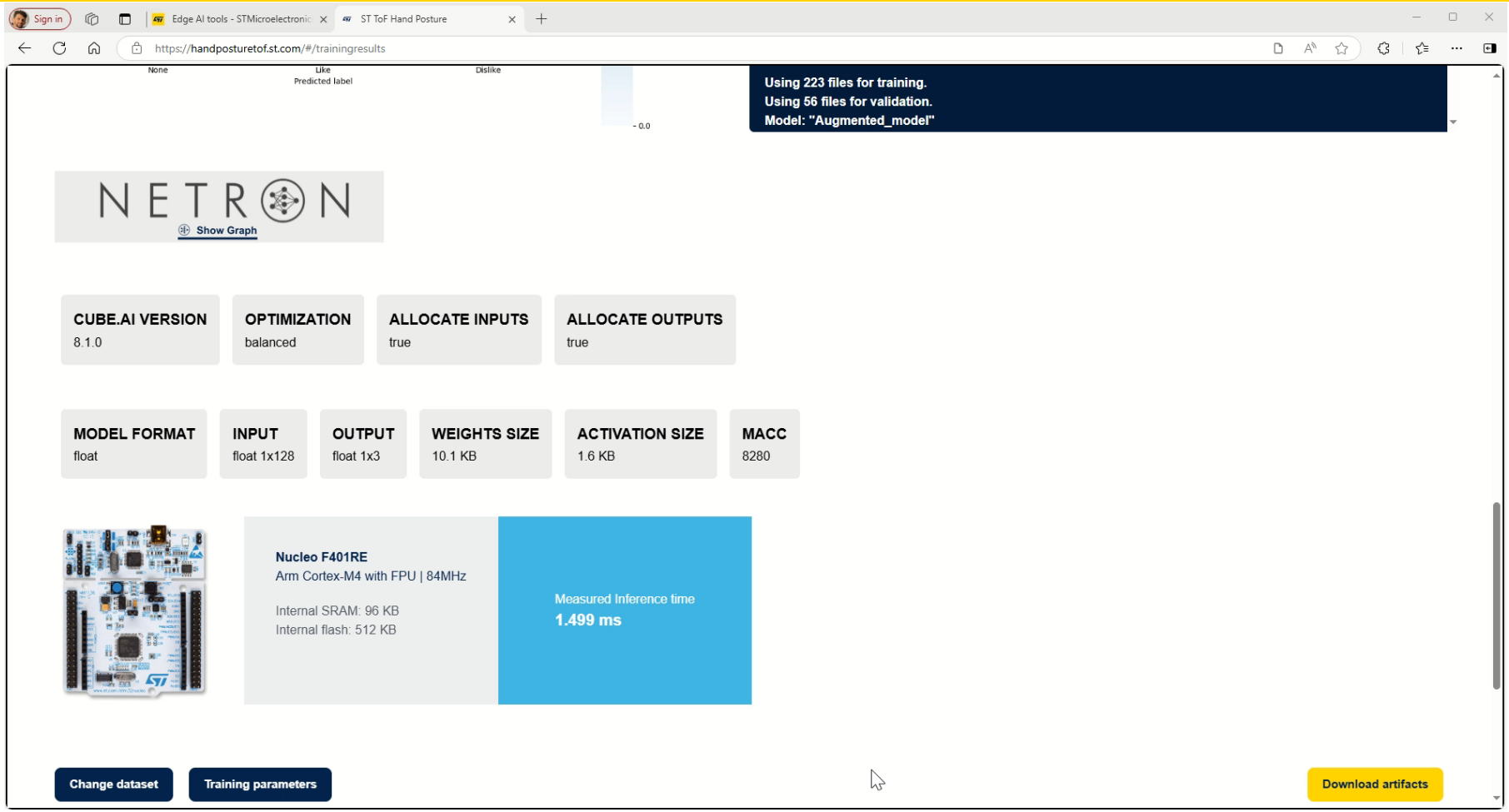
## Evaluate the model



# Create your hand posture solution

1 2 3 4 **5** 6 7

## Deploy the solution



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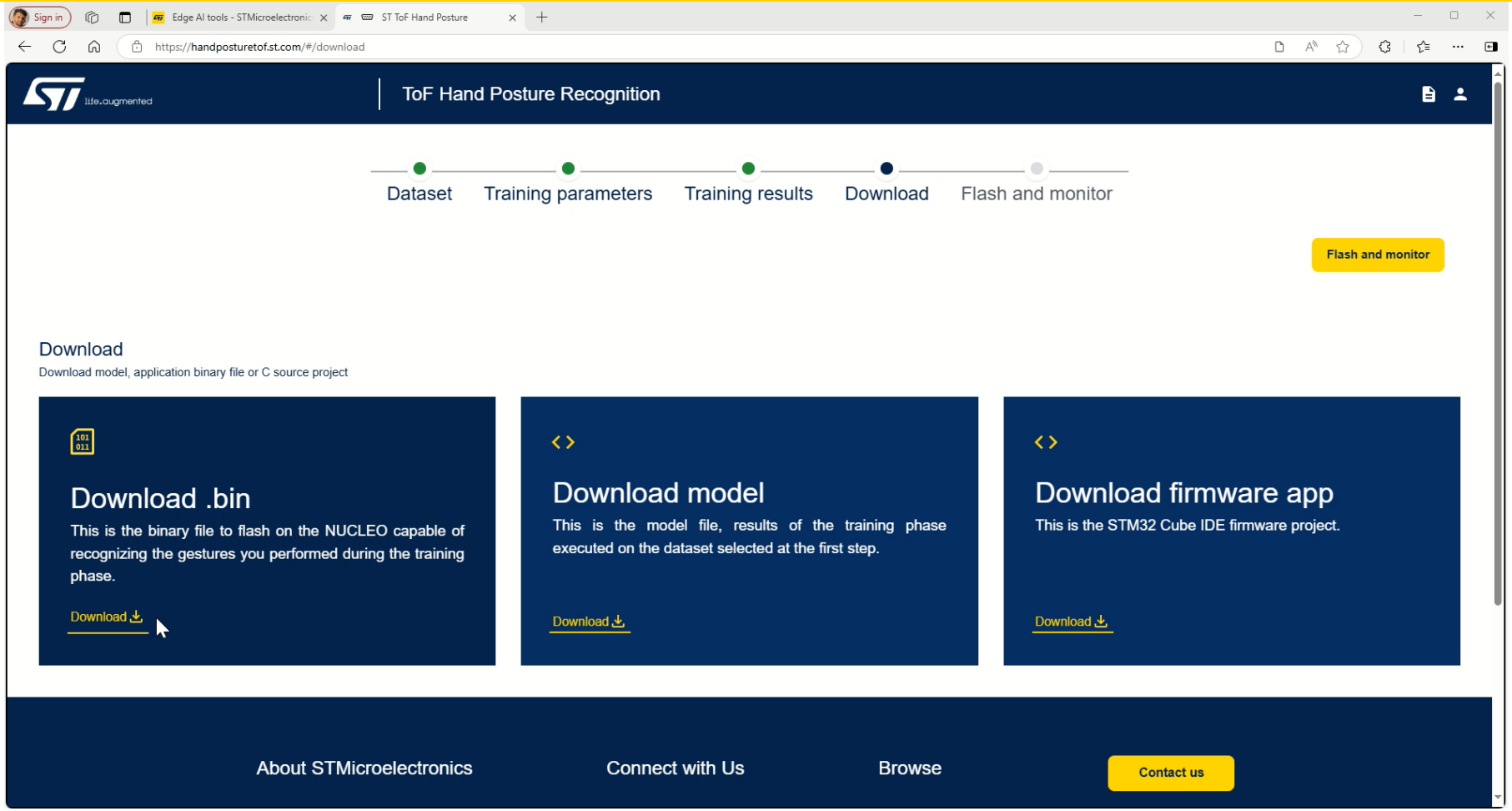
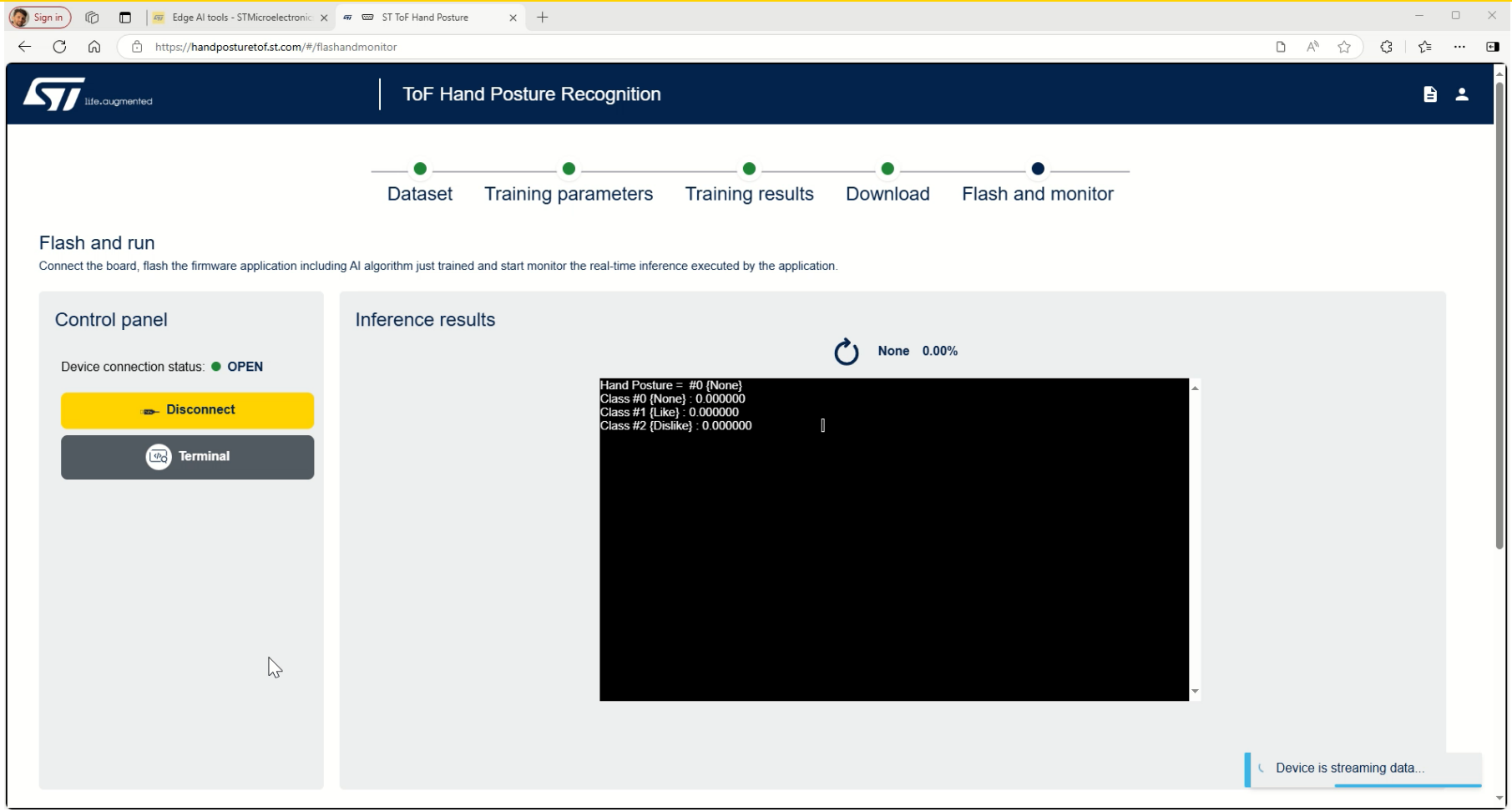
## Test your application



# Create your hand posture solution

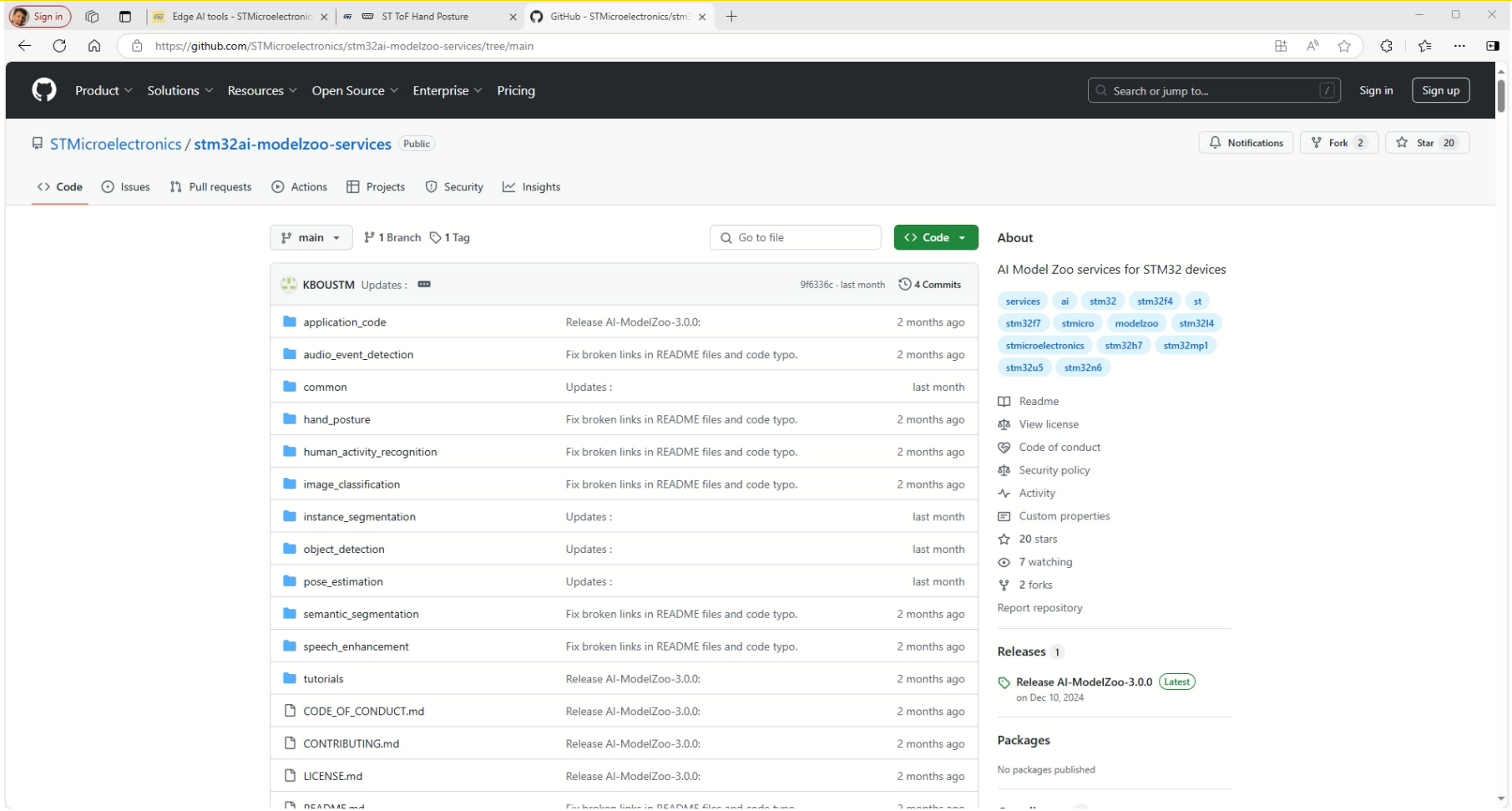
1 2 3 4 5 6 **7**

## Enhance your model



# Quick visit to the ST GitHub model zoo

## ST Modelzoo

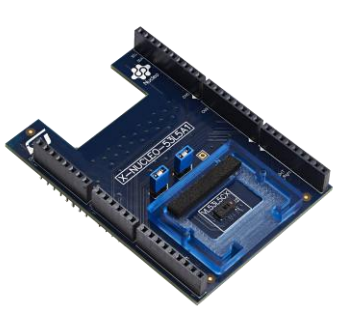


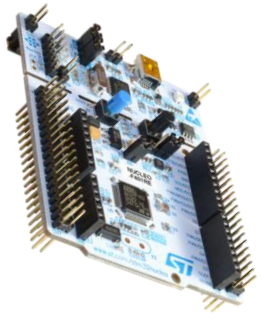
# What is available today?

# Get started with your development

## Where to find all the resources

### Hardware
ToF, X-NUCLEO, STM32



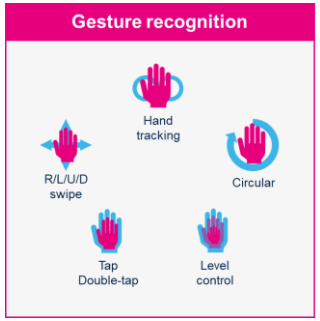


**VL53L7CX** Link

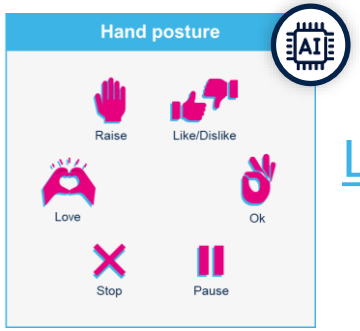
**VL53L8CX** Link

+

### Software links




Link




Link

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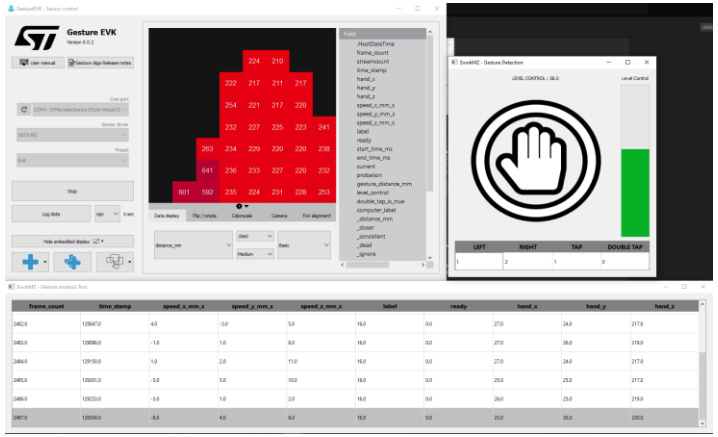
Evaluate our solution

### STSW-IMG035
GUI Gesture EVK



# Conclusion

# ST Gesture & hand posture recognition summary

## Market leader in ToF with key benefits

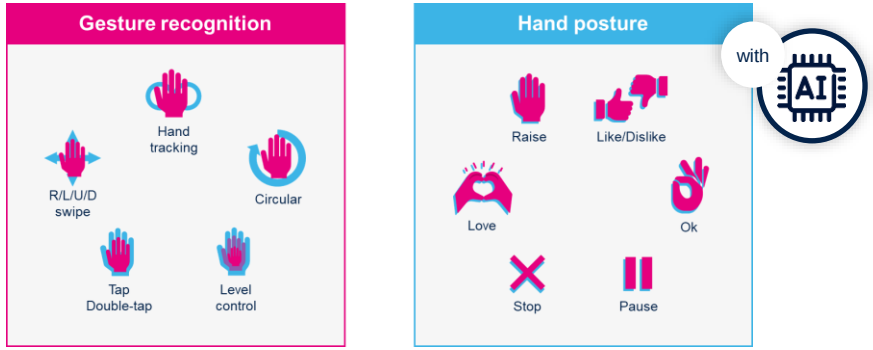
Flight Sense = 1st

**VL53L7CX**
- **90° wide FoV**
- Up to 350 cm ranging

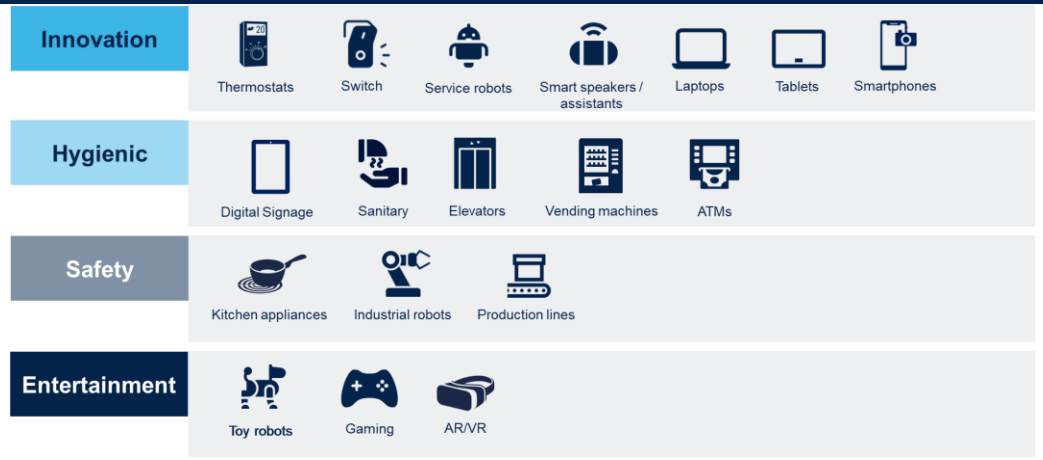
**VL53L8CX**
- **Ambient light immunity**
- **Low power**
- 65° wide FoV
- Up to 400 cm ranging

- 100% privacy (no camera, no image)
- Easy integration due to all-in-one module
- Low cost
- Robust

## Two unique software solutions




## Unlimited markets & applications




## Evolving roadmap

**Current**

VL53L7CX
VL53L8CX

**Future**

3DToF: VL53L9CX

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