



life.augmented

FlightSense ST time-of-flight ranging sensors

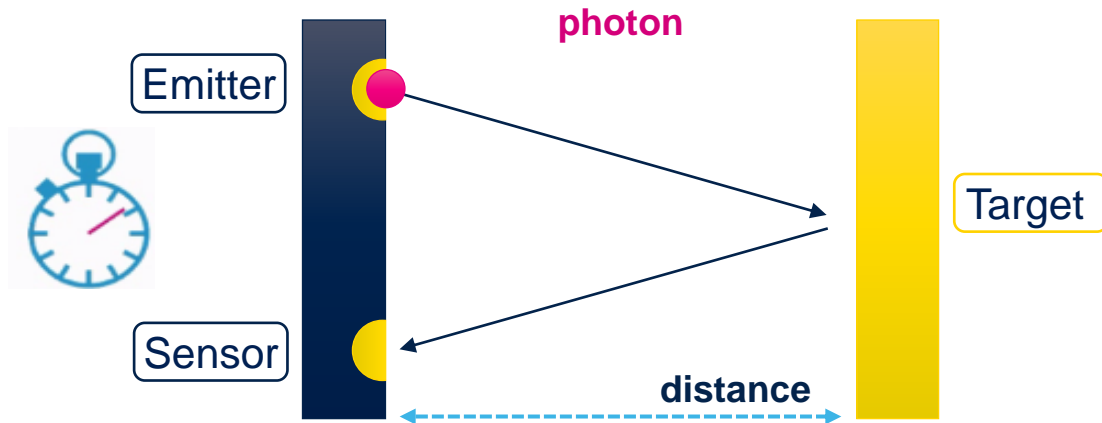
ST Imaging Division

서필기 부장



FlightSense* ... Making Light work

Time-of-Flight Principle



$$\text{Measured distance} = \text{Photon travel time} / 2 \times \text{Speed of light}$$

1cm round-trip takes 67ps

● ST proprietary FlightSense technology

● True distance measurement
Independent of target size, color & reflectance

● Fast and low power

● Truly invisible 940nm illumination



FlightSense typical module overview

All-in-One (illumination & sensor) Time of Flight System
→ **Optimized Size/ Perf/ Cost mix**

Advanced optics with
integrated IR filter

State-of-art assembly & testing
manufacturing ST line in SHZ

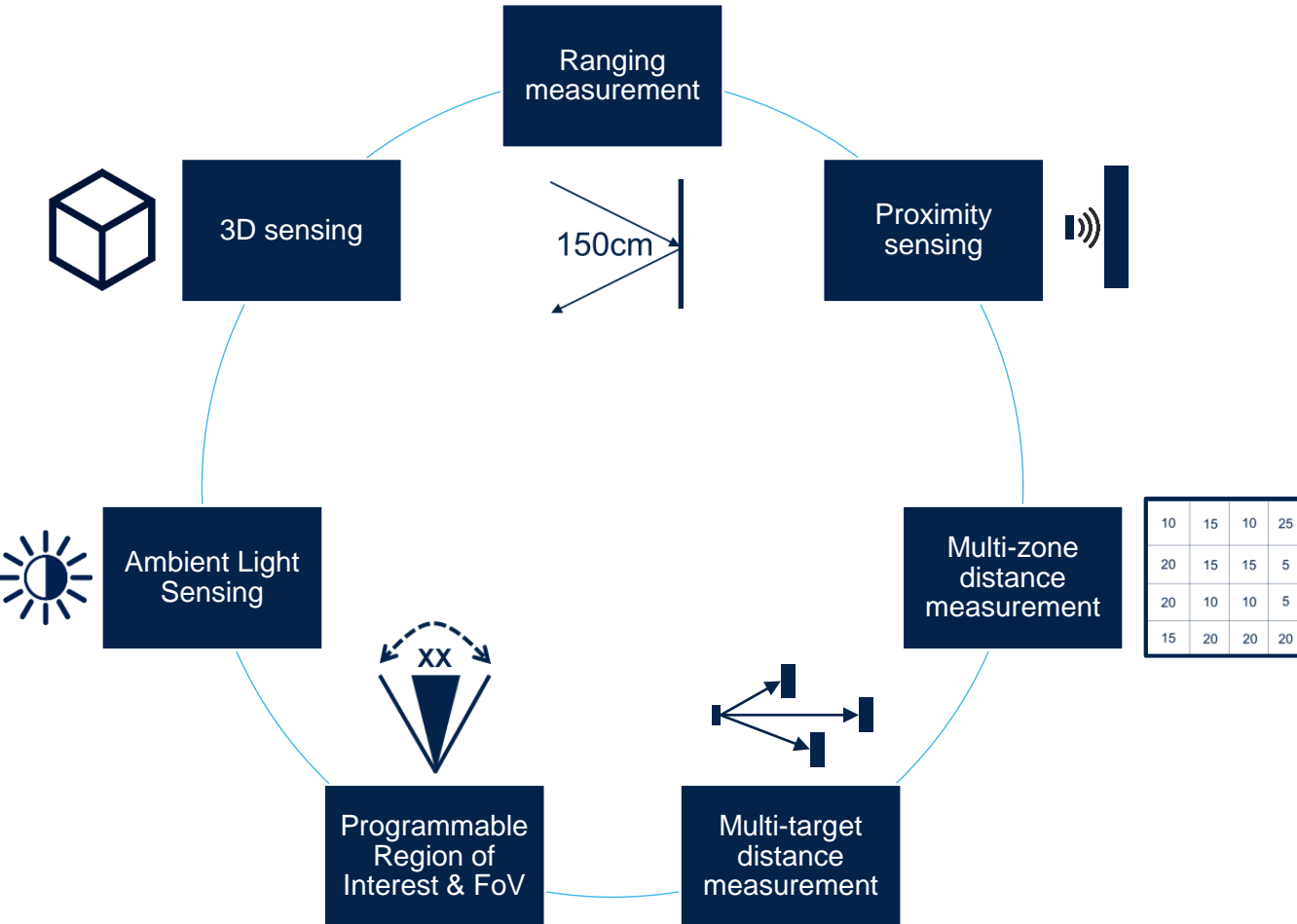


Monolithic ToF SoC, SPAD Array, RAM/ROM
& powerful Class1 VCSEL driver

High power VCSEL
Full Class 1 safety



FlightSense sensors main functions






Enabling multiple Use-Cases :

- Touchless Button
- System Activation
- Eye Protection
- Occupancy Detection
- Power Saving (Presence)
- Auto Display Brightness
- Crop/plant/food health
- Inventory Management
- Autofocus
- Biometric/User Distance Assist (Auto Intensity Adjustment)
- Content Level Monitoring
- Liquid Level Monitoring
- People Counting
- Keystone Correction
- Obstacle Avoidance
- Wall Tracking
- Cliff Detection
- Ceiling Detection
- Floor Mapping
- Floor Material Detection
- Bar Code Reading
- Gesture Control
- Face Identification
- Posture Control

To develop unlimited Markets...

New products

VL53L7CX and VL53L8CX

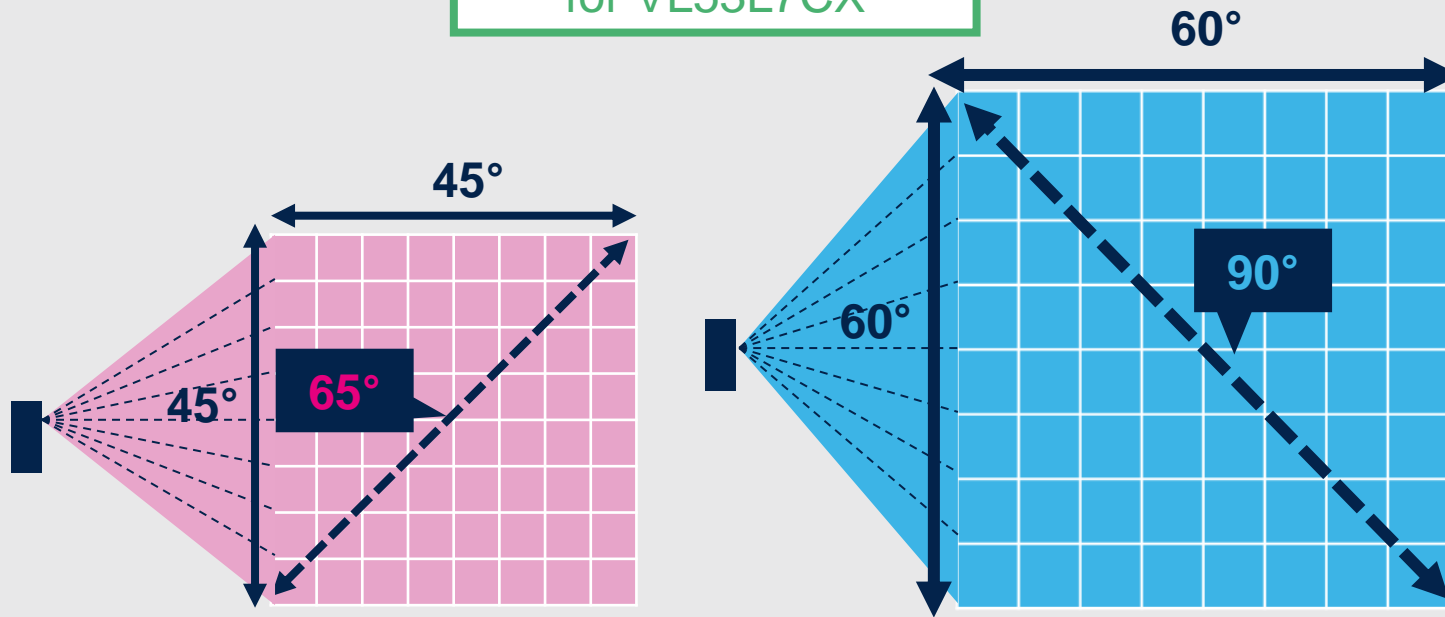
	 VL53L5CX 45° x 45° (65° diag.)	 VL53L7CX 60° x 60° (90° diag.)	 VL53L8CX 45° x 45° (65° diag.)
Field of view			
Resolution	8x8 and 4x4		
Processing mode	Histogram		
Common features	Autonomous low power mode Motion indicator Crosstalk immunity >60 cm		
Additional features			Auto-stop External synchronization pin
Driver	100% compatible		
Module size	6.4 x 3.0 x 1.5 mm	6.4 x 3.0 x 1.6 mm	6.4 x 3.0 x 1.75 mm
Interface	I ² C	I ² C	I ² C and SPI
Distance ranging	Dark condition* 400 cm	350 cm	400 cm
	Under ambient light* 170 cm	65 cm	285 cm
Power consumption**	4.5mW	8.3mW	1.6mW

VL53L7CX – Field of View

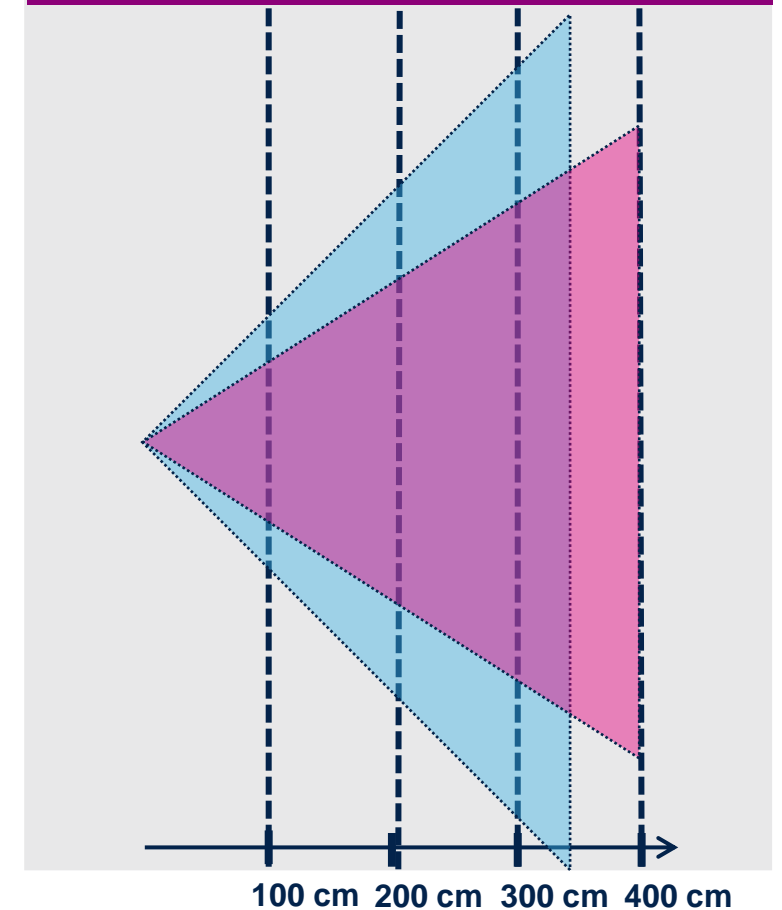
The VL53L7CX has a wider FoV, the VL53L8CX ranges further

Coverage zone

+ 33% of Field of View
for VL53L7CX



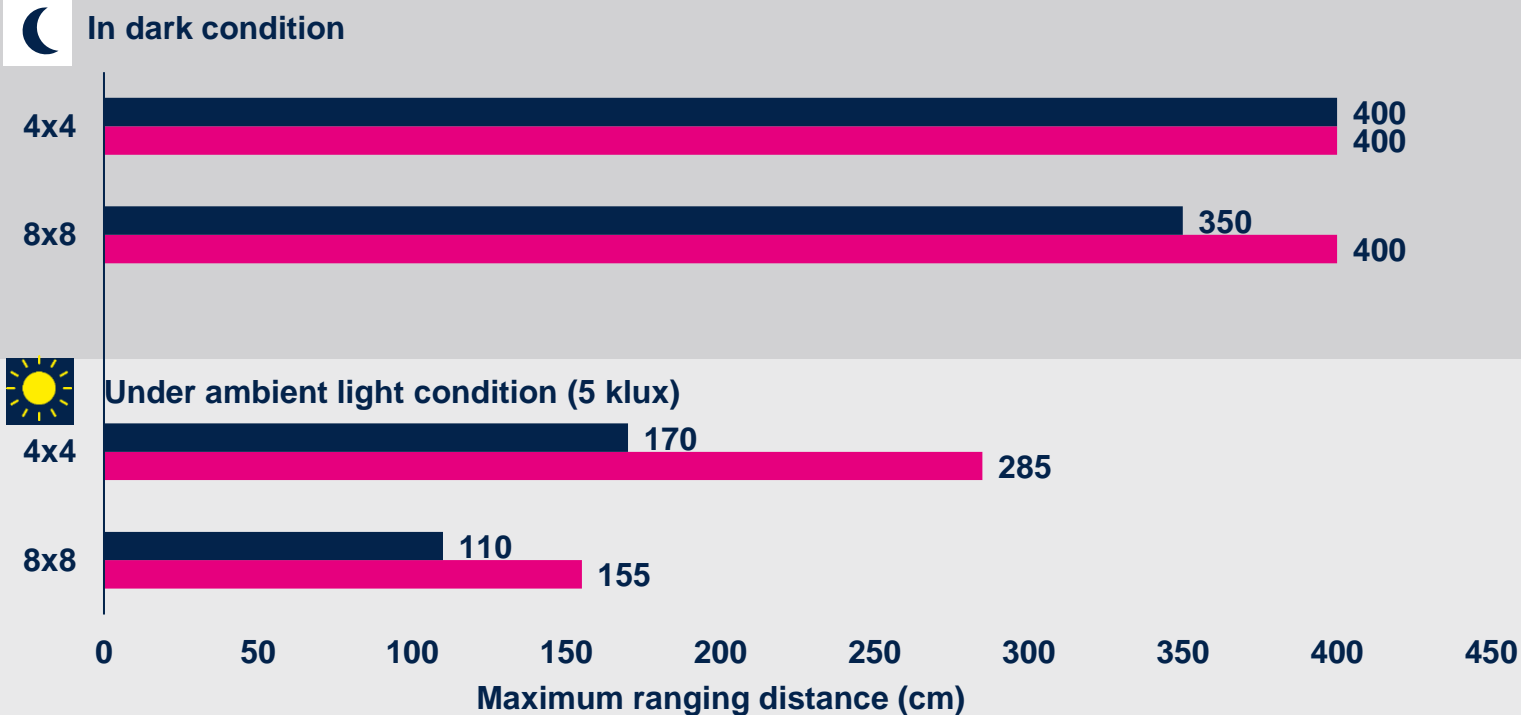
Maximum distance ranging Drawing at scale



VL53L8CX - Continuous mode

+ Equal power consumption for increased maximum ranging distance with VL53L8CX

Maximum distance ranging



Typical power consumption in Continuous mode (mW)



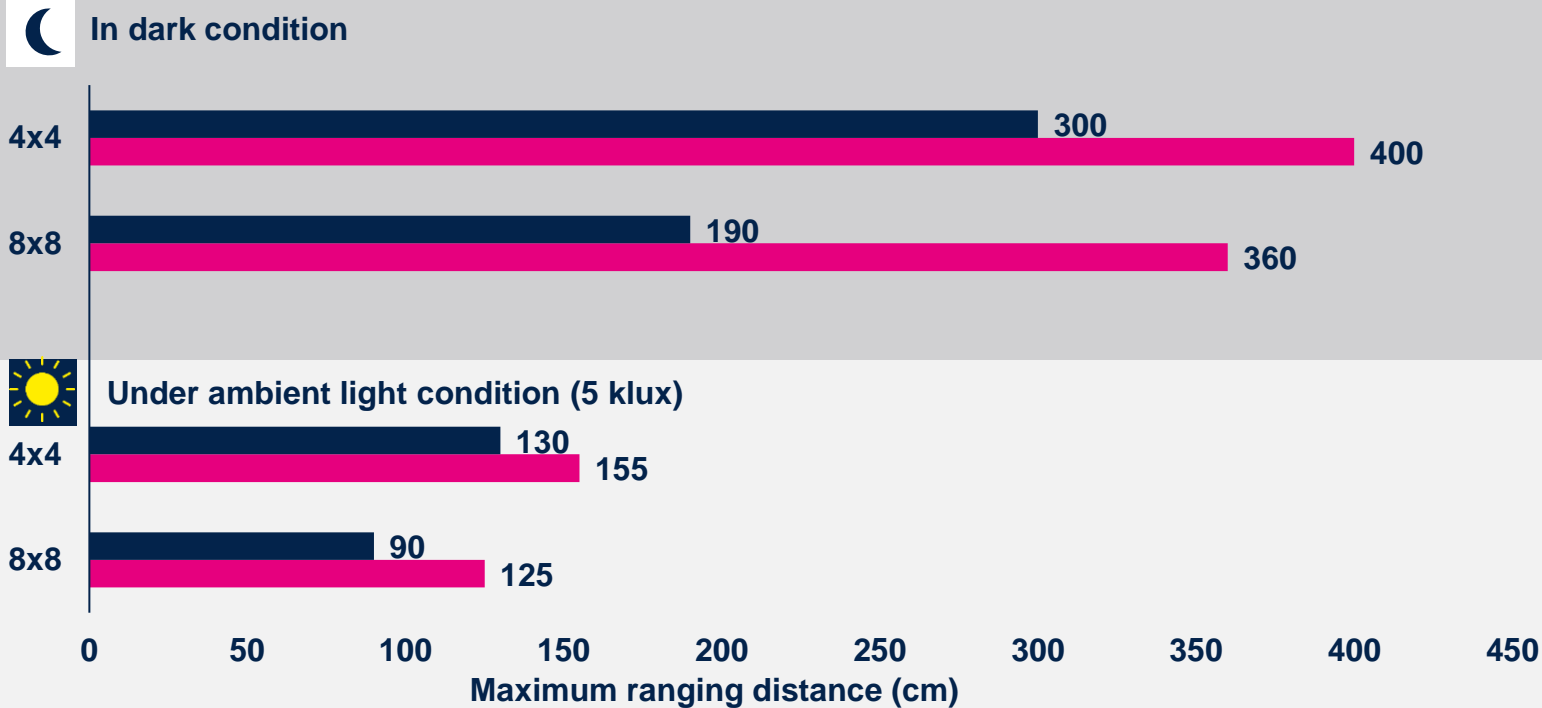
- Measurement conditions :
 - Power consumption measured with 3.3 V analog and VCSEL supply
 - Ranging continuously at 30Hz, with white target reflectance 88%

VL53L8CX - Autonomous mode

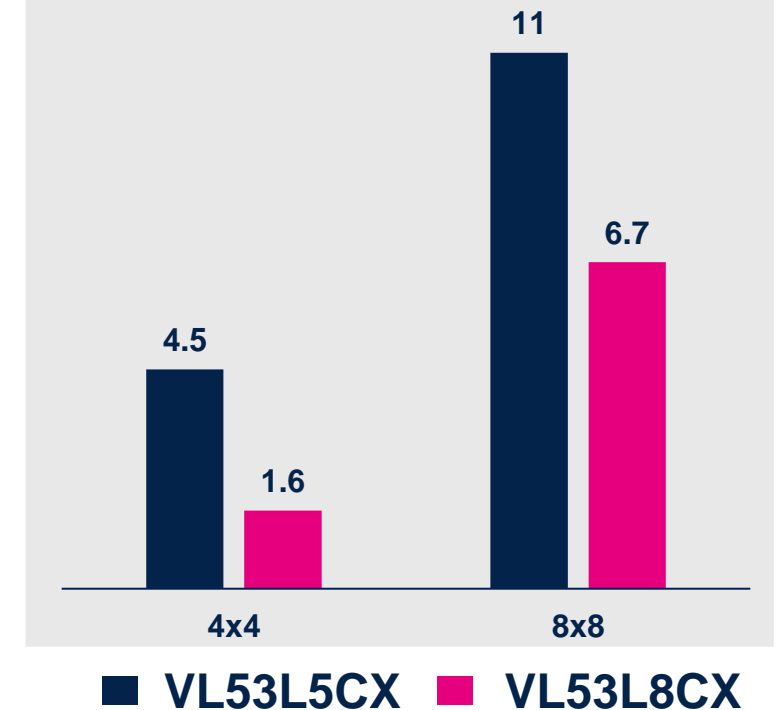


Reduced power consumption for increased maximum ranging distance with VL53L8CX

Maximum distance ranging



Typical power consumption in Autonomous mode (mW)

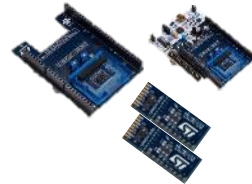


- Measurement conditions :
 - Power consumption measured with 3.3 V analog and VCSEL supply
 - Integration time 5 ms at 1Hz, with white target reflectance 88%

Technical resources

VL53L7CX and VL53L8CX online support

Boards



	 VL53L7CX	 VL53L8CX
Expansion board	<u>X-NUCLEO-53L7A1</u>	<u>X-NUCLEO-53L8A1</u>
Expansion kit	<u>P-NUCLEO-53L7A1</u>	<u>P-NUCLEO-53L8A1</u>
Breakout boards	SATEL-VL53L7CX	SATEL-VL53L8

Software



Ultra Lite Driver (ULD)	<u>STSW-IMG036</u>	<u>STSW-IMG040</u>
GUI	<u>STSW-IMG037</u>	<u>STSW-IMG041</u>
Linux driver	<u>STSW-IMG038</u>	<u>STSW-IMG042</u>
Gesture recognition	<u>STSW-IMG035</u>	soon
X-CUBE package	<u>X-CUBE-TOF1</u>	

Documentation



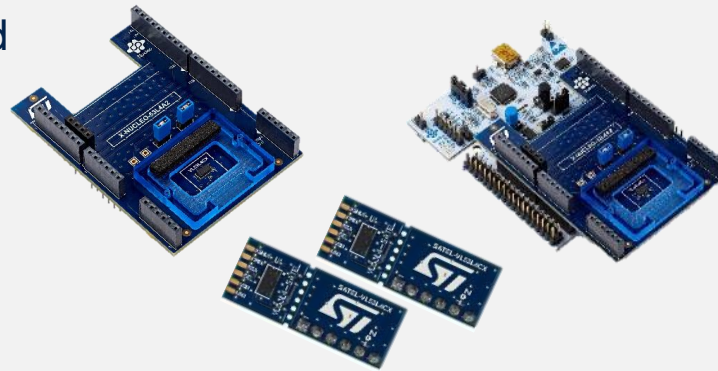
Datasheet	<u>DS13865</u>	<u>DS14161</u>
User Manual	<u>UM3038</u>	<u>UM3109</u>
SATEL connection	<u>AN5883</u>	<u>AN5945</u>

Ecosystem and tools

Imaging products supported by ST ecosystem

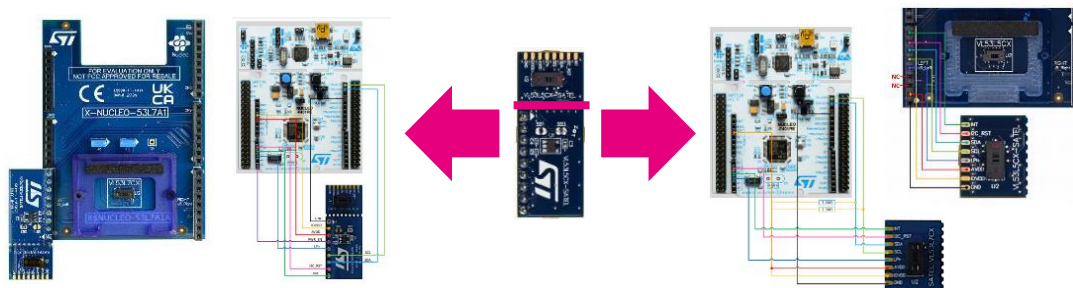
Development boards

- X-NUCLEO expansion board
- P-NUCLEO packs with STM32 NUCLEO
- Stand-alone Breakout boards
 - Breakout boards enable easy & swift integration at customers
 - Can be connected to X-NUCLEO or any NUCLEO board



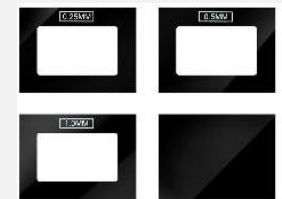
STM32 ODE

- FlightSense™ fully integrated in STM32 Ecosystem
- Compatible with all STM32 NUCLEO boards thanks to **CubeMX**
- Referenced on mbed, Arduino & Raspberry Pi platforms



Cover glass

- Square cover glass
- 3 spacers 0.25/0.5/1mm to create various air gaps
- Cover glass holder






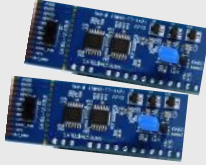
VL53L7CX Ordering codes

Go to www.st.com/en/product/VL53L7CX or contact your usual distributor

Item	Picture	Commercial Product (= Order Code)	Comments
VL53L7CX sensor		VL53L7CXV0GC/1	Delivery in T&R MOQ: 3.6ku With protective liner LT = 24 weeks
VL53L7CX Expansion board		X-NUCLEO-53L7A1/	To go along with STM32F401 Nucleo board. Comes with cover-glass holder, cover-window sample, 3x spacers
Pack: VL53L7CX Nucleo™ Expansion board + STM32F401 NUCLEO		P-NUCLEO-53L7A1/	X-NUCLEO-53L7A1 expansion board delivered together with STM32F401 NUCLEO board
VL53L7CX Breakout boards		SATEL-VL53L7CX	2x Breakout boards delivered

VL53L8CX Ordering codes

Go to www.st.com/en/product/VL53L8CX or contact your usual distributor

Item	Picture	Commercial Product (= Order Code)	Comments
VL53L8CX sensor		VL53L8CXV0GC/1	Delivery in T&R MOQ: 3.6ku With protective liner LT = 24 weeks
VL53L8CX Expansion board		X-NUCLEO-53L8A1/	To go along with STM32F401 Nucleo board. Comes with cover-glass holder, cover-window sample, 3x spacers
Pack: VL53L8CX Nucleo™ Expansion board + STM32F401 NUCLEO		P-NUCLEO-53L8A1/	X-NUCLEO-53L8A1 expansion board delivered together with STM32F401 NUCLEO board
VL53L8CX Breakout boards		SATEL-VL53L8	2x Breakout boards delivered

Markets and use-cases





FlightSense Unlimited markets & applications

PC, Tablets & Peripherals

Home Appliance & Home Automation

Smart Services & Retail Automation

Industrial & Factory Automation

Educational Tablets

Headsets

AR/VR

Smart Home

Home assistants

Air purifiers

Smart storage

Biometric ID Readers

Factory management

Sanitary

Monitors

Laptops

Wearable & IoT

Projectors

Home Automation

Home assistants

Cleaning Robots

ATM

Locks

Conveyor belts

Lighting

Faucets

Tablets

Printers

Instant Cameras

Toys

Home Appliances

Cleaning Robots

ATM

Lockers

Tanks

Dispensers

Faucets

Keyboards

TVs

Smartphones

Smart Speakers

Lamps

White Goods

Pet Robots

Trucks

Lockers

Tanks

Packing

Dispensers

Faucets

Personal Electronics & Smartphones

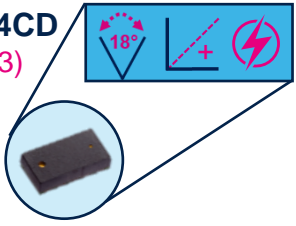
Cleaning Robots & Robots

Access Control & Security

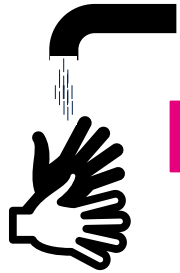
Sanitary Devices & Equipment



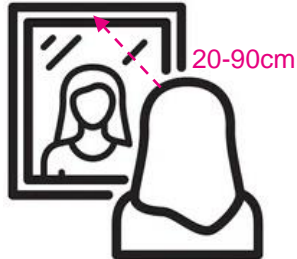
VL53L4CD
(Gen3)



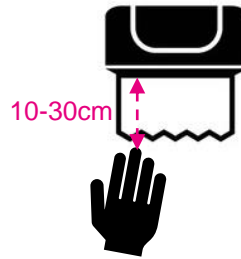
VL53L4CD markets and use-cases



Faucets



Mirrors



Dispensers

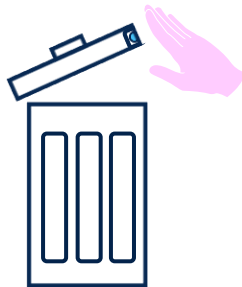
Urinals



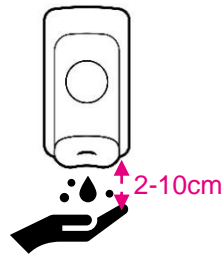
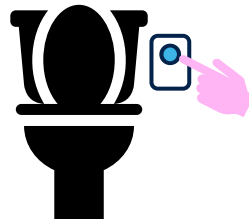
Sanitary

- System activation**
Triggers when users hand is detected
- Presence detection**
Wake the system upon user approach

Bins

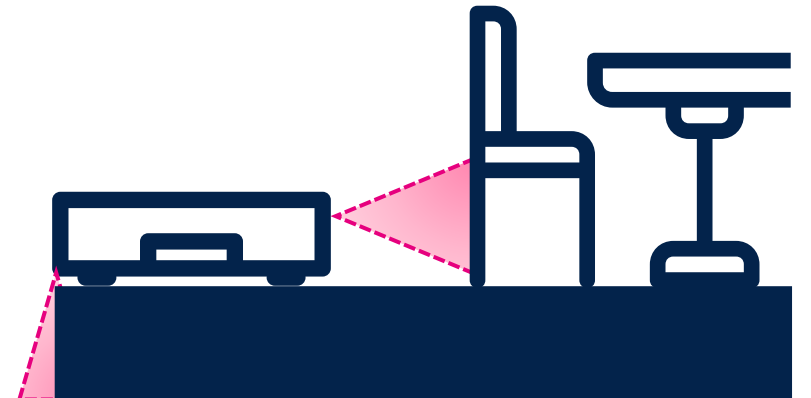


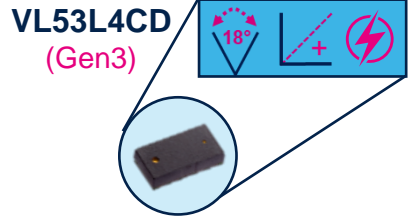
Toilet flush



Robotics

- Wall tracking and obstacle avoidance**
Anti-collision system
- Cliff detection**
Fast and accurate ranging at short distance





VL53L4CD markets and use-cases

Smart lighting



20-70cm



Washing machines



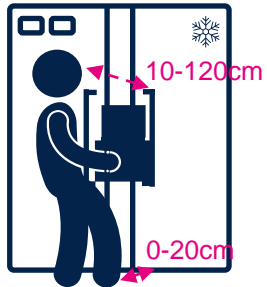
Typical activation range 0.5-3cm

Thermostats

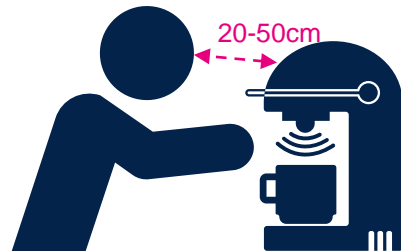
Home automation

System activation
Enable device display on approach

Touchless switch
Turn on/off the light without touching the button



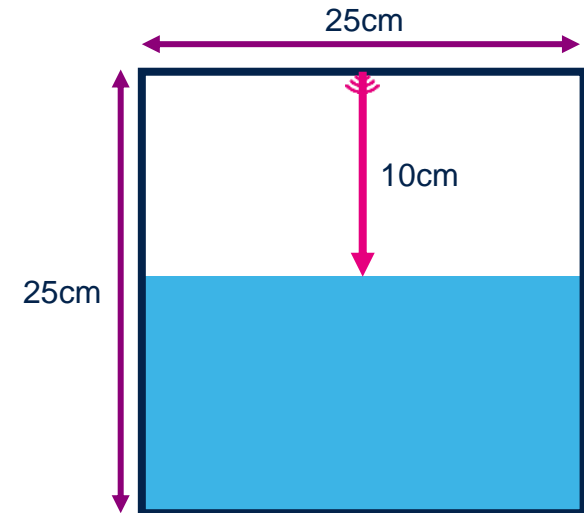
Fridges



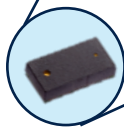
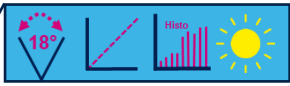
Coffee machines

Tanks

Liquid level control
Measure the volume, whatever the liquid and the tank shape/color



VL53L4CX
(Gen3)



VL53L4CX markets and applications

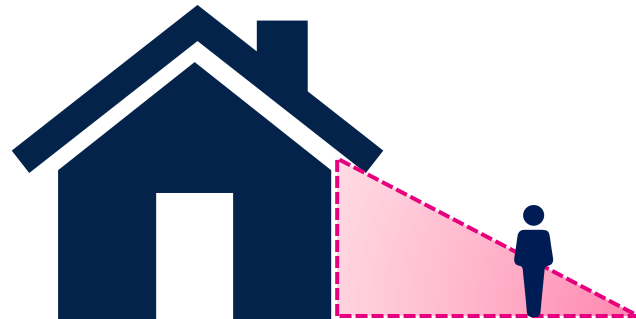
ATM / Automatic access

System activation

Turn on/off device when approaching

Presence detection

Wake the system upon user approach



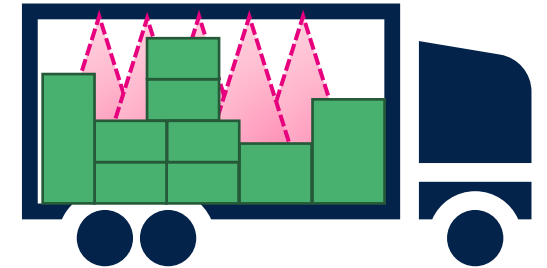
Security control

People detection

Check if someone is approaching

Access control

Wake-on-Approach



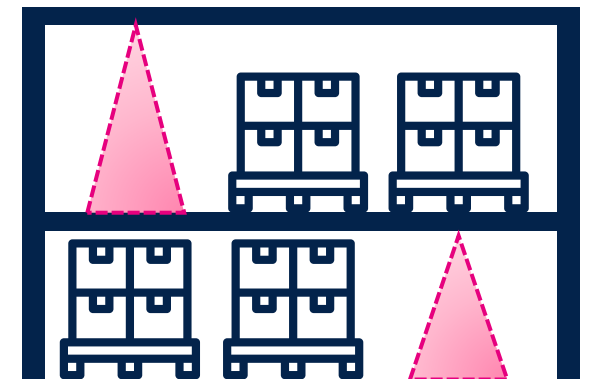
Logistics

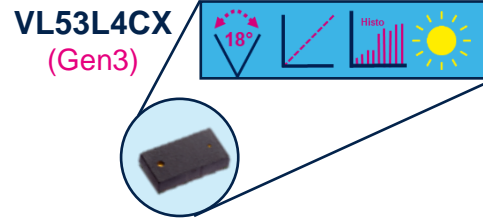
Occupancy detection

Storage/Parking management

Entry/Exit counting

Statistics and flow management

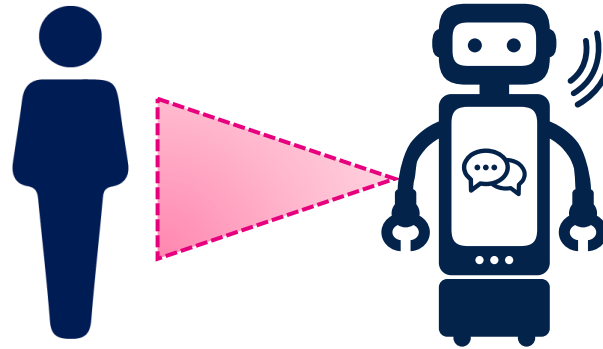
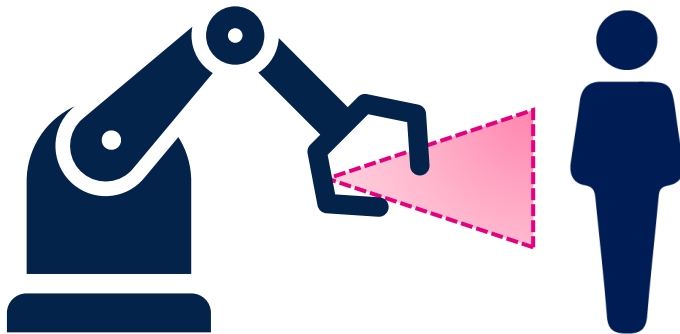




VL53L4CX markets and applications

Industrial

Safety
Keep safe the operators using the machines



Service robots

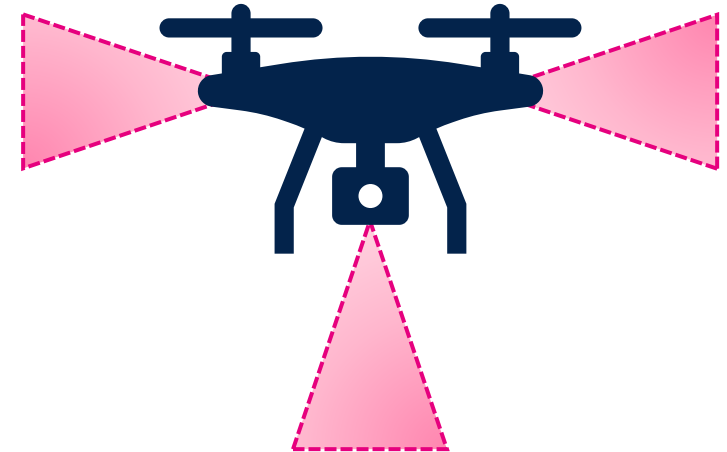
Wall tracking and obstacle avoidance
Anti-collision system

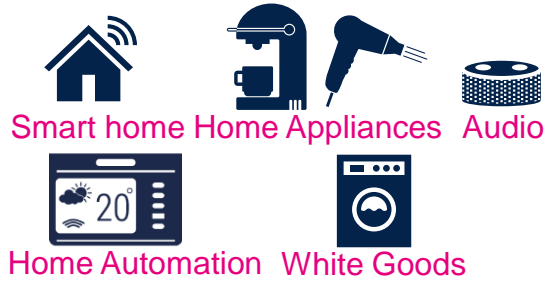
Cliff detection
Fast and accurate ranging at short distance

Indoor drones

Landing assist
Make sure that the drone will land slowly

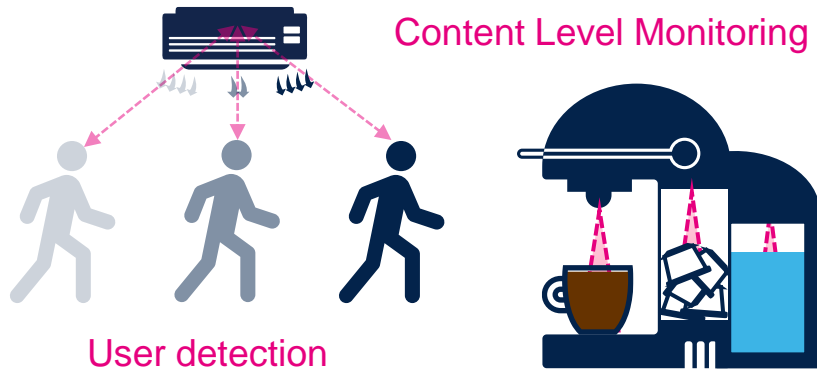
Obstacle avoidance
Anti-collision system





Home Appliance & Home Automation

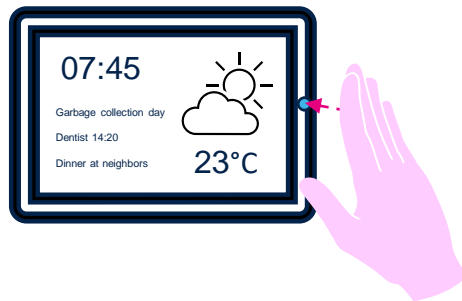
Seamless & contactless operation for effortless user experience with health & safety benefits



Content Level Monitoring

User detection

Touchless button



System activation

Use Cases:

System Activation

Auto Intensity Adjustment

Touchless Button

Content Level Monitoring

Auto Display Brightness

Coming next:

Gesture Control
Face Identification
Occupancy Detection

Core Benefits:

Robust & fast presence detection
Seamless & power saving

Fast & accurate ranging
Robust to material variation

Robust proximity sensing
No contact interaction

Power Efficient Sensors
Low power mode operation

Wide range of sensor choice
Single sensor for several use cases



Products: VD6283TX, VL6180V1/X, VL53L0CX, VL53L3CX, VL53L1CX/CB, VL53L5CX



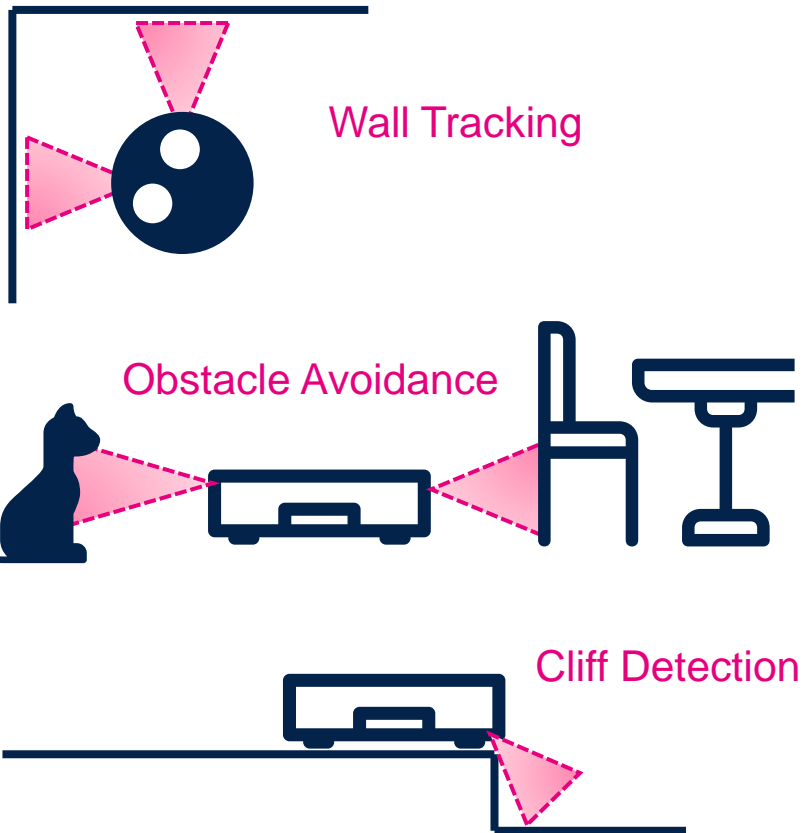
Cleaning Robots



Air purifiers

Cleaning Robots

Supporting multiple functions in one Robot with best ease of integration



Use Cases:

Obstacle Avoidance

Wall Tracking

Cliff Detection

Ceiling Detection

Coming next:

Floor Mapping

Floor Material Detection

Back to Base

Object Identification

Core Benefits:

Robust to Smudge

Excellent under dirty cover glass

Fast & accurate ranging

Robust to material variation

Performance proven

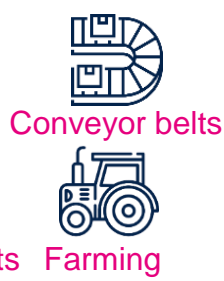
For challenging industrial designs

Multiple sensors in one Robot

Ease of integration

Low memory footprint

Cost effective systems



Packing

Industrial robots

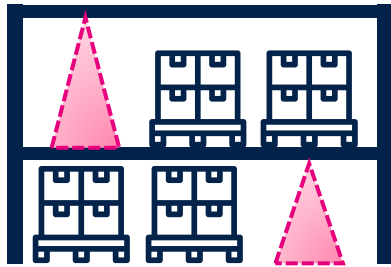
Farming

Industrial & Factory Automation

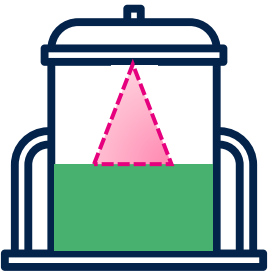
A wide range of sensors ready for flexible multi-usage integration



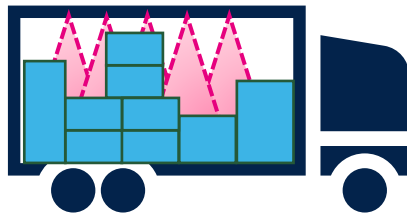
Operator Safety



Inventory Management



Content Level Monitoring



Use Cases:

System Activation

Touchless Button

Operator Safety

Content Level Monitoring

Inventory Management

Bar Code Reading

Coming next:

Gesture Control & Face ID

Core Benefits:

Robust & fast presence detection
Efficient operation & ultimate safety

Fast & accurate ranging
Precision independent of material

Wide range of sensor choice
With multi-object & configurable FoV

Robust to Smudge
Excellent under cover glass

High sensor count integration
Easy multi-sensor operation



Products: VL53L0CX, VL53L3CX, VL53L1CX/CB & VL53L5CX



Lighting



Mirrors



Sanitary



Faucets



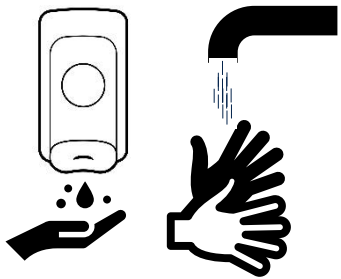
Dispensers



Bins

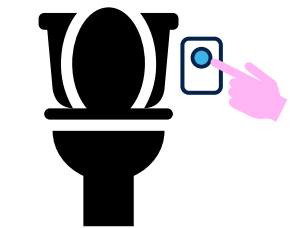
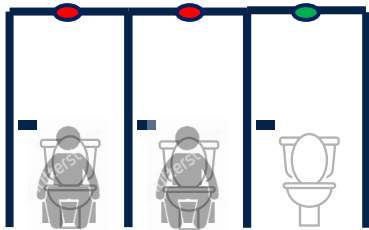
Sanitary Devices

Low power mode & small footprint enabling best power saving

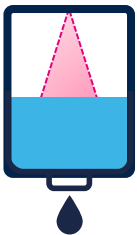


System activation

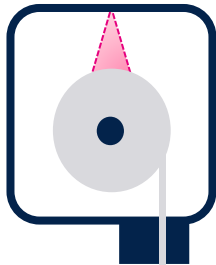
Occupancy detection



Touchless Button



Inventory Management



Use Cases:

System Activation

Occupancy Detection

Touchless Button

Content Monitoring

Coming next:
Gesture Control

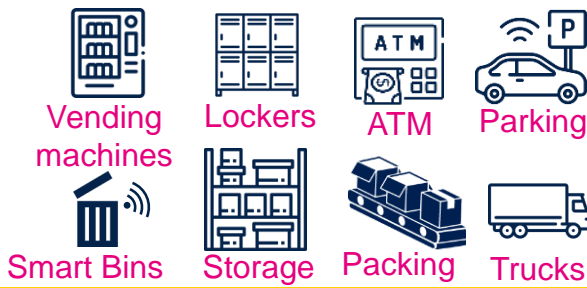
Core Benefits:

Robust & fast presence detection
Seamless & power saving

Robust to Smudge
Even under high IP modules

Robust proximity sensing
No contact interaction

Wide range of sensor choice
Many Range & field of view options



Smart Service & Retail Automation

Multiple sensor low power mode & small footprint for Content Detection & monitoring



Use Cases:

- Inventory Management
- Content Level Monitoring
- System Activation
- Touchless Button
- Auto Intensity Adjustment
- People Counting
- Bar Code Reading

Coming next:

Gesture Control & Face ID

Core Benefits:

- High sensor count integration**
Easy multi-sensor operation
- Robust & fast presence detection**
Seamless & power saving
- Robust proximity sensing**
No contact interaction
- Fast & accurate ranging**
Robust to material variation
- Wide range of sensor choice**
With multi-object & configurable FoV
- Robust to Smudge**
Excellent under cover glass

Products : VL53L3CX, VL53L1CX/CB & VL53L5CX





Locks



Parking



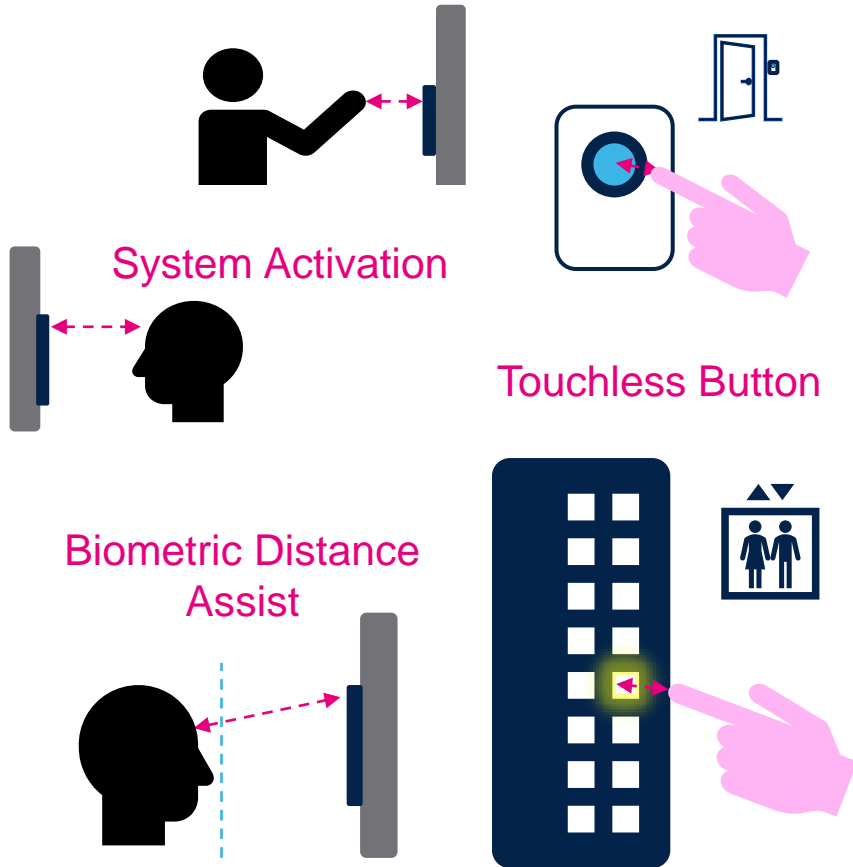
Vending machines

Lockers

Biometric ID Readers

Access Control

Full product range from close distance to 8m detection



Use Cases:

System Activation

Biometric Distance Assist

Touchless Button

Coming next:

Gesture Control
Face Identification

Core Benefits:

Robust & fast presence detection
Seamless & power saving

Fast & accurate ranging
Efficient & reducing false negative

Robust proximity sensing
No contact interaction

Robust to Smudge
Excellent under cover glass

Well controlled field of view
Programmable if required

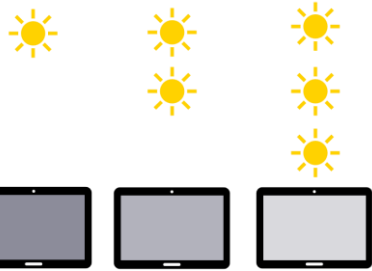


Educational
Tablets

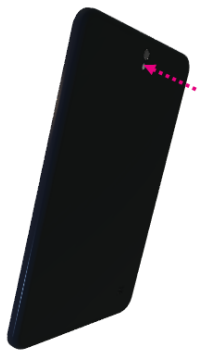
Educational Tablets

Ultimate 2-in-1 sensor for eye protection and ALS in Educational Tablet today

Eye Protection



Auto Display Brightness



Autofocus

Use Cases:

Eye Protection
(Reading Distance Management)

Auto Display Brightness

Autofocus

Coming next:

Power Saving "Presence"
Posture Correction
Gesture Control
Face ID

Core Benefits:

Robust & fast presence detection
Ultimate eye safety

Cost, size, power optimized
ALS & eye safety in single sensor

High speed ranging
Seamless & fast autofocus

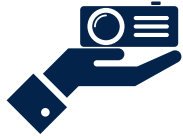
Embedded presence algos
Excellent under cover glass



Products: VL6180X, VL53L0CX, VL53L3, VL53L1CX/CB & VL53L5



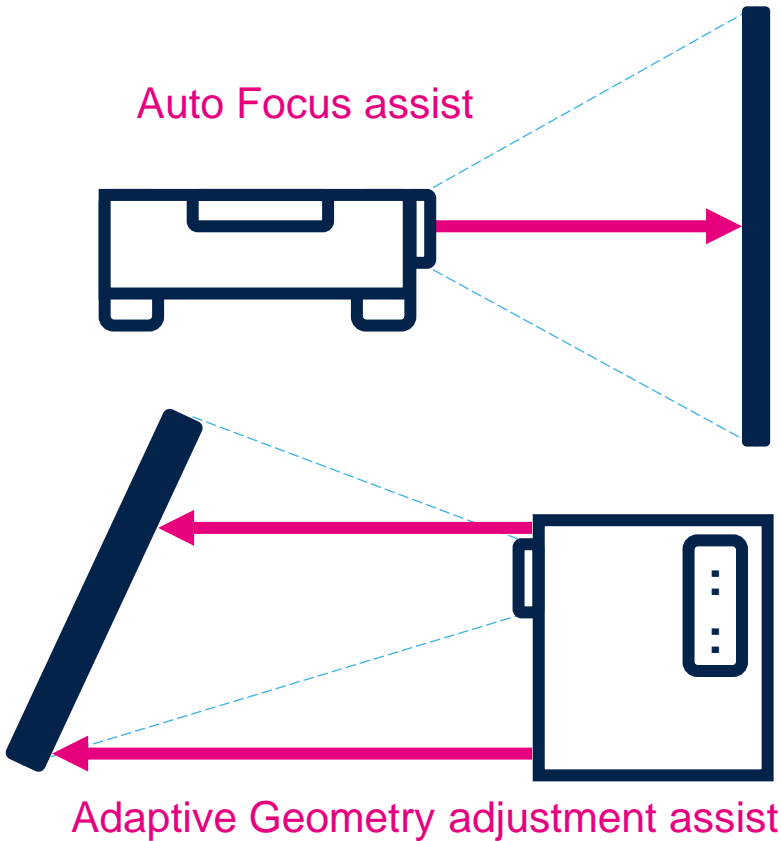
Projectors



Mini and micro-Projectors

Projectors

High accuracy & high-speed creating added value and enhanced user experience



Use Cases:

- Autofocus
- Eye protection
- Keystone correction

Coming next:
Gesture Control

Core Benefits:

High speed distance detection
Fast image adjustment

High-speed light dimming
User eye safety protection

Multiple points detection Automatic keystone correction

Battery-operated, high-performance applications - Down to 175 μ W at 1 Hz

PC, Tablets & Peripherals



Presence: Award winning innovation enabling new user experience, deployed in volumes & expanding

PC presence detection



Conference call system presence detection



Tablet proximity measurement



Use-Cases:

- Walk Away Lock (WAL)
- Wake On Approach (WOA)
- Power saving
- Wellness
- Adaptive Controls
- User Intent detection
- Gesture Control

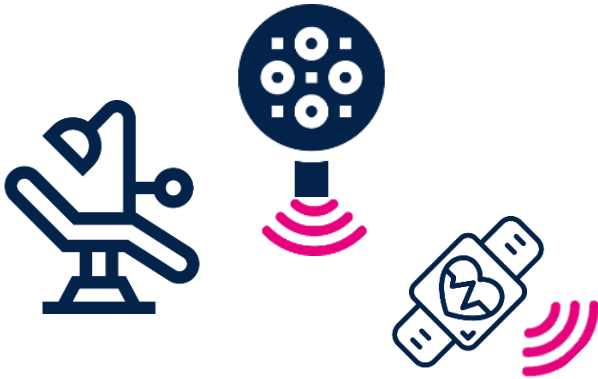
Core Benefits:

- Immediate session lock & sleep
- Zero touch log-in
- Passing by detect
- Towards 24 hours battery life-time
- Eye Protection / User posture
- Man-behind-shoulders detection
- Simple & reliable interface



FlightSense Applications No Limits...

Medical



Basic gesture recognition
“zero-touch” device or utility control

Proximity Sensing

Distance Detection

More than More

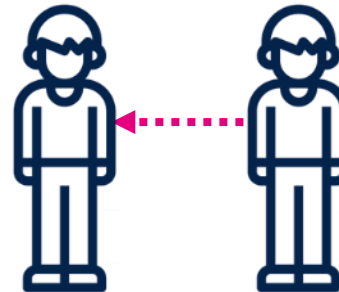
Reaching Worldwide



**Unlimited
end products**



**Fighting
COVID19**



Drones



Flying assist

Hand command

Collision avoidance
Obstacle, ceiling or floor detection

Our technology starts with You



Find out more at www.st.com

© STMicroelectronics - All rights reserved.

ST logo is a trademark or a registered trademark of STMicroelectronics International NV or its affiliates in the EU and/or other countries.

For additional information about ST trademarks, please refer to www.st.com/trademarks.

All other product or service names are the property of their respective owners.



life.augmented