**Sub-track III –
IoT & Connectivity Presentation**

ST ToF enriches smart living

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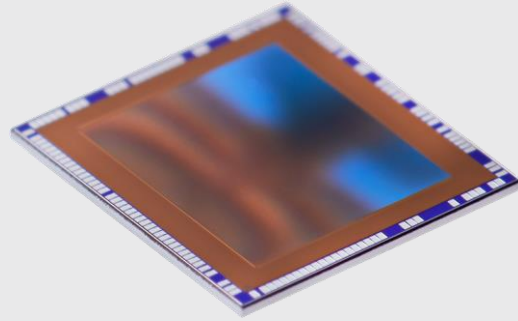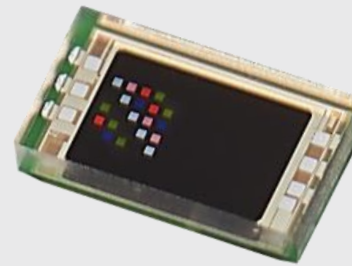# Market leading smart optical sensing solutions

dToF module	iToF sensor	ALS & combo	Global shutter
Single point to multizone	High resolution	ALS & proximity sensor	High sensitivity
All-in-one module	Indirect & direct ToF	High sensitivity	Smallest size
SPAD 40 nm process	3D stacked BSI 40 nm	Under OLED operation	Ultra low power

2 Bu
ToF sensors sold

500 Mu
ALS sensors sold

1 Bu
Global shutter sensors sold

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Fundamentals of Time-of Flight

FlightSense™ Principle

Emitter

t0 ● Photon

Sensor

Target

t1
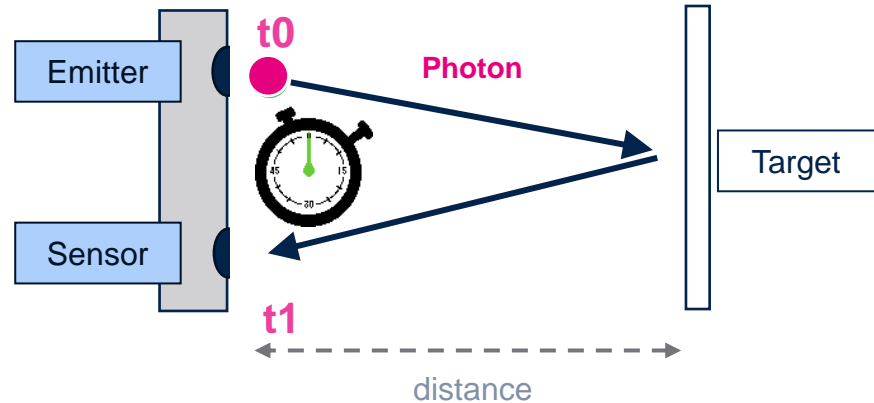
distance

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

1cm round-trip at 67ps!

- At t0, the VCSEL emits Multiple train pulses to generate a time-of-arrival histogram towards a target

- Photons are partially reflected by the target to the receiver SPAD array (t1)

- The SPAD generates a small pulse for each received photon

- Time between initial pulse and reconstructed received pulse is measured and added to time counters to create a photon event histogram.

- Time is converted in distance using dedicated algo

- Distance value ready to be read in sensor registers

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FlightSense
unlimited markets & applications

PC, Tablets & Peripherals

Home Appliance & Home Automation

Smart Services & Retail Automation

Industrial & Factory Automation

Educational Tablets

Monitors

Laptops

Tablets

Printers

Keyboards

TVs

Conf. systems

Headsets

AR/VR

Smart Home

Home assistants

Air purifiers

Smart storage

Biometric ID Readers

Factory management

Sanitary

Wearable & IoT

Projectors

Home Automation

Cleaning Robots

ATM

Conveyor belts

Locks

Lighting

Faucets

Instant Cameras

Toys

Home Appliances

Pet Robots

Trucks

Lockers

Tanks

Packing

Dispensers

Smartphones

Smart Speakers

White Goods

Service Robots

Parking

Vending machines

Industrial robots

Logistics

Smart Bins

Smart Mirrors

Lamps

Personal Electronics & Smartphones

Cleaning Robots & Robots

Access Control & Security

Sanitary Devices & Equipment

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FlightSense industrial & mass market portfolio

Multi-zone

High resolution (up to 256 zones)
Histogram mode

LONGEVITY 7 YEARS COMMITMENT

Compact Normalized Histogram

VL53L8UX
65° FoV
256 zones (16x16)
300cm dark
Low Power Consumption

Up to 64 zones (8x8)
Compact Normalized Histogram
Suitable for AI

STGesture™ recognition

VL53L7CH
90° FoV
64 zones (8x8)
350cm dark

VL53L8CH
65° FoV
64 zones (8x8)
400cm dark / 285cm amb
Low Power Consumption

Up to 64 zones (8x8)
Histogram mode
Autonomous mode

VL53L5CX
65° FoV
64 zones (8x8)
400cm dark / 170cm amb

VL53L7CX
90° FoV
64 zones (8x8)
350cm dark

VL53L8CX
65° FoV
64 zones (8x8)
400cm dark / 285cm amb
Low Power Consumption

Single zone

Long distance up to 8m
Histogram mode
High ambient immunity

VL53L3CX
25° FoV
500cm dark / 140cm amb
ULP mode

VL53L4CX
18° FoV
600cm dark / 180cm amb
10mm linearity

VL53L1CB
27° FoV configurable
800cm dark / 160cm amb
Sequential 2x2 zones

Ranging up to 4m
Autonomous mode

VL53L0CX
25° FoV
200cm dark

VL53L1CX
27° FoV configurable
400cm dark / 130cm amb
ULP mode

Proximity up to 1.3m
Short distance linearity
Low Power consumption

VL6180V1
25° FoV
60cm dark
10mm linearity

VL6180X
Integrated ambient light sensor

VL53L4CD
18° FoV
130cm dark
1mm linearity
ULP mode

VL53L4ED
L4CD + Extended temperature. range

Legacy Product
Recent product
Coming soon
Product variant

Ultra Low Power mode

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Direct ToF multi-zone technology

Package size : 6.4 x 3.0 x 1.5 mm
Square **FoV** : 43.5° x 43.5° (61° diag)
Multi zone

**Proximity
Ranging
3D Low resolution
Gesture recognition**

- 4th generation F**light**Sense™ technology
- 4x4 zones @ 60 fps / 8x8 zones @ 15 fps
- ToF histogram processing embedded (32bit MCU)
- I2C or SPI interface (1.8/2.8V I/O)
- Consumer grade products

- Typical power consumption: 95mW
- Multitarget detection and distance measurement in each zone
- Automatic fingerprint smudge compensation

VL53L5
for Gesture

VL53L5: Consumer grade (MP)
VL53L8: Automotive grade (Schedule TBC)

**Delivering more than hardware
ST software solution**
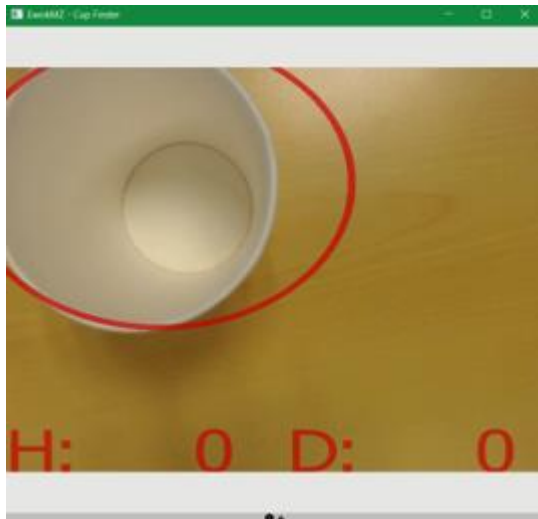
Infinite numbers of applications

ST Time-of-Flight are used everywhere in daily life

Cup detection

- Diameter estimation
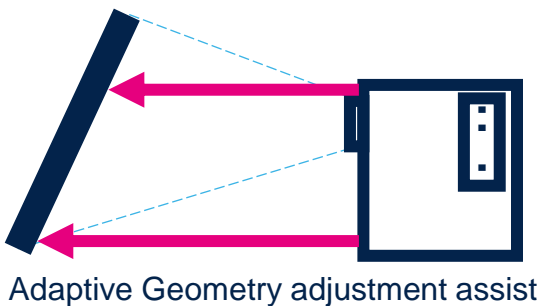- Height measurement
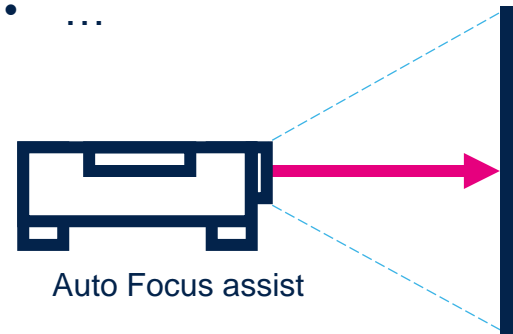- Liquid level monitoring
- …

Presence detection

- Wake-on-Approach
- Passing-by filtering
- Walk-away lock
- …

VL53L5CP Multizone   VL53L3CP Singlezone

Projectors

- Autofocus
- Eye protection
- Keystone correction
- …

Auto Focus assist

Adaptive Geometry adjustment assist

Others

- Drones
- Cameras
- Laptops/Tablets
- Industrial

ST delivering **turnkey solutions** for **gesture recognition**, **liquid level and cup detection**, **autonomous and ultra low power system activation**, **content management**, **robotics,** and more to come

STGesture – Gesture recognition

Turnkey solution working with VL53L5CX, VL53L7CX and VL53L8CX

Applications

User-friendly

Laptops Thermostats Switch

Hygiene

Digital Signage Sanitary Elevators

Safety
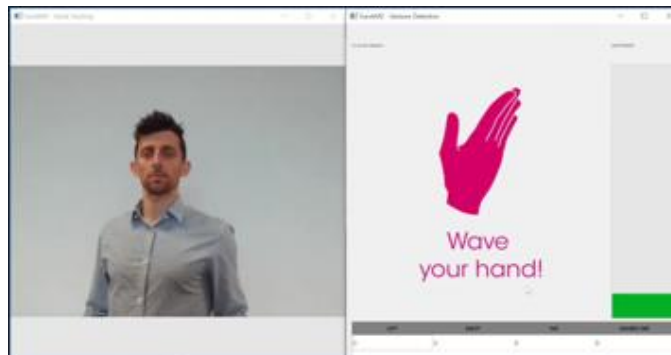
Kitchen appliances Industrial robots Production lines

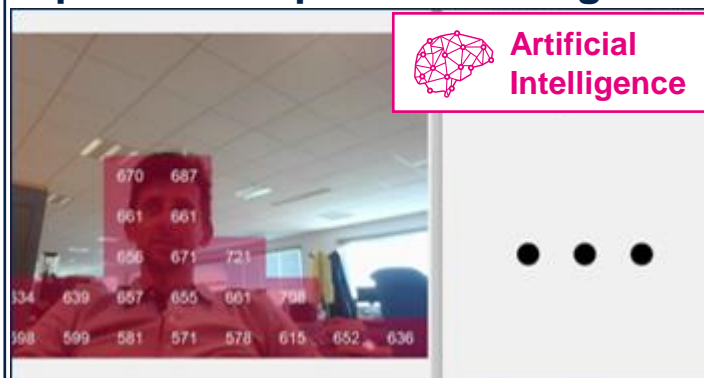## Motion gesture recognition

Turnkey STGesture libraries:
- Hand tracking
- Tap: single and double
- Swipe: left, right, up, and down
- Level control

Wave your hand!

Download STSW-IMG035 package

Hand posture recognition

Up to 7 hand postures recognized

Artificial Intelligence

Discover now our solution on
stm32ai.st.com

AI framework available on
GitHub.com/STMicroelectronics

Want to learn more?

Go to the landing page:
www.st.com/gesture-recognition

You will find:
- Real-life examples
- Technical resources
- On-demand webinar

BENEFITS

Cost effective	Privacy	Ready to use	Low power
Inexpensive system architecture, and development	No image unlike camera. Only ranging distance	No image unlike camera. Only ranging distance	Low power ToF compared to other technology

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Non-intrusive liquid level monitoring solutions

A dual throng solution portfolio for best end-system integration adequation

Two ST Solutions

- **VL53L4CD**
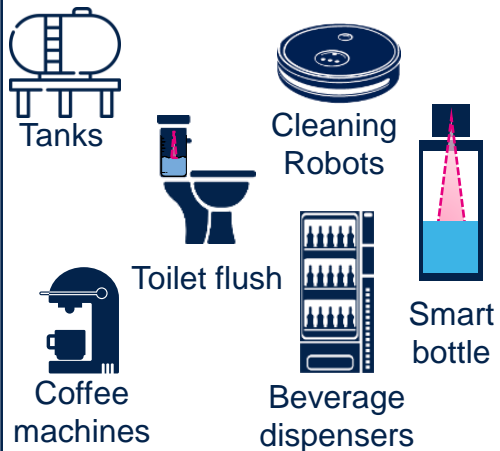 - Single-zone sensor Narrow 18° FoV
  - 120cm max distance

- **VL53L5CX**
  - 8x8 multizone
  - 65° wide FoV
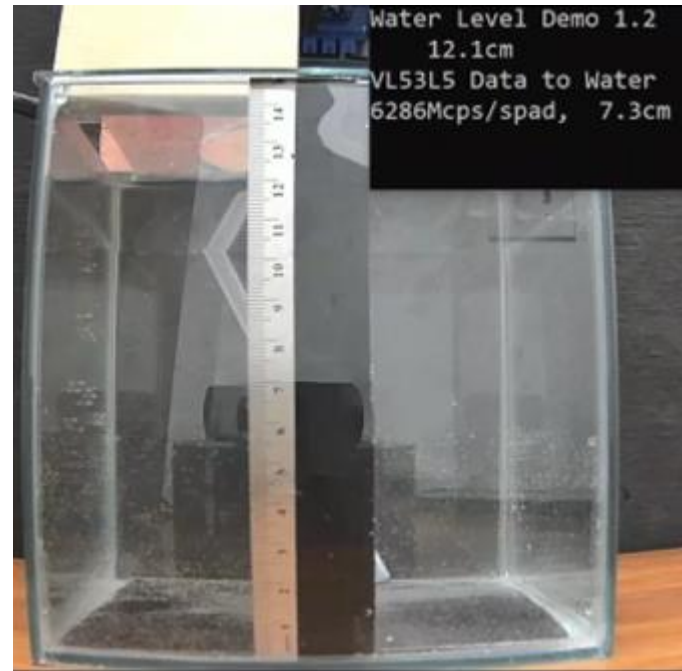 - Up to 400 cm ranging

Applications

Tanks

Cleaning Robots

Toilet flush

Coffee machines

Beverage dispensers

Smart bottle

Core Benefits

- **Not "intrusive"**

- **Works with all liquids**

- **Small size**

V53L5CX demo

Water Level Demo 1.2
12.1cm
VL53L5 Data to Water
6286Mcps/spad, 7.3cm
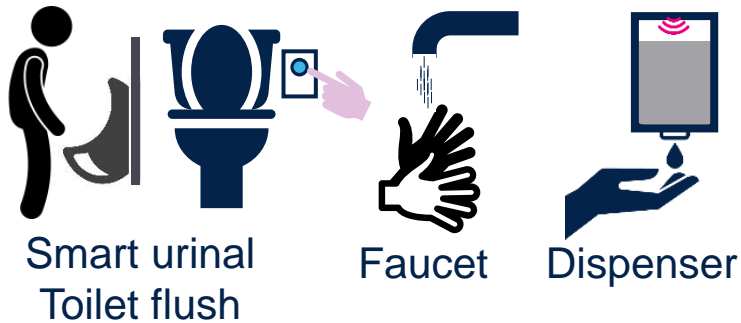
Want to learn more?

Go to the landing page:

Coming soon

You will find:
- Source codes
- Technical documentation
- On-demand webinar

Avoid any contact with physical buttons thanks to ToF detection sensors

Sanitary
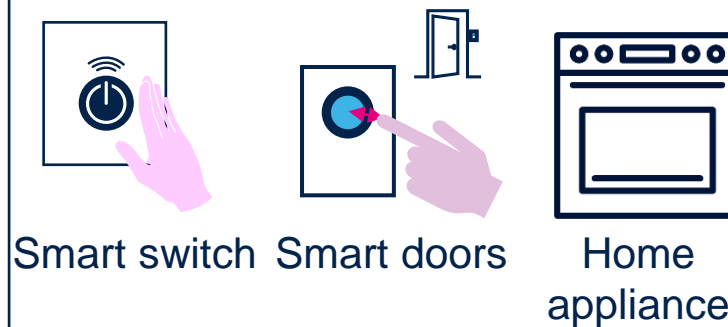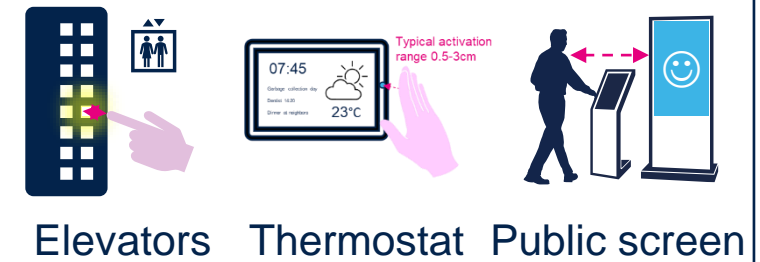
Smart urinal
Toilet flush

Faucet

Dispenser

⚡ **ULP mode**

ToF

Home automation

Smart switch

Smart doors

Home appliance

Access control

Elevators

Thermostat

Typical activation range 0.5-3cm

07:45

23°C

Public screen

Autonomous mode

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Inventory management, waste management and liquid level control

Markets and applications

White Goods

Lockers

Vending machines

Tanks

Warehouse

ATM

Trucks

Dispensers

Core Benefits

Histo — Long distance ranging & multi-object detection

400cm — Accurate distance measurement

64 — Multi-zone ranging up to 8x8 zones

90° — From narrow to ultra wide Field-of-View

Multiple sensors integration

Low power
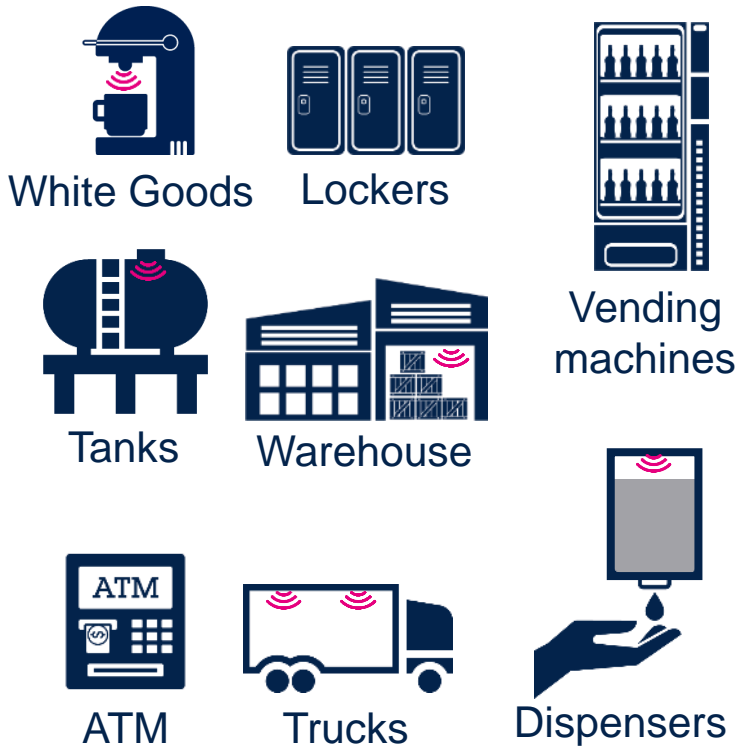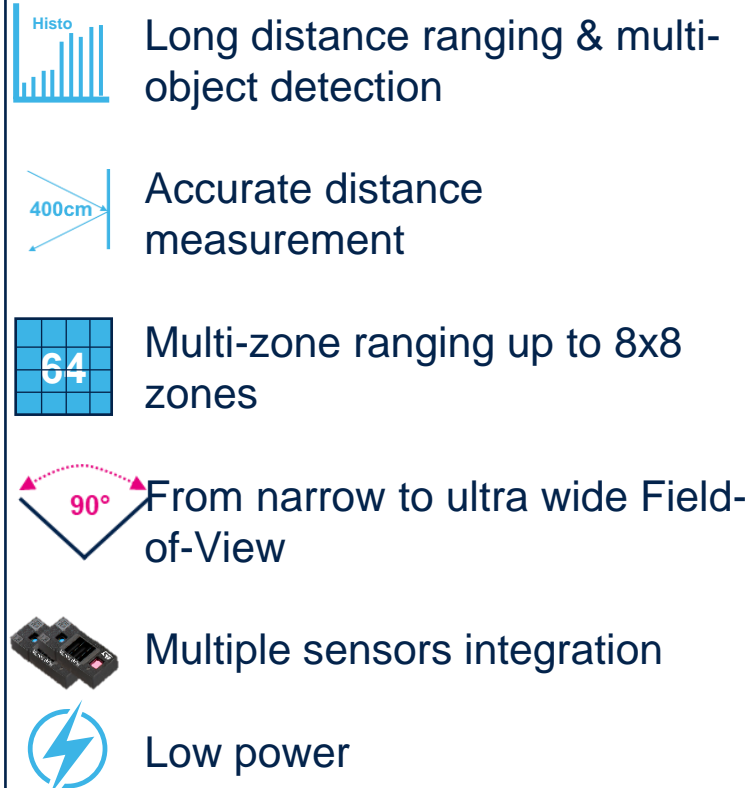
Smart Shelves demo

- Using **VL53L1CX** and programmable Region of Interest

- www.youtube.com/watch?v=iayV3r5ALbk
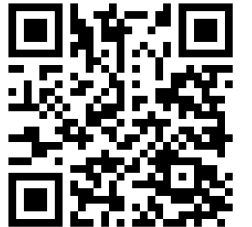
Robotics multi-applications

Only one ST ToF multi-zone sensor supporting up to 6 use-cases

Cliff / Edge / Slope prediction

- Signature change on lower rows can detect approach to stairs/slope

- Estimate object size (including flat object & cables) and precise distance in order to avoid them

Small Object Detection

Floor sensing

- Surface recognition (soft or hard) to support mopping or vacuum mode using **VL53L5CX**

- https://stm32ai.st.com/use-case/floor-type-detection-for-vacuum-cleaners/

Artificial Intelligence

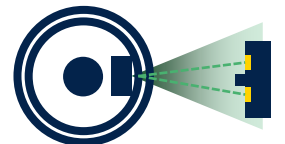### Other use-cases

- Wall tracking

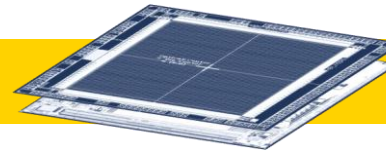- Collision Avoidance

- Ceiling/Gap Detection

- Safe Docking Assist

ST 3D ToF (iToF)
with 3rd party module

VD55H1 | ref designs & use-cases

672

804

Thanos
Flood illumination

0.5 Mpix

iToF's merit = high native resolution

VD55H1 – 0.5 MPix

35 x 38

Cyclops
Spot illumination

1,330 points

High resolution, short / medium distance
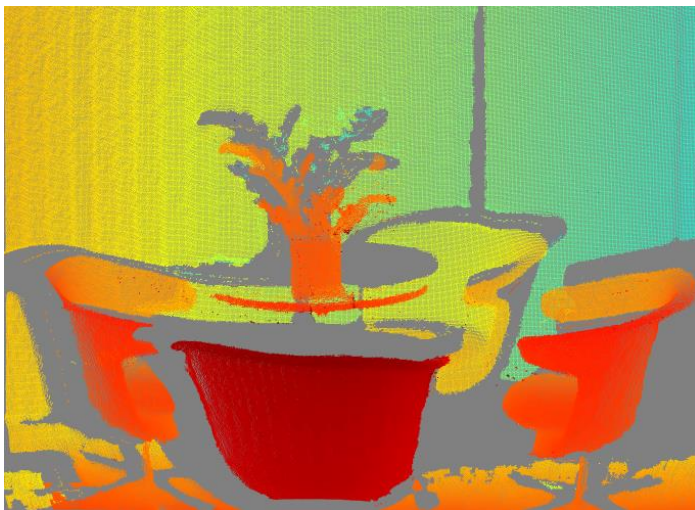
Up to 500k depth points, <5m

FaceID with antispoofing

Object scanning — 3D 360°

Bokeh Segmentation

Room mapping

Low resolution, Long distance (LIDAR)
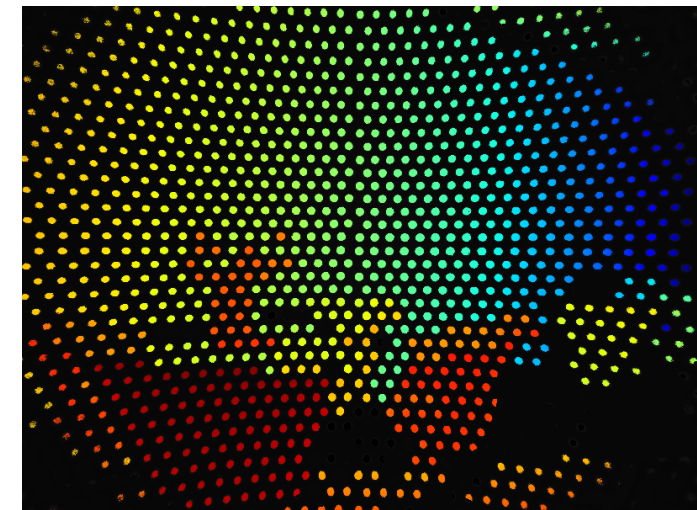
1,300 dots, >5m ranging under ambient

Less points but increased local SNR in the dots = longer ranging + improved ambient resilience

Room mapping

AF assist

ST ALS (ambient light sensor)

Ambient light sensors & under OLED combo

VD6283
6 channels ALS + Flicker

- ✓ **Smallest color sensor** on the market
- ✓ **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

intel — **C1 certified**

Qualcomm certified

Mass Production

- Screen color management
- Screen brightness
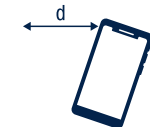- Camera flicker removal

VL6285
Under OLED Color + Proxy

- ✓ **3-in-1 combo:** RGB ALS + Proxy + 2x VCSELs
- ✓ **Totally invisible** under OLED screen
- ✓ **High Lux and CCT accuracy**
- ✓ **White dot free** Proximity
- ✓ Operates **under ultra low transmittance material** (down to 1%)

EVK available MP in Q4 2023
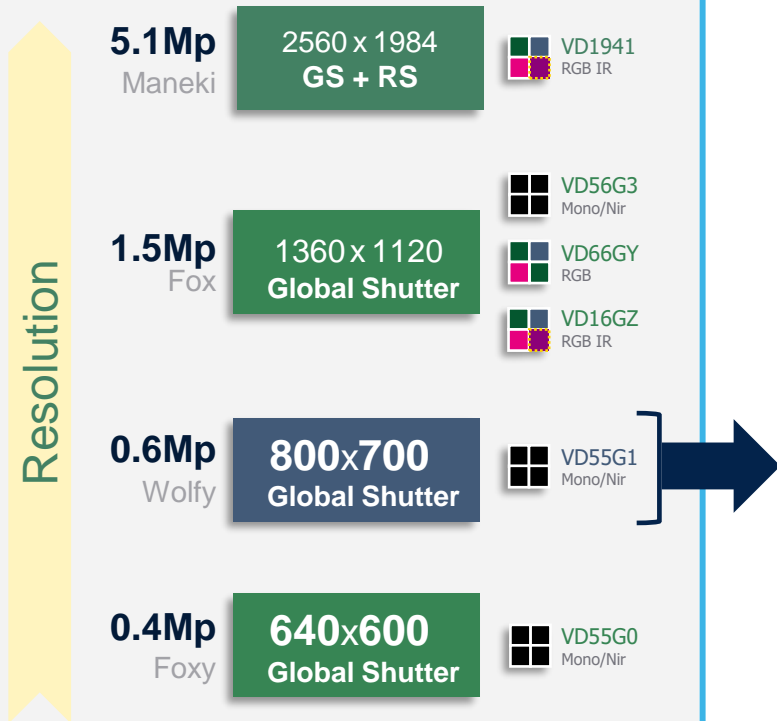
- Under OLED Lux/CCT
- Under OLED Proxy
- Closing detection

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ST GS image sensor
& camera w/3rd party

ST global shutter sensors

ST global shutter sensors

Resolution

5.1Mp Maneki	**2560 x 1984 GS + RS**		VD1941 RGB IR
1.5Mp Fox	**1360 x 1120 Global Shutter**		VD56G3 Mono/Nir
			VD66GY RGB
			VD16GZ RGB IR
0.6Mp Wolfy	**800x700 Global Shutter**		VD55G1 Mono/Nir
0.4Mp Foxy	**640x600 Global Shutter**		VD55G0 Mono/Nir

VD55G1

Smaller GS sensor than other VGA !
- Useable as a VGA and up to 800x700
- Smallest pixel 2.16um vs 2.2um or 2.8um

Competition 640x480 2.2µm

800x700 2.16µm

42% smaller than competition with VGA resolution

82% higher resolution for wider FoV
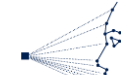
0.7mm smaller
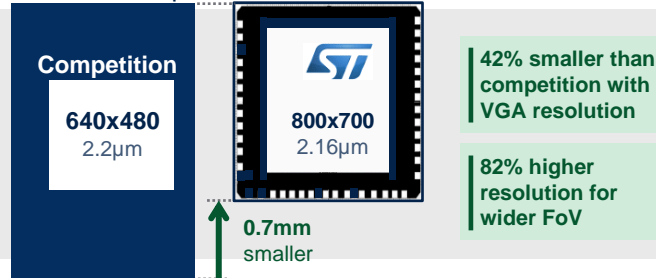
Very & ultra-low power sensor
- Always-on 1mW scene change detection
- VGA 15mW @30fps with high Image Quality
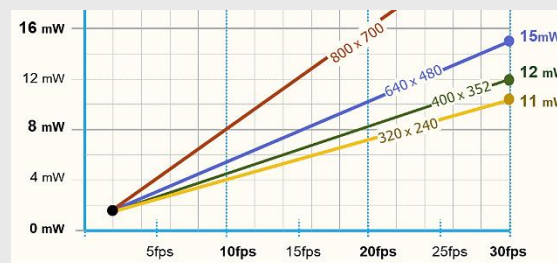
Smart storage

Biometric ID Readers

Factory management

Industrial robots

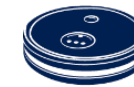**Home assistants**

Pet Robots
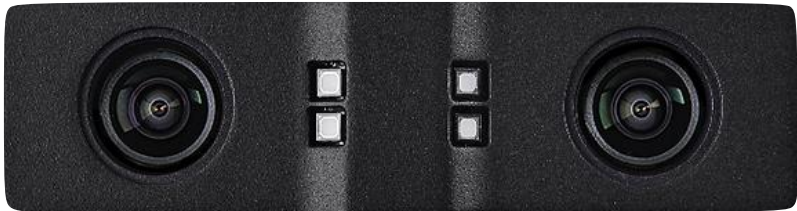
Laptops

AR/VR

Service Robots

Cleaning Robots

Smartphones

Multiple spec camera promo-modules (using G0, G3, GY & G1 global shutter sensors) available to support sensor promotion and evaluation

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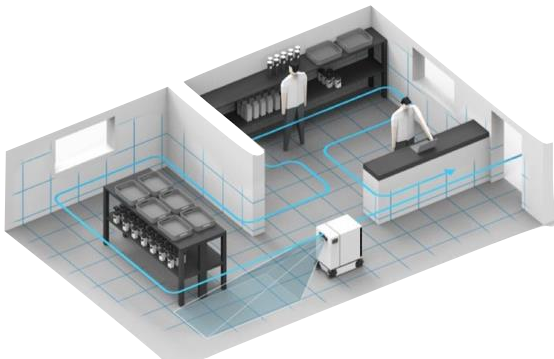## Domain-Specific Active Stereo Camera With ST Micro Global Shutters

Powered by **VD56G3** **VD55G0**

	Ref B3	Ref B6
TARGET DEPTH FOV (H*V)	62 x 48	90 x 70
SENSOR	**VD55G0 [644 x 604]**	**VD56G3 [1124 x 1364]**
RESOLUTION	Up to 640 x 480	Up to 900 x 1200
BASELINE	3CM	6CM

Our technology starts with You

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