車用物聯網

TOF 辨識技術及車用 Gerda® 解決方案

Stan Lin 林士強
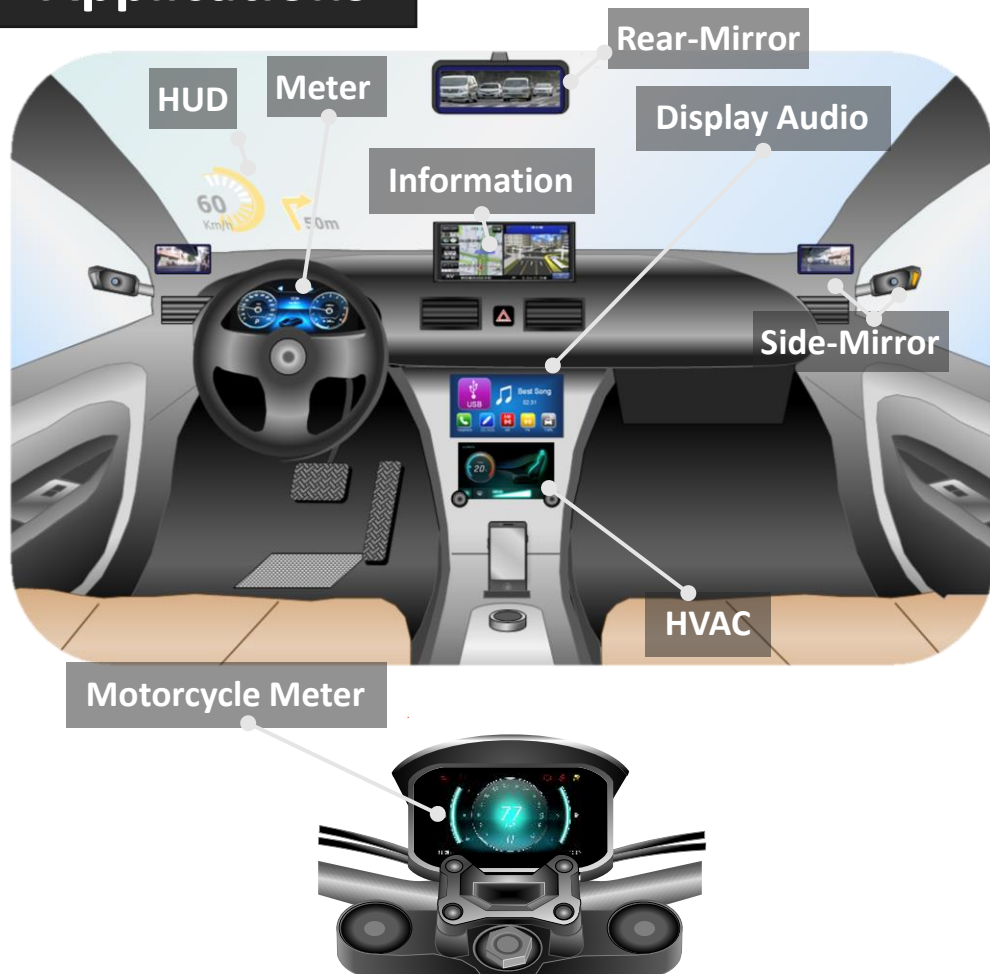
Introduction of Automotive HMI Solution- Gerda

About Gerda®

Rear-Mirror
HUD
Meter
Display Audio
Information
Side-Mirror
HVAC
Motorcycle Meter
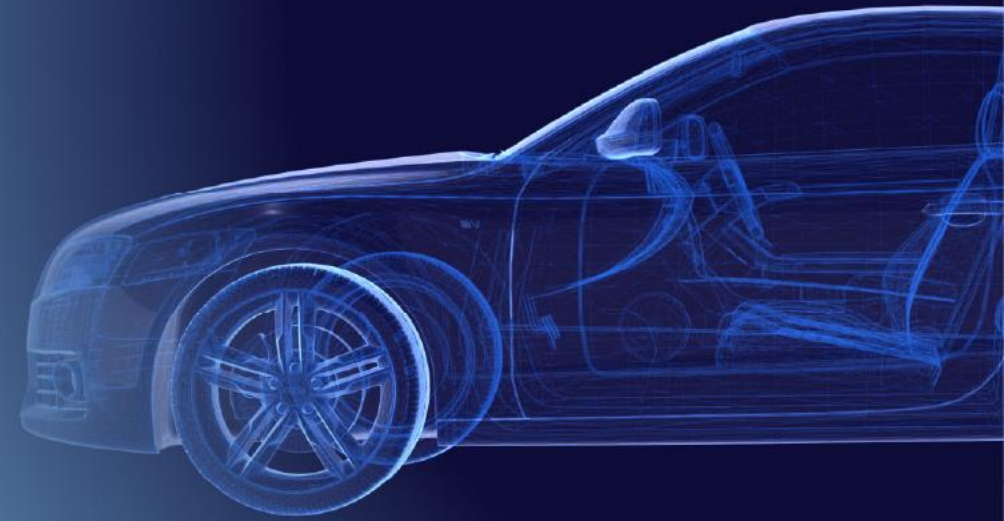
Feature

Reliability	● Fast Boot: Displayed within 0.5s ● Improved visibility of images: Super resolution /Contrast correction
Secure	● Security: Program tampering prevention ● Failure diagnosis: Anomaly detection of telltale display
Comfortable	● High quality graphics: 2.5D/ 3D ● Music playback, smartphone cooperation

Applications for Gerda®

Application / Resolution	Meter Cluster	HVAC	HUD	e-Mirror
WXGA	**Gerda-4L** 256 pin: external SDRAM — Security / SRE / ICE / Functional safety / DCE			**Gerda-EINS** 216 pin built-in RAM — SRE / DCE / Security
	Gerda-4L 216 pin: built-in RAM — Security / SRE / ICE / Functional safety / DCE			
WVGA	**Gerda-ZWEI** 144 pin: external Hyper-RAM 100 pin/128pin: built-in RAM — Security / Functional safety			
WQVGA				

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Gerda® Solutions for Meter Cluster

Translucent:
Add Strength with Translucent processing for Icons like Alert

Display High Quality:
Anti-Aliasing Function to smoothen the outline of meter needle pointer

Efficient Flash Memory Design:
Various Expression like Animation or Multi-language
By Texture Material Compression Technology (Compressibility: approx. 25-50%)

High Quality Display:
Smooth Gradation Color with Dithering

Colorful Display:
By 3D Icon Texture, Colorful Expression Available with 2.5D Engine
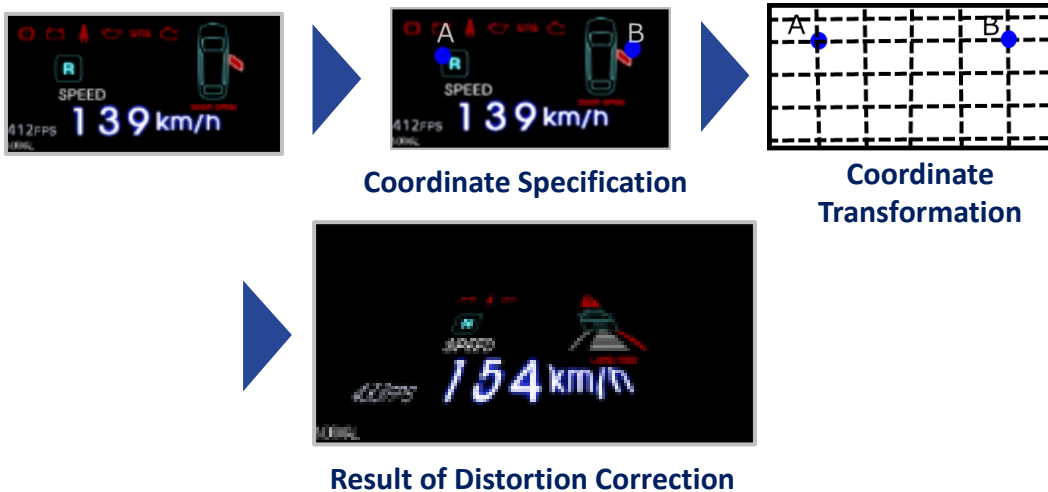
Efficient Image Memory (RAM) Design:
High Resolution and Clear Image By Frame Memory Compression Technology

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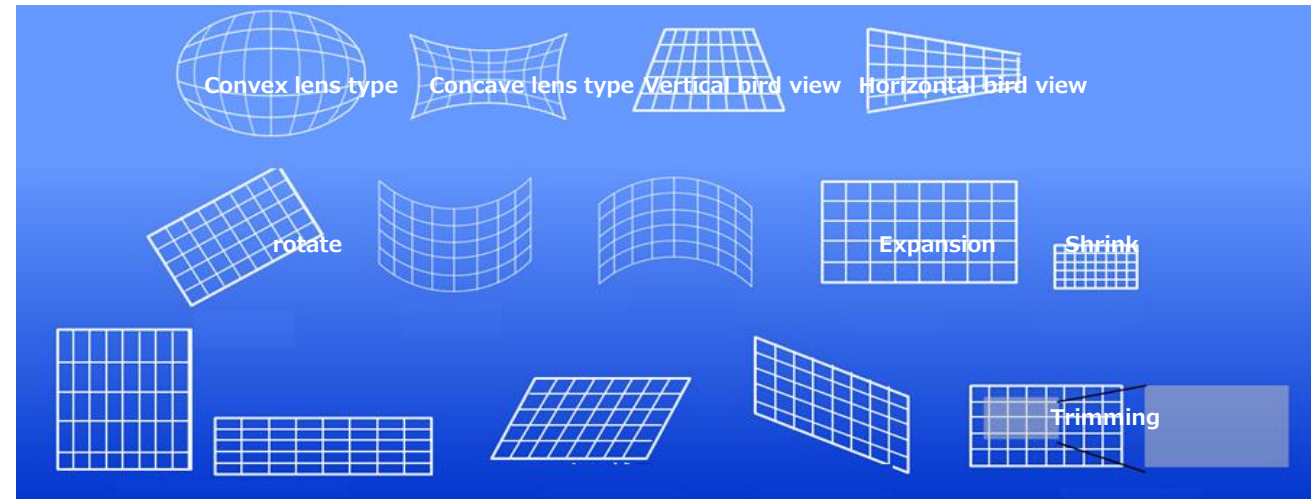
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Gerda® HUD Features

Correct Distortion with Low Latency

By hard engine processing, reduce the
load on display or other functions.

Example: Keystone correction

Coordinate Specification

Coordinate Transformation

Result of Distortion Correction

Other Available Correction Types

Convex lens type   Concave lens type   Vertical bird view   Horizontal bird view

rotate

Expansion   Shrink

Trimming

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Gerda® E-Mirror Features

Mirror System

Fast boot

displayed within 0.5s

Improved visibility of Images (Clearance)

Hi-resolution

Improved visibility of Images (dark place)

Contrast Correction

Dirt detection

Dirt Detection

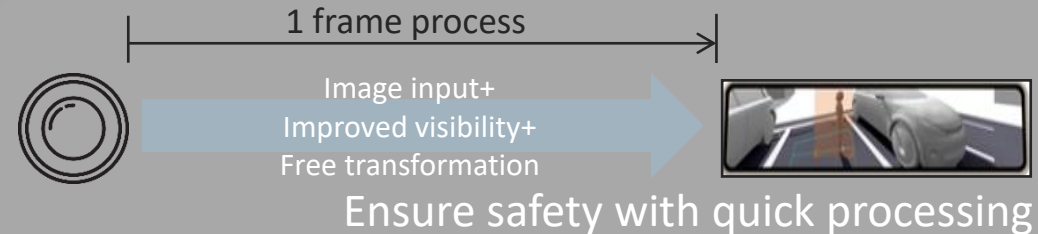petal detection → activate washer

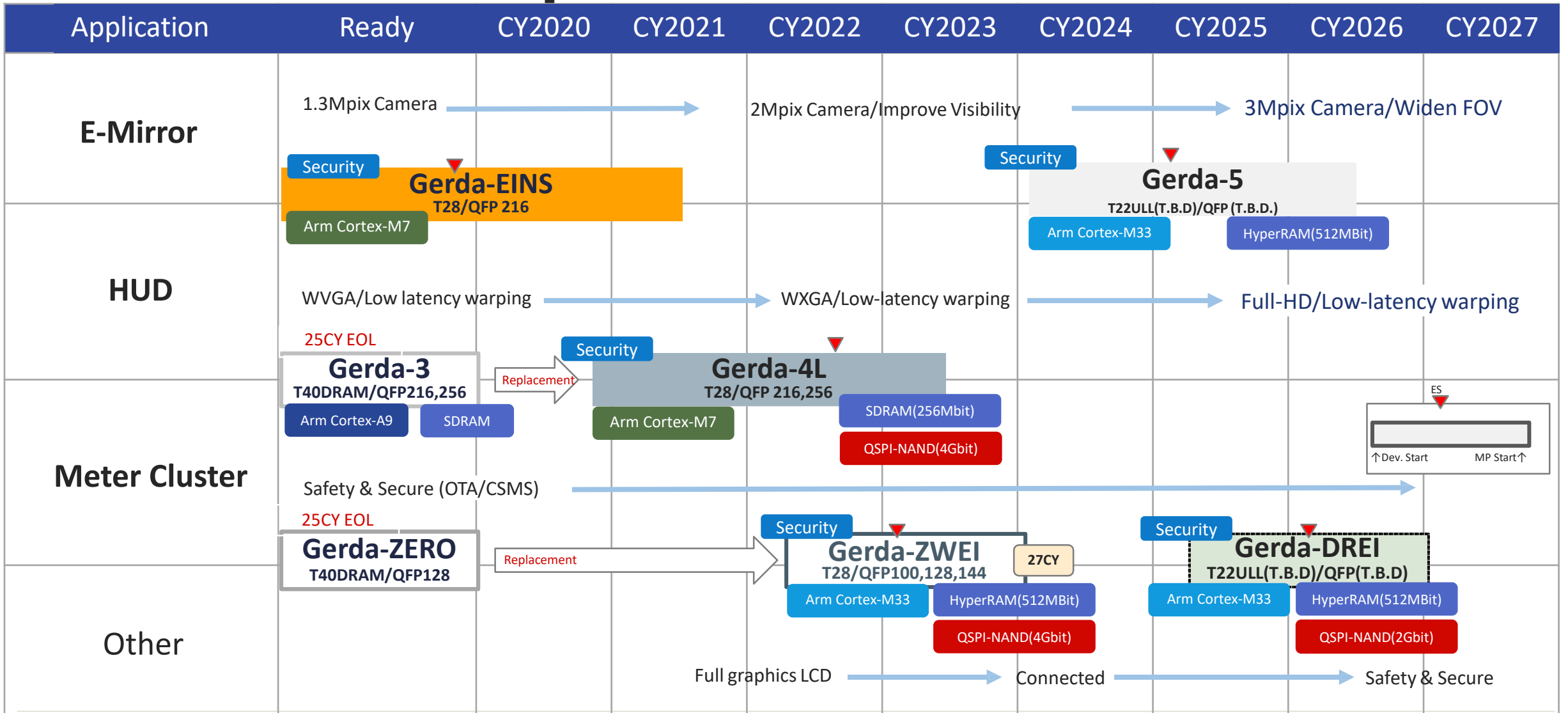**View point transformation (free form)**

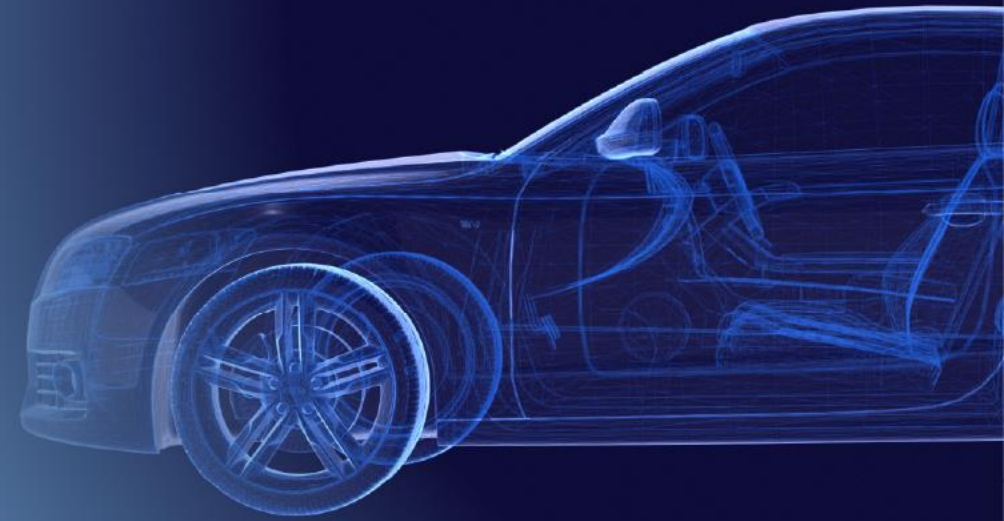Distortion Correction

Easy-to-Recognize Images

Processing with low latency

1 frame process

Image input+
Improved visibility+
Free transformation

Ensure safety with quick processing

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Product Roadmap

Application	Ready	CY2020	CY2021	CY2022	CY2023	CY2024	CY2025	CY2026	CY2027

E-Mirror

1.3Mpix Camera → 2Mpix Camera/Improve Visibility → 3Mpix Camera/Widen FOV

Security
Gerda-EINS
T28/QFP 216
Arm Cortex-M7

Security
Gerda-5
T22ULL(T.B.D)/QFP (T.B.D.)
Arm Cortex-M33   HyperRAM(512MBit)

HUD

WVGA/Low latency warping → WXGA/Low-latency warping → Full-HD/Low-latency warping

25CY EOL
Gerda-3
T40DRAM/QFP216,256
Arm Cortex-A9   SDRAM

Replacement →

Security
Gerda-4L
T28/QFP 216,256
Arm Cortex-M7
SDRAM(256Mbit)
QSPI-NAND(4Gbit)

ES
↑Dev. Start   MP Start↑

Meter Cluster

Safety & Secure (OTA/CSMS) →

25CY EOL
Gerda-ZERO
T40DRAM/QFP128

Replacement →

Security
Gerda-ZWEI
T28/QFP100,128,144   27CY
Arm Cortex-M33   HyperRAM(512MBit)
QSPI-NAND(4Gbit)

Security
Gerda-DREI
T22ULL(T.B.D)/QFP(T.B.D)
Arm Cortex-M33   HyperRAM(512MBit)
QSPI-NAND(2Gbit)

Other

Full graphics LCD → Connected → Safety & Secure

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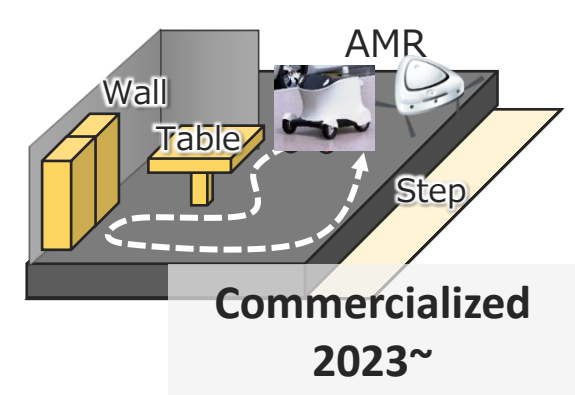**nuvoTon**

Introduction of TOF sensing solution

Principle of pulse indirect TOF measurement

Measuring distance utilizing reflection of illuminated pulsed Near Infra Red (NIR)
Detect W/D/H of objects → Describes 3D coordinates by point cloud

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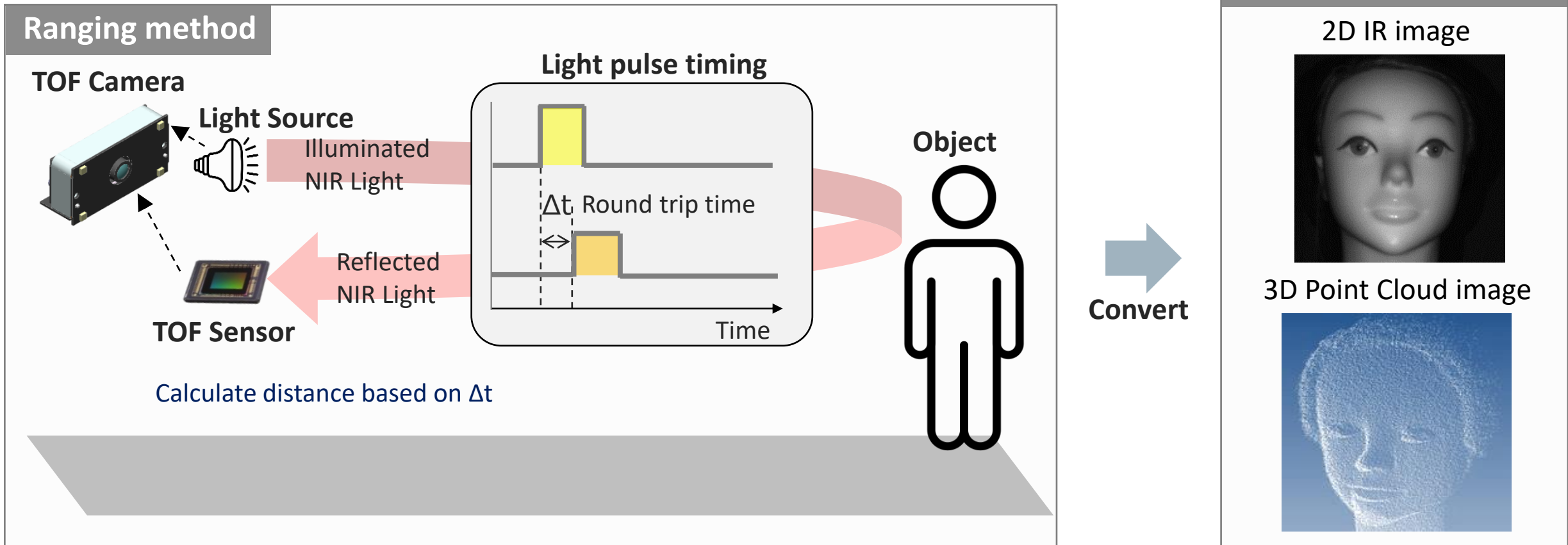
Target Applications

Applications cover a variety of applications that require low-motion blur, outdoor use, and long-distance ranging.

XR (VR/AR/MR)	Human Monitoring	AMR*	Digital Container
Commercialized 2016~	**Commercialized 2019~**	**Commercialized 2023~**	**On going**

Indoor	Outdoor	Indoor ~ Outdoor	

Distance	1m	3m	6m	18m

*AMR: Autonomous Mobile Robot
**SLAM: Simultaneous Localization and Mapping

Target Specs (Our estimation)

Gesture U/I	Behavior Detection	SLAM**	Obstacle Detection
Low latency < 20 ms	**Sunlight tolerance > 100K lux**	Wide angle > 90°	Sunlight tolerance > 100K lux
Low motion blur < 10 ms	Wide angle > 90°	**Mid range > 5m**	**Long range > 10m**
High resolution > QVGA	High accuracy < 1%	High accuracy < 1%	High resolution > VGA

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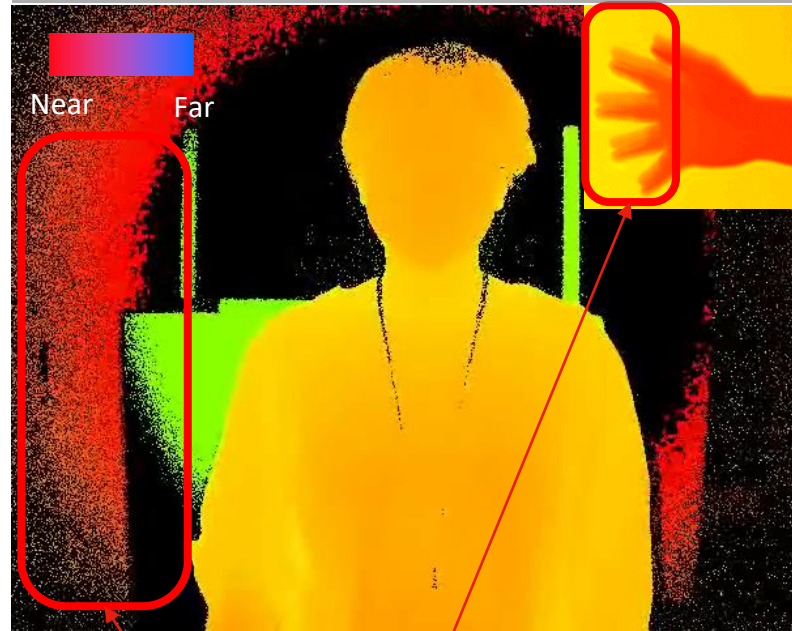# Comparison of Motion Blur Performance

Nuvoton TOF can effectively suppress motion blur and depth aliasing.
→ Perfect for use with moving cameras and detecting moving objects
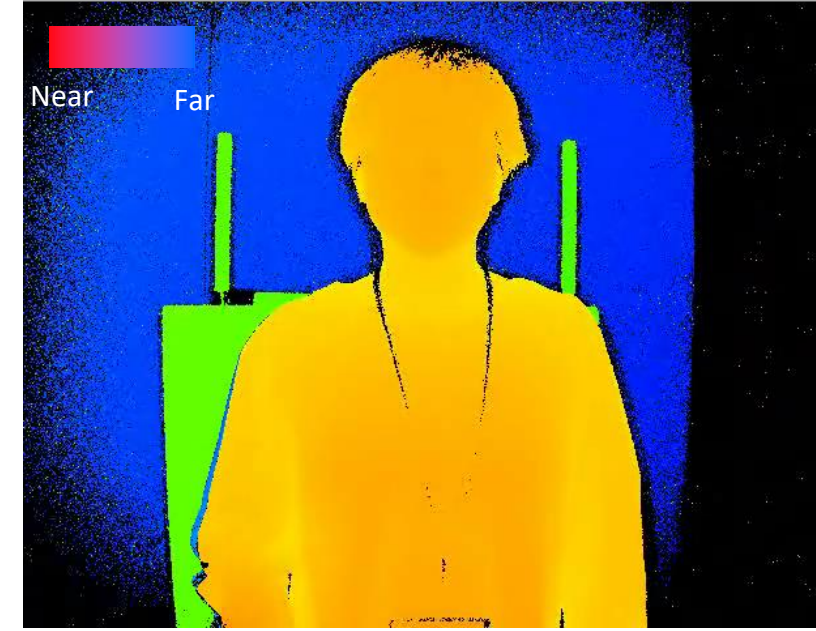

Nuvoton-TOF KW33000
Unique TOF (4-Tap Pulse TOF)

Near   Far
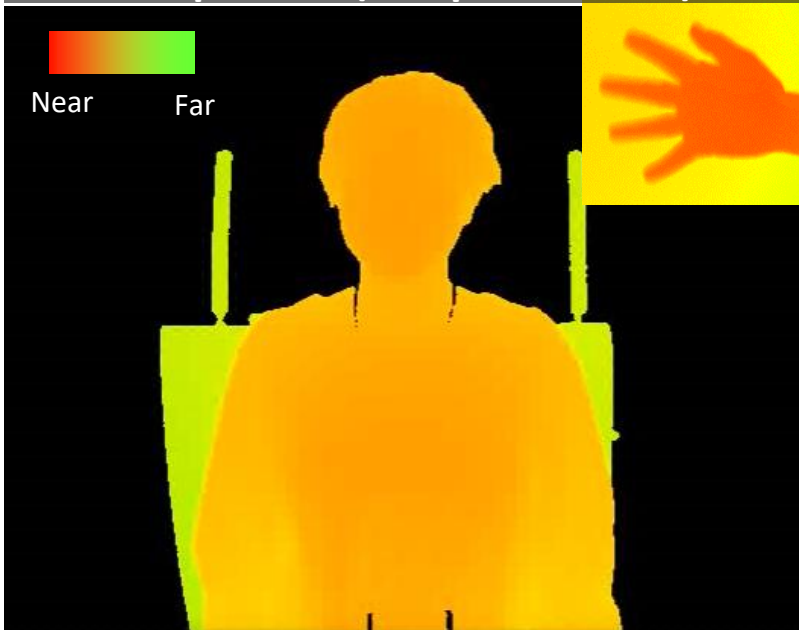
Low motion blur

No depth aliasing

Conventional TOF
Single frequency mode (2-Tap CW*-TOF)

Near   Far

Medium motion blur

Depth aliasing occurs

*CW: Continuous Wave

Conventional TOF
Dual frequency mode (2-Tap CW-TOF)

Near   Far

High motion blur

Less depth aliasing
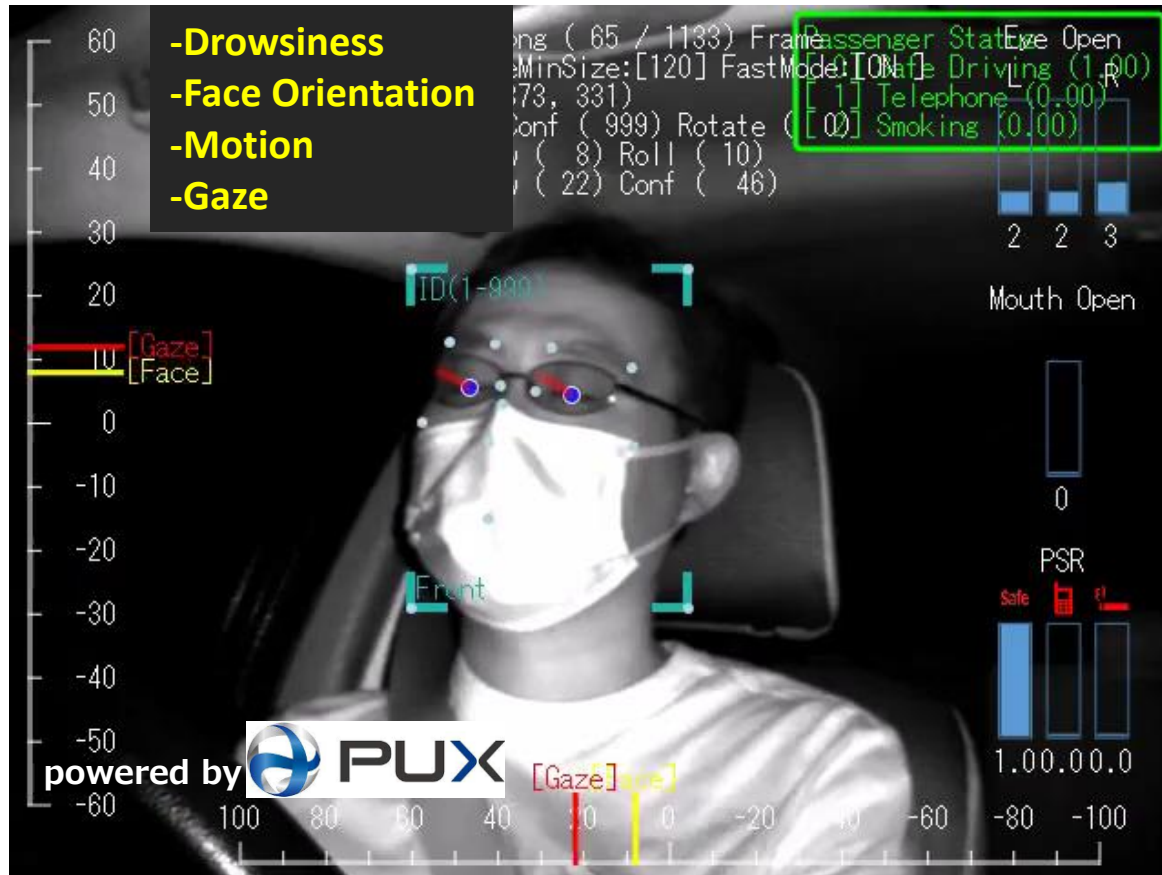
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High Sunlight Tolerance

Nuvoton TOF camera can detect correctly "under strong sunlight" and "wear glasses."
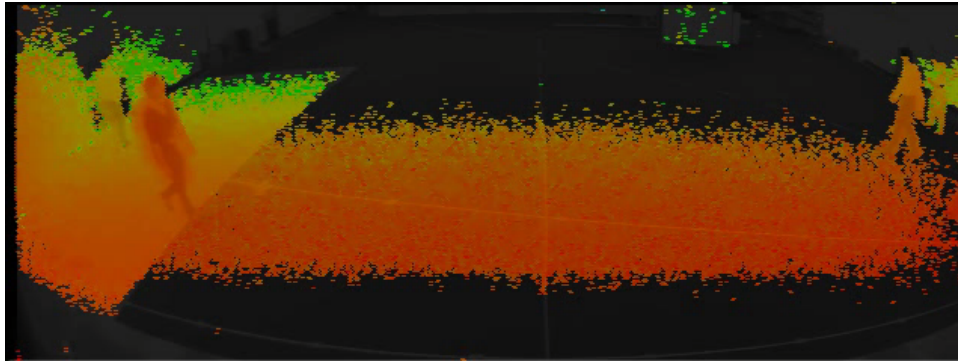
Nuvoton TOF Camera(IR mode) **General purpose NIR camera**

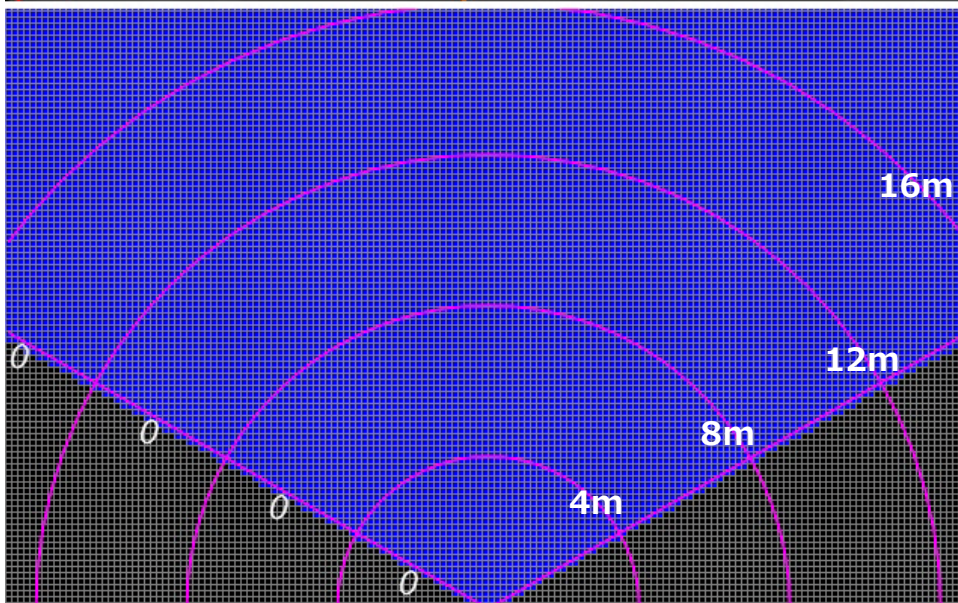 NuDeveloper Ecosystem – Make engineers' jobs easier.

Long Range Measurement (Human Detection)

Nuvoton pulse TOF and TOF library can support over 10m and wide range measurement.
And we can recognize intrusion into a particular area, flow line, people counting, and height.
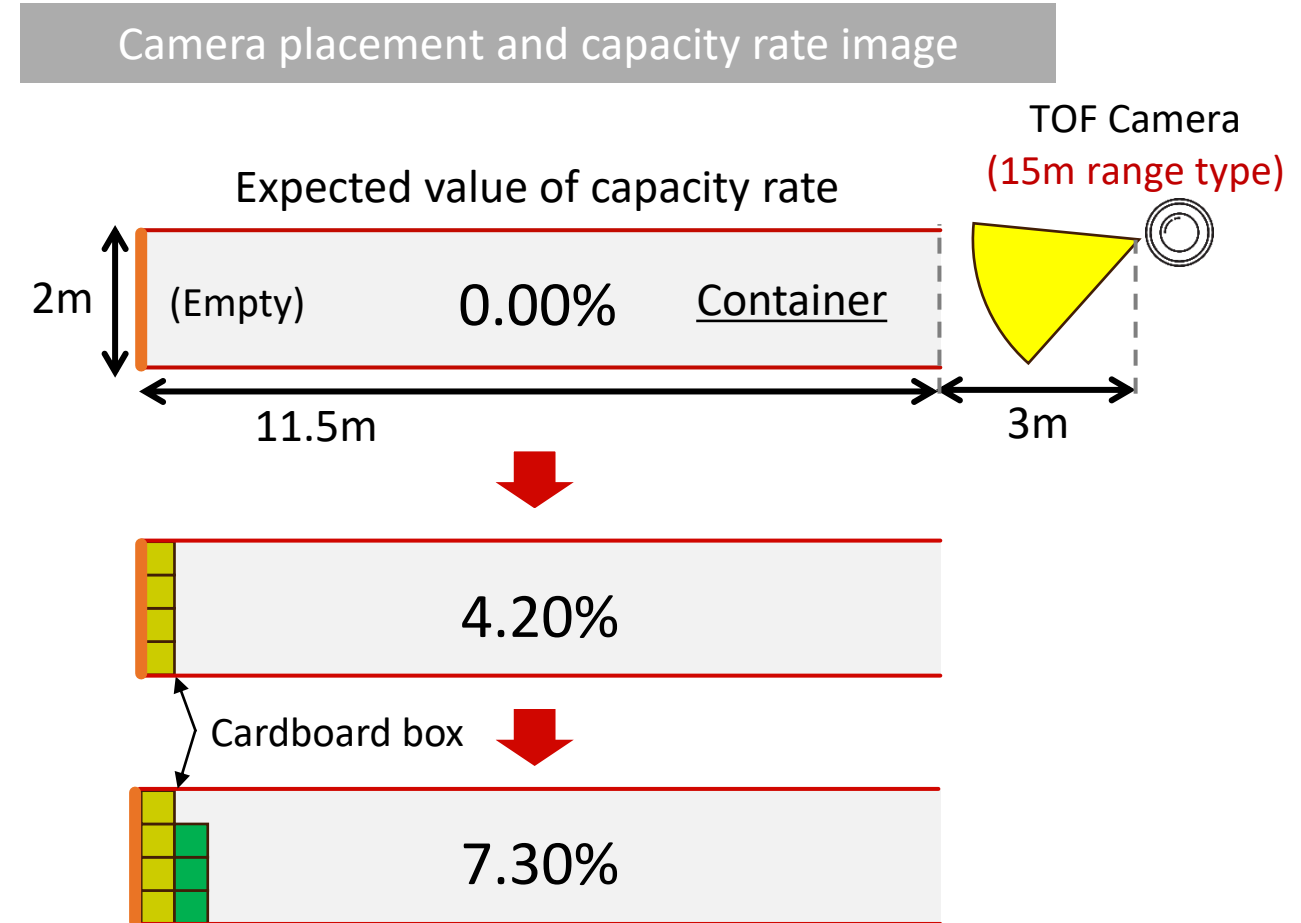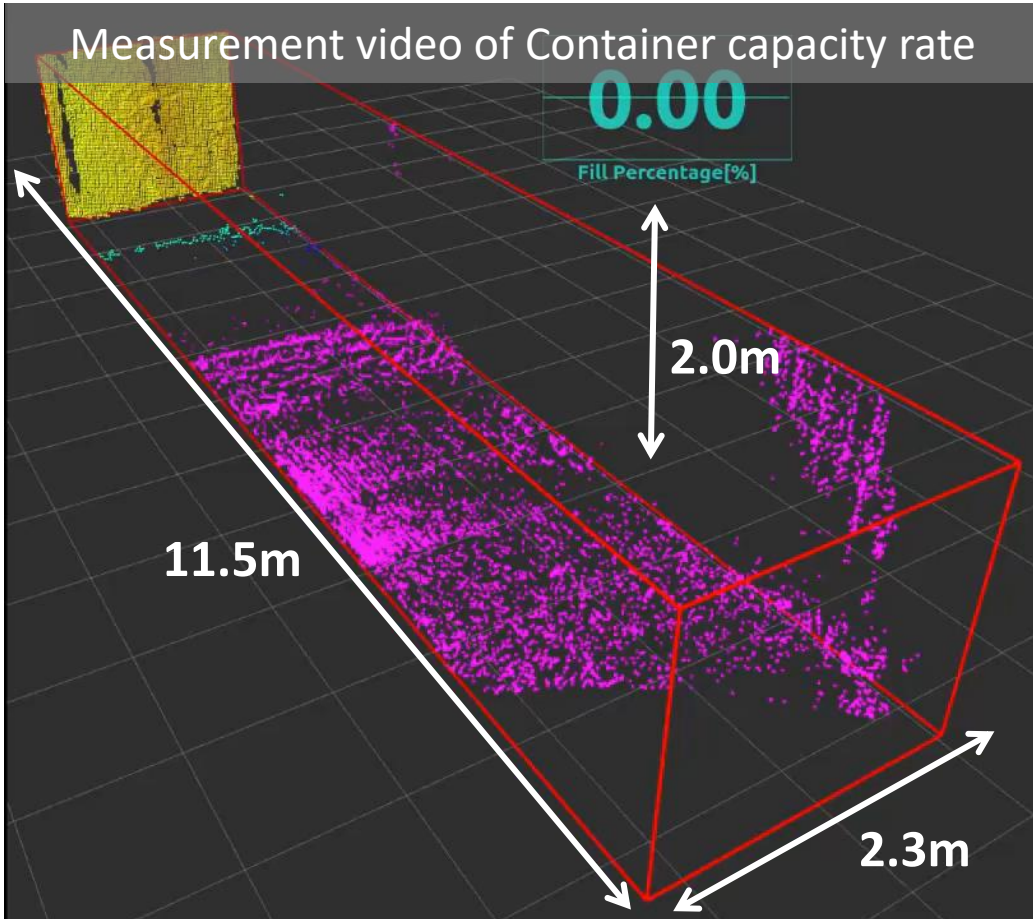

Human detection
Height measurement

People count
Movement direction prediction
Movement vector after 1 second
Movable area estimation

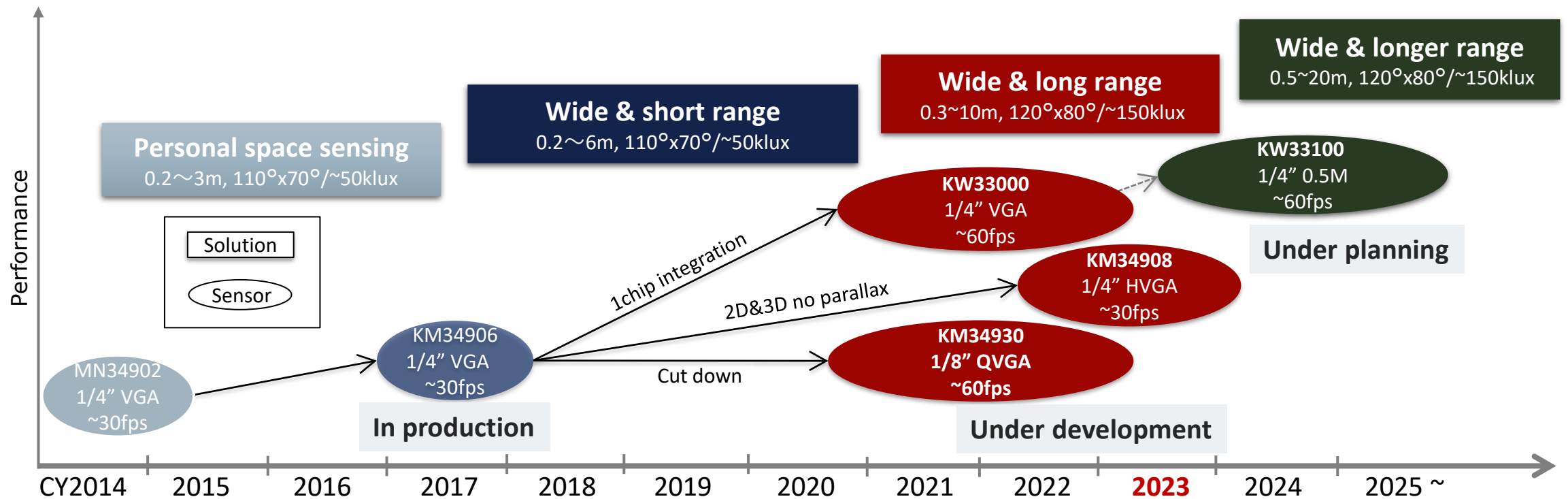|	
Red circle	: current position
White arrow direction	: moving direction
White arrow length	: moving speed
White fan range	: area of human mobility

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Long Range Measurement (Digital Container Capacity Rate)

Nuvoton 4-tap pulse TOF can support over 10m range measurement

Measurement video of Container capacity rate

0.00
Fill Percentage[%]

2.0m

11.5m

2.3m

Camera placement and capacity rate image

TOF Camera
(15m range type)

Expected value of capacity rate

2m — (Empty)   0.00%   Container

11.5m   3m

4.20%

Cardboard box

7.30%

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TOF Sensor Roadmap

Nuvoton will improve the TOF sensor to the needs of 3D applications.

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谢谢
謝謝
Děkuji
Bedankt
Thank you
Kiitos
Merci
Danke
Grazie
ありがとう
감사합니다
Dziękujemy
Obrigado
Спасибо
Gracias
Teşekkür ederim
Cảm ơn

Joy of innovation
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