

SEAMLESS TINYML DEVELOPMENT AND DEPLOYMENT OF AIOT

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DATA EXPLOSION



85%
CAGR
(2017-2025)

ENDPOINT DATA
CREATION
GROWTH

80
ZETTA BYTES
(IN 2025)

TOTAL DATA
GENERATED BY
IOT DEVICES

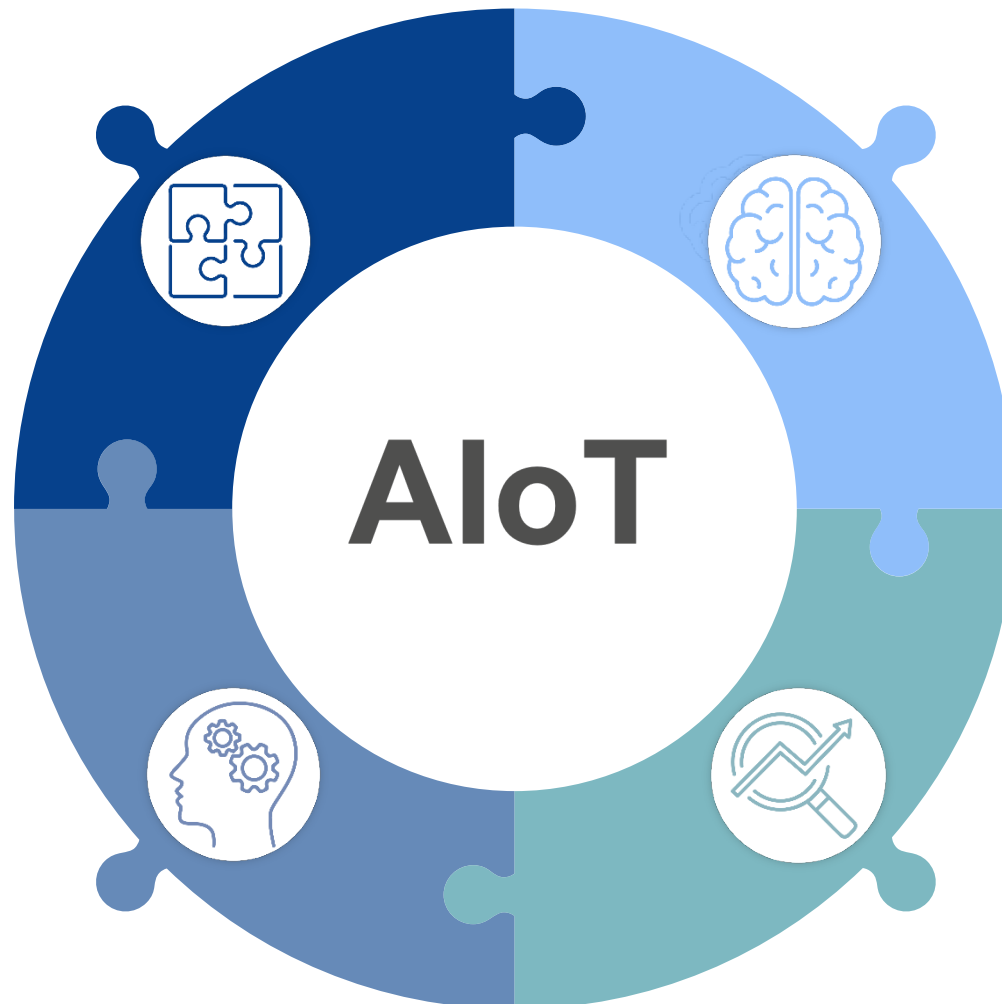
90%

ENTERPRISE
DATA IS NEVER
USED

TECHNOLOGY ALIGNMENT IN AIOT

TECHNOLOGY CONVERGENCE

IOT, AI, 5G maturing roughly at the same time



DECENTRALIZED INTELLIGENCE

Tremendous benefits of a distributed intelligence model

NEW DESIGN MINDSET

AI transforms data to actionable insights

DATA EXPLOSION

Endpoint data creation to grow at 85% CAGR (2017-2025)

WHY DECENTRALIZE INTELLIGENCE?



REAL-TIME RESPONSE

- ✓ Minimized latency by transforming data at source
- ✓ Optimized processing for time-critical applications



SECURITY & DATA PRIVACY

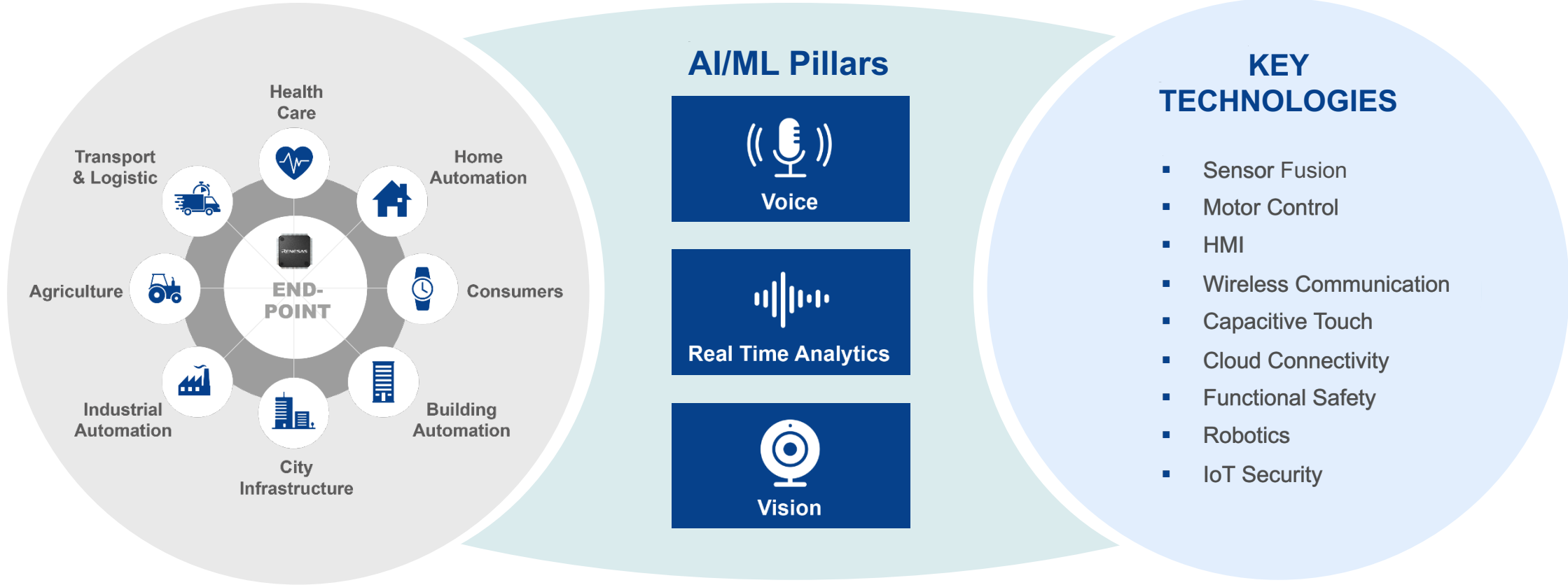
- ✓ Minimized security concerns related to transfer & flow of data
- ✓ On-device data handling tightly coupled to hardware root-of-trust



NETWORK AGILITY

- ✓ Maximizing data gravity by operating on data at the source
- ✓ Reduced data transport improves power & cost efficiencies

MCU / MPU CENTRIC AI/ML ON THE EDGE



AI/ ML can solve-for or enhance aspects of IOT systems related to maintenance, effectiveness, liability, personalization, service, safety, security, and more

MCU / MPU CENTRIC AI/ML ON THE EDGE



RA6M3/Asset Movement AI/ML – Realtime Analytics



Asset Tracking

AI based asset movement detection

This demo showcases AI based asset motion tracking solution developed using Reality AI Tools and deployed on AIK-RA6M3.



Key Features

- On-board accelerometer-based tracking.
- Resource efficient model.

Key Benefits

- Easy to generate models using Reality AI Tools.

Key Applications

- Consumer
- IoT devices
- Industrial.

To be
launched later
Q4 2023

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People Detection AI/ML - Vision



People Detection

Complete software solution for camera-based people detection. The AI software solution is readily available for the RA family of MCUs and runs on Arm Cortex-M33, Cortex-M4, and Cortex-M85 microcontrollers.



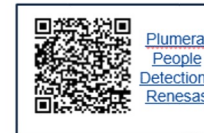
Key Features & Benefits

- Detects each person in view, even if partially occluded
- Tracks people and assigns up to 20 unique IDs
- Detection distance of more than 20m / 65ft
- Trained with over 32 million labeled images
- Extensively validated on diverse people and scenarios
- Supports lenses up to 180 FOV



Key Applications

- Intelligent people detection sensors
- Security cameras and video analytics
- Video conferencing and webcams
- Video doorbells and smart home cameras



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RA2L1/Voice Recognition AI/ML - Voice



Voice Control

World-wide first VUI on CM23 – 48MHz

Palm size Voice kit platform, ready with RA2 for low power requirements of an application matter most for these device definitions. Realizes with ecosystem partner: Cyberon.



	Voice Engine		
	Compact	Level 0	Level 1
RA2	✓	✓	✓
RA2L1	✓	✓	✓
RA2L1P0	✓	✓	✓
Idle noise	100%	100%	100%
SNR* 12dB	90%	94%	100%
6dB	88%	90%	98%
0dB	44%	58%	96%

Key Features

- Endpoint voice recognition algorithm
- No latency, perform real time control
- Friendly voice modeling tool: DSMT
- Global 44+ language support.
- High Robustness and Accuracy
- Maximum three main points

Key Benefits

- One hand solution provider
- Simplify Design
- Fully System Cost Reduction
- Accelerate to Revenue
- Faster Go-To-Market



Key Applications

- IoT Devices
- Home Appliances
- Wearable/Hearable Devices

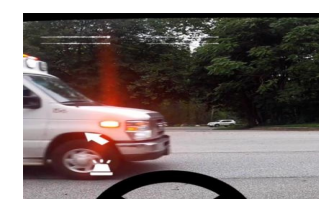


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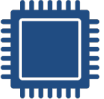



AI IS DISRUPTING EVERYTHING

The impact of AI in our lives is more visible than ever!



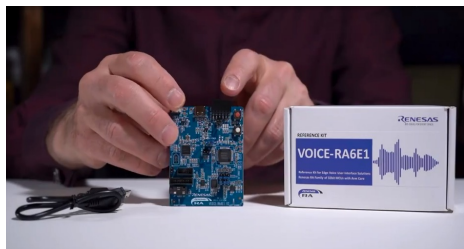
AI @ RENESAS

Comprehensive portfolio of AI/ ML tools and solutions

STARTING WITH	 SENSOR/SIGNAL DATA	 USE CASE REQUIREMENTS	 TRAINED MODEL OR MODEL FROM RENESAS APPLICATION ZOO		 VOICE COMMANDS
 AVAILABLE TOOLS	RealityAI Tools® RealityCheck™ AD RealityCheck™ Motor	RealityCheck™ HVAC Automotive SWS	RZ/V AI SDK DRP-AI TVM DRP-AI Translator	e-AI Translator	Dspotter Tool
 SUPPORTED COMPUTE ARCHITECTURES					

AI @ RENESAS

VOICE PLATFORM SUPPORTING 44 LANGUAGES

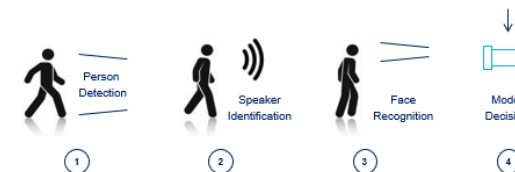


Comprehensive & intuitive toolchain
 Support for 44+ languages
 Scalable + smart software features
 Runs on Cortex M23/ M33 devices
 License free development

Home Appliances, Wearables, IoT Devices

MULTI-MODAL MACHINE ACCESS/ PERSONALIZATION

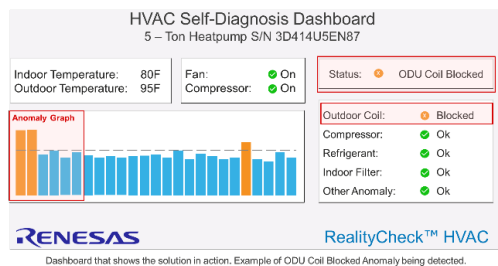
Enhances user safety or personalizes operation
 User facial & voice signatures for authentication
 Multi-modal design runs on M33 devices



Smart Appliances, Machines, etc.

AI/ ML SOLUTIONS

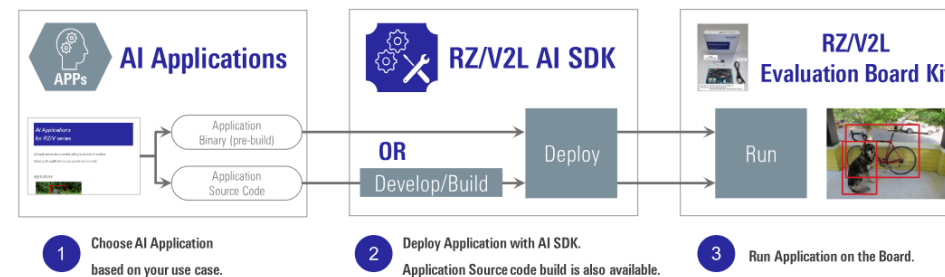
HVAC, Refrigeration



Complete end-to-end service
 H/W, S/W reference design
 AI-enabled anomaly detection
 Predicting operating conditions

REALITYCHECK HVAC SOLUTION SUITE

Multiple IoT verticals.



20+ PRE-TRAINED MACHINE VISION APPLICATIONS

SUMMARY & KEY TAKEAWAYS

- The convergence of AI & IoT is a megatrend that cannot be ignored
- With explosive growth in endpoint data creation a decentralized intelligence architecture will unlock tremendous potential
- Renesas with its comprehensive offering of hardware, software, tools & ecosystem provides all the building blocks for you to unleash your creativity
- Join Renesas and experts & through-leaders from across the industry at Renesas AI, where we present the latest innovations in this space.
- Come talk to us about your next AIoT challenge!

Discover AI Resources That Fit Your Needs

Which AI category are you interested in?

Vision
Voice
Real-time Analytics

Multi-modal
Not Sure

• • • •

Enabling intelligence from the cloud to the edge and endpoint sustainably

Artificial Intelligence (AI) is transforming every aspect of life. Artificial Intelligence of Things (AIoT) is a transformational megatrend driven by four underlying market dynamics which include technology convergence, decentralized intelligence, a new design mindset, and an explosion of data.

Technology Convergence

IoT, AI, 5G maturing roughly at the same time

Decentralized Intelligence

Tremendous benefits of a distributed intelligence model

New Design Mindset

AI disrupting system design approaches

Data Explosion

Endpoint data creation to grow at 85% (2017-2025)*

*Source: IDC Research

Traditionally, the IoT has been built on a cloud-centric intelligence architecture. To truly scale and enable intelligence at all levels of the network, a decentralized intelligence architecture is needed. This means running cloud-independent inference engines on power-efficient or tiny computers within the edge and endpoints. A decentralized intelligence model has tremendous technical and economic benefits as shown below.

Why decentralize intelligence?

<p>Real-Time Response</p> <ul style="list-style-type: none"> Minimize latency by transforming data at the source Optimize processing for time-critical applications 	<p>Security & Data Privacy</p> <ul style="list-style-type: none"> Minimize security concerns related to the transfer and flow of data On-device data handling tightly coupled to hardware root-of-trust
<p>Network Agility</p> <ul style="list-style-type: none"> Maximizing data gravity by operating on data at the source Reduced data transport improves power and cost efficiencies 	

IoT systems can be thought of as an interplay of one or more core technologies shown in the diagram below. AI and Machine Learning (ML) can be viewed as an enabler that bridges underlying technologies and applications. The use of AI can be classified broadly into three categories – Voice which deals with spoken voice and linguistics, Vision which deals with cameras, machine vision and robot vision and, finally, Real-Time Analytics which deals with mostly sensor data and time-series data that is captured from sensors.

Renesas offers a comprehensive solution stack for AI/ML developers. A broad product portfolio spanning across sensing, connectivity, computing, and actuation covers all layers of the IoT. In addition, software, tools, solutions, and a partner ecosystem that has been purpose-built to accelerate your AIoT designs.

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