

智慧工業物聯網方案

嵌入式機器學習

Johnson Shen 沈子嵐



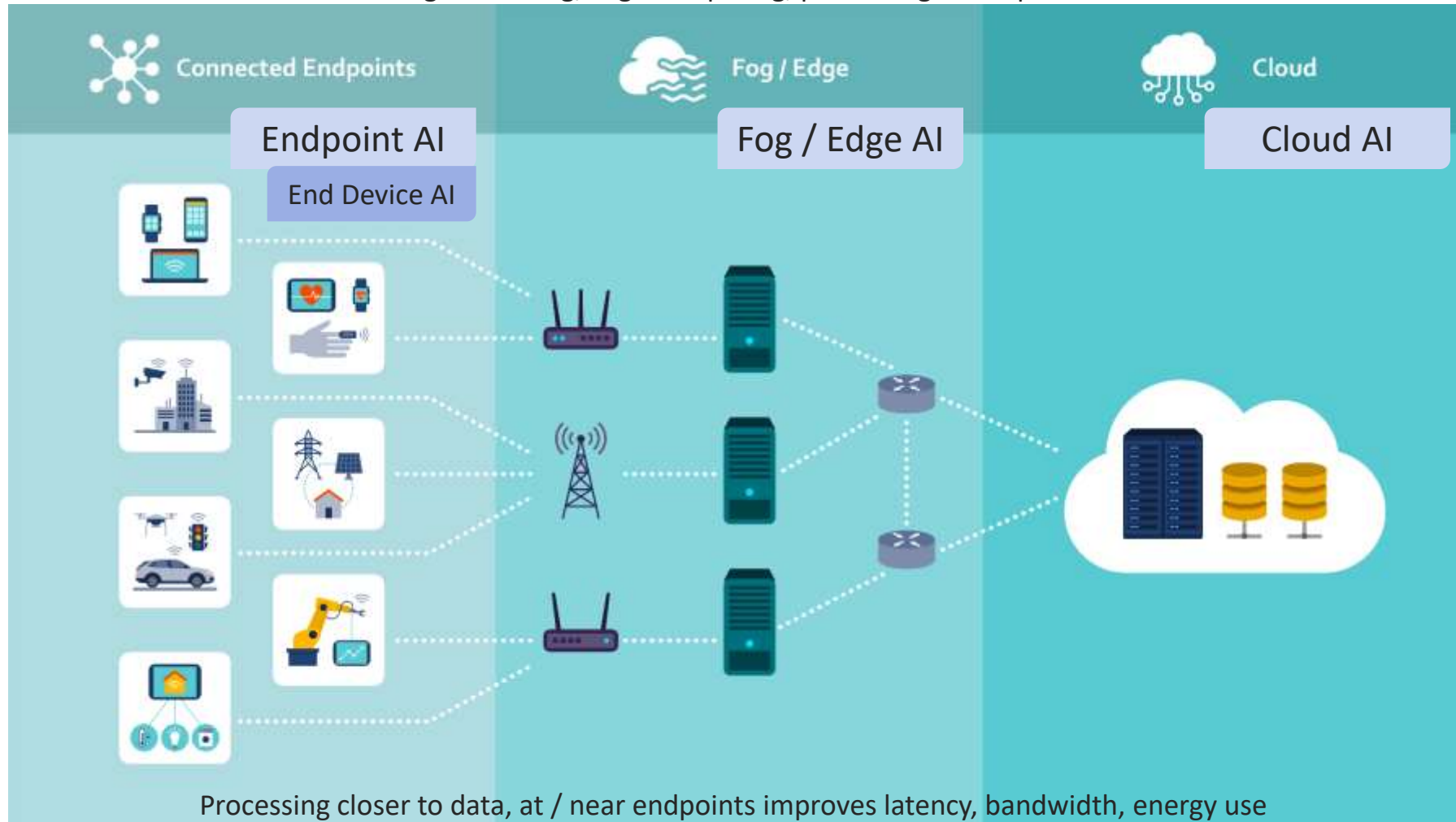
Endpoint AI Introduction

Embedded device starts to think



| AI Computing Topologies

Emergence of fog/edge computing, processing at endpoints



| What are the benefits of Endpoint AI?



Rich Sensors Connectivity



Multi-Sensor Fusion



Real-Time Inference



Fast Response Time

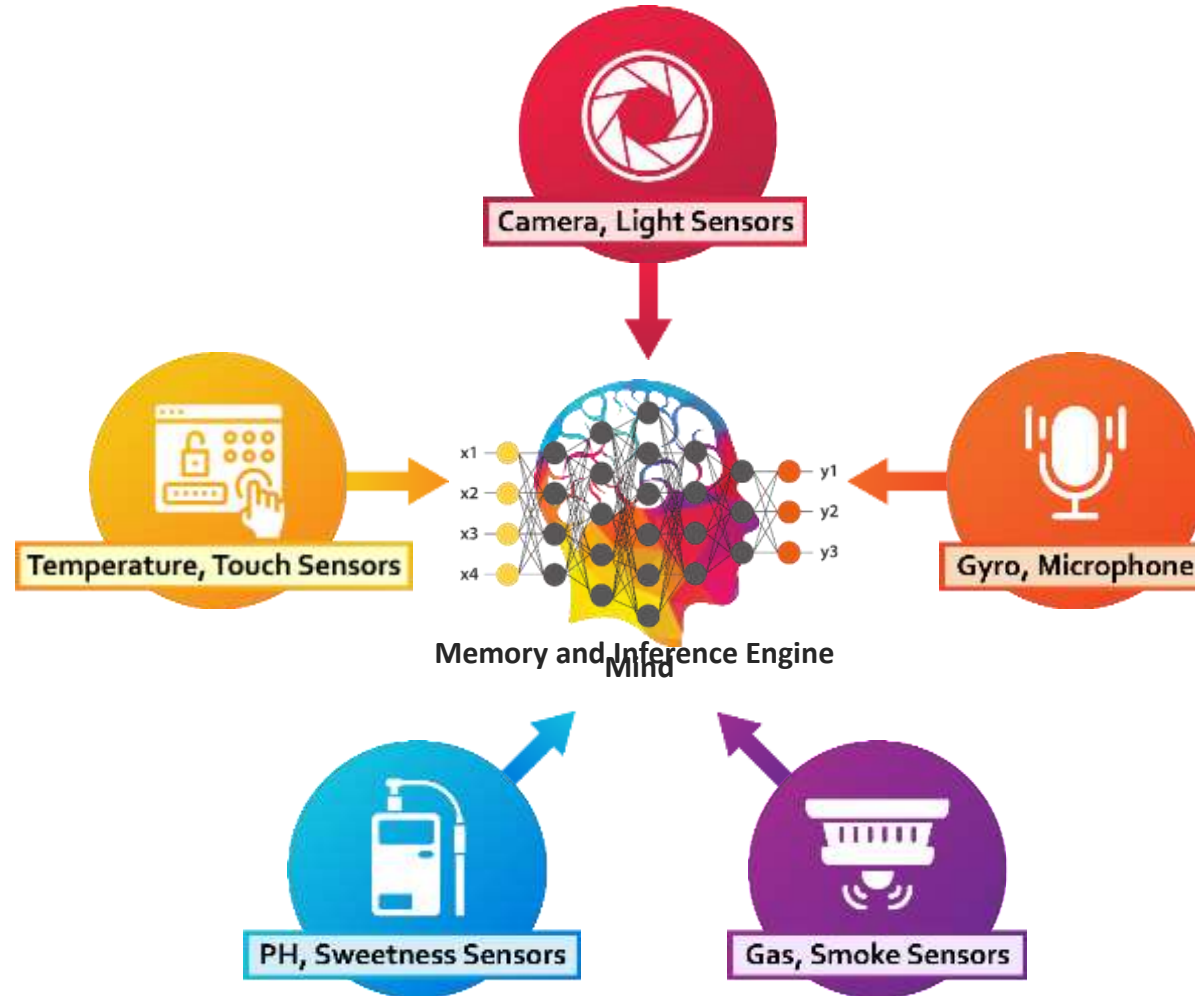


Energy Efficiency



Data Security

| Endpoint AI Sensors vs. Human Senses



Endpoint AI Technology Trends

- Smaller model size
- Higher model performance

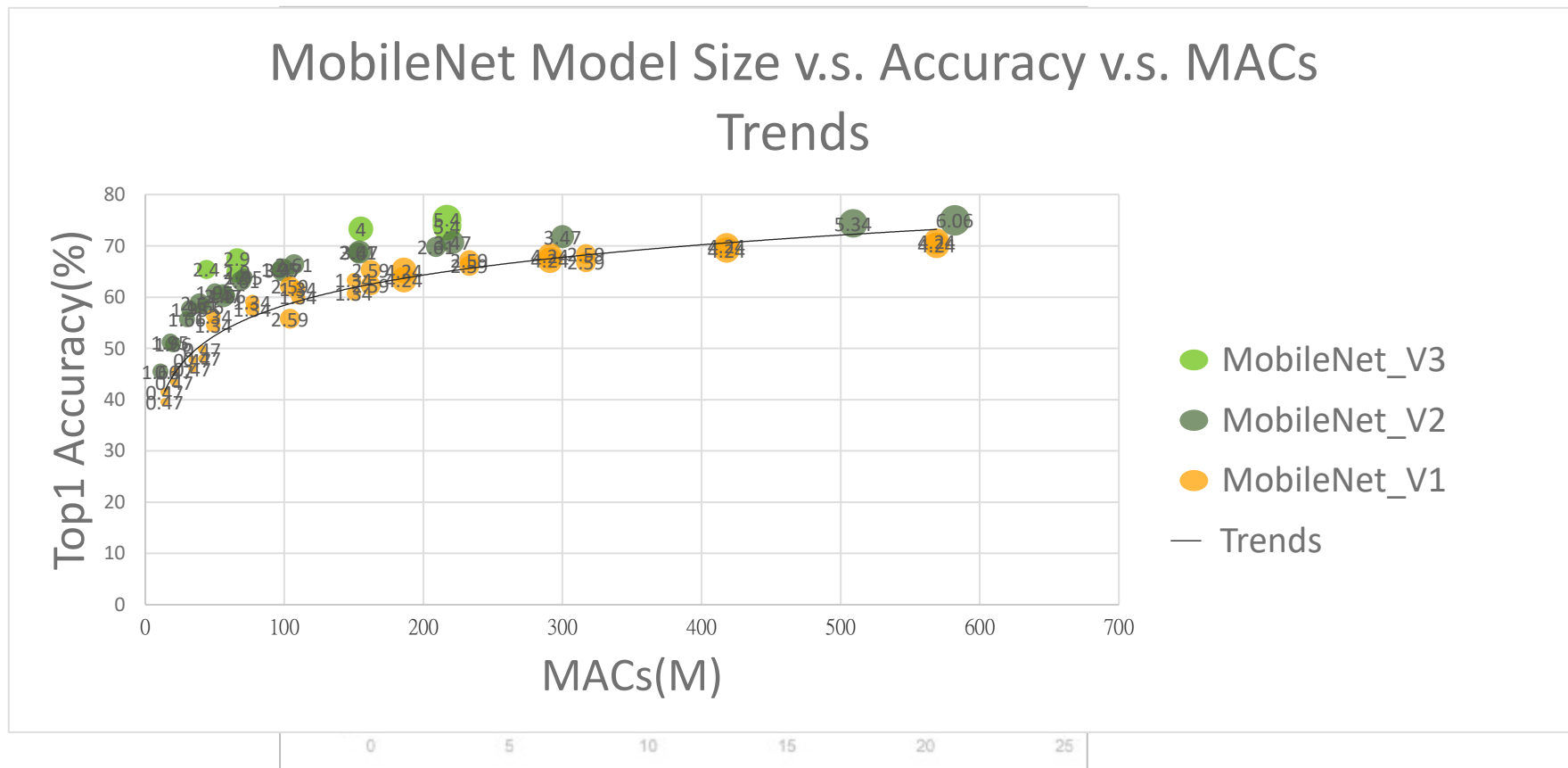
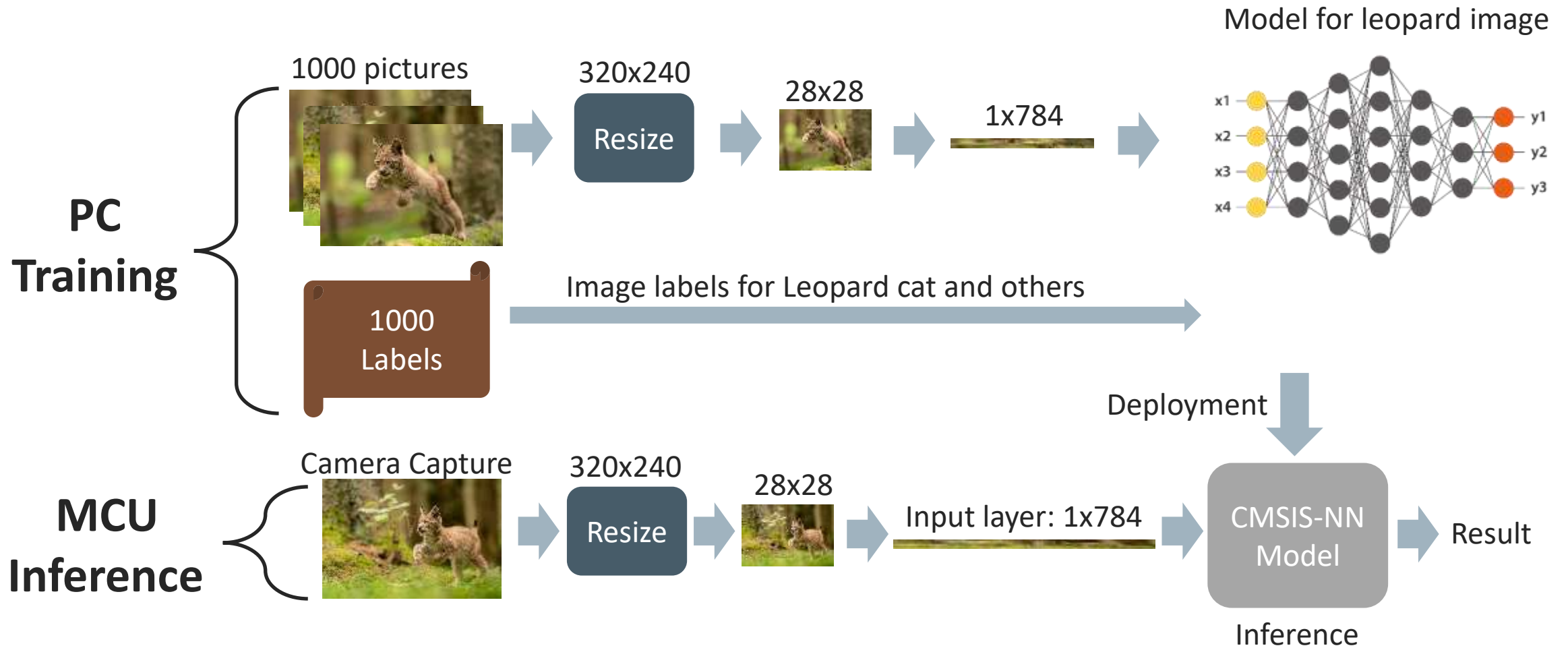


Image Recognition on Endpoint

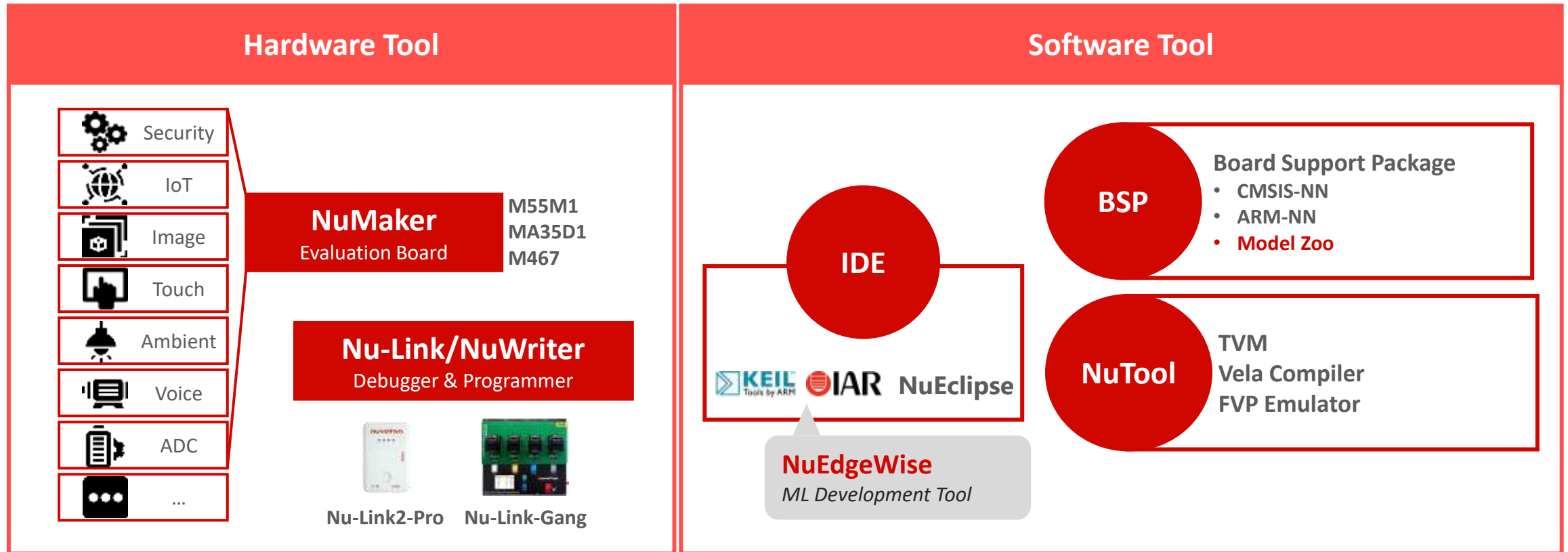


NuEdgeWise IDE

Nuvoton Embedded AI Development Tool

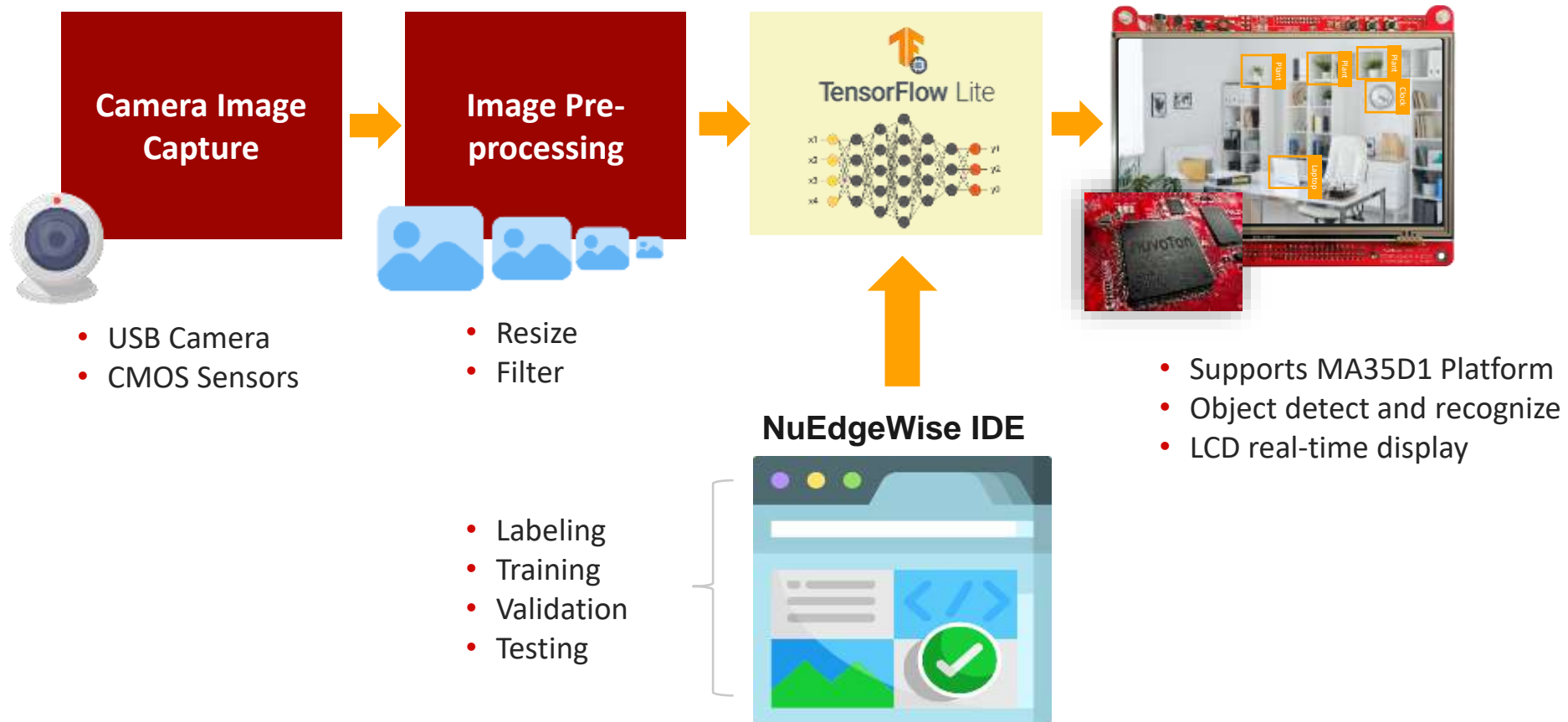


NuDeveloper Ecosystem – NuEdgeWise IDE

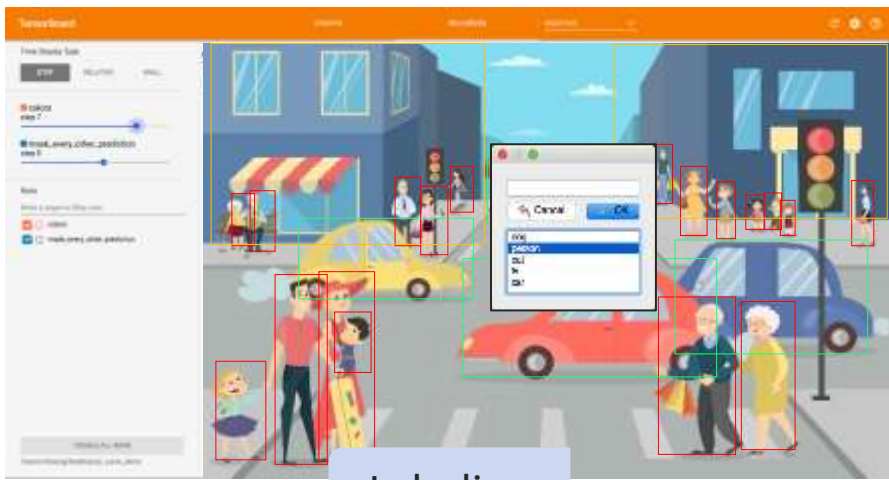


Documentation		Technical Support & Communities					Reference Design Example Code		
Datasheet	Application Note	Online Course	Webinar	Online Chat	Forum	GitHub	Plate Billing	Motion Detection	
TRM	...						KWS	People Counting	...

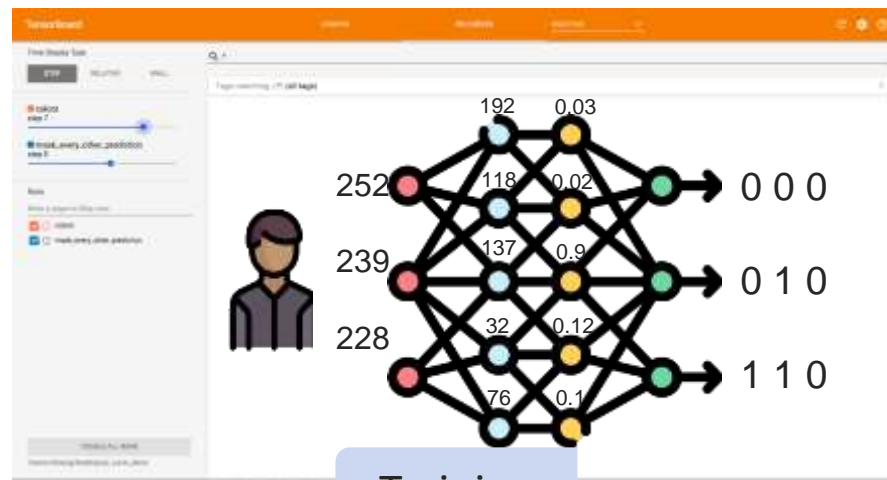
NuEdgeWise IDE – Object Detection



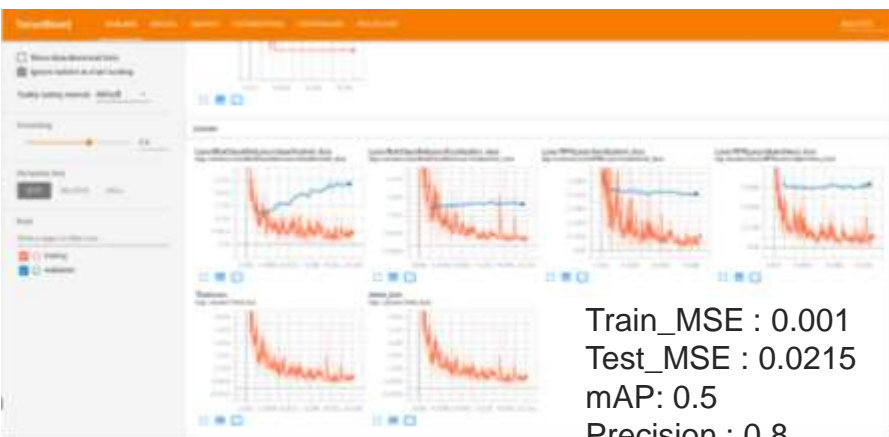
NuEdgeWise IDE – Function



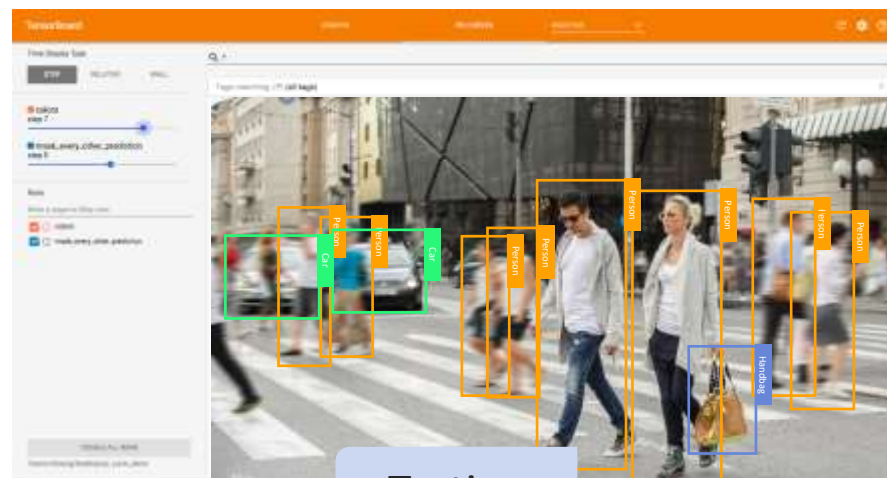
Labeling



Training



Validation



Testing

Endpoint AI Applications

NuMicro[®] MA35D1

NuMicro[®] M460

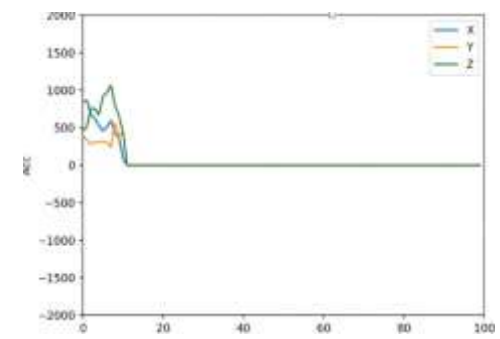
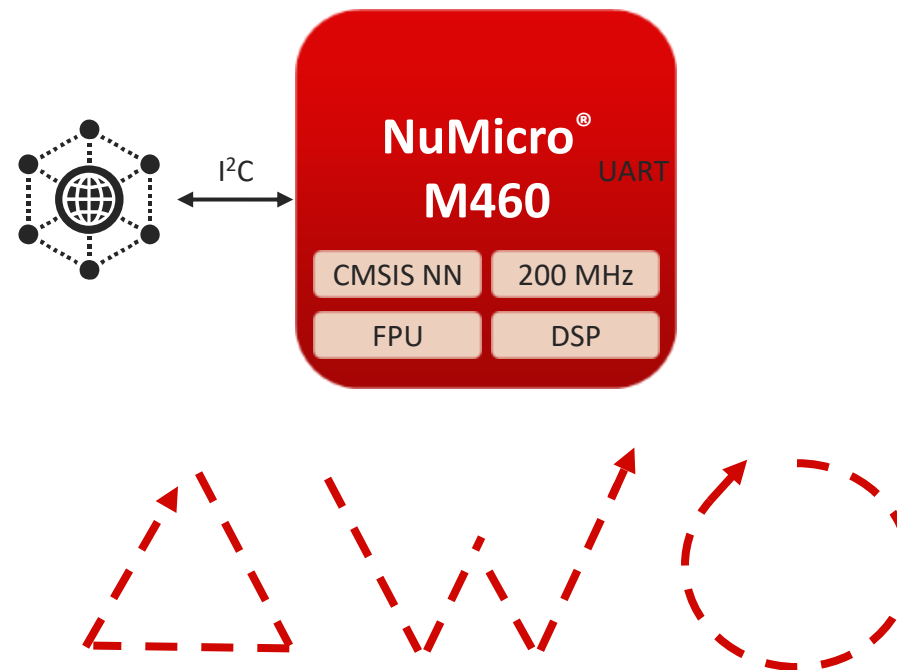


Gesture Sensing

- NuMicro® M460HJ MCU
- IMU (Gyro + Acc)
- Supports 480x242 LCD
- Internal 512 KB SRAM
- Supports external memory
 - QSPI, SDHC, EBI 16-bit, HyperRAM
- Performance
 - Inference Rate: 30 FPS
 - Model: CNN
 - Flash: 205 KB
 - RAM: 76 KB

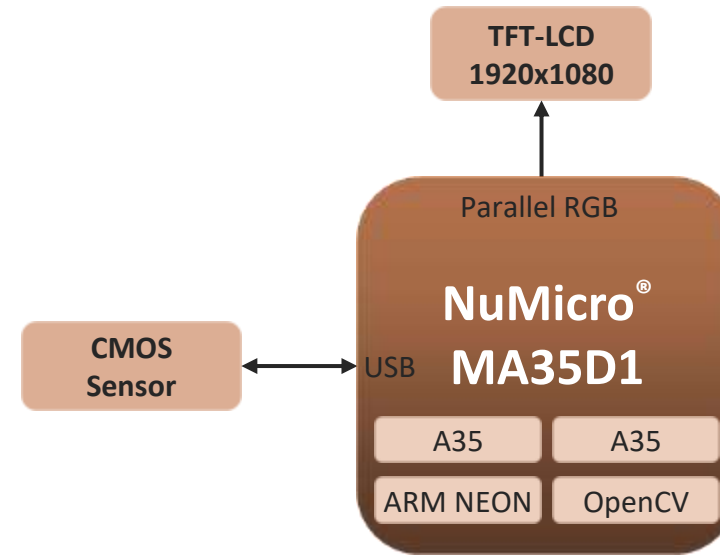


NuMaker-IoT-M467



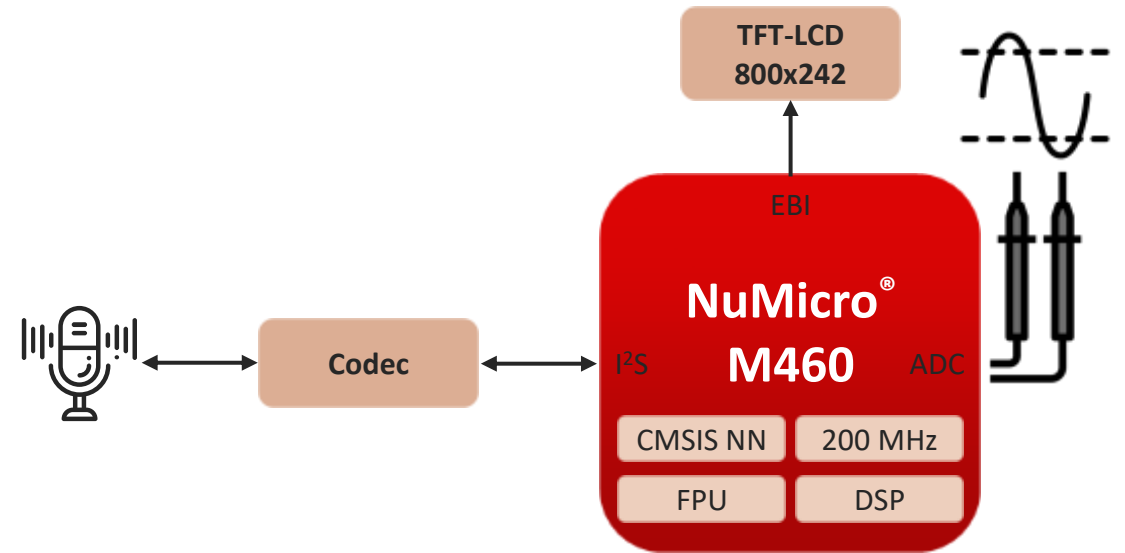
People Counting

- NuMicro® MA35D1 MPU
- Parallel port camera or USB Webcam interface
- Supports 1920x1080 LCD
- Internal 256 KB SRAM
- Supports external memory
 - SDRAM, QSPI, SDHC, EBI 16-bit
- Performance
 - Inference Rate: 20 FPS
 - Model: MobileNet_v2_SSD
 - Flash: Model Size (4.5 MB) Code (5 MB)
 - RAM: 75 MB



Voice Control Scope

- NuMicro® M460HJ MCU
- DMIC
- Supports 480x242 LCD
- Internal 512 KB SRAM
- Supports external memory
 - QSPI, SDHC, EBI 16-bit, HyperRAM
- Performance
 - Inference Rate: 15 FPS
 - Model: CNN
 - Flash: 436 KB
 - RAM: 500 KB



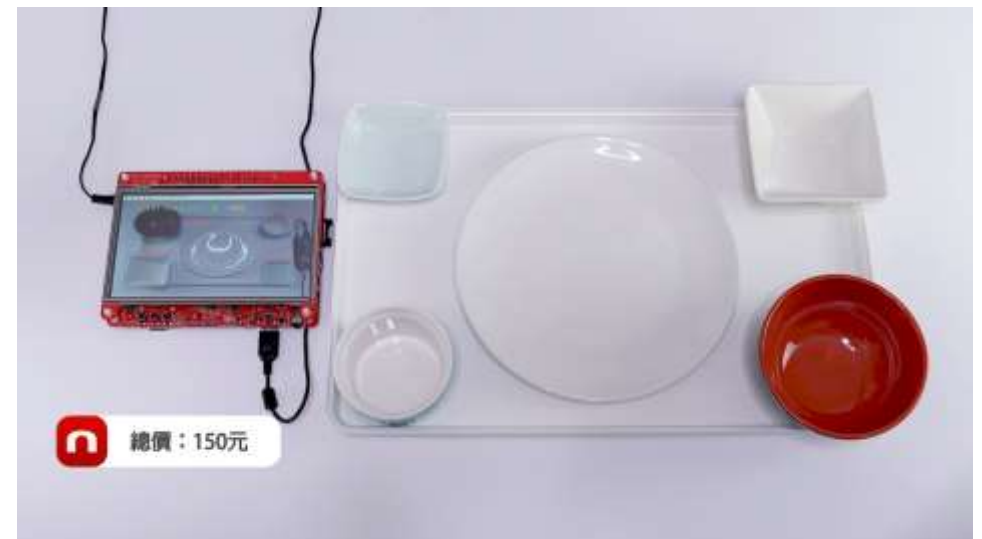
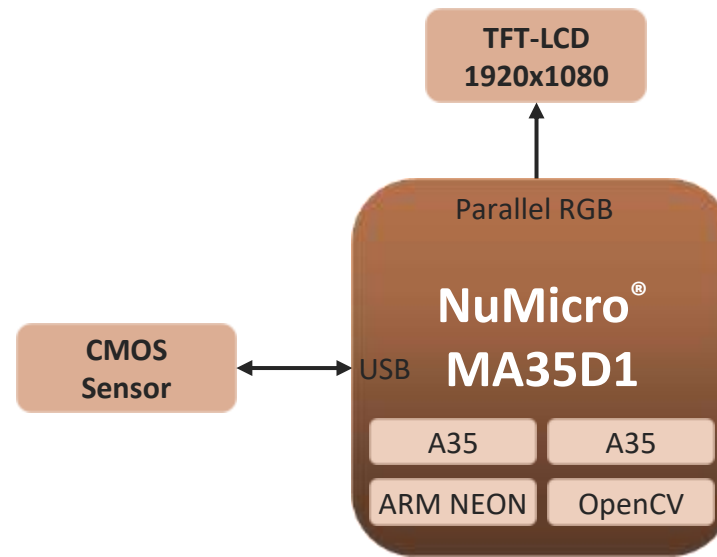
- trigger
- run
- stop
- zoom in/out
- reset



NuMaker-M467HJ

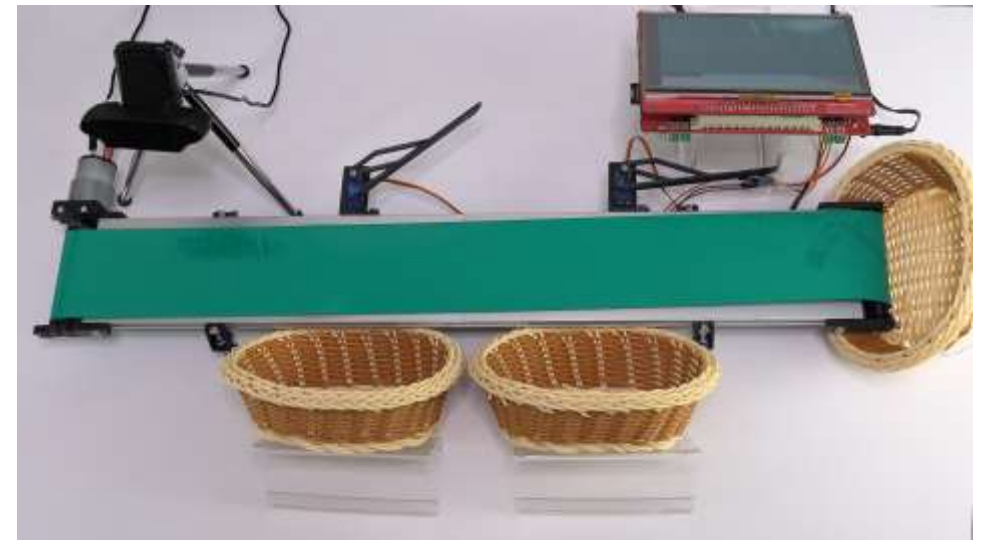
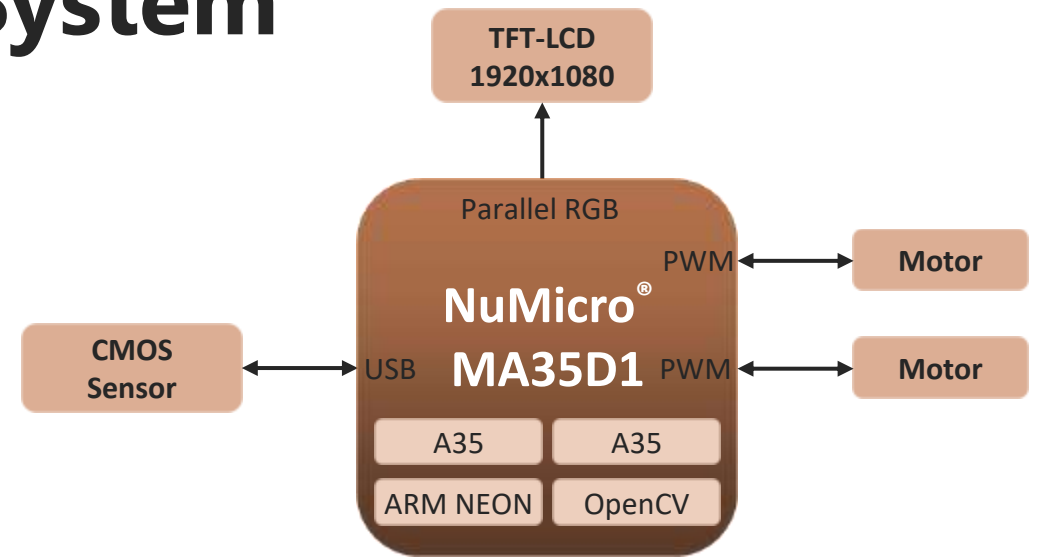
Auto Plate Billing

- NuMicro® MA35D1 MPU
- Parallel port camera or USB Webcam interface
- Supports 1920x1080 LCD
- Internal 256 KB SRAM
- Supports external memory
 - SDRAM, QSPI, SDHC, EBI 16-bit
- Performance
 - Inference Rate: 20 FPS
 - Model: MobileNet_v2_SSD
 - Flash: Model Size (4.5 MB) Code (5 MB)
 - RAM: 72 MB



Warehouse Management System

- NuMicro® MA35D1 MPU
- USB CMOS Sensor interface
- Supports 1920x1080 LCD
- Internal 256 KB SRAM
- Supports external memory
 - SDRAM, QSPI, SDHC
- Performance
 - Inference Rate: 20 FPS
 - Model: MobileNet
 - Flash: 10 MB
 - RAM: 53 MB



Joy of innovation
nuvoTon

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