

NXP EDGEREADY, CERTIFIED AND QUALIFIED TURNKEY SOLUTIONS



Solution Kit with Out-Of-Box-Experience Demos



Software Package with Source Code and Libraries

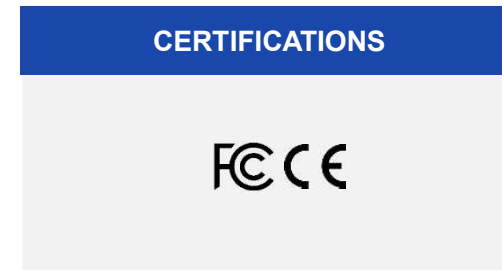
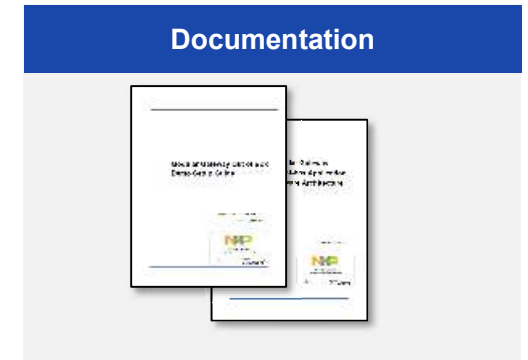
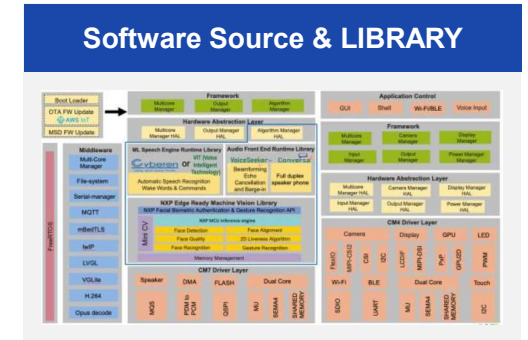
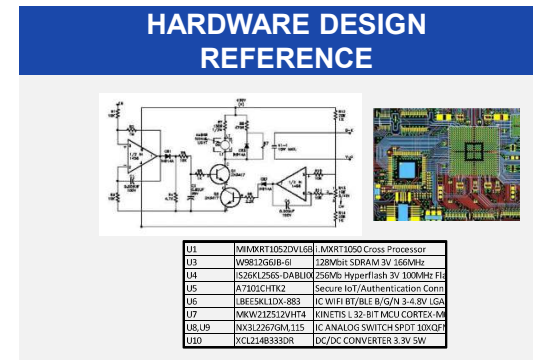
- ML Vision Algorithms (user identification, gesture recognition, person detection, etc.)
- Voice Algorithms (far-field voice control and communication, etc.)
- Middleware, Stacks, Libraries (graphics, connectivity, security, etc.)
- Software Framework to support ease-of-use customization
- Demo Application Code



Hardware Reference Design with Schematic, Layout and BOM



NXP One-Stop-Shop for Support & Licensing



NXP EDGEREADY SOLUTIONS ROADMAP

ACCESS CONTROL



i.MX RT106F
SLN-VIZNLC-IOT
 Offline Secure Face Recognition
 Optimized System BOM
 Features Upgrade with display and low power system controller

Q1'23



i.MX RT117F
SLN-VIZN3D-IOT
 Offline Advanced Secure Face Recognition
 3D Structured Light Camera



LPC55, K32W, RT117F, SR150, SE05x
 Smart Access platform supporting modular design of Smart Lock with Matter, UWB, Biometric and NFC access control technologies



Phase II
 2023

HUMAN MACHINE INTERFACE



i.MX RT105S/6S
SLN-LOCAL2-IOT
 Offline Far-field Voice Control
 Multiple Languages Support



i.MX RT106V/P/C
SLN-SVUI-IOT
 Offline Far-field Voice Control
 Online Far-field Voice Assistant
 NXP Voice Technologies: VoiceSeeker, VoiceSpot, VIT, Conversa, etc.

Q2'23



i.MX RT117H/T/C
SLN-TLHMI-IOT
 Offline User Identification, Gesture Control, Far-field Voice Recognition and Graphical UI
 Smart HMI Platform to expand more vision and voice capabilities

Q4'22



i.MX RT1170, IW416
SLN-TLHMI-IOT
 Working as Smart HMI Platform, leverage NXP rich core IPs (vision, voice, GUI) and software framework to maximum the reuse of the design efforts, easily migration from low to high end

Q3'23

Crossing IoT / Industrial / Auto Edge Segments

Targeting Smart Home, Smart Appliance, Smart Building, Smart City Applications

Smart HMI Platform Solution



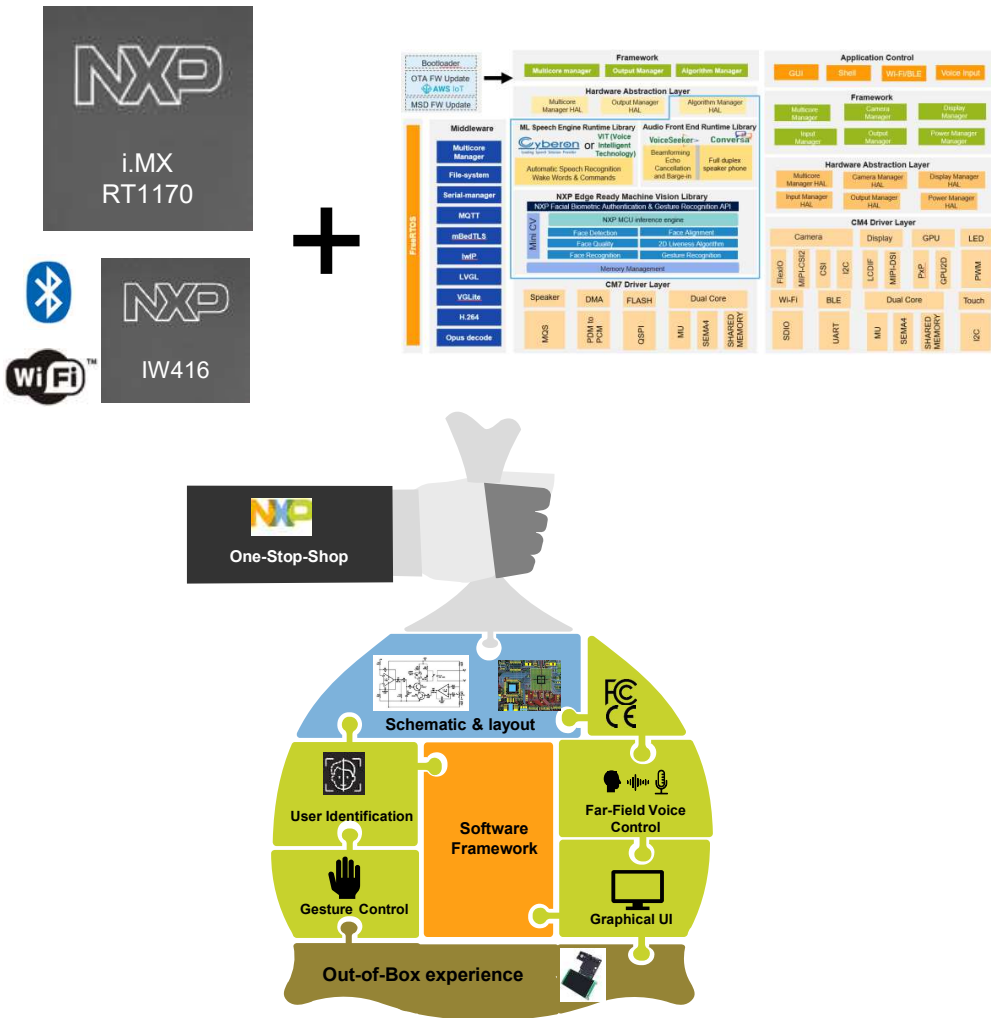
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SMART HMI PLATFORM SOLUTION BASED ON RT1170, IW416



Value Proposition



High integration & Simple system design

Enable smart HMI with ML/AI vision, voice, graphical UI and connectivity capabilities locally on one simple MCU and Wi-Fi BLE combo transceiver to simplify overall system design and optimize system BOM



Flexibility

Software Framework to support flexible designs & customization of vision and voice functions; utilize a combination of these features to support versatile use-cases



Fast & Easy

Production ready software package with source code and libraries, hardware reference design package, and plug & play out-of-box-experience, low risk and fast time to market

--ML Vision algorithms (user identification, gesture recognition, person detection, image classification, etc.)

--Voice algorithms(multi-microphone voice control audio front end, wake word & voice command, speech to intent, full-duplex uplink & downlink voice processing software)

--Graphical UI (LVGL, HW accelerator- PXP, VG Lite, GUI Guider)

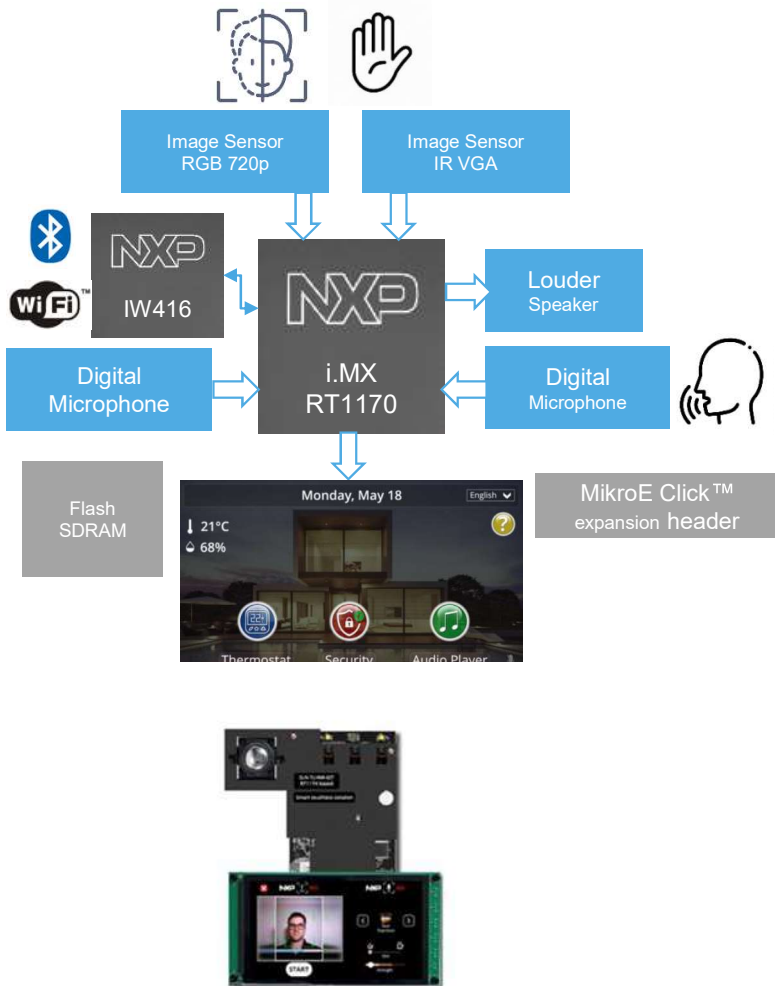
--Middleware, stacks, Libraries (graphics, connectivity, security, etc.)



Scalability

Working as Smart HMI Platform, leverage NXP rich core IPs and software framework to maximum the reuse of the design efforts, easily migration from low to high end

SMART HMI PLATFORM SOLUTION BASED ON RT1170, IW416



Solution Kit: SLN-TLHMI-IOT

	RT117H Smart HMI Solution	RT1170 Smart HMI Platform solution
Solution Kit	SLN-TLHMI-IOT	
Demo app	Coffee Machine, Elevator	Smart Panel
Graphical User Interface	<ul style="list-style-type: none"> 5.5-inch 720P MIPI LCD display LVGL and VG Lite 2D graphics accelerator support 	
Machine Vision	720P RGB and VGA IR Image Sensors	
	Face recognition uses RGB camera w/o liveness detection for user identification	<ul style="list-style-type: none"> Face recognition uses IR camera, well fit for nighttime applications Anti-spoofing is activated for secure access Gesture control for touchless interaction
Machine Voice	<ul style="list-style-type: none"> 2 onboard digital microphones. Additional microphones available via expansion board (not included) VoiceSeeker to support acoustic echo cancellation, noise reduction, beamforming and barge-in VIT or 3rd-Party as complementary option to support wake word and local voice commands 	
Wireless	<ul style="list-style-type: none"> Dual-band 1x1 Wi-Fi 4 + BLE5.2 combo: IW416 Cloud-based device management, user data management, OTA, etc. 	
Schedule	Nov 2022	Jul 2023
Deliveries	<ul style="list-style-type: none"> i.MX RT117H/T/C/O MCU, IW416 Solution kit SLN-TLHMI-IOT - \$299 MSRP Coffee Machine, Elevator, Smart Panel demo app Documents: Get Started Guide, User Guide, Hardware development Guide, Schematics, BOM and Design files, Software development Guide, Application Notes Open-source code of software framework Open-source code of demo apps released on GitHub, regular software update Trainings: Videos, CAS and DFAE training Support: Community, CAS(L1), SE(L2) and R&D(L3) normal support model Marketing collaterals: Fact sheet, Blog, Six-Pack NXP Website Showroom 	

TARGET APPLICATIONS-SMART HMI PLATFORM SOLUTION (I.MX RT1170, IW416)

Smart HMI Applications

Smart Appliances

- White goods
- Counter-top (e.g., coffee machine, purifier, etc.)

Smart Home

- Alarm and smart home control panels
- Thermostats
- Universal remote controls
- Home entertainment

Smart Building, Smart Industrial

- Elevator
- Garage door openers and access panels
- Industrial HMI
- Healthcare
- Transportation

Others

- Remote conference control
- Personal health care



COFFEE MACHINE DEMO APP

Vision Use Case

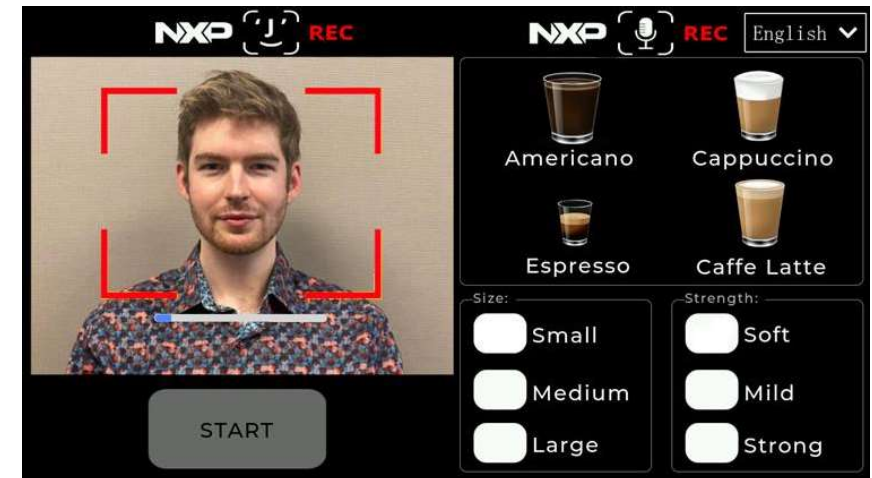
- Identify users using face recognition
- If a new user, offer to save selection as preferred coffee settings
- If a recognized user, ask whether to use preferred coffee settings

Voice Use Case

- Enable touchless interaction using far-field voice control
- Use voice commands to select coffee settings, save users, delete users, and brew coffee

Graphics User Interface

- 720p MIPI LCD display with LVGL GUI design



SMART ELEVATOR DEMO APP

Vision Use Case

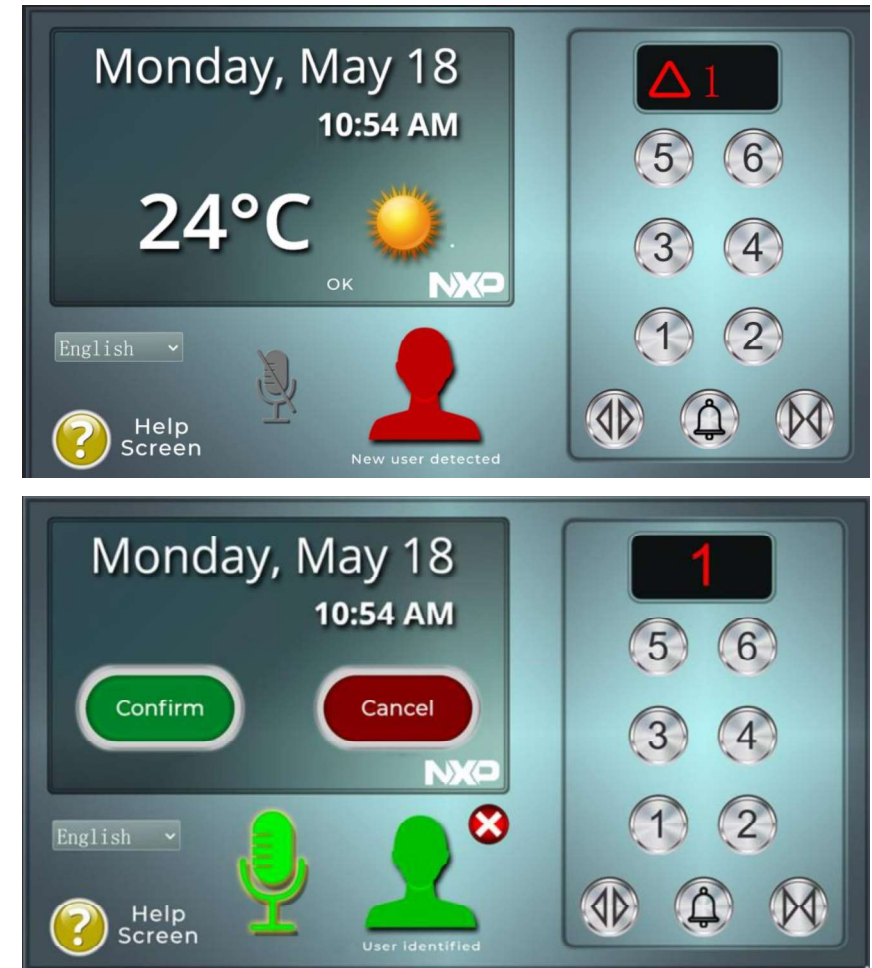
- Identify user using face recognition
- If a new user, ask whether to save selection as preferred settings
- If a registered user, allow using preferred settings or select a new floor

Voice Use Case

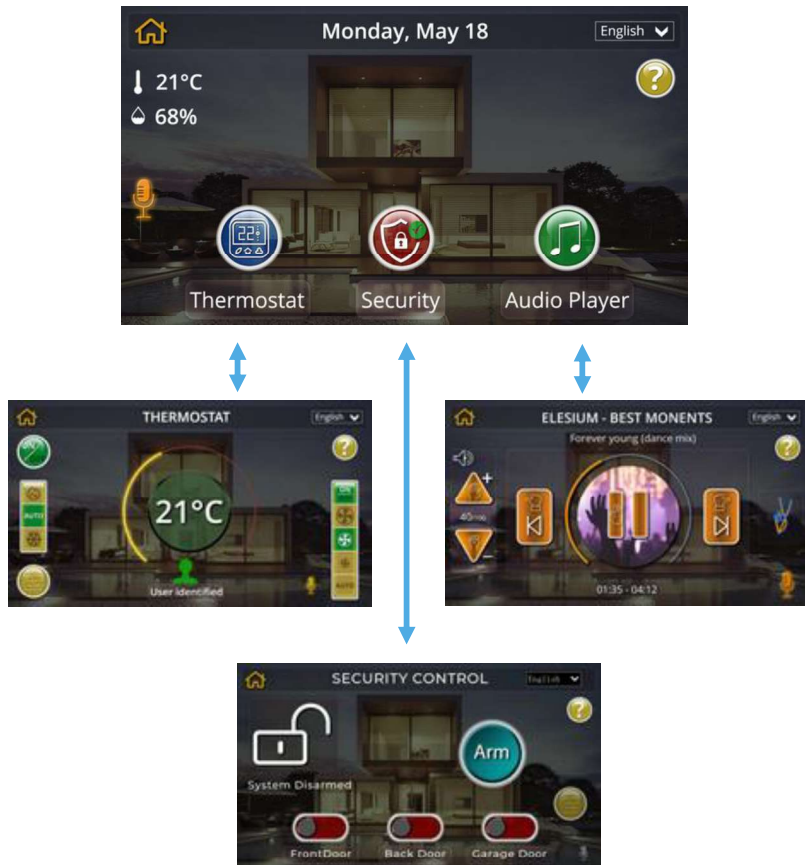
- Enable touchless interaction with far-field voice control
- Use voice commands to select target floor, save new users, and delete existing users,

Graphics User Interface

- 720p MIPI LCD display with LVGL GUI design



SMART PANEL DEMO APP



Graphics User Interface

- 720p MIPI LCD display with LVGL GUI design
- 3 sub apps UI: Thermostat, Security, Audio Player

Vision Use Case

- User identification through face recognition to load favorite thermostat settings automatically
- Anti-spoofing face recognition to control door access
- Camera based gesture control for audio player

Voice Use Case

- Enable touchless interaction with far-field voice control
- Use voice commands to set thermostat, control door access and audio player
- Support barge-in when playing music

Hardware Block Diagram



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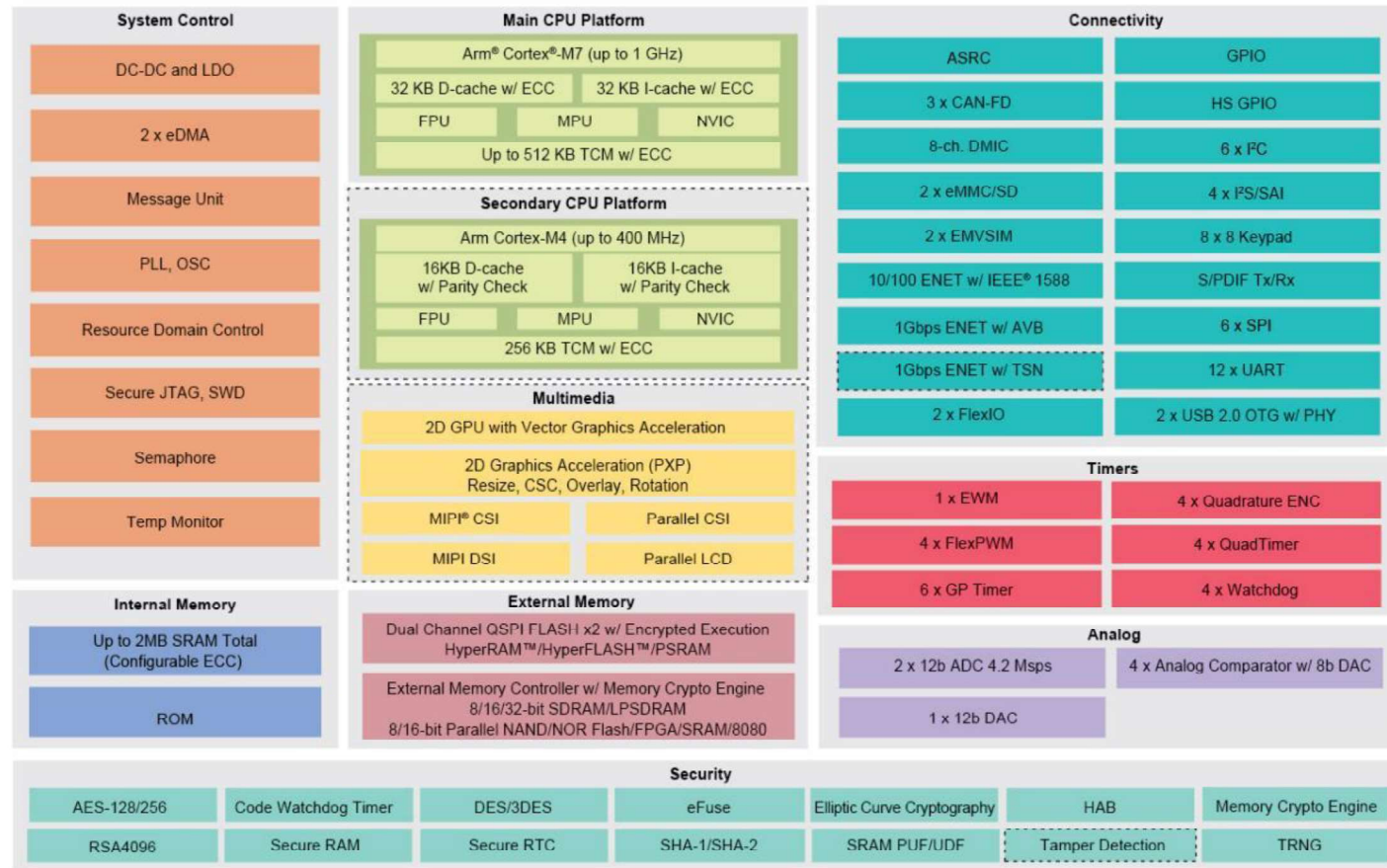
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i.MX RT1170 CROSSOVER MCUS

• Key Features

- Arm Cortex-M7 CPU (1 GHz)
 - 32KB/32KB L1 Cache, 512KB TCM
- Arm Cortex-M4 CPU (400MHz) (optional)
 - 16KB/16KB L1 Cache, 256KB TCM
- 2MB on-chip SRAM (including TCM for CPU core)
- Parallel LCD Display
 - Up to WXGA (1280x800) @60fps
- 8/16/24-bit Parallel Camera Sensor Interface
- 2-lane MIPI CSI and 2-lane MIPI DSI
- 2D GPU & Graphics Accelerator
- 8/16/32-bit SDRAM controller up to 200MHz
- 8/16-bit Parallel SRAM / FLASH (NOR or NAND)
- 2x Dual-channel FlexSPI with on-the-fly decryption
 - Serial NOR, serial NAND, HyperBUS devices
- 2x eMMC 5.0/SD 3.0/SDIO Port
- 2x USB 2.0 OTG, HS/FS, Device or Host with PHY
- Audio:
 - 4x I²S/SAI
 - 1x S/PDIF Tx/Rx
 - ASRC
 - 8-ch digital microphone input
- 3x ENET:
 - 1Gbps ENET w/ AVB
 - 10/100 ENET w/ IEEE 1588
 - 1Gbps ENET w/ TSN
- 2x 12-bit ADC, 4.2 Msps, up to 20 channels total
- 4x Analog comparator,
- 12-bit DAC
- Full PMU Integration – DC-DC + LDOs



Available on certain products within the family

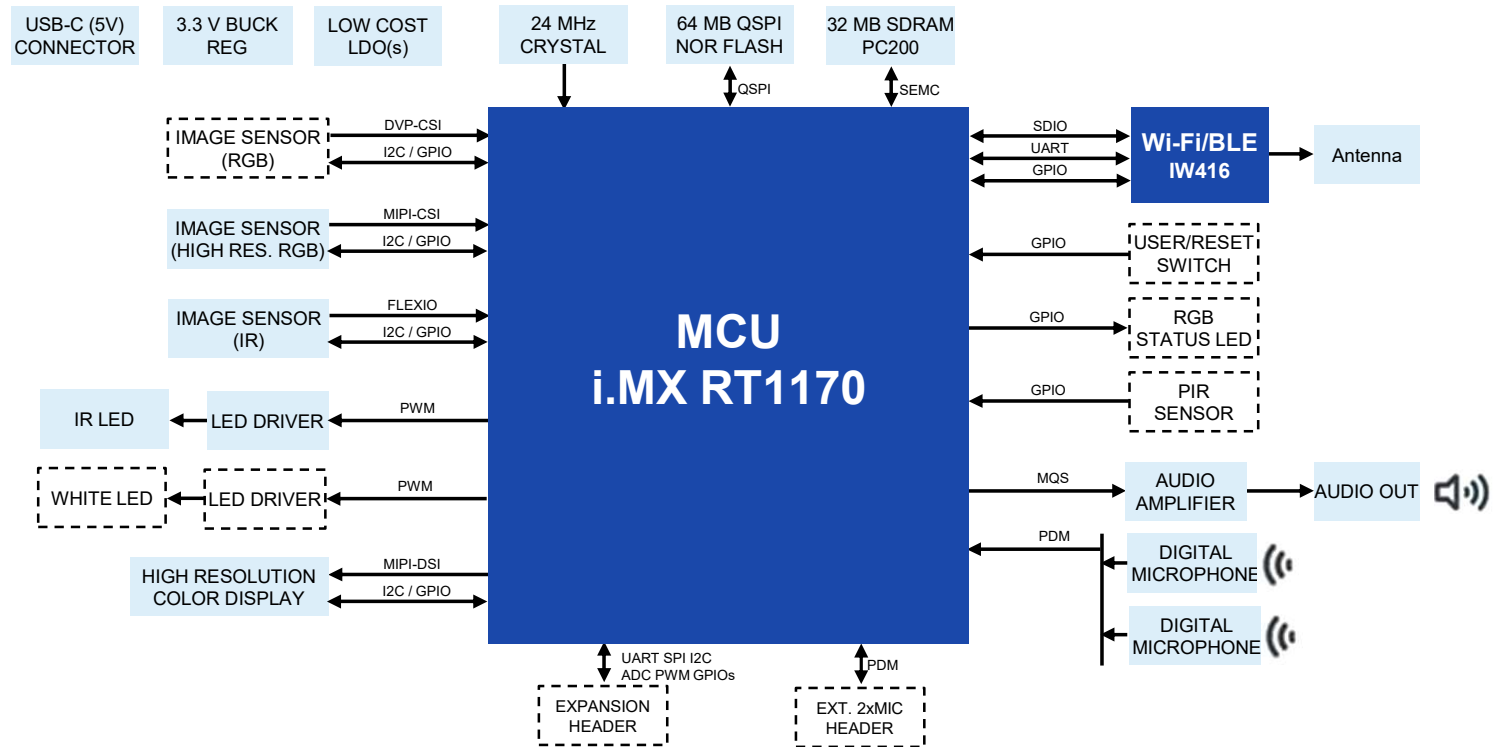
i.MX RT1170 MCU CONFIGURATIONS

	i.MX RT1171	i.MX RT1172	i.MX RT117F	i.MX RT1173	i.MX RT1175	i.MX RT1176	i.MX RT117H
Cortex-M7	1 GHz* / 800 MHz**	1 GHz* / 800 MHz**	1 GHz* / 800 MHz**	800 MHz**	1 GHz* / 800 MHz**	1 GHz* / 800 MHz**	1 GHz* / 800 MHz**
Cortex-M4	-	-	-	400 MHz	400 MHz	400 MHz	400 MHz
MIPI CSI / DSI	-	Y	Y	Y	-	Y	Y
OpenVG 1.1	-	Y	Y	Y	-	Y	Y
CSI / LCDIF / PXP	-	Y	Y	Y	-	Y	Y
Ethernet	Y	Y	Y	Y	Y	Y	Y
TSN	-	-	-	-	-	Y	Y
Tamper Protection	-	-	-	Y	-	-	-
HAB / AES / DES	Y	Y	Y	Y	Y	Y	Y
Face recognition	-	-	Y	-	-	-	Y
Local voice control	-	-	-	-	-	-	Y
Package	289 MAPBGA	289 MAPBGA	289 MAPBGA	289 MAPBGA	289 MAPBGA	289 MAPBGA	289 MAPBGA
Qualification (Temperature)	Consumer (0-95°C) Industrial (-40-105°C) Automotive (-40-125°C)	Consumer (0-95°C) Industrial (-40-105°C) Automotive (-40-125°C)	Consumer (0-95°C) Industrial (-40-105°C) Automotive (-40-125°C)	Industrial (-40-105°C)	Consumer (0-95°C) Industrial (-40-105°C) Automotive (-40-125°C)	Consumer (0-95°C) Industrial (-40-105°C) Automotive (-40-125°C)	Consumer (0-95°C) Industrial (-40-105°C) Automotive (-40-125°C)
Part Numbers	MIMXRT1171DVMAA MIMXRT1171CVM8A MIMXRT1171AVM8A (Auto)	MIMXRT1172DVMAA MIMXRT1172CVM8A MIMXRT1172AVM8A (Auto)	MIMXRT117FDVMAA MIMXRT117FCVM8A MIMXRT117FAVM8A (Auto)	MIMXRT1173CVM8A	MIMXRT1175DVMAA MIMXRT1175CVM8A MIMXRT1175AVM8A (Auto)	MIMXRT1176DVMAA MIMXRT1176CVM8A MIMXRT1176AVM8A (Auto)	MIMXRT117HDVMAA MIMXRT117HCVM8A MIMXRT117HAVM8A (Auto)

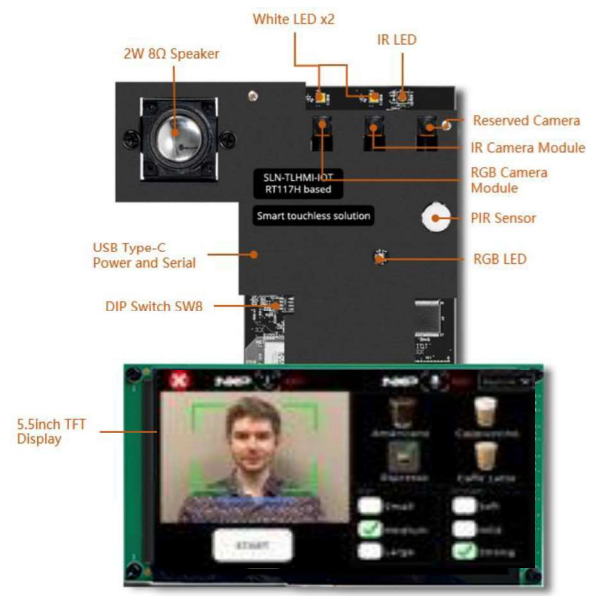
* Speed of consumer qualified device.

** Speed listed is for industrial and automotive/extended industrial qualified devices.

SMART HMI PLATFORM SOLUTION DEVELOPMENT KIT (SLN-TLHMI-IOT) HARDWARE BLOCK DIAGRAM



- NXP Technology
- Non NXP Technology
- Optional Technology



SLN-TLHMI-IOT Contains

- i.MX RT1170-based development kit
- USB Type-C cable

Out-Of-Box

- Coffee Machine, Elevator, and Smart Panel demo apps
- Onboard switches to select desired demo app

SLN-TLHMI-IOT HARDWARE SPECIFICATIONS

MAIN

Application MCU **NXP i.MX RT117H**
Dual core ARM® Cortex®-M7 @1 GHz+ Cortex®-M4 @400 MHz
2 MB on chip SRAM

Memory **Winbond W25Q512JVEIQ**
64 MB QSPI NOR Flash at 133 MHz

Memory **Winbond W9825G6KH-5**
32 MB SDRAM x16 at 200 MHz

VIDEO

RGB camera **JSX-Vision GC20-0SLN-F0** with **Galaxy GC2145**
1280 X 720 MIPI interface

IR camera **JSX-Vision GC03-0SLN-F0** with **Galaxy GC0308**
VGA with FlexIO

IR and white LEDs **OSRAM** with **MPS MP2410AGJ** LED driver

AUDIO

Audio amplifier **diodes include PAM8013** with i.MX RT MQS
mono, class-D, up to 2W at 8Ω

Speaker **PUI Audio ASE02808MR-LW150-R**
28 mm Enclosed Speaker, 2W cont. 3W max. with 8Ω impedance

Microphone **Knowles Acoustics SPH0641LM4H-1** X 2
MICROPHONE DIGITAL ZERO HEIGHT SISONIC 64DB -0.3-5V SMT

RADIO

WIFI/BLE combo module **Azurewave AW-AM510** with **NXP IW416**
dual band 1x1 WIFI 4+ BLE 5.2

DISPLAY

MIPI display **Rocktech RK055AHD091**
5.5-inch TFT 1280*720 pixels with LED backlight

POWER

Power supply: USB Type-C

Selectable source to wake-up RT117H from low power mode
switch, PIR, WIFI, BLE, external signal

Separate power circuitry during RT117H low power mode
only power necessary components

OTHER

User-switches for low power mode wakeup(SW0), load different
application when booting(SW1,2,3)

RGB and status LEDs, PIR

MikroE Click™ expansion header (debug/programming)

General purpose header

External microphones

Software Block Diagram



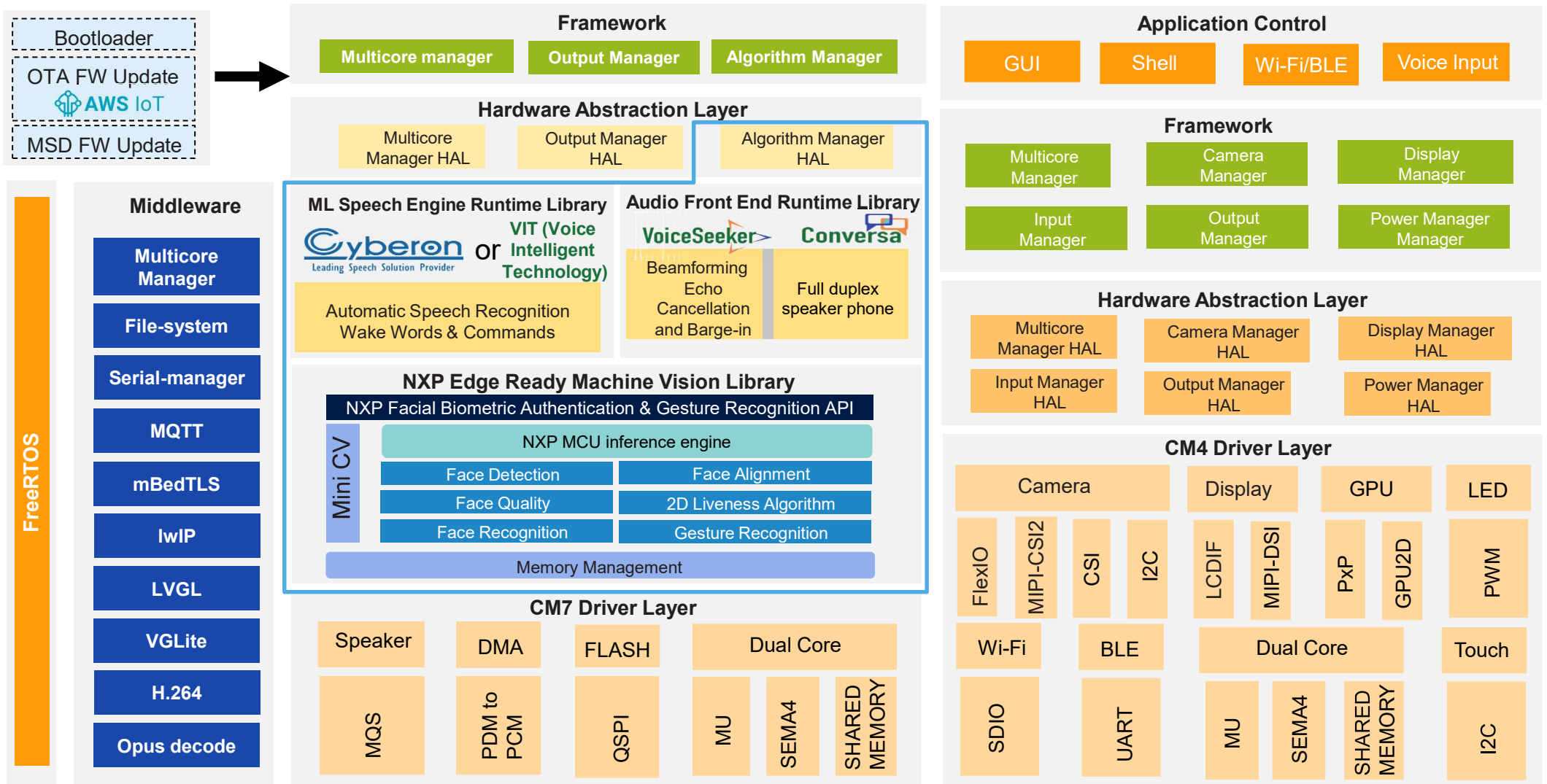
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SLN-TLHMI-IOT (i.MX RT1170) NXP EDGEREADY SOLUTION SOFTWARE BLOCK DIAGRAM



KEY ALGORITHM COMPONENTS

Local voice algorithm

-AFE (Audio Front End)

- Voiceseeker (NXP)

-ASR (Automatic speech recognition)

- VIT(NXP)
- Cyberon (3rd party)
- Speech to Intent

-Full-duplex uplink & downlink voice

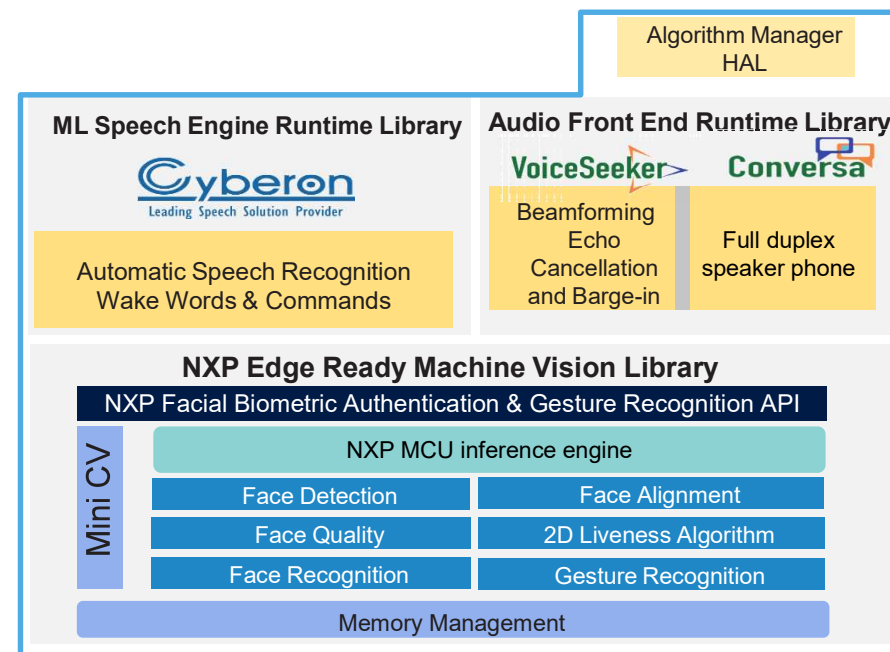
- Conversa

Vision algorithm

-Optimized MCU inference engine (NXP)

-AI model and Non-AI algorithm (NXP)

- Face detection/alignment/quality
- Face recognition with anti-spoofing
- Gesture recognition

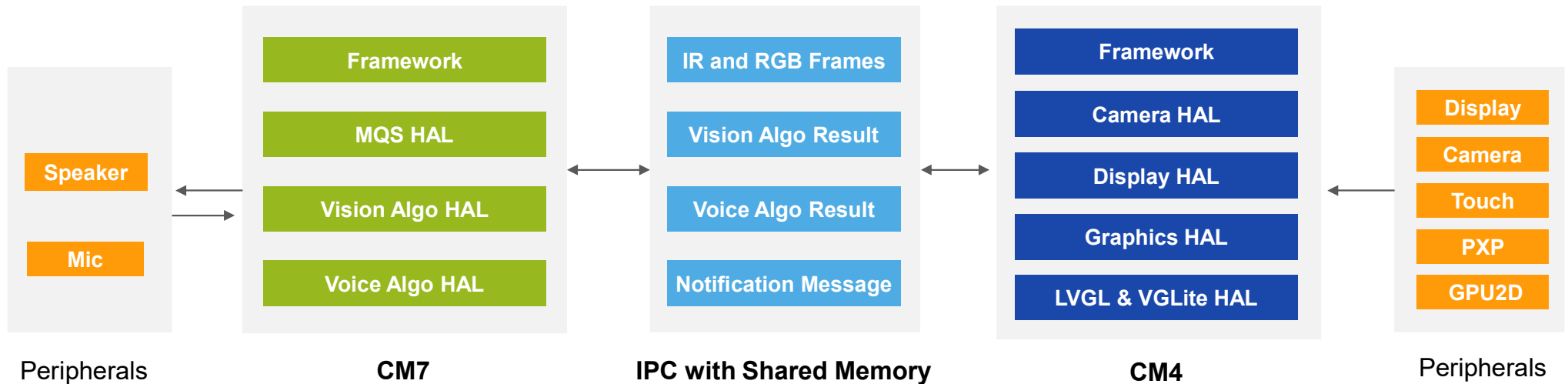


Integrated/Production ready

Ready to integrate/Production ready

Integrated/Could be improved with more data

SLN-TLHMI-IOT (i.MX RT1170) EDGEREADY SOLUTION SOFTWARE ARCHITECTURE



CM7 (Vision and Voice algorithm accelerator):

- Framework
- Vision algorithm with VGA input frames
- Voice algorithm (AFE + ASR) with mic input
- MQS audio playback
- IPC communication with shared memory

CM4 (UI and System control unit):

- Framework
- CSI/MIPI Camera preview @VGA
- LVGL GUI @720p with VGLite 2D GPU acceleration
- Vision algorithm input frames color space conversion with PXP
- Touch panel input
- IPC communication with shared memory

Local Voice Control



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VIT LANGUAGES SUPPORT AND MODEL GENERATION

Features

- Always-on technology
- Phonemic models, wake word and custom commands using Text to Model, no audio database required
- [Online VIT model generation tool](#)
- Voice Activity Detection (VAD) helping minimize processing load during silent, non-speech period
- Up to 3 Wake Words supported in parallel
- Current limit of 12 commands per model, will be updated to ~30 in Jul

Language	2022 Q3	2022 Q4	2023 Q1	2023 Q4
English	•	•	•	•
Mandarin	•	•	•	•
Turkish	•	•	•	•
German	•	•	•	•
Spanish	•	•	•	•
Japanese	•	•	•	•
Korean	•	•	•	•
French		•	•	•
Italian			•	•
Portuguese				•

Notes:

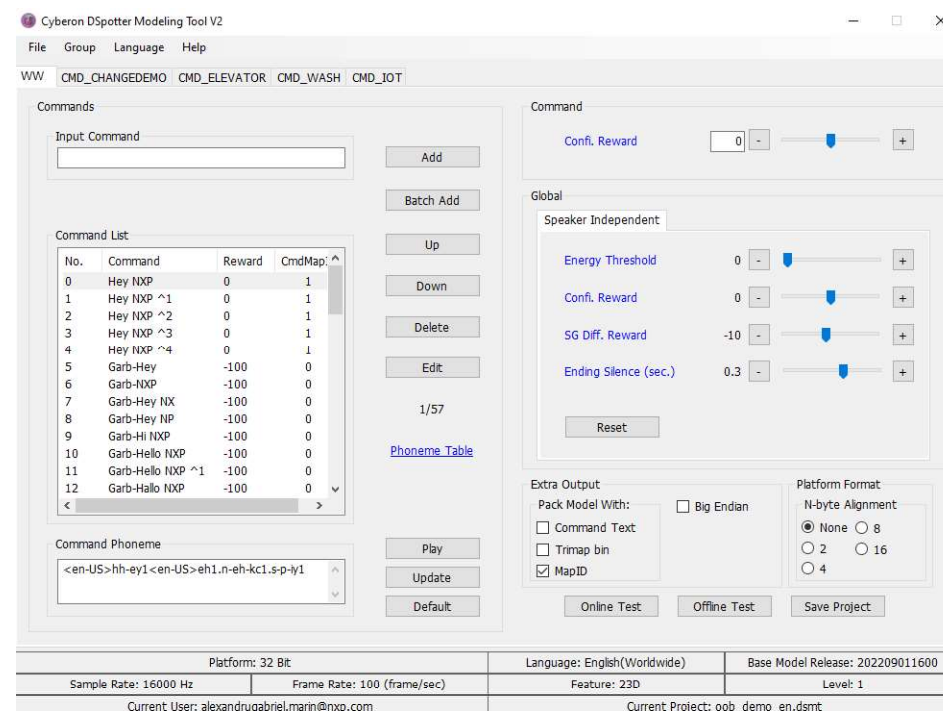
1. English and Mandarin are available in the MCUXpresso SDK and supported by online model creation tools.
2. Other Languages are delivered as standalone features on customer demand; models created by SE by customer request
3. All languages will be supported by the MCUXpresso SDK from version 2.14 and Linux BSP from 2Q2023.

DSMT LANGUAGES SUPPORT AND MODEL GENERATION

Supported languages / accents:

- Arabic
- Bahasa (Indonesia)
- Bahasa (Melayu)
- Bengali
- Cantonese (HK)
- Chinese (CHN)
- Chinese (CHN) / English
- Chinese (TWN)
- Czech
- Danish
- Dutch
- English (Australia)
- English (India)
- English (Philippines)
- English (SE Asia)
- English (Singapore)
- English (Taiwan)
- English (UK)
- English (USA)
- English (WW)
- Finnish
- French
- German
- Greek
- Hindi
- Hungarian
- Italian
- Japanese
- Japanese / English
- Kannada
- Korean
- Korean / English
- Malayalam
- Norwegian
- Persian
- Polish
- Portuguese (BR)
- Portuguese (EU)
- Russian
- Slovak
- Spanish (EU)
- Spanish (LA)
- Swedish
- Tagalog
- Taiwanese
- Tamil
- Telugu
- Thai
- Turkish
- Ukrainian
- Vietnamese

PC based speech modeling tool enables developers to quickly create custom commands & wake words



Contact local-commands@nxp.com
for free access to DSMT speech modeling tool

Vision



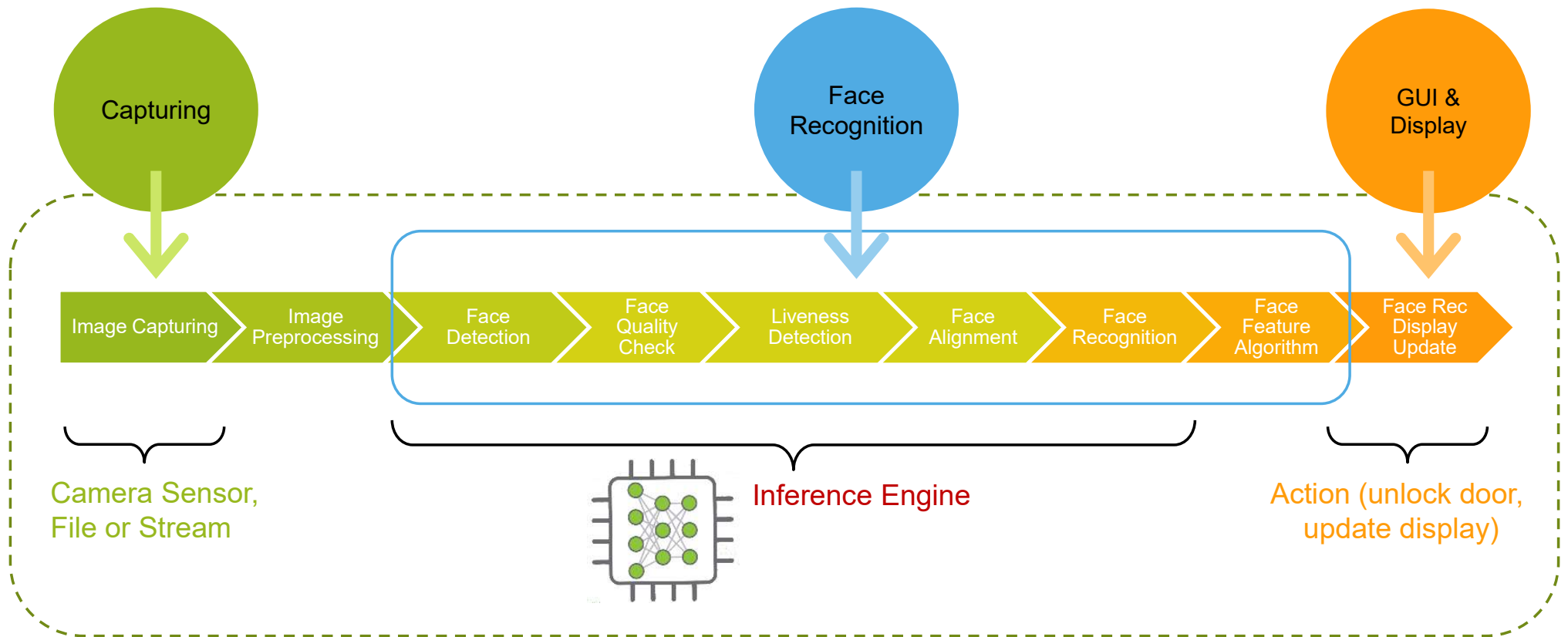
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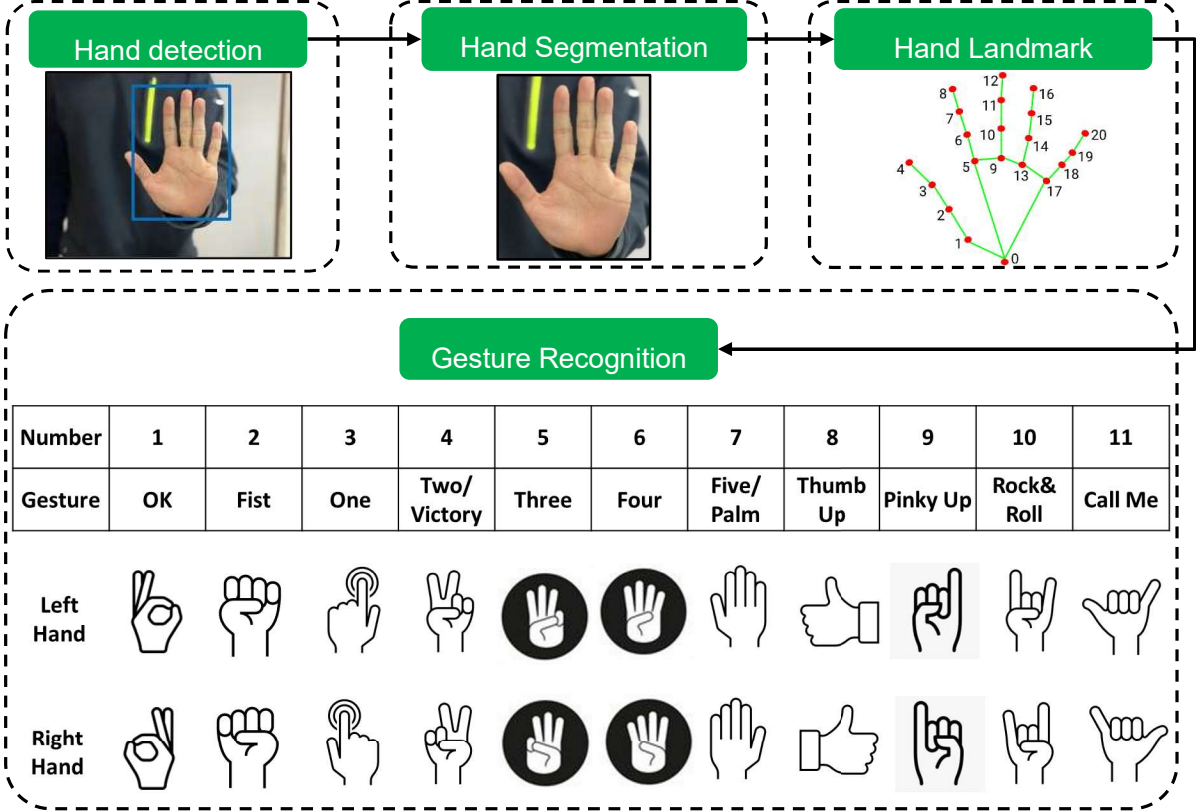
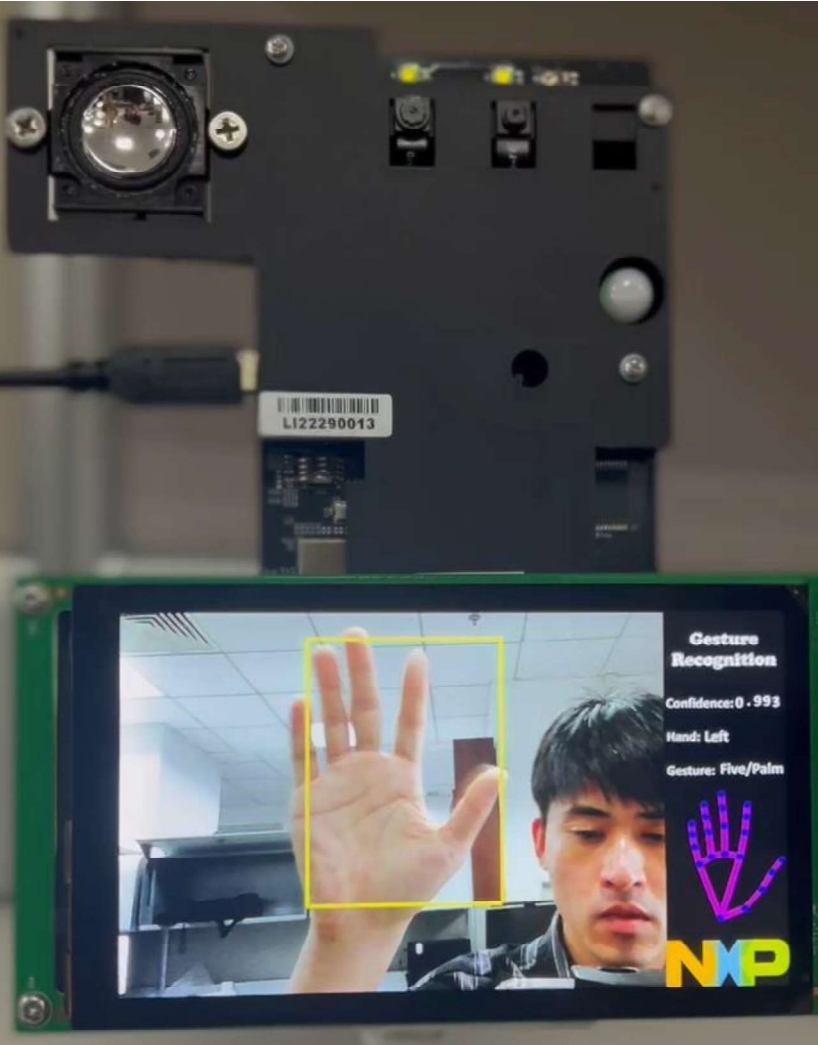
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FACIAL BIOMETRIC AUTHENTICATION SOFTWARE PIPELINE



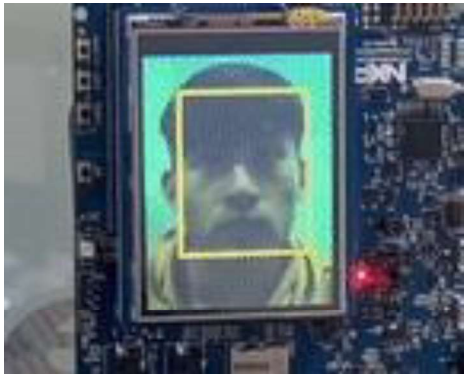
GESTURE CONTROL VIA HAND SHAPE RECOGNITION ON i.MX RT117H



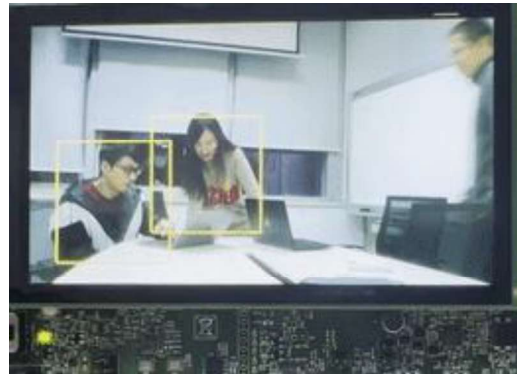
Light-weighted MCU optimized pipeline and model provides low latency and reduced footprint.

MCU VISION USE CASES & INNOVATION (PARTIALLY)

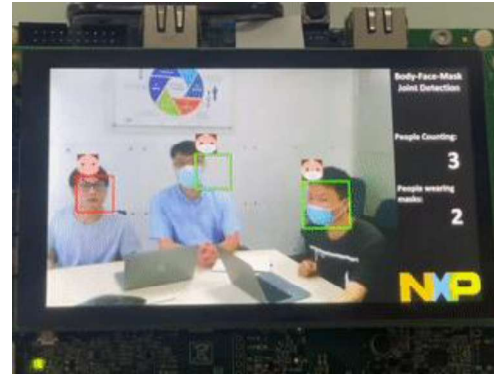
Face detection
LPC55S69 (MCU)



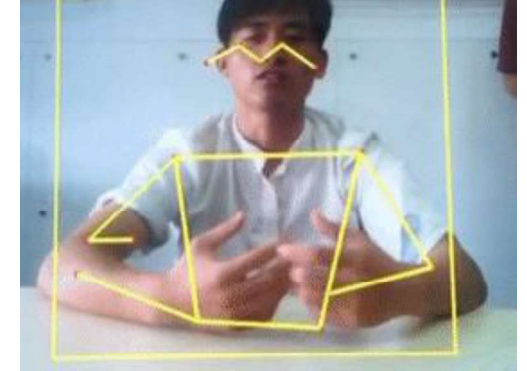
Person detection
RT1170 (MCU)



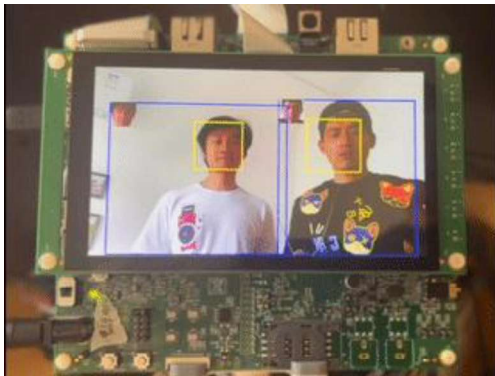
Body-face-mask joint
detection - RT1170



Sitting posture
estimation



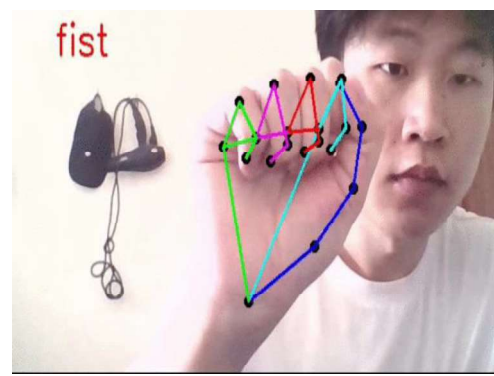
Multiple Person/face
detection and recognition
RT1170



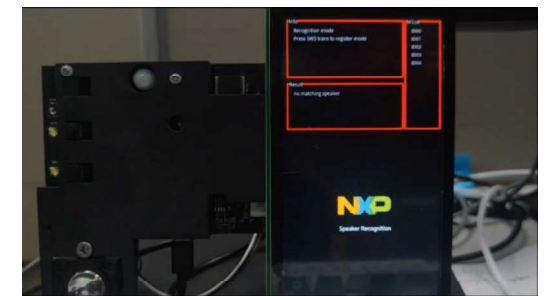
Driver Monitoring System
(DMS), RT1170



Hand Landmark detection
and gesture recognition,
RT1170



Speaker recognition,
RT1170



NXP EDGEREADY SMART HMI SOLUTIONS – ADVANTAGES SUMMARY



High-integration and low complexity

- Enable Smart HMI with ML/AI Vision, Voice and Graphical UI capabilities locally on a single MCU to simplify overall system design and with optimized system BOM
- Ability to trade off inference time vs. CPU load



Flexible

- Software framework to support flexible design customization of vision and voice functions, and combination of features to support versatile use cases
- Flexibility to change external components



Fast & Easy

- Production-ready software package with source code and libraries, no ML/AI expertise necessary and low risk/investment on it
- Solution demo kit with plug and play out-of-box experience
- Fast time to market



Scalable

- Working as Smart HMI Platform, leverage NXP rich core IPs and software framework to maximum the reuse of the design efforts, easily migration from low to high end

FOR MORE INFORMATION... www.nxp.com/mcu-smhmi

NXP EdgeReady Smart HMI Solution based on i.MX RT117H with ML Vision, Voice and Graphical UI

SLN-TLHMI-IOT-RD [Receive alerts](#)

[Overview](#) [Product Details](#) [Documentation](#) [Design Resources](#) [Support](#)

BUY OPTIONS

GET STARTED



Click over video to play



The NXP EdgeReady Smart Human Machine Interface (SMHMI) solution leverages the i.MX RT117H crossover MCU to allow developers to quickly and easily enable multi-modal, intelligent, hands-free capabilities including machine learning (ML), vision for face and gesture recognition, far-field voice control and 2D graphical user interface (GUI) in their products. These functions can be mixed and matched to simplify overall system design using just this single NXP high-performance crossover MCU.

This solution's development kit, the SLN-TLHMI-IOT, comes with a variety of features to help minimize time to market, risk, and development effort including: fully-integrated turnkey software, hardware reference designs and NXP one-stop-shop support for quick out-of-the-box operation. Face/gesture recognition and voice control are performed entirely offline thanks to the i.MX RT117H, eliminating the need for the cloud as well as the privacy and latency

More

DESIGN FILES

Product Details

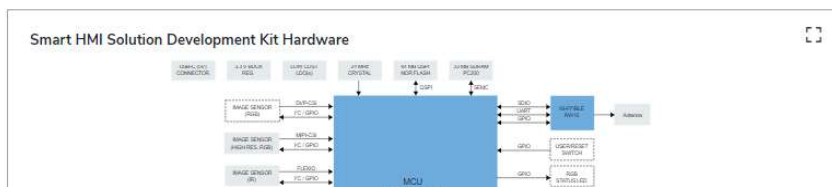
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SLN-TLHMI-IOT

NXP EdgeReady Smart HMI Solution based on i.MX RT117H with ML Vision, Voice and Graphical UI.

Kit Contains:

- i.MX RT117H Touchless HMI Solution Development Kit
- USB Type-C Cable

\$299.00 USD

For a quantity of 1

Availability: In stock Inventory: 39
Shipping: Normally ships 1-2 business days

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 - Code link on GitHub https://github.com/NXP/sln_tlhmi_iot
- **Buy** SLN-TLHMI-IOT kits (\$299)
- **View** getting started pages and videos



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