NuMaker - MA35D1
Integrated Demonstration

Agenda

- Overview
- H.264 Video Playback
- ML People Counting
- 2D Accelerator
- Data Security
- Key Word Spotting by RTP M4
- VoIP
- APP Installation
- Q&A

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Overview

Main Menu

Video Playback	Display mp4 videos via VC8000 h.264 decoder
ML People Counting	Camera preview with people counting
2D-Accelerator	Animated tiles permutation changes on the screen
Data Security	Certification check in OP-TEE
KWS by RTP M4	Key Word Spotting via RTP M4
VoIP	Voice over Internet Protocol with h.264 streaming

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H.264 Video Playback

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H.264 Video Playback

H.264 Video Playback

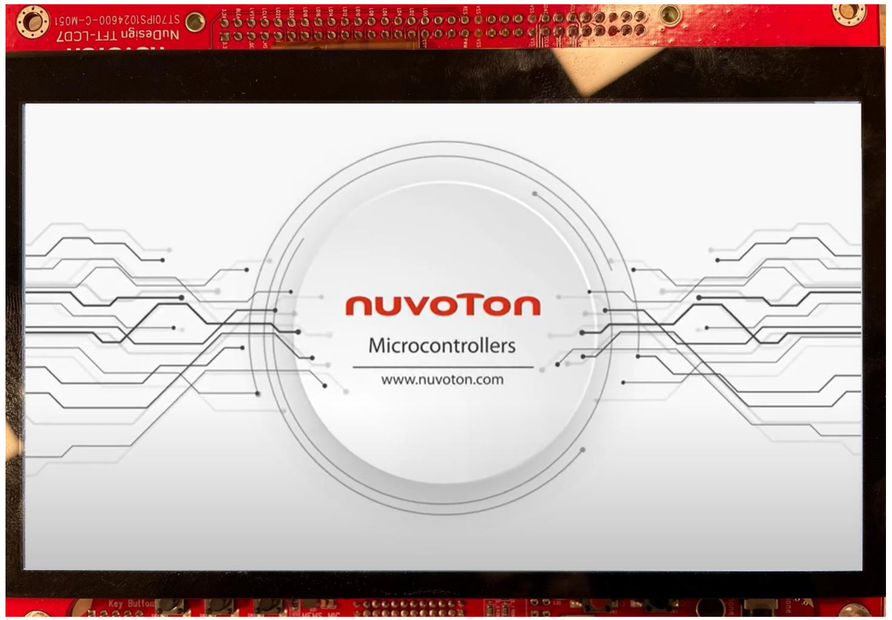
1. Demonstrate MA35D1's ability to display mp4 videos via VC8000 h.264 decoder
2. Use Gstreamer to display 720p videos in full screen
3. GStreamer command

> gst-launch-1.0 filesrc location=/opt/video_mp4.mp4 ! qtdemux name=demux demux.audio_0 ! queue ! decodebin ! audioconvert ! audioresample ! autoaudiosink demux.video_0 ! queue ! decodebin ! nufbdevsink fb=0 width=1024 height=600 x-pos=0 y-pos=0 ! fakesink

4. Required files: ma35d1-vc8000.ko, libgstnufbdevsink.so
5. Performance:

1080P: 30fps

720P: 60fps



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ML People Counting

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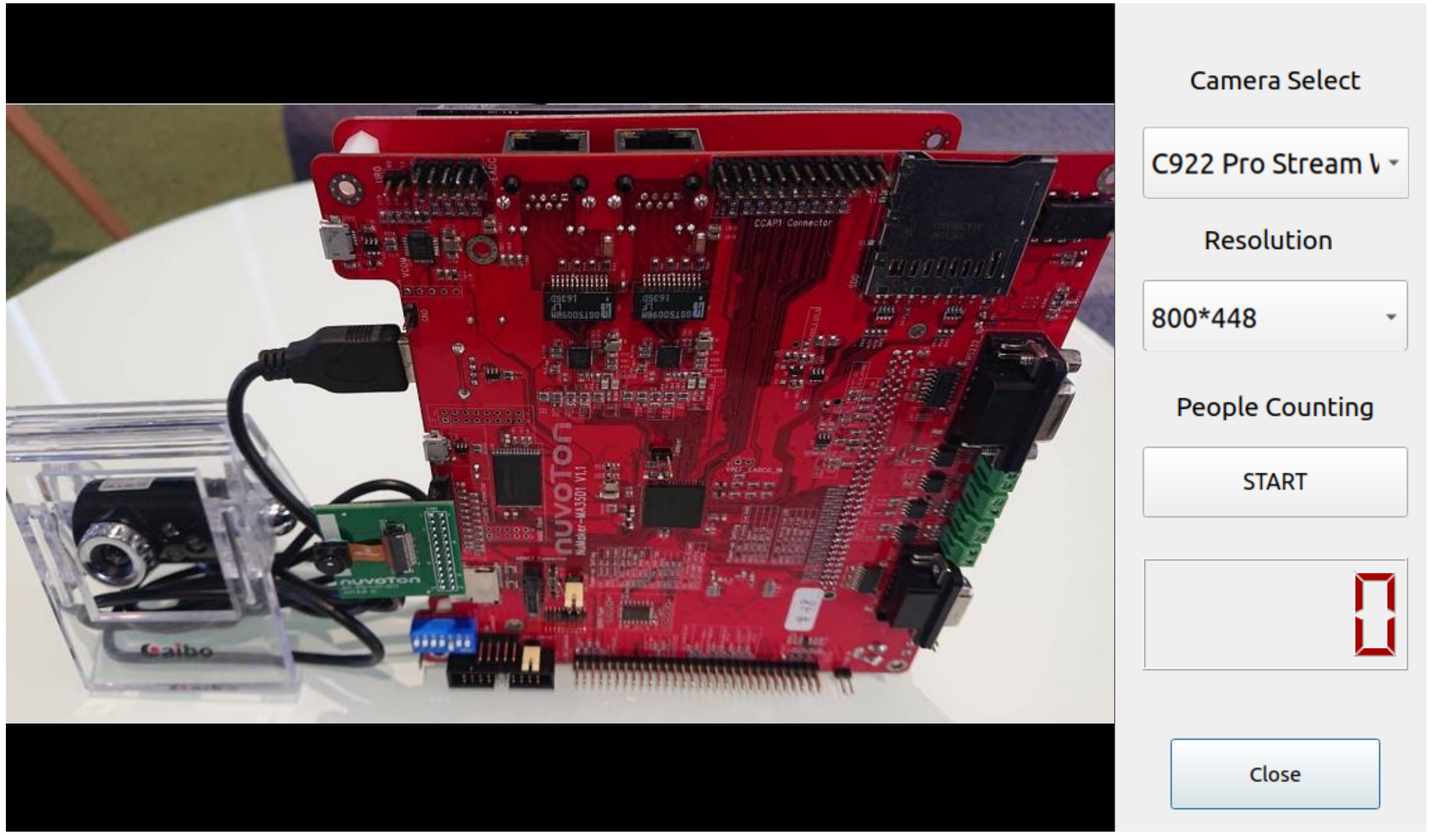
ML People Counting

Camera Control

Control Options:

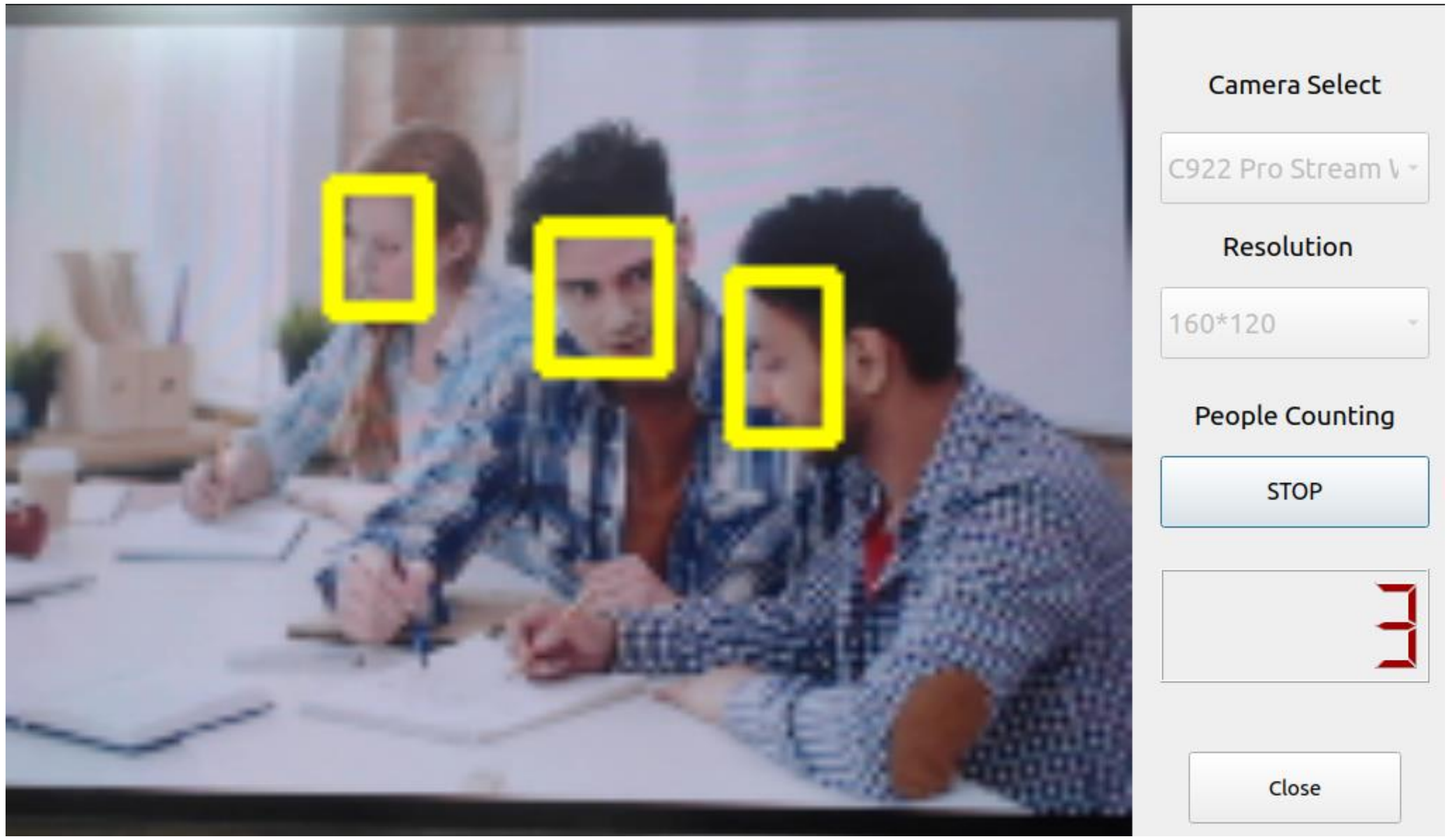
- Support UVC cameras & CMOS sensor(Himax m1055)
- Support camera inputs switch & resolution switch



People Counting

Control Options:

- Click “People Counter” to start people counting
- Based on OpenCV
- Fix resolution and FPS



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2D Accelerator

2D Acclerator

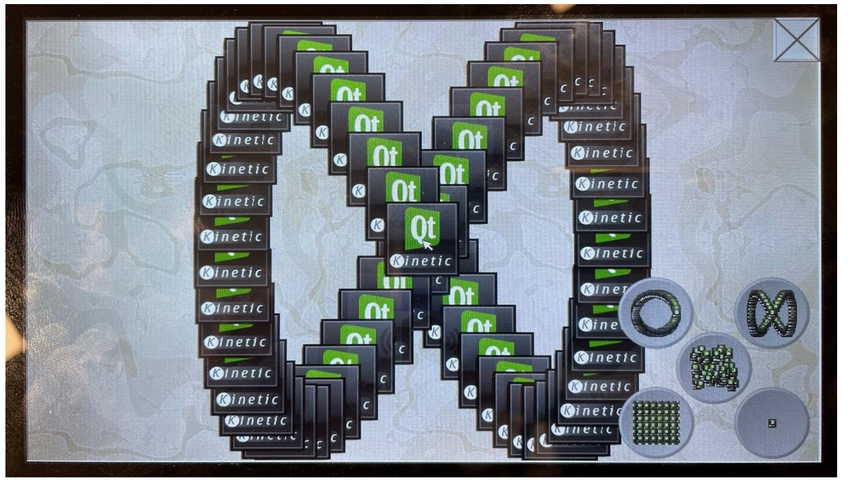
Image Programming and System Boot

- 2D hardware acceleration engine through DirectFB
    1. Draw Rectangle
    2. Fill Rectangle
    3. Bit Blit
- The Linux Command to start a Qt application with DirectFB

```
~# ./Qt_APP -platform directfb
```

- The Linux Command to start a Qt application runs on framebuffer 1

```
~# ./Qt_APP -platform linuxfb:fb=/dev/fb1
```



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Data Security

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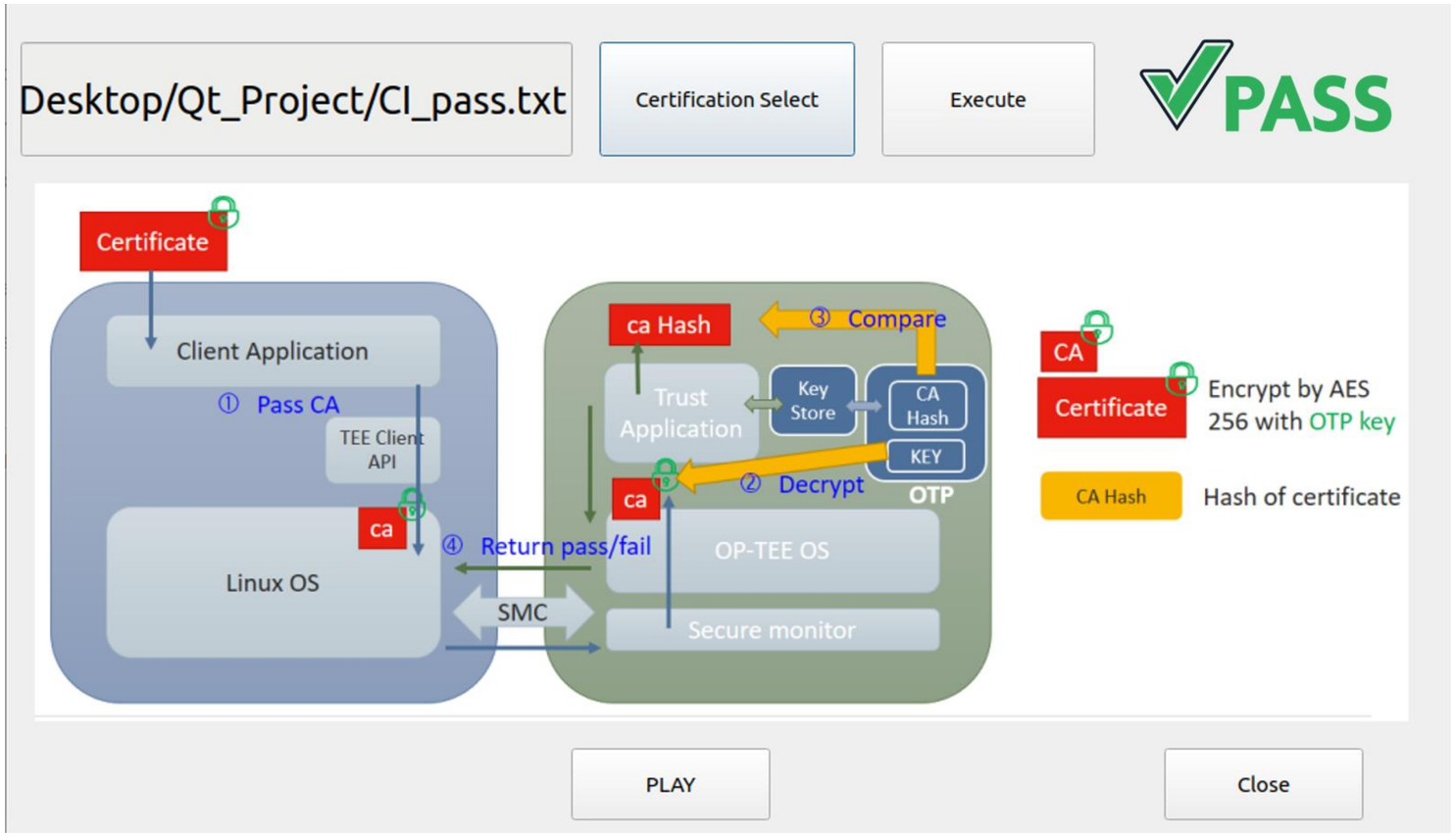
Data Security

Introduction

- Use a secure key(SW key) to restore the protected data
- Secure key is encrypted by OTP key in OP-TEE

- Click “Certification Select” and select the certifications
- The result will be shown on right-top side
- A images loops helps users to understand the process



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Key Word Spotting by RTP M4

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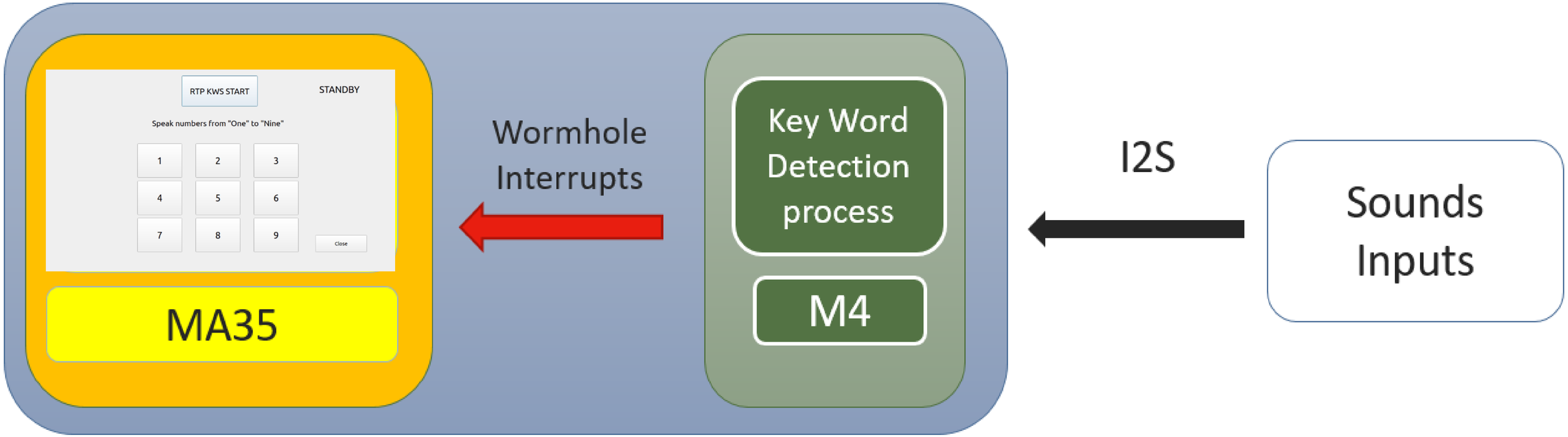
Key Word Spotting by RTP M4

Introduction

- MA35 Load KWS FW to RTP via Linux Rpmsg
- M4 starts to await a wakeup keyword
- If RTP gets a wakeup keyword, RTP reports the number to MA35 and MA35 will show the result on LCD panel

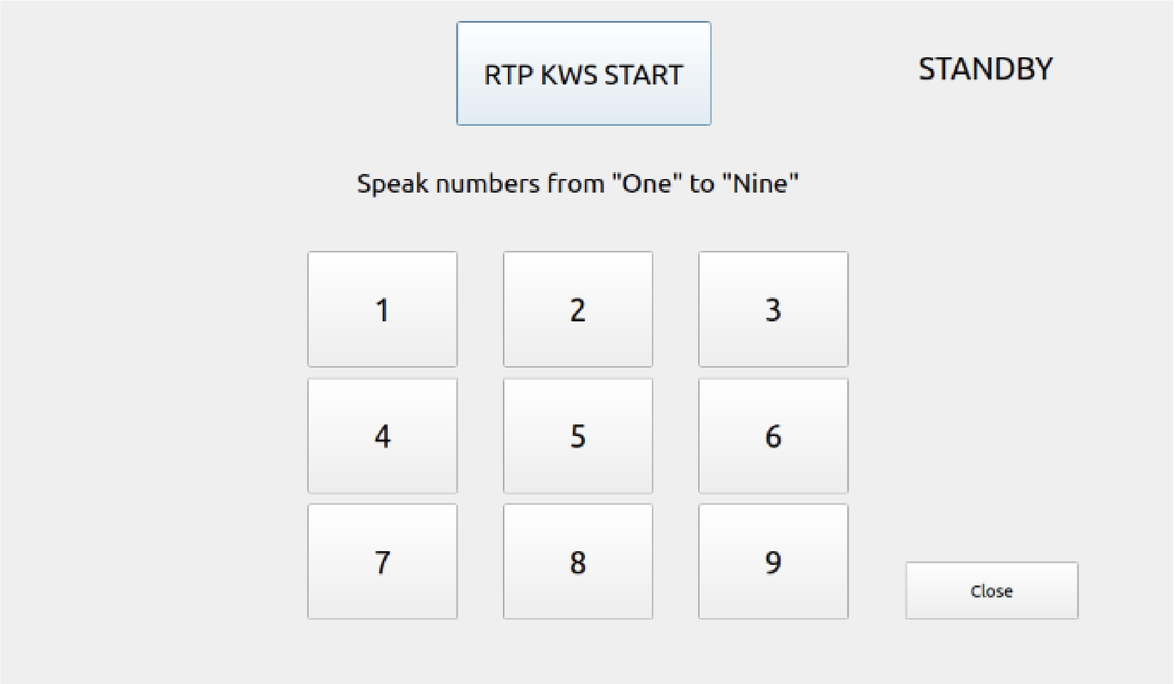


Demo

1. Clock “RTP KWS START” to start KWS
2. The RTP status is on top-right side

   STANDBY means that RTP is ready for listening key words.

   TRIGGERING mean that RTP is collecting and analyzing audio data.
3. If the result is within 1 to 9, the corresponding number will be enlarged.



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VoIP

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VoIP


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H.264
Video Playback
ML People counting
2D Accelerator
Data Security
Key Word Spotting
by RTP M4
VOIP

Demo

Mobile phone

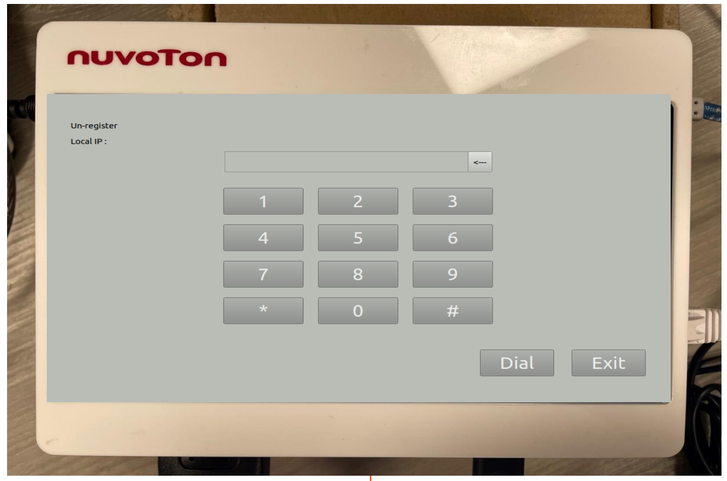
PC

Laptop

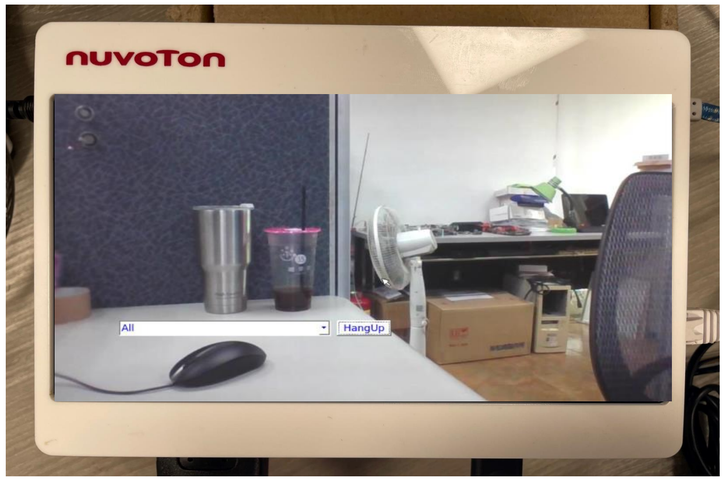
Linphone

SIP

Standby



Talking



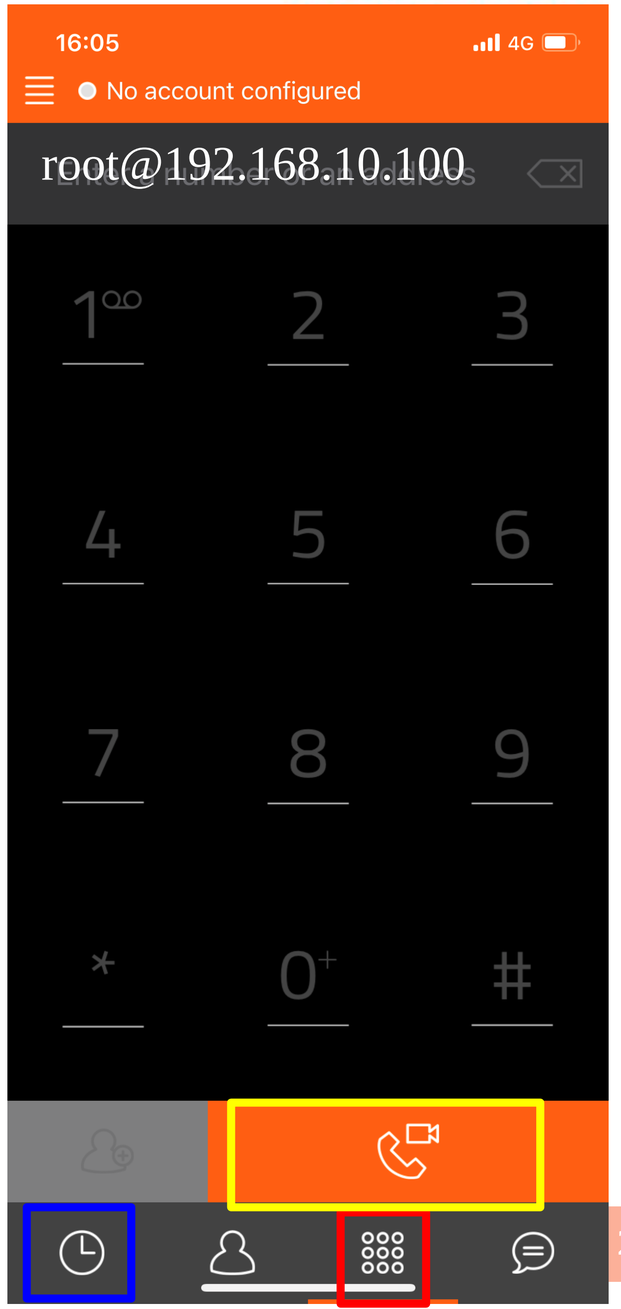
Ethernet Port 1

Wi-Fi Router

LINPHONE Setting

1. Connect MA35 Ethernet port 1 with Wi-Fi router
2. Open LINPHONE APP on PC/Mobile phone
3. Make sure that MA35 and PC/Mobile phone are under the same network
4. Go to “Settings” and configure video->codec to H.264
5. Typing MA35 Local IP : root@192.168.10.100 ， click yellow fame to call MA35

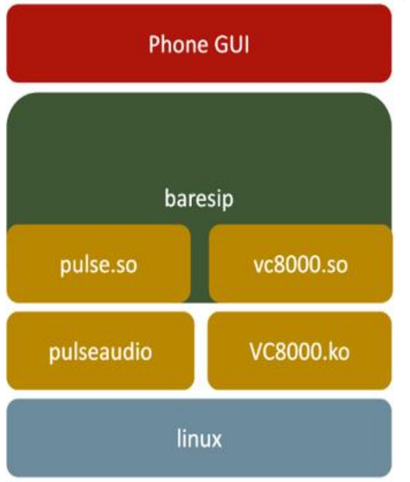
   (Red frame for typing IP, blue frame for the records)

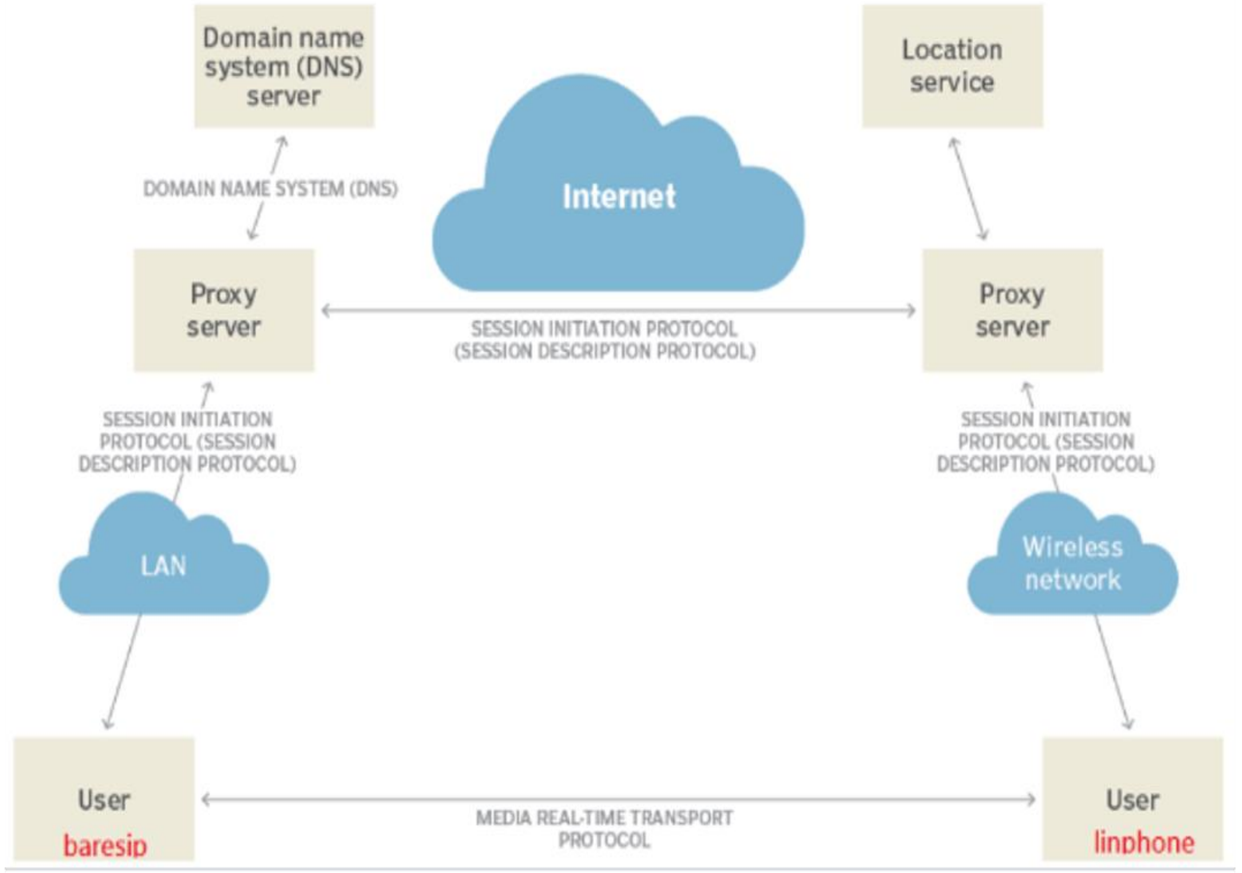


Resource

- H.264 Hardware decode and streaming on framebuffer 0
- Qt GUI on framebuffer 1 and use source over mode to overlay in framebuffer 0
- WebRTC AEC3 support(software AEC)
- Source code : https://github.com/OpenNuvoton/SIP-phone.git

Architecture

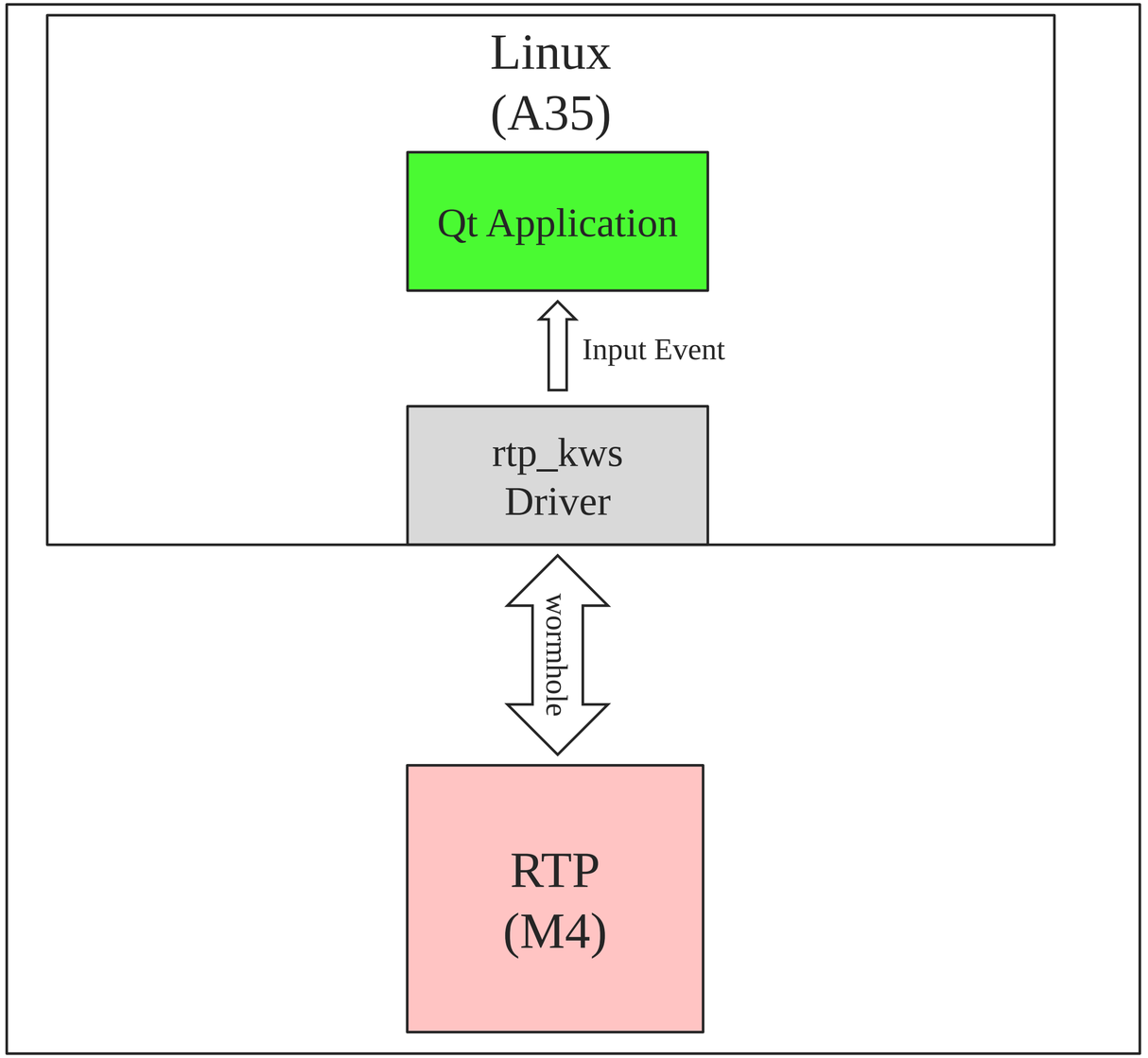




Resources Download

- Demo Video
- List
  - Qt/MA35D1: Application source code
  - RTP-KWS: RTP-KWS driver code
  - recipe-demo: recipe for Yocto to build Demo project

RTP-KWS Linux Driver Architecture



RTP-KWS Linux Driver

- **Input Device**
  - In order to let user could adapt RTP-KWS into their application easily, the driver registers RTP-KWS as a ’Input Device’ in the Linux.
- **Touch Key**
  - The driver register RTP-KWS as a ’keyboard’ and reports key codes (KEY_A, KEY_B…etc) and key status (pressed/released) to the system

To Build RTP-KWS Driver (1/2)

- **Copy file**

  Put rtp-kws.c to *${Your Linux TOPDIR}/drivers/input/misc/*

- **Modify KCONFIG & Makefile**

KCONFIG

```
config INPUT_RTP_KWS
        tristate "Nuvoton MA35 RTP Key Word Spot support"
        depends on ARCH_MA35D1
        select MAILBOX
        select MA35D1_WORMHOLE
        help
          Say Y to enable support for MA35 RTP Key Word Spot function.
```

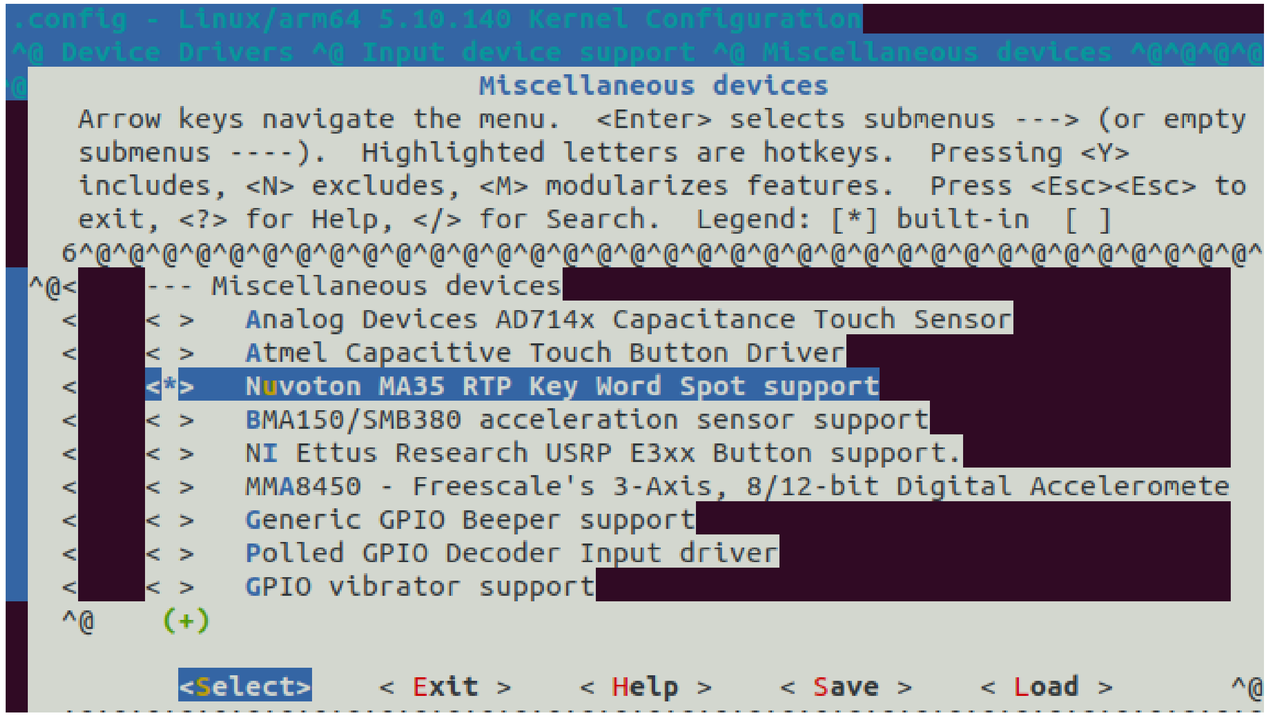
Makefile

```
obj-$(CONFIG_INPUT_RTP_KWS)                 += rtp_kws.o
```

To Build RTP-KWS Driver (2/2)

- **Enable RTP-KWS Driver by menuconfig**

  Device Drivers -> Input device support -> Miscllaneous



*: Built-in Driver

M: Loadable Driver

RTP-KWS Device Tree

- **RTP-KWS**

Linux Kernel

```
rtp_kws {
        compatible      = "nuvoton,rtp-kws";
        mboxes = <&wormhole 3>;
        status = "okay";
};
```

TF-A

```
sspcc: sspcc@404F0000 {
        compatible = "nuvoton,ma35d1-sspcc";
        reg = <0x0 0x404F0000 0x0 0x1000>;
        config = <UART0_TZNS>,
                 <SDH0_TZNS>,
                 <SDH1_TZNS>,
                 <NAND_TZNS>,
                 <QSPI0_TZNS>,
                 <CRYPTO_TZNS>,
                 <WDTWWDT1_TZNS>,
                 <HSUSBD_TZNS>,
                 <PDMA0_TZNS>,
                 <PDMA1_TZNS>,
                 <TIMER01_TZNS>,
                 <UART16_SUBM>,
                 <I2S1_SUBM>,
                 <PDMA2_SUBM>,
                 <TRNG_TZNS>;
};
```

```
&sspcc {
        gpio_s = <PD6_S>,
                 <PD7_S>,
                 <PK2_SUBM>,
                 <PK3_SUBM>,
                 <PL9_SUBM>,
                 <PD10_SUBM>;
};
```

APP Installation(1/2)

- **Build**:

  KWS/Linux:

  Add RTP KWS Linux driver

  Refer to dts/ma35d1.dtsi to add rtp_kws driver node

  Copy rtp_kws.c, Kconfig, Makefile to ${Your Linux TOPDIR}/drivers/input/misc/

  Enter Linux menuconfig -> enable rtp-fws

  re-compile Linux kernel-> bitbake linux-ma35d1 -C compile

  re-pack blob -> bitbake nvt-image-qt5 -c cleanall && bitbake nvt-image-qt5

  KWS/TF-A:

  Refer to fdts/ma35d1.dtsi and fdts/ma35d1-cpu800-wb-256m.dts to assign I2S/DMA to RTP M4

  re-compile tf-a -> bitbake tf-a-ma35d1 -C compile

  re-pack blob -> bitbake nvt-image-qt5 -c cleanall && bitbake nvt-image-qt5

APP Installation(2/2)

- **Build**:

  recipes-demo:

  Install Integrated Demo in Yocto:

  Copy recipes-demo to Yocto-TOPDIR/meta-ma35d1/

  Open ${YOCTO TOP DIR}/build/local.conf and add "integrateddemo" in CORE_IMAGE_EXTRA_INSTALL variable

  e.x. CORE_IMAGE_EXTRA_INSTALL += "integrateddemo"

  bitbake nvt-image-qt5

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Q&A

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Resourse

Official Website www.nuvoton.com

Forum

NuForum English
http://forum.nuvoton.com/

牛卧堂 Simplified Chinese
http://www.nuvoton-MCU.com

21ic 中国电子网 .com Simplified Chinese
http://bbs.21ic.com/iclist-187-1.html

BSP Updates

GitHub
https://github.com/OpenNuvoton

Social Media

facebook
https://www.facebook.com/NuvotonNuMicro/

WeChat
ID: nuvoton_mcu

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Thank You