

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

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

H.264 Video Playback

H.264 Video Playback

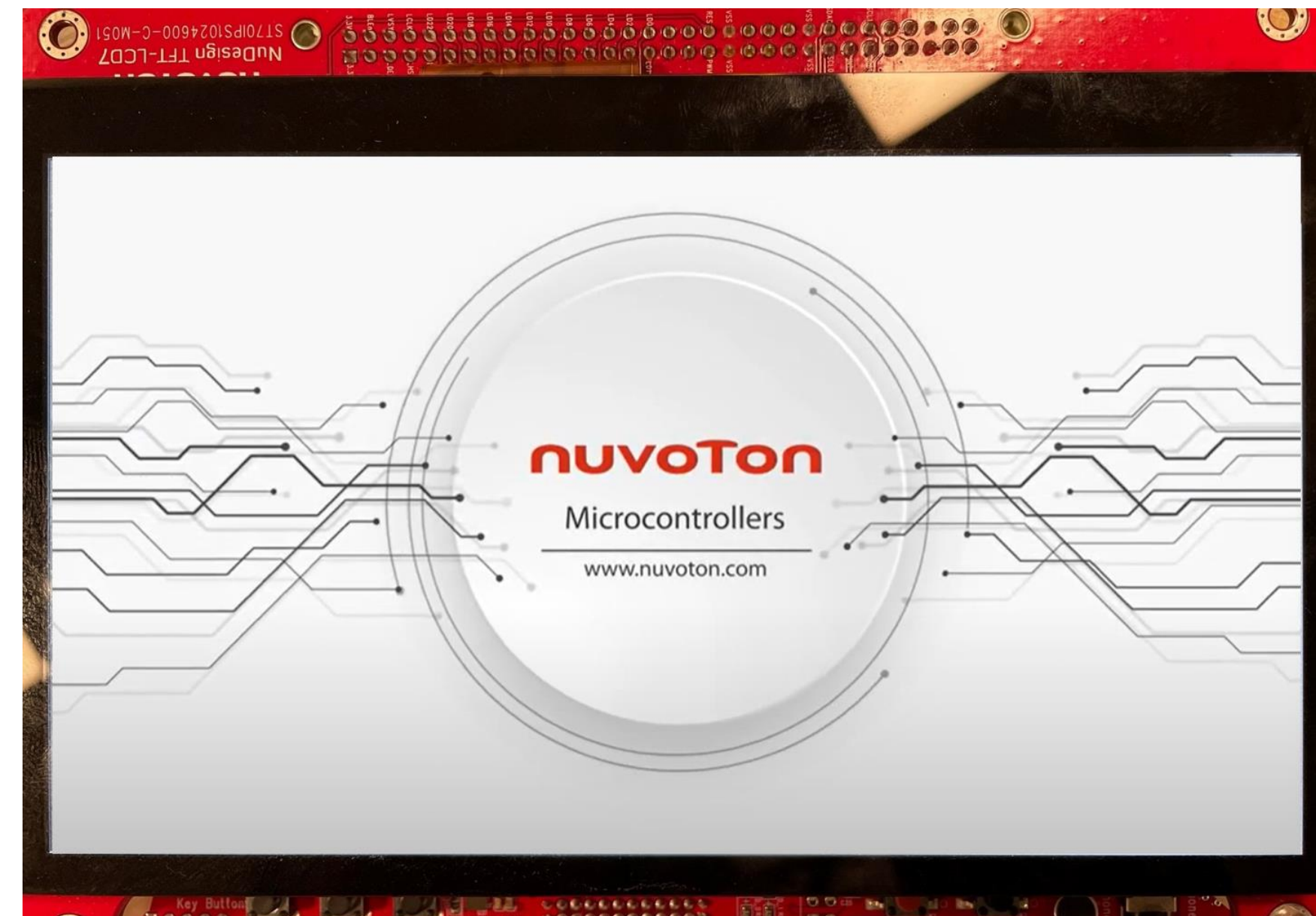


H.264 Video Playback

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



ML People Counting

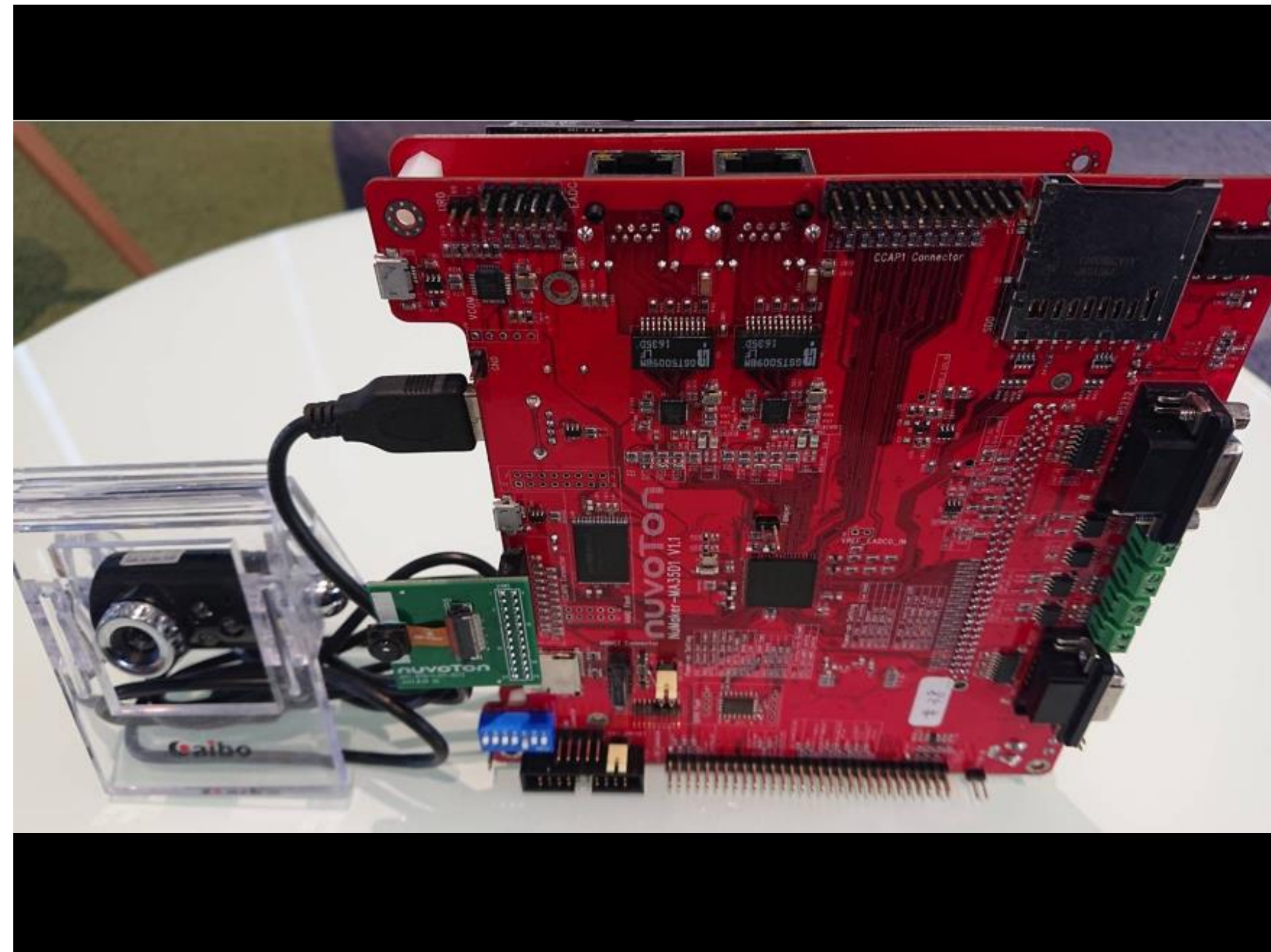
ML People Counting



Camera Control

Control Options:

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



Camera Select

C922 Pro Stream v ▾

Resolution

800*448 ▾

People Counting

START

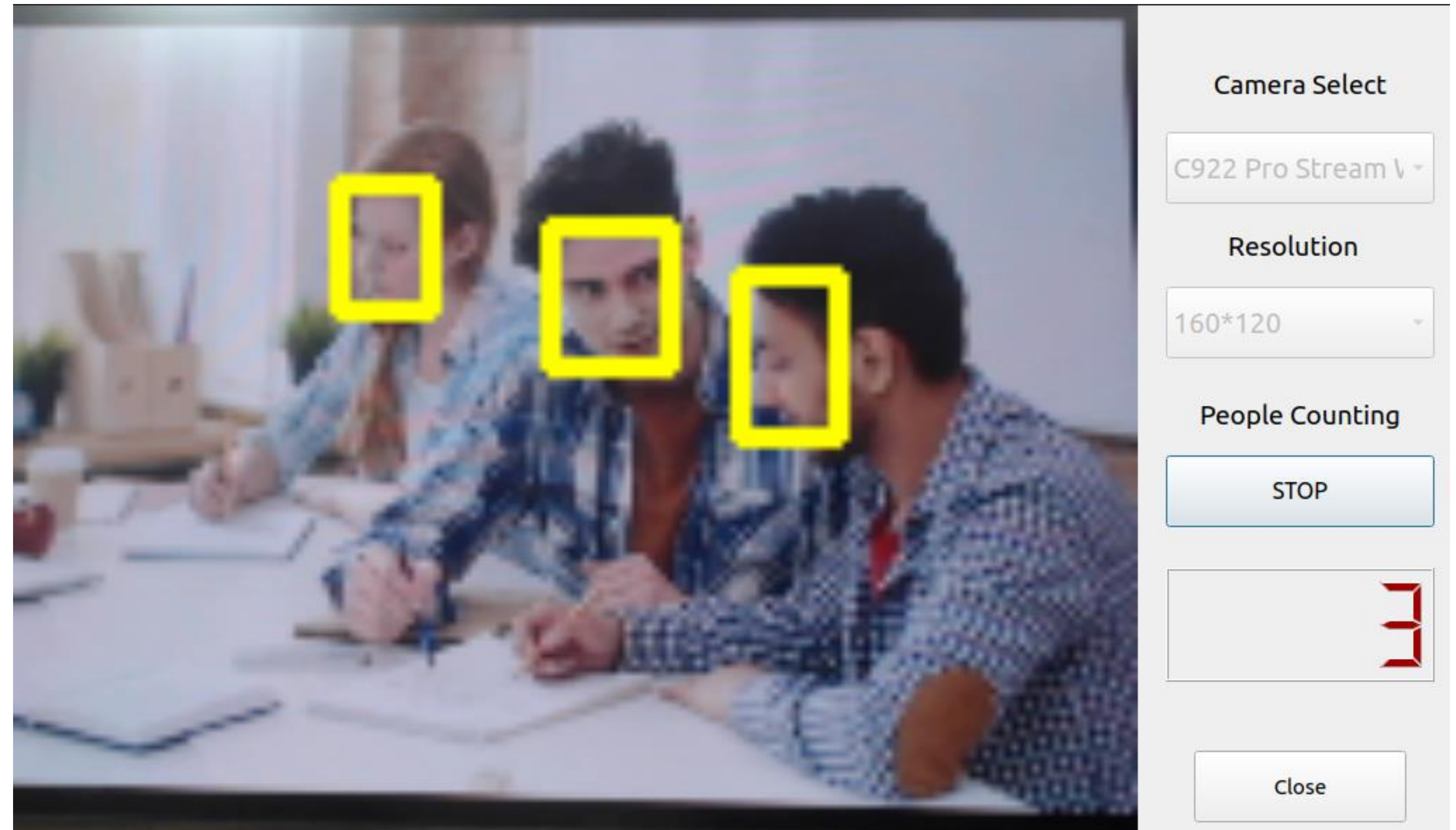


Close

People Counting

Control Options:

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



2D Accelerator

2D Accelerator



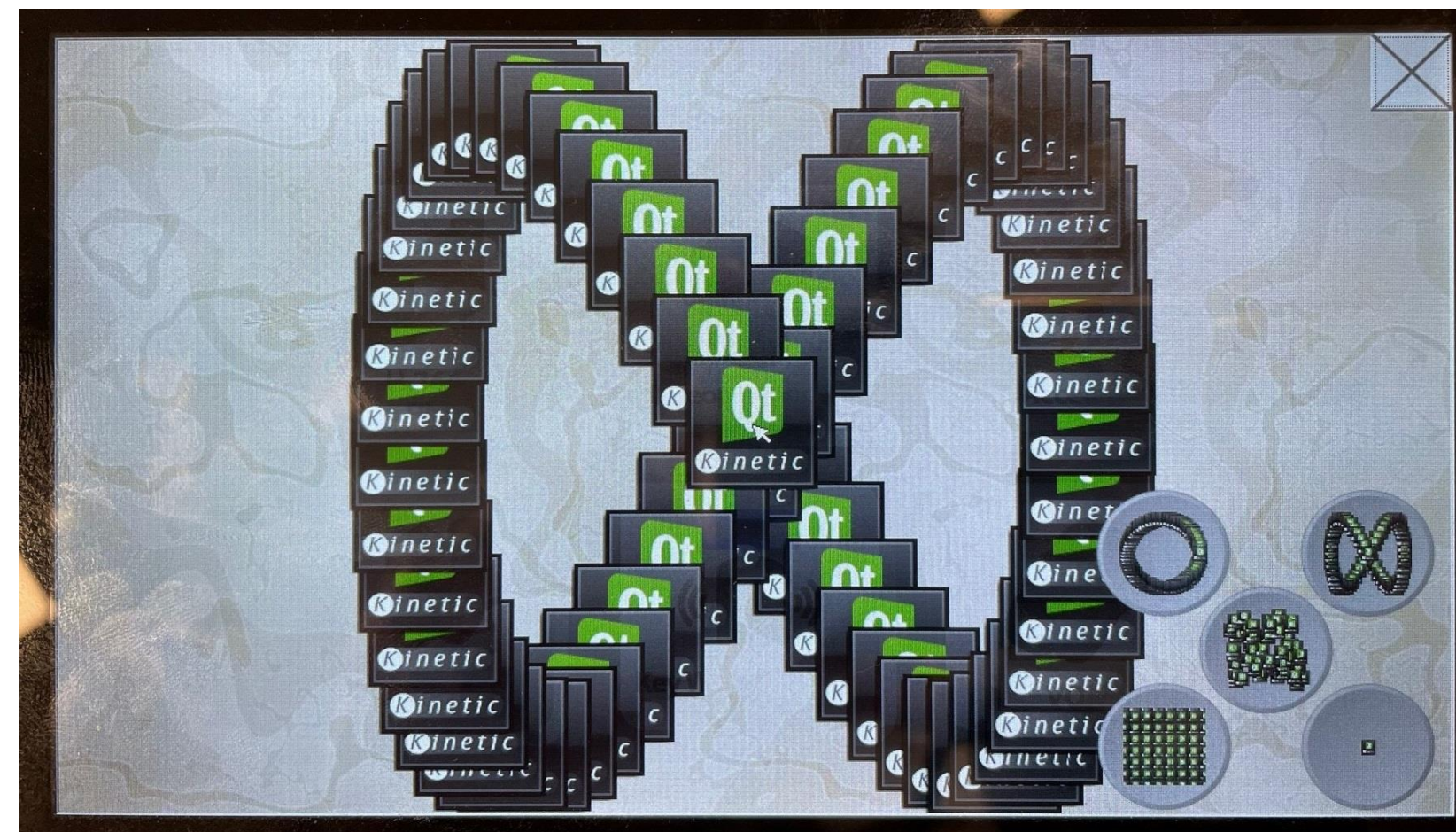
Image Programming and System Boot

- 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
```



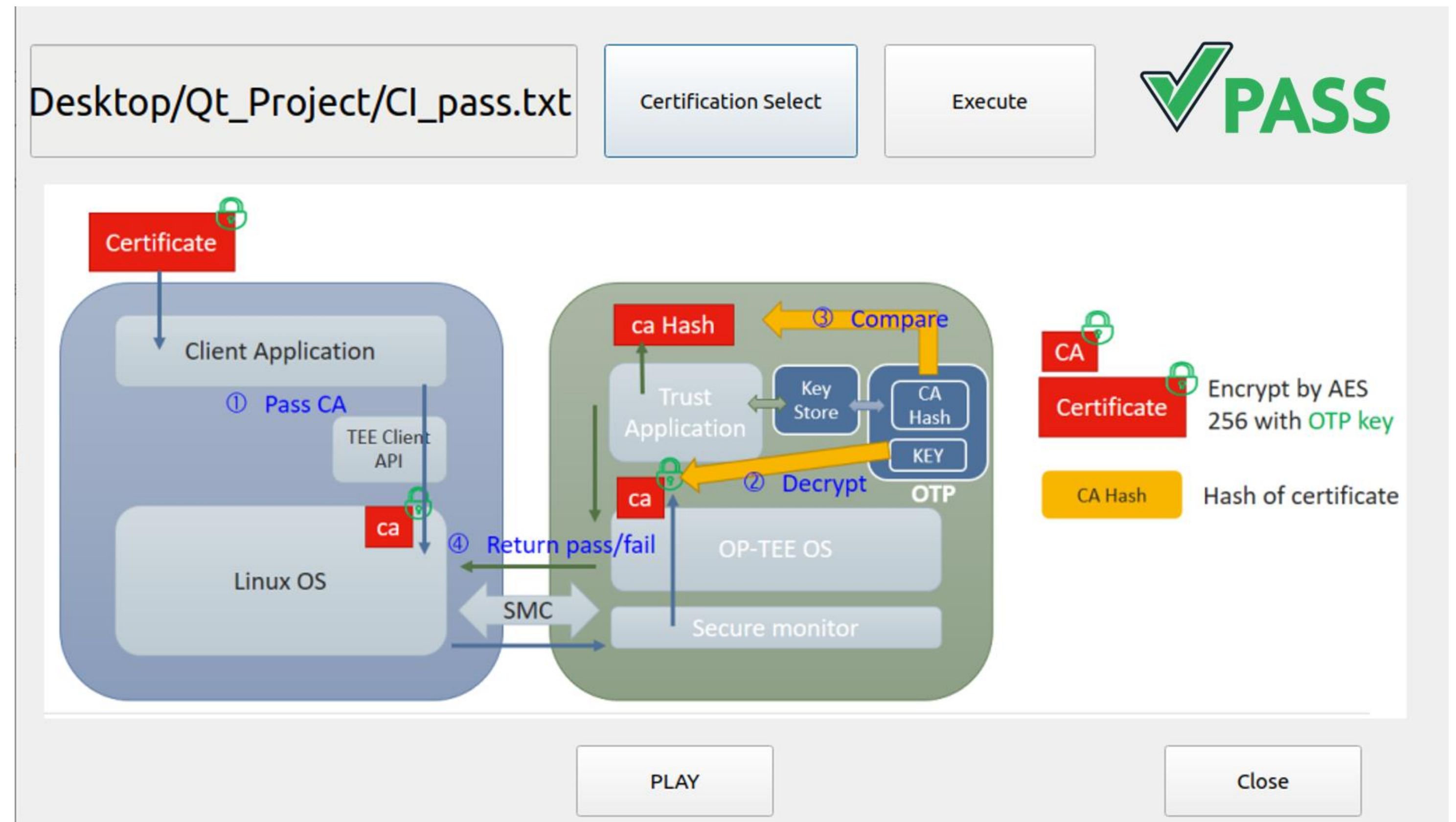
Data Security

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



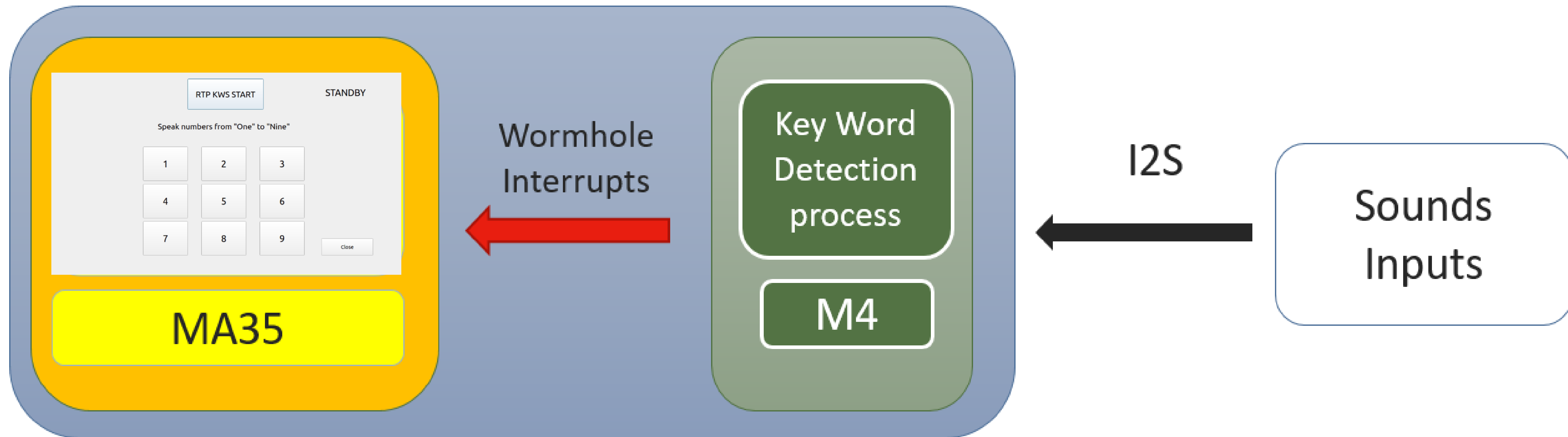
Key Word Spotting by RTP M4

Key Word Spotting by RTP M4



Introduction

- MA35 Load KWS FW to RTP via Linux Rpmmsg
- 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



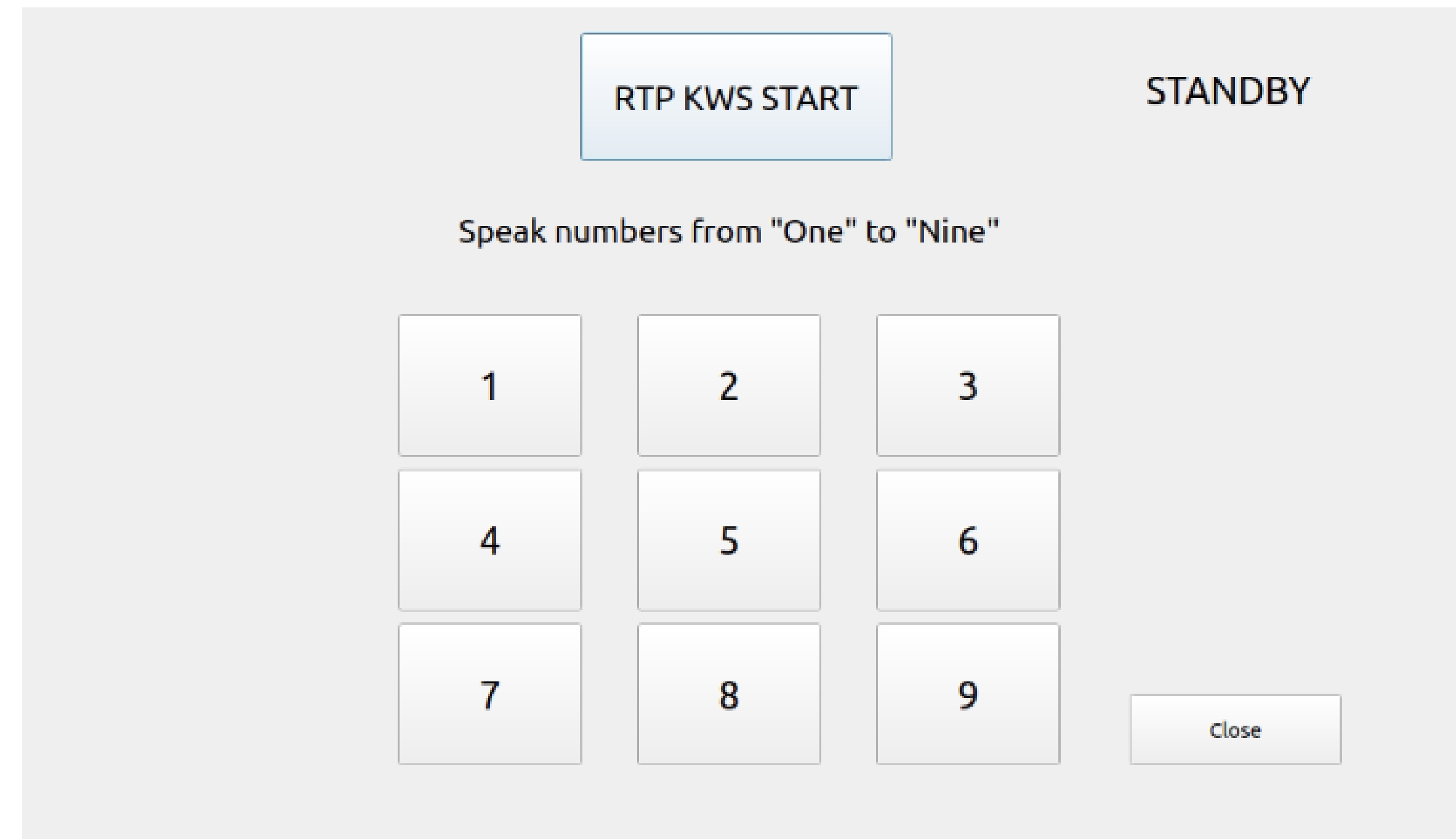
Demo

1. Click “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.

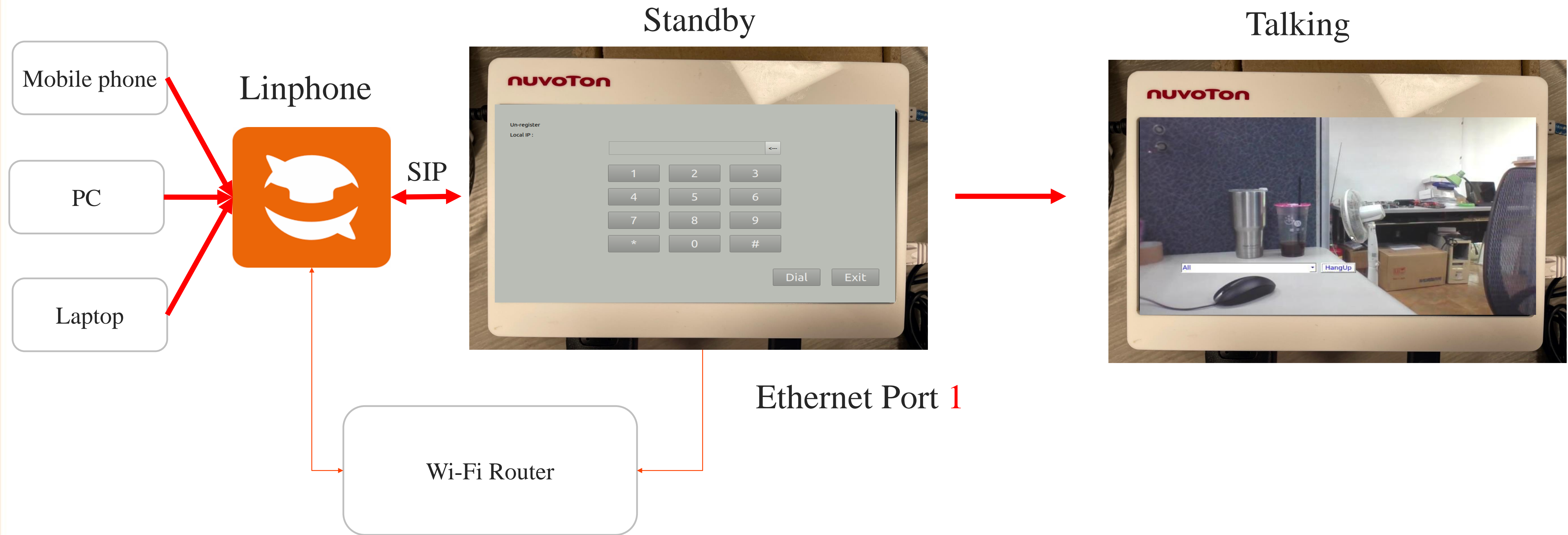
3. If the result is within 1 to 9, the corresponding number will be enlarged.



VoIP



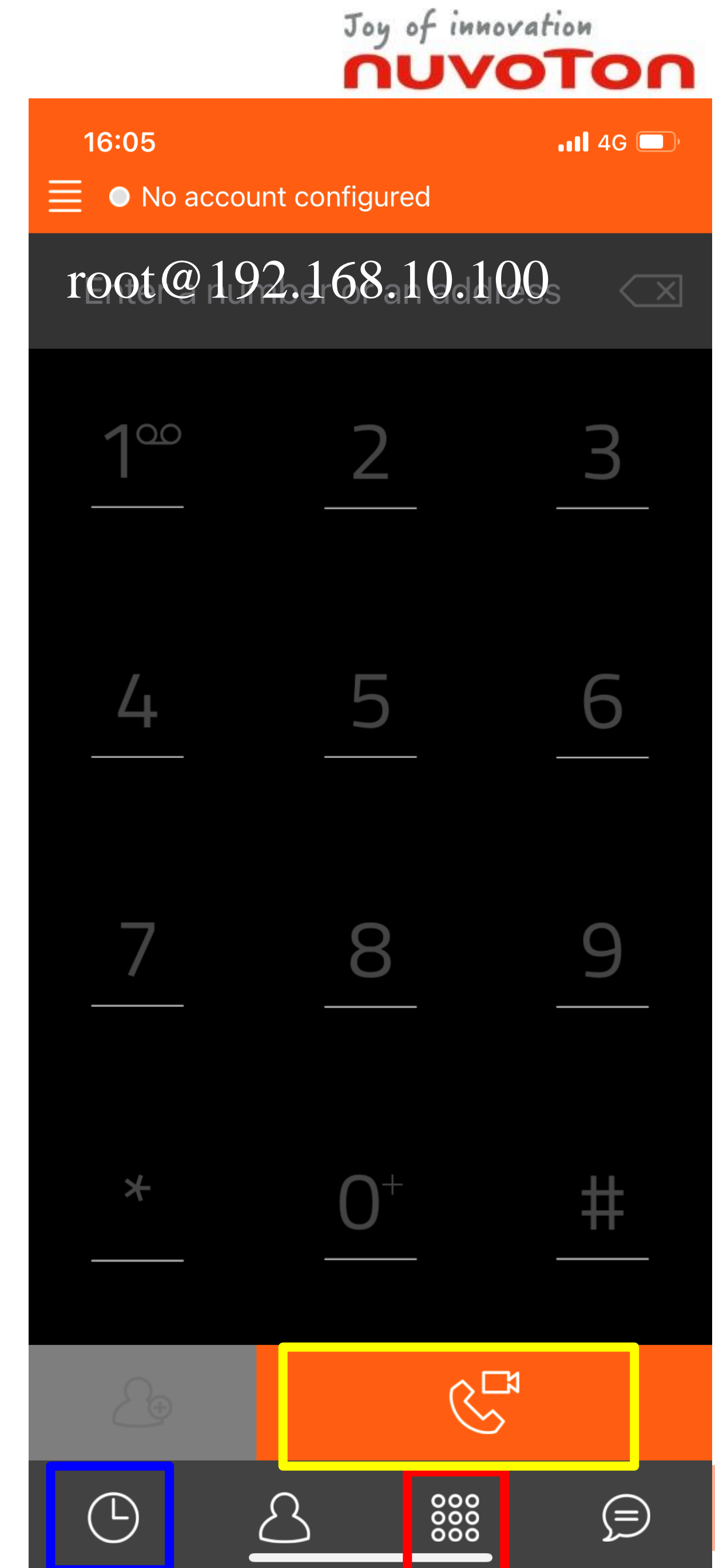
Demo



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](tel:root@192.168.10.100) , click yellow fame to call MA35

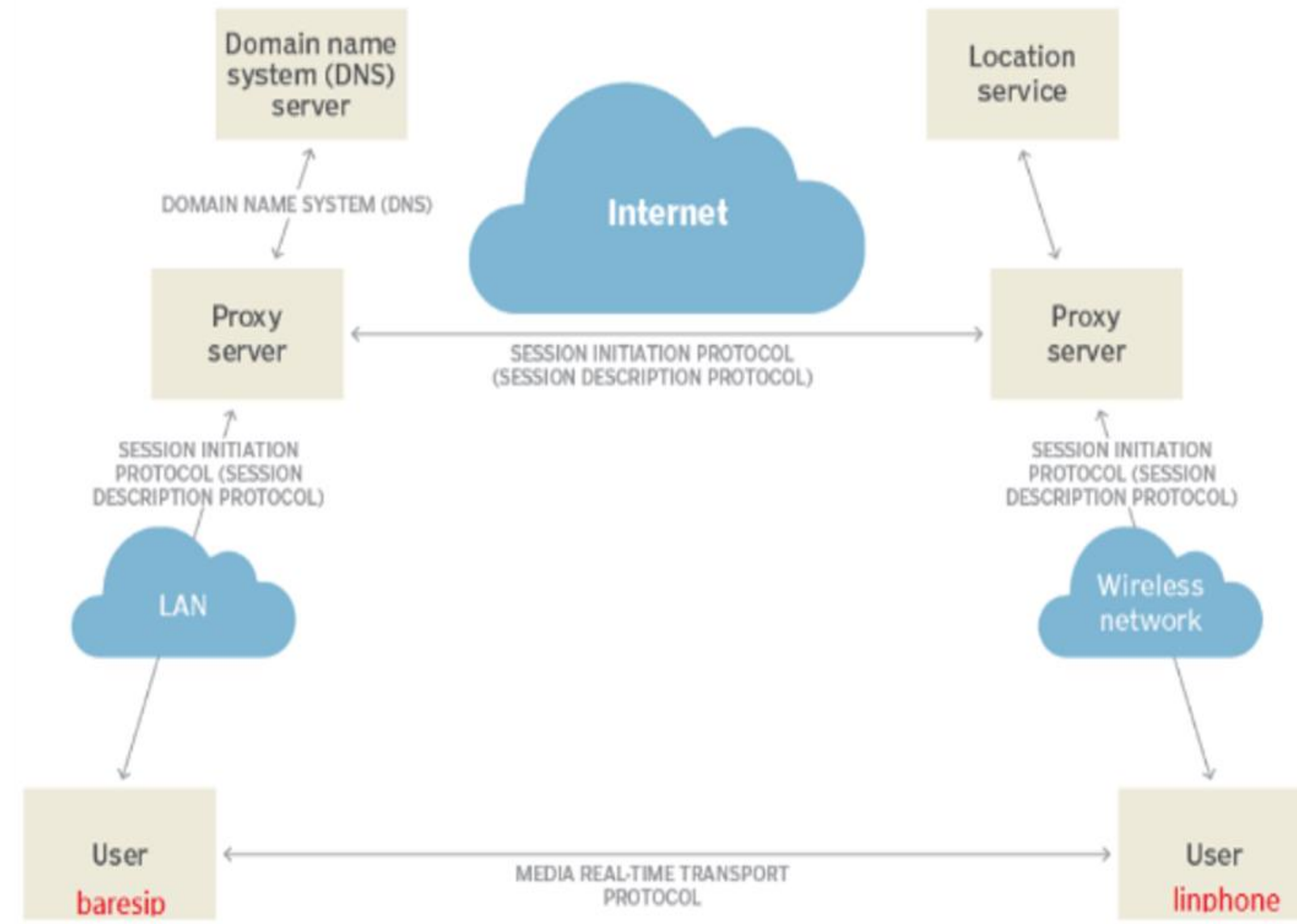
(Red frame for typing IP, blue frame for the records)



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>

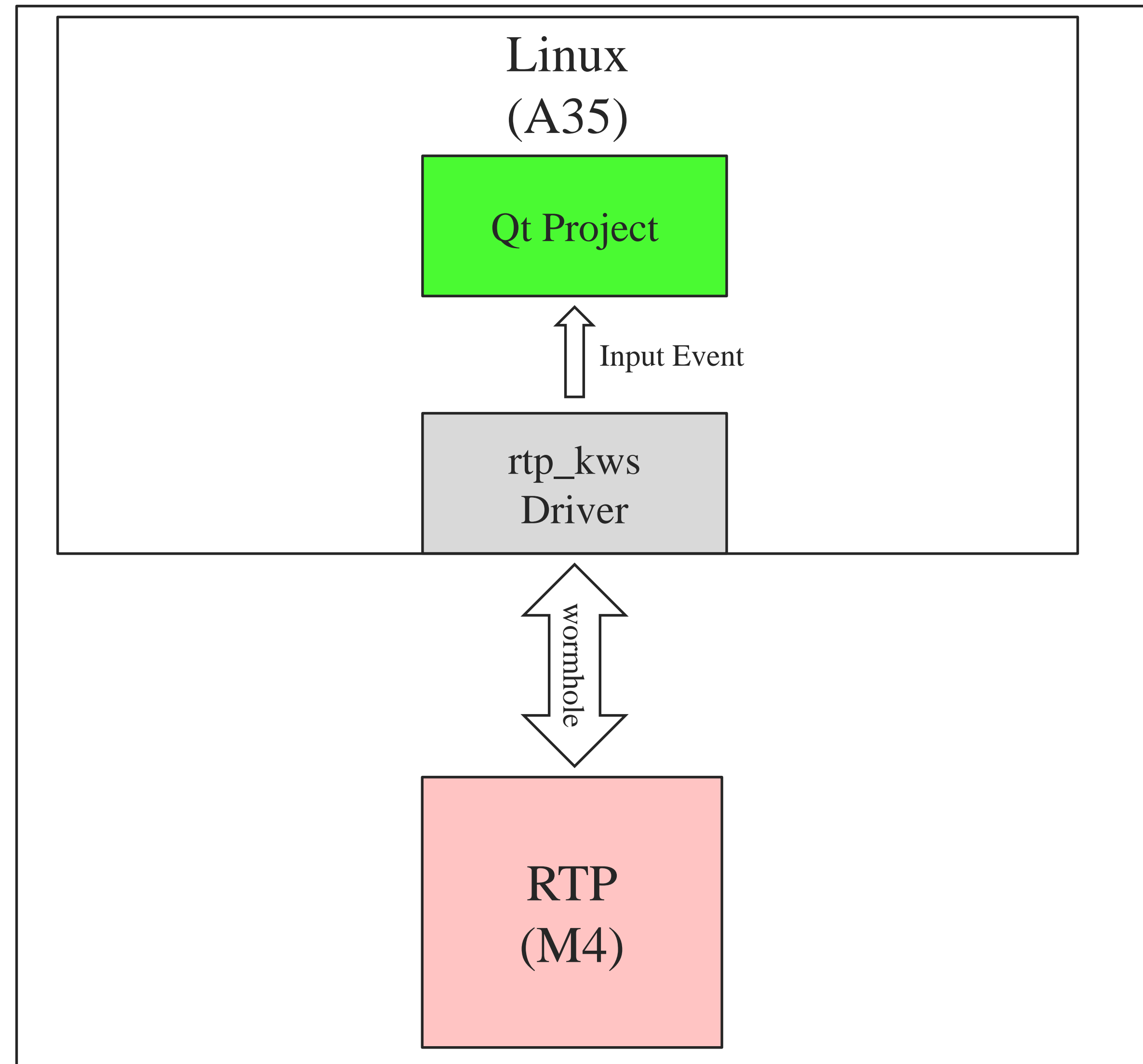
Architecture



Resources Download

- [MA35D1_Integrated_Demo](#)
- **List**
 - Qt/MA35D1: Userspace C++ 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 -> Miscellaneous

```
.config - Linux/arm64 5.10.140 Kernel Configuration
^@ Device Drivers ^@ Input device support ^@ Miscellaneous devices ^@@^@^@
^@                                     Miscellaneous devices
Arrow keys navigate the menu. <Enter> selects submenus ---> (or empty
submenus ----). Highlighted letters are hotkeys. Pressing <Y>
includes, <N> excludes, <M> modularizes features. Press <Esc><Esc> to
exit, <?> for Help, </> for Search. Legend: [*] built-in [ ]
6^@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@
^@<- -- Miscellaneous devices
< < > Analog Devices AD714x Capacitance Touch Sensor
< < > Atmel Capacitive Touch Button Driver
< <* > Nuvoton MA35 RTP Key Word Spot support
< < > BMA150/SMB380 acceleration sensor support
< < > NI Ettus Research USRP E3xx Button support.
< < > MMA8450 - Freescale's 3-Axis, 8/12-bit Digital Acceleromete
< < > Generic GPIO Beeper support
< < > Polled GPIO Decoder Input driver
< < > GPIO vibrator support
^@ (+)

[Select]    < Exit >    < Help >    < Save >    < Load >
```

*: Built-in Driver

M: Loadable Driver

RTP-KWS Device Tree

- RTP-KWS

Linux Kernel

```
rtp_kws {
    compatible      = "nuvoton,rtp-kws";
    mboxs = <&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>,
            <WDTWWD1_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 fdt/ma35d1.dtsi and fdt/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`

Q&A

Resource



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

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



Online Store

nuvoton
DIRECT

Global

<https://direct.nuvoton.com/>



天猫 Tmall.com

China

<http://nuvoton.tmall.com/>



Thank You



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