



Technical note

Harmony OS system panel embedded into KNX system

Introduction

This document demonstrates the installation of the Harmony OS system mirror image using STM32CubeProgrammer and MobaXterm, the execution of the smart home UI with DevEco Studio software, and the communication with the KNX system.

It provides detailed steps for the board firmware operation and includes specific test examples using the ETS tool to test the panel function.

1 Overview

This panel is based on the BearPi-HM micro development board operating the OpenHarmony system board. For embedding the KNX system, it is necessary to develop an API to connect with other devices. The HarmonyOS system runs with the driver and API interface between the physical and application levels. The interface can be called to transmit and receive data from other devices. Download the OS by following these steps:

Turn the DIP switch of the development board to "000" programming mode and press the RESET button



Figure 1. Panel view

- Open the STM32CubeProgrammer tool and choose the USB-burning way, click the refresh button and click "connect"
- Click the "+" button on the STM32Programmer tool and then choose the burning configuration file "tvs"



Figure 2. Image configuration download

• Then click the browse button and choose the image file path

Figure 3. Image download

| | entory | | m_micro.tsv × + | | | | | | USB |
|--|----------|----------|-----------------|------------|---------|------------|------------------------------|-----------------------------------|--------------|
| Address | | | * Size | Data width | 2-bit 👻 | | | Download 👻 | |
| Select | Opt | ld | Name | Type | IP | Offset | | Binary | Port |
| | | 0×1 | fsb11-boot | Binary | none | 0x00000000 | arm-trusted-firmware/tf-a-st | m32mp157a-bearpi-hm_micro-mx-seri | Serial numbe |
| | | 0x3 | ssbl-boot | Binary | none | 0x00000000 | bootloader/u-boot_bootloader | .stm32 | |
| | P | 0×4 | fsbl1 | Binary | mmc1 | 0x000000B | arm-trusted-firmware/tf-a-st | m32mp157a-bearpi-hm_micro-mx-trus | |
| | р | 0x5 | fsb12 | Binary | mmc1 | 0x000000B | arm-trusted-firmware/tf-a-st | m32mp157a-bearpi-hm_micro-mx-trus | |
| \checkmark | PD | 0×6 | ssbl | Binary | mmc1 | 0x00080000 | bootloader/u-boot.stm32 | | |
| | р | 0x21 | boot | System | mmc1 | 0x00280000 | kernel/OHOS_Image.stm32 | | |
| \checkmark | p | 0x22 | rootfs | Binary | mmc1 | 0x02280000 | kernel/rootfs_vfat.img | | |
| | Р | 0x23 | userfs | FileSystem | mmc1 | 0x04280000 | kernel/userfs_vfat.img | | |
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| and the second | | | 2021/12/11 6:48 | 文件实 | | | | 4 | |
| lashlayout | | | | | | | | | |

- Click the download button and start burning and wait for the end.
- Open the MobaXterm software, click the session and serial button
- Set port and speed

Figure 4. COM configuration



- Turn the DIP switch to "010" mode of the panel, and press the RESET button.
- Wait for log end of the run and press the enter button to go into shell

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2 UI install and operation

The UI is designed to meet the need of the KNX system including home page, lighting control, curtain control, RGB light, HVAC control and sensor control page. The UI designing tool is DevEco studio. The following steps are processed:

• Open the tool and choose an empty ability project. Then configure the project, set the type as application, choose the language JS and set the device type as smart vision. Next the project displays three files in the index directory including CSS, HML, and JS. The CSS file is aim to adjust the location and size of the element. The HML file is aimed at layout page elements. The JS file is aimed at designing functions.

After these steps, the development interface and program interface will display at the same time. So, the development will be easier.

| 📕 index.hml × | Previewer | Tr G 🔻 🗢 🔐 |
|--|-----------------------------------|------------|
| 1 C <div class="container"></div> | entry : default/pages/index/index | 8 0 0 1 |
| <pre>2 <text class="title"></text></pre> | 7 1 3 | |
| <pre>3 Hello {{ title }}</pre> | | 0 |
| 4 | SmartVision (large) | ιψ. |
| 5 ⊖ | | Prev |
| 6 | | ewe |
| | | 4 |
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| div.container | | |

Figure 5. UI development interface

- Compile the code to hap file before downloading it to the panel. And it is necessary to set some
 parameters. Set OhosBuild variants on the bottom left of the windows and choose release mode, then click
 the build->build Hap(s)/App(s)->build Hap(s). Get the hap file after the building process.
- The next step is installing the HAP application:
 - Press the RESET button on the panel board.
 - When you see the message "Hit any key to stop autoboot", press the [Enter] key.
 - A hint displays.
 - Input the command ums 0 mmc 1.
 - Several U disks appear in the windows.
 - Ignore the format and choose the directory below.
 - Copy the HAP file into the directory.
 - Restart the panel board.





| CPU: STM32MP157AAC Rev.Z Model: STMicroelectronics custom STM32CubeMX board - openstlinux-5.10-dunfell-mp 1 21 03 21 |
|--|
| 1-21-03-31 Paard, stm22mm1 in trusted mode (st stm22mm157s baarni hm misra my) |
| DRAM - 512 MiR |
| nhy nover: no nhy-nover? |
| |
| - MPU : 650 MHz |
| - MCU : 208.878 MHz |
| - AXI : 266.500 MHz |
| - PER : 0 MHz |
| - DDR : 533 MHz |
| WDT: Started with servicing (32s timeout) |
| NAND: 0 MiB |
| MMC: STM32 SD/MMC: 2, STM32 SD/MMC: 0, STM32 SD/MMC: 1 |
| Loading Environment from MMC *** Warning - bad CRC, using default environment |
| |
| In: serial |
| Out: serial |
| Err: serial |
| invalid MAC address in OTP 00:00:00:00:00 |
| Net: No ethernet found. |
| Hit any key to stop autoboot: 0 |
| STM32MP> ums 0 mmc 1 |

Figure 7. Mount file phase

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|---|--------------------------|-----------------|---------|
| 文件 主页 🗧 | 共享 查看 驱动器工具 | | ~ ? |
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| > 🧹 软件 (D:) | ^ 名称 [^] | 修改日期 | 类型 |
| > 🧹 文档 (E:) | 📕 bin | 2022/7/4 23:51 | 文件夹 |
| > 🧹 U 盘 (F:) | dev | 2022/7/4 23:51 | 文件夹 |
| › 🧹 U 盘 (G:) | 📙 etc | 2022/7/4 23:51 | 文件夹 |
| › 🧹 U 盘 (H:) | 📕 lib | 2022/7/4 23:51 | 文件夹 |
| › 🧹 U 盘 (I:) | 📜 proc | 2022/7/4 23:51 | 文件夹 |
| ۰. ۱۱ (۲۰) | 📙 sdcard | | 文件夹 |
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| | ✓ < | | > |
| 12 个项目 | | | |

• Input command line "./bm set –s disable","./bm set –d enable","./bm install –p xxxx.hap", the hap file is built file before, and xxx is a special name. Click the app image on the panel to access different function pages on the home page. The interface is shown below:

Figure 8. User interface



3 KNX communication

It is necessary to link the KNX module to the Harmony OS panel to realize KNX communication. KNX module is as below. Communication between panel and KNX module uses UART. Connect the VCC, GND, TX, RX to the panel pins. Connect the BUS+ and BUS-with KNX power then download the hex file with the SWD port and use the ETS tool to download the database into the KNX module.



Up to now, operate the application interface and send data to KNX bus and corresponding group items are controlled and the status is displayed in the panel when KNX bus appears item status updates. The following is the function operation interface.



Figure 10. Function interface

It is necessary to link





Figure 11. STDES-HARMONYKNX circuit schematic



Schematic diagrams

TN1555

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5 Bill of materials

Table 1. STDES-HARMONYKNX bill of materials

| Item | Q.ty | Ref. | Part / Value | Description | Manufacturer | Order code |
|------|------|-----------------------|-----------------|-----------------------|--------------|---|
| 1 | 2 | C1,C16 | 4.7uF | | SAMSUNG | CL10A475KO8NNNC |
| 2 | 3 | C2,C14,C21 | 100nF | | YAGEO | CC0603KRX7R9BB104 |
| 3 | 1 | C3 | 220nF/6.3V | | SAMSUNG | CL10B224KA8NNNC |
| 4 | 1 | C4 | 10uF/50V | | SAMSUNG | CL31A106KBHNNNE |
| 5 | 1 | C5 | 10uF/35V | | SAMSUNG | CL31A106KBHNNNE |
| 6 | 1 | C6 | 470nF/35V | | SAMSUNG | CL21B474KBFNNNE |
| 7 | 2 | C7,C10 | 47nF/35V | | SAMSUNG | CL10B473KB8NNNC |
| 8 | 1 | C9 | 220uF/35V | | PANASONIC | EEET1H221GP |
| 9 | 2 | C11,C12 | 22pF | | SAMSUNG | CL10C220JB8NNNC |
| 10 | 1 | C13 | 10nf/50V | | FH | 0603B103K500NT |
| 11 | 1 | C15 | 100nF/6.3V | | YAGEO | CC0603KRX7R9BB104 |
| 12 | 2 | C17,C19 | 100nF/50V | | YAGEO | CC0603KRX7R9BB104 |
| 13 | 1 | C18 | 1nF | | SAMSUNG | CL10B102KB8NNNC |
| 14 | 1 | C22 | 22uF | | muRata | GRM31CR61E226KE15L |
| 15 | 1 | CFB1 | 180pF | | TDK | CGA3E2C0G1H181JT0Y0N |
| 16 | 3 | D1,D2,D5 | TS4148 | | ST | LL4148 |
| 17 | 1 | D6 | SMAJ40CA | SMA | ST | SMAJ40CA-TR |
| 18 | 1 | FB1 | 600Ω@100MHz | | Sunlord | GZ1608D601TF |
| 19 | 1 | H1 | HDR-M-2.54_1x5 | | Ckmtw | 210S-1*5P L=11.6MMGold- plated black |
| 20 | 1 | J1 | HDR-M-2.54_1x4 | | LCSC | C124378 |
| 21 | 1 | KEY_PROG | TS3320A | | SHOU HAN | TS3320A |
| 22 | 1 | L1 | 33uH | | TDK | VLS6045EX-330M |
| 23 | 1 | L2 | GZ1608D601TF | | Sunlord | GZ1608D601TF |
| 24 | 3 | LED1,LED_MCU,LED_PROG | LED0603_RED | | EVERLIGHT | 19-217/R6C-AL1M2VY/3T |
| 25 | 2 | PIN1,PIN2 | WAGO243-113 | | WAGO | WAGO243-113 |
| 26 | 1 | R4 | 68R | | YAGEO | AC2512FK-0768RL |
| 27 | 2 | R7,R8 | 1K | | UNI-ROYAL | 0603WAF1001T5E |
| 28 | 1 | R9 | 4.7M | | UNI-ROYAL | 0603WAF4704T5E |
| 29 | 4 | R11,R16,R20,R21 | 2.2K | | UNI-ROYAL | 0603WAF2201T5E |
| 30 | 1 | RFB1 | 30kΩ | | Viking | AR03BTCX3002 |
| 31 | 1 | RFB2 | 13kΩ | | YAGEO | RT0603BRB0713KL |
| 32 | 1 | U1 | STM32G070CBT6TR | LQFP 48 7x7x1.4 mm | ST | STM32G070CBT6TR |
| 33 | 1 | U2 | STKNX | QFN-24L | ST | STKNX |
| 34 | 1 | X1 | 16MHz | | EPSON | X1E000021011900 |



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Revision history

Table 2. Document revision history

| Date | Revision | Changes |
|-------------|----------|------------------|
| 21-Oct-2024 | 1 | Initial release. |



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