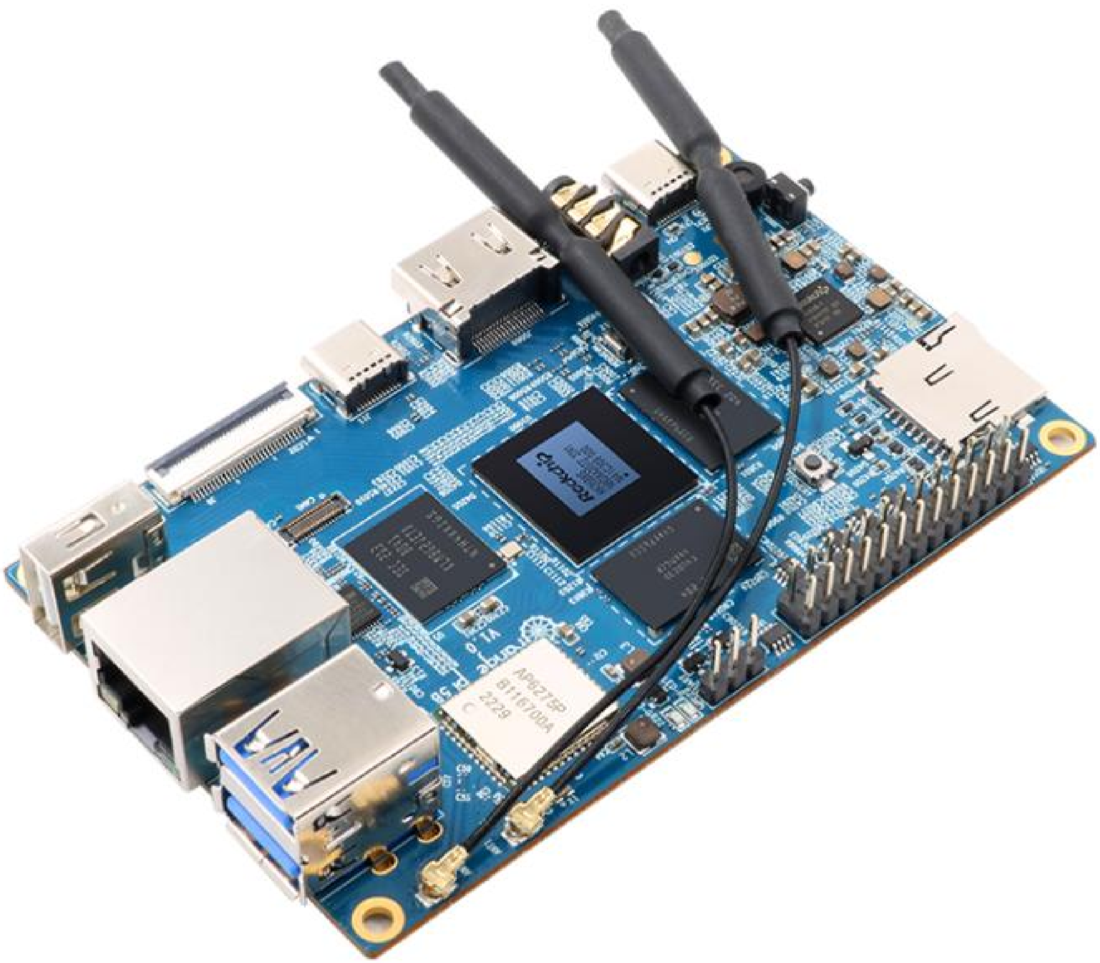
Orange Pi 5B
User Manual



Contents

1. Basic features of Orange Pi 5B

1. 1. What is Orange Pi 5B

Orange Pi 5B adopts Rockchip RK3588S new-generation octa-core 64-bit ARM processor, specifically quad-core A76 and quad-core A55, using Samsung 8nm LP process technology, large-core main frequency up to 2.4GHz, integrated ARM Mali -G610 MP4 GPU, embedded with high-performance 3D and 2D image acceleration modules, built-in AI accelerator NPU with a computing power of up to 6 Tops, with 4GB/8GB/16GB (LPDDR4/4x) memory and 32GB/64GB/128GB/256GB onboard eMMC , with up to 8K display processing capability.

Orange Pi 5B introduces quite a lot of interfaces, including HDMI output, Type-C, WIFI6, Bluetooth, Gigabit Ethernet port, USB2.0, USB3.0 interface and 26pin expansion pin header, etc. It can be widely used in high-end tablet, edge computing, artificial intelligence, cloud computing, AR/VR, smart security, smart home and other fields, covering various AIoT industries.

Orange Pi 5B supports Orange Pi OS, the official operating system developed by Orange Pi. At the same time, it supports Android 12.1, Debian11, Ubuntu20.04 and Ubuntu22.04 and other operating systems.

1. 2. Purpose of Orange Pi 5B

We can use it to achieve:

- A Linux desktop computer
- A Linux web server
- Android tablet
- Android game console, etc.

Of course, there are more functions, because the Orange Pi 5B development board can install Linux systems such as Debian and Ubuntu, as well as systems such as Android, which means that we can implement it within the scope of the development board hardware and software support. Various functions.

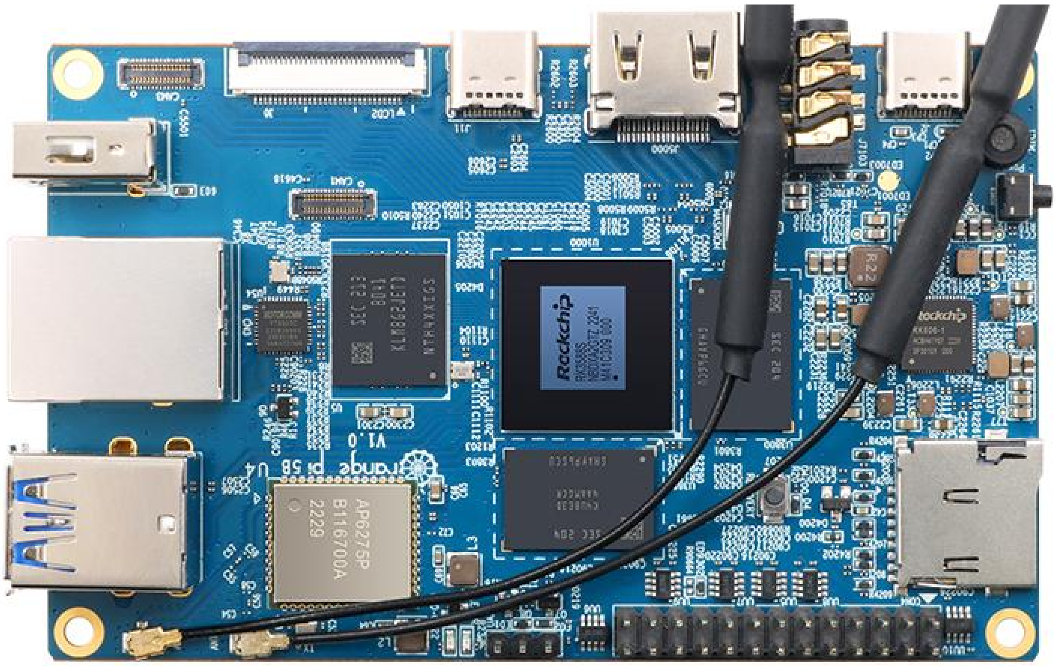
1. 3. Hardware features of Orange Pi 5B

Introduction to hardware features	
CPU	• Rockchip RK3588S (8nm LP process) • 8-core 64-bit processor • 4-core Cortex-A76 and 4-core Cortex-A55 core architecture • The main frequency of the large core is up to 2.4GHz, and the main frequency of the small core is up to 1.8GHz
GPU	• Integrated ARM Mali-G610 • OpenGL ES1.1/2.0/3.2, OpenCL 2.2 and Vulkan 1.2
NPU	• Built-in AI accelerator NPU with a computing power of up to 6 Tops • Support INT4/INT8/INT16 mixed operation
video output	• HDMI 2.1, up to 8K @60Hz • DP1.4（DisplayPort） • 2 * MIPI D-PHY TX 4Lane
Memory	4GB/8GB/16GB（LPDDR4/4x）
Camera	• 1 * MIPI CSI 4Lane • 2 * MIPI D-PHY RX 4Lane
PMU	RK806-1
onboard storage	• MicroSD (TF) Card Slot • 32/64/128/256 GB eMMC
ethernet	10/100/1000Mbps ethernet (YT8531C)
WIFI+BT	Onboard WI-FI6+BT 5.0 module (AP6275P), supports BLE
audio	• 3.5mm headphone jack audio in/out • Onboard MIC input • HDMI output
USB interface	1 * USB3.0 interface 2 * USB2.0 interface (one of which is shared with Type-C interface) 1 * USB3.0 Type-C port
26pin extension header	Used to expand UART, PWM, I2C, SPI, CAN and GPIO

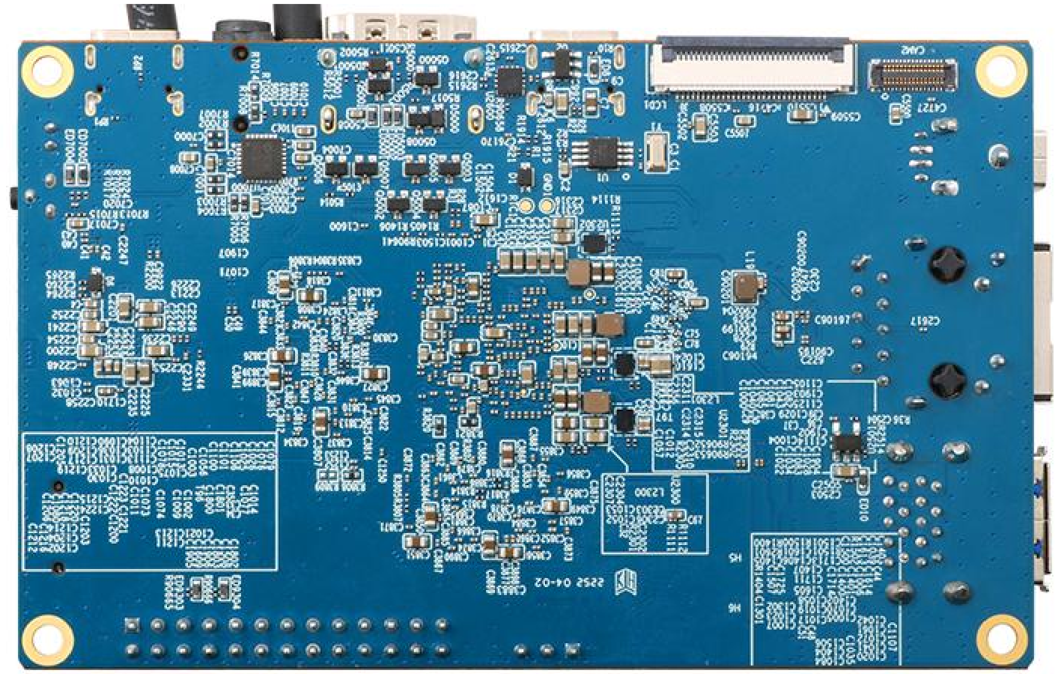
	interfaces
Debug serial port	3pin debugging serial port
LED	Power light and status light
button	1 * MaskROM key, 1 * RECOVERY, 1 * switch key
Power supply	Type-C interface power supply 5V/4A;
Supported OS	Operating systems such as Orange Pi OS (Droid), Android12.1, Debian11, Ubuntu20.04 and Ubuntu22.04
Introduction of Appearance Specifications	
Product Size	100mm*62mm
weight	46g
range Pi™ is a registered trademark of Shenzhen Xunlong Software Co., Ltd.	

1.4. Top view and bottom view of Orange Pi 5B

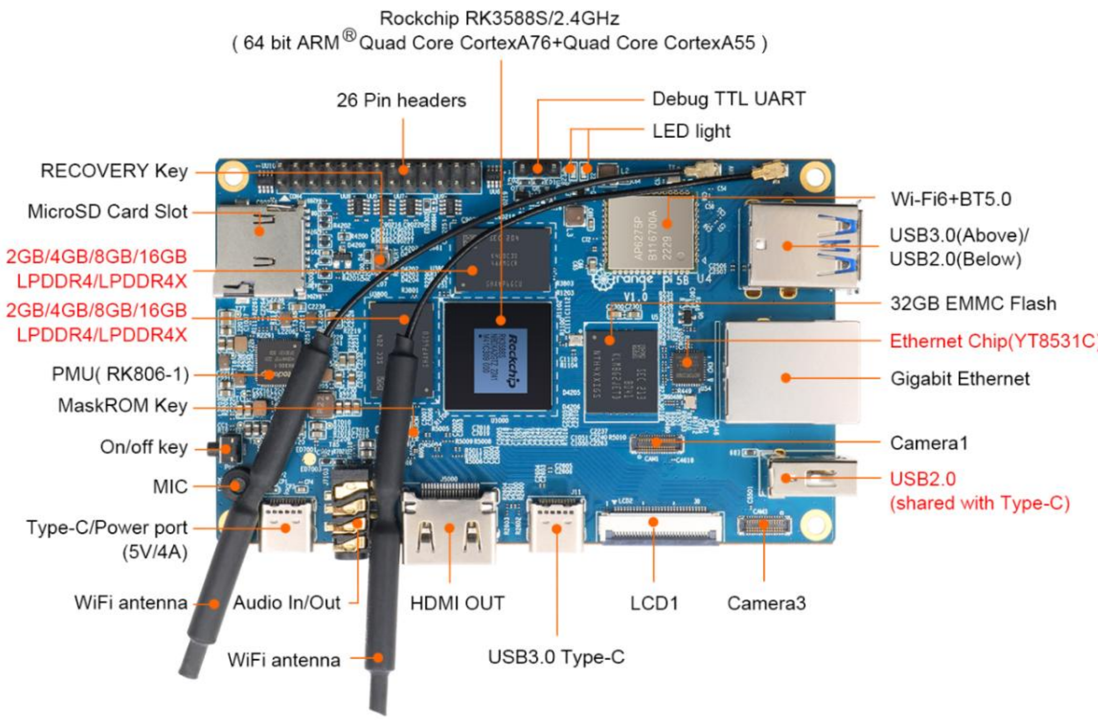
Top view:



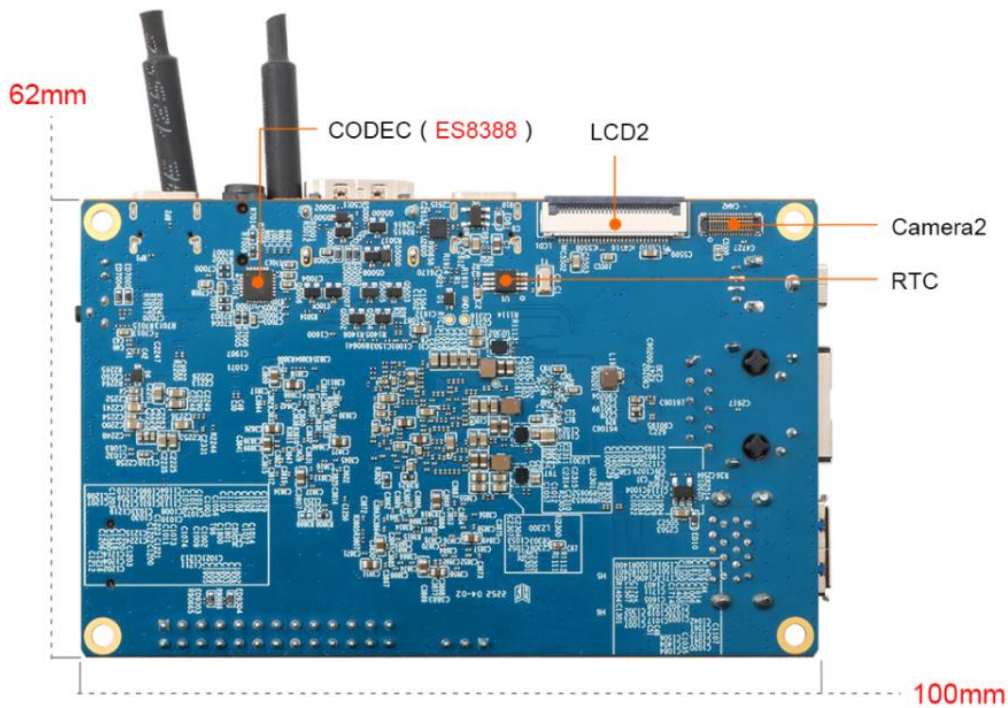
Bottom view:



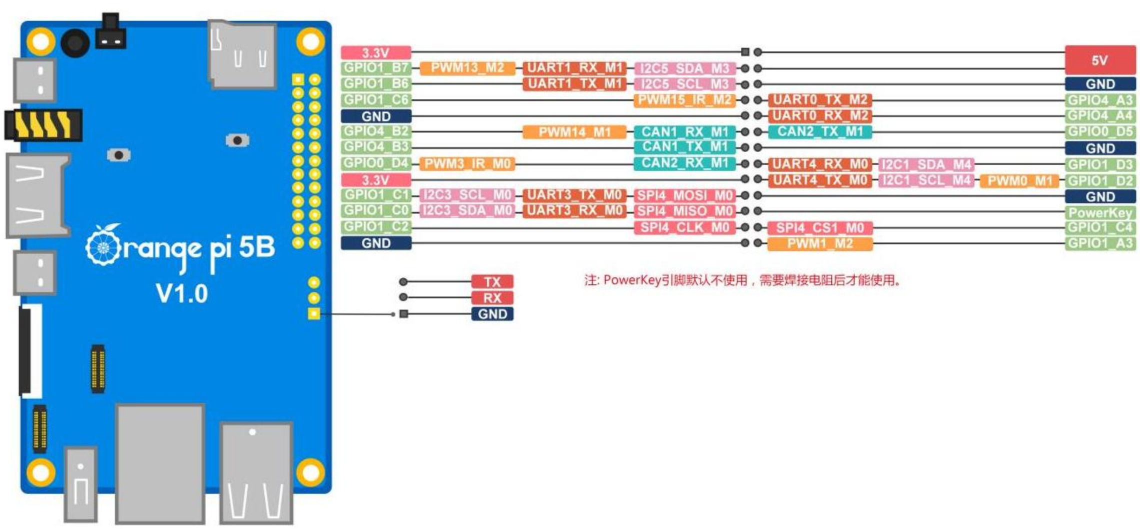
1.5. Interface details of Orange Pi 5B



Top View



Bottom View



The diameter of the four positioning holes is 3.0mm.

2. Introduction to the use of the development board

2. 1. Prepare the required accessories

1) TF card, a class 10 or above high-speed SanDisk card with a minimum capacity of 8GB (32GB or above is recommended)

2) TF card reader, used to burn the image into the TF card

3) Display with HDMI interface

4) HDMI to HDMI cable, used to connect the development board to an HDMI monitor or TV for display

Note, if you want to connect a 4K or 8K display, please make sure that the HDMI cable supports 4K or 8K video output.

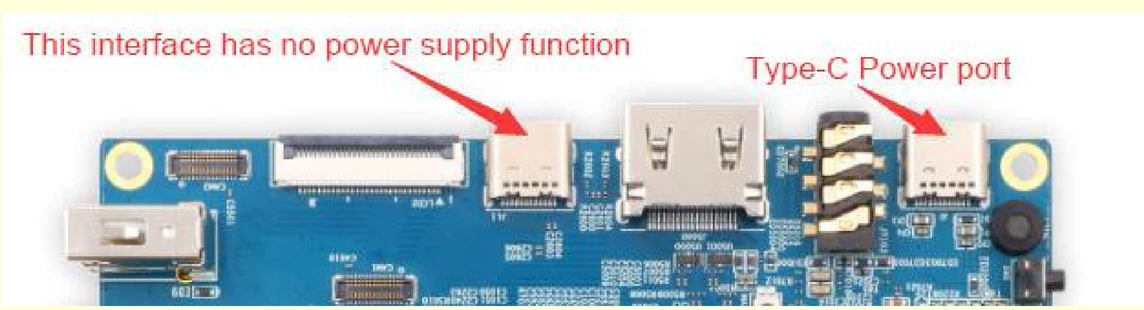
5) Type-C to HDMI cable, connect the development board to an HDMI monitor or TV for display through the Type-C interface

6) Type-C to USB adapter, used to connect USB storage devices or USB devices such as mouse and keyboard

7) 10.1-inch MIPI screen, used to display the system interface of the development board

8) Power adapter, Orange Pi 5B is recommended to use 5V/4A Type-C power supply for power supply

There are two Type-C ports that look the same on the development board. The one on the right is the power port, and the one in the middle has no power supply function. Please don't connect it wrong.



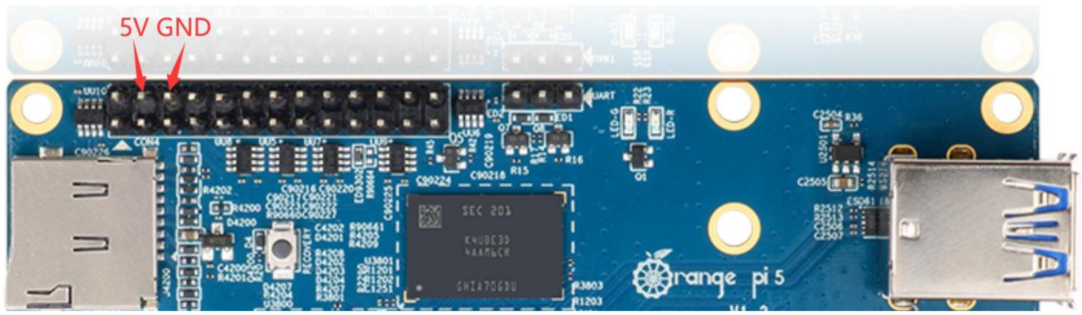
The Type-C power interface of the development board does not support the PD negotiation function, and only supports a fixed 5V voltage input.

9) The mouse and keyboard of the USB interface, as long as the mouse and keyboard of the standard USB interface are acceptable, the mouse and keyboard can be used to control the Orange Pi development board

10) USB camera

11) 5V cooling fan. As shown in the figure below, the 5V and GND pins on the 26pin interface of the development board can be connected to the cooling fan. The spacing between the 26pin headers is **2.54mm**. The power interface of the cooling fan can be purchased from Taobao according to this specification.

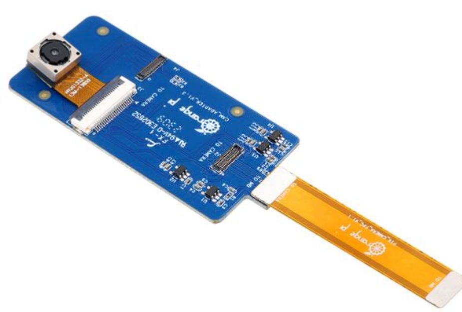
Note that the 5V pin on the 26pin pin header can be used directly after the development board is plugged into the power supply of the Type-C interface. No other settings are required. In addition, the output voltage of the 5V pin on the 26pin pin header cannot be adjusted and turned off by software. (no PWM function).



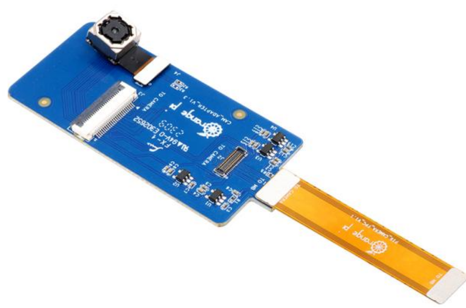
12) 100M or 1000M network cable, used to connect the development board to the Internet

13) Data cable of Type-C interface, used for burning image, using ADB and other functions

14) OV13850 camera with 13 million MIPI interface



15) OV13855 camera with 13 million MIPI interface



16) Matching shell (pictures and assembly methods to be added)

17) **3.3V** USB to TTL module and DuPont line, when using serial port debugging function, need USB to TTL module and DuPont line to connect the development board and computer

18) Personal computer with Ubuntu and Windows operating systems installed

1	Ubuntu22.04 PC	Optional, used to compile Linux source code
2	Windows PC	For burning Android and Linux images

2. 2. Download the image of the development board and related materials

1) The website for downloading the Chinese version is:

http://www.orangepi.cn/html/hardWare/computerAndMicrocontrollers/service-and-support/Orange-pi-5.html

2) The website for downloading the English version is:

http://www.orangepi.org/html/hardWare/computerAndMicrocontrollers/service-and-support/Orange-pi-5.html

3) The information mainly includes

a. **Android source code:** Save on Google Drive
b. **Linux source code:** saved on Github
c. **User Manual and Schematic:** Save on Google Drive
d. **Official tools:** It mainly includes the software that needs to be used in the process of using the development board
e. **Android image:** Save on Google Drive
f. **Ubuntu image:** Save on Google Drive
g. **Debian image:** Save on Google Drive

2. 3. How to burn Linux image to TF card

2. 3. 1. Method of burning Linux image to TF card based on Windows PC

Note that the Linux image mentioned here specifically refers to the image of Linux distributions such as Debian or Ubuntu downloaded from the Orange Pi data download page.

2. 3. 1. 1. How to use balenaEtcher to burn Linux image

1) First prepare a TF card with a capacity of 16GB or more. The transmission speed of the TF card must be **class 10** or above. It is recommended to use a TF card of SanDisk and other brands

2) Then use the card reader to insert the TF card into the computer

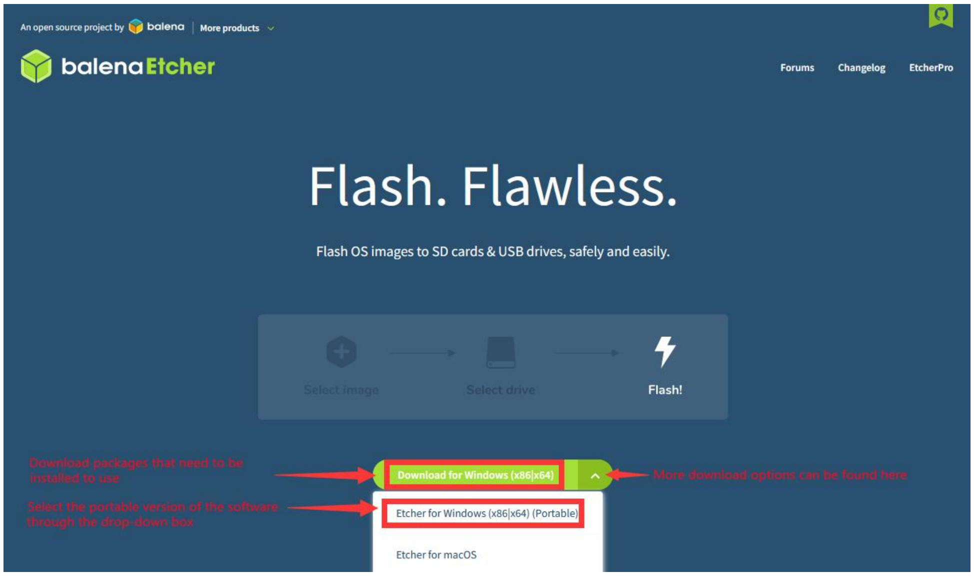
3) Download the Linux operating system image file compression package that you want to burn from **the Orange Pi data download page**, and then use the decompression software to decompress it. Among the decompressed files, the file ending with "**.img**" is the image file of the operating system. The size is generally more than 2GB

4) Then download the burning software of Linux image——**balenaEtcher**, the download address is

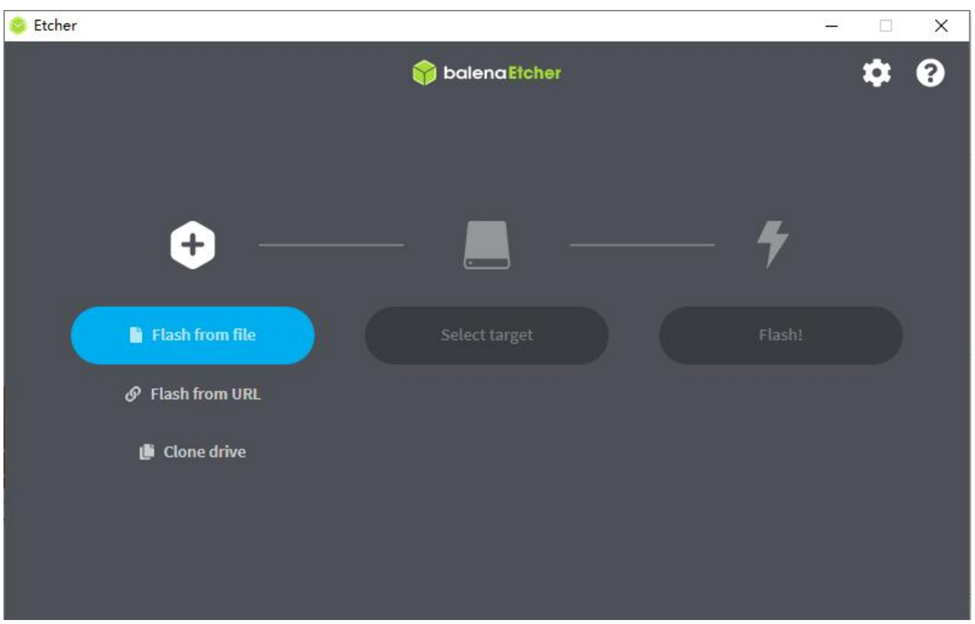
```
https://www.balena.io/etcher/
```

5) After entering the balenaEtcher download page, click the green download button to

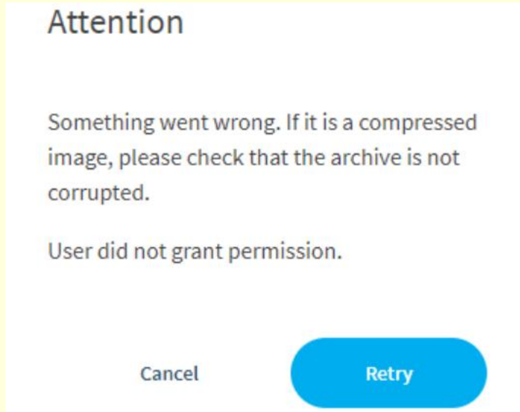
download the installation package of balenaEtcher. You can also select the Portable version of the balenaEtcher software through the drop-down box. The Portable version does not need to be installed, and it can be used by double-clicking to open it



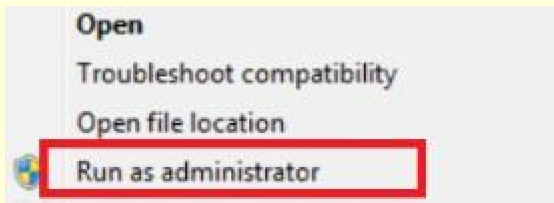
6) If the downloaded version of balenaEtcher needs to be installed, please install it before using it. If you downloaded the Portable version of balenaEtcher, just double-click to open it. The opened balenaEtcher interface is shown in the figure below



When opening balenaEtcher, if the following error is prompted:



Please select balenaEtcher, right-click, and select Run as administrator.

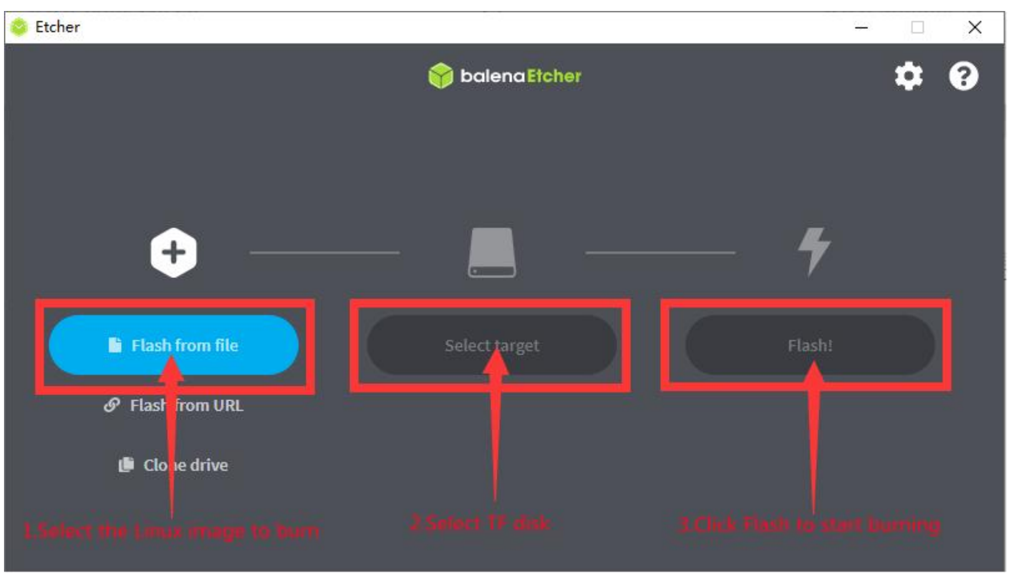


7) The specific steps to use balenaEtcher to burn the Linux image are as follows

a. First select the path of the Linux image file to be burned

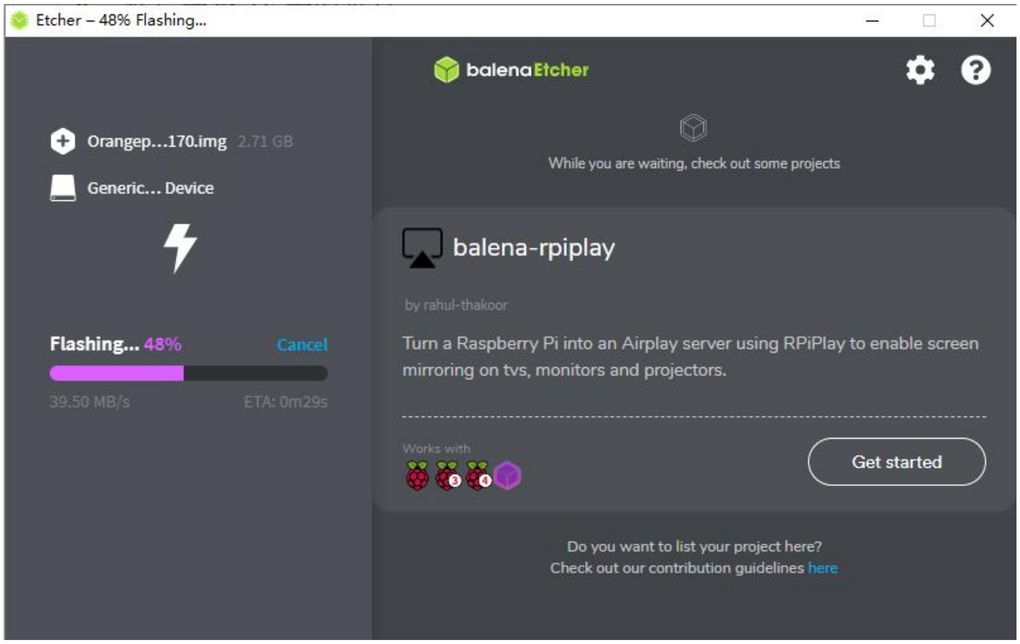
b. Then select the drive letter of the TF card

c. Finally, click Flash to start burning the Linux image to the TF card

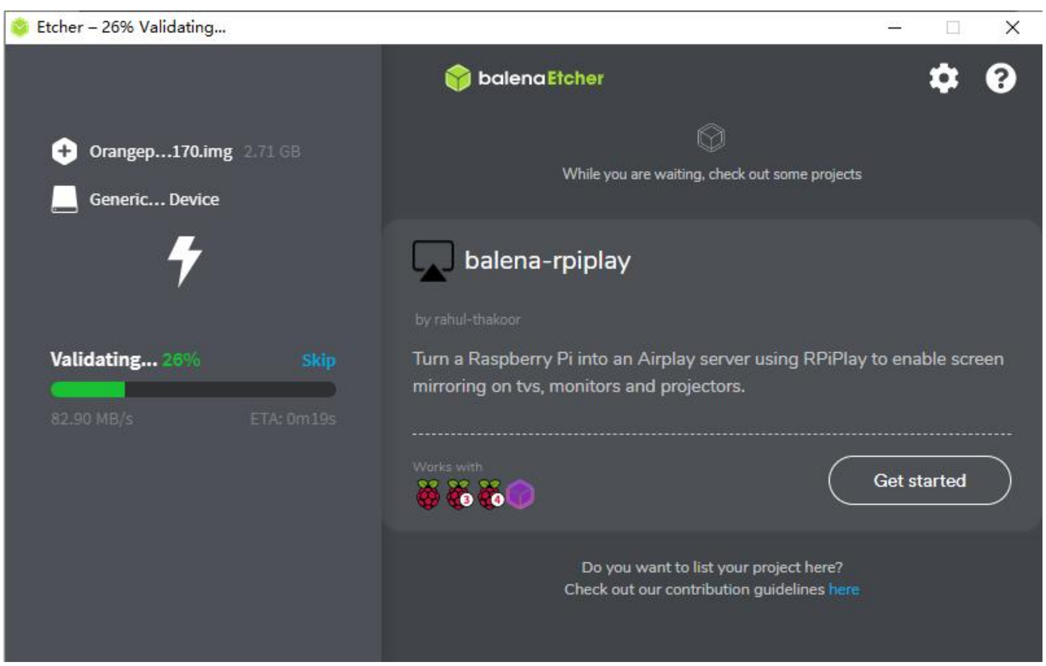


8) The interface displayed in the process of burning the Linux image by balenaEtcher is shown in the figure below, and the progress bar displays purple, indicating that the Linux

image is being burned into the TF card

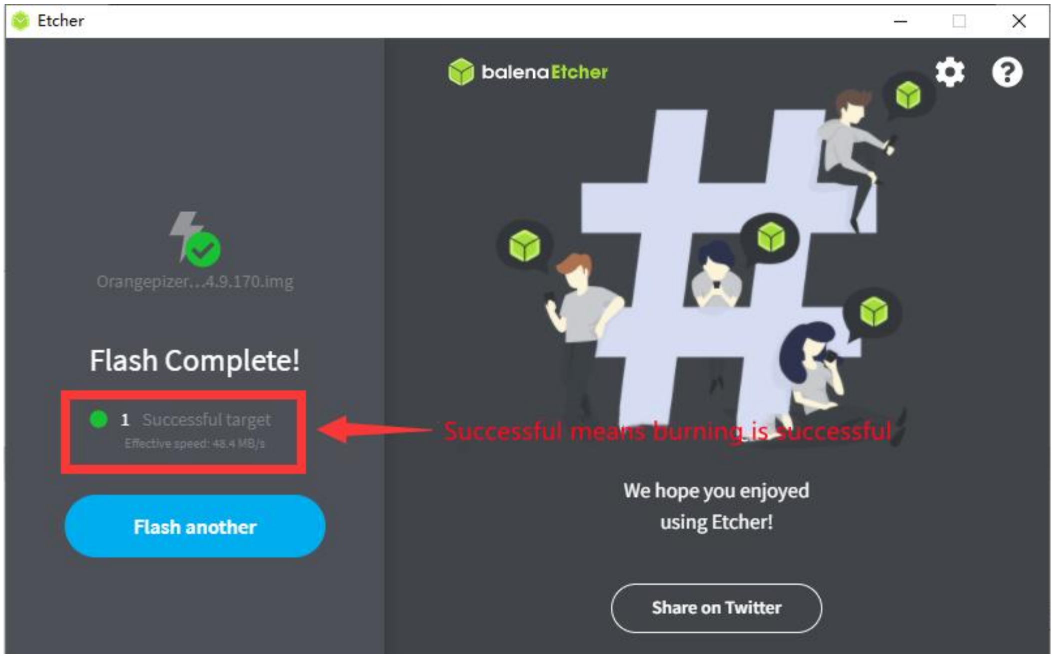


9) After burning the Linux image, balenaEtcher will also verify the image burned into the TF card by default to ensure that there is no problem in the burning process. As shown in the figure below, a green progress bar indicates that the image has been burnt, and balenaEtcher is verifying the burnt image



10) After successful burning, the display interface of balenaEtcher is shown in the figure

below. If a green indicator icon is displayed, it means that the image burning is successful. At this time, you can exit balenaEtcher, and then pull out the TF card and insert it into the TF card slot of the development board for use. up

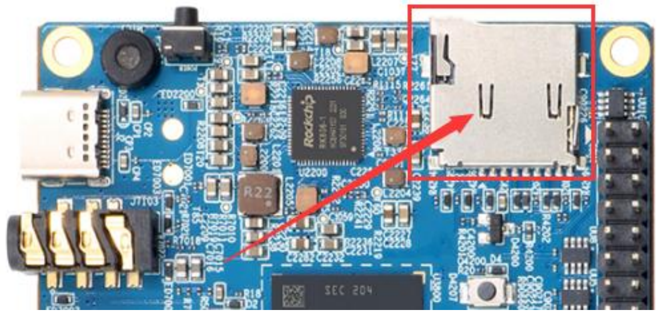


2. 3. 1. 2. How to use RKDevTool to burn Linux image to TF card

1) First, you need to prepare a data cable with a good quality Type-C interface

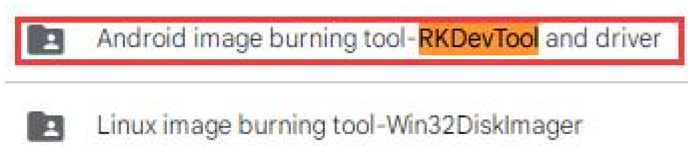
2) You also need to prepare a 16GB or larger capacity TF card. The transmission speed of the TF card must be class 10 or above. It is recommended to use a TF card of SanDisk and other brands

3) Then insert the TF card into the card slot of the development board

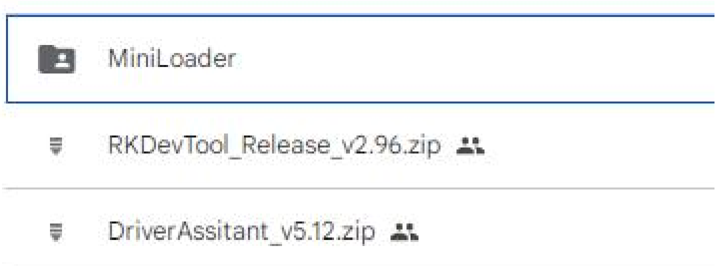


4) Then download Rockchip **DriverAssitant_v5.12.zip** and **MiniLoader** and the burning tool **RKDevTool_Release_v2.96.zip** from **the Orange Pi data download page**, please make sure that the version of the downloaded **RKDevTool** tool is **v2.96**

a. On the data download page of Orange Pi, first select **the official tool**, and then enter the following folder



b. Then download all the files below

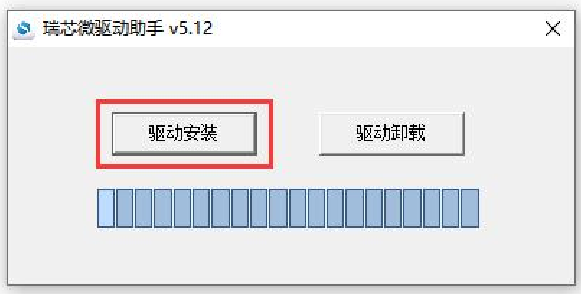


5) Then download the Linux operating system image file compression package that you want to burn from **the Orange Pi data download page**, and then use the decompression software to decompress it. Among the decompressed files, the file ending with "**.img**" is the image file of the operating system , the size is generally more than 2GB

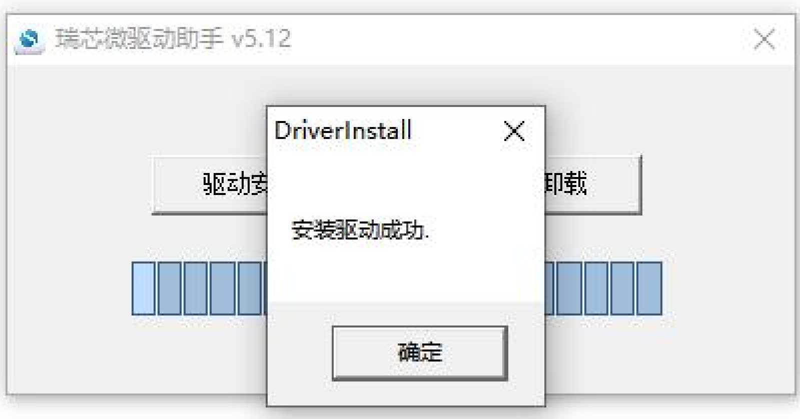
6) Then use the decompression software to decompress **DriverAssitant_v5.12.zip**, and then find the **DriverInstall.exe** executable file in the decompressed folder and open it

7) After opening **DriverInstall.exe**, the steps to install the Rockchip driver are as follows

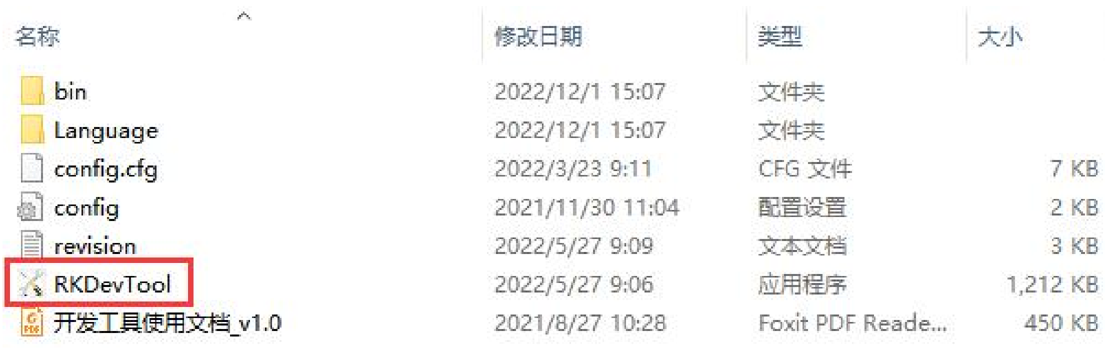
a. Click the "**Driver Installation**" button



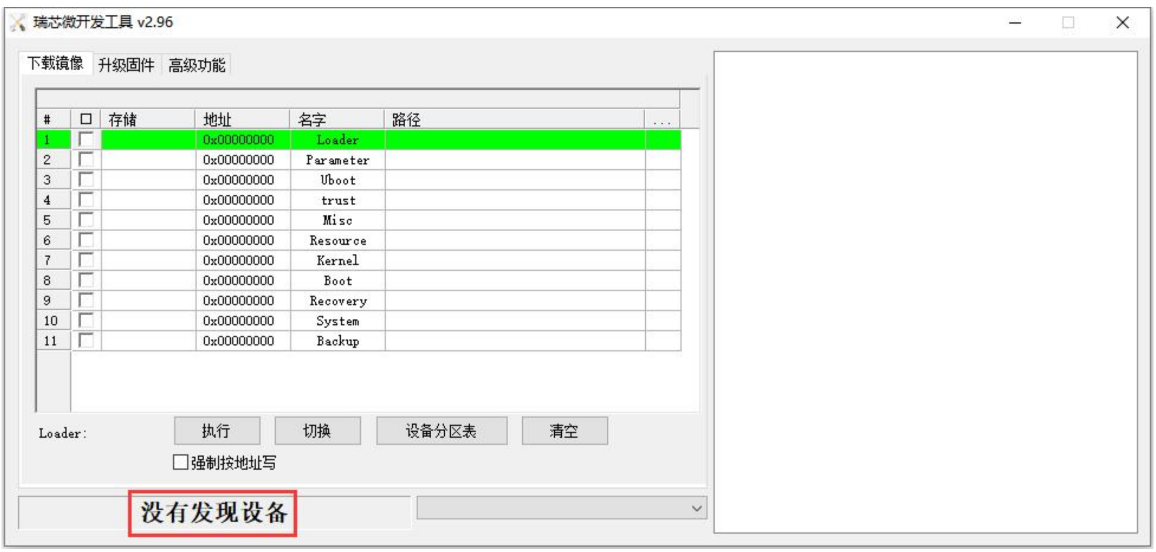
b. After waiting for a period of time, a pop-up window will prompt "**The driver is installed successfully**", and then click the "**OK**" button.



8) Then decompress **RKDevTool_Release_v2.96.zip**, this software does not need to be installed, just find **RKDevTool** in the decompressed folder and open it

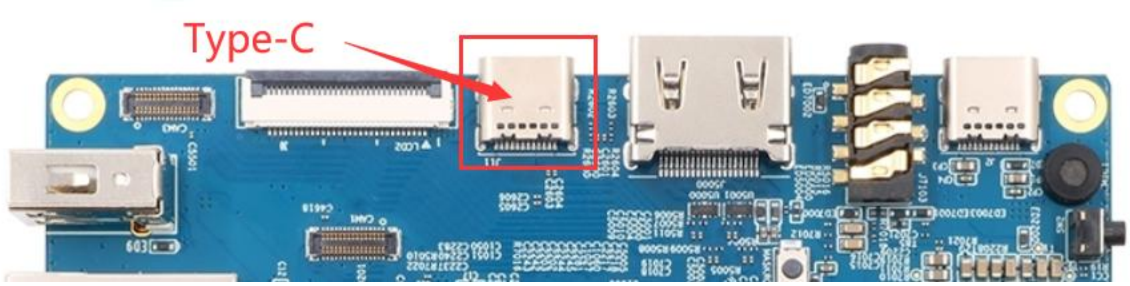


9) After opening the **RKDevTool** burning tool, because the computer is not connected to the development board through the Type-C cable at this time, the lower left corner will prompt "**No device found**"



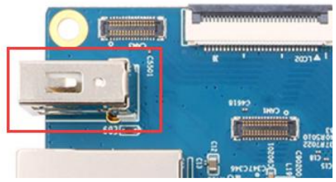
10) Then start burning the Linux image into eMMC

a. First, connect the development board to the Windows computer through the Type-C data cable. The position of the Type-C interface on the development board is shown in the figure below



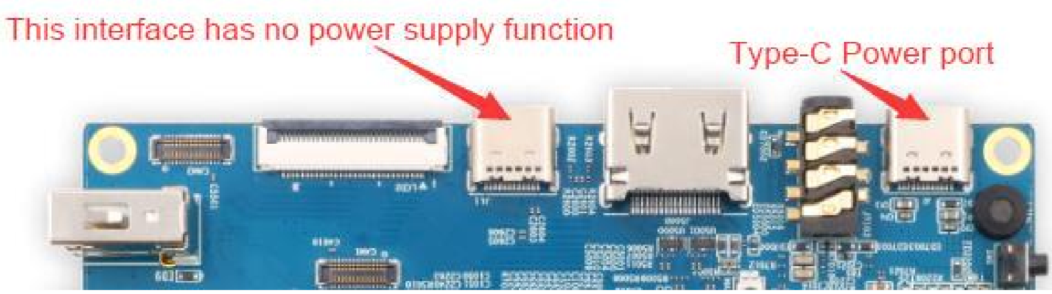
b. Make sure the development board is not connected to the power supply

c. Also need to ensure that the white USB2.0 interface in the position shown below is not plugged into a USB device

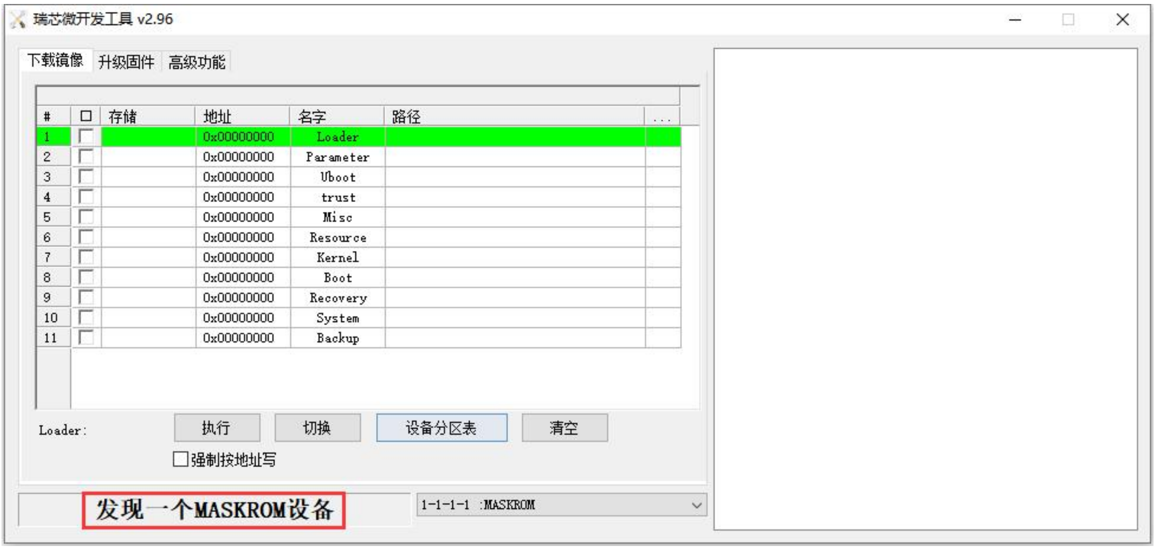


d. Then press and hold the MaskROM button on the development board. The position of the MaskROM button on the development board is shown in the figure below:

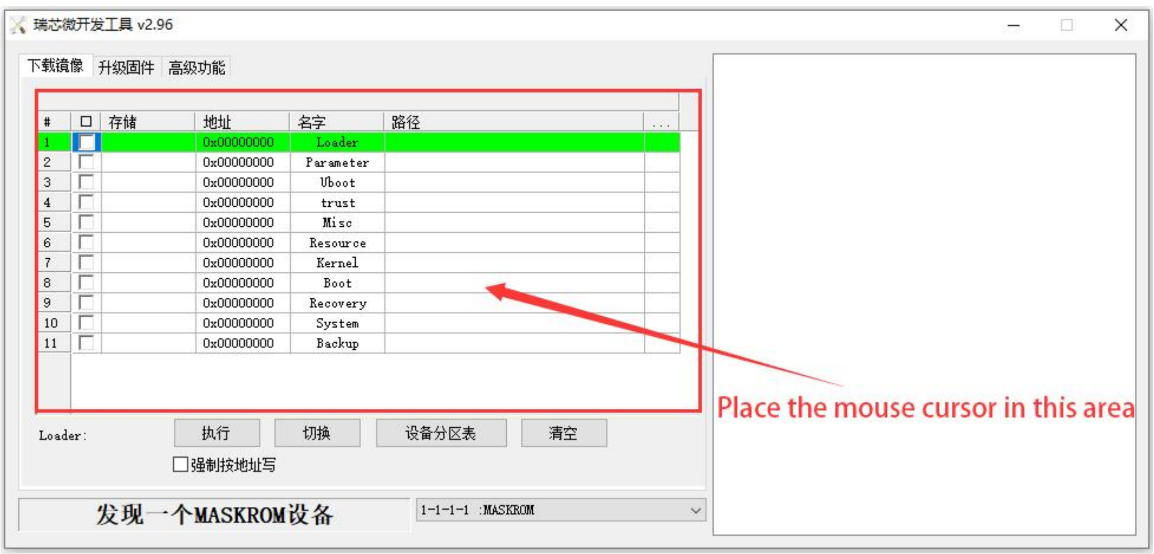
e. Then connect the power supply of the Type-C interface to the development board and power on



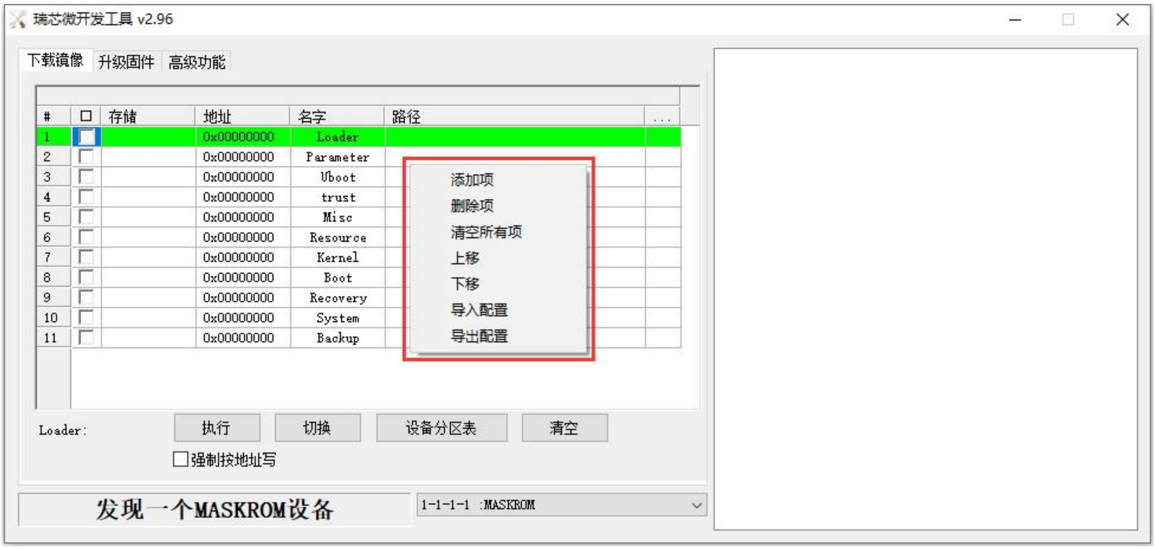
f. If the previous steps are successful, the development board will enter the MASKROM mode at this time, and the interface of the burning tool will prompt "**found a MASKROM device**"



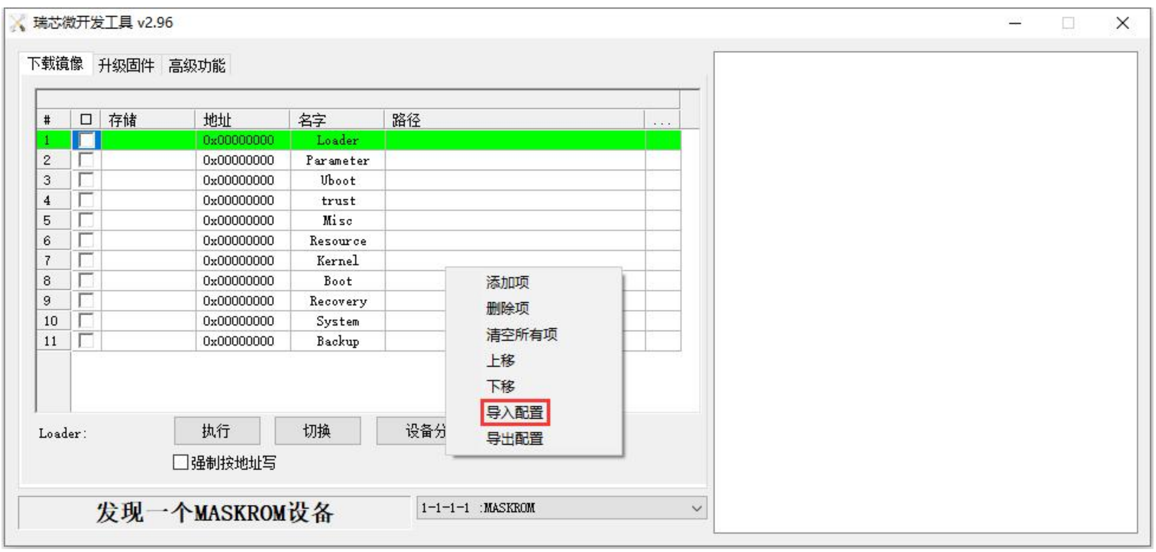
g. Then place the mouse cursor in the area below



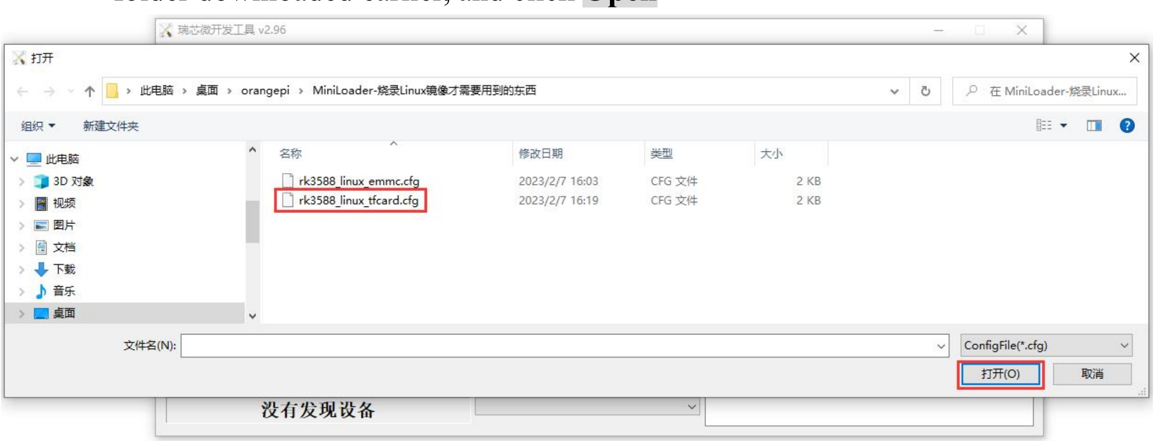
h. Then click the right mouse button and the selection interface shown in the figure below will pop up



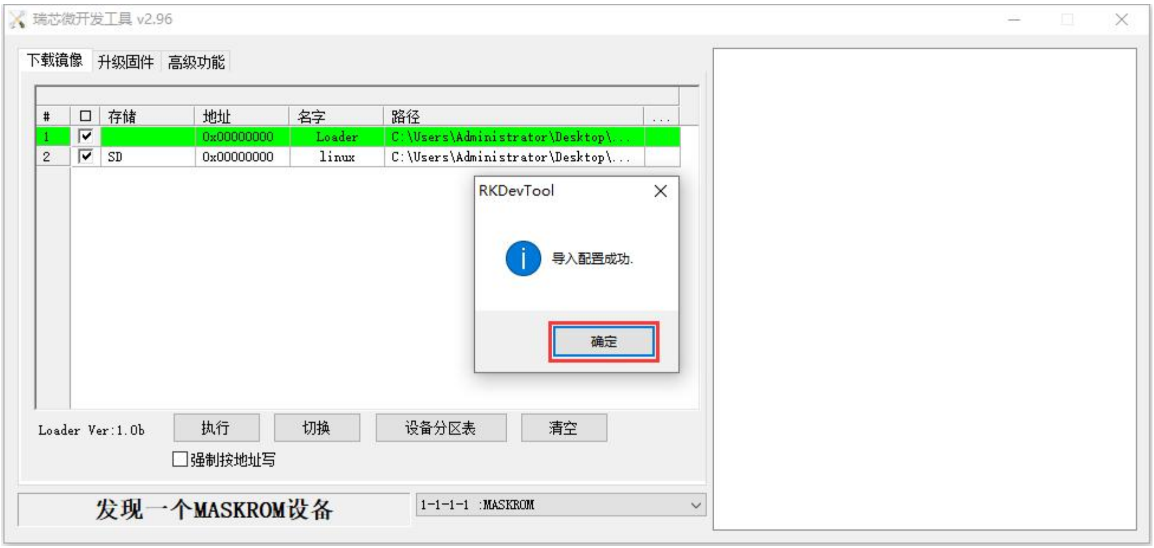
i. Then select **the import configuration** option



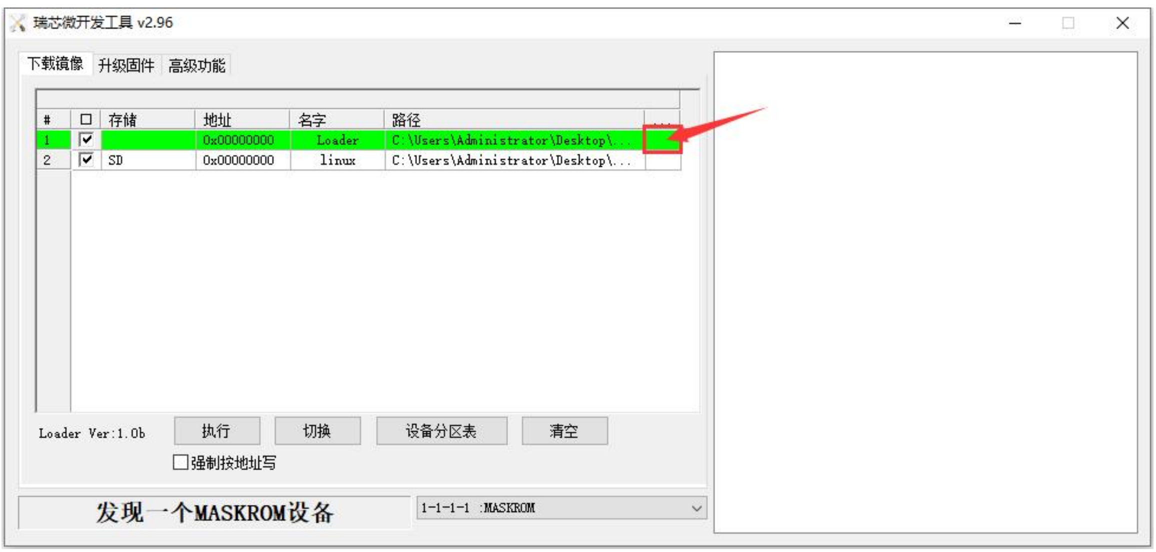
j. Then select the **rk3588_linux_tfcard.cfg** configuration file in the **MiniLoader** folder downloaded earlier, and click **Open**



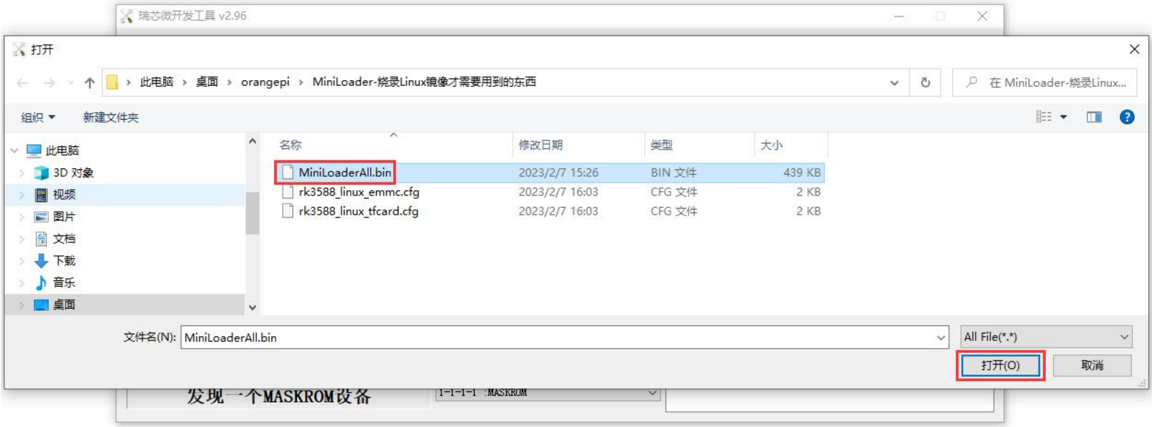
k. Then click **OK**



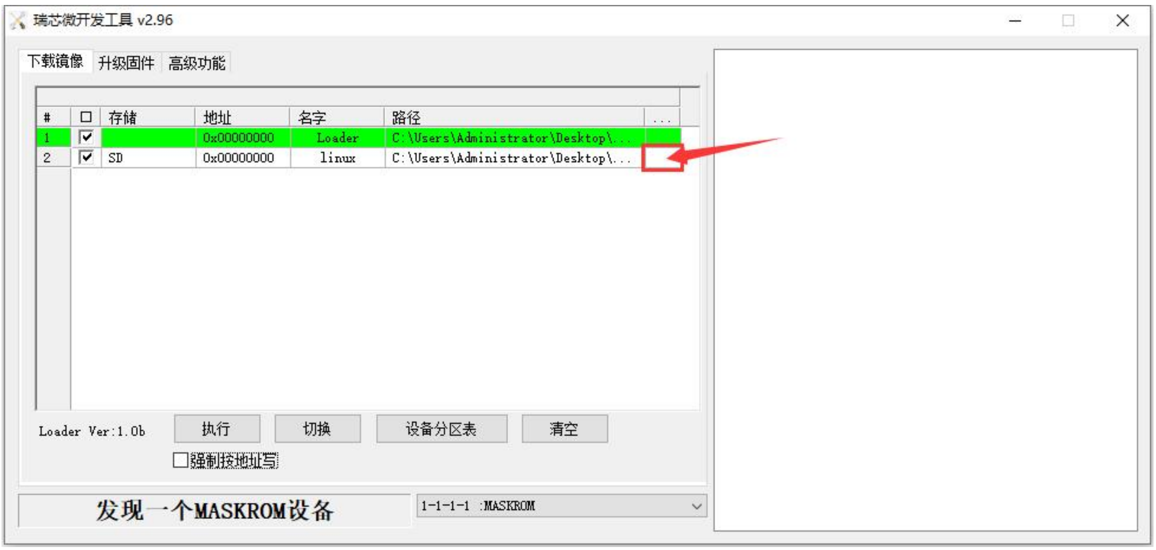
l. Then click the position shown in the figure below



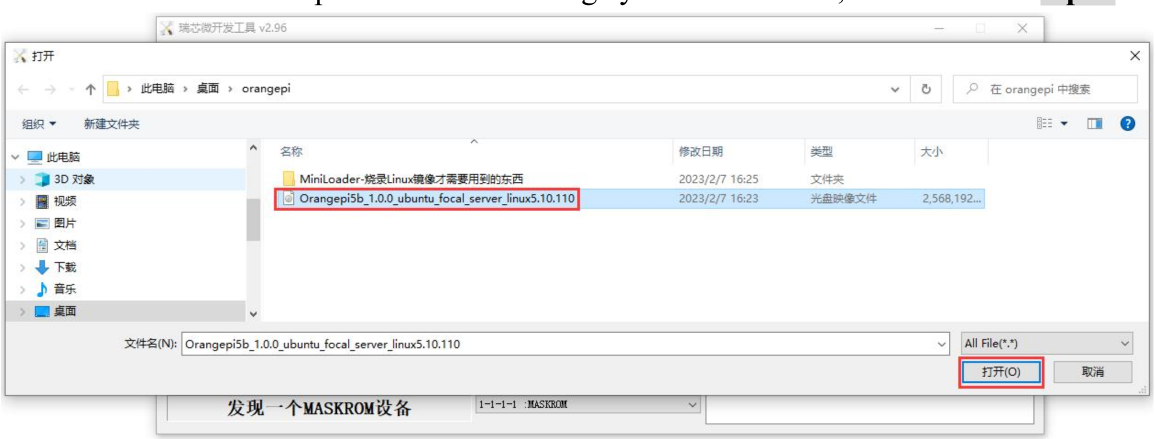
m. Then select **MiniLoaderAll.bin** in the **MiniLoader** folder downloaded earlier, and then click **Open**



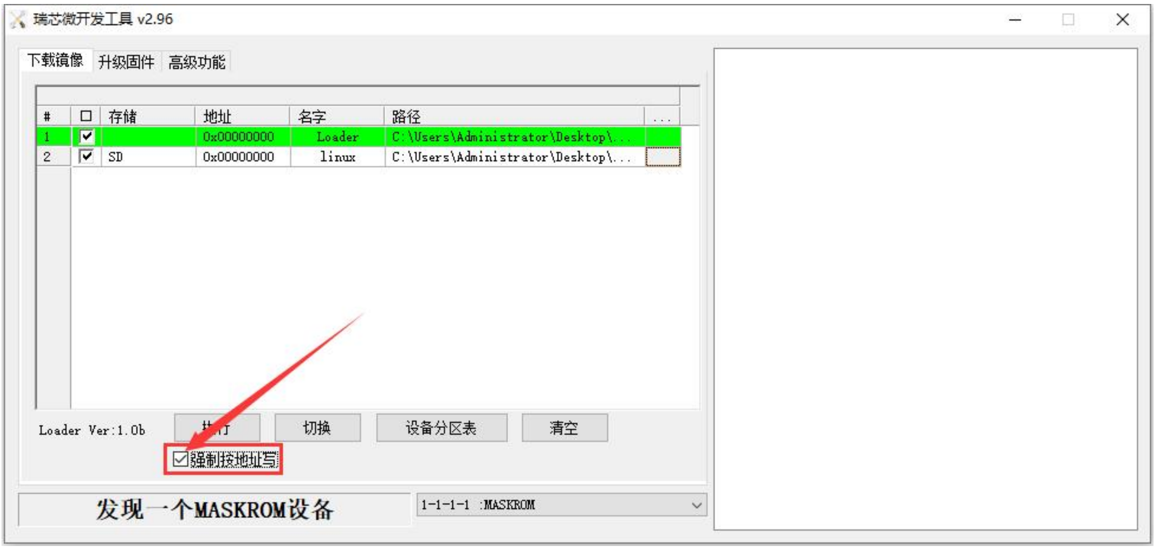
n. Then click the position shown in the figure below



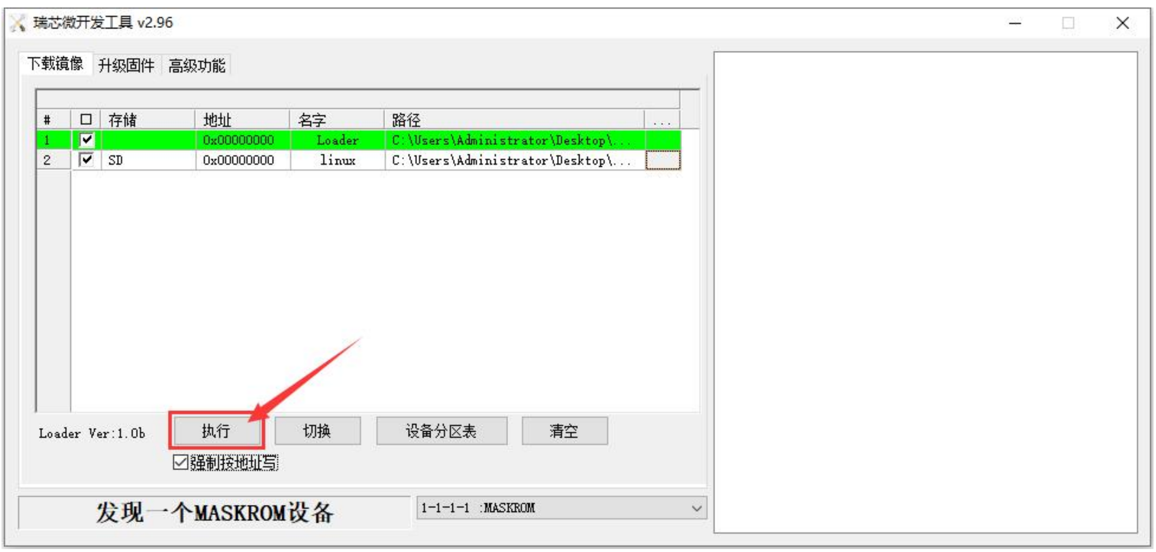
o. Then select the path of the linux image you want to burn, and then click **Open**



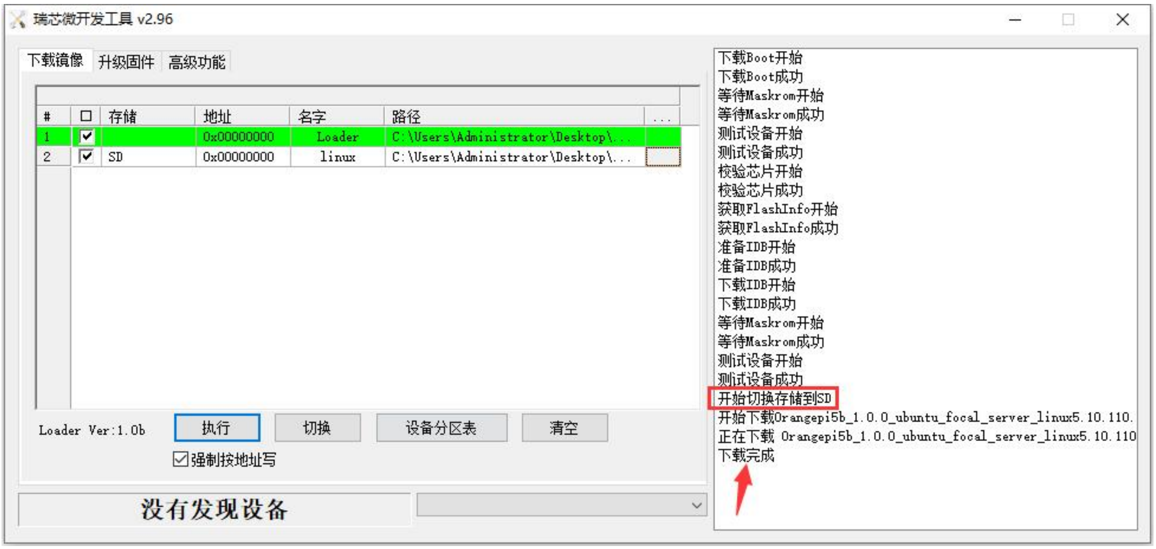
p. Then please check the option to **force writing by address**



q. Click the execute button again to start burning the linux image to the tf card of the development board



r. The display log after burning the linux image is shown in the figure below



s. After burning the linux image to the TF card, the linux system will start automatically.

2. 3. 1. 3. How to use Win32Diskimager to burn Linux image

1) First prepare a TF card with a capacity of 16GB or more. The transmission speed of the TF card must be **class 10** or above. It is recommended to use a TF card of SanDisk and other brands

2) Then use the card reader to insert the TF card into the computer

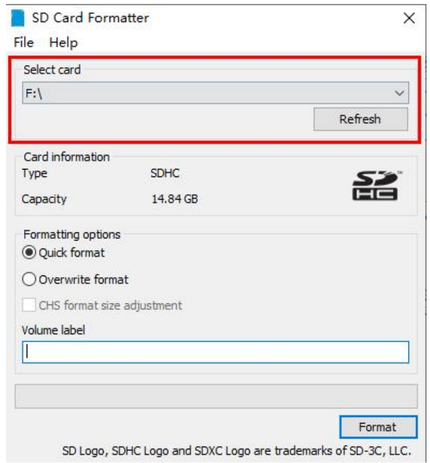
3) Then format the TF card

a. **SD Card Formatter** can be used to format the TF card. The download address is:

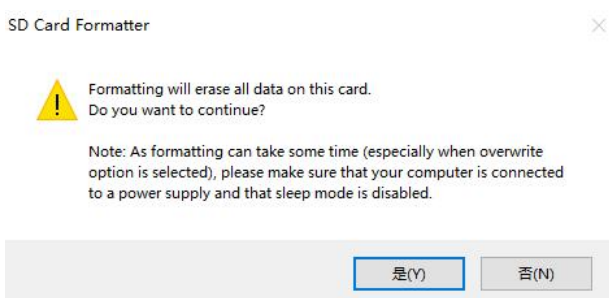
https://www.sdcard.org/downloads/formatter/eula_windows/SDCardFormatterv5_WinEN.zip

b. After downloading, unzip and install directly, and then open the software

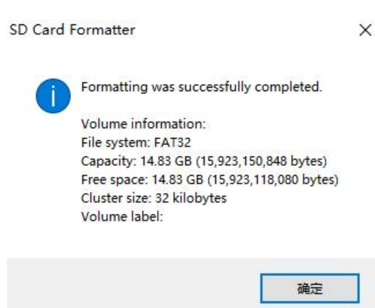
c. If only a TF card is inserted into the computer, the drive letter of the TF card will be displayed in the "**Select card**" column. If multiple USB storage devices are inserted into the computer, you can select the corresponding drive letter of the TF card through the drop-down box



d. Then click "**Format**", a warning box will pop up before formatting, and formatting will start after selecting "Yes (Y)"



e. After formatting the TF card, the information shown in the figure below will pop up, click OK



4) Download the Linux operating system image file compression package that you want to burn from **the Orange Pi data download page**, and then use the decompression software to decompress it. Among the decompressed files, the file ending with "**.img**" is the image file of the operating system. The size is generally more than 2GB

5) Use **Win32Diskimager** to burn the Linux image to the TF card

a. The download page of Win32Diskimager is

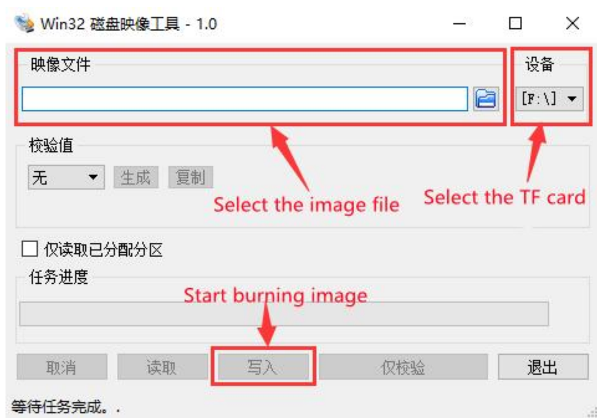
http://sourceforge.net/projects/win32diskimager/files/Archive/

b. After downloading, install it directly. The interface of Win32Diskimager is as follows

a) First select the path of the image file

b) Then confirm that the drive letter of the TF card is consistent with that displayed in the "**Device**" column

c) Finally click "**Write**" to start burning



c. After the image writing is completed, click the "**Exit**" button to exit, and then you can pull out the TF card and insert it into the development board to start

2. 3. 2. Method of burning Linux image to TF card based on Ubuntu PC

Note that the Linux image mentioned here specifically refers to the image of Linux distributions such as Debian or Ubuntu downloaded from the Orange Pi data download page, and the Ubuntu PC refers to the personal computer with the Ubuntu system installed.

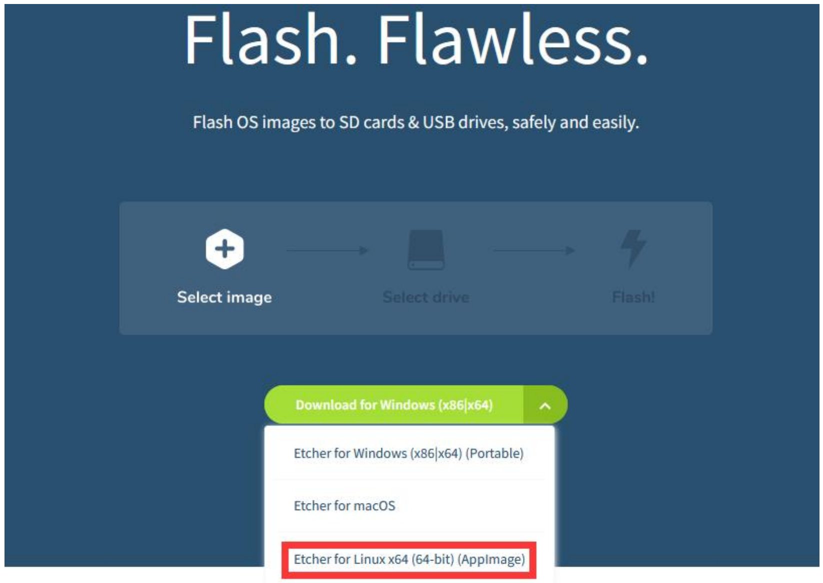
1) First prepare a TF card with a capacity of 16GB or more. The transmission speed of the TF card must be **class 10** or above. It is recommended to use a TF card of SanDisk and other brands

2) Then use the card reader to insert the TF card into the computer

3) Download the balenaEtcher software, the download address is

```
https://www.balena.io/etcher/
```

4) After entering the balenaEtcher download page, please select the Linux version of the software from the drop-down box to download



5) Download the Linux operating system image file compression package that you want to burn from **the Orange Pi data download page**, and then use the decompression software to decompress it. Among the decompressed files, the file ending with "**.img**" is the image file of the operating system. The size is generally more than 2GB

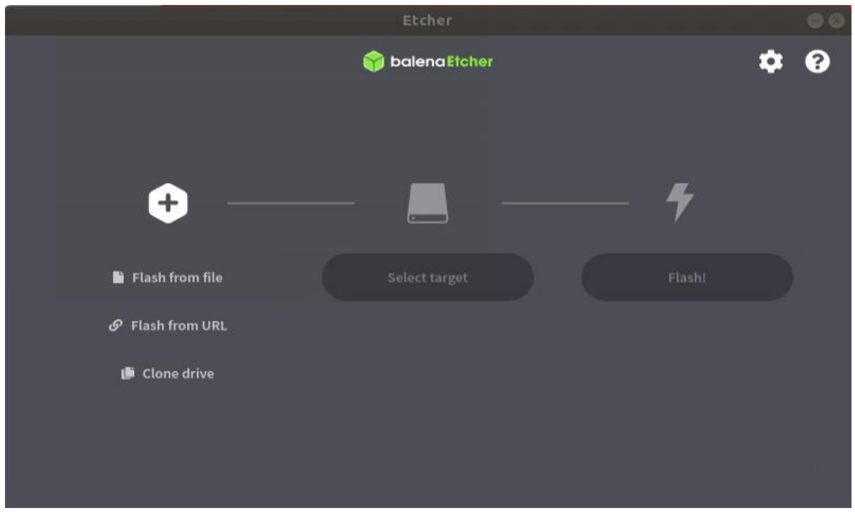
The decompression command for the compressed package ending in 7z is as follows

```
test@test:~$ 7z x orangepi5b_1.0.0_debian_bullseye_desktop_xfce_linux5.10.110.7z
test@test:~$ ls orangepi5b_1.0.0_debian_bullseye_desktop_xfce_linux5.10.110.*
orangepi5b_1.0.0_debian_bullseye_desktop_xfce_linux5.10.110.7z
orangepi5b_1.0.0_debian_bullseye_desktop_xfce_linux5.10.110.sha     #checksum and file
orangepi5b_1.0.0_debian_bullseye_desktop_xfce_linux5.10.110.img    #image file
```

6) After decompressing the image, you can first use the **sha256sum -c *.sha** command to calculate whether the checksum is correct. If the prompt is **successful**, it means that the downloaded image is correct, and you can safely burn it to the TF card. If it prompts that **the checksum does not match**, it means There is a problem with the downloaded image, please try to download again

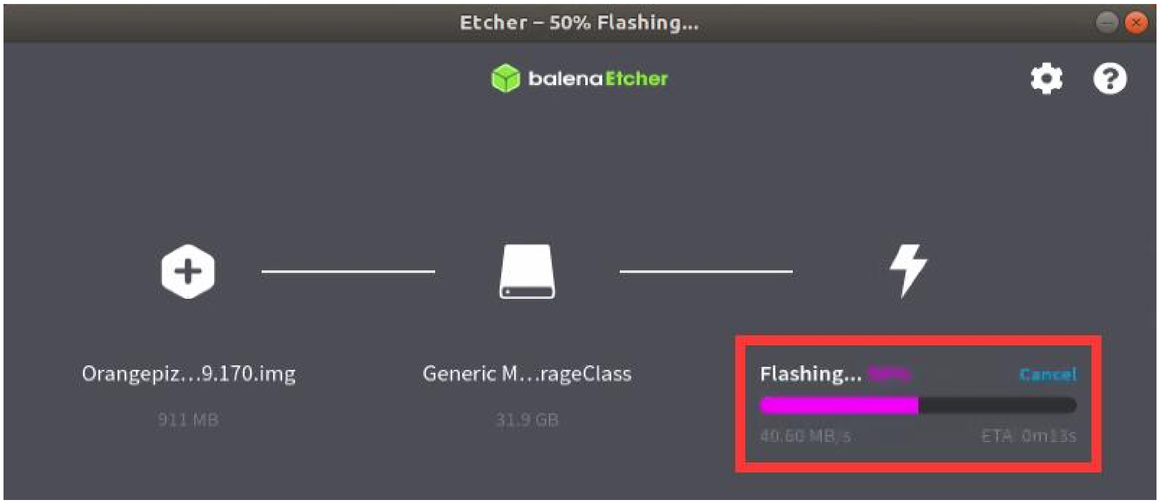
```
test@test:~$ sha256sum -c *.sha
orangepi5b_1.0.0_debian_bullseye_desktop_xfce_linux5.10.110.img: OK
```

7) Then double-click **balenaEtcher-1.5.109-x64.AppImage** on the graphical interface of Ubuntu PC to open balenaEtcher (**no installation required**), and the interface after balenaEtcher is opened is shown in the figure below

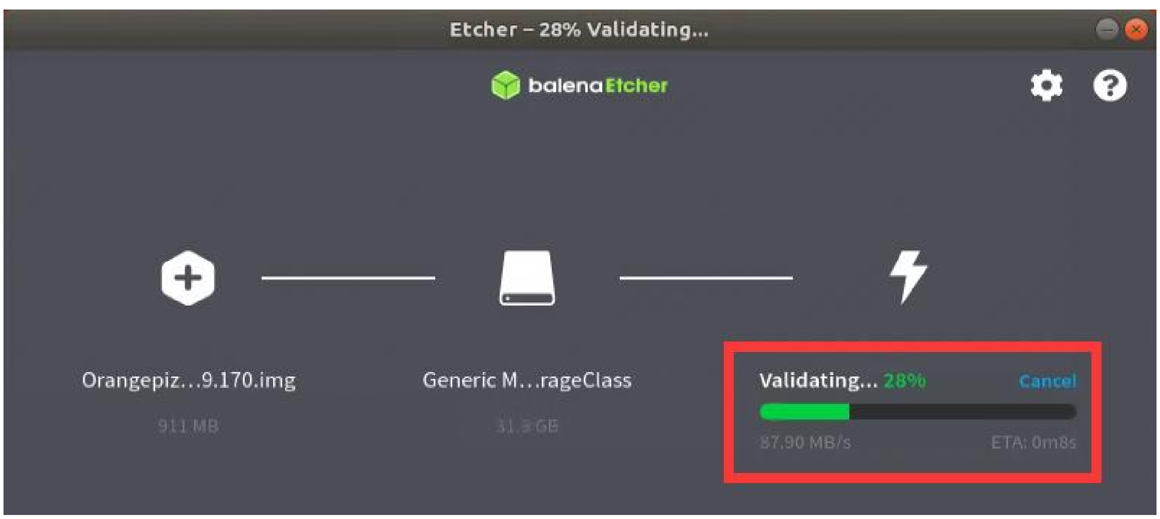


8) The specific steps to use balenaEtcher to burn the Linux image are as follows
   a. First select the path of the Linux image file to be burned
   b. Then select the drive letter of the TF card
   c. Finally, click Flash to start burning the Linux image to the TF card

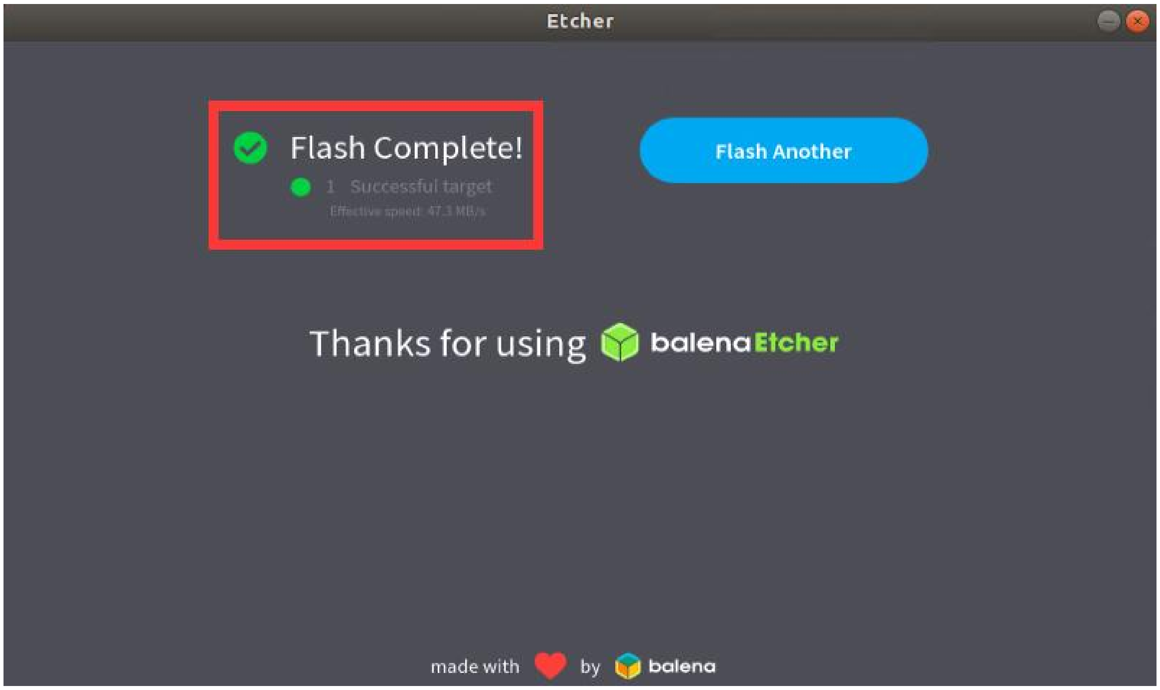
9) The interface displayed in the process of burning the Linux image by balenaEtcher is shown in the figure below, and the progress bar displays purple, indicating that the Linux image is being burned into the TF card



11) After burning the Linux image, balenaEtcher will also verify the image burned into the TF card by default to ensure that there is no problem during the burning process. As shown in the figure below, a green progress bar indicates that the image has been burnt, and balenaEtcher is verifying the burnt image



12) After successful burning, the display interface of balenaEtcher is shown in the figure below. If a green indicator icon is displayed, it means that the image burning is successful. At this time, you can exit balenaEtcher, and then pull out the TF card and insert it into the TF card slot of the development board for use. up



2. 4. How to burn Android image to TF card

Note that all the following operations are performed on a Windows computer.

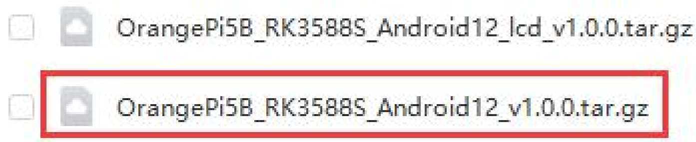
1) First prepare a TF card with 8GB or larger capacity. The transmission speed of the TF card must be class10 or above. It is recommended to use a TF card of SanDisk and other brands

2) Then use the card reader to insert the TF card into the computer

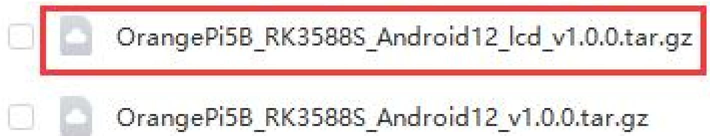
3) Then download the SDDiskTool programming tool from **the Orange Pi data download page**, **please ensure that the version of the SDDiskTool tool is the latest v1.72**

4) Then download the Android image from **Orange Pi's download page**. After opening the download link of the Android image, you can see the following two types of Android images. The difference between them is:

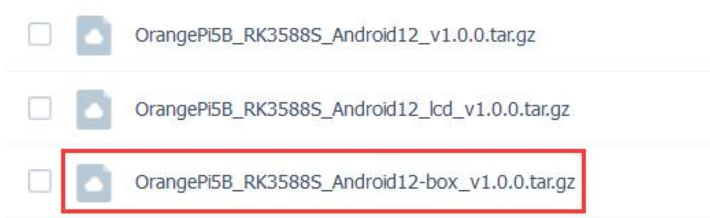
a. The image without lcd is specially used for HDMI display, if you don't use LCD screen, please download the image without lcd



b. If you want to use LCD screen, please choose image with lcd

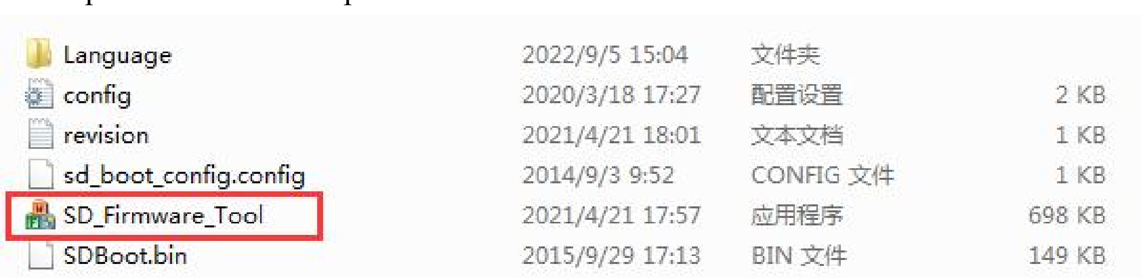


c. The image with box is the image of TV box type



5) Then use the decompression software to decompress the compressed package of the downloaded Android image. Among the decompressed files, the file ending with ".img" is the Android image file, and the size is more than 1GB

6) Then use decompression software to decompress **SDDiskTool_v1.72.zip**, this software does not need to be installed, just find **SD_Firmware_Tool.exe** in the decompressed folder and open it



7) After opening **SDDiskTool**, if the TF card is recognized normally, the inserted disk device will be displayed in the "**Select Removable Disk Device**" column. **Please be sure to confirm that the displayed disk device is consistent with the drive letter of the TF card you want to burn**, if there is no display, you can try to unplug the TF card

8) After confirming the drive letter, you can format the TF card first, click **the restore disk** button in **SDDiskTool**, or use the **SD Card Formatter** mentioned above to format the TF card

9) Then start writing the Android image to the TF card

a. First check "**SD Boot**" in "**Select Function Mode**"

b. Then select the path of the Android image in the "**Select to upgrade firmware**" column

c. Finally click the "**Start Create**" button to start burning the Android image to the TF card

10) After burning, you can exit the SDDiskTool software, and then you can pull out the TF card from the computer and insert it into the development board to start

2. 5. How to burn Orange Pi OS (Droid) image to TF card

Note that all the following operations are performed on a Windows computer.

1) First prepare a TF card with 8GB or larger capacity. The transmission speed of the TF card must be class10 or above. It is recommended to use a TF card of SanDisk and other brands

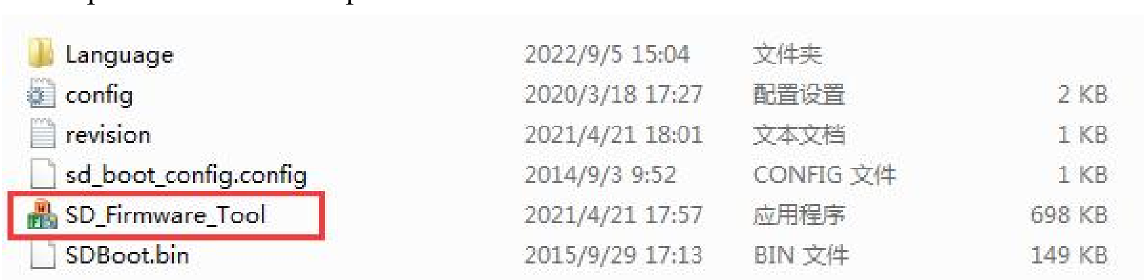
2) Then use the card reader to insert the TF card into the computer

3) Then download the SDDiskTool programming tool from **the Orange Pi data download page**, **please ensure that the version of the SDDiskTool tool is the latest v1.72**

4) Then download the Orange Pi OS (Droid) image from **the Orange Pi download page**

5) Then use the decompression software to decompress the compressed package of the downloaded Orange Pi OS (Droid) image. Among the decompressed files, the file ending with ".img" is the Orange Pi OS (Droid) image file, and the size is more than 1GB

6) Then use decompression software to decompress **SDDiskTool_v1.72.zip**, this software does not need to be installed, just find **SD_Firmware_Tool.exe** in the decompressed folder and open it



7) After opening **SDDiskTool**, if the TF card is recognized normally, the inserted disk device will be displayed in the "**Select Removable Disk Device**" column. **Please be sure to confirm that the displayed disk device is consistent with the drive letter of the TF card you want to burn**, if there is no display, you can try to unplug the TF card

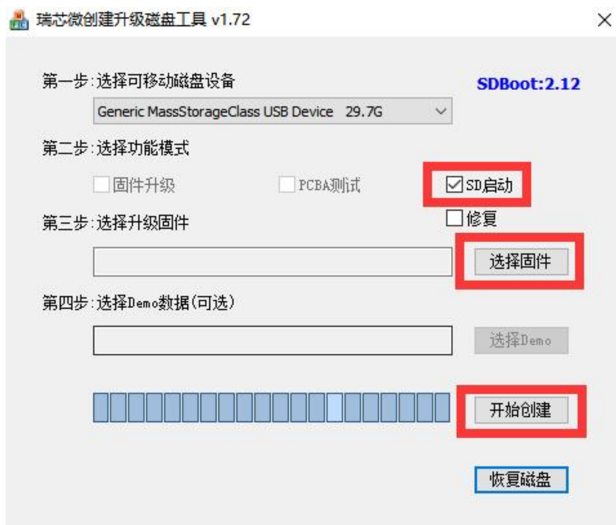
8) After confirming the drive letter, you can format the TF card first, click **the restore disk** button in SDDiskTool, or use the **SD Card Formatter** mentioned above to format the TF card

9) Then start to write the Orange Pi OS (Droid) image to the TF card

a. First check "**SD Boot**" in "**Select Function Mode**"

b. Then select the path of the Orange Pi OS (Droid) image in the "**Select to upgrade firmware**" column

c. Finally, click the "**Start Create**" button to start burning the Orange Pi OS (Droid) image to the TF card



10) After burning, you can exit the SDDiskTool software, and then you can pull out the TF card from the computer and insert it into the development board to start

2.6. How to burn Linux image into eMMC

2.6.1. How to use RKDevTool to burn Linux image to eMMC

Note that all the following operations are performed on a Windows computer.

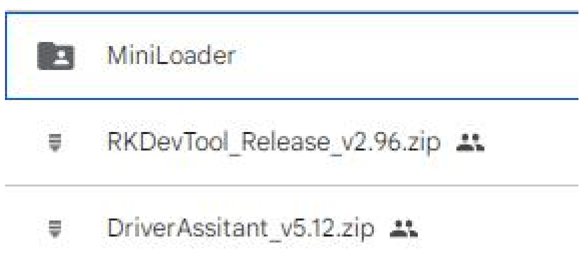
Note that the Linux image mentioned here specifically refers to the image of Linux distributions such as Debian or Ubuntu downloaded from the Orange Pi data download page.

1) First, you need to prepare a data cable with a good quality Type-C interface

2) Then download Rockchip **DriverAssitant_v5.12.zip** and **MiniLoader** and the burning tool **RKDevTool_Release_v2.96.zip** from **the Orange Pi data download page**, please make sure that the version of the downloaded **RKDevTool** tool is v2.96

a. On the data download page of Orange Pi, first select the official tool, and then enter the following folder

b. Then download all the files below

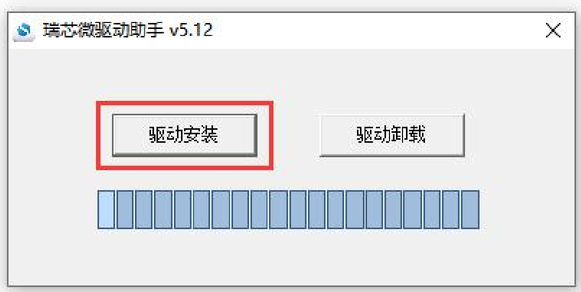


3) Then download the Linux operating system image file compression package that you want to burn from **the Orange Pi data download page**, and then use the decompression software to decompress it. Among the decompressed files, the file ending with "**.img**" is the image file of the operating system , the size is generally more than 2GB

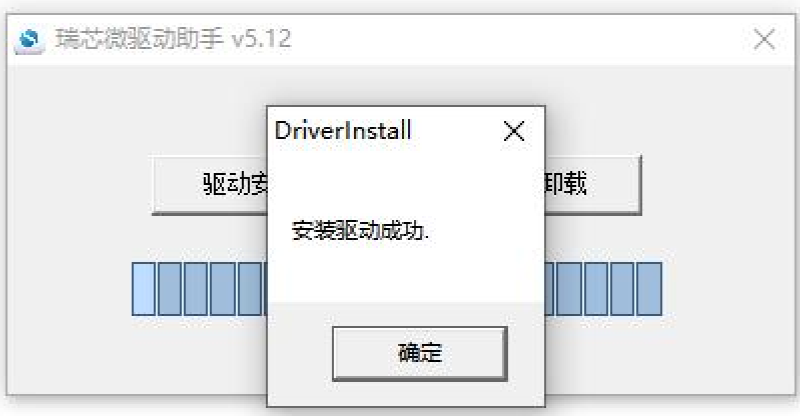
4) Then use the decompression software to decompress **DriverAssitant_v5.12.zip**, and then find the **DriverInstall.exe** executable file in the decompressed folder and open it

5) After opening **DriverInstall.exe**, the steps to install the Rockchip driver are as follows

a. Click the "**Driver Installation**" button

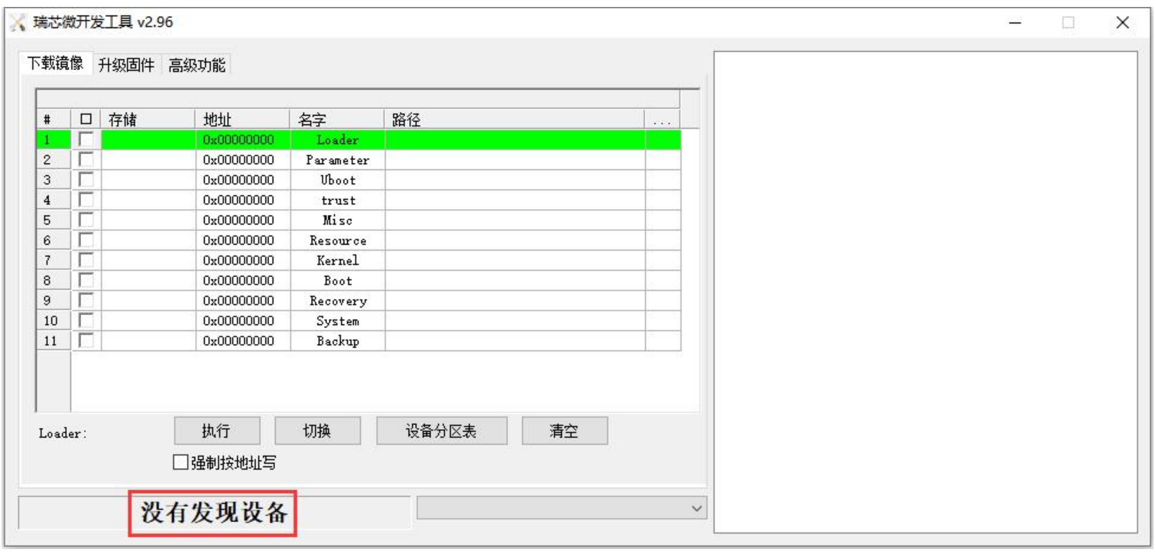


b. After waiting for a period of time, a pop-up window will prompt "**The driver is installed successfully**", and then click the "**OK**" button.



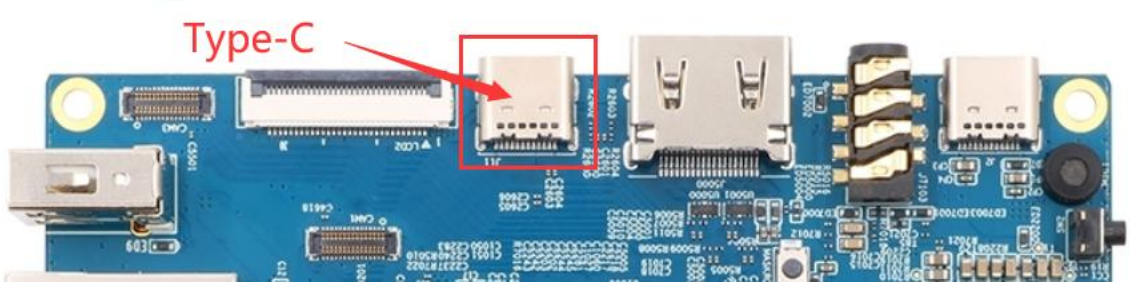
6) Then decompress **RKDevTool_Release_v2.96.zip**, this software does not need to be installed, just find **RKDevTool** in the decompressed folder and open it

7) After opening the **RKDevTool** burning tool, because the computer is not connected to the development board through the Type-C cable at this time, the lower left corner will prompt "**No device found**"



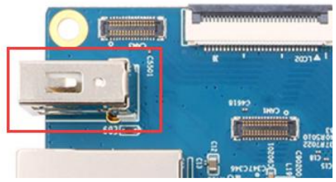
8) Then start burning the Linux image into eMMC

a. First, connect the development board to the Windows computer through the Type-C data cable. The position of the Type-C interface on the development board is shown in the figure below

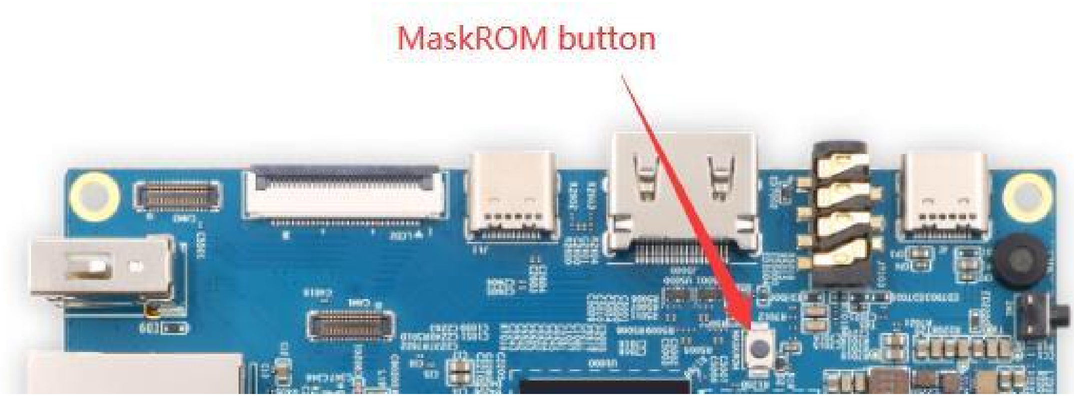


b. Make sure that the development board is not inserted into the TF card and not connected to the power supply

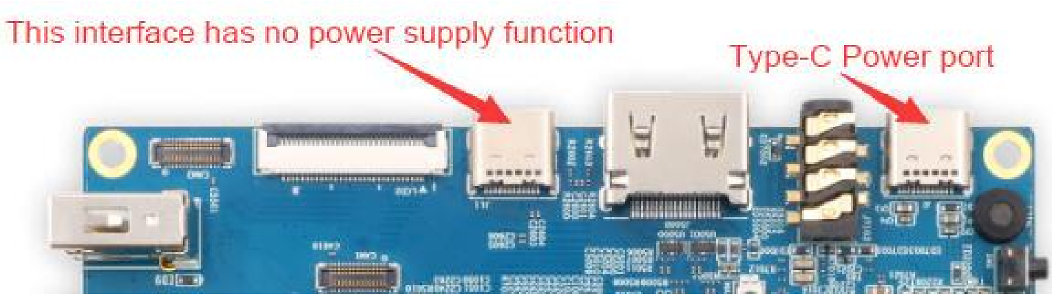
c. Also need to ensure that the white USB2.0 interface in the position shown below is not plugged into a USB device



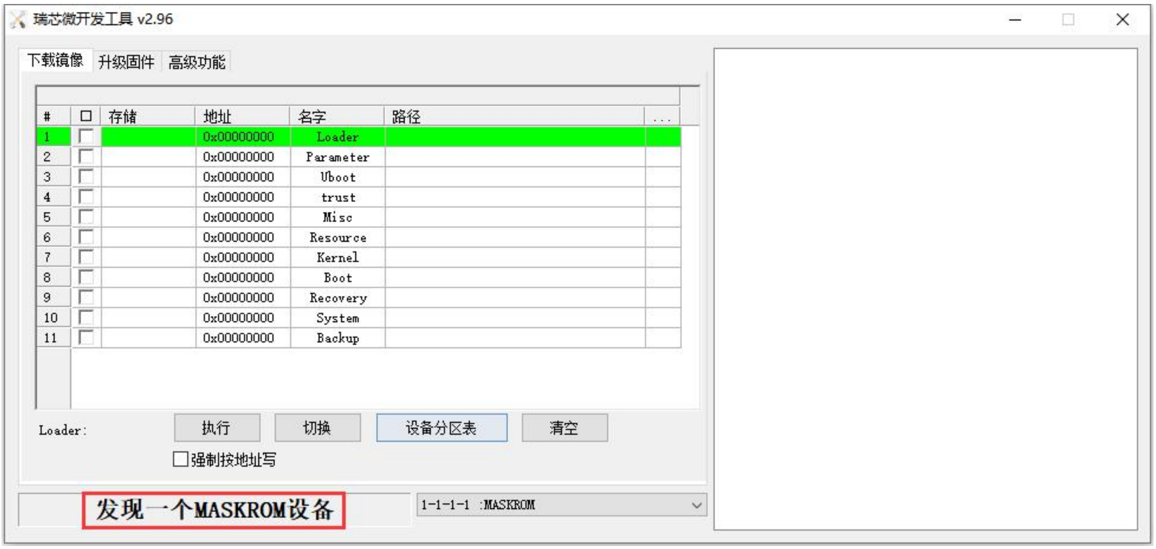
d. Then press and hold the MaskROM button on the development board. The position of the MaskROM button on the development board is shown in the figure below:



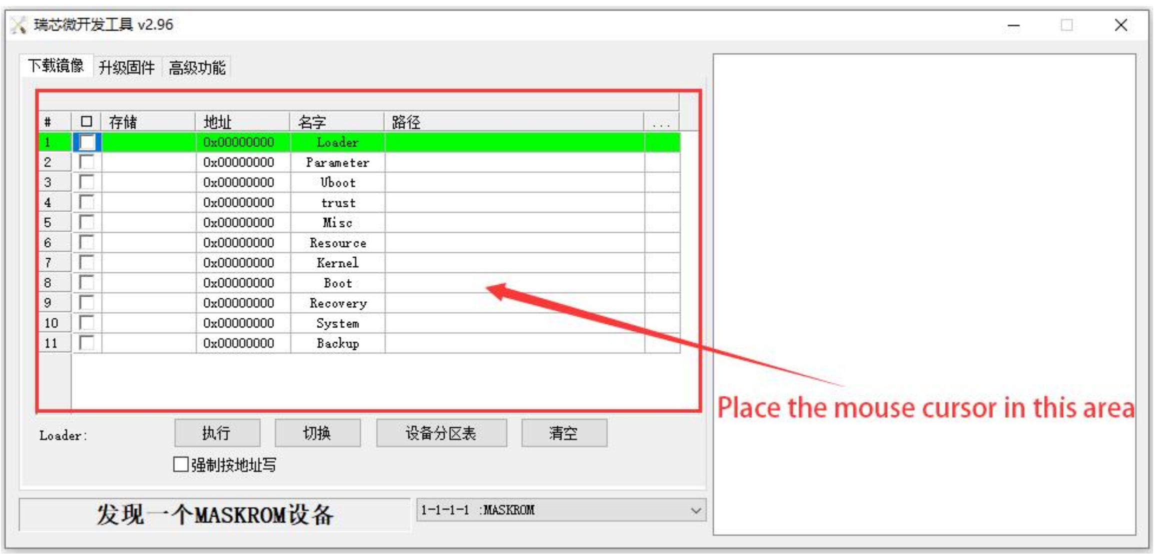
e. Then connect the power supply of the Type-C interface to the development board and power on



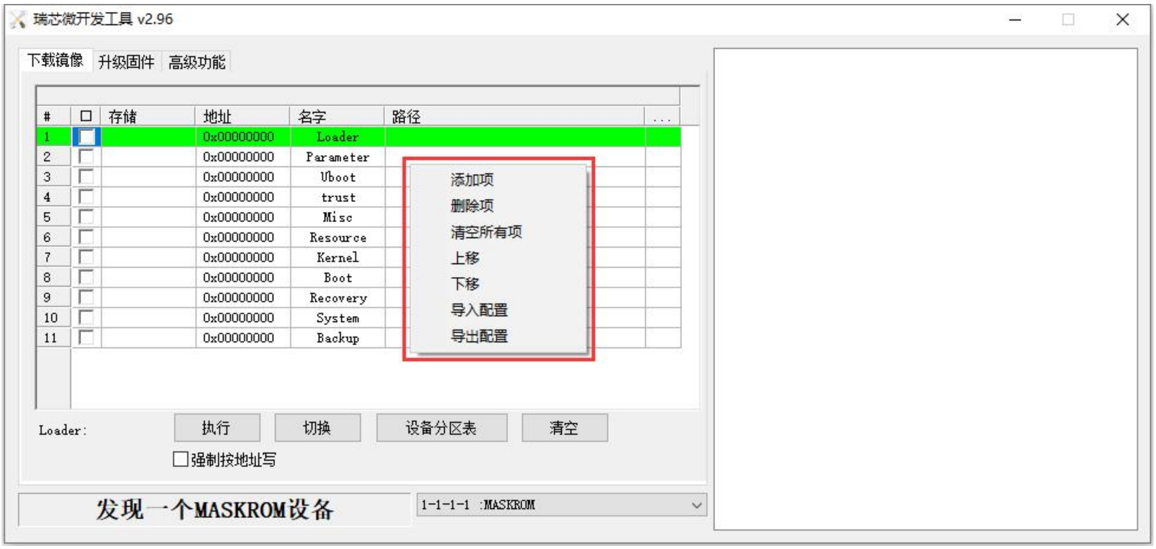
f. If the previous steps are successful, the development board will enter the **MASKROM** mode at this time, and the interface of the burning tool will prompt "**found a MASKROM device**"



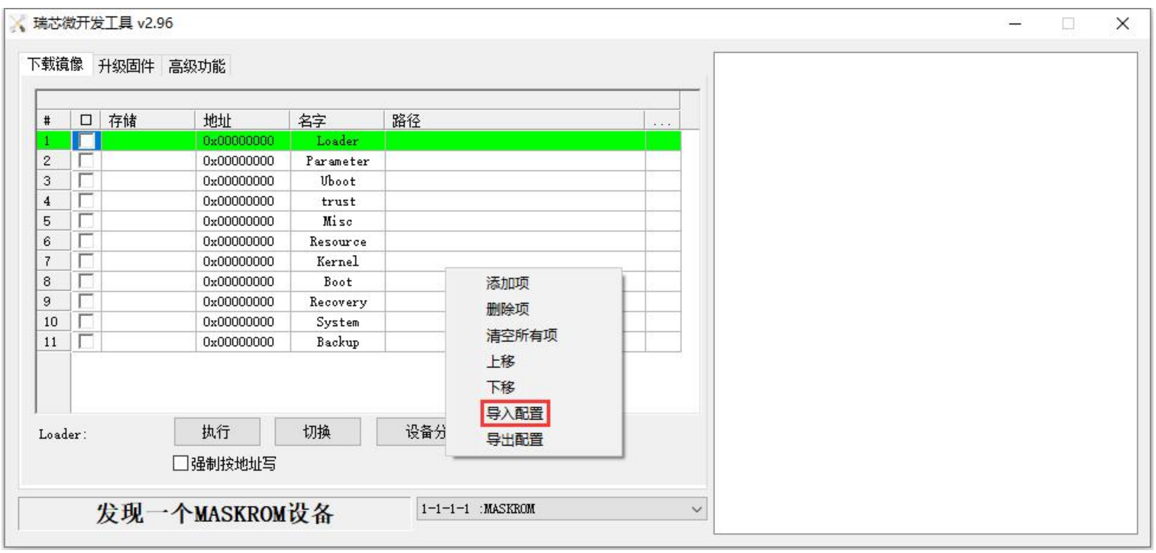
g. Then place the mouse cursor in the area below



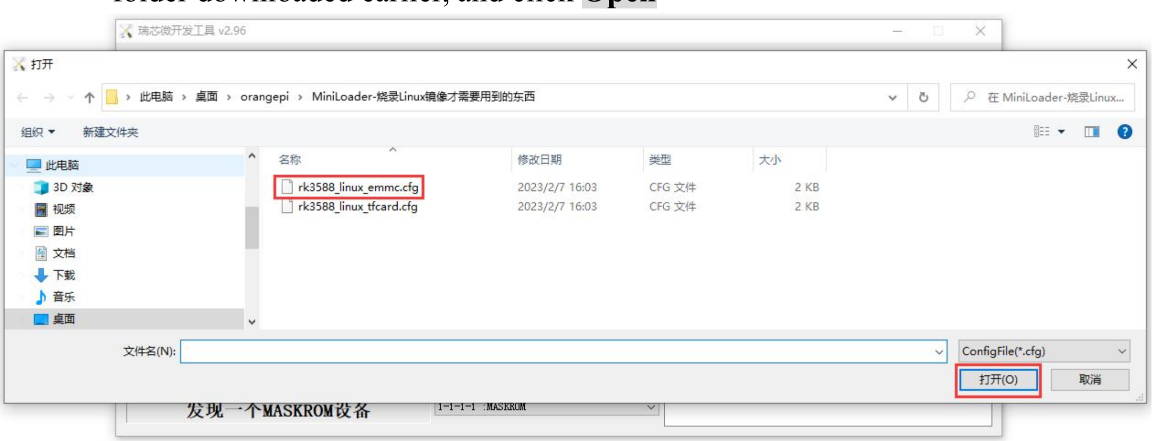
h. Then click the right mouse button and the selection interface shown in the figure below will pop up



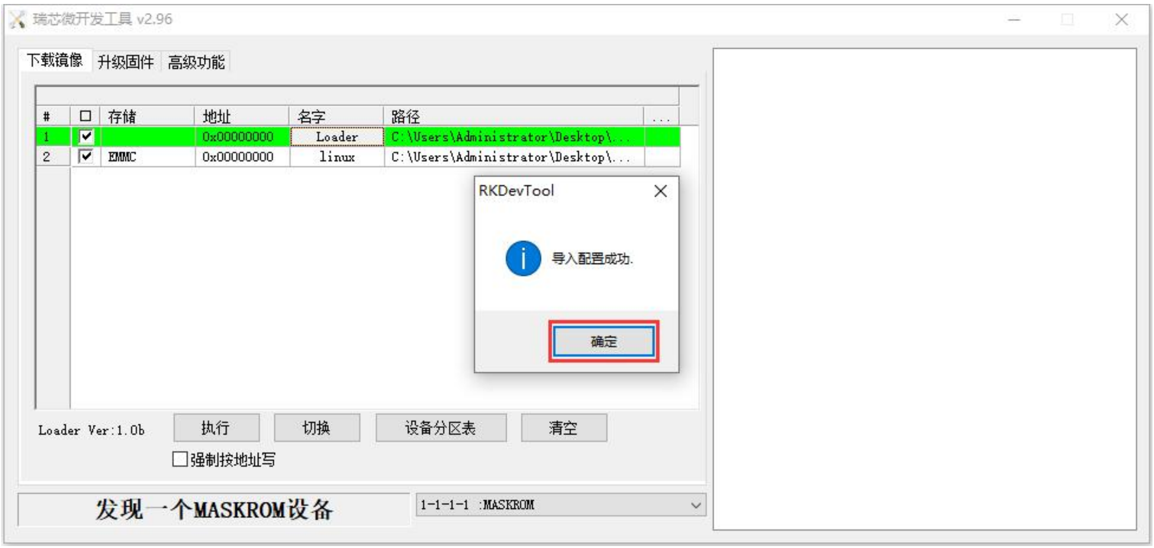
i. Then select **the import configuration** option



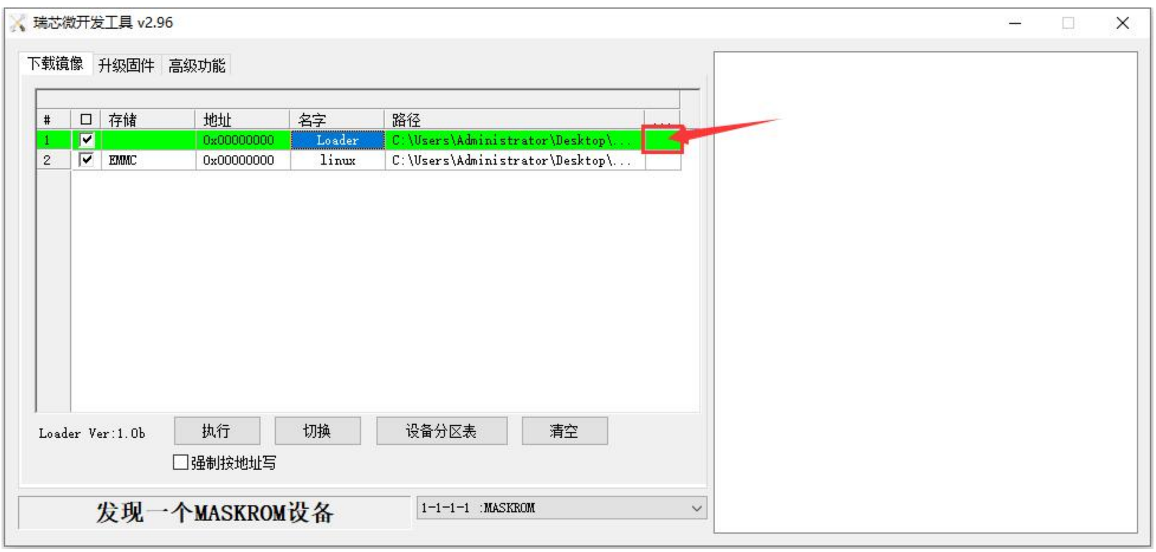
j. Then select the **rk3588_linux_emmc.cfg** configuration file in the **MiniLoader** folder downloaded earlier, and click **Open**



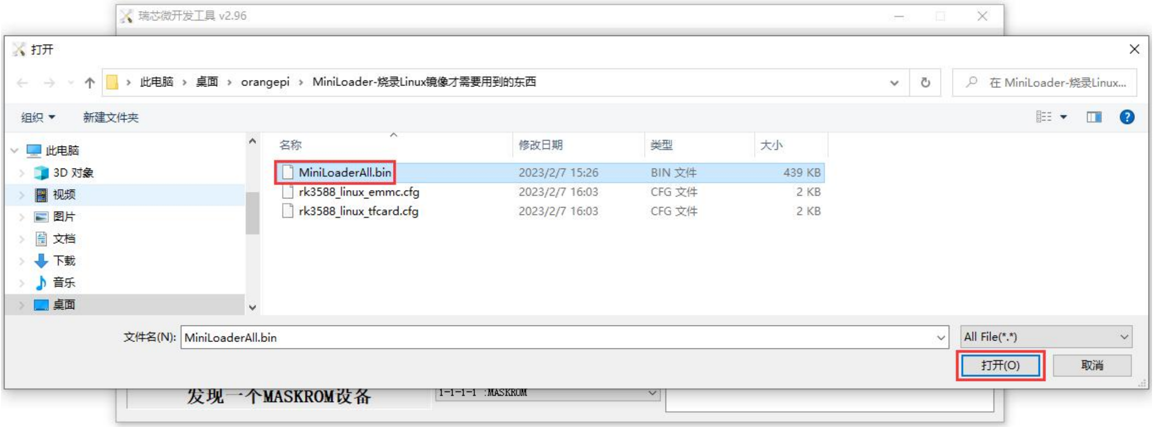
k. Then click **OK**



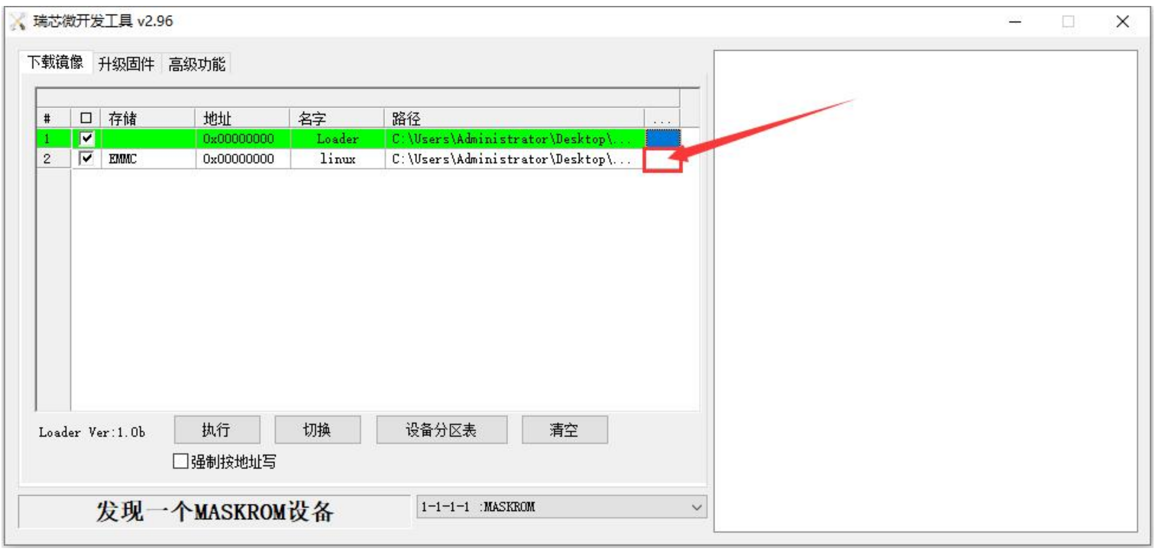
l. Then click the position shown in the figure below



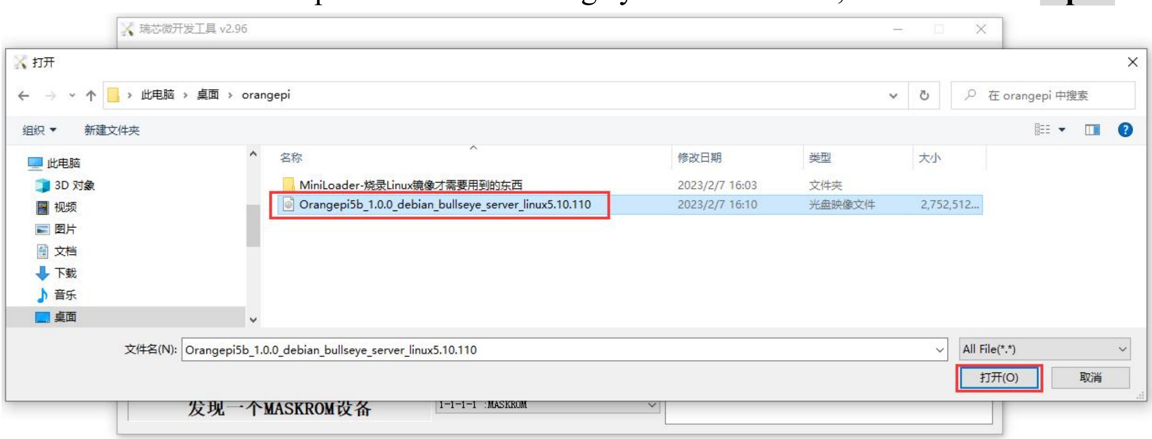
m. Then select **MiniLoaderAll.bin** in the MiniLoader folder downloaded earlier, and then click to **open**



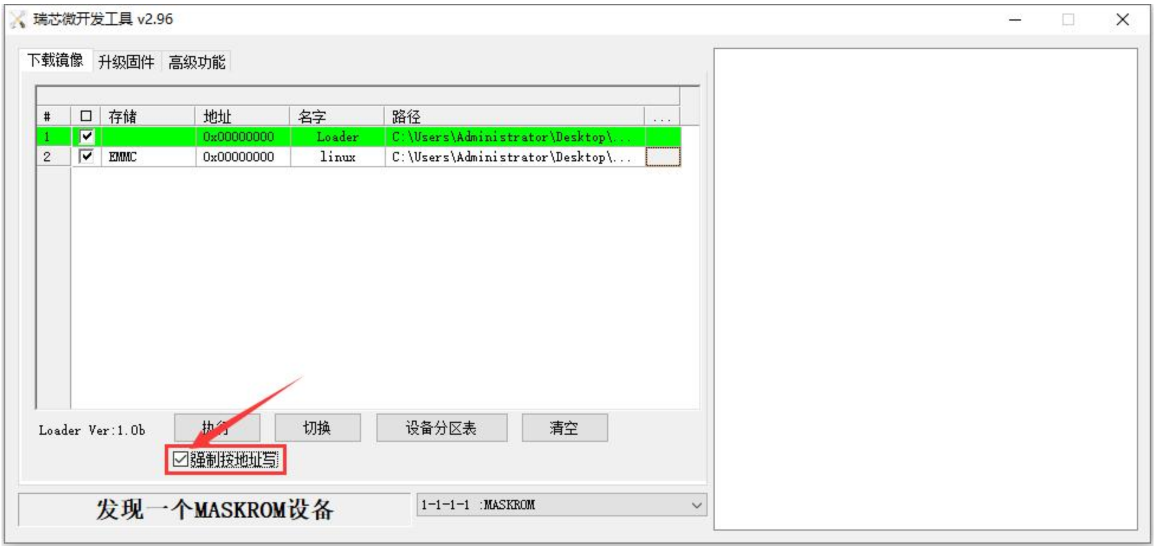
n. Then click the position shown in the figure below



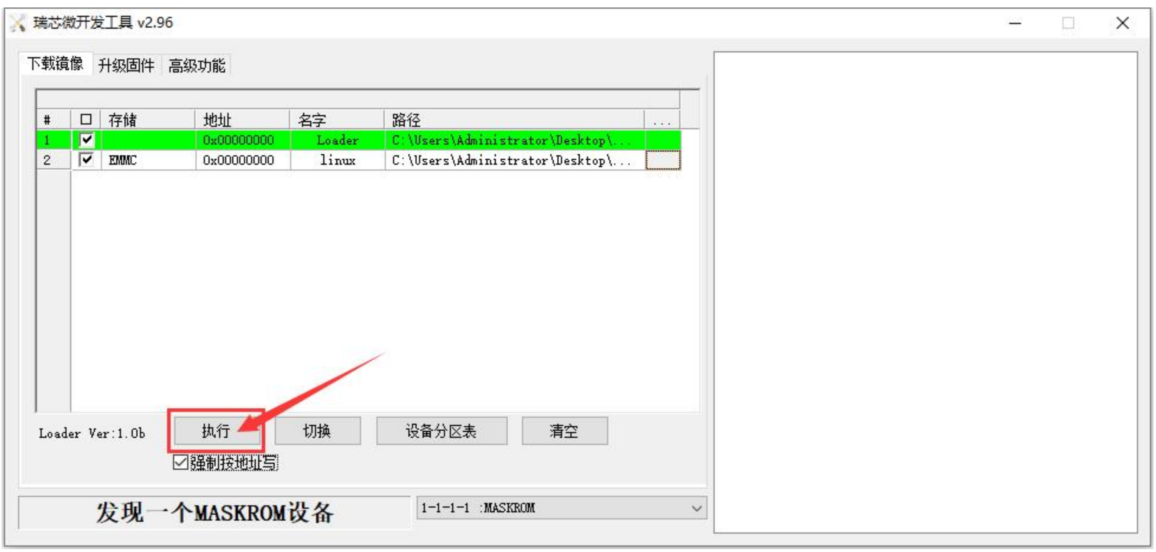
o. Then select the path of the linux image you want to burn, and then click **Open**



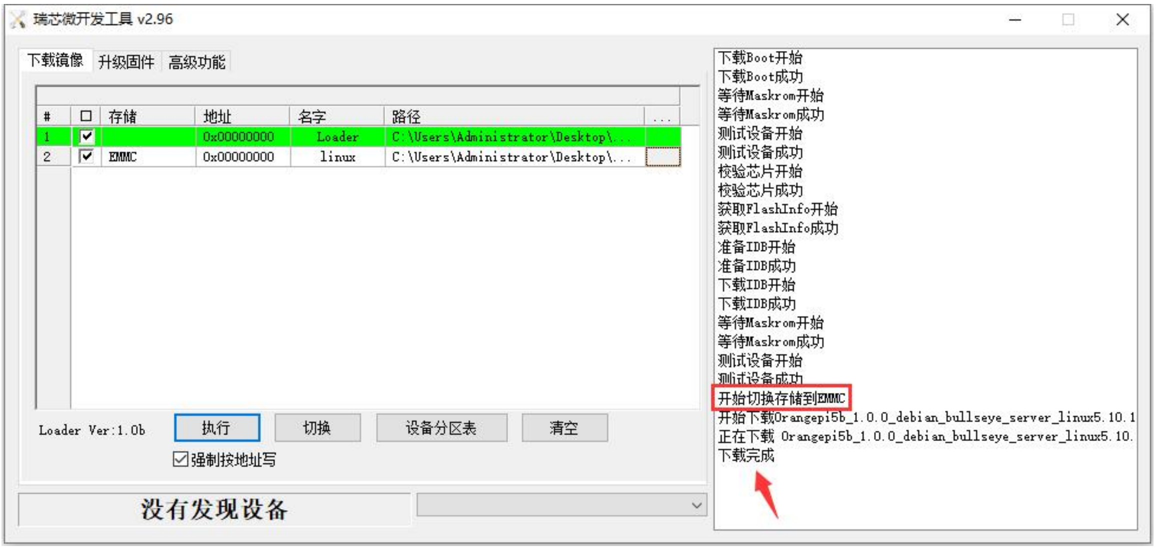
p. Then please check **the mandatory write by address** option



q. Click the Execute button again to start burning the linux image to the eMMC of the development board



r. After the r.linux image is burnt, the display log is shown in the figure below



s. After burning the linux image into the eMMC, the linux system will start automatically.

2.6.2. After burning the linux image into the eMMC, the linux system will start automatically.

Note that the Linux image mentioned here specifically refers to the image of Linux distributions such as Debian or Ubuntu downloaded from the Orange Pi data download page.

1) Using the dd command to burn the linux image to eMMC needs to be completed with the help of a TF card, so first you need to burn the linux image to the TF card, and then use the TF card to start the development board to enter the linux system. For the method of burning the Linux image to the TF card, please refer to the description of **the method of burning the Linux image to the TF card**.

2) After using the TF card to start the linux system, we first upload the decompressed linux image file (Debian or Ubuntu image downloaded from the official website) to the TF card. For the method of uploading the linux image file to the development board, please refer to the description in the section of **the method of uploading files to the development board Linux system**.

3) After uploading the image to the linux system of the development board, we enter the storage path of the image file in the command line of the linux system of the development board. For example, I store the linux image of the development board in the

/home/orangepi/Desktop directory Download it, and then enter the **/home/orangepi/Desktop** directory to see the uploaded image file.

```
orangepi@orangepi:~$ cd /home/orangepi/Desktop
orangepi@orangepi:~/Desktop$ ls
Orangepi5b_x.x.x_debian_bullseye_desktop_xfce_linux5.10.110.img
```

How to enter the command line of the development board linux system?

1. For the method of using the serial port to log in to the terminal, please refer to the instructions in the section on how to use the debugging serial port.

2. Use ssh to remotely log in to the Linux system, please refer to the instructions in the section of SSH remote login to the development board.

3. If HDMI, LCD and other display screens are connected, you can open a command line terminal on the desktop.

4) Next, we first use the following command to confirm the device node of eMMC

```
orangepi@orangepi:~/Desktop$ ls /dev/mmcblk*boot0 | cut -c1-12
/dev/mmcblk0
```

5) Then we can use the dd command to clear the eMMC. Note that after the **of=** parameter, please fill in the output result of the above command

```
orangepi@orangepi:~/Desktop$ sudo dd bs=1M if=/dev/zero of=/dev/mmcblk0 count=1000 status=progress
orangepi@orangepi:~/Desktop$ sudo sync
```

6) Then you can use the dd command to burn the linux image of the development board into the eMMC

a. In the following command, the **if=** parameter is followed by the full path where the linux image is stored + the name of the Linux image (such as **the name of /home/orangepi/Desktop/Linux image**). Because we have entered the path of the linux image above, we only need to fill in the name of the Linux image.

b. Please do not copy the linux image name in the following command, but replace it with the actual image name (because the version number of the image may be updated).

```
sudo dd bs=1M if=Orangepi5b_x.x.x_debian_bullseye_desktop_xfce_linux5.10.110.img of=/dev/mmcblk0 status=progress

sudo sync
```

Note, if you upload a linux image compressed file ending in .7z, please remember to decompress it before using the dd command to burn.

The detailed description of all parameters of the dd command and more usage can be viewed by executing the man dd command in the linux system.

7) After successfully burning the linux image of the development board to the eMMC, you can use the **poweroff** command to shut down. Then please pull out the TF card, and then short press the power button to turn on, and then the linux system in the eMMC will be started.

8) After starting the system in eMMC, use the **df -h** command to see the actual hard disk capacity

```
orangepi@orangepi:~$ df -h
Filesystem      Size  Used Avail Use% Mounted on
tmpfs           769M  9.5M  760M   2% /run
/dev/mmcblk0p2   29G  5.4G   23G  20% /
tmpfs           3.8G     0  3.8G   0% /dev/shm
tmpfs           5.0M  4.0K  5.0M   1% /run/lock
tmpfs           3.8G   12K  3.8G   1% /tmp
/dev/mmcblk0p1  256M  116M  141M  46% /boot
/dev/zram1      188M  2.8M  171M   2% /var/log
tmpfs           769M   80K  769M   1% /run/user/1000
```

2. 7. How to burn Android image into eMMC

2. 7. 1. How to burn Android image into eMMC via Type-C cable

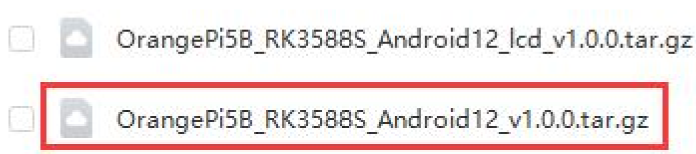
Note that all the following operations are performed on a Windows computer.

1) First, you need to prepare a data cable with a good quality Type-C interface

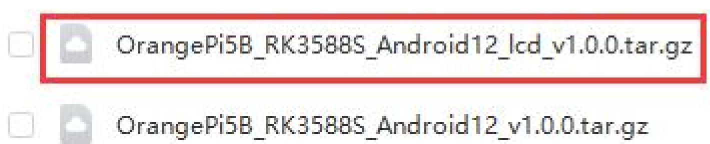
2) Then download the Rockchip driver **DriverAssitant_v5.12.zip** and the burning tool **RKDevTool_Release_v2.96.zip** from the Orange Pi data download page, please ensure that the version of the downloaded **RKDevTool** tool is **v2.96**

3) Then download the Android image from **Orange Pi's download page**. After opening the download link of the Android image, you can see the following two types of Android images. The difference between them is:

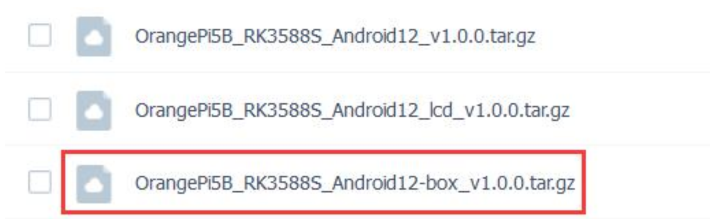
a. The image without lcd is specially used for HDMI display, if you don't use LCD screen, please download the image without lcd



b. If you want to use LCD screen, please choose image with lcd



c. The image with box is the image of TV box type



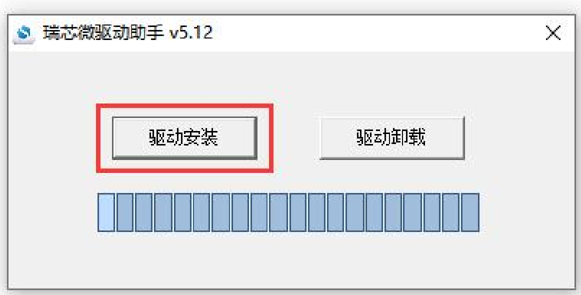
4) Then use the decompression software to decompress the compressed package of the

downloaded Android image. Among the decompressed files, the file ending with ".img" is the Android image file, and the size is more than 1GB

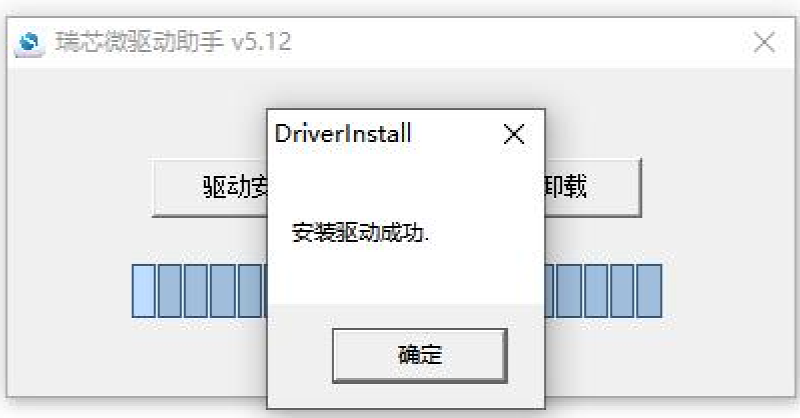
5) Then use the decompression software to decompress **DriverAssitant_v5.12.zip**, and then find the **DriverInstall.exe** executable file in the decompressed folder and open it

6) After opening **DriverInstall.exe**, the steps to install the Rockchip driver are as follows

a. Click the "**Driver Installation**" button

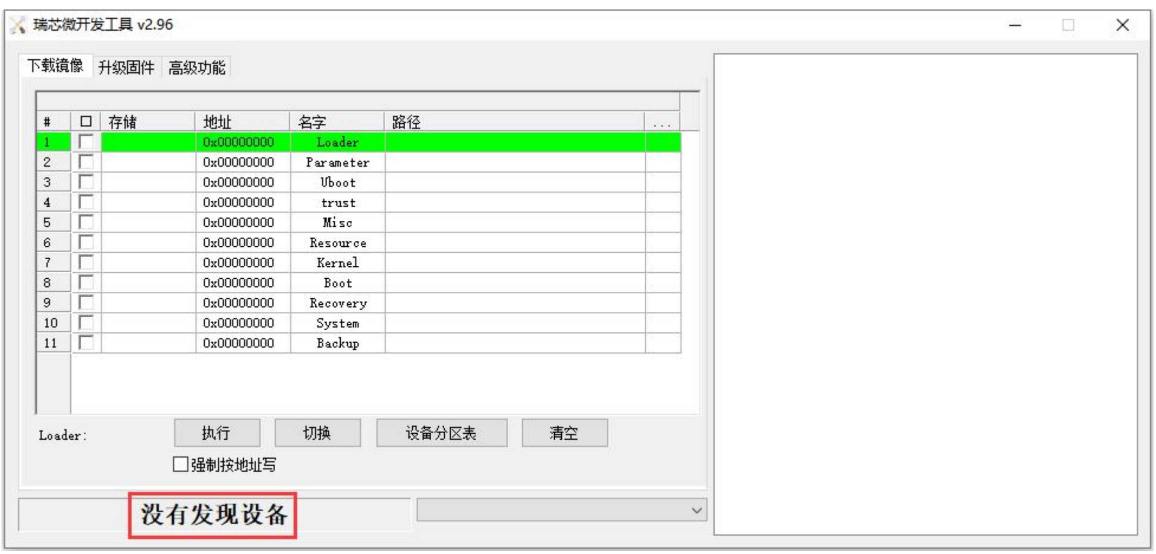


b. After waiting for a period of time, a pop-up window will prompt "**The driver is installed successfully**", and then click the "**OK**" button.



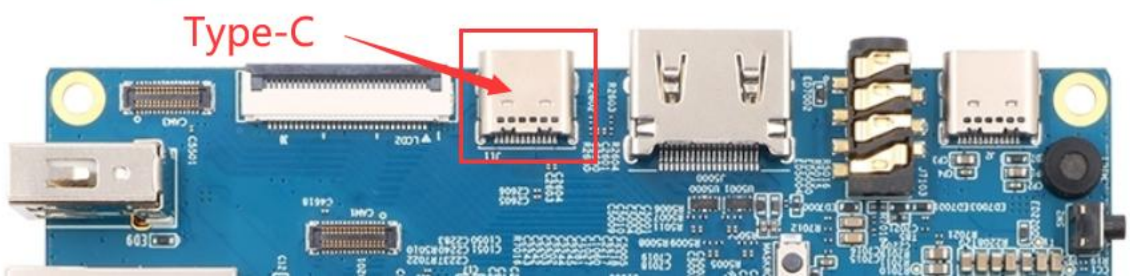
7) Then decompress **RKDevTool_Release_v2.96.zip**, this software does not need to be installed, just find **RKDevTool** in the decompressed folder and open it

8) After opening the **RKDevTool** burning tool, because the computer has not been connected to the development board through the Type-C cable at this time, the lower left corner will prompt "**No device found**"



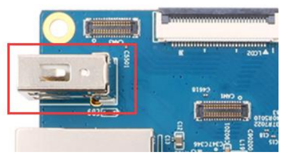
9) Then start burning the Android image into eMMC

   a. First, connect the development board to the Windows computer through the Type-C data cable. The position of the Type-C interface on the development board is shown in the figure below

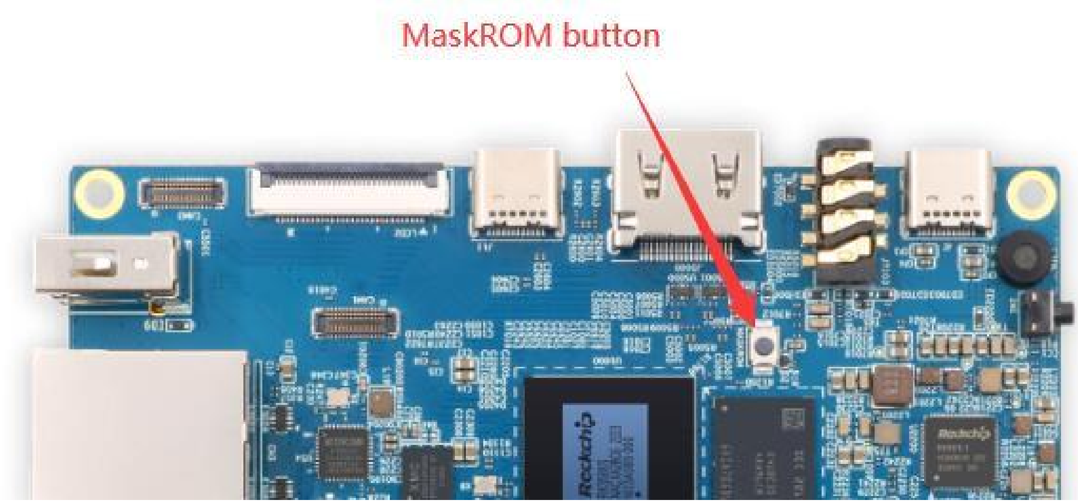


b. Make sure that the development board is not inserted into the TF card and not connected to the power supply

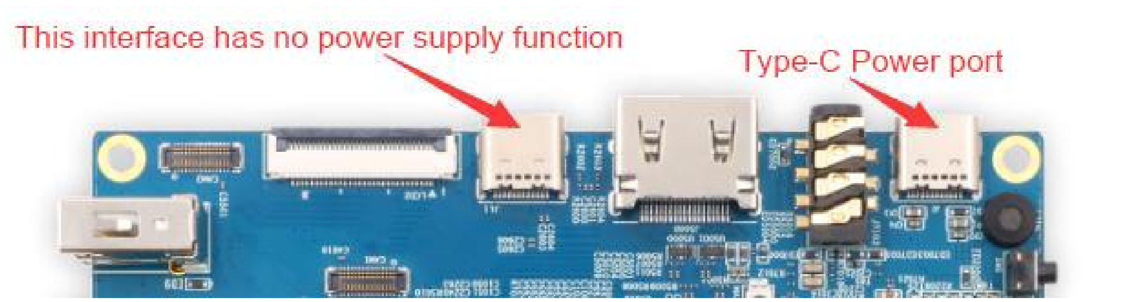
c. Also need to ensure that the white USB2.0 interface in the position shown below is not plugged into a USB device



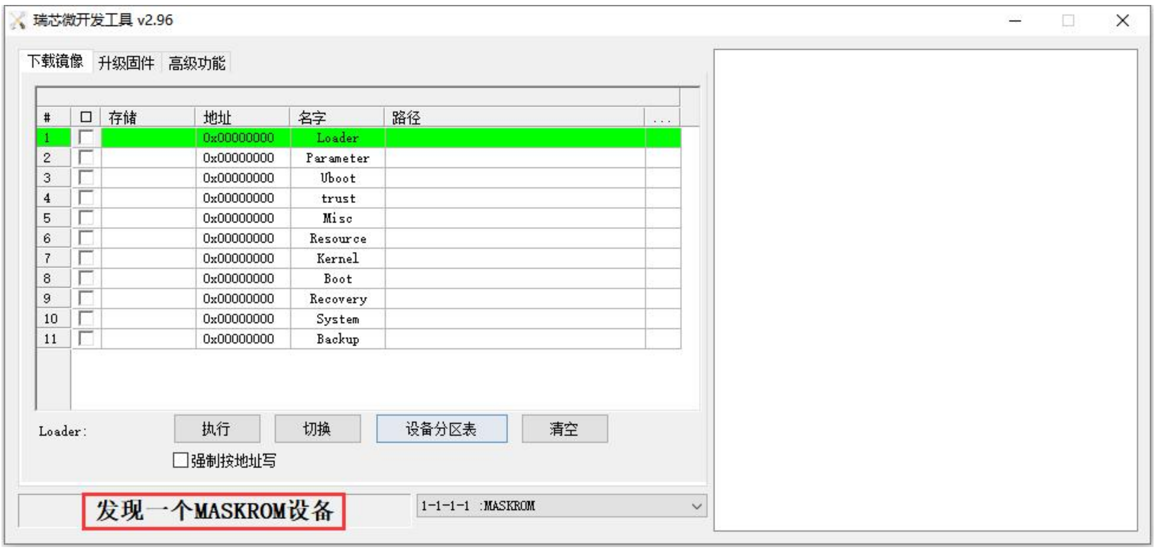
d. Then press and hold the MaskROM button on the development board. The position of the MaskROM button on the development board is shown in the figure below:



e. Then connect the power supply of the Type-C interface to the development board and power on



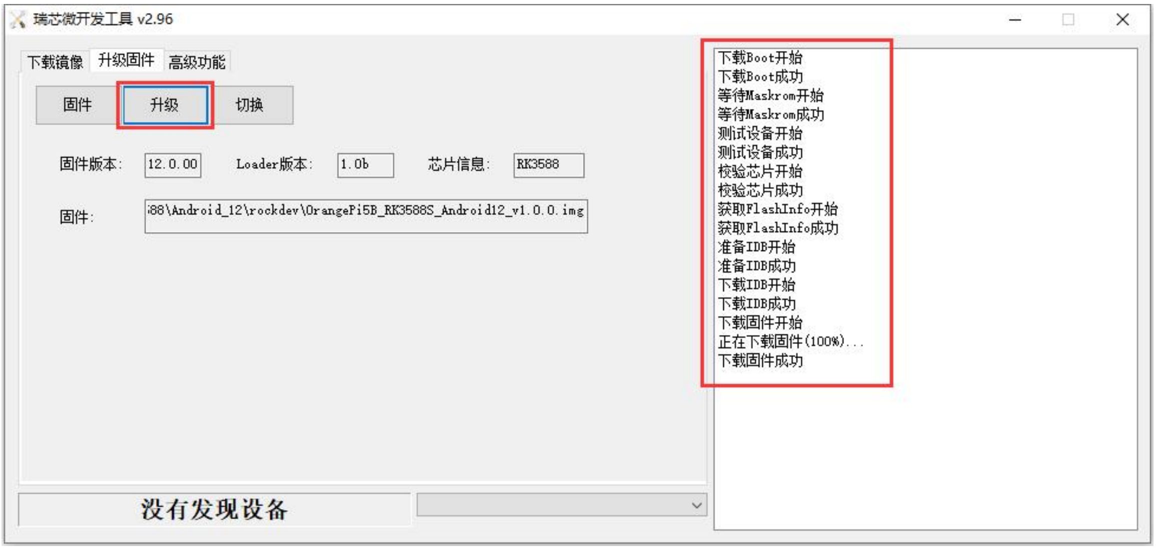
f. If the previous steps are successful, the development board will enter the **MASKROM** mode at this time, and the interface of the burning tool will prompt "**found a MASKROM device**"



g. Then click the "**Upgrade Firmware**" column of the burning tool

h. Then click the "**Firmware**" button to select the path of the Android image that needs to be burned

i. Finally, click the "**Upgrade**" button to start burning, and the log during the burning process is shown in the figure below. After burning is completed, the Android system will start automatically.



2. 7. 2. How to burn Android 12 image into eMMC via TF card

Note that all the following operations are performed on a Windows computer.

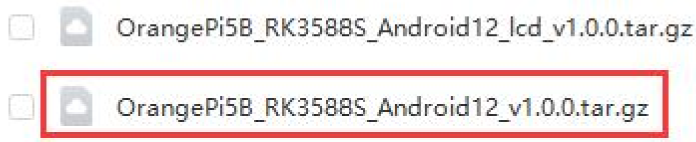
1) First prepare a TF card with 8GB or larger capacity. The transmission speed of the TF card must be class10 or above. It is recommended to use a TF card of SanDisk and other brands

2) Then use the card reader to insert the TF card into the computer

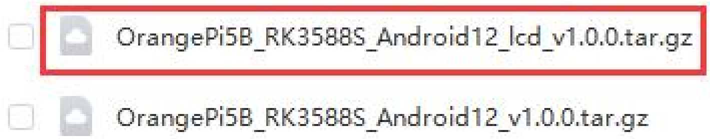
3) Then download the SDDiskTool programming tool from **the Orange Pi data download page**, **please ensure that the version of the SDDiskTool tool is the latest v1.72**

4) Then download the Android image from **Orange Pi's download page**. After opening the download link of the Android image, you can see the following two types of Android images. The difference between them is:

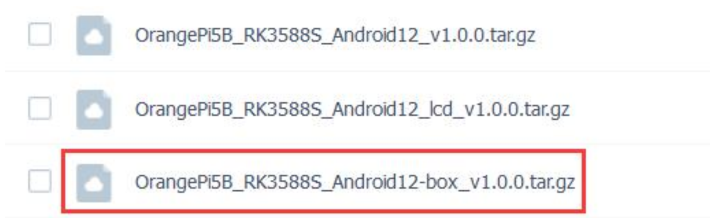
a. The image without lcd is specially used for HDMI display, if you don't use LCD screen, please download the image without lcd



b. If you want to use LCD screen, please choose image with lcd

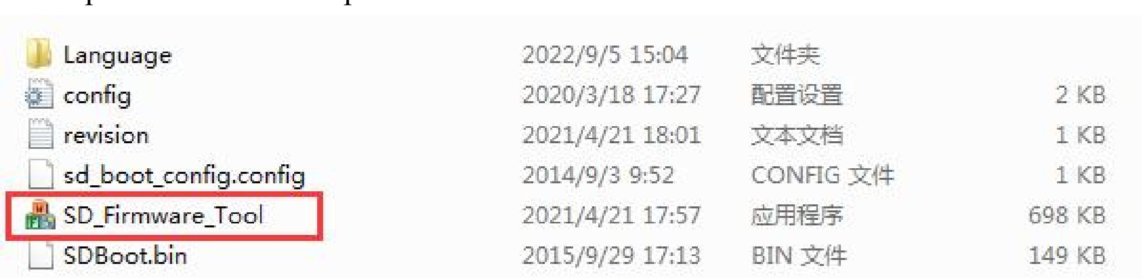


c. The image with box is the image of TV box type



5) Then use the decompression software to decompress the compressed package of the downloaded Android image. Among the decompressed files, the file ending with ".img" is the Android image file, and the size is more than 1GB

6) Then use decompression software to decompress **SDDiskTool_v1.72.zip**, this software does not need to be installed, just find **SD_Firmware_Tool.exe** in the decompressed folder and open it

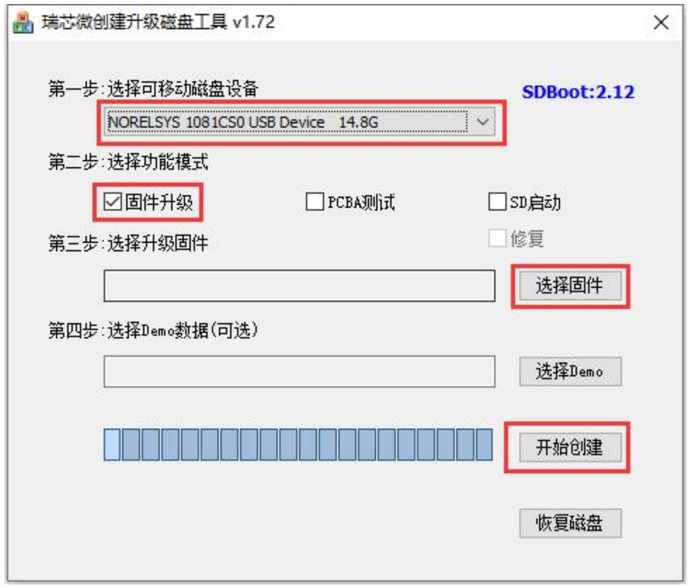


7) After opening **SDDiskTool**, if the TF card is recognized normally, the inserted disk device will be displayed in the "**Select Removable Disk Device**" column. **Please make sure that the displayed disk device is consistent with the drive letter of the TF card you want to burn**, if there is no display, you can try to unplug the TF card

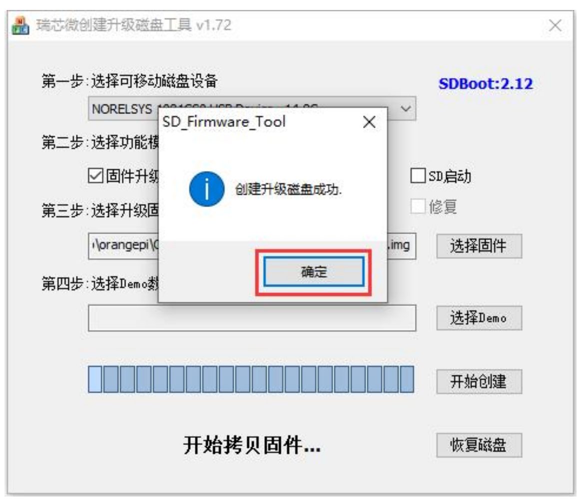
8) After confirming the drive letter, you can format the TF card first, click **the restore disk** button in SDDiskTool, or use the **SD Card Formatter** mentioned above to format the TF card

9) Then start writing the Android image to the TF card

a. First confirm that the displayed drive letter is the drive letter corresponding to the TF card under "**Select Removable Disk Device**"
b. Then select "**Firmware Upgrade**" in "**Select Function Mode**"
c. Then select the path of the Android firmware in the "**Select Upgrade Firmware**" column
d. Finally, click the "**Start Create**" button to start burning

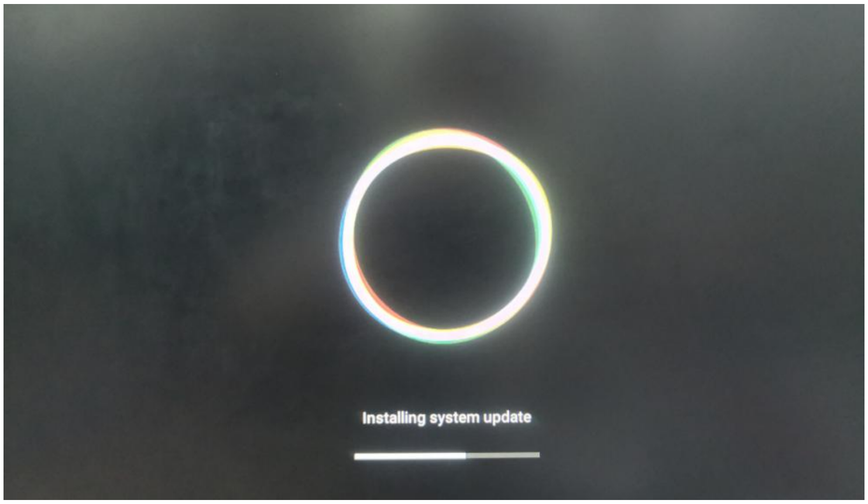


10) After the burning is completed, the display is as shown in the figure below, and then you can exit SDDiskTool

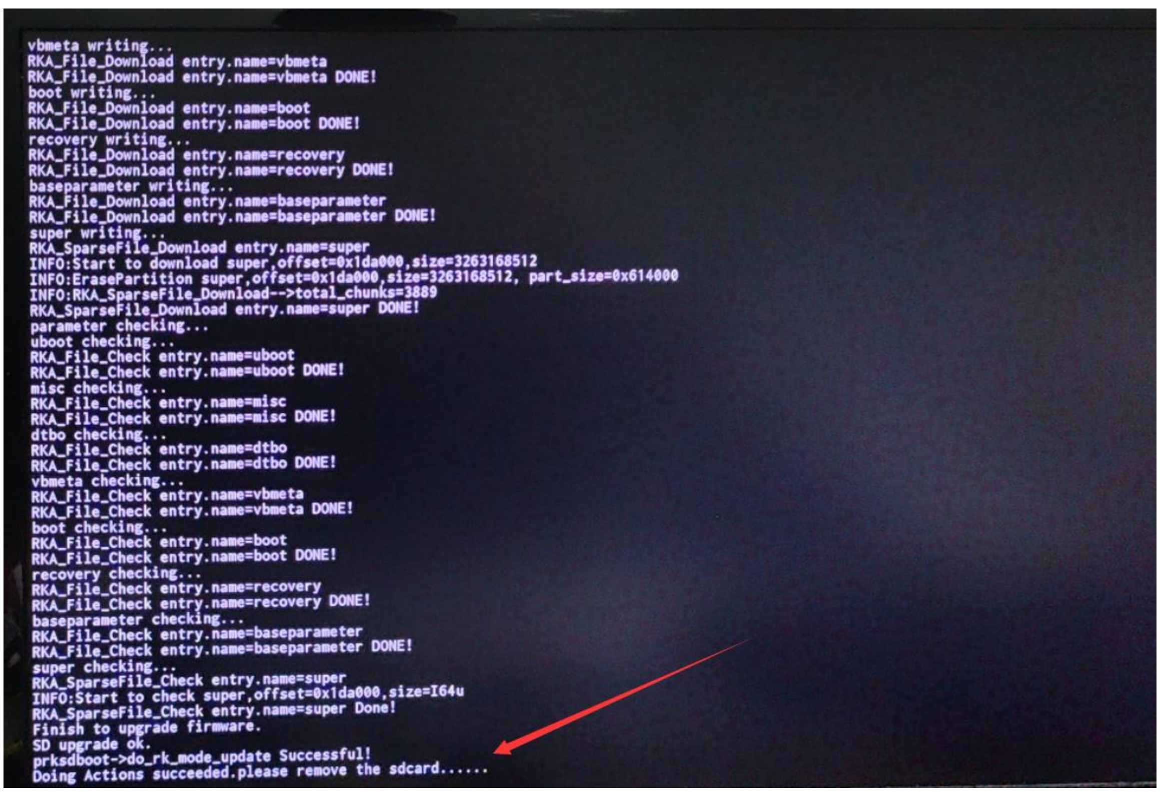


11) Then pull out the TF card from the computer and insert it into the development board. After the development board is powered on, it will automatically start burning the Android image in the TF card to the eMMC of the development board.

12) If the development board is connected to an HDMI display, you can also see the progress bar of burning the Android image to eMMC from the HDMI display



13) When the HDMI monitor displays the following information, it means that the burning of the Android image into the eMMC has been completed. At this time, the TF card can be pulled out, and then the Android system in the eMMC will start.



2.8. How to burn Orange Pi OS (Droid) image into eMMC

2.8.1. Burn Orange Pi OS (Droid) image to eMMC via Type-C cable

Note that all the following operations are performed on a Windows computer.

1) First, you need to prepare a data cable with a good quality Type-C interface

2) Then download the Rockchip driver **DriverAssitant_v5.12.zip** and the burning tool **RKDevTool_Release_v2.96.zip** from **the Orange Pi data download page**, please ensure that the version of the downloaded **RKDevTool** is **v2.96**

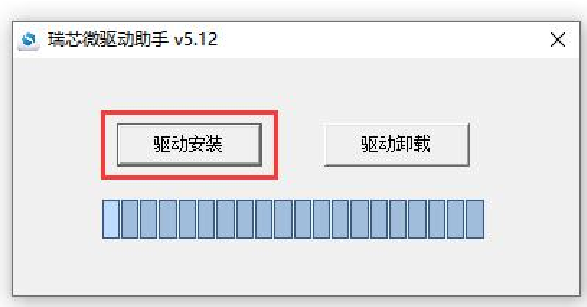
3) Then download the Orange Pi OS (Droid) image from **the Orange Pi download page**

4) Then use the decompression software to decompress the compressed package of the downloaded Orange Pi OS (Droid) image. Among the decompressed files, the file ending with ".img" is the Orange Pi OS (Droid) image file, and the size is more than 1GB

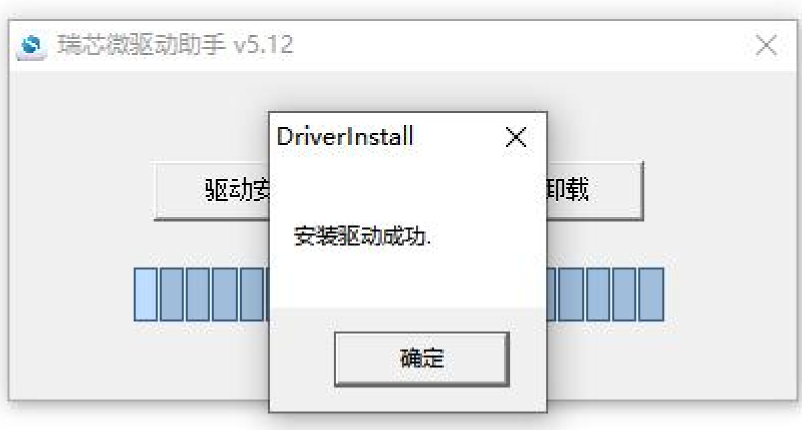
5) Then use the decompression software to decompress **DriverAssitant_v5.12.zip**, and then find the **DriverInstall.exe** executable file in the decompressed folder and open it

6) After opening **DriverInstall.exe**, the steps to install the Rockchip driver are as follows

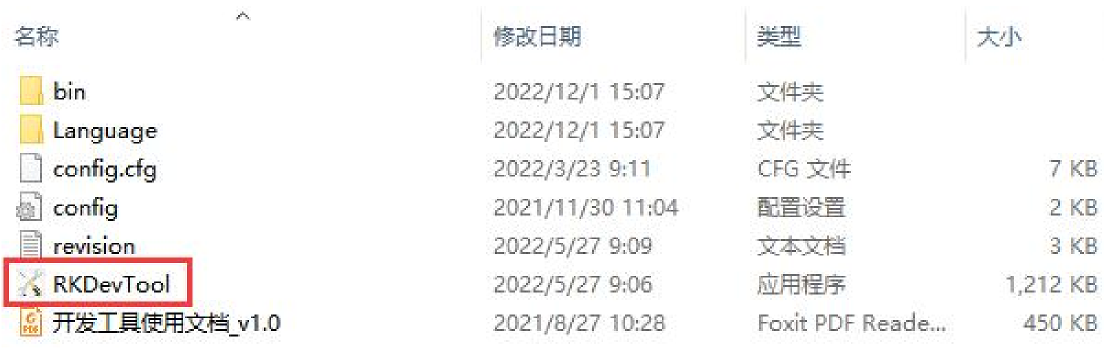
a. Click the "**Driver Installation**" button



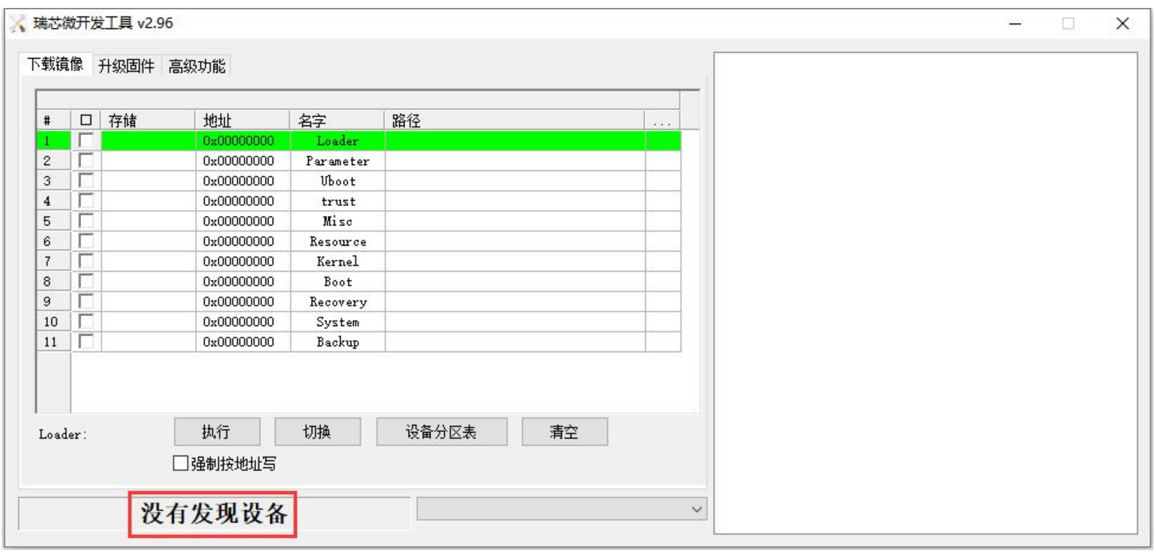
b. After waiting for a period of time, a pop-up window will prompt "**The driver is installed successfully**", and then click the "**OK**" button.



7) Then decompress **RKDevTool_Release_v2.96.zip**, this software does not need to be installed, just find **RKDevTool** in the decompressed folder and open it

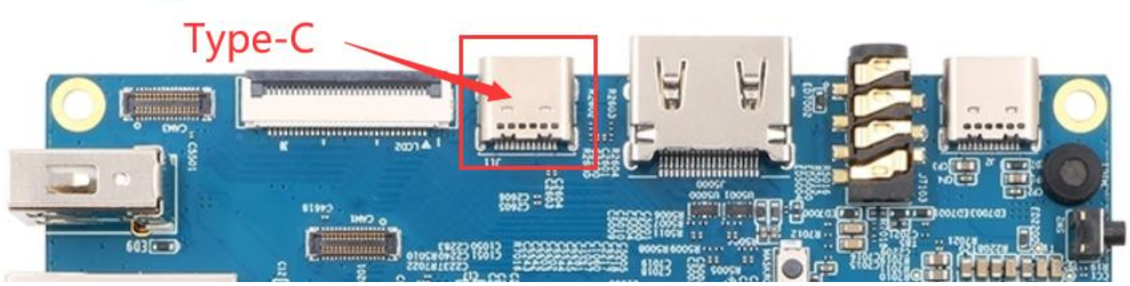


8) After opening the **RKDevTool** burning tool, because the computer has not been connected to the development board through the Type-C cable at this time, the lower left corner will prompt "**No device found**"



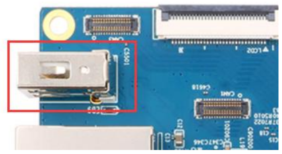
9) Then start burning the Orange Pi OS (Droid) image into eMMC

a. First, connect the development board to the Windows computer through the Type-C data cable. The position of the Type-C interface on the development board is shown in the figure below

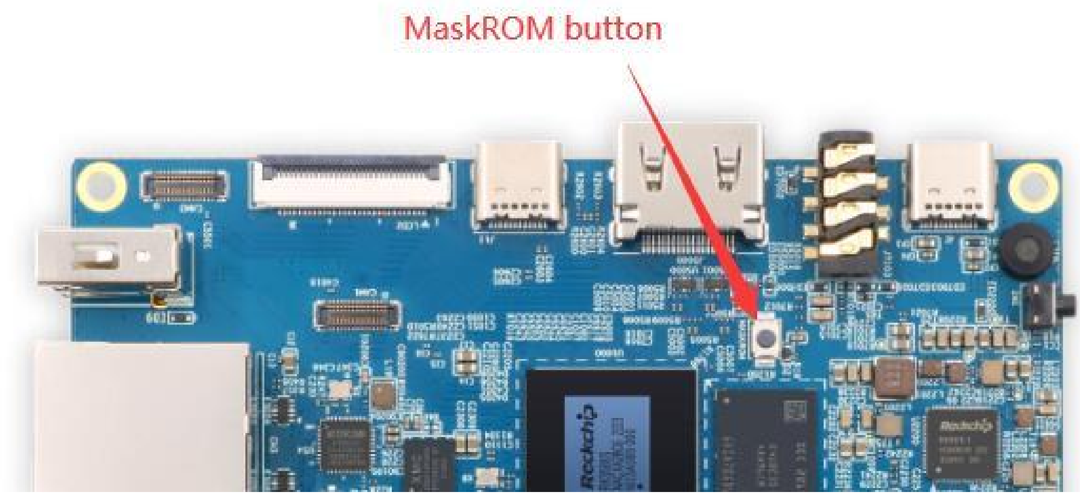


b. Make sure that the development board is not inserted into the TF card and not connected to the power supply

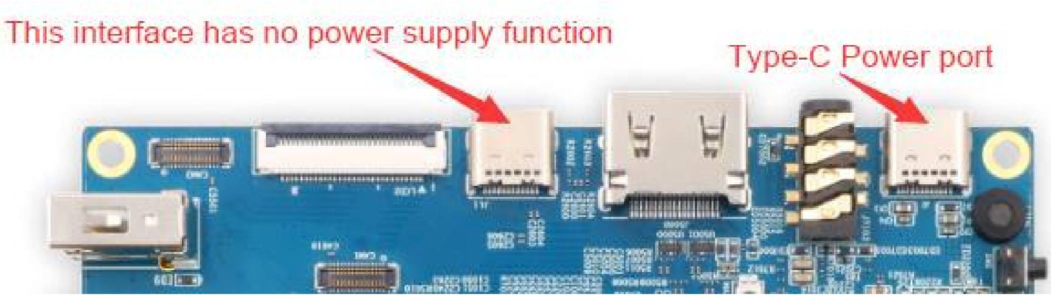
c. Also need to ensure that the white USB2.0 interface in the position shown below is not plugged into a USB device



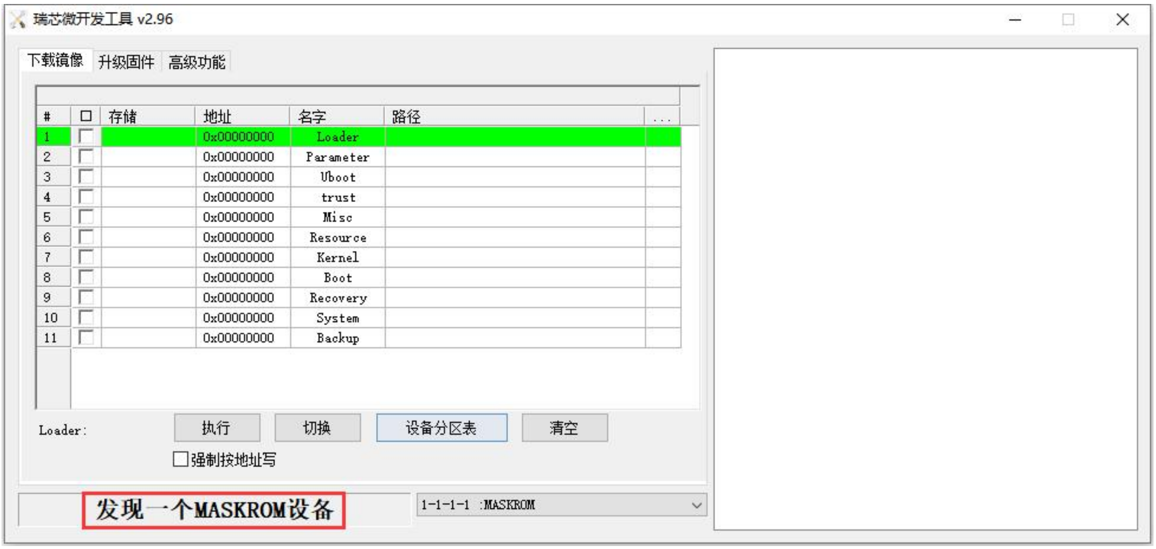
d. Then press and hold the MaskROM button on the development board. The position of the MaskROM button on the development board is shown in the figure below:



e. Then connect the power supply of the Type-C interface to the development board and power on



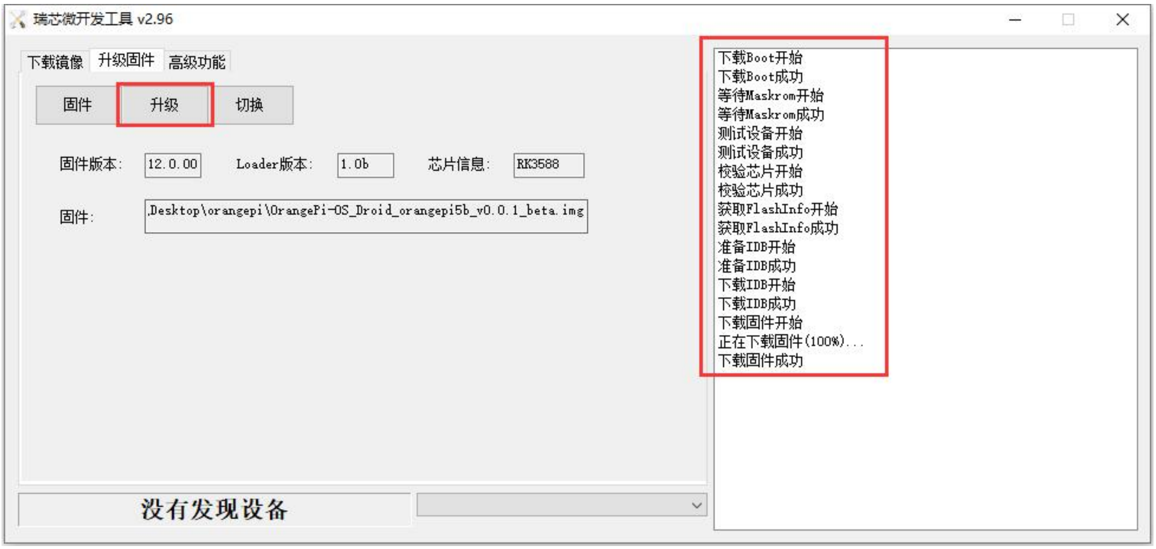
f. If the previous steps are successful, the development board will enter the **MASKROM** mode at this time, and the interface of the burning tool will prompt "**found a MASKROM device**"



g. Then click the "**Upgrade Firmware**" column of the burning tool

h. Then click the "**Firmware**" button to select the path of the Orange Pi OS (Droid) image that needs to be burned

i. Finally, click the "**Upgrade**" button to start burning, and the log during the burning process is shown in the figure below. After burning, the Orange Pi OS (Droid) system will start automatically.



2. 8. 2. Burn Orange Pi OS (Droid) image to eMMC via TF card

Note that all the following operations are performed on a Windows computer.

1) First prepare a TF card with 8GB or larger capacity. The transmission speed of the TF card must be class10 or above. It is recommended to use a TF card of SanDisk and other brands

2) Then use the card reader to insert the TF card into the computer

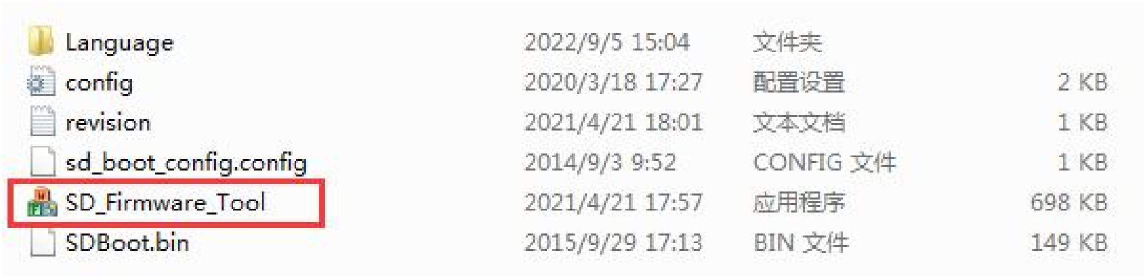
3) Then download the SDDiskTool programming tool from **the Orange Pi data download page**, **please ensure that the version of the SDDiskTool tool is the latest v1.72**

4) Then download the Orange Pi OS (Droid) image from **the Orange Pi download page**

5) Then use the decompression software to decompress the compressed package of the downloaded Orange Pi OS (Droid) image. Among the decompressed files, the file ending with ".img" is the Orange Pi OS (Droid) image file, and the size is more than 1GB

6) Then use decompression software to decompress **SDDiskTool_v1.72.zip**, this software does not need to be installed, just find **SD_Firmware_Tool.exe** in the

decompressed folder and open it



7) After opening **SDDiskTool**, if the TF card is recognized normally, the inserted disk device will be displayed in the "**Select Removable Disk Device**" column. **Please make sure that the displayed disk device is consistent with the drive letter of the TF card you want to burn**, if there is no display, you can try to unplug the TF card

8) After confirming the drive letter, you can format the TF card first, click the **restore disk** button in **SDDiskTool**, or use the **SD Card Formatter** mentioned above to format the TF card

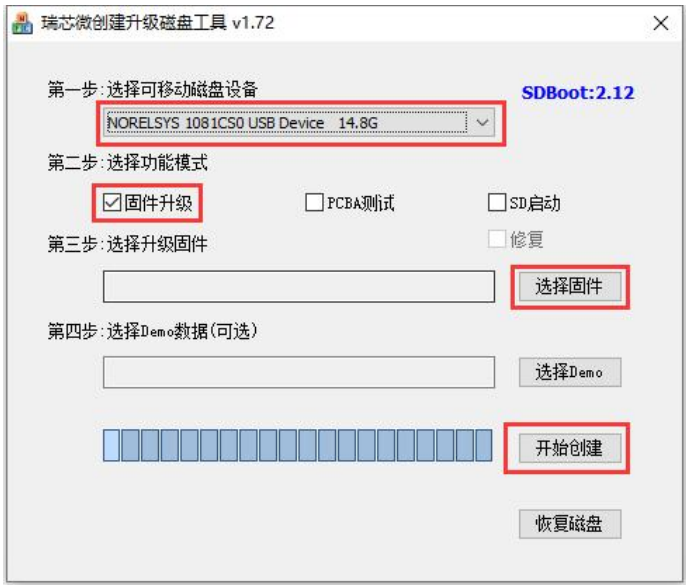
9) Then start to write the Orange Pi OS (Droid) image to the TF card

a. First confirm that the displayed drive letter is the drive letter corresponding to the TF card under "**Select Removable Disk Device**"

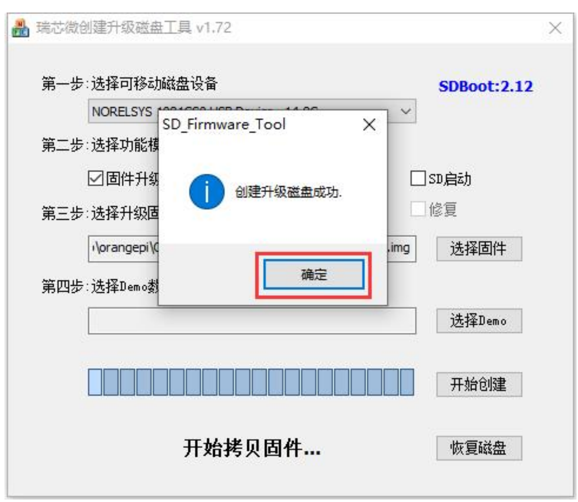
b. Then select "**Firmware Upgrade**" in "**Select Function Mode**"

c. c. Then select the path of the Orange Pi OS (Droid) firmware in the "**Select to upgrade firmware**" column

d. d. Finally, click the "**Start Create**" button to start burning



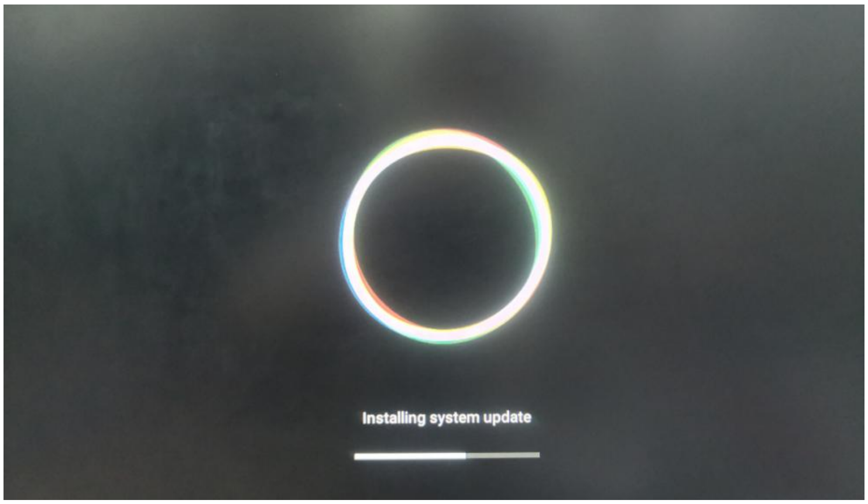
10) After the burning is completed, the display is as shown in the figure below, and then you can exit SDDiskTool



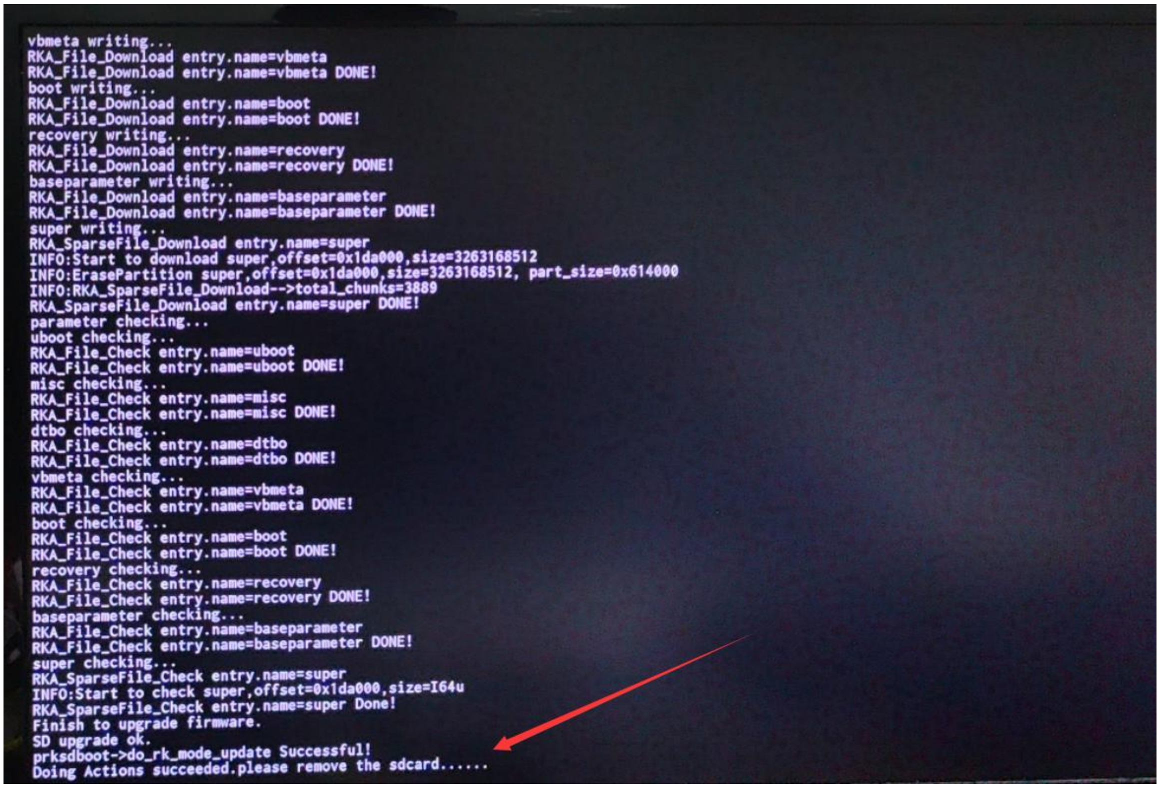
11) Then pull out the TF card from the computer and insert it into the development board.

After the development board is powered on, it will automatically start burning the Orange Pi OS (Droid) image in the TF card to the eMMC of the development board.

12) If the development board is connected to an HDMI display, you can also see the progress bar of burning the Orange Pi OS (Droid) image to eMMC from the HDMI display



13) When the HDMI monitor displays the following information, it means that the burning of the Orange Pi OS (Droid) image to the eMMC has been completed. At this time, the TF card can be pulled out, and then the Orange Pi OS (Droid) system in the eMMC will start to start .



2. 9. Start the Orange Pi development board

1) The development board has an on-board eMMC, and the Orange Pi OS (Droid) image is burned by default. You can directly use the image in the eMMC to start and fully function test after you get the development board.

2) If you need to use the linux image, you can insert the TF card with the linux image burned into the TF card slot of the Orange Pi development board.

3) The development board has an HDMI interface, and the development board can be connected to a TV or HDMI display through an HDMI-to-HDMI cable. If you buy an LCD screen, you can also use the LCD screen to display the system interface of the development board. If there is a Type-C to HDMI cable, the system interface of the development board can also be displayed through the Type-C interface.

4) Connect a USB mouse and keyboard to control the Orange Pi development board.

5) The development board has an Ethernet port, which can be plugged into a network cable for Internet access.

6) Connect a high-quality power adapter with a 5V/4A USB Type-C interface.

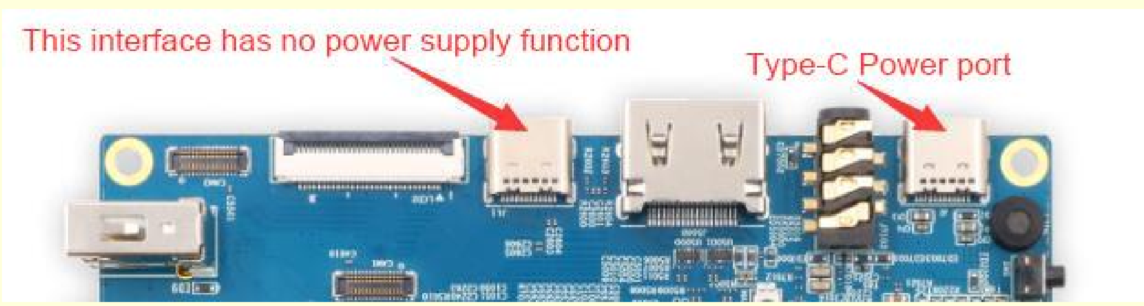
Remember not to plug in a power adapter with a voltage output greater than 5V, as this will burn out the development board.

Many unstable phenomena during the power-on and start-up process of the system are basically caused by problems with the power supply, so a reliable power adapter is very important. If you find that there is a phenomenon of continuous restart during the startup process, please replace the power supply or the Type-C data cable and try again.

The Type-C power port does not support PD negotiation.

In addition, please do not connect the USB interface of the computer to power the development board.

There are two Type-C ports that look the same on the development board. The one on the right is the power port, and the one in the middle has no power supply function. Please don't connect it wrong.



7) Then turn on the switch of the power adapter. If everything is normal, you can see the startup screen of the system on the HDMI monitor or LCD screen.

8) If you want to view the output information of the system through the debugging serial port, please use the serial cable to connect the development board to the computer. For the connection method of the serial port, please refer to the section on **how to use the debugging serial port**.

2. 10. How to use the debugging serial port

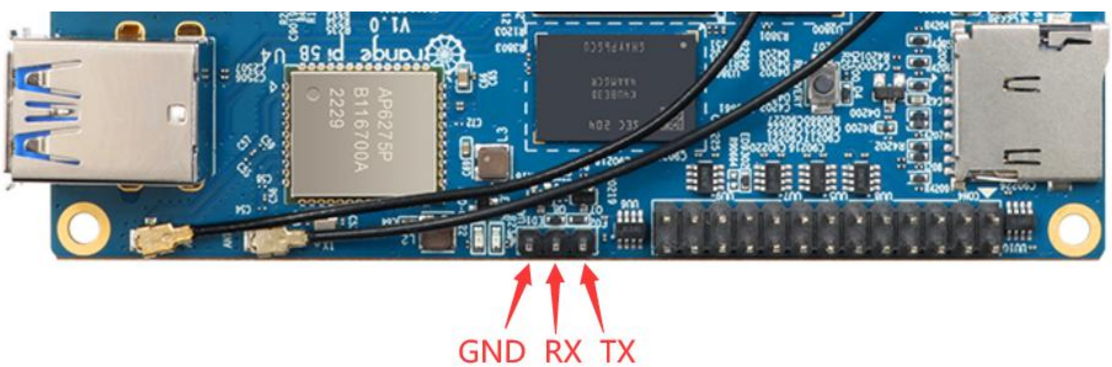
2. 10. 1. Connection instruction of debugging serial port

1) First, you need to prepare a 3.3V USB to TTL module, and then insert the USB interface end of the USB to TTL module into the USB interface of the computer.

For better compatibility, it is recommended to use the CH340 USB to TTL module instead of the CP2102 USB to TTL module.

Before purchasing a USB to TTL module, please confirm that the module supports a baud rate of 1500000.

2) The corresponding relationship between GND, RXD and TXD pins of the debugging serial port of the development board is shown in the figure below



3) The GND, TXD and RXD pins of the USB to TTL module need to be connected to the debugging serial port of the development board through a DuPont line

a. The GND of the USB to TTL module is connected to the GND of the development board
b. The RX of the USB to TTL module is connected to the TX of the development board
c. The TX of the USB to TTL module is connected to the RX of the development board

4) The schematic diagram of connecting the USB to TTL module to the computer and the Orange Pi development board is as follows

Schematic diagram of connecting the USB to TTL module to the computer and the Orange Pi development board

The TX and RX of the serial port need to be cross-connected. If you don't want to carefully distinguish the order of TX and RX, you can connect the TX and RX of the serial port casually. If there is no output in the test, then exchange the order of TX and RX, so that there is always a the order is right

2. 10. 2. How to use the debugging serial port on the Ubuntu platform

There are many serial port debugging software that can be used under Linux, such as putty, minicom, etc. The following demonstrates how to use putty.

1) First, insert the USB-to-TTL module into the USB port of the Ubuntu computer. If the connection and recognition of the USB-to-TTL module is normal, you can see the corresponding device node name under **/dev** on the Ubuntu PC. Remember this node name, and then set the serial port software will be used

```
test@test:~$ ls /dev/ttyUSB*
/dev/ttyUSB0
```

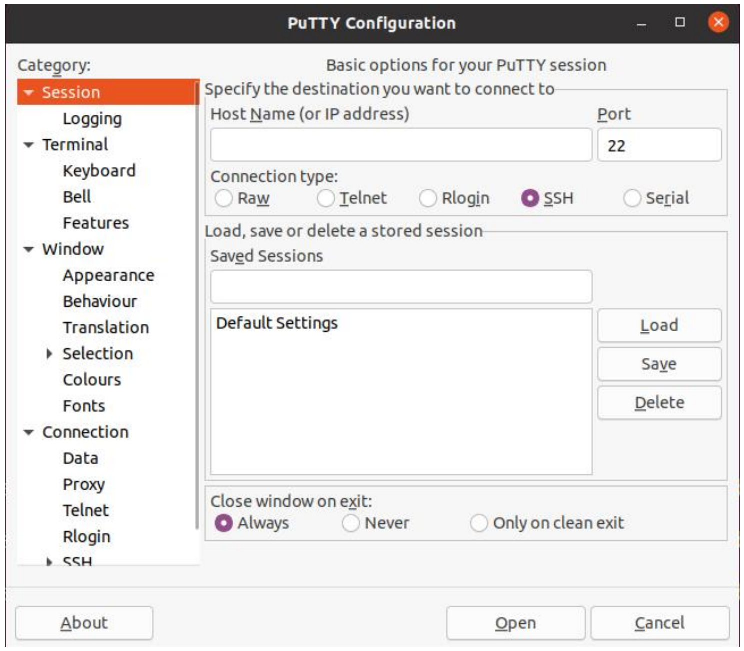
2) Then use the following command to install putty on Ubuntu PC

```
test@test:~$ sudo apt-get update
test@test:~$ sudo apt-get install -y putty
```

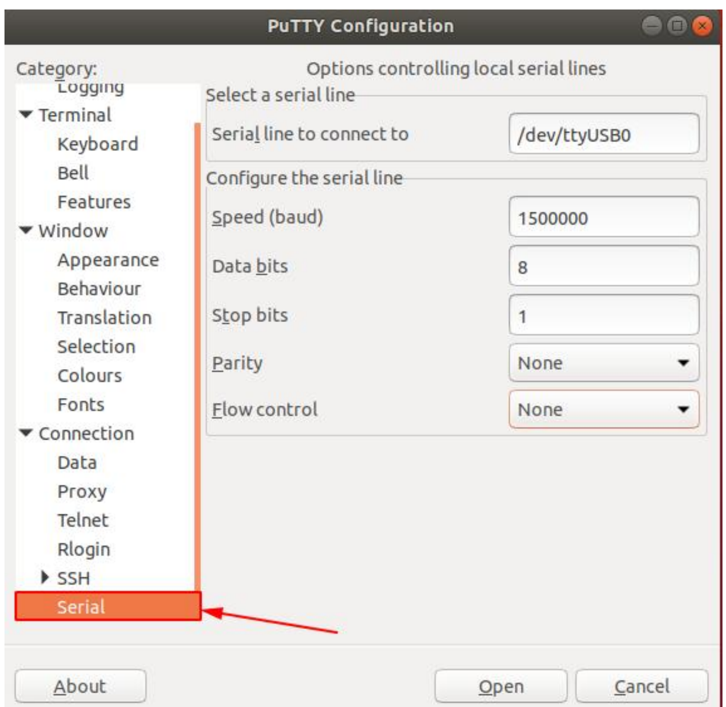
3) Then run putty, **remember to add sudo permission**

```
test@test:~$ sudo putty
```

4) After executing the putty command, the following interface will pop up



5) First select the setting interface of the serial port

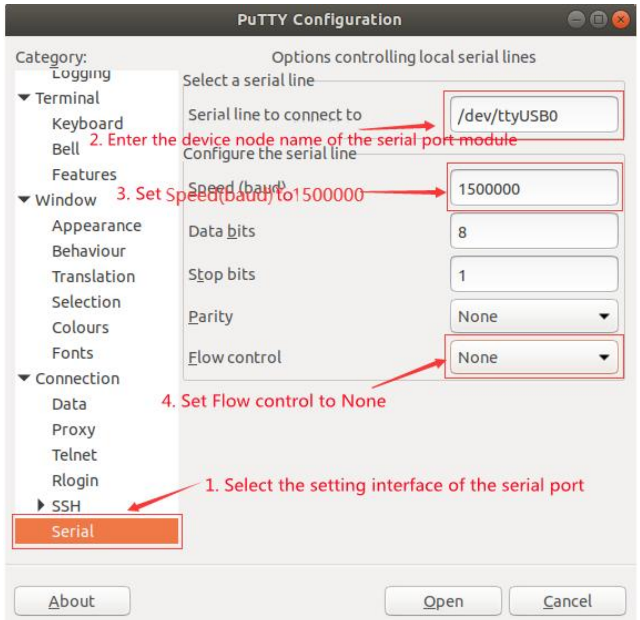


6) Then set the parameters of the serial port

a. Set the Serial line to connect to as /dev/ttyUSB0 (modify to the corresponding node name, generally /dev/ttyUSB0)

b. Set Speed(baud) to 1500000 (the baud rate of the serial port)

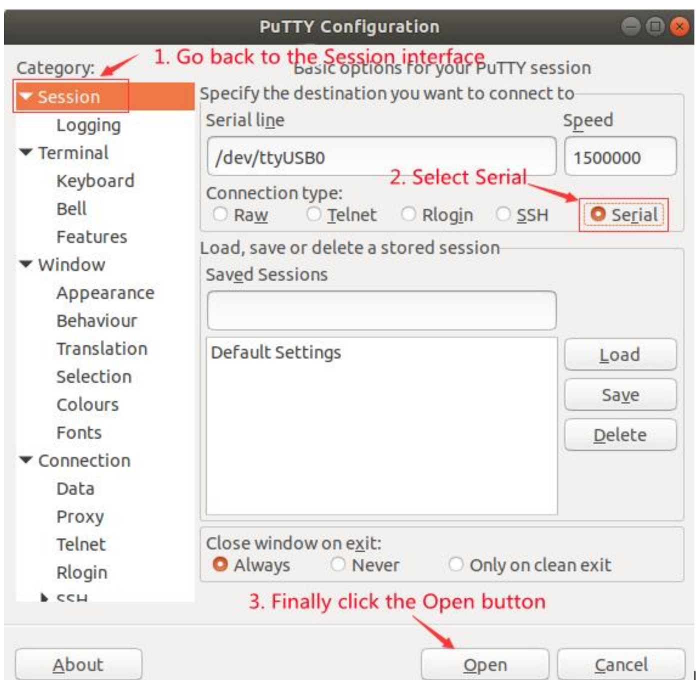
c. Set Flow control to None



7) After setting the serial port setting interface, return to the Session interface

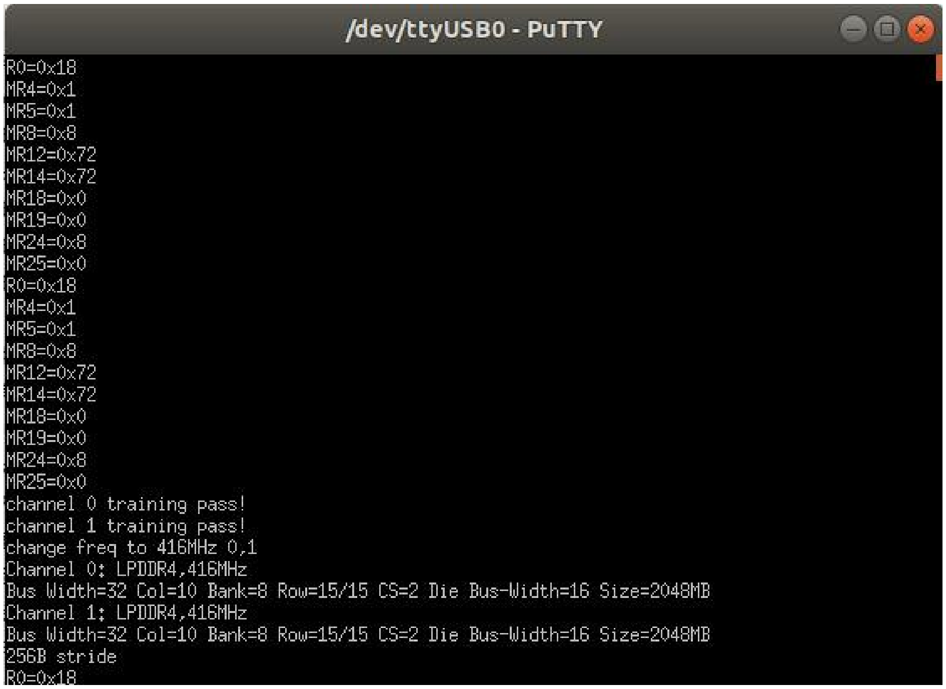
a. First select the Connection type as Serial

b. Then click the Open button to connect to the serial port



8) After starting the development board, you can see the Log information output by the

system from the opened serial port terminal



2. 10. 3. How to use the debugging serial port on Windows platform

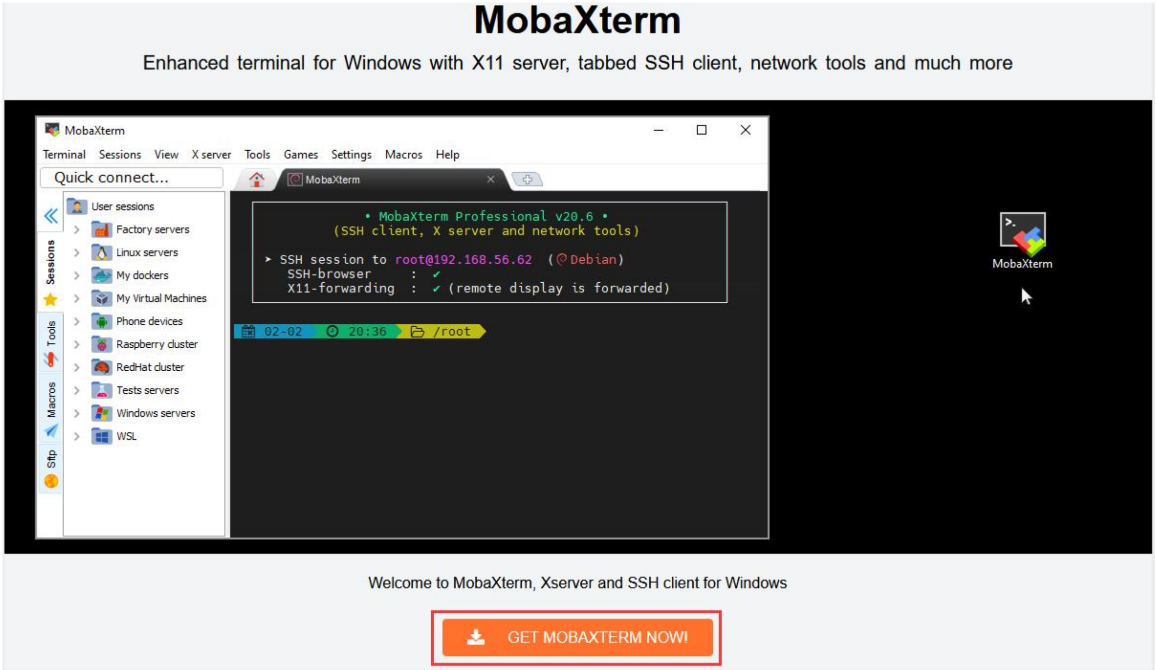
There are many serial port debugging software that can be used under Windows, such as SecureCRT, MobaXterm, etc. The following demonstrates how to use MobaXterm. This software has a free version and can be used without buying a serial number.

1) Download MobaXterm

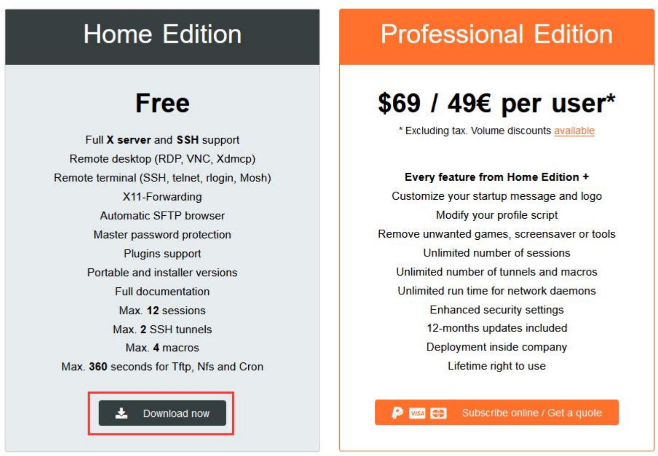
a. Download MobaXterm website as follows

https://mobaxterm.mobatek.net

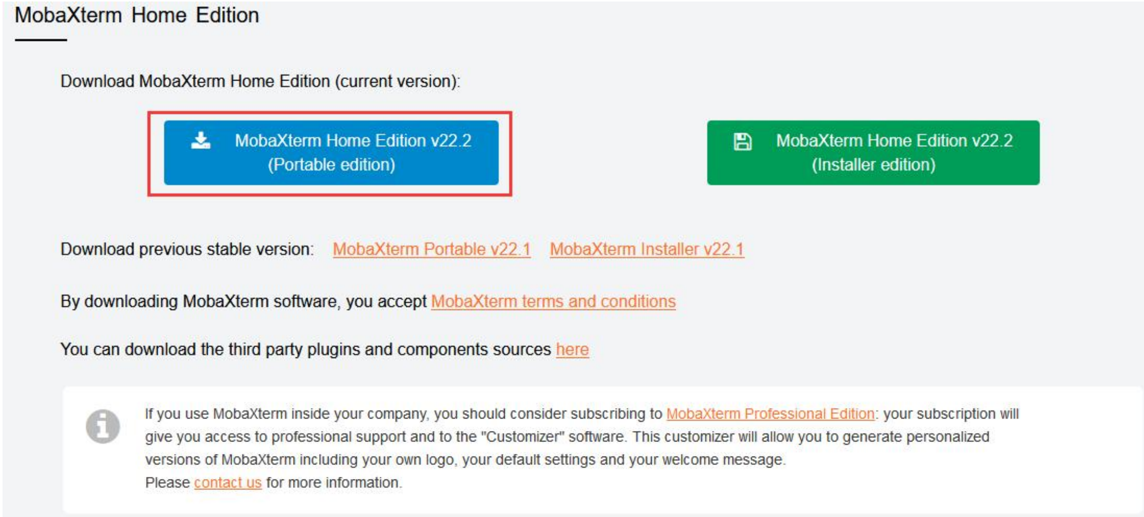
b. After entering the MobaXterm download page, click **GET XOBATERM NOW!**



c. Then choose to download the Home version



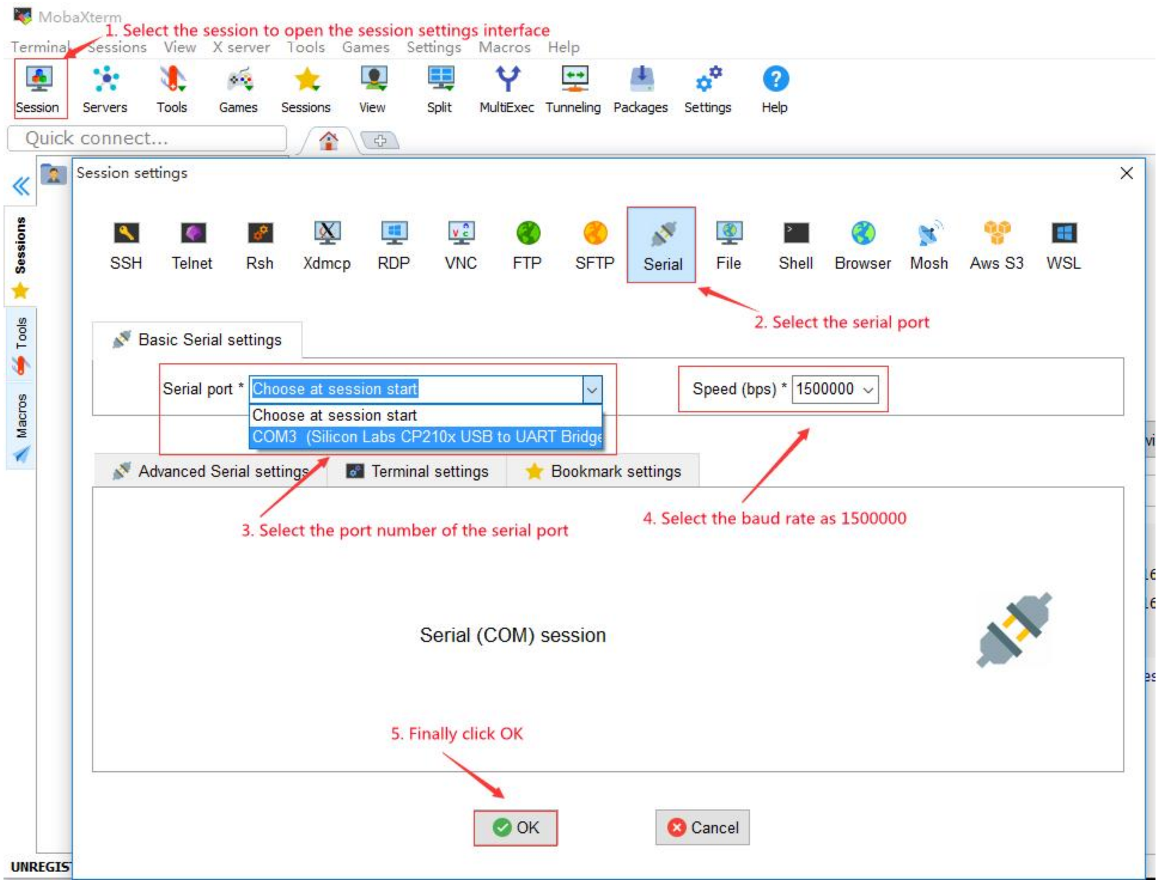
d. Then select Portable portable version, no need to install after downloading, just open it and use it



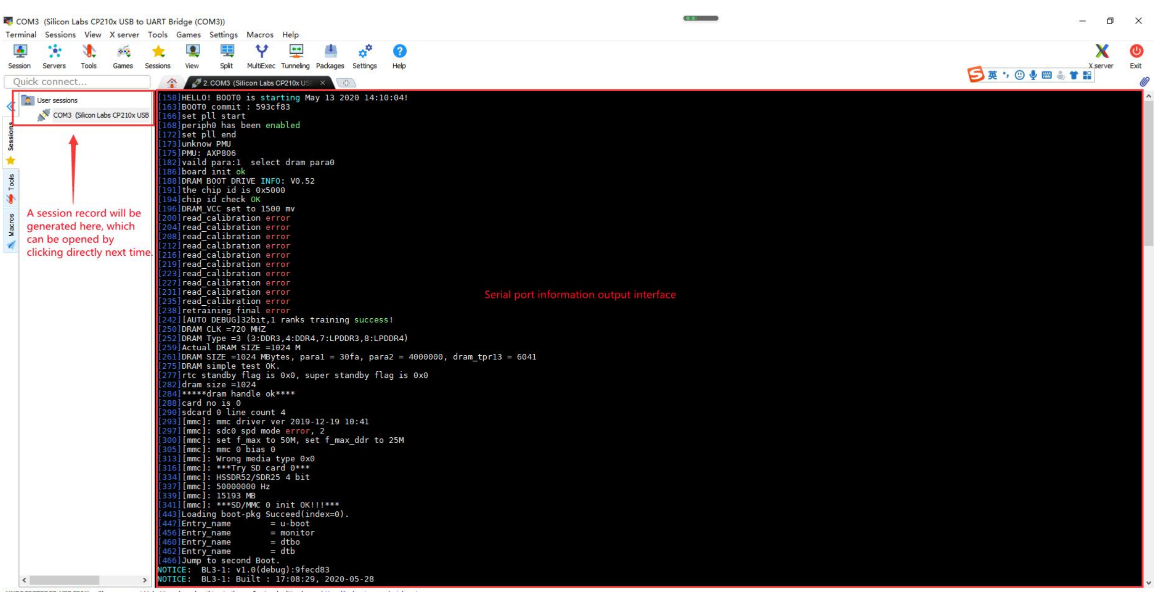
2) After downloading, use decompression software to decompress the downloaded compressed package, you can get the executable software of MobaXterm, and then double-click to open

3) After opening the software, the steps to set up the serial port connection are as follows

a. Select the serial port type
b. Select the port number of the serial port (select the corresponding port number according to the actual situation), if you can't see the port number, please use **360 Driver Master** to scan and install the driver of the USB to TTL serial port chip
c. Select the baud rate of the serial port as **1500000**
d. Finally click the "**OK**" button to complete the settings



4) After clicking the "**OK**" button, you will enter the following interface. At this time, start the development board and you can see the output information of the serial port



2.11. Instructions for using the 5v pin in the 26pin interface of the development board to supply power

The power supply method we recommend for the development board is to use the 5V/4A Type C interface power cord to plug into the Type-C power interface of the development board for power supply. If you need to use the 5V pin in the 26pin interface to power the development board, please make sure that the power cord and power adapter used can meet the power supply requirements of the development board. If the use is unstable, please switch back to the Type-C power supply.

1) First, you need to prepare a power cord as shown in the figure below

The power cord shown in the picture above can be bought on Taobao, please search and buy by yourself.

2) Use the 5V pin in the 26pin interface to supply power to the development board. The connection method of the power line is as follows

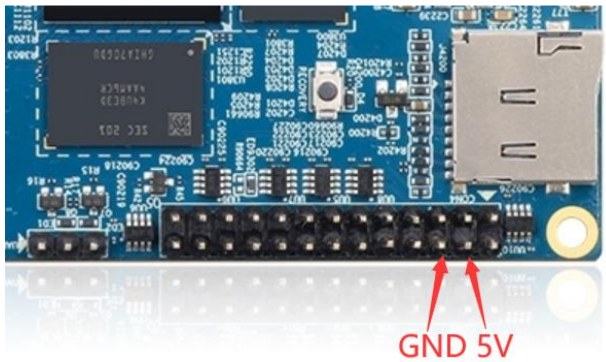
a. The USB A port of the power cord shown in the above picture needs to be plugged into the 5V/4A power adapter connector (**please do not plug into the**

USB port of the computer for power supply)

b. b. The red DuPont line needs to be plugged into the 5V pin of the development board 26pin

c. c. The black DuPont line needs to be inserted into the GND pin of the 26pin interface

d. The position of the 5V pin and GND pin of the 26pin interface on the development board is shown in the figure below, **remember not to reverse the connection**



3. Linux system instructions

Ubuntu images and Debian images are generally referred to as Linux images (they both use the Linux kernel), so when you see a Linux image or Linux system in the manual, it refers to a image or system like Ubuntu or Debian.

Many people will have doubts about whether they can use pure Ubuntu or pure Debian systems (pure here can be understood as systems downloaded from Ubuntu or Debian official websites). The answer is no, because Ubuntu and Debian do not provide an adapted system for the Orange Pi development board.

We can see from the official websites of Ubuntu and Debian that they both support the arm64 architecture (the SOC of the development board is the arm64 architecture), but please note that the support mentioned here refers only to the arm64 version of the software warehouse provided by Ubuntu or Debian (including Tens of thousands of software packages) or rootfs (these are the packages that Orange Pi uses when making Ubuntu or Debian systems). To make an Ubuntu or Debian system that can be used for a certain development board also needs to transplant U-boot and Linux kernel, etc., as well as repair the encountered bugs and optimize some functions, all of which are done by Orange Pi.

If Linux distributions such as CentOS, Kali, or OpenWRT are not ported by other developers or ported and adapted by themselves, they cannot be used on the development board of Orange Pi (hardware running these systems is no problem).

In addition, people often ask whether the system of other development boards can be used on the Orange Pi development board. The answer is no, because the chips and circuit connections used by different development boards are generally different. A system developed for a certain development board basically cannot be used on other development boards.

The content of this chapter is written based on the image of the server version and the image of the xfce desktop version.

If you are using the Ubuntu22.04 Gnome image, please first check the instructions in the chapter Ubuntu22.04 Gnome Wayland Desktop System Instructions,

You can refer to the instructions in this chapter for the content that does not exist in the chapter of Ubuntu22.04 Gnome Wayland Desktop System User Manual, but some details may be different, please pay special attention to this point.

3. 1. Supported Linux image types and kernel versions

Linux image type	kernel version	server version	desktop version
Debian 11 - Bullseye	Linux5.10	support	support
Ubuntu 20.04 - Focal	Linux5.10	support	support
Ubuntu 22.04 - Jammy	Linux5.10	support	support

3. 2. Linux system adaptation

Function	Linux5.10 driver	Debian11	Ubuntu20.04	Ubuntu22.04
USB2.0x2	OK	OK	OK	OK
USB3.0x1	OK	OK	OK	OK
USB Type-C 3.0	OK	OK	OK	OK
DP display	OK	OK	OK	OK

eMMC	**OK**	**OK**	**OK**	**OK**
AP6275P-WIFI	**OK**	**OK**	**OK**	**OK**
AP6275P-Bluetooth	**OK**	**OK**	**OK**	**OK**
GPIO（26pin）	**OK**	**OK**	**OK**	**OK**
UART（26pin）	**OK**	**OK**	**OK**	**OK**
SPI（26pin）	**OK**	**OK**	**OK**	**OK**
I2C（26pin）	**OK**	**OK**	**OK**	**OK**
CAN（26pin）	**OK**	**OK**	**OK**	**OK**
PWM（26pin）	**OK**	**OK**	**OK**	**OK**
3pin debugging serial port	**OK**	**OK**	**OK**	**OK**
TF card start	**OK**	**OK**	**OK**	**OK**
HDMI video	**OK**	**OK**	**OK**	**OK**
HDMI audio	**OK**	**OK**	**OK**	**OK**
OV13850 camera	**OK**	**OK**	**OK**	**OK**
OV13855 camera	**OK**	**OK**	**OK**	**OK**
LCD1	**OK**	**OK**	**OK**	**OK**
LCD2	**OK**	**OK**	**OK**	**OK**
Gigabit Ethernet port	**OK**	**OK**	**OK**	**OK**
Network port status light	**OK**	**OK**	**OK**	**OK**
MIC	**OK**	**OK**	**OK**	**OK**
headphone playback	**OK**	**OK**	**OK**	**OK**
headphone recording	**OK**	**OK**	**OK**	**OK**
LED	**OK**	**OK**	**OK**	**OK**
GPU	**OK**	**OK**	**OK**	**OK**
NPU	**OK**	**OK**	**OK**	**OK**
VPU	**OK**	**OK**	**OK**	**OK**
switch button	**OK**	**OK**	**OK**	**OK**
watchdog test	**OK**	**OK**	**OK**	**OK**
Chromium hard solution video	**OK**	**OK**	**OK**	**OK**

3. 3. The format of linux commands in this manual

1) In this manual, all commands that need to be entered in the Linux system will be framed in the following box

As shown below, the content in the yellow box indicates the content that needs special attention, except for the commands in it.

2) Description of the prompt type in front of the command

a. The prompt in front of the command refers to the content of the red part in the box below, which is not part of the linux command, so when entering the command in the linux system, please do not enter the content of the red font part.

```
orangepi@orangepi:~$ sudo apt update
root@orangepi:~# vim /boot/boot.cmd
test@test:~$ ssh root@192.168.1.xxx
root@test:~# ls
```

b. **root@orangepi:~$** prompt indicates that this command is entered in **the linux system of the development board.** The **$** at the end of the prompt indicates that the current user of the system is an ordinary user. When executing a privileged command, you need to add **sudo**

c. **root@orangepi:~#** prompt indicates that this command is entered in **the linux system of the development board**, and the last # of the prompt indicates that the current user of the system is the root user, who can execute any desired command

d. **test@test:~$** prompt indicates that this command is entered in the Ubuntu PC or Ubuntu virtual machine, not in the linux system of the development board. The $ at the end of the prompt indicates that the current user of the system is an ordinary user. When executing privileged commands, **sudo** needs to be added

e. **root@test:~#** prompt indicates that this command is entered in the Ubuntu PC or Ubuntu virtual machine, not in the linux system of the development board. The # at the end of the prompt indicates that the current user of the system is the root user and can execute any command you want

3) What are the commands that need to be entered?

a. As shown below, **the black bold part** is the command that needs to be input, and the content below the command is the output content (some commands have output, some may not have output), this part of the content does not need to be input

```
root@orangepi:~# cat /boot/orangepiEnv.txt
verbosity=7
bootlogo=false
console=serial
```

b. As shown below, some commands cannot be written in one line and will be placed on the next line. As long as the black and bold parts are all commands that need to be input. When these commands are entered into one line, the last "\" of each line needs to be removed, this is not part of the command. In addition, there are spaces in different parts of the command, please don't miss it

```
orangepi@orangepi:~$ echo \
"deb [arch=$(dpkg --print-architecture) \
signed-by=/usr/share/keyrings/docker-archive-keyring.gpg] \
https://download.docker.com/linux/debian \
$(lsb_release -cs) stable" | sudo tee /etc/apt/sources.list.d/docker.list > /dev/null
```

3. 4. Linux system login instructions

3. 4. 1. Linux system default login account and password

account	password
root	orangepi
orangepi	orangepi

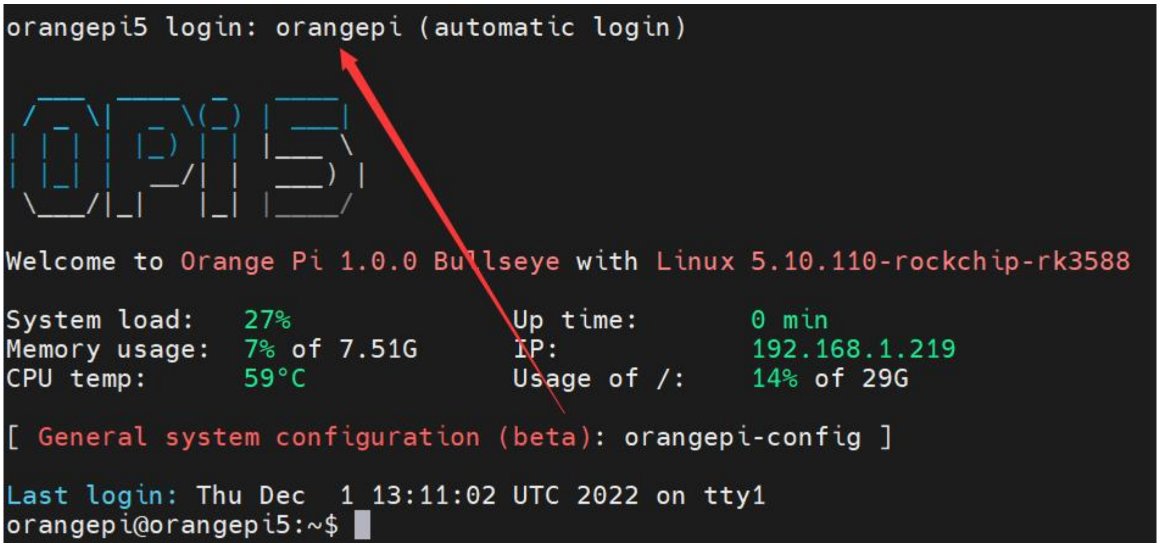
Note that when entering the password, the specific content of the entered password will not be displayed on the screen, please do not think that there is any fault, just press Enter after inputting.

When the wrong password is prompted, or there is a problem with the ssh connection, please note that as long as you are using the Linux image provided by Orange Pi, please do not suspect that the above password is wrong, but look for

other reasons.

3. 4. 2. How to set automatic terminal login in linux system

1) By default, the Linux system automatically logs in to the terminal, and the default login user name is **orangepi**



2) Use the following command to set the root user to automatically log in to the terminal

```
orangepi@orangepi:~$ sudo auto_login_cli.sh root
```

3) Use the following command to disable automatic login terminal

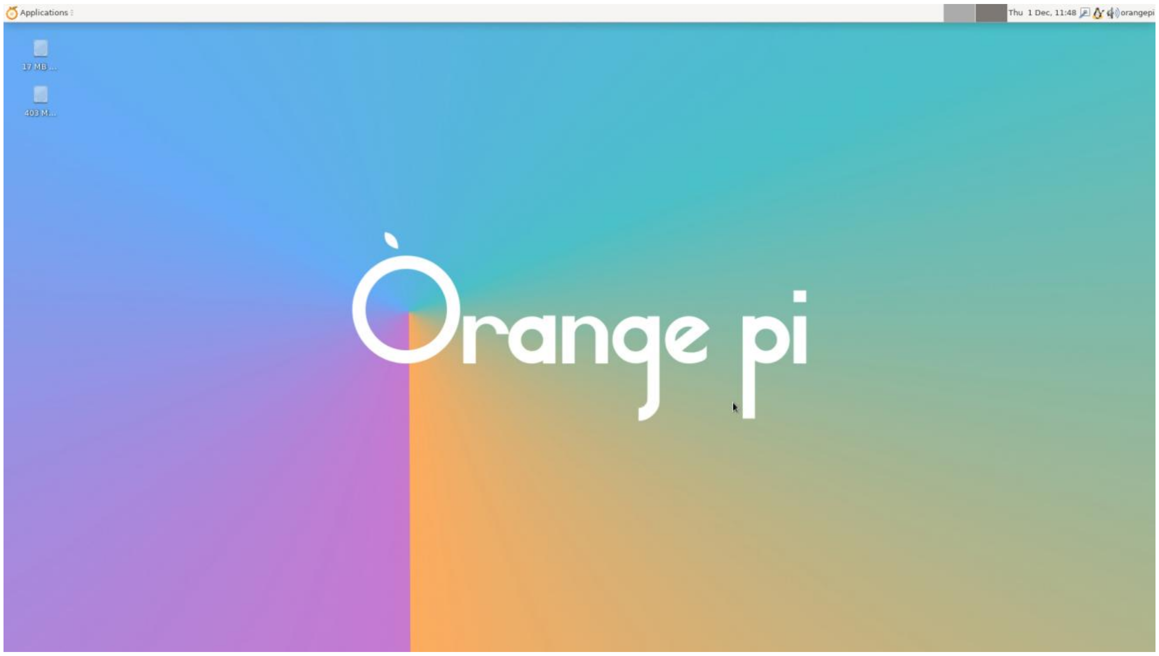
```
orangepi@orangepi:~$ sudo auto_login_cli.sh -d
```

4) Use the following command to set the orangepi user to automatically log in to the terminal again

```
orangepi@orangepi:~$ sudo auto_login_cli.sh orangepi
```

3. 4. 3. Instructions for automatic login of Linux desktop version system

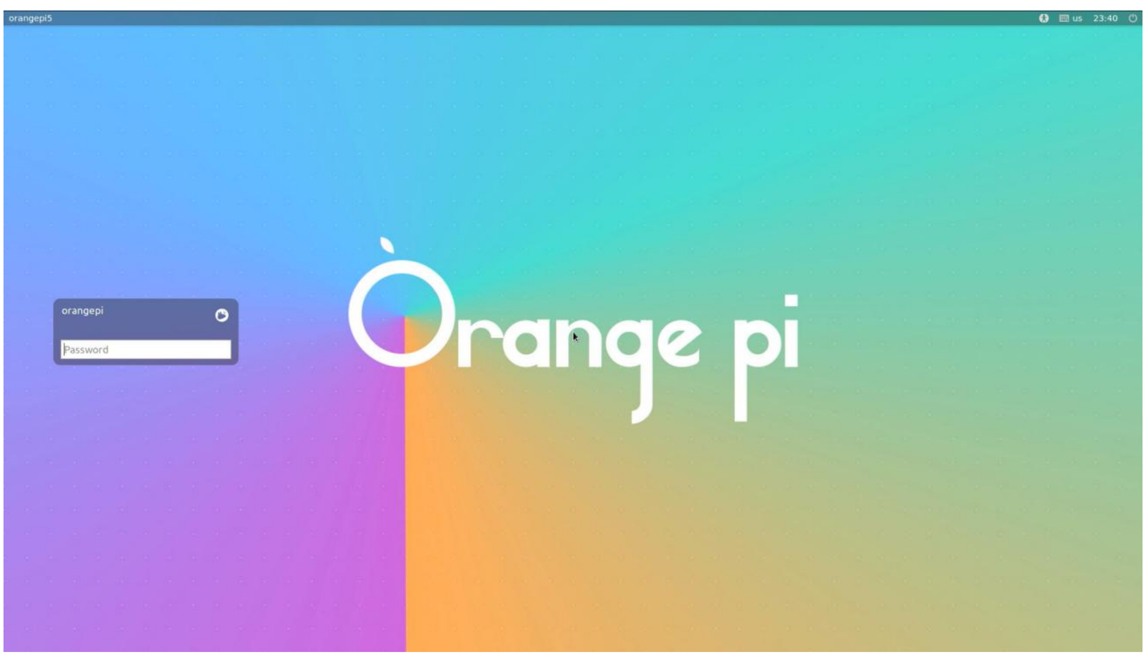
1) After the desktop version system is started, it will automatically log in to the desktop without entering a password



2) Run the following command to prohibit the desktop system from automatically logging into the desktop

```
orangepi@orangepi:~$ sudo disable_desktop_autologin.sh
```

3) Then restart the system and a login dialog box will appear, at which point a password is required to enter the system



3. 4. 4. The setting method of root user automatic login in Linux desktop version system

1) Execute the following command to set the desktop system to automatically log in as the root user

```
orangepi@orangepi:~$ sudo desktop_login.sh root
```

2) Then restart the system, it will automatically use the root user to log in to the desktop

Note that if you log in to the desktop system as the root user, you cannot use pulseaudio in the upper right corner to manage audio devices.

Also note that this is not a bug, since pulseaudio is not allowed to run as root.

3) Execute the following command to set the desktop system to log in automatically with the orangepi user again

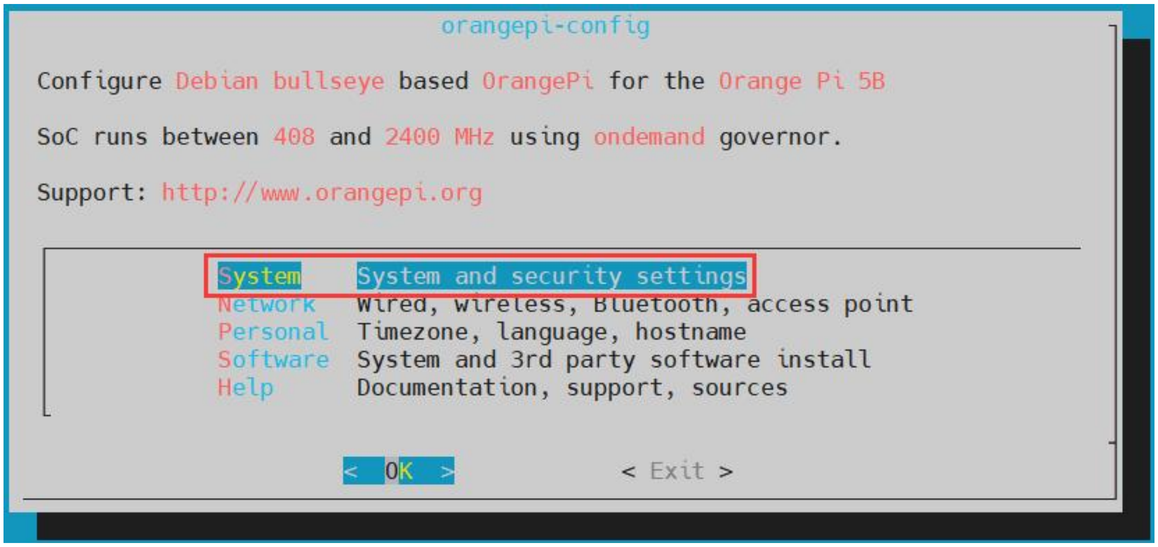
```
orangepi@orangepi:~$ sudo desktop_login.sh orangepi
```

3. 4. 5. The method of disabling the desktop in the Linux desktop version system

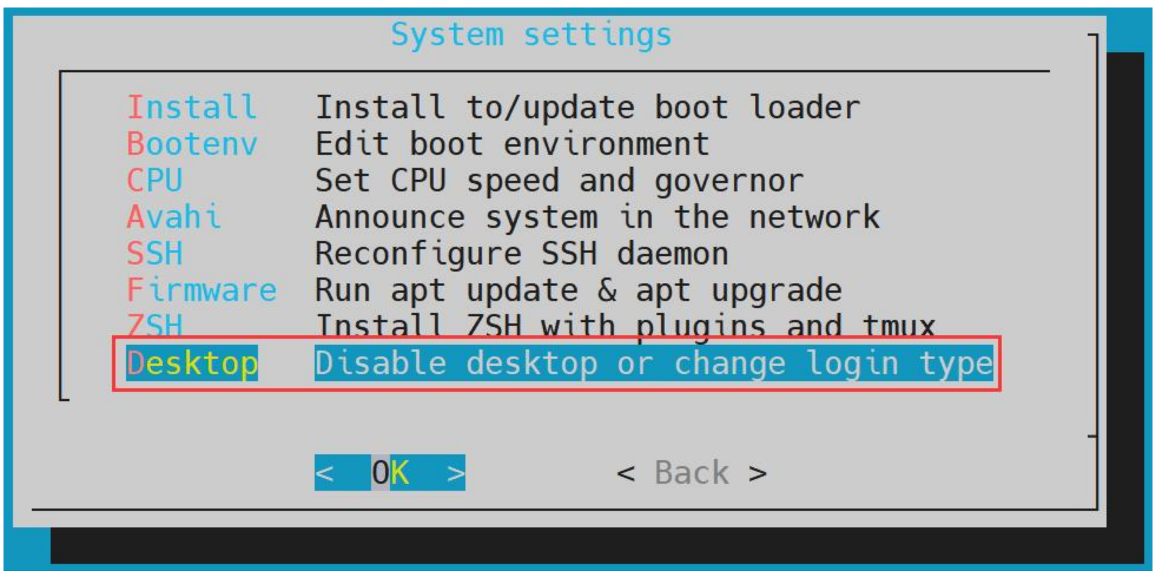
1) First enter the following command in the command line, **please remember to add sudo permission**

```
orangepi@orangepi:~$ sudo orangepi-config
```

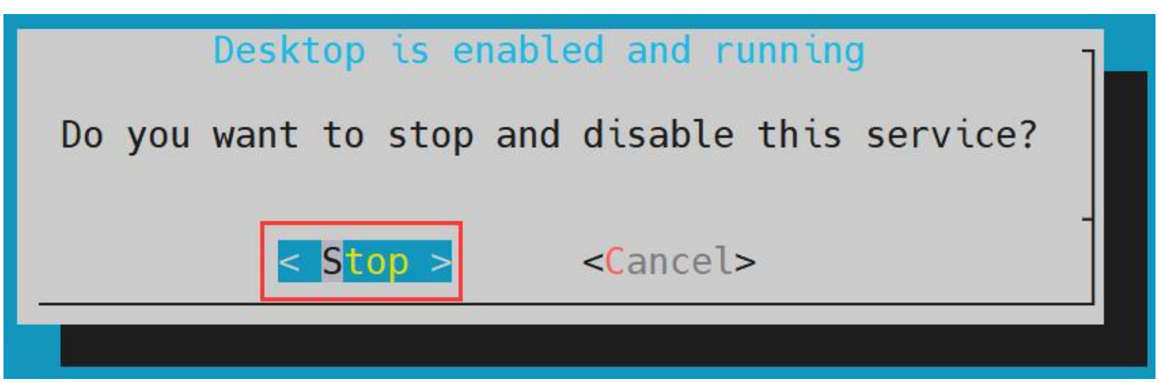
2) Then select **System**



3) Then select **Desktop**



4) Then select **<Stop>**



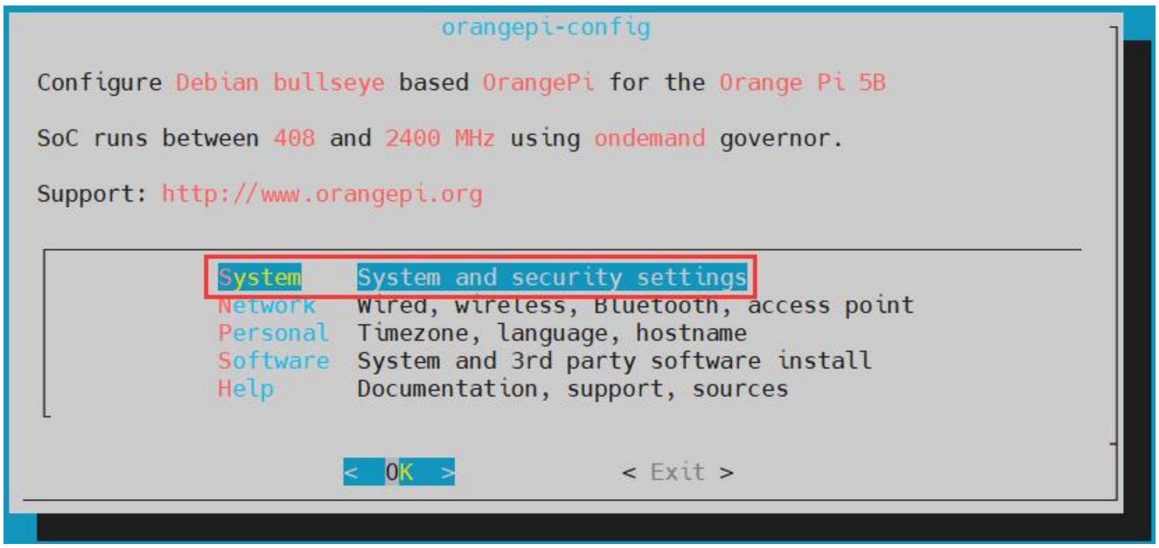
5) **Then restart the Linux system and you will find that the desktop will not be displayed**

6) The steps to reopen the desktop are as follows:

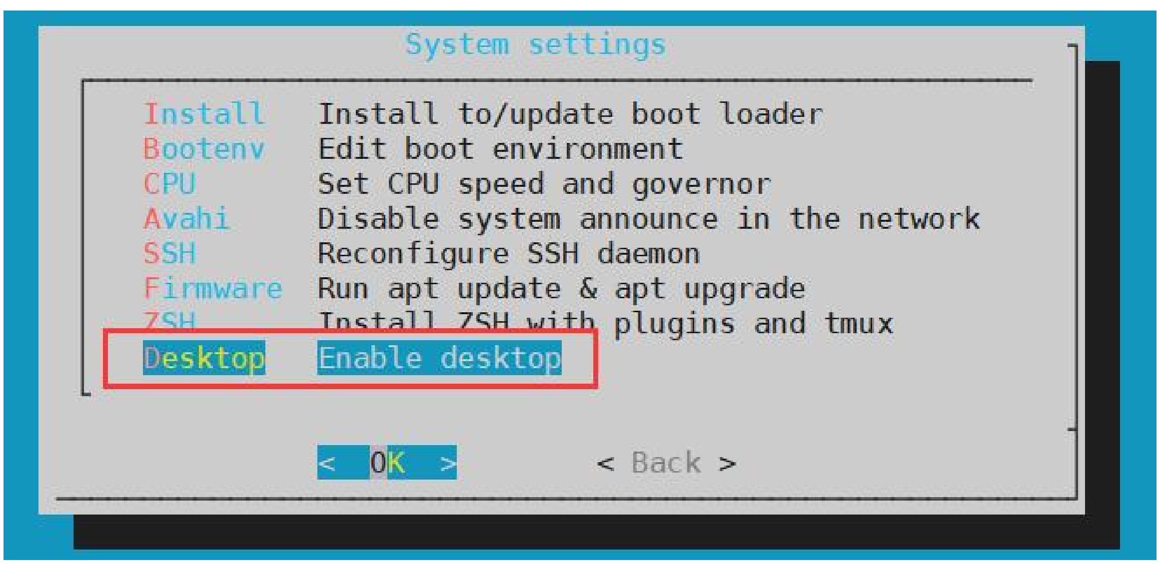
a. First enter the following command in the command line, **please remember to add sudo permission**

```
orangepi@orangepi:~$ sudo orangepi-config
```

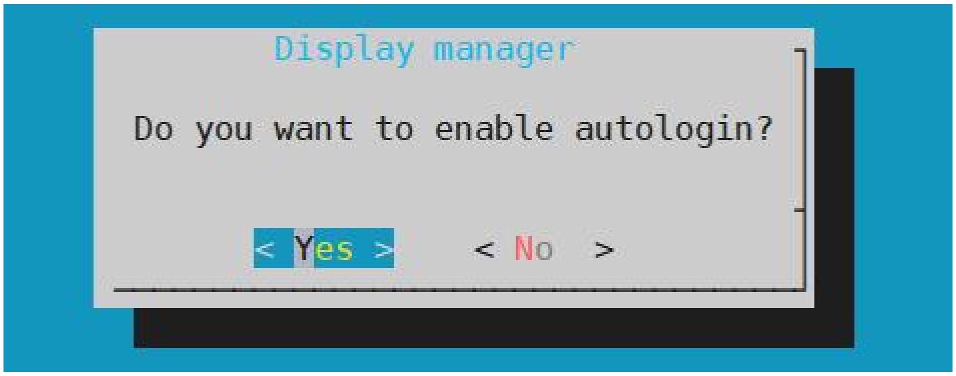
b. Then select **System**



c. Then select **Desktop Enable desktop**



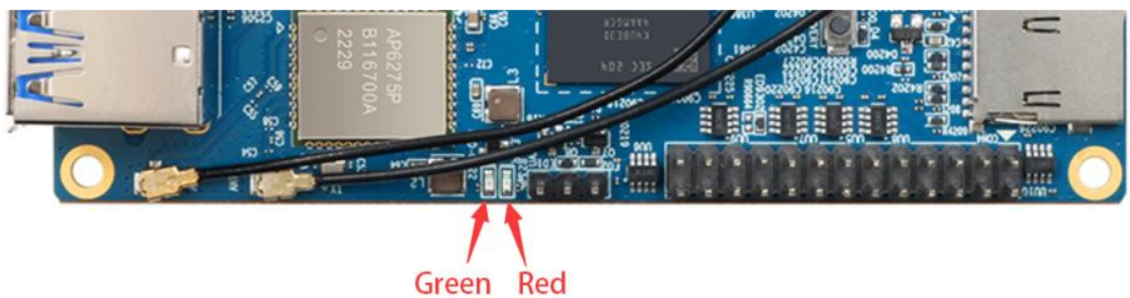
d. Then choose whether to automatically log in to the desktop. If you select **<Yes>**, you will automatically log in to the desktop. If you select **<No>**, the input interface for user and password will be displayed, and you need to enter the password to enter the desktop.



e. After selection, the HDMI monitor will display the desktop

3. 5. Onboard LED Light Test Instructions

1) There are two LED lights on the development board, one is green and the other is red. The location is shown in the figure below:



2) As long as the development board is powered on, the red LED light will always be on, which is controlled by the hardware and cannot be turned off by the software.

3) The green LED light will keep flashing after the kernel is started, which is controlled by software.

4) The method of setting the green light on and off and flashing is as follows

Note that the following operations should be performed under the root user.

a. First enter the setting directory of the green light

```
root@orangepi:~# cd /sys/class/leds/status_led
```

b. The command to set the green light to stop flashing is as follows

```
root@orangepi:/sys/class/leds/status_led# echo none > trigger
```

c. The command to set the green light to be on is as follows

```
root@orangepi:/sys/class/leds/status_led# echo default-on > trigger
```

d. The command to set the green light to flash is as follows

```
root@orangepi:/sys/class/leds/status_led# echo heartbeat > trigger
```

3. 6. Network connection test

3. 6. 1. Ethernet port test

1) First, insert one end of the network cable into the Ethernet interface of the development board, and connect the other end of the network cable to the router, and ensure that the network is unblocked

2) After the system starts, it will automatically assign an IP address to the Ethernet card through **DHCP**, **without any other configuration**

3) The command to view the IP address in the Linux system of the development board is as follows

```
orangepi@orangepi:~$ ip addr show eth0
2: eth0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc mq state UP group default qlen 1000
    link/ether 4a:fe:2b:3d:17:1c brd ff:ff:ff:ff:ff:ff
    inet 192.168.1.150/24 brd 192.168.1.255 scope global dynamic noprefixroute eth0
        valid_lft 43150sec preferred_lft 43150sec
    inet6 fe80::9a04:3703:faed:23be/64 scope link noprefixroute
        valid_lft forever preferred_lft forever
```

When using ifconfig to view the IP address, if the following information is prompted, it is because sudo is not added. The correct command is: sudo ifconfig

```
orangepi@orangepi:~$ ifconfig
Command 'ifconfig' is available in the following places
  * /sbin/ifconfig
  * /usr/sbin/ifconfig
```

```
The command could not be located because '/sbin:/usr/sbin' is not included in the PATH environment variable.
This is most likely caused by the lack of administrative privileges associated with your user account.
ifconfig: command not found
```

There are three ways to check the IP address after the development board starts:

1. Connect the HDMI monitor, then log in to the system and use the ip addr show eth0 command to view the IP address

2. Enter the ip addr show eth0 command in the debugging serial terminal to view the IP address

3. If there is no debugging serial port and no HDMI display, you can also check the IP address of the development board's network port through the router's management interface. However, in this method, some people often cannot see the IP address of the development board normally. If you can't see it, the debug method looks like this:

A) First check whether the Linux system has started normally. If the green light of the development board is blinking, it is generally started normally. If only the red light is on, it means that the system has not started normally;

B) Check whether the network cable is plugged in tightly, or try another network cable;

C) Try another router (I have encountered many problems with the router, such as the router cannot assign the IP address normally, or the IP address has been assigned normally but cannot be seen in the router);

D) If there is no router to replace, you can only connect to an HDMI display or use the debugging serial port to check the IP address.

In addition, it should be noted that the development board DHCP automatically assigns an IP address without any settings.

4) The command to test the network connectivity is as follows, the **ping** command can be interrupted through the shortcut key of Ctrl+C

```
orangepi@orangepi:~$ ping www.baidu.com -I eth0
PING www.a.shifen.com (14.215.177.38) from 192.168.1.12 eth0: 56(84) bytes of data.
```

```
64 bytes from 14.215.177.38 (14.215.177.38): icmp_seq=1 ttl=56 time=6.74 ms
64 bytes from 14.215.177.38 (14.215.177.38): icmp_seq=2 ttl=56 time=6.80 ms
64 bytes from 14.215.177.38 (14.215.177.38): icmp_seq=3 ttl=56 time=6.26 ms
64 bytes from 14.215.177.38 (14.215.177.38): icmp_seq=4 ttl=56 time=7.27 ms
^C
--- www.a.shifen.com ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3002ms
rtt min/avg/max/mdev = 6.260/6.770/7.275/0.373 ms
```

3.6.2. WIFI connection test

Please do not connect to WIFI by modifying the /etc/network/interfaces configuration file. There will be problems connecting to the WIFI network in this way.

3.6.2.1. The server image connects to WIFI through commands

When the development board is not connected to Ethernet, not connected to HDMI display, but only connected to the serial port, it is recommended to use the commands demonstrated in this section to connect to the WIFI network. Because nmtui can only display characters in some serial port software (such as minicom), and cannot display the graphical interface normally. Of course, if the development board is connected to an Ethernet or HDMI display, you can also use the commands demonstrated in this section to connect to the WIFI network.

1) First log in to the linux system, there are the following three ways

   a. If the development board is connected with a network cable, you can remotely log in to the Linux system through ssh

   a. If the development board is connected to the debugging serial port, you can use the serial port terminal to log in to the Linux system

   b. If the development board is connected to the HDMI display, you can log in to the linux system through the terminal displayed on the HDMI

2) First use the nmcli dev wifi command to scan the surrounding WIFI hotspots

```
orangepi@orangepi:~$ nmcli dev wifi
```

```
root@orangepi:~# nmcli dev wifi
IN-USE  BSSID              SSID                 MODE   CHAN  RATE        SIGNAL  BARS  SECURITY
        28:6C:07:6E:87:2E  [redacted]_orangepi  Infra  9     260 Mbit/s  97      ▂▄▆█  WPA1 WPA2
        D8:D8:66:A5:BD:D1  [redacted]           Infra  10    270 Mbit/s  90      ▂▄▆█  WPA1 WPA2
        A0:40:A0:A1:72:20  [redacted]           Infra  4     405 Mbit/s  82      ▂▄▆█  WPA2
        28:6C:07:6E:87:2F  [redacted] orangepi_5G  Infra  149   540 Mbit/s  80      ▂▄▆_  WPA1 WPA2
        CA:50:E9:89:E2:44  [redacted]           Infra  1     130 Mbit/s  79      ▂▄▆_  WPA1 WPA2
        A0:40:A0:A1:72:31  [redacted]           Infra  100   405 Mbit/s  67      ▂▄▆_  WPA2
        D4:EE:07:08:A9:E0  [redacted]           Infra  4     130 Mbit/s  55      ▂▄__  WPA1 WPA2
        88:C3:97:49:25:13  [redacted]           Infra  6     130 Mbit/s  52      ▂▄__  WPA1 WPA2
        00:BD:82:51:53:C2  [redacted]           Infra  12    130 Mbit/s  49      ▂▄__  WPA1 WPA2
        C0:61:18:FA:49:37  [redacted]           Infra  149   270 Mbit/s  47      ▂▄__  WPA1 WPA2
        04:79:70:8D:0C:B8  [redacted]           Infra  153   270 Mbit/s  47      ▂▄__  WPA2
        04:79:70:FD:0C:B8  [redacted]           Infra  153   270 Mbit/s  47      ▂▄__  WPA2
        9C:A6:15:DD:E6:0C  [redacted]           Infra  10    270 Mbit/s  45      ▂▄__  WPA1 WPA2
        B4:0F:3B:45:D1:F5  [redacted]           Infra  48    270 Mbit/s  45      ▂▄__  WPA1 WPA2
        E8:CC:18:4F:7B:44  [redacted]           Infra  157   135 Mbit/s  45      ▂▄__  WPA1 WPA2
        B0:95:8E:D8:2F:ED  [redacted]           Infra  11    405 Mbit/s  39      ▂▄__  WPA1 WPA2
        C0:61:18:FA:49:36  [redacted]           Infra  11    270 Mbit/s  24      ▂___  WPA1 WPA2
root@orangepi:~#
```

3) Then use the nmcli command to connect to the scanned WIFI hotspot, where:

a. **wifi_name** needs to be replaced with the name of the WIFI hotspot you want to connect to

b. **wifi_passwd** needs to be replaced with the password of the WIFI hotspot you want to connect to

```
orangepi@orangepi:~$ nmcli dev wifi connect wifi_name password wifi_passwd
Device 'wlan0' successfully activated with 'cf937f88-ca1e-4411-bb50-61f402eef293'.
```

4) Through the **ip addr show wlan0** command, you can view the IP address of wifi

```
orangepi@orangepi:~$ ip addr show wlan0
11: wlan0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state UP group default qlen 1000
    link/ether 23:8c:d6:ae:76:bb brd ff:ff:ff:ff:ff:ff
    inet 192.168.1.11/24 brd 192.168.1.255 scope global dynamic noprefixroute wlan0
        valid_lft 259192sec preferred_lft 259192sec
    inet6 240e:3b7:3240:c3a0:c401:a445:5002:ccdd/64 scope global dynamic noprefixroute
        valid_lft 259192sec preferred_lft 172792sec
    inet6 fe80::42f1:6019:a80e:4c31/64 scope link noprefixroute
        valid_lft forever preferred_lft forever
```

5) Use the **ping** command to test the connectivity of the wifi network, and the **ping** command can be interrupted through the shortcut key **Ctrl+C**

```
orangepi@orangepi:~$ ping www.orangepi.org -I wlan0
PING www.orangepi.org (182.92.236.130) from 192.168.1.49 wlan0: 56(84) bytes of data.
64 bytes from 182.92.236.130 (182.92.236.130): icmp_seq=1 ttl=52 time=43.5 ms
64 bytes from 182.92.236.130 (182.92.236.130): icmp_seq=2 ttl=52 time=41.3 ms
64 bytes from 182.92.236.130 (182.92.236.130): icmp_seq=3 ttl=52 time=44.9 ms
64 bytes from 182.92.236.130 (182.92.236.130): icmp_seq=4 ttl=52 time=45.6 ms
64 bytes from 182.92.236.130 (182.92.236.130): icmp_seq=5 ttl=52 time=48.8 ms
^C
--- www.orangepi.org ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4006ms
rtt min/avg/max/mdev = 41.321/44.864/48.834/2.484 ms
```

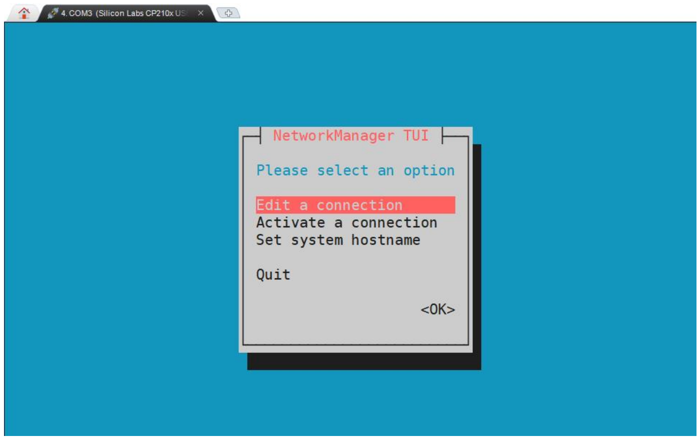
3.6.2.2. The server image connects to WIFI in a graphical way

1) First log in to the linux system, there are the following three ways
   a. If the development board is connected with a network cable, you can remotely log in to the Linux system through ssh
   b. If the development board is connected to the debugging serial port, you can use the serial port terminal to log in to the linux system (please use MobaXterm for the serial port software, and minicom cannot display the graphical interface)
   c. If the development board is connected to the HDMI display, you can log in to the linux system through the terminal displayed on the HDMI

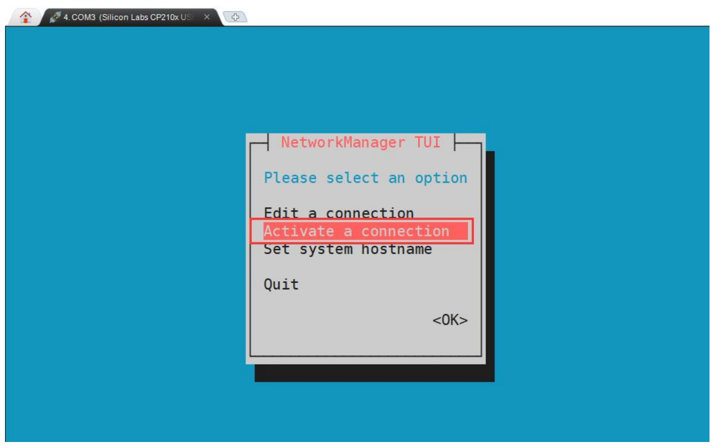
2) Then enter the nmtui command in the command line to open the wifi connection interface

```
orangepi@orangepi:~$ nmtui
```

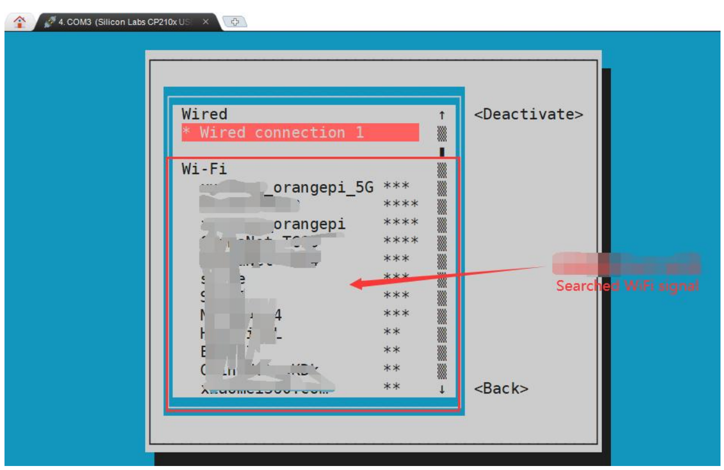
3) Enter the nmtui command to open the interface as shown below



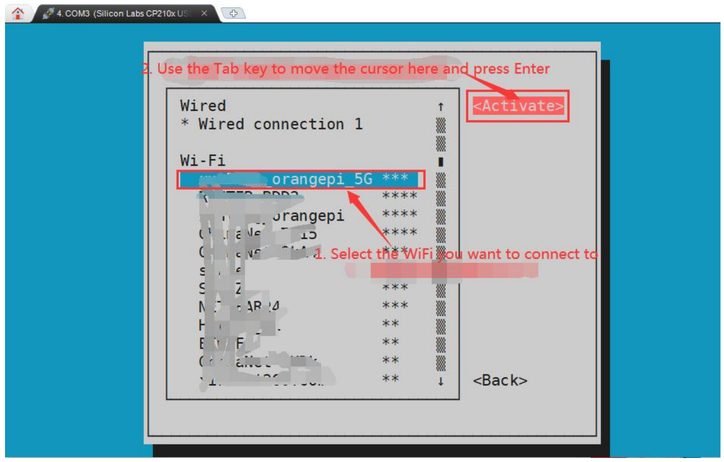
4) Select **Activate a connect** and press Enter



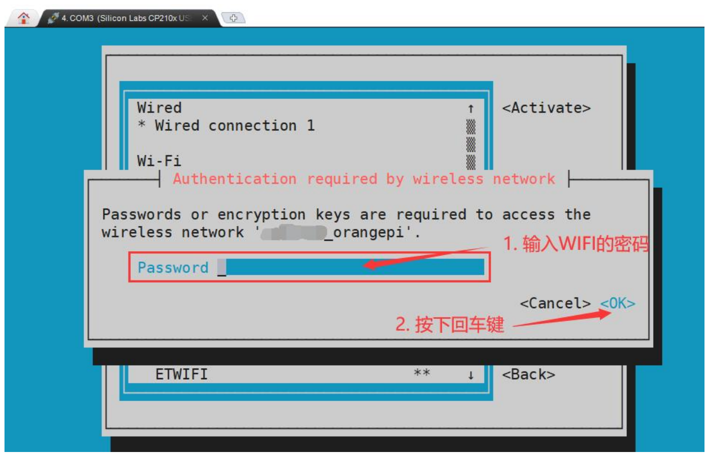
5) Then you can see all the searched WIFI hotspots



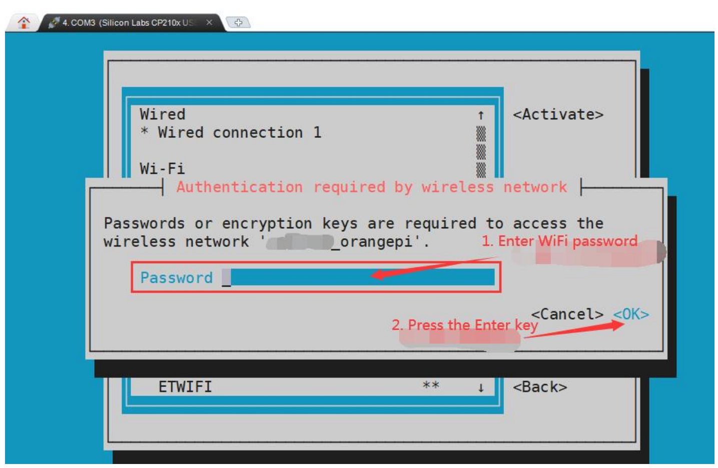
6) Select the WIFI hotspot you want to connect to, then use the Tab key to position the cursor on **Activate** and press Enter



7) Then a dialog box for entering a **password** will pop up, enter the corresponding password in Pssword and press Enter to start connecting to WIFI



8) After the WIFI connection is successful, a "*" will be displayed in front of the connected WIFI name



9) You can view the IP address of wifi through the **ip addr show wlan0** command

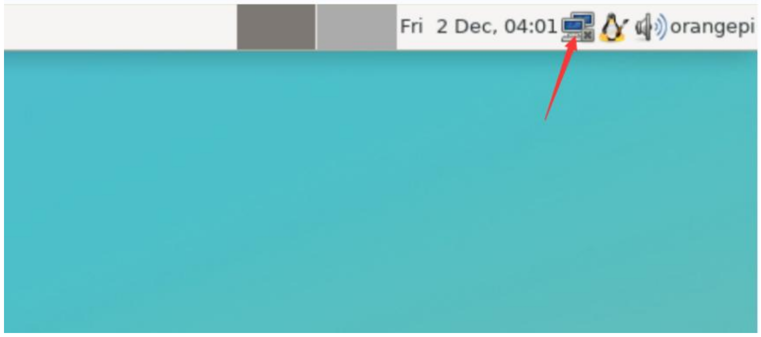
```
orangepi@orangepi:~$ ip addr show wlan0
11: wlan0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state UP group default qlen 1000
    link/ether 24:8c:d3:aa:76:bb brd ff:ff:ff:ff:ff:ff
    inet 192.168.1.11/24 brd 192.168.1.255 scope global dynamic noprefixroute wlan0
       valid_lft 259069sec preferred_lft 259069sec
    inet6 240e:3b7:3240:c4a0:c401:a445:5002:ccdd/64 scope global dynamic noprefixroute
       valid_lft 259071sec preferred_lft 172671sec
    inet6 fe80::42f1:6019:a80e:4c31/64 scope link noprefixroute
       valid_lft forever preferred_lft forever
```

10) Use the **ping** command to test the connectivity of the wifi network, and the **ping** command can be interrupted through the shortcut key **Ctrl+C**

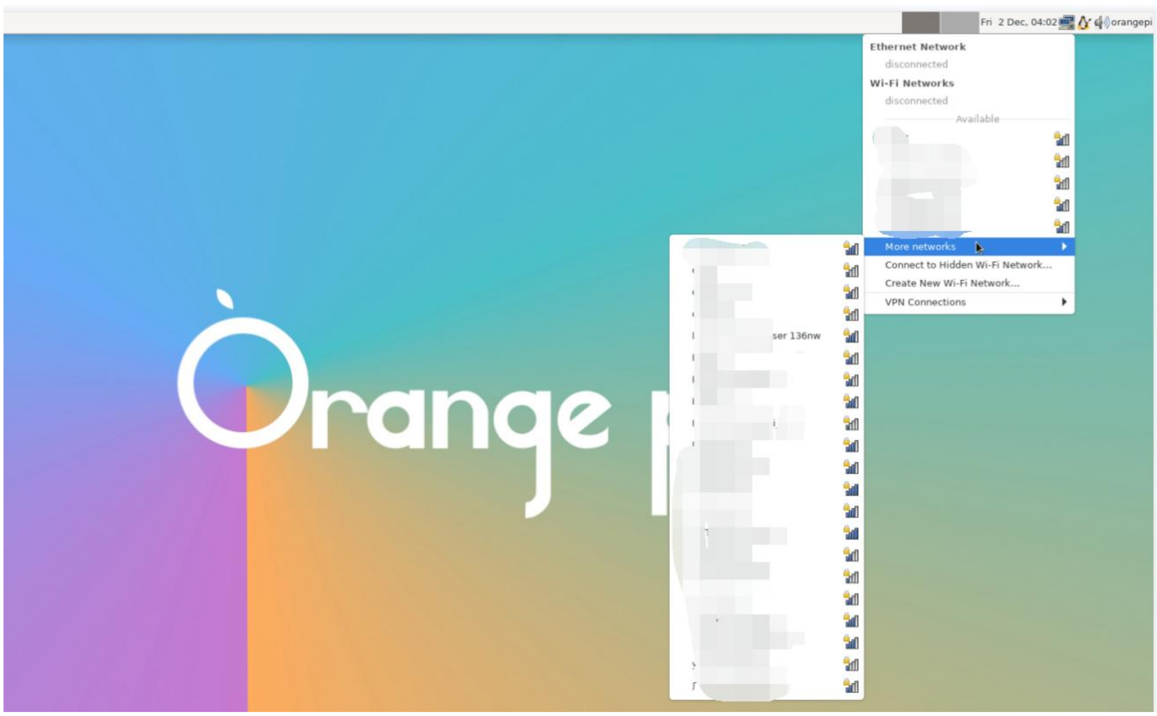
```
orangepi@orangepi:~$ ping www.orangepi.org -I wlan0
PING www.orangepi.org (182.92.236.130) from 192.168.1.49 wlan0: 56(84) bytes of data.
64 bytes from 182.92.236.130 (182.92.236.130): icmp_seq=1 ttl=52 time=43.5 ms
64 bytes from 182.92.236.130 (182.92.236.130): icmp_seq=2 ttl=52 time=41.3 ms
64 bytes from 182.92.236.130 (182.92.236.130): icmp_seq=3 ttl=52 time=44.9 ms
64 bytes from 182.92.236.130 (182.92.236.130): icmp_seq=4 ttl=52 time=45.6 ms
64 bytes from 182.92.236.130 (182.92.236.130): icmp_seq=5 ttl=52 time=48.8 ms
^C
--- www.orangepi.org ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4006ms
rtt min/avg/max/mdev = 41.321/44.864/48.834/2.484 ms
```

3. 6. 2. 3. Test method of desktop image

1) Click the network configuration icon in the upper right corner of the desktop (please do not connect the network cable when testing WIFI)

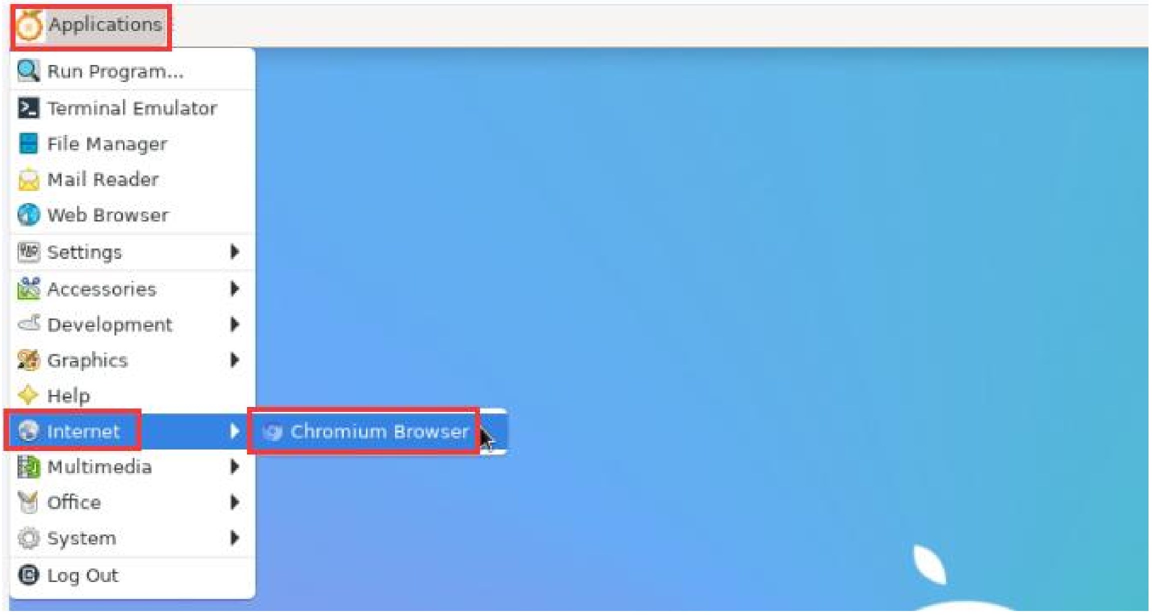


2) Click **More networks** in the pop-up drop-down box to see all scanned WIFI hotspots, and then select the WIFI hotspot you want to connect to

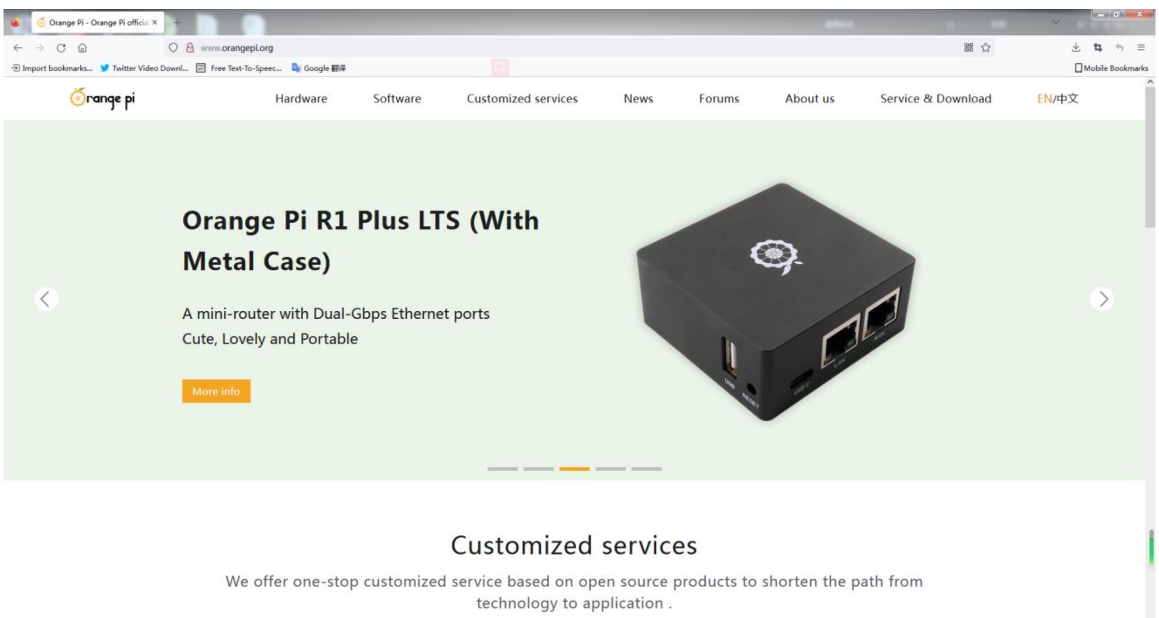


3) Then enter the password of the WIFI hotspot, and then click **Connect** to start connecting to WIFI

4) After connecting to WIFI, you can open the browser to check whether you can access the Internet. The entrance of the browser is shown in the figure below



5) If you can open other web pages after opening the browser, it means that the WIFI connection is normal



3. 6. 3. How to set a static IP address

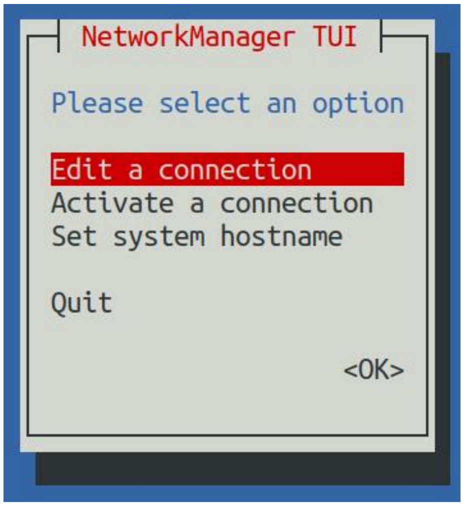
Please do not set a static IP address by modifying the /etc/network/interfaces configuration file.

3.6.3.1. Use the nmtui command to set a static IP address

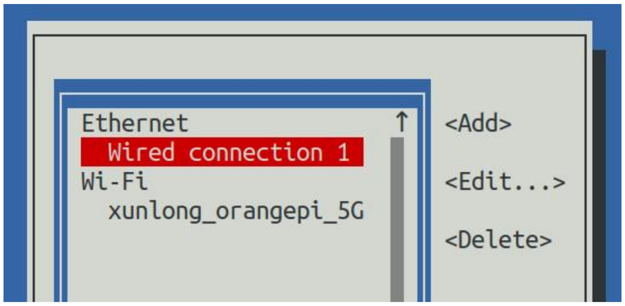
1) First run the **nmtui** command

```
orangepi@orangepi:~$ nmtui
```

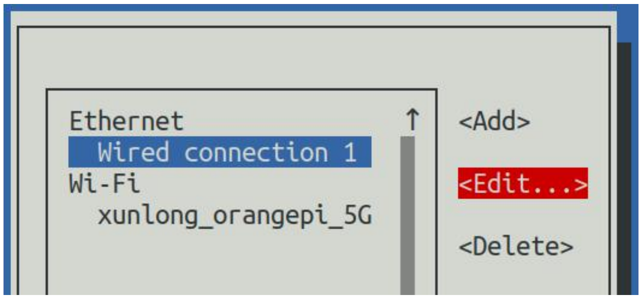
2) Then select **Edit a connection** and press Enter



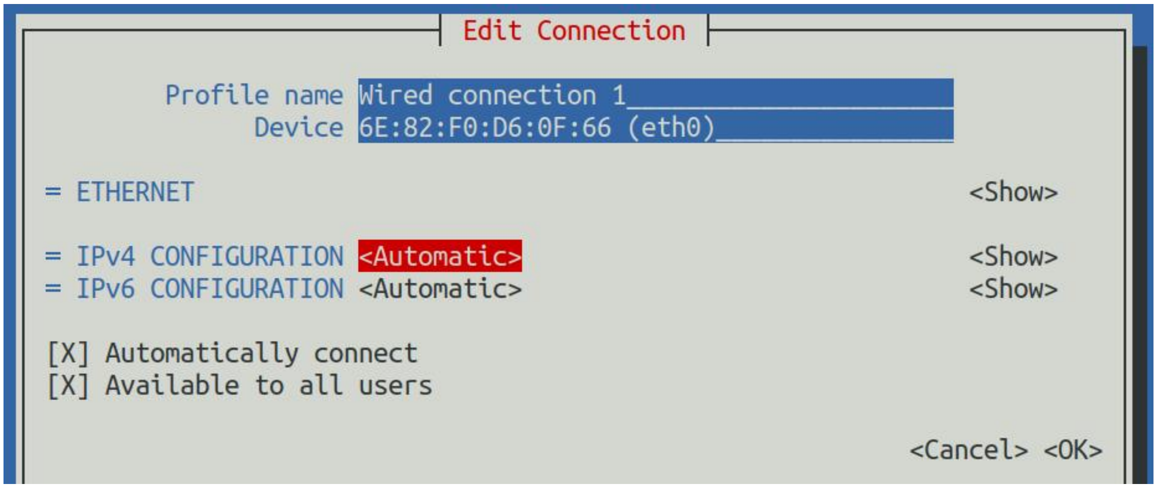
3) Then select the network interface that needs to set a static IP address, for example, to set the static IP address of the **Ethernet** interface, select **Wired connection 1**.



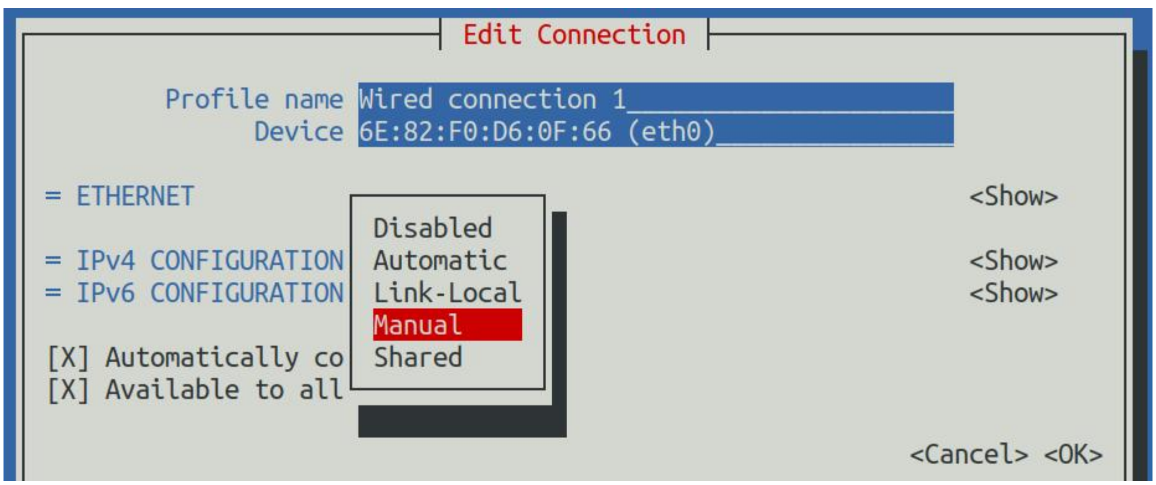
4) Then select **Edit** via the **Tab** key and press the Enter key



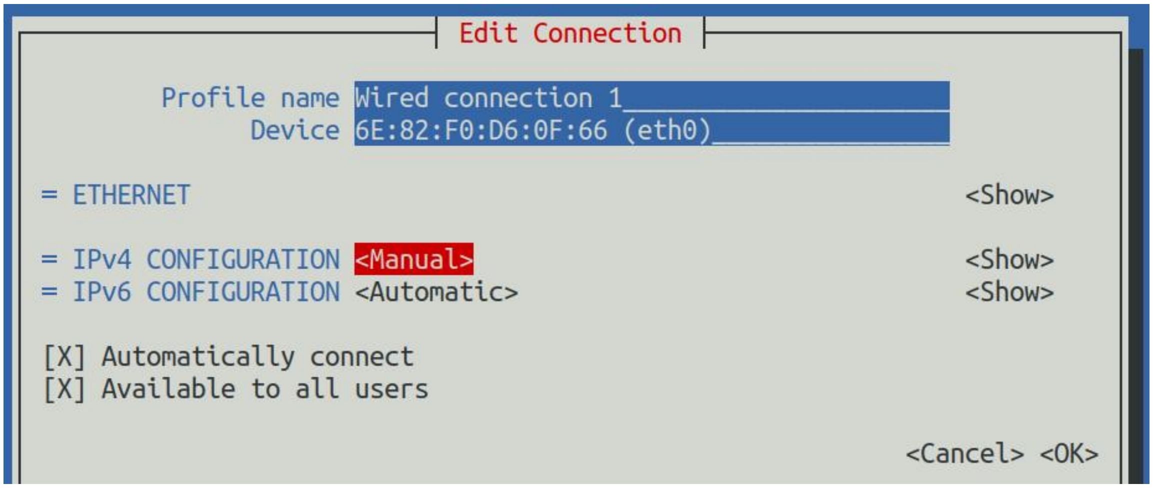
5) Then use the Tab key to move the cursor to the **<Automatic>** position shown in the figure below to configure IPv4



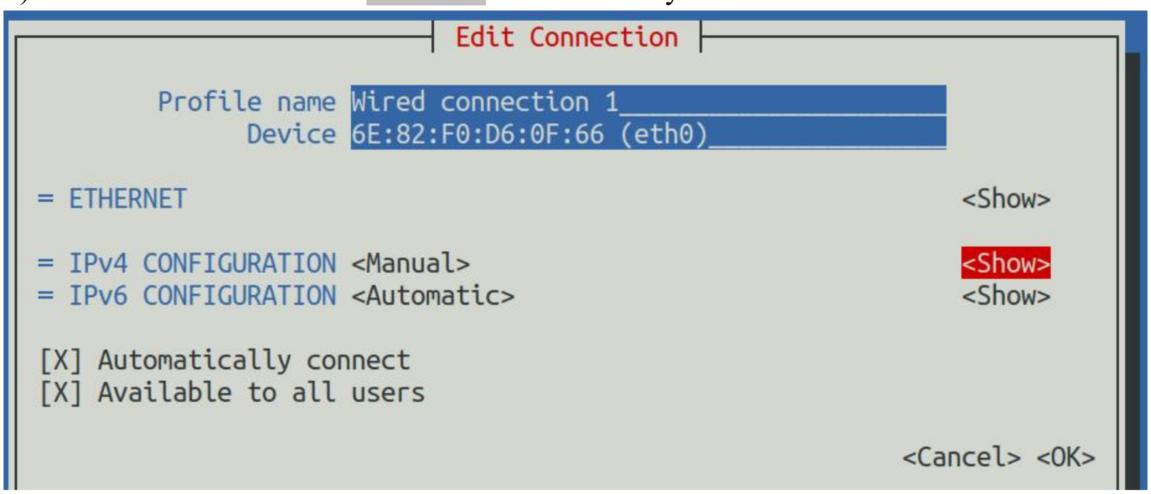
6) Then press Enter, select **Manual** through the up and down arrow keys, and press Enter to confirm



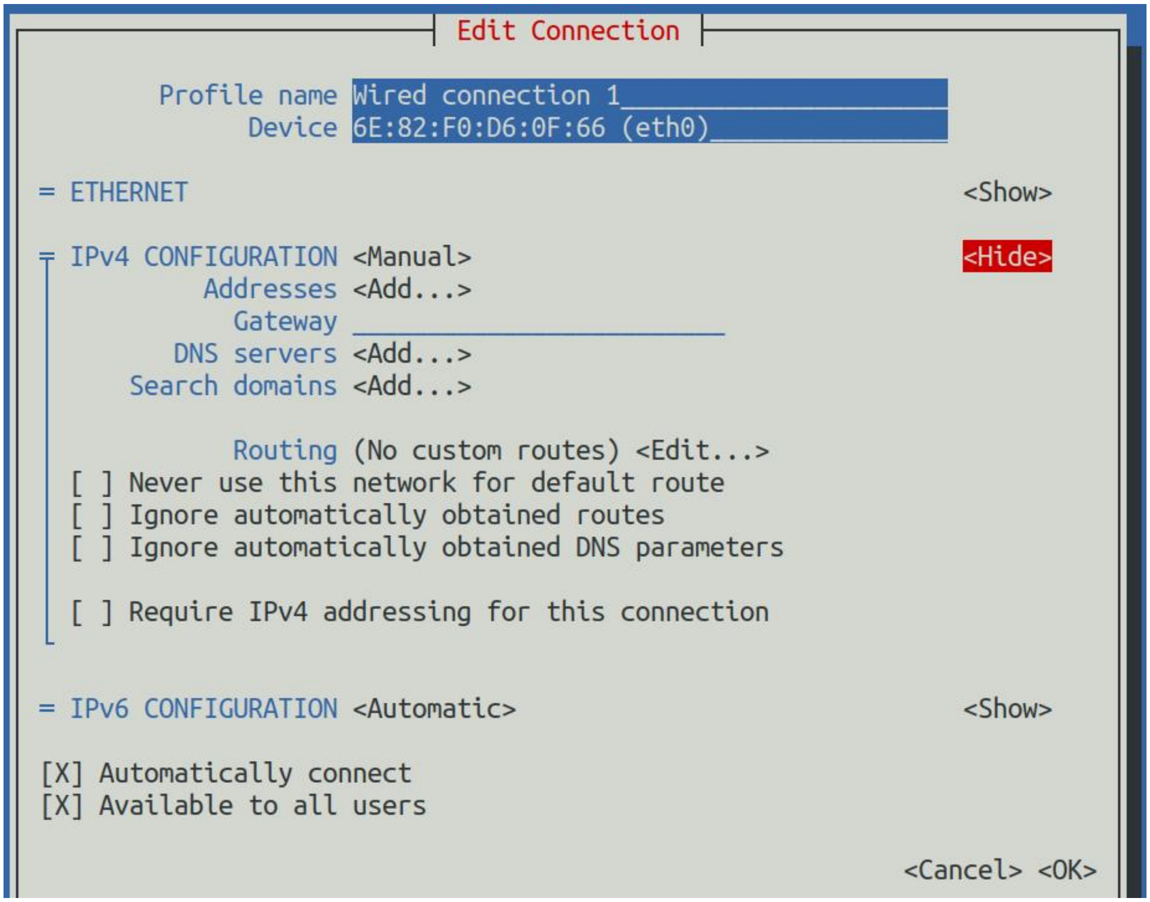
7) The display after selection is shown in the figure below



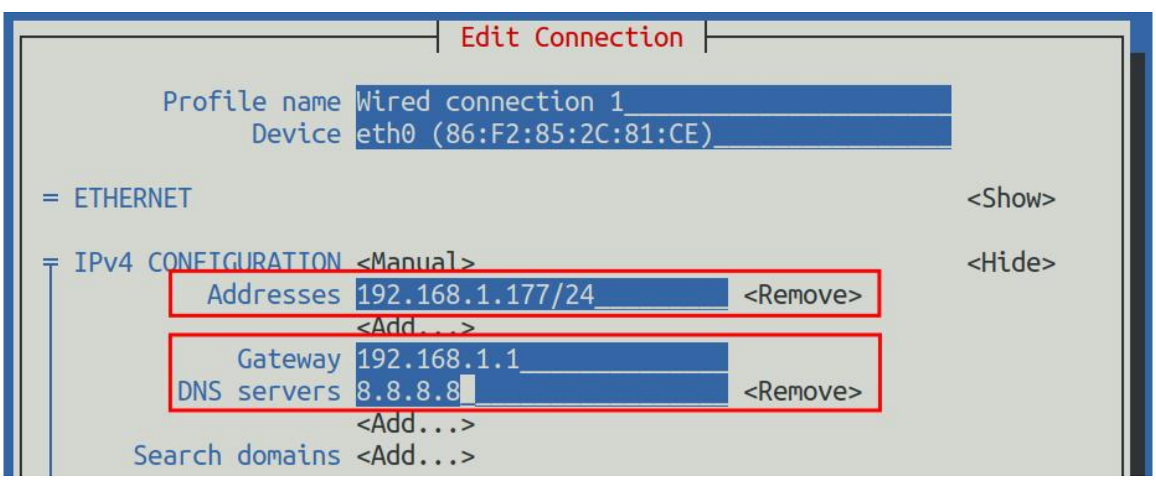
8) Then move the cursor to **<Show>** via the Tab key



9) Then press Enter, and the following setting interface will pop up after entering

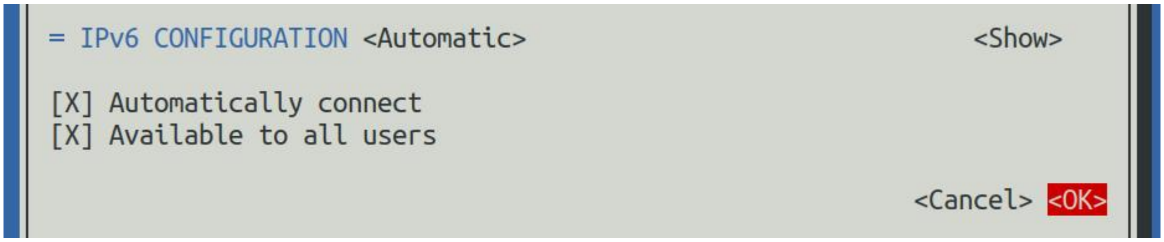


10) Then you can set the IP address (Addresses), gateway (Gateway) and DNS server address in the position shown in the figure below (there are many other setting options in it, please explore by yourself), **please set according to your specific needs, The values set in the image below are just an example**

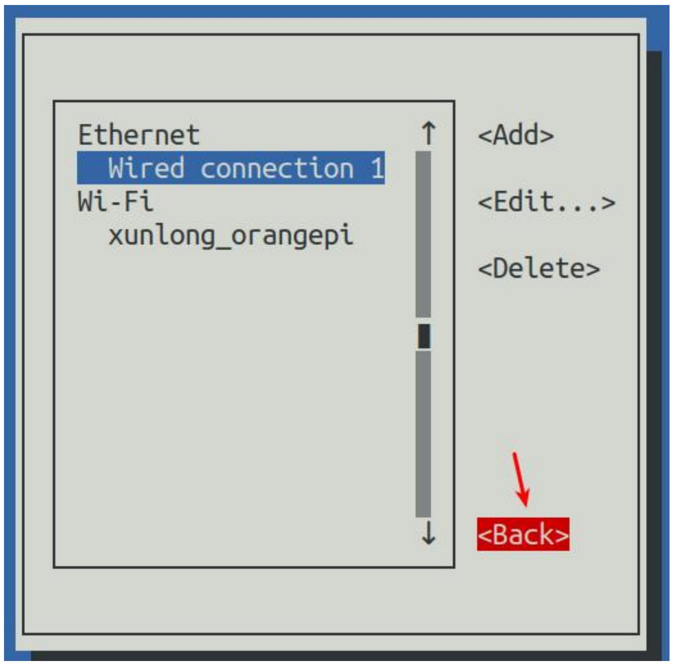


11) After setting, move the cursor to **<OK>** in the lower right corner, and press Enter to

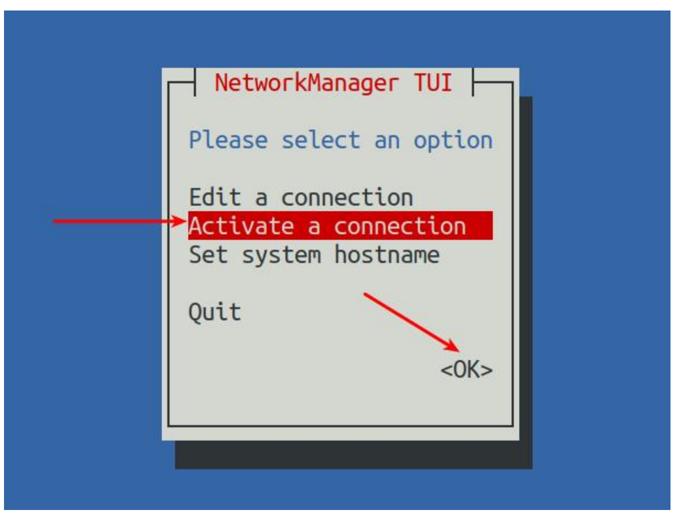
confirm



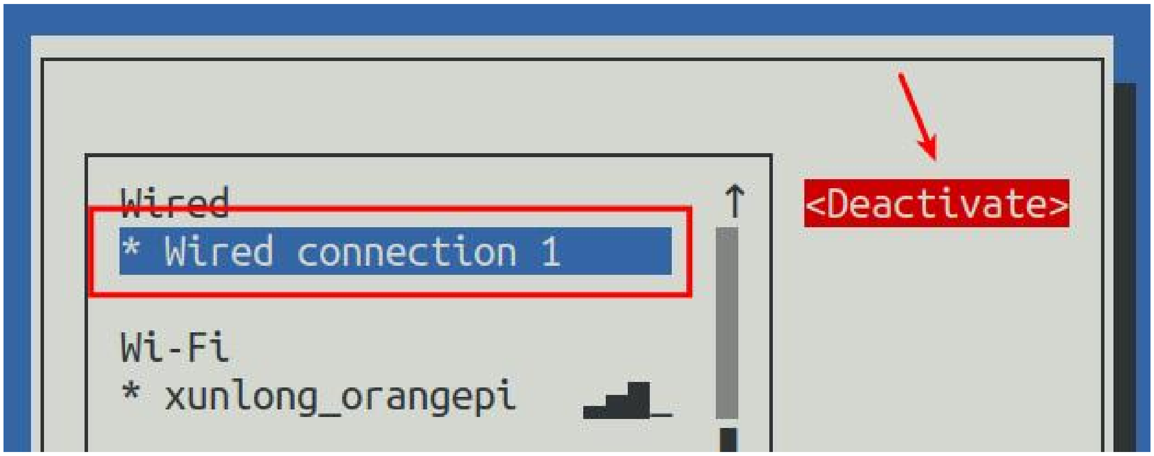
12) Then click **<Back>** to return to the previous selection interface



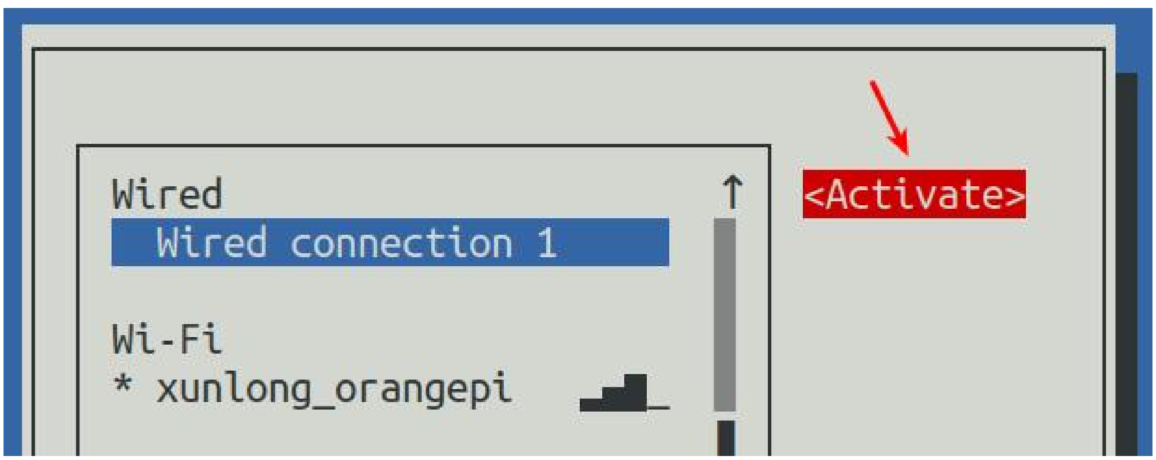
13) Then select **Activate a connection**, then move the cursor to **<OK>**, and finally click Enter



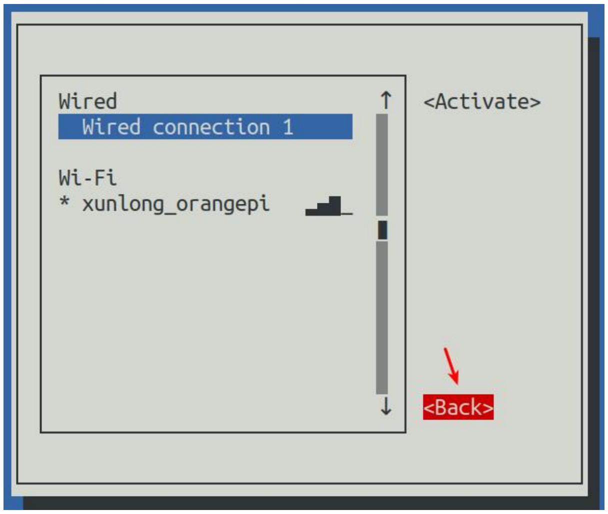
14) Then select the network interface that needs to be set, such as **Wired connection 1**, then move the cursor to **<Deactivate>**, and press Enter to disable **Wired connection 1**

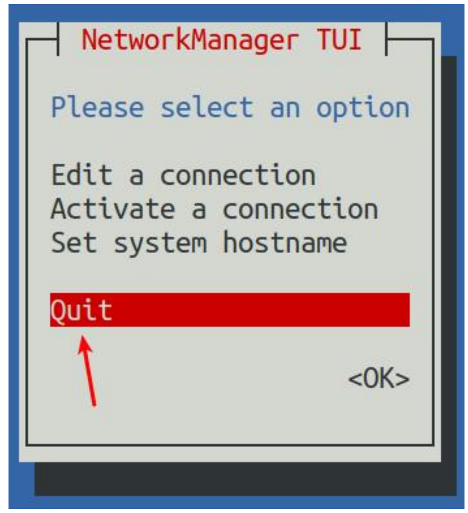


15) Then please do not move the cursor, and then press the Enter key to re-enable **Wired connection 1**, so that the static IP address set earlier will take effect



16) Then you can exit nmtui through the **<Back>** and **Quit** buttons





17) Then through **ip addr show eth0**, you can see that the IP address of the network port has changed to the static IP address set earlier

```
orangepi@orangepi:~$ ip addr show eth0
3: eth0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state UP group default qlen 1000
    link/ether 5e:ac:14:a5:92:b3 brd ff:ff:ff:ff:ff:ff
    inet 192.168.1.177/24 brd 192.168.1.255 scope global noprefixroute eth0
       valid_lft forever preferred_lft forever
    inet6 241e:3b8:3240:c3a0:e269:8305:dc08:135e/64 scope global dynamic noprefixroute
       valid_lft 259149sec preferred_lft 172749sec
    inet6 fe80::957d:bbbe:4928:3604/64 scope link noprefixroute
       valid_lft forever preferred_lft forever
```

18) Then you can test the connectivity of the network to check whether the IP address is configured OK, and the **ping** command can be interrupted through the shortcut key **Ctrl+C**

```
orangepi@orangepi:~$ ping 192.168.1.47 -I eth0
PING 192.168.1.47 (192.168.1.47) from 192.168.1.188 eth0: 56(84) bytes of data.
64 bytes from 192.168.1.47: icmp_seq=1 ttl=64 time=0.233 ms
64 bytes from 192.168.1.47: icmp_seq=2 ttl=64 time=0.263 ms
64 bytes from 192.168.1.47: icmp_seq=3 ttl=64 time=0.273 ms
64 bytes from 192.168.1.47: icmp_seq=4 ttl=64 time=0.269 ms
64 bytes from 192.168.1.47: icmp_seq=5 ttl=64 time=0.275 ms
```

```
^C
--- 192.168.1.47 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4042ms
rtt min/avg/max/mdev = 0.233/0.262/0.275/0.015 ms
```

3. 6. 3. 2. Use the nmcli command to set a static IP address

1) If you want to set the static IP address of the network port, please insert the network cable into the development board first. **If you need to set the static IP address of WIFI, please connect the WIFI first**, and then start to set the static IP address

2) Then you can view the name of the network device through the **nmcli con show** command, as shown below

a. **orangepi** is the name of the WIFI network interface (the name is not necessarily the same)

b. **Wired connection 1** is the name of the Ethernet interface

```
orangepi@orangepi:~$ nmcli con show
NAME                UUID                                  TYPE      DEVICE
orangepi            cfc4f922-ae48-46f1-84e1-2f19e9ec5e2a  wifi      wlan0
Wired connection 1  9db058b7-7701-37b8-9411-efc2ae8bfa30  ethernet  eth0
```

3) Then enter the following command, where

a. **"Wired connection 1"** means to set the static IP address of the Ethernet port. If you need to set the static IP address of the WIFI, please change it to the corresponding name of the WIFI network interface (you can get it through the **nmcli con show** command)

b. **ipv4.addresses** is followed by the static IP address to be set, which can be modified to the value you want to set

c. **ipv4.gateway** represents the address of the gateway

```
orangepi@orangepi:~$ nmcli con mod "Wired connection 1"   \
ipv4.addresses "192.168.1.110"   \
ipv4.gateway "192.168.1.1"   \
ipv4.dns "8.8.8.8"   \
ipv4.method "manual"
```

4) Then restart the linux system

```
orangepi@orangepi:~$ sudo reboot
```

5) Then re-enter the linux system and use the **ip addr show eth0** command to see that the IP address has been set to the desired value

```
orangepi@orangepi:~$ ip addr show eth0
3: eth0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state UP group default qlen 1000
    link/ether 5e:ae:14:a5:91:b3 brd ff:ff:ff:ff:ff:ff
    inet 192.168.1.110/32 brd 192.168.1.110 scope global noprefixroute eth0
       valid_lft forever preferred_lft forever
    inet6 240e:3b7:3240:c3a0:97de:1d01:b290:fe3a/64 scope global dynamic noprefixroute
       valid_lft 259183sec preferred_lft 172783sec
    inet6 fe80::3312:861a:a589:d3c/64 scope link noprefixroute
       valid_lft forever preferred_lft forever
```

3. 6. 4. AP6275P PCIe NIC creates WIFI hotspot via create_ap

create_ap is a script that helps quickly create WIFI hotspots on Linux, and supports bridge and NAT modes. It can automatically combine hostapd, dnsmasq and iptables to complete the setting of WIFI hotspots, avoiding complex configuration for users. The github address is as follows:

https://github.com/oblique/create_ap

If you are using the latest image, the create_ap script has been pre-installed, and you can create a WIFI hotspot through the create_ap command. The basic command format of create_ap is as follows:

create_ap [options] <wifi-interface> [<interface-with-internet>] [<access-point-name> [<passphrase>]]

*** options: You can use this parameter to specify the encryption method, the frequency band of the WIFI hotspot, the bandwidth mode, the network sharing method, etc. You can get the options through create_ap -h**
*** wifi-interface: the name of the wireless network card**
*** interface-with-internet: The name of the network card that can be connected to**

the Internet, usually eth0
*** access-point-name: hotspot name**
*** passphrase: the password of the hotspot**

3. 6. 4. 1. create_ap method to create WIFI hotspot in NAT mode

1）Enter the following command to create a WIFI hotspot named **orangepi** and password **orangepi** in NAT mode

```
orangepi@orangepi5b:~$ sudo create_ap -m nat wlan0 eth0 orangepi orangepi
```

2）If the following information is output, it means that the WIFI hotspot is created successfully

```
orangepi@orangepi5b:~$ sudo create_ap -m nat wlan0 eth0 orangepi orangepi
Config dir: /tmp/create_ap.wlan0.conf.fPItFUJ2
PID: 3831
Network Manager found, set ap0 as unmanaged device... DONE
Creating a virtual WiFi interface... ap0 created.
Sharing Internet using method: nat
hostapd command-line interface: hostapd_cli -p
/tmp/create_ap.wlan0.conf.fPItFUJ2/hostapd_ctrl
ap0: interface state UNINITIALIZED->ENABLED
ap0: AP-ENABLED
```

3）Take out the mobile phone at this time, in the searched WIFI list, you can find the WIFI hotspot named **orangepi** created by the development board, and then click **orangepi** to connect to the hotspot, the password is the **orangepi** set above

4）After the connection is successful, the display is as shown in the figure below

5）In NAT mode, the wireless device connected to the hotspot of the development board requests an IP address from the DHCP service of the development board, so there will be two different network segments, for example, the IP of the development board is 192.168.1.X

```
orangepi@orangepi5b:~$ ifconfig eth0
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.1.150  netmask 255.255.255.0  broadcast 192.168.1.255
        inet6 fe80::938f:8776:5783:afa2  prefixlen 64  scopeid 0x20<link>
        ether 4a:a0:c8:25:42:82  txqueuelen 1000  (Ethernet)
        RX packets 25370  bytes 2709590 (2.7 MB)
```

```
        RX errors 0    dropped 50    overruns 0    frame 0
        TX packets 3798    bytes 1519493 (1.5 MB)
        TX errors 0    dropped 0 overruns 0    carrier 0    collisions 0
        device interrupt 83
```

By default, the DHCP service of the development board will assign an IP address of **192.168.12.0/24** to the device connected to the hotspot. At this time, click on the connected WIFI hotspot **orangepi**, and then you can see that the IP address of the mobile phone is **192.168.12.X**

6）If you want to specify a different network segment for the connected device, you can specify it through the -g parameter, such as specifying the network segment of the access point AP through the -g parameter as 192.168.2.1

```
orangepi@orangepi5b:~$ sudo create_ap -m nat wlan0 eth0 orangepi orangepi -g 192.168.2.1
```

At this time, after connecting to the hotspot through the mobile phone, click the connected WIFI hotspot **orangepi**, and then you can see that the IP address of the mobile phone is **192.168.2.X**

7) If the **--freq-band** parameter is not specified, the hotspot created by default is in the 2.4G frequency band. If you want to create a hotspot in the 5G frequency band, you can specify it through the **--freq-band 5** parameter. The specific command is as follows

```
orangepi@orangepi:~$ sudo create_ap -m nat wlan0 eth0 orangepi orangepi --freq-band 5
```

8) If you need to hide the SSID, you can specify the **--hidden** parameter, the specific command is as follows

```
orangepi@orangepi:~$ sudo create_ap -m nat wlan0 eth0 orangepi orangepi --hidden
```

At this time, the mobile phone cannot search for the WIFI hotspot. You need to manually specify the name of the WIFI hotspot and enter the password to connect to the WIFI hotspot.

3. 6. 4. 2. create_ap method to create WIFI hotspot in bridge mode

1）Enter the following command to create a WIFI hotspot named **orangepi** and password **orangepi** in bridge mode

```
orangepi@orangepi:~$ sudo create_ap -m bridge wlan0 eth0 orangepi orangepi
```

2）If the following information is output, it means that the WIFI hotspot is created successfully

```
orangepi@orangepi:~$ sudo create_ap -m bridge wlan0 eth0 orangepi orangepi
[sudo] password for orangepi:
Config dir: /tmp/create_ap.wlan0.conf.fg9U5Xgt
PID: 3141
Network Manager found, set ap0 as unmanaged device... DONE
Creating a virtual WiFi interface... ap0 created.
Sharing Internet using method: bridge
Create a bridge interface... br0 created.
hostapd command-line interface: hostapd_cli -p
/tmp/create_ap.wlan0.conf.fg9U5Xgt/hostapd_ctrl
ap0: interface state UNINITIALIZED->ENABLED
ap0: AP-ENABLED
```

3）Take out the mobile phone at this time, and you can find the WIFI hotspot named

orangepi created by the development board in the searched WIFI list, and then you can click **orangepi** to connect to the hotspot, and the password is the **orangepi** set above

4）After the connection is successful, the display is as shown in the figure below

5）In bridge mode, the wireless device connected to the hotspot of the development board also requests an IP address from the DHCP service of the main router (the router connected to the development board), for example, the IP of the development board is **192.168.1.X**

```
orangepi@orangepi:~$ ifconfig eth0
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.1.150  netmask 255.255.255.0  broadcast 192.168.1.255
        inet6 fe80::938f:8776:5783:afa2  prefixlen 64  scopeid 0x20<link>
```

```
        ether 4a:a0:c8:25:42:82  txqueuelen 1000  (Ethernet)
        RX packets 25370  bytes 2709590 (2.7 MB)
        RX errors 0  dropped 50  overruns 0  frame 0
        TX packets 3798  bytes 1519493 (1.5 MB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
        device interrupt 83
```

The IP of the device connected to the WIFI hotspot is also assigned by the main router, so the mobile phone connected to the WIFI hotspot and the development board are in the same network segment. At this time, click on the connected WIFI hotspot **orangepi**, and then you can see the IP address of the mobile phone Also **192.168.1.X**

6）If the **--freq-band** parameter is not specified, the hotspot created by default is in the 2.4G frequency band. If you want to create a hotspot in the 5G frequency band, you can specify the **--freq-band 5** parameter. The specific command is as follows

```
orangepi@orangepi:~$ sudo create_ap -m bridge wlan0 eth0 orangepi orangepi --freq-band 5
```

7）If you need to hide the SSID, you can specify the **--hidden** parameter, the specific command is as follows

```
orangepi@orangepi:~$ sudo create_ap -m bridge wlan0 eth0 orangepi orangepi --hidden
```

At this time, the mobile phone cannot search for the WIFI hotspot. You need to manually specify the name of the WIFI hotspot and enter the password to connect to the WIFI hotspot.

3. 7. SSH remote login development board

Linux systems enable ssh remote login by default and allow the root user to log in to the system. Before logging in with ssh, you first need to ensure that the Ethernet or wifi network is connected, and then use the ip addr command or check the router to obtain the IP address of the development board.

3. 7. 1. SSH remote login development board under Ubuntu

1) Obtain the IP address of the development board

2) Then you can remotely log in to the linux system through the ssh command

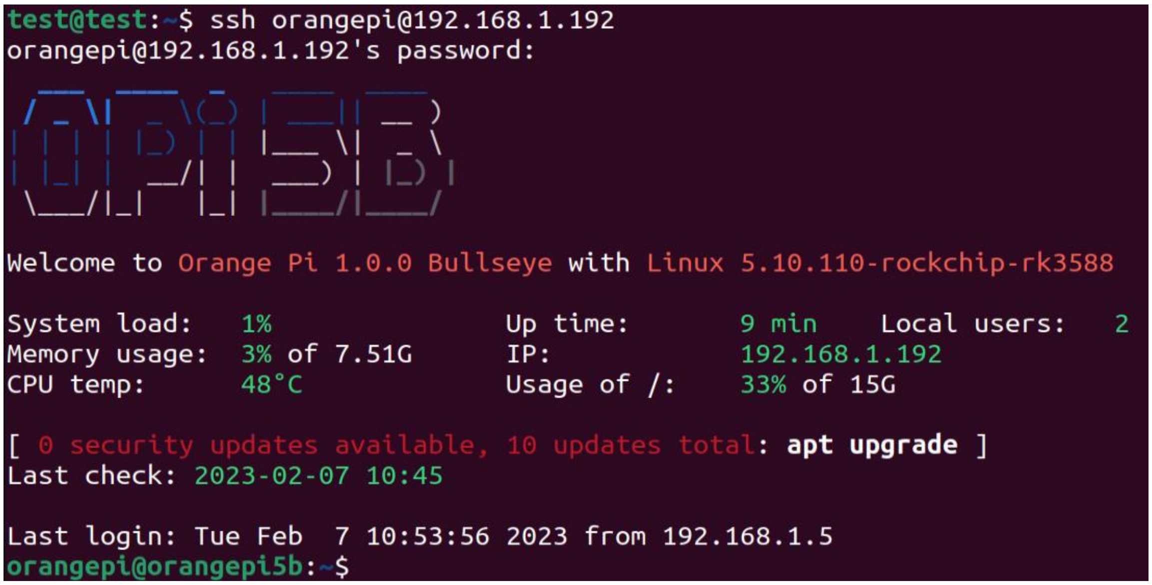
```
test@test:~$ ssh root@192.168.1.xxx          (Need to be replaced with the IP address of the development board)
root@192.168.1.xx's password:          （Enter the password here, the default password is orangepi）
```

Note that when entering the password, the specific content of the entered password will not be displayed on the screen, please do not think that there is any fault, just press Enter after inputting.

If you are prompted to refuse the connection, as long as you are using the image

provided by Orange Pi, please do not suspect that the password orangepi is wrong, but find other reasons.

3) After successfully logging in to the system, the display is as shown in the figure below



If ssh cannot log in to the linux system normally, please first check whether the IP address of the development board can be pinged. If the ping is ok, you can log in to the linux system through the serial port or HDMI display and then enter the following command on the development board and try again. Can you connect:

root@orangepi:~# **reset_ssh.sh**

If it still doesn't work, please reset the system and try again

3. 7. 2. SSH remote login development board under Windows

1) First obtain the IP address of the development board

2) Under Windows, you can use MobaXterm to remotely log in to the development board, first create a new ssh session

a. Open **Session**

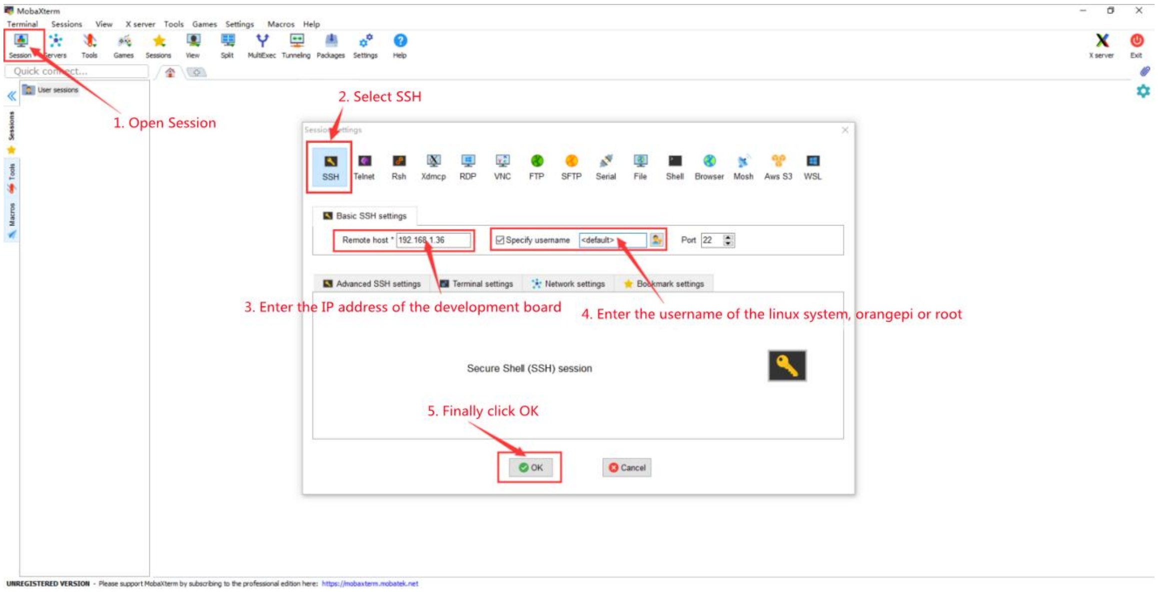
b. Then select **SSH** in **Session Setting**

c. Then enter the IP address of the development board in the **Remote host**

d. Then enter the user name **root** or **orangepi** of the linux system in **Specify**

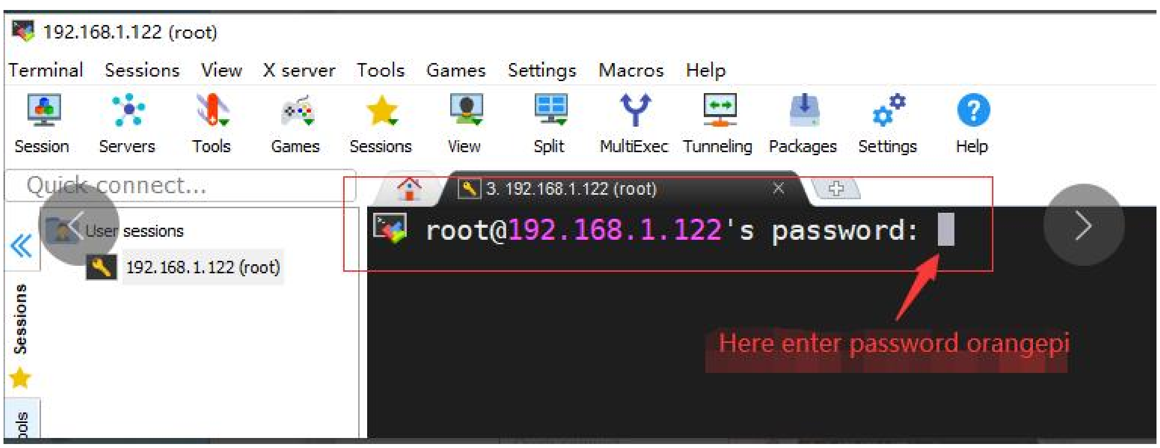
username

e. Finally click **OK**

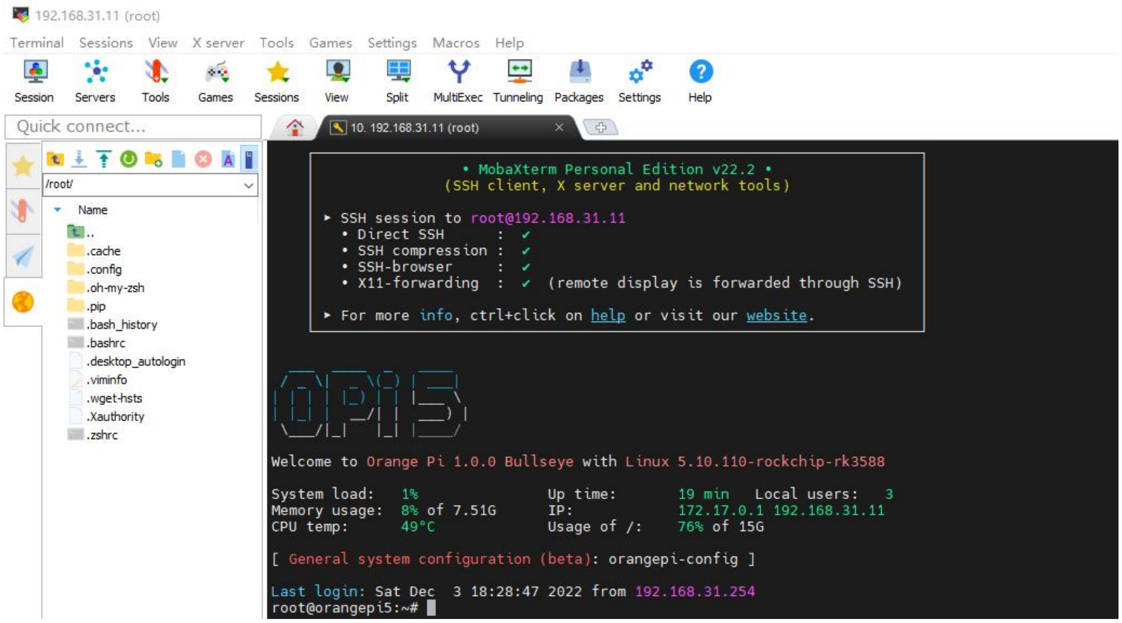


3) Then you will be prompted to enter a password. The default passwords for root and orangepi users are orangepi

Note that when entering the password, the specific content of the entered password will not be displayed on the screen, please do not think that there is any fault, just press Enter after inputting.



4) After successfully logging in to the system, the display is as shown in the figure below



3. 8. How to use ADB

3. 8. 1. How to use network adb

1) After the system starts, please confirm that **adbd** has been started

```
orangepi@orangepi:~$ ps -ax | grep "adbd"
    808 ?          Sl     0:00 /usr/bin/adbd
   3707 ttyFIQ0    S+     0:00 grep --color=auto adbd
```

2) Then check the IP address of the development board and write it down

3) Then install the adb tool on the Ubuntu PC

```
test@test:~$ sudo apt-get update
test@test:~$ sudo apt-get install -y adb
```

4) Then use the following command to connect to the network adb

```
test@test:~$ adb connect 192.168.1.xx:5555     #Please replace the IP address with the IP address of the development board
* daemon not running; starting now at tcp:5037
* daemon started successfully
connected to 192.168.1.xx:5555
test@test:~$ adb devices
```

```
List of devices attached
192.168.1.xx:5555        device
```

5) Then use the following command to log in to the linux system of the development board

test@test:~$ **adb shell**

root@orangepi5b:/#   <--- After seeing this prompt, it means that you have successfully logged in to the development board

6) The command to upload files to the development board using adb is as follows

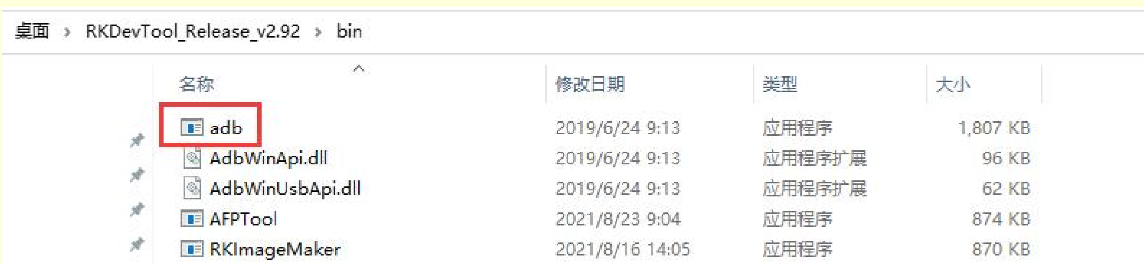
test@test:~$ **adb push filename /root**

filename: 1 file pushed. 3.7 MB/s (1075091 bytes in 0.277s)

7) The command to restart the development board using adb is as follows

test@test:~$ **adb reboot**

If you do not have the adb tool in your Windows system, you can use the adb program in the RKDevTool software (this software is useful in the section on how to burn the Android image to SPIFlash+NVMe SSD).



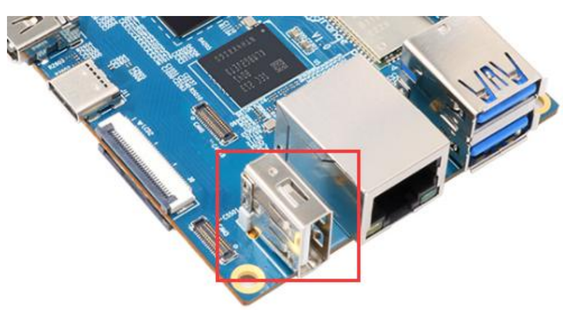
An example of using adb in windows is shown below:

```
命令提示符
Microsoft Windows [版本 10.0.19044.2251]
(c) Microsoft Corporation。保留所有权利。

C:\Users\Administrator>cd C:\Users\Administrator\Desktop\RKDevTool_Release_v2.92\bin

C:\Users\Administrator\Desktop\RKDevTool_Release_v2.92\bin>dir
 驱动器 C 中的卷没有标签。
 卷的序列号是 62AE-5AED

 C:\Users\Administrator\Desktop\RKDevTool_Release_v2.92\bin 的目录

2022/08/09  13:19    <DIR>          .
2022/08/09  13:19    <DIR>          ..
2019/06/24  09:13         1,850,368 adb.exe
2019/06/24  09:13            97,792 AdbWinApi.dll
2019/06/24  09:13            62,976 AdbWinUsbApi.dll
2021/08/23  09:04           894,976 AFPTool.exe
2021/08/16  14:05           890,368 RKImageMaker.exe
               5 个文件      3,796,480 字节
               2 个目录 64,033,034,240 可用字节

C:\Users\Administrator\Desktop\RKDevTool_Release_v2.92\bin>.\adb.exe connect 192.168.1.144
connected to 192.168.1.144:5555

C:\Users\Administrator\Desktop\RKDevTool_Release_v2.92\bin>.\adb.exe devices
List of devices attached
192.168.1.144:5555      device


C:\Users\Administrator\Desktop\RKDevTool_Release_v2.92\bin>.\adb.exe push adb.exe /root
adb.exe: 1 file pushed. 4.1 MB/s (1850368 bytes in 0.427s)

C:\Users\Administrator\Desktop\RKDevTool_Release_v2.92\bin>
```

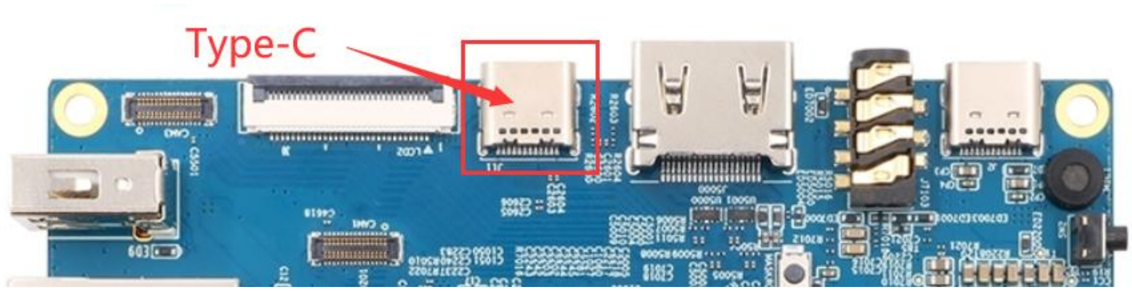
3.8.2. Use type-c data cable to connect to adb

1) First prepare a good quality Type-C data cable

2) Then please make sure that there is no USB device plugged into the USB interface below



3) Then connect the development board to the Ubuntu PC through the Type-C data cable. The position of the Type-C interface on the development board is shown in the figure below：



4) Then run the following command to set the Type-C interface to **device** mode

```
orangepi@orangepi:~$ sudo set_device.sh
```

If the **set_device.sh** script does not exist in the linux system, please use the following command directly：

```
orangepi@orangepi:~$ sudo bash -c "echo device > /sys/kernel/debug/usb/fc000000.usb/mode"
orangepi@orangepi:~$ sudo systemctl restart usbdevice
```

5) **Then please confirm that adbd has been started**

```
orangepi@orangepi:~$ ps -ax | grep "adbd"
    808 ?          Sl      0:00 /usr/bin/adbd
   3707 ttyFIQ0    S+      0:00 grep --color=auto adbd
```

6) Then install the adb tool on the Ubuntu PC

```
test@test:~$ sudo apt-get update
test@test:~$ sudo apt-get install -y adb
```

7) Then use the following command to see if the adb device is recognized

```
test@test:~$ adb devices
List of devices attached
e0f9f71bc343c305     device
```

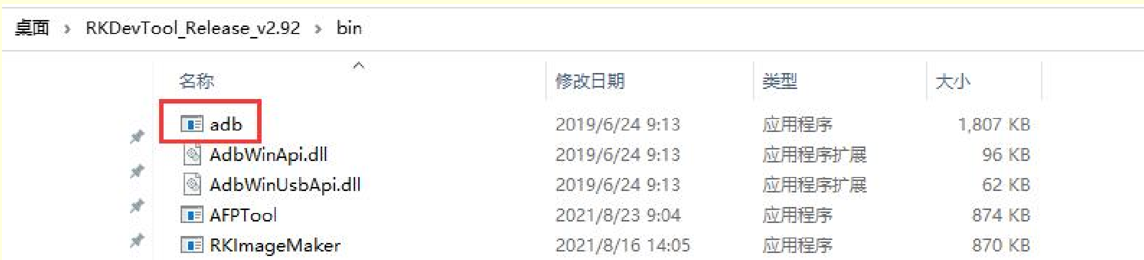
8) Then use the following command to log in to the linux system of the development board

```
test@test:~$ adb shell
root@orangepi5b:/#       <--- After seeing this prompt, it means that you have successfully logged in to the development board
```

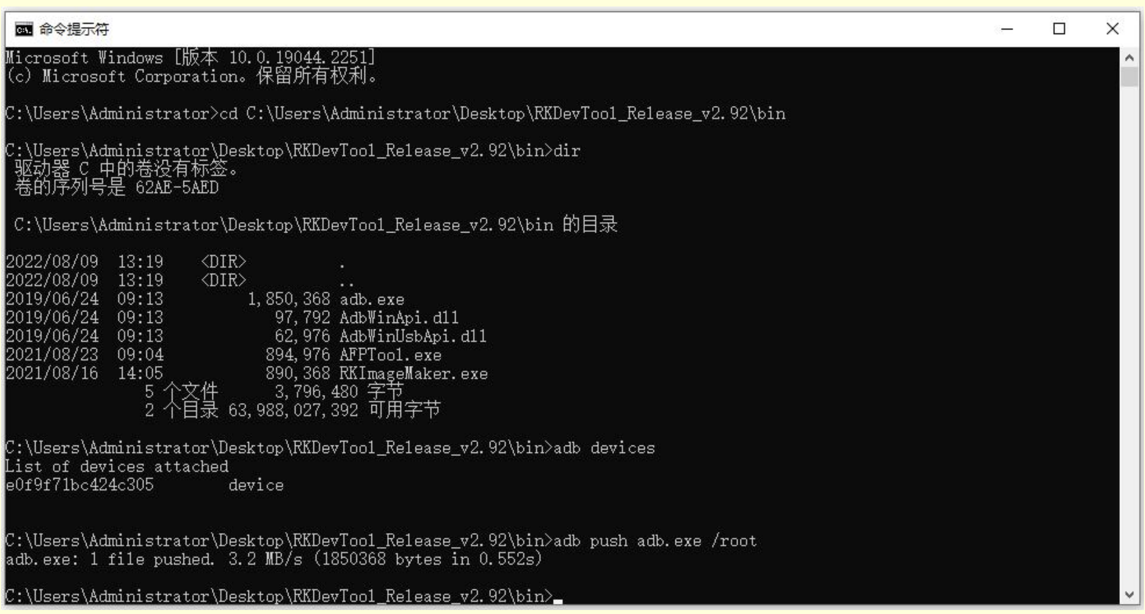
9) The command to upload files to the development board using adb is as follows

```
test@test:~$ adb push filename /root
filename: 1 file pushed. 3.7 MB/s (1075091 bytes in 0.277s)
```

If you do not have the adb tool in your Windows system, you can use the adb program in the RKDevTool software (this software is useful in the section on how to burn the Android image to SPIFlash+NVMe SSD).



An example of using adb in windows is shown below:



3.9. The method of uploading files to the Linux system of the development board

3.9.1. The method of uploading files to the development board Linux system in Ubuntu PC

3.9.1.1. How to upload files using the scp command

1) Use the scp command to upload files from the Ubuntu PC to the Linux system of the development board. The specific commands are as follows

a. **file_path：** Need to be replaced with the path of the file to be uploaded
b. **orangepi：** It is the user name of the Linux system of the development board, and it can also be replaced with other ones, such as root
c. **192.168.xx.xx:** It is the IP address of the development board, please modify it according to the actual situation
d. **/home/orangepi:** The path in the Linux system of the development board can also be modified to other paths

```
test@test:~$ scp file_path orangepi@192.168.xx.xx:/home/orangepi/
```

2) If you want to upload a folder, you need to add the -r parameter

```
test@test:~$ scp -r dir_path orangepi@192.168.xx.xx:/home/orangepi/
```

3) There are more usages of scp, please use the following command to view the man manual

```
test@test:~$ man scp
```

3.9.1.2. How to upload files using filezilla

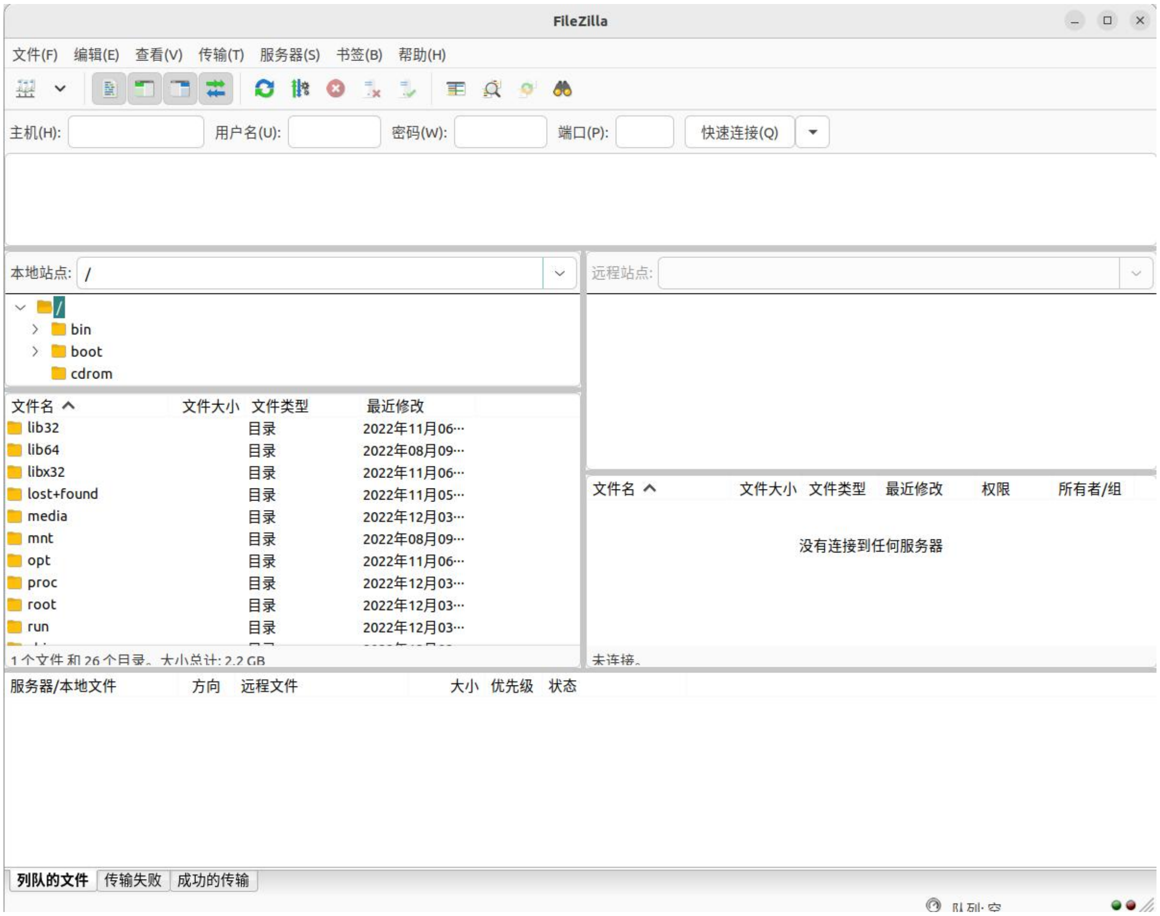
1) First install filezilla in Ubuntu PC

```
test@test:~$ sudo apt install -y filezilla
```

2) Then use the following command to open filezilla

```
test@test:~$ filezilla
```

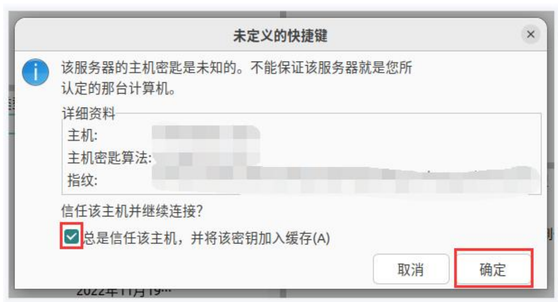
3) The interface after filezilla is opened is as follows, at this time, the display under the remote site on the right is empty



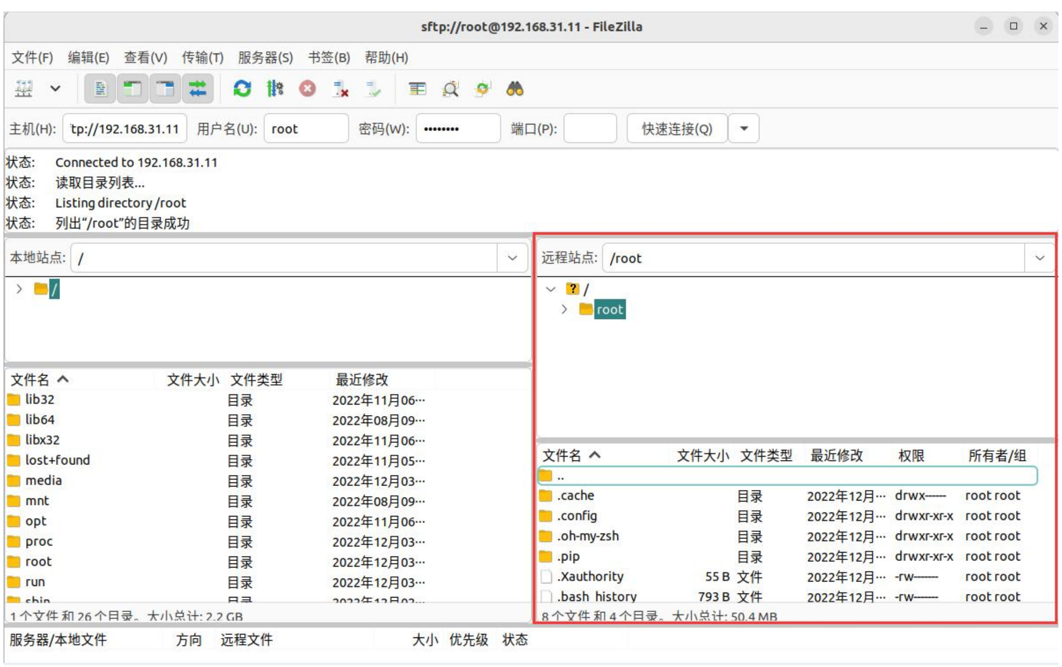
4) The method of connecting the development board is shown in the figure below

5) Then choose to **save the password**, and then click **OK**

6) Then choose to **always trust this host**, and then click **OK**

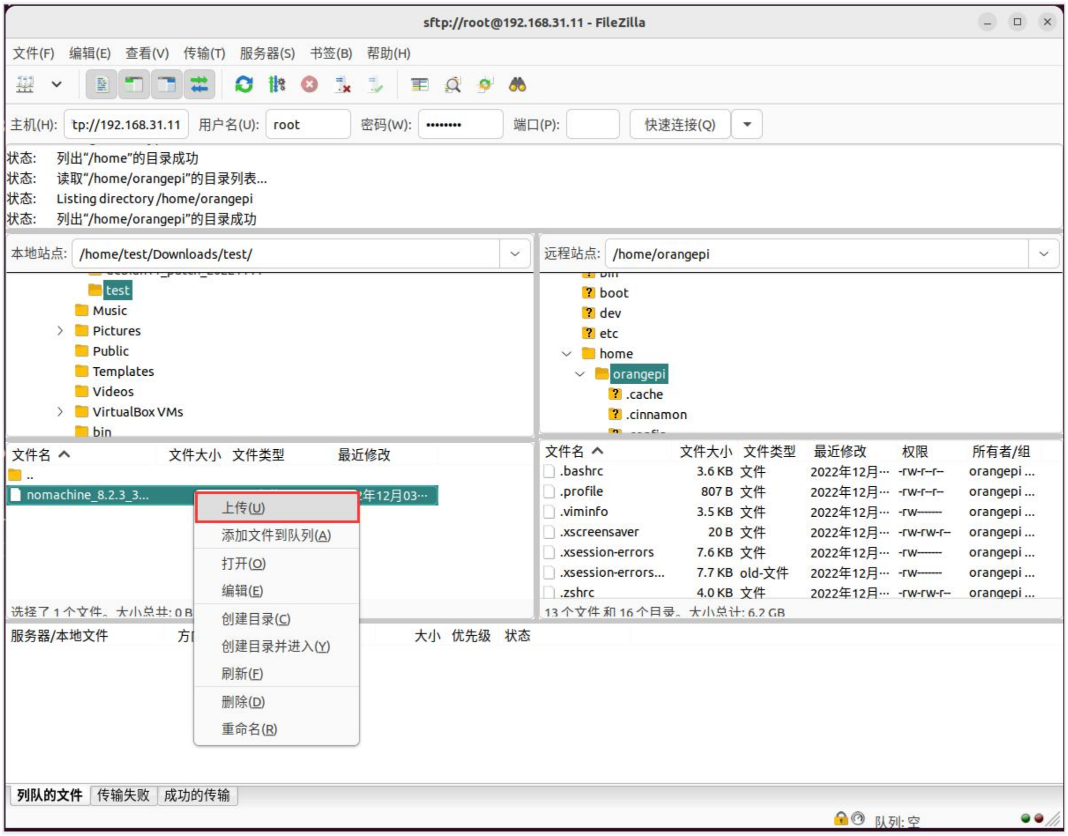


7) After the connection is successful, you can see the directory structure of the development board linux file system on the right side of the filezilla software



8) Then select the path to be uploaded to the development board on the right side of the

filezilla software, and then select the file to be uploaded in the Ubuntu PC on the left side of the filezilla software, then click the right mouse button, and then click the upload option to start uploading the file to the development board bingo.



9) After the upload is complete, you can go to the corresponding path in the Linux system of the development board to view the uploaded file

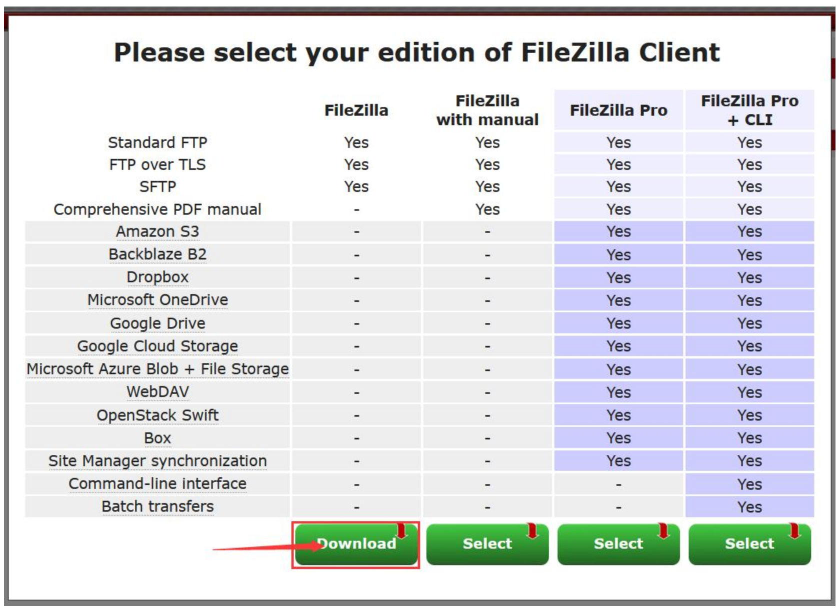
10) The method of uploading a folder is the same as that of uploading a file, so I won’t go into details here

3.9.2. The method of uploading files to the Linux system of the development board in Windows PC

3.9.2.1. How to upload files using filezilla

1) First download the installation file of the Windows version of the filezilla software, the download link is as follows

https://filezilla-project.org/download.php#close



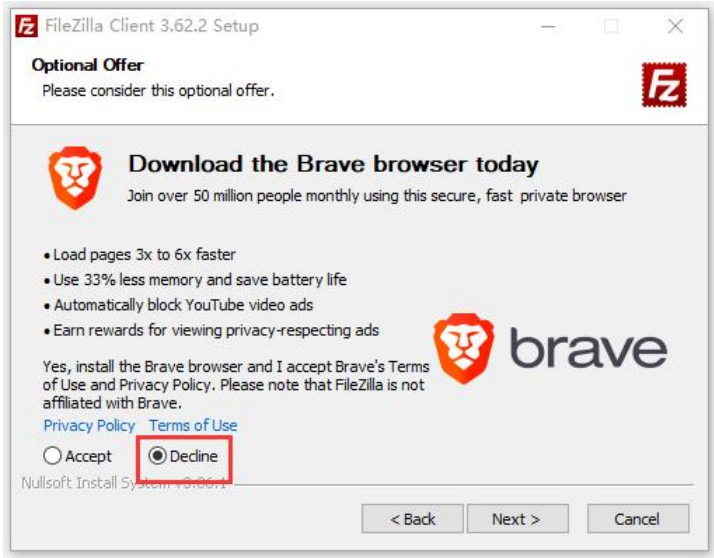
Please select your edition of FileZilla Client

	FileZilla	FileZilla with manual	FileZilla Pro	FileZilla Pro + CLI
Standard FTP	Yes	Yes	Yes	Yes
FTP over TLS	Yes	Yes	Yes	Yes
SFTP	Yes	Yes	Yes	Yes
Comprehensive PDF manual	-	Yes	Yes	Yes
Amazon S3	-	-	Yes	Yes
Backblaze B2	-	-	Yes	Yes
Dropbox	-	-	Yes	Yes
Microsoft OneDrive	-	-	Yes	Yes
Google Drive	-	-	Yes	Yes
Google Cloud Storage	-	-	Yes	Yes
Microsoft Azure Blob + File Storage	-	-	Yes	Yes
WebDAV	-	-	Yes	Yes
OpenStack Swift	-	-	Yes	Yes
Box	-	-	Yes	Yes
Site Manager synchronization	-	-	Yes	Yes
Command-line interface	-	-	-	Yes
Batch transfers	-	-	-	Yes
	Download	Select	Select	Select

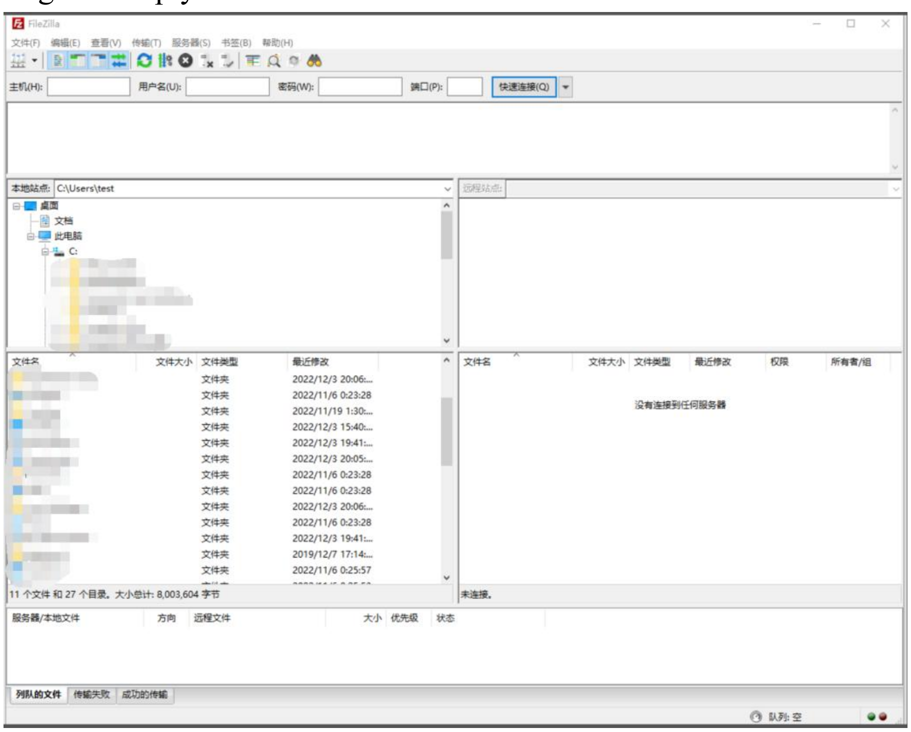
2) The downloaded installation package is as follows, and then double-click to install directly

FileZilla_Server_1.5.1_win64-setup.exe

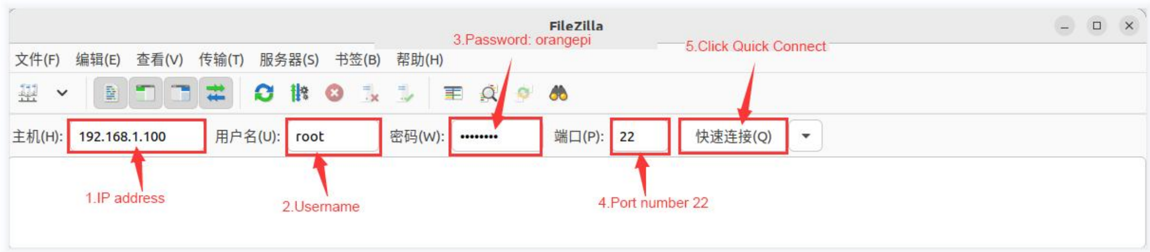
3) During the installation process, please select Decline on the following installation interface, and then select Next>



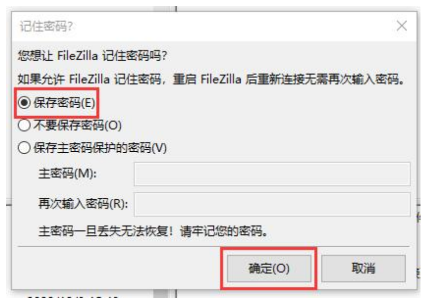
4) The interface after filezilla is opened is as follows, and the display under the remote site on the right is empty



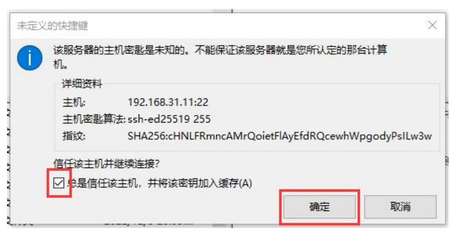
5) The method of connecting the development board is shown in the figure below：



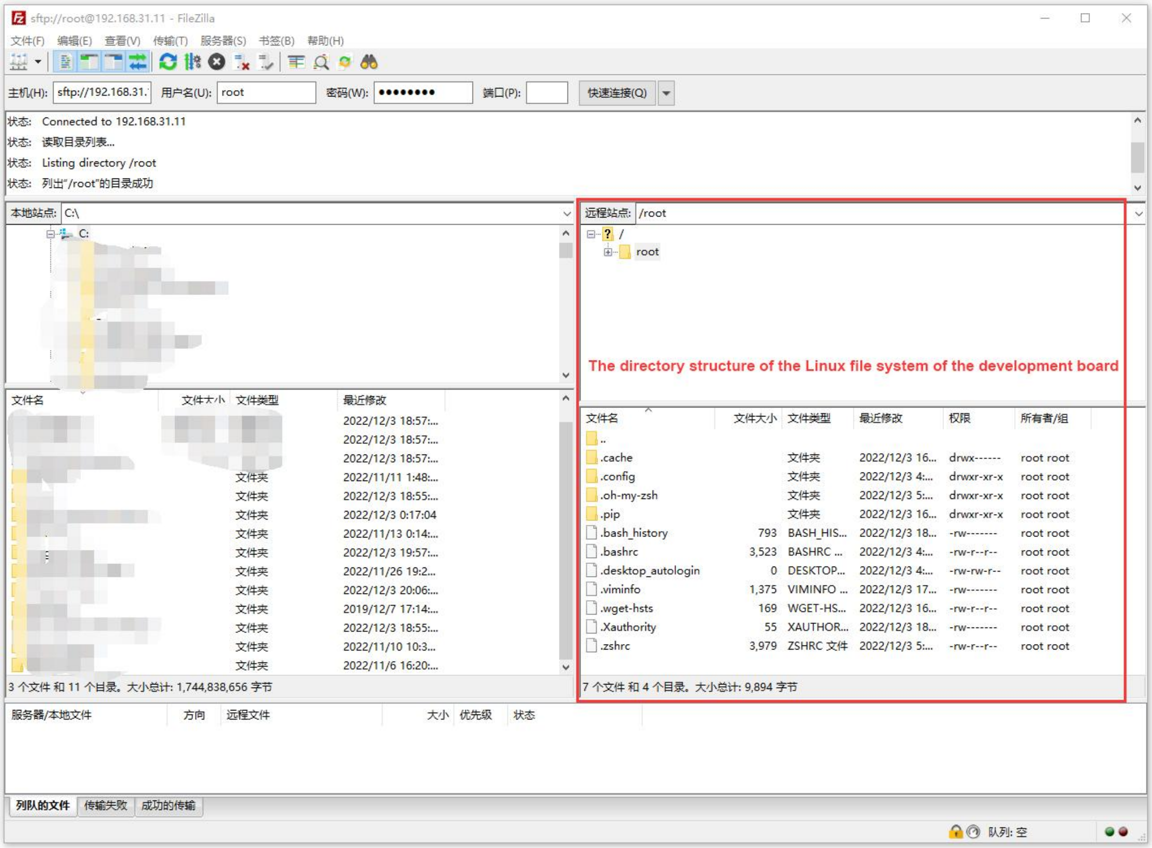
6) Then choose to **save the password**, and then click **OK**



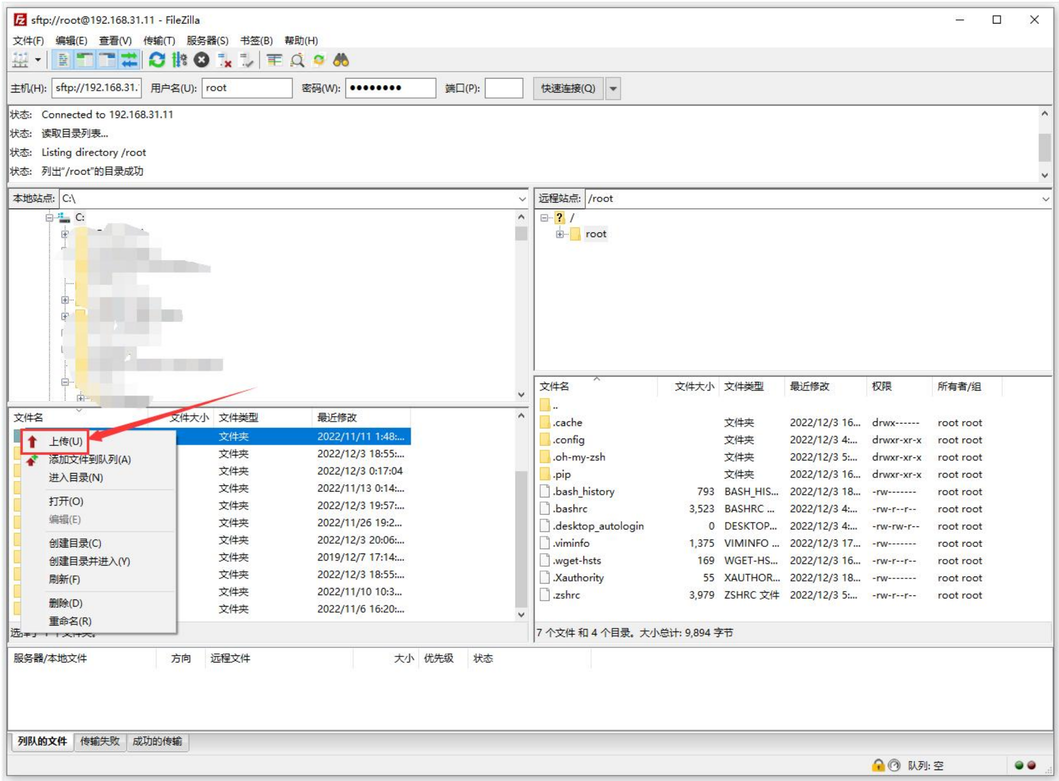
7) Then choose to **always trust this host**, and then click **OK**



8) After the connection is successful, you can see the directory structure of the development board linux file system on the right side of the filezilla software



9) Then select the path to be uploaded to the development board on the right side of the filezilla software, and then select the file to be uploaded on the Windows PC on the left side of the filezilla software, then click the right mouse button, and then click the upload option to start uploading the file to the development board bingo



10) After the upload is complete, you can go to the corresponding path in the Linux system of the development board to view the uploaded files

11) The method of uploading a folder is the same as that of uploading a file, so I won't go into details here

3. 10. HDMI test

3. 10. 1. HDMI display test

1) Use HDMI to HDMI cable to connect Orange Pi development board and HDMI display

2) After starting the linux system, if the HDMI monitor has image output, it means that the HDMI interface is working normally

Note that although many laptops have an HDMI interface, the HDMI interface of the notebook generally only has the output function, and does not have the function of HDMI in, that is to say, the HDMI output of other devices cannot be displayed on the notebook screen.

When you want to connect the HDMI of the development board to the HDMI port of the laptop, please make sure that your laptop supports the HDMI in function.

When the HDMI is not displayed, please check whether the HDMI cable is plugged in tightly. After confirming that there is no problem with the connection, you can change a different screen and try to see if it is displayed.

3.10.2. HDMI to VGA display test

1) First, you need to prepare the following accessories

a. HDMI to VGA Converter

b. A VGA cable

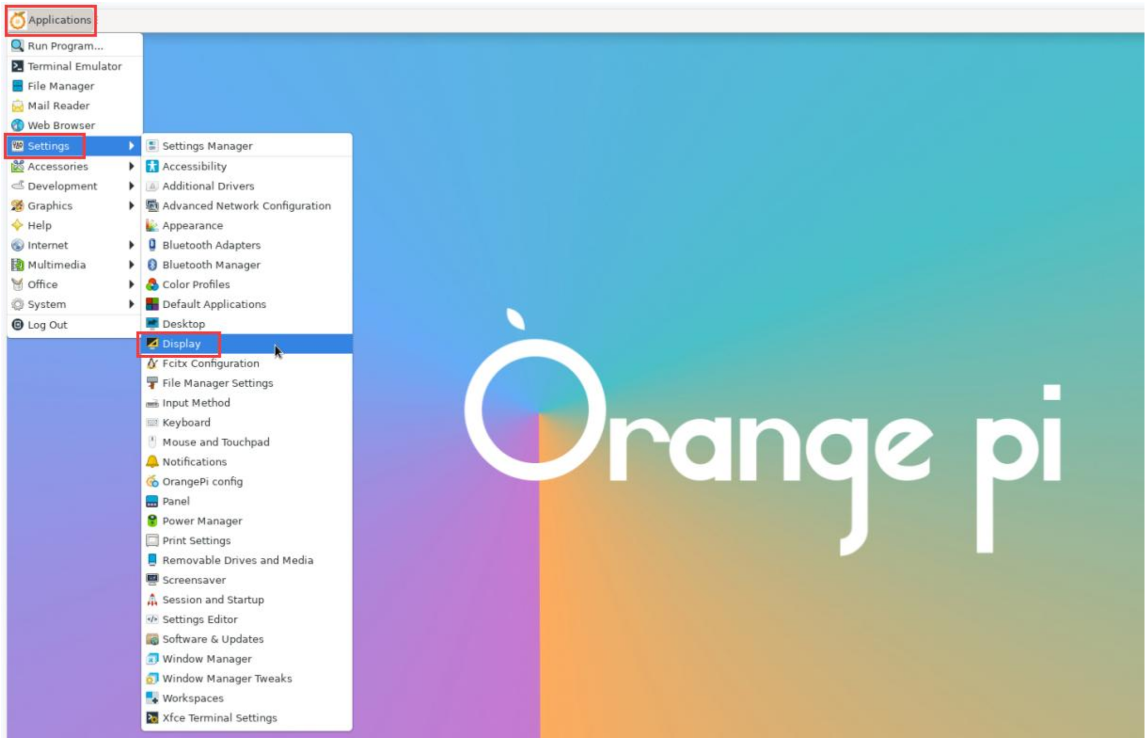
c. A monitor or TV that supports VGA interface

2) HDMI to VGA display test as shown below

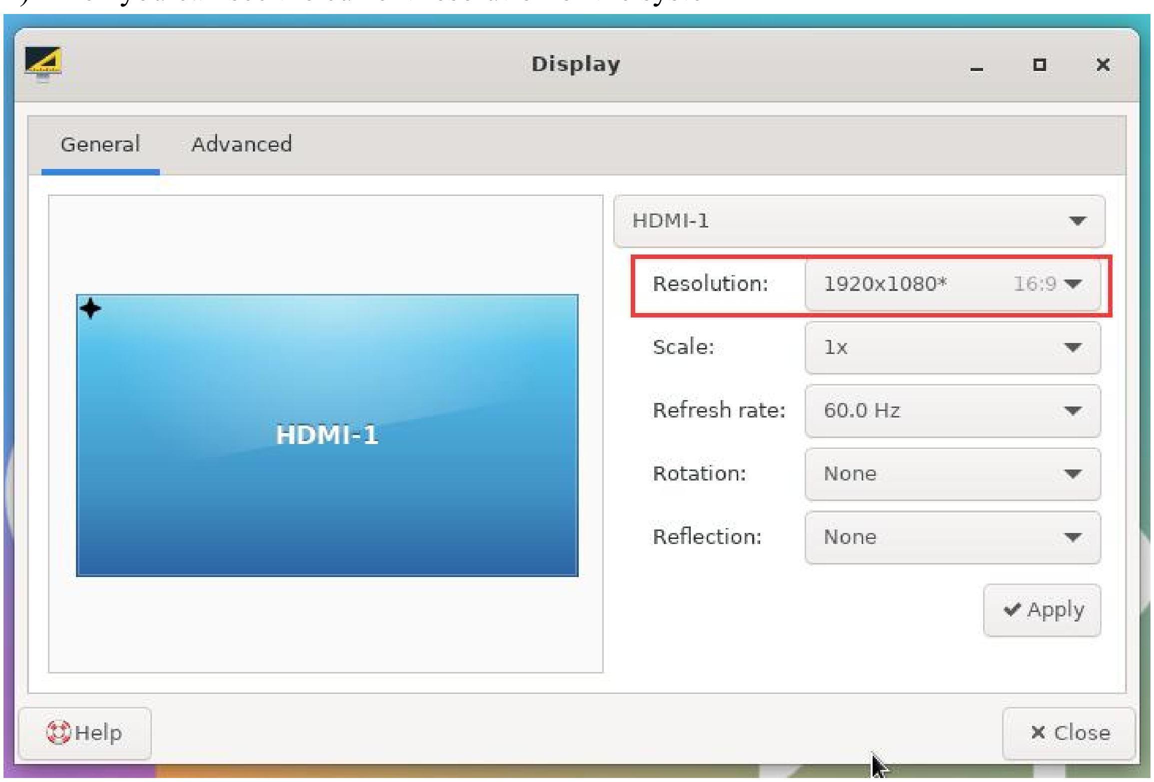
When using HDMI to VGA display, the development board and the Linux system of the development board do not need to make any settings, only the HDMI interface of the development board can display normally. So if there is a problem with the test, please check whether there is a problem with the HDMI to VGA converter, VGA cable and monitor.

3. 10. 3. HDMI resolution setting method

1) First open **Display** in **Settings**

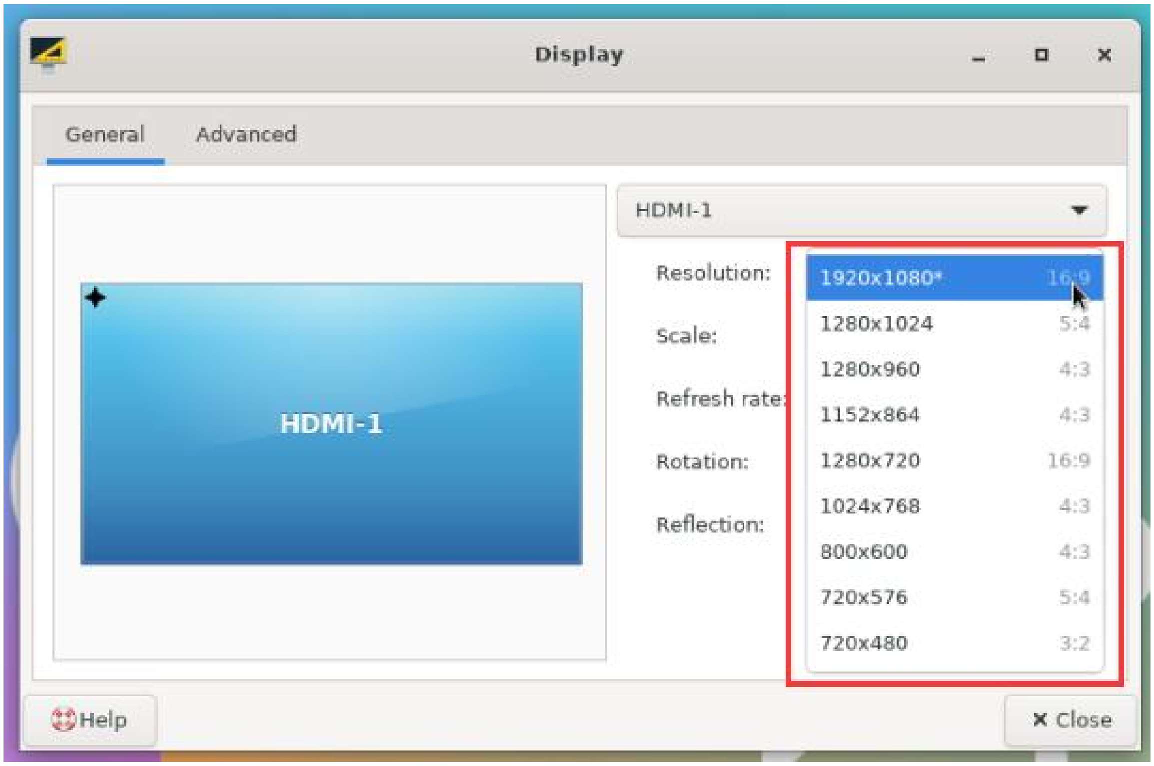


2) Then you can see the current resolution of the system

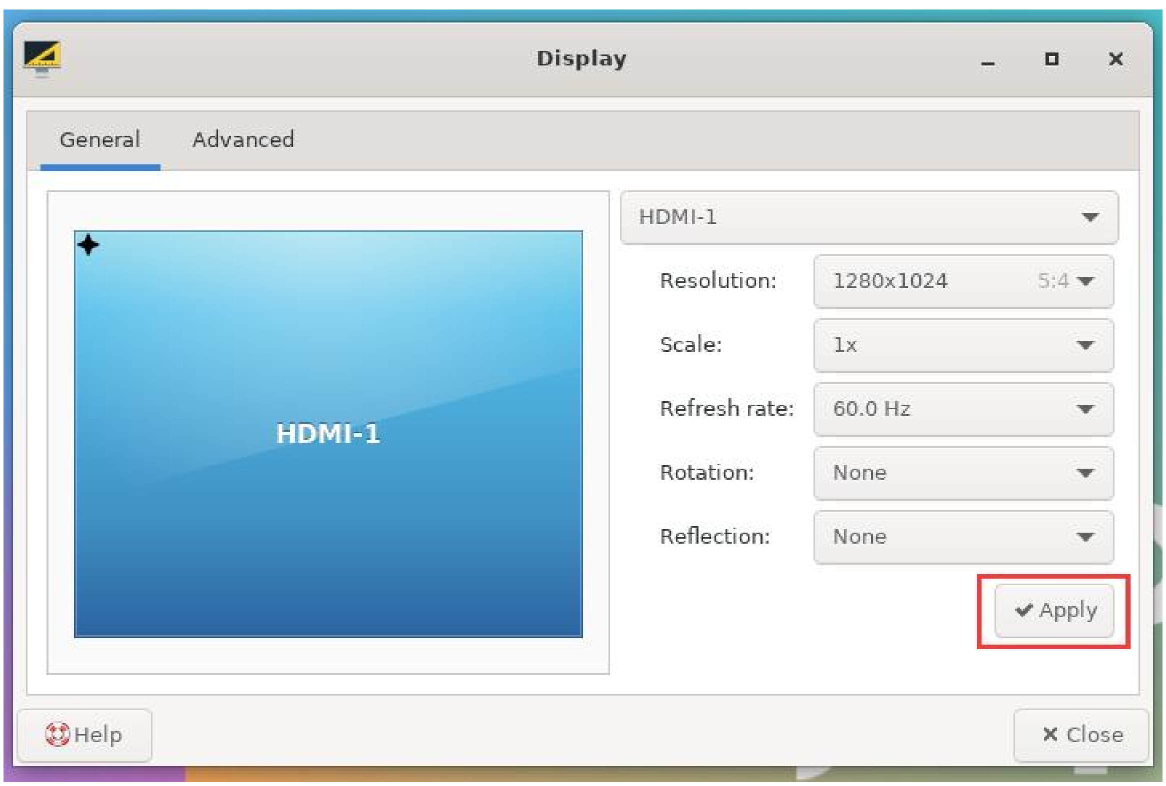


3) Click the drop-down box of Resolution to see all resolutions currently supported by

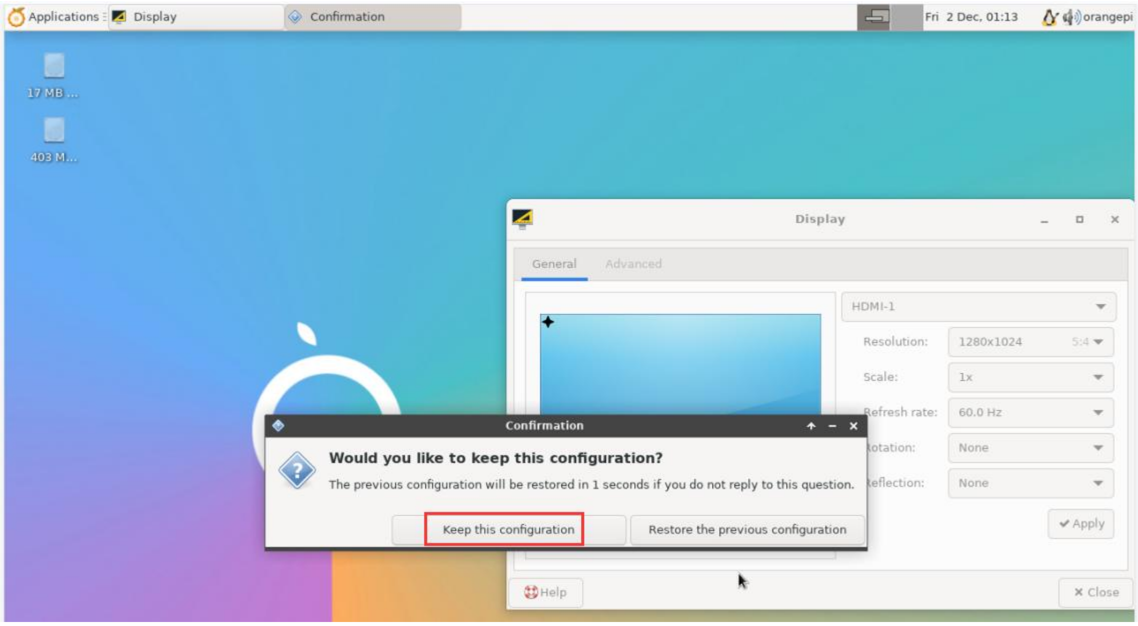
the display



4) Then select the resolution you want to set, and click Apply



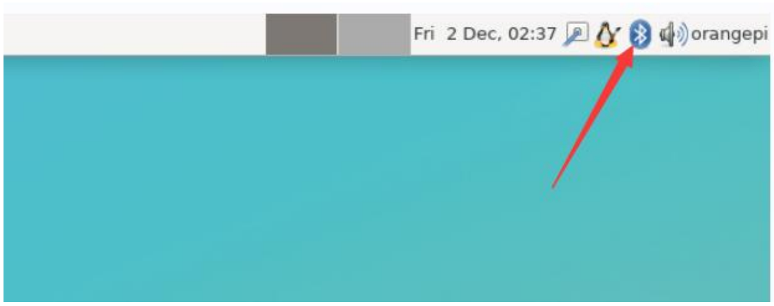
5) After the new resolution is set, select **Keep the configuration**



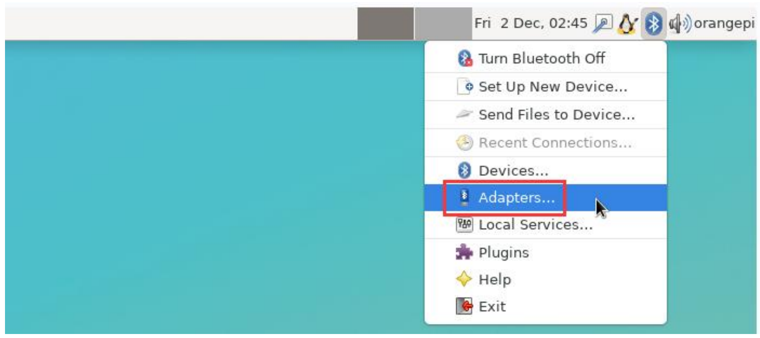
3. 11. How to use Bluetooth

3. 11. 1. Test method of desktop image

1) Click the Bluetooth icon in the upper right corner of the desktop

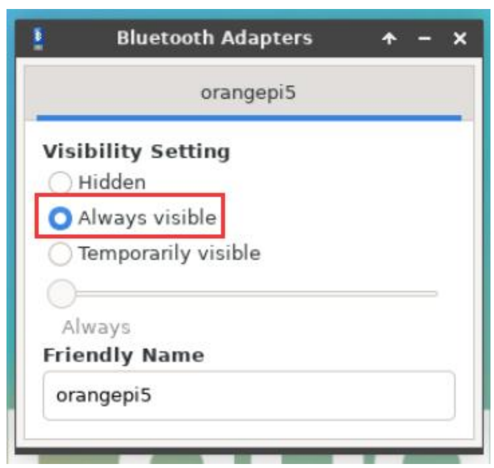


2) Then select the adapter

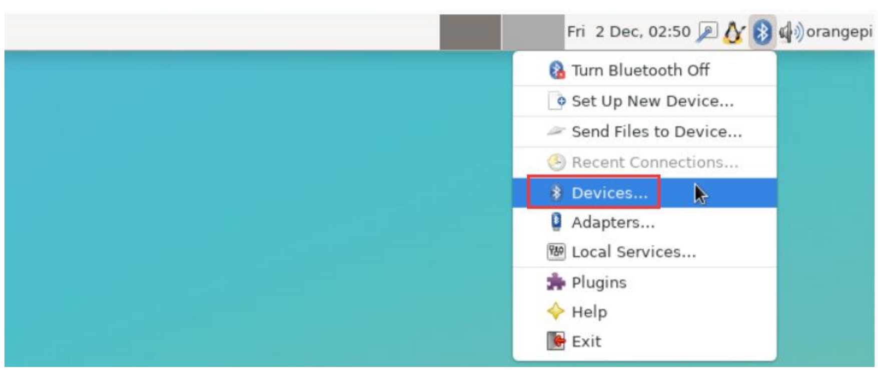


3) If there is a prompt on the following interface, please select **Yes**

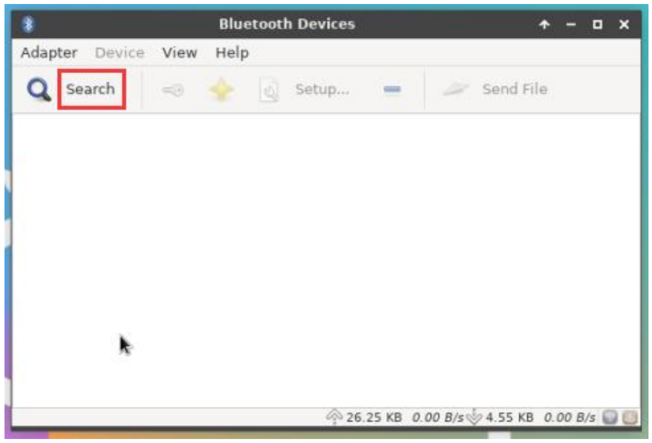
4) Then set the **Visibility Setting** to **Always visible** in the Bluetooth adapter setting interface, and then close it



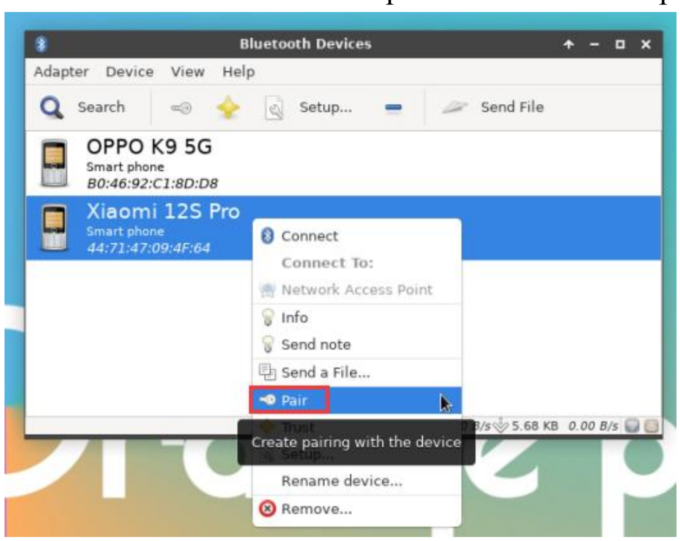
5) Then open the configuration interface of the Bluetooth device



6) Click **Search** to start scanning the surrounding Bluetooth devices

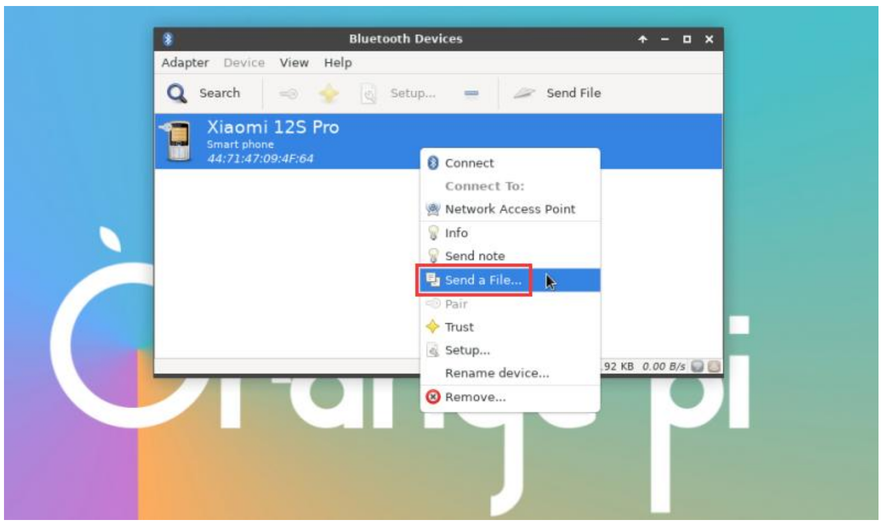


6) Then select the Bluetooth device you want to connect to, and then click the right button of the mouse to pop up the operation interface of the Bluetooth device, select **Pair** to start pairing, and the demonstration here is to pair with an Android phone

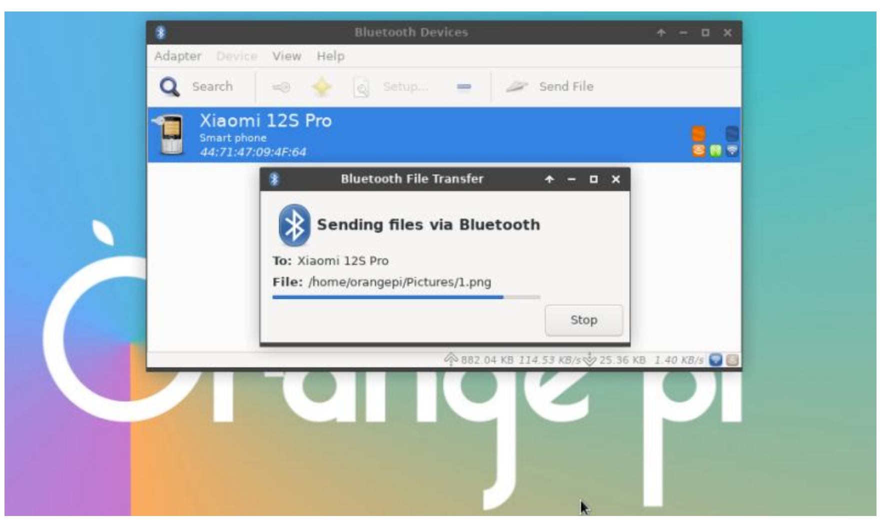


7) When pairing, a pairing confirmation box will pop up in the upper right corner of the desktop, just select **Confirm** to confirm, and the phone also needs to confirm at this time

8) After pairing with the mobile phone, you can select the paired Bluetooth device, then right-click and select **Send a File** to start sending a picture to the mobile phone



9) The interface for sending pictures is as follows



3. 12. USB interface test

The USB interface can be connected to a USB hub to expand the number of USB interfaces.

3. 12. 1. Connect USB mouse or keyboard to test

1) Insert the USB interface keyboard into the USB interface of the Orange Pi development board

2) Connect the Orange Pi development board to the HDMI display

3) If the mouse or keyboard can operate normally, it means that the USB interface is working normally (the mouse can only be used in the desktop version of the system)

3. 12. 2. Connect USB storage device test

1) First insert the U disk or USB mobile hard disk into the USB interface of the Orange Pi development board

2) Execute the following command, if you can see the output of sdX, it means that the U disk is recognized successfully

```
orangepi@orangepi:~$ cat /proc/partitions | grep "sd*"
major minor    #blocks    name
    8          0      30044160 sda
    8          1      30043119 sda1
```

3) Use the mount command to mount the U disk to **/mnt**, and then you can view the files in the U disk

```
orangepi@orangepi:~$ sudo mount /dev/sda1 /mnt/
orangepi@orangepi:~$ ls /mnt/
test.txt
```

4) After mounting, you can view the capacity usage and mount point of the U disk through the **df -h** command

```
orangepi@orangepi:~$ df -h | grep "sd"
/dev/sda1            29G    208K     29G     1% /mnt
```

3. 12. 3. USB camera test

1) First, you need to prepare a USB camera that supports the UVC protocol as shown in the figure below or similar, and then insert the USB camera into the USB port of the Orange Pi development board

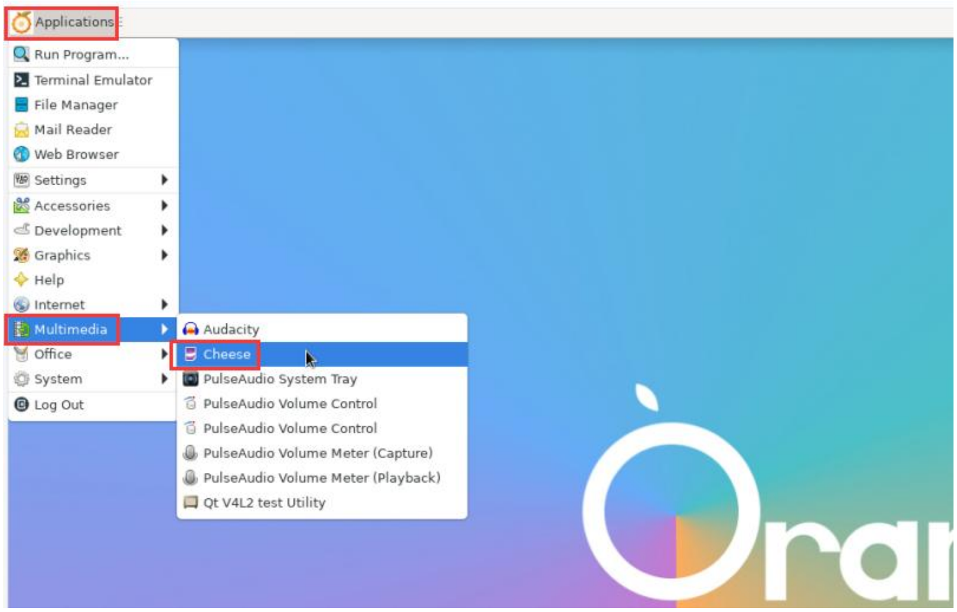
2) Through the v4l2-ctl command, you can see that the device node information of the USB camera is /dev/video0

```
orangepi@orangepi:~$ v4l2-ctl --list-devices
Q8 HD Webcam: Q8 HD Webcam (usb-fc880000.usb-1):
        /dev/video0
        /dev/video1
        /dev/media0
```

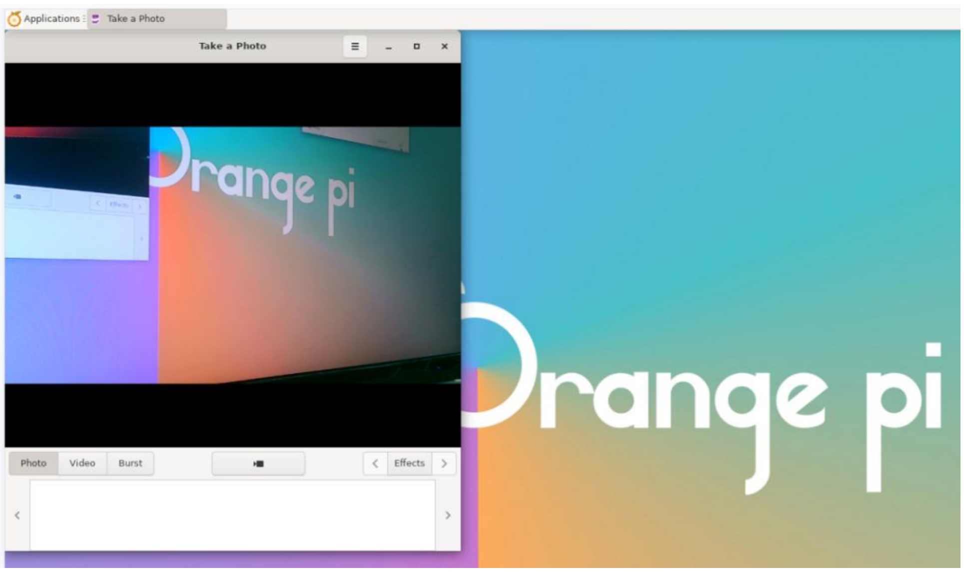
Note that the l in v4l2 is a lowercase letter l, not the number 1.

In addition, the serial number of the video is not necessarily video0, please refer to what you actually see.

3) In the desktop system, Cheese can be used to directly open the USB camera. The method of opening Cheese is shown in the figure below.:



The interface after Cheese turns on the USB camera is shown in the figure below：



4) Method of using fswebcam to test USB camera

a. Install fswebcam

```
orangepi@orangepi:~$ sudo apt update
orangepi@orangepi:~$ sudo apt-get install -y fswebcam
```

b. After installing fswebcam, you can use the following command to take pictures

a)-d option is used to specify the device node of the USB camera

b) --no-banner is used to remove the watermark of the photo

c) The -r option is used to specify the resolution of the photo

d) The -S option is used to set the number of previous frames to skip

e)./image.jpg is used to set the name and path of the generated photo

```
orangepi@orangepi:~$ sudo fswebcam -d /dev/video0  \
--no-banner -r 1280x720 -S 5 ./image.jpg
```

c. In the server version of the linux system, you can use the scp command to transfer the taken pictures to the Ubuntu PC for image viewing after taking pictures

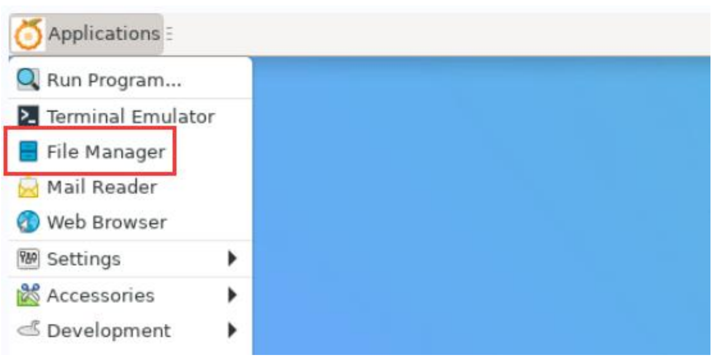
```
orangepi@orangepi:~$ scp image.jpg test@192.168.1.55:/home/test （Modify the IP address and path according to the actual situation）
```

d. In the desktop version of the linux system, you can directly view the captured pictures through the HDMI display

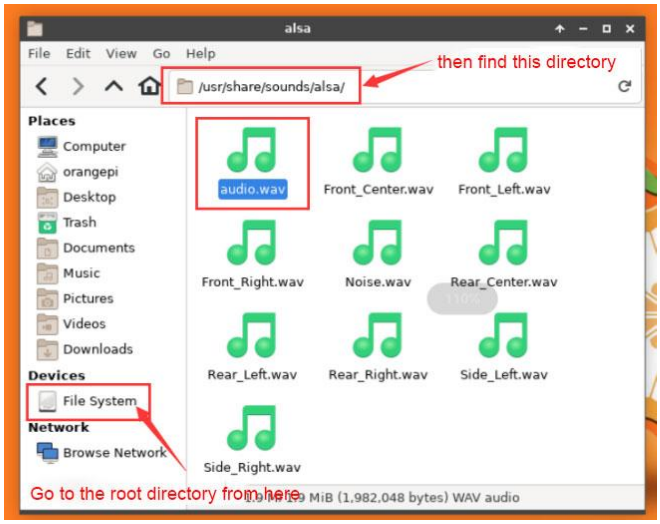
3. 13. Audio Test

3. 13. 1. Testing audio methods on desktop systems

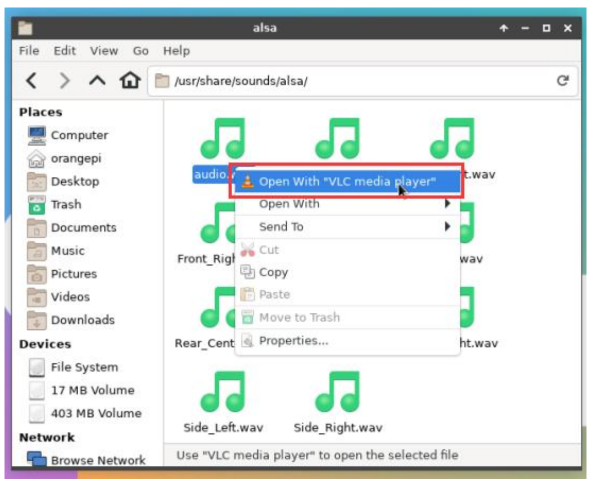
1) First open the file manager



2) Then find the following file (if there is no audio file in the system, you can upload an audio file to the system yourself)

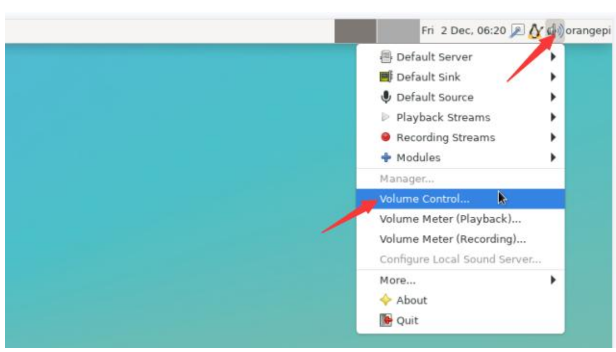


3) Then select the audio.wav file, right click and select open with vlc to start playing

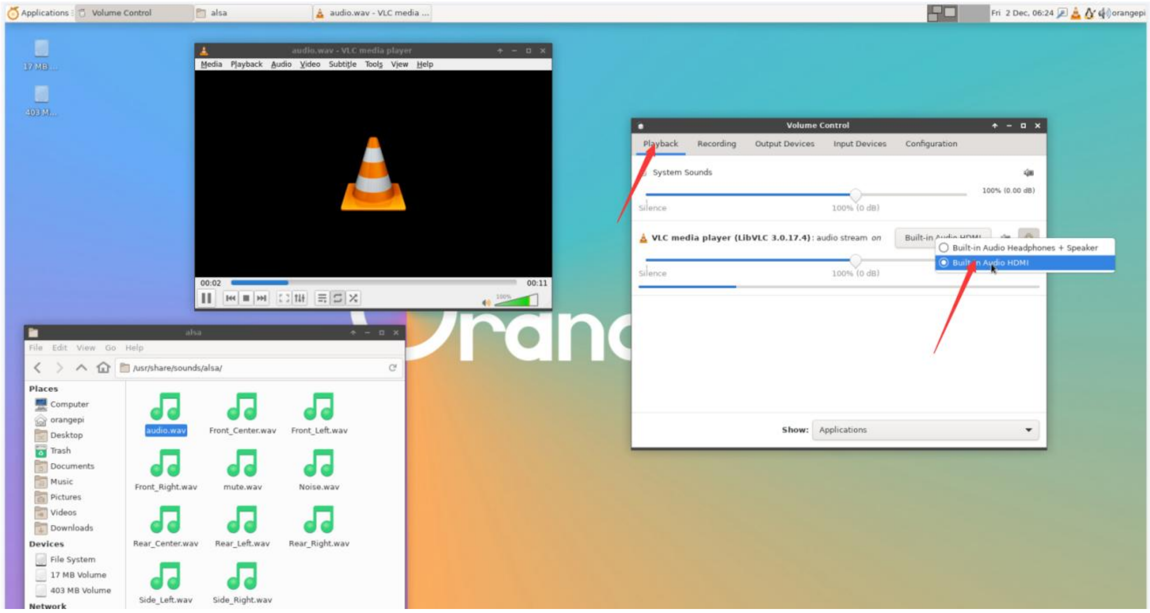


4) How to switch between different audio devices such as HDMI playback and headphone playback

a. First open the volume control interface



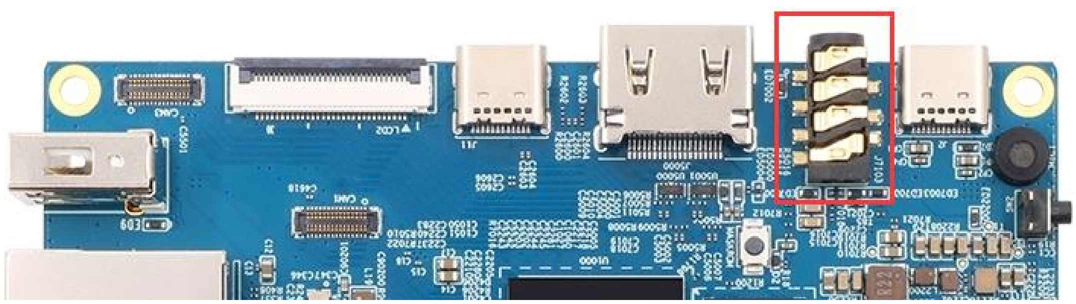
b. When playing audio, the audio device options that the playback software can use will be displayed in **Playback**, as shown in the figure below, where you can set which audio device to play to



3. 13. 2. The method of using commands to play audio

3. 13. 2. 1. Headphone interface playback audio test

1) First insert the earphone into the earphone jack of the development board



2) Then you can use the **aplay -l** command to view the sound card devices supported by the linux system. From the output below, you can see that **card 2** is the sound card device of es8388, that is, the sound card device of the headset

```
orangepi@orangepi:~$ aplay -l
**** List of PLAYBACK Hardware Devices ****
card 0: rockchipdp0 [rockchip-dp0], device 0: rockchip-dp0 spdif-hifi-0 [rockchip-dp0 spdif-hifi-0]
  Subdevices: 1/1
  Subdevice #0: subdevice #0
card 1: rockchiphdmi0 [rockchip-hdmi0], device 0: rockchip-hdmi0 i2s-hifi-0 [rockchip-hdmi0 i2s-hifi-0]
```

```
    Subdevices: 1/1
    Subdevice #0: subdevice #0
card 2: rockchipes8388 [rockchip-es8388], device 0: dailink-multicodecs ES8323.6-0010-0 [dailink-multicodecs ES8323.6-0010-0]
    Subdevices: 1/1
    Subdevice #0: subdevice #0
```

3) Then use the **aplay** command to play the audio file that comes with the system. If the earphone can hear the sound, it means that the hardware can be used normally.

```
orangepi@orangepi:~$ aplay -D hw:2,0 /usr/share/sounds/alsa/audio.wav
Playing WAVE 'audio.wav' : Signed 16 bit Little Endian, Rate 44100 Hz, Stereo
```

3. 13. 2. 2. HDMI audio playback test

1) First use the HDMI to HDMI cable to connect the Orange Pi development board to the TV (other HDMI monitors need to ensure that they can play audio)

2) Then check the serial number of the HDMI sound card. From the output below, you can know that the HDMI sound card is **card 1**

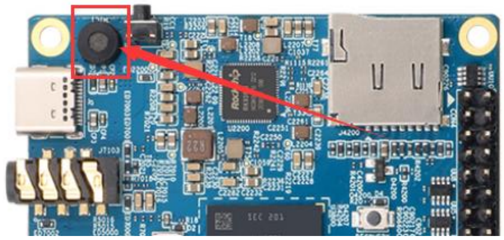
```
orangepi@orangepi:~$ aplay -l
**** List of PLAYBACK Hardware Devices ****
card 0: rockchipdp0 [rockchip-dp0], device 0: rockchip-dp0 spdif-hifi-0 [rockchip-dp0 spdif-hifi-0]
    Subdevices: 1/1
    Subdevice #0: subdevice #0
card 1: rockchiphdmi0 [rockchip-hdmi0], device 0: rockchip-hdmi0 i2s-hifi-0 [rockchip-hdmi0 i2s-hifi-0]
    Subdevices: 1/1
    Subdevice #0: subdevice #0
card 2: rockchipes8388 [rockchip-es8388], device 0: dailink-multicodecs ES8323.6-0010-0 [dailink-multicodecs ES8323.6-0010-0]
    Subdevices: 1/1
    Subdevice #0: subdevice #0
```

3) Then use the **aplay** command to play the audio file that comes with the system. If the HDMI monitor or TV can hear the sound, it means that the hardware can be used normally.

```
orangepi@orangepi:~$ aplay -D hw:1,0 /usr/share/sounds/alsa/audio.wav
```

3. 13. 3. Method of using commands to test recording

1) There is an onboard MIC on the development board, the location is as follows:



2) Running the **test_record.sh main** command will record a piece of audio through the onboard MIC, and then play it to HDMI and headphones.

```
orangepi@orangepi:~$ test_record.sh main
Start recording: /tmp/test.wav
Recording WAVE '/tmp/test.wav' : Signed 16 bit Little Endian, Rate 44100 Hz, Stereo
Start playing
Playing WAVE '/tmp/test.wav' : Signed 16 bit Little Endian, Rate 44100 Hz, Stereo
Playing WAVE '/tmp/test.wav' : Signed 16 bit Little Endian, Rate 44100 Hz, Stereo
```

3) In addition to the onboard MIC, we can also record audio through headphones with MIC function. After inserting the headset with MIC function into the development board, run the **test_record.sh headset** command to record a piece of audio through the headset, and then play it to HDMI and the headset.

```
orangepi@orangepi:~$ test_record.sh headset
Start recording: /tmp/test.wav
Recording WAVE '/tmp/test.wav' : Signed 16 bit Little Endian, Rate 44100 Hz, Stereo
Start playing
Playing WAVE '/tmp/test.wav' : Signed 16 bit Little Endian, Rate 44100 Hz, Stereo
Playing WAVE '/tmp/test.wav' : Signed 16 bit Little Endian, Rate 44100 Hz, Stereo
```

3. 14. Temperature sensor

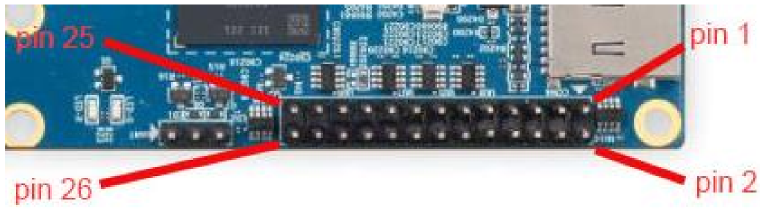
The command to view the system temperature sensor is:

```
orangepi@orangepi:~$ sensors
gpu_thermal-virtual-0
Adapter: Virtual device
```

```
temp1:        +47.2°C

littlecore_thermal-virtual-0
Adapter: Virtual device
temp1:        +47.2°C

bigcore0_thermal-virtual-0
Adapter: Virtual device
temp1:        +47.2°C

tcpm_source_psy_6_0022-i2c-6-22
Adapter: rk3x-i2c
in0:           0.00 V  (min =  +0.00 V, max =  +0.00 V)
curr1:         0.00 A  (max =  +0.00 A)

npu_thermal-virtual-0
Adapter: Virtual device
temp1:        +47.2°C

center_thermal-virtual-0
Adapter: Virtual device
temp1:        +47.2°C

bigcore1_thermal-virtual-0
Adapter: Virtual device
temp1:        +47.2°C

soc_thermal-virtual-0
Adapter: Virtual device
temp1:        +47.2°C  (crit = +115.0°C)
```

3. 15. 26 Pin Interface Pin Description

1) Please refer to the figure below for the order of the 26 pin interface pins on the Orange Pi 5B development board



2) The functions of the 26 pin interface pins of the Orange Pi 5B development board are shown in the table below

a. The following is the complete pin diagram of 26pin

复用功能	复用功能	复用功能	GPIO	GPIO序号	引脚序号	引脚序号	GPIO序号	GPIO	复用功能	复用功能	复用功能
			3.3V		1	2		5V			
PWM13_M2（febf0010）	UART1_RX_M1（feb40000）	I2C5_SDA_M3	GPIO1_B7	47	3	4		5V			
	UART1_TX_M1	I2C5_SCL_M3	GPIO1_B6	46	5	6		GND			
		PWM15_IR_M2（febf0030）	GPIO1_C6	54	7	8	131	GPIO4_A3	UART0_TX_M2（fd890000）		
			GND		9	10	132	GPIO4_A4	UART0_RX_M2		
	PWM14_M1（febf0020）	CAN1_RX_M1	GPIO4_B2	138	11	12	29	GPIO0_D5	CAN2_TX_M1	I2C1_SDA_M2	
		CAN1_TX_M1	GPIO4_B3	139	13	14		GND			
PWM3_IR_M0（fd8b0030）	I2C1_SCL_M2	CAN2_RX_M1	GPIO0_D4	28	15	16	59	GPIO1_D3	UART4_RX_M0（feb70000）	I2C1_SDA_M4	PWM1_M1（fd8b0010）
			3.3V		17	18	58	GPIO1_D2	UART4_TX_M0	I2C1_SCL_M4	PWM0_M1（fd8b0000）
I2C3_SCL_M0	UART3_TX_M0（feb60000）	SPI4_MOSI_M0	GPIO1_C1	49	19	20		GND			
I2C3_SDA_M0	UART3_RX_M0	SPI4_MISO_M0	GPIO1_C0	48	21	22		PowerKey			
	PWM3_IR_M2（fd8b0030）	SPI4_CLK_M0	GPIO1_C2	50	23	24	52	GPIO1_C4	SPI4_CS1_M0		
			GND		25	26	35	GPIO1_A3	PWM1_M2（fd8b0010）		

b. The table below is the picture of the left half of the complete table above, so you can see it clearly

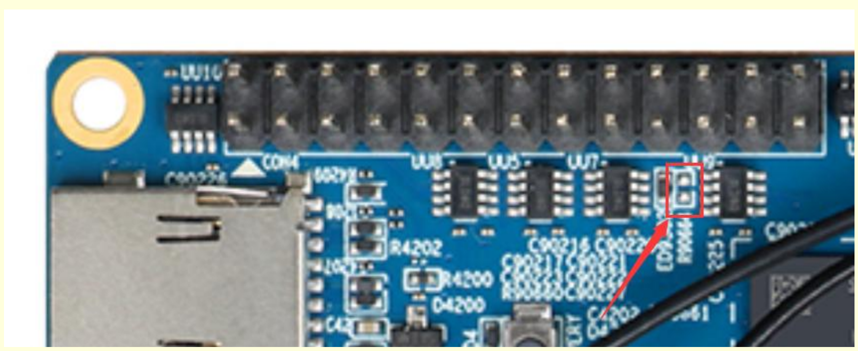
复用功能	复用功能	复用功能	GPIO	GPIO序号	引脚序号
			3.3V		1
PWM13_M2（febf0010）	UART1_RX_M1（feb40000）	I2C5_SDA_M3	GPIO1_B7	47	3
	UART1_TX_M1	I2C5_SCL_M3	GPIO1_B6	46	5
		PWM15_IR_M2（febf0030）	GPIO1_C6	54	7
			GND		9
	PWM14_M1（febf0020）	CAN1_RX_M1	GPIO4_B2	138	11
		CAN1_TX_M1	GPIO4_B3	139	13
PWM3_IR_M0（fd8b0030）	I2C1_SCL_M2	CAN2_RX_M1	GPIO0_D4	28	15
			3.3V		17
I2C3_SCL_M0	UART3_TX_M0（feb60000）	SPI4_MOSI_M0	GPIO1_C1	49	19
I2C3_SDA_M0	UART3_RX_M0	SPI4_MISO_M0	GPIO1_C0	48	21
	PWM3_IR_M2（fd8b0030）	SPI4_CLK_M0	GPIO1_C2	50	23
			GND		25

c. The table below is the picture of the right half of the complete table above, so you can see it clearly

引脚序号	GPIO序号	GPIO	复用功能	复用功能	复用功能
2		5V			
4		5V			
6		GND			
8	131	GPIO4_A3	UART0_TX_M2（fd890000）		
10	132	GPIO4_A4	UART0_RX_M2		
12	29	GPIO0_D5	CAN2_TX_M1	I2C1_SDA_M2	
14		GND			
16	59	GPIO1_D3	UART4_RX_M0（feb70000）	I2C1_SDA_M4	PWM1_M1（fd8b0010）
18	58	GPIO1_D2	UART4_TX_M0	I2C1_SCL_M4	PWM0_M1（fd8b0000）
20		GND			
22		PowerKey			
24	52	GPIO1_C4	SPI4_CS1_M0		
26	35	GPIO1_A3	PWM1_M2（fd8b0010）		

The pwm in the above table has marked the base address of the corresponding register, which is useful when checking which pwmchip in /sys/class/pwm/ corresponds to which pwm pin in the 26pin header.

The 22nd pin in the 26pin is floating and has no purpose by default. But if you solder the lower resistor (100R) on the development board, it can be used as a power-on/off pin (connecting this pin to GND will trigger a shutdown action).



3) There are a total of 16 GPIO ports in the 26pin interface, and the voltage of all GPIO ports is **3.3v**

3. 16. How to install wiringOP

Note that wiringOP has been pre-installed in the linux image released by Orange Pi. Unless the code of wiringOP is updated, there is no need to re-download, compile and install, just use it directly.

The storage path of the compiled wiringOP deb package in orangepi-build is:

orangepi-build/external/cache/debs/arm64/wiringpi_x.xx.deb

After entering the system, you can run the gpio readall command. If you can see the output below, it means that wiringOP has been pre-installed and can be used normally.

```
root@orangepi5b:~# gpio readall
 +------+-----+----------+--------+---+   PI5B   +---+--------+----------+-----+------+
 | GPIO | wPi |   Name   |  Mode  | V | Physical | V |  Mode  | Name     | wPi | GPIO |
 +------+-----+----------+--------+---+----++----+---+--------+----------+-----+------+
 |      |     |     3.3V |        |   |  1 || 2  |   |        | 5V       |     |      |
 |   47 |   0 |    SDA.5 |     IN | 1 |  3 || 4  |   |        | 5V       |     |      |
 |   46 |   1 |    SCL.5 |     IN | 1 |  5 || 6  |   |        | GND      |     |      |
 |   54 |   2 |    PWM15 |     IN | 1 |  7 || 8  | 0 | IN     | RXD.0    | 3   | 131  |
 |      |     |      GND |        |   |  9 || 10 | 0 | IN     | TXD.0    | 4   | 132  |
 |  138 |   5 |  CAN1_RX |     IN | 1 | 11 || 12 | 1 | IN     | CAN2_TX  | 6   | 29   |
 |  139 |   7 |  CAN1_TX |     IN | 1 | 13 || 14 |   |        | GND      |     |      |
 |   28 |   8 |  CAN2_RX |     IN | 1 | 15 || 16 | 1 | IN     | SDA.1    | 9   | 59   |
 |      |     |     3.3V |        |   | 17 || 18 | 1 | IN     | SCL.1    | 10  | 58   |
 |   49 |  11 | SPI4_TXD |     IN | 1 | 19 || 20 |   |        | GND      |     |      |
 |   48 |  12 | SPI4_RXD |     IN | 1 | 21 || 22 |   |        | PowerKey |     |      |
 |   50 |  13 | SPI4_CLK |     IN | 1 | 23 || 24 | 1 | IN     | SPI4_CS1 | 14  | 52   |
 |      |     |      GND |        |   | 25 || 26 | 1 | IN     | PWM1     | 15  | 35   |
 +------+-----+----------+--------+---+----++----+---+--------+----------+-----+------+
 | GPIO | wPi |   Name   |  Mode  | V | Physical | V |  Mode  | Name     | wPi | GPIO |
 +------+-----+----------+--------+---+   PI5B   +---+--------+----------+-----+------+
root@orangepi5b:~#
```

wiringOP is currently mainly adapted to the functions of setting GPIO port input and output, setting GPIO port output high and low levels, and setting pull-up and pull-down resistors. Features like hardware PWM are not available.

1) Download the code of wiringOP

orangepi@orangepi:~$ **sudo apt update**

orangepi@orangepi:~$ **sudo apt install -y git**

orangepi@orangepi:~$ **git clone https://github.com/orangepi-xunlong/wiringOP.git -b next**

Note that Orange Pi 5B needs to download the code of the wiringOP next branch, please don't miss the -b next parameter.

If you have problems downloading the code from GitHub, you can go to the official tool on the Orange Pi 5B data download page to download the source code compression package of wiringOP.tar.gz.

wiringOP source code compressed package

2) Compile and install wiringOP

```
orangepi@orangepi:~$ cd wiringOP
orangepi@orangepi:~/wiringOP$ sudo ./build clean
orangepi@orangepi:~/wiringOP$ sudo ./build
```

3) Test the output of the gpio readall command as follows

```
root@orangepi5b:~# gpio readall
 +------+-----+----------+--------+---+   PI5B   +---+--------+----------+-----+------+
 | GPIO | wPi |   Name   |  Mode  | V | Physical | V |  Mode  | Name     | wPi | GPIO |
 +------+-----+----------+--------+---+----++----+---+--------+----------+-----+------+
 |      |     |     3.3V |        |   |  1 || 2  |   |        | 5V       |     |      |
 |   47 |   0 |    SDA.5 |     IN | 1 |  3 || 4  |   |        | 5V       |     |      |
 |   46 |   1 |    SCL.5 |     IN | 1 |  5 || 6  |   |        | GND      |     |      |
 |   54 |   2 |    PWM15 |     IN | 1 |  7 || 8  | 0 | IN     | RXD.0    | 3   | 131  |
 |      |     |      GND |        |   |  9 || 10 | 0 | IN     | TXD.0    | 4   | 132  |
 |  138 |   5 |  CAN1_RX |     IN | 1 | 11 || 12 | 1 | IN     | CAN2_TX  | 6   | 29   |
 |  139 |   7 |  CAN1_TX |     IN | 1 | 13 || 14 |   |        | GND      |     |      |
 |   28 |   8 |  CAN2_RX |     IN | 1 | 15 || 16 | 1 | IN     | SDA.1    | 9   | 59   |
 |      |     |     3.3V |        |   | 17 || 18 | 1 | IN     | SCL.1    | 10  | 58   |
 |   49 |  11 | SPI4_TXD |     IN | 1 | 19 || 20 |   |        | GND      |     |      |
 |   48 |  12 | SPI4_RXD |     IN | 1 | 21 || 22 |   |        | PowerKey |     |      |
 |   50 |  13 | SPI4_CLK |     IN | 1 | 23 || 24 | 1 | IN     | SPI4_CS1 | 14  | 52   |
 |      |     |      GND |        |   | 25 || 26 | 1 | IN     | PWM1     | 15  | 35   |
 +------+-----+----------+--------+---+----++----+---+--------+----------+-----+------+
 | GPIO | wPi |   Name   |  Mode  | V | Physical | V |  Mode  | Name     | wPi | GPIO |
 +------+-----+----------+--------+---+   PI5B   +---+--------+----------+-----+------+
root@orangepi5b:~#
```

3. 17. 26pin interface GPIO, I2C, UART, SPI and PWM test

Note, if you need to set overlays to open multiple configurations at the same time, please use spaces to separate them and write them on one line as follows.

orangepi@orangepi:~$ **sudo vim /boot/orangepiEnv.txt**

overlays=i2c1-m2 lcd1 ov13850-c1 pwm13-m2 spi4-m0-cs1-spidev uart0-m2

3. 17. 1. 26pin GPIO port test

The linux system released by Orange Pi has a pre-installed blink_all_gpio program, which will set all 16 GPIO ports in the 26pin to switch between high and low levels continuously.

After running the blink_all_gpio program, when using a multimeter to measure

the level of the GPIO port, you will find that the GPIO pin will switch between 0 and 3.3v continuously. Using this program we can test whether the GPIO port is working properly.

The way to run the blink_all_gpio program is as follows:

orangepi@orangepi5b:~$ **sudo blink_all_gpio** #Remember to add sudo permission
[sudo] password for orangepi: #A password is required here

1) A total of **16** GPIO ports can be used in the 26pins of the development board. The following uses pin 7—the corresponding GPIO is GPIO1_C6——the corresponding wPi serial number is 2—as an example to demonstrate how to set the high and low levels of the GPIO port

```
root@orangepi5b:~# gpio readall
 +------+-----+----------+--------+---+   PI5B   +---+--------+----------+-----+------+
 | GPIO | wPi |   Name   |  Mode  | V | Physical | V |  Mode  | Name     | wPi | GPIO |
 +------+-----+----------+--------+---+----++----+---+--------+----------+-----+------+
 |      |     |     3.3V |        |   |  1 || 2  |   |        | 5V       |     |      |
 |   47 |   0 |    SDA.5 |     IN | 1 |  3 || 4  |   |        | 5V       |     |      |
 |   46 |   1 |    SCL.5 |     IN | 1 |  5 || 6  |   |        | GND      |     |      |
 |   54 |   2 |    PWM15 |     IN | 1 |  7 || 8  | 0 | IN     | RXD.0    | 3   | 131  |
 |      |     |      GND |        |   |  9 || 10 | 0 | IN     | TXD.0    | 4   | 132  |
```

2) First set the GPIO port to output mode, where the third parameter needs to input the serial number of wPi corresponding to the pin

root@orangepi:~/wiringOP# **gpio mode 2 out**

3) Then set the GPIO port to output a low level. After setting, you can use a multimeter to measure the voltage value of the pin. If it is 0v, it means that the low level is set successfully.

root@orangepi:~/wiringOP# **gpio write 2 0**

Use gpio readall to see that the value (V) of pin 7 has changed to 0

```
root@orangepi5b:~# gpio readall
 +------+-----+----------+--------+---+   PI5B   +---+--------+----------+-----+------+
 | GPIO | wPi |   Name   |  Mode  | V | Physical | V |  Mode  | Name     | wPi | GPIO |
 +------+-----+----------+--------+---+----++----+---+--------+----------+-----+------+
 |      |     |     3.3V |        |   |  1 || 2  |   |        | 5V       |     |      |
 |   47 |   0 |    SDA.5 |     IN | 1 |  3 || 4  |   |        | 5V       |     |      |
 |   46 |   1 |    SCL.5 |     IN | 1 |  5 || 6  |   |        | GND      |     |      |
 |   54 |   2 |    PWM15 |    OUT | 0 |  7 || 8  | 0 | IN     | RXD.0    | 3   | 131  |
 |      |     |      GND |        |   |  9 || 10 | 0 | IN     | TXD.0    | 4   | 132  |
```

4) Then set the GPIO port to output a high level. After setting, you can use a multimeter

to measure the voltage value of the pin. If it is 3.3v, it means that the high level is set successfully.

```
root@orangepi:~/wiringOP# gpio write 2 1
```

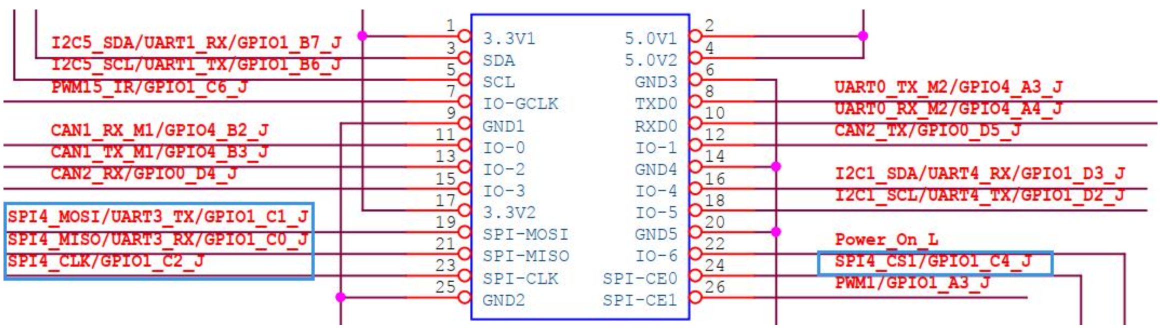
Use gpio readall to see that the value (V) of pin 7 has changed to 1

```
root@orangepi5b:~# gpio readall
 +------+-----+----------+--------+---+   PI5B   +---+--------+----------+-----+------+
 | GPIO | wPi |   Name   |  Mode  | V | Physical | V |  Mode  | Name     | wPi | GPIO |
 +------+-----+----------+--------+---+----++----+---+--------+----------+-----+------+
 |      |     |     3.3V |        |   |  1 || 2  |   |        | 5V       |     |      |
 |   47 |   0 |    SDA.5 |     IN | 1 |  3 || 4  |   |        | 5V       |     |      |
 |   46 |   1 |    SCL.5 |     IN | 1 |  5 || 6  |   |        | GND      |     |      |
 |   54 |   2 |    PWM15 |    OUT | 1 |  7 || 8  | 0 | IN     | RXD.0    | 3   | 131  |
 |      |     |      GND |        |   |  9 || 10 | 0 | IN     | TXD.0    | 4   | 132  |
```

5) The setting method of other pins is similar, just modify the serial number of wPi to the corresponding serial number of the pin

3. 17. 2. 26pin SPI test

1) According to the schematic diagram of the 26pin interface, the spi available for Orange Pi 5B is spi4



In the Linux system, the spi4 in the 26pin is closed by default, and it needs to be opened manually to use it.

Add the following red font configuration in /boot/orangepiEnv.txt, and then restart the Linux system to open spi4.

```
orangepi@orangepi:~$ sudo vim /boot/orangepiEnv.txt
overlays=spi4-m0-cs1-spidev
```

2) First check whether there is a **spidev4.1** device node in the linux system. If it exists, it means that SPI4 has been set up and can be used directly

```
orangepi@orangepi:~$ ls /dev/spidev4.1
```

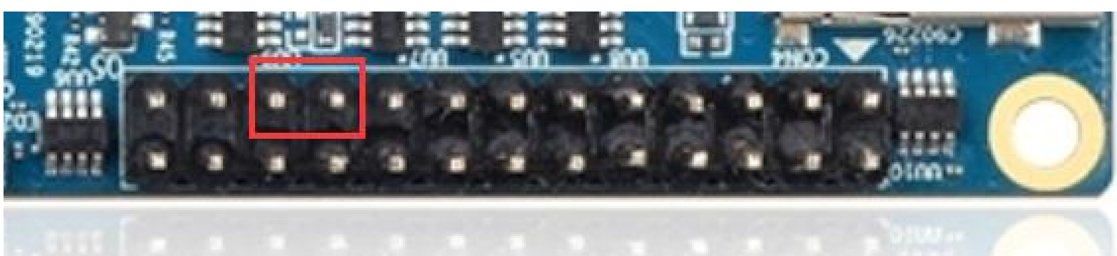
```
/dev/spidev4.1
```

Note that /dev/spidev4.0 cannot be used, please use /dev/spidev4.1, don't make a mistake.

3) Do not short-circuit the mosi and miso pins of SPI4, the output result of running spidev_test is as follows, you can see that the data of TX and RX are inconsistent

```
orangepi@orangepi:~$ sudo spidev_test -v -D /dev/spidev4.1
spi mode: 0x0
bits per word: 8
max speed: 500000 Hz (500 KHz)
TX | FF FF FF FF FF FF 40 00 00 00 00 95 FF FF FF FF FF FF FF FF FF FF FF FF FF
FF FF FF FF FF F0 0D  | ......@....▒.................▒.
RX | FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
FF FF FF FF FF FF FF FF  | ................................
```

4) Then short-circuit the two pins of mosi (the 19th pin in the 26pin interface) and miso (the 21st pin in the 26pin interface) of SPI4, and then run the output of spidev_test as follows, you can see the sending and receiving same data



```
orangepi@orangepi:~$ sudo spidev_test -v -D /dev/spidev4.1
spi mode: 0x0
bits per word: 8
max speed: 500000 Hz (500 KHz)
TX | FF FF FF FF FF FF 40 00 00 00 00 95 FF FF FF FF FF FF FF FF FF FF FF FF FF
FF FF FF FF FF F0 0D  | ......@....▒.................▒.
RX | FF FF FF FF FF FF 40 00 00 00 00 95 FF FF FF FF FF FF FF FF FF FF FF FF FF
FF FF FF FF FF F0 0D  | ......@....▒.................▒.
```

3. 17. 3. 26pin I2C test

1) As can be seen from the table below, the available i2c for Orange Pi 5B is i2c1, i2c3

and i2c5, a total of three sets of i2c buses

复用功能	复用功能	复用功能	GPIO	GPIO序号	引脚序号	引脚序号	GPIO序号	GPIO	复用功能	复用功能	复用功能
			3.3V		1	2		5V			
PWM13_M2（febf0010）	UART1_RX_M1（feb40000）	I2C5_SDA_M3	GPIO1_B7	47	3	4		5V			
	UART1_TX_M1	I2C5_SCL_M3	GPIO1_B6	46	5	6		GND			
		PWM15_IR_M2（febf0030）	GPIO1_C6	54	7	8	131	GPIO4_A3	UART0_TX_M2（fd890000）		
			GND		9	10	132	GPIO4_A4	UART0_RX_M2		
	PWM14_M1（febf0020）	CAN1_RX_M1	GPIO4_B2	138	11	12	29	GPIO0_D5	CAN2_TX_M1	I2C1_SDA_M2	
		CAN1_TX_M1	GPIO4_B3	139	13	14		GND			
PWM3_IR_M0（fd8b0030）	I2C1_SCL_M2	CAN2_RX_M1	GPIO0_D4	28	15	16	59	GPIO1_D3	UART4_RX_M0（feb70000）	I2C1_SDA_M4	PWM1_M1（fd8b0010）
			3.3V		17	18	58	GPIO1_D2	UART4_TX_M0	I2C1_SCL_M4	PWM0_M1（fd8b0000）
I2C3_SCL_M0	UART3_TX_M0（feb60000）	SPI4_MOSI_M0	GPIO1_C1	49	19	20		GND			
I2C3_SDA_M0	UART3_RX_M0	SPI4_MISO_M0	GPIO1_C0	48	21	22		PowerKey			
	PWM3_IR_M2（fd8b0030）	SPI4_CLK_M0	GPIO1_C2	50	23	24	52	GPIO1_C4	SPI4_CS1_M0		
			GND		25	26	35	GPIO1_A3	PWM1_M2（fd8b0010）		

As can be seen from the above table, i2c1 can be derived from pins 12 and 15 of 26pin (i2c1_m2), and can also be derived from pins 16 and 18 of 26pin (i2c1_m4), please follow your own needs Just select a group. Please don't think that these are two different sets of i2c buses.

In the linux system, the i2c in the 26pin is turned off by default, and it needs to be turned on manually before it can be used.

Add the following configuration in red font to /boot/orangepiEnv.txt, and then restart the Linux system to open i2c1, i2c3 and i2c5 at the same time. If you only need to open one, then just fill in one.

Select the settings for i2c1_m2 as shown below:

```
orangepi@orangepi:~$ sudo vim /boot/orangepiEnv.txt
overlays=i2c1-m2    i2c3-m0    i2c5-m3
```

Select the settings for i2c1_m4 as shown below:

```
orangepi@orangepi:~$ sudo vim /boot/orangepiEnv.txt
overlays=i2c1-m4    i2c3-m0    i2c5-m3
```

2) After starting the linux system, first confirm that there is an i2c device node under /dev

```
orangepi@orangepi:~$ ls /dev/i2c-*
/dev/i2c-0    /dev/i2c-10    /dev/i2c-3    /dev/i2c-6    /dev/i2c-9
/dev/i2c-1    /dev/i2c-2     /dev/i2c-5    /dev/i2c-7
```

3) Then connect an i2c device to the i2c pin of the 26pin connector

	i2c1-m2	i2c1-m4	i2c3-m0	i2c5-m3

Sda pin	Corresponding to pin 12	Corresponding to pin 16	Corresponding to pin 21	Corresponding to pin 3
Sck pin	Corresponding to pin 15	Corresponding to pin 18	Corresponding to pin 19	Corresponding to pin 5
Vcc pin	Corresponding to pin 1	Corresponding to pin 1	Corresponding to pin 1	Corresponding to pin 1
Gnd pin	Corresponding to pin 6	Corresponding to pin 6	Corresponding to pin 6	Corresponding to pin 6

4) Then use the **i2cdetect -y** command, if the address of the connected i2c device can be detected, it means that i2c can be used normally

```
orangepi@orangepi:~$ sudo i2cdetect -y 1        #i2c1 command
orangepi@orangepi:~$ sudo i2cdetect -y 3        #i2c3 command
orangepi@orangepi:~$ sudo i2cdetect -y 5        #i2c5 command
```

```
orangepi@orangepi5:~$ sudo i2cdetect -y 5
[sudo] password for orangepi:
     0  1  2  3  4  5  6  7  8  9  a  b  c  d  e  f
00:                         -- -- -- -- -- -- -- --
10: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
20: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
30: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
40: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
50: 50 -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
60: -- -- -- -- -- -- -- -- 68 -- -- -- -- -- -- --
70: -- -- -- -- -- -- -- --
orangepi@orangepi5:~$
```

3. 17. 4. 26pin UART test

1) As can be seen from the table below, the available uarts for Orange Pi 5B are four groups of uart buses: uart0, uart1, uart3 and uart4

复用功能	复用功能	复用功能	GPIO	GPIO序号	引脚序号	引脚序号	GPIO序号	GPIO	复用功能	复用功能	复用功能
			3.3V		1	2		5V			
PWM13_M2（febf0010）	UART1_RX_M1（feb40000）	I2C5_SDA_M3	GPIO1_B7	47	3	4		5V			
	UART1_TX_M1	I2C5_SCL_M3	GPIO1_B6	46	5	6		GND			
		PWM15_IR_M2（febf0030）	GPIO1_C6	54	7	8	131	GPIO4_A3	UART0_TX_M2（fd890000）		
			GND		9	10	132	GPIO4_A4	UART0_RX_M2		
	PWM14_M1（febf0020）	CAN1_RX_M1	GPIO4_B2	138	11	12	29	GPIO0_D5	CAN2_TX_M1	I2C1_SDA_M2	
		CAN1_TX_M1	GPIO4_B3	139	13	14		GND			
PWM3_IR_M0（fd8b0030）	I2C1_SCL_M2	CAN2_RX_M1	GPIO0_D4	28	15	16	59	GPIO1_D3	UART4_RX_M0（feb70000）	I2C1_SDA_M4	PWM1_M1（fd8b0010）
			3.3V		17	18	58	GPIO1_D2	UART4_TX_M0	I2C1_SCL_M4	PWM0_M1（fd8b0000）
I2C3_SCL_M0	UART3_TX_M0（feb60000）	SPI4_MOSI_M0	GPIO1_C1	49	19	20		GND			
I2C3_SDA_M0	UART3_RX_M0	SPI4_MISO_M0	GPIO1_C0	48	21	22		PowerKey			
	PWM3_IR_M2（fd8b0030）	SPI4_CLK_M0	GPIO1_C2	50	23	24	52	GPIO1_C4	SPI4_CS1_M0		
			GND		25	26	35	GPIO1_A3	PWM1_M2（fd8b0010）		

In the Linux system, the uart in the 26pin is closed by default, and it needs to be opened manually before it can be used.

Add the following red font configuration in /boot/orangepiEnv.txt, and then restart the Linux system to open uart0, uart1, uart3 and uart4 at the same time. If you only need to open one, then fill in one.

```
orangepi@orangepi:~$ sudo vim /boot/orangepiEnv.txt
overlays=uart0-m2 uart1-m1 uart3-m0 uart4-m0
```

2) After entering the linux system, first confirm whether there is a device node corresponding to uart under /dev

```
orangepi@orangepi:~$ ls /dev/ttyS*
/dev/ttyS0 /dev/ttyS1 /dev/ttyS3 /dev/ttyS4 /dev/ttyS9
```

3) Then start to test the uart interface, first use the DuPont line to short the rx and tx of the uart interface to be tested

	uart0	uart1	uart3	uart4
Tx pin	Corresponding to pin 8	Corresponding to pin 5	Corresponding to pin 19	Corresponding to pin 18
Rx pin	Corresponding to pin 10	Corresponding to pin 3	Corresponding to pin 21	Corresponding to pin 16

4) Use the **gpio serial** command to test the loopback function of the serial port as shown below. If you can see the following print, it means that the serial port communication is normal

a. Test UART0

```
orangepi@orangepi:~$ sudo gpio serial /dev/ttyS0
[sudo] password for orangepi:    #enter password here

Out:    0:  ->   0
Out:    1:  ->   1
```

```
Out:    2:  ->   2
Out:    3:  ->   3
Out:    4:  ->   4
Out:    5:  ->   5^C
```

b. Test UART1

```
orangepi@orangepi:~$ sudo gpio serial /dev/ttyS1
[sudo] password for orangepi:   #enter password here

Out:    0:  ->   0
Out:    1:  ->   1
Out:    2:  ->   2
Out:    3:  ->   3
Out:    4:  ->   4
Out:    5:  ->   5^C
```

c. Test UART3

```
orangepi@orangepi:~$ sudo gpio serial /dev/ttyS3
[sudo] password for orangepi:   #enter password here

Out:    0:  ->   0
Out:    1:  ->   1
Out:    2:  ->   2
Out:    3:  ->   3
Out:    4:  ->   4
Out:    5:  ->   5^C
```

d. Test UART4

```
orangepi@orangepi:~$ sudo gpio serial /dev/ttyS4
[sudo] password for orangepi:   #enter password here

Out:    0:  ->   0
Out:    1:  ->   1
Out:    2:  ->   2
Out:    3:  ->   3
Out:    4:  ->   4
Out:    5:  ->   5^C
```

3. 17. 5. PWM test method

1) As can be seen from the table below, the available pwm for Orange Pi 5B includes pwm0, pwm1, pwm3, pwm13, pwm14 and pwm15, a total of six pwm

复用功能	复用功能	复用功能	GPIO	GPIO序号	引脚序号	引脚序号	GPIO序号	GPIO	复用功能	复用功能	复用功能
			3.3V		1	2		5V			
PWM13_M2（febf0010）	UART1_RX_M1（feb40000）	I2C5_SDA_M3	GPIO1_B7	47	3	4		5V			
	UART1_TX_M1	I2C5_SCL_M3	GPIO1_B6	46	5	6		GND			
		PWM15_IR_M2（febf0030）	GPIO1_C6	54	7	8	131	GPIO4_A3	UART0_TX_M2（fd890000）		
			GND		9	10	132	GPIO4_A4	UART0_RX_M2		
	PWM14_M1（febf0020）	CAN1_RX_M1	GPIO4_B2	138	11	12	29	GPIO0_D5	CAN2_TX_M1	I2C1_SDA_M2	
		CAN1_TX_M1	GPIO4_B3	139	13	14		GND			
PWM3_IR_M0（fd8b0030）	I2C1_SCL_M2	CAN2_RX_M1	GPIO0_D4	28	15	16	59	GPIO1_D3	UART4_RX_M0（feb70000）	I2C1_SDA_M4	PWM1_M1（fd8b0010）
			3.3V		17	18	58	GPIO1_D2	UART4_TX_M0	I2C1_SCL_M4	PWM0_M1（fd8b0000）
I2C3_SCL_M0	UART3_TX_M0（feb60000）	SPI4_MOSI_M0	GPIO1_C1	49	19	20		GND			
I2C3_SDA_M0	UART3_RX_M0	SPI4_MISO_M0	GPIO1_C0	48	21	22		PowerKey			
	PWM3_IR_M2（fd8b0030）	SPI4_CLK_M0	GPIO1_C2	50	23	24	52	GPIO1_C4	SPI4_CS1_M0		
			GND		25	26	35	GPIO1_A3	PWM1_M2（fd8b0010）		

As can be seen from the table above:

pwm1 can be derived from pin 16 of 26pin (pwm1_m1), or from pin 26 of 26pin (pwm1_m2)

pwm3 can be derived from pin 15 of 26pin (pwm3_m0), or from pin 23 of 26pin (pwm3_m2)

Please select the corresponding pin according to your needs. Please don't think that these are two different pwm buses.

In the linux system, the pwm in the 26pin is closed by default, and it needs to be opened manually to use it.

Add the following red font configuration in /boot/orangepiEnv.txt, and then restart the Linux system to open pwm0, pwm13, pwm14 and pwm15 at the same time. If you only need to open one, then fill in one.

```
orangepi@orangepi:~$ sudo vim /boot/orangepiEnv.txt
overlays=pwm0-m1    pwm13-m2    pwm14-m1    pwm15-m2
```

Select the settings of pwm1_m1 as shown below, please do not open pwm1-m1 and pwm1-m2 at the same time:

```
orangepi@orangepi:~$ sudo vim /boot/orangepiEnv.txt
overlays=pwm1-m1
```

Select the settings for pwm1_m2 as shown below:

```
orangepi@orangepi:~$ sudo vim /boot/orangepiEnv.txt
overlays=pwm1-m2
```

Select the settings of pwm3_m0 as shown below, please do not open pwm3-m0 and pwm3-m2 at the same time:

orangepi@orangepi:~$ **sudo vim /boot/orangepiEnv.txt**

overlays=pwm3-m0

Select the settings for pwm3_m2 as shown below:

orangepi@orangepi:~$ **sudo vim /boot/orangepiEnv.txt**

overlays=pwm3-m2

2) After opening a pwm, there will be an extra pwmchipX in **/sys/class/pwm/** (X is a specific number), for example, after opening pwm15, check the pwmchipX under **/sys/class/pwm/** two became three

```
orangepi@orangepi:~$ ls /sys/class/pwm/
pwmchip0    pwmchip1    pwmchip2
```

3) Which pwmchip above corresponds to pwm15? Let's check the output of the **ls /sys/class/pwm/ -l** command first, as shown below:

```
orangepi@orangepi5:~$ ls /sys/class/pwm/ -l
total 0
lrwxrwxrwx 1 root root 0 Dec  2 10:20 pwmchip0 -> ../../devices/platform/fd8b0020.pwm/pwm/pwmchip0
lrwxrwxrwx 1 root root 0 Dec  2 10:20 pwmchip1 -> ../../devices/platform/febd0020.pwm/pwm/pwmchip1
lrwxrwxrwx 1 root root 0 Dec  2 10:20 pwmchip2 -> ../../devices/platform/febf0030.pwm/pwm/pwmchip2
orangepi@orangepi5:~$
```

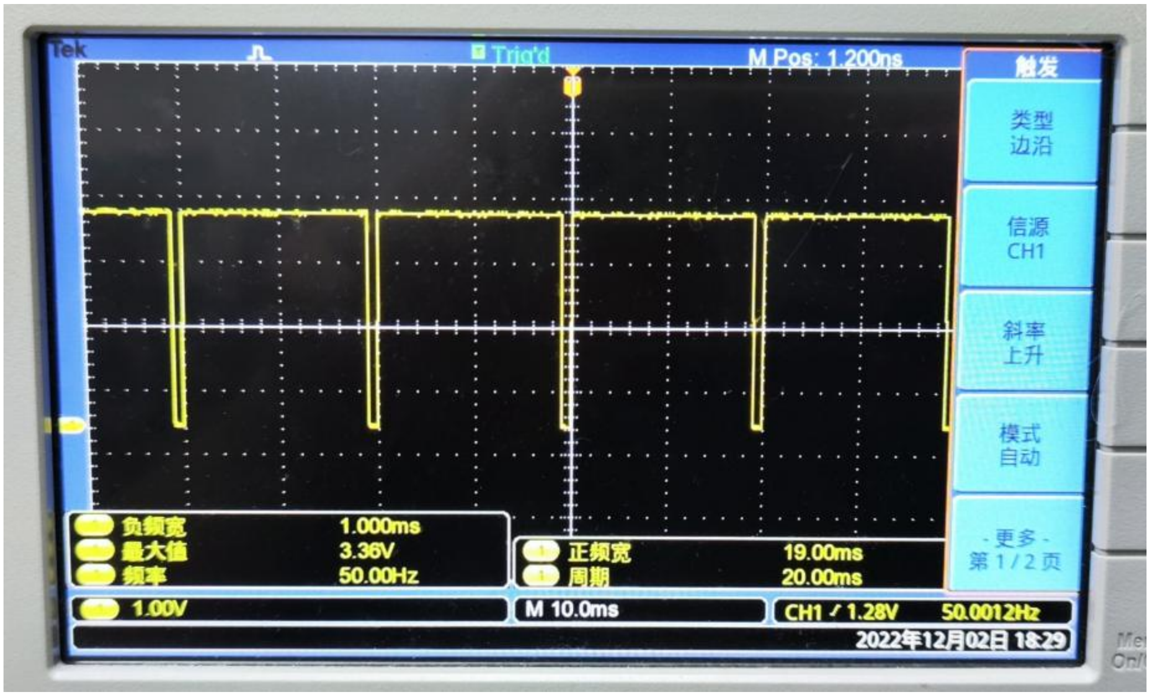
4) Then it can be known from the table below that the base address of the pwm15 register is febf0030, and then look at the output of the **ls /sys/class/pwm/ -l** command, you can see that pwmchip2 is linked to febf0030.pwm, so pwm15 corresponds to pwmchip as pwmchip2

复用功能	复用功能	复用功能	GPIO	GPIO序号	引脚序号	引脚序号	GPIO序号	GPIO	复用功能	复用功能	复用功能
			3.3V		1	2		5V			
PWM13_M2（febf0010）	UART1_RX_M1（feb40000）	I2C5_SDA_M3	GPIO1_B7	47	3	4		5V			
	UART1_TX_M1	I2C5_SCL_M3	GPIO1_B6	46	5	6		GND			
		PWM15_IR_M2（febf0030）	GPIO1_C6	54	7	8	131	GPIO4_A3	UART0_TX_M2（fd890000）		
			GND		9	10	132	GPIO4_A4	UART0_RX_M2		
	PWM14_M1（febf0020）	CAN1_RX_M1	GPIO4_B2	138	11	12	29	GPIO0_D5	CAN2_TX_M1	I2C1_SDA_M2	
		CAN1_TX_M1	GPIO4_B3	139	13	14		GND			
PWM3_IR_M0（fd8b0030）	I2C1_SCL_M2	CAN2_RX_M1	GPIO0_D4	28	15	16	59	GPIO1_D3	UART4_RX_M0（feb70000）	I2C1_SDA_M4	PWM1_M1（fd8b0010）
			3.3V		17	18	58	GPIO1_D2	UART4_TX_M0	I2C1_SCL_M4	PWM0_M1（fd8b0000）
I2C3_SCL_M0	UART3_TX_M0（feb60000）	SPI4_MOSI_M0	GPIO1_C1	49	19	20		GND			
I2C3_SDA_M0	UART3_RX_M0	SPI4_MISO_M0	GPIO1_C0	48	21	22		PowerKey			
	PWM3_IR_M2（fd8b0030）	SPI4_CLK_M0	GPIO1_C2	50	23	24	52	GPIO1_C4	SPI4_CS1_M0		
			GND		25	26	35	GPIO1_A3	PWM1_M2（fd8b0010）		

5) Then use the following command to make pwm15 output a 50Hz square wave (please switch to the root user first, and then execute the following command)

```
root@orangepi:~# echo 0 > /sys/class/pwm/pwmchip2/export
```

```
root@orangepi:~# echo 20000000 > /sys/class/pwm/pwmchip2/pwm0/period
root@orangepi:~# echo 1000000 > /sys/class/pwm/pwmchip2/pwm0/duty_cycle
root@orangepi:~# echo 1 > /sys/class/pwm/pwmchip2/pwm0/enable
```



6) The test method of pwm15 demonstrated above is similar to other pwm test methods.

3. 18. How to install and use wiringOP-Python

wiringOP-Python is the Python language version of wiringOP, which is used to operate the hardware resources of the development board, such as GPIO, I2C, SPI and UART, in the Python program.

In addition, please note that all the following commands are operated under the root user.

3. 18. 1. How to install wiringOP-Python

1) First install the dependency package

```
root@orangepi:~# sudo apt-get update
root@orangepi:~# sudo apt-get -y install git swig python3-dev python3-setuptools
```

2) Then use the following command to download the source code of wiringOP-Python

Note that the following git clone --recursive command will automatically download the source code of wiringOP, because wiringOP-Python depends on wiringOP. Please make sure that the download process does not report errors due to network problems.

If the code cannot be downloaded, please go to the official tool to download the source code compression package.


```
root@orangepi:~# git clone --recursive https://github.com/orangepi-xunlong/wiringOP-Python -b next


Cloning into 'wiringOP-Python'...
remote: Enumerating objects: 602, done.
remote: Counting objects: 100% (40/40), done.
remote: Compressing objects: 100% (28/28), done.
remote: Total 602 (delta 20), reused 26 (delta 12), pack-reused 562
Receiving objects: 100% (602/602), 309.30 KiB | 1.23 MiB/s, done.
Resolving deltas: 100% (349/349), done.
Submodule 'wiringOP' (https://github.com/orangepi-xunlong/wiringOP.git) registered for path 'wiringOP'
Cloning into '/root/test/wiringOP-Python/wiringOP'...
remote: Enumerating objects: 654, done.
remote: Counting objects: 100% (273/273), done.
remote: Compressing objects: 100% (33/33), done.
remote: Total 654 (delta 244), reused 245 (delta 238), pack-reused 381
Receiving objects: 100% (654/654), 360.54 KiB | 1.73 MiB/s, done.
Resolving deltas: 100% (424/424), done.
Submodule path 'wiringOP': checked out '85f1331cd8fda668115461ec1c06cb342057eb03'
```

3) Then use the following command to compile wiringOP-Python and install it into the Linux system of the development board

```
root@orangepi:~# cd wiringOP-Python
root@orangepi:~/wiringOP-Python# python3 generate-bindings.py > bindings.i
root@orangepi:~/wiringOP-Python# sudo python3 setup.py install
```

4) Then enter the following command, if there is help information output, it means that

wiringOP-Python is installed successfully, press the **q** key to exit the help information interface

```
root@orangepi:~/wiringOP-Python# python3 -c "import wiringpi;    help(wiringpi)"
Help on module wiringpi:

NAME
    wiringpi

DESCRIPTION
    # This file was automatically generated by SWIG (http://www.swig.org).
    # Version 4.0.2
    #
    # Do not make changes to this file unless you know what you are doing--modify
    # the SWIG interface file instead.
```

5) The steps to test whether wiringOP-Python is successfully installed under the python command line are as follows:

a. First use the python3 command to enter the command line mode of python3

```
root@orangepi:~# python3
```

b. Then import the python module of wiringpi

```
>>> import wiringpi;
```

c. Finally, enter the following command to view the help information of wiringOP-Python, and press the **q** key to exit the help information interface

```
>>> help(wiringpi)
Help on module wiringpi:

NAME
    wiringpi

DESCRIPTION
    # This file was automatically generated by SWIG (http://www.swig.org).
    # Version 4.0.2
    #
    # Do not make changes to this file unless you know what you are doing--modify
    # the SWIG interface file instead.
```

```
CLASSES
    builtins.object
        GPIO
        I2C
        Serial
        nes

    class GPIO(builtins.object)
     |   GPIO(pinmode=0)
     |

>>>
```

3. 18. 2. 26pin GPIO port test

wiringOP-Python is the same as wiringOP, you can also determine which GPIO pin to operate by specifying the wPi number, because there is no command to check the wPi number in wiringOP-Python, so you can only use the gpio command in wiringOP to check the correspondence between the board wPi number and the physical pin.

```
root@orangepi5b:~# gpio readall
 +------+-----+----------+--------+---+   PI5B   +---+--------+----------+-----+------+
 | GPIO | wPi |   Name   |  Mode  | V | Physical | V |  Mode  | Name     | wPi | GPIO |
 +------+-----+----------+--------+---+----++----+---+--------+----------+-----+------+
 |      |     |     3.3V |        |   |  1 || 2  |   |        | 5V       |     |      |
 |   47 |   0 |    SDA.5 |     IN | 1 |  3 || 4  |   |        | 5V       |     |      |
 |   46 |   1 |    SCL.5 |     IN | 1 |  5 || 6  |   |        | GND      |     |      |
 |   54 |   2 |    PWM15 |     IN | 1 |  7 || 8  | 0 | IN     | RXD.0    | 3   | 131  |
 |      |     |      GND |        |   |  9 || 10 | 0 | IN     | TXD.0    | 4   | 132  |
 |  138 |   5 |  CAN1_RX |     IN | 1 | 11 || 12 | 1 | IN     | CAN2_TX  | 6   | 29   |
 |  139 |   7 |  CAN1_TX |     IN | 1 | 13 || 14 |   |        | GND      |     |      |
 |   28 |   8 |  CAN2_RX |     IN | 1 | 15 || 16 | 1 | IN     | SDA.1    | 9   | 59   |
 |      |     |     3.3V |        |   | 17 || 18 | 1 | IN     | SCL.1    | 10  | 58   |
 |   49 |  11 | SPI4_TXD |     IN | 1 | 19 || 20 |   |        | GND      |     |      |
 |   48 |  12 | SPI4_RXD |     IN | 1 | 21 || 22 |   |        | PowerKey |     |      |
 |   50 |  13 | SPI4_CLK |     IN | 1 | 23 || 24 | 1 | IN     | SPI4_CS1 | 14  | 52   |
 |      |     |      GND |        |   | 25 || 26 | 1 | IN     | PWM1     | 15  | 35   |
 +------+-----+----------+--------+---+----++----+---+--------+----------+-----+------+
 | GPIO | wPi |   Name   |  Mode  | V | Physical | V |  Mode  | Name     | wPi | GPIO |
 +------+-----+----------+--------+---+   PI5B   +---+--------+----------+-----+------+
root@orangepi5b:~#
```

1) A total of **16** GPIO ports can be used in the 26pins of the development board. The following uses pin 7—the corresponding GPIO is GPIO1_C6——the corresponding wPi serial number is 2—as an example to demonstrate how to set the high and low levels of

the GPIO port

```
root@orangepi5b:~# gpio readall
 +------+-----+----------+--------+---+   PI5B   +---+--------+----------+-----+------+
 | GPIO | wPi |   Name   |  Mode  | V | Physical | V |  Mode  | Name     | wPi | GPIO |
 +------+-----+----------+--------+---+----++----+---+--------+----------+-----+------+
 |      |     |     3.3V |        |   |  1 || 2  |   |        | 5V       |     |      |
 |   47 |   0 |    SDA.5 |     IN | 1 |  3 || 4  |   |        | 5V       |     |      |
 |   46 |   1 |    SCL.5 |     IN | 1 |  5 || 6  |   |        | GND      |     |      |
 |   54 |   2 |    PWM15 |     IN | 1 |  7 || 8  | 0 | IN     | RXD.0    | 3   | 131  |
 |      |     |      GND |        |   |  9 || 10 | 0 | IN     | TXD.0    | 4   | 132  |
```

2) The steps to test directly with the command are as follows:

a. First set the GPIO port to the output mode, where the first parameter of the **pinMode** function is the serial number of the wPi corresponding to the pin, and the second parameter is the GPIO mode

```
root@orangepi:~/wiringOP-Python# python3 -c "import wiringpi; \
from wiringpi import GPIO; wiringpi.wiringPiSetup() ; \
wiringpi.pinMode(2, GPIO.OUTPUT) ;  "
```

b. Then set the GPIO port to output low level. After setting, you can use a multimeter to measure the voltage value of the pin. If it is 0v, it means that the low level is set successfully.

```
root@orangepi:~/wiringOP-Python# python3 -c "import wiringpi; \
 from wiringpi import GPIO; wiringpi.wiringPiSetup() ;\
wiringpi.digitalWrite(2, GPIO.LOW)"
```

c. Then set the GPIO port to output a high level. After setting, you can use a multimeter to measure the voltage value of the pin. If it is 3.3v, it means that the high level is set successfully.

```
root@orangepi:~/wiringOP-Python# python3 -c "import wiringpi; \
 from wiringpi import GPIO; wiringpi.wiringPiSetup() ;\
wiringpi.digitalWrite(2, GPIO.HIGH)"
```

3) The steps to test in the command line of python3 are as follows:

a. First use the python3 command to enter the command line mode of python3

```
root@orangepi:~# python3
```

b. Then import the python module of wiringpi

```
>>> import wiringpi
>>> from wiringpi import GPIO
```

c. Then set the GPIO port to output mode, where the first parameter of the **pinMode** function is the serial number of the wPi corresponding to the pin, and the second parameter is the GPIO mode

```
>>> wiringpi.wiringPiSetup()
0
>>> wiringpi.pinMode(2, GPIO.OUTPUT)
```

d. Then set the GPIO port to output a low level. After setting, you can use a multimeter to measure the voltage value of the pin. If it is 0v, it means that the low level is set successfully.

```
>>> wiringpi.digitalWrite(2, GPIO.LOW)
```

e. Then set the GPIO port to output a high level. After setting, you can use a multimeter to measure the voltage value of the pin. If it is 3.3v, it means that the high level is set successfully.

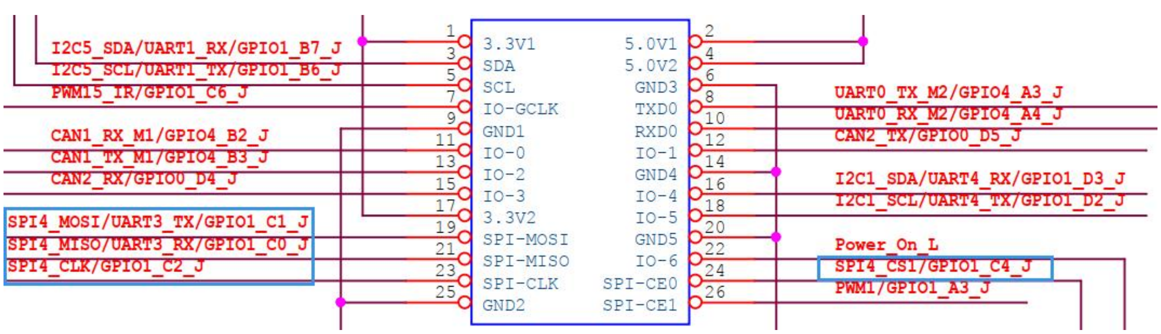
```
>>> wiringpi.digitalWrite(2, GPIO.HIGH)
```

4) The method of wiringOP-Python to set GPIO high and low levels in python code can refer to the **blink.py** test program in the examples below. The **blink.py** test program will set the voltage of all GPIO ports in the 26 pins of the development board to change continuously.

```
root@orangepi:~/wiringOP-Python# cd examples
root@orangepi:~/wiringOP-Python/examples# ls blink.py
blink.py
root@orangepi:~/wiringOP-Python/examples# python3 blink.py
```

3. 18. 3. 26pin SPI test

1) According to the schematic diagram of the 26pin interface, the spi available for Orange Pi 5B is spi4



In the Linux system, the spi4 in the 26pin is closed by default, and it needs to be opened manually to use it.

Add the following red font configuration in /boot/orangepiEnv.txt, and then restart the Linux system to open spi4.

orangepi@orangepi:~$ **sudo vim /boot/orangepiEnv.txt**
overlays=spi4-m0-cs1-spidev

2) First check whether there is a **spidev4.1** device node in the linux system. If it exists, it means that SPI4 has been set up and can be used directly

```
orangepi@orangepi:~$ ls /dev/spidev4.1
/dev/spidev4.1
```

Note that /dev/spidev4.0 cannot be used, please use /dev/spidev4.1, don't make a mistake.

3) Then you can use the **spidev_test.py** program in the examples to test the loopback function of the SPI. The **spidev_test.py** program needs to specify the following two parameters:

a. **--channel**: Specifies the channel number of the SPI
b. **--port**: Specify the port number of the SPI

4) Do not short-circuit the mosi and miso pins of SPI4, the output result of running spidev_test.py is as follows, you can see that the data of TX and RX are inconsistent

```
root@orangepi:~/wiringOP-Python# cd examples
root@orangepi:~/wiringOP-Python/examples# python3 spidev_test.py \
--channel 4 --port 1
spi mode: 0x0
max speed: 500000 Hz (500 KHz)
Opening device /dev/spidev4.1
TX | FF FF FF FF FF FF 40 00 00 00 00 95 FF FF FF FF FF FF FF FF FF FF FF FF FF
FF FF FF FF FF F0 0D  |......@..........|
RX | FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
FF FF FF FF FF FF FF FF  |.................|
```

5) Then use the Dupont wire to short-circuit the two pins of txd (pin 19 in the 26pin interface) and rxd (pin 21 in the 26pin interface) of SPI4 and then run spidev_test.py The

output is as follows, you can see The data sent and received are the same, indicating that the SPI4 loopback test is normal

```
root@orangepi:~/wiringOP-Python# cd examples
root@orangepi:~/wiringOP-Python/examples# python3 spidev_test.py \
--channel 4 --port 1
spi mode: 0x0
max speed: 500000 Hz (500 KHz)
Opening device /dev/spidev4.1
TX | FF FF FF FF FF FF 40 00 00 00 00 95 FF FF FF FF FF FF FF FF FF FF FF FF FF
FF FF FF FF FF F0 0D   |......@..........|
RX | FF FF FF FF FF FF 40 00 00 00 00 95 FF FF FF FF FF FF FF FF FF FF FF FF FF
FF FF FF FF FF F0 0D   |......@..........|
```

3. 18. 4. 26pin I2C test

1) As can be seen from the table below, the available i2c for Orange Pi 5B is i2c1, i2c3 and i2c5, a total of three sets of i2c buses

复用功能	复用功能	复用功能	GPIO	GPIO序号	引脚序号	引脚序号	GPIO序号	GPIO	复用功能	复用功能	复用功能
			3.3V		1	2		5V			
PWM13_M2（febf0010）	UART1_RX_M1（feb40000）	I2C5_SDA_M3	GPIO1_B7	47	3	4		5V			
	UART1_TX_M1	I2C5_SCL_M3	GPIO1_B6	46	5	6		GND			
		PWM15_IR_M2（febf0030）	GPIO1_C6	54	7	8	131	GPIO4_A3	UART0_TX_M2（fd890000）		
			GND		9	10	132	GPIO4_A4	UART0_RX_M2		
	PWM14_M1（febf0020）	CAN1_RX_M1	GPIO4_B2	138	11	12	29	GPIO0_D5	CAN2_TX_M1	I2C1_SDA_M2	
		CAN1_TX_M1	GPIO4_B3	139	13	14		GND			
PWM3_IR_M0（fd8b0030）	I2C1_SCL_M2	CAN2_RX_M1	GPIO0_D4	28	15	16	59	GPIO1_D3	UART4_RX_M0（feb70000）	I2C1_SDA_M4	PWM1_M1（fd8b0010）
			3.3V		17	18	58	GPIO1_D2	UART4_TX_M0	I2C1_SCL_M4	PWM0_M1（fd8b0000）
I2C3_SCL_M0	UART3_TX_M0（feb60000）	SPI4_MOSI_M0	GPIO1_C1	49	19	20		GND			
I2C3_SDA_M0	UART3_RX_M0	SPI4_MISO_M0	GPIO1_C0	48	21	22		PowerKey			
	PWM3_IR_M2（fd8b0030）	SPI4_CLK_M0	GPIO1_C2	50	23	24	52	GPIO1_C4	SPI4_CS1_M0		
			GND		25	26	35	GPIO1_A3	PWM1_M2（fd8b0010）		

As can be seen from the above table, i2c1 can be derived from pins 12 and 15 of 26pin (i2c1_m2), and can also be derived from pins 16 and 18 of 26pin (i2c1_m4), please follow your own needs Just select a group. Please don't think that these are two different sets of i2c buses.

In the linux system, the i2c in the 26pin is turned off by default, and it needs to be turned on manually before it can be used.

Add the following configuration in red font to /boot/orangepiEnv.txt, and then restart the Linux system to open i2c1, i2c3 and i2c5 at the same time. If you only need to open one, then just fill in one.

Select the settings for i2c1_m2 as shown below:

orangepi@orangepi:~$ **sudo vim /boot/orangepiEnv.txt**

overlays=i2c1-m2 i2c3-m0 i2c5-m3

Select the settings for i2c1_m4 as shown below:

orangepi@orangepi:~$ **sudo vim /boot/orangepiEnv.txt**

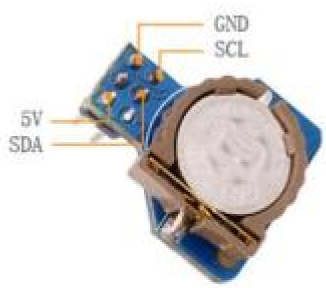
overlays=i2c1-m4 i2c3-m0 i2c5-m3

2) After starting the linux system, first confirm that there is an i2c device node under /dev

```
orangepi@orangepi:~$ ls /dev/i2c-*
/dev/i2c-0    /dev/i2c-10    /dev/i2c-3    /dev/i2c-6    /dev/i2c-9
/dev/i2c-1    /dev/i2c-2     /dev/i2c-5    /dev/i2c-7
```

3) Then connect an i2c device to the i2c pin of the 26pin connector, here we take the ds1307 RTC module as an example

	i2c1-m2	i2c1-m4	i2c3-m0	i2c5-m3
Sda pin	Corresponding to pin 12	Corresponding to pin 16	Corresponding to pin 21	Corresponding to pin 3
Sck pin	Corresponding to pin 15	Corresponding to pin 18	Corresponding to pin 19	Corresponding to pin 5
Vcc pin	Corresponding to pin 1	Corresponding to pin 1	Corresponding to pin 1	Corresponding to pin 1
Gnd pin	Corresponding to pin 6	Corresponding to pin 6	Corresponding to pin 6	Corresponding to pin 6



4) Then use the **i2cdetect -y** command, if the address of the connected i2c device can be detected, it means that i2c can be used normally

```
orangepi@orangepi:~$ sudo i2cdetect -y 1       #i2c1 command
orangepi@orangepi:~$ sudo i2cdetect -y 3       #i2c3command
orangepi@orangepi:~$ sudo i2cdetect -y 5       #i2c5command
```

```
orangepi@orangepi5:~$ sudo i2cdetect -y 5
[sudo] password for orangepi:
     0  1  2  3  4  5  6  7  8  9  a  b  c  d  e  f
00:                         -- -- -- -- -- -- -- --
10: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
20: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
30: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
40: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
50: 50 -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
60: -- -- -- -- -- -- -- -- 68 -- -- -- -- -- -- --
70: -- -- -- -- -- -- -- --
orangepi@orangepi5:~$
```

5) Then you can run the **ds1307.py** test program in the **examples** to read the RTC time

```
root@orangepi:~/wiringOP-Python# cd examples
root@orangepi:~/wiringOP-Python/examples# python3 ds1307.py --device \
"/dev/i2c-5"
Thu 2023-01-05    14:57:55
Thu 2023-01-05    14:57:56
Thu 2023-01-05    14:57:57
^C
exit
```

3. 18. 5. 26pin UART test

1) As can be seen from the table below, the available uarts for Orange Pi 5B are four groups of uart buses: uart0, uart1, uart3 and uart4

复用功能	复用功能	复用功能	GPIO	GPIO序号	引脚序号	引脚序号	GPIO序号	GPIO	复用功能	复用功能	复用功能
			3.3V		1	2		5V			
PWM13_M2（febf0010）	UART1_RX_M1（feb40000）	I2C5_SDA_M3	GPIO1_B7	47	3	4		5V			
	UART1_TX_M1	I2C5_SCL_M3	GPIO1_B6	46	5	6		GND			
		PWM15_IR_M2（febf0030）	GPIO1_C6	54	7	8	131	GPIO4_A3	UART0_TX_M2（fd890000）		
			GND		9	10	132	GPIO4_A4	UART0_RX_M2		
	PWM14_M1（febf0020）	CAN1_RX_M1	GPIO4_B2	138	11	12	29	GPIO0_D5	CAN2_TX_M1	I2C1_SDA_M2	
		CAN1_TX_M1	GPIO4_B3	139	13	14		GND			
PWM3_IR_M0（fd8b0030）	I2C1_SCL_M2	CAN2_RX_M1	GPIO0_D4	28	15	16	59	GPIO1_D3	UART4_RX_M0（feb70000）	I2C1_SDA_M4	PWM1_M1（fd8b0010）
			3.3V		17	18	58	GPIO1_D2	UART4_TX_M0	I2C1_SCL_M4	PWM0_M1（fd8b0000）
I2C3_SCL_M0	UART3_TX_M0（feb60000）	SPI4_MOSI_M0	GPIO1_C1	49	19	20		GND			
I2C3_SDA_M0	UART3_RX_M0	SPI4_MISO_M0	GPIO1_C0	48	21	22		PowerKey			
	PWM3_IR_M2（fd8b0030）	SPI4_CLK_M0	GPIO1_C2	50	23	24	52	GPIO1_C4	SPI4_CS1_M0		
			GND		25	26	35	GPIO1_A3	PWM1_M2（fd8b0010）		

In the Linux system, the uart in the 26pin is closed by default, and it needs to be opened manually before it can be used.

Add the following red font configuration in /boot/orangepiEnv.txt, and then restart the Linux system to open uart0, uart1, uart3 and uart4 at the same time. If you only need to open one, then fill in one.

```
orangepi@orangepi:~$ sudo vim /boot/orangepiEnv.txt
overlays=uart0-m2   uart1-m1   uart3-m0   uart4-m0
```

2) After entering the linux system, first confirm whether there is a device node corresponding to uart under /dev

```
orangepi@orangepi:~$ ls /dev/ttyS*
/dev/ttyS0   /dev/ttyS1   /dev/ttyS3   /dev/ttyS4   /dev/ttyS9
```

3) Then start to test the uart interface, first use the DuPont line to short the rx and tx of the uart interface to be tested

	uart0	uart1	uart3	uart4
Tx pin	Corresponding to pin 8	Corresponding to pin 5	Corresponding to pin 19	Corresponding to pin 18
Rx pin	Corresponding to pin 10	Corresponding to pin 3	Corresponding to pin 21	Corresponding to pin 16

4) Use the **serialTest.py** program in the examples to test the loopback function of the serial port as shown below. If you can see the following print, it means that the serial port communication is normal

a. Test UART0

```
root@orangepi:~/wiringOP-Python/examples# python3 serialTest.py --device \
"/dev/ttyS0"

Out:    0: ->    0
Out:    1: ->    1
Out:    2: ->    2
Out:    3: ->    3
Out:    4:^C
exit
```

b. Test UART1

```
root@orangepi:~/wiringOP-Python/examples# python3 serialTest.py --device \
"/dev/ttyS1"

Out:    0: ->   0
Out:    1: ->   1
Out:    2: ->   2
Out:    3: ->   3
Out:    4:^C
exit
```

c. Test UART3

```
root@orangepi:~/wiringOP-Python/examples# python3 serialTest.py --device \
"/dev/ttyS3"

Out:    0: ->   0
Out:    1: ->   1
Out:    2: ->   2
Out:    3: ->   3
Out:    4:^C
exit
```

d. Test UART4

```
root@orangepi:~/wiringOP-Python/examples# python3 serialTest.py --device \
"/dev/ttyS4"

Out:    0: ->   0
Out:    1: ->   1
Out:    2: ->   2
Out:    3: ->   3
Out:    4:^C
exit
```

3. 19. Hardware watch the door dog test

Watchdog_test program is pre -installed in the linux system released by Orange PI, which can be tested directly.

The method of running the WatchDog_test program is shown below：

a. The second parameter 10 indicates the counting of the door dog. If the dog is not fed in this time, the system will restart.
b. We can feed the dog by pressing any key (except ESC) on the keyboard. After the dog is fed, the program will print a line of Keep Alive.

```
orangepi@orangepi:~$ sudo watchdog_test 10
open success
options is 33152,identity is sunxi-wdt
put_usr return,if 0,success:0
The old reset time is: 16
return ENOTTY,if -1,success:0
return ENOTTY,if -1,success:0
put_user return,if 0,success:0
put_usr return,if 0,success:0
keep alive
keep alive
keep alive
```

3. 20. View the serial number of the RK3588S chip

The commands of the RK3588S chip serial number are shown below. The serial number of each chip is different, so you can use the serial number to distinguish multiple development boards。

```
orangepi@orangepi:~$ cat_serial.sh
Serial          : 1404a7682e86830c
```

3. 21. Method of installing docker

1) The linux image provided by Orange Pi has been pre -installed with Docker, but the Docker service is not opened by default.

2) Use **Enable_docker.SH** script to enable the docker service, and then you can start using the docker command, and the docker service will be automatically activated when

the system starts the system next time

```
orangepi@orangepi:~$ enable_docker.sh
```

3) Then you can use the following command to test the docker.

```
orangepi@orangepi:~$ docker run hello-world
Unable to find image 'hello-world:latest' locally
latest: Pulling from library/hello-world
256ab8fe8778: Pull complete
Digest:
sha256:7f0a9f93b4aa3022c3a4c147a449ef11e0941a1fd0bf4a8e6c9408b2600777c5
Status: Downloaded newer image for hello-world:latest

Hello from Docker!
This message shows that your installation appears to be working correctly.
.....
```

3. 22. Download the method of downloading and installing ARM64 version of Balenaetcher

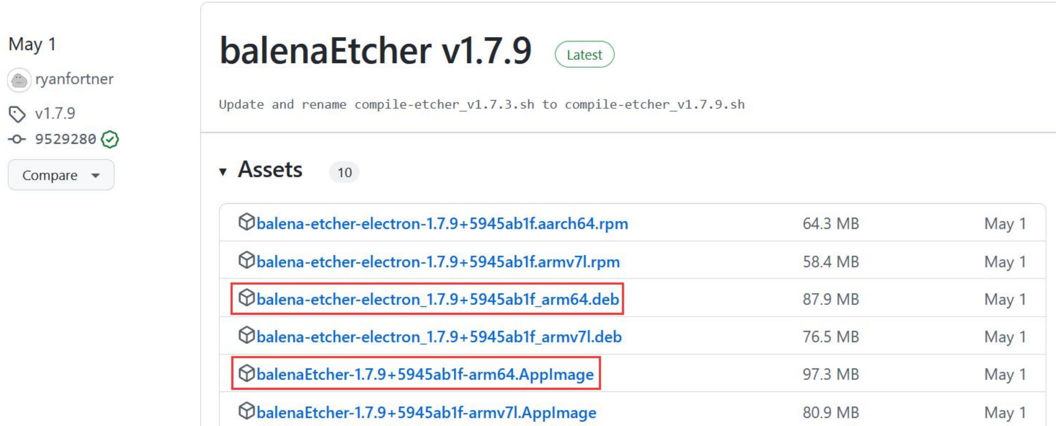
1) The download address of Balenaetcher ARM64 is：

a. The download address of the .deb installation package is shown below, you need to install it to use

https://github.com/Itai-Nelken/BalenaEtcher-arm/releases/download/v1.7.9/balena-etcher-electron_1.7.9+5945ab1f_arm64.deb

b. The download address of the AppImage version without installation is shown below：

https://github.com/Itai-Nelken/BalenaEtcher-arm/releases/download/v1.7.9/balenaEtcher-1.7.9+5945ab1f-arm64.AppImage

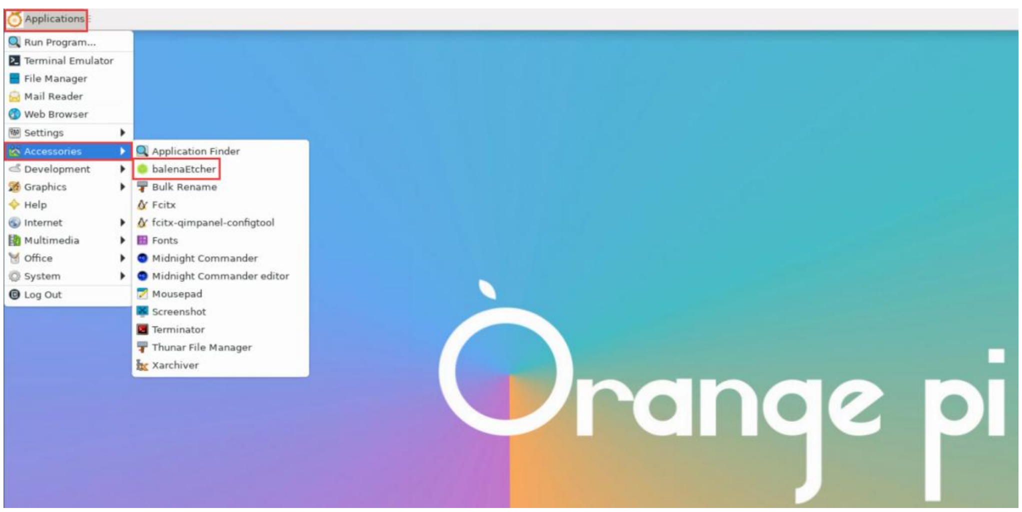


2) How to install and use the deb version of Balenaetcher：

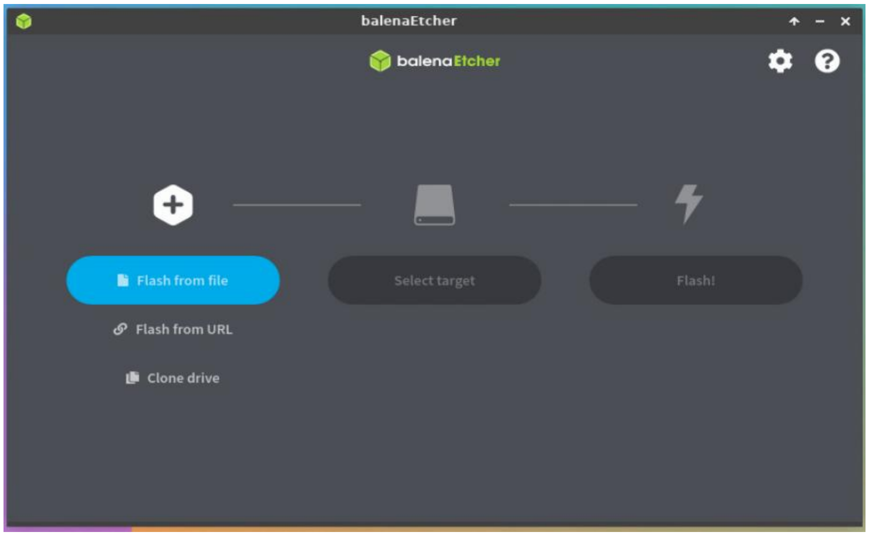
a. deb version of BalenaEtcher installation commands as shown below：

```
orangepi@orangepi:~$ sudo apt install -y    \
--fix-broken ./balena-etcher-electron_1.7.9+5945ab1f_arm64.deb
```

b. After the BalenaEtcher installation of deb version is completed, it can be opened in the Application



c. The interface after BalenaEtcher is opened is shown below：

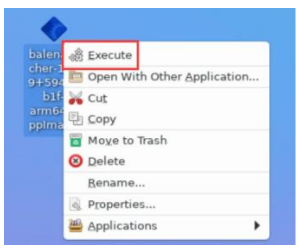


3) How to use the AppImage version of Balenaetcher：

a. First add permissions to BalenaEtcher

```
orangepi@orangepi:~/Desktop$ chmod +x balenaEtcher-1.7.9+5945ab1f-arm64.AppImage
```

b. Then select the AppImage version BalenaEtcher, click right -click, and then click Execute to open Balenaetcher



3. 23. The installation method of the BT linux panel

BT Linux panel is a server management software that improves operation and maintenance efficiency. It supports more than 100 server management functions such as one -click LAMP/LNMP/cluster/monitoring/website/FTP/database/Java (excerpt from the official website of the BT).

1) The order of compatibility recommendation of the BT Linux system is

```
Debian11 > Ubuntu 22.04
```

2) Then enter the following command in the Linux system to start the installation of the BT

```
orangepi@orangepi:~$ sudo install_bt_panel.sh
```

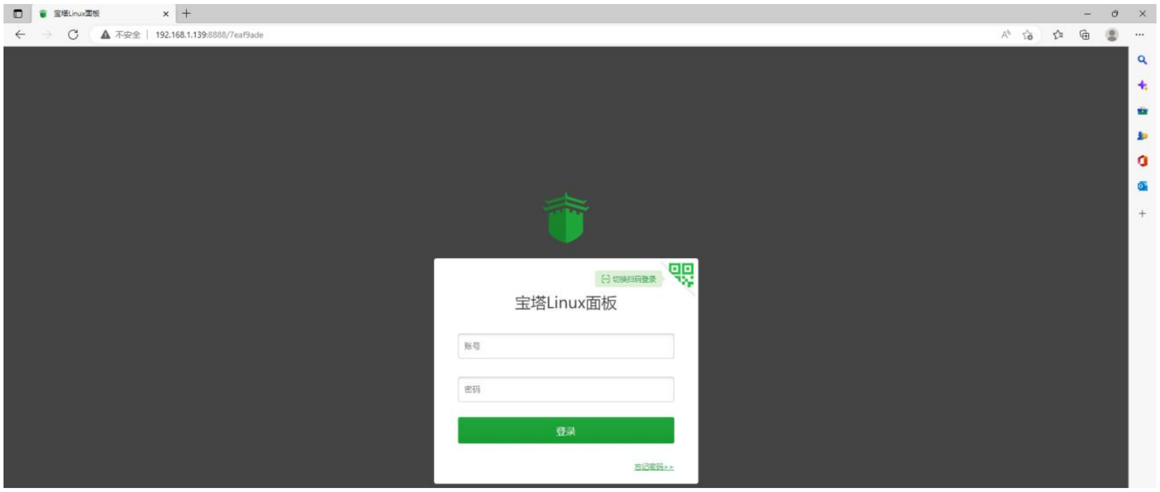
3) Then the pagoda installation program will remind whether to install the **BT-Panel** to the**/www** folder. At this time, enter Y

```
+----------------------------------------------------------------------
| Bt-WebPanel FOR CentOS/Ubuntu/Debian
+----------------------------------------------------------------------
| Copyright © 2015-2099 BT-SOFT(http://www.bt.cn) All rights reserved.
+----------------------------------------------------------------------
| The WebPanel URL will be http://SERVER_IP:8888 when installed.
+----------------------------------------------------------------------

Do you want to install Bt-Panel to the /www directory now?(y/n): y
```

4) Then you have to wait patiently. When you see the printing information below the terminal output, it means that the pagoda has been installed. The entire installation process takes about 12 minutes. There may be some differences according to the difference in network speed.

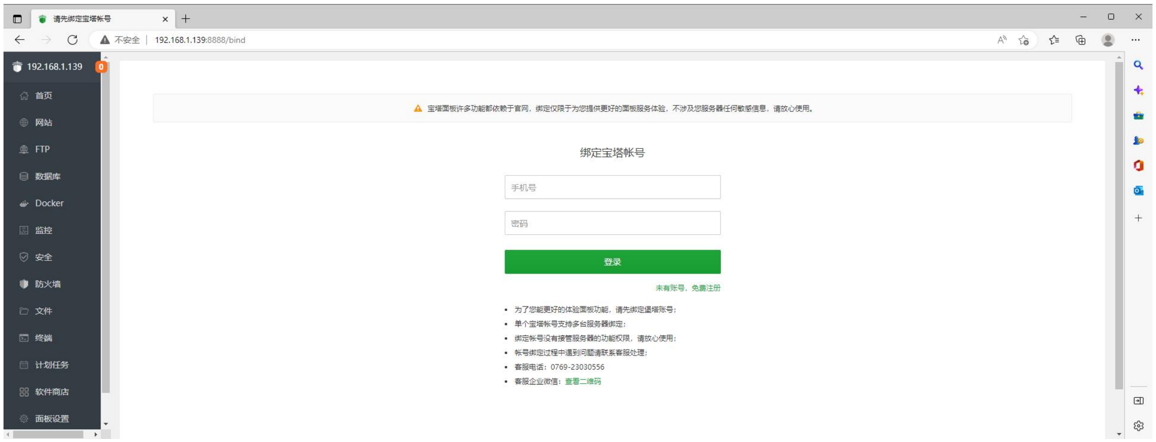
```
==================================================================
Congratulations! Installed successfully!
==================================================================
外网面板地址: http://183.15.204.10:8888/7eaf9ade
内网面板地址: http://192.168.1.139:8888/7eaf9ade
username: nslvetif
password: fec12d4b
If you cannot access the panel,
release the following panel port [8888] in the security group
若无法访问面板，请检查防火墙/安全组是否有放行面板[8888]端口
==================================================================
Time consumed: 12 Minute!
root@orangepi5:~#
```

5) Enter the **panel address** displayed above in the browser to open the login interface of the pagoda Linux panel, and then enter the **username** and **password** displayed in the corresponding position.

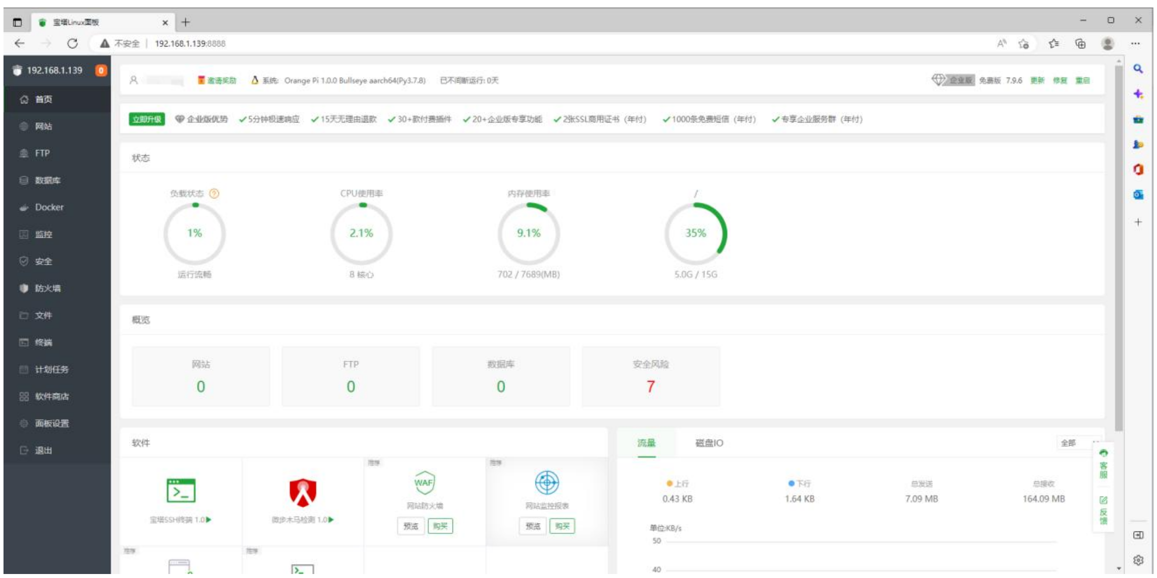


6) After successfully logging in to the BT, the following welcome interface will pop up. First, please take the intermediate user notice to read to the bottom, and then you can choose "I have agreed and read" User Agreement ", and then click" Enter the panel " You can enter the BT.

7) After entering the pagoda, you will first prompt that you need to bind the account of the pagoda official website. If you do n’t have an account, you can go to the official website of the pagoda (**https://www.bt.cn**) to register one.

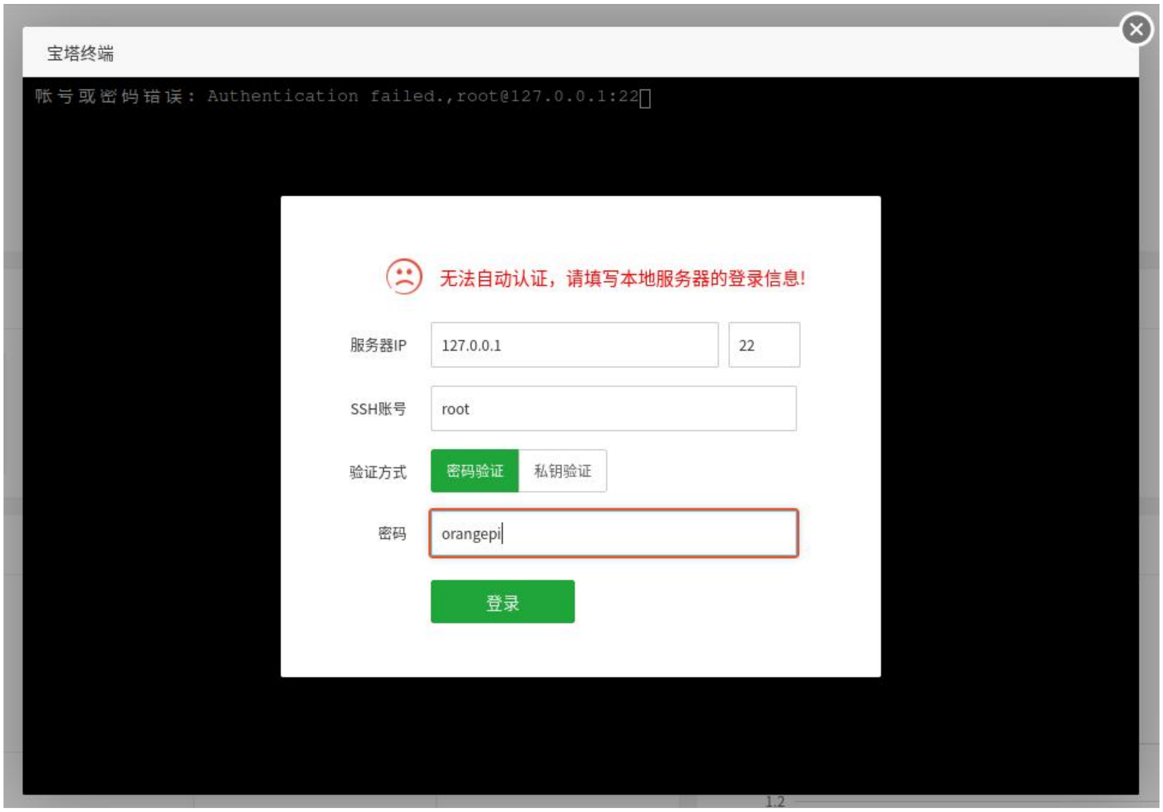


8) The final display interface is shown in the figure below. You can intuitively see some status information of the development board Linux system, such as load status, CPU usage, memory usage and storage space usage.

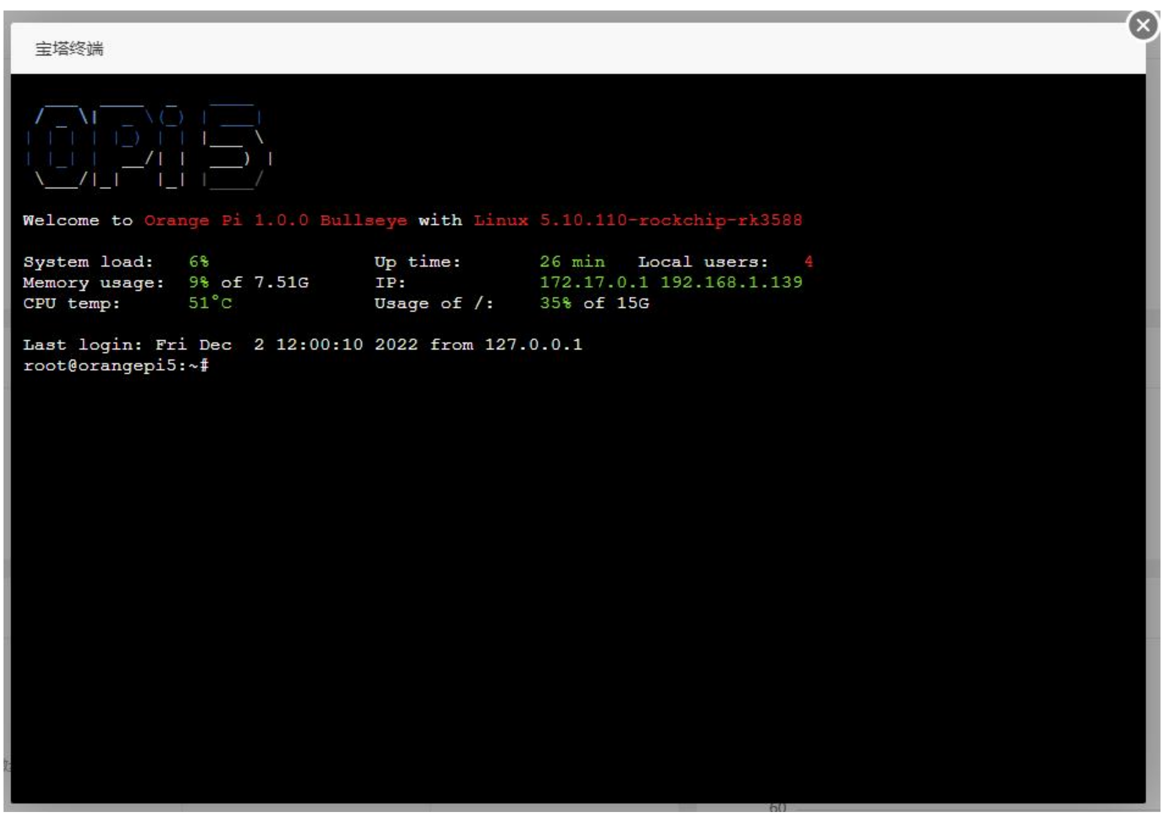


9) Test the SSH terminal login of the BT

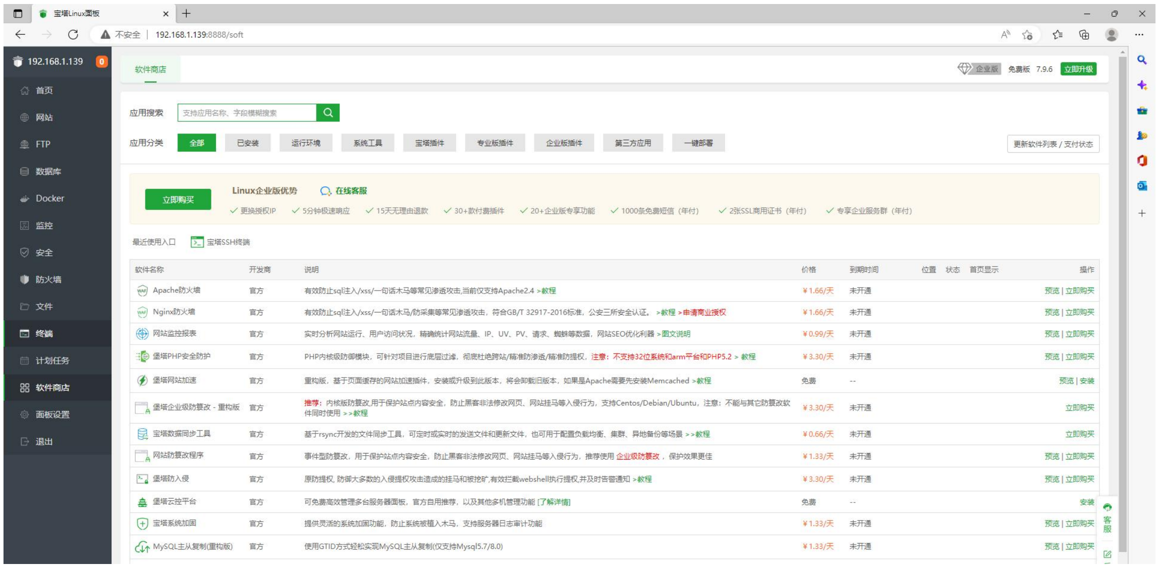
a. After opening the SSH terminal of the pagoda, you will first prompt that you need to enter the password of the development board system. At this time, enter **orangepi** in the password box (the default password, if you have modification, please fill in the modified one).



b. The display after successful login is shown in the figure below



10) Software such as Apache, MySQL, and PHP can be installed in the software store of the pagoda. You can also deploy various applications in one click. Please explore it yourself.



11) Pagoda command line tool test

```
orangepi@orangepi5:~$ sudo bt
[sudo] password for orangepi:
===============宝塔面板命令行==================
(1) 重启面板服务           (8) 改面板端口
(2) 停止面板服务           (9) 清除面板缓存
(3) 启动面板服务           (10) 清除登录限制
(4) 重载面板服务
(5) 修改面板密码           (12) 取消域名绑定限制
(6) 修改面板用户名         (13) 取消IP访问限制
(7) 强制修改MySQL密码      (14) 查看面板默认信息
(22) 显示面板错误日志      (15) 清理系统垃圾
(23) 关闭BasicAuth认证     (16) 修复面板(检查错误并更新面板文件到最新版)
(24) 关闭动态口令认证          (17) 设置日志切割是否压缩
(25) 设置是否保存文件历史副本  (18) 设置是否自动备份面板
(0) 取消                   (29) 取消访问设备验证
===============================================
请输入命令编号：14
===============================================
正在执行(14)...
===============================================
curl: (28) Resolving timed out after 10000 milliseconds
==================================================================
BT-Panel default info!
==================================================================
外网面板地址: http://:8888/7eaf9ade
内网面板地址: http://192.168.1.139:8888/7eaf9ade
*以下仅为初始默认账户密码，若无法登录请执行bt命令重置账户/密码登录
username: nslvetif
password: ********
If you cannot access the panel,
release the following panel port [8888] in the security group
若无法访问面板，请检查防火墙/安全组是否有放行面板[8888]端口
==================================================================
orangepi@orangepi5:~$
```

12) For more functions of the BT, please refer to the following information to explore by yourself

manual: **http://docs.bt.cn**
Forum address: **https://www.bt.cn/bbs**
GitHub Link: **https://github.com/aaPanel/BaoTa**

3. 24. Set the Chinese environment and install Chinese input method

Note that before installing the Chinese input method, please ensure that the Linux system used in the development board is the desktop version system。

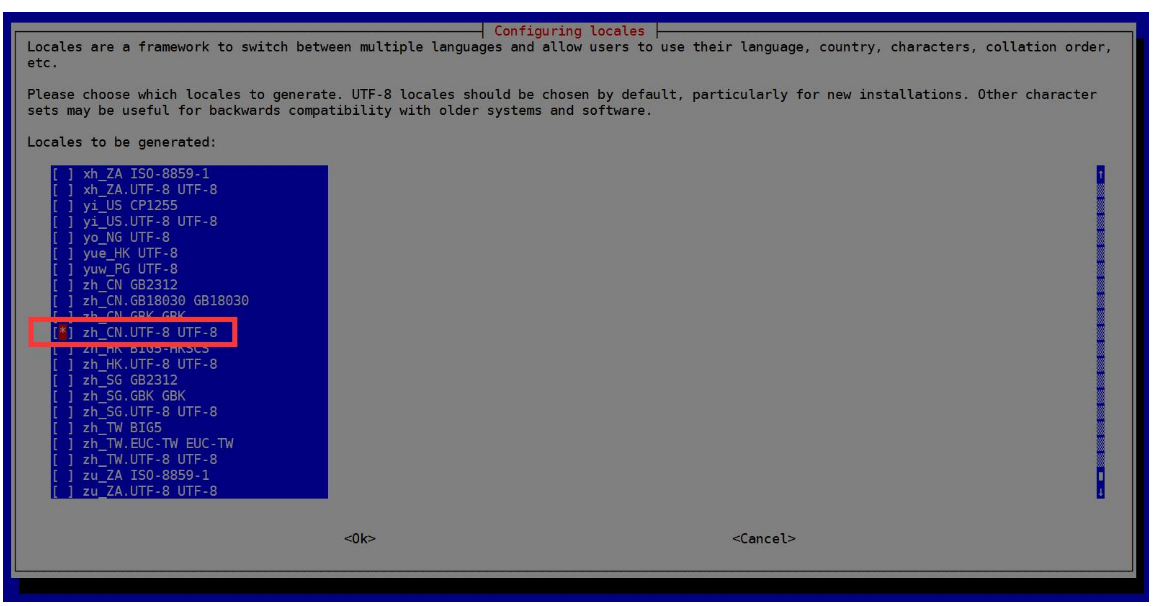
3. 24. 1. Debian 11 System installation method

1) First set the default **local** as Chinese

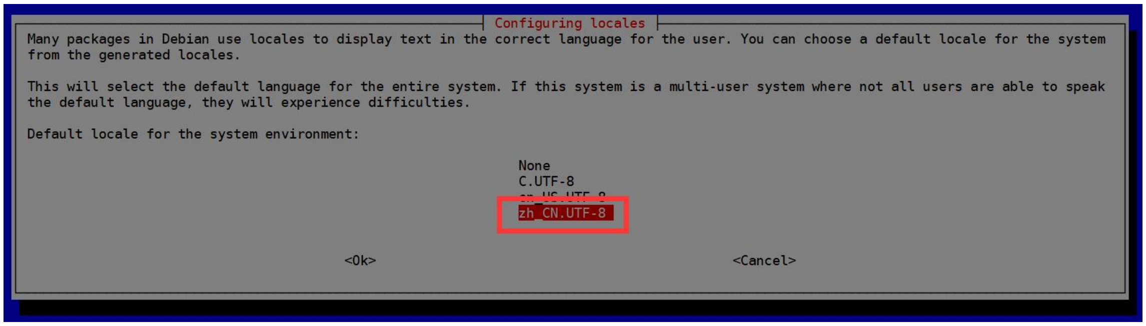
a. Enter the command below to start configuration **locale**

```
orangepi@orangepi:~$ sudo dpkg-reconfigure locales
```

b. Then select **zh_CN.UTF-8 UTF-8** in the pop-up interface (through the upper and lower direction keys on the keyboard to move up and down, select it through the space key, and finally move the cursor to **<OK>** through the TAB key, and then return to the back to return. Just car)



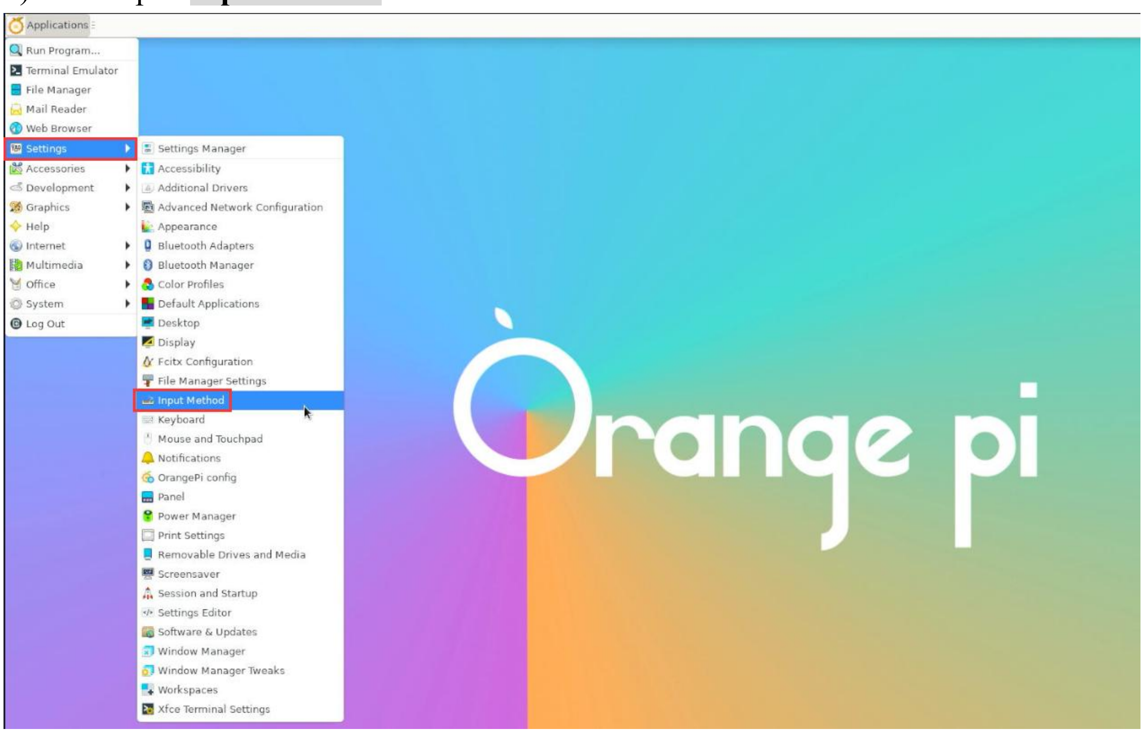
c. Then set the default **locala** to **zh_CN.UTF-8**



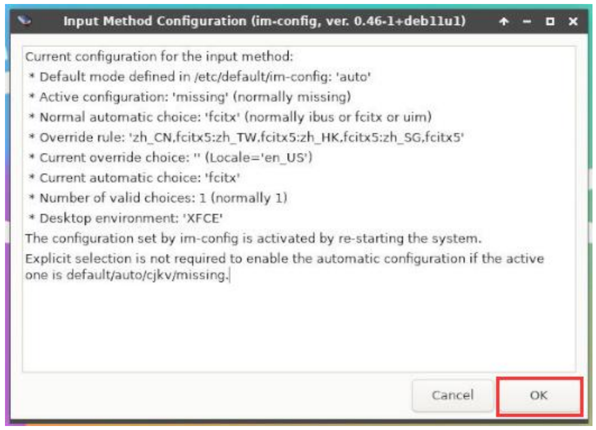
d. After exiting the interface, **Locale** will be set. The output displayed by the command line is shown below

```
orangepi@orangepi:~$ sudo dpkg-reconfigure locales
Generating locales (this might take a while)...
  en_US.UTF-8... done
  zh_CN.UTF-8... done
Generation complete.
```

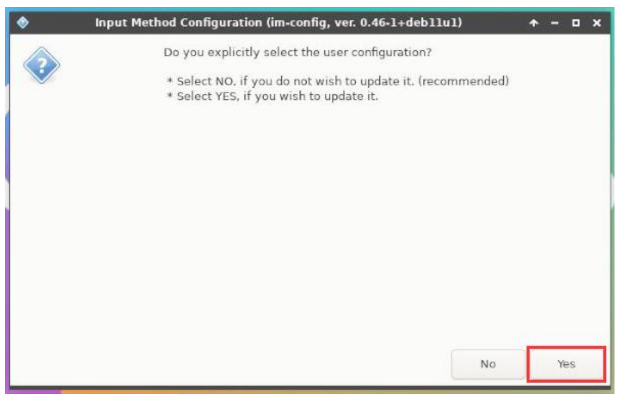
2) Then open **Input Method**



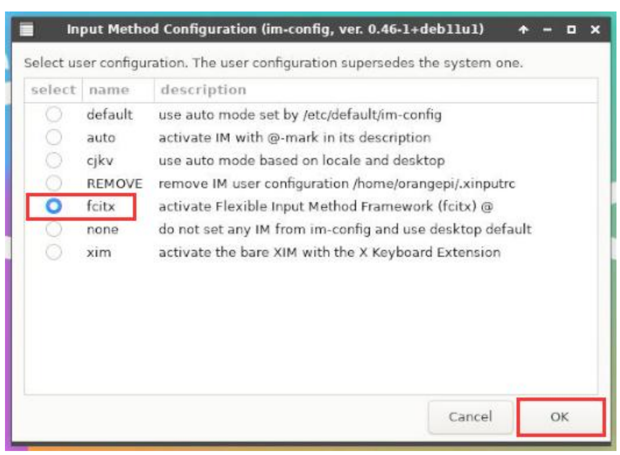
3) Then choose **OK**



4) Then choose **Yes**



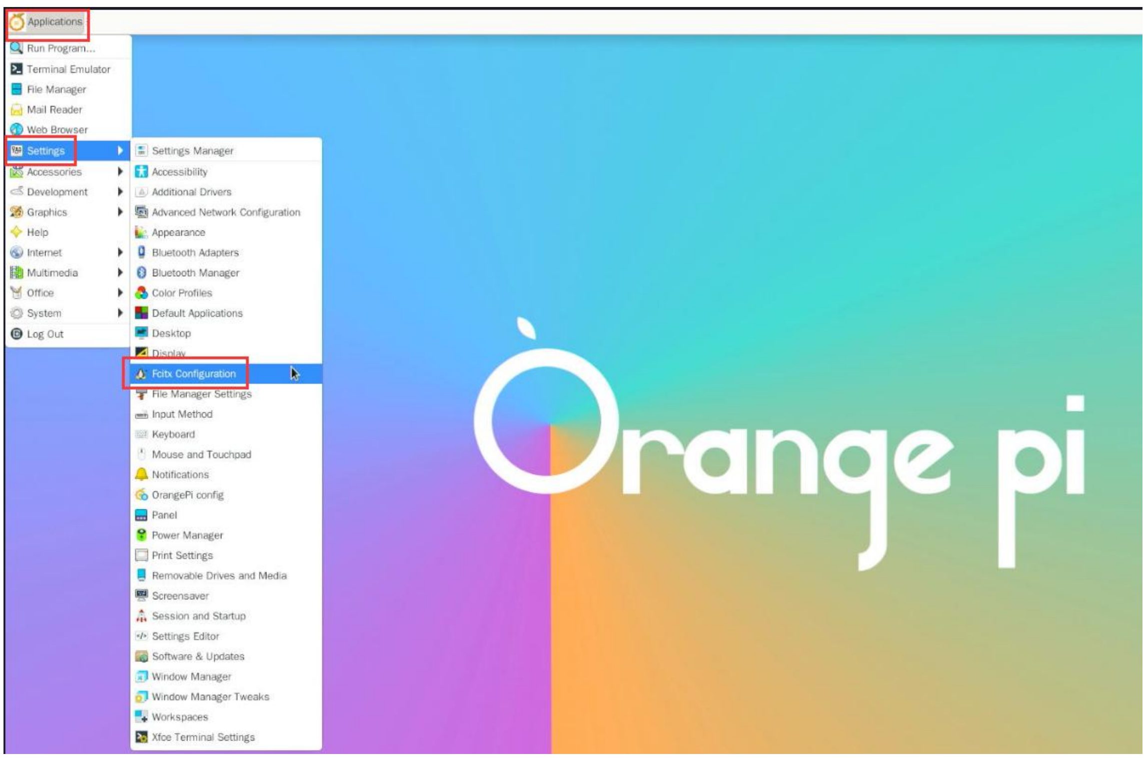
5) Then choose **fcitx**



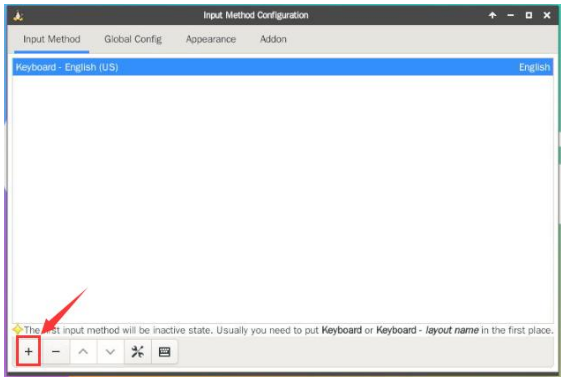
6) Then choose **OK**

7) **Then restart the Linux system to make the configuration effective**

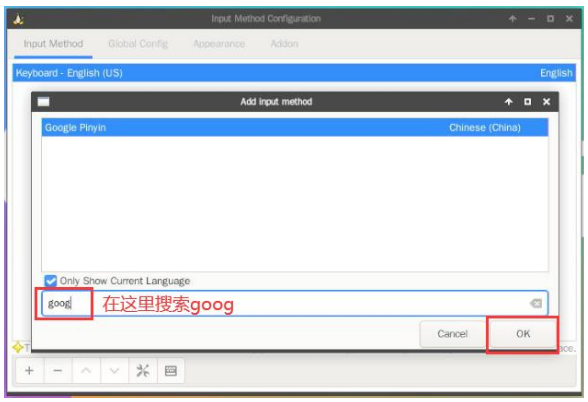
8) Then open **Fcitx configuration**



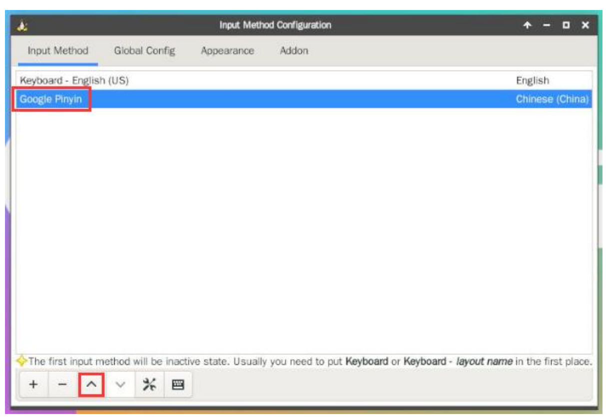
9) Then click the "+" of the position shown in the figure below

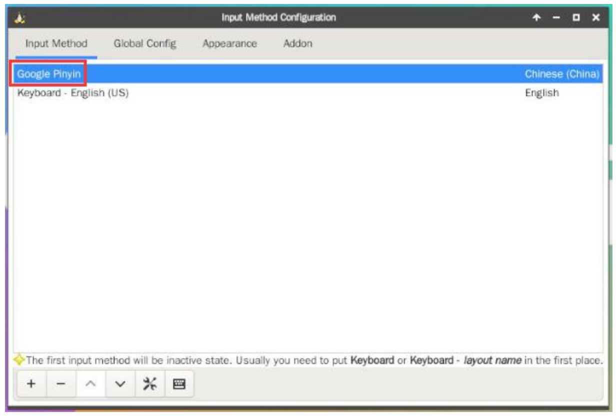


10) Then search **Google Pinyin** and click **OK**

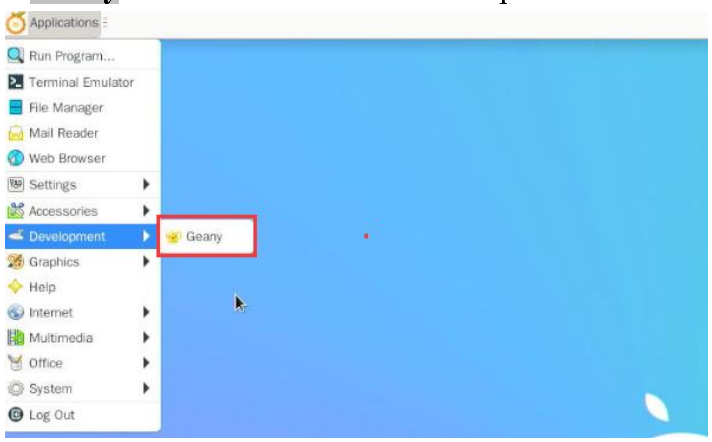


11) Then put **Google Pinyin** to the front.

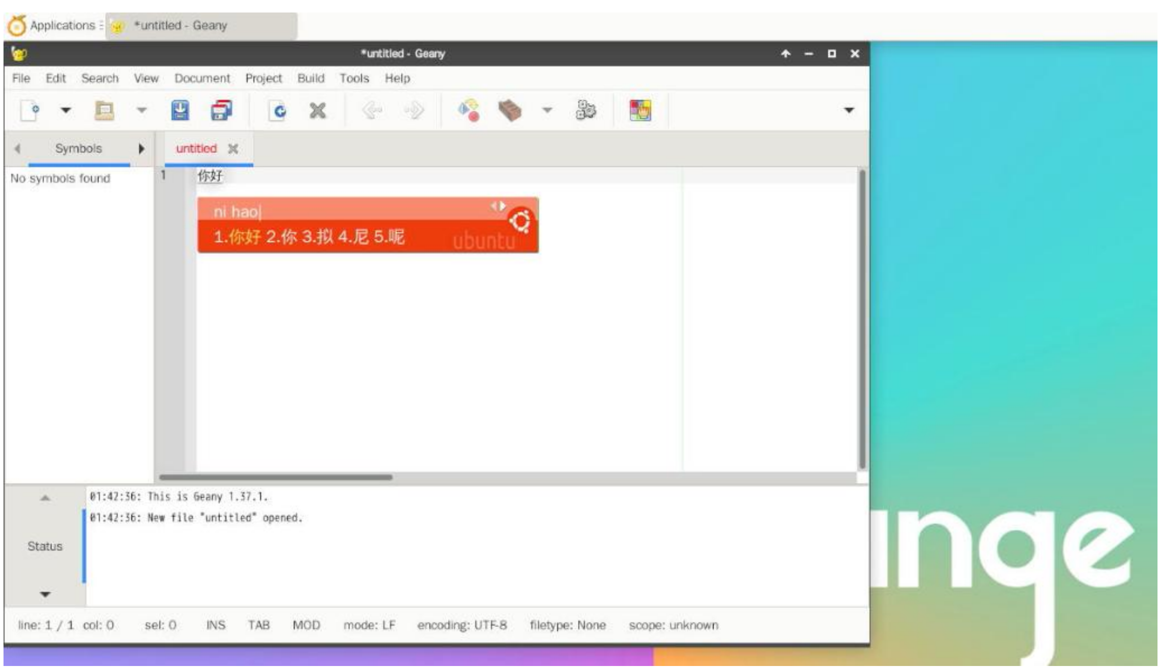




12) Then open the **Geany** editor and test the Chinese input method



13) The Chinese input method test is shown below

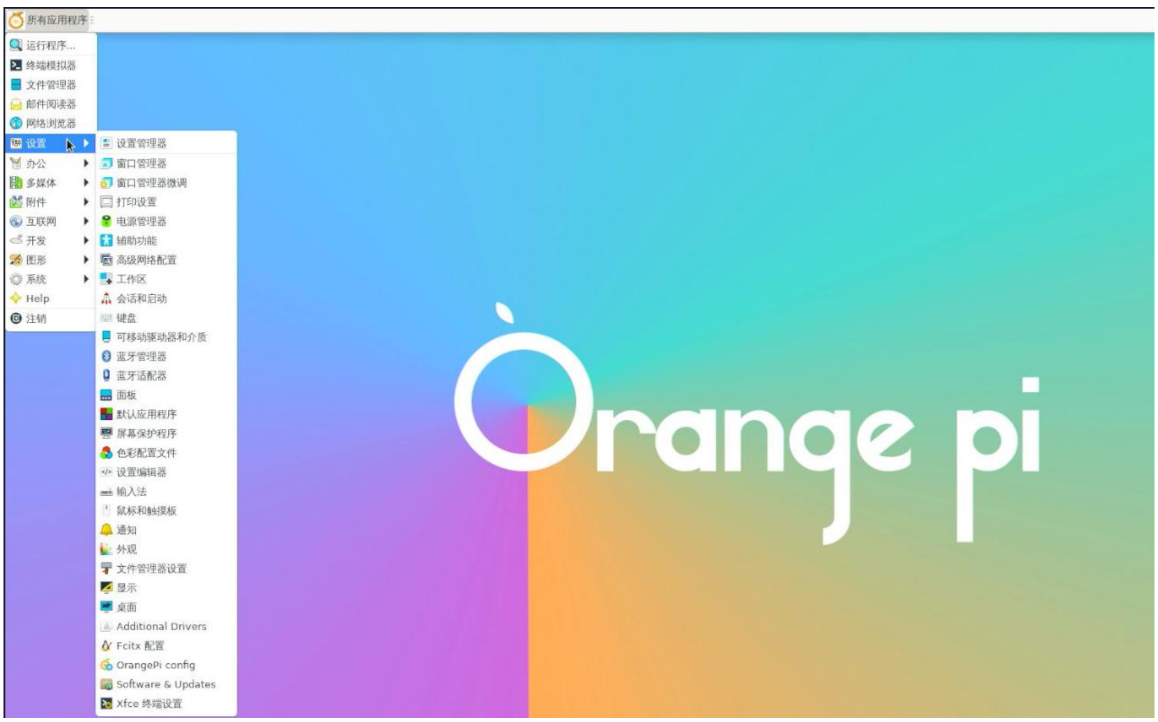


14) You can switch between Chinese and English input methods through the **Ctrl+Space** shortcut key

15) If the entire system is required as Chinese, you can set the variables **in/etc/default/local** to set to **zh_CN.UTF-8**

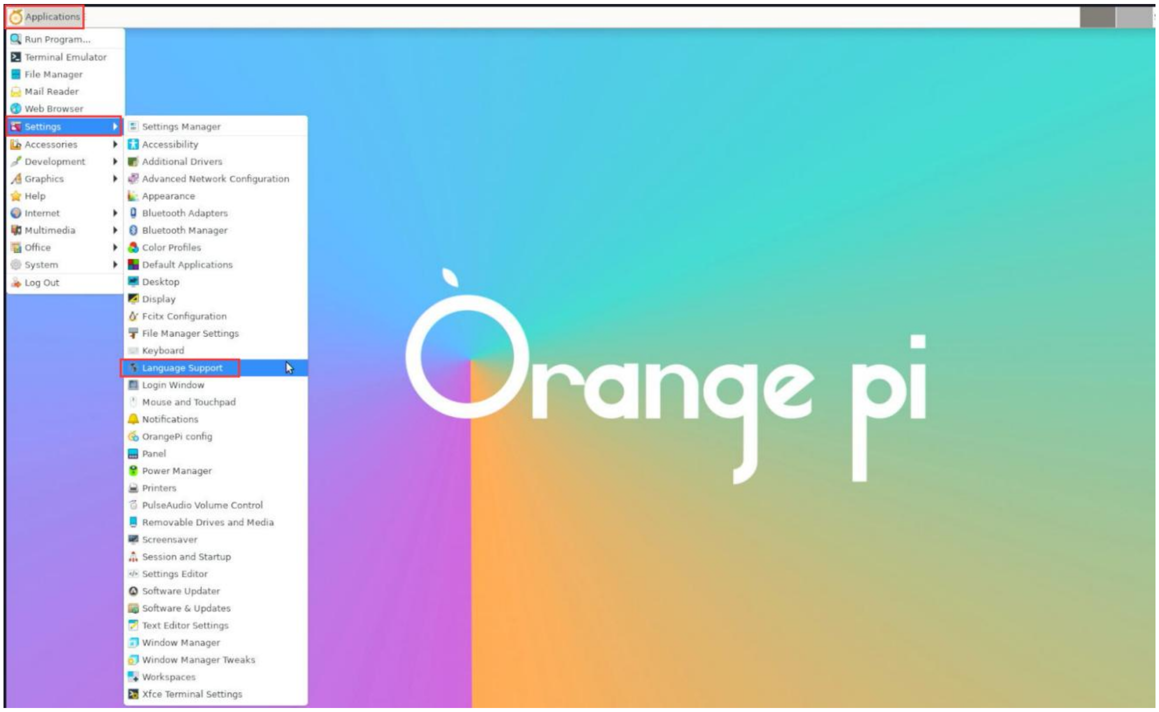
```
orangepi@orangepi:~$ sudo vim /etc/default/locale
#    File generated by update-locale
LC_MESSAGES=zh_CN.UTF-8
LANG=zh_CN.UTF-8
LANGUAGE=zh_CN.UTF-8
```

16) Then **restart the system** to see the system display as Chinese

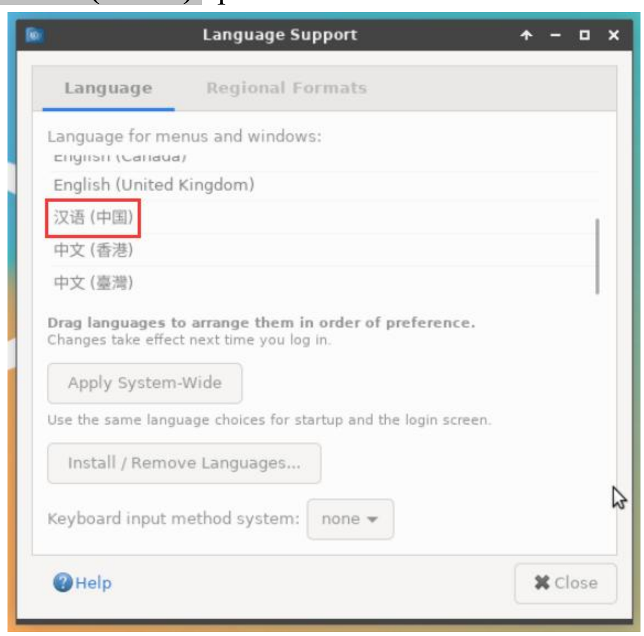


3. 24. 2. UBuntu 20.04 system installation method

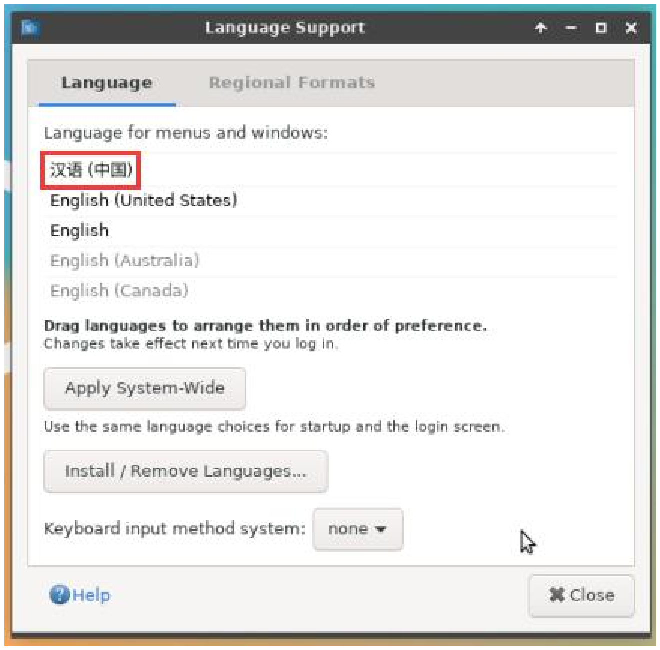
1) First open **Language Support**



2) Then find the **Chinese (China)** option

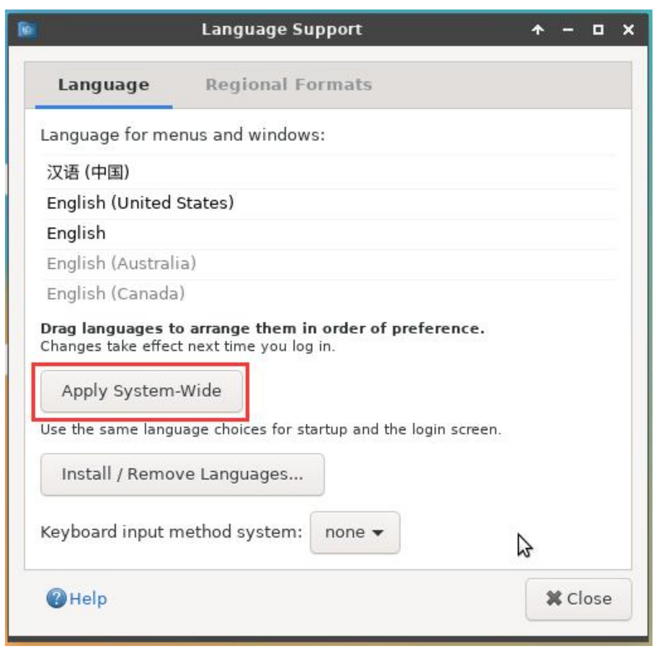


3) Then please use the mouse to select **Chinese (China)** and hold it down, and then drag it up to the beginning. The display after the dragging is shown in the figure below:：



Note that this step is not easy to drag, please try more patiently.

4) Then select the **Apply System-Wide** to apply the Chinese settings to the entire system.

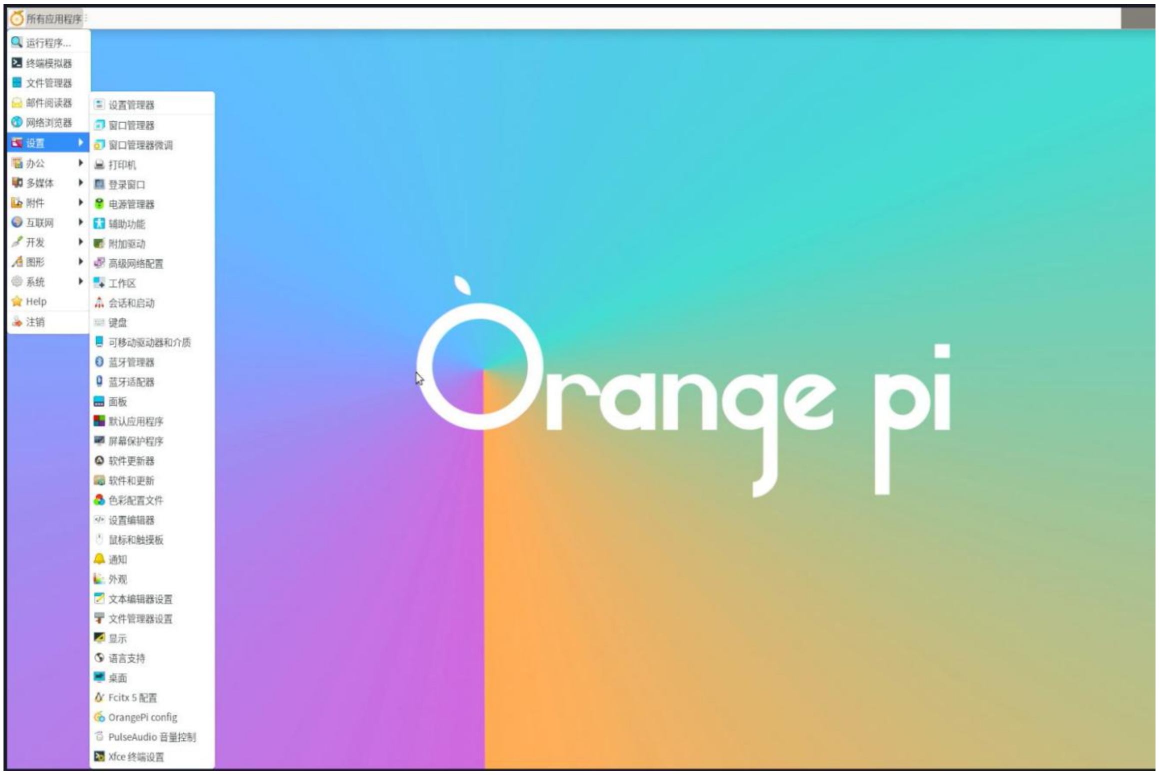


5) Then set the **keyboard input method system** to **fcitx**

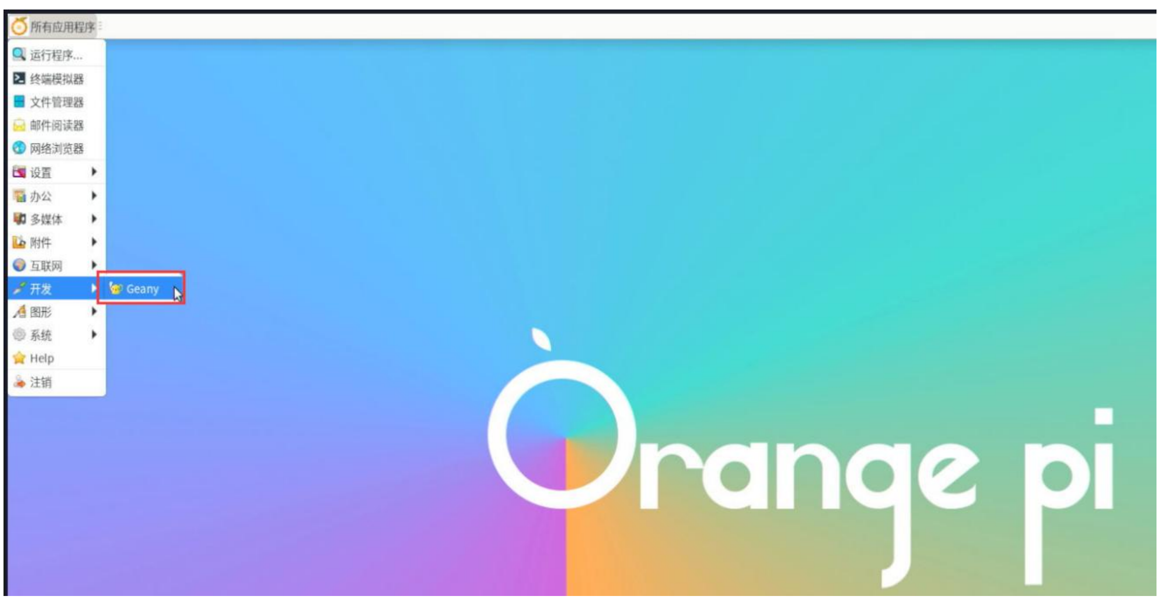
6) **Then restart the linux system to make the configuration effective**

7) After re -entering the system, select **do not ask me again** at the interface below, and then determine whether the standard folder should be updated to Chinese according to your preference

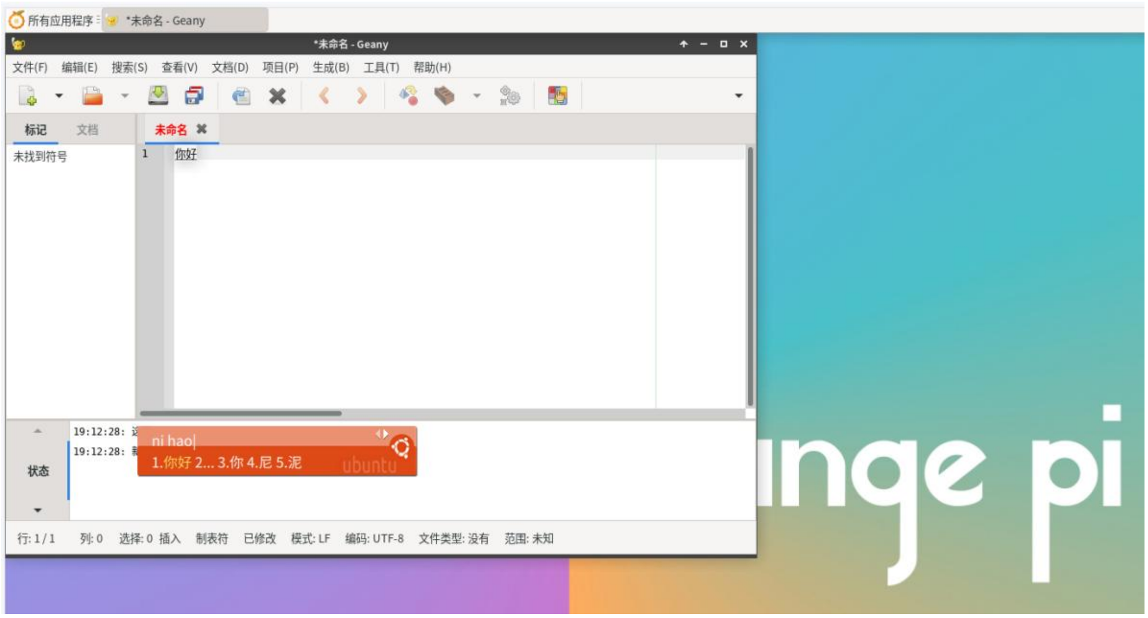
8) Then you can see that the desktop is displayed as Chinese



9) Then we can open the **Geany** test in the Chinese input method. The way to open the way is shown in the figure below

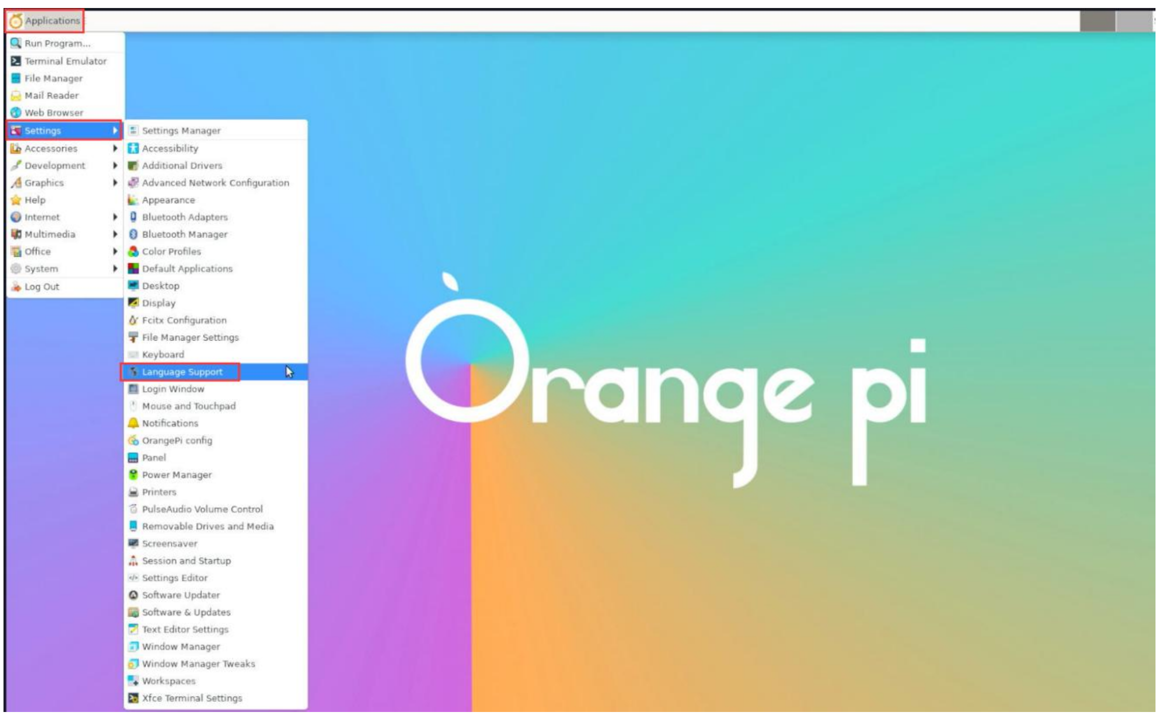


10) After opening **Geany**, the default is an English input method. We can switch into Chinese input method through the **Ctrl+Space** shortcut keys, and then we can enter Chinese.



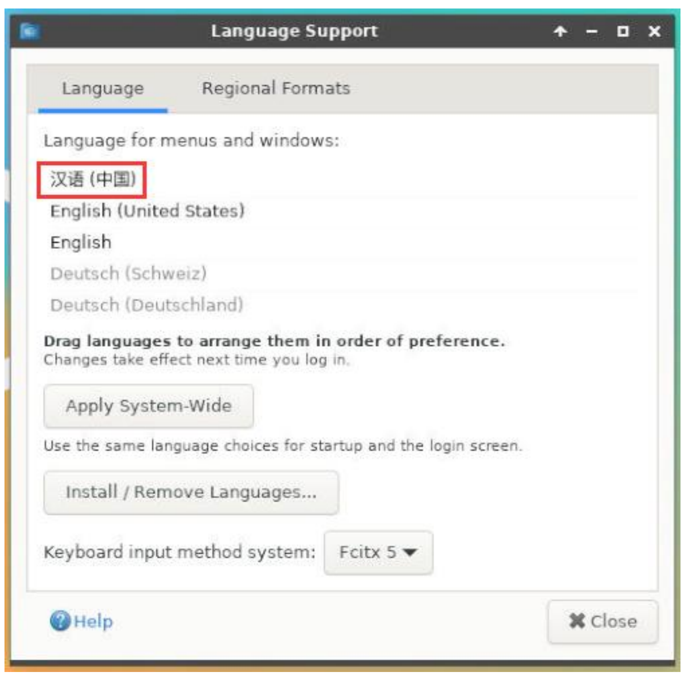
3. 24. 3. ubuntu 22.04 installation method

1) First open **Language Support**



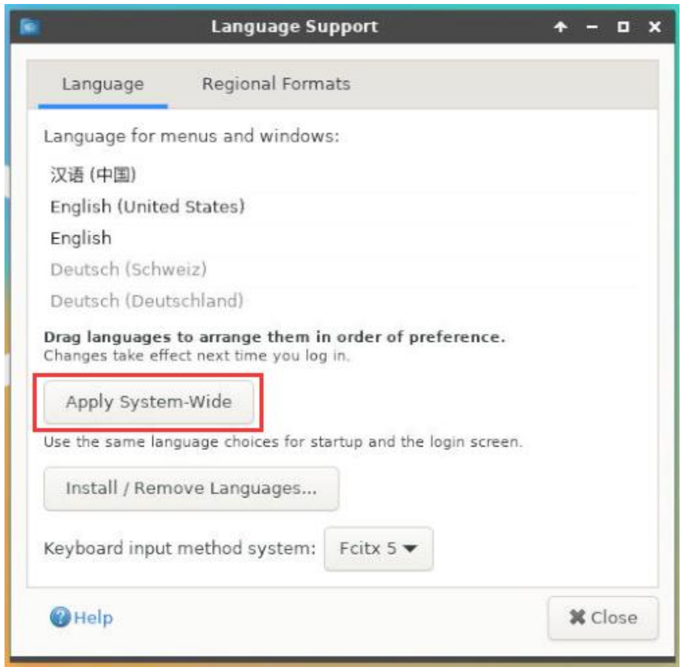
2) Then find the **Chinese (China)** option

3) Then please use the mouse to select **Chinese (China)** and hold it down, and then drag it up to the beginning. The display after the dragging is shown in the figure below:



Note that this step is not easy to drag, please try more patiently.

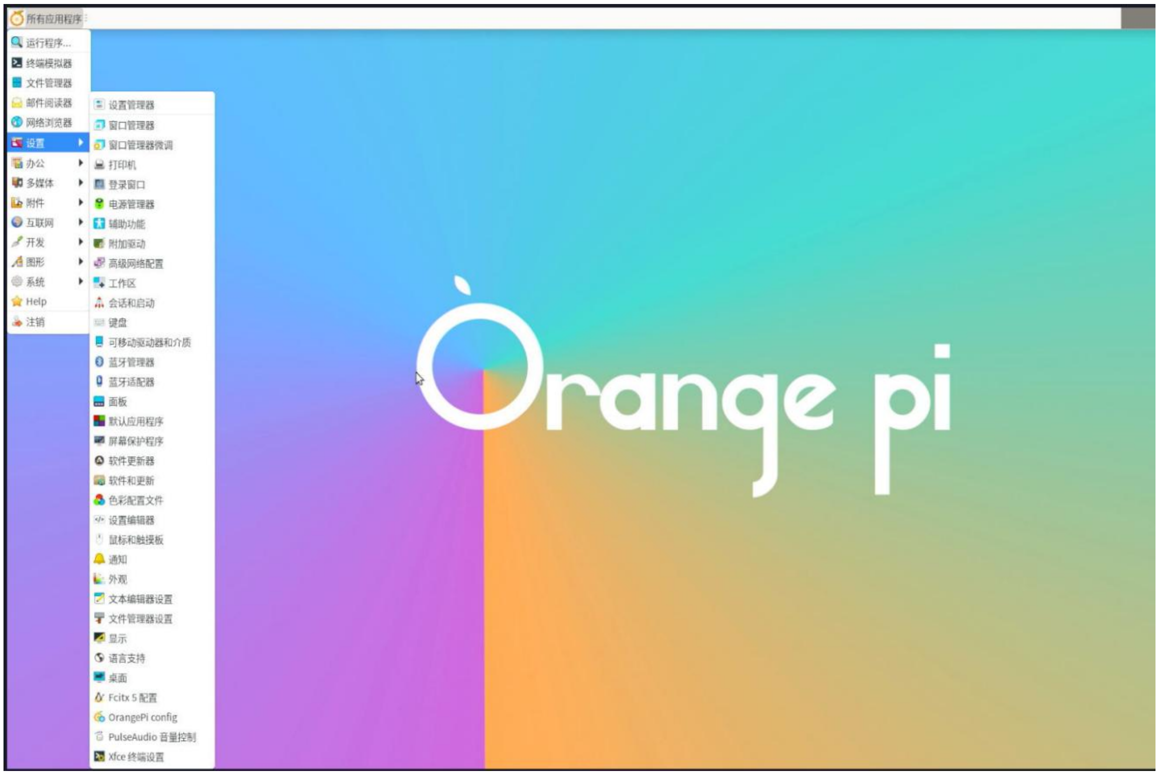
4) Then select the **Apply System-Wide** to apply the Chinese settings to the entire system



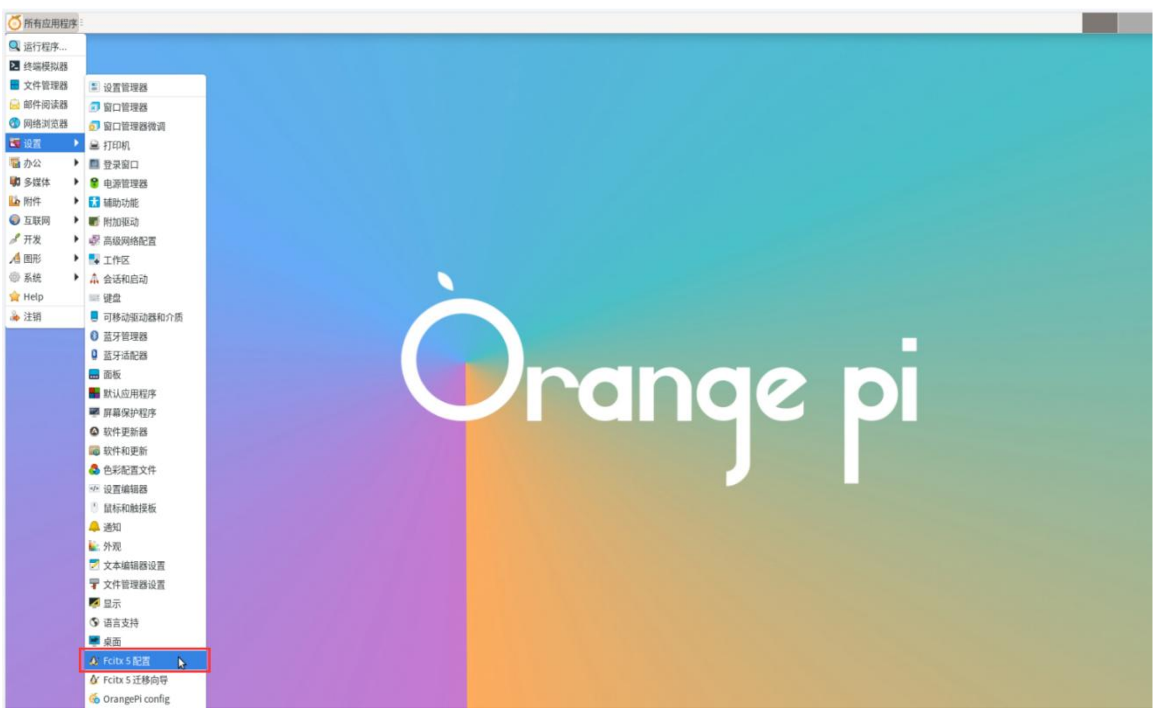
5) **Then restart the linux system to make the configuration effective**

6) After re -entering the system, please choose **not to ask me again** at the interface below, and then determine whether the standard folder should be updated to Chinese according to your preference.

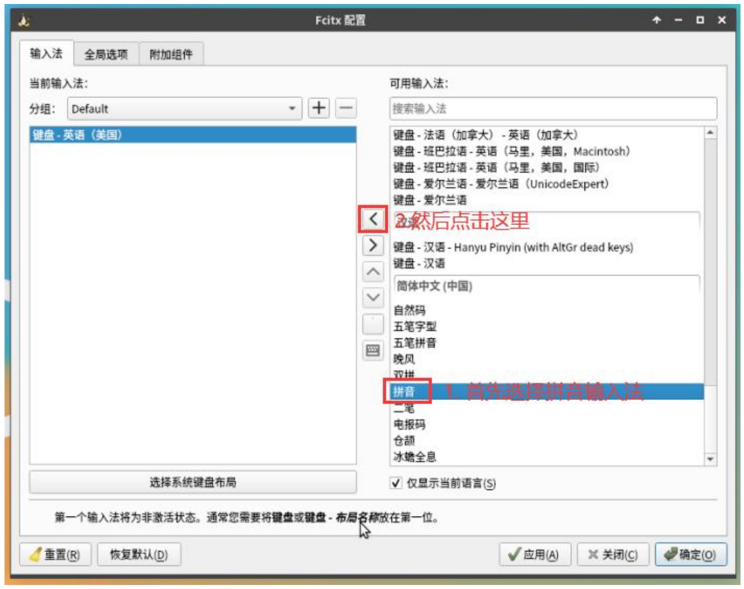
7) Then you can see that the desktop is displayed as Chinese



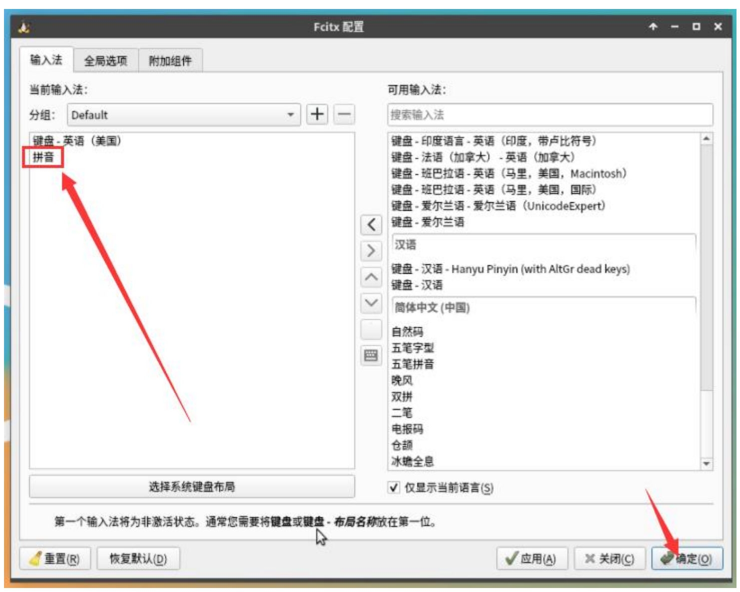
8) Then open the Fcitx5 configuration program



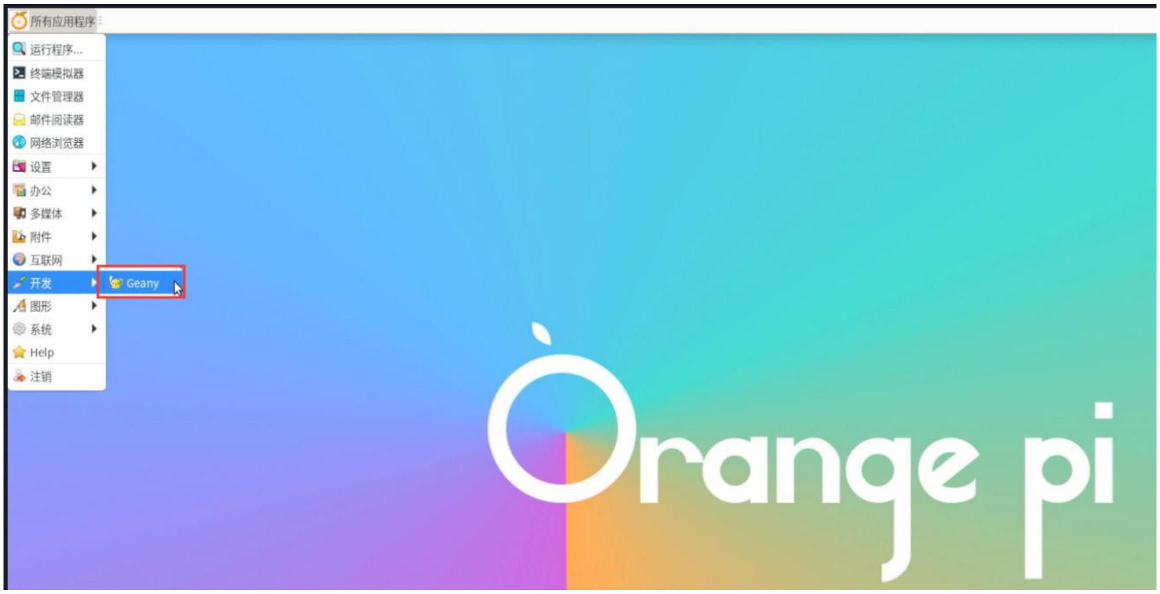
9) Then choose to use Pinyin input method



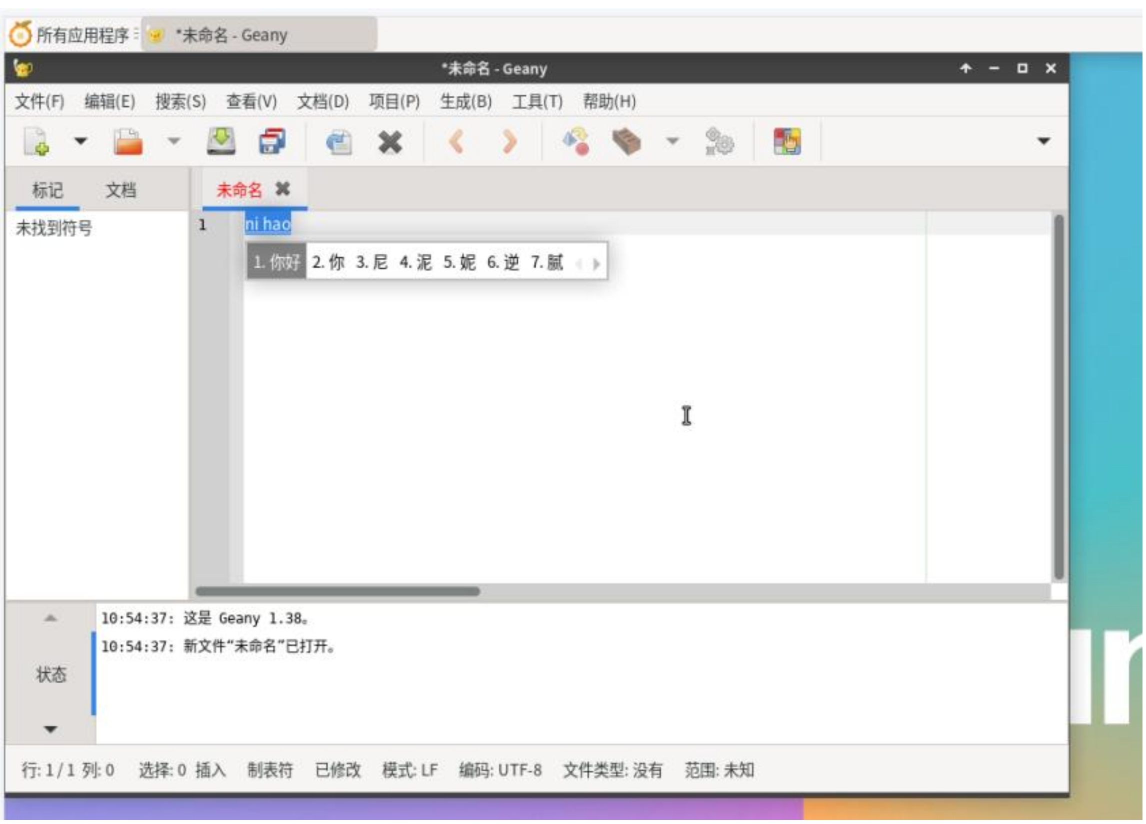
10) The interface after selecting is shown below, then click OK



11) Then we can open the **Geany** test in the Chinese input method,The way to open is shown in the figure below



12) After opening **Geany**, the default is an English input method. We can switch into Chinese input method through the **Ctrl+Space** shortcut keys, and then we can enter Chinese.



3. 25. Remote login Linux system desktop method

3. 25. 1. Use nomachine remote login

Make sure the Ubuntu or Debian system installed on the development board is a desktop version. In addition, NoMachine also provides detailed documents. It is strongly recommended to read this document to be familiar with the use of NoMachine. The document link is shown below::

https://knowledgebase.nomachine.com/DT10R00166

NoMachine supports Windows, Mac, Linux, iOS, and Android platforms, so we can remotely log in to control Orange PI development boards through NoMachine on multiple devices. The following demonstrates the Linux system desktop of the Orange PI development board through Nomachine in Windows. For installation methods of other platforms, please refer to the official documentation of nomachine。

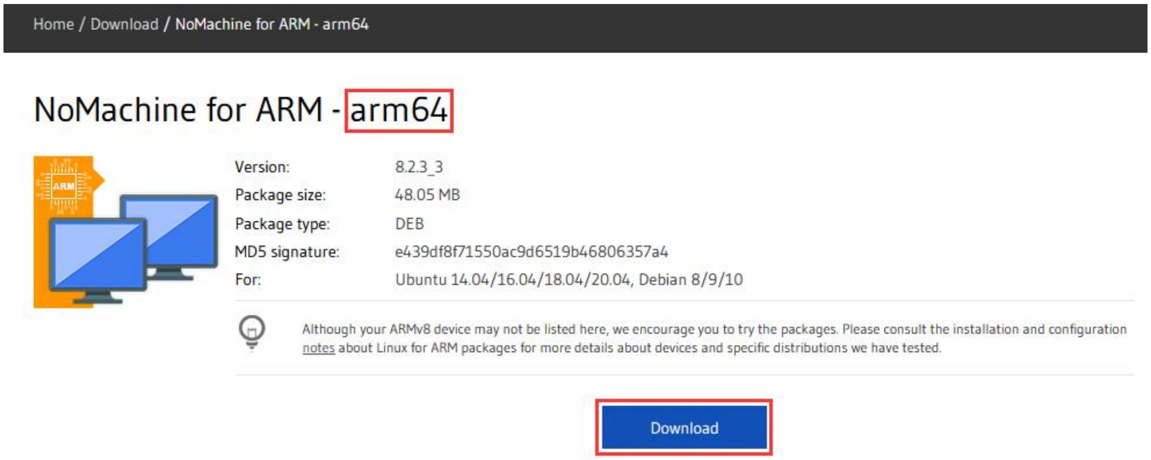
Please ensure that Windwos computers and development boards are in the same local area network before operation, and can log in to the Ubuntu or Debian system that can log in to the development board normally。

1) First download the NoMachine software Linux **arm64** deb version of the installation package, and then install it in the Linux system of the development board

a. Since RK3588s is a SOC of the ARMV8 architecture, the system we use is Ubuntu or Debian, so you need to download **NoMachine for ARM ARMv8 DEB** installation package. The download link is shown below:

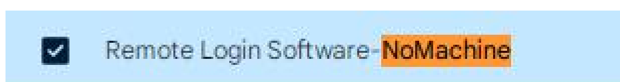
Note that this download link may change, please recognize the DEB package of the ArmV8/Arm64 version.

```
https://downloads.nomachine.com/download/?id=116&distro=ARM
```

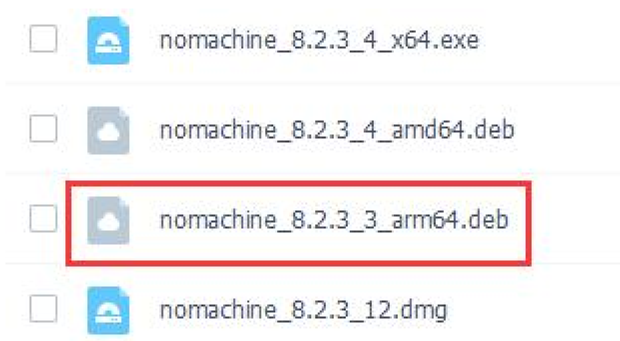


b. In addition, you can also download the installation package of **Nomachine** in the **official tools**.

First enter the **remote login software-NoMachine** folder



Then download the arm64 version of the deb installation package



c. Then upload the downloaded **nomachine_8.2.3_3_arm64.deb** to the Linux system of the development board

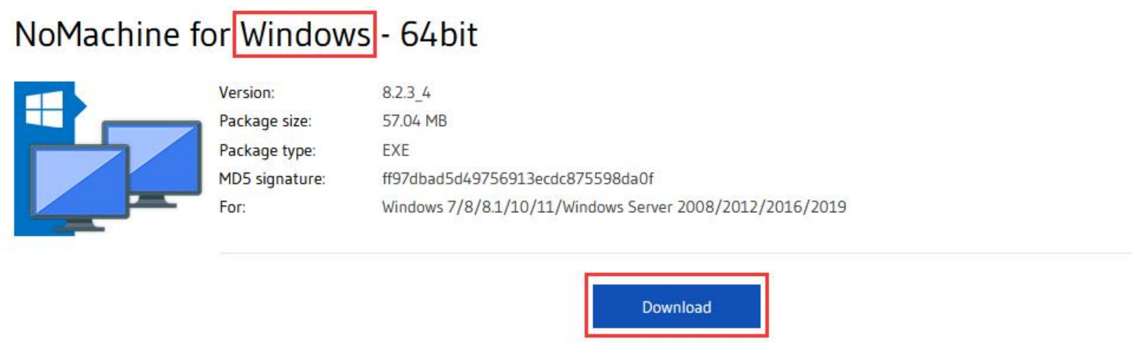
d. Then use the following command to install **NoMachine** in the linux system of the development board

```
orangepi@orangepi:~$ sudo dpkg -i nomachine_8.2.3_3_arm64_arm64.deb
```

2) Then download the nomachine software Windows version of the installation package,

the download address is shown below

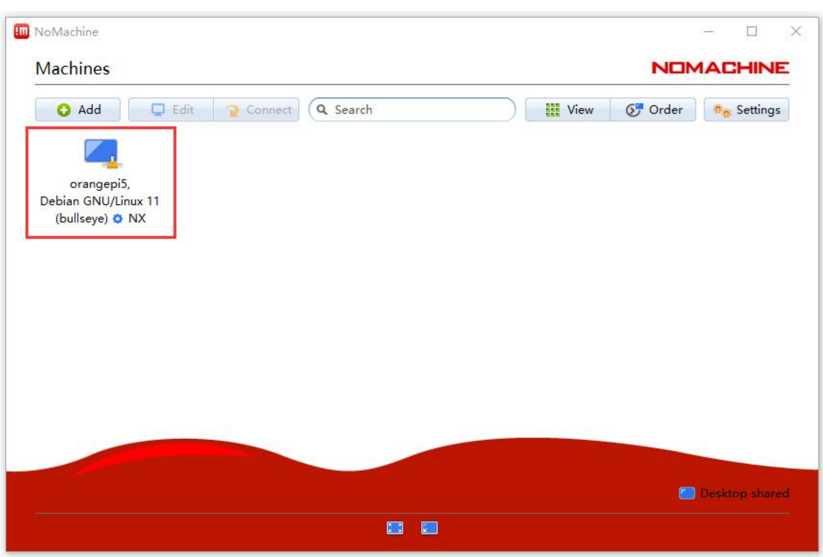
https://downloads.nomachine.com/download/?id=8



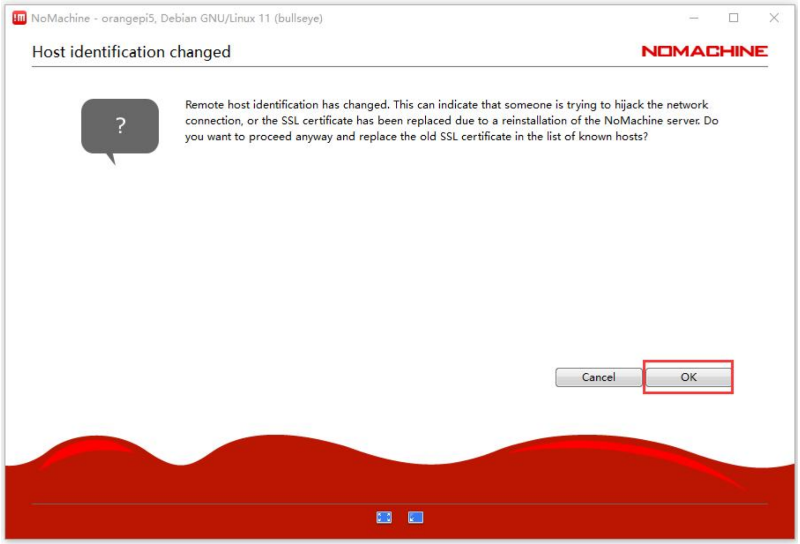
3) Then install NoMachine in Windows, **Please restart the computer after installation**

4) Then open **NoMachine** in Window

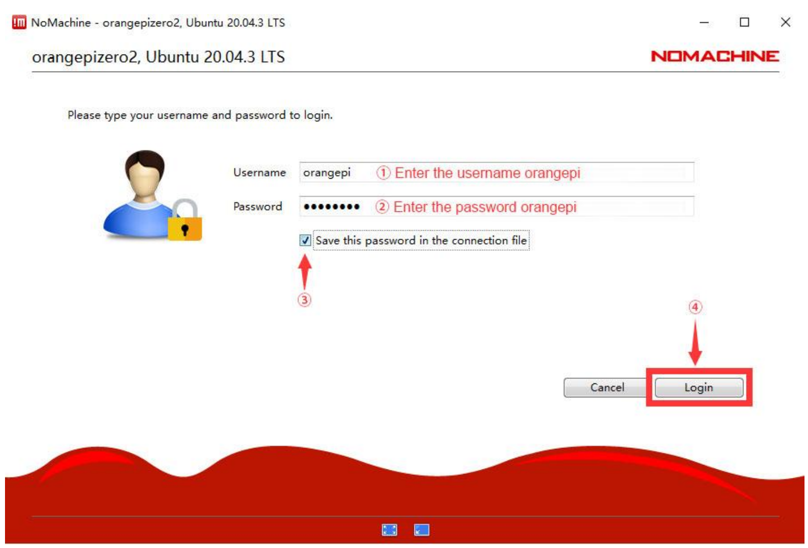
5) After Nomachine is started, it will automatically scan other devices installed in the local area network. After entering the main interface of Nomachine, you can see that the development board is already in the connected device list, and then click the location shown in the red box below in the figure below. You can start logging in to the linux system desktop of the development board



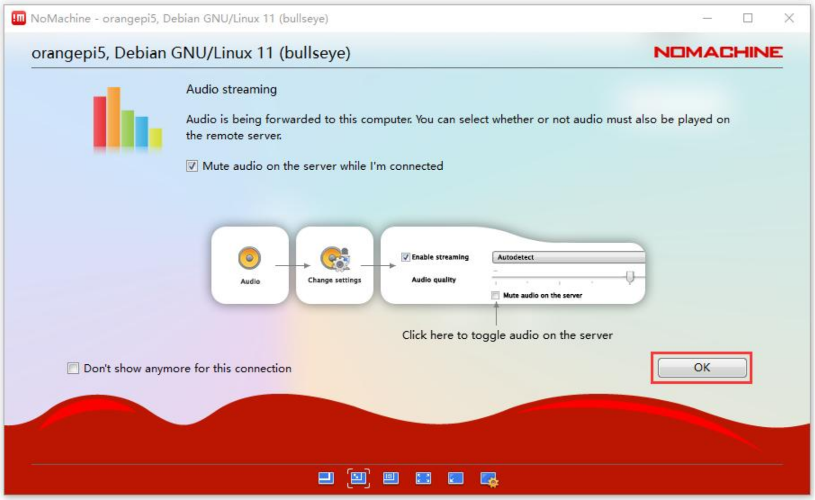
6) Then click **OK**



7) Then enter the username and password of the linux system in the corresponding position in the figure below, and then click **login** to start login

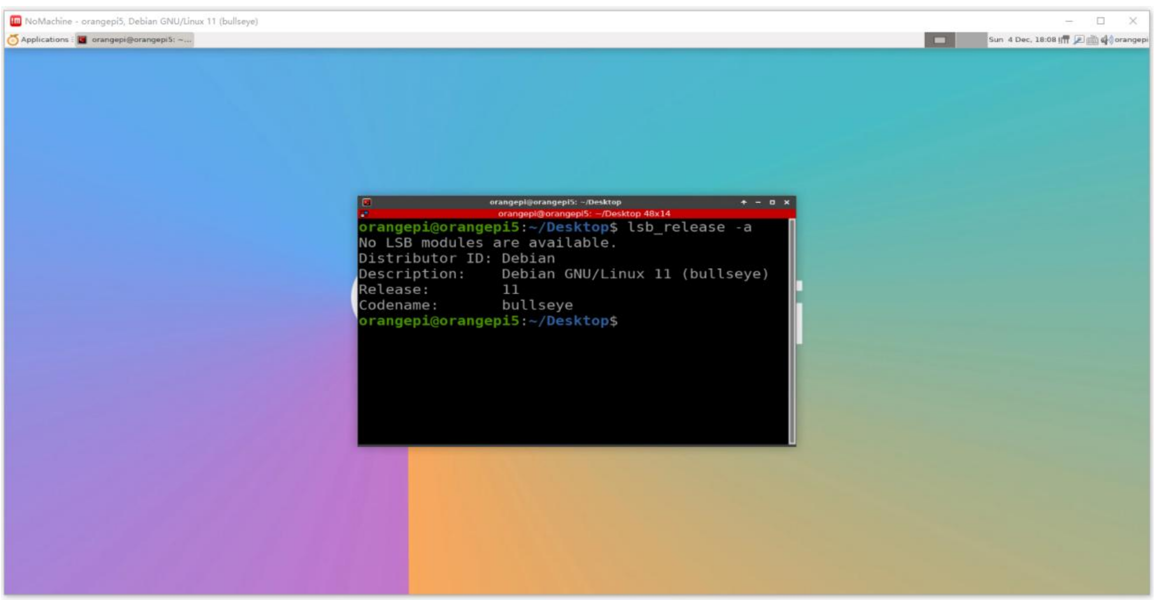


8) Then click OK in the next interface

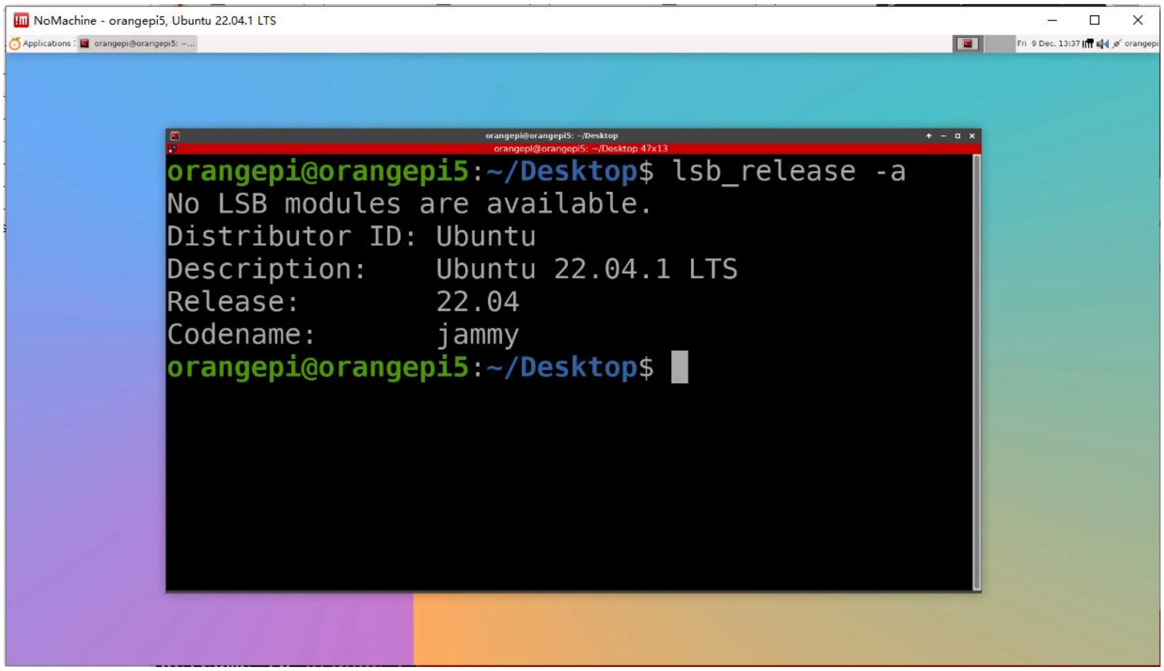


9) Finally, you can see the desktop of the development board Linux system

a. Debian11



b. Ubuntu22.04



3. 25. 2. Use VNC remote login

Before operation, please ensure that the Windows computer and the development board are in the same local area network, and can log in to the Ubuntu or Debian system that can log in to the development board normally.

Ubuntu 20.04 tests many problems with VNC, please do not use this method.

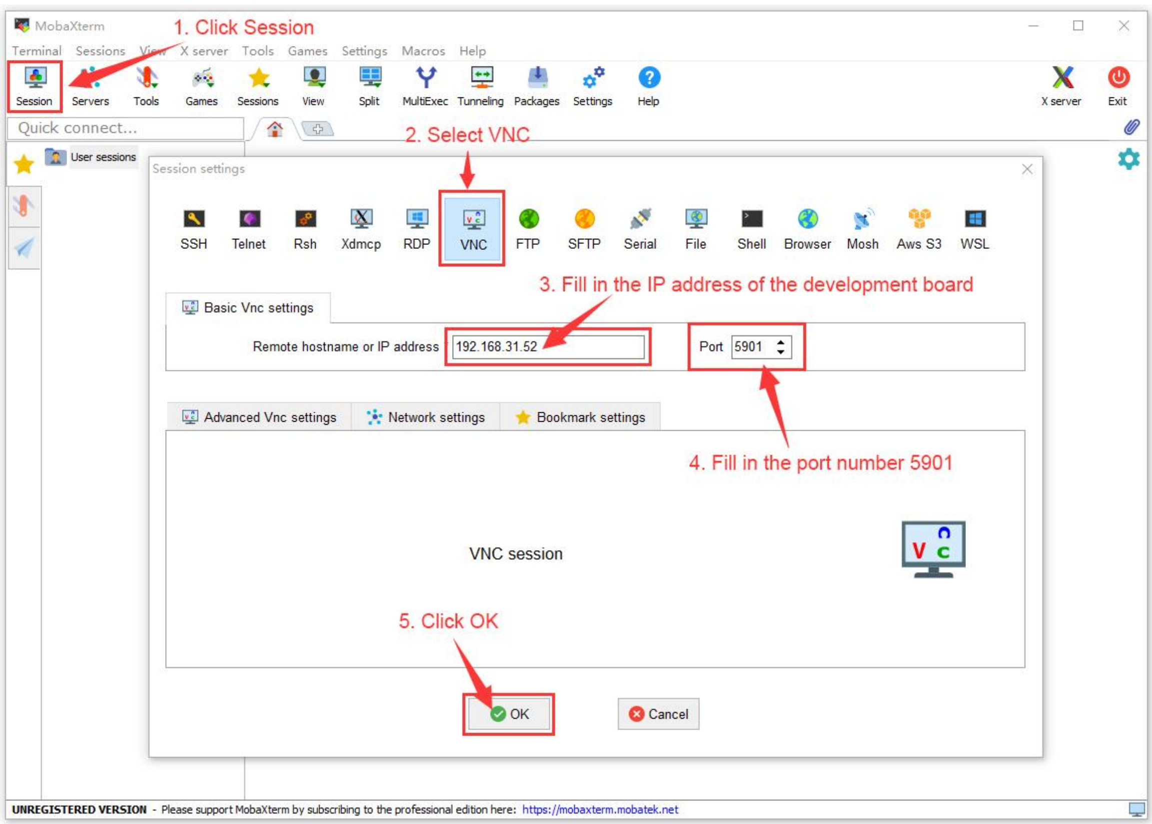
1) First run the **SET_VNC.SH** script settings, and **remember to add Sudo permissions**.

```
orangepi@orangepi:~$ sudo set_vnc.sh
You will require a password to access your desktops.

Password:          #Set the VNC password here, 8 -bit characters
Verify:            #Set the VNC password here, 8 -bit characters
Would you like to enter a view-only password (y/n)? n
xauth:    file /root/.Xauthority does not exist

New 'X' desktop is orangepi5b:1

Creating default startup script /root/.vnc/xstartup
Starting applications specified in /root/.vnc/xstartup
```

```
Log file is /root/.vnc/orangepi5b:1.log

Killing Xtightvnc process ID 3047

New 'X' desktop is orangepi5b:1

Starting applications specified in /root/.vnc/xstartup
Log file is /root/.vnc/orangepi5b:1.log
```

2) The steps to connect the development board Linux system desktop using MobaxTerm software are shown below:

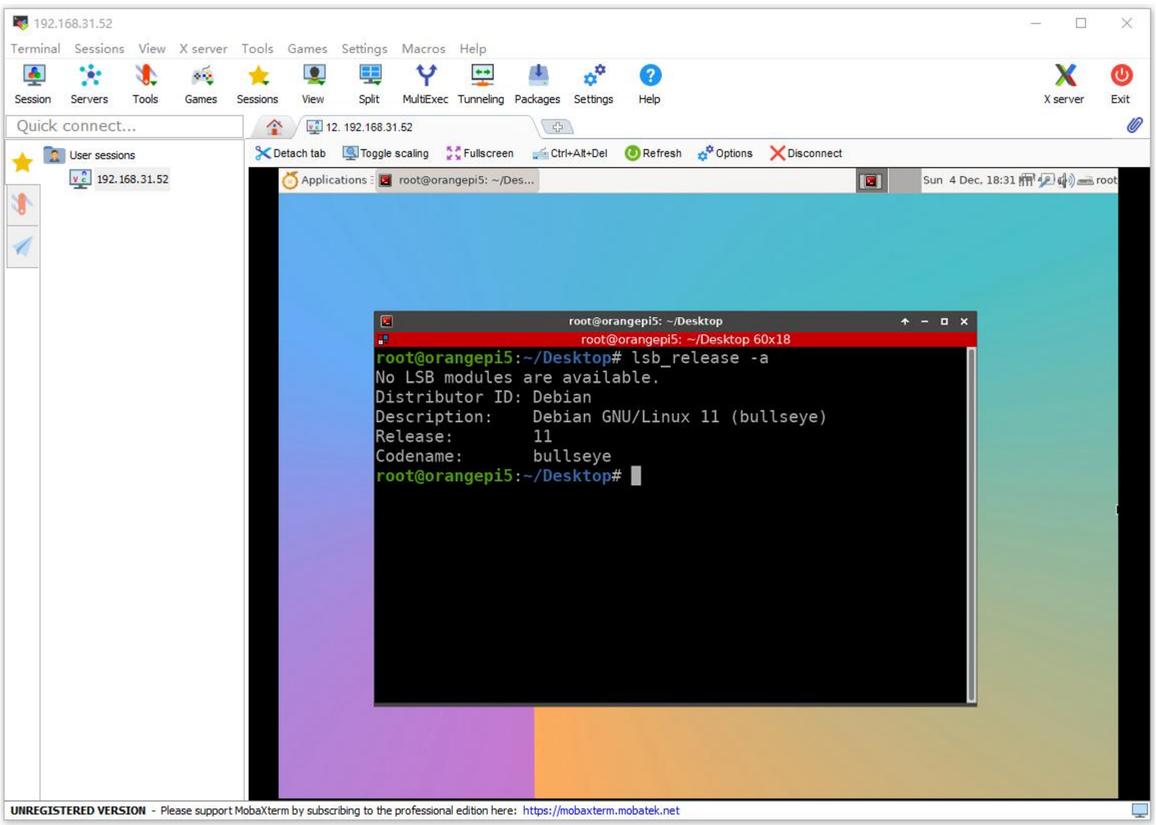
a. First click session, then select VNC, then fill in the IP address and port of the development board, and finally click OK to confirm



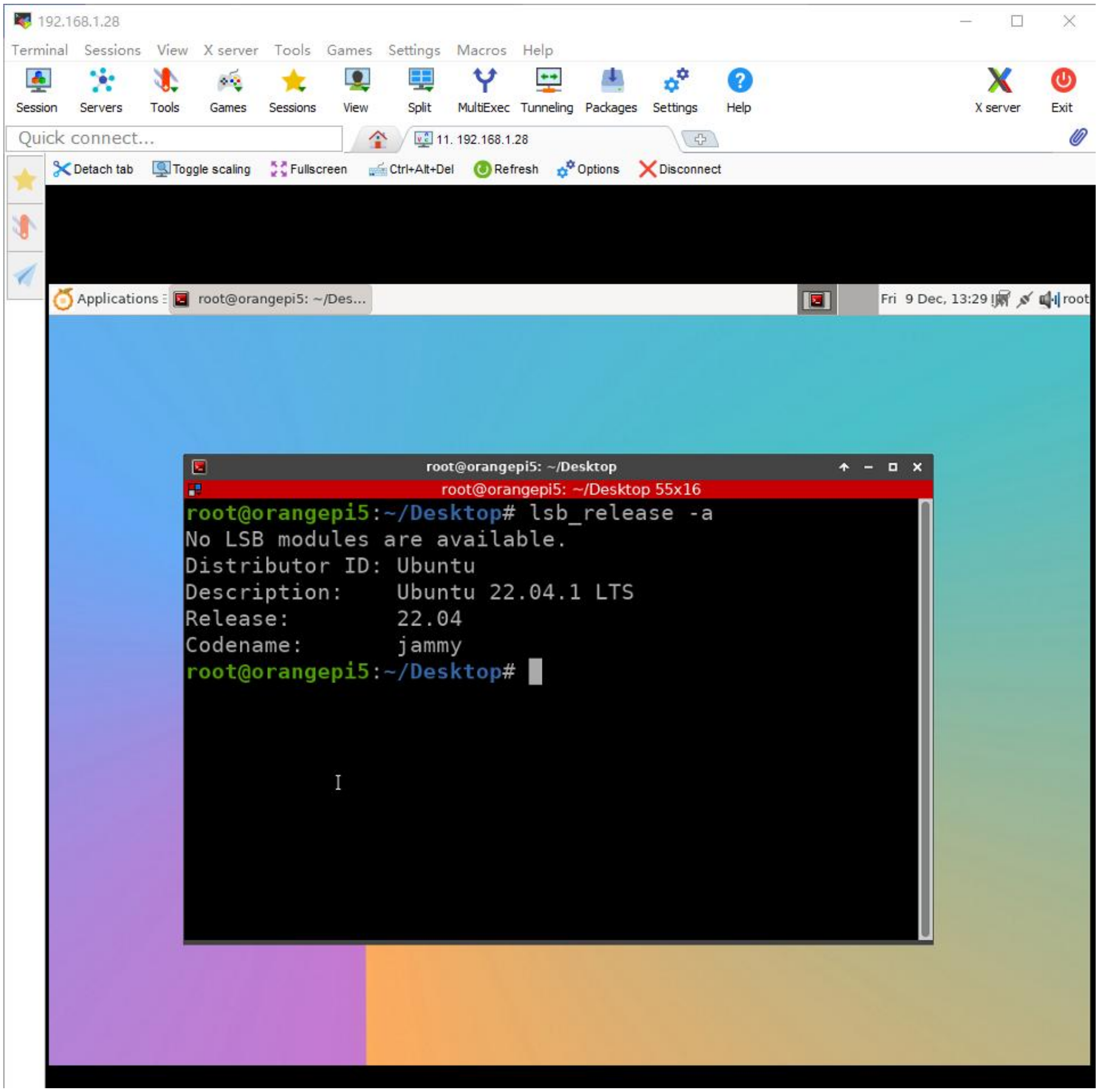
b. Then enter the password of the VNC set before

c. The interface after the successful login is displayed as shown in the figure below, and then you can remotely operate the desktop of the linux system remotely

a) Debian11 login shows as shown below

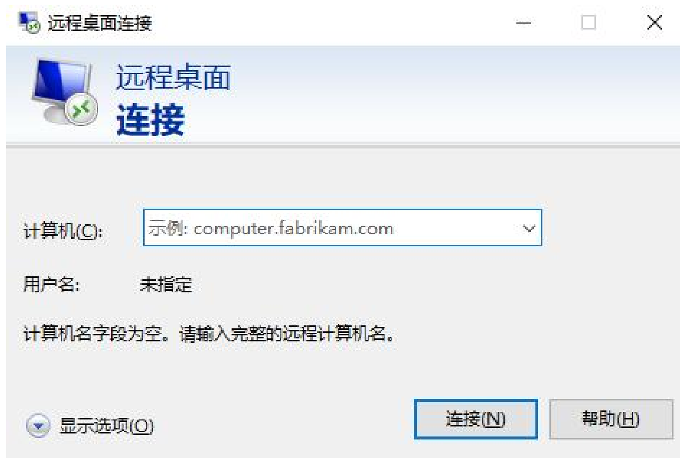


b) Ubuntu22.04 Login shows as shown below



3) The steps to log in to the development board Linux system desktop using the **remote desktop connection** application of Windows are

a. First open the **remote desktop connection** that comes with Windows



b. Then enter the IP address of the development board

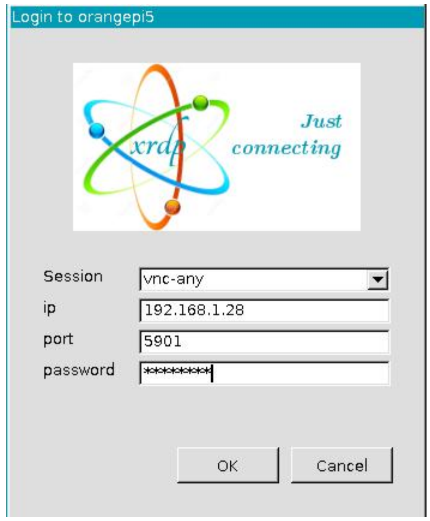
c. Then set the connection information according to the description below

a) **Session：** Need to choose vnc-any

b) **ip：** You can enter 127.0.0.0 or the IP address of the development board

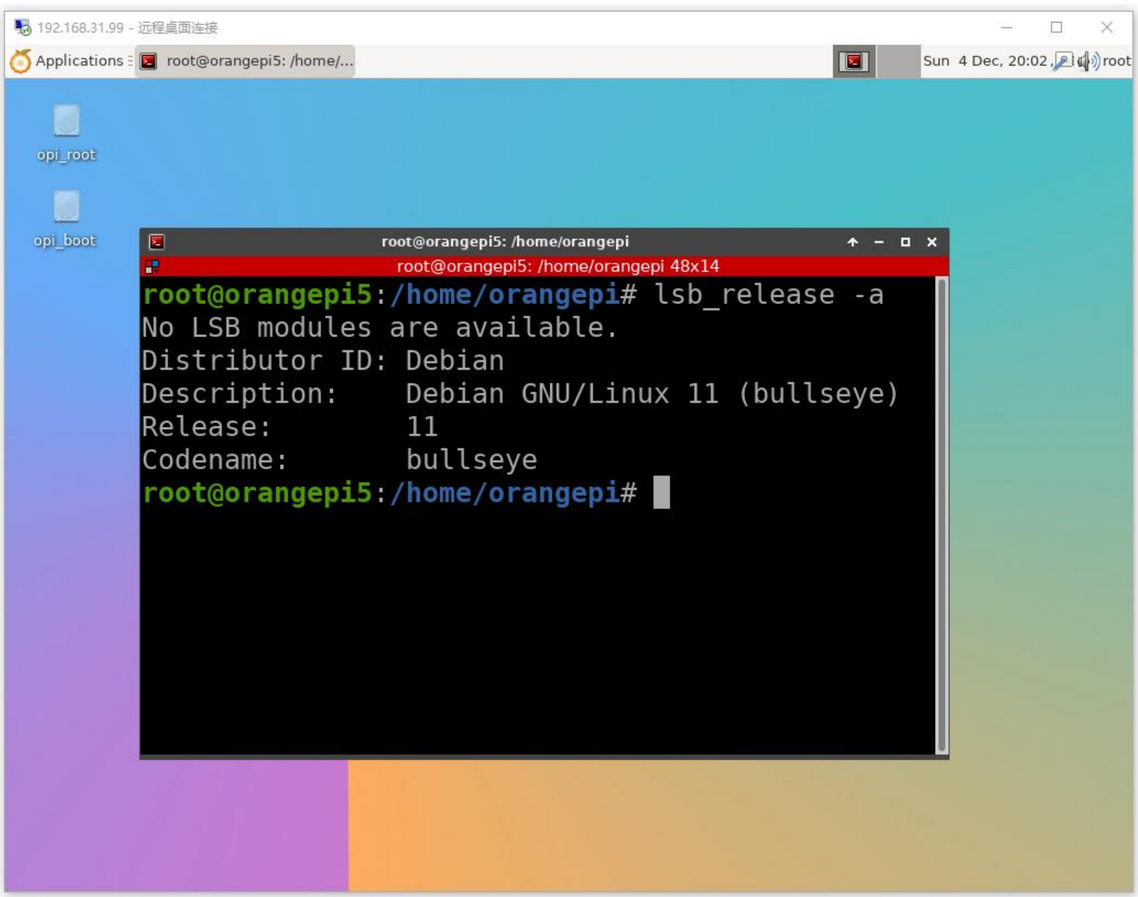
c) **port：** Generally 5901

d) **password：** You need to enter the password of VNC



d. The display of the desktop of the LINUX system successfully logged in to the development board is shown in the figure below

a) Debian11 login shows as shown below



b) Ubuntu22.04 is currently not available, please do not use this method

3. 26. Some programming language test supported by the linux system

3. 26. 1. Debian Bullseye System

1) Debian Bullseye is installed with the gcc compilation tool chain by default, which can directly compile the C language program in the linux system of the development board

a. The version of gcc is shown below

```
orangepi@orangepi:~$ gcc --version
gcc (Debian 10.2.1-6) 10.2.1 20210110
Copyright (C) 2020 Free Software Foundation, Inc.
This is free software; see the source for copying conditions.   There is NO
warranty; not even for MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.
```

b. The **hello_World.c** program that writes c language

```
orangepi@orangepi:~$ vim hello_world.c
#include <stdio.h>

int main(void)
{
        printf("Hello World!\n");

        return 0;
}
```

c. Then compile and run **hello_world.c**

```
orangepi@orangepi:~$ gcc -o hello_world hello_world.c
orangepi@orangepi:~$ ./hello_world
Hello World!
```

2) Debian Bullseye defaults to install Python3

a. The specific version of Python is shown below

```
orangepi@orangepi:~$ python3
Python 3.9.2 (default, Feb 28 2021, 17:03:44)
[GCC 10.2.1 20210110] on linux
Type "help", "copyright", "credits" or "license" for more information.
>>>
```

b. The **hello_world.py** program that writes python language

```
orangepi@orangepi:~$ vim hello_world.py
print('Hello World!')
```

c. The results of running **Hello_World.py** are shown below

```
orangepi@orangepi:~$ python3 hello_world.py
Hello World!
```

3) Debian Bullseye's compilation tool and operating environment that is not installed in Java by default

a. You can use the following command to install openjdk. The latest version in Debian Bullseye is OpenJDK-17

```
orangepi@orangepi:~$ sudo apt install -y openjdk-17-jdk
```

b. After installation, you can check the version of Java

```
orangepi@orangepi:~$ java --version
```

c. Write the java version **hello_world.java**

```
orangepi@orangepi:~$ vim hello_world.java
public class hello_world
{
        public static void main(String[] args)
        {
                System.out.println("Hello World!");
        }
}
```

d. Then compile and run **hello_world.java**

```
orangepi@orangepi:~$ javac hello_world.java
orangepi@orangepi:~$ java hello_world
Hello World!
```

3. 26. 2. Ubuntu Focal system

1) Ubuntu Focal has a gcc compilation tool chain by default, which can directly compile the C language program in the linux system of the development board

a. The version of gcc is shown below

```
orangepi@orangepi:~$ gcc --version
gcc (Ubuntu 9.4.0-1ubuntu1~20.04.1) 9.4.0
Copyright (C) 2019 Free Software Foundation, Inc.
```

```
This is free software; see the source for copying conditions.   There is NO
warranty; not even for MERCHANTABILITY or FITNESS FOR A PARTICULAR
PURPOSE.
```

b. The **hello_World.c** program that writes c language

```
orangepi@orangepi:~$ vim hello_world.c
#include <stdio.h>

int main(void)
{
        printf("Hello World!\n");

        return 0;
}
```

c. Then compile and run **hello_world.c**

```
orangepi@orangepi:~$ gcc -o hello_world hello_world.c
orangepi@orangepi:~$ ./hello_world
Hello World!
```

2) Ubuntu Focal's default installation with Python3

a. python3 specific version is shown below

```
orangepi@orangepi:~$ python3
Python 3.8.10 (default, Nov 14 2022, 12:59:47)
[GCC 9.4.0] on linux
Type "help", "copyright", "credits" or "license" for more information.
>>>
```

b. The **hello_world.py** program that writes python language

```
orangepi@orangepi:~$ vim hello_world.py
print('Hello World!')
```

c. The results of running **Hello_World.py** are shown below

```
orangepi@orangepi:~$ python3 hello_world.py
Hello World!
```

3) Ubuntu Focal defaults to compile tools and operating environments that are not installed in Java

a. You can use the following command to install Openjdk-17

```
orangepi@orangepi:~$ sudo apt install -y openjdk-17-jdk
```

b. After installation, you can check the version of Java

```
orangepi@orangepi:~$ java --version
openjdk 17.0.2 2022-01-18
OpenJDK Runtime Environment (build 17.0.2+8-Ubuntu-120.04)
OpenJDK 64-Bit Server VM (build 17.0.2+8-Ubuntu-120.04, mixed mode, sharing)
```

c. Write the java version **hello_world.java**

```
orangepi@orangepi:~$ vim hello_world.java
public class hello_world
{
        public static void main(String[] args)
        {
                System.out.println("Hello World!");
        }
}
```

d. Then compile and run **hello_world.java**

```
orangepi@orangepi:~$ javac hello_world.java
orangepi@orangepi:~$ java hello_world
Hello World!
```

3. 26. 3. Ubuntu Jammy system

4) Ubuntu Jammy is installed with the gcc compilation tool chain by default, which can directly compile the C language program in the linux system of the development board

a. The version of gcc is shown below

```
orangepi@orangepi:~$ gcc --version
gcc (Ubuntu 11.2.0-19ubuntu1) 11.2.0
Copyright (C) 2021 Free Software Foundation, Inc.
This is free software; see the source for copying conditions.   There is NO
warranty; not even for MERCHANTABILITY or FITNESS FOR A PARTICULAR
PURPOSE.
```

b. The **hello_World.c** program that writes C language

```
orangepi@orangepi:~$ vim hello_world.c
#include <stdio.h>

int main(void)
{
```

```
        printf("Hello World!\n");

        return 0;
}
```

c. Then compile and run **hello_world.c**

```
orangepi@orangepi:~$ gcc -o hello_world hello_world.c
orangepi@orangepi:~$ ./hello_world
Hello World!
```

5) Ubuntu jammy is installed with Python3 by default

a. Python3 specific version is shown below

```
orangepi@orangepi:~$ python3
Python 3.10.4 (main, Apr  2 2022, 09:04:19) [GCC 11.2.0] on linux
Type "help", "copyright", "credits" or "license" for more information.
>>>
```

b. The **hello_world.py** program that writes python language

```
orangepi@orangepi:~$ vim hello_world.py
print('Hello World!')
```

c. The results of running **Hello_World.py** are shown below

```
orangepi@orangepi:~$ python3 hello_world.py
Hello World!
```

6) Ubuntu Jammy defaults to compile tools and operating environment without installing Java

a. You can use the following command to install openjdk-18

```
orangepi@orangepi:~$ sudo apt install -y openjdk-18-jdk
```

b. After installation, you can check the version of Java

```
orangepi@orangepi:~$ java --version
openjdk 18-ea 2022-03-22
OpenJDK Runtime Environment (build 18-ea+36-Ubuntu-1)
OpenJDK 64-Bit Server VM (build 18-ea+36-Ubuntu-1, mixed mode, sharing)
```

c. Write the java version **hello_world.java**

```
orangepi@orangepi:~$ vim hello_world.java
public class hello_world
{
```

```
        public static void main(String[] args)
        {
                System.out.println("Hello World!");
        }
}
```

d. Then compile and run **hello_world.java**

```
orangepi@orangepi:~$ javac hello_world.java
orangepi@orangepi:~$ java hello_world
Hello World!
```

3. 27. QT installation method

1) You can install QT5 and QT Creator with the following scripts

```
orangepi@orangepi:~$ install_qt.sh
```

2) After the installation is installed, it will automatically print the QT version number

a. Ubuntu20.04's own QT version is 5.12.8

```
orangepi@orangepi:~$ install_qt.sh
......
QMake version 3.1
Using Qt version 5.12.8 in /usr/lib/aarch64-linux-gnu
```

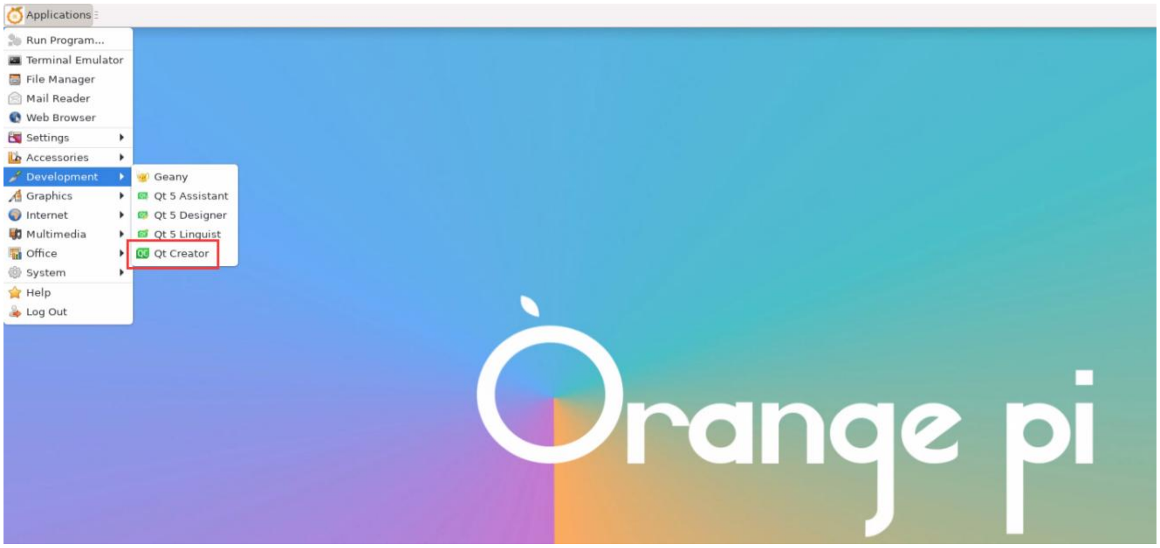
b. Ubuntu22.04's own QT version is **5.15.3**

```
orangepi@orangepi:~$ install_qt.sh
......
QMake version 3.1
Using Qt version 5.15.3 in /usr/lib/aarch64-linux-gnu
```

c. The QT version comes with Debian11 is **5.15.2**

```
orangepi@orangepi:~$ install_qt.sh
......
QMake version 3.1
Using Qt version 5.15.2 in /usr/lib/aarch64-linux-gnu
```

3) Then you can see the lax icon of QT Creator in **Applications**



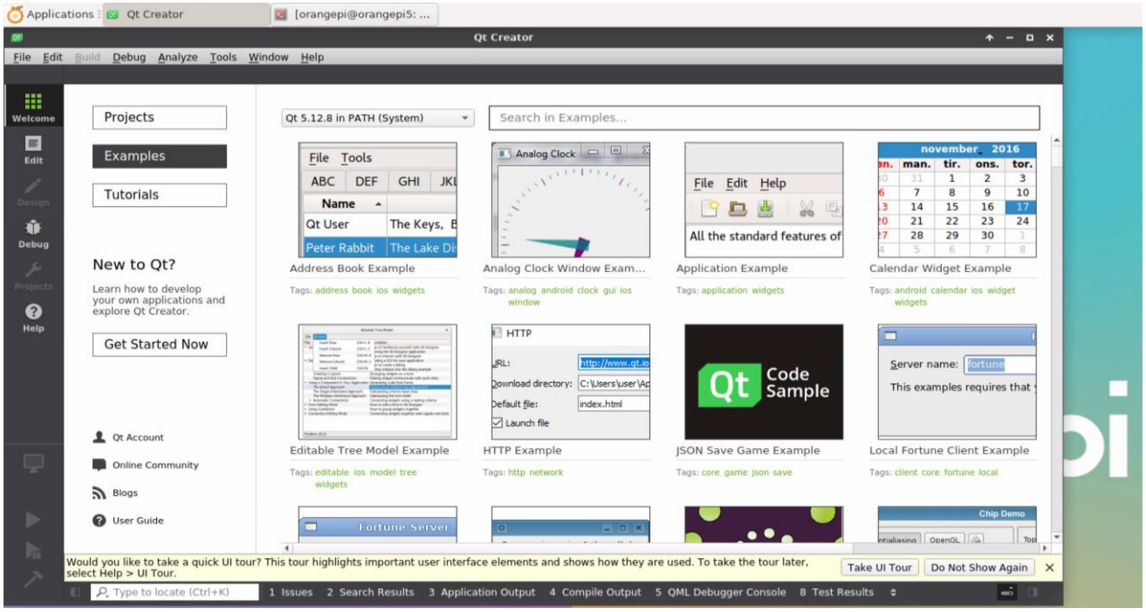
You can also use the following command to open QT Creator

```
orangepi@orangepi:~$ qtcreator
```

During the startup process of QT and QT applications, if the error below is prompted, please ignore it directly. This error will not affect the operation of the application.

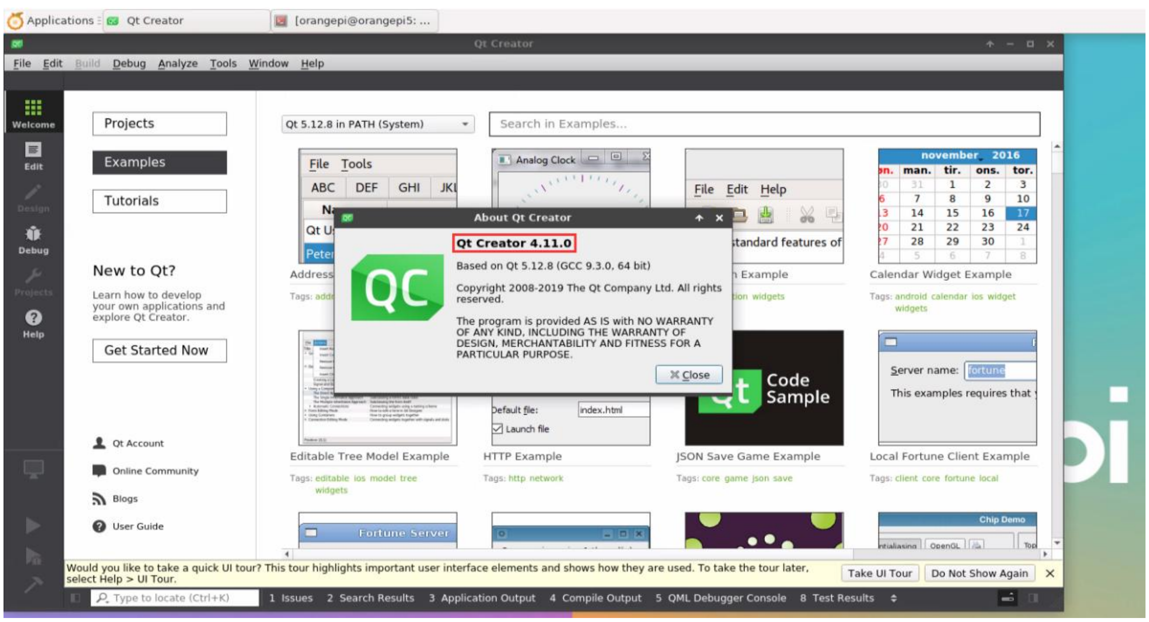
libGL error: failed to create dri screen
libGL error: failed to load driver: rockchip
libGL error: failed to create dri screen
libGL error: failed to load driver: rockchip

4) The interface after the QT Creator is opened is shown below

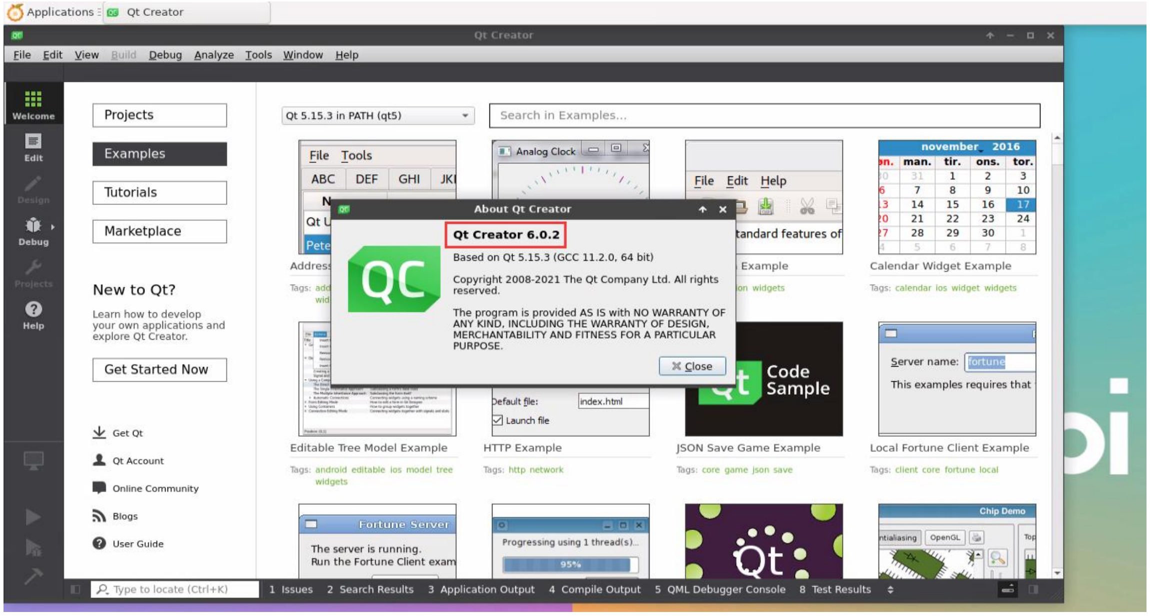


5) The version of QT Creator is shown below

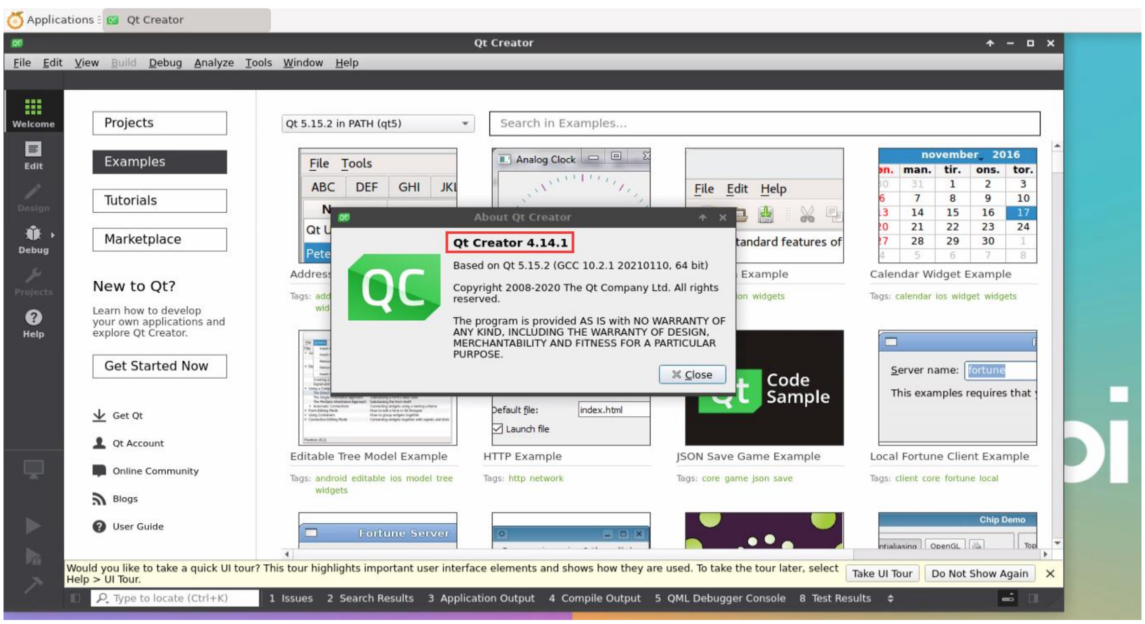
a. The default version of QT Creator in **Ubuntu20.04** is shown below



b. The default version of QT Creator in **Ubuntu22.04** is shown below

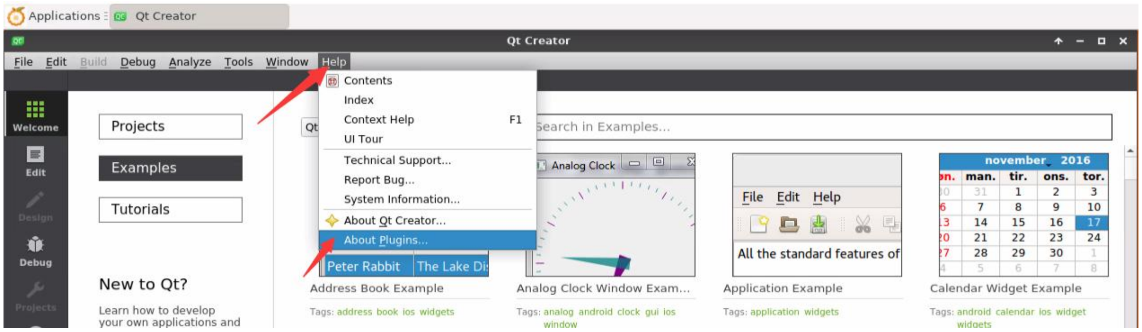


c. The default version of QT Creator in **Debian11** is shown below

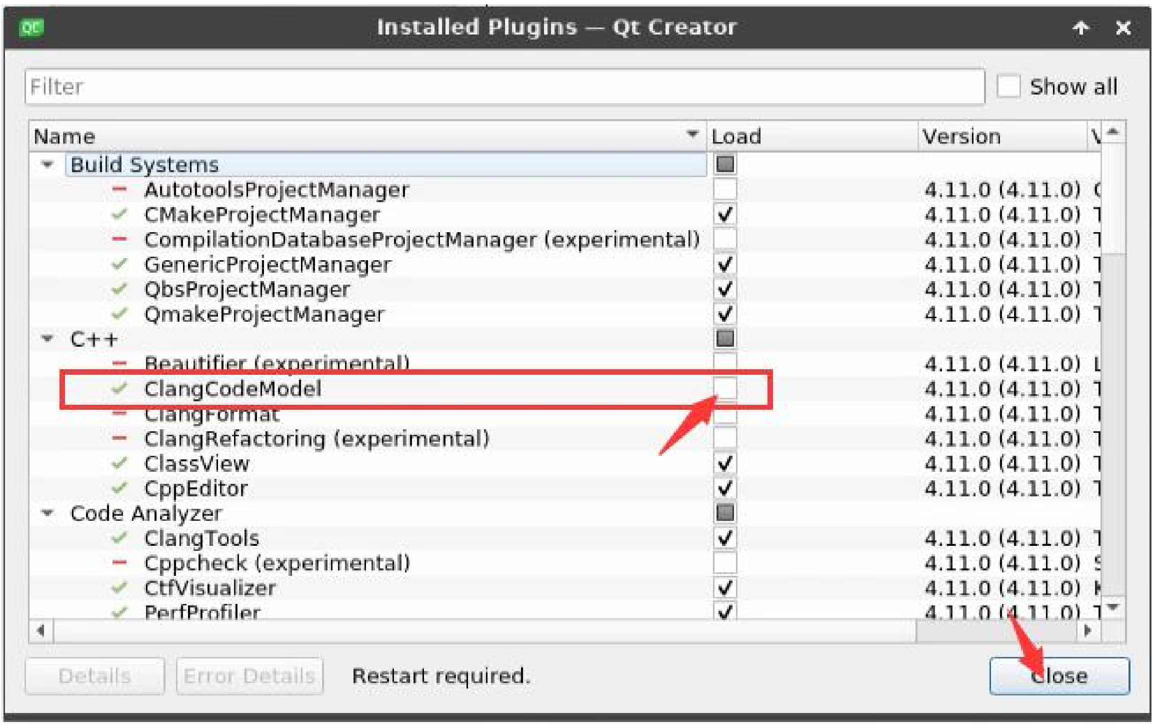


6) Then set it QT

a. First open **Help**->**About Plugins...**

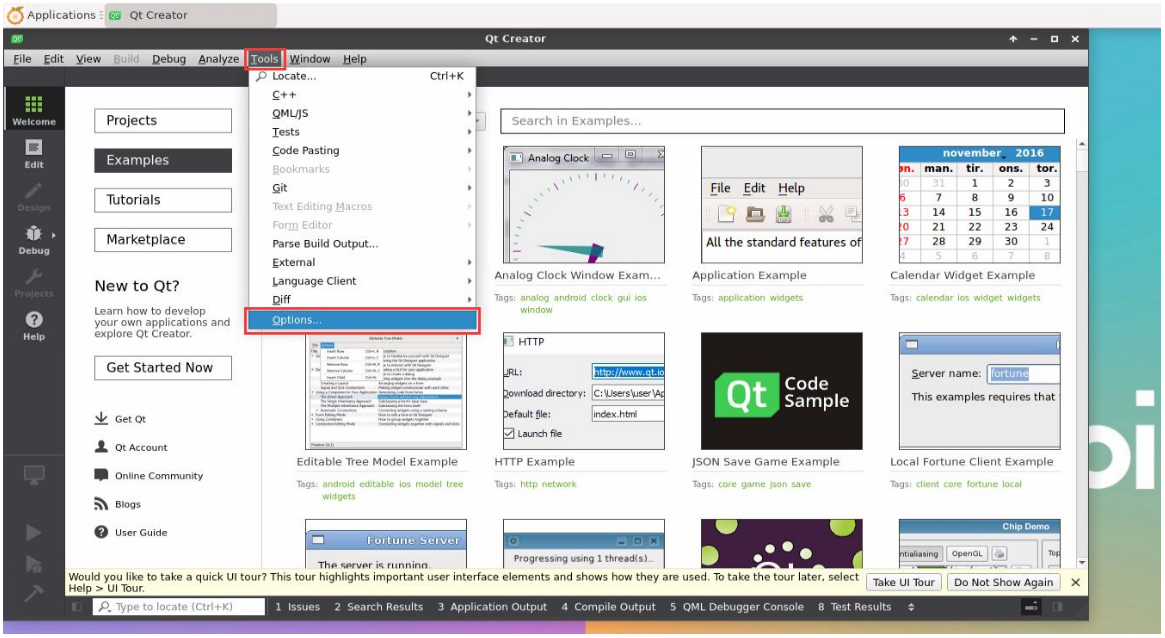


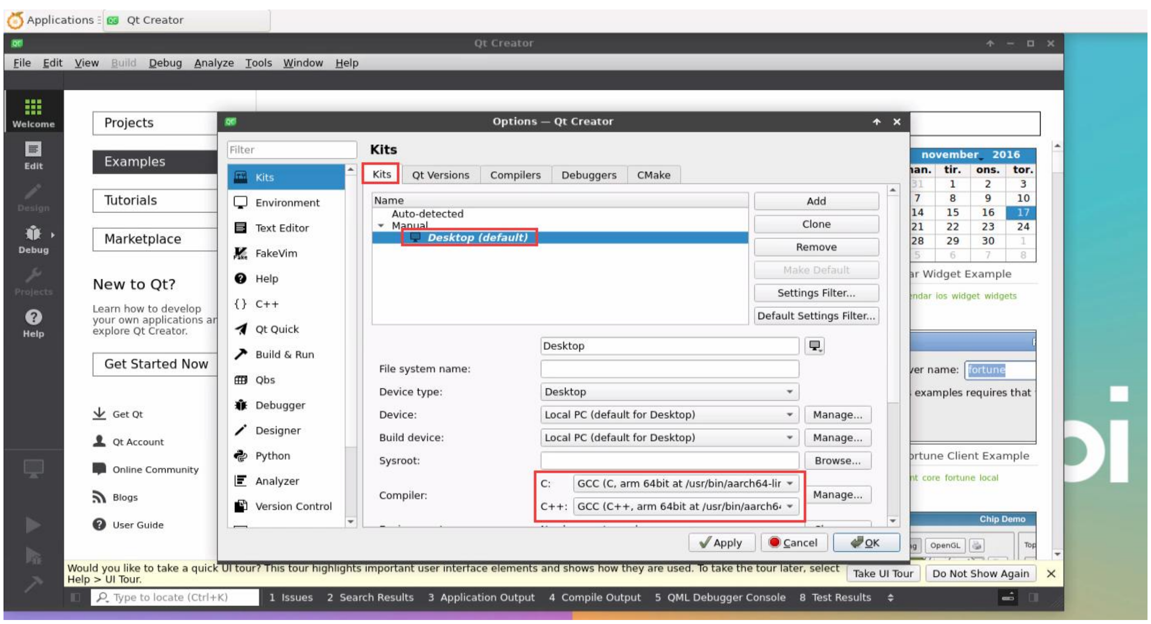
b. Then remove the hook of **ClangCodeModel**



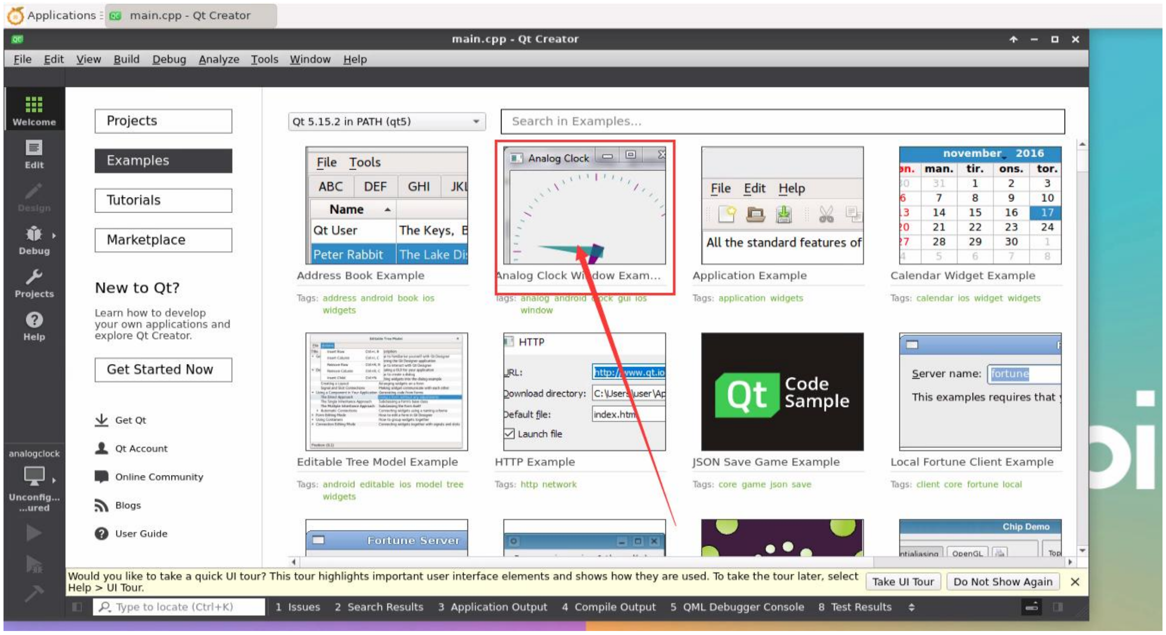
c. **After setting, you need to restart QT Creator**

d. Then make sure that the GCC compiler used by QT Creator, if the default is Clang, please modify it to GCC

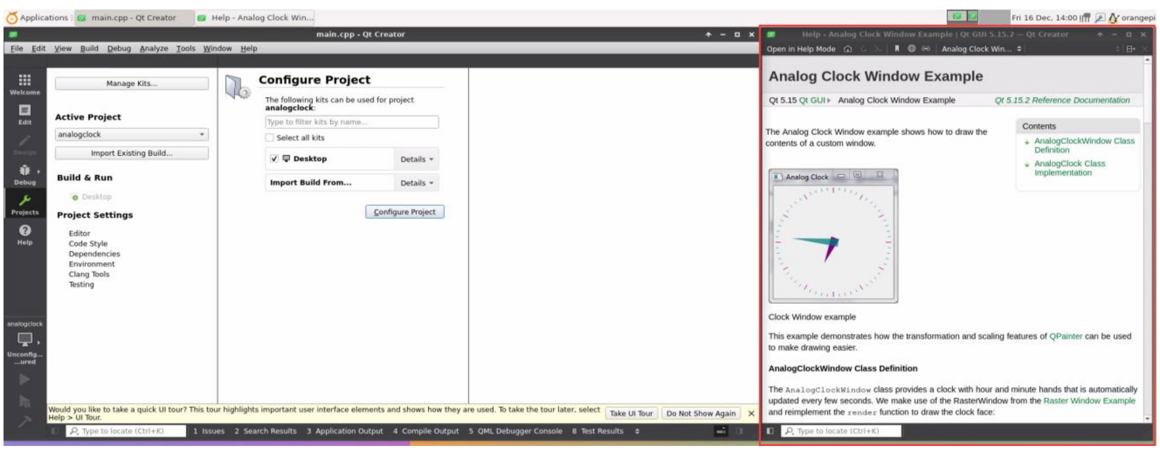




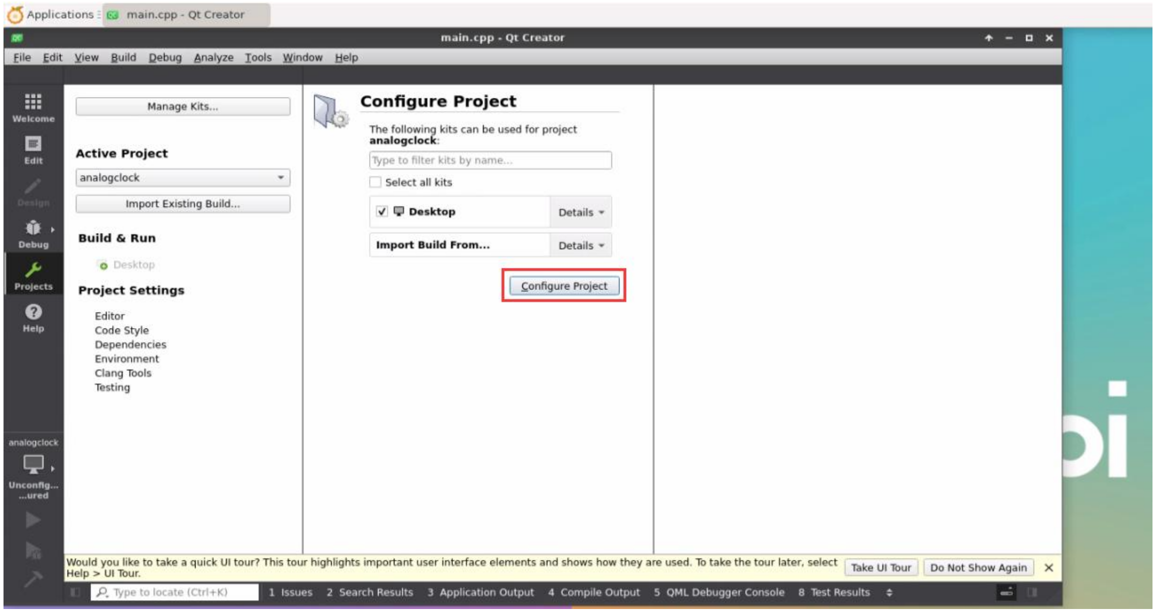
7) Then you can open an example code



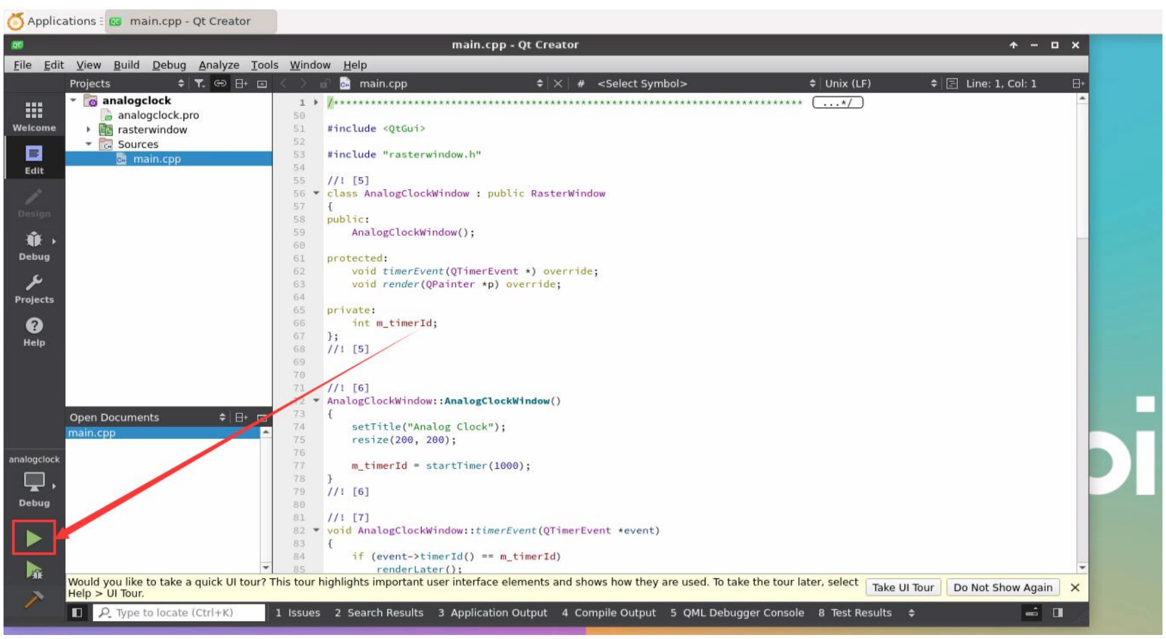
8) After clicking the example code, you will automatically open the corresponding description document. You can carefully look at the instructions for usage



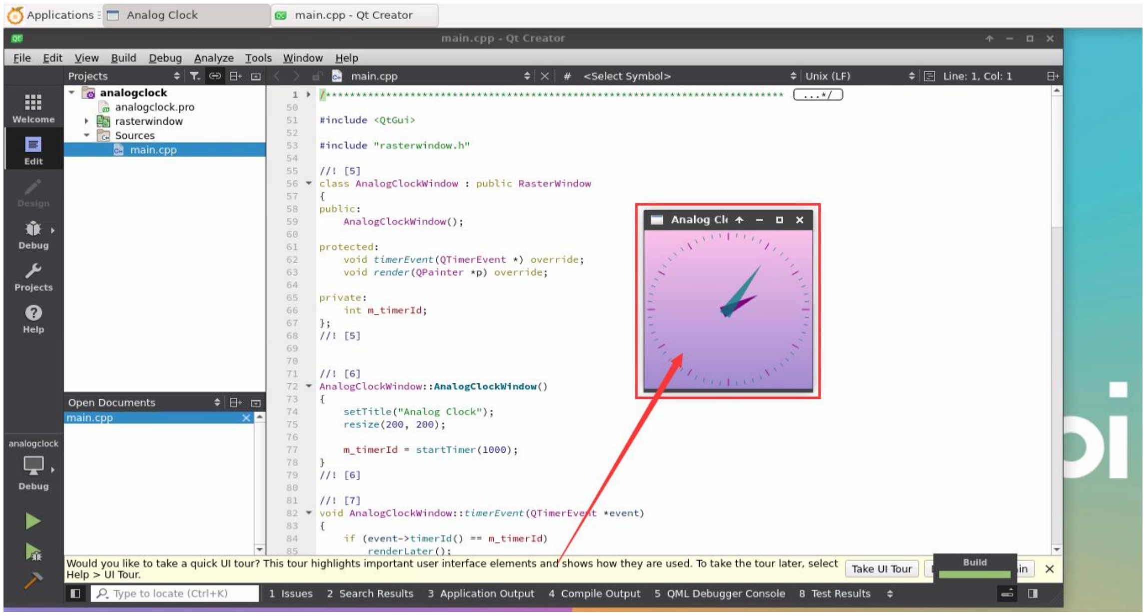
9) Then click down **Configure Project**



10) Then click the sample code under the green triangle compilation and run in the lower left corner



11) After waiting for a while, the interface shown in the figure below will pop up. At this time, it means that QT can compile and run normally



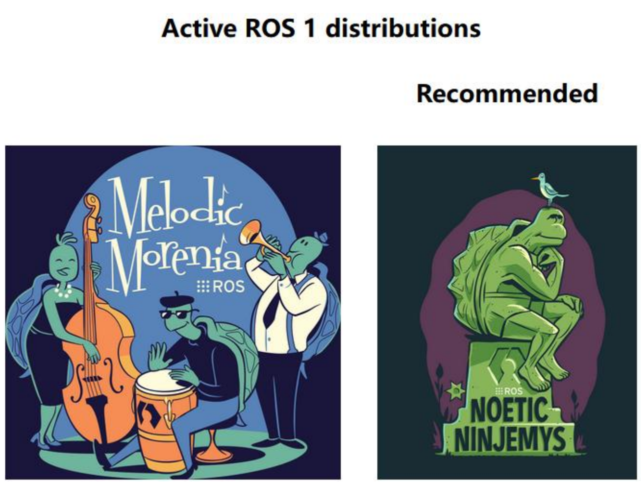
12) Reference materials

https://wiki.qt.io/Install_Qt_5_on_Ubuntu
https://download.qt.io/archive/qtcreator
https://download.qt.io/archive/qt

3. 28. ROS installation method

3. 28. 1. Ubuntu20.04 to install ROS 1 Noetic

1) The current active version of ROS 1 is shown below. The recommended version is **Noetic Ninjemys**



Distro	Release date	Poster	*Tuturtle*, turtle in tutorial	EOL date
ROS Noetic Ninjemys (**Recommended**)	May 23rd, 2020			May, 2025 (Focal EOL)
ROS Melodic Morenia	May 23rd, 2018			May, 2023 (Bionic EOL)

http://docs.ros.org
https://wiki.ros.org/Distributions

2) ROS 1 **Noetic Ninjemys** official installation document links are shown below：

http://wiki.ros.org/noetic/Installation/Ubuntu

3) ROS **Noetic Ninjemys** The official installation document of Ubuntu recommends Ubuntu20.04, so please make sure that the system used in the development board is **Ubuntu20.04 desktop version system**

http://wiki.ros.org/noetic/Installation

4) Then use the following script to install ros1

```
orangepi@orangepi5b:~$ install_ros.sh ros1
```

5) Before using the ROS tool, first of all, you need to initialize rosdep, and then you can quickly install some system dependencies and some core components in ROS when compiling the source code

Note that running the following commands need to ensure that the development board can access GitHub normally, otherwise it will report an error due to network problems。

install_ros.sh script will try to modify/etc/hosts and run the following commands automatically. However, this method cannot guarantee that you can access GitHub normally. If Install_ros.sh has the following errors after the ros1 is installed, please think other methods to allow the linux system of the development board to access GitHub normally.Then manually run the following command。

https://raw.githubusercontent.com/ros/rosdistro/master/rosdep/osx-homebrew.yaml
Hit https://raw.githubusercontent.com/ros/rosdistro/master/rosdep/base.yaml
ERROR: error loading sources list:
The read operation timed out

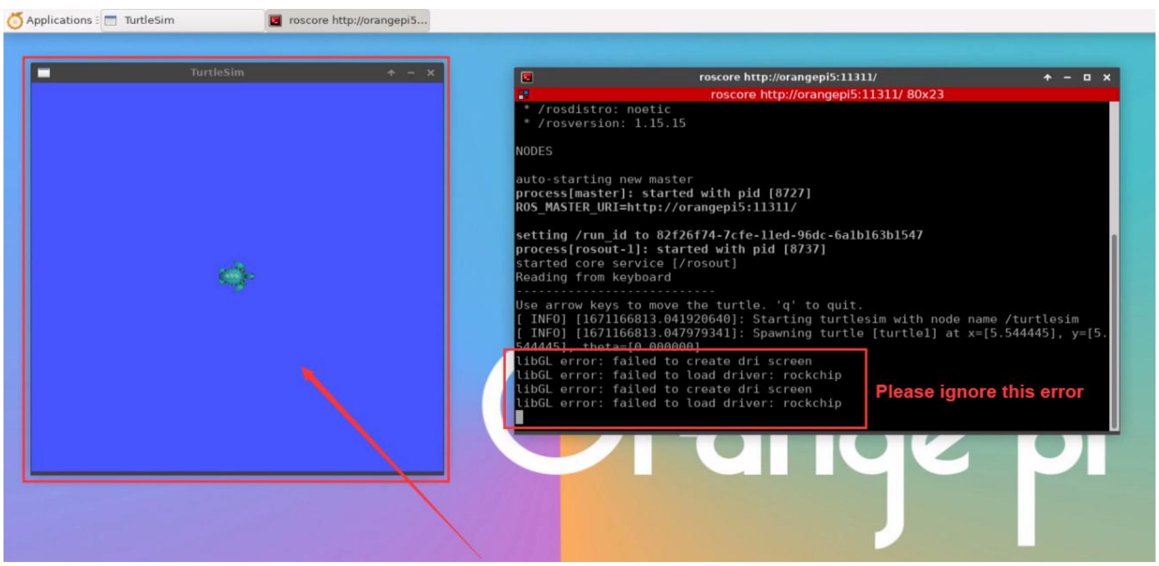
```
orangepi@orangepi:~$ source /opt/ros/noetic/setup.bash
orangepi@orangepi:~$ sudo rosdep init
Wrote /etc/ros/rosdep/sources.list.d/20-default.list
Recommended: please run

        rosdep update
orangepi@orangepi:~$ rosdep update
reading in sources list data from /etc/ros/rosdep/sources.list.d
Hit https://raw.githubusercontent.com/ros/rosdistro/master/rosdep/osx-homebrew.yaml
Hit https://raw.githubusercontent.com/ros/rosdistro/master/rosdep/base.yaml
Hit https://raw.githubusercontent.com/ros/rosdistro/master/rosdep/python.yaml
Hit https://raw.githubusercontent.com/ros/rosdistro/master/rosdep/ruby.yaml
Hit https://raw.githubusercontent.com/ros/rosdistro/master/releases/fuerte.yaml
Query rosdistro index
https://raw.githubusercontent.com/ros/rosdistro/master/index-v4.yaml
Skip end-of-life distro "ardent"
Skip end-of-life distro "bouncy"
Skip end-of-life distro "crystal"
Skip end-of-life distro "dashing"
Skip end-of-life distro "eloquent"
Add distro "foxy"
```

```
Add distro "galactic"
Skip end-of-life distro "groovy"
Add distro "humble"
Skip end-of-life distro "hydro"
Skip end-of-life distro "indigo"
Skip end-of-life distro "jade"
Skip end-of-life distro "kinetic"
Skip end-of-life distro "lunar"
Add distro "melodic"
Add distro "noetic"
Add distro "rolling"
updated cache in /home/orangepi/.ros/rosdep/sources.cache
```

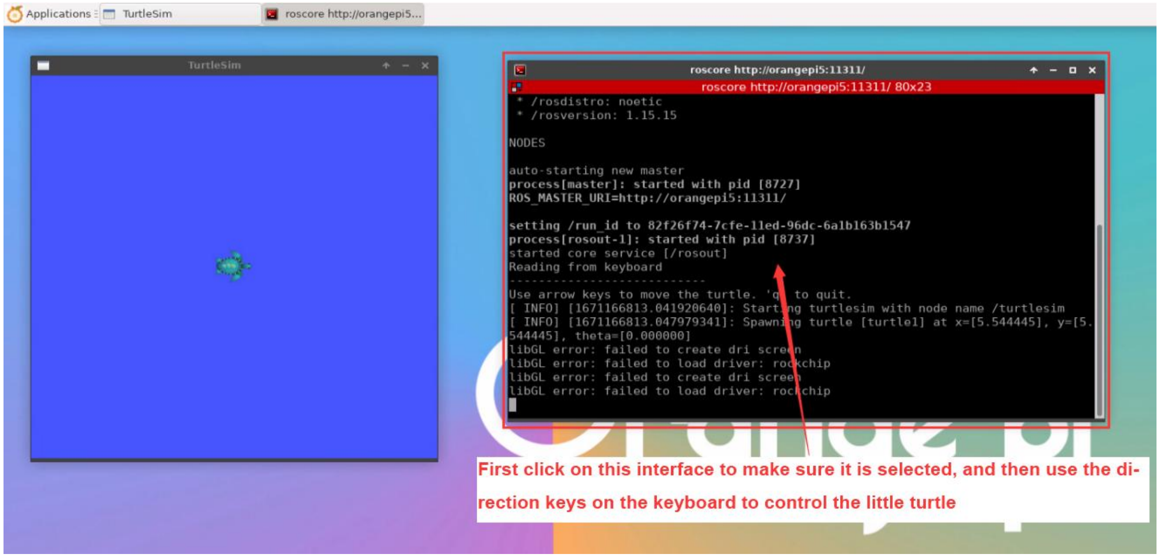
6) Then open a command line **window** on the desktop, and then use the **test_ros.sh** script to start the routine of a small turtle to test whether the ROS can be used normally

```
orangepi@orangepi:~$ test_ros.sh
```

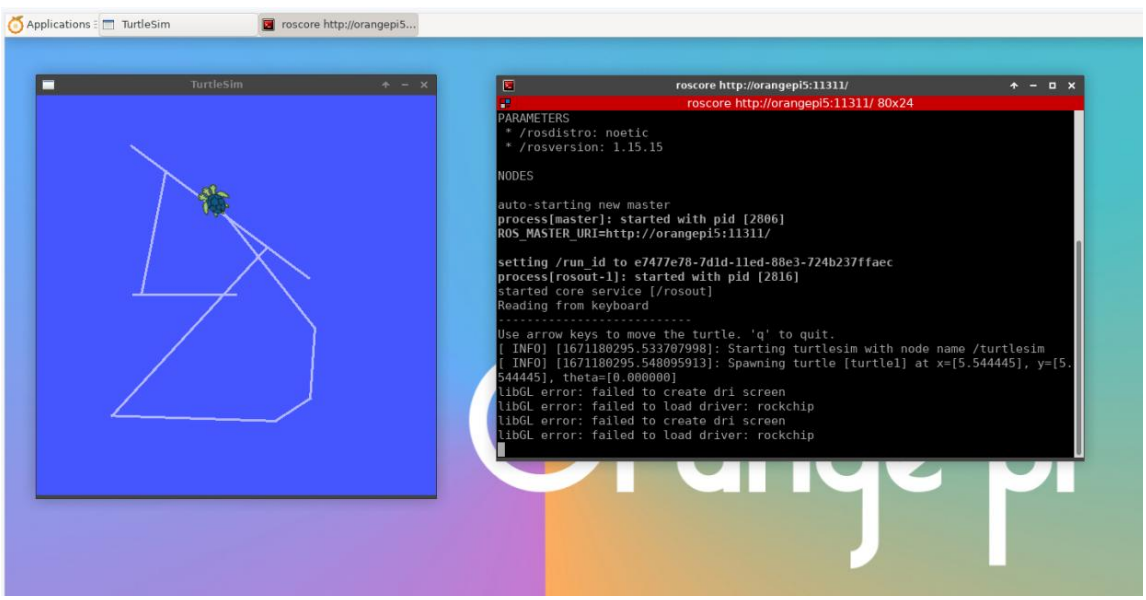
7) After running the **test_ros.sh** script, a small turtle shown in the figure below will pop up



8) Then please keep the terminal window just open at the top



9) At this time, press the direction button on the keyboard to control the small turtles up, down, left and right.



3. 28. 2. Ubuntu20.04 to install ROS 2 Galactic

1) The current active version of ROS 2 is shown below. The recommended version is **Galactic Geochelone**

Active ROS 2 distributions

Recommended **Development**

Distro	Release date	Logo	EOL date
Humble Hawksbill	May 23rd, 2022		May 2027
Galactic Geochelone	May 23rd, 2021		November 2022
Foxy Fitzroy	June 5th, 2020		May 2023

http://docs.ros.org
http://docs.ros.org/en/galactic/Releases.html

2) Ros 2 **Galactic Geochelone**'s official installation document link is shown below:

docs.ros.org/en/galactic/Installation.html
http://docs.ros.org/en/galactic/Installation/Ubuntu-Install-Debians.html

3) ROS 2 **Galactic Geochelone**'s official installation document is recommended to use Ubuntu 20.04, so please make sure that the system used in the development board is **Ubuntu20.04 desktop version system**. There are several ways to install ROS 2. The following demonstrates the Ros 2 **Galactic Geochelone** by Debian Packages

4) You can install Ros2you Can Install Ros2 with **Install_ros.sh** Script

```
orangepi@orangepi:~$ install_ros.sh ros2
```

5) **install_ros.sh** script will automatically run the **ros2 -h** command after ROS2. If you can see the following printing, it means that ROS2 installation is complete.

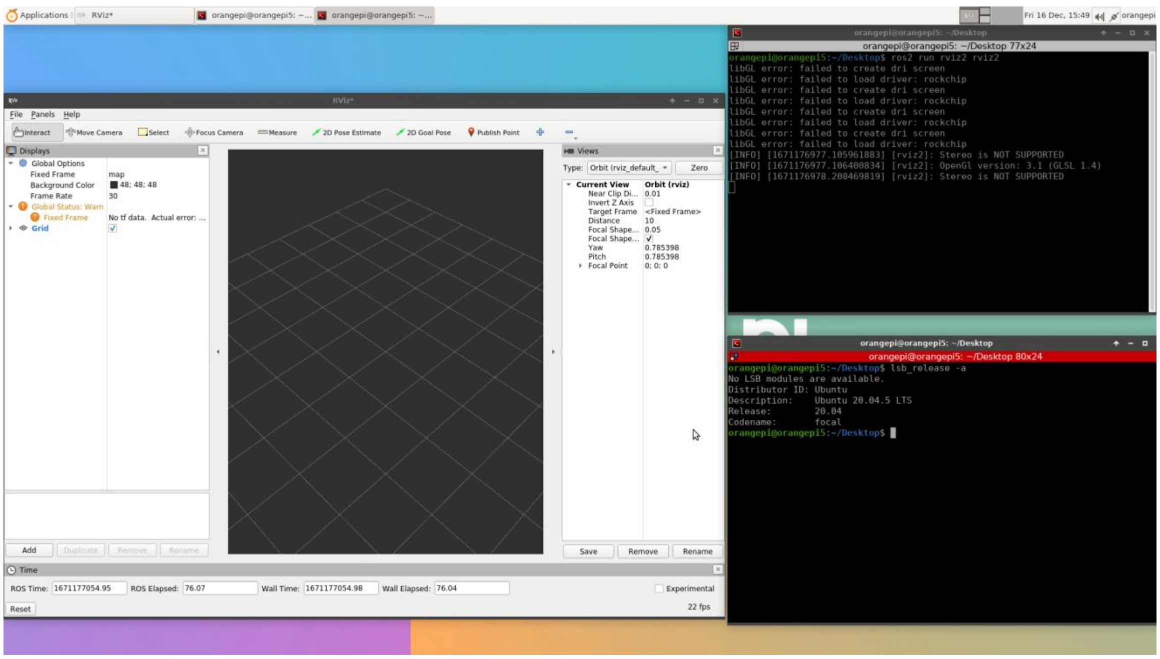
```
usage: ros2 [-h] Call `ros2 <command> -h` for more detailed usage. ...

ros2 is an extensible command-line tool for ROS 2.

optional arguments:
  -h, --help            show this help message and exit

Commands:
  action     Various action related sub-commands
  bag        Various rosbag related sub-commands
  component  Various component related sub-commands
  daemon     Various daemon related sub-commands
  doctor     Check ROS setup and other potential issues
  interface  Show information about ROS interfaces
  launch     Run a launch file
  lifecycle  Various lifecycle related sub-commands
  multicast  Various multicast related sub-commands
  node       Various node related sub-commands
  param      Various param related sub-commands
  pkg        Various package related sub-commands
  run        Run a package specific executable
  security   Various security related sub-commands
  service    Various service related sub-commands
  topic      Various topic related sub-commands
  wtf        Use `wtf` as alias to `doctor`

  Call `ros2 <command> -h` for more detailed usage.
```

6) Then you can use the **test_ros.sh** script to test whether the ROS 2 is successfully installed. If you can see the printing below, it means that ROS 2 can run normally

```
orangepi@orangepi5b:~$ test_ros.sh
[INFO] [1671174101.200091527] [talker]: Publishing: 'Hello World: 1'
[INFO] [1671174101.235661048] [listener]: I heard: [Hello World: 1]
[INFO] [1671174102.199572327] [talker]: Publishing: 'Hello World: 2'
[INFO] [1671174102.204196299] [listener]: I heard: [Hello World: 2]
[INFO] [1671174103.199580322] [talker]: Publishing: 'Hello World: 3'
[INFO] [1671174103.204019965] [listener]: I heard: [Hello World: 3]
```

7) Run the following command to open rviz2

```
orangepi@orangepi:~$ source /opt/ros/galactic/setup.bash
orangepi@orangepi:~$ ros2 run rviz2 rviz2
```



8) How to use ROS, please refer to the document of ROS 2

http://docs.ros.org/en/galactic/Tutorials.html

3. 28. 3. Ubuntu22.04 The method of installing ROS 2 Humble

1) You can install ROS2 with **Install_ros.sh** script

```
orangepi@orangepi:~$ install_ros.sh ros2
```

2) **Install_ros.sh** script will automatically run the **ros2 -h** command after ROS2 is installed. If you can see the following printing, it means that ROS2 installation is complete.

```
usage: ros2 [-h] Call `ros2 <command> -h` for more detailed usage. ...

ros2 is an extensible command-line tool for ROS 2.

optional arguments:
  -h, --help            show this help message and exit

Commands:
  action      Various action related sub-commands
  bag         Various rosbag related sub-commands
  component   Various component related sub-commands
  daemon      Various daemon related sub-commands
  doctor      Check ROS setup and other potential issues
  interface   Show information about ROS interfaces
  launch      Run a launch file
  lifecycle   Various lifecycle related sub-commands
  multicast   Various multicast related sub-commands
  node        Various node related sub-commands
  param       Various param related sub-commands
  pkg         Various package related sub-commands
  run         Run a package specific executable
  security    Various security related sub-commands
  service     Various service related sub-commands
  topic       Various topic related sub-commands
  wtf         Use `wtf` as alias to `doctor`

  Call `ros2 <command> -h` for more detailed usage.
```

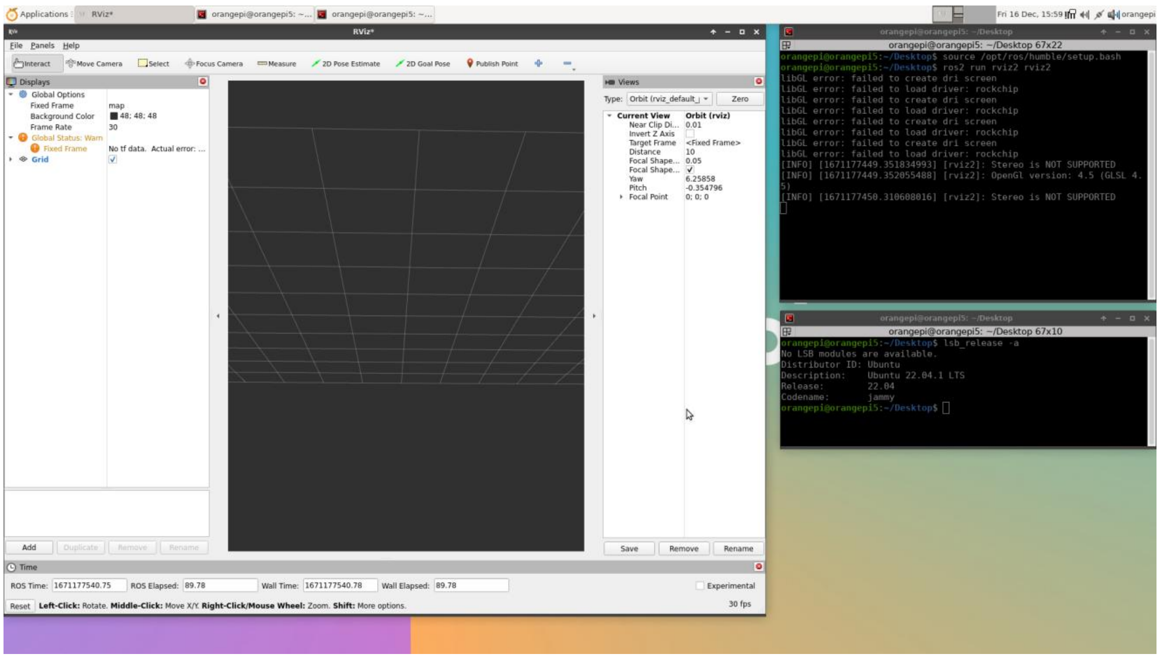
3) Then you can use the **test_ros.sh** script to test whether the ROS 2 is successfully installed. If you can see the printing below, it means that ROS 2 can run normally

```
orangepi@orangepi5b:~$ test_ros.sh
[INFO] [1671174101.200091527] [talker]: Publishing: 'Hello World: 1'
[INFO] [1671174101.235661048] [listener]: I heard: [Hello World: 1]
[INFO] [1671174102.199572327] [talker]: Publishing: 'Hello World: 2'
[INFO] [1671174102.204196299] [listener]: I heard: [Hello World: 2]
[INFO] [1671174103.199580322] [talker]: Publishing: 'Hello World: 3'
```

```
[INFO] [1671174103.204019965] [listener]: I heard: [Hello World: 3]
```

4) Run the following command to open rviz2

```
orangepi@orangepi:~$ source /opt/ros/humble/setup.bash
orangepi@orangepi:~$ ros2 run rviz2 rviz2
```



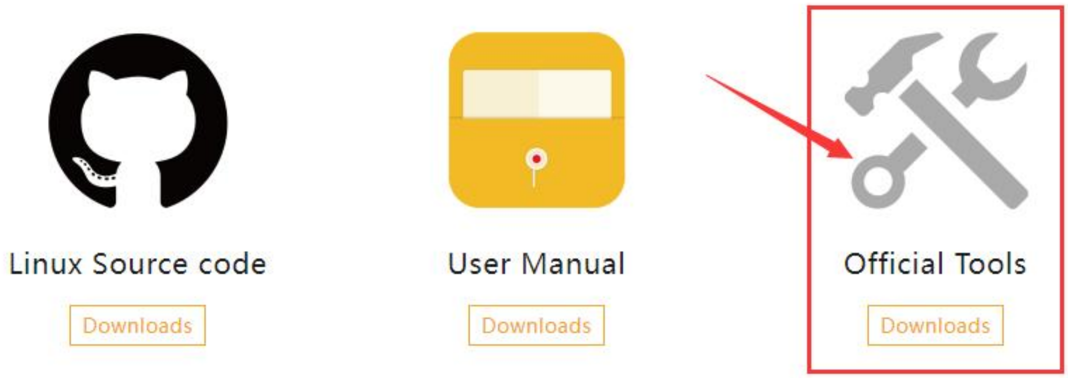
5) Reference document

http://docs.ros.org/en/humble/index.html
http://docs.ros.org/en/humble/Installation/Ubuntu-Install-Debians.html

3. 29. How to install the kernel header file

1) There are two ways to obtain the kernel header file:

a. Method 1: Download from the **official tools** of the development board data download page。



b. Method 2: Compile the kernel source code using Orangepi-Build to automatically generate the DEB package of the kernel header file. For specific methods, please refer to the instructions of the **4.4. Chapter Compiled Linux kernel**。

2) Then upload the kernel header file deb to the **Linux system of the development board**. The upload method can refer to the explanation of the method of the upload file to the method of the development board Linux system.

3) Then use the following command to install the kernel header file deb package

The name of the kernel file deb package needs to be replaced with the actual name, please do not copy it.

```
orangepi@orangepi:~$ sudo dpkg -i linux-headers-legacy-rockchip-rk3588_1.x.x_arm64.deb
```

4) After installation, you can see the folder where the kernel header file is located under the**/usr/src**

```
orangepi@orangepi:~$ ls /usr/src
linux-headers-5.10.110-rockchip-rk3588
```

5) Then you can write a hello kernel module test under the kernel header file

a. First write the code of the hello kernel module, as shown below：

```
orangepi@orangepi:~$ vim hello.c
#include <linux/init.h>
#include <linux/module.h>

static int hello_init(void)
```

```
{
        printk("Hello Orange Pi -- init\n");

        return 0;
}
static void hello_exit(void)
{
        printk("Hello Orange Pi -- exit\n");

        return;
}

module_init(hello_init);
module_exit(hello_exit);

MODULE_LICENSE("GPL");
```

b. Then write the Makefile file that compiles the Hello kernel module, as shown below：

```
orangepi@orangepi:~$ vim Makefile
ifneq ($(KERNELRELEASE),)
obj-m:=hello.o
else
KDIR :=/lib/modules/$(shell uname -r)/build
PWD   :=$(shell pwd)
all:
	make -C $(KDIR) M=$(PWD) modules
clean:
	rm -f *.ko *.o *.mod.o *.mod *.symvers *.cmd   *.mod.c *.order
endif
```

c. Then use the make command to compile the Hello kernel module, and the output of the compilation process is shown below：

If you compile the code you copy here, if you have any problems, go to the official tool to download the source code test。


```
orangepi@orangepi:~$ make
make -C /lib/modules/5.10.110-rockchip-rk3588/build M=/home/orangepi modules
make[1]: Entering directory '/usr/src/linux-headers-5.10.110-rockchip-rk3588'
  CC [M]  /home/orangepi/hello.o
  MODPOST /home/orangepi/Module.symvers
  CC [M]  /home/orangepi/hello.mod.o
  LD [M]  /home/orangepi/hello.ko
make[1]: Leaving directory '/usr/src/linux-headers-5.10.110-rockchip-rk3588'
```

d. After compiling, the **Hello.ko** kernel module will be generated

```
orangepi@orangepi:~$ ls *.ko
hello.ko
```

e. Use the **Insmod** command to insert the **hello.ko** kernel module into the kernel

```
orangepi@orangepi:~$ sudo insmod hello.ko
```

f. Then use the **demsg** command to view the output of the **Hello.ko** kernel module. If you can see the output instructions below

```
orangepi@orangepi:~$ dmesg | grep "Hello"
[ 2871.893988] Hello Orange Pi -- init
```

g. Use the **rmmod** command to uninstall the **hello.ko** kernel module

```
orangepi@orangepi:~$ sudo rmmod hello
orangepi@orangepi:~$ dmesg | grep "Hello"
[ 2871.893988] Hello Orange Pi -- init
[ 3173.800892] Hello Orange Pi -- exit
```

3. 30. How to use 10.1 inch MIPI LCD screen

3. 30. 1. 10.1 -inch MIPI screen assembly method

1) First prepare the required accessories

a. 10.1 -inch MIPI LCD display+touch screen

b. Screen divert plate+31pin to 40pin line

c. 30pin mipi line

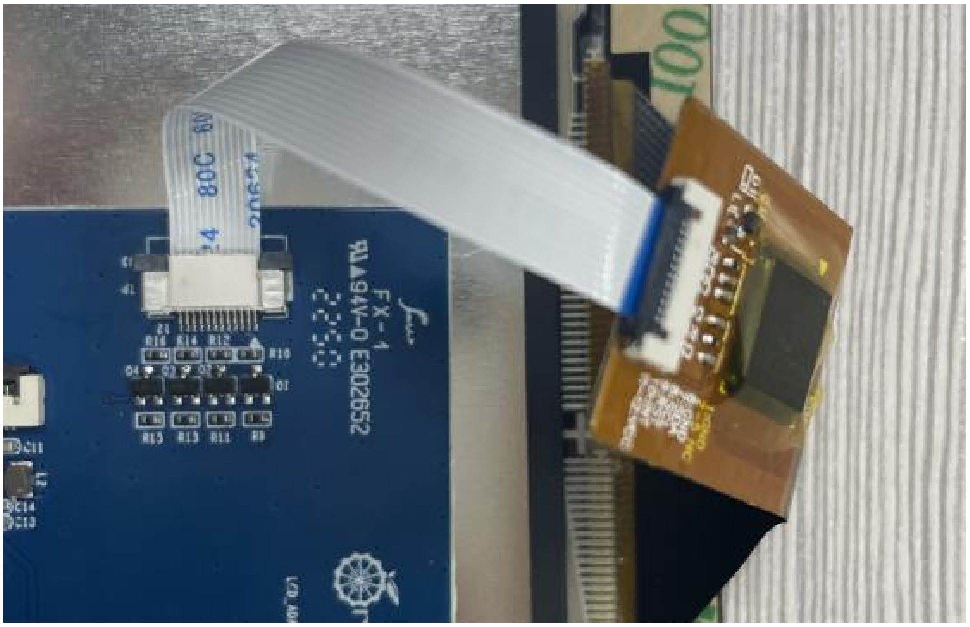
d. 12pin touch screen row line

2) According to the figure below, the 12PIN touch screen row, 31PIN to 40PIN ducts, and 30pin MIPI cables get on the screen dial board. **Pay attention to the blue insulation face of the touch screen line line**. If you get a mistake, it will cause no display or unable to touch the problem

3) Place the connected rotor connected to the row line on the MIPI LCD screen, and connect the MIPI LCD screen and the rotary board through 31PIN to 40Pin row

4) Then connect the touch screen and the rotor board through the 12PIN touch screen

line, pay attention to the orientation of the insulating surface.



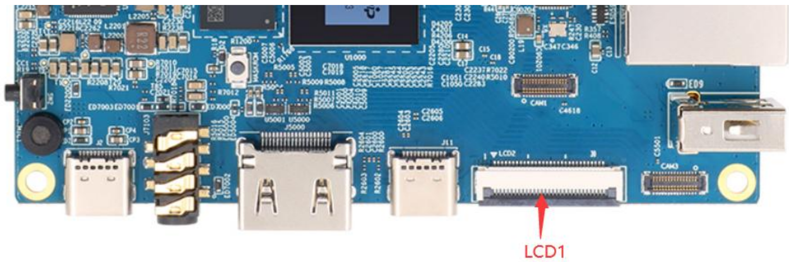
5) Finally connect to the LCD interface of the development board through the 30pin MIPI duct.

3. 30. 2. Open 10.1 -inch MIPI LCD screen configuration method

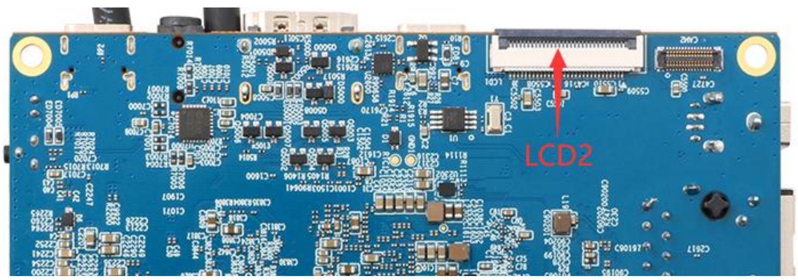
1) The Linux image defaults to the configuration of the MIPI LCD screen by default. If you need to use the MIPI LCD screen, you need to open it manually。

2) There are two interfaces of the MIPI LCD screen on the development board. We define.：

a. The location of the lcd1 interface is：



b. The position of the lcd2 interface is:

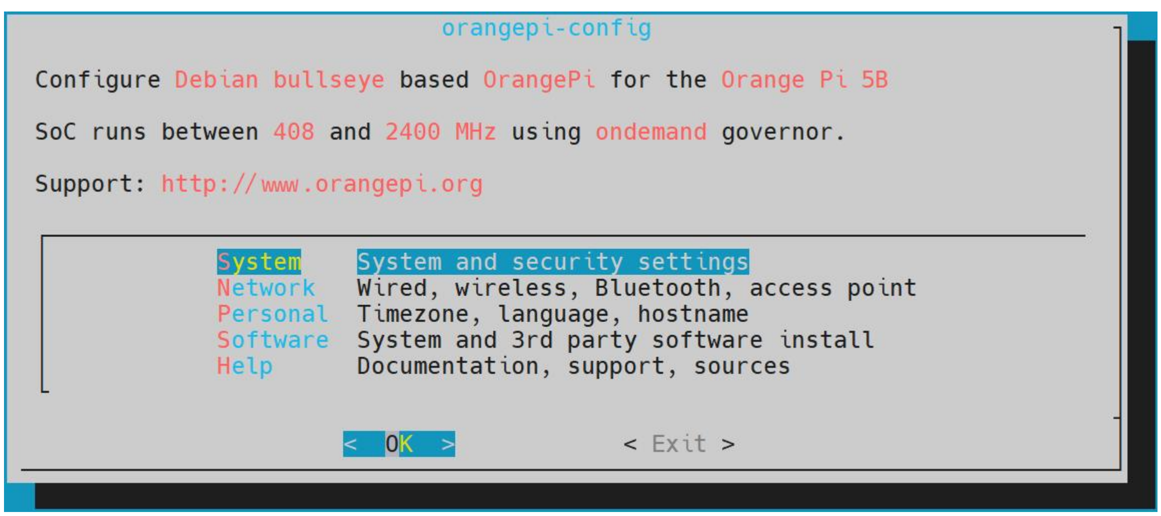


3) The steps of opening the MIPI LCD configuration are shown below:

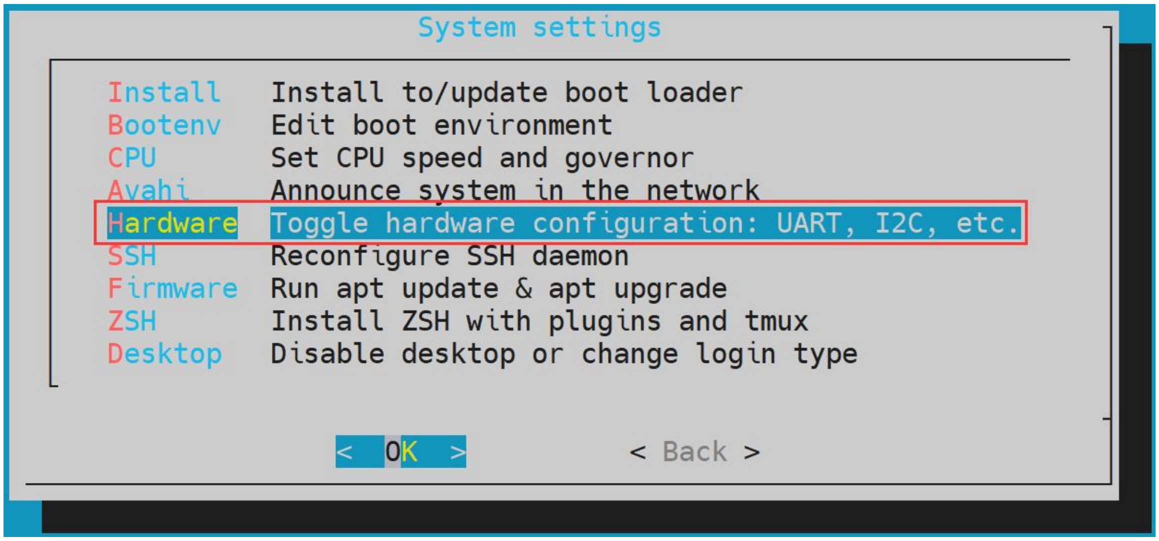
a. First run the **orangepi-config**. Ordinary users remember to add **sudo** permissions

```
orangepi@orangepi:~$ sudo orangepi-config
```

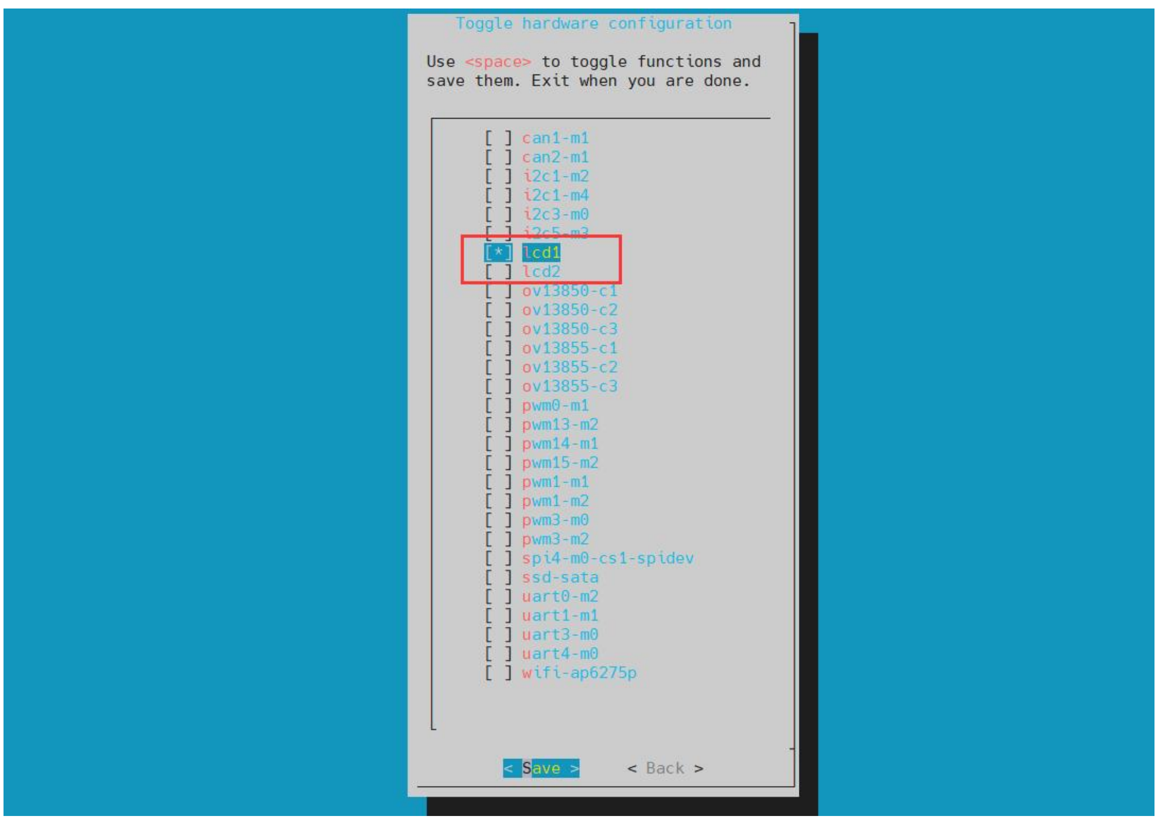
b. Then choose **System**



c. Then choose **Hardware**

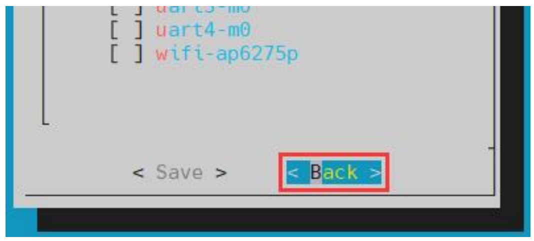


d. Then use the arrow keys of the keyboard to lcd1 or lcd2 (which one you want to use, and two screens can be opened at the same time), and then use the **space** to select

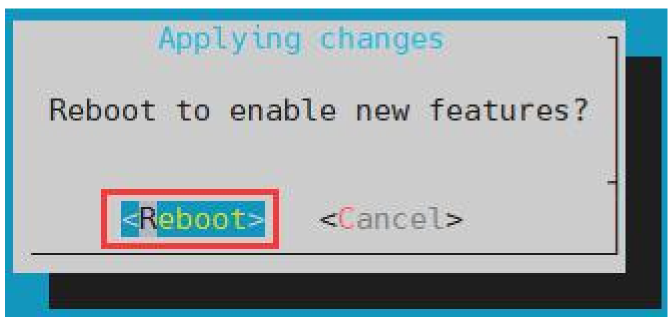


e. Then select <**Save**> Save

f. Then select **<back>**



g. Then select the **<ReBoot>** restart system to make the configuration take effect



The above settings will eventually add overlays=lcd1 or overlays=lcd2 or overlays=lcd1 lcd2 in /boot/orangepiEnv.txt. You can check it first after setting. If this configuration does not exist, then there is a problem with settings.

If you think it is more troublesome to use orangepi-config, you can also use VIM editors to open /boot/orangepiEnv.txt, and then add overlays = lcd1 or overlays = lcd2 or overlays = lcd1 lcd2.

orangepi@orangepi:~$ **cat /boot/orangepiEnv.txt | grep "lcd"**

overlays=lcd1 #Sample configuration

4) After starting, you can see the display of the lcd screen as shown below (the default vertical screen):

3. 30. 3. The server version of the image rotation display direction method

1) Add **Extraargs = fbcon = rotate: The direction to rotate** into **/boot/orangepiEnv.txt.** This configuration can set the direction of the LINUX system of the server version, where the numerals behind **fbcon=rotate** can be set to：

a. 0: Normal screen (default vertical screen)

b. 1: Turn 90 degrees clock

c. 2: Flip 180 degrees

d. 3: Turn to 270 degrees clock

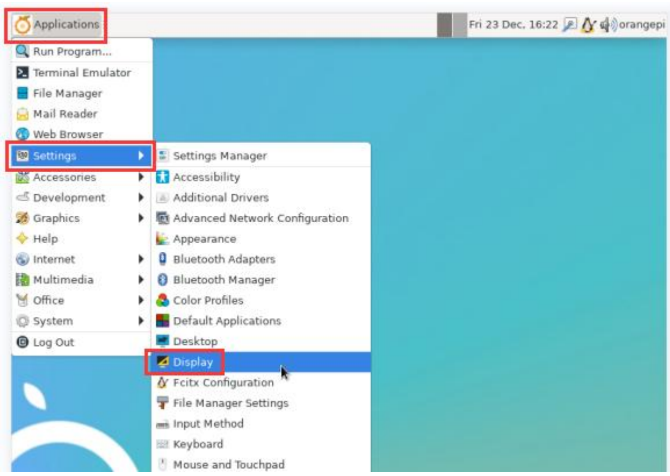
```
orangepi@orangepi:~$ sudo vim /boot/orangepiEnv.txt
overlays=lcd1
extraargs=cma=64M fbcon=rotate:3
```

Note that if/boot/orangepienv.txt is configured in the default default exiArgs = CMA = 64M, FBCon = Rotate: 3 This configuration can be added to extraargs = cma = 64m (need to be separated with spaces).

2) Then **restart** the Linux system to see that the direction of the lcd screen display has been rotated

3. 30. 4. The desktop image rotation display and touch direction method

1) First open **Display** settings in the Linux system



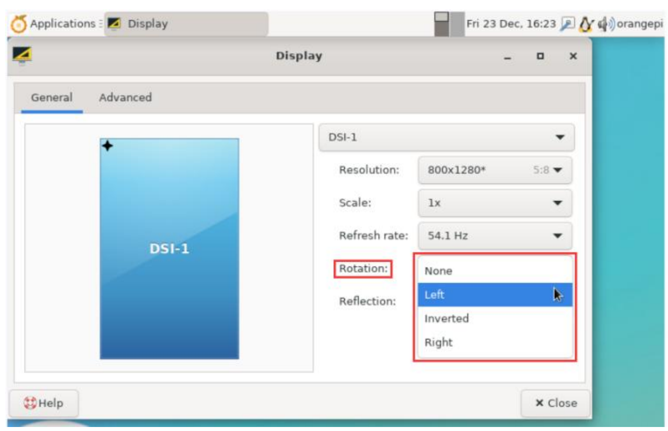
2) Then select the direction you want to rotate in the **Rotation**

a. **None**: Not rotate

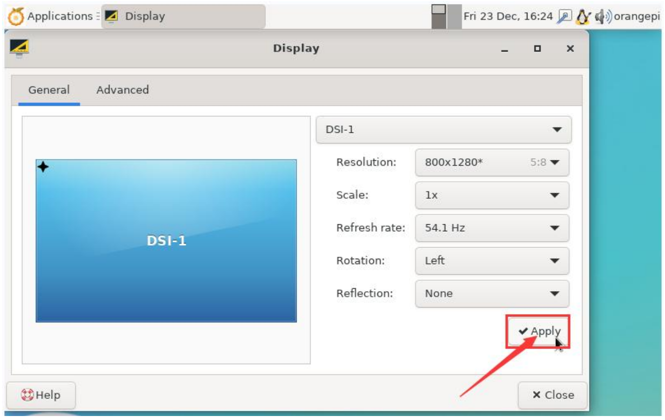
b. **Left**: Rotate 90 degrees to the left

c. **Inverted**: Flipting up and down, equivalent to rotating 180 degrees

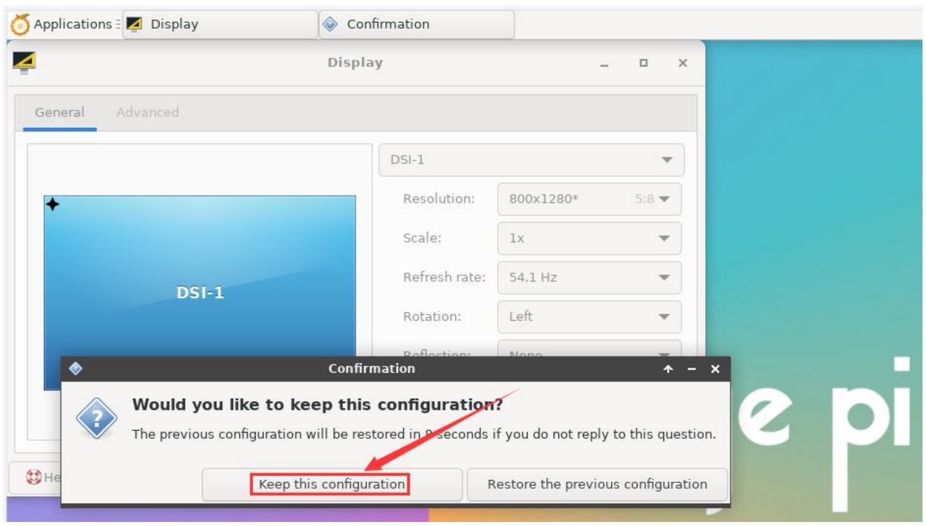
d. **Right**: Rotate 90 degrees to the right



3) Then click **Apply**



4) Then choose **Keep this configuration**



5) At this time, the screen display has been rotated, and then the **Display** program is turned off

6) The above steps will only select the display direction, and it will not rotate the direction of touch. Use **set_lcd_rotate.sh** script to rotate the direction of touch. After this script is set, it will be automatically restarted. Then you can test whether the touch can be used normally.

a. **None**: Not rotate

```
orangepi@orangepi:~$ set_lcd_rotate.sh none
```

b. **Left**: Rotate 90 degrees to the left

```
orangepi@orangepi:~$ set_lcd_rotate.sh left
```

c. **Inverted**: Flipting up and down, equivalent to rotating 180 degrees

```
orangepi@orangepi:~$ set_lcd_rotate.sh inverted
```

d. **Right**: Rotate 90 degrees to the right

```
orangepi@orangepi:~$ set_lcd_rotate.sh right
```

set_lcd_rotate.sh The script mainly does four things:

1. **Rotate the direction displayed by Framebuffer**
2. **The direction of rotating touch**
3. **Turn off logo**
4. **Restart the system**

The direction of the rotating touch is achieved by adding Option "TransformFormationMatrix" "x x x x x x x x x" in /usr/share/X11/xorg.conf.d/40-libinput.conf,Among them, "x x x x x x x x x" is different in different directions.

7) References document for touch rotation

```
https://wiki.ubuntu.com/X/InputCoordinateTransformation
```

3. 31. Instructions for opening the logo use

1) The default logo is displayed by default in the desktop version

2) Set the **bootlogo** variable to **false** in **/boot/orangepiEnv.txt** to turn off the switch to the logo.

```
orangepi@orangepi:~$ vim /boot/orangepiEnv.txt
verbosity=1
bootlogo=false
```

3) Set up **bootlogo** variable in **/boot/orangepiEnv.txt** to **turn** the switch to the turn -off logo

```
orangepi@orangepi:~$ vim /boot/orangepiEnv.txt
verbosity=1
bootlogo=true
```

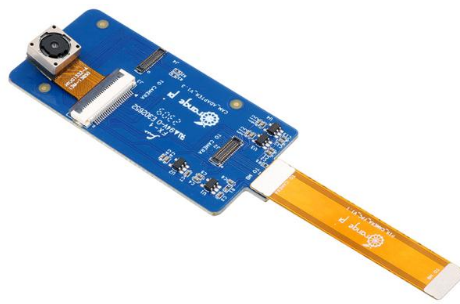
4) The location of the logo picture in the Linux system is

/usr/share/plymouth/themes/orangepi/watermark.png

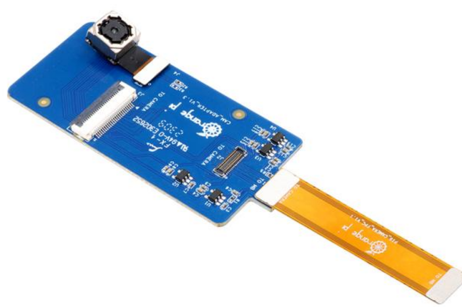
3. 32. OV13850 and OV13855 MIPI test methods for testing

At present, the development board supports two MIPI cameras, OV13850 and OV13855, and the specific pictures are shown below：

a. OV13850 camera at 13MP MIPI interface



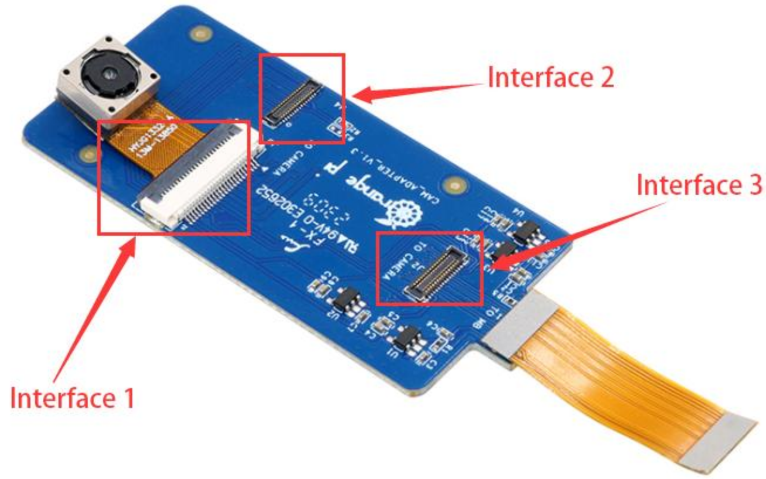
b. OV13855 camera at 13MP MIPI interface



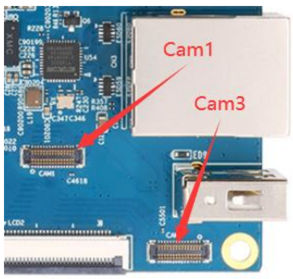
The rotary board used by OV13850 and OV13855 cameras is the same as the FPC cable, but the two cameras are different from the position on the rotary board. The FPC exhaust line is shown in the following figure. Please note that the FPC line is directed. The end marked **TO MB** that it needs to be inserted into the camera interface of the development board. The end marked **TO CAMERA** needs to be inserted on the camera to the board.

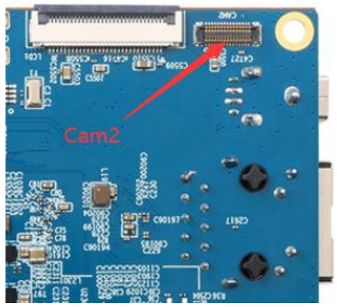
There are a total of 3 cameras on the camera to connect to the board, which can only be used at the same time, as shown in the figure below， about：

a. **1 interface OV13850 camera**
b. **2 interface OV13855 camera**
c. 3 interface is not used, just ignore it

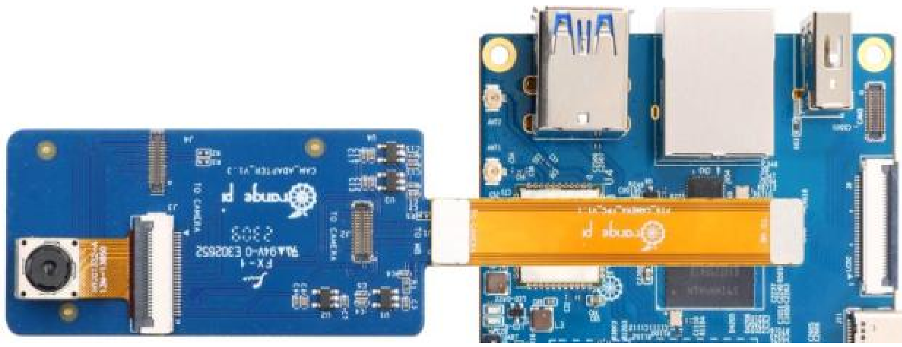


Orange Pi 5B development board has a total of 3 camera interfaces. We define the positions of CAM1, CAM2, and CAM3 as shown in the figure below：





The method of the Cam1 interface inserted in the camera is shown below：



The method of the Cam2 interface inserted in the camera is shown below:

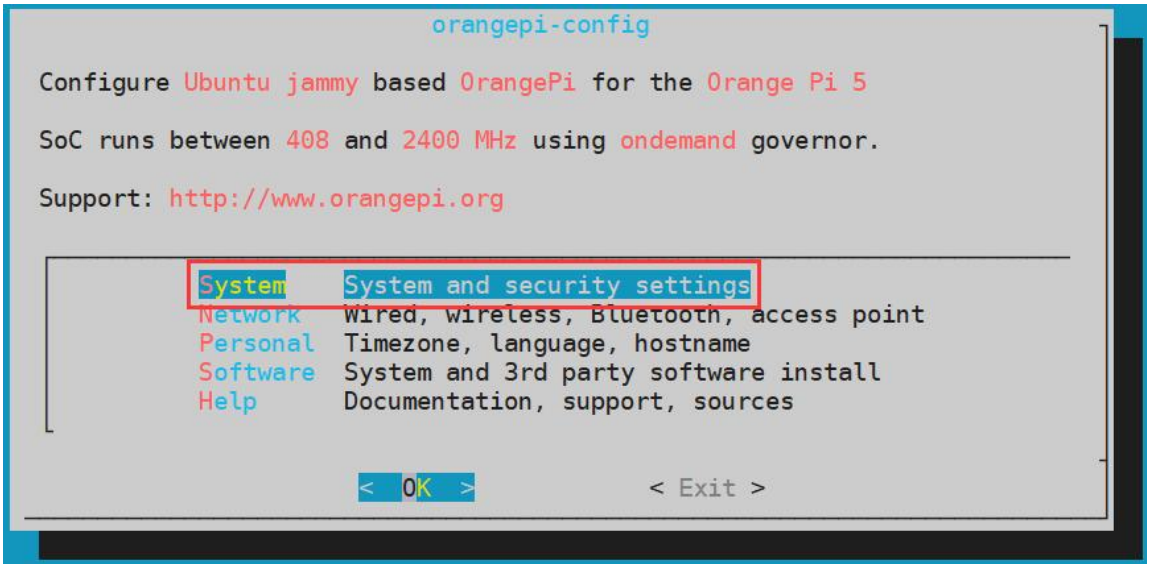
The method of the Cam3 interface inserted in the camera is shown below:

After connecting the camera to the development board, we can use the following method to test the next camera:

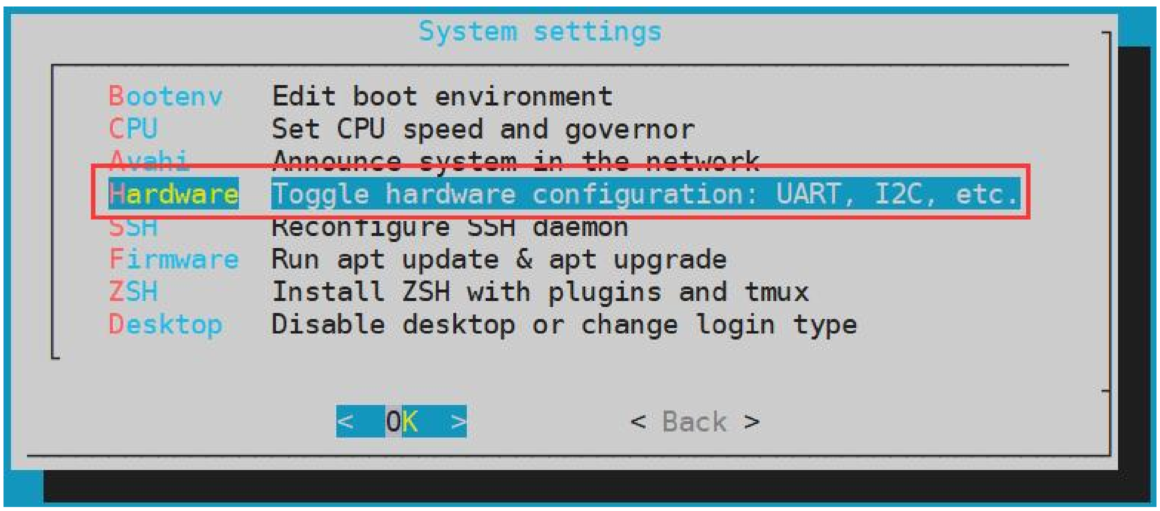
a. First run the **orangepi-config**. Ordinary users remember to add **sudo** permissions

```
orangepi@orangepi:~$ sudo orangepi-config
```

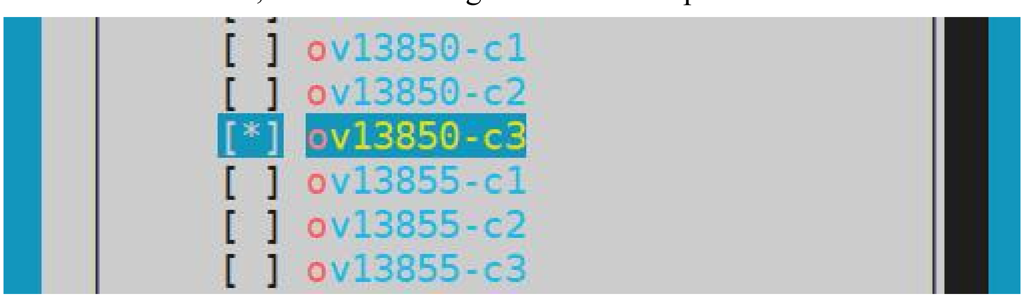
b. Then choose **System**



c. Then choose **Hardware**

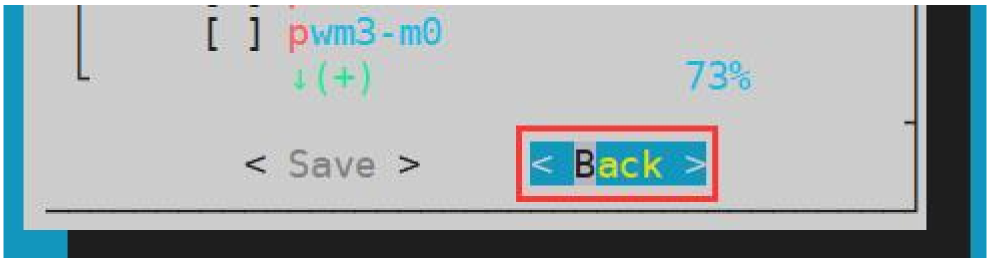


d. Then use the direction key of the keyboard to position the position shown in the figure below, and then use the **space** to select the camera you want to open. Among them, **ov13850-c1** indicates that the **ov13855-c2** camera is used in the CAM1 interface of the development board. Use an OV13855 camera in the CAM2 interface, and other configurations can be pushed。

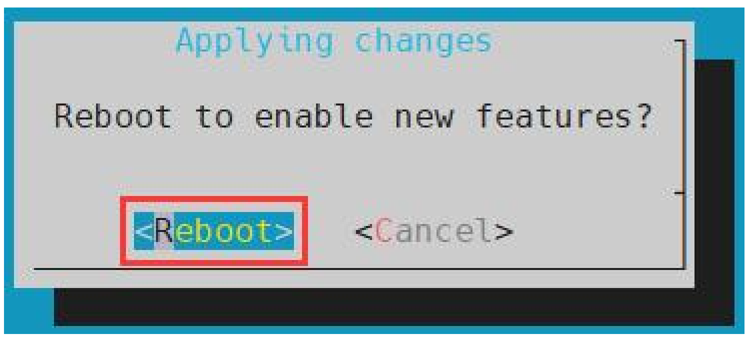


e. Then select **<Save>** Save

f. Then select **<Back>**



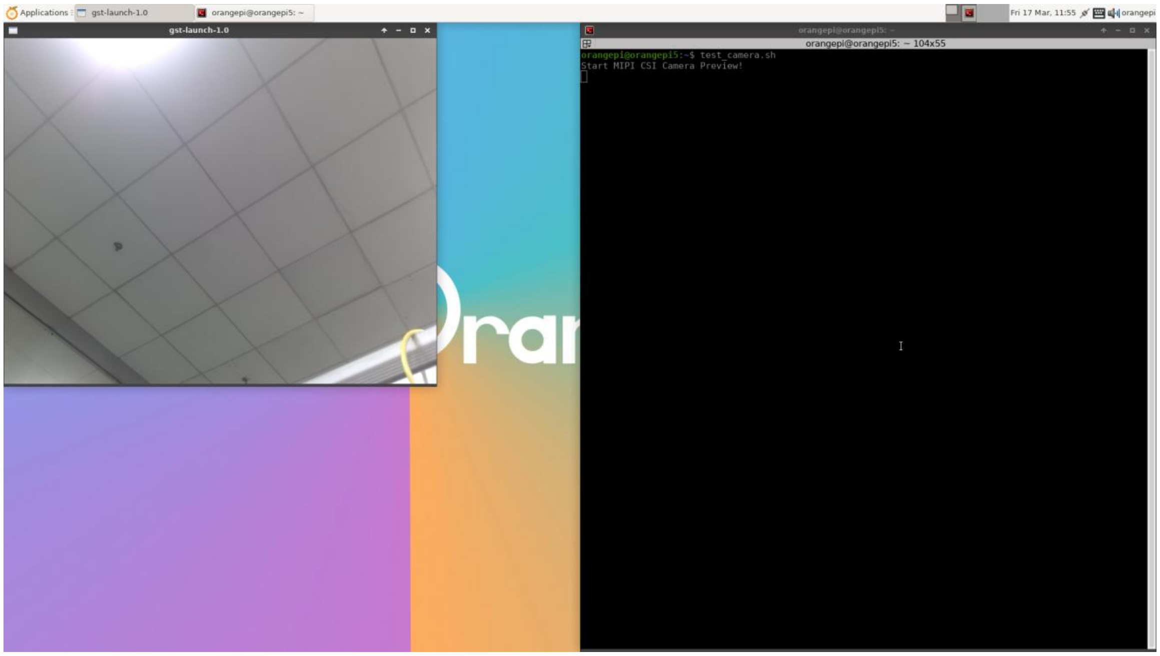
g. Then select the **<Reboot>** restart system to make the configuration take effect



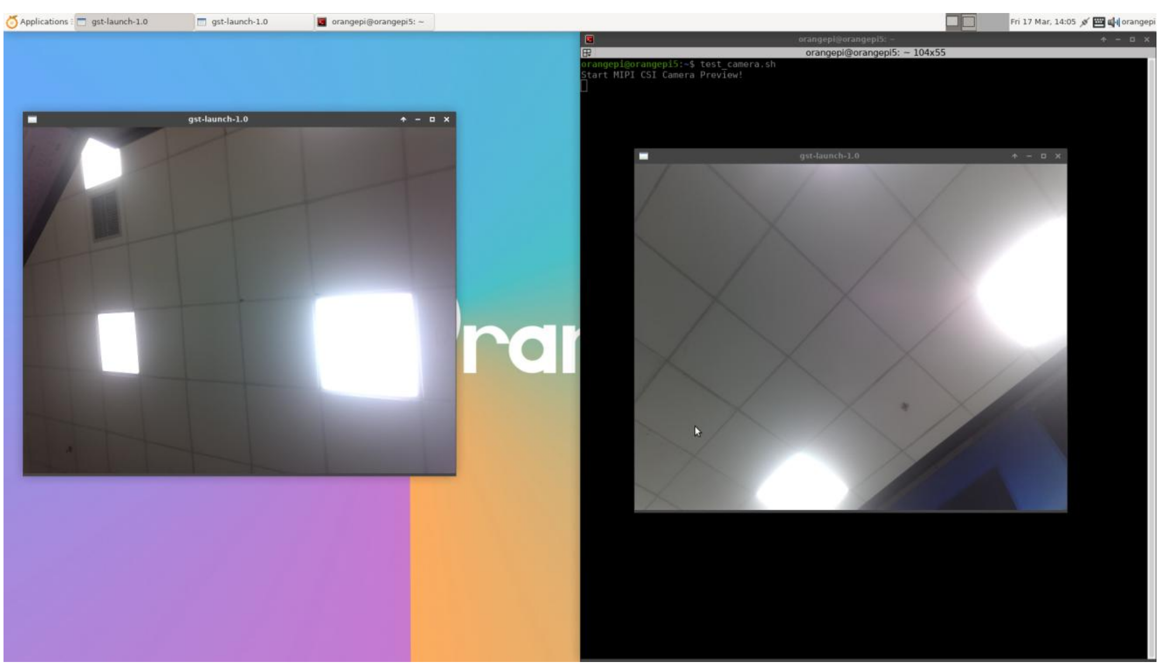
h. Then open a terminal in the desktop system and run the script below

```
orangepi@orangepi:~$ test_camera.sh
```

i. Then you can see the preview of the camera



In addition to single cameras, we can also use two cameras at the same time. It should be noted that the current test dual camera should be used for combinations of **Cam1+Cam3** (supporting OV13850 and OV13855 mix and match). After receiving the dual camera, like the previous steps, open the configuration of the Cam1+Cam3 through **orangepi-config**, restart the system, and then open the terminal on the desktop to run the **test_camera.sh** script to see the preview screen of the two cameras, as follows Shown in the figure：



Please refer to the link below for the camera dts configuration. If you need it, you can modify it by yourself;

https://github.com/orangepi-xunlong/linux-orangepi/blob/orange-pi-5.10-rk3588/arch/arm64/boot/dts/rockchip/rk3588s-orangepi-5-camera1.dtsi

https://github.com/orangepi-xunlong/linux-orangepi/blob/orange-pi-5.10-rk3588/arch/arm64/boot/dts/rockchip/rk3588s-orangepi-5-camera2.dtsi

https://github.com/orangepi-xunlong/linux-orangepi/blob/orange-pi-5.10-rk3588/arch/arm64/boot/dts/rockchip/rk3588s-orangepi-5-camera3.dtsi

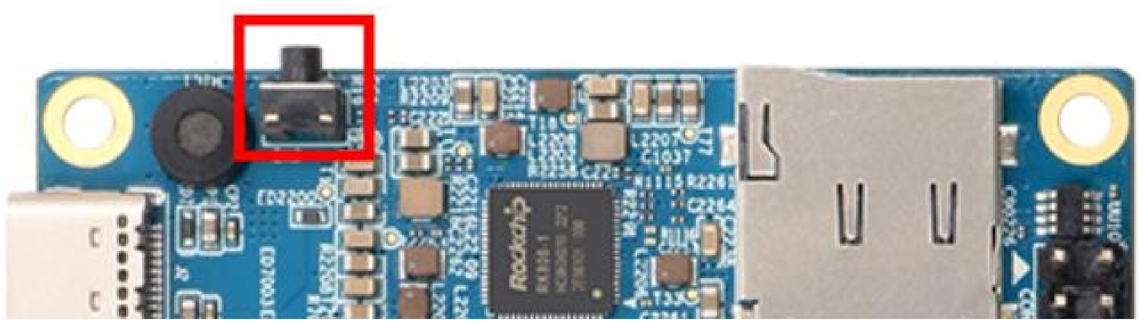
dt overlay configuration is in the directory below:
https://github.com/orangepi-xunlong/linux-orangepi/tree/orange-pi-5.10-rk3588/arch/arm64/boot/dts/rockchip/overlay

3. 33. The method of shutting down and restarting the development board

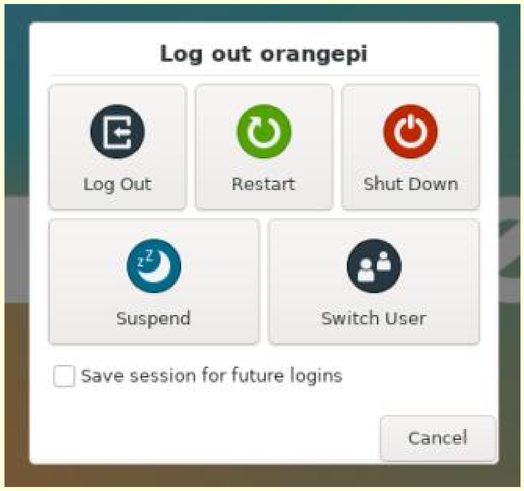
1) In the process of running the Linux system, if the Type-C power supply is directly out of power, it may cause the file system to lose certain data or damage. Therefore, please use the **poweroff** command to turn off the linux system of the development board before power off. Unplug the power supply.。

```
orangepi@orangepi:~$ sudo poweroff
```

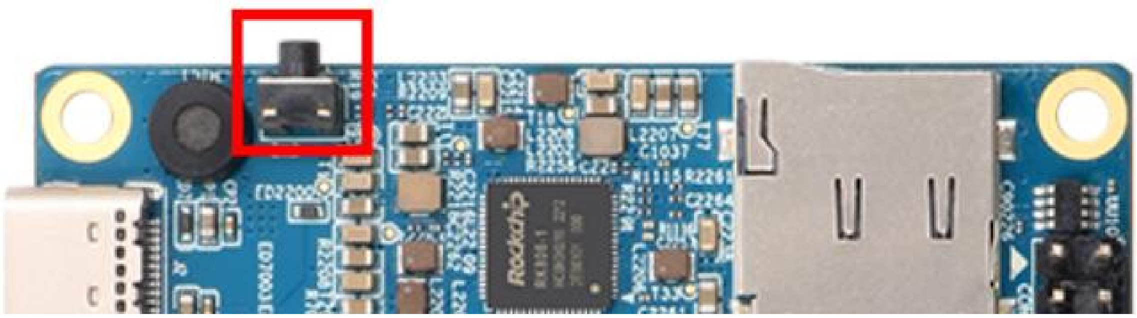
2) In addition, the development board is equipped with a switch button, and you can also **Short Press** the switch button on the development board to turn off。



Note that the Linux desktop system will pop up the confirmation box shown in the figure below after pressing the buttons. You need to click the Shut Down option before turning off。



3) After shutting down, press the switch button on the development board to turn on.。



4) Restart the command of the linux system to be

orangepi@orangepi:~$ **sudo reboot**

4. Ubuntu22.04 Gnome Wayland Desktop System Instructions

ubuntu 22.04 gnome image is pre-installed with the panfork mesa user space library by default, and the pre-installed KODI player and Chromium browser support hardware decoding to play videos.

NOTED: This image needs to be used under wayland. If you need to use x11, please choose the image of xfce type.

4. 1. Ubuntu22.04 Gnome Desktop System Adaptation

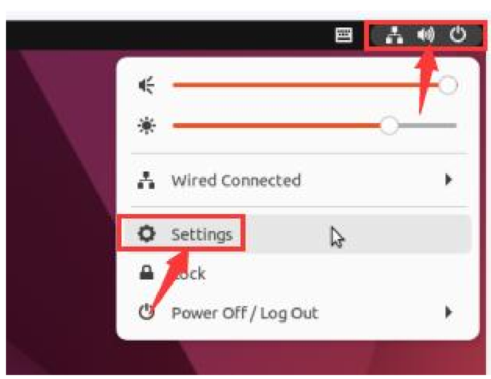
Function	Ubuntu22.04 Gnome Wayland
USB2.0x2	OK
USB3.0x1	OK
USB Type-C 3.0	OK
DP Display	OK
eMMC	OK
AP6275P-WIFI	OK
AP6275P-Bluetooth	OK
GPIO（26pin）	OK
UART（26pin）	OK
SPI（26pin）	OK
I2C（26pin）	OK
CAN（26pin）	OK
PWM（26pin）	OK
3pin Debug Serial Port	OK
TF Card Start up	OK
HDMI Video	OK
HDMI Audio	OK
OV13850 Camera	OK
OV13855 Camera	OK
LCD1	OK

LCD2	**OK**
Gigabit Ethernet Port	**OK**
Network Port Status Light	**OK**
MIC	**OK**
Headphone Playback	**OK**
Headphone Recording	**OK**
LED Light	**OK**
GPU	**OK**
NPU	**OK**
VPU	**OK**
switch button	**OK**
watchdog test	**OK**
Chromium hard solution video	**OK**
Kodi hard solution video	**OK**
MPV hard solution video	**OK**

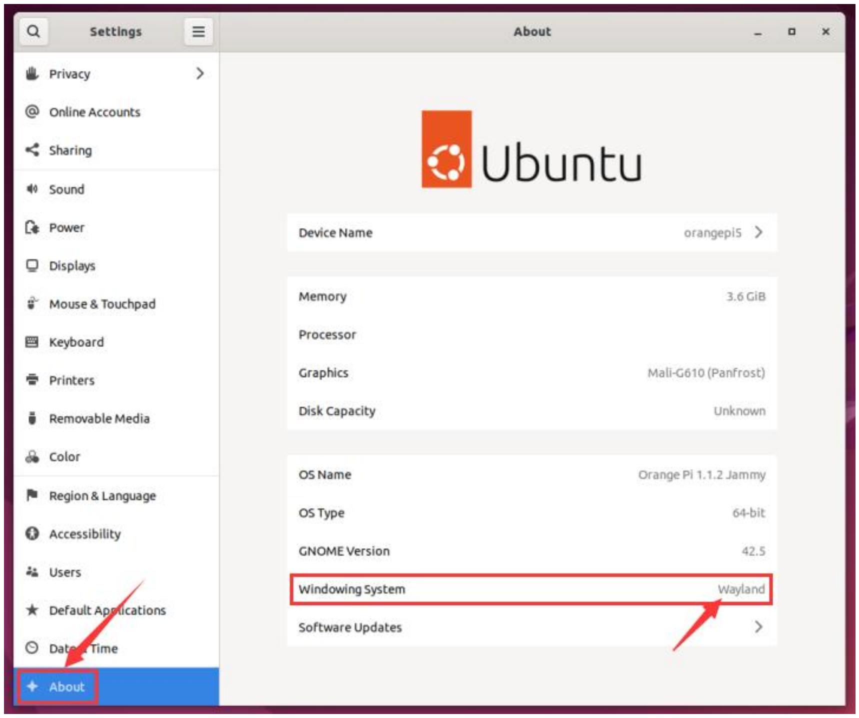
4. 2. How to confirm that the window system currently is wayland

1) The default window system used by the system is wayland, the confirmation method is as follows：

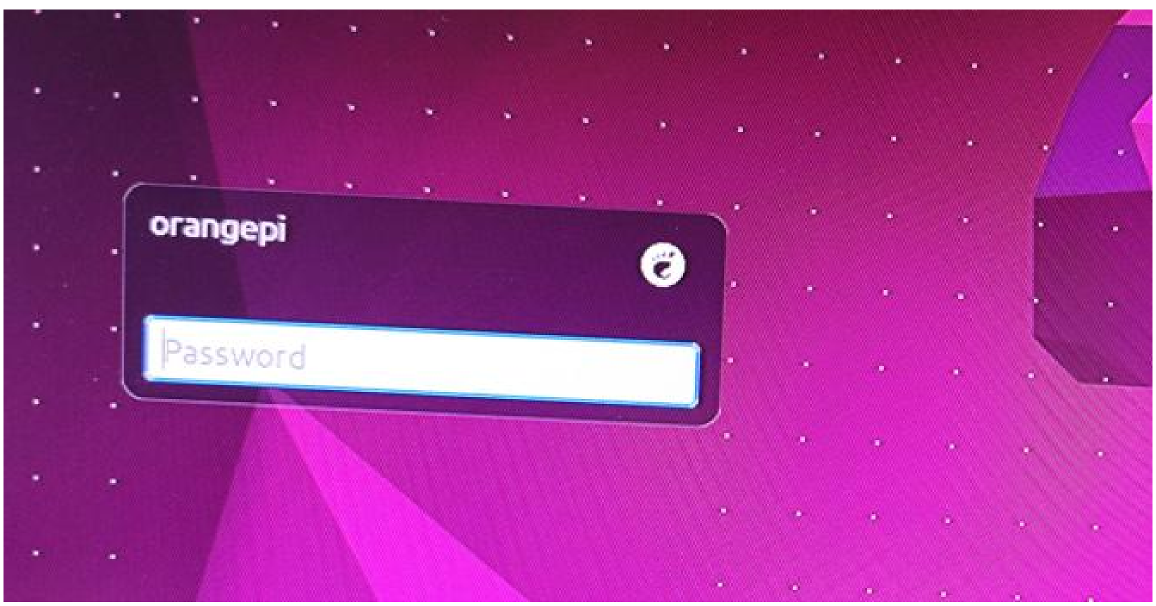
a. First open the **settings**



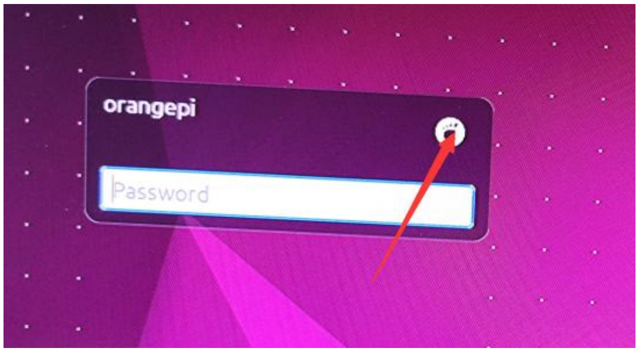
b. Then select **About**, if the **wayland** description displayed in the **Windowing System**, it means set correctly.



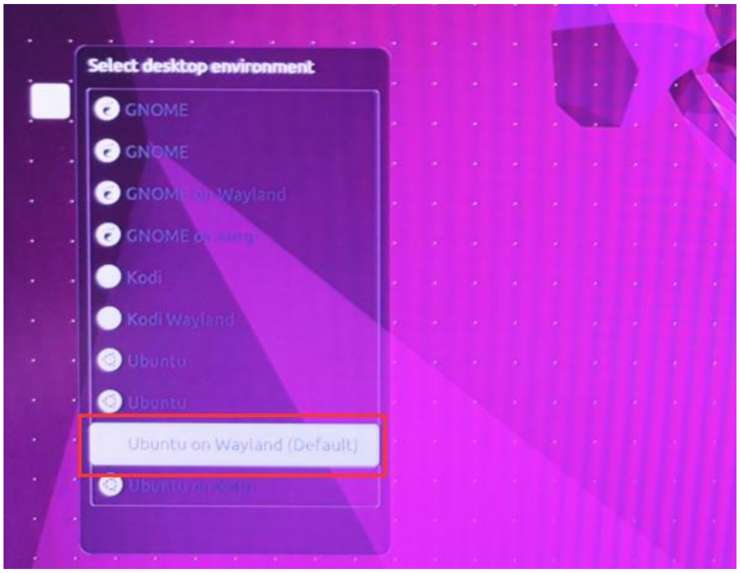
2) When **Log Out** exits the system, it will enter the following login interface



3) Before logging in to the system again, please click the location shown in the figure below

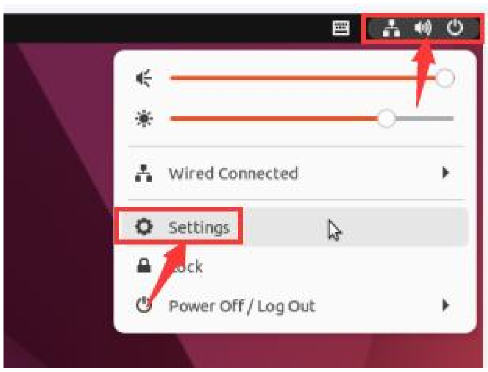


4) Then select **Ubuntu on Wayland**, and then enter the password to log in to the system

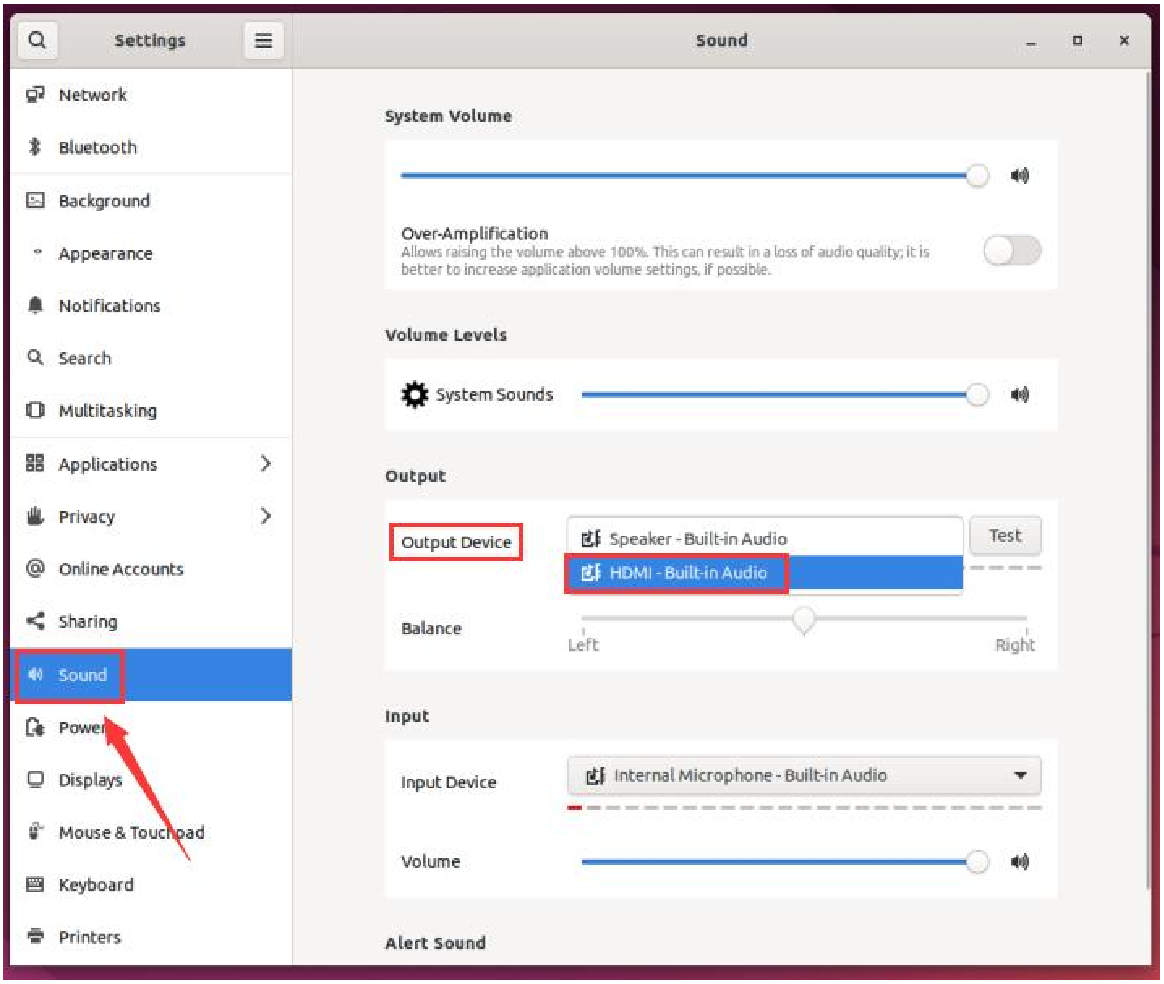


4. 3. How to switch the default audio device

1) First open the settings



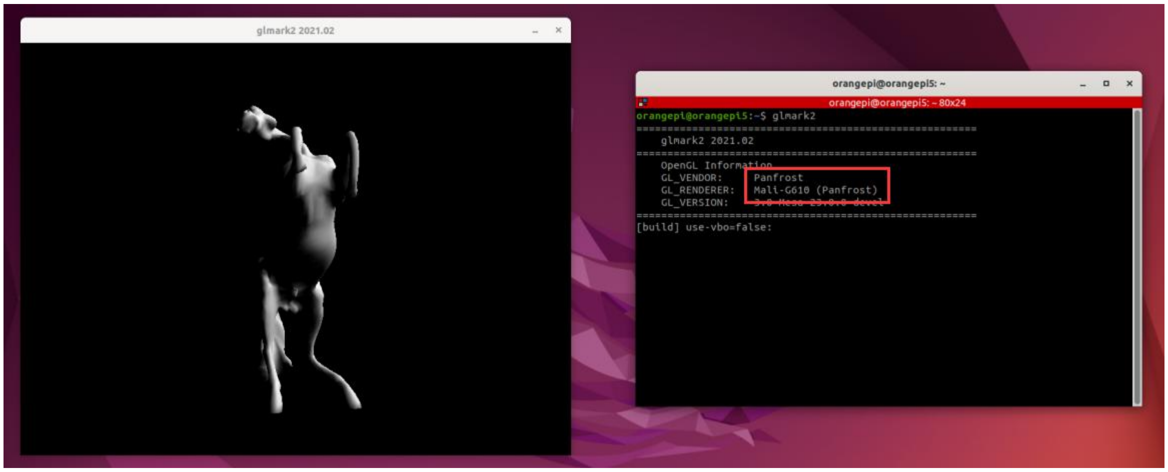
2) Then select **Sound**, and then select the audio device you want to use in **Output Device**



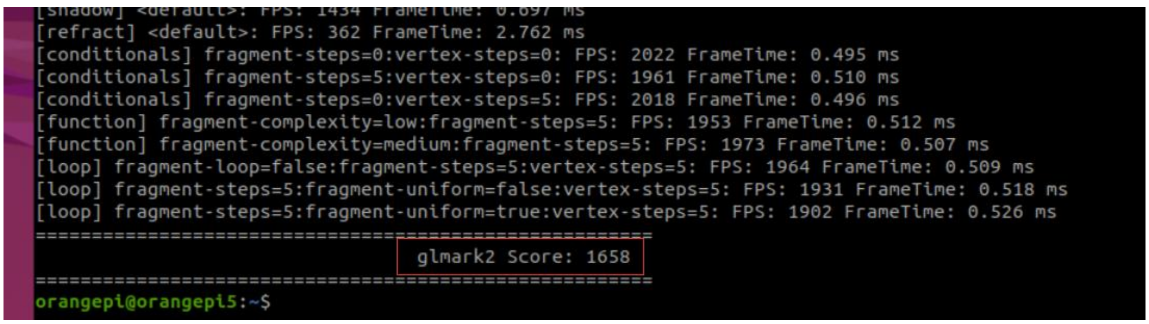
4. 4. How to test GPU

1) Open a terminal on the desktop, and then enter the **glmark2** command. If you can see that **GL_VERDOR** is displayed as **Panfrost,** it means that the GPU is used.

```
orangepi@orangepi:~$ glmark2
```

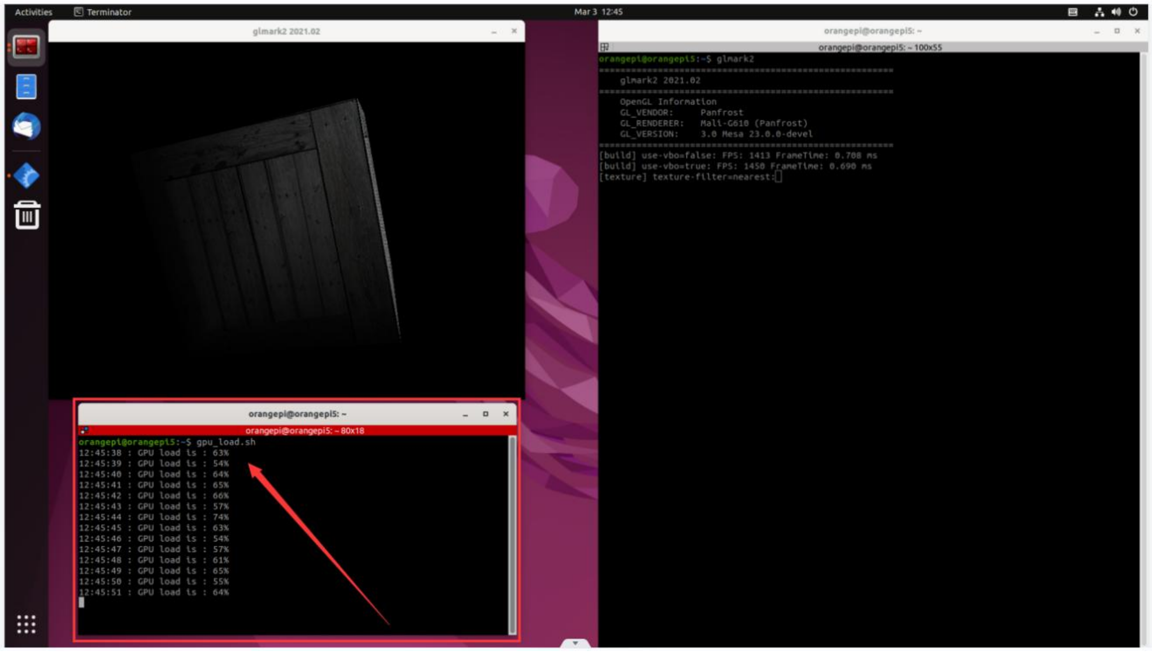


2) The glmark2 running score test is generally more than 1000 points.



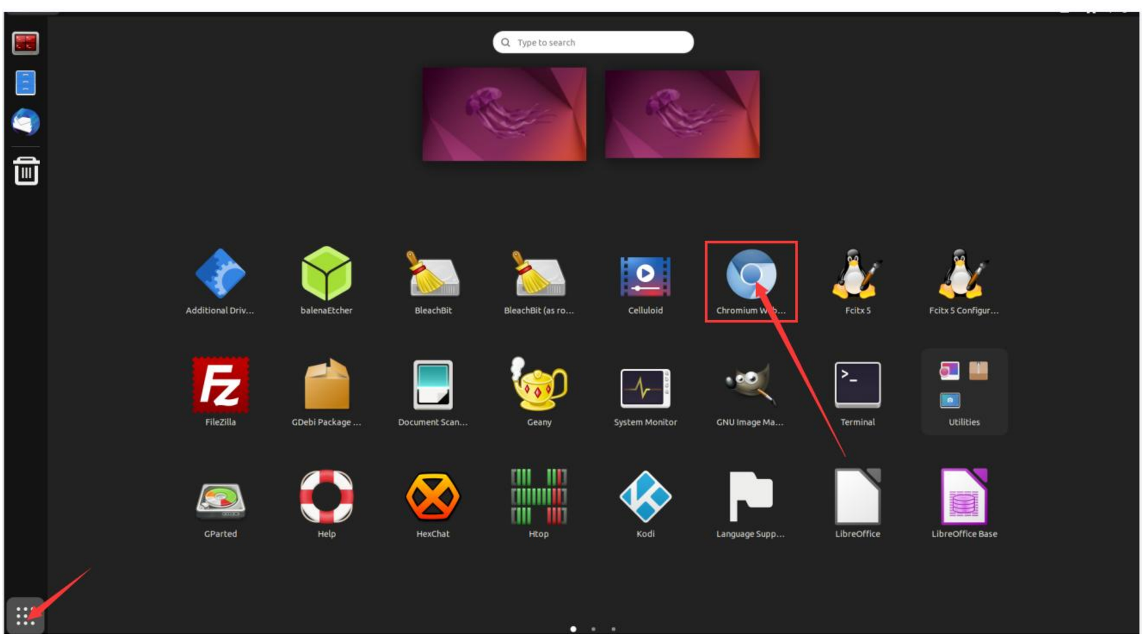
3) Run the **gpu_load.sh** script to view the current load of the GPU

orangepi@orangepi:~$ **gpu_load.sh**

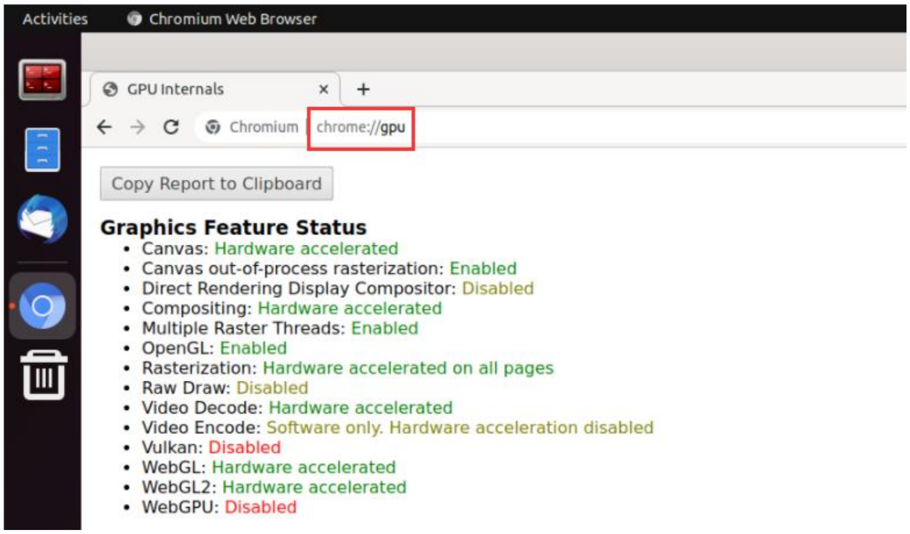


4. 5. How to play Chromium browser hardware solution video

1) First open the Chromium browser



2) Then enter **chrome://gpu** in the Chromium browser to check the support of GPU and video decoding

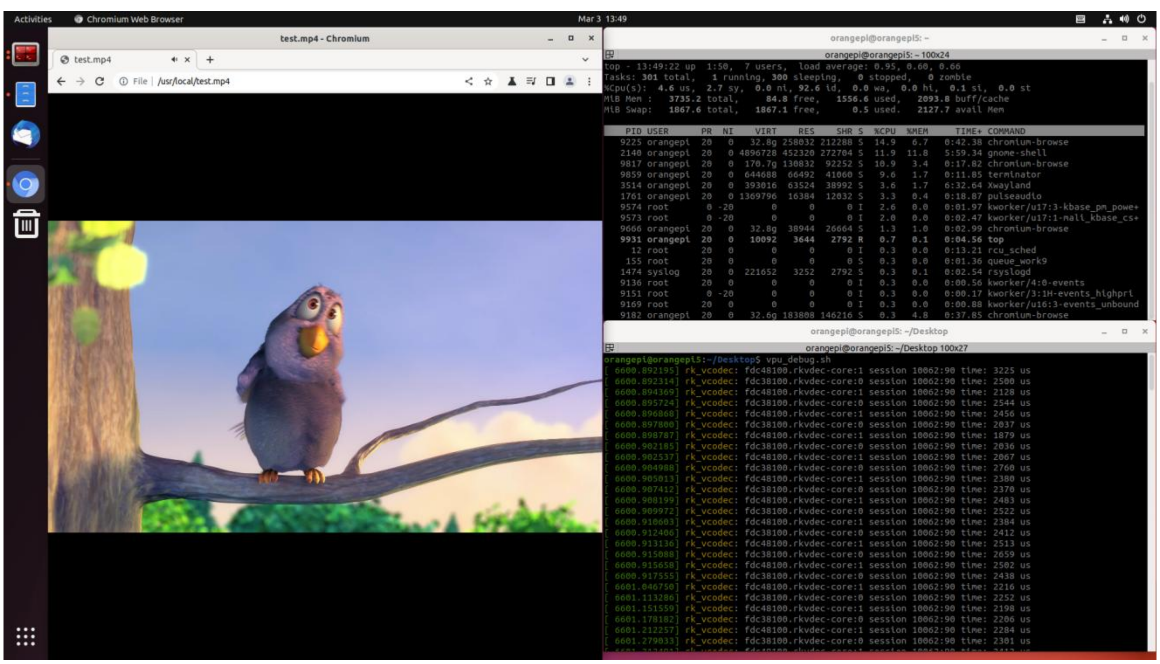


3) Then you can open the video website to play a video file, or enter the following path name in the browser to play a test video file that comes with the system

/usr/local/test.mp4

4) When playing a video, you can run the **vpu_debug.sh** script in the terminal. If there is a printout in the lower right corner of the figure below, it means that hardware is used to decode the video

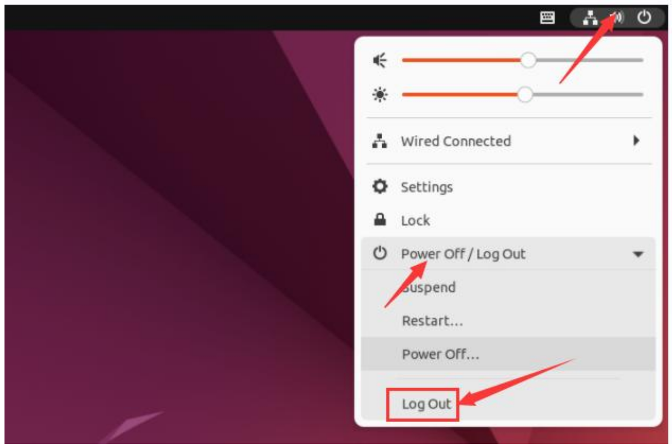
orangepi@orangepi:~$ **vpu_debug.sh**

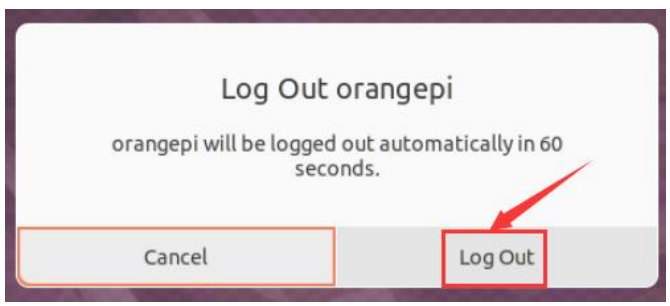


4. 6. How to play Kodi hardware solution video

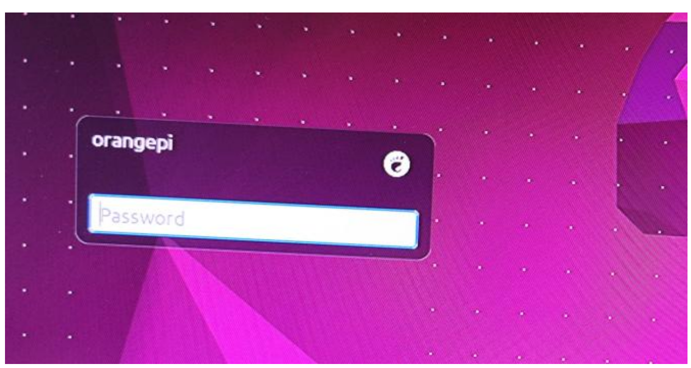
Note: There will be problems when opening Kodi directly on the Wayland desktop, please strictly follow the method below to open Kodi.

1) First log out of the system

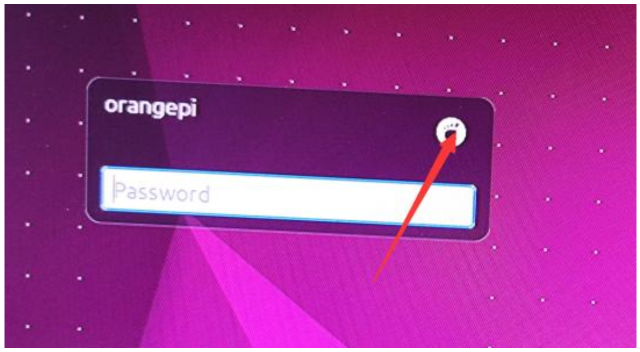




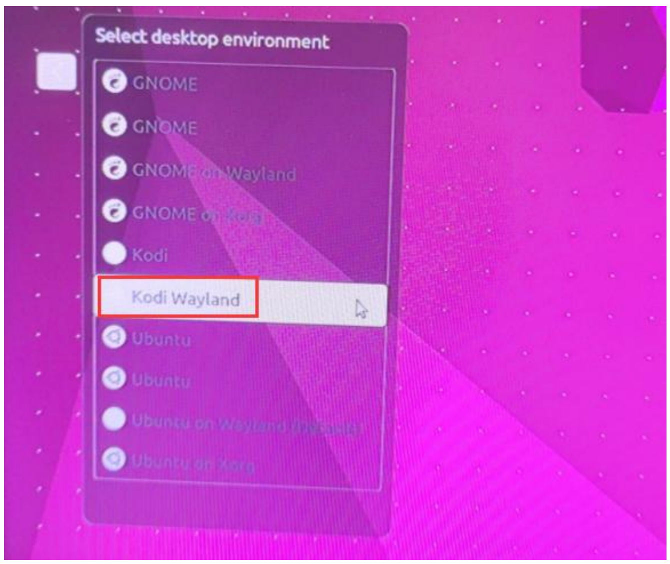
2) When you log out of the system, you will enter the following login interface



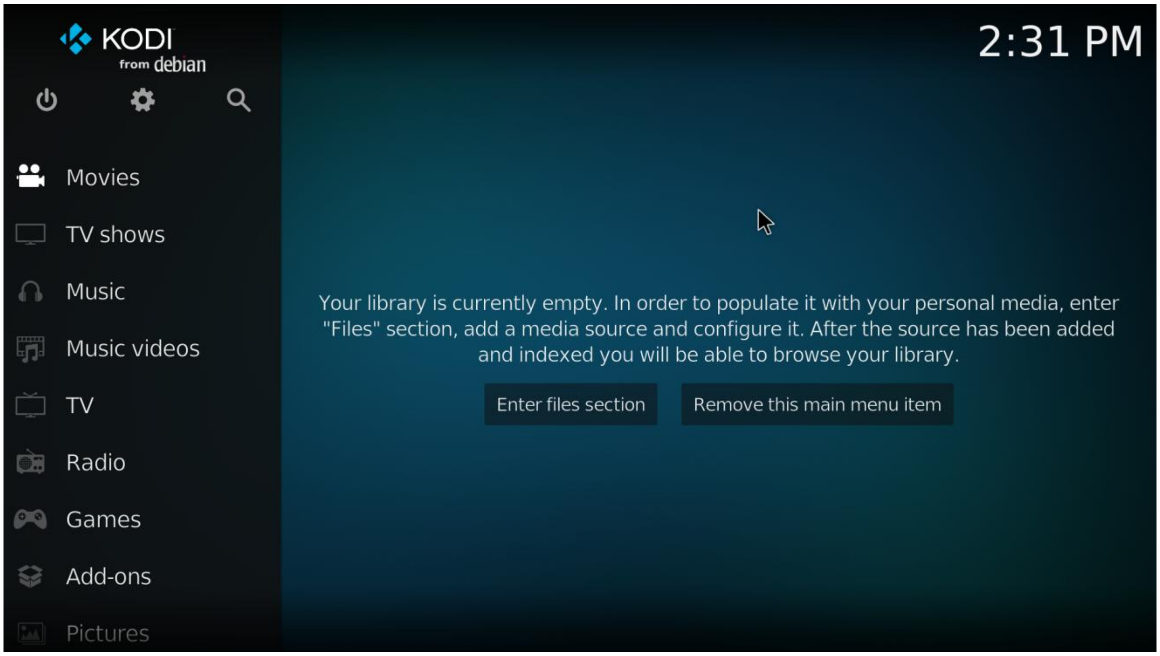
3) Then click the location shown in the figure below



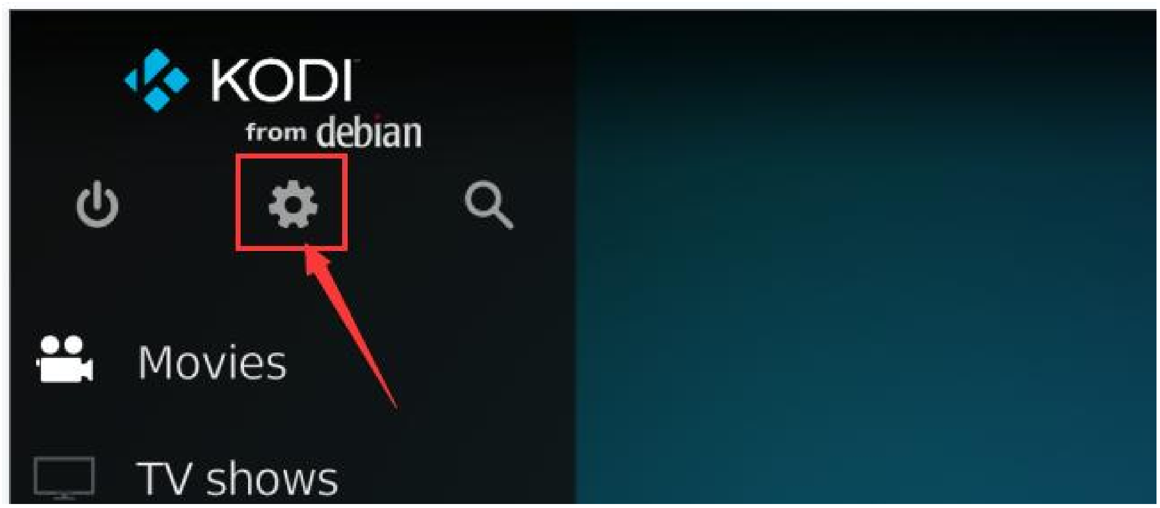
4) Then select **Kodi Wayland**, and then enter the password to log in to the system



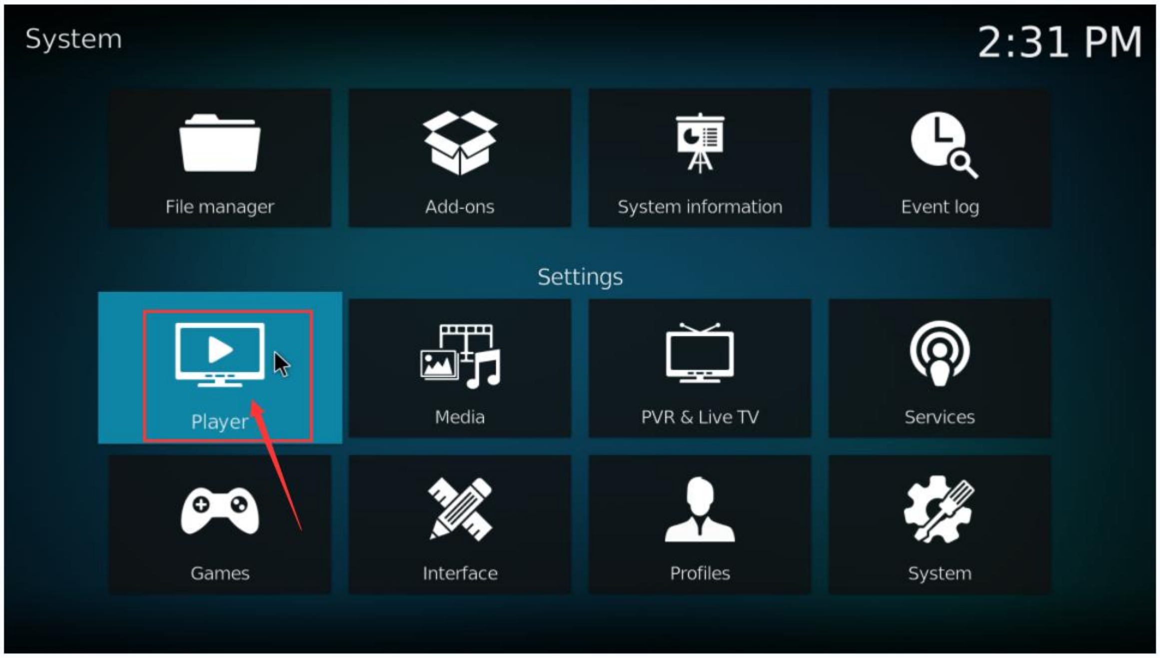
5) The interface after Kodi is opened is shown as follows



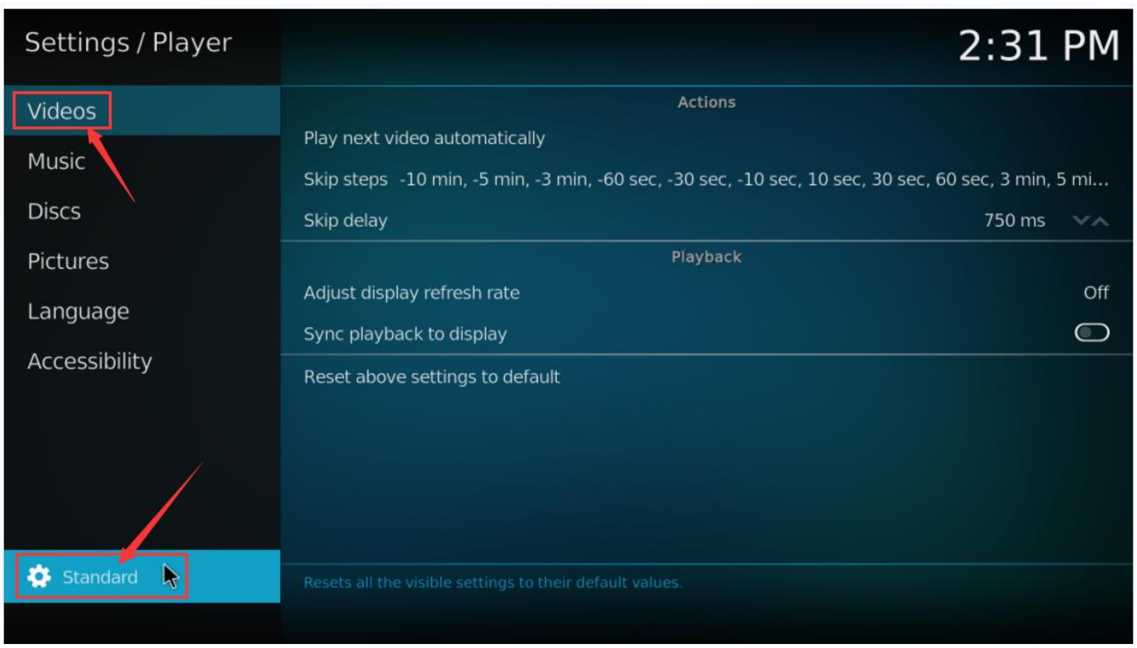
6) Then click Settings



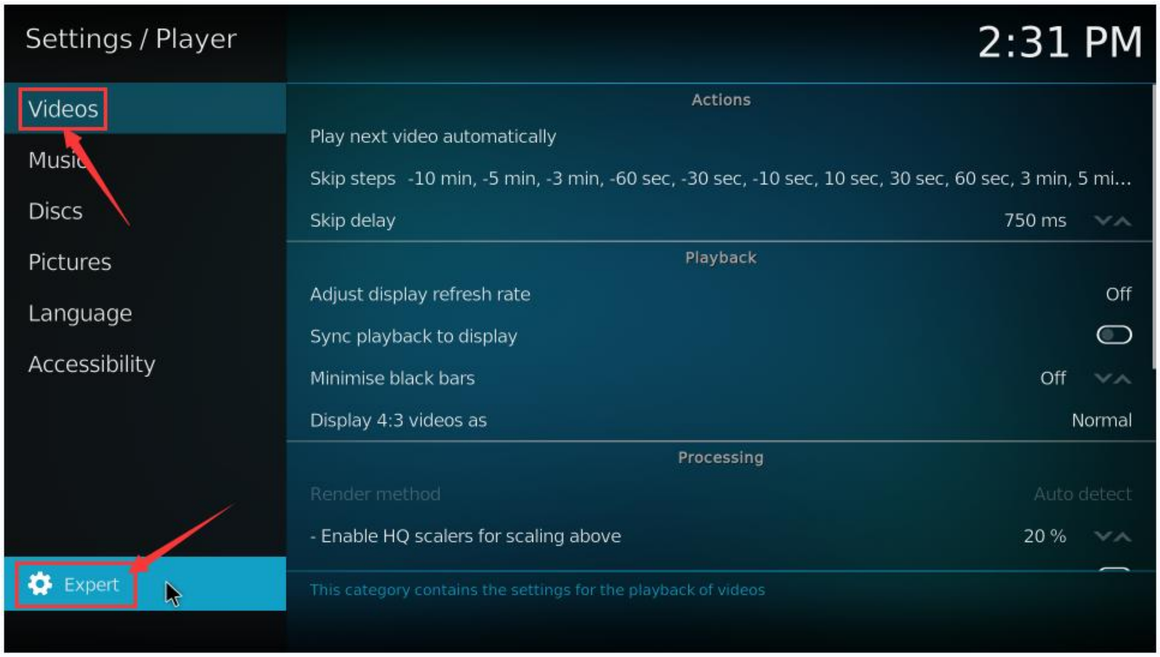
7) And then select **Player**



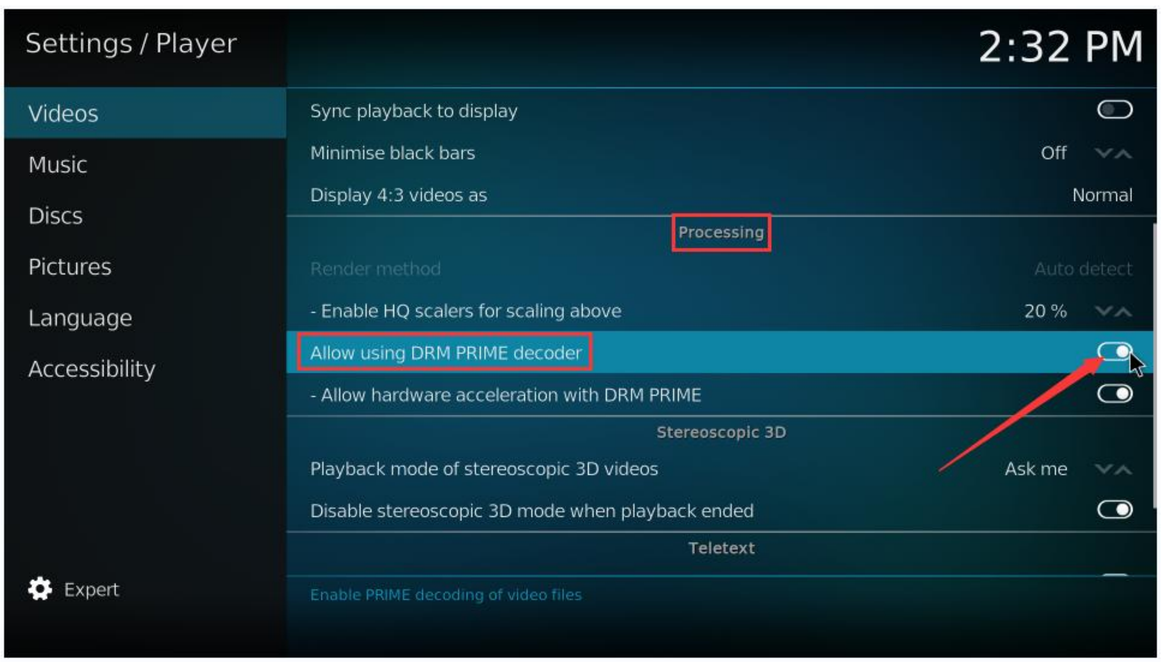
8) Select **Videos**， and click **Standard**



9) After clicking twice, it will switch to **Expert** mode, as shown in the figure below

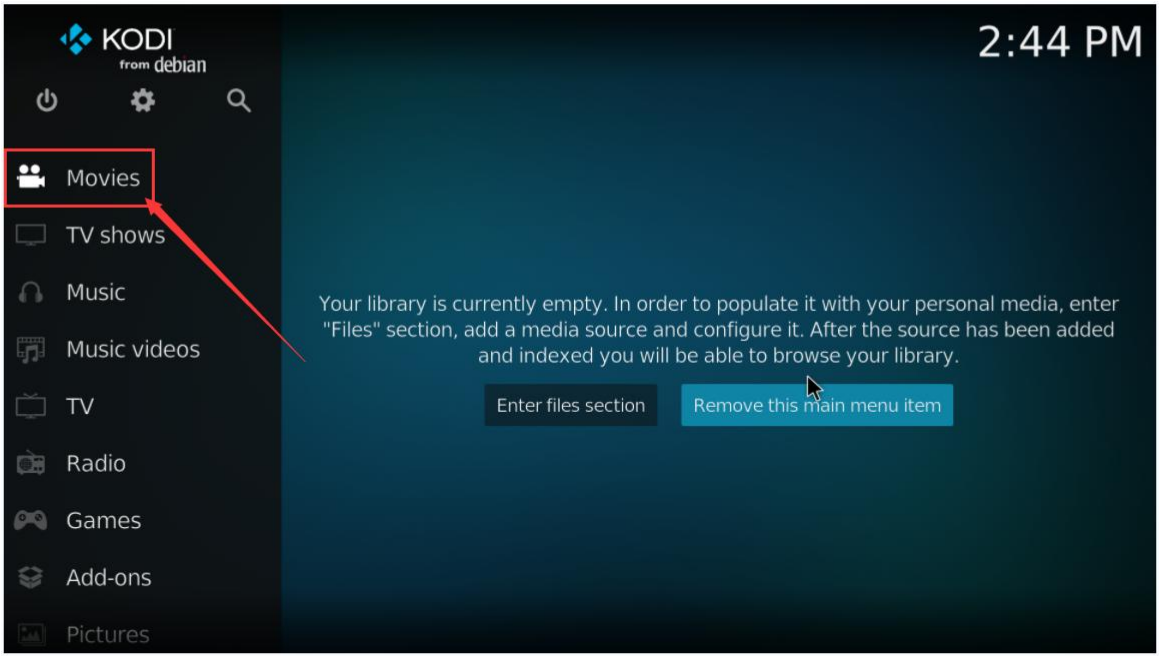


10) Then turn on **Allow using DRM PRIME decoder** in the **Processing** settings

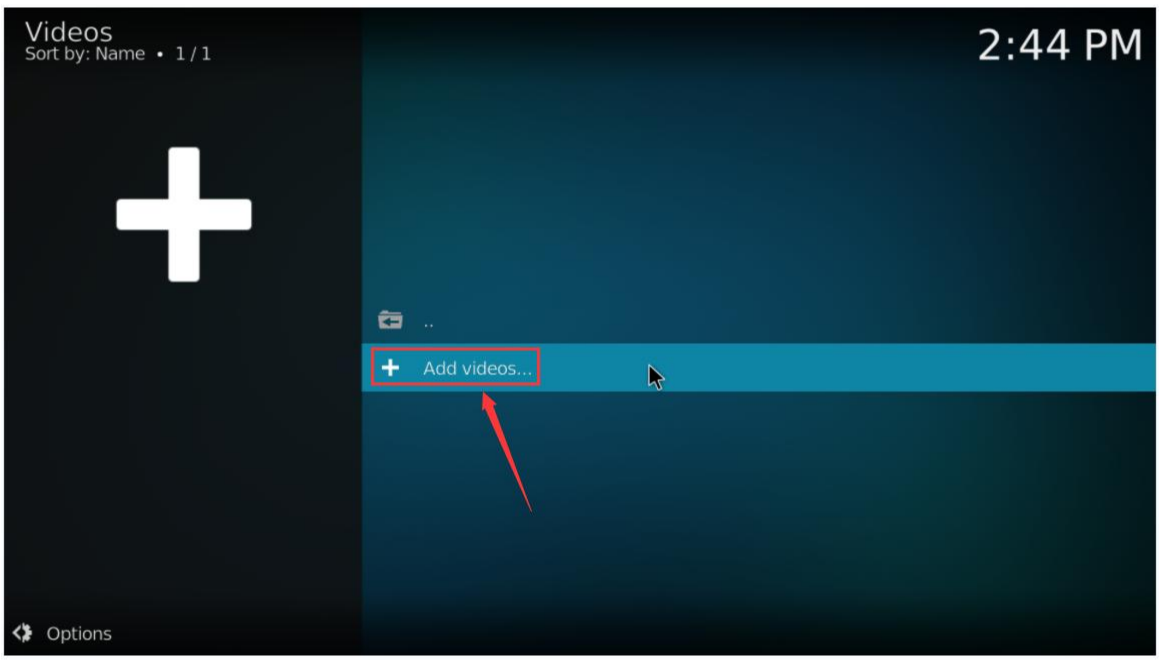


11) Then let's import a test video that comes with the system for testing. You can also upload the video you want to play to the system, and then import and play it.

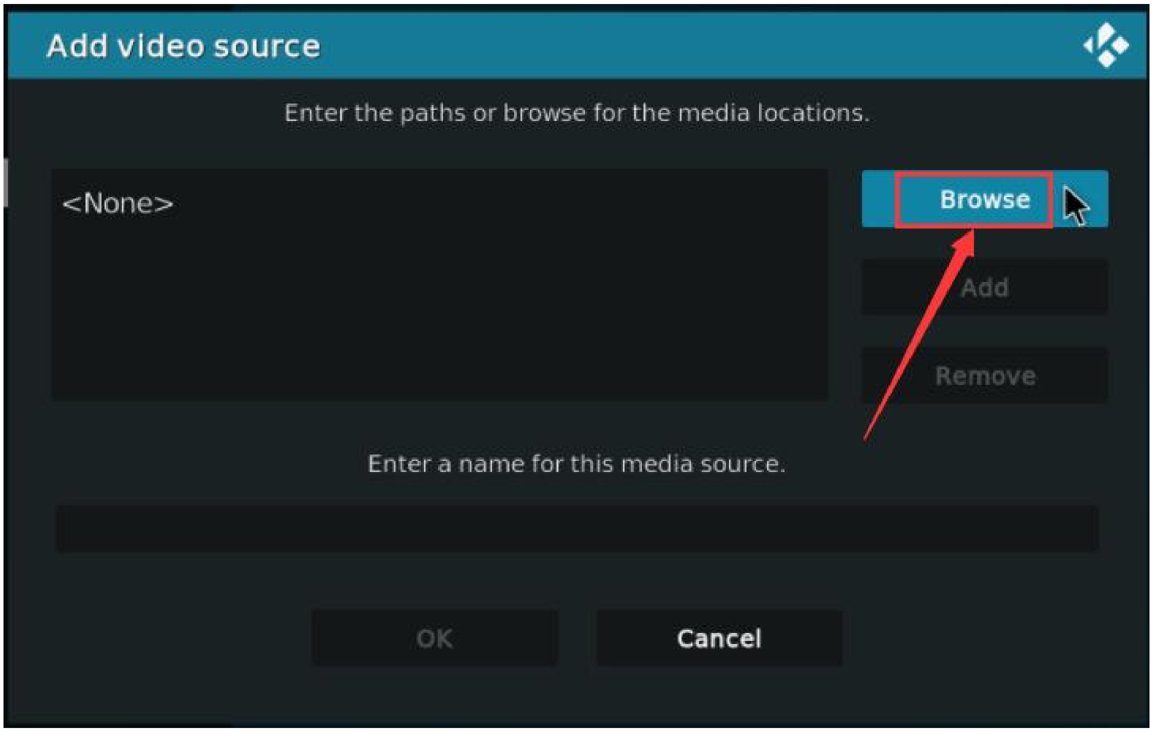
a. First enter the main interface, then select **Movies**



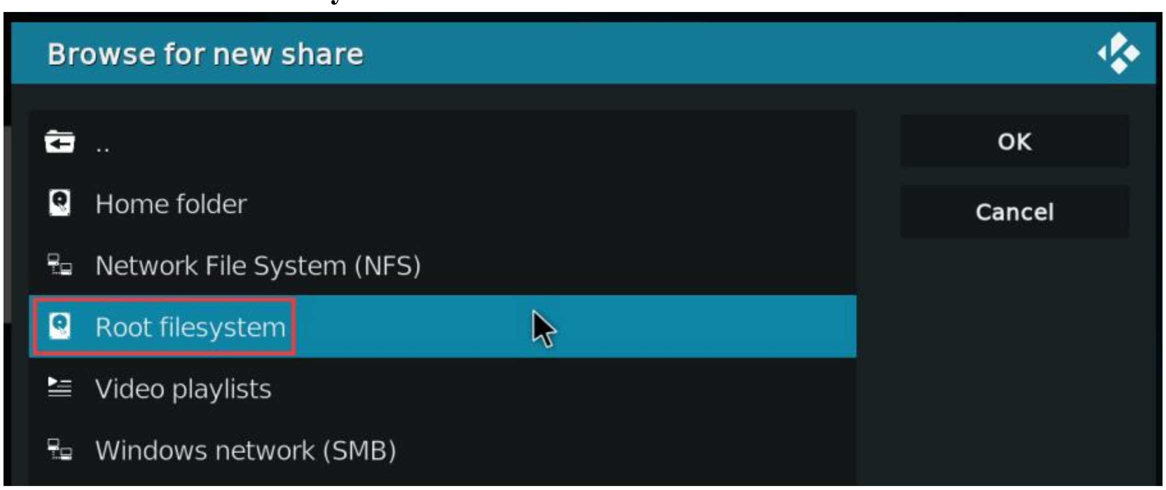
b. Then select **Add videos...**



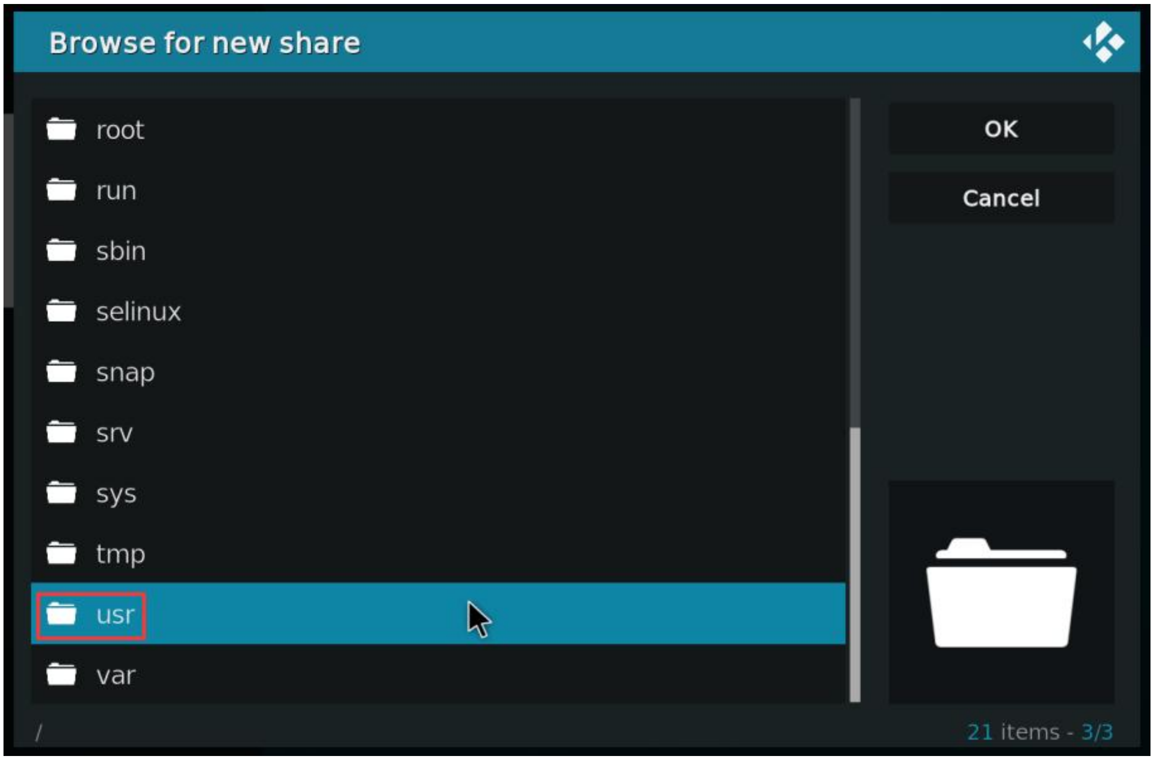
c. And then select **Browse**



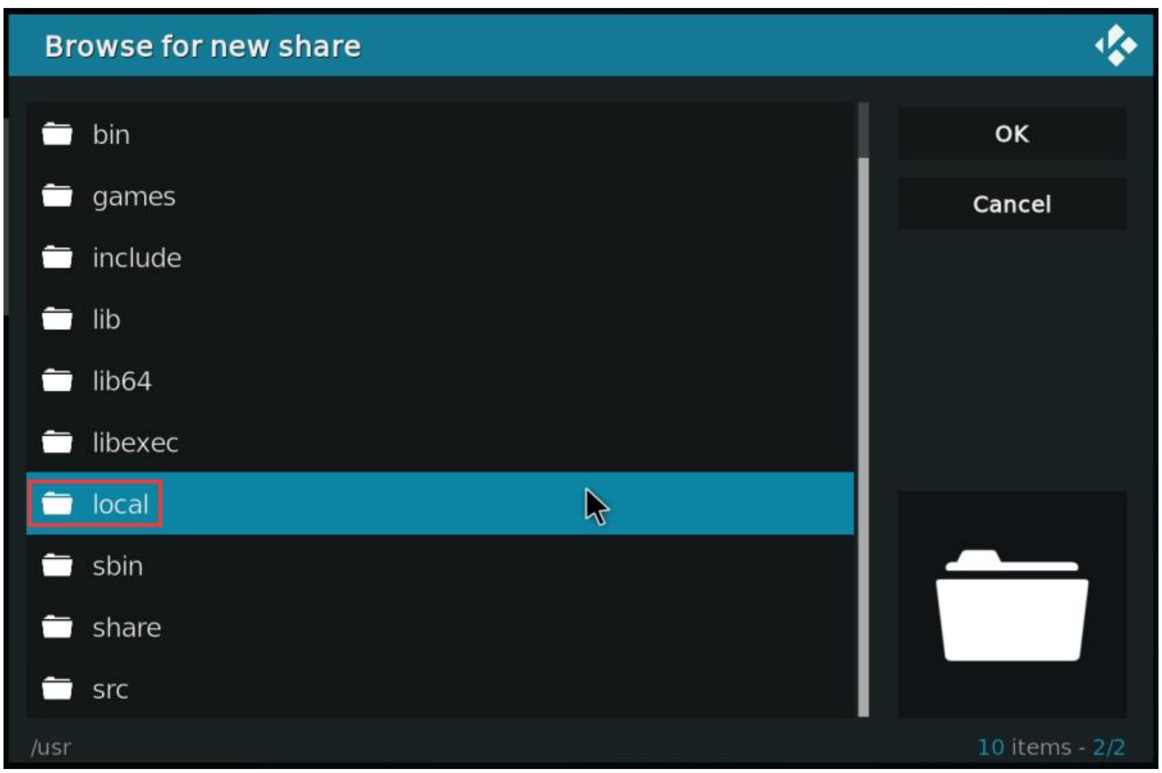
d. Select **Root filesystem**



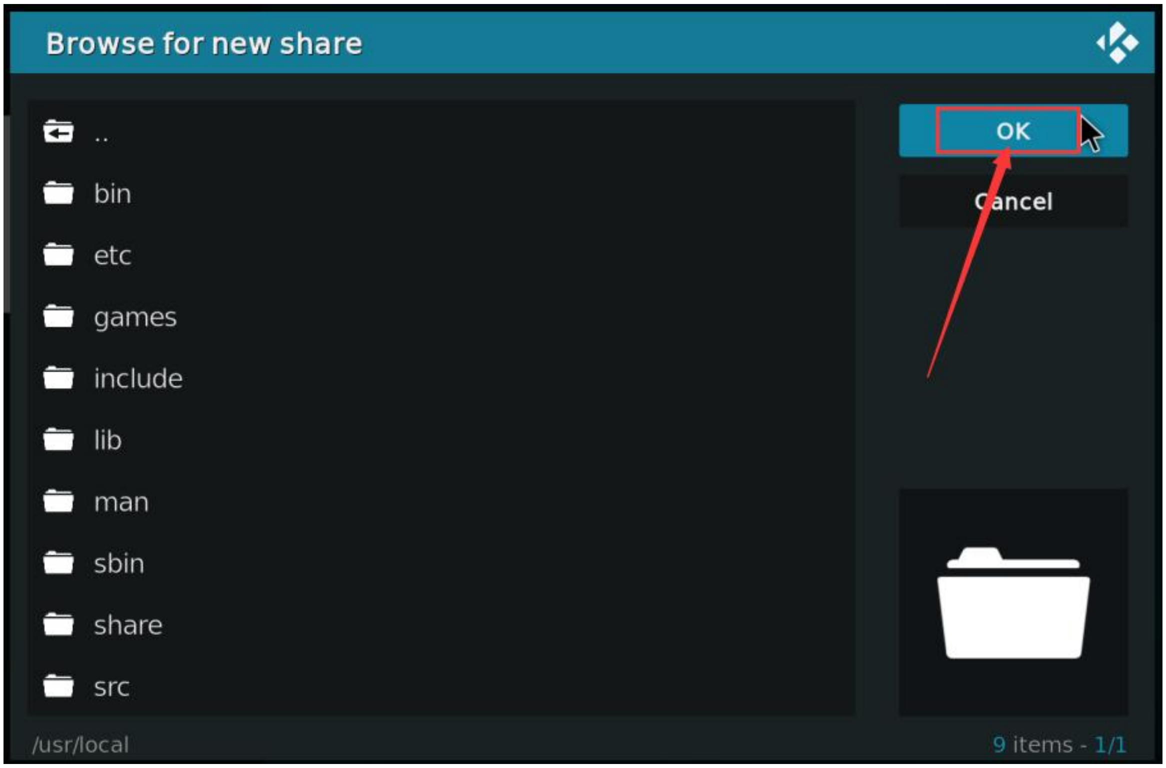
e. Select **usr**



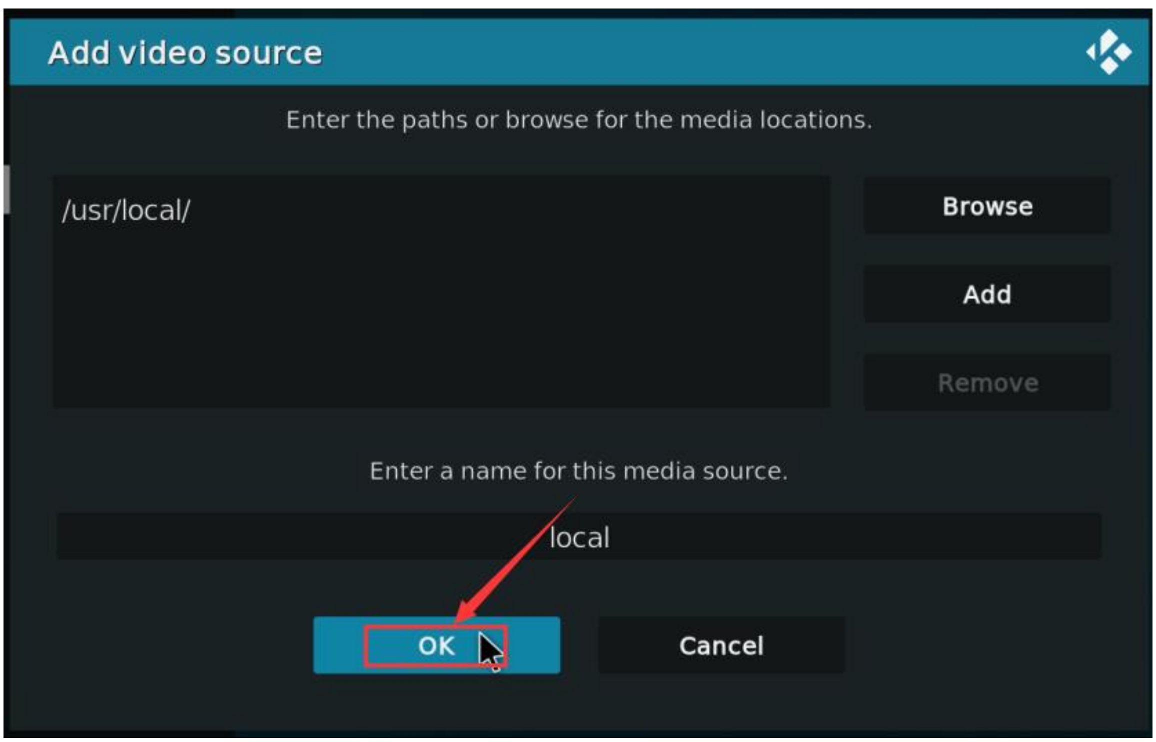
f. Select **local**



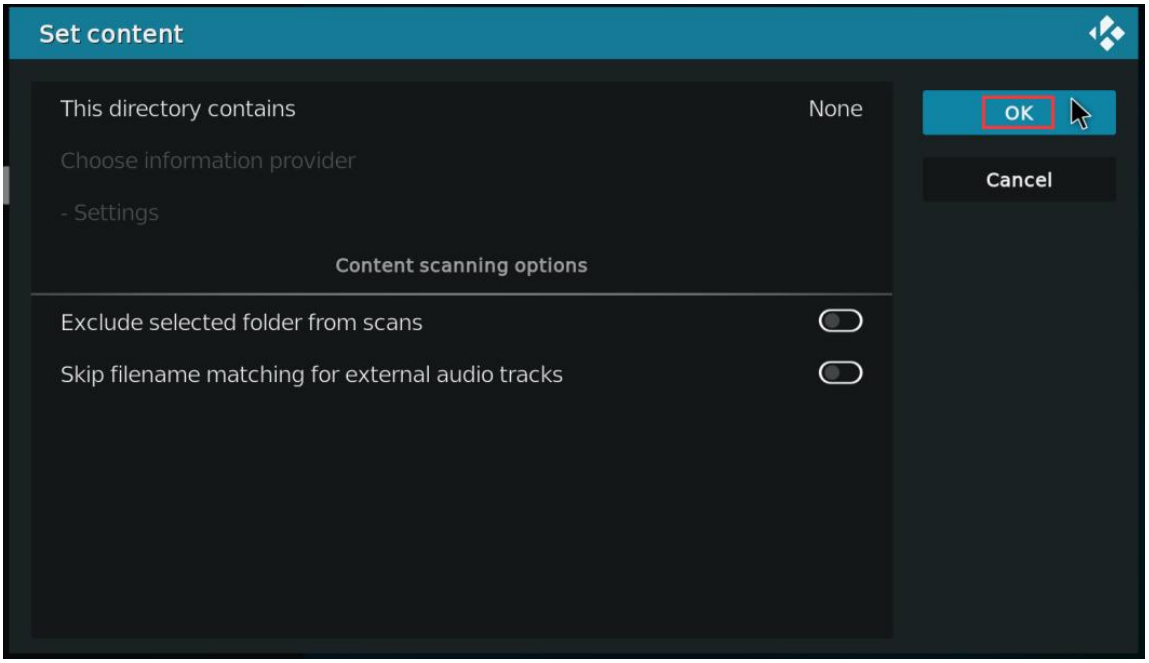
g. Select **OK**



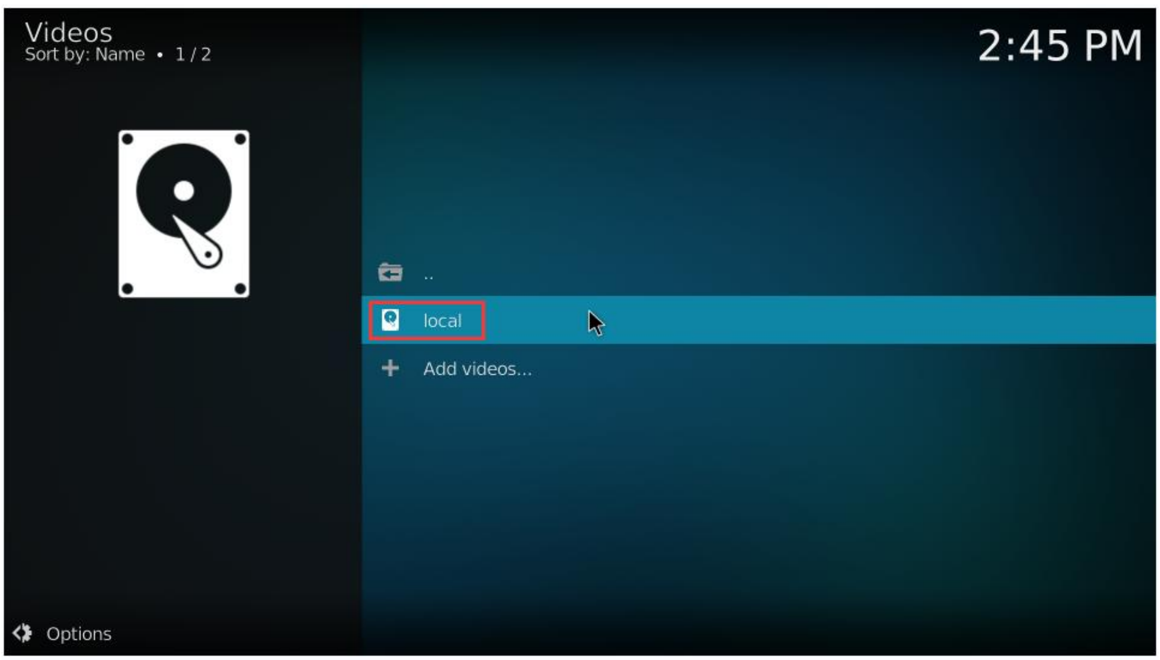
h. Select **OK**



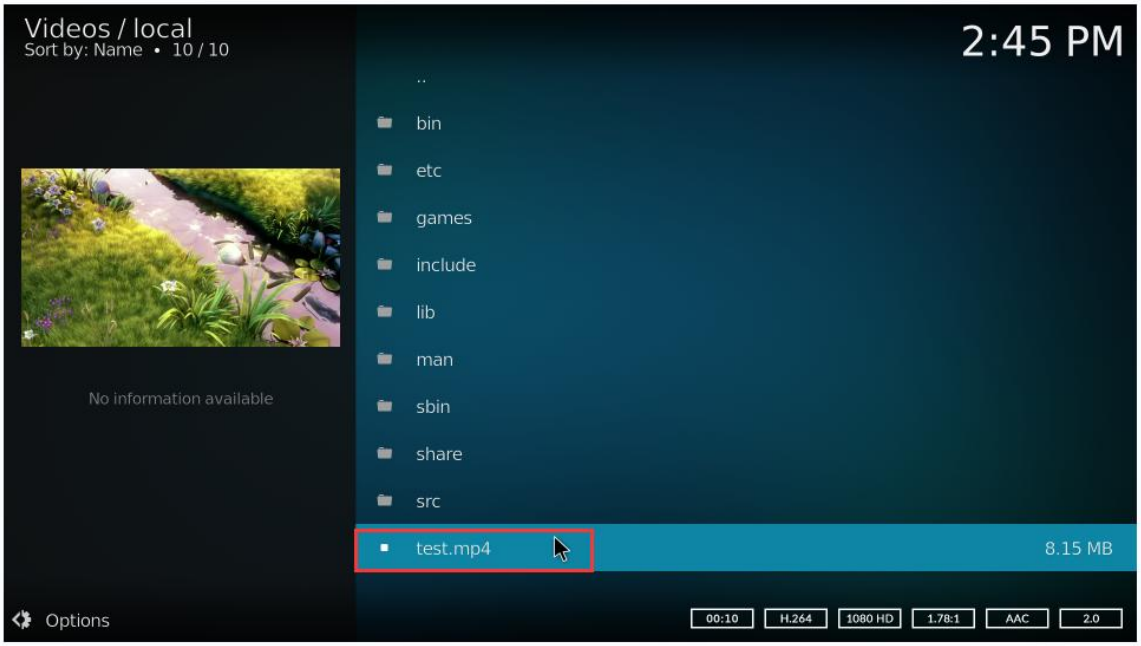
i. Select OK



j. Then enter the local folder



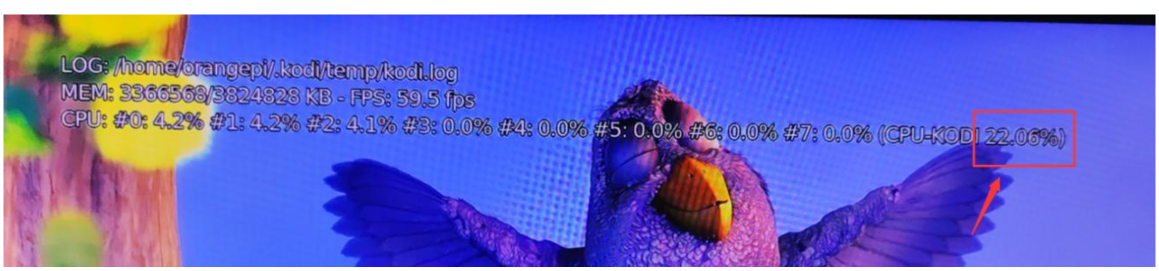
k. Then you can play the **test.mp4** test video



12) When playing the video, you can run the **vpu_debug.sh** script on the command line (via ssh or serial port). If there is the following printout, it means that the video is decoded by hardware

```
orangepi@orangepi:~$ vpu_debug.sh
[ 1830.938378] rk_vcodec: fdc48100.rkvdec-core:1 session 3573:2 time: 2728 us
[ 1830.938461] rk_vcodec: fdc38100.rkvdec-core:0 session 3573:2 time: 2617 us
[ 1830.941179] rk_vcodec: fdc48100.rkvdec-core:1 session 3573:2 time: 2661 us
[ 1830.941777] rk_vcodec: fdc38100.rkvdec-core:0 session 3573:2 time: 2708 us
[ 1830.944727] rk_vcodec: fdc48100.rkvdec-core:1 session 3573:2 time: 3444 us
[ 1830.945211] rk_vcodec: fdc38100.rkvdec-core:0 session 3573:2 time: 3331 us
[ 1830.970563] rk_vcodec: fdc48100.rkvdec-core:1 session 3573:2 time: 2547 us
[ 1831.199650] rk_vcodec: fdc38100.rkvdec-core:0 session 3573:2 time: 2703 us
```

13) The CPU usage of playing the **test.mp4** video file is around **20%~30%** 占用率在 **20%~30%**.



4. 7. How to install ROS2 Humble on Ubuntu22.04 Gnome

1) Ros2 can be installed using the **install_ros.sh** script

```
orangepi@orangepi:~$ install_ros.sh ros2
```

2) The install**_ros.sh** script will automatically run the **ros2 -h** command after installing ros2. If you can see the following print, it means that the ros2 installation is complete.

```
usage: ros2 [-h] Call `ros2 <command> -h` for more detailed usage. ...

ros2 is an extensible command-line tool for ROS 2.

optional arguments:
  -h, --help            show this help message and exit

Commands:
  action     Various action related sub-commands
  bag        Various rosbag related sub-commands
  component  Various component related sub-commands
  daemon     Various daemon related sub-commands
  doctor     Check ROS setup and other potential issues
  interface  Show information about ROS interfaces
  launch     Run a launch file
  lifecycle  Various lifecycle related sub-commands
  multicast  Various multicast related sub-commands
  node       Various node related sub-commands
  param      Various param related sub-commands
  pkg        Various package related sub-commands
  run        Run a package specific executable
  security   Various security related sub-commands
  service    Various service related sub-commands
  topic      Various topic related sub-commands
  wtf        Use `wtf` as alias to `doctor`
```

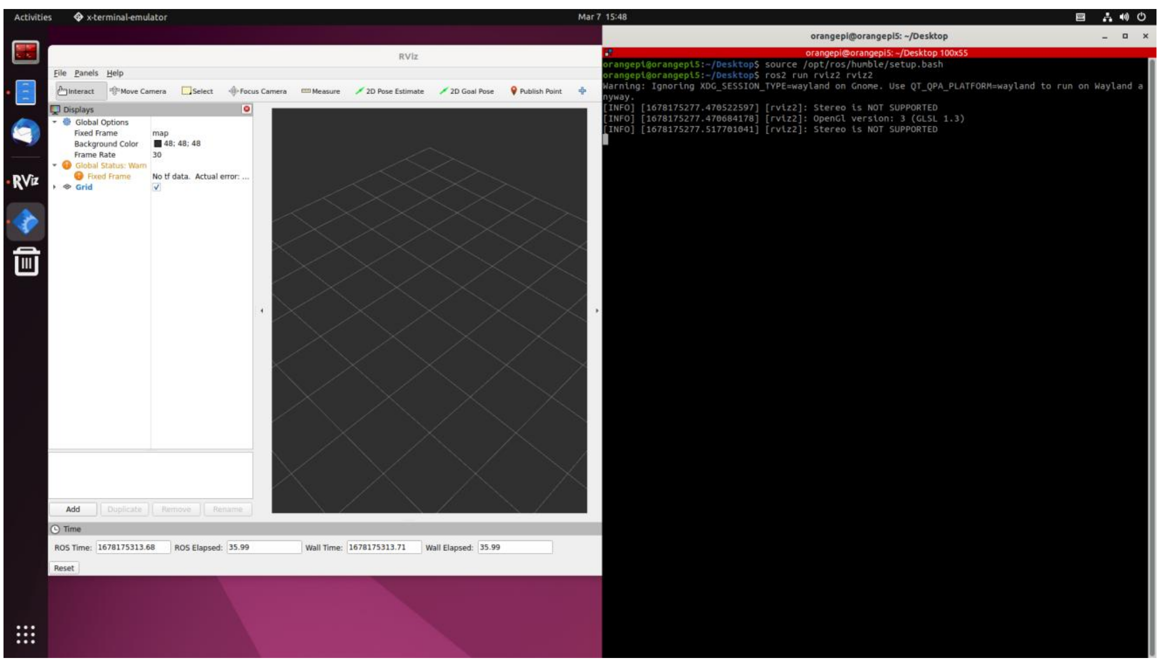
```
Call `ros2 <command> -h` for more detailed usage.
```

3) Then you can use the **test_ros.sh** script to test whether ROS2 is installed successfully. If you can see the following print, it means that ROS 2 can run normally.

```
orangepi@orangepi5b:~$ test_ros.sh
[INFO] [1671174101.200091527] [talker]: Publishing: 'Hello World: 1'
[INFO] [1671174101.235661048] [listener]: I heard: [Hello World: 1]
[INFO] [1671174102.199572327] [talker]: Publishing: 'Hello World: 2'
[INFO] [1671174102.204196299] [listener]: I heard: [Hello World: 2]
[INFO] [1671174103.199580322] [talker]: Publishing: 'Hello World: 3'
[INFO] [1671174103.204019965] [listener]: I heard: [Hello World: 3]
```

4) Run the following command to open rviz2.

```
orangepi@orangepi:~$ source /opt/ros/humble/setup.bash
orangepi@orangepi:~$ ros2 run rviz2 rviz2
```

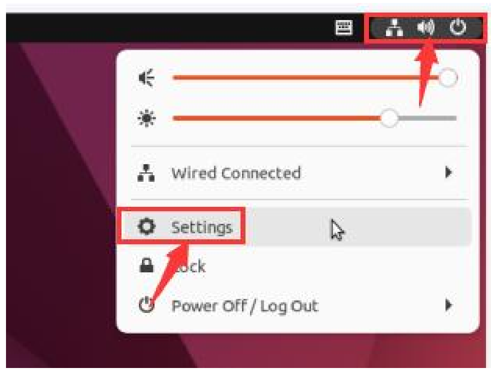


5) Reference documents

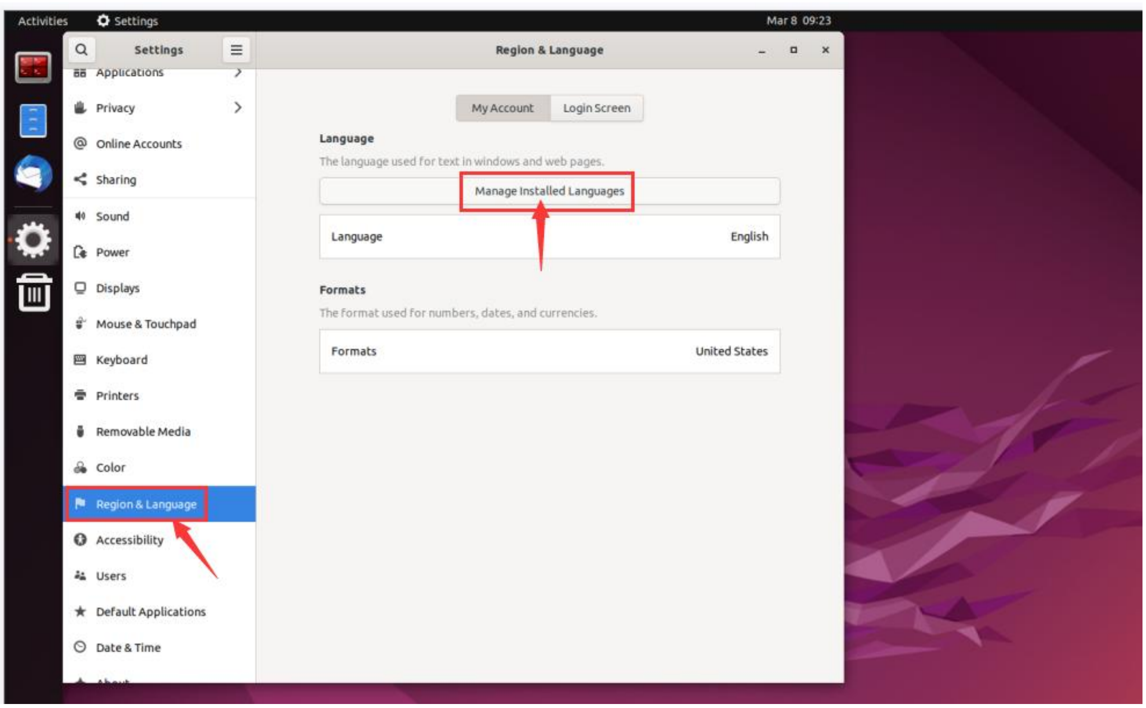
http://docs.ros.org/en/humble/index.html
http://docs.ros.org/en/humble/Installation/Ubuntu-Install-Debians.html

4.8. How to set Chinese environment and install Chinese input method

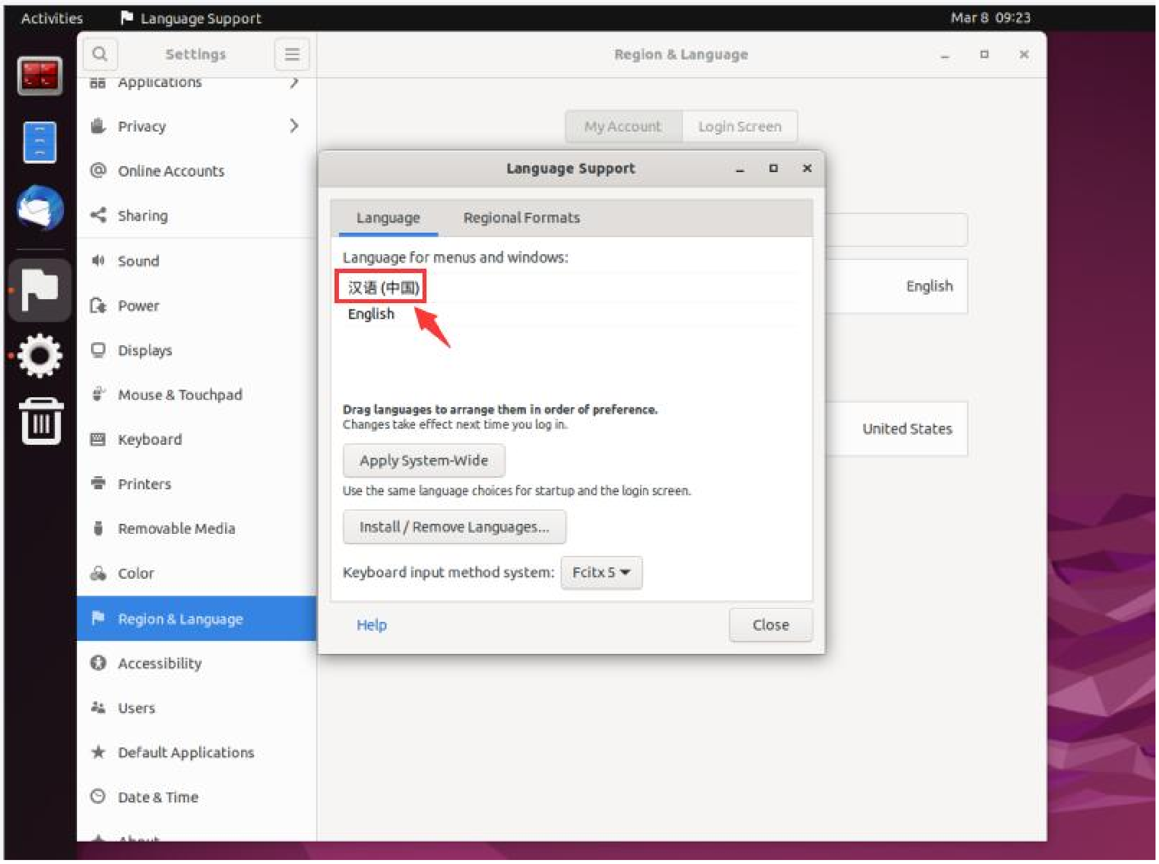
1) First open the settings



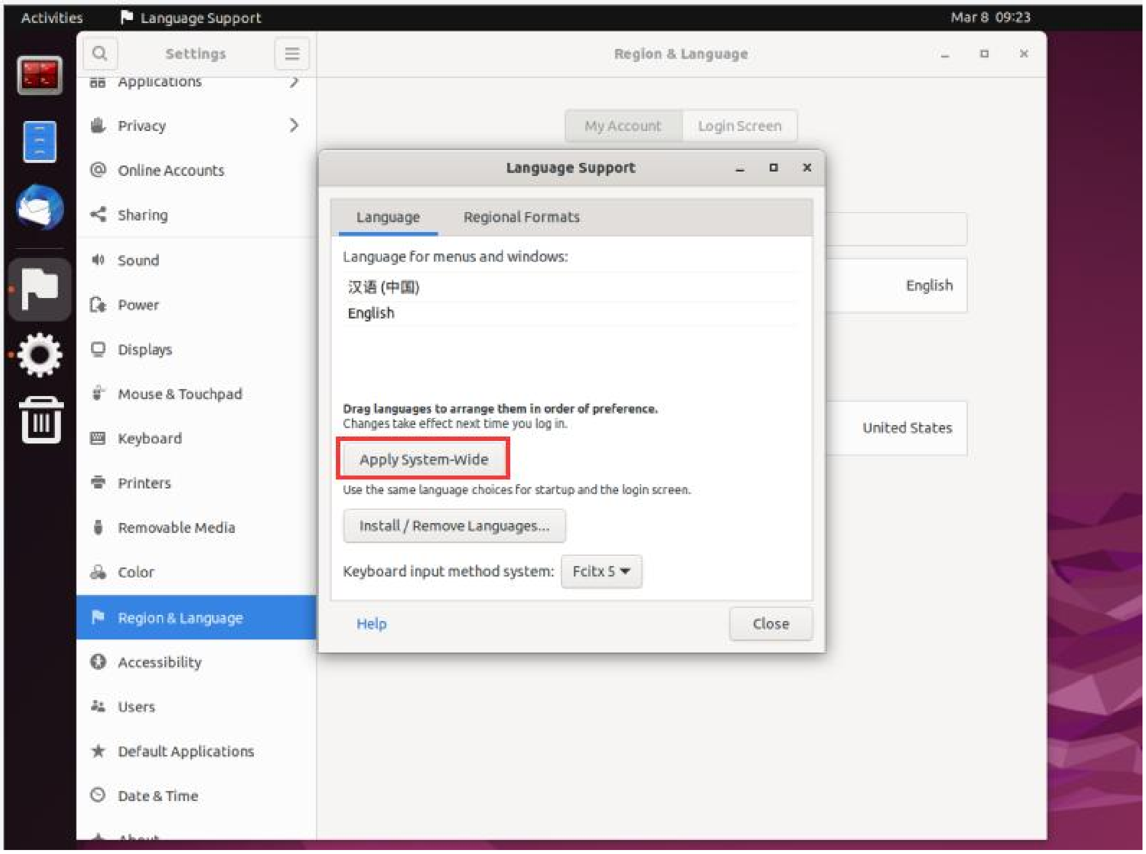
2) Then find the **Region & Language** option, and click the **Manage Installed Languages** option



3) Then please use the left mouse button to select **Chinese (China)** and hold it down, then drag it up to the initial position, and the display after dragging is shown in the figure below:



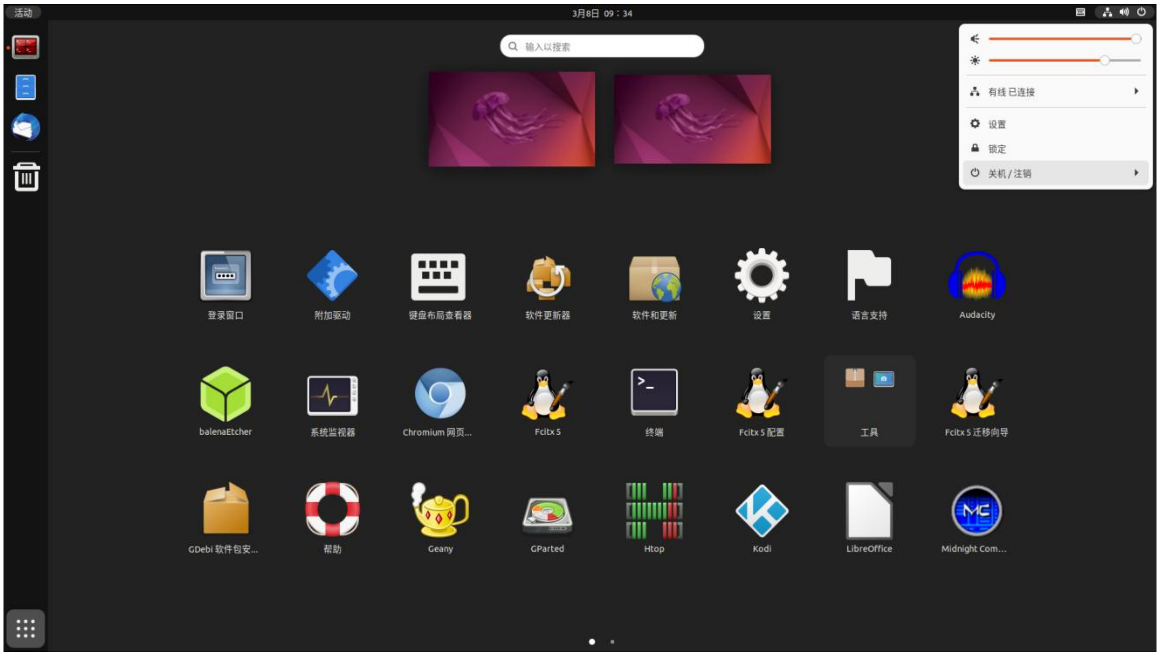
4) Then select **Apply System-Wide** to apply the Chinese settings to the entire system.



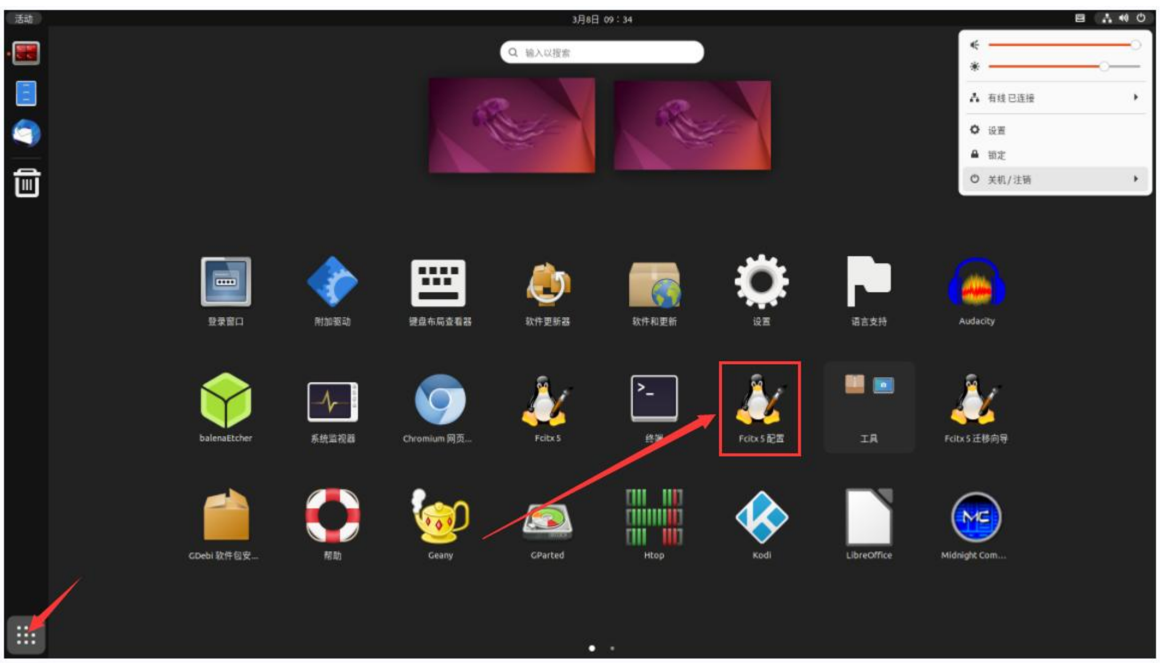
5) **Then restart the Linux system to make the configuration take effect**

6) After re-entering the system, please choose **not to ask me again** in the following interface, and then please decide whether the standard folder should also be updated to Chinese according to your preferences

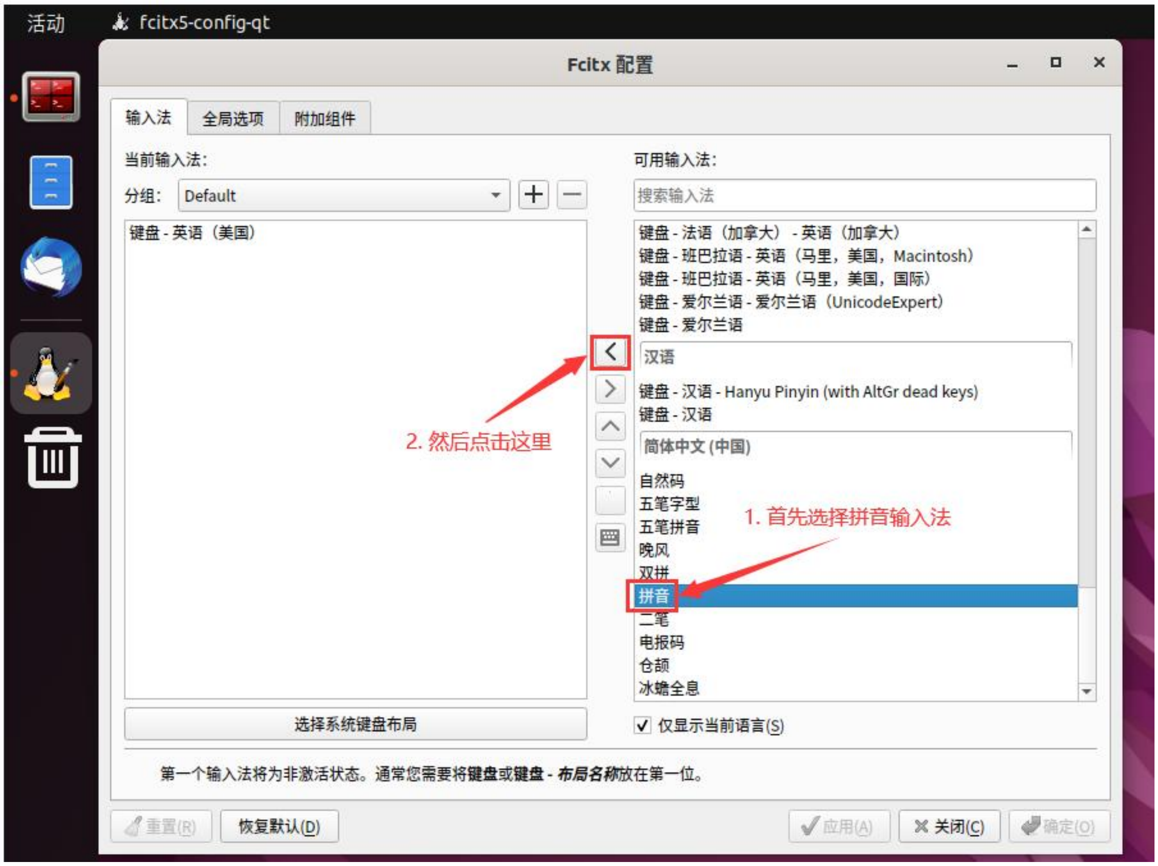
7) Then you can see that the desktop is displayed in Chinese



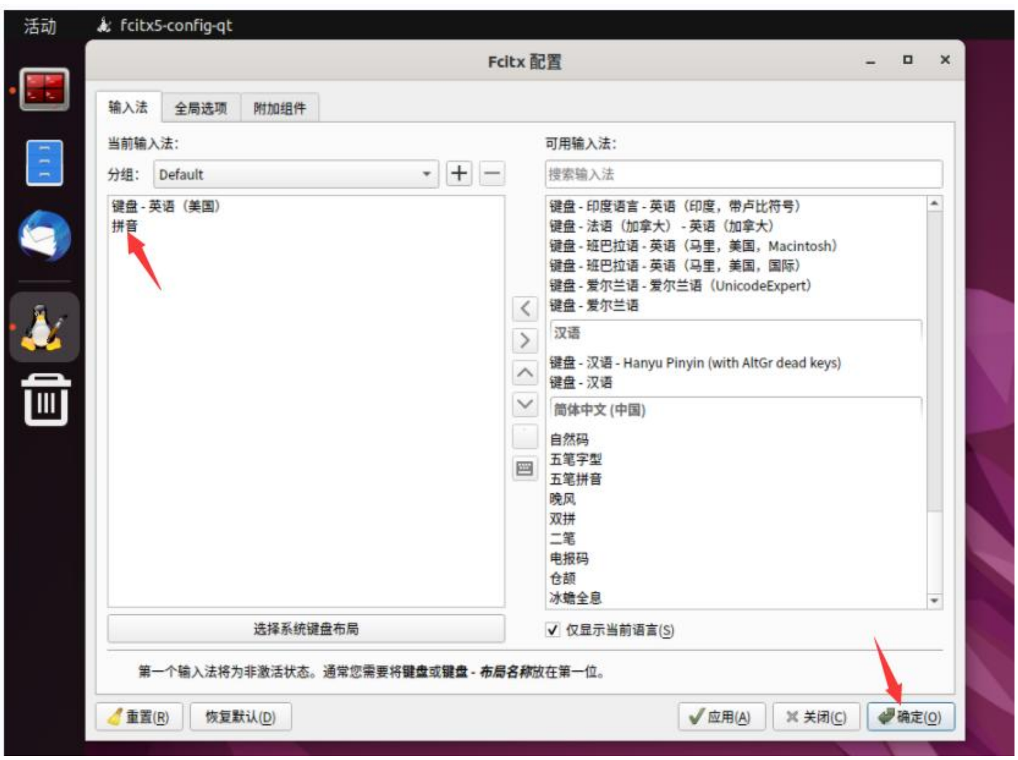
8) Then open the Fcitx5 configuration program



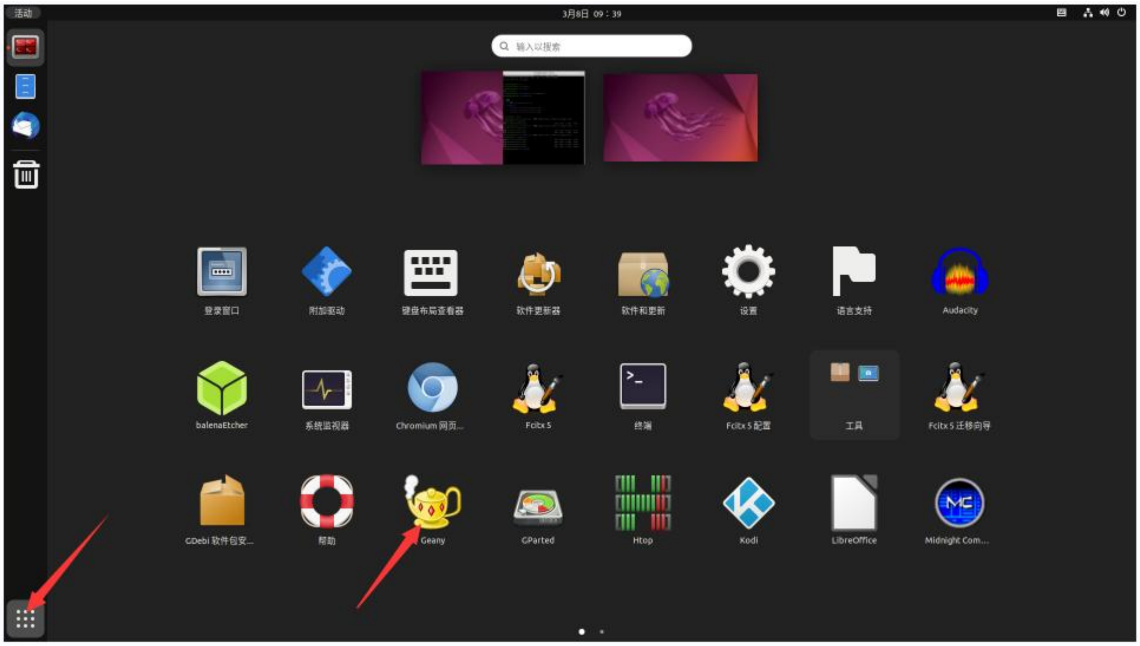
9) Then choose to use Pinyin input method



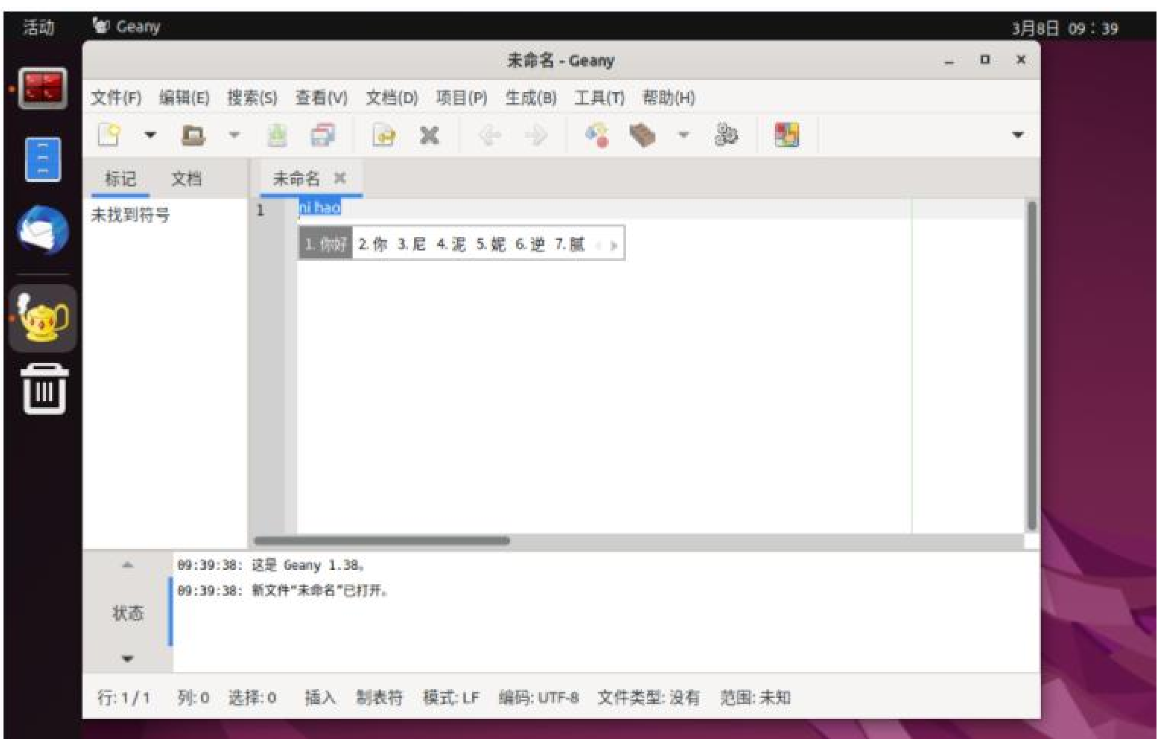
10) The interface after selection is as shown below, and then click OK



11) Then we can open **Geany** to test the Chinese input method, as shown in the figure below.



12) After opening **Geany,** the default is English input method, we can switch to Chinese input method through **Ctrl+Space** shortcut key, and then we can input Chinese



5. Linux SDK——Orange Pi Build Instruction

5. 1. Compile system requirements

We can compile the linux image of the development board in the x64 computer, or compile the linux image of the development board in the Ubuntu22.04 system of the development board, Please choose one according to your preference.

If you use orangepi-build to compile the Linux image in the Ubuntu22.04 system of the development board to compile the Linux image, please do heat dissipation, especially when SSD startup. If the heat dissipation is not done well, it is prone to error in the file system running.

5. 1. 1. Use the development board Ubuntu 22.04 system to compile

1) Linux SDK, orangepi-build, supports the upper operation of the development board's **Ubuntu 22.04** (other systems have not been tested), so before downloading Orangepi-Build, first make sure that the Ubuntu version installed on the development board is Ubuntu 22.04. The command of the Ubuntu version installed on the development board is shown below. If the Release field is not **22.04,** it means that the current Ubuntu version does not meet the requirements. Please replace the system before performing the following operations.

```
orangepi@orangepi:~$ lsb_release -a
No LSB modules are available.
Distributor ID:    Ubuntu
Description:       Ubuntu 22.04.1 LTS
Release:           22.04
Codename:          jammy
```

2) Since the source code such as kernel and U-Boot is stored on GitHub, it is very important to ensure that the development board can download the code from GitHub normally when compiling image.

5. 1. 2. Use X64's Ubuntu 22.04 computer to compile

1) Linux SDK, orangepi-build, supports running on a computer with **Ubuntu 22.04,** so before downloading Orangepi-Build, first make sure that the Ubuntu version of your computer installed is Ubuntu 22.04. Check the command of the Ubuntu version installed by the computer as shown below. If the release field is not **22.04**, it means that the current Ubuntu version does not meet the requirements. Please replace the system before performing the following operations.

```
test@test:~$ lsb_release -a
No LSB modules are available.
Distributor ID:     Ubuntu
Description:        Ubuntu 22.04 LTS
Release:            22.04
Codename:           jammy
```

2) If the computer is installed with a Windows system, there is no computer with Ubuntu 22.04, you can consider using **VirtualBox** or **VMware** to install a Ubuntu 22.04 virtual machine in the Windows system. But please note that Orange-Build is compiled on the WSL virtual machine. Because Orangepi-BUILD has not been tested in the WSL virtual machine, it cannot be ensured that it can use Orangepi-Build in WSL. orangepi-build.

3) Ubuntu 22.04 **amd64** version installation image download address is:

```
https://mirrors.tuna.tsinghua.edu.cn/ubuntu-releases/22.04/ubuntu-22.04-desktop-amd64.iso
OR
https://repo.huaweicloud.com/ubuntu-releases/22.04/ubuntu-22.04.1-desktop-amd64.iso
```

4) After installing Ubuntu 22.04 in the computer or virtual machine, please set up the software source of Ubuntu 22.04 as a Tsinghua source first, otherwise it is easy to make mistakes due to network reasons when installing the software later.

a. The method of replacing Tsinghua source refer to the instructions of this webpage

```
https://mirrors.tuna.tsinghua.edu.cn/help/ubuntu/
```

b. Note that the Ubuntu version needs to be switched 22.04

c. The content of the /etc/apt/sources.list file that needs to be replaced is

```
test@test:~$ sudo mv /etc/apt/sources.list /etc/apt/sources.list.bak
test@test:~$ sudo vim /etc/apt/sources.list
# The source code image is annotated by default to improve the speed of APT Update. If necessary, you can cancel the annotation by yourself.
deb https://mirrors.tuna.tsinghua.edu.cn/ubuntu/ jammy main restricted universe multiverse
# deb-src https://mirrors.tuna.tsinghua.edu.cn/ubuntu/ jammy main restricted universe multiverse
deb https://mirrors.tuna.tsinghua.edu.cn/ubuntu/ jammy-updates main restricted universe multiverse
# deb-src https://mirrors.tuna.tsinghua.edu.cn/ubuntu/ jammy-updates main restricted universe multiverse
deb https://mirrors.tuna.tsinghua.edu.cn/ubuntu/ jammy-backports main restricted universe multiverse
# deb-src https://mirrors.tuna.tsinghua.edu.cn/ubuntu/ jammy-backports main restricted universe multiverse
deb https://mirrors.tuna.tsinghua.edu.cn/ubuntu/ jammy-security main restricted universe multiverse
# deb-src https://mirrors.tuna.tsinghua.edu.cn/ubuntu/ jammy-security main restricted universe multiverse

# Pre -release software sources, it is not recommended to enable
# deb https://mirrors.tuna.tsinghua.edu.cn/ubuntu/ jammy-proposed main restricted universe multiverse
# deb-src https://mirrors.tuna.tsinghua.edu.cn/ubuntu/ jammy-proposed main restricted universe multiverse
```

d. After replacement, you need to update the package information and make sure there is no error

```
test@test:~$ sudo apt update
```

e. In addition, because the source code such as kernel and U-Boot is stored on GitHub, please make sure that the computer can download the code normally when compiling images, which is very important.

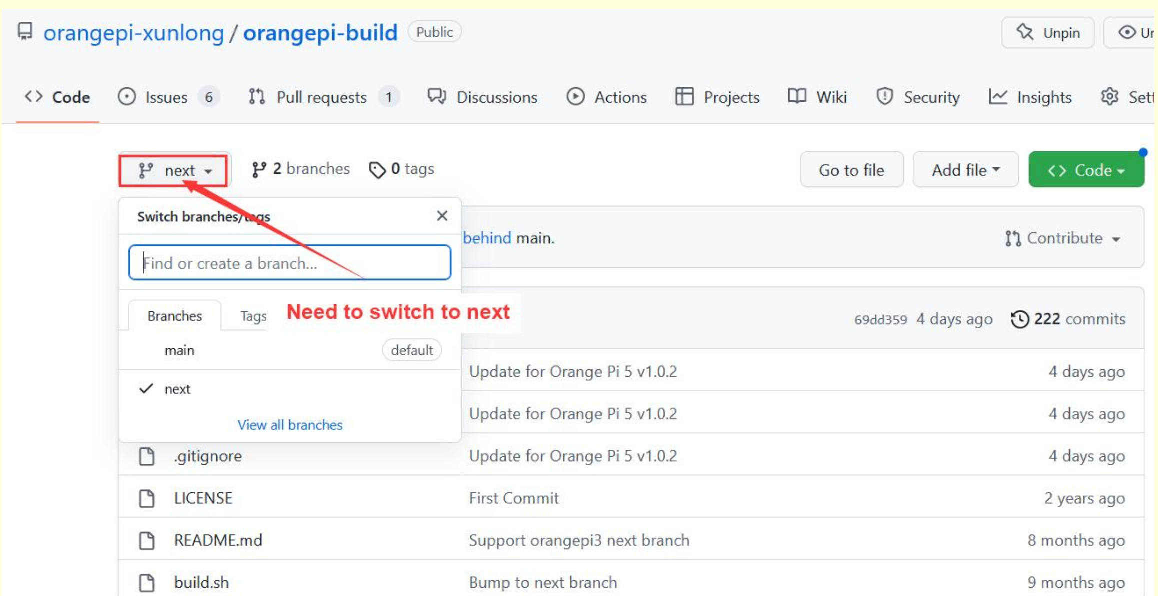
5. 2. Get the source code of linux sdk

5. 2. 1. Download orangepi-build from github

1) Linux sdk actually refers to the Orange-Build code. Orangepi-Build is modified based on the Armbian Build compilation system. OrangePi-Build can compile multiple version of Linux images. First download the code-build code, and the command is shown below:

```
test@test:~$ sudo apt-get update
test@test:~$ sudo apt-get install -y git
test@test:~$ git clone https://github.com/orangepi-xunlong/orangepi-build.git -b next
```

Note that the Orange Pi 5 development board needs to download the next branch source code of orangepi-build. The Git Clone command above needs to specify the branch of orangepi-build source code to next.



Download orangepi-build code through the git clone command is the user name and password that does not need to enter the GitHub account (the same is the same for downloading other code in this manual). Names and passwords are usually input errors in the address input of OrangePi Build repository behind Git Clone. Please check the command whether there is any error in the command, instead of thinking that we have forgotten the username and password of the github account here.

2) The u-boot and linux kernel versions currently used in the development board are shown below

Branch	u-boot version	linux Kernel version
legacy	u-boot 2017.09	linux5.10

The branches mentioned here are not the same thing as orangepi-build source code, please do not confuse. This branch is mainly used to distinguish different kernel source code.

At present, the linux 5.10 bsp kernel provided by RK is defined as the legacy branch. If the main line is supported in the future, a Current branch will be added.

3) orangepi-build will contain the following files and folders after download

a. **build.sh**: Compile the startup script
b. **external**: Including configuration files, specific scripts, and source code of some programs, etc.
c. **LICENSE**: GPL 2 License
d. **README.md**: orangepi-build description file
e. **scripts**: General script compiled Linux image

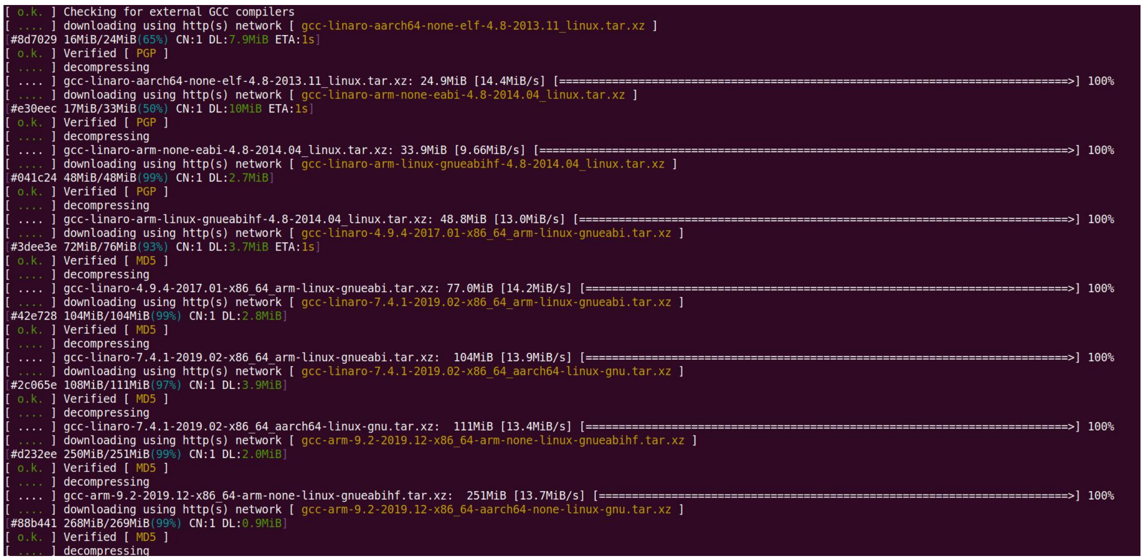
```
test@test:~/orangepi-build$ ls
build.sh    external    LICENSE    README.md    scripts
```

If the orangepi-build code downloaded from github, you may find that after downloading, you may find that orangepi-build does not include the source code of the U-Boot and Linux kernels, nor does it compile the U-Boot and Linux kernel needs to be used. Chain, this is normal, because these things are stored in other separate GitHub warehouses or some servers (the address will be described in detail below). orangepi-build will specify the address of the U-Boot, Linux kernel and cross compilation tool chain in the script and configuration file. When running Orange-Build, when it is found that there are no these things in the local area, it will automatically download the corresponding places.

5. 2. 2. Download the cross compilation tool chain

Only by using orangepi-build to compile images in the x64 computer, the cross compile tool chain is downloaded. The Linux image compiled to compile the development board in the development board's Ubuntu 22.04 will not download the cross compilation tool chain. At this time, orangepi-build/toolchains will be an empty folder.

1) orangepi-build will automatically download the cross-compile tool chain in the **toolchains** folder when running for the first time. After running Orangepi-Build's build.sh script every time, it will check whether the cross compile toolchain in **toolchains** exists. If there is no existence, it will start downloading again. If it exists, it will be used directly and will not be downloaded repeatedly.



```
[ o.k. ] Checking for external GCC compilers
[ .... ] downloading using http(s) network [ gcc-linaro-aarch64-none-elf-4.8-2013.11_linux.tar.xz ]
[#8d7029 16MiB/24MiB(65%) CN:1 DL:7.9MiB ETA:1s]
[ o.k. ] Verified [ PGP ]
[ .... ] decompressing
[ .... ] gcc-linaro-aarch64-none-elf-4.8-2013.11_linux.tar.xz: 24.9MiB [14.4MiB/s] [==========================================>] 100%
[ .... ] downloading using http(s) network [ gcc-linaro-arm-none-eabi-4.8-2014.04_linux.tar.xz ]
[#e30eec 17MiB/33MiB(50%) CN:1 DL:10MiB ETA:1s]
[ o.k. ] Verified [ PGP ]
[ .... ] decompressing
[ .... ] gcc-linaro-arm-none-eabi-4.8-2014.04_linux.tar.xz: 33.9MiB [9.66MiB/s] [==========================================>] 100%
[ .... ] downloading using http(s) network [ gcc-linaro-arm-linux-gnueabihf-4.8-2014.04_linux.tar.xz ]
[#041c24 48MiB/48MiB(99%) CN:1 DL:2.7MiB]
[ o.k. ] Verified [ PGP ]
[ .... ] decompressing
[ .... ] gcc-linaro-arm-linux-gnueabihf-4.8-2014.04_linux.tar.xz: 48.8MiB [13.0MiB/s] [==========================================>] 100%
[ .... ] downloading using http(s) network [ gcc-linaro-4.9.4-2017.01-x86_64_arm-linux-gnueabi.tar.xz ]
[#3dee3e 72MiB/76MiB(93%) CN:1 DL:3.7MiB ETA:1s]
[ o.k. ] Verified [ MD5 ]
[ .... ] decompressing
[ .... ] gcc-linaro-4.9.4-2017.01-x86_64_arm-linux-gnueabi.tar.xz: 77.0MiB [14.2MiB/s] [==========================================>] 100%
[ .... ] downloading using http(s) network [ gcc-linaro-7.4.1-2019.02-x86_64_arm-linux-gnueabi.tar.xz ]
[#42e728 104MiB/104MiB(99%) CN:1 DL:2.8MiB]
[ o.k. ] Verified [ MD5 ]
[ .... ] decompressing
[ .... ] gcc-linaro-7.4.1-2019.02-x86_64_arm-linux-gnueabi.tar.xz:  104MiB [13.9MiB/s] [==========================================>] 100%
[ .... ] downloading using http(s) network [ gcc-linaro-7.4.1-2019.02-x86_64_aarch64-linux-gnu.tar.xz ]
[#2c065e 108MiB/111MiB(97%) CN:1 DL:3.9MiB]
[ o.k. ] Verified [ MD5 ]
[ .... ] decompressing
[ .... ] gcc-linaro-7.4.1-2019.02-x86_64_aarch64-linux-gnu.tar.xz:  111MiB [13.4MiB/s] [==========================================>] 100%
[ .... ] downloading using http(s) network [ gcc-arm-9.2-2019.12-x86_64-arm-none-linux-gnueabihf.tar.xz ]
[#d232ee 250MiB/251MiB(99%) CN:1 DL:2.0MiB]
[ o.k. ] Verified [ MD5 ]
[ .... ] decompressing
[ .... ] gcc-arm-9.2-2019.12-x86_64-arm-none-linux-gnueabihf.tar.xz:  251MiB [13.7MiB/s] [==========================================>] 100%
[ .... ] downloading using http(s) network [ gcc-arm-9.2-2019.12-x86_64-aarch64-none-linux-gnu.tar.xz ]
[#88b441 268MiB/269MiB(99%) CN:1 DL:0.9MiB]
[ o.k. ] Verified [ MD5 ]
[ .... ] decompressing
```

2) The image website of the cross-compilation tool chain in China is the open source software image station of Tsinghua University.

https://mirrors.tuna.tsinghua.edu.cn/armbian-releases/_toolchain/

3) After the download of **toolchains** is downloaded, it will contain multiple versions of cross compilation tool chain. The development board will only use two of them.

```
test@test:~/orangepi-build$ ls toolchains/
gcc-arm-11.2-2022.02-x86_64-aarch64-none-linux-gnu
gcc-arm-11.2-2022.02-x86_64-arm-none-linux-gnueabihf
gcc-arm-9.2-2019.12-x86_64-aarch64-none-linux-gnu
gcc-arm-9.2-2019.12-x86_64-arm-none-linux-gnueabihf
gcc-linaro-4.9.4-2017.01-x86_64_arm-linux-gnueabi
gcc-linaro-5.5.0-2017.10-x86_64_arm-linux-gnueabihf
gcc-linaro-7.4.1-2019.02-x86_64_aarch64-linux-gnu
gcc-linaro-7.4.1-2019.02-x86_64_arm-linux-gnueabi
gcc-linaro-aarch64-none-elf-4.8-2013.11_linux
gcc-linaro-arm-linux-gnueabihf-4.8-2014.04_linux
```

```
gcc-linaro-arm-none-eabi-4.8-2014.04_linux
```

4) The cross compilation tool chain used by compiling the linux kernel source code is
   a. linux5.10

```
gcc-arm-11.2-2022.02-x86_64-aarch64-none-linux-gnu
```

5) The cross compilation tool chain used by compiling the u-boot source code is
   a. v2017.09

```
gcc-linaro-7.4.1-2019.02-x86_64_aarch64-linux-gnu
```

5. 2. 3. orangepi-build complete directory structure description

1) orangepi-build warehouse does not include Linux kernel, u-boot source code, and cross compilation tool chain after downloading

   a. The git warehouse stored in the Linux kernel source code is shown below：

```
https://github.com/orangepi-xunlong/linux-orangepi/tree/orange-pi-5.10-rk3588
```

   b. The git warehouse stored in the u-boot source code is shown below：

```
https://github.com/orangepi-xunlong/u-boot-orangepi/tree/v2017.09-rk3588https://github.com/orangepi-xunlong/u-boot-orangepi/tree/v2018.05-sun50iw9
```

2) orangepi-build will download the cross compile tool chain, u-boot, and Linux kernel source code when running the first run. After successfully compiling the Linux image, there are files and folders that can be seen in orangepi-build.

   a. **build.sh**: Compile the startup script
   b. **external**: Including the configuration file, a specific function script, and the
   c. source code of some programs need to be used. The rootfs compression packet that has been cached during the compile image is also stored in externa.
   d. **kernel**: The source code stored in the Linux kernel, which is **orange-pi-5.10-rk3588** folder is stored in the RK3588/RK3588S series of the kernel source code of the legacy branch. Please do not modify the name of the file folder of the kernel source. The kernel source code will be downloaded again when the compilation system is running.
   e. **LICENSE**: GPL 2 License
   f. **README.md**: orangepi-build description file
   g. **output**: Linux and other deb bags, compile logs, and compile-generated images and other files
   h. **scripts**: General script compiled Linux image

i. **toolchains**: Staying cross compilation tool chain

j. **u-boot**: The source code stored in u-boot, which is called **v2017.09-rk3588**, is stored in the RK3588/RK3588S series of the u-boot source code of the legacy branch. Modified, the U-Boot source code will be downloaded again when the compilation system is running.

k. **userpatches**: Store the configuration file needed to be used in the compilation script

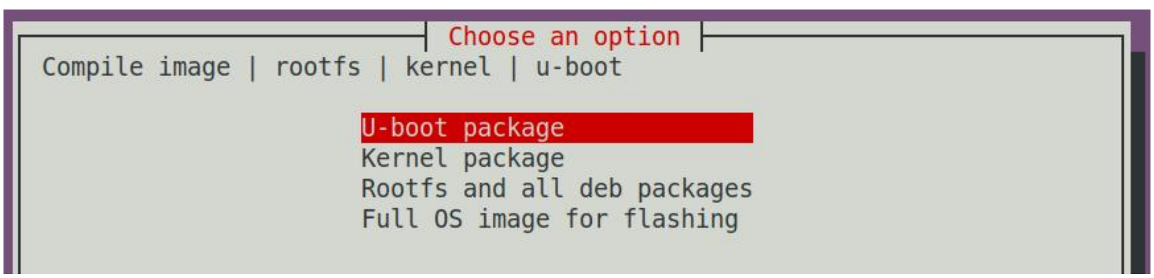
```
test@test:~/orangepi-build$ ls
build.sh    external    kernel    LICENSE    output    README.md    scripts
toolchains    u-boot    userpatches
```

5. 3. Compile u-boot

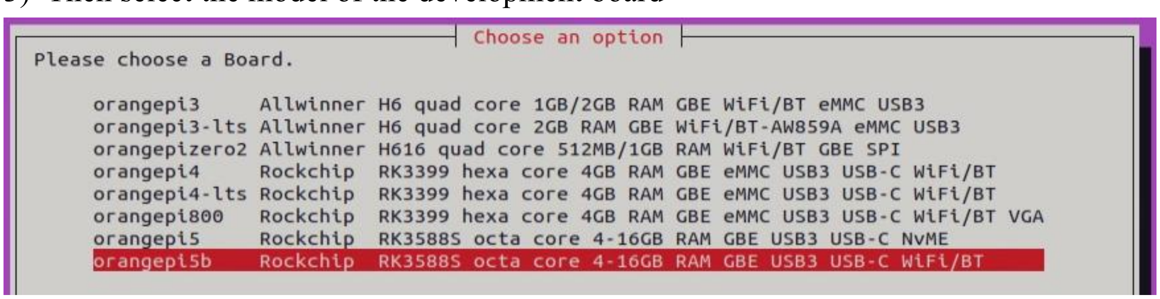
1) Run the build.sh script, remember to add Sudo permissions

```
test@test:~/orangepi-build$ sudo ./build.sh
```

2) Select **U-boot package**, then press Enter



3) Then select the model of the development board



4) Then I will start to compile u-boot, and the part of the information prompted during compilation will be as follow

a. u-boot Source code version

```
[ o.k. ] Compiling u-boot [ v2017.09 ]
```

b. The version of the cross compile toolchain

```
[ o.k. ] Compiler version [ aarch64-linux-gnu-gcc 7.4.1 ]
```

c. The path of the u-boot deb package generated by compilation.

```
[ o.k. ] Target directory [ orangepi-build/output/debs/u-boot ]
```

d. The package name of the compiled u-boot deb package

```
[ o.k. ] File name [ linux-u-boot-legacy-orangepi5b_1.0.0_arm64.deb ]
```

e. Time to compile

```
[ o.k. ] Runtime [ 1 min ]
```

f. Repeat the command of the u-boot. Use the following commands to select the u-boot directly through the graphic interface

```
[ o.k. ] Repeat Build Options [ sudo ./build.sh BOARD=orangepi5b BRANCH=legacy
BUILD_OPT=u-boot KERNEL_CONFIGURE=no ]
```

5) View compiled u-boot deb package

```
test@test:~/orangepi-build$ ls output/debs/u-boot/
linux-u-boot-legacy-orangepi5b_1.0.0_arm64.deb
```

6) The file contained in the deb package generated by the generated u-boot is shown below

a. Use the following commands to decompress the deb package

```
test@test:~/orangepi-build$ cd output/debs/u-boot
test@test:~/orangepi_build/output/debs/u-boot$ $ dpkg -x \
linux-u-boot-legacy-orangepi5b_1.0.0_arm64.deb .    (Note that there is a "." at the
end of the command)
test@test:~/orangepi_build/output/debs/u-boot$ ls
linux-u-boot-legacy-orangepi5b_1.0.0_arm64.deb    usr
```

b. The file after decompression is shown below

```
test@test:~/orangepi-build/output/debs/u-boot$ tree usr
usr
└── lib
    ├── linux-u-boot-legacy-orangepi5b_1.0.0_arm64
    │   ├── idbloader.img
    │   ├── rkspi_loader.img
    │   └── u-boot.itb
```

```
    └── u-boot
        ├── LICENSE
        ├── orangepi_5_defconfig
        └── platform_install.sh

3 directories, 6 files
```

7) When orangepi-bulid compile system compile u-boot source code, the source code of u-boot is first synchronized with the u-boot source code of the github server. Therefore, if you want to modify the source code of the u-boot, you need to close the download and update function of the source code（**You need to compile the u-boot once to close this feature, otherwise you will not be prompted to find the source code of the u-boot. If it is downloaded from the source code compression package from Google Drive, there is no such problem because the source code of U-Boot is all the source code of u-boot. It has been cached.**), Otherwise, the modifications will be restored, and the method is as follows:

Set the IGNORE_UPDATES variable in userpatches/config-default.conf to "yes"

```
test@test:~/orangepi-build$ vim userpatches/config-default.conf
IGNORE_UPDATES="yes"
```

8) When debugging the u-boot code, you can use the following method to update U-Boot in the Linux image for testing

a. Upload the compiled U-Boot DEB package to the Linux system of the development board

```
test@test:~/orangepi-build$ cd output/debs/u-boot
test@test:~/orangepi_build/output/debs/u-boot$ scp \
linux-u-boot-legacy-orangepi5b_1.0.0_arm64.deb root@192.168.1.xxx:/root
```

b. Then log in to the development board and uninstall the installed u-boot deb package

```
root@orangepi:~# apt purge -y linux-u-boot-orangepi5b-legacy
```

c. Install the new u-boot deb package just uploaded

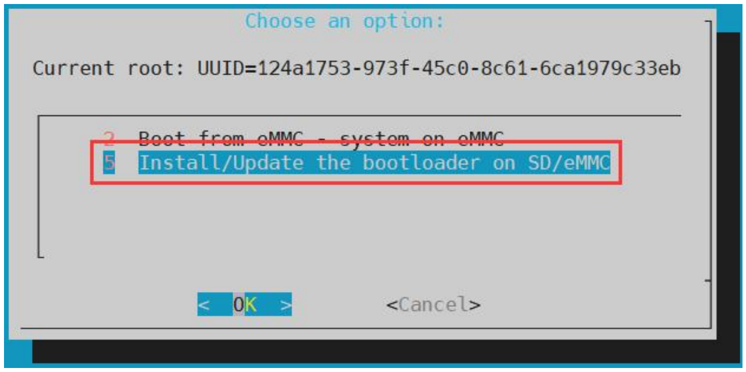
```
root@orangepi:~# dpkg -i linux-u-boot-legacy-orangepi5b_1.0.0_arm64.deb
```

d. Then run nand-sata-install script

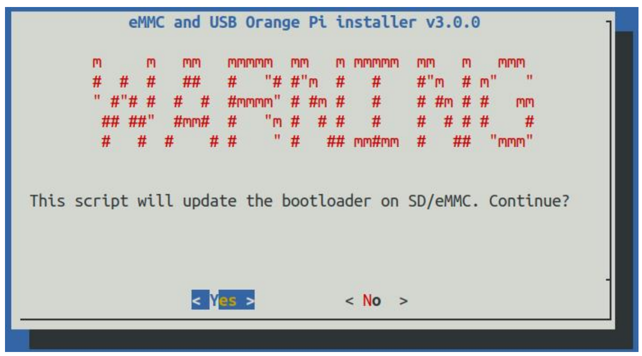
```
root@orangepi:~# nand-sata-install
```

e. Then select 5 **5 Install/Update the bootloader on SD/eMM** to update the

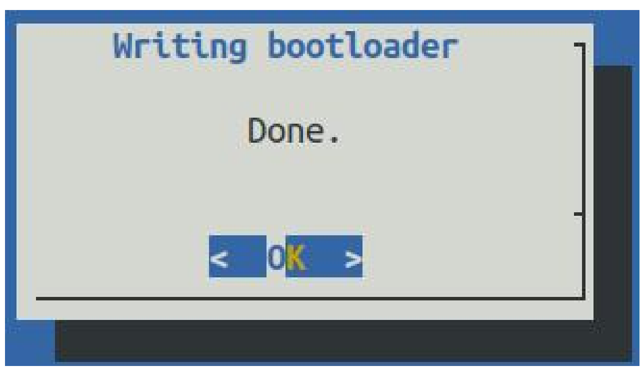
U-Boot（If it is a linux system started by eMMC, the update is u-boot in eMMC）



f. After pressing the Enter key, a warring will pop up first



g. Press the cabbage key to update the U-Boot, and the following information will be displayed after the update



h. Then you can restart the development board to test whether the modification of the U-Boot has taken effect

9) Other useful information

a. u-boot 2017.09 Source code, the Defconfig configuration file used in the development board is

```
orangepi-build/u-boot/v2017.09-rk3588/configs/orangepi_5b_defconfig
```

b. u-boot 2017.09 Source code, the development board uses a dts file.

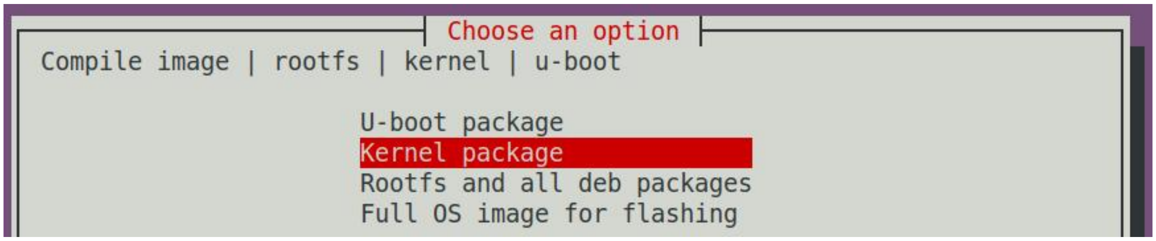
orangepi-build/u-boot/v2017.09-rk3588/arch/arm/dts/rk3588s-orangepi-5b.dts

Compile the linux kernel

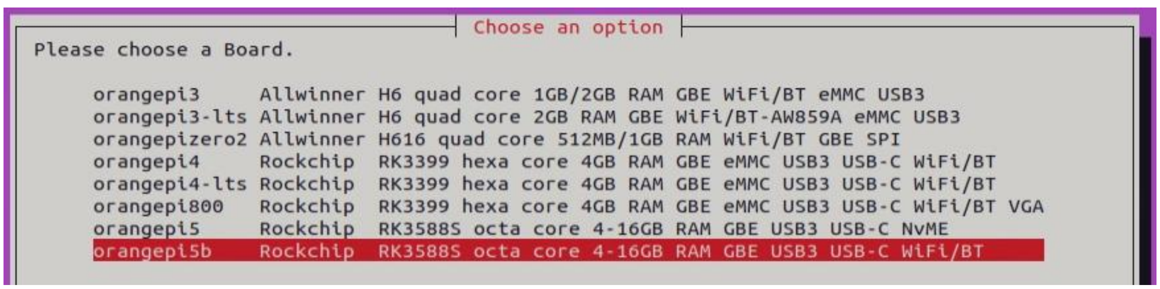
1) Run the build.sh script, remember to add Sudo permission

```
test@test:~/orangepi-build$ sudo ./build.sh
```

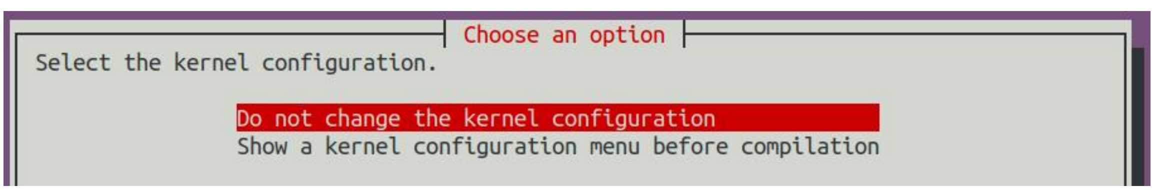
2) Select **Kernel package** and press Enter



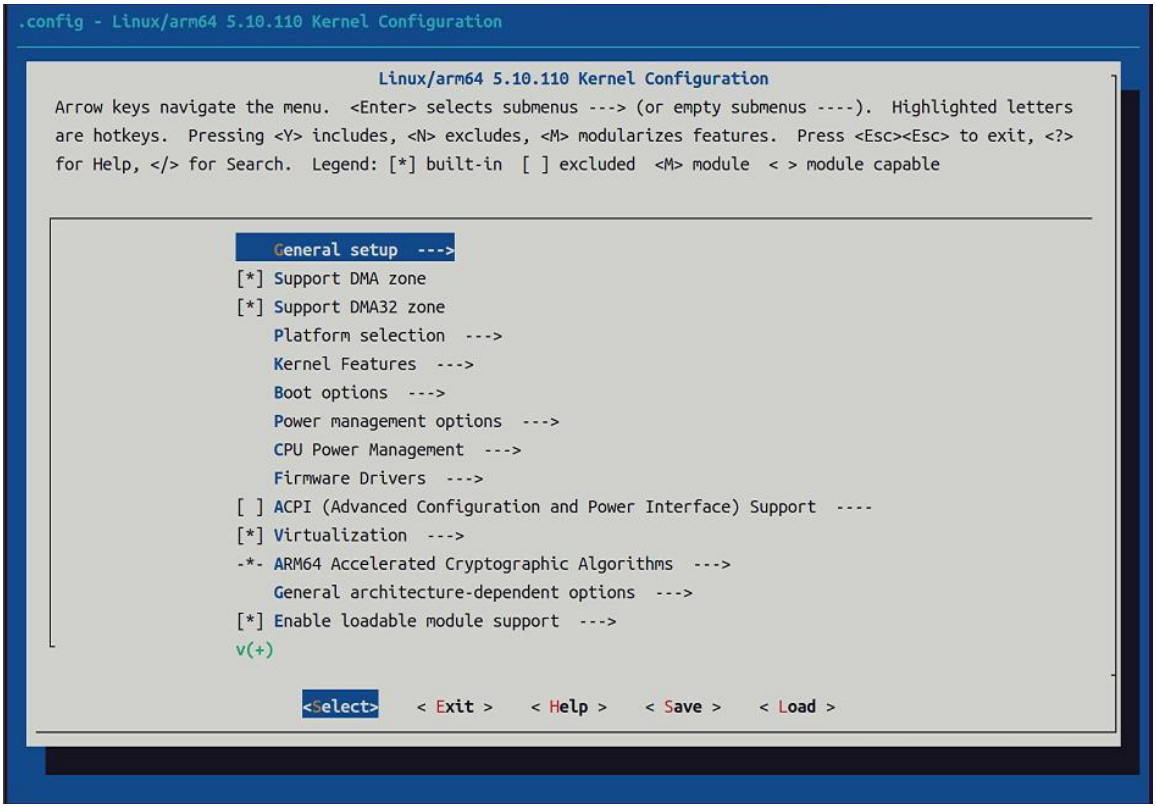
3) Then select the model of the development board



4) Then it will be prompted whether the kernel configuration interface needs to be displayed. If the kernel configuration is not required, select the first one. If you need to modify the kernel configuration, select the second one



5) If the step 4 is selected to display the kernel configuration menu (the second option), the interface of the kernel configuration opened through the **make menuconfig** will pop up. At this time, you can directly modify the kernel configuration. However, after exiting, the kernel source code will be compiled.



a. If you do not need to modify the configuration option of the kernel, when running the build.sh script,Passing the **KERNEL_CONFIGURE=no** to temporarily shield the configuration interface of the pop -up kernel.

```
test@test:~/orangepi-build$ sudo ./build.sh KERNEL_CONFIGURE=no
```

b. You can also set **orangepi-build/user patches/config-default.conf** configuration file. **KERNEL_CONFIGURE=no**, which can permanently disable this function.

c. When compiling the kernel, if the error is prompted, this is because the terminal interface of the Ubuntu PC is too small, causing the interface of the **make menuconfig** to be displayed.Please maximize the terminal of Ubuntu PC, and then rerun the build.sh script.

```
  HOSTCC  scripts/kconfig/mconf.o
  HOSTCC  scripts/kconfig/lxdialog/checklist.o
  HOSTCC  scripts/kconfig/lxdialog/util.o
  HOSTCC  scripts/kconfig/lxdialog/inputbox.o
  HOSTCC  scripts/kconfig/lxdialog/textbox.o
  HOSTCC  scripts/kconfig/lxdialog/yesno.o
  HOSTCC  scripts/kconfig/lxdialog/menubox.o
  HOSTLD  scripts/kconfig/mconf
scripts/kconfig/mconf  Kconfig
Your display is too small to run Menuconfig!
It must be at least 19 lines by 80 columns.
scripts/kconfig/Makefile:28: recipe for target 'menuconfig' failed
make[1]: *** [menuconfig] Error 1
Makefile:560: recipe for target 'menuconfig' failed
make: *** [menuconfig] Error 2
[ error ] ERROR in function compile_kernel [ compilation.sh:376 ]
[ error ] Error kernel menuconfig failed
[ o.k. ] Process terminated
```

6) Part of the information prompted when compiling the kernel source code

a. Linux kernel source version

[o.k.] Compiling current kernel [**5.10.110**]

b. The version of the cross compilation tool chain used

[o.k.] Compiler version [**aarch64-none-linux-gnu-gcc 11.2.1**]

c. The configuration file used by the core and the path it stored

[o.k.] Using kernel config file [**config/kernel/linux-rockchip-rk3588-legacy.config**]

d. The path of the compiled kernel-related deb package

[o.k.] Target directory [**orangepi-build/output/debs/**]

e. Compiled and generated kernel images deb bag name

[o.k.] File name [**linux-image-legacy-rockchip-rk3588_1.0.0_arm64.deb**]

f. The time of compilation and use

[o.k.] Runtime [**5 min**]

g. Finally, the compilation command of the kernel selected repeatedly will be displayed. The following commands are not selected by the graphic interface, and the kernel source code can be directly compiled

[o.k.] Repeat Build Options [**sudo ./build.sh BOARD=orangepi5b BRANCH=legacy BUILD_OPT=kernel KERNEL_CONFIGURE=no**]

7) View compiled core -related deb package

a. **linux-dtb-legacy-rockchip-rk3588_1.0.0_arm64.deb** containing kernels dtb file

b. **linux-headers-legacy-rockchip-rk3588_1.0.0_arm64.deb** Contains kernel header files

c. **linux-image-legacy-rockchip-rk3588_1.0.0_arm64.deb** Contains kernel images and kernel modules

```
test@test:~/orangepi-build$ ls output/debs/linux-*
output/debs/linux-dtb-legacy-rockchip-rk3588_1.0.0_arm64.deb
output/debs/linux-image-legacy-rockchip-rk3588_1.0.0_arm64.deb
output/debs/linux-headers-legacy-rockchip-rk3588_1.0.0_arm64.deb
```

8) The file contained in the deb package generated by the generated linux-image is shown below

a. Use the following commands to decompress the deb package

```
test@test:~/orangepi-build$ cd output/debs
test@test:~/orangepi_build/output/debs$ mkdir test
test@test:~/orangepi_build/output/debs$ cp \
linux-image-legacy-rockchip-rk3588_1.0.0_arm64.deb test/
test@test:~/orangepi_build/output/debs$ cd test
test@test:~/orangepi_build/output/debs/test$ dpkg -x \
linux-image-legacy-rockchip-rk3588_1.0.0_arm64.deb .
test@test:~/orangepi_build/output/debs/test$ ls
boot   etc   lib   linux-image-legacy-rockchip-rk3588_1.0.0_arm64.deb   usr
```

b. The decompressive file is shown below

```
test@test:~/orangepi-build/output/debs/test$ tree -L 2
.
├── boot
│   ├── config-5.10.110-rockchip-rk3588
│   ├── System.map-5.10.110-rockchip-rk3588
│   └── vmlinuz-5.10.110-rockchip-rk3588
├── etc
│   └── kernel
├── lib
│   └── modules
├── linux-image-legacy-rockchip-rk3588_1.0.0_arm64.deb
└── usr
    ├── lib
    └── share
```

9) orangepi-bulid compile system compiles Linux kernel source code first will synchronize the Linux kernel source code with the Linux kernel source code of the

GitHub server. If you want to modify the source code of the Linux kernel, you need to close the update function of the source code（**need to compile it completely once. This function can be closed after the Linux kernel source code, otherwise it will be prompted that the source code of the Linux kernel cannot be found. If it is downloaded from the source code compressed from the Google Drive, there is no such problem, because the source code of Linux has been cached**）, otherwise, the modification will be restored, the method is as follows:

Set the IGNORE_UPDATES variable in **userpatches/config-default.conf** to "yes"

```
test@test:~/orangepi-build$ vim userpatches/config-default.conf
IGNORE_UPDATES="yes"
```

10) If you modify the kernel, you can use the following method to update the kernel and kernel module of the development board Linux system

a. Upload the compiled deb package in Linux kernel to be uploaded to the Linux system of the development board

```
test@test:~/orangepi-build$ cd output/debs
test@test:~/orangepi-build/output/debs$ scp \
linux-image-legacy-rockchip-rk3588_1.0.0_arm64.deb root@192.168.1.xxx:/root
```

b. Then log in to the development board, install the installed Linux kernel deb bag

```
root@orangepi:~# apt purge -y linux-image-legacy-rockchip-rk3588
```

c. Install the deb package in the new Linux kernel that just uploaded up

```
root@orangepi:~# dpkg -i linux-image-legacy-rockchip-rk3588_1.0.0_arm64.deb
```

d. Then restart the development board, and then check whether the kernel -related modification has taken effect.

```
root@orangepi:~# reboot
```

10) Other useful infor

a. The kernel configuration file storage position is shown below. Please do not go to the kernel source code to find the kernel configuration file used in the development board

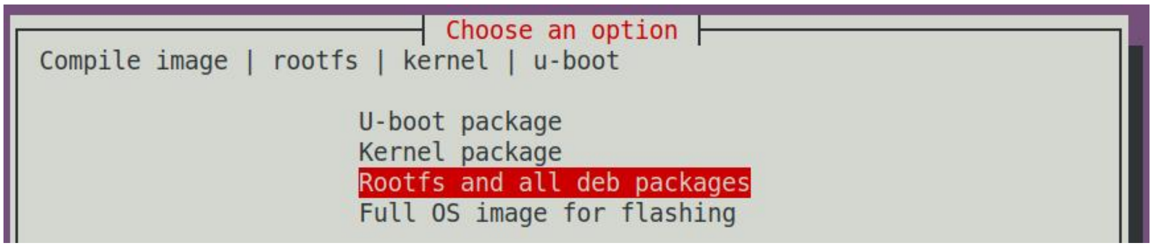
```
orangepi-build/external/config/kernel/linux-rockchip-rk3588-legacy.config
 The location of the dts file used in the development board is
orangepi-build/kernel/orange-pi-5.10-rk3588/arch/arm64/boot/dts/rockchip/rk3588s
-orangepi-5b.dts
```

5. 4. Compile rootfs

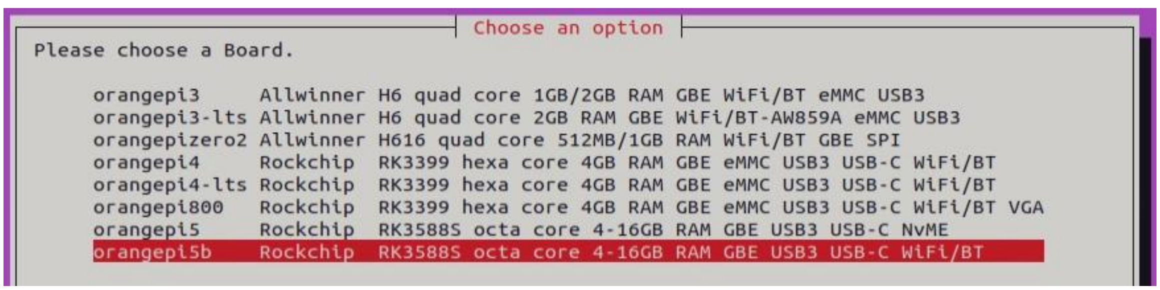
1) Run the build.sh script, remember to add Sudo permissions

```
test@test:~/orangepi-build$ sudo ./build.sh
```

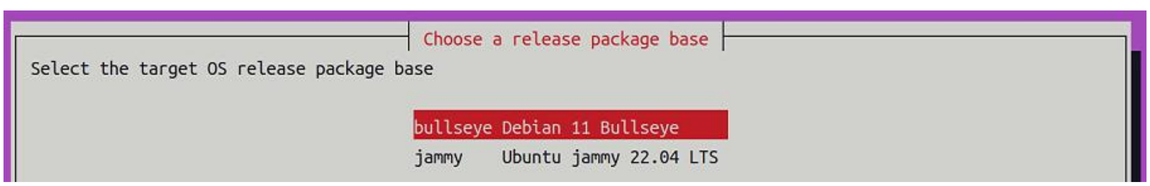
2) Select **Rootfs and all deb packages,** and then press Enter



3) Then select the model of the development board



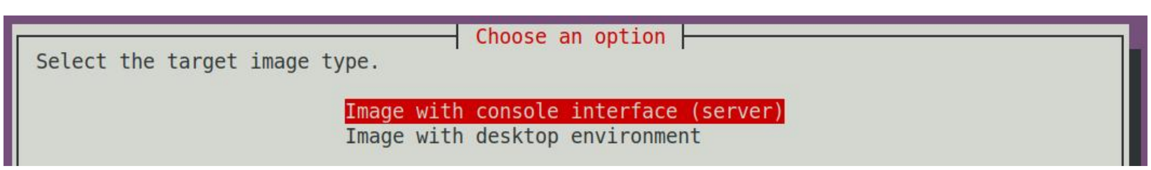
4) Then select the type of rooot fs



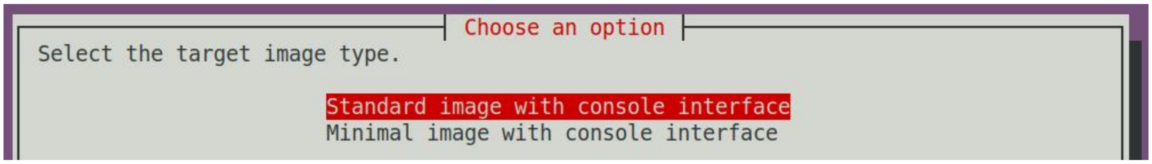
5) Then select the type of the image

a. **Image with console interface (server)** Indicates the image of the server version, the volume is small

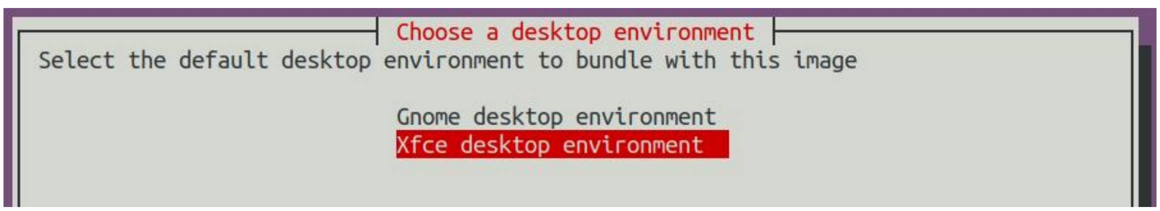
b. **Image with desktop environment** Indicates an image with a desktop, which is relatively large

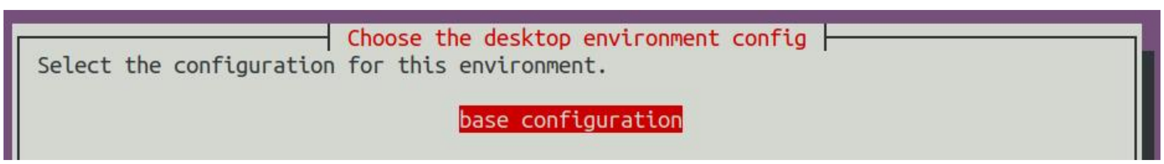


6) If it is a image that compiles the server version, you can also choose to compile the standard version or the minimal version. The pre -installed software pre -installed software will be much less than the Standard version.（**No special needs, please do not choose the minimal version, because many things are not pre -installed by default, some functions may not be used**）

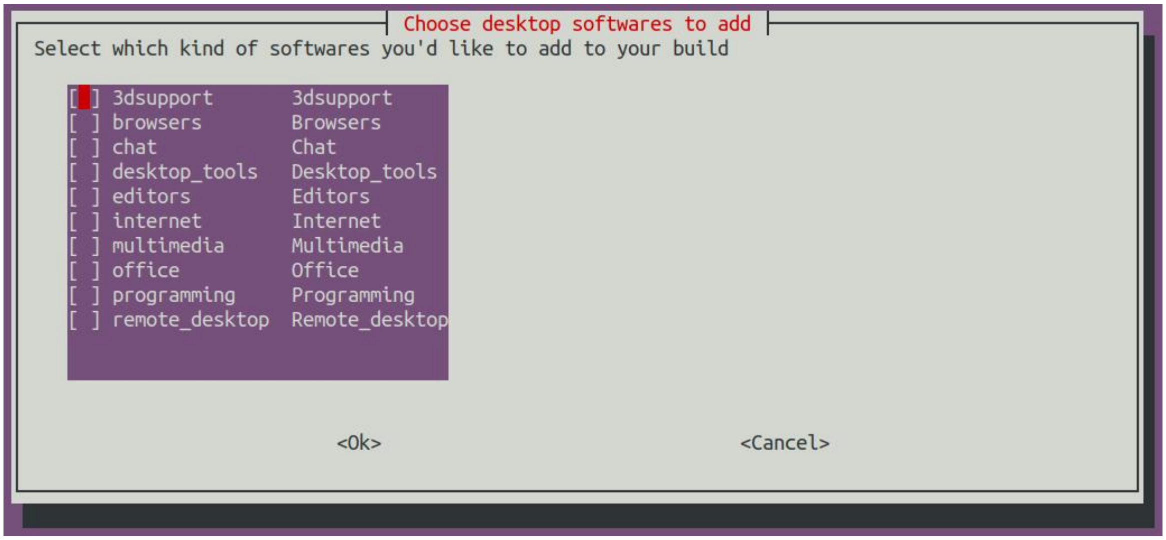


7) If the image of the desktop version also needs to choose the type of desktop environment，Currently Ubuntu Jammy supports both XFCE and Gnome desktops, while Ubuntu Focal and Debian only support XFCE.





Then you can choose an additional software package you need to install. Press the Enter key here directly.



8) Then you will start compiling rootfs, and part of the information prompted during compilation is shown below

a. Rootfs type

[o.k.] local not found [Creating new rootfs cache for **jammy**]

b. The storage path of the compiled rootfs compressed package

[o.k.] Target directory [**external/cache/rootfs**]

c. The name of the compile rootfs compressed package

[o.k.] File name [**jammy-xfce-arm64.f930ff6ebbac1a72108a2e100762b18f.tar.lz4**]

d. Time to compile

[o.k.] Runtime [**13 min**]

9) View compiled rootfs compression package

a. **jammy-xfce-arm64.f930ff6ebbac1a72108a2e100762b18f.tar.lz4**. It is a compressed package for rootfs. The meaning of each field of the name

   a) **jammy** Represents the type of rootfs Linux release version

   b) **xfce** Indicates that rootfs is the type of desktop version, if it is **cli**, it means

   c) the server version type

   d) **arm64** Indicates the architecture of rootfs

   e) **f930ff6ebbac1a72108a2e100762b18f** It is the MD5 hash value generated by the package names of all software packages installed by rootfs. As long as the list of software packages installed by rootfs is not modified, this value will not change. The compilation script will use this MD5 hash value to determine whether it needs

b. **jammy-xfce-arm64.f930ff6ebbac1a72108a2e100762b18f.tar.lz4.list** List the package name of all software packages installed by Rootfs

```
test@test:~/orangepi-build$ ls external/cache/rootfs/
bullseye-xfce-arm64.5250ec7002de9e81a41de169f1f89721.tar.lz4
bullseye-xfce-arm64.5250ec7002de9e81a41de169f1f89721.tar.lz4.current
bullseye-xfce-arm64.5250ec7002de9e81a41de169f1f89721.tar.lz4.list
```

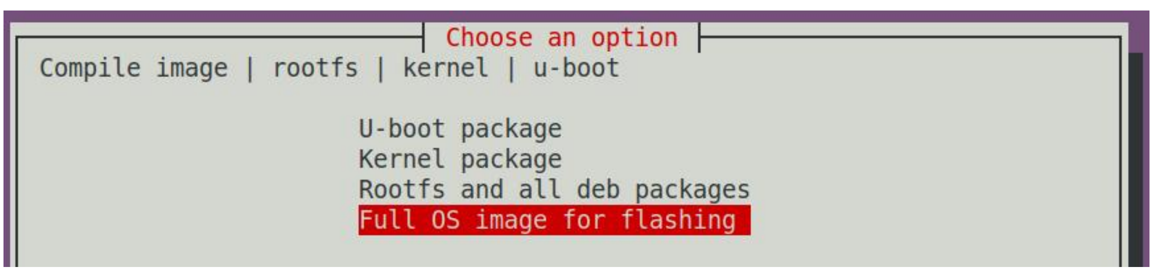
10) If the required rootfs already exists under **external/cache/rootfs,** then compile rootfs again will skip the compilation process directly, and will not start compiling again. When compiling the image, you will also go to the **external/cache/rootfs** to find out if there is a cache rootfs. If you have it, you can use it directly, so that you can save a lot of download compilation time.

5. 5. Compile linux images

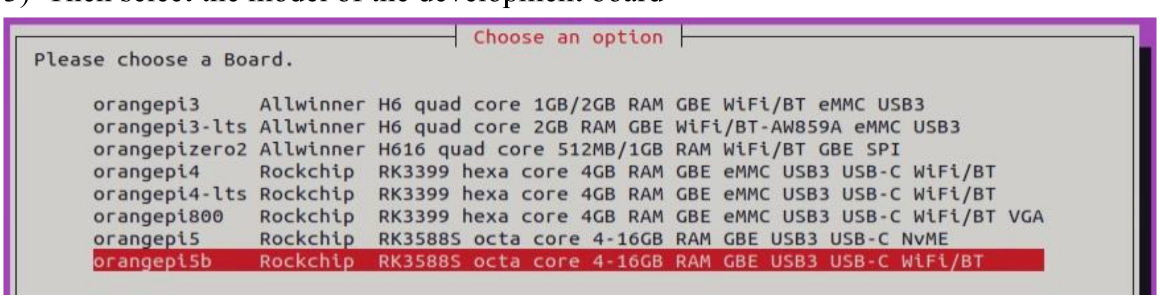
1) Run the build.sh script, remember to add Sudo permission

```
test@test:~/orangepi-build$ sudo ./build.sh
```

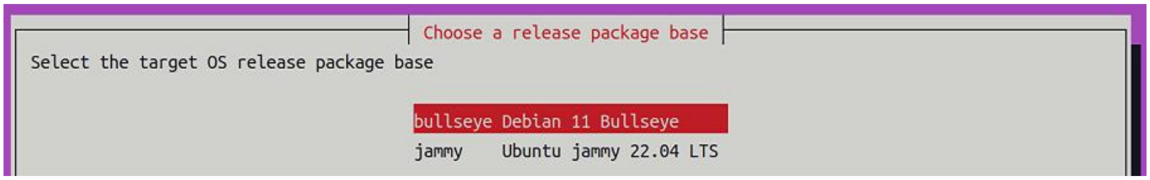
2) Select **Full OS image for flashing,** and then press Enter



3) Then select the model of the development board



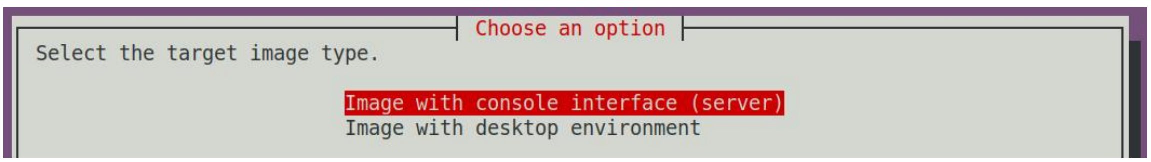
4) Then select the type of rootfs



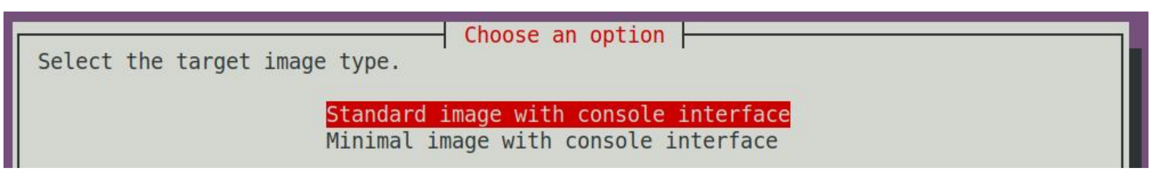
5) Then select the type of the image

a. **Image with console interface (server)**Indicates the image of the server version, the volume is small

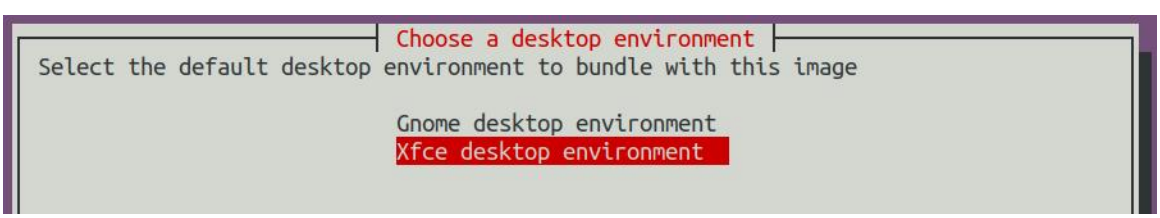
b. **Image with desktop environment**Indicates an image with a desktop, which is relatively large

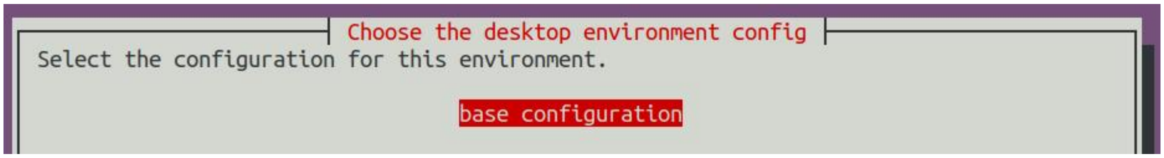


6) If it is a image that compiles the server version, you can also choose to compile the standard version or the minimal version. The pre -installed software pre -installed software will be much less than the Standard version.（**No special needs, please do not choose the minimal version, because many things are not pre -installed by default, some functions may not be used**）

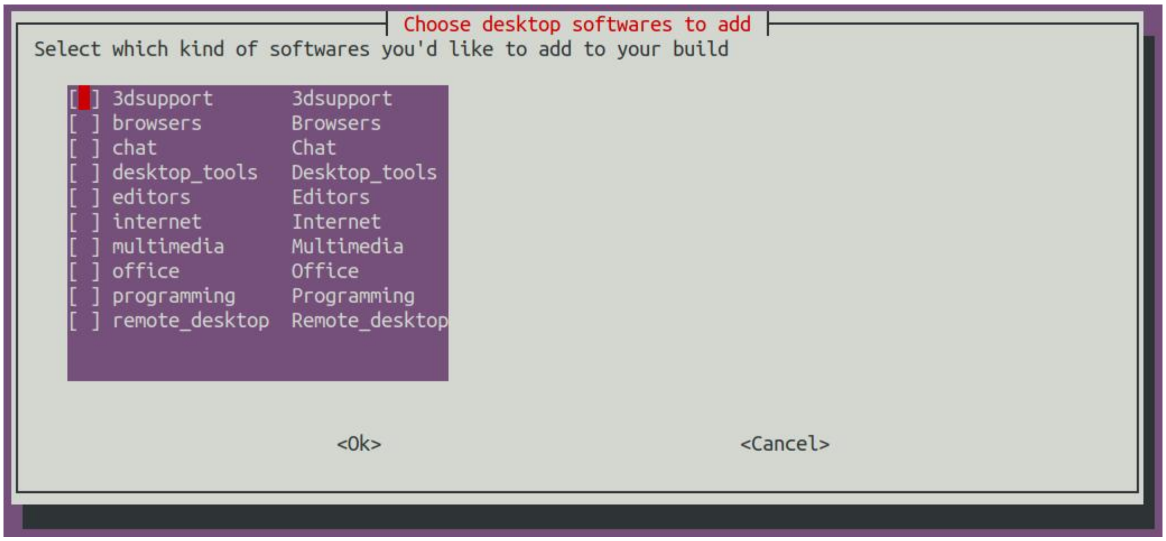


7) If the image of the desktop version also needs to choose the type of desktop environment，Currently Ubuntu Jammy supports both XFCE and Gnome desktops, while Ubuntu Focal and Debian only support XFCE.





Then you can choose an additional software package you need to install. Press the Enter key here directly.



8) Then you will start to compile Linux image, and the general process of compilation will be as follows

a. Initialize the compilation environment of Ubuntu PC, install the software package required for the compilation process.
b. Download the source code of the U-Boot and Linux kernel (if it has cached, only the code is updated)
c. Compile the U-Boot source code and generate the deb package of U-Boot
d. Compile Linux source code and generate Linux -related deb packages
e. Make Linux Firmware deb package
f. Make deb package of Orange-Config tools
g. Make a board -level Deb package.
h. If it is compiled the desktop version of the image, it will also make a desktop-related Deb package.
i. Check whether rootfs has cached. If there is no cache, re -make rootfs. If it has cached, it will be used directly.
j. Install the deb package to the rootfs that generated before.

k. Make some specific settings for different development boards and different types of images, such as pre -installed software packages, modifying system configurations, etc.
l. Then make a image file and format the partition, the default type is ext4
m. Copy the configured rootfs into the partition of the image
n. Then update initramfs
o. Finally, the u-boot bin file is written into the image through the dd command 将 u-boot

9) The following information will be prompted after compiling the image
   a. The storage path of the compiled

```
[ o.k. ] Done building
[ output/images/orangepi5b_1.0.0_debian_bullseye_linux5.10.110_xfce_desktop/orangepi5b_1.0.0_debian_bullseye_linux5.10.110_xfce_desktop.img ]
```

   b. Time to compile

```
[ o.k. ] Runtime [ 19 min ]
```

   c. Repeat the command of the Compile image. Use the following command without the need to choose through the graphic interface. You can directly start the Compile image

```
[ o.k. ] Repeat Build Options [ sudo ./build.sh  BOARD=orangepi5b BRANCH=legacy BUILD_OPT=image RELEASE=bullseye BUILD_MINIMAL=no BUILD_DESKTOP=no KERNEL_CONFIGURE=yes ]
```

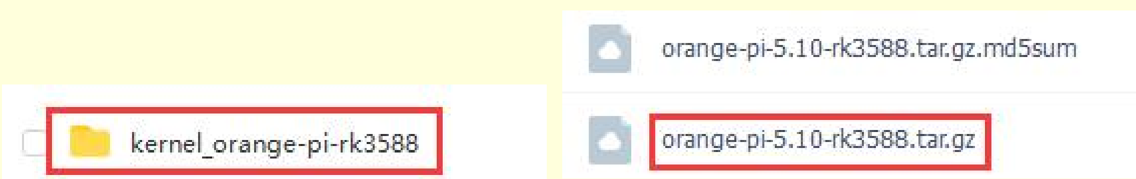
6. Linux Development Manual

6.1. How to compile the kernel source code separately in the linux system of the development board

1) First download the Linux kernel source code of the development board

```
orangepi@orangepi:~$ git clone --depth=1 -b orange-pi-5.10-rk3588 https://github.com/orangepi-xunlong/linux-orangepi
```

If you have problems downloading the code from github, you can go to the official information of the development board to download the compressed kernel source code package, then upload it to the Linux system of the development board, and then decompress it.



The command to decompress the compressed kernel source code package is 命:

orangepi@orangepi:~$ **tar zxf orange-pi-5.10-rk3588.tar.gz**

orangepi@orangepi:~$ **mv orange-pi-5.10-rk3588 linux-orangepi**

After decompression, please execute the following command to synchronize the source code with github to ensure that the source code is in the latest state:

orangepi@orangepi:~$ **cd linux-orangepi**

orangepi@orangepi:~/linux-orangepi$ **git pull**

2) Then configure the default kernel configuration

```
orangepi@orangepi:~$ cd linux-orangepi
orangepi@orangepi:~/linux-orangepi$ make rockchip_linux_defconfig
```

rockchip_linux_defconfig The path in the kernel source code is arch/arm64/configs/

3) Then compile the kernel source code

```
orangepi@orangepi:~/linux-orangepi$ make -j10
```

4) Then install the kernel module

```
orangepi@orangepi:~/linux-orangepi$ sudo make modules_install
```

The installation path of the kernel module is: /lib/modules

After executing the sudo make modules_install command, you can see that there will be an additional kernel module folder under /lib/modules/:

```
orangepi@orangepi5b:~$ ls /lib/modules
5.10.110+    5.10.110-rockchip-rk3588
```

5) Then install the kernel image and uInitrd

```
orangepi@orangepi:~/linux-orangepi$ sudo make install
```

The installation path of the kernel image and uInitrd is: /boot/

After executing the sudo make install command, you can see that there will be one more kernel file under /boot/:

```
orangepi@orangepi5b:~/orange-pi-5.10-rk3588$ ls /boot/vmlinuz*
/boot/vmlinuz-5.10.110+    /boot/vmlinuz-5.10.110-rockchip-rk3588
```

The file /boot/Image is actually loaded when the system starts, and Image is a copy of the vmlinuz file.

6) Then install the dtb file into **/boot/dtb**

```
orangepi@orangepi:~/linux-orangepi$ sudo make dtbs_install INSTALL_DTBS_PATH=/boot/dtb/
```

7) Then restart the Linux system and the newly compiled kernel will be loaded

```
orangepi@orangepi:~$ uname -r
5.10.110+
```

7. How to use the Android 12 system.

7. 1. The Android versions supported

Android Version	Kernel Version
Android 12	Linux5.10
Android 12 Box	Linux5.10

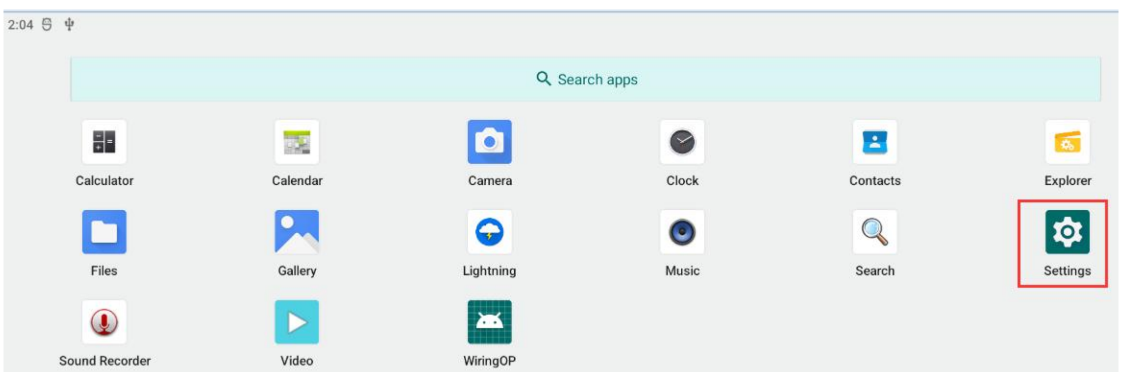
7. 2. Adaptation of Android functions

Functions	Android 12	Android12 Box
USB2.0x2	OK	OK
USB3.0x1	OK	OK
USB Type-C 3.0	OK	OK
DP Display	OK	OK
eMMC Start	OK	OK
AP6275P-WIFI	OK	OK
AP6275P-Bluetooth	OK	OK
GPIO（26pin）	OK	OK
UART（26pin）	OK	OK
SPI（26pin）	OK	OK
I2C（26pin）	OK	OK
PWM（26pin）	OK	OK
3pin Debug Serial Port	OK	OK
TF-Card Start	OK	OK
HDMI Video	OK	OK
HDMI Audio	OK	OK
OV13850 Carema	OK	OK

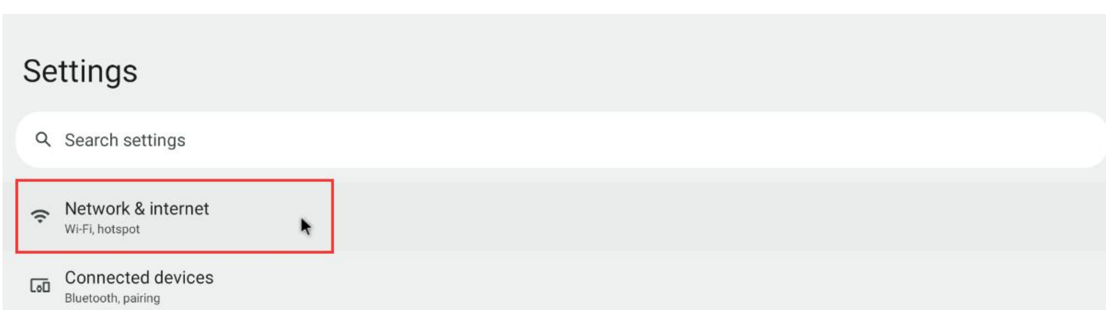
OV13855 Carema	**OK**	**OK**
LCD1	**OK**	**NO**
LCD2	**OK**	**NO**
Gigabit Ethernet Port	**OK**	**OK**
Network Port Status Light	**OK**	**OK**
MIC	**OK**	**OK**
Headphone Playback	**OK**	**OK**
Headphone Recording	**OK**	**OK**
LED Light	**OK**	**OK**
GPU	**OK**	**OK**
NPU	**OK**	**OK**
VPU	**OK**	**OK**
Switch Button	**OK**	**OK**
HDMI CEC Function	**NO**	**OK**

7. 3. WIFI connection test method

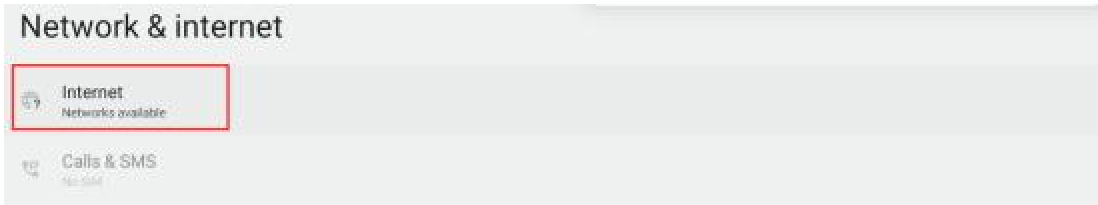
1) First click to enter the **Setting**



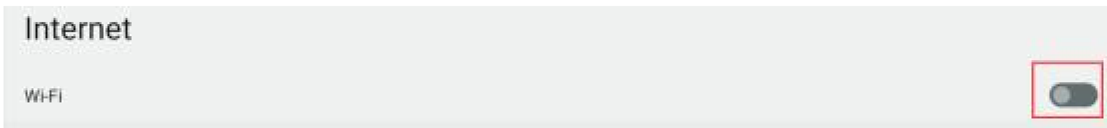
2) Then select **Network & internet**



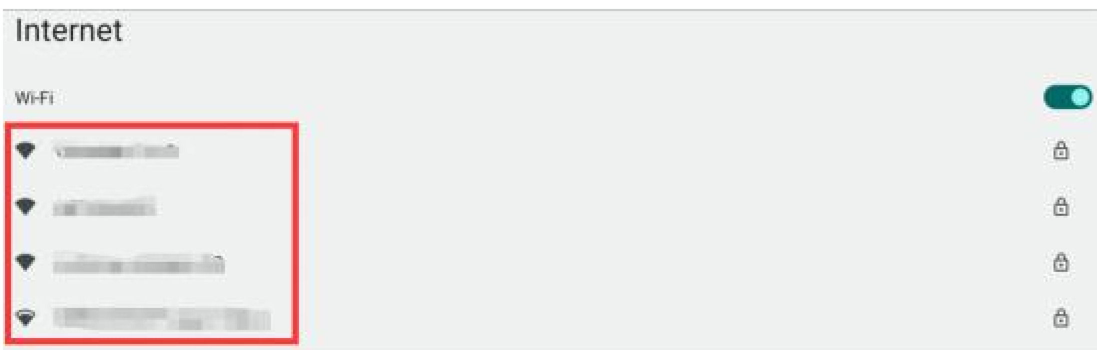
3) Select **Internet**



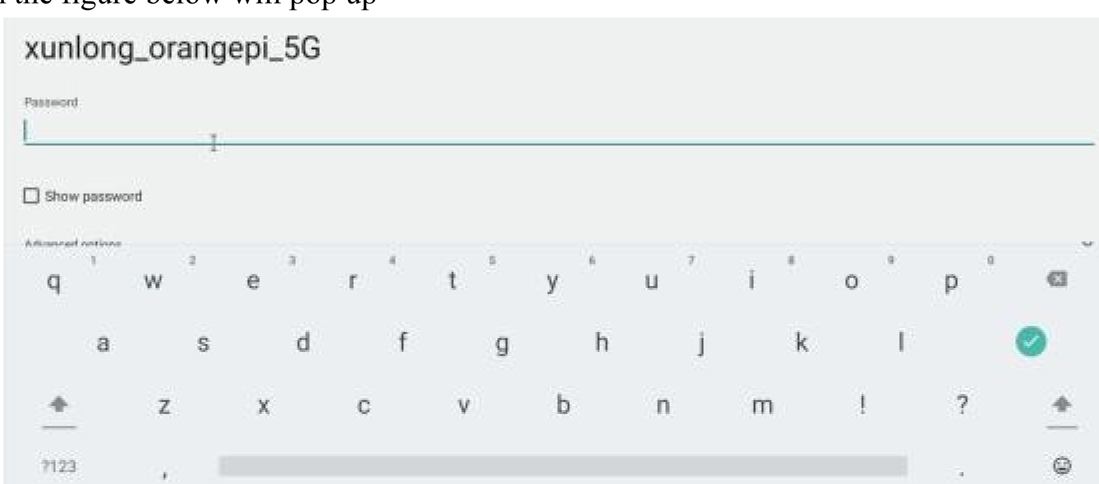
4) Switch **Wi-Fi**



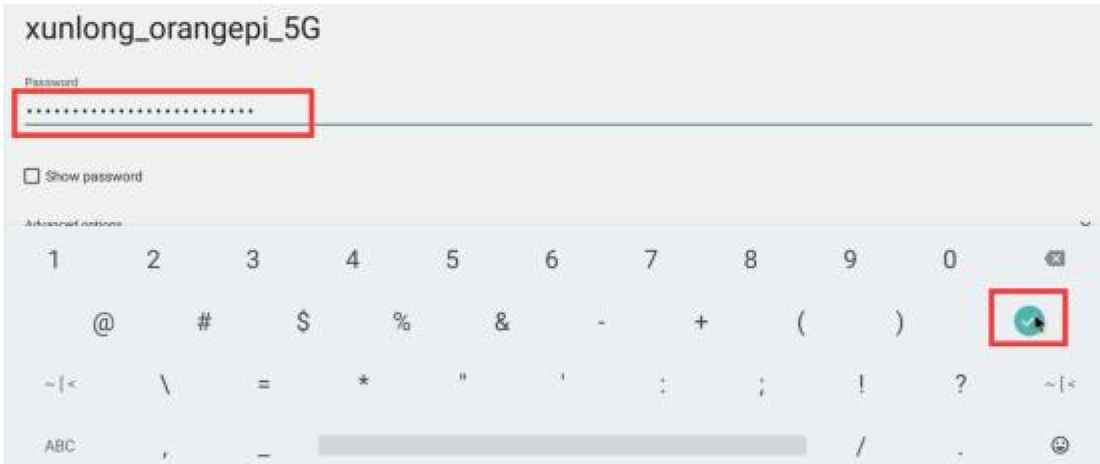
5) After turning on **Wi-Fi**, if everything is normal, you can scan for nearby Wi-Fi hotspots.



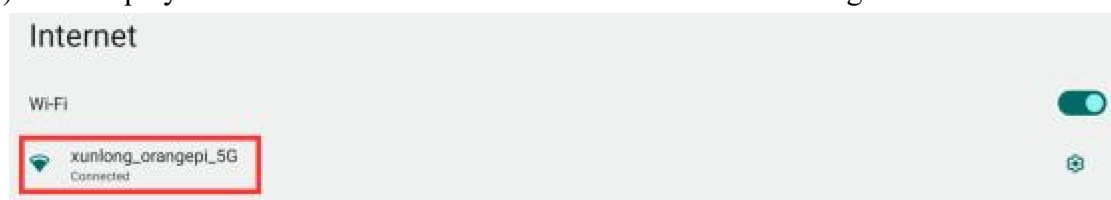
6) Then select the Wi-Fi you want to connect to, and the password input interface shown in the figure below will pop up



7) Then use the keyboard to enter the password corresponding to Wi-Fi, and then use the mouse to click the Enter button in the virtual keyboard to start connecting to Wi-Fi



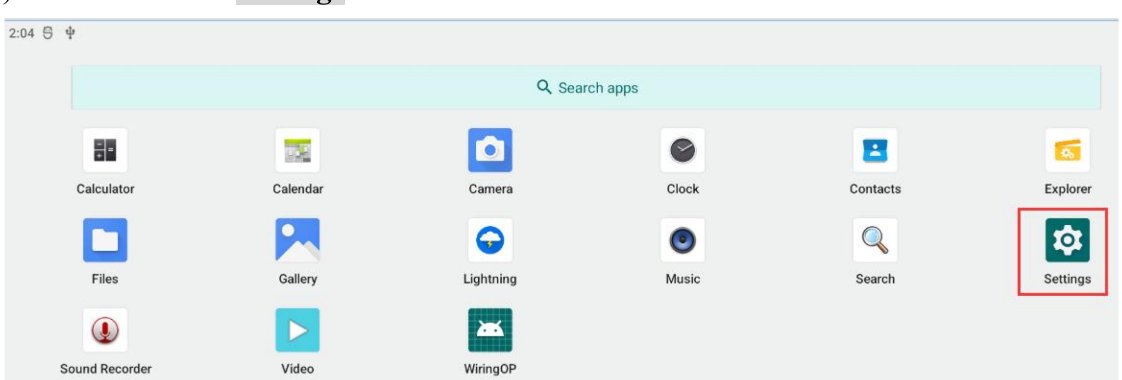
8) The display after successful Wi-Fi connection is shown in the figure below：



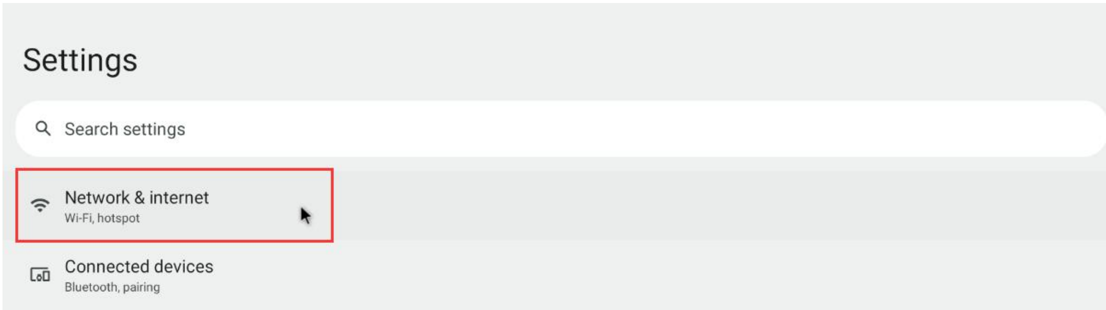
7. 4. How to use Wi-Fi hotspot

1) First, please make sure that the Ethernet port is connected to the network cable and can access the Internet normally.

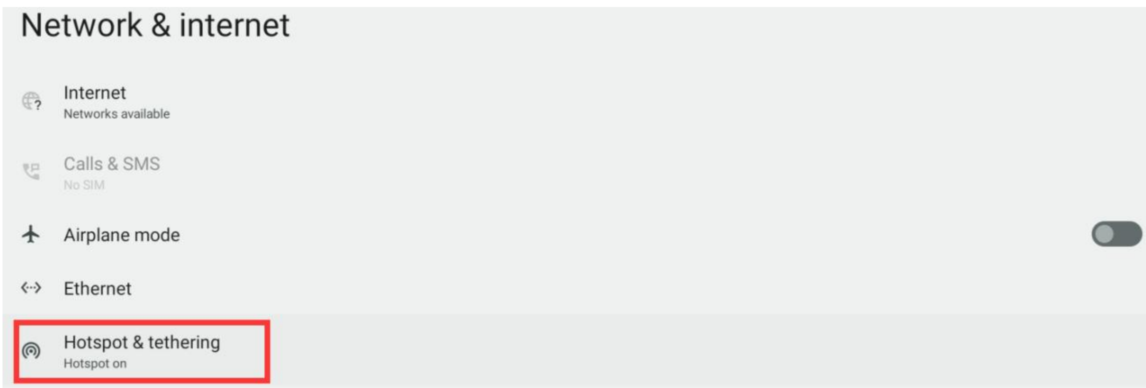
2) And then select **Settings**



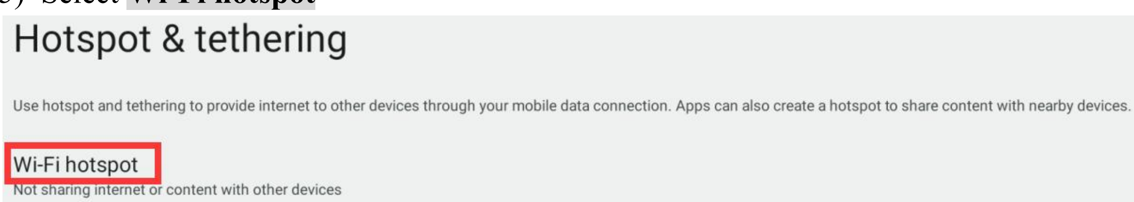
3) Select **Network & internet**



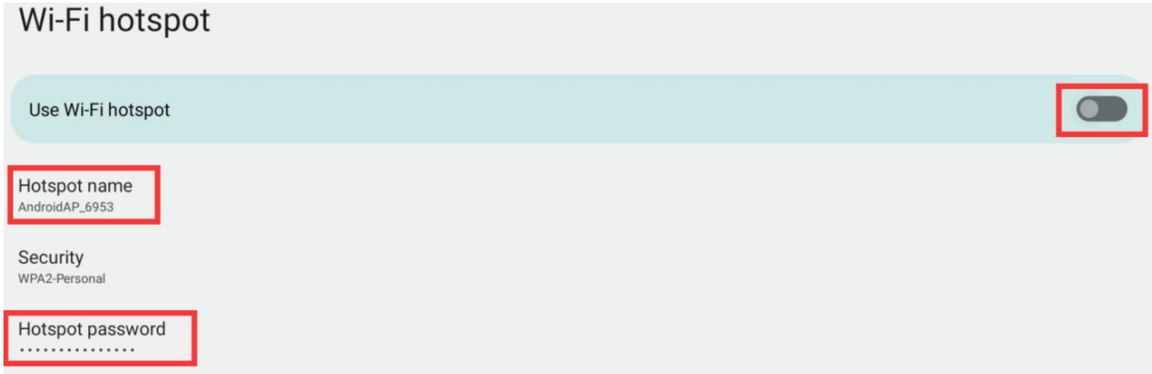
4) Select **Hotspot & tethering**



5) Select **Wi-Fi hotspot**



6) Then turn on the **Wi-Fi hotspot**, you can also see the name and password of the generated hotspot in the figure below, remember them and use them when connecting to the hotspot (if you need to modify the name and password , you need to turn off the **Wi-Fi hotspot** first before modification)

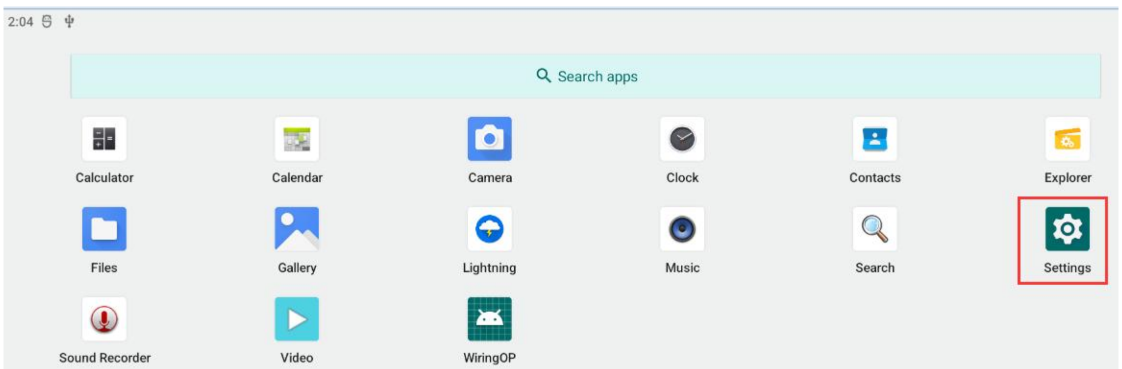


7) At this point, you can take out your mobile phone. If everything is normal, you can find the **Hotspot name** above in the WIFI list searched by the mobile phone（**Name is AndroidAP_6953**）.Then you can click **AndroidAP 6953** to connect to the hotspot, and the password can be seen under the **Hotspot password** in the above picture

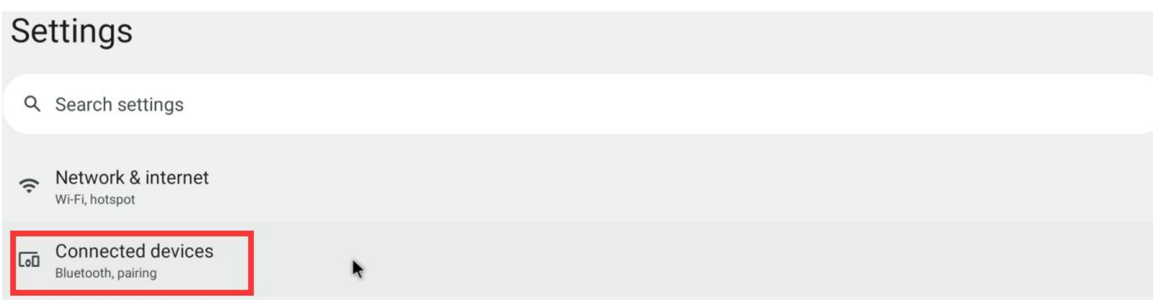
8) After the connection is successful, it will be displayed as shown in the figure below (the interface of different mobile phones will be different, the specific interface is subject to the display of your mobile phone). At this point, you can open a webpage on your mobile phone to see if you can access the Internet. If you can open the webpage normally, it means that the **WI-FI Hotspot** of the development board can be used normally.

7. 5. How to test Bluetooth

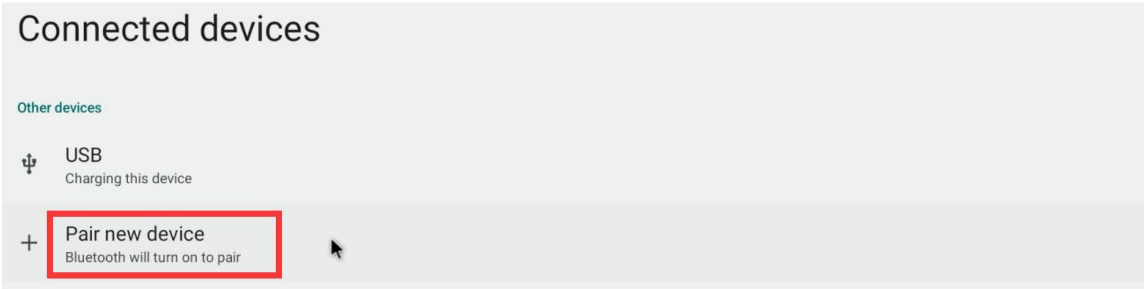
1) First enter **Setting**



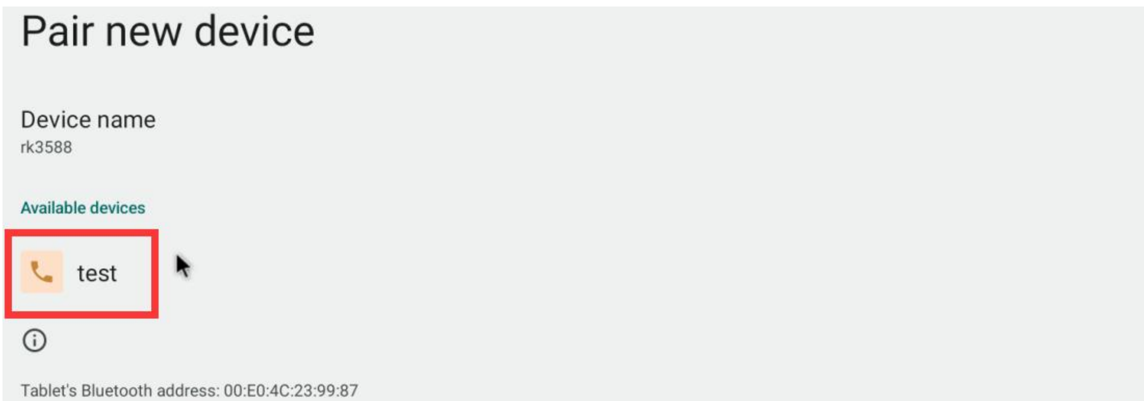
2) And then select **Connected devices**



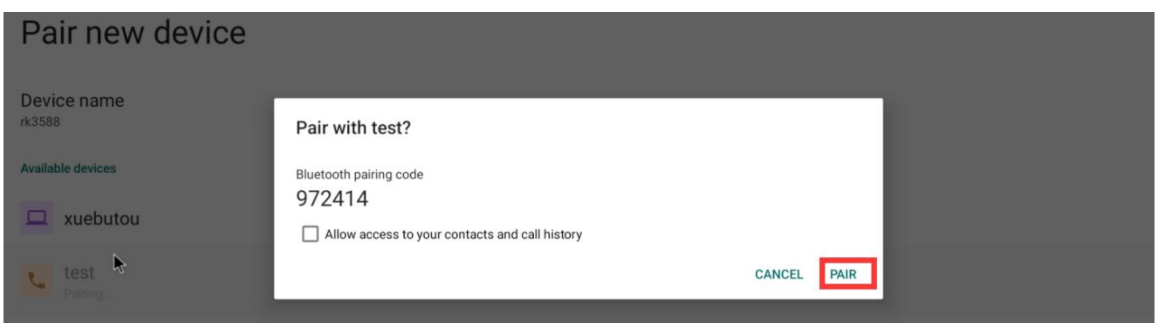
3) Then click **Pair new device** to turn on Bluetooth and start scanning the surrounding Bluetooth devices.



4) The search Bluetooth devices will be displayed under **Available devices**

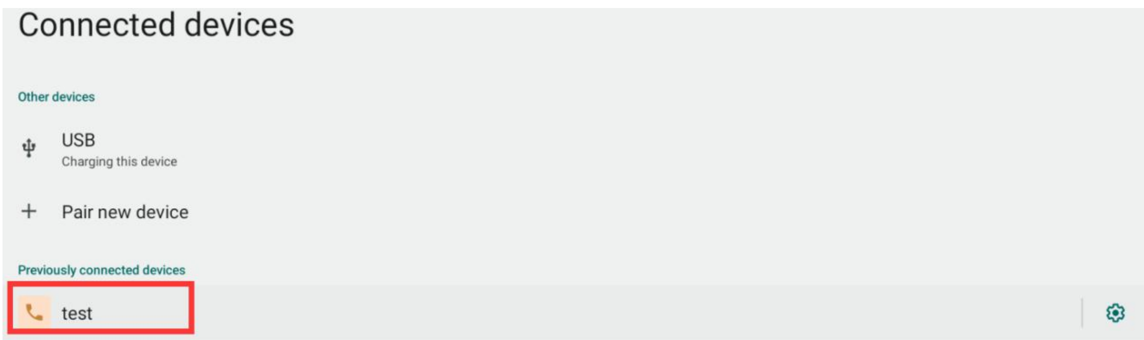


5) Then click the Bluetooth device you want to connect to start pairing. When the following interface pops up, please use the mouse to select the **Pair** option.

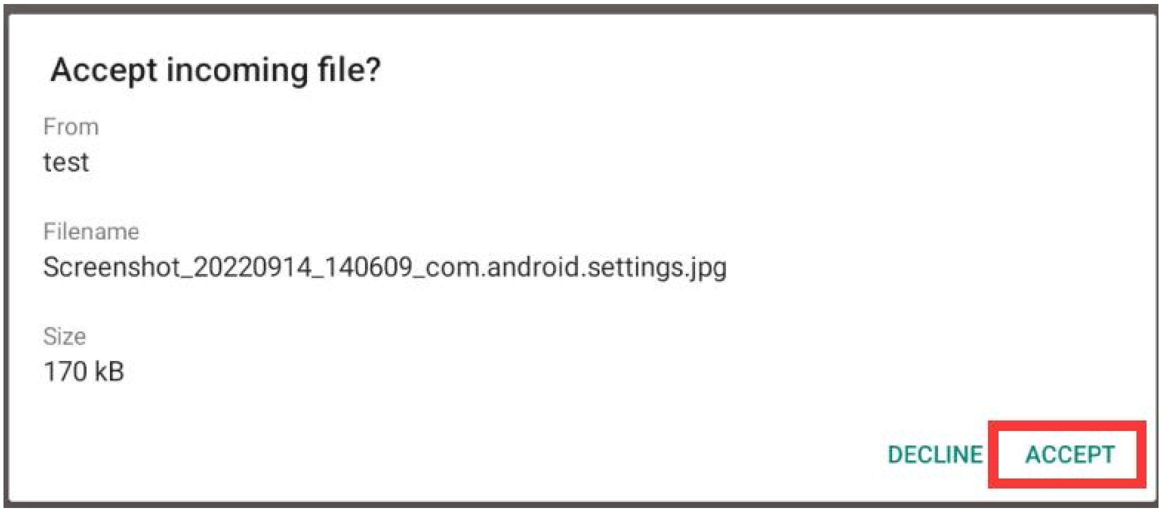


6) The test here is the configuration process of the development board and the Bluetooth of the Android mobile phone. At this time, the following confirmation interface will pop up on the mobile phone, and the pairing process will start after clicking the pairing button on the mobile phone.

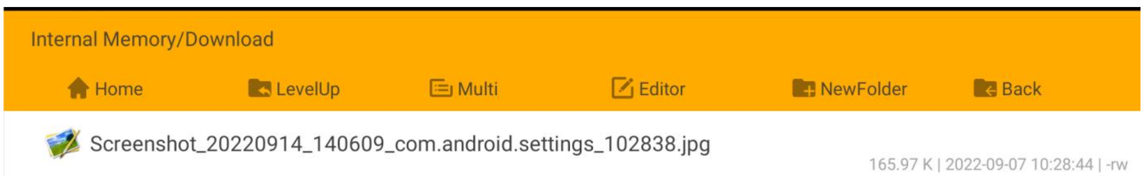
7) After the pairing is complete, you can see the paired Bluetooth devices as shown in the figure below



8) At this time, you can use the Bluetooth of your mobile phone to send a picture to the development board. After sending, you can see the following confirmation interface in the Android system of the development board, and then click **Accept** to start receiving the picture sent by the mobile phone.



9) You can open the **Download** directory in the file manager to view the pictures received by the Android system Bluetooth of the development board.



7. 6. How to use 10.1 inch MIPI screen

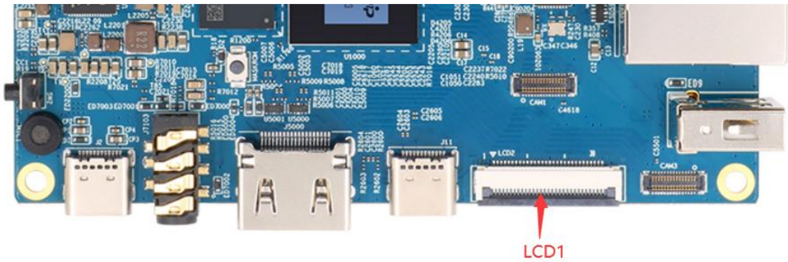
Please make sure that the Android image used is the image of the following version:

orangepi5b_RK3588S_Android12_lcd_v1.x.x.img

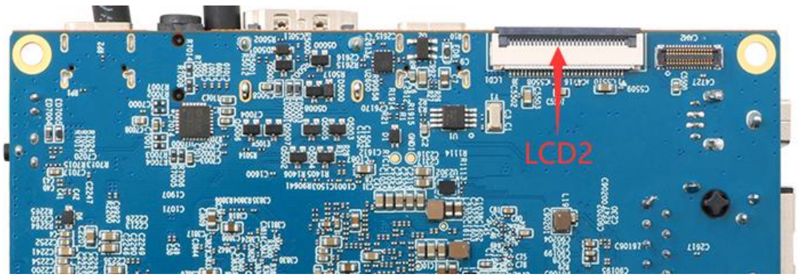
1) First you need to assemble the screen, please refer to the assembly **method of the 10.1-inch MIPI screen**

2) There are two mipi lcd screen interfaces on the development board, we define:

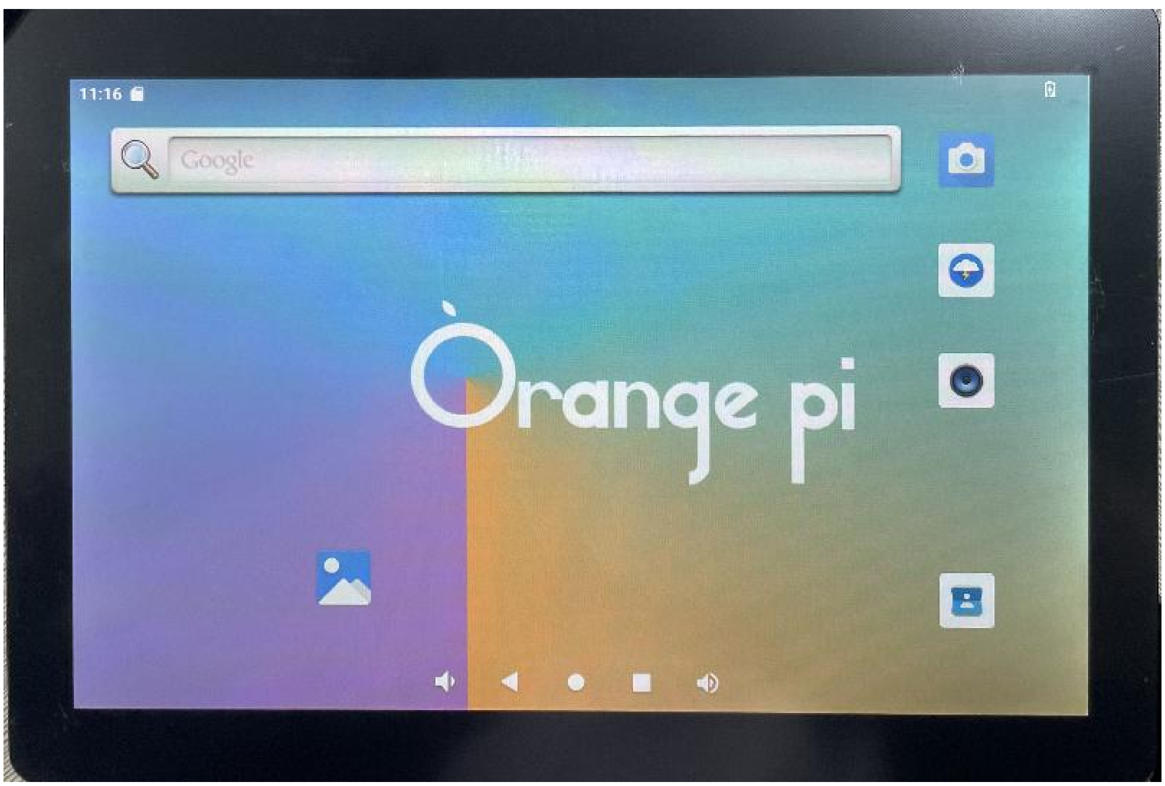
a. The location of the lcd1 interface is:



b. The location of the lcd2 interface is：



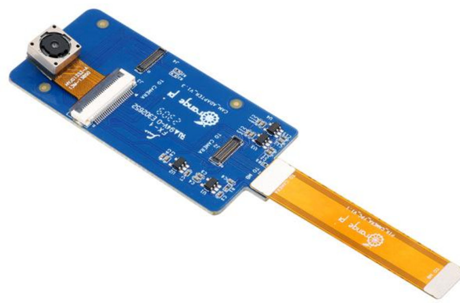
3) Connect the assembled screen to the lcd1 or lcd2 interface, connect the Type-C power supply to the board, and power it on. After the system starts, you can see the screen display as shown in the figure below



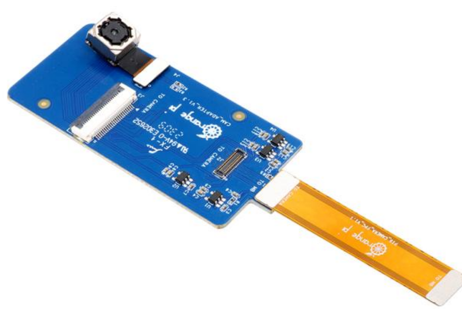
7. 7. How to test OV13850 and OV13855 MIPI camera

Currently the development board supports two MIPI cameras, OV13850 and OV13855, the specific pictures are as follows：

a. OV13850 camera with 13 million MIPI interface



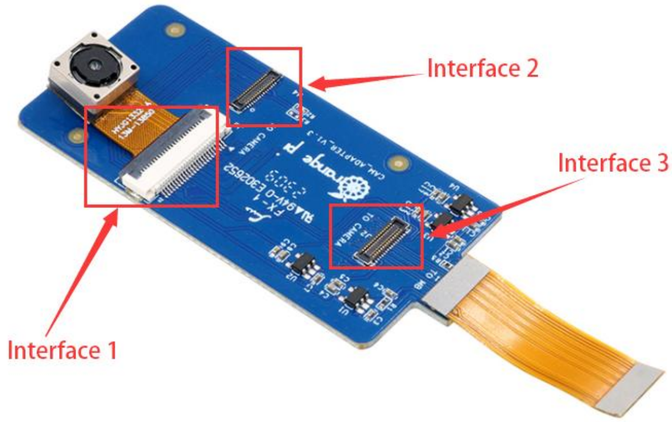
b. OV13855 camera with 13 million MIPI interface



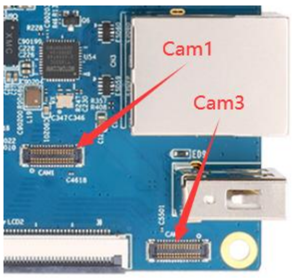
he adapter board and FPC cable used by the OV13850 and OV13855 cameras are the same, but the positions of the two cameras connected to the adapter board are different. FPC cable is shown in the figure below. Please note that the FPC cable has a direction. The end marked **TO MB** needs to be inserted into the camera interface of the development board, and the end marked **TO CAMERA** needs to be inserted into the camera adapter board.

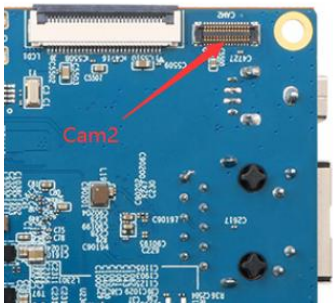
There are a total of 3 camera interfaces on the camera adapter board, and only one can be used at a time, as shown in the figure below：

a. **No. 1 interface is connected to the OV13850 camera**
b. **No. 2 interface is connected to the OV13855 camera**
c. No. 3 interface is not used, just ignore it



There are a total of 3 camera interfaces on the Orange Pi 5B development board. We define the positions of Cam1, Cam2 and Cam3 as shown in the figure below：





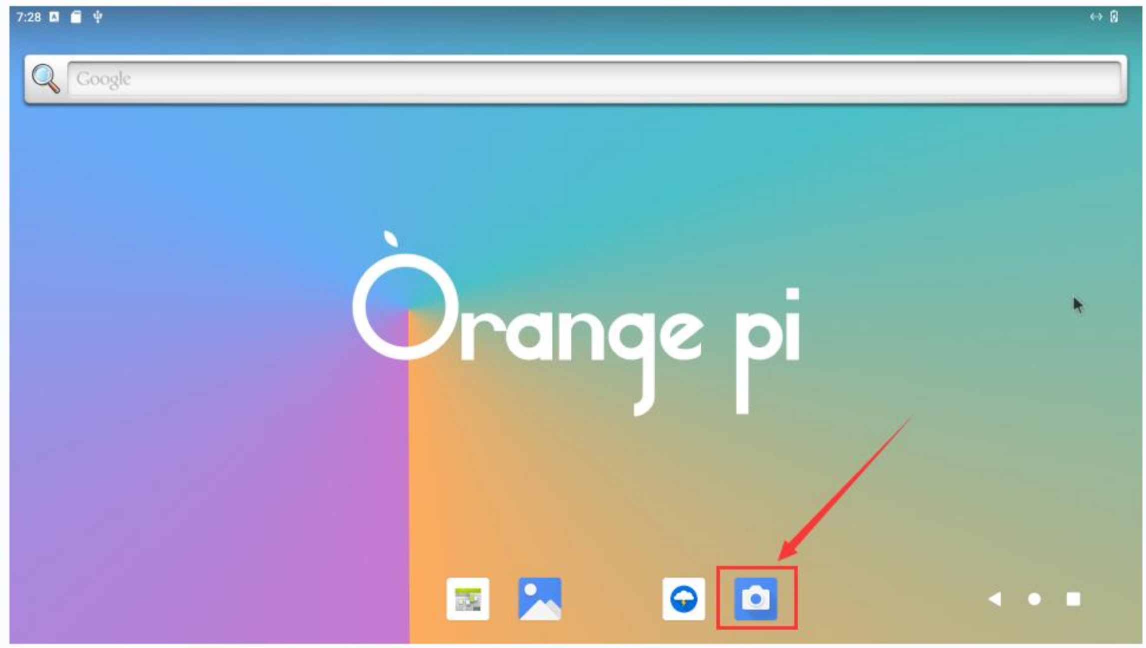
The method of inserting the camera into the Cam1 interface of the development board is as follows：

The method of inserting the camera into the Cam2 interface of the development board is as follows：

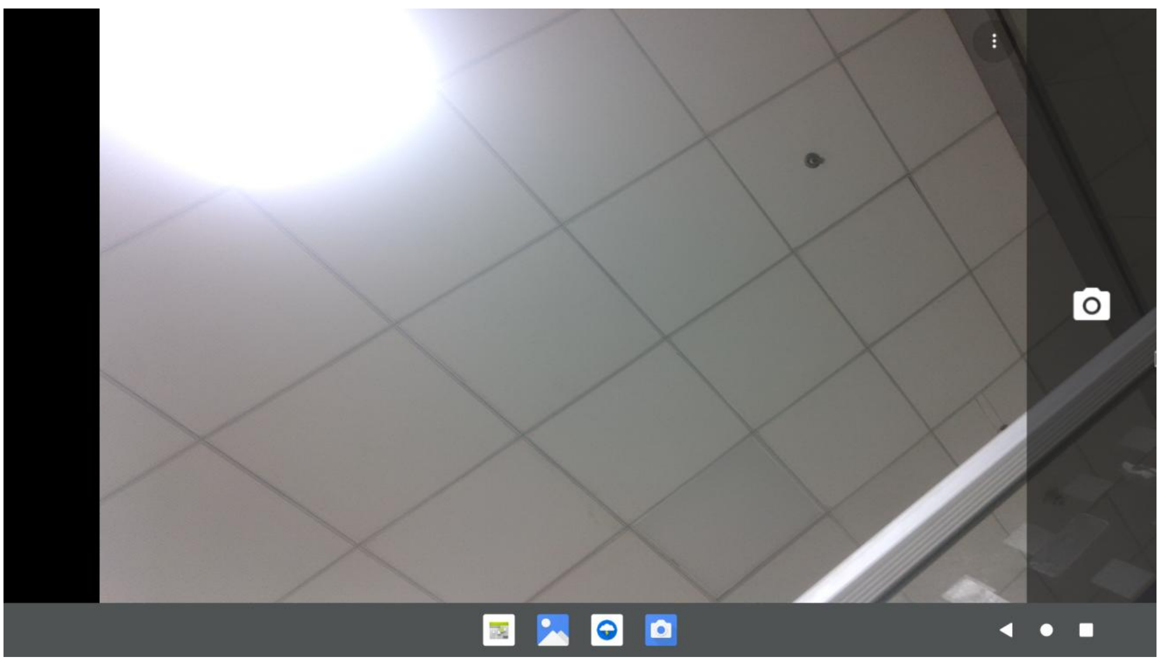
The method of inserting the camera into the Cam3 interface of the development board is as follows：

The Android system defaults to the configuration of **Cam1** and **Cam3**, so if you want to use the camera, please choose one of the **Cam1** and **Cam3** interfaces. After connecting the camera to the development board, we can use the following method to test the camera：

a. Open the camera APP on the desktop



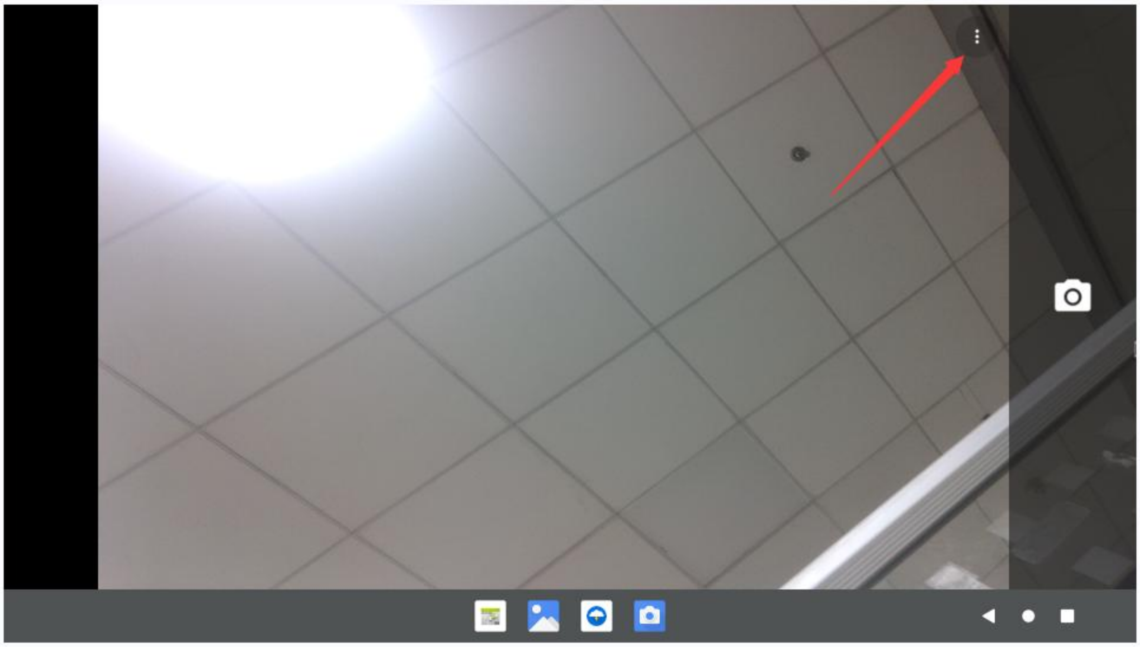
b. Then you can see the preview screen of the camera.



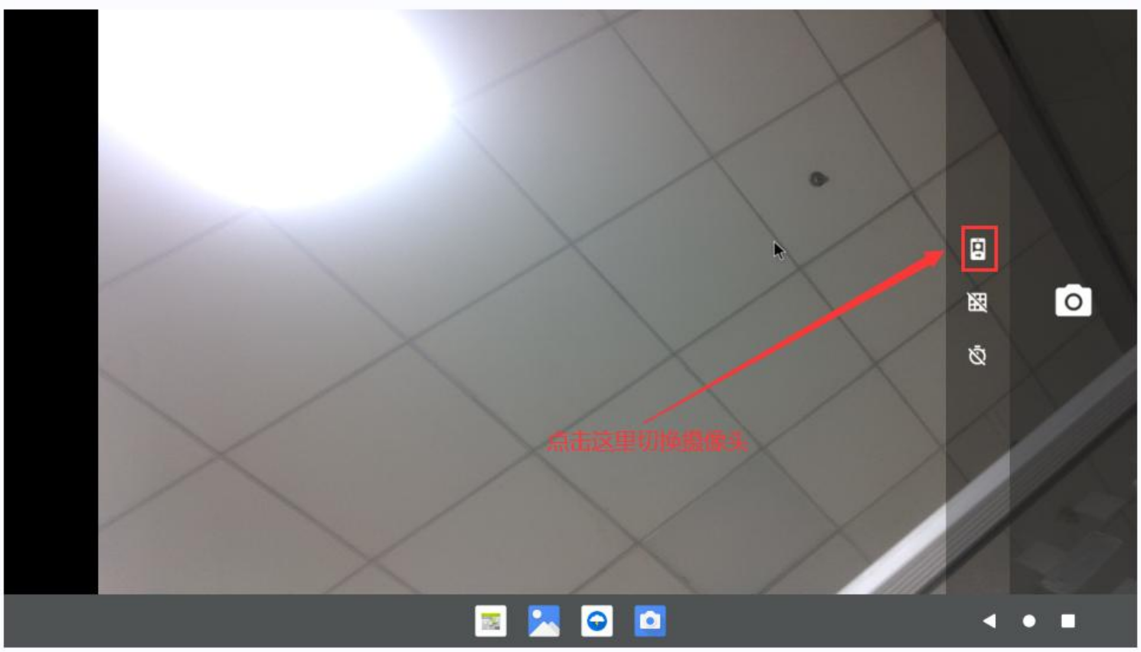
In addition to single camera, we can also connect two cameras at the same time. It should be noted that currently, please use the combination of Cam1+Cam3 for testing dual cameras (support ov13850 and ov13855 mix and match). After connecting the dual cameras, open the camera APP to see the picture of one of the cameras as in the previous steps.

The method to switch to another camera is：

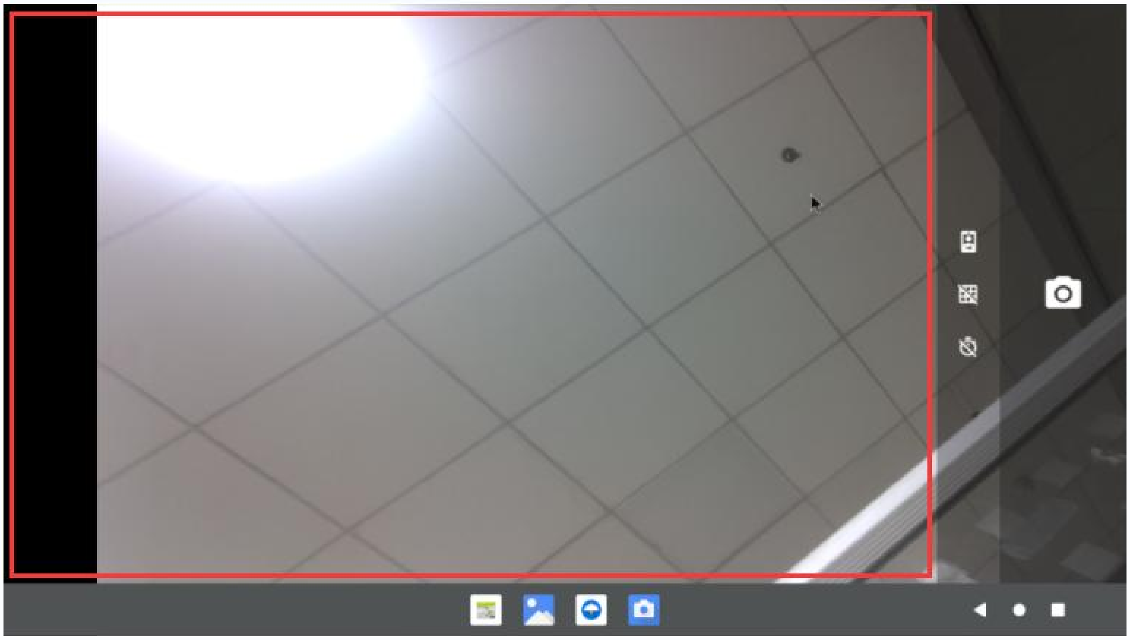
a. First click the three dots in the upper right corner



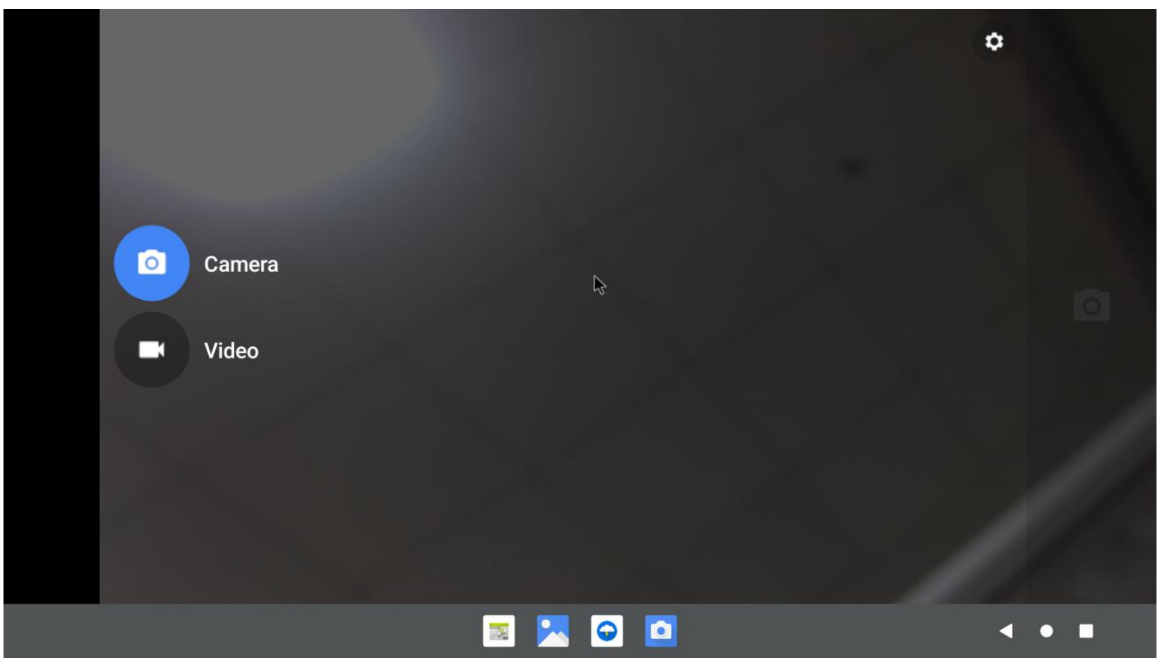
b. Then click the position shown in the figure below to switch the camera



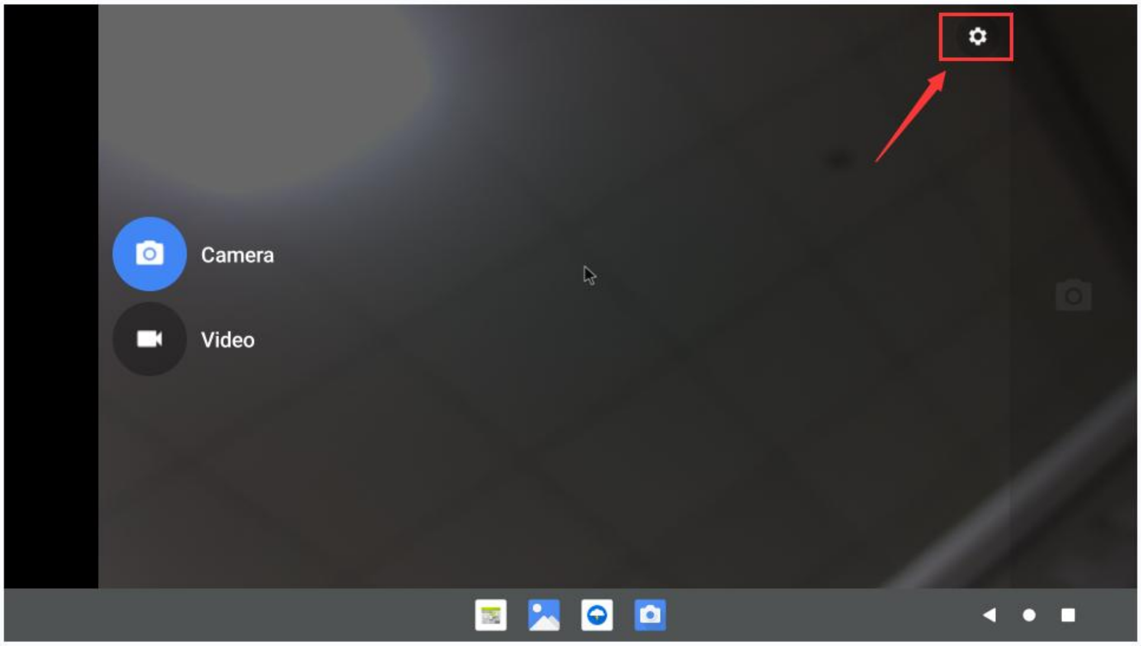
Press and hold the mouse in the area shown in the red box in the picture below of the camera APP and then drag to the right to call up the switching interface for taking pictures and recording



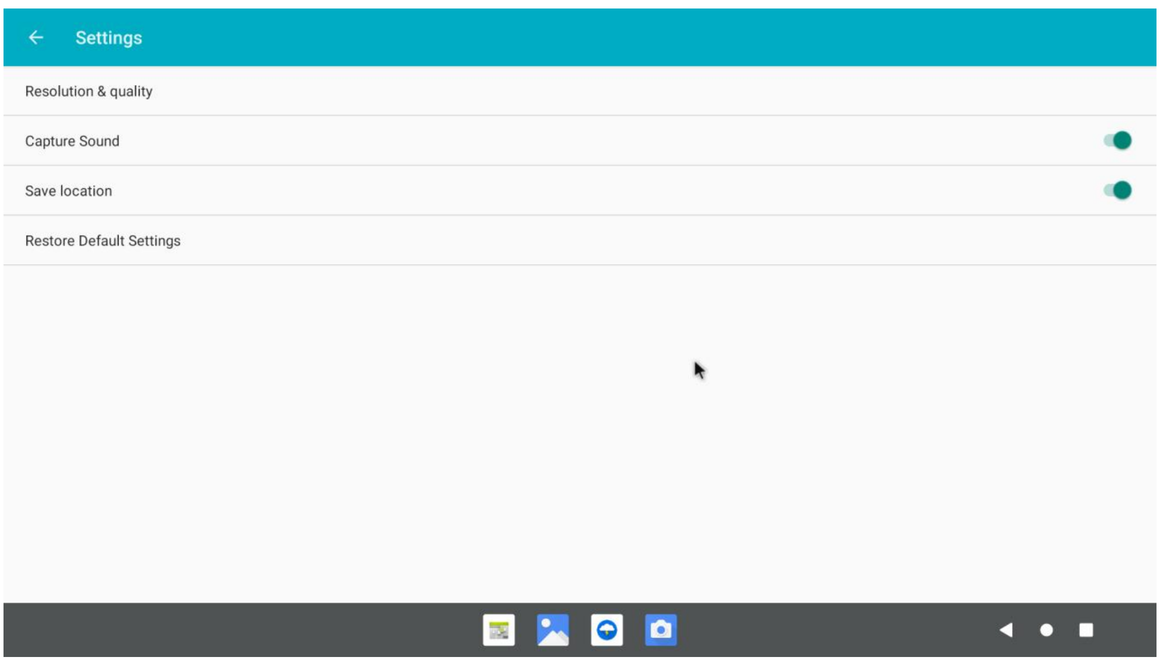
The switching interface of taking pictures and recording is as follows, click **Video** to switch to video recording mode



Click the position shown in the figure below to enter the camera setting interface



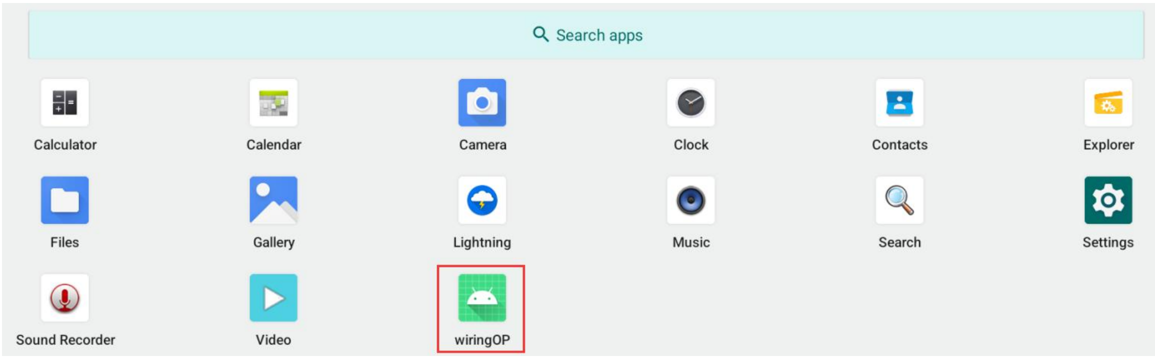
The setting interface of the camera is as follows：



7. 8. 26 Pin interface GPIO, UART, SPI and PWM test

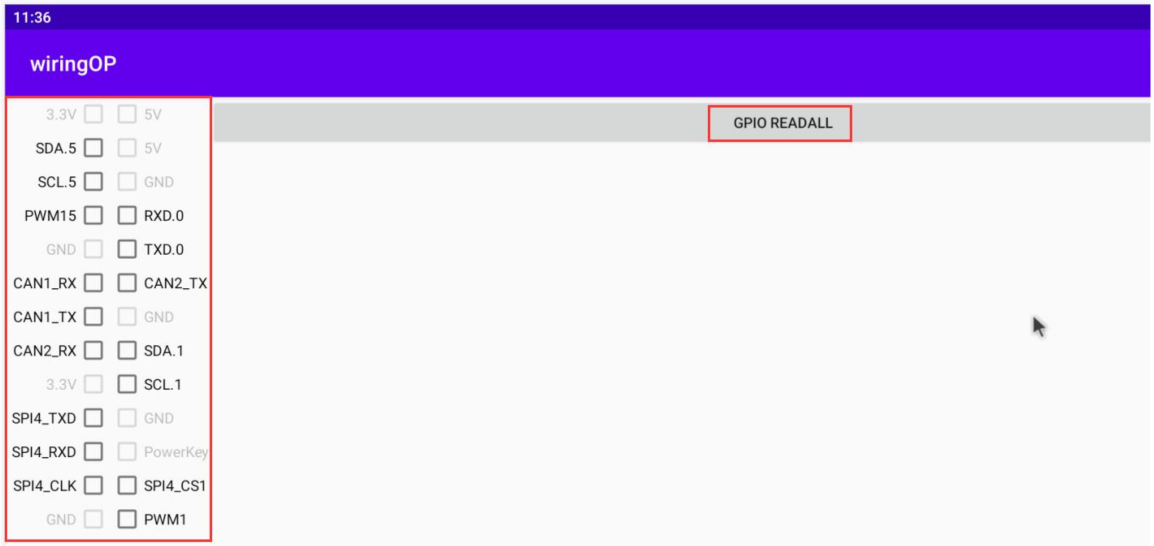
7. 8. 1. 26pin GPIO port

1) First click the Wiringop icon to open the Wiringop App

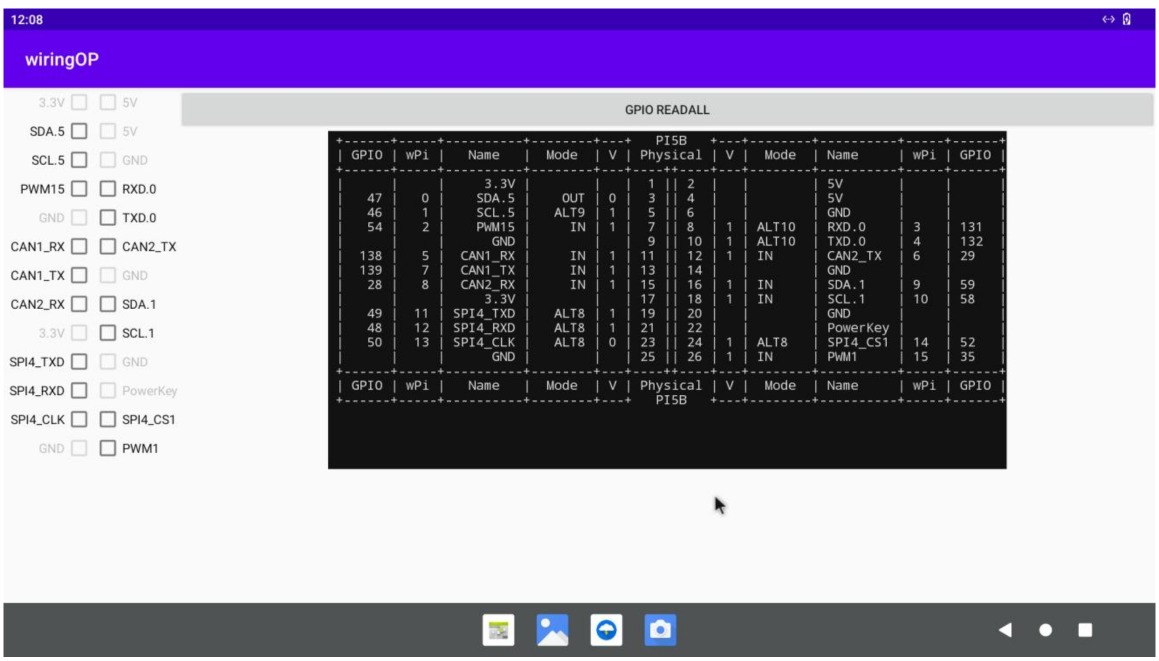


2) The main interface of the Wiringop app is displayed as shown in the fithen gure below, and click the **GPIO_TEST** button to open the GPIO test interface

3) The GPIO test interface is shown in the figure below. The two rows of the **CheckBox** button on the left and the 26PIN pin are one -to -one relationship. When checking the **CheckBox** button, the corresponding pin will be set to **OUT** mode, the pin level settings will be set. For high levels, when the check -up is canceled, the pin level is set to a low level; when clicking the G**PIO READALL** button on the right, you can get the WPI, GPIO mode, pin level information, etc

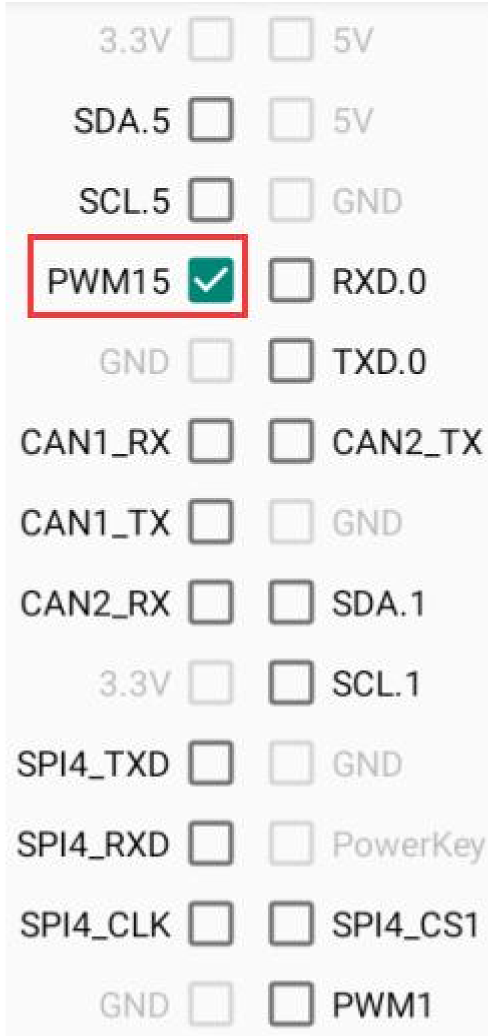


4) Then click the **GPIO READALL** button, and the output information is shown in the figure below：

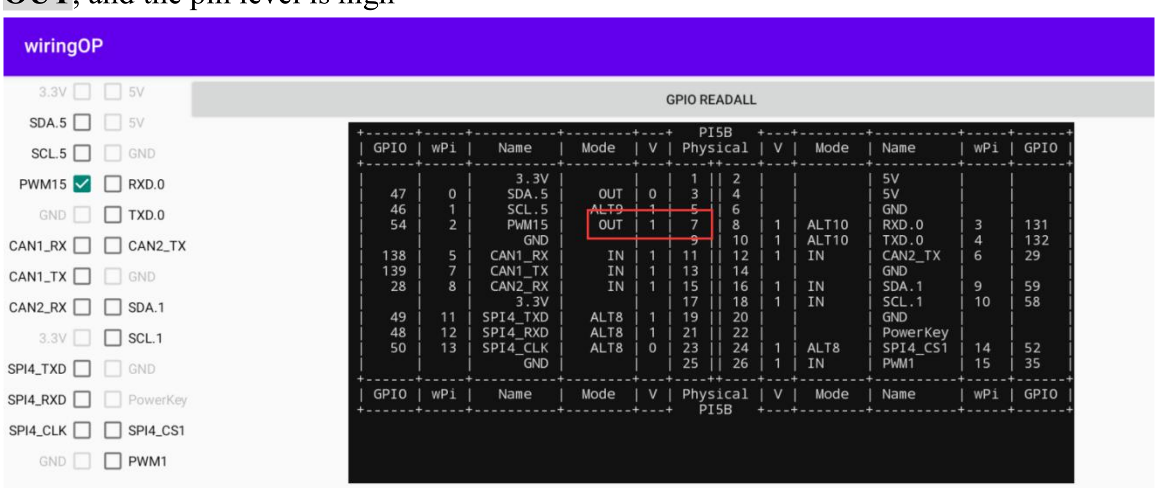


5) There are a total of 16 GPIO ports in the 26 pins of the development board that can be used. The following uses 7 pin (the corresponding GPIO is GPIO1_C6—the corresponding wPi serial number is 2)as an example to demonstrate how to set the high and low levels of the GPIO port. First click the **CheckBox** button corresponding to 7 pin . When the button is selected, 7 pin will be set to high level. After setting, you can use a multimeter to measure the voltage value of the pin. If it is **3.3v,** it means setting high level

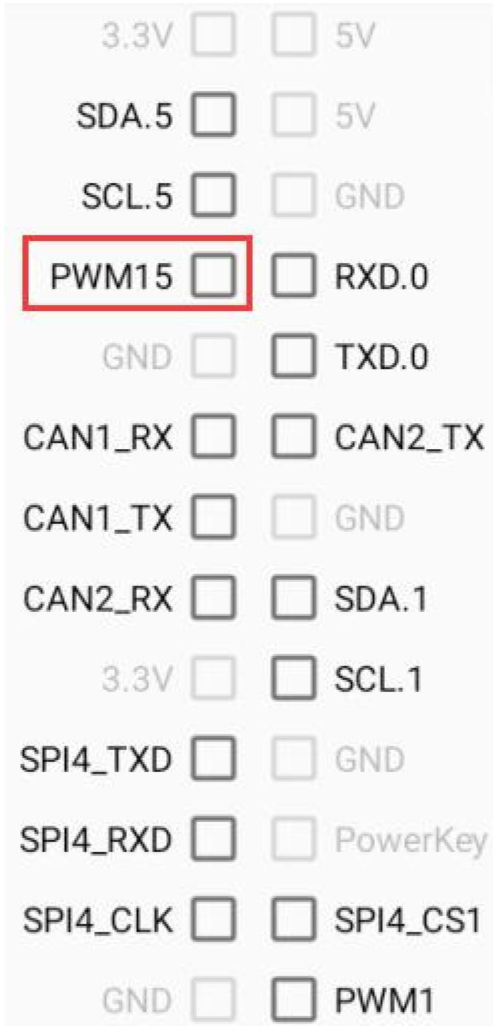
success



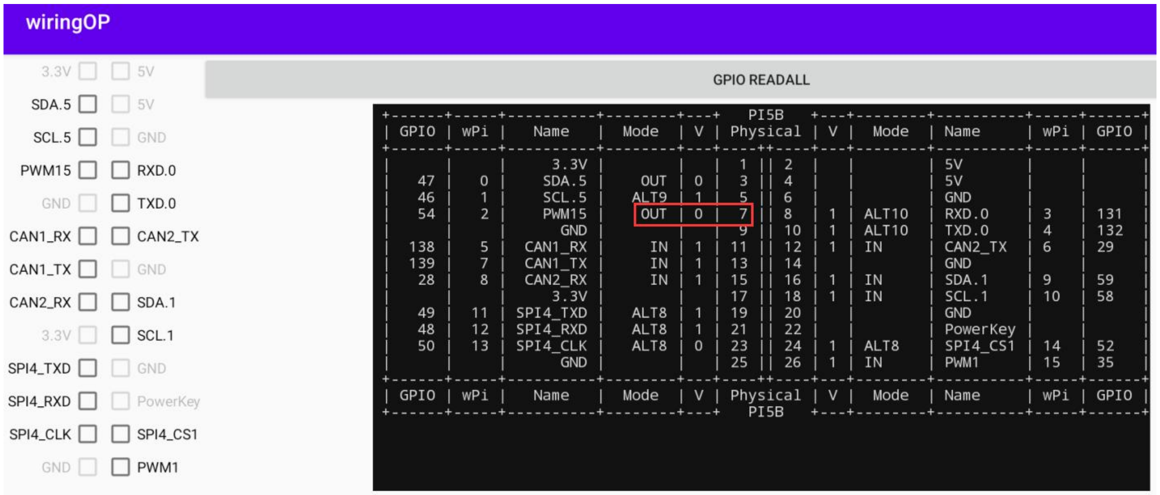
6) Then click the **GPIO READALL** button, you can see that the current pin 7 mode is **OUT**, and the pin level is high



7) Click the **CheckBox** button in the figure below again to uncheck the status, and pin 7 will be set to low level. After setting, you can use a multimeter to measure the voltage value of the pin. If it is **0v**, it means that the low level is set successfully.



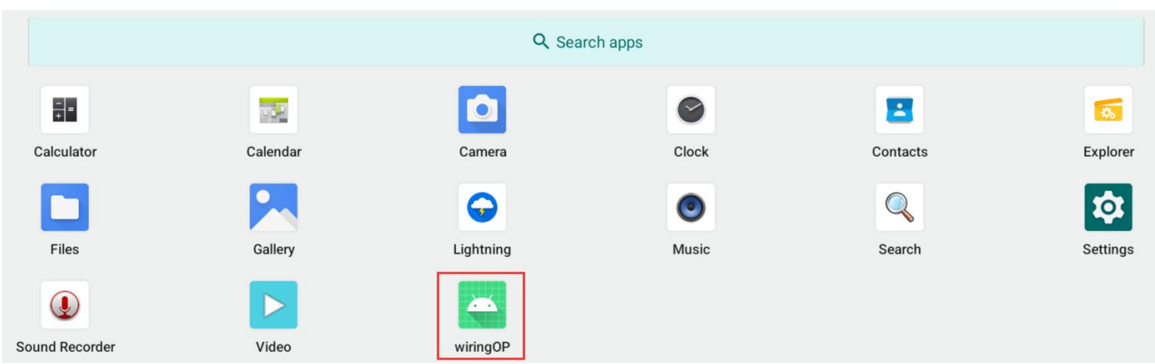
8) Then click the **GPIO READALL** button, you can see that the current mode of pin 7 is OUT, and the pin level is low



7. 8. 2. 26pin UART test

1) In Android default, the UART0 serial port is only opened. The position of UART0 at 26 pin is shown in the figure below. The corresponding device node is **dev/ttyS0**

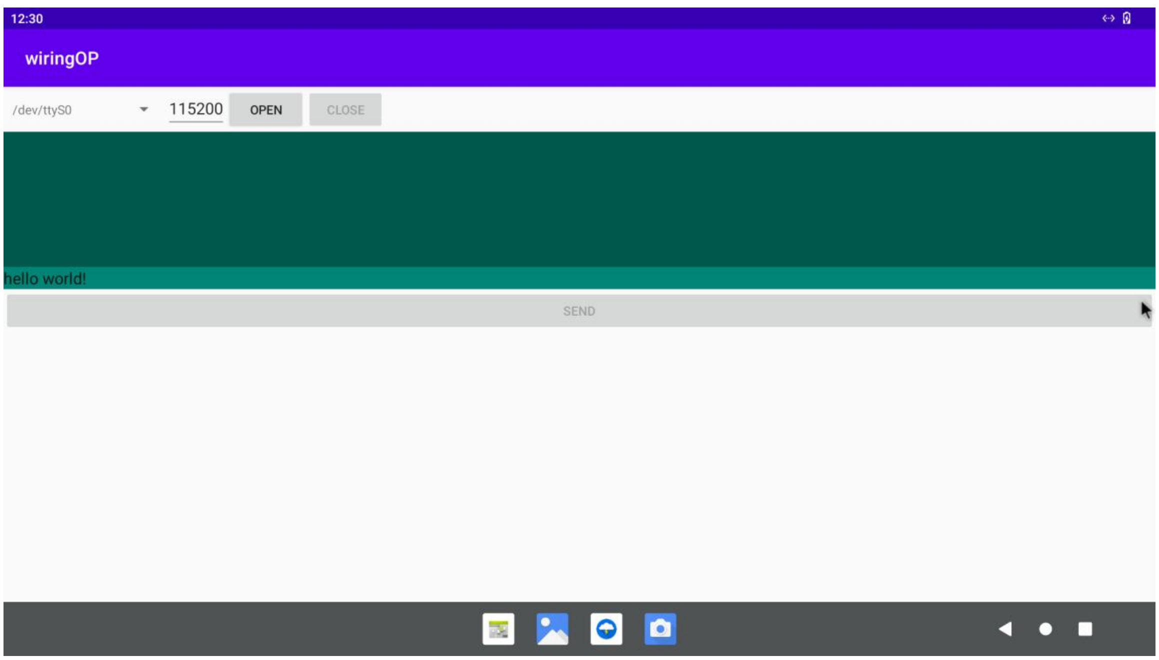
2) First click the WiringOP icon to open the wiringOP APP



3) The main interface of the WiringOP APP is displayed as shown in the figure below, and then click the **UART_TEST** button to open the UART test

interface 

4) The serial test interface of the APP is shown in the figure below

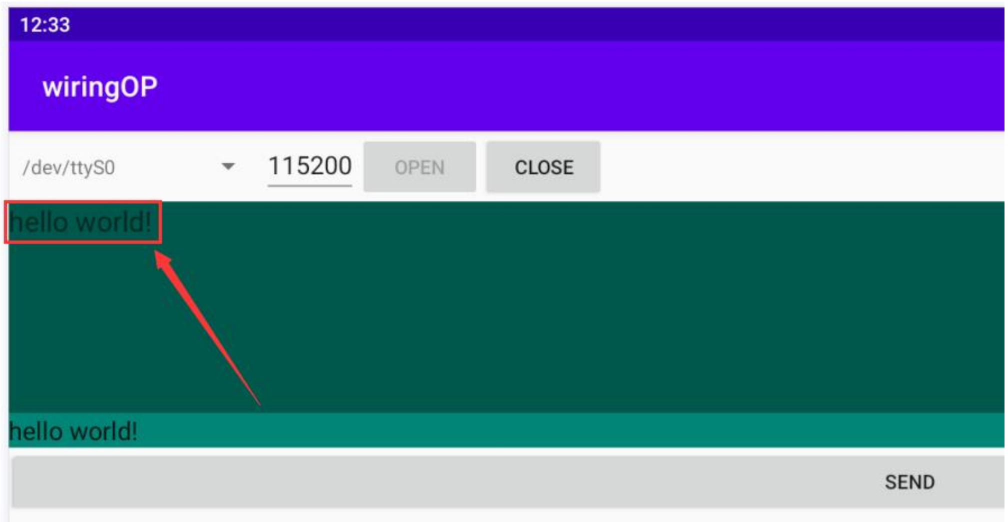


5) Then enter the baud rate you want to set in the editing box, and then click the **OPEN** button to open the **/dev/ttyS0** node. After successful, the **OPEN** button becomes an optional state.The **CLOSE** button and the **SEND** button become an optional state

6) Then use the DuPont line to shorten the RXD and TXD

7) Then you can enter a section of characters in the editing box below, click the **SEND** button to start sending

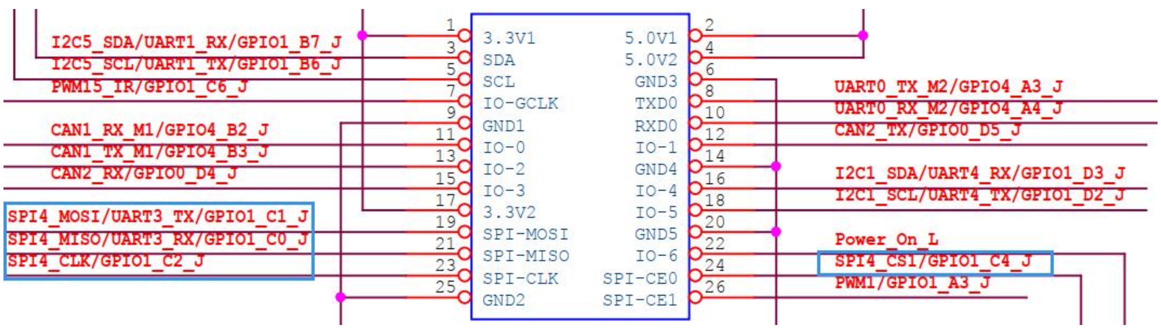
8) If everything is normal, the receiving string will be displayed in the receiving



box

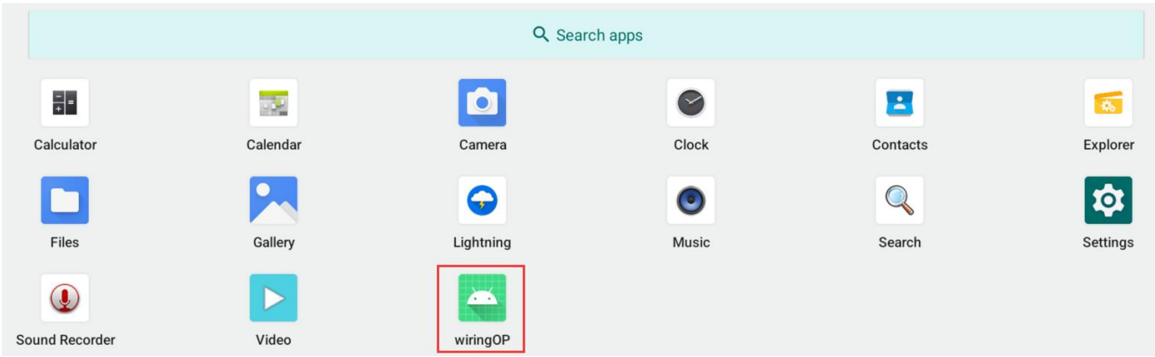
7. 8. 3. 26pin SPI test

1) From the schematic diagram of the 26pin interface, the SPI available for Orange Pi 5B is spi4



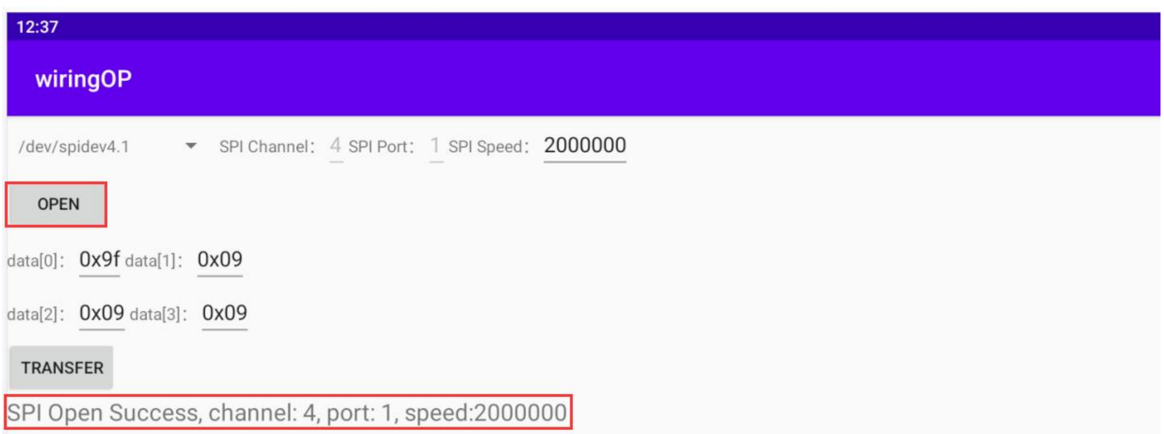
2) Here is the w25q64 module to test the SPI interface, and first access the w25q64 device at the SPI4 interface

3) Then click the WiringOP icon to open the wiringOP APP

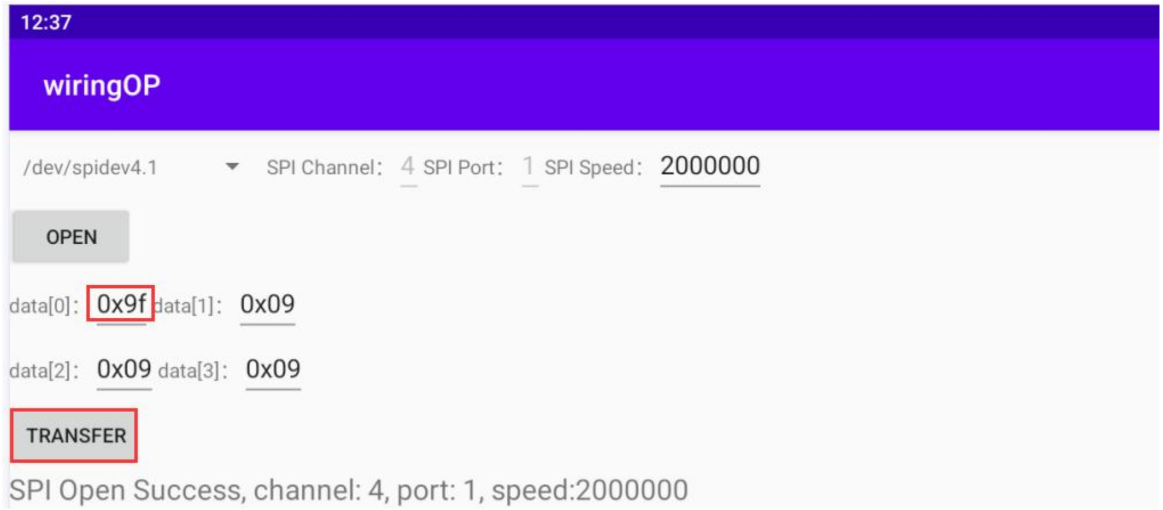


4) The main interface of the WiringOP APP shows as shown in the figure below, click the SPI_TEST button to open the SPI test interface

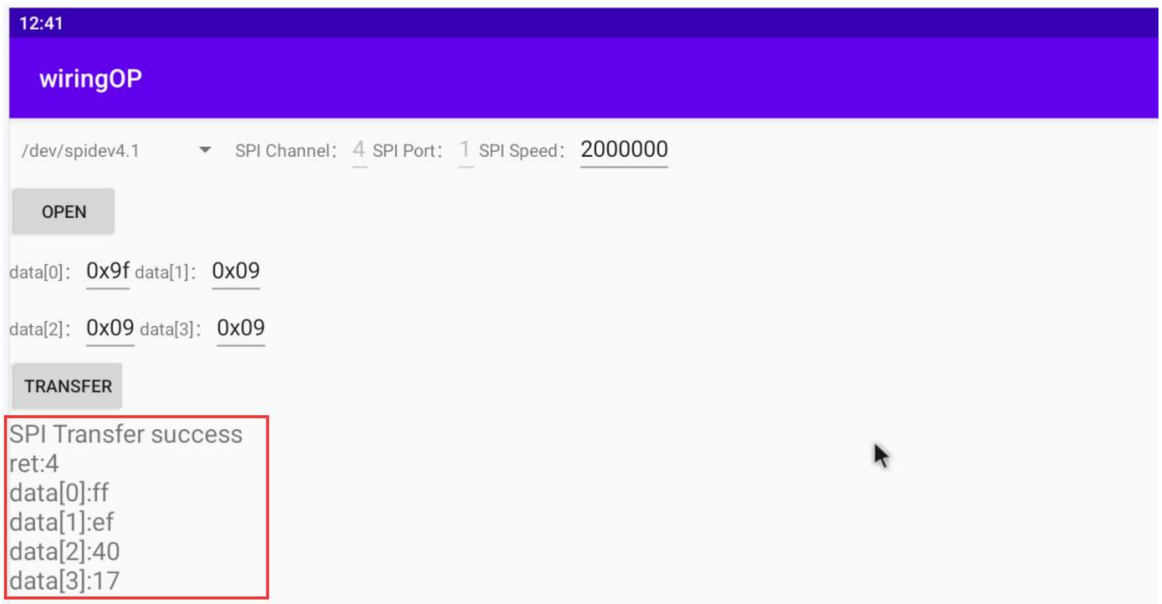
5) Then click the **OPEN** button to initialize SPI



6) Then fill in bytes that need to be sent, such as reading the ID information of W25Q64, fill in the address 0x9F in data [0], and then click the **TRANSFER**



7) The last app will display the ID information read

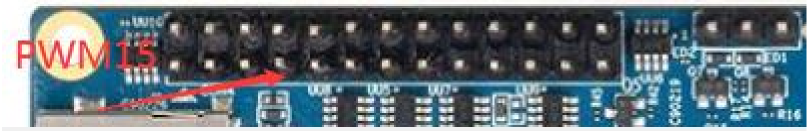


8) The MANUFACTURER ID of the w25q64 module is EFh, the Device ID is 4017h, and the value read above is corresponding (H represents hexadecimal)

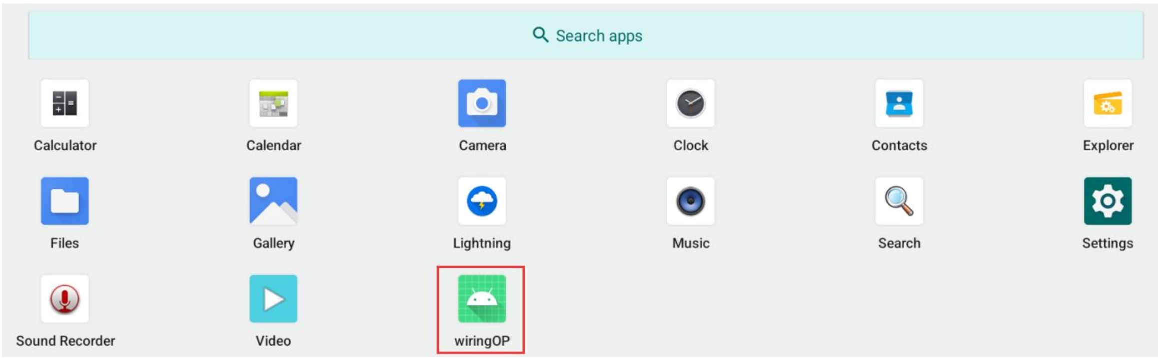
MANUFACTURER ID	**(MF7 - MF0)**	
Winbond Serial Flash	EFh	
Device ID	**(ID7 - ID0)**	**(ID15 - ID0)**
Instruction	**ABh, 90h, 92h, 94h**	**9Fh**
W25Q64FV (SPI)	16h	4017h
W25Q64FV (QPI)	16h	6017h

7.8.4. 26 pin PWM test

1) Android only opened **PWM 15** by default. The corresponding pins are at the position of 26 Pin

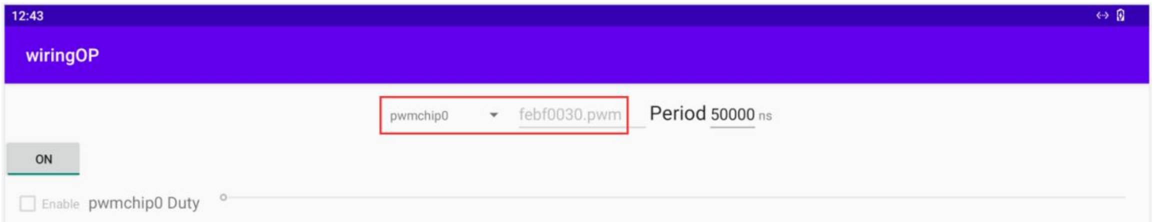


2) First click the WiringOP icon to open the Wiringop App



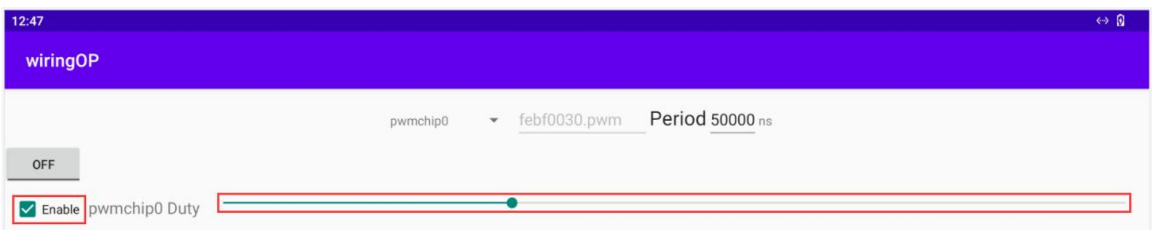
3) Then click the **PWM_TEST** button to enter the PWM test interface at the main interface of WiringOP

4) The corresponding address corresponding to the PWM15 is **febf0030.** The right side of PWMCHIP0 is exactly the **febf0030.pwm**. If the displayed base address is wrong, please click the drop -down option to select other PWMCHIP until the **febf0030** is displayed on the right.

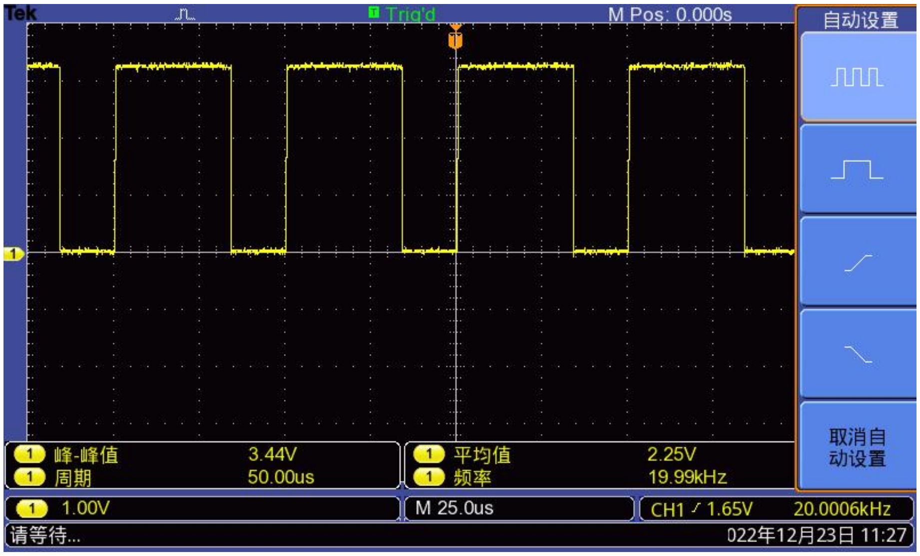


5) Then confirm the PWM cycle. The default configuration is **50000ns**, and the PWM frequency is **20KHz.** You can modify it by yourself.Click on the button to export **PWM15**

6) Then drag the drag bar below to change the PWM duty cycle, and then check Enable to output the PWM waveform



7) Then use an oscilloscope to measure the No. 7 pin in the 26pin of the development board, and you can see the following waveform.



7.9. How to use ADB

7.9.1. Use a data cable to connect to adb debugging

1) First prepare a good quality Type-C data cable

2) Then use the Type-C data cable to connect the development board to the USB interface of the computer (please use the Type-C power supply to power the development board at the same time)

3) Install adb tool on Ubuntu PC

```
test@test:~$ sudo apt update
test@test:~$ sudo apt -y install adb
```

4) You can view the identified ADB devices with the following command

```
test@test:~$ adb devices
```

```
List of devices attached
S63QCF54CJ      device
test@test:~$ lsusb
Bus 003 Device 006: ID 2207:0006
```

5) Then you can log in to the android system through the adb shell on the Ubuntu PC

```
test@test:~$ adb shell
console:/ $
```

6) Execute the command to remount the Android system

```
test@test:~$ adb root
test@test:~$ adb remount
```

7) Then you can transfer files to the Android system

```
test@test:~$ adb push example.txt /system/
```

7. 9. 2. adb debug using network connection

Using the network adb does not require a USB Type C interface data cable to connect the computer and the development board, but to communicate through the network, so first make sure that the wired or wireless network of the development board has been connected, and then obtain the IP address of the development board that will be used later.

1) Make sure **service.adb.tcp.port** of Android system is set to port number 5555

```
console:/ # getprop | grep "adb.tcp"
[service.adb.tcp.port]: [5555]
```

2) If **service.adb.tcp.port** is not set, you can use the following command to set the port number of network adb

```
console:/ # setprop service.adb.tcp.port 5555
console:/ # stop adbd
console:/ # start adbd
```

3) Install adb tool on Ubuntu PC

```
test@test:~$ sudo apt update
test@test:~$ sudo apt install -y adb
```

4) Then connect network adb on Ubuntu PC

```
test@test:~$ adb connect 192.168.1.xxx     (The IP address needs to be changed to the IP address of the development board)
* daemon not running; starting now at tcp:5037
* daemon started successfully
connected to 192.168.1.xxx:5555

test@test:~$ adb devices
List of devices attached
192.168.1.xxx:5555          device
```

5) Then you can log in to the android system through the adb shell on the Ubuntu PC

```
test@test:~$ adb shell
console:/ #
```

7. 10. 2.4G USB remote control tested by Android Box

1) 2.4G USB remote control that has been tested so far is shown in the figure below

a. contains a remote

b. A USB wireless receiver

2) The Android Box system does not require any configuration, it can be used after plugging it in

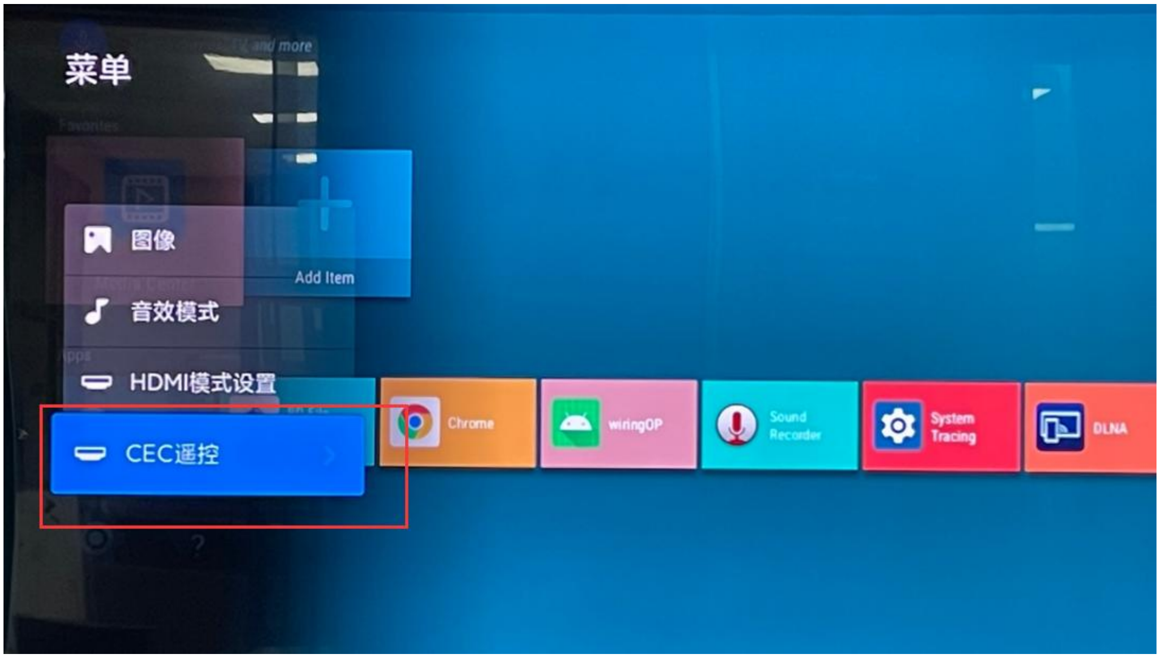
7. 11. How to use HDMI CEC function in Android Box system

HDMI CEC allows users to control all connected devices through HDMI with only one remote control. Based on this function, we can control the development board with the remote control of the TV.

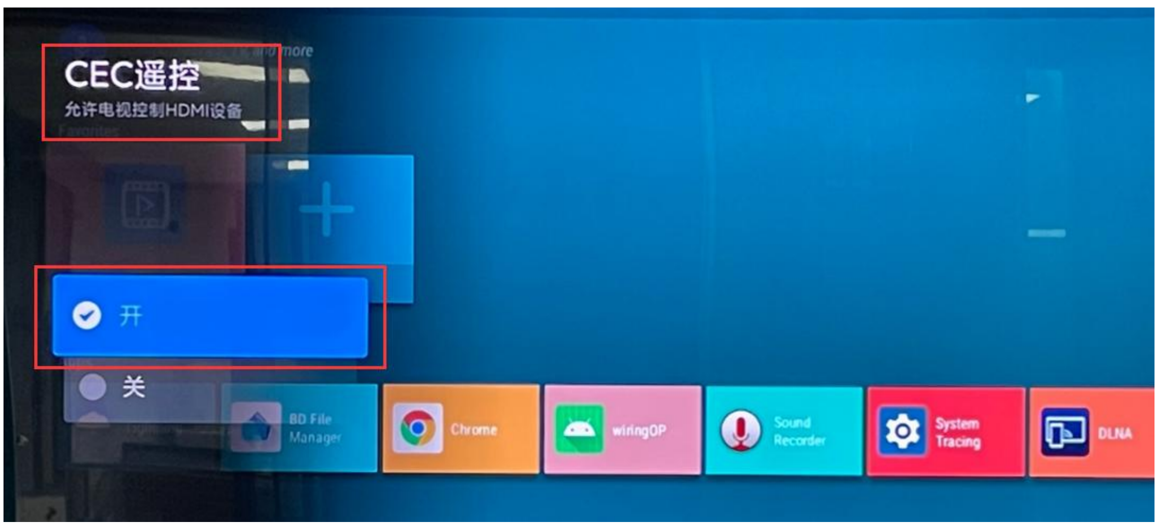
Before testing this function, please make sure your TV supports HDMI CEC.

1) First connect the development board to the TV via the HDMI cable, then power on and start

2) Then turn on the HDMI CEC function in the TV settings. Different TVs may have different ways to turn it on. Here we take Xiaomi TV as an example. Press the menu button on the remote control, then select CEC remote control and press the confirmation button



3) Then select "On" to open the HDMI CEC remote control



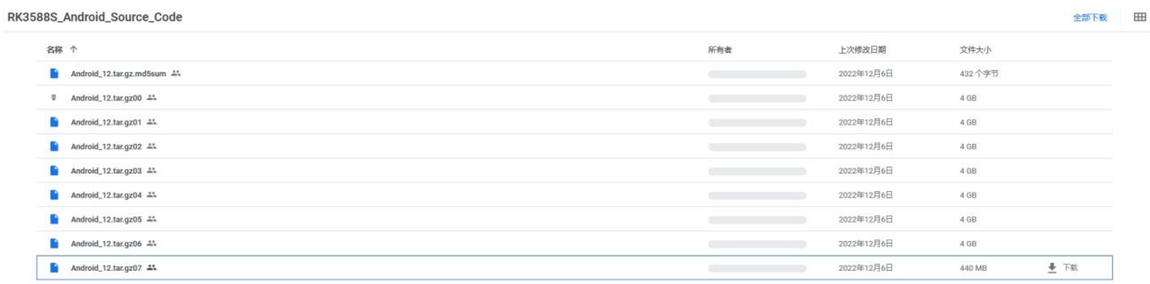
4) At this point, you can control the Android Box system of the development board through the remote control of the TV

8. The compilation method of the Android 12 source code

8. 1. Download the source code of Android 12

1) First download the sub -roll compression package of Android 12 source code from Google Drive

a. Google network disk



2) After downloading the sub -roll compression package of Android 12 source code, please check the MD5 check and whether it is correct. If it is not correct, please download the source code again.

```
test@test:~$ md5sum -c Android_12.tar.gz.md5sum
Android_12.tar.gz00: Sure
Android_12.tar.gz01: Sure
Android_12.tar.gz02: Sure
Android_12.tar.gz03: Sure
Android_12.tar.gz04: Sure
Android_12.tar.gz05: Sure
Android_12.tar.gz06: Sure
Android_12.tar.gz07: Sure
```

3) Then you need to merge multiple compression files into one, and then decompress it.

```
test@test:~$ cat Android_12.tar.gz0* > Android_12.tar.gz
test@test:~$ tar -xvf Android_12.tar.gz
```

8. 2. Compile the source code of Android 12

1) First install the software package required to compile the Android 12 source code

```
test@test:~$ sudo apt-get update
test@test:~$ sudo apt-get install -y git gnupg flex bison gperf build-essential \
zip curl zlib1g-dev gcc-multilib g++-multilib libc6-dev-i386 \
lib32ncurses5-dev x11proto-core-dev libx11-dev lib32z1-dev ccache \
libgl1-mesa-dev libxml2-utils xsltproc unzip
test@test:~$ sudo apt-get install -y u-boot-tools
```

2) In the source code, there are build.sh compile scripts, and the compile parameters are as follow

c. **-U**： Compile uboot
d. **-K**： Compile kernel
e. **-A**： Compile android
f. **-u**： Package generates update.img and update_spi_nvme.img
g. **-o**： Compile OTA bag
h. **-d**： Specify kernel dts

3) Compile Uboot, Kernel, Android and pack it into update.img.

a. The command to compile and support HDMI 8K display mirroring (LCD off by default) is as follows：

```
test@test:~$ cd Android_12
test@test:~/ Android_12$ export BOARD=orangepi5b
test@test:~/ Android_12$ source build/envsetup.sh
test@test:~/ Android_12$ lunch rk3588s_s-userdebug
test@test:~/ Android_12$ ./build.sh -AUKu
```

b. The command to compile and support LCD display image is as follows：

```
test@test:~$ cd Android_12
test@test:~/ Android_12$ export BOARD=orangepi5
test@test:~/ Android_12$ export DUAL_LCD=true
test@test:~/ Android_12$ source build/envsetup.sh
test@test:~/ Android_12$ lunch rk3588s_s-userdebug
test@test:~/ Android_12$ ./build.sh -AUKu
```

4) After the compilation is completed, the following information will be printed

```
********rkImageMaker ver 2.1********
Generating new image, please wait...
Writing head info...
Writing boot file...
Writing firmware...
Generating MD5 data...
MD5 data generated successfully!
New image generated successfully!
Making update.img OK.
Make update image ok!
```

5) The final image file will be placed in the **rockdev/Image-rk3588s_s** directory. Among them, **update.img** is a TF card startup image, and update spi nvme.img is NVMe SSD boot image.

```
test@test:~/Android_12$ cd rockdev/Image-rk3588s_s
test@test:~/Android_12/rockdev/Image-rk3588s_s $ ls update.img
update.img
```

9. Appendix

9. 1. User Manual Update History

Version	Date	Update Notes
v1.0	2023-04-12	initial version

9. 2. Image Update History

Date	Update Notes
2023-04-12	Orangepi5b_1.0.0_debian_bullseye_server_linux5.10.110.7z Orangepi5b_1.0.0_debian_bullseye_desktop_xfce_linux5.10.110.7z Orangepi5b_1.0.0_debian_bullseye_desktop_kde-plasma_linux5.10.110.7z Orangepi5b_1.0.0_ubuntu_focal_server_linux5.10.110.7z Orangepi5b_1.0.0_ubuntu_focal_desktop_xfce_linux5.10.110.7z Orangepi5b_1.0.0_ubuntu_jammy_server_linux5.10.110.7z Orangepi5b_1.0.0_ubuntu_jammy_desktop_xfce_linux5.10.110.7z Orangepi5b_1.0.0_ubuntu_jammy_desktop_gnome_linux5.10.110.7z OrangePi5B_RK3588S_Android12_v1.0.0.tar.gz OrangePi5B_RK3588S_Android12_lcd_v1.0.0.tar.gz OrangePi5B_RK3588S_Android12-box_v1.0.0.tar.gz Opios-droid-aarch64-opi5b-23.04-linux5.10.110.tar.gz Opios-droid-aarch64-opi5b-23.04-linux5.10.110-en.tar.gz * initial version