

IDO-EVB3588-V1C Ubuntu系统使用手册

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IDO-EVB3588-V1B

Ubuntu 系统使用说明

文档修订历史

版本	修订内容	修订	审核	日期
V1.0	创建文档	谭文学		2023/05/05
	文档验证	何伟聪		2023/05/10
V1.1	修改IDO-EVB3588-V1为IDO-EVB3588-V1B	谭文学		2023/05/11
V1.2	修改IDO-EVB3588-V1B为IDO-EVB3588-V1C	谭文学		2023/07/11
V1.3	增加gcc安装方法； 增加导出文件系统一节；	谭文学		2023/09/13
V1.4	修改在recovery模式下导出文件系统；	谭文学		2023/11/02
V1.5	增加HDMIRX接口测试方法；	谭文学		2023/11/07

1. 硬件资源概况

1.1 主板照片

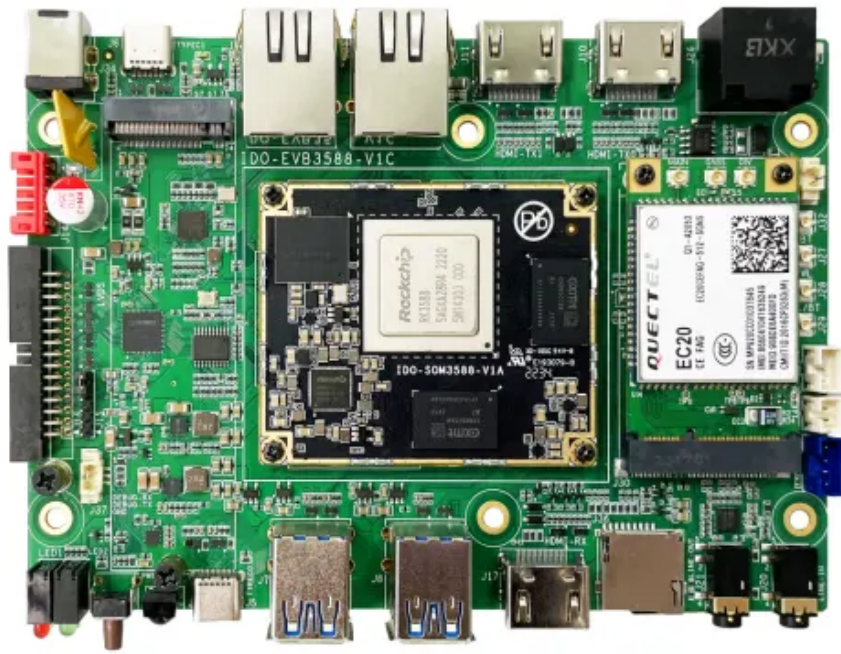


图1. IDO-EVB3588-V1正面接口图

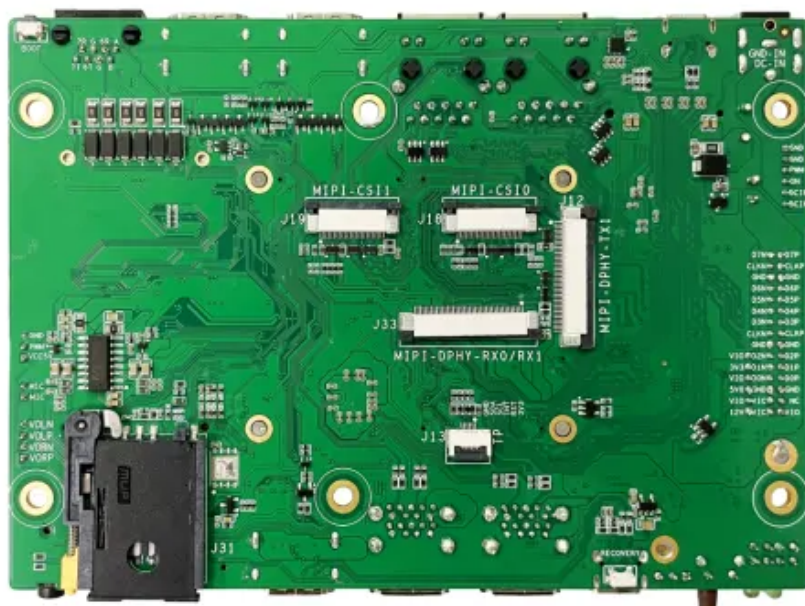


图2. IDO-EVB3588-V1背面接口图

1.2 硬件资源及设备节点

序号	名称	描述	设备节点
1	内核版本	Linux 5.10.110	
2	系统版本	Ubuntu20.04	
3	内存	LPDDR4, 8GB	
4	存储	eMMC, 64GB	
5	供电	默认12V/2A供电	

6	显示	1x HDMI2.1接口，支持（8K/60fps或4K/120fps）输出 1x HDMI2.0接口，支持4K/60fps输出 1x MIPI DSI接口，支持4k@60fps输出 1x 双LVDS接口，支持1920x1080@60fps输出	
7	USB OTG		
8	USB HOST	USB3.0 HOST(Type-A) X 4 TYPEC3.0 X 3	
9	TF Card	TF Card x 1	
10	以太网	千兆以太网 x 2	eth0、eth1
11	WIFI/BT	6222B-SRB（欧智通），RTL8852BS	wlan0、hci0
12	扬声器		
13	耳机	3.5mm 美标	
14	IINE_IN	3.5mm 美标	
15	Camera	IMX415 X 2	
16	串口	RS232 x 2 RS485 x 1	
17	调试串口	TTL x 1	
18	RTC	HYM8563S	
19	LED	电源指示灯 X 1 系统运行呼吸灯 X 1 自定义指示灯 x2	
20	4G	EC20	
21	按键	Recovery按键、Boot按键、Power-on按键、Reset按键	
22	PWM	x1	
23	MIC		

24	HDMI-IN	支持4K/60fps, HDCP2.3	
25	MIPI_DPHY_RX		

2.硬件接口使用说明

2.1 调试

2.1.1 串口调试

调试串口位于J37，电平类型为TTL电平，通信参数为1500000 8 N 1。

默认以用户industio登录，登录密码为industio。

或选择以用户root登录，登录密码为industio。

```
1 ▾ [ OK ] Started Session c1 of user industio.
2 ▾ [ 5.271135] dma-pl330 fea30000.dma-controller: fill_queue:2263 Bad Desc
  (2)
3
4 Ubuntu 20.04.5 LTS Industio ttyFIQ0
5
6 Industio login: industio
7 Password:
8 Welcome to Ubuntu 20.04.5 LTS (GNU/Linux 5.10.110 aarch64)
9
10 * Documentation:  https://help.ubuntu.com
11 * Management:    https://landscape.canonical.com
12 * Support:       https://ubuntu.com/advantage
13
14 This system has been minimized by removing packages and content that are
15 not required on a system that users do not log into.
16
17 To restore this content, you can run the 'unminimize' command.
18
19 * Introducing Expanded Security Maintenance for Applications.
20   Receive updates to over 25,000 software packages with your
21   Ubuntu Pro subscription. Free for personal use.
22
23   https://ubuntu.com/pro
24
25 Expanded Security Maintenance for Applications is not enabled.
26
27 0 updates can be applied immediately.
28
29 Enable ESM Apps to receive additional future security updates.
30 See https://ubuntu.com/esm or run: sudo pro status
31
32 Failed to connect to https://changelogs.ubuntu.com/meta-release-lts. Chec
33 k your Internet connection or proxy settings
34
35 Last login: Mon Mar  6 23:06:10 CST 2023 on ttyFIQ0
36 industio@Industio:~$
```

如industio用户需切换至root用户，需执行**sudo -i**。

2.1.2 ADB 调试

ADB调试端口位于J5（TYPEC-0，与烧录端口一致）。


```

Shell |
1 D:\>adb shell
2 * daemon not running. starting it now on port 5037 *
3 * daemon started successfully *
4 root@Industio:/# ls
5 ls
6 bin  dev  lib      mnt  root  sdcard  sys    udisk  vendor
7 boot etc  lost+found  opt  run  snap   system  usr
8 data home media    proc sbin  srv    tmp     var
9 root@Industio:/#

```

2.2 串口

主板共配置3路串口（不包括调试串口），其中2路RS232，一路RS485。3路串口均位于J26。

编号	设备节点	类型
1	/dev/ttyS4	RS485
2	/dev/ttyS6	RS232
3	/dev/ttyS7	RS232

使用microcom可以进行收发测试：

```

Shell |
1 sudo apt-get update
2 sudo apt-get install microcom

```

2.3 USB

主板共配置4路USB接口，均为USB3.0，这里以USB1、USB2、USB3和USB4标记。

编号	位置
USB1	J7, 上
USB2	J8, 下
USB3	J8, 上

USB4	J7, 下
------	-------

2.3.1 电源控制

主板默认开启4路USB电源，同时提供方法控制USB电源开启或关闭。

编号	控制节点
USB1	/sys/class/leds/usb_host1_pwr/brightness
USB2	/sys/class/leds/usb_host2_pwr/brightness
USB3	/sys/class/leds/usb_host3_pwr/brightness
USB4	/sys/class/leds/usb_host4_pwr/brightness

以USB1为例（其他USB类似）：

```
Shell |
1 //关闭USB1的电源
2 industio@Industio:~$ sudo -i
3 root@Industio:~# echo 0 > /sys/class/leds/usb_host1_pwr/brightness
4
5 //开启USB1的电源
6 industio@Industio:~$ sudo -i
7 root@Industio:~# echo 255 > /sys/class/leds/usb_host1_pwr/brightness
```

2.3.2 U盘的挂载

4个USB接口默认插入U盘会自动挂载到 /mnt/udisk/xxx目录下：

```
Shell |
1 industio@Industio:~$ mount
2 /dev/mmcblk0p8 on / type ext4 (rw,relatime)
3 ...
4 /dev/sda1 on /mnt/udisk/KINGSTON type vfat (rw,relatime,async,fmask=0022,dmask=0022,codepage=936,iocharset=utf8,shortname=mixed,errors=remount-ro)
```

2.4 SD

主板配置一路SD接口，位于J36。

默认插入SD卡会自动挂载到/mnt/sdcard目录下：

```
industio@Industio:~$ mount
/dev/mmcblk0p8 on / type ext4 (rw,relatime)
...
/dev/mmcblk1p1 on /mnt/sdcard type vfat (rw,relatime,uid=1000,gid=1000,mask=0022,dmask=0022,codepage=936,ioccharset=utf8,shortname=mixed,showexec,utf8,flush,errors=remount-ro)
```

2.5 以太网网口

主板配置2路1000M以太网接口，位于J24和J25，系统中对应的网络节点为enP4p65s0（J25）和eth1（J24）。

2.5.1 查看IP地址

```
industio@Industio:~$ ifconfig enP4p65s0
enP4p65s0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 192.168.1.113 netmask 255.255.255.0 broadcast 192.168.1.255
    inet6 fe80::39fe:3942:c29e:27b3 prefixlen 64 scopeid 0x20<link>
    ether e6:e1:3e:a5:54:6c txqueuelen 1000 (Ethernet)
    RX packets 10 bytes 1867 (1.8 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 27 bytes 3507 (3.5 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
    device interrupt 156 base 0x5000
industio@Industio:~$ ifconfig eth1
eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 192.168.1.132 netmask 255.255.255.0 broadcast 192.168.1.255
    inet6 fe80::eddc:ff39:b9c5:61c1 prefixlen 64 scopeid 0x20<link>
    ether 96:8c:5b:c2:75:cb txqueuelen 1000 (Ethernet)
    RX packets 14559 bytes 18948346 (18.9 MB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 7023 bytes 624114 (624.1 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
    device interrupt 85
```

2.5.2 设置临时IP地址

```
▼ Shell |
1  industio@Industio:~$ sudo ifconfig enP4p65s0 192.168.1.100
2  industio@Industio:~$ sudo ifconfig eth1 192.168.1.101
```

2.5.3 设置永久静态IP地址

修改/etc/network/interfaces:

```
▼ Shell |
1  # interfaces(5) file used by ifup(8) and ifdown(8)
2  # # Include files from /etc/network/interfaces.d:
3  source /etc/network/interfaces.d/*
4
5  auto eth1
6      iface eth1 inet static
7      address 192.168.1.11
8      netmask 255.255.255.0
9      gateway 192.168.1.1
10     nameserver 192.168.1.1
11
12  auto enP4p65s0
13     iface enP4p65s0 inet static
14     address 192.168.2.11
15     netmask 255.255.255.0
16     gateway 192.168.2.1
17     nameserver 192.168.2.1
18
```

立即生效:

```
▼ Shell |
1  sudo systemctl restart networking
```

设备断电重启, 此静态IP设置仍然生效。

2.6 WiFi

主板配置一路2.4G/5G双频wifi, 型号为RTL8852BS。

系统启动会默认打开WiFi，对应的网络节点为wlan0：

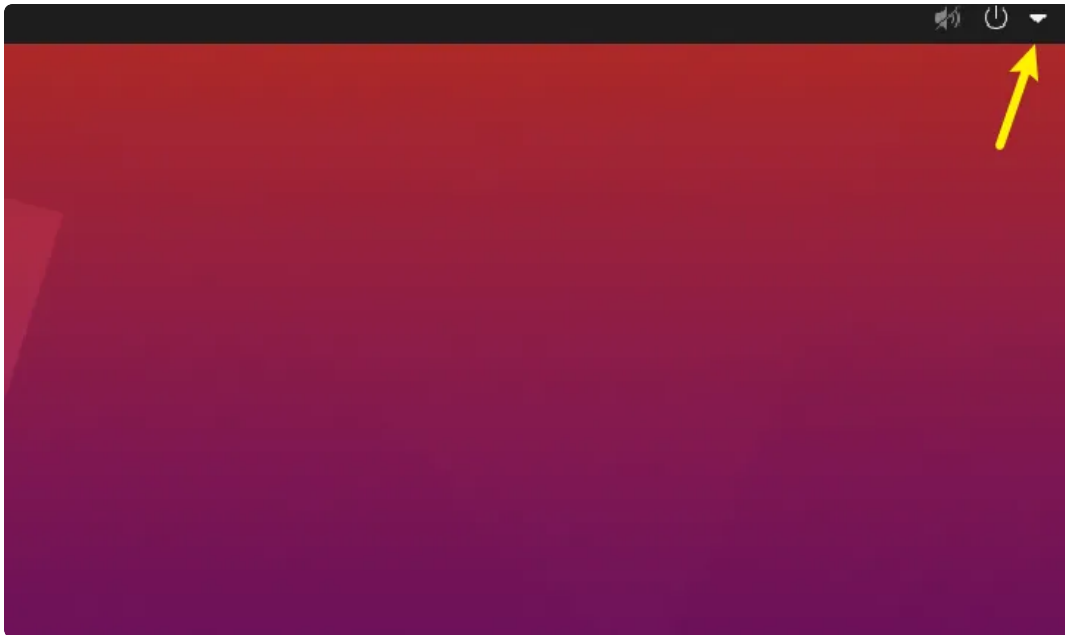
```
industio@Industio:~$ ifconfig wlan0
wlan0: flags=4099<UP,BROADCAST,MULTICAST> mtu 1500
    ether 10:bb:f3:55:cf:25 txqueuelen 1000 (Ethernet)
    RX packets 0 bytes 1477367 (1.4 MB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 2372 bytes 212714 (212.7 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
```

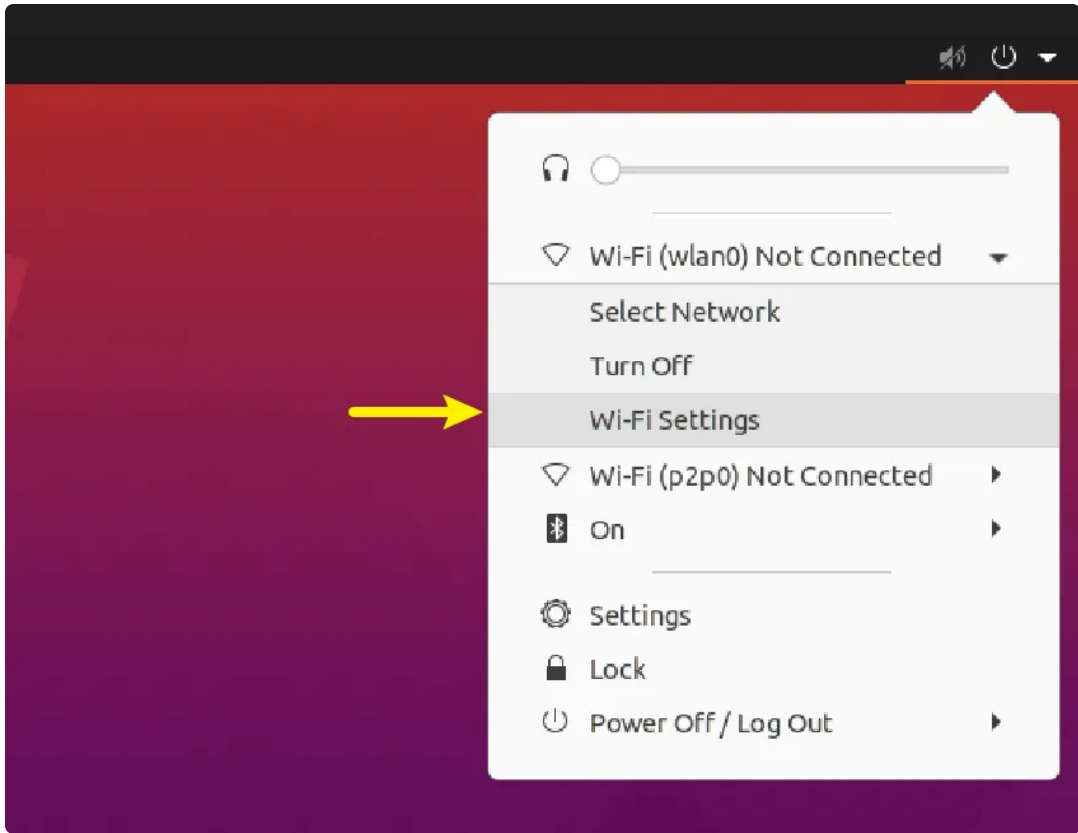
2.6.1 连接WiFi热点

连接热点可以在桌面上操作，也可以使用命令行操作。

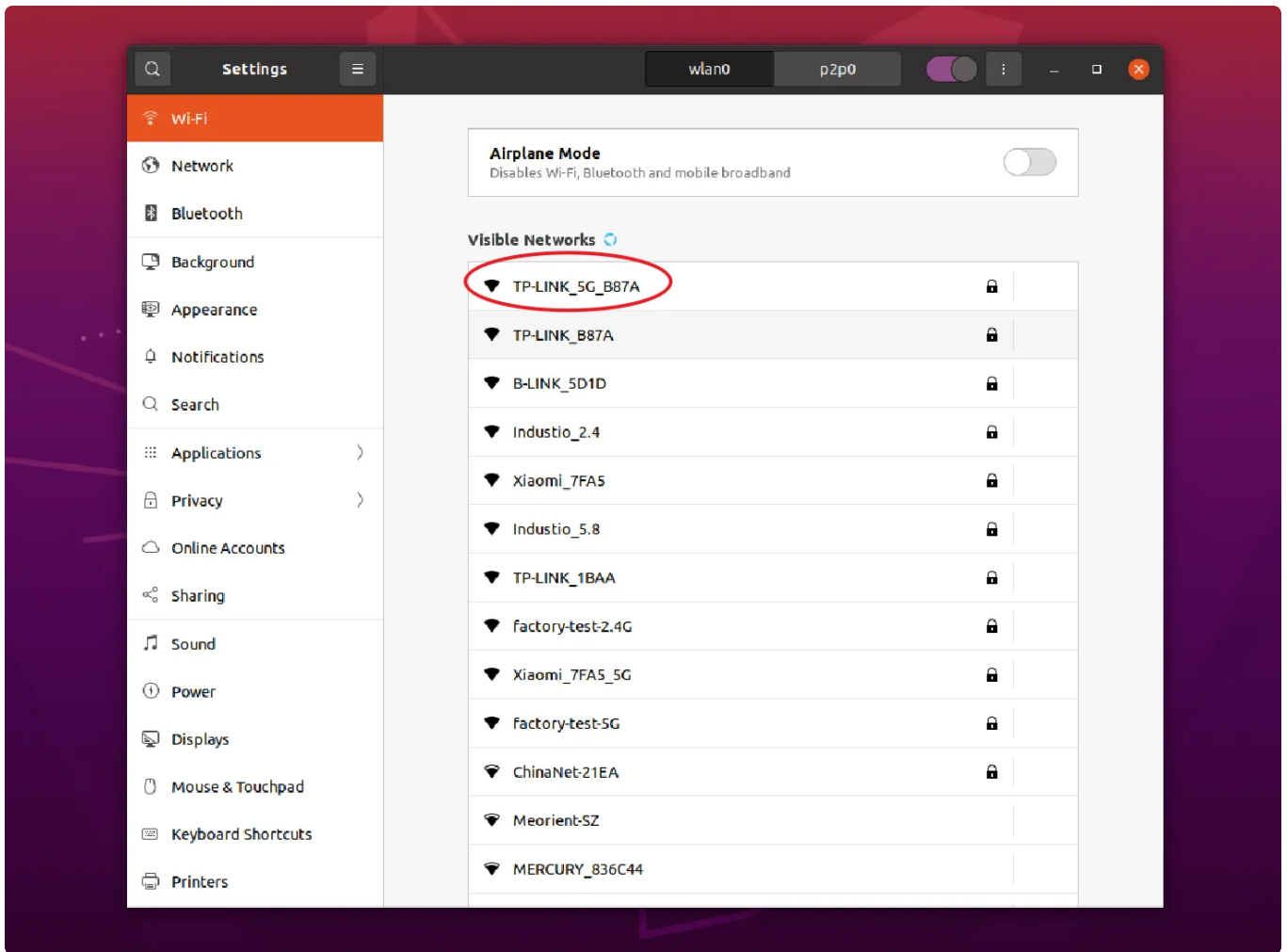
在桌面上操作

点击桌面右上角的下拉选项按钮，弹出的列表中点击Wi-Fi(wlan0)，继续点击Wi-Fi Settings：

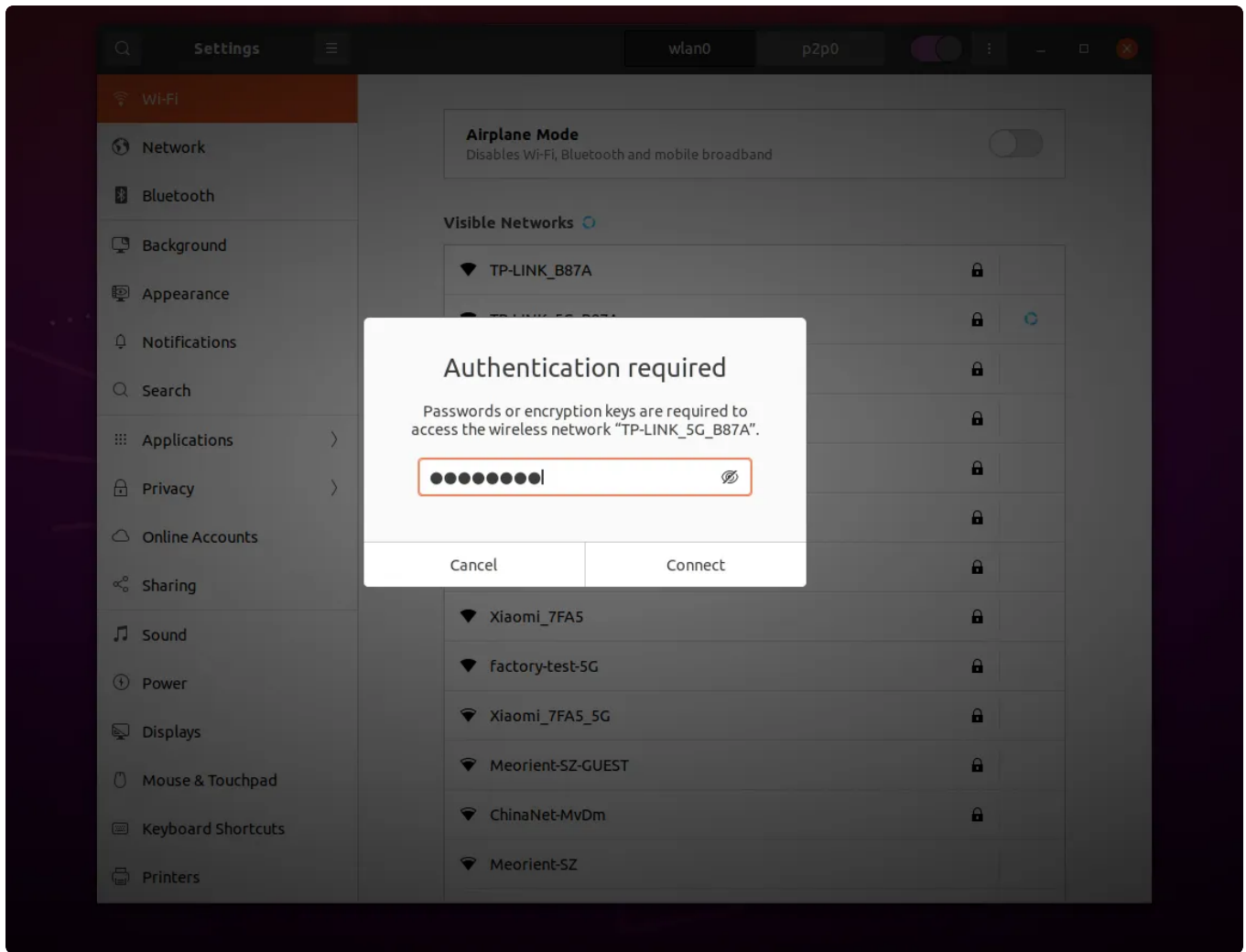




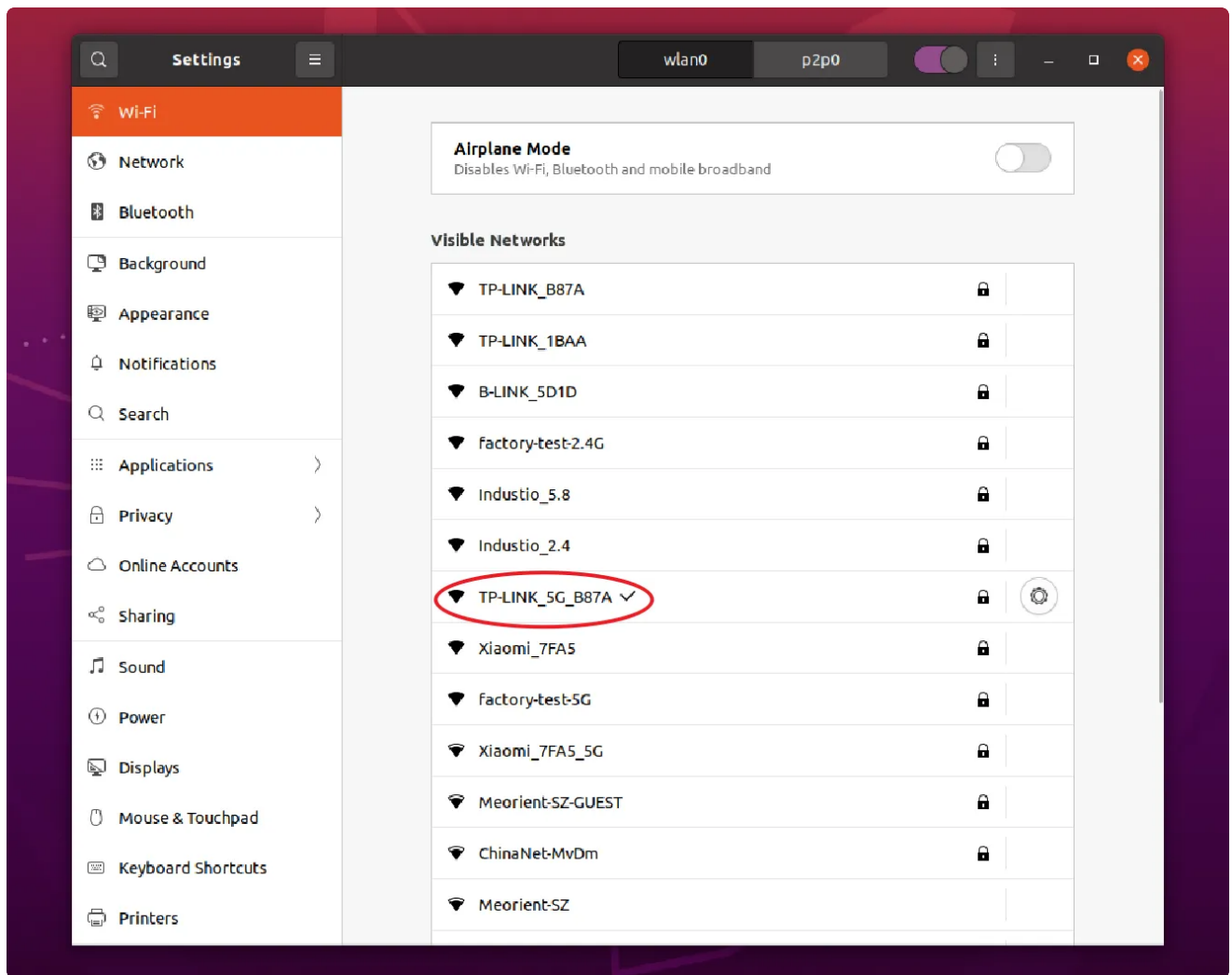
弹出WiFi热点列表，点击要连接的热点名称：



弹出密码输入框，使用键盘输入密码：



如果热点名称后面有"√"标记，表示连接成功：



或者通过ifconfig 命令查看wlan0的IP地址确认：

```
Shell |
1  industio@Industio:~$ ifconfig wlan0
2  wlan0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
3      inet 192.168.1.170  netmask 255.255.255.0  broadcast 192.168.1.255
4      inet6 fe80::636b:35e9:63df:e09a  prefixlen 64  scopeid 0x20<link>
5      inet6 fe80::174c:5956:620a:b2c9  prefixlen 64  scopeid 0x20<link>
6      ether 10:bb:f3:55:cf:25  txqueuelen 1000  (Ethernet)
7      RX packets 0  bytes 1464623 (1.4 MB)
8      RX errors 0  dropped 0  overruns 0  frame 0
9      TX packets 2225  bytes 203231 (203.2 KB)
10     TX errors 0  dropped 0  overruns 0  carrier 0  collisions 0
```

使用命令行操作

命令行可以使用nmcli工具连接wifi热点。

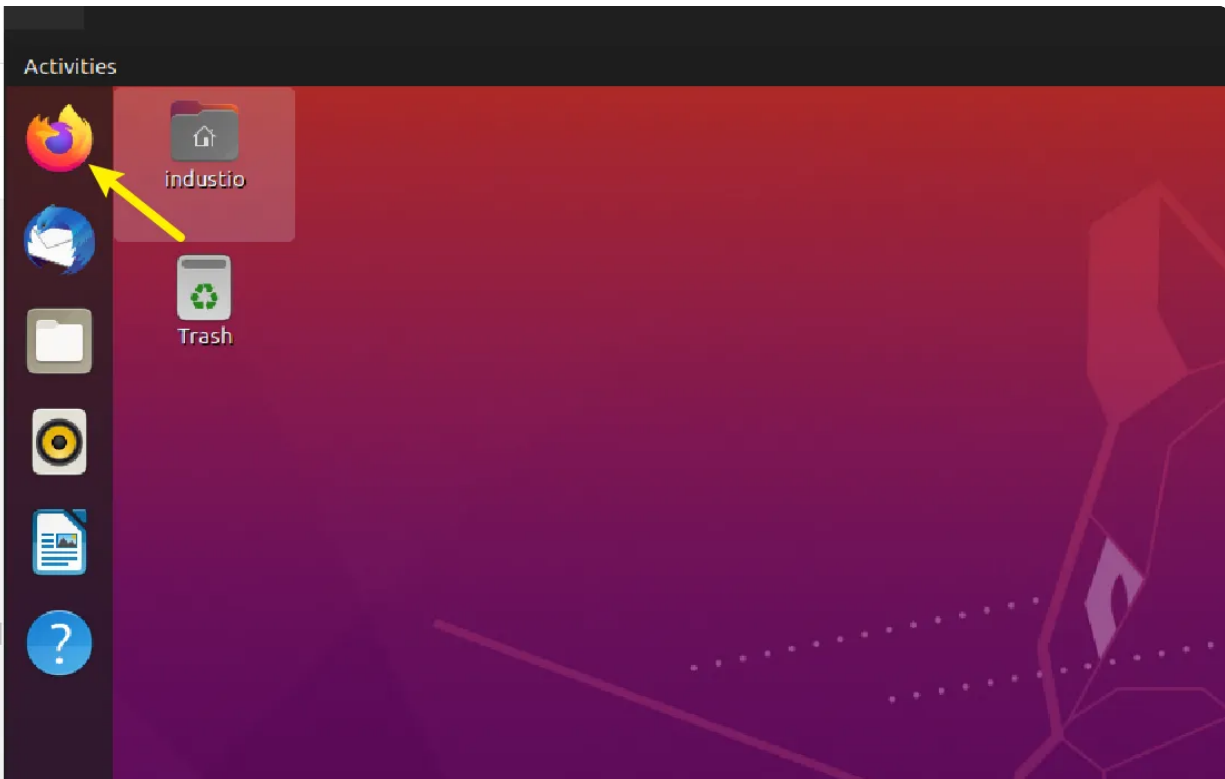
```
Shell |
1  industio@Industio:~$ sudo nmcli dev wifi connect TP-LINK_B87A password 1234
   5678
2  Device 'p2p0' successfully activated with '625bea9c-1a64-469e-8024-5c3c82c7
   976d'.
```

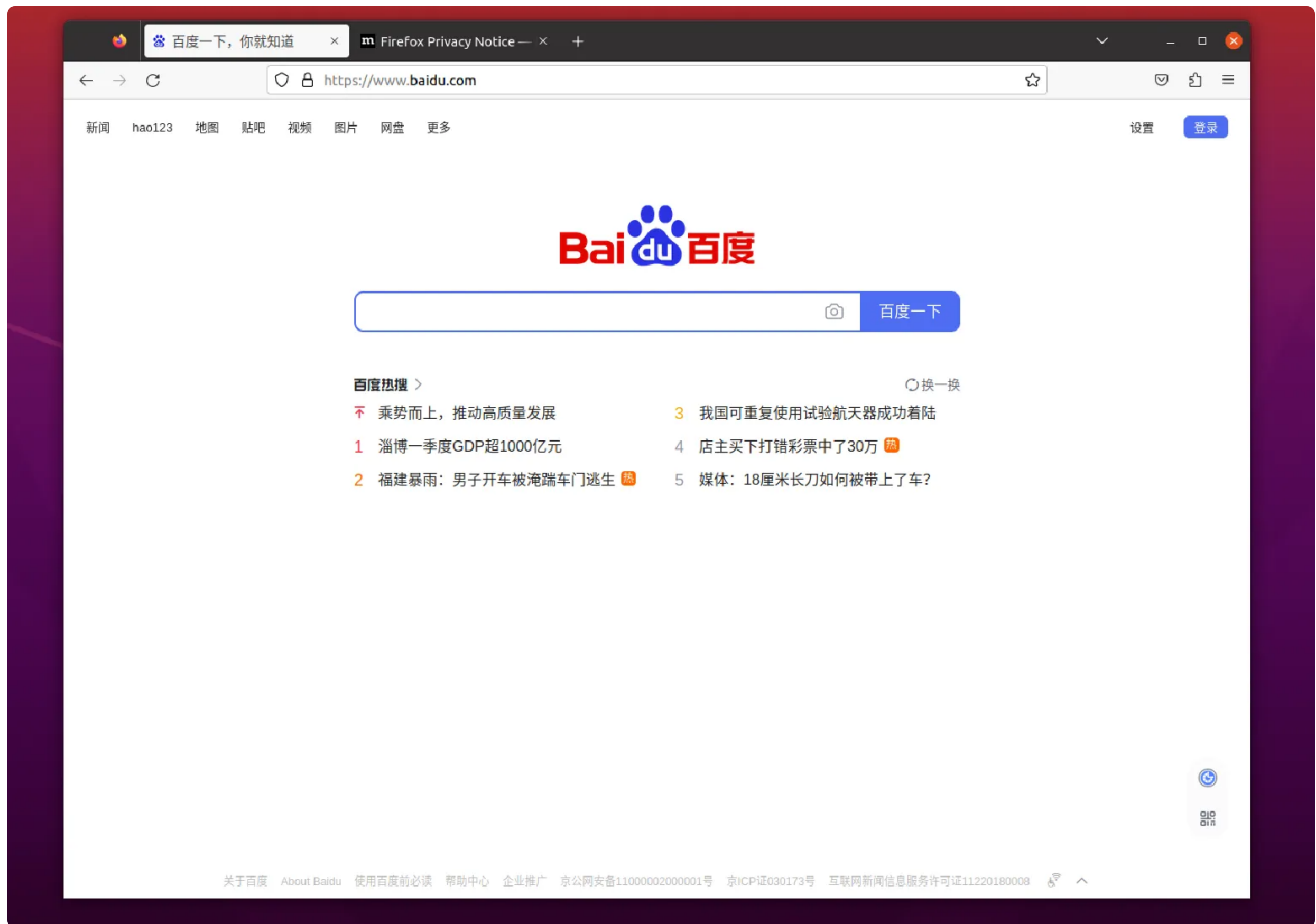
查看p2p0的IP地址，确认连接成功：

```
Shell |
1  industio@Industio:~$ ifconfig p2p0
2  p2p0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
3      inet 192.168.1.118  netmask 255.255.255.0  broadcast 192.168.1.255
4      inet6 fe80::c81a:b213:d6fd:8a06  prefixlen 64  scopeid 0x20<link>
5      ether 12:bb:f3:55:cf:25  txqueuelen 1000  (Ethernet)
6      RX packets 0  bytes 7120 (7.1 KB)
7      RX errors 0  dropped 0  overruns 0  frame 0
8      TX packets 81  bytes 9389 (9.3 KB)
9      TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

2.6.2 测试WiFi网络上网

WiFi连接成功后，点击桌面左上角的浏览器图标打开浏览器：





能够打开网页，说明WiFi网络功能正常。

或者使用ping工具测试上网功能：

```
Shell |
1  industio@Industio:~$ ping www.baidu.com -I wlan0
2  PING www.a.shifen.com (14.119.104.189) from 192.168.1.171 p2p0: 56(84) bytes of data.
3  64 bytes from 14.119.104.189 (14.119.104.189): icmp_seq=1 ttl=54 time=10.0 ms
4  64 bytes from 14.119.104.189 (14.119.104.189): icmp_seq=2 ttl=54 time=15.3 ms
5  64 bytes from 14.119.104.189 (14.119.104.189): icmp_seq=3 ttl=54 time=10.3 ms
```

2.7 蓝牙

主板配置1路蓝牙模块（型号为RTL8852BS）。

2.7.1 查看蓝牙控制器

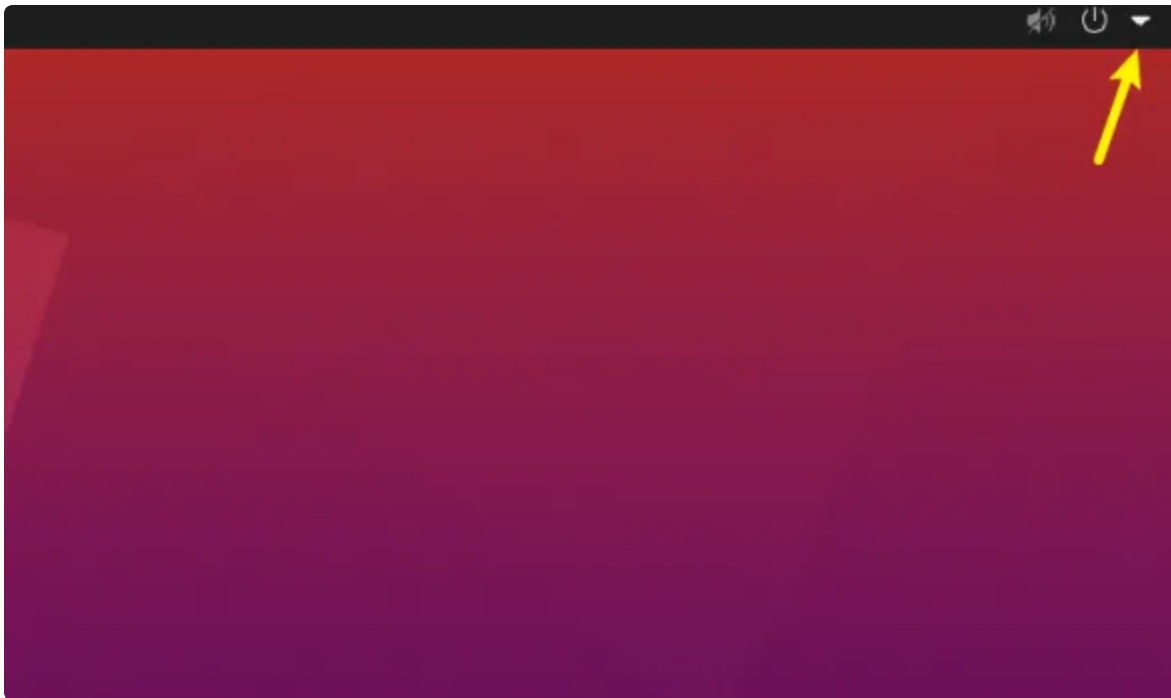
```
Shell |
1  industio@Industio:~$ hciconfig
2  hci0:  Type: Primary  Bus: UART
3         BD Address: 10:BB:F3:56:44:55  ACL MTU: 1021:6  SCO MTU: 255:12
4         UP RUNNING
5         RX bytes:1772 acl:0 sco:0 events:61 errors:0
6         TX bytes:4739 acl:0 sco:0 commands:61 errors:0
7
8  industio@Industio:~$
```

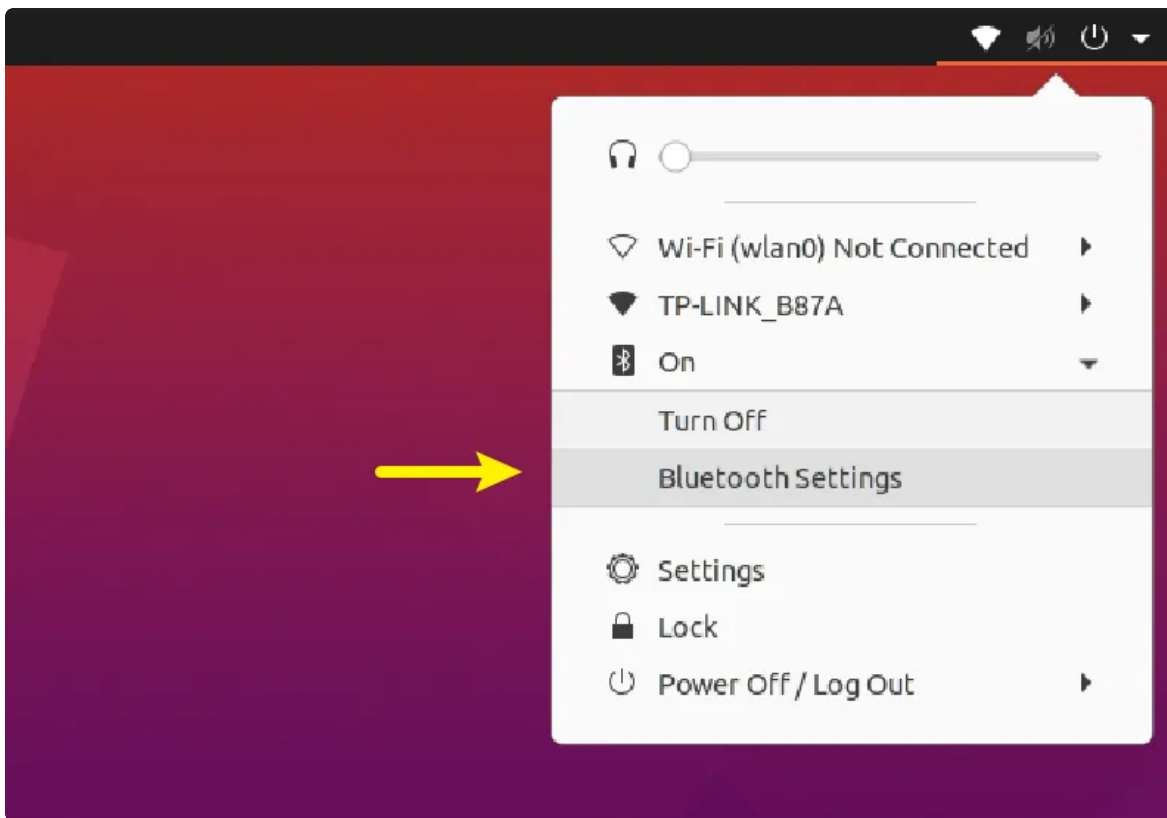
2.7.2 连接蓝牙设备

连接蓝牙设备可以在桌面上操作，也可以使用命令行操作。

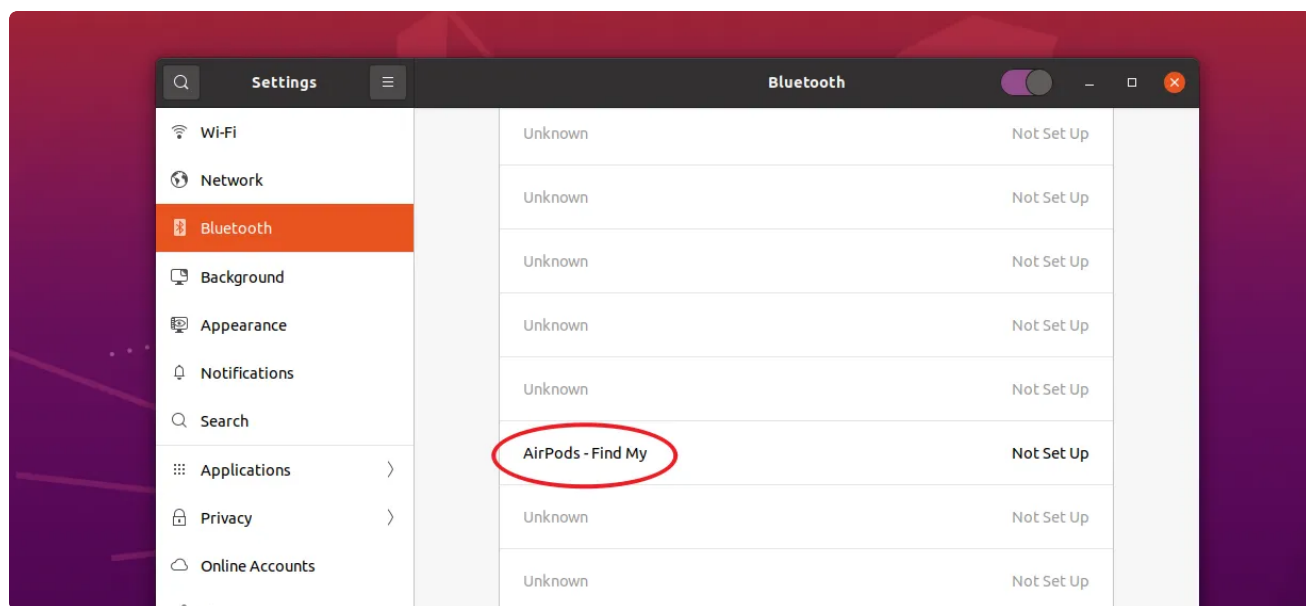
在桌面上操作

点击桌面右上角的下拉选项按钮，弹出的列表中点击蓝牙，继续点击Bluetooth Setting:

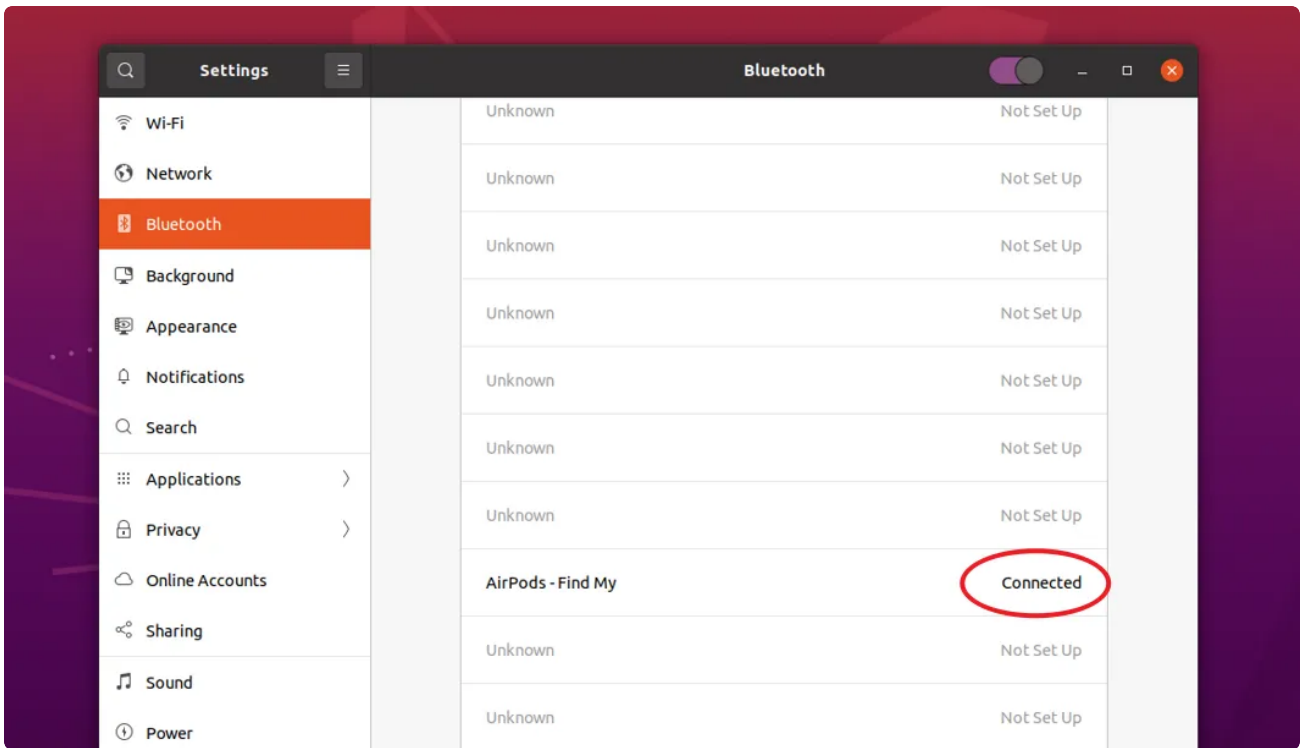




弹出蓝牙扫描列表，点击要连接的蓝牙设备名称，连接蓝牙设备：



设备名称后面提示"Connected", 表示该设备已连接成功：



使用命令行操作

扫描蓝牙设备：

```
industio@Industio:~$ hciconfig hci0 iscan
industio@Industio:~$ bluetoothctl
Agent registered
[CHG] Controller 10:BB:F3:56:44:55 Pairable: yes
[bluetooth]# scan on
Discovery started
[CHG] Controller 10:BB:F3:56:44:55 Discovering: yes
[CHG] Device 24:4C:AB:09:98:A6 RSSI: -92
...
[NEW] Device 7C:C1:80:09:DD:6C AirPods - Find My
...
```

通过mac配对蓝牙设备：

```

1 ▾ [bluetooth]# trust 7C:C1:80:09:DD:6C
2 ▾ [CHG] Device 7C:C1:80:09:DD:6C Trusted: yes
3 Changing 7C:C1:80:09:DD:6C trust succeeded
4 ▾ [bluetooth]# pair 7C:C1:80:09:DD:6C
5 Attempting to pair with 7C:C1:80:09:DD:6C
6 ▾ [CHG] Device 7C:C1:80:09:DD:6C Connected: yes
7 ▾ [CHG] Device 7C:C1:80:09:DD:6C Name: AirPods
8 ▾ [CHG] Device 7C:C1:80:09:DD:6C Alias: AirPods
9 ▾ [CHG] Device 7C:C1:80:09:DD:6C Modalias: bluetooth:v004Cp2013dB087
10 ▾ [CHG] Device 7C:C1:80:09:DD:6C UUIDs: 00001000-0000-1000-8000-00805f9b34fb
11 ▾ [CHG] Device 7C:C1:80:09:DD:6C UUIDs: 0000110b-0000-1000-8000-00805f9b34fb
12 ▾ [CHG] Device 7C:C1:80:09:DD:6C UUIDs: 0000110c-0000-1000-8000-00805f9b34fb
13 ▾ [CHG] Device 7C:C1:80:09:DD:6C UUIDs: 0000110e-0000-1000-8000-00805f9b34fb
14 ▾ [CHG] Device 7C:C1:80:09:DD:6C UUIDs: 0000111e-0000-1000-8000-00805f9b34fb
15 ▾ [CHG] Device 7C:C1:80:09:DD:6C UUIDs: 00001200-0000-1000-8000-00805f9b34fb
16 ▾ [CHG] Device 7C:C1:80:09:DD:6C UUIDs: 74ec2172-0bad-4d01-8f77-997b2be0722a
17 ▾ [CHG] Device 7C:C1:80:09:DD:6C ServicesResolved: yes
18 ▾ [CHG] Device 7C:C1:80:09:DD:6C Paired: yes
19 Pairing successful
20 ▾ [AirPods - Find My]# exit

```

2.8 指示灯

主板共配置4个LED指示灯，各个指示灯详细信息见下表：

编号	位置	颜色	说明
1	LED1, 上	红色	电源指示灯，亮起表示主板供电正常
2	LED1, 下	绿色	系统指示灯，闪烁表示系统运行正常
3	LED2, 上	绿色	用户预留，user1-led2
4	LED2, 下	绿色	4G/5G指示灯，闪烁表示4G/5G正在工作

其中2个用户预留灯可以通过如下方法控制其亮灭：

```

1 //user-led2灭
2 industio@Industio:~$ sudo echo 0 > /sys/class/leds/led2/brightness
3 //user-led2亮
4 industio@Industio:~$ sudo echo 1 > /sys/class/leds/led2/brightness

```

2.9 按键

主板共配置4个按键，各个按键的说明见下表：

编号	名称	说明
1	POWER	电源按键，用于开机/关机；
2	RESET	复位按键，用于硬件复位；
3	RECOVERY	烧录按键，用于烧录，或系统启动后，按下上报KEY_VOLUMEUP；
4	BOOT	BOOT按键，按住该按键上电，会进入MASKROM烧录模式；

2.10 4G/5G

默认支持EC20（4G）模块。

安装好4G/5G模块及SIM卡，主板上电后，会自动拨号。

当wwan0网络节点获取到IP，说明拨号成功：

```

1 industio@Industio:~$ ifconfig wwan0
2 wwan0: flags=4305<UP,POINTOPOINT,RUNNING,NOARP,MULTICAST> mtu 1500
3     inet 10.84.74.157 netmask 255.255.255.252 destination 10.84.74.15
4     7
5     unspec 00-00-00-00-00-00-00-00-00-00-00-00-00-00-00 txqueuelen
6     1000 (UNSPEC)
7     RX packets 7574 bytes 10692984 (10.6 MB)
8     RX errors 0 dropped 0 overruns 0 frame 0
9     TX packets 4447 bytes 268420 (268.4 KB)

```


测试4G/5G上网功能是否正常：

```
industio@Industio:~$ ping www.baidu.com -I wwan0
PING www.a.shifen.com (120.232.145.144) from 10.84.74.157 wwan0: 56(84) bytes of data.
 64 bytes from 120.232.145.144 (120.232.145.144): icmp_seq=1 ttl=53 time=42.6 ms
 64 bytes from 120.232.145.144 (120.232.145.144): icmp_seq=2 ttl=53 time=47.5 ms
 64 bytes from 120.232.145.144 (120.232.145.144): icmp_seq=3 ttl=53 time=62.2 ms
 64 bytes from 120.232.145.144 (120.232.145.144): icmp_seq=4 ttl=53 time=60.8 ms
 64 bytes from 120.232.145.144 (120.232.145.144): icmp_seq=5 ttl=53 time=60.2 ms
 64 bytes from 120.232.145.144 (120.232.145.144): icmp_seq=6 ttl=53 time=58.5 ms
 64 bytes from 120.232.145.144 (120.232.145.144): icmp_seq=7 ttl=53 time=56.3 ms
```

2.11 NGFF/NVME

主板配置了一路NGFF/NVME接口，可接NVME硬盘使用。

接入NVME硬盘后，使用fdisk工具查看该设备：

```

1  industio@Industio:~$ sudo fdisk -l
2  [sudo] password for industio:
3  Disk /dev/ram0: 4 MiB, 4194304 bytes, 8192 sectors
4  Units: sectors of 1 * 512 = 512 bytes
5  Sector size (logical/physical): 512 bytes / 4096 bytes
6  I/O size (minimum/optimal): 4096 bytes / 4096 bytes
7
8
9  Disk /dev/nvme0n1: 119.25 GiB, 128035676160 bytes, 250069680 sectors
10 Disk model: Thinklife ST8000 PCI-E M.2 128G
11 Units: sectors of 1 * 512 = 512 bytes
12 Sector size (logical/physical): 512 bytes / 512 bytes
13 I/O size (minimum/optimal): 512 bytes / 512 bytes
14 Disklabel type: dos
15 Disk identifier: 0x00000000
16
17 Device          Boot Start          End  Sectors   Size Id Type
18 /dev/nvme0n1p1      2048 250069646 250067599 119.2G  c W95 FAT32 (LBA)

```

使用mount工具挂载到指定目录，即可使用该硬盘。

```

1  industio@Industio:~$ sudo mount /dev/nvme0n1p1 /mnt/sdcard
2  industio@Industio:~$ ls /mnt/sdcard/
3  Alarms  Audiobooks  Documents  LOST.DIR  Music          Pictures  Recordi
4  gns
5  Android  DCIM          Download  Movies    Notifications  Podcasts  Rington
6  es
7  industio@Industio:~$ sudo df -h
8  Filesystem      Size  Used Avail Use% Mounted on
9  /dev/root       56G   3.8G   50G   8% /
10 devtmpfs        3.9G   0    3.9G   0% /dev
11 tmpfs           3.9G   0    3.9G   0% /dev/shm
12 tmpfs           793M   2.7M  790M   1% /run
13 tmpfs           5.0M   4.0K   5.0M   1% /run/lock
14 tmpfs           3.9G   0    3.9G   0% /sys/fs/cgroup
15 tmpfs           793M   16K   793M   1% /run/user/1000
16 /dev/sda1       29G   16G   14G   53% /mnt/udisk/KINGSTON
17 /dev/nvme0n1p1 120G   67M  120G   1% /mnt/sdcard

```

2.12 音频

主板共配置4个声卡设备（包含rockchip-es8388、hdmi0、hdmi1和dp0/1）。

使用aplay/arecord工具可以查看系统所有声卡设备：

```
industio@Industio:~$ aplay -l
**** List of PLAYBACK Hardware Devices ****
card 0: rockchiphdmi0 [rockchip-hdmi0], device 0: rockchip-hdmi0 i2s-hifi-0 [rockchip-hdmi0 i2s-hifi-0]
  Subdevices: 1/1
  Subdevice #0: subdevice #0
card 1: rockchiphdmi1 [rockchip-hdmi1], device 0: rockchip-hdmi1 i2s-hifi-0 [rockchip-hdmi1 i2s-hifi-0]
  Subdevices: 1/1
  Subdevice #0: subdevice #0
card 2: rockchipdp0 [rockchip,dp0], device 0: rockchip,dp0 spdif-hifi-0 [rockchip,dp0 spdif-hifi-0]
  Subdevices: 1/1
  Subdevice #0: subdevice #0
card 3: rockchipes8388 [rockchip-es8388], device 0: dailink-multicodecs ES8323.7-0011-0 [dailink-multicodecs ES8323.7-0011-0]
  Subdevices: 1/1
  Subdevice #0: subdevice #0
industio@Industio:~$
```

2.12.1 扬声器

主板配置了一路双声道扬声器接口，位于J23。

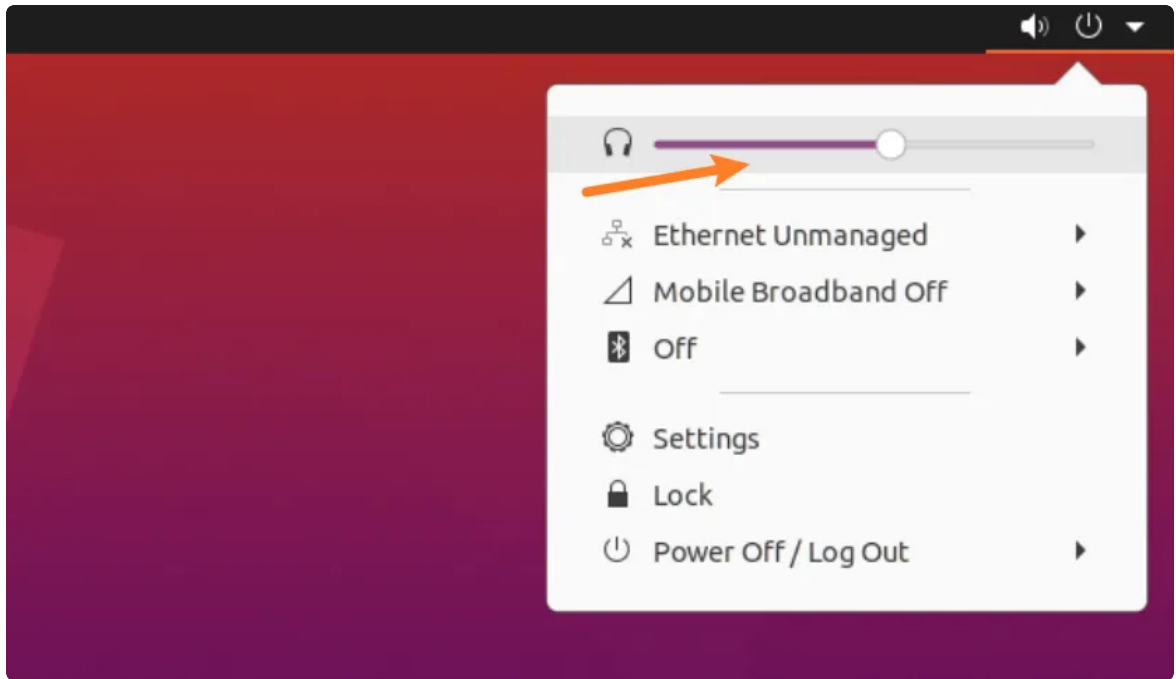
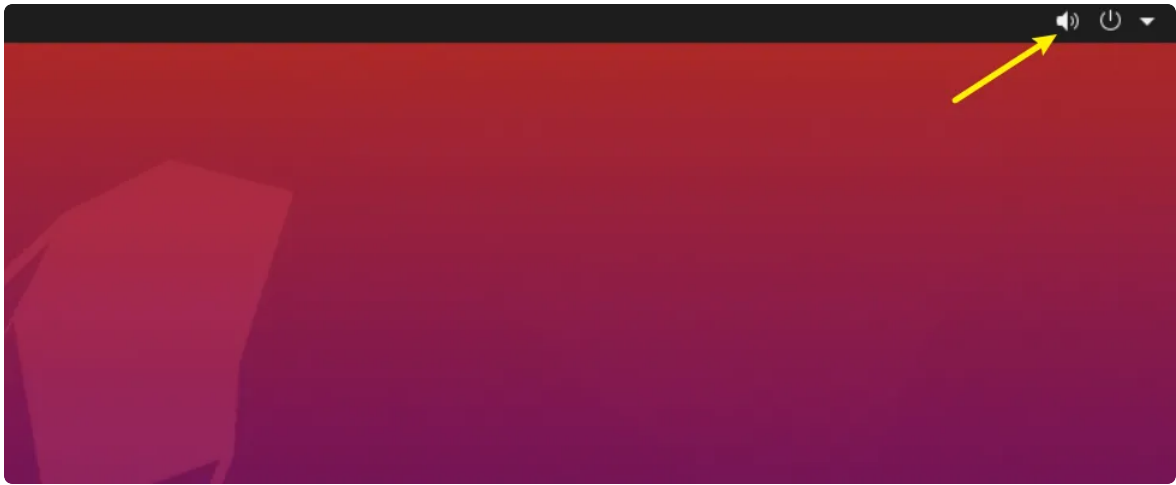
播放音频

接上扬声器，拔出耳机，执行以下命令播放音频：

```
industio@Industio:~$ aplay /usr/share/sounds/alsa/Front_Center.wav
Playing WAVE '/usr/share/sounds/alsa/Front_Center.wav' : Signed 16 bit Little Endian, Rate 48000 Hz, Mono
```

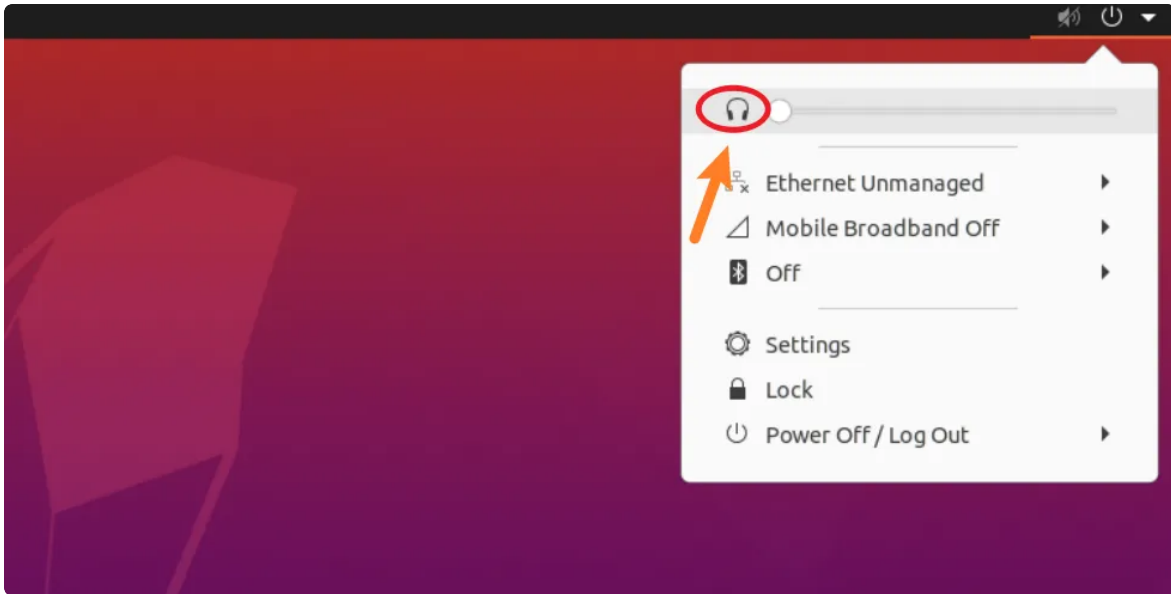
调节播放音量

点击桌面右上角的音量图标，通过滑动音量进度条来调节音量大小：



静音

点击桌面右上角的音量图标，通过点击静音按钮来控制按钮：



2.12.2 耳机/Line Out

主板配置了一路耳机接口，位于J21。

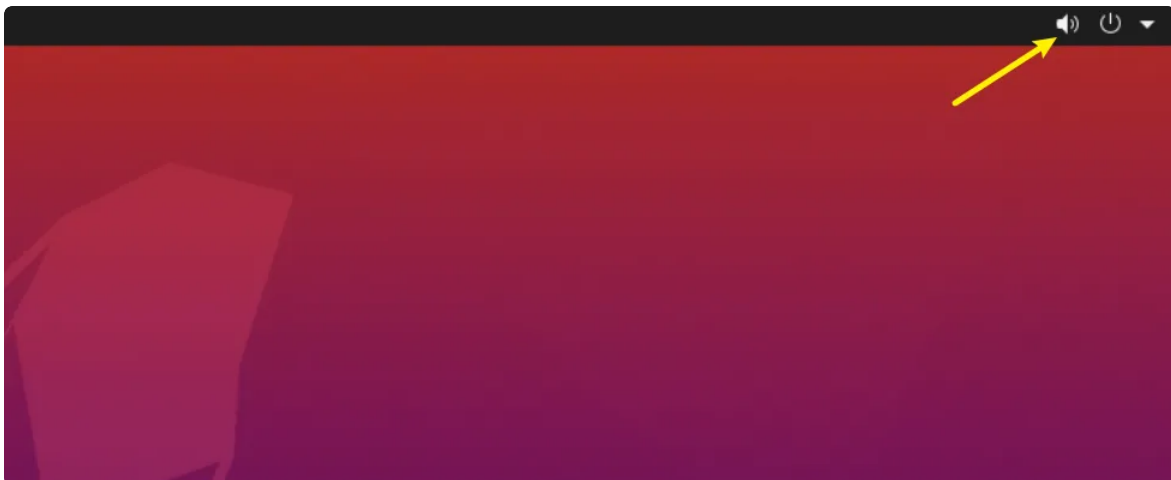
播放音频

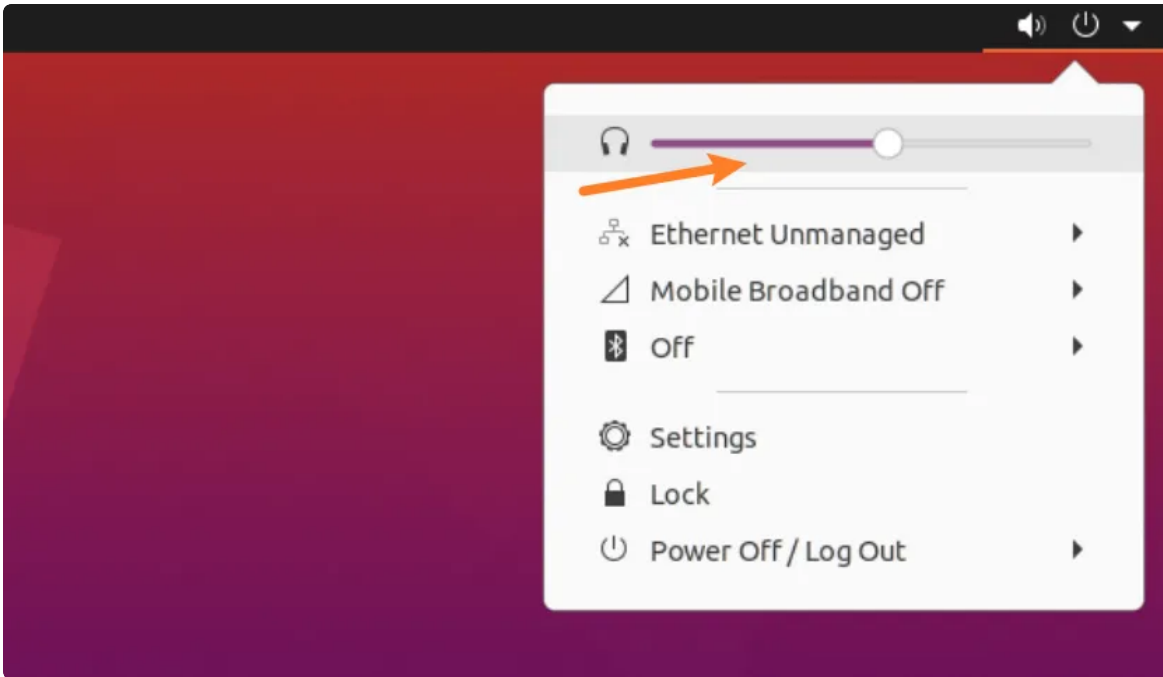
插入耳机，执行以下命令播放音频：

```
industio@Industio:~$ aplay /usr/share/sounds/alsa/Front_Center.wav
Playing WAVE '/usr/share/sounds/alsa/Front_Center.wav' : Signed 16 bit Little Endian, Rate 48000 Hz, Mono
```

调节播放音量

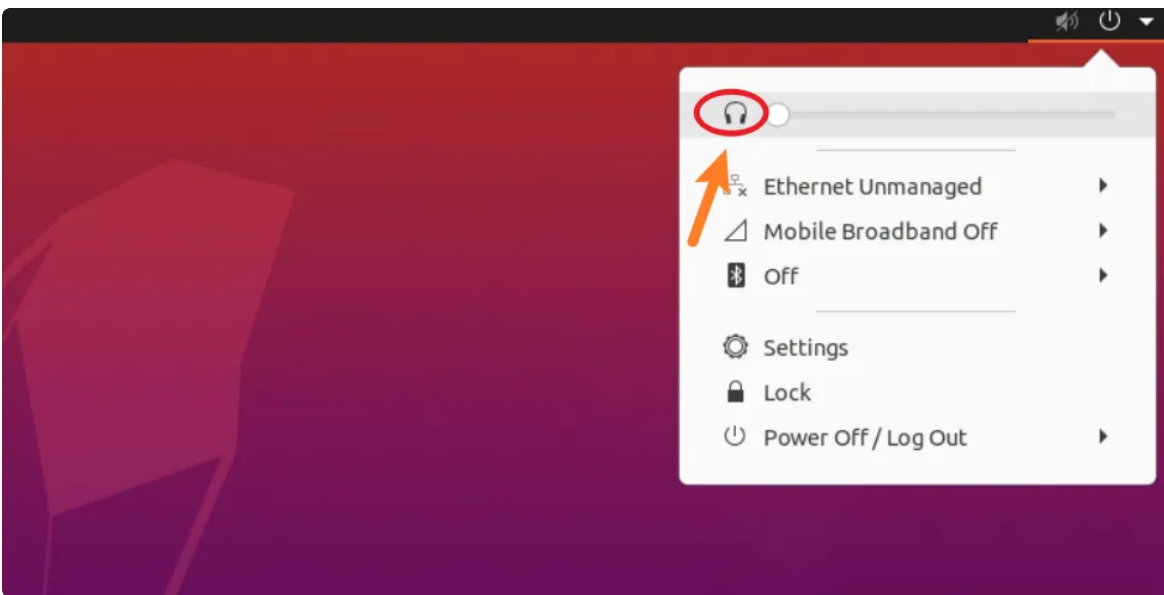
点击桌面右上角的音量图标，通过滑动音量进度条来调节音量大小：





静音

点击桌面右上角的音量图标，通过点击静音按钮来控制按钮：



2.12.3 MIC

主板配置了一路双声道MIC，位于J22。

使用以下命令进行录音测试：

```
▼ Shell |
1  industio@Industio:~$ arecord -D hw:3,0 -r 48000 -c 2 -f S16_LE test.wav
2  Recording WAVE 'test.wav' : Signed 16 bit Little Endian, Rate 48000 Hz, Stereo
3  ^CAborted by signal Interrupt...
```

录音完后播放测试:

```
▼ Shell |
1  industio@Industio:~$ aplay ./test.wav
2  Playing WAVE './test.wav' : Signed 16 bit Little Endian, Rate 48000 Hz, Stereo
```

2.12.4 Line In

2.13 RTC

主板共配置1路RTC (HYM8563) , 对应的设备节点为rtc0。

读取RTC时间

```
▼ Shell |
1  industio@Industio:~$ sudo hwclock
2  2023-05-05 16:45:22.677763+08:00
```

设置RTC时间

```
▼ Shell |
1  industio@Industio:~$ sudo date -s '2023-5-1 17:00:00'
2  industio@Industio:~$ sudo hwclock -w
3  industio@Industio:~$ sudo hwclock
4  2023-05-01 17:00:19.455966+08:00
```

2.14 IR

主板配置了一路红外接口, 支持NEC编码遥控器, 默认适配的遥控器型号为HTR-A07。



HTR-A07的键值表如下：

编号	按键	键值	编号	按键	键值
1	电源	KEY_POWER	21	1	KEY_1
2	TV	KEY_SCREEN	22	2	KEY_2
3	橙色	KEY_F1	23	3	KEY_3
4	绿色	KEY_F2	24	4	KEY_4
5	黄色	KEY_F3	25	5	KEY_5
6	紫色	KEY_F4	26	6	KEY_6
7	音量+	KEY_VOLUMEUP	27	7	KEY_7
8	音量-	KEY_VOLUMEDOWN	28	8	KEY_8
9	屏显	KEY_DISPLAY_OFF	29	9	KEY_9
10	静音	KEY_MUTE	30	TVNOW	KEY_DOT
11	上一节目	KEY_VIDEO_PREV	31	0	KEY_0
12	下一节目	KEY_VIDEO_NEXT	32	截屏	KEY_PRINT

13	上	KEY_UP	33		
14	左	KEY_LEFT	34		
15	下	KEY_DOWN	35		
16	右	KEY_RIGHT	36		
17	确认	KEY_ENTER	37		
18	返回	KEY_BACK	38		
19	主页	KEY_HOME	39		
20	菜单	KEY_MENU	40		

注：使用以下命令可以从调试串口打印按键的键值。

```

1  industio@Industio:~$ sudo -i
2  root@Industio:~# echo 1 > /sys/module/rockchip_pwm_remotectl/parameters/co
   de_print
3  root@Industio:~# dmesg | tail -n 10
4  [ 384.970360] USERCODE=0x1818
5  [ 384.997362] RMC_GETDATA=99
6  [ 385.434378] USERCODE=0x1818
7  [ 385.461372] RMC_GETDATA=97
8  [ 415.720310] USERCODE=0x1818
9  [ 415.747313] RMC_GETDATA=ff
10 [ 416.098607] USERCODE=0x1818
11 [ 416.125608] RMC_GETDATA=fe
12 [ 416.429896] USERCODE=0x1818
13 [ 416.456895] RMC_GETDATA=fd

```

使用evtest工具可以查看按键上报键值：

```
1 root@Industio:~# evtest
2 No device specified, trying to scan all of /dev/input/event*
3 Available devices:
4 /dev/input/event0: febd0030.pwm
5 /dev/input/event1: rockchip-hdmi0 rockchip-hdmi0
6 /dev/input/event2: rockchip-hdmi1 rockchip-hdmi1
7 /dev/input/event3: rockchip,dp0 rockchip,dp0
8 /dev/input/event4: rk805 pwrkey
9 /dev/input/event5: adc-keys
10 /dev/input/event6: headset-keys
11 /dev/input/event7: rockchip-es8388 Headset
12 /dev/input/event8: USB OPTICAL MOUSE
13 Select the device event number [0-8]: 0
14 Input driver version is 1.0.1
15 Input device ID: bus 0x19 vendor 0x524b product 0x6 version 0x100
16 Input device name: "febd0030.pwm"
17 Supported events:
18   Event type 0 (EV_SYN)
19   Event type 1 (EV_KEY)
20     Event code 2 (KEY_1)
21     Event code 3 (KEY_2)
22     Event code 4 (KEY_3)
23     Event code 5 (KEY_4)
24     Event code 6 (KEY_5)
25     Event code 7 (KEY_6)
26     Event code 8 (KEY_7)
27     Event code 9 (KEY_8)
28     Event code 10 (KEY_9)
29     Event code 11 (KEY_0)
30     Event code 14 (KEY_BACKSPACE)
31     Event code 28 (KEY_ENTER)
32     Event code 52 (KEY_DOT)
33     Event code 59 (KEY_F1)
34     Event code 60 (KEY_F2)
35     Event code 61 (KEY_F3)
36     Event code 62 (KEY_F4)
37     Event code 102 (KEY_HOME)
38     Event code 103 (KEY_UP)
39     Event code 104 (KEY_PAGEUP)
40     Event code 105 (KEY_LEFT)
41     Event code 106 (KEY_RIGHT)
42     Event code 108 (KEY_DOWN)
43     Event code 109 (KEY_PAGEDOWN)
44     Event code 113 (KEY_MUTE)
45     Event code 114 (KEY_VOLUMEDOWN)
```

```

46     Event code 115 (KEY_VOLUMEUP)
47     Event code 116 (KEY_POWER)
48     Event code 139 (KEY_MENU)
49     Event code 143 (KEY_WAKEUP)
50     Event code 158 (KEY_BACK)
51     Event code 183 (KEY_F13)
52     Event code 184 (KEY_F14)
53     Event code 185 (KEY_F15)
54     Event code 186 (KEY_F16)
55     Event code 210 (KEY_PRINT)
56     Event code 217 (KEY_SEARCH)
57     Event code 232 (KEY_REPLY)
58     Event code 241 (KEY_VIDEO_NEXT)
59     Event code 242 (KEY_VIDEO_PREV)
60     Event code 245 (KEY_DISPLAY_OFF)
61     Event code 248 (KEY_MICMUTE)
62     Event code 373 (KEY_MODE)
63     Event code 375 (KEY_SCREEN)
64     Event code 388 (KEY_TEXT)
65     Event code 400 (KEY_YELLOW)
66     Event code 401 (KEY_BLUE)
67     Event code 402 (KEY_CHANNELUP)
68
69 Properties:
70 Testing ... (interrupt to exit)
71 Event: time 1683280412.701901, type 1 (EV_KEY), code 105 (KEY_LEFT), value 1
72 Event: time 1683280412.701901, ----- SYN_REPORT -----
73 Event: time 1683280412.760097, type 1 (EV_KEY), code 105 (KEY_LEFT), value 0
74 Event: time 1683280412.760097, ----- SYN_REPORT -----
75 Event: time 1683280414.280667, type 1 (EV_KEY), code 103 (KEY_UP), value 1
76 Event: time 1683280414.280667, ----- SYN_REPORT -----
77 Event: time 1683280414.338898, type 1 (EV_KEY), code 103 (KEY_UP), value 0
78 Event: time 1683280414.338898, ----- SYN_REPORT -----
79 Event: time 1683280414.770143, type 1 (EV_KEY), code 106 (KEY_RIGHT), value 1
80 Event: time 1683280414.770143, ----- SYN_REPORT -----
81 Event: time 1683280414.861818, type 1 (EV_KEY), code 106 (KEY_RIGHT), value 0
82 Event: time 1683280414.861818, ----- SYN_REPORT -----
83 Event: time 1683280415.263106, type 1 (EV_KEY), code 108 (KEY_DOWN), value 1
84 Event: time 1683280415.263106, ----- SYN_REPORT -----
85 Event: time 1683280415.321364, type 1 (EV_KEY), code 108 (KEY_DOWN), value 0
86 Event: time 1683280415.321364, ----- SYN_REPORT -----
87 Event: time 1683280415.727046, type 1 (EV_KEY), code 28 (KEY_ENTER), value 1

```

```
87 Event: time 1683280415.727046, ----- SYN_REPORT -----
88 Event: time 1683280415.785291, type 1 (EV_KEY), code 28 (KEY_ENTER), value 0
89
90 Event: time 1683280415.785291, ----- SYN_REPORT -----
```

2.15 摄像头

主板共配置2路摄像头，型号均为IMX415。

2.15.1 抓取视频

使用v4l2工具抓取视频并播放。执行以下命令安装v4l2工具和播放工具：

```
▼ Shell |
1  industio@Industio:~$ sudo apt-get install v4l-utils ffmpeg
```

执行以下命令抓取摄像头录像：

```
industio@Industio:~$ v4l2-ctl --verbose -d /dev/video0 --set-fmt-video=width=1920,height=1080,pixelformat='NV12' --stream-mmap=4 --set-selection=target=crop,flags=0,top=0,left=0,width=1920,height=1080 --stream-to=./out.yuv
VIDIOC_QUERYCAP: ok
VIDIOC_G_FMT: ok
VIDIOC_S_FMT: ok
Format Video Capture Multiplanar:
    Width/Height      : 1920/1080
    Pixel Format       : 'NV12' (Y/CbCr 4:2:0)
    Field              : None
    Number of planes  : 1
    Flags              : premultiplied-alpha, 0x000000fe
    Colorspace         : SMPTE 170M
    Transfer Function  : Unknown (0x00000070)
    YCbCr/HSV Encoding: Unknown (0x000000ff)
    Quantization       : Default
    Plane 0            :
        Bytes per Line : 3840
        Size Image      : 12441600
VIDIOC_G_SELECTION: ok
VIDIOC_S_SELECTION: failed: Inappropriate ioctl for device
    VIDIOC_REQBUFS returned 0 (Success)
    VIDIOC_QUERYBUF returned 0 (Success)
    VIDIOC_QUERYBUF returned 0 (Success)
```

按Ctrl-C停止抓取，视频流保存到文件out.yuv。

使用ffplay工具播放抓取的视频流：

```
industio@Industio:~$ ffplay ./out.yuv
```

2.16 FAN

主板共配置一路风扇接口，位于J35，电压为12V，默认开机处于关闭状态。

```
Shell |
1 //关闭风扇
2 industio@Industio:~$ sudo -i
3 industio@Industio:~$ echo 0 > /sys/class/leds/fan/brightness
4
5 //打开风扇
6 industio@Industio:~$ sudo -i
7 industio@Industio:~$ echo 255 > /sys/class/leds/fan/brightness
```

2.17 HDMIRX

使用以下脚本测试HDMIRX功能。

```
Shell |
1 #!/bin/bash
2
3 export LD_LIBRARY_PATH=$LD_LIBRARY_PATH:/usr/lib/gstreamer-1.0
4
5 gst-launch-1.0 v4l2src device=/dev/video40 ! video/x-raw,width=1920,height=1080,framerate=25/1 ! videoconvert ! autovideosink
```

3、系统的使用

3.1 安装gcc

```
Shell |
1 sudo apt-get update
2 sudo apt-get install gcc
3 sudo apt-get install g++
```

3.2 导出文件系统

量产时，如果我们需要把样机配置好的文件系统更新到固件中，使得量产机器能够复制样机的状态，不需要重复配置，则可以通过导出文件系统的方法实现。大概的流程如下：

- 1.打包样机的文件系统；

- 2.将样机的文件系统打包成.img格式；
- 3.将样机文件系统合并到固件update.img；
- 4.将update.img烧录到量产机器。

3.2.1 进入recovery模式

主板断开type-c线，按住recovery键上电3秒后松开，即可进入recovery模式。

```

▼ Shell |
1 root@rk3588:/# ls
2 bin lib opt sys
3 busybox.fragment lib64 proc system
4 data linuxrc res tmp
5 dev media root udisk
6 etc misc run userdata
7 info mnt sbin usr
8 init oem sdcard var
9 root@rk3588:/#

```

3.2.1 打包文件系统

主板接上U盘，默认会挂载到/mnt/udisk目录下，可通过mount命令查看：

```

▼ Shell |
1 root@rk3588:/# mount
2 none on / type rootfs (rw)
3 ...
4 /dev/sda1 on /mnt/udisk type vfat (rw,relatime,fmask=0022,dmask=0022,codepage=936,iocharset=utf8,shortname=mixed,errors=remount-ro)

```

U盘挂载正常后，即可把ubuntu文件系统打包到U盘：

```

▼ Shell |
1 root@rk3588:/# mount /dev/mmcblk0p8 /opt/
2 [ 497.651159] EXT4-fs (mmcblk0p8): mounted filesystem with ordered data mode. Opts: (null)
3 root@rk3588:/#
4 root@rk3588:/# cd /opt/
5 root@rk3588:/opt# rm ./var/lib/misc/firstrun
6 root@rk3588:/opt# tar -cvf /mnt/udisk/ubuntu-rootfs.tar ./*
7 ...

```

打包完成后，卸载U盘：

```
Shell |
1 root@rk3588:/# cd /
2 root@rk3588:/# sync
3 root@rk3588:/# umount /mnt/udisk
```

3.2.2 将文件系统打包成.img文件

将U盘中的ubuntu-rootfs.tar拷贝到sdk的rootfs目录，并解压：

```
Shell |
1 $ cd rootfs
2 $ mv ubuntu2004-desktop-evb3588-v1.img ubuntu2004-desktop-evb3588-v1-bk.img
3 $ sudo tar -xvf ubuntu-rootfs.tar -C mount
```

新建mk-image.sh：

```
Shell |
1 #!/bin/bash -e
2
3 TARGET_ROOTFS_DIR=./mount
4 ROOTFSIMAGE=ubuntu2004-desktop-evb3588-v1.img
5 EXTRA_SIZE_MB=300
6 IMAGE_SIZE_MB=$(( $(sudo du -sh -m ${TARGET_ROOTFS_DIR} | cut -f1) + ${EXTRA_SIZE_MB} ))
7
8
9 echo Making rootfs!
10
11 if [ -e ${ROOTFSIMAGE} ]; then
12     rm ${ROOTFSIMAGE}
13 fi
14
15 dd if=/dev/zero of=${ROOTFSIMAGE} bs=1M count=0 seek=${IMAGE_SIZE_MB}
16
17 sudo mkfs.ext4 -d ${TARGET_ROOTFS_DIR} ${ROOTFSIMAGE}
18
19 echo Rootfs Image: ${ROOTFSIMAGE}
```

执行mk-image.sh：


```
1 $ chmod a+x ./mk-image.sh
2 $ sudo ./mk-image.sh
```

执行成功后，得到ubuntu2004-desktop-evb3588-v1.img即为文件系统镜像（顶层目录执行build.sh时，会将此文件系统镜像打包到update.img中，见build.sh脚本中build_rootfs()方法）。

mount目录下的文件，如不需要，可删除：

```
1 $ sudo rm ./mount/* -rf
```

3.2.3 编译固件

回到sdk顶层目录，执行./build.sh编译完整固件：

```
1 $ ./build.sh lunch
2 选择BoardConfig-evb3588-2hdmi-ubuntu.mk
3 $ ./build.sh
```

生成rockdev/update.img即为完整固件。