

# ***TechNexion***

INNOVATORS OF TECHNOLOGY

## **Android Pie User Manual**

VER. 2.20  
December 20, 2019

## REVISION HISTORY

Revision	Date	Originator	Notes
1.00	March 9, 2019	TechNexion	First public release
1.10	March 30, 2019	TechNexion	Add pico-imx8mm
2.00	July 30, 2019	TechNexion	Improve system
2.01	August 7, 2019	TechNexion	Add uuu install
2.10	September 20, 2019	TechNexion	Add 32-bit platforms
2.20	December 20, 2019	TechNexion	Add new devices and new features

## Table of Contents

<b>1. Introduction .....</b>	<b>4</b>
1.1 About Android Pie .....	4
1.2 How to read this document .....	4
<b>2. Supported Hardware .....</b>	<b>5</b>
<b>3. Software Configuration.....</b>	<b>6</b>
3-1 Software Revision .....	6
3-2 Memory Layout of the Android 9 Image .....	6
3.3 Image Installation .....	8
3.4 Serial Debug .....	8
3.5 Network.....	8
3.6 Expansion Pin Header.....	10
3.7 Termux app.....	11
3.8 Audio HAT .....	13
3.9 Serial Link.....	14
3.10 Android Treble.....	16
3.11 Libgpod JNI Test APP.....	18
<b>4. Software Development and Upgrade.....</b>	<b>19</b>
<b>5. Q &amp; A .....</b>	<b>20</b>

## 1. Introduction

### 1.1 About Android Pie

Android Pie (9.0) is the latest Android distribution from 2018 ends, keep improve user friendly and performance.

Customized features:

Industry	Networking	OS Features	Multimedia
UART Serial Test APP	ETHTOOL runtime libraries	OTA upgrade	Dual Camera
LIBGPIOD Test APP	SSH runtime libraries	A/B system	Dual Display
CANBUS Test APP	Bluetooth-LE	Fastboot	Voice-HAT
I2C runtime libraries	BT A2DP audio source	Termux app	Software Web browser (IMX7)

### 1.2 How to read this document

Chapter 2 is about this distribution.

Chapter 3 is about the software functions and features.

Chapter 4 is about how to develop your own android 9 on Technexion hardware boards.

Chapter 5 we will list common questions.

## 2. Supported Hardware

Following Android Pie distribution is provided for Technexion platforms:

- IMX8 Series
  - PICO-IMX8M
  - PICO-IMX8MM
  - FLEX-IMX8MM
  - EDM-IMX8M
- IMX6 Series
  - PICO-IMX6
  - EDM-IMX6
  - TC0700
  - TC1000
  - TEP-1010
  - TEP-1560
- IMX7 Series
  - PICO-IMX7
  - TEP1-IMX7

Each hardware has its own different functions and features, please refer the specifications first from Technexion official website if possible.

## 3. Software Configuration

### 3-1 Software Revision

#### IMX8 Series

Name	Revision
u-boot	2018.03-g84c3460
linux kernel	4.14.98-gfcddbab
Android	9.0.0-2.0.1_8m-ga-tn2.0

#### IMX6/IMX7 Series

Name	Revision
u-boot	2018.03-g84c3460
linux kernel	4.14.98-gfcddbab
Android	9.0.0-2.2.0-ga-tn2.0

### 3-2 Memory Layout of the Android 9 Image

For the boards use eMMC/SD as boot storage:

#### IMX8 Series

Section	Description
GPT	Partition information
Bootloader	u-boot.imx: First stage u-boot image
Partition 1 dtbo_a (backup partition)	dtbo.img
Partition 2 dtbo_b	dtbo.img
Partition 3 (FAT32) boot_a (backup partition)	boot.img: <ul style="list-style-type: none"> <li>kernel image</li> <li>recovery mode ramdisk</li> </ul>
Partition 4 (FAT32) boot_b	boot.img: <ul style="list-style-type: none"> <li>Image: kernel image</li> <li>ramdisk.img: recovery mode ramdisk</li> </ul>
Partition 5 (EXT4) system_a (backup partition)	system.img
Partition 6 (EXT4) system_b	system.img
Partition 7 misc	For recovery store bootloader message, reserve
Partition 8 metadata	For system slide show
Partition 9 persistdata	Option to operate unlock\unlock
Partition 10 (EXT4) vendor_a (backup partition)	vendor.img
Partition 11 (EXT4) vendor_b	vendor.img

Partition 12 (EXT4) userdata	Application data storage for system application, and for internal media partition, in /mnt/sdcard/dir
Partition 13 (EXT4) fbmisc	For storing the state of lock or unlock
Partition 12 vbmeta_a (backup partition)	For storing the verify boot's metadata
Partition 13 vbmeta_b	For storing the verify boot's metadata

### IMX6/IMX7 Series

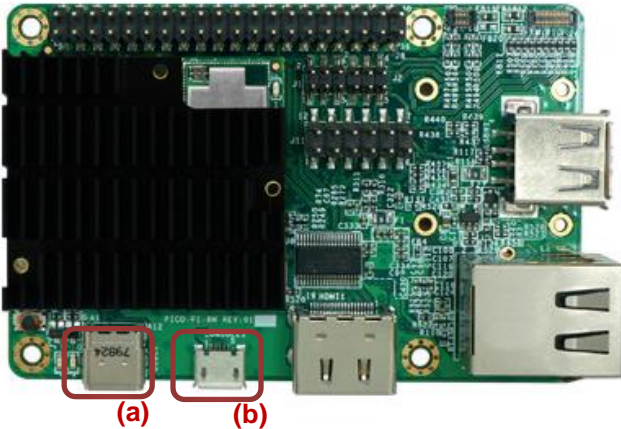
Section	Description
GPT	Partition information
Bootloader	SPL: First stage u-boot image, u-boot.img: Second stage image
Partition 1 dtbo (backup partition)	dtbo.img
Partition 2 (FAT32) boot	boot.img: <ul style="list-style-type: none"> <li>• kernel image</li> <li>• ramdisk</li> </ul>
Partition 3 (FAT32) recovery	boot.img: <ul style="list-style-type: none"> <li>• kernel image</li> <li>• ramdisk of recovery mode</li> </ul>
Partition 4 (EXT4) system	system.img
Partition 5 cache	Android cache for image store of OTA
Partition 6 misc	For recovery storage bootloader message, reserve
Partition 7 datafooter	For crypto footer of DATA partition encryption
Partition 8 metadata	For system slide show

### 3.3 Image Installation

Android 9 distribution provide an eMMC flashing tool as following this [link](#) to flash the image which you download.

### 3.4 Serial Debug

Please plug-in a micro USB cable to the connector(b) on the PI baseboard, and open any terminal communicate application that you common use such as minicom, Putty, setting 115200 bps as default speed.



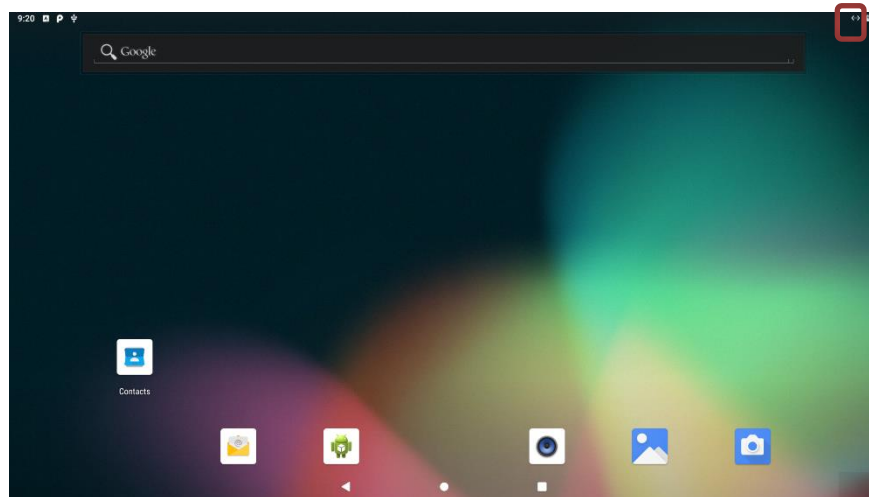
PI baseboard

ADB way: plug-in a type-C USB cable to the connector(a) on the PI baseboard, and issue the command 'adb shell' such as android base mobile phone, then you can start debugging.

### 3.5 Network

#### ➤ Ethernet

Android is auto running a DHCP daemon when boot, so we recommend it's better for plug-in the cable before boot.



#### ➤ WiFi

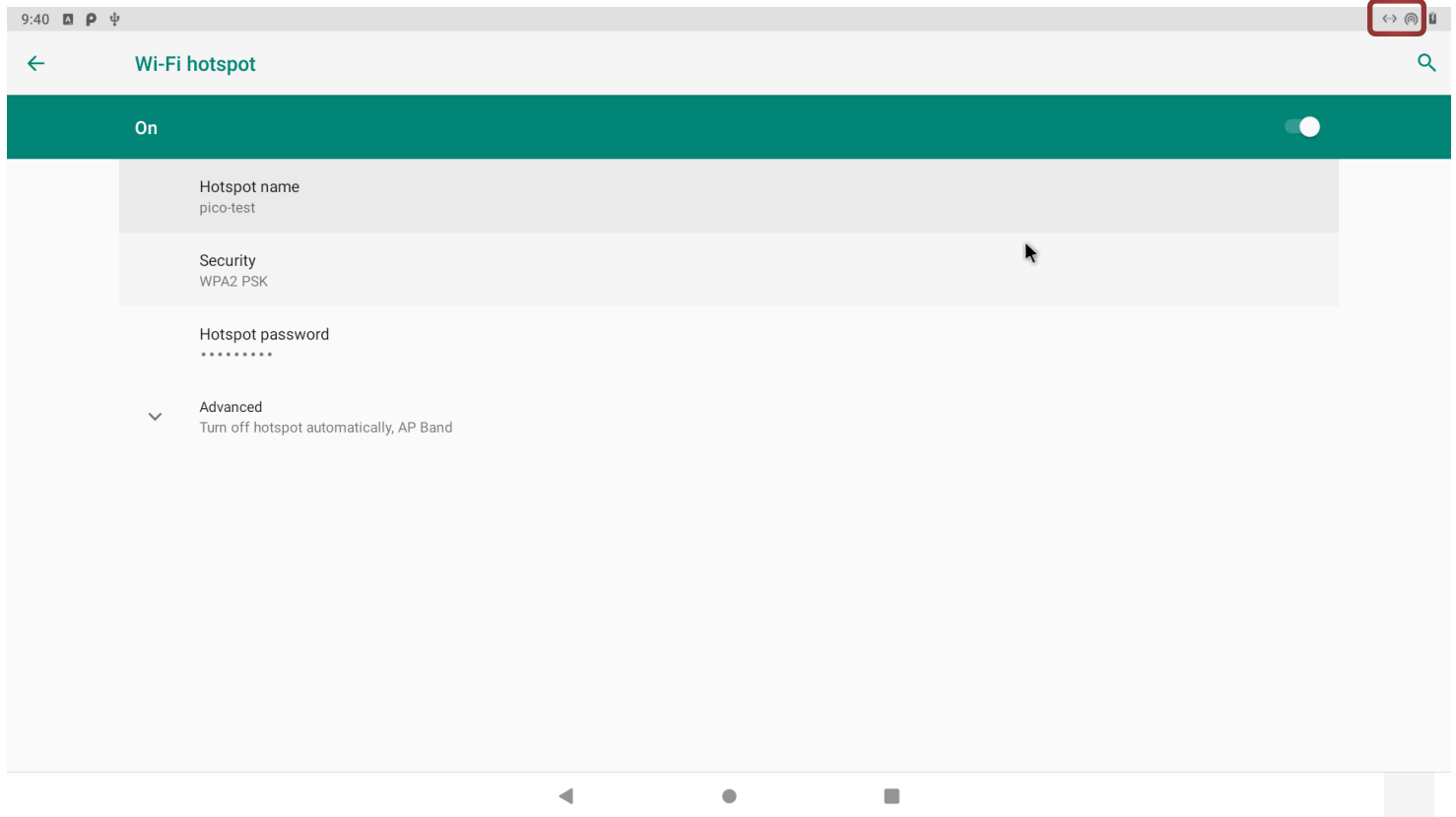
- Station mode  
Both support 2.4GHz and 5GHz band
- AP(Access Point) mode  
Support 2.4GHz only with WPA- PSK security password

NOTE 1: It's alternative between ethernet and WiFi station mode, it will show a failed WiFi connection when ethernet is working, please remove the ethernet cable first if you want to focus on WiFi station mode, or issue the command to disable the ethernet using chapter 3.2 way.

```
# ifconfig eth0 down
```

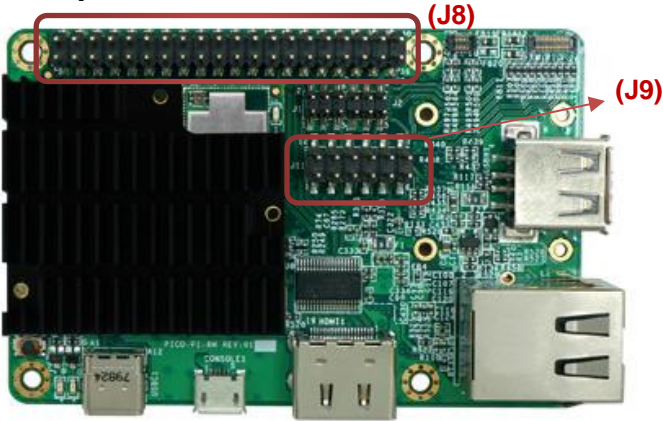


NOTE 2: Ethernet is necessary if you want to enable AP mode, ethernet will be a network node that can connect to outside on a Wide Area Network, so please plug-in the ethernet cable before boot up, or it will be a Local Area Network only.

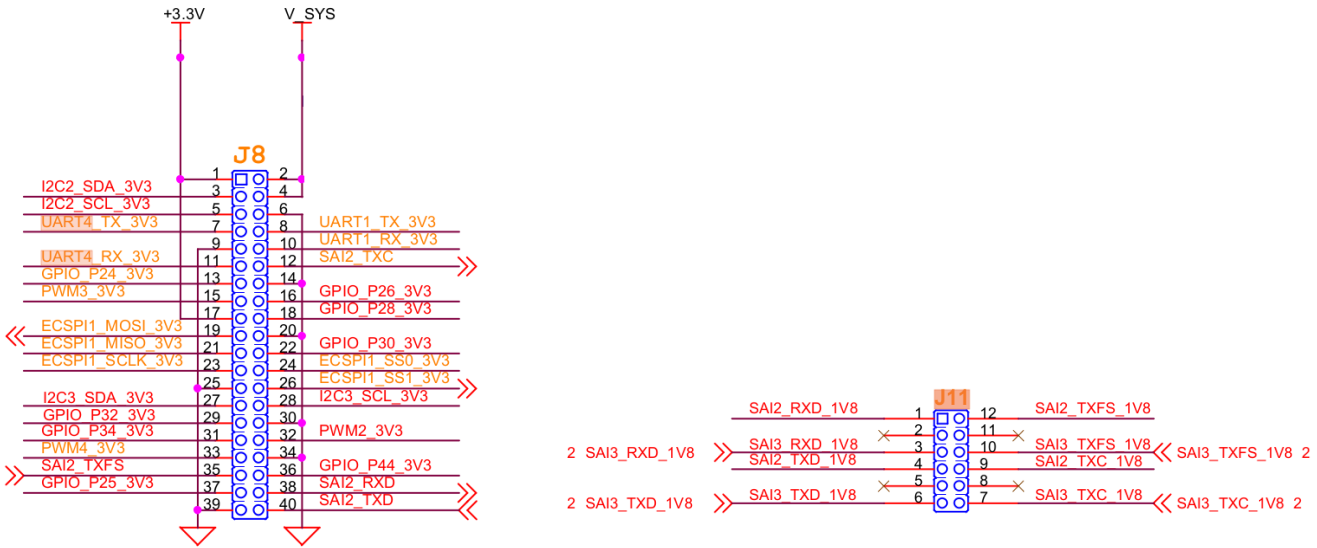


- Bluetooth
  - Support Bluetooth Classic mode
  - Support Bluetooth LE mode
  - Support A2DP source mode

### 3.6 Expansion Pin Header



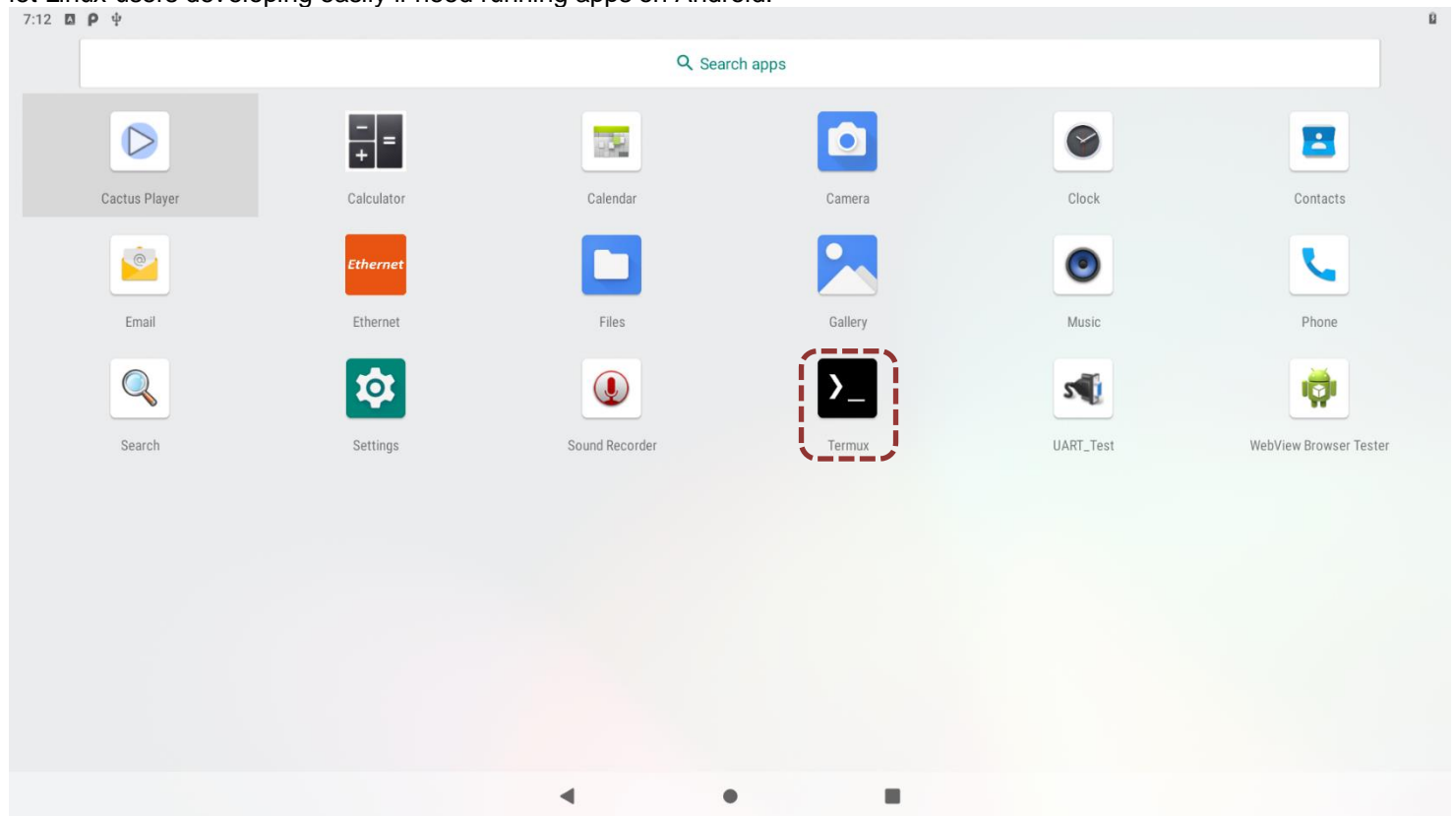
PI baseboard



PI baseboard provide an expansion pin header as above pin definition, the customers can easy to expand the customized I/O devices using GPIO, I<sup>2</sup>S, I<sup>2</sup>C, SPI and PWM low speed interfaces.

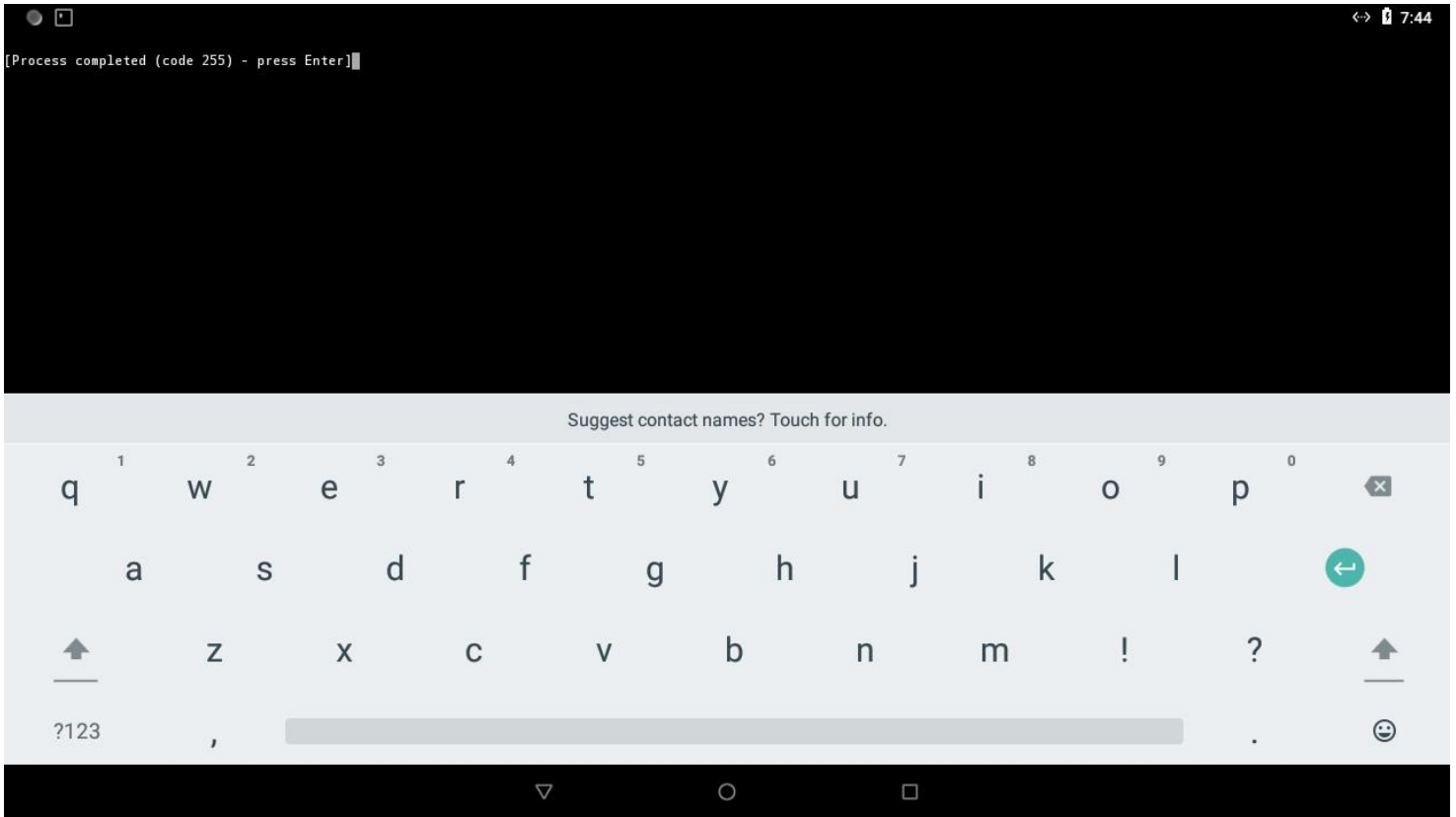
### 3.7 Termux app

Termux is a terminal emulator with Linux environment for Android, most of all, it support apt and opkg package managers, let Linux users developing easily if need running apps on Android.

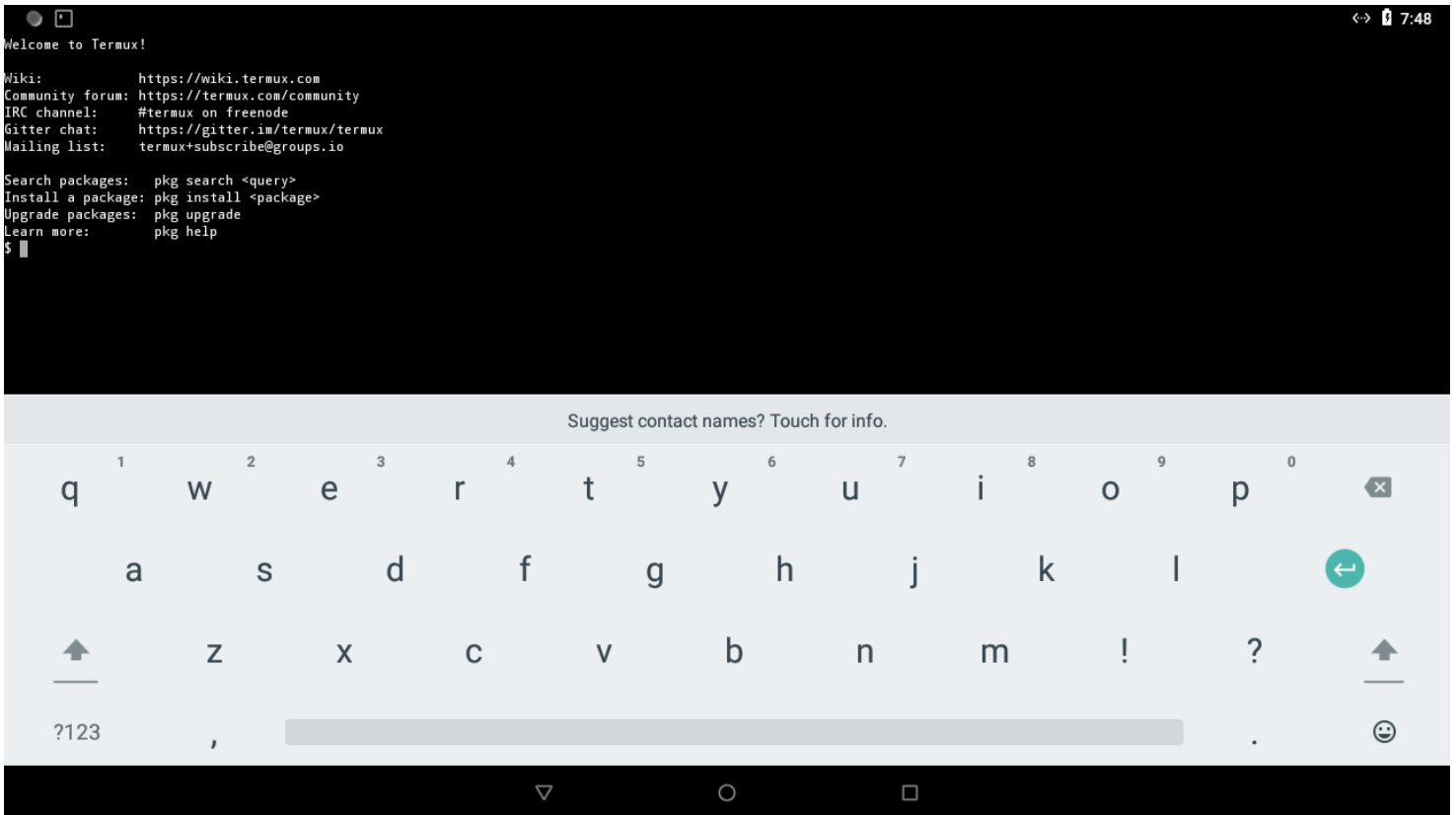


However, considering the security part (selinux on Android), so Termux cannot running on the normal user mode, users have to issue the commands to unlock the security limitation first, then starting enjoying the Linux apps development:

```
$ adb shell
$ su
# setenforce 0
```

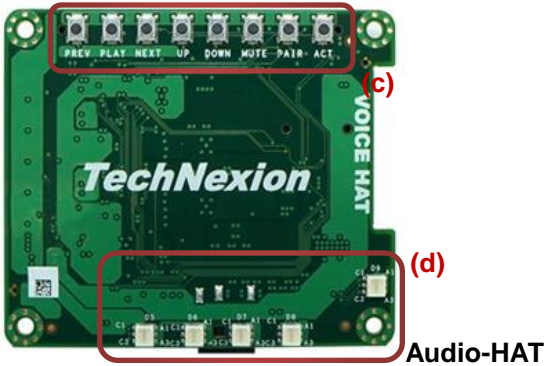


Termux not working when Android selinux locked.



Termux works when Android selinux unlocked.

### 3.8 Audio HAT



This Audio-HAT is design for expansion pin header as chapter 3.5, it can connect onto the expansion pin header directly, easy to use, Android 9 does support IMX7 and IMX8 platforms.

However, this distribution provide Termux app, it can easy to control the functions of Audio-HAT as following:

- 16 channel LED array, **(d)** as above picture

```
# ls /sys/class/leds/
gpio-led  pca995x:blue0  pca995x:blue4  pca995x:green2  pca995x:red1
mmc0::   pca995x:blue1  pca995x:blue5  pca995x:green3  pca995x:red2
mmc1::   pca995x:blue2  pca995x:green0  pca995x:green4  pca995x:red3
mmc2::   pca995x:blue3  pca995x:green1  pca995x:red0   pca995x:red4

echo 0 > /sys/class/leds/pca995x:blue0/brightness # (0% brightness)
echo 125 > /sys/class/leds/pca995x:blue0/brightness # (50% brightness)
echo 255 > /sys/class/leds/pca995x:blue0/brightness # (100% btightness)
```

- Button array, **(c)** as above picture  
Default button configuration as following:  
These buttons can be modified the trigger event on kernel device tree of source code.



- Speakers
  1. Commands Testing  
In Android, tinyalsa relative tool is easy to play the wave file, note that this speaker is support <= 16 bits.

```
# tinyplay test.wav -D 2 -c 2
Playing sample: 2 ch, 48000 hz, 16 bit (you can choose mono mode or stereo mode using -c parameter)
```

2. APP Developing  
tn-p9.0.0\_2.0.0\_8m-ga is already support this speaker in system, the customers can use it directly.

- MEMS microphone
  1. Commands Testing  
Note that this microphone is support 32 bits only.

```
# tynycap test.wav -D 0 -c 2 -r 48000 -b (you can choose mono mode or stereo mode using -c parameter)
```

2. APP Testing  
Adapt the SoundRecorder app on desktop to test this, note that the sample rate is 48kHz

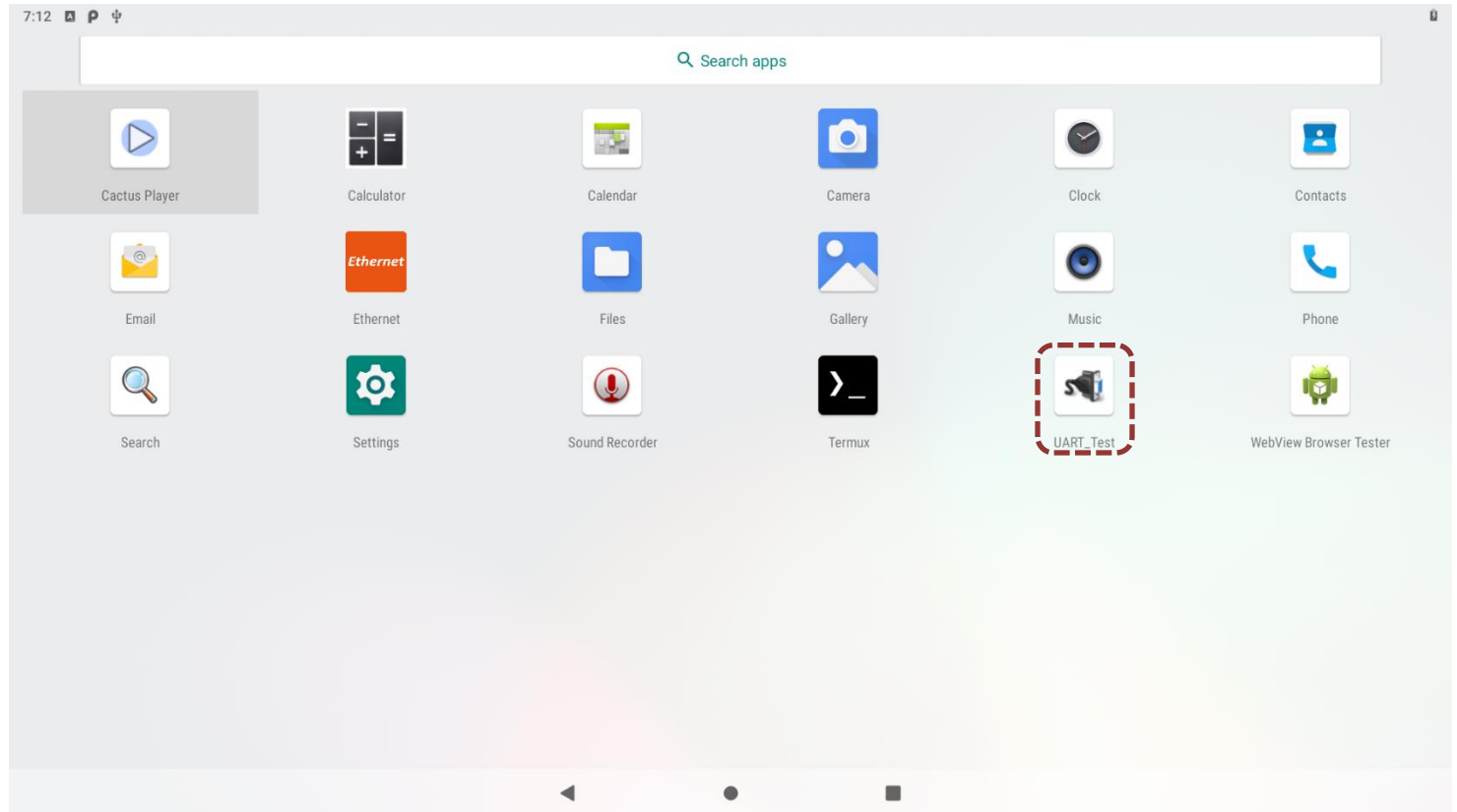
### 3.9 Serial Link

Supporting a 2-wire RS232 port on 40-pin expansion pin header as (J8) of chapter 3.5.

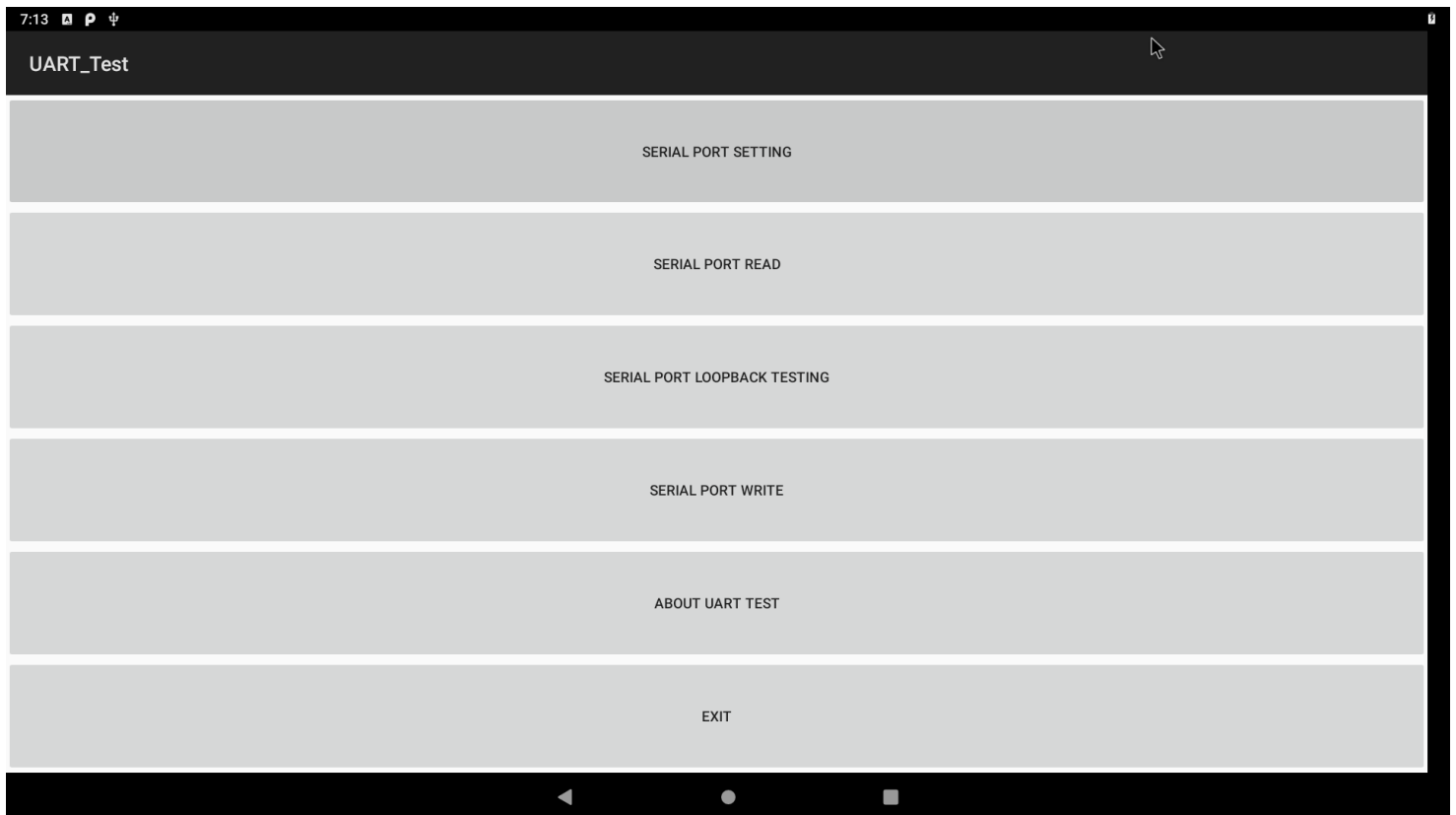
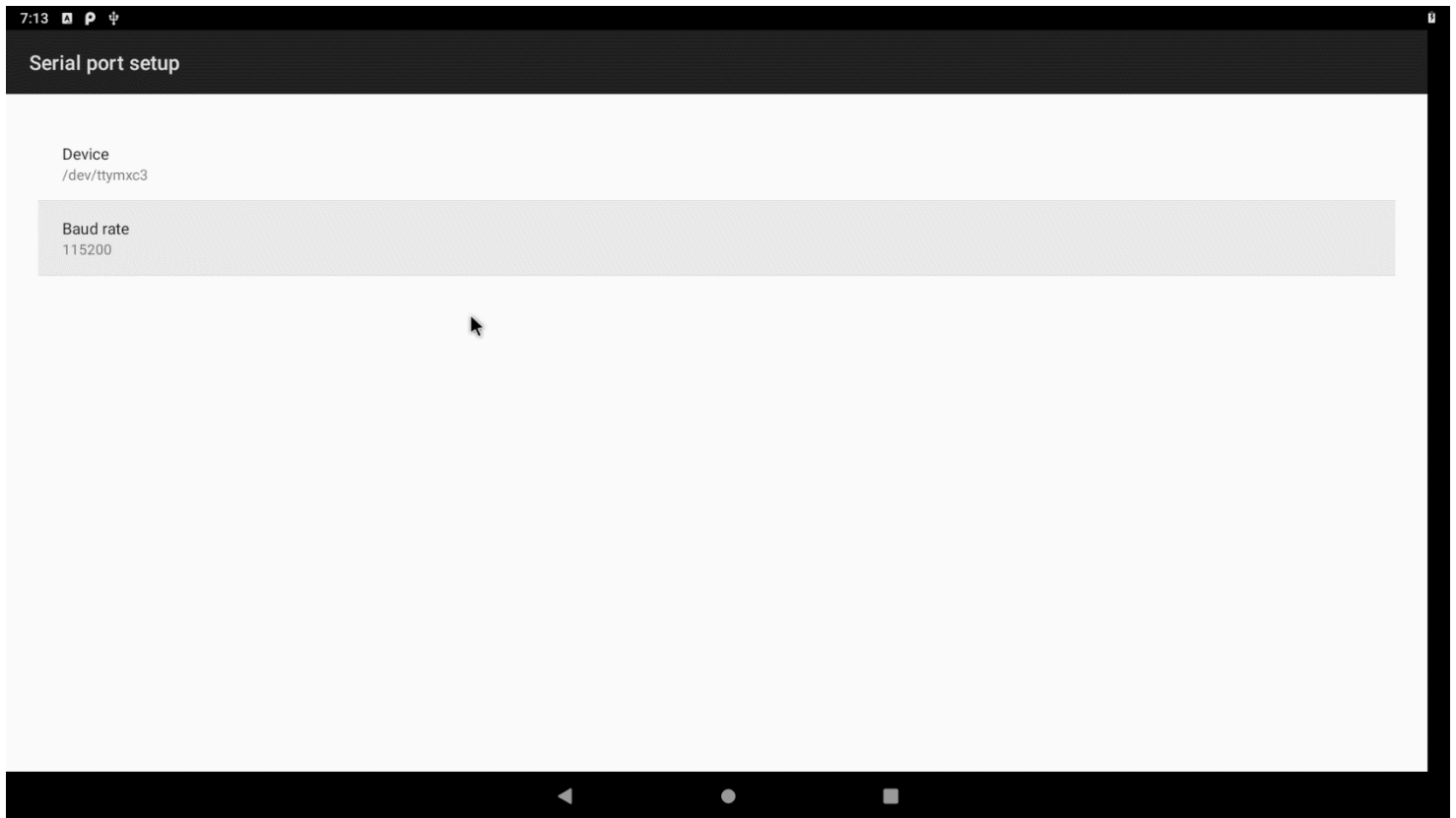
TX: Pin 7

RX: Pin 11

Then open Technexion customized UART test app to do simple tests:



Clicking the “SERIAL PORT SETTING” to config the UART node and baud rate, then you can easy to test read, write and loopback function.



### 3.10 Android Treble

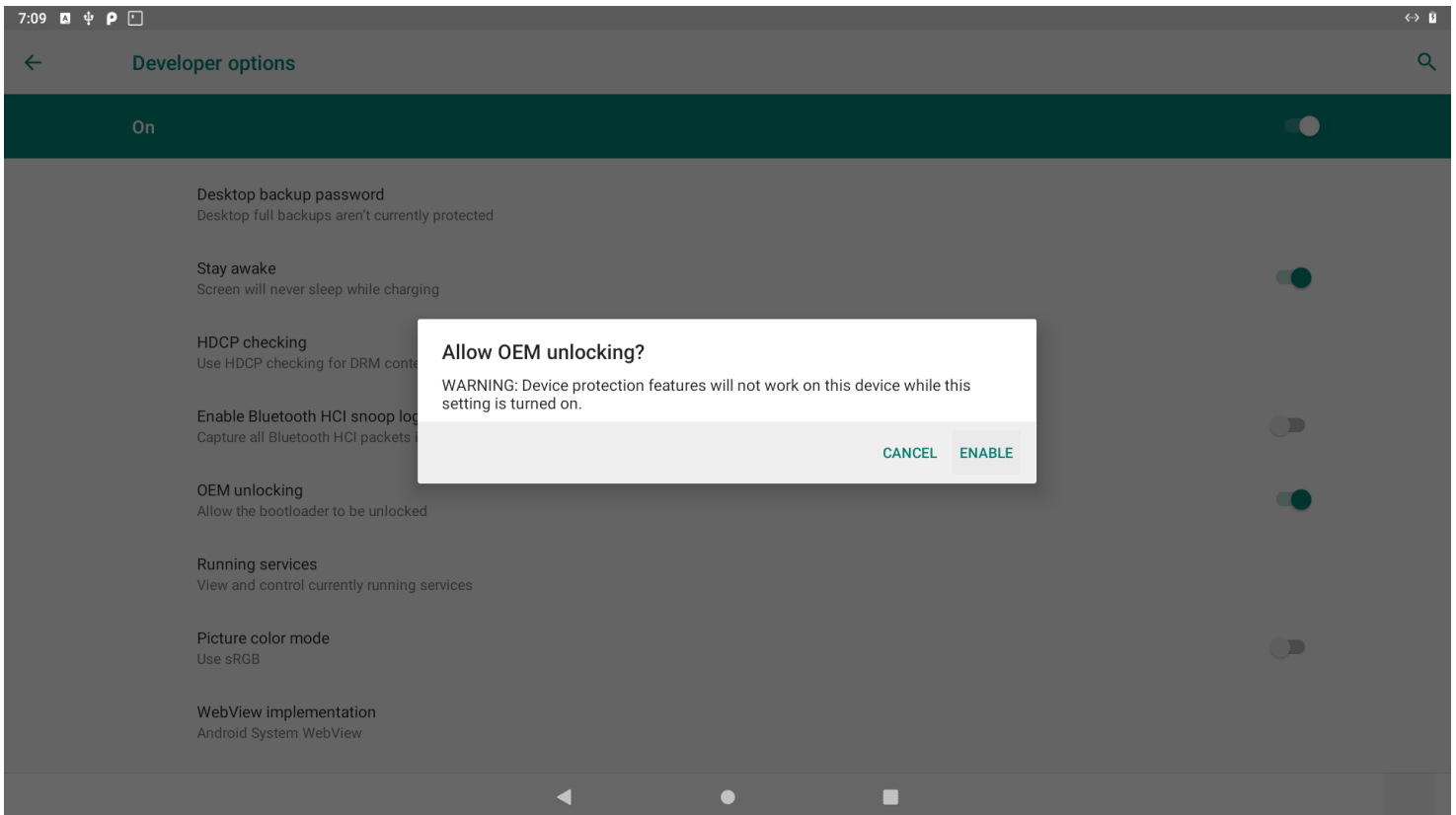
- ADB

Connecting a USB type C cable between Host PC and hardware board, issue the commands to debug:

```
Root permission
$ adb root
Normal permission
$ adb shell
```

- Fastboot

In Android 9, users must be unlocking the permission of partition flashing using fastboot command, or you cannot do any upgrade behavior.



Unlock the flashing permission on developer options

After OEM unlocking, please reboot in fastboot mode (or issue fastboot -q on u-boot prompt) , issue the commands to unlock first and start flashing new images on your host PC:

```
$ sudo fastboot flashing unlock
# boot part upgrade
$ sudo fastboot flash dtbo_a dtbo-imx8mq.img
$ sudo fastboot flash dtbo_b dtbo-imx8mq.img
$ sudo fastboot flash boot_a boot.img
$ sudo fastboot flash boot_b boot.img
# system part upgrade
$ sudo fastboot flash vbmeta_a vbmeta-imxpico_8m.img
$ sudo fastboot flash vbmeta_b vbmeta-imxpico_8m.img
$ sudo fastboot flash system_a system.img
$ sudo fastboot flash system_b system.img
$ sudo fastboot flash vendor_a vendor.img
$ sudo fastboot flash vendor_b vendor.img
$ sudo fastboot reboot
```



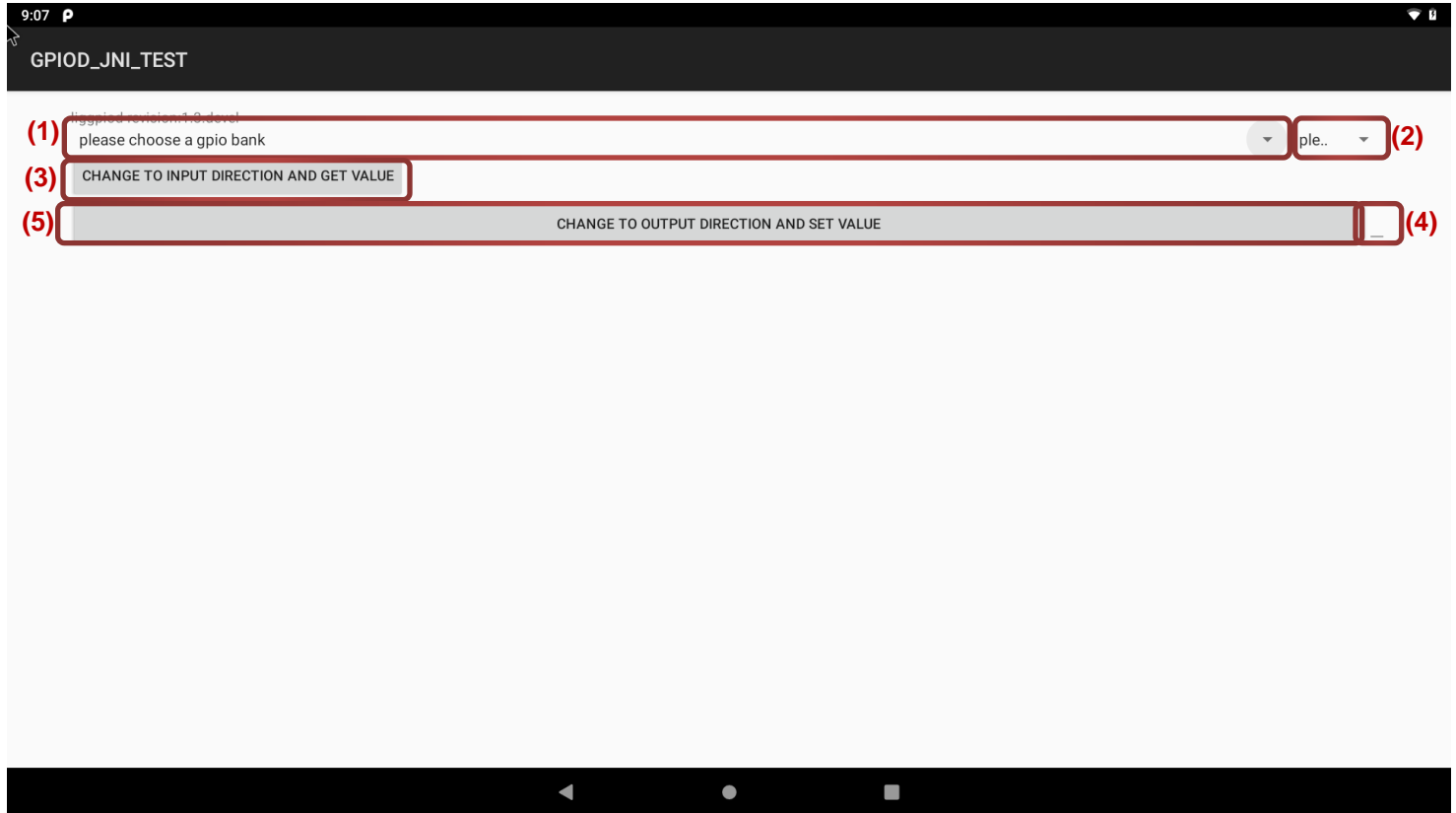
- A/B system
- OTA upgrade
- Treble structure of source code

It's fully supports on above three features, users can develop on our github SDK.

### 3.11 Libgpiod JNI Test APP

Libgpiod is a modular library on Linux which can easy to control the gpio pin instead of classic sysfs way, Technexion is porting to Android already, the customers can easy use libgpiod to developing HAL API, simple execute program or utility command-line tools, but the customers have to define the gpios on linux kernel device tree before use this library.

Latest TN2.0 release provide a libgpiod JNI test app, the customers can verify the JNI api easily.



Step 1. Choose a gpiobank

Step 2. Choose a gpioline

For example, gpio3\_7: gpiobank=3, gpioline=7

Step 3. The users can set this gpio as a GPIO input with a value getting, the hardware behavior will be triggered directly. Or skip this step and go to next step

Step 4. The users can set this gpio as a GPIO output with a value, please input a value first and go to Step 5.

Step 5. Setting GPIO as a GPIO output, the hardware behavior will be triggered directly

## 4. Software Development and Upgrade

Online Github SDK including the source code and instruction.  
<https://github.com/technexion-android/cookers/>

## 5. Q & A

1. IMX8: Video player only support portrait mode using MIPI-DSI LCD panel on landscape mode

**Ans:** It's due to the OMX VPU library of chip vendor has some bugs, but we have a workaround way to change the parameters on your video using ffmpeg tool:

```
Ubuntu host example
$ ffmpeg -i original_test.mov -vf "transpose=1" mipi_lcd_test.mov
$ ffmpeg -i mipi_lcd_test.mov -c copy -metadata:s:v:0 rotate=90 mipi_lcd_test_out.mov
```

Then it will be working on landscape mode using video player if you adapt MIPI-DSI LCD panel.

2. IMX8: How to remount the system/vendor partition as a writeable partition?

**Ans:** Step 1. Unlock the flashing permission such as chapter 3.10 and reboot in fastboot mode.

```
# reboot bootloader
```

Step 2. Unlock the device again in fastboot mode on host side.

```
$ sudo fastboot oem unlock
$ sudo fastboot reboot
```

Step 3. Disabling the secure function using adb command on host side, then reboot again.

```
$ adb root
$ adb disable-verity
$ adb reboot
```

Step 4. Remount the all partitions as writeable partitions, for now, users can create a file to test.

```
## Host side
$ adb root
$ adb remount
$ adb shell
## Jump to Android side
$ su
# touch /system/test
# touch /vendor/test
```

3. IMX8: How to install uuu in different environment?

**Ans:** Windows

```
c:\uuu_image_folder>mkdir c:\utility
c:\uuu_image_folder>copy uuu.exe c:\utility
c:\uuu_image_folder>copy libusb-1.0.dll c:\utility
c:\uuu_image_folder>set PATH=%PATH%;c:\utility
```

**Ans:** Ubuntu

```
$ cd uuu_image_folder
$ sudo cp uuu /bin
```

4. IMX8: How to improve the graphic performance on demo image?

**Ans:** In demo image, the CMA configuration is for 1GB memory Sku., it's in order to one image for all Sku., but it cause the performance is no good for 2GB, 4GB memory revision, please re-setting the CMA size again if you have requirement.

Re-config the boot argument on u-boot prompt (It means you need connect a debug console):

IMX8MQ:

```
# setenv bootargs console=ttymxc0,115200 earlycon=imxuart,0x30860000,115200
init=/init androidboot.hwrotation=0 androidboot.gui_resolution=1080p
androidboot.console=ttymxc0 consoleblank=0
androidboot.hardware=freescale cma=1280M androidboot.primary_display=imx-drm
firmware_class.path=/vendor/firmware transparent_hugepage=never androidboot.wifivendor=qca
androidboot.wificountrycode=TW quiet
```

- Note that your panel configuration
- Note that the good configuration are: CMA=800M for 2GB memory, CMA=1280M for 4GB memory

IMX8MM:

```
# setenv bootargs console=ttymxc1,115200 earlycon=ec_imx6q,0x30890000,115200 init=/init
androidboot.hwrotation=90 androidboot.console=ttymxc1 androidboot.hardware=freescale
cma=736M androidboot.primary_display=imx-drm firmware_class.path=/vendor/firmware
transparent_hugepage=never quiet androidboot.wifivendor=qca androidboot.wificountrycode=TW
```